Sustainable Hand Harvesting of *Ascophyllum nodosum* at Clew Bay, Co. Mayo

NATURA IMPACT STATEMENT

Updated Version: 5th of September 2024

[redacted]

EXECUTIVE SUMMARY

BioAtlantis Ltd. is a biotechnology company which provides solutions to a global market using natural bioactives to stimulate defence, immunity and microbiota. Securing supply of raw material, the common brown seaweed *Ascophyllum nodosum*, is essential to future development.

A previous study entitled 'Mapping and assessment of the seaweed resources (*A. nodosum*, *Laminaria* spp.) off the west coast of Ireland' (Hession et al., 1998) indicates that the Clew Bay region has the potential to sustainably yield from 14,870 tonnes per annum up to a maximum of 16,970 tonnes of *A. nodosum* seaweed per annum. BioAtlantis' original application estimated that there is a maximum annual sustainable harvest of ~12,900 tonnes in Clew Bay, based on a sustainable harvest methodology of a 20% harvest per site per annum and cutting of 8-12 inches (200-300mm) above the holdfast. This figure was updated following assessments of the *A. nodosum* resource in Clew Bay in 2016 by University College Dublin (UCD) and with the exclusion of areas where there are existing appurtenant rights to gather or remove seaweed. The revised estimated annual harvest of *A. nodosum* in Clew Bay is 11,018 tonnes. BioAtlantis propose to incorporate known rates of *A. nodosum* recovery within Clew Bay into a broader system of harvesting, based primarily with sustainability in mind. Central to this approach will be a harvesting methodology which is minimally invasive and ensures rapid recovery and re-growth of *A. nodosum* post-harvest. By using hand-harvesting techniques, known to be environmentally friendly, and incorporating their use into a sustainable best practice approach, BioAtlantis aims to implement a sustainable mode of seaweed harvesting in Clew Bay.

BioAtlantis Ltd. has a current requirement of c. 7,000 wet tonnes of *A. nodosum*, which is expected to rise to c.11,018 wet tonnes between 2024 and 2026. It has been identified that the only Annex 1 habitat potentially impacted by hand harvesting of *A. nodosum* is Large Shallow Inlets and Bays and specifically the reef and shingle habitats within that, at disturbance limit levels of 4.9% and 12.7% respectively per annum of their total area. Large shallow inlets and bays [1160] is a qualifying interest of the Clew Bay Complex SAC within which the proposed activities will occur, and is fully considered in this NIS. This is a complex habitat consistent of several sub-habitats two of which are reef and shingle. Reef is not designated as a qualifying interest of the SAC however Reef [1170] is an Annex 1 habitat under the EU Habitats Directive and taking the precautionary principle into account we assess the reef habitat here as an Annex I habitat. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,189 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. The percentage of the total area of Large shallow Inlets and Bays [1160] that be utilized per annum during hand harvesting activities in the intertidal zone, is 1.54%.

The preparation of this Natura Impact Statement (NIS) is to inform the Appropriate Assessment process, as required under the Habitats Directive (92/43/EEC), in instances where a plan or project may give rise to significant effects upon a Natura 2000 site. The Screening for Appropriate Assessment is included in Addendum 1. The Screening for Appropriate Assessment identifies designated sites within the potential impact zone of the proposed project, following the guidance published in the manual 'Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities' published by (DoEHLG, 2010). The Screening for Appropriate Assessment considers the potential for adverse effects upon the conservation objectives and qualifying interests (including habitats and species) within affected designated Natura 2000 sites. If the effects are deemed to be significant, potentially significant, or uncertain, or where the Screening process becomes overly complicated, then the preparation of an NIS, to inform the Appropriate Assessment process, is required under the requirements of Article 6(3) of the EU Habitats Directive (92/43/EEC).

The EU 'Habitats Directive' was transposed into Irish law by the 'European Community (Natural Habitats) Regulations 1997' (S.I. No. 94/1997). The most recent transposition of this legislation in Ireland is the 'European Communities (Birds and Natural Habitats) Regulations 2011' (S.I. No. 477 of 2011). The Birds Directive (2009/147/EC), which is now included in these previous regulations, seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs). The Habitats Directive does the same for habitats and other species groups within Special Areas of Conservation (SACs), which are designated or proposed as candidate Special Areas of Conservation (cSACs). Both SAC and SPA sites are identified as Natura 2000 sites and collectively form the Natura 2000 network within the EU.

Specific guidance for the preparation of Natura Impact Statement reporting and the evaluation of effects on Natura 2000 sites has been utilised in the current report, including:

- DoEHLG (2010) Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities;
- NPWS (2012) Marine Natura Impact Statements in Irish Special Areas of Conservation: A Working Document. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht; and
- EC (2002) Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive (92/43/EEC). European Commission.

In addition to existing baseline studies and impact assessment reporting set out in the previously prepared assessments for the Foreshore Licence Application, the current NIS has been informed by detailed coastal and marine baseline studies completed on behalf of the NPWS and utilised in developing the conservation objectives of the Clew Bay Complex SAC. This NIS has been updated following an NPWS appraisal of an earlier version and further consultation with the NPWS. This updated NIS contains additional information on the proposal, a response to an NPWS request for further information (see foreword of BioAtlantis license application), a broad examination of the nature, extent and impact of harvesting and more detailed mitigation. In August 2024 this report was updated to provide additional information and context on the Large Shallow Inlets and Bays [1160] habitat designated within the Clew Bay Complex Special Area of Conservation (SAC) and the sub-habitats that make up this qualifying interest including reef habitat. In the August 2024 report the maps were also updated to include the most up to date GIS layers. This additional information and clarifications have been added to the assessment in order to allow the Competent Authority to complete the Appropriate Assessment process for the proposed project based on the rationale and evidence outlined here.

This report also includes an assessment of the percentage area of specific marine community types affected by the annual harvest of *A. nodosum*, and takes cognisance of the NPWS recommendation that continuous disturbance of each community type within Clew Bay Complex SAC should not exceed an approximate area of 15%. According to the EU Commission (EC) Article 17 reporting, a site is rated "unfavourable-inadequate" regarding structure and functions if "the area of habitat with 'unfavourable' ('not good') condition (field 6.1) is less than 25%". It is rated "unfavourable-bad" if "more than 25% of the area is unfavourable ('not good' in field 6.1) as regards its specific structure and functions (including typical species)" (EC, 2017). This 25% cut-off for Unfavourable Inadequate vs Unfavourable Bad has resulted in NPWS deciding on a continuous disturbance of 15% of the total habitat area in the SAC as complying with Article 17. In the Clew Bay Complex SAC the status of Large Shallow Inlets and Bays [1160] is currently "Unfavourable-Bad" for structure and function as well as for future prospects (Scally et al. 2020) following the EU Article 17 assessment guidelines (EC, 2017). The unfavourable status of

Large shallow inlets and bays [1160] in Clew Bay has been attributed to the loss of seagrass beds (*Zostera* spp.), a significant decrease in the abundance of seagrass shoots within a bed, and an increase in negative indicators (Scally *et al*., 2020). The conservation status of Reef [1170] is considered 'Favourable' in terms of area, structure and function, and future prospects in Ireland. This includes both inshore and offshore reef areas (Scally et al., 2020). While Reef [1170] is not a qualifying interest of the Clew Bay Complex SAC it is a designated annex I habitat, and reef is a component of the Large Shallow Inlets and Bays habitat. Therefore, taking the precautionary principle the reef habitat is assess here as being an Annex I habitat. *A. nodosum* primarily grows on intertidal reef substratum.

The key qualifying interests of the Clew Bay Complex SAC identified as being potentially affected by the proposal and assessed in the NIS report include Annex I listed habitats (Large shallow inlets and bays) and Annex II listed mammals (Common seals and Otter). Specific mitigation measures have been set out in a detailed 'Code of Practice', developed by BioAtlantis and included in the Licence Application (BioAtlantis, 2024), in order to avoid significant direct, indirect and cumulative effects on these qualifying interests. These best practice guidelines have been developed on the basis of findings from the peer reviewed literature, best scientific knowledge and previous surveys carried out in the Clew Bay Complex.

From examination of the information available, it is considered that as long as all mitigation measures listed in this NIS are adhered to, there will be no impacts on the integrity of the Clew Bay Complex SAC as a result of the proposed hand harvesting of *A. nodosum* in Clew Bay by BioAtlantis.

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1. INTRODUCTION

1.1 Background

ECOFACT Environmental Consultants Ltd. was commissioned by BioAtlantis Ltd. to prepare a Natura Impact Statement (NIS) for the proposed hand-harvesting of the seaweed *Ascophyllum nodosum* in a sustainable manner from Clew Bay, Co. Mayo. The proposed licence area within Clew Bay is presented in Figure 1 and is located within Clew Bay Complex Special Area of Conservation (Site Code: 001482). The Screening for Appropriate Assessment for the project is included in Addendum 1. The Article 12 (Habitats Directive) Screening for the project is included in Addendum 2.

BioAtlantis Ltd. is a biotechnology company which provides solutions to a global market using natural bioactives to stimulate defence, immunity and microbiota. Securing supply of raw material, the common brown seaweed *Ascophyllum nodosum*, is essential to future development.

In August 2024 this report was updated to provide additional information and context on the Large Shallow Inlets and Bays [1160] habitat designated within the Clew Bay Complex Special Area of Conservation (SAC) and the sub-habitats that make up this qualifying interest including reef habitat. Large shallow inlets and bays [1160] is a qualifying interest of the Clew Bay Complex SAC within which the proposed activities will occur, and is fully considered in this NIS. Reef [1170] is a qualifying interest of several SACs in Ireland and therefore is an Annex I habitat. It is not designated in the Clew Bay Complex SAC but does occur with the Large Shallow Inlets and Bays, and therefore taking the precautionary principle it is treated as an Annex I habitat in this assessment. In the August 2024 report the maps were also updated to include the most up to date GIS layers. This additional information and clarifications have been added to the assessment in order to allow the Competent Authority to complete the Appropriate Assessment process for the proposed project based on the rationale and evidence outlined here.

A study completed by Hession C. *et al*. (1998) indicates that the Clew Bay region has the potential to sustainably yield from 14,870 tonnes per annum up to a maximum of 16,970 tonnes of *A. nodosum* seaweed per annum. BioAtlantis Ltd. has a current requirement of 7,000 wet tonnes, which is expected to rise to 11,018 tonnes between 2024 and 2026. BioAtlantis will work within a 15% disturbance limit of any specific habitat within the SAC. The only habitats to be impacted by hand harvesting of *A. nodosum* are reef and shingle, at levels of 4.9% and 12.7% respectively per annum, below the 25% limit for structure and function measures used for assessing conservation status and below the NPWS recommendation that continuous disturbance of each community type within Clew Bay Complex SAC should not exceed an approximate area of 15%. Reef and shingle are component habitats of the Large Shallow Inlets and Bays [1160] habitat which is a qualifying interest of the SAC. Reef and shingle are not designated habitats within the Clew Bay Complex SAC but are constituent habitats of the qualifying interest Large shallow Inlets and Bays [1160]. Although not a qualifying interest, Reefs are an Annex I habitat under the EU Habitats Directive and therefore taking the precautionary principle they are assessed as potentially being an Annex I habitat in Clew Bay. The percentage of the reef and shingle which are Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160], that will be impacted each year is very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,189 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. The percentage of the total area of Large shallow Inlets and Bays [1160] that be utilized per annum during hand harvesting activities in the intertidal zone, is 1.54%. BioAtlantis will incorporate known rates of *A. nodosum* recovery within Clew Bay into a broader system of harvesting, based primarily with sustainability in mind. Central to this approach will be a harvesting methodology which is minimally invasive and ensures rapid recovery and re-growth of *A. nodosum* post- harvest. By applying hand-harvesting techniques, known to be environmentally friendly, and incorporating their use within a sustainable best practice approach, BioAtlantis aims to implement a sustainable mode of seaweed harvesting in Clew Bay. The proposed harvesting activities are subject to significant management oversight and protocols to limit disturbance to sensitive qualifying interests and ecological receptors within the Clew Bay Complex SAC. These protocols have been developed taking account of the existing fishing and aquaculture industry within Clew Bay.

Ascophyllum nodosum is the most important species of seaweed in Ireland from a commercial perspective. In Ireland over 90% of *A. nodosum* cover that is harvested comes from counties Galway, Mayo and Donegal. With the sickle/knife method, which is used here and considered to be a traditional method of hand harvesting seaweed, typically 1 – 4 tonnes can be cut in a single tide. Beds are left fallow for some years between harvests. Generally, in the UK the rule is "*seaweed should be cut (with scissors), not pulled, and no more than ⅓ of any species should be taken from any shore in one year*" when harvesting small seaweeds. However, not much work has been undertaken on this subject in Ireland. Due to the invertebrate life on the fronds, it is suggested that not cutting directly at the base, but higher up allows for a smaller impact on biodiversity. The time it takes *A. nodosum* to recover and its impact can vary. The author also points out that there are "*minor ecosystem concerns*" regarding harvesting *A. nodosum* commercially and with sufficient studies these concerns can be alleviated (Angus, 2017). The cutting height, the recovery period between harvests, the spatial patterns and the scale of exploitation all need to be taken into consideration to ensure sustainable harvesting and protection of the *Ascophyllum* resource and associated communities (Gendron *et al.* 2018).

This NIS provides a detailed impact assessment of the implications of the proposed hand harvesting of *A. nodosum* from Clew Bay, alone and in combination with other plans and projects, on the integrity of the Natura 2000 site network in view of the conservation objectives of these sites. This assessment takes account of the best scientific evidence and methods available. This NIS has been updated following an NPWS appraisal of an earlier version and updated mitigation following public consultation. This updated NIS contains additional information on the proposal, a response to an NPWS request for further information (see foreword), a broad examination of the nature, extent and impact of harvesting and more detailed mitigation. This report also includes an assessment of the percentage area of specific marine community types affected by the annual harvest of *A. nodosum*, and takes cognisance of the NPWS recommendation that continuous disturbance of each community type within Clew Bay Complex SAC should not exceed an approximate area of 15%. According to the EU Commission (EC) Article 17 reporting, a site is rated "*Unfavourable-inadequate*" regarding structure and functions if *"the area of habitat with 'unfavourable'('not good') condition (field 6.1) is less than 25%".* It is rated "*unfavourable-bad*" if "*more than 25% of the area is unfavourable ('not good' in field 6.1) as regards its specific structure and functions (including typical species)"* (EC, 2017). This 25% cut-off for Unfavourable Inadequate vs Unfavourable Bad has resulted in NPWS deciding on a continuous disturbance of 15% of the total habitat area in the SAC as complying with Article 17. In the Clew Bay Complex SAC the status of Large Shallow Inlets and Bays [1160] is currently "*Unfavourable-Bad*" for structure and function as well as for future prospects (Scally *et al*. 2020) following the EU Article 17 assessment guidelines (EC, 2017). The Large Shallow Inlets and Bays complex is made up of several habitats or community types, some of which are driving the "*Unfavourable-Bad status.* The unfavourable status of Large shallow inlets and bays [1160] in Clew Bay has been attributed to the loss of seagrass beds (*Zostera* spp.), a significant decrease in the abundance of seagrass shoots within a bed and an increase in negative indicators (Scally *et al.,* 2020). It is not proposed to carry out harvesting in these areas, but rather in reef and shingle areas. The conservation status of Reef [1170] is considered 'Favourable' in terms of area, structure and function, and future prospects in Ireland. This includes both inshore and offshore reef areas (Scally *et al.,* 2020). *A. nodosum* primarily grows on intertidal reef substratum.

This Natura Impact Statement (NIS) has been prepared in accordance with the provisions of Part XAB of the Planning and Development Act 2000 (as amended) (the 2000 Act), the requirements of Council Directive 92/43/EEC of 21st of May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and the European Communities (Birds and Natural Habitats) Regulations, 2011 (SI. No 477 of 2011) (as amended). This NIS is also completed in accordance with the provisions of the European Union (Foreshore Act 1933) (Environmental Impact Assessment (Amendment)) Regulations 2021. This NIS, prepared by ECOFACT Environmental Consultants Ltd. on behalf of BioAtlantis, will inform and assist the competent authority in carrying out its Appropriate Assessment as to whether or not the proposed activities will adversely affect the integrity of any European site, either alone or in combination with other plans and projects, taking into account their conservation objectives. This NIS accompanies the application by BioAtlantis Ltd. for a licence to sustainably hand harvest *Ascophyllum nodosum* in Clew Bay, as required under the Foreshore Act 1933 as amended or as may be amended in the future.

1.2 Legislative context

Part XAB of the 2000 Act and SI. No 477 of 2011 transpose into Irish law, Directive 2009/147/EC of the European Parliament and of the Council of 30th of November 2009 on the conservation of wild birds (the Birds Directive) and Council Directive 92/43/EEC of 21st of May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). These Directives require Ireland to establish protected sites as part of a European wide network of sites (known in Ireland as European sites) for habitats and species that are of international importance for conservation. In Ireland, European sites include Special Areas of Conservation (SACs, including candidate SACs) and Special Protection Areas (SPAs). Article 6, paragraphs 3 and 4 of the EC 'Habitats' Directive (1992) state that:

6(3) 'Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.'

6(4) 'If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted. Where the site concerned hosts a priority natural habitat type and / or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.'

In addition, the European Court of Justice in Case C-127/02 (the "Waddenzee Ruling") has made a relevant ruling in relation to Appropriate Assessment and this is reflected in the current assessment:

‘Any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site’s conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or project” and that the plan or project may only be authorised where no reasonable scientific doubt remains as to the absence of such effects.’ - Case C-127/02 (Landelijke Vereniging tot Behoud van de Waddenzee, Nederlandse vereniging tot Bescherming van Vogels v. Staatssecretaris van Landbouw, Naturbeheer en Visserij).

2. DESCRIPTION OF PROJECT

Clew Bay has in excess of 90 islands and 100km of coastline that contain harvestable quantities of *A. nodosum*. Given the ecological sensitivities identified within the Clew Bay area, harvesting must be carried out in a manner which does not negatively affect the biological environs. Utilising sustainable hand-harvesting techniques and extraction (Kelly *et al.,* 2001; Guiry & Morrison, 2013) and incorporating their use within a best practice approach, BioAtlantis have developed a sustainable model of seaweed harvesting in Clew Bay. Subject to obtaining a licence to harvest in Clew Bay, BioAtlantis will contract up to 16 full-time hand harvesters from the region, to harvest up to a maximum of 11,018 tonnes per annum. BioAtlantis will recruit harvesters with previous experience or whose families have farms or fishing interests in the area and will work with the harvesters to apply sustainable methods of harvesting, collection and conservation of the resource. In their proposal, BioAtlantis will explore the applicability of purchasing a boat for the area to collect the harvested *A. nodosum*, whilst also providing the option for harvesters to tow the floating bags/nets directly to pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

2.1 Operational phase of the proposal

The BioAtlantis proposal for sustainable hand-harvesting of *A. nodosum* from Clew Bay will include an area extending from Rosmurrevagh point on the north of Clew Bay to Leckanvy Pier in the south, including the islands within the Bay. Through use of data obtained from the field studies and evaluations by BioAtlantis Ltd. (BioAtlantis, 2024 and associated appendices) and Hession *et al*. (1998) and maps and aerial photographs of the region, it is calculated that the current maximum yield of *A. nodosum* from Clew Bay to be in the order of 64,759 tonnes. BioAtlantis’ original application estimated that there is a maximum annual sustainable harvest of ~12,900 Tonnes in Clew Bay. This figure was updated following assessments of the resource by UCD in 2016 and with the removal of areas from the harvesting plan where existing appurtenant seaweed harvesting rights were identified. The revised estimated annual sustainable harvest is 11,018 tonnes, based on harvesting a maximum of 20% of the total available *A. nodosum* biomass per site per annum (BioAtlantis, 2024 and associated appendices). As above, BioAtlantis will employ a site-specific management approach to the Clew Bay Complex SAC, throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited. BioAtlantis Ltd. will employ a Resource Manager or Project Manager to operate on site, preferably with relevant environmental qualifications, a marine ecology background and/or experience in the fishing / marine resources industry. This individual will be responsible for managing activities within the harvesting area and in ensuring sustainability of these activities. They will report directly to the company CEO, and work as part of the resource management team. The person tasked with assessing recovery post-harvesting will have a marine ecology background. Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of a collection boat (if deemed applicable to the area) ensures ease of access to the sites in use. This brings full traceability to the process, as the quality of harvest from each location is monitored and biomass is weighed on collection and recorded on a Goods Received Note (GRN), with sites also inspected post-harvest to ensure the sustainability of the methods employed (Site Inspection Form, SIF). The benefits of this approach is that harvester's times is no longer spent hauling seaweed ashore and coastal damage that could be caused by bringing in large quantities of seaweed ashore at inappropriate locations is avoided. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded. Information recorded via GRN, SIF, etc may alternatively be provided in other suitable formats by electronic or other means on site and/or at production facilities. Hand-harvested *A. nodosum* will be transported to production facilities in Tralee, Co. Kerry for further processing.

A key requirement in implementing and securing a functioning system for sustainably hand harvesting. *A. nodosum* are effective control measures, reporting, and monitoring systems. These are set out in the Code of Practice document and form a key framework for managing and ensuring that the system is being adhered to in a precise, correct, seamless and traceable manner. A key component to ensuring that the systems are being adhered to, and at the levels set out in the Code of Practice, will be a strong and robust auditing system. BioAtlantis will conduct quarterly and annual audits covering the areas below:

1. Quarterly Audit
   - i. Audit Part A: Records, Forms and Documents
     - i. Step 1: Forms: receipt of training & verification of understanding
     - ii. Step 2: Completed training certificates (obtained through training above)
     - iii. Step 3: Records, forms & documents (general)
   - ii. Audit Part B: Quality Assessment (documentation)
     - i. Step 1: Goods Received Note (GRNs): Clew Bay
     - ii. Step 2: GRNs (production facilities)
     - iii. Step 3: Incident reports
     - iv. Step 4: Non-conformance reports
     - v. Step 5: Software systems
     - vi. Step 6: Site inspection forms

2. Annual Audit (on-site)
   - i. Step 1: Site quality (inspection of harvested sites)
   - ii. Step 2: Harvest methods (inspection of techniques)
   - iii. Tep 3: Collection boat (if deemed applicable to the area)

The main BioAtlantis licence application document is provided in Addendum 3, and the BioAtlantis Code of Practice is provided in Addendum 4. The BioAtlantis Impact Assessment document is provided in Addendum 5. For more information on the auditing system and its contents, please consult Addendum 7 (Clew Bay Audit Forms – Appendix 8) of the main BioAtlantis licence application document. All control measures, action limits/non-conformance, analytical procedures, monitoring schedule (frequency), corrective actions and verification are detailed in the licence application main text document. In addition, the harvesting system will be reviewed annually to assess and verify the control measures and determine areas in need of improvement.

2.1.1 Overview of the proposed operational phase

In carrying out the operational stage of the proposal, harvest will be recorded using BioAtlantis Compliance and Record Forms (see Addendum 6). BioAtlantis has developed a management plan set out in the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC – Appendix 4', included as Addendum 4 in the current NIS. This includes the development of a database, to take account of the study area of Clew Bay including over 90 islands and 100km of coastline that contain harvestable quantities of *A. nodosum*. This database will be used to:

- Determine and manage sites which require a fallowing period to allow for adequate recovery from recent activities.
- Determine and manage rotation requirements (i.e., extrapolation and calculation of the duration or fallowing period required prior to a particular area being deemed fit for re-harvest);
- Prevent harvest activities that would lead to a decline in yield; and
- Record the details of each harvest, how much, by whom and when.

Moreover, this database represents a central, working component of the BioAtlantis best practice guidelines for harvesting *A. nodosum*, requiring:

- Development of pre-harvest plans in advance of harvest activities;
- A cap of 20% on the level of available biomass which can be harvested from a given site per annum; and
- Limitations of a 200 – 300mm (8 – 12 inches) cutting height of *A. nodosum* stipe / frond.

Table 1 below sets out the islands and shore-line areas identified as being within the proposed harvesting area for the BioAtlantis project, with *A. nodosum* densities and coverage included. There are four main types of activities associated with the operational phase include:

- Operation/Activity No. 1: Management & implementation;
- Operation/Activity No. 2: Monitoring, recording & reporting;
- Operation/Activity No. 3: Verification & analysis; and
- Operation/Activity No. 4: Long term assessment of biomass and community structure

All operations/activities are described in detail in the Code of Practice prepared by BioAtlantis, included in the Licence Application (BioAtlantis, 2024 and associated appendices) and presented in Addendum 4 of this NIS. When planning future harvests some islands will be marked as unavailable for certain times of the year, in order to ensure that known seal breeding, moulting and resting, and bird breeding and wintering sites are avoided. The resource manager will be responsible for ensuring that these sites are avoided. The list of restricted sites is set out in the Code of Practice (Addendum 4); this will be updated to reflect ongoing consultation and data available from NPWS into the future; taking account of time of year and the presence of Common seals and breeding and wintering bird populations.

BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done by visiting each site and performing an assessment of the growth and density of *A. nodosum* on each and updating the production plan as necessary with the results of this analysis.

2.1.2 Management and implementation during operations

Management and implementation components include activities relating to:

1. *Planning and scheduling of harvesting activities*: In the initial stages, it is necessary to establish details of when each area was last harvested. This will be done by working closely with the existing local harvesters, and through analysis of derived datasets, the dates and quantities of the most recent harvests for each island and coastal zone can be established. This data can then be used to derive when a region will next be available for harvest. The nominal recovery time is generally accepted to be 3-5 years from a complete harvest; a maximum harvest of 20% of the total available biomass of seaweed is permitted per site per annum to ensure sustainability.
2. *Numbers of personnel to be managed and harvest rates:* Approximately 16 full time people, or 32 part-time, will be contracted to work for an average of 230 days/year, harvesting approximately 3.5 tonnes per day (rate of ~10.4kg/m^2). The amounts harvested will be recorded to ensure adherence to licensing limits. The area harvested will be 26,923m^2 per day per 16 harvesters. This reflects a harvest rate of 20% of *A. nodosum* biomass per site per annum. This corresponds to an area occupied of 1,683m^2 per person/day or 0.4 acres per person per day, for approximately 6-8 hours per day. Approximately 2 – 4 harvesters are permitted on small-medium sized sites. Medium to large islands may require between 4 – 6 harvesters, while larger islands will likely require approximately 6 – 10 harvesters. Thus, the low number of people over a wide area reduces the potential for anthropogenic impacts (e.g., intensity of trampling) on the biotope. In fact, given that the plan targets specific areas at specific times of the year, the low levels of trampling events will also be largely episodic in nature. It is unlikely therefore, that any significant change in the structure of *A. nodosum* assemblages will occur. Furthermore, as a policy against holdfast removal will be implemented, the incidence of *A. nodosum* mortality will be reduced considerably (see 'Code of Practice', Addendum 4). As such, the harvest level of 20% of the total available biomass represents a relatively constant figure and will not be exacerbated due to significant levels of *A. nodosum* mortality due to partial or complete holdfast removal.
3. *Exploitation Levels*: As a policy against holdfast removal will be implemented, *A. nodosum* mortality and whole plant removal will therefore be prevented. Hence, the harvest rate figure of 20% of the total available biomass will remain largely constant and will not be breached due to increased mortality rates.
4. Once the re-harvesting date for each island is established, this information will be used to plan the next seasons harvesting. BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done by visiting each site and performing an assessment of the growth and density of *A. nodosum* on each, and updating the production plan as necessary with the results of this analysis.
5. *Data recording and analysis*: BioAtlantis will explore the applicability of purchasing a boat for the area to be used for the collection of harvested *A. nodosum*, piloted by the resource manager or other suitably trained employee. The seaweed collected from each point will be weighed and the details of the harvest recorded, at each collection point. The person or transport company in receipt of the harvested seaweed will complete a 'Goods Received Note' to record the harvest from each site. This also includes measurement of amount and quality of the harvested seaweed. Bag/nets will be weighted on the boat (if applicable to the area) or at the pick-up point or processing facility. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded.
6. The Resource Manager will inspect sites post-harvest to ensure the standards with respect to

the sustainability of the methods employed (Site Inspection Form, SIF). A second GRN will be completed on receipt of the harvested seaweed at BioAtlantis' factory in Tralee. Details from the GRNs will be uploaded into the main database. The quality of the supplied *A. nodosum* will be assessed by the quality control and/or production team and details of any deviations from the specified requirements recorded on the harvest record. Computerised data will be maintained of all harvest records and non-conformances.

7. *Access and Navigation at harvest sites*: The harvesters shall use their own boats to navigate to and from the island sites. In the case of coastal sites, the harvesters shall be responsible for access to and from the sites via existing access routes. The size of the shore area covered by an individual bag or net will be approximately $2m^2 – 8m^2$. Harvest will occur at islands and shorelines as described in the harvest management plan. Floating nets or bags will then be picked up at each location in which harvest took place. Alternatively, harvesters may tow the floating nets or bags from the harvest site directly to the pick-up points. Final pick-up points will be at established piers and harbours, particularly in Westport and Newport. Access to the northern coastal area will be via the roads at Knockmanus road, Roskeen South Road, Carrowsallagh Road, Keeloges Road, and via boat. Access to the Milcum harvesting site will be via the Teevmore Road. The coast roads on Knockeeragh and Rosclave provide good access to the harvesting sites in this area. The harvesting site at Rosanrubble can be accessed by boat and from the road to Rosanrubble Point. The harvesting area between Bleanrosdooaun Strand and Monkelly can be accessed by road to Roslaher, Rostoohy Pier, Moyna Strand, Ardkeen Quay, Roscahil Road, Rosmindle Road, Castleaffy, Rosmoney, Rusheen, Carrowcally, Bawn Strand, & Monkelly Strand. BioAtlantis will explore the applicability of purchasing a boat for the area, that will be approved by the Marine Survey Office (MSO) for use on the open waters of Clew Bay, and used to collect the harvested A. *nodosum* from the designated sites. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. The harvesters will be made aware that all harvested *A. nodosum* must be collected by BioAtlantis for weighing and processing, and the seaweed will only be collected from the sites or pick up points identified on the harvesting schedule or at sites which are approved by BioAtlantis. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.
8. *Communication*: The number of harvesters involved in harvesting the requirements of BioAtlantis will be below ten initially, rising to sixteen over time. Communication of the harvesting plan will be done in advance each month/quarter via email or post. This will include information on sites that are to be harvested and the quantity and dates for each harvest site. Sites will be identified on a map and the anticipated quantities for each site indicated. Communications with the harvesters during harvesting activities will be either via a mobile phone or 2 way radios, as deemed appropriate and will be managed by BioAtlantis and the BioAtlantis Resource Manager;
9. *Hand-harvest methodology*: Training will be provided to harvesters, where necessary, to ensure competence in skills required to harvest *A. nodosum* in an environmentally friendly and sustainable manner. Activities will be carried out in accordance with a clearly defined protocol which will prevent any damage to the environment or underlying growth substrate, whilst also facilitating sufficient re- growth and re-generation of the vegetation post-harvest. The 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC' is set out in the Licence Application (BioAtlantis, 2024) and is included in Addendum 4 of the current report;
10. *Health and safety measures*: All harvesters will be provided with appropriate and certified Health & Safety Training. BioAtlantis will run regular training days for the harvesters, where necessary. The seaweed collection boat (if deemed applicable to the area) will be equipped with all necessary safety equipment as required by the marine survey office.

Table 1 Harvesting locations and quantity estimates within the Clew Bay study area.

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg/ m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
	Bartraw – Westport	CZ 1.1	61074	0	46%	0.0 T	0.0 T
		CZ 1.2	83288	0.7	100%	58.3 T	11.7 T
		CZ 1.3	57560	0.7	98%	39.4 T	7.9 T
		CZ 1.4	46890	0.7	100%	32.8 T	6.6 T
		CZ 1.5	59466	0.7	70%	29.3 T	5.9 T
		CZ 1.6	32360	1.25	100%	40.4 T	8.1 T
		CZ 1.7	47684	0.7	100%	33.4 T	6.7 T
		CZ 1.8	77259	0	54%	0.0 T	0.0 T
		CZ 1.9	7961	0.7	100%	5.6 T	1.1 T
		CZ 1.10	5559	1.25	100%	6.9 T	1.4 T
		CZ 1.11	11271	1.25	100%	14.1 T	2.8 T
		CZ 1.12	4254	1.25	100%	5.3 T	1.1 T
		CZ 1.13	136927	10.5	94%	1354.0 T	270.8 T
		CZ 1.14	76090	10.5	94%	751.9 T	150.4 T
		CZ 1.15	37232	0.5	100%	18.6 T	3.7 T
		CZ 1.16	35400	0.5	100%	17.7 T	3.5 T
		CZ 1.17	35419	0.5	100%	17.7 T	3.5 T
		CZ 1.18	6633	0.5	100%	3.3 T	0.7 T
	Westport - Rosmoney	CZ 2.1	38658	0	82%	0.0 T	0.0 T
		CZ 2.2	5199	0	100%	0.0 T	0.0 T
		CZ 2.3	8889	0	100%	0.0 T	0.0 T
		CZ 2.4	35324	0	94%	0.0 T	0.0 T
		CZ 2.5	74945	0.55	98%	40.4 T	8.1 T
		CZ 2.6	30076	0.8	100%	24.1 T	4.8 T
		CZ 2.7	7831	0	57%	0.0 T	0.0 T
		CZ 2.8	6710	0	100%	0.0 T	0.0 T
		CZ 2.9	125537	0.8	100%	100.4 T	20.1 T
		CZ 2.10	109815	0.8	97%	85.0 T	17.0 T
		CZ 2.11	9303	0	100%	0.0 T	0.0 T
		CZ 2.12	27612	0	91%	0.0 T	0.0 T
		CZ 2.13	328	0	100%	0.0 T	0.0 T
		CZ 2.14	22527	0	100%	0.0 T	0.0 T
		CZ 2.15	3842	0	94%	0.0 T	0.0 T
		CZ 2.16	6082	0	100%	0.0 T	0.0 T
		CZ 2.17	3636	0	0%	0.0 T	0.0 T
	Rosmoney - Moyna Strand	CZ 3.1	18865	0	50%	0.0 T	0.0 T
		CZ 3.2	40641	4.35	100%	176.8 T	35.4 T
		CZ 3.3	97095	4.35	100%	422.4 T	84.5 T
		CZ 3.4	12914	4.35	100%	56.2 T	11.2 T
		CZ 3.5	9650	4.35	100%	42.0 T	8.4 T
		CZ 3.6	78317	4.35	95%	323.9 T	64.8 T
		CZ 3.7	117114	4.35	100%	509.4 T	101.9 T
		CZ 3.8	8398	4.35	100%	36.5 T	7.3 T
	Rostoohy Pt - Newport	CZ 4.1	84464	4.35	92%	339.0 T	67.8 T
		CZ 4.2	27181	4.35	100%	118.2 T	23.6 T
		CZ 4.3	150517	4.35	100%	654.8 T	131.0 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg/m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
		CZ 4.4	38351	4.35	99%	164.9 T	33.0 T
		CZ 4.5	26354	0	96%	0.0 T	0.0 T
		CZ 4.6	6397	0	83%	0.0 T	0.0 T
		CZ 4.7	5572	0	100%	0.0 T	0.0 T
		CZ 4.8	6703	0	100%	0.0 T	0.0 T
		CZ 4.9	9671	0	100%	0.0 T	0.0 T
		CZ 4.10	24594	0	64%	0.0 T	0.0 T
		CZ 4.11	117165	0.85	81%	80.2 T	16.0 T
		CZ 4.12	77555	0.85	100%	65.9 T	13.2 T
		CZ 4.13	278265	0.85	79%	187.7 T	37.5 T
		CZ 4.14	110969	0.85	100%	94.3 T	18.9 T
	Newport Mallaranny Pier	CZ 5.1	61157	0	100%	0.0 T	0.0 T
		CZ 5.2	58948	3.5	79%	163.3 T	32.7 T
		CZ 5.3	105121	3.5	84%	310.9 T	62.2 T
		CZ 5.4	258002	3.5	92%	833.8 T	166.8 T
		CZ 5.5	82278	3.5	83%	240.2 T	48.0 T
		CZ 5.6	41272	3.5	100%	144.5 T	28.9 T
		CZ 5.7	145329	3.5	89%	454.2 T	90.8 T
		CZ 5.8	84126	3.5	100%	294.4 T	58.9 T
		CZ 5.9	8260	3.5	100%	28.9 T	5.8 T
		CZ 5.10	17114	3.5	100%	59.9 T	12.0 T
		CZ 5.11	4451	3.5	100%	15.6 T	3.1 T
		CZ 5.12	1689	3.5	100%	5.9 T	1.2 T
		CZ 5.13	29666	3.5	100%	103.8 T	20.8 T
		CZ 5.14	3900	1.75	100%	6.8 T	1.4 T
		CZ 5.15	30450	1.75	100%	53.3 T	10.7 T
		CZ 5.16	11735	1.75	100%	20.5 T	4.1 T
		CZ 5.17	47890	1.75	79%	65.8 T	13.2 T
1	Forillan, Illanavrick	IS 11.1	40653	6	100%	243.9 T	48.8 T
		IS 11.2	13763	10	100%	137.6 T	27.5 T
2	Kid Isd East		3966	14	100%	55.5 T	11.1 T
3	Roslynagh		7990	0	0%	0.0 T	0.0 T
4	Illannambraher		57901	19	96%	1053.2 T	210.6 T
5	Inishdasky		14818	18	100%	266.7 T	53.3 T
6	Inishquirk		25206	15	82%	308.9 T	61.8 T
7	Inishtubrid		45540	18	100%	819.7 T	163.9 T
8	Inishlim		13308	16	100%	212.9 T	42.6 T
9			41752	18	100%	75.1 T	15.0 T
	Beetle Isd North						
	Inishbobunnan						
10			566589	16	27%	246.1 T	49.2 T
10	Inishgowla						
10	Beetle Isd South						
11	InishKeel	IS 11.1	16036	12.5	100%	200.5 T	40.1 T
		IS 11.2	2083	16.75	100%	34.9 T	7.0 T
		IS 11.3	300	17.5	100%	5.3 T	1.1 T
		IS 11.4	5876	17.5	100%	102.8 T	20.6 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg/ m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
12	Black Rock		24348	2.5	100%	60.9 T	12.2 T
13	Moynish More		0	0	0%	0.0 T	0.0 T
14	Moynish Beg		0	0	0%	0.0 T	0.0 T
15	Inisherkin		53097	18	41%	387.7 T	77.5 T
16	Inishnacross		46888	18.5	61%	525.0 T	105.0 T
17	Inishilra		36300	18	78%	507.0 T	101.4 T
18	Inishcooa		70929	12	57%	486.2 T	97.2 T
19	Roeillaun		77113	5	100%	385.6 T	77.1 T
20	Inishdeashbeag Inishdeashmore		62555	0	100%	0.0 T	0.0 T
21	Inishcorky		17912	18.75	100%	335.8 T	67.2 T
22	Inishcarrick		34846	19	60%	397.3 T	79.5 T
23	Inishcoragh		24041	15	100%	360.6 T	72.1 T
24	Muckinish		33800	19.25	100%	650.6 T	130.1 T
25	Inishdaweel		22175	20	77%	342.8 T	68.6 T
26	Rabbit Isd		52391	8	58%	242.1 T	48.4 T
27	Illanascrraw		10411	18	100%	187.4 T	37.5 T
28	Freaghillanluggag h		23358	20	100%	467.2 T	93.4 T
29	Inishkee		16398	19	100%	311.6 T	62.3 T
30			15889	18	100%	286.0 T	57.2 T
31	Freaghillan West		20456	19	50%	194.8 T	39.0 T
32	Innishcannon		8656	16	100%	138.5 T	27.7 T
33	Carricklahan		0	0	0%	0.0 T	0.0 T
34	Carrickachorra		0	0	0%	0.0 T	0.0 T
35	Illanmaw		74045	0	66%	0.0 T	0.0 T
36	Freaghillan East		6422	18	100%	115.6 T	23.1 T
37			1476	16	100%	23.6 T	4.7 T
38	Inishcuill West		82042	20.75	79%	1348.2 T	269.6 T
39	Mauherillan		14262	16.75	91%	217.5 T	43.5 T
40	Inishfesh		54236	18	70%	685.8 T	137.2 T
41	Inishmolt		23618	18	100%	425.1 T	85.0 T
42	Inishloy		36182	18.5	100%	669.4 T	133.9 T
43	Inishdaff		70875	20.5	100%	1452.9 T	290.6 T
44	Inishbollog		13201	20.75	100%	273.9 T	54.8 T
45	Inishlaughil		55888	0	100%	0.0 T	0.0 T
46	Inishgowla		67983	16	22%	243.7 T	48.7 T
47	Inishoo		23072	0	13%	0.0 T	0.0 T
48	InishTurk	IS 48.1	56134	21	100%	1178.8 T	235.8 T
		IS 48.2	10755	21	100%	225.9 T	45.2 T
49	Illannaconney		17437	15	77%	201.6 T	40.3 T
50	Inishakillew	IS 50.1	69800	21.75	100%	1518.1 T	303.6 T
		IS 50.2	18583	21.75	100%	404.2 T	80.8 T
	Trawbaun		256815	19.5	89%	4468.7 T	893.7 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg/ m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
51	Carrigeenglass North						
	Moneybeg						
	Inishcottle						
52	Calf Island		30778	19.75	81%	490.3 T	98.1 T
53	Inishbee, Derrinish & Dernish West		200836	17.5	58%	2021.6 T	404.3 T
54	Freaghillan	IS 54.1	27454	19.75	66%	357.1 T	71.4 T
		IS 54.2	55101	20	90%	989.7 T	197.9 T
		IS 54.3	5995	21	100%	125.9 T	25.2 T
55	Clynish		102154	18.5	77%	1463.2 T	292.6 T
56	Ilaunnamona		25370	16	95%	384.3 T	76.9 T
57	Rabbit Island, Island More &Quinnsheen Island	IS 57.1	14757	19.5	100%	287.8 T	57.6 T
		IS 57.2	92903	16	88%	1307.4 T	261.5 T
		IS 57.3	7894	17.5	100%	138.1 T	27.6 T
		IS 57.4	9330	18	100%	167.9 T	33.6 T
58	Collan More, Carrigeenglass South & Collan Beg	IS 58.1	501217	16.75	100%	8395.4 T	1679.1 T
		IS 58.2	55220	18.75	100%	1035.4 T	207.1 T
		IS 58.3	29858	19.5	100%	582.2 T	116.4 T
59	Inishgort		64954	15.5	57%	571.7 T	114.3 T
60	Inishlyre		121285	5	57%	347.3 T	69.5 T
61	Illanataggart & Crovinish		442259	14	99%	6133.0 T	1226.6 T
62	Ininhgowla South + Carrickwee		183389	15	100%	2750.8 T	550.2 T
63	Forilan		30569	9.75	100%	298.0 T	59.6 T
64	Carrickawart	IS 64.1	26696	16	100%	427.1 T	85.4 T
64		IS 64.2	1276	14.25	100%	18.2 T	3.6 T
65	Inishlaghan		32314	14.5	83%	388.4 T	77.7 T
66	Dorinish More & Dornish Beag		27107	12.5	100%	338.8 T	67.8 T
67	Inishimmel		0	0	0%	0.0 T	0.0 T
68	Inishleauge		54366	8	77%	334.3 T	66.9 T
69	Inishdaugh		22949	6.5	72%	108.0 T	21.6 T
70	Inishraher		81224	14.7	85%	1014.1 T	202.8 T
71	Inisheeney		53625	16	85%	725.4 T	145.1 T
72	Finnaun Island		0	0	0%	0.0 T	0.0 T
73	Corillan	IS 73.1	6787	6.5	100%	44.1 T	8.8 T
		IS 73.2	1016	6.5	100%	6.6 T	1.3 T
		IS 73.3	1737	6.5	100%	11.3 T	2.3 T
		IS 73.4	3001	6.5	100%	19.5 T	3.9 T
74	Carricknamore	IS 74.1	2436	6.75	100%	16.4 T	3.3 T
		IS 74.2	1393	6.75	100%	9.4 T	1.9 T
		IS 74.3	2640	6.75	100%	17.8 T	3.6 T
75	Stony Island	IS 75.1	0	6.75	100%	43.8 T	0.0 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg/ m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
		IS 75.2	0	6.75	100%	7.5 T	0.0 T
		IS 75.3	0	6.75	100%	36.9 T	0.0 T
		IS 75.4	0	0	100%	0.0 T	0.0 T
		IS 75.5	0	5	100%	29.1 T	0.0 T
		IS 75.6	0	6.5	100%	69.2 T	0.0 T
		IS 75.7	0	6.5	100%	10.7 T	0.0 T
		IS 75.8	0	6.5	100%	61.7 T	0.0 T
76	Green Islands	IS 76.1	0	0	100%	0.0 T	0.0 T
		IS 76.2	0	0	100%	0.0 T	0.0 T
		IS 76.3	0	0	100%	0.0 T	0.0 T
77	Carricknacally		2860	6.5	100%	18.6 T	3.7 T
78	Monkellys Rock		4425	8.75	100%	38.7 T	7.7 T
79	Inishweela		24604	10	97%	238.7 T	47.7 T
80	Illanroe		28522	14	100%	399.3 T	79.9 T
81	Roeillan		16126	15	100%	241.9 T	48.4 T
Totals							11,018 T**

* Harvesting Zone ID's were assigned by BioAtlantis as part of establishing the management system.
** Revised Total (BioAtlantis, 2024).
† Maximum Annual Harvest (Tonnes) is calculated as 20% of the total available biomass per site. The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site, per annum.
§ Denotes the percentage of coastline which can support *A. nodosum* growth.

2.2 Monitoring of the *A. nodosum* resource

The biomass of *A. nodosum* will be assessed according to standard methods. The general approach to assessing biomass levels is summarised below, and may be subject to change depending on the sites involved, the underlying analytical methodology and the parameters/statistical methods employed:

- Sites located and photographed as required;
- 1m^2 quadrants may provide more robust measures of biomass over a larger area than otherwise smaller 0.25m^2 units used by Kelly *et al*. (2001) and others. Typically, 4 replicates taken per site with a distance of approximately 3 meters between each quadrant, where possible. Where density is deemed relatively homogenous according to visual estimation scales, lower number of replicates may be used;
- Harvest *A. nodosum* from each quadrant and measure wet weight per unit area;
- Record all data in the database and ensure that site is not subjected to further harvest activities until *A. nodosum* density has recovered;
- Statistical analysis: Different regions of Clew Bay will have different rates of *A. nodosum* growth. Therefore, it will be important to calculate the level of variation of *A. nodosum* in as many regions as possible. The datasets will allow for high density mapping of the distribution of the resource within the complex. This will build upon the study by Hession *et al*. (1998) and provide a more detailed analysis of the extent of the resource in the area. Analysis will be performed using geospatial tools and/or by means of One-Way ANOVA, linear regression or similar tests using software such as GraphPad PRISM;
- Following the assigned fallowing period, repeat the steps outlined above, and where possible, 1m^2 quadrants will be assigned in the same location as previously. Alternatively, replicates may

be assigned randomly if required.

- Harvest *A. nodosum* and record data as described above;
- Replicate size, type and number and statistical methods may be changed to enhance the accuracy of the assessment.

Immediately following harvest, *A. nodosum* will be bagged and weighed automatically on the boat (if deemed applicable to the area) or at the pickup point or processing facility. Details will be recorded on the GRN on arrival at the pier, thus allowing for accurate recording of the locations and quantities of *A. nodosum* harvested per unit area. The resource manager will be responsible for uploading the data from the GRN forms to the harvest database. The maintenance of the database will be the responsibility of BioAtlantis staff. Other staff (e.g. scientific, production and quality personnel) will have access to the database as required for the correct implementation of their duties.

Locations and periods of harvest must be planned in a manner which ensures that (a) there is no damage incurred to the environs of this SAC region, (b) there is sufficient *A. nodosum* biomass available for harvest and (c) sufficient time has passed to allow for recovery. The most accurate means of ensuring that each of these goals are met is through the statistical analysis of datasets as they emerge. In this way, staff at BioAtlantis will make decisions which are informed by knowledge of the rates of *A. nodosum* re-growth and regeneration. Data relating to biomass levels, re-growth and re-generation will be incorporated into the harvest management database for use in planning harvest periods.

In terms of quality control, BioAtlantis, as a GMP+ certified company, must ensure full traceability to end users of the origin and location of the raw material used in the products manufactured. Therefore, the Quality Control system in BioAtlantis will play a key role in the management and monitoring of work relating to harvest of *A. nodosum* in Clew Bay. In brief, this will involve:

- Assessment of quality control checks on harvesting activities in Clew Bay to ensure conformance with quality and other requirements for the SAC;
- Assessment of quality control checks to ensure recording is conducted appropriately (Goods Received Notes (GRN), Site Inspection Form (SIF) etc);
- Implementation of corrective actions where necessary;
- Liaise with BioAtlantis GMP+ Team on non-conformance issues should they arise;
- Utilisation of this knowledge in the preparation, scheduling and allocation of resources for harvesting;
- Assist in the implementation and training of personnel & contractors involved in hand harvesting activities in the Clew Bay area;
- Liaise with the BioAtlantis R&D Department regarding interpretation of data and on research and development related issues; and
- Ensure customers have full traceability from point of harvest to the end product.

The quota for each island is a sustainable harvest of 20% of *A. nodosum.* The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site per annum. If this quota is exceeded, the Resource Manager will issue a Non-Conformance Report (NCR) to BioAtlantis management. Harvesters will be provided with training if necessary. Harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the Property Registration Authority of Ireland (PRAI), the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. The Resource Manager will routinely inspect sites post-harvest to ensure compliance of harvesters with sustainable hand harvest methods. Harvest will be recorded using BioAtlantis Compliance and Record Forms (see Addendum 6).

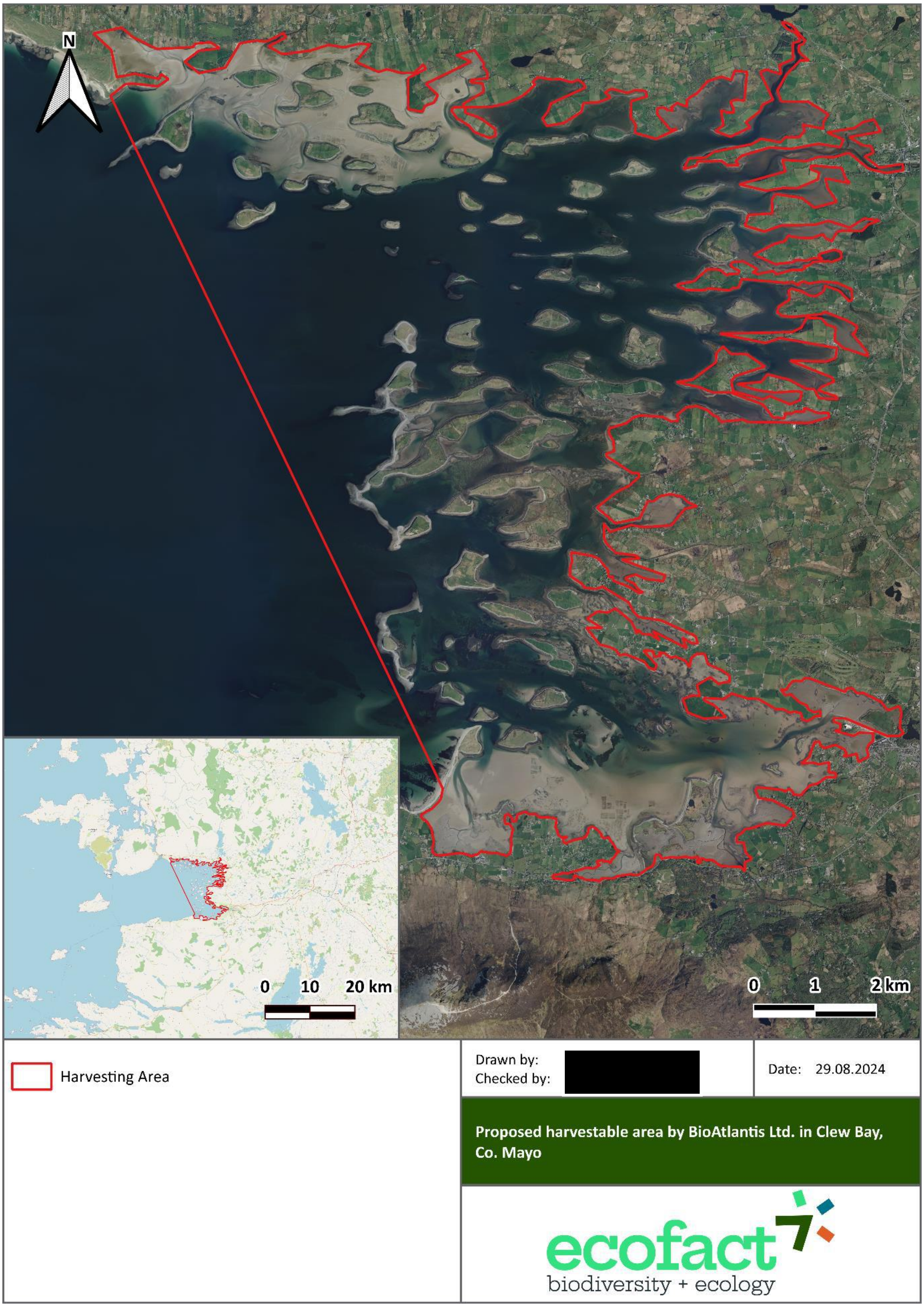

Figure 1 Proposed harvestable areas by BioAtlantis Ltd. In Clew Bay, Co. Mayo

3. METHODOLOGY

3.1 Desk study

A desktop study was undertaken to identify the extent and scope of the potentially affected designated Natura 2000 sites within the current study area in relation to the proposed hand-harvesting of *A. nodosum* within Clew Bay. The desktop study identified the designated Natura 2000 sites within the zone of influence of the project and identified this as the study area for consideration in the current NIS. Following the DoEHLG (2010) guidance publication a distance of 15km is presented as a suitable radius for sites potentially affected, in the absence of pathways identified where Natura 2000 sites outside of this radius could potentially be affected. The desk study undertaken for the current NIS included a review of the baseline survey data undertaken to inform the Conservation Objectives for Clew Bay Complex, including marine and intertidal surveys commissioned by the NPWS:

- Aqua-Fact (1999) A survey of selected littoral and sublittoral sites in Clew Bay, Co. Mayo. Duchas, The Heritage Service, Dublin;
- Falvey, *et al*., (1997) Survey of intertidal sediment biotopes in estuaries in Ireland. Unpublished report to the National Parks and Wildlife Service;
- McCorry (2007) Saltmarsh Monitoring Project 2006: Summary Report. Research Branch, National Parks and Wildlife Service, Dublin;
- McCorry & Ryle (2009) Saltmarsh Monitoring Project 2007-2008: Volume 4. Research Branch, National Parks and Wildlife Service, Dublin;
- MERC Consultants (2006) Surveys of sensitive subtidal benthic communities in Slyne Head Peninsula SAC, Clew Bay Complex SAC and Galway Bay Complex SAC. Project Report on behalf of the National Parks and Wildlife Service;
- NPWS (2011a) Conservation Objectives: Clew Bay Complex SAC 001482. Version 1.0 (July 2011). National Parks and Wildlife Service, Dublin;
- NPWS (2011b) Clew Bay SAC (001482) Conservation objectives supporting document - coastal habitats. Version 1. National Parks and Wildlife Service, Dublin;
- NPWS (2011c) Clew Bay Complex SAC (001482) Conservation objectives supporting document- marine habitats and species. Version 1. National Parks and Wildlife Service, Dublin;
- Ryle*, et al.* (2009) Coastal Monitoring Project 2004-2006. National Parks and Wildlife Service, Dublin.

Additional reporting prepared by BioAtlantis was also reviewed with regard to field survey observations within the study area and the assessments undertaken with regard to sustainable harvest management, potential impacts and interactions, as set out in the updated Foreshore Licence Application (BioAtlantis, 2024). To assess cumulative effects, data was also taken from online resources to measure the extent of existing activities. Information on aquaculture activities, other harvesting activities, or harvesting of invertebrates, and information for tourism, and recreation, was also taken from online sources. Some information was derived through word-of-mouth or as ‘common knowledge’.

3.2 Site survey

A broad-scale survey was completed in 2013 and comprised a walkover survey of the Clew Bay area. A site walkover survey and visual assessment was undertaken to inform the NIS with regard to the qualifying interests and conservation features of the Natura 2000 sites within the study area of the proposed project.

3.3 Consultation

During preparation of this document consultation was undertaken, both directly and indirectly (via publicly available information / databases / websites) with relevant statutory bodies and stakeholders. Additional consultation undertaken by BioAtlantis Ltd. informed the assessment including early stage discussions and scoping with the Department of the Environment, Community and Local Government. Direct consultation of relevance to the current NIS was also undertaken with Inland Fisheries Ireland (IFI) and with NPWS.

A consultation meeting with the regional staff of NPWS was held on the 13th of November 2013, in order to inform the Appropriate Assessment and to highlight ecological constraints and sensitivities at a local level. This meeting was also attended by a representative Marine Ecologist from the Science and Biodiversity section of the NPWS. Key constraints and sensitivities with regard to the Clew Bay Complex SAC and wider ecological issues, outside the remit of the Appropriate Assessment process were identified, with requirements for the avoidance of significant adverse effects clearly specified at this meeting.

BioAtlantis Ltd. submitted a Natura Impact Statement to the Department of the Environment, Heritage and Local Government. NPWS identified a number of deficiencies in the Natura Impact Statement submitted for the proposed project and requested significant additional information. The observations from the NPWS are detailed in a response (reference: FS6269). These items of further information are listed hereunder:

- Greater clarity is required in relation to the spatial extent of the harvesting techniques and this should make reference to the noted intention to manage expansive and prolonged operations. The potential interaction of seaweed harvesting may include impacts from targeted and non-targeted removal of species, disturbance and displacement of species (particularly benthic species), changes in community structure (the cited measure (Kelly et. al. 2001) of biodiversity stasis is deficient in respect of its short study duration, focus towards macro-invertebrates, and the lack of quantitative information on species prevalence), changes in hydrodynamics, and potential disturbance of marine fauna. It is encouraged that a more holistic examination is generated.
- The potential interaction with coastal habitats is inadequately covered. It is recognised that primary production on the shore is critical in the formation of some coastal habitat types. The loss or removal of this source has not been recognised in the accompanying documentation and is critical in examining the conservation interaction with those features.
- The interaction of other operations within the Bay which act in-combination requires further detail. In terms of unlicensed or traditional harvesting of seaweed the current estimation is unresolved. Further information will be required in relation to the interaction of planned and casual harvesting of seaweed to ensure compliance with the conservation objectives of the site.
- In relation to invasive species, such as *Didemnum vexillum*, the proponent must include information to demonstrate the potential interaction of the proposed activities and if necessary derived mitigation or management measures to ensure that harvesting of seaweed is not a vector for spread within Clew Bay Complex SAC.

Consultations between NPWS and BioAtlantis took place between 04/09/14 and 09/09/14, thus providing clarity on obligations for ensuring that four key measures of conservation status are adhered to. These are area, range, structure and function. Future prospects are also required when considering effects in SAC and SPA areas. As hand harvesting of *A. nodosum* does not give rise to permanent damage to the shore, it does not interact with the parameters of area or range (NPWS, personal correspondence). However, targeted removal of species has potential to result in alterations to structure and function. The NIS completed in 2014 has been updated to reflect the most recent European Court of Justice (ECJ) judgements and guidance as well as to reflect updated mitigation provided by BioAtlantis which have been included in their documents as a result of public consultations.

3.4 Calculation of community area within Clew Bay

Taking cognisance of the NPWS recommendation that continuous disturbance of each community type within Clew Bay Complex SAC should not exceed an approximate area of 15%, there was a requirement to perform calculations. To measure the potential impact on structure and function in Clew Bay, BioAtlantis requested marine community type datasets for Clew Bay. A shapefile of relevant community types was provided by NPWS in ESRI format (18/08/2014). Using this data BioAtlantis calculated the total area (m^2) in Clew Bay SAC of each marine community type, the area affected by harvest activities/annum (m^2 and percentage). BioAtlantis calculations are presented in the current report.

3.5 Assessment Methodology

The European Commission Guidance Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC prescribes a staged process, as set out below, the need for each stage being dependent on the outcomes of the preceding stage.

1. Screening for Appropriate Assessment
2. Appropriate Assessment
3. Assessment of Alternative Solutions
4. Assessment where no alternative solutions exist and adverse impacts remain, i.e., the Imperative Reasons of Overriding Public Interest test, and compensatory measures

Stage 1 of the process is referred to as screening for Appropriate Assessment and identifies whether the proposed activities, either on its own or in combination with other plans or projects, would be "likely to have a significant effect" upon any European site in view of best scientific knowledge and taking into account the sites conservations objectives.

If effects are considered likely to be significant, potentially significant or uncertain, or if the screening process becomes overly complicated, the process must proceed to Stage 2: Appropriate Assessment, with the preparation of a Natura Impact Statement to inform the Appropriate Assessment that is to be conducted by the competent authority.

3.5.1 Natura Impact Statement

A Natura Impact Statement (NIS) considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. The current report is set out in the format of a NIS and comprises a scientific examination of the plan / project and the relevant Natura 2000 sites; to identify and characterise any possible implications for the site in view of the site's conservation objectives, structure and function, taking account of in-combination effects. The requirements for Appropriate Assessment derive directly from Article 6(3) of the EU Habitats Directive (1992).

Direct and indirect impacts in isolation or in combination with other plans and projects on the identified Natura 2000 sites in view of the sites' conservation objectives have been examined. Case law of the European Court of Justice (ECJ) has established that Appropriate Assessment must be based on best scientific knowledge in the field. These are the qualifying interests i.e., Annex I habitats, Annex I bird species (EU Birds Directive, incorporated into the EU Habitats Directive) and Annex II species hosted by a site and for which that site has been selected. The conservation objectives for Natura sites (SACs and SPAs) are determined under Article 4 of the Habitats Directive and are intended to ensure that the relevant qualifying interests, i.e. Annex I habitats, Annex I bird species and Annex II species present within the designated sites, are maintained in a favourable condition. The current assessment of the proposed hand harvesting provides a description of the project and the receiving environment. The conservation objectives of Natura 2000 sites potentially affected by the proposal are listed and potential impacts outlined with respect to the integrity of the Natura 2000 site. Mitigation measures have been proposed for the protection of the conservation interests and the avoidance of impacts to Natura 2000 sites occurring within the study area.

4. EUROPEAN SITES LIKELY TO BE AFFECTED

The screening for Appropriate Assessment has identified Natura 2000 sites within a 15km radius of the proposed project, following the guidance published by DoEHLG (2010). The Screening for Appropriate Assessment Report is included in Addendum 1. The conservation interests of the Natura 2000 sites and the potential for interactions leading to significant adverse effects arising from the proposed project are identified for each site, included in Addendum 1. The only Natura 2000 site identified as being potentially impacted by the proposed activities is the Clew Bay Complex SAC. The locations of the SAC and SPA Natura 2000 sites within the study area are presented in Figure 2 & 3.

4.1 Clew Bay Complex SAC

Clew Bay is a wide, west-facing bay on the west coast of Co. Mayo. It is open to the westerly swells and winds from the Atlantic, with Clare Island giving only a small amount of protection. This drumlin landscape was formed during the last glacial period when sediments were laid down and smoothed over by advancing ice. The sea has subsequently inundated the area, creating a multitude of islands. The geomorphology of the bay has resulted in a complex series of interlocking bays creating a wide variety of marine and terrestrial habitats. The Clew Bay Complex SAC is designated for the presence of the following Annex I habitats: mudflats and sandflats, coastal lagoons, large shallow inlets and bays, annual vegetation of drift lines, embryonic shifting dunes, marram dunes (white dunes), perennial vegetation of stony banks, shifting dunes along the shoreline with *Ammophila arenaria*, machairs, old sessile oak woods and Atlantic salt meadows. This SAC is also designated for the protection of the following Annex II species: Geyer's whorl snail, Otter and Common Seal.

4.1.1 Qualifying Habitats

The Clew Bay Complex SAC is designated for the presence of the following Annex I habitats: mudflats and sandflats, coastal lagoons, large shallow inlets and bays, annual vegetation of drift lines, embryonic shifting dunes, marram dunes (white dunes), perennial vegetation of stony banks, shifting dunes along the shoreline with *Ammophila arenaria*, machairs, old sessile oak woods and Atlantic salt meadows.

Table 2 Account of the coastal habitats for which the Clew Bay Complex SAC has been selected. Description and ecological characteristics taken from NPWS (2011b) and JNCC website.

Habitat	Description and ecological characteristics
Mudflats and sandflats [1140]	Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. In areas of low energy, or sheltered shores, sediments are poorly sorted with high levels of organic matter and silt content. Extreme shelter favours the establishment of a predominantly sessile tube-dwelling community of polychaetes with often high numbers of bivalves also well represented. As in moderately exposed shores, some species characteristic of subtidal areas may also be present. In *Zostera marina* addition, beds of the seagrass may occur at the lower margins. A wide range of species, such as *Arenicola marina* lugworm, and other polychaete worms and bivalve molluscs can colonise these sediments.
Coastal lagoons [1150]	There are two lagoons within the SAC: Lough Furnace and Claggan Lough. Lough Furnace is located at the north-eastern corner of Clew Bay. The lough is a good example of a deep, stratified, saline lake lagoon in a very natural state. Salinity levels can vary considerably here depending on rainfall and tides. The lake is one of the very few permanently stratified lakes known in Ireland and Britain.

Habitat	Description and ecological characteristics
Large shallow inlets and bays [1160]	Large shallow inlets and bays Annex I habitat encompasses the Annex I habitat Mudflats and sandflats not covered by seawater at low tide and Reefs (not designated in the SAC). As well as the communities that occur within these habitats the following benthic communities also occur within Large shallow inlets and bays: *Zostera* dominated community; maerl dominated communities; sandy mud with polychaetes and bivalves community complex, fine sand dominated by *Nephtys cirrosa* community, shingle, reef, mudflats and sandflats not covered by seawater at low tide, intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex.
Annual vegetation of drift lines [1210]	This habitat type occurs on deposits of shingle lying at or above mean high-water spring tides. The types of deposits involved are generally at the lower end of the size range of shingle (2-200 mm diameter), with varying amounts of sand interspersed in the shingle matrix. These shingle deposits occur as fringing beaches that are subject to periodic displacement or overtopping by high tides and storms. The distinctive vegetation, which may form only sparse cover, is therefore ephemeral and composed of annual or short-lived perennial species.
Perennial vegetation of stony banks [1220]	Perennial vegetation of stony banks is vegetation that is found at or above the mean high water spring tide mark on shingle beaches (i.e., beaches composed of cobbles and pebbles). It is dominated by perennial species (i.e., plants that continue to grow from year to year). The first species to colonise are annuals or short-lived perennials that are tolerant of periodic displacement or overtopping by high tides and storms. Level, or gently-sloping, high-level mobile beaches, with limited human disturbance, support the best examples of this vegetation. More permanent ridges are formed by storm waves. Several of these storm beaches may be piled against each other to form extensive structures.
Atlantic salt meadows [1330]	Saltmarshes are stands of vegetation that occur along sheltered coasts, mainly on mud or sand, and are flooded periodically by the sea. They are restricted to the area between mid-neap tide level and high water spring tide level.
Embryonic shifting dunes [2110] & Shifting dunes along the shoreline [2120] & Marram dunes (white dunes) [2120]	Sand dunes are hills of wind-blown sand that have become progressively more stabilised by a cover of vegetation. In general, most sites display a progression through strandline, foredunes, mobile dunes and fixed dunes. Dune systems are in a constant state of change and maintaining this natural dynamism is essential to ensure that all of the habitats present at a site achieve favourable conservation condition. Embryonic dunes are low accumulations of sand that form above the strandline. They are sometimes referred to as foredunes, pioneer dunes or embryo dunes, as they can represent the primary stage of dune formation. Where sand accumulation is more rapid, marram grass (*Ammophila arenaria*) invades, initiating the transition to mobile dunes (Shifting dunes along the shoreline with *Ammophila arenaria*). Marram growth is actively stimulated by sand accumulation. These unstable and mobile areas are sometimes referred to as 'yellow dunes' (or white dunes in some European countries), owing to the areas of bare sand visible between the tussocks of marram. Tidal litter contains the remains of marine algal and faunal material, as well as a quantity of seeds. Decaying detritus in the tidal litter releases.
Machairs [21A0]	Machair is a distinctive sand dune formation formed by a particular combination of physical factors, including climate and landform. Vegetation develops that is typical of calcareous to neutral sandy grassland. The most extensive and floristically-rich formations occur as a mosaic of driftline, foredune, machair plan and transitions to saline lagoons and saltmarsh, or to calcareous lochs, acidic grasslands, fens, heath or bog. In the Clew Bay Complex SAC, the majority of the machair grassland is relatively level and occurs on a fine sand substrate that is free-draining. Small patches of damp machair are often found in conjunction with the saltmarsh or low-lying depressions where water from incoming high tides occasionally reaches.
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]	This habitat type comprises a range of woodland types dominated by mixtures of oak *Quercus rober* and/or *Q. petraea* and birch *Betula pendula* and/or *B. pubescens*. It is characteristic of base-poor soils in areas of at least moderately high rainfall. In the Clew Bay Complex SAC, Keeloges Wood lies in a sheltered location between several drumlins in the north-east corner of Clew Bay. The soil type here is shallow, moist, brown-earth soil with an organic rich horizon which is occasionally peaty.

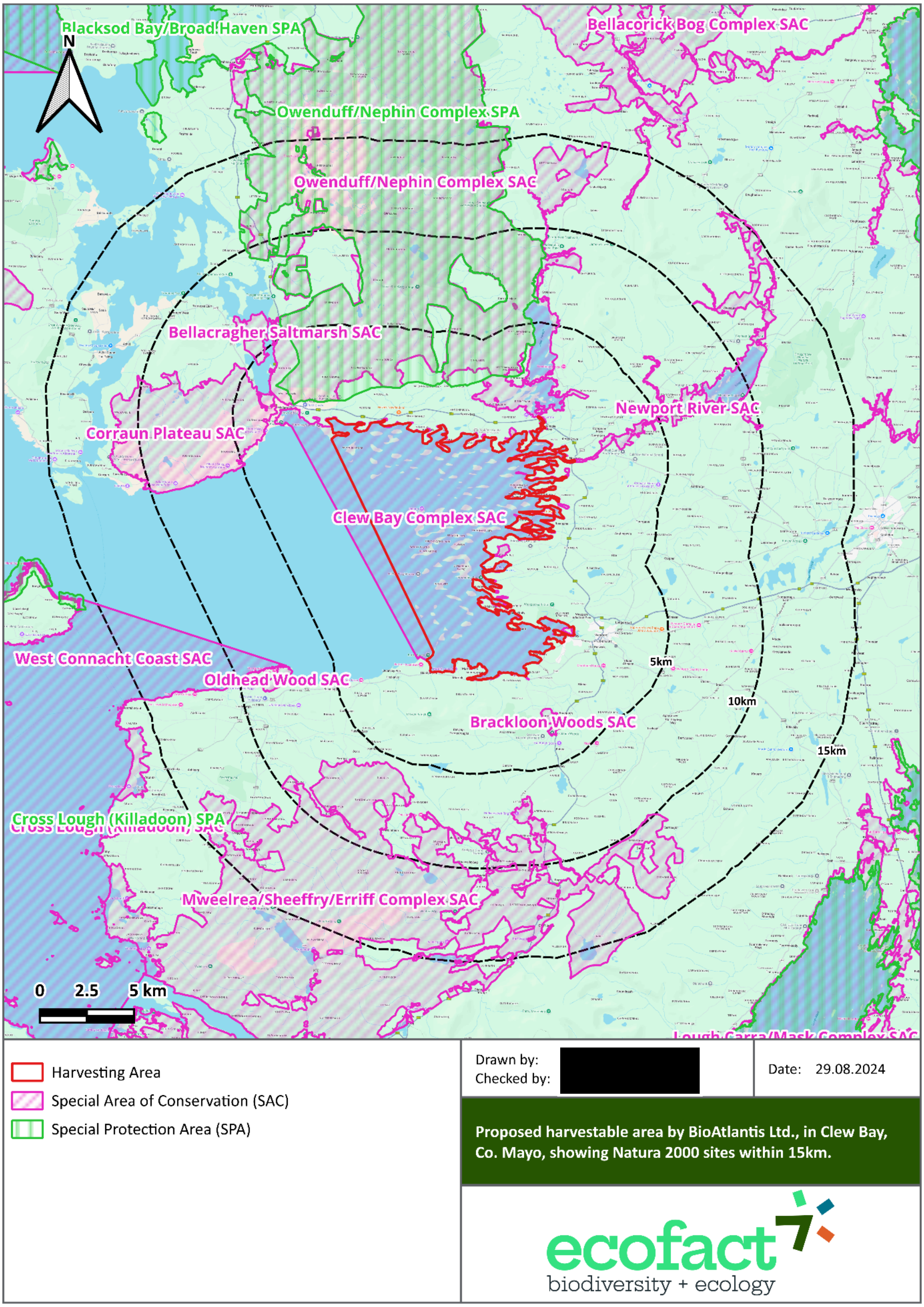

Figure 2 Proposed harvestable area by BioAtlantis Ltd., in Clew Bay, Co. Mayo showing Natura 2000 sites within 15km.

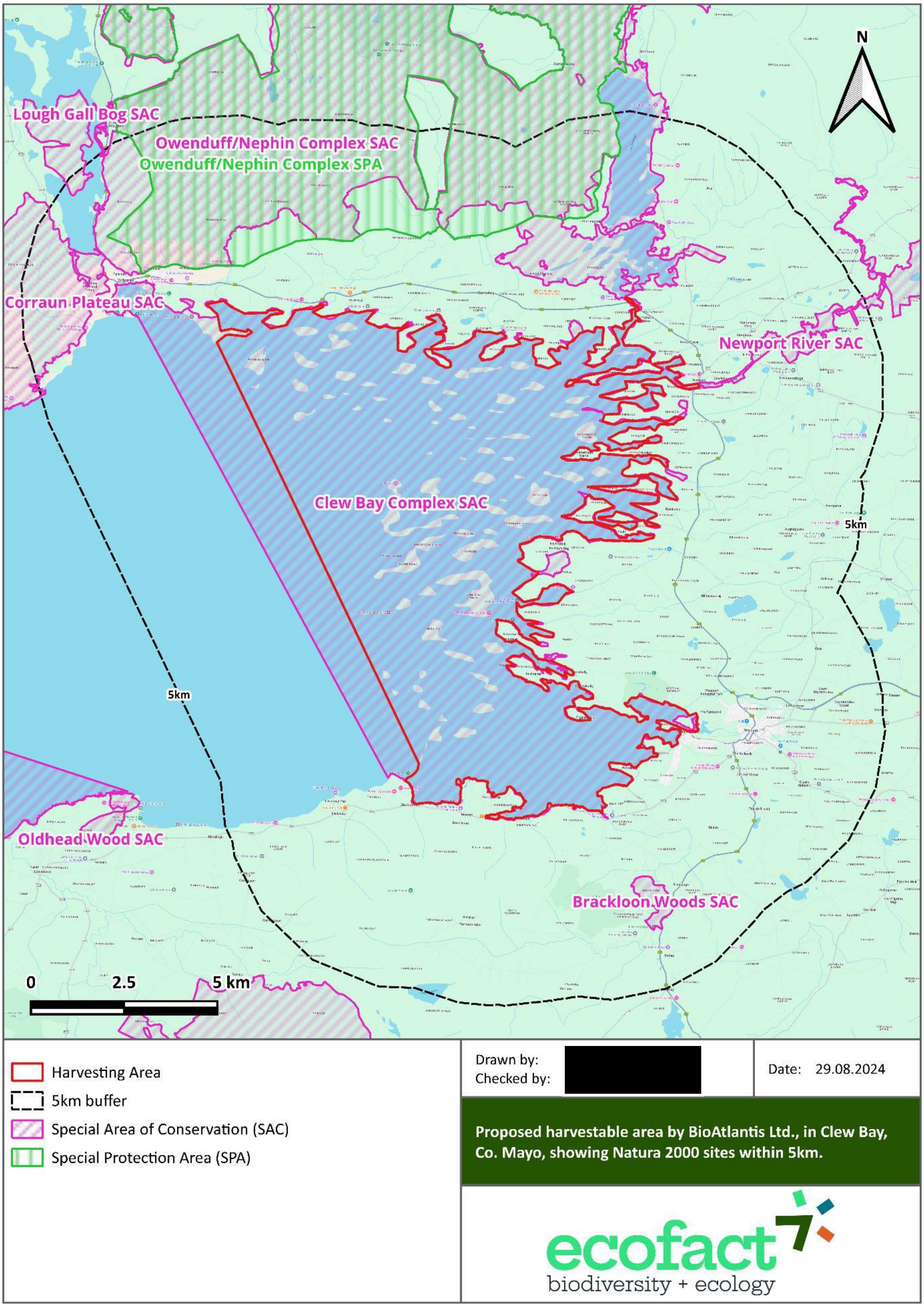

Figure 3 Proposed harvestable area by BioAtlantis Ltd., in Clew Bay, Co. Mayo showing Natura 2000 sites within 5km.

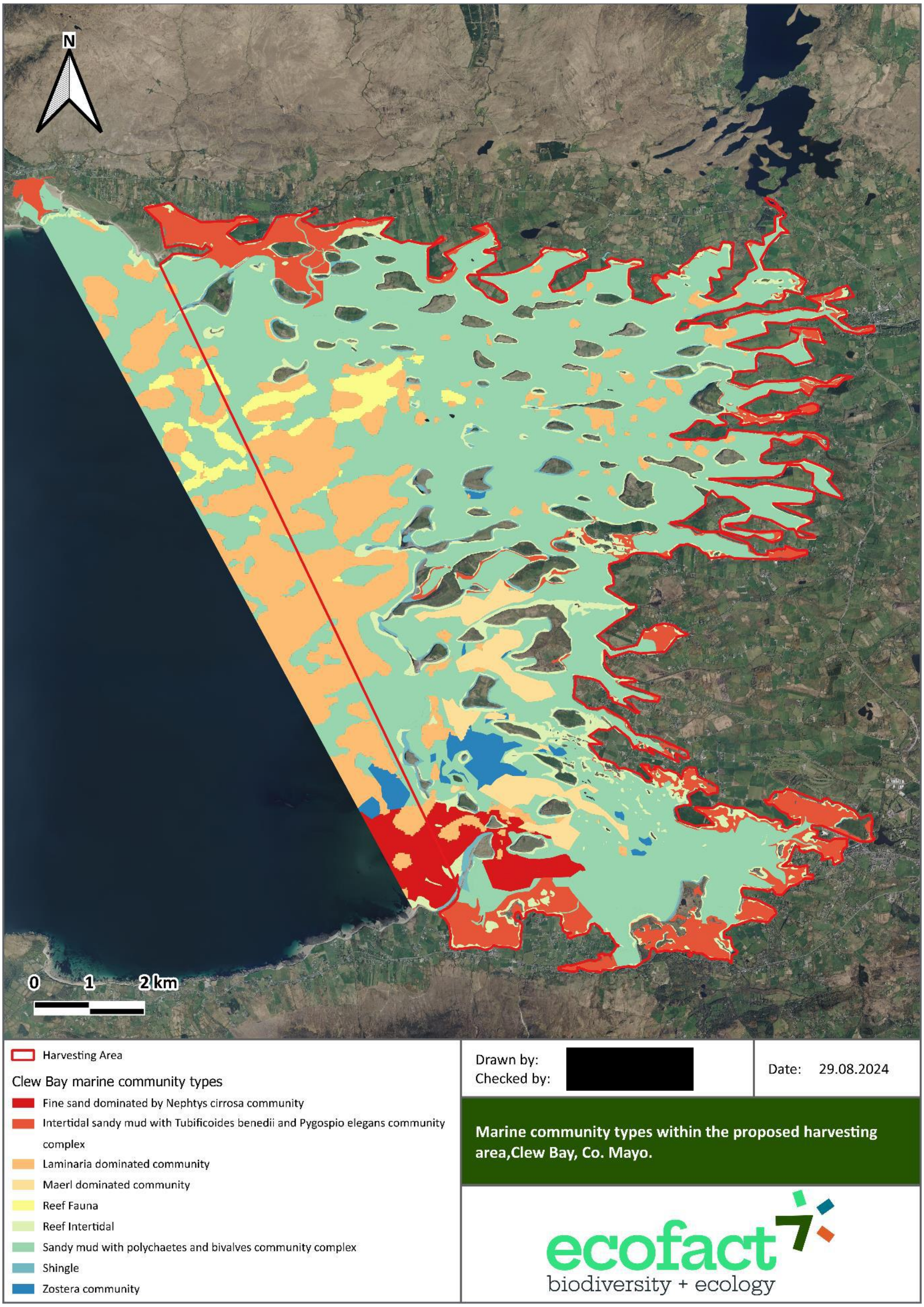

Figure 4 Marine community types with the proposed harvesting area, Clew Bay, Co Mayo.

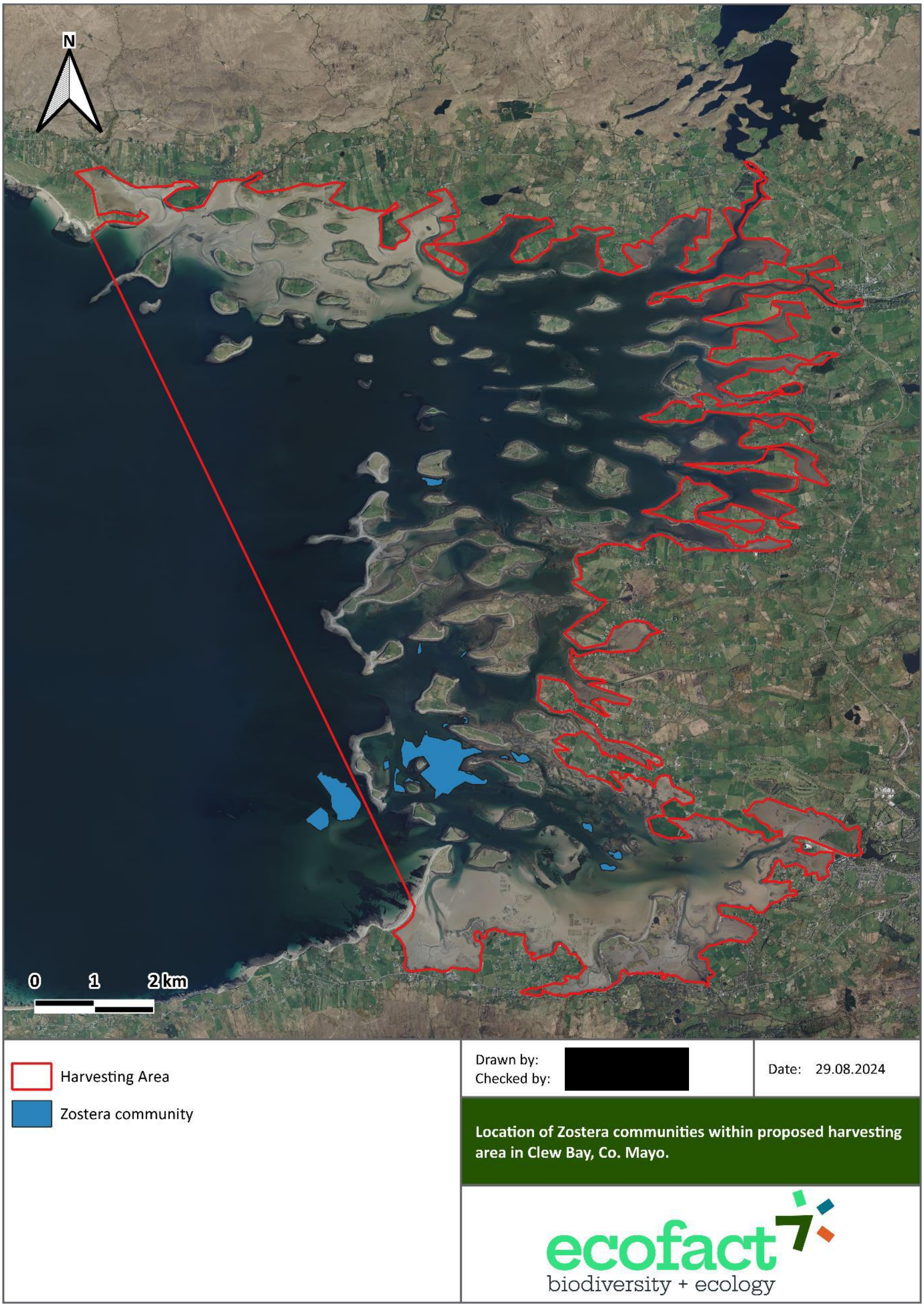

Figure 5 Location of Zostera communities with the proposed harvesting are in Clew Bay, Co Mayo.

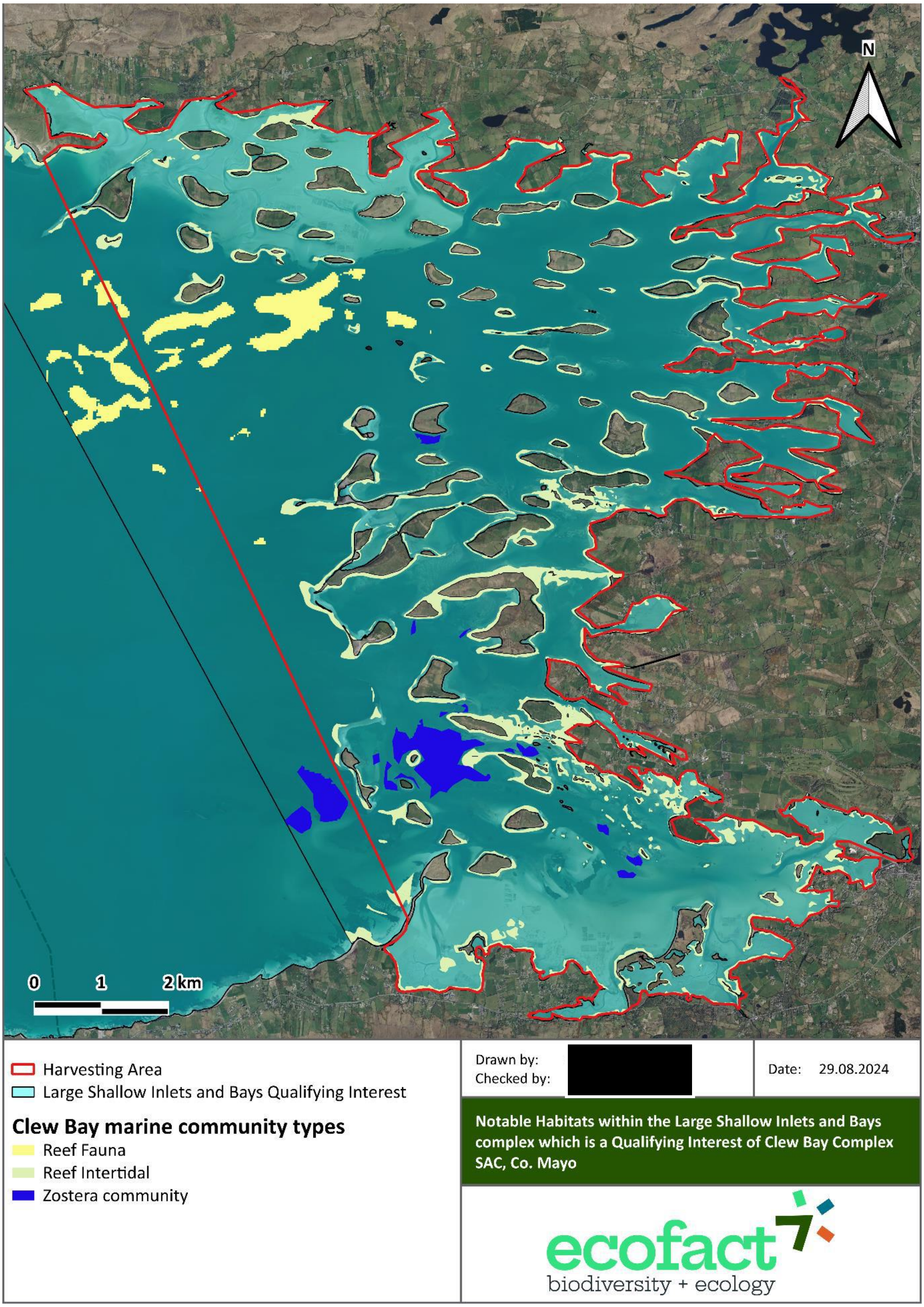

Figure 6 Notable Habitats within the Large Shallow Inlets and Bays complex which is a Qualifying Interest of Clew Bay Complex SAC, Co. Mayo**.**

4.1.2 Annex II species: Common (or harbour) seal and Otter

A description of the Common seal population and habitat requirements within the Clew Bay Complex SAC is set out in the NPWS Conservation Objectives for the site (NPWS, 2011c). The Common seal occurs in estuarine, coastal and offshore waters but also utilises a range of intertidal and terrestrial habitats for important life history functions such as breeding, moulting, resting and social activity. When hauling out ashore, common seals tend to prefer comparatively sheltered locations where exposure to wind, wave action and precipitation, for example, are minimised. Common seals occupy both aquatic and terrestrial habitats in Clew Bay Complex SAC, including intertidal shorelines that become exposed during the tidal cycle. The species is present at the site throughout the year during all aspects of its annual life cycle which includes breeding (May – July approx.), moulting (August – September approx.) and non-breeding foraging and resting phases. In acknowledging the limited understanding of aquatic habitat use by the species within the site, it should be noted that all suitable aquatic habitat is considered relevant to the species' range and ecological requirements at the site and is therefore of potential use by harbour seals.

Common seals are vulnerable to disturbance during periods in which time is spent ashore, or in shallow waters, by individuals or groups of animals. This occurs immediately prior to and during the annual breeding season, which takes place predominantly during the months of May – July. The necessity for individual seals to undergo an annual moult (i.e., hair shedding and replacement), which generally results in seals spending more time ashore during a relatively discrete season, is considered an intensive, energetically demanding process, which incurs further vulnerability for individuals during this period. Terrestrial or intertidal locations where seals can be found ashore are known as haul-out sites. The Common seal moult season takes place predominantly during the months of August – September.

The NPWS Conservation Objectives for the Clew Bay Complex SAC does include a general map of areas within the SAC that are utilised by Otters (NPWS, 2011c). This includes marine aquatic, marine terrestrial, freshwater aquatic, freshwater terrestrial, and freshwater aquatic linear habitat as well as a 250m commuting buffer around these areas. These maps typically show that Otters may utilise the majority of the SAC, both marine and freshwater, in particular the islands in Clew Bay (NPWS, 2011c).

4.1.3 Clew Bay

Clew Bay is a wide, west-facing bay on the west coast of Co. Mayo. It is open to the westerly swells and winds from the Atlantic with Clare Island giving only a small amount of protection. The drumlin landscape was formed during the last glacial period when sediments were laid down and smoothed over by advancing ice - the sea has subsequently inundated this area, creating a multitude of islands. These glacial features vary considerably in size from large islands supporting dwellings and pastures to little more than raised features on the sea floor. The numerous islands give rise to shallow straits and lagoons between which flow deep channels. This, together with the erosion of existing and submerged drumlins with their coarse glacial deposits, gives rise to a heterogeneous sediment environment. The presence of coarse material may therefore be an artefact of the glacial deposits rather than simply reflecting the level of energy present.

The geomorphology of the bay has resulted in a complex series of interlocking bays creating a wide variety of marine and terrestrial habitats, including several listed on Annex I of the E.U. Habitats Directive: large shallow bay, lagoon, Atlantic salt meadows, drift lines, perennial vegetation of stony banks, embryonic shifting dunes, Marram dunes, dune slacks and old Oak woodland. Around the edges of the inner part of the bay are shores of mixed boulders, cobbles, gravel with some sand and mud.

They have a typical zonation of intertidal communities found on sheltered shores of mixed substratum. The Rosmurrevagh area in the north of Clew Bay displays a high diversity of habitats, from seashore to dunes and coastal grassland, as well as saltmarsh, bog and fen. A further dune system occurs at Bartraw in the south-west of the site. The Clew Bay Complex is identified as being important with regard to the populations of Otter and Common seal within the bay, listed as qualifying interests of the Clew Bay Complex SAC.

A number of intertidal and marine communities/community complexes have been identified in the bay. The development of a community complex arises when an area possesses similar abiotic features but records a number of biological communities that are not regarded as being sufficiently stable and/or distinct temporally or spatially to become the focus of conservation efforts. In this case, examination of the available data from Clew Bay identified a number of biological communities whose species composition overlapped significantly. Such biological communities are grouped together into what experts consider are sufficiently stable units (i.e., a complex) for the purposes of setting conservation targets with respect to the designated Natura 2000 status of the Clew Bay Complex SAC as a whole.

In 2018 a catchment assessment was published for the Eriff-Clew Bay catchment (2010-2015). This assessment rated most of Clew Bay as “Good” waterbody status and is “under review” to define the risks present. The area within which the Clew Bay complex SAC is located was rated “High” waterbody status. There are 7 designated marine bathing areas in the catchment, six designated shellfish areas and no nutrient sensitive areas. Upstream of the bay there are 16 “at risk” river waterbodies and one lake. Pressures upstream in the catchment include agriculture, forestry, hydromorphology, domestic wastewater, extractive industry, urban wastewater treatment plants, aquaculture, and diffuse urban pressures (EPA, 2018).

A report by the Marine Institute on the need for assessment of aquaculture and fisheries in the Clew Bay Complex SAC outlines the proposed plans and projects for the area. This list includes 11 aquaculture activities and 15 fisheries. The report states that “the aquaculture activities, at the current and proposed or likely future scale and frequency of activity are consistent with the Conservation Objectives.” (Marine Institute, 2019).

As part of the NPWS saltmarsh monitoring programme Clew Bay was surveyed. Regarding the Saltmarsh Angiosperm Assessment Tool for Ireland (SMAATIE) the Inner Clew Bay area was rated as having “Poor” ecological status (Brophy, 2019). A study on the Mudflats and sandflats not covered by seawater at low tide [1140] rated the Clew Bay complex SAC as “Favourable”, and for Large shallow inlets and bays [1160] it was found to be “Unfavourable” (Scally *et al.* 2020). Large shallow inlets and bays [1160] are complex and consist of several different sub-habitats that vary from site to site. For the assessment Large shallow inlets and bays [1160] is a broad category with 5 attributes encompassing 7 habitats/community types: Sandy mud with polychaetes and bivalve community complex, Fine sand dominated by *Nephtys cirrosa* community, Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex, Shingle, and Reef. Reef is not designated within this SAC, however it is an Annex I habitat under the Habitats Directive and is a qualifying interest of other SACs in Ireland. The location of reef habitat within Clew Bay Complex SAC and the Large shallow inlets and bays [1160] habitat is shown in Figure 6.

The overall conservation status of Large shallow inlets and bays, both on a national level and in Clew Bay SAC, is considered as ‘Unfavourable-Bad’. In the context of Clew Bay, the ‘Unfavourable- Bad’ conservation status has been attributed to impacts on *Zostera* spp. (Scally *et al.,* 2020). The conservation status of Reef, which is an Annex I habitat although not specifically designated in Clew

Bay Complex SAC, is considered 'Favourable' in terms of area, structure and function, and future prospects in Ireland. This includes both inshore and offshore reef areas (Scally *et al*., 2020). *A. nodosum* primarily grows on intertidal reef substratum. Estuaries [1130] are considered as 'unfavourable-inadequate' condition in Ireland. While mudflats and sandflats not covered by seawater at low tide [1140] are in 'favourable' condition in Clew Bay, they are considered as being in 'Unfavourable-Inadequate' condition on a national level. Submerged or partially submerged sea caves [8330] and Sandbanks which are slightly covered by sea water all the time [1110] are both in 'favourable' condition nationally (Scally *et al.,* 2020).

Birds of conservation concern that were recorded in Clew Bay during the 2015/2016 I-WeBs (with counts indicated) included Pintail (1), Golden plover (32), Lapwing (71), Dunlin (159), Curlew (423), Black-headed gull (291) and Herring gull (154) which are all red-listed species. Amber listed species included Mute Swan (12), Barnacle goose (11), Light-bellied Brent goose (294), Shelduck (43), Teal (242), Goosander (6), Red-throated diver (3) Little grebe (30), Cormorant (72), Shag (31), Oystercatcher (549) Black-tailed godwit (105), Bar tailed godwit, (135), Redshank (310), Common gull (435), Lesser black-backed gull (22) and Great black-black backed gull (25) (IWeBs, 2018, Colhoun & Cummins, 2013).

The Standard Data Natura 2000 form for the SAC notes the threats and pressures currently having an impact on the qualifying interests. The threats having a high impact on the SAC are listed as nautical sports, erosion, storm and cyclone, marine and freshwater aquaculture, urbanisation, residential and commercial development. The threats listed as having a medium impact are hunting, piers / tourist harbours or recreational piers, transportation and service corridors, sand and gravel extraction, fertilisation, port areas, pollution, intensive maintenance of public parks / cleaning of beaches, hunting, fishing or collecting activities, silviculture and forestry, and flooding. The threats listed as low impact are motorised nautical sports, utility and service lines, restructuring agricultural land holding, walking, horse riding and non-motorised vehicles, non-motorised nautical sports, and bridges, viaducts (NPWS, 2020).

Westport WwTP discharges into Clew Bay at Westport. This plant provides primary, secondary and tertiary treatment along with nutrient removal. The current carrying capacity is 15042 pe and the current load is 9908 pe. This plant is therefore under carrying capacity by 5134 pe as of 2020. The effluent monitoring indicates the plant was compliant for all variables in 2020 including Biological Oxygen Demand, Carbon Oxygen Demand, Total Suspended Solids and Ammonia (as N) (Irish Water, 2020). The agglomeration in Newport, Co. Mayo is not served by a WwTP and the effluent is not compliant with the Emission Limit Values. There are plans to upgrade the plant by 2028 to ensure compliance with the licence (Irish Water, 2022). The Environmental Protection Agencies mapping portal (https://gis.epa.ie/EPAMaps/) shows that there is also a WwTP at Mallaranny which carries out secondary treatment and is not over carrying capacity (of 1017 pe) with a current pe of 667 (Irish Water, 2021). At Louisburgh there is another WwTP carrying out secondary treatment with a carrying capacity of 1000 pe and a current loading of 1118 pe, therefore 118 pe over the carrying capacity (Irish Water, 2021).

4.1.4 *Zone of Influence*

In the case of projects, the Department's Guidance on 'Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities', recognises that the likely zone of influence must be established on a case-by-case basis with reference to the following key variables (DoEHLG, 2010):

- The nature, size and location of the project;
- The sensitivities of the ecological receptors; and

- The potential for cumulative effects.

The proposed hand harvesting for Clew Bay was analysed and assessed to identify the potential impacts associated with the proposed activities that could affect the ecological environment. From this, the Zone of Influence (ZoI) of the proposed activity was defined (i.e., the area within which the proposed activities could affect the receiving environment). Based on the identified impacts, and their ZoI, the European sites potentially at risk of any direct or indirect impacts were identified.

In the case of the current proposed sustainable hand harvesting at Clew Bay, potential pathways for impacts were identified as the direct area proposed for harvesting in the intertidal zone, as well as any docking points for boats. This includes all of the islands and areas proposed by BioAtlantis for harvesting within the Clew Bay area. Any habitats which occur in the direct area of harvesting as well as those at docking points are within the ZoI for impacts. Marine habitats that could be affected by hydrological changes are within the ZoI. Additionally, any species which occur in these areas and within distance of indirect small scale human disturbance are also within the ZoI for the project.

5. ASSESSMENT OF IMPACTS

In this section the qualifying interests of the Clew Bay Complex SAC, within the Zone of Influence, will be assessed in relation to potential impacts on the integrity of the Natura 2000 site arising from the proposed activities, alone or in combination with other projects or plans.

5.1 Clew Bay Complex SAC

5.1.1 Potential for direct impacts affecting Annex I habitats

The proposal includes the sustainable harvesting of *A. nodosum* by hand within the inner Clew Bay Complex SAC, including the shoreline of the bay and the islands. The removal of *A. nodosum* from within the Annex I habitat 'Large shallow inlet and bays' has the potential for the small-scale removal of substrate material (sand, shingle and stone). The Large shallow inlet and bays habitat consists of several sub-habitats that are in different conditions and would not be uniformly impacted by the proposed project. One of these habitats is Reef, which is an Annex I habitat but is not a qualifying interest of this SAC. The reef component of the intertidal / sub-littoral habitat within the 'Large shallow inlets and Bays' is identified in the Conservation Objectives of this site as being part of the overall intertidal complex of Clew Bay, rather than as a stand-alone Annex I 'Reef' habitat; 'Reef' is not listed as a qualifying interest of the SAC, although it is an Annex I habitat. The proposal requires access to the intertidal zone of Clew Bay and will result in small-scale trampling and removal of 20% of the total available *A. nodosum* biomass harvested per site per annum. The conservation objectives of the Clew Bay Complex SAC (NPWS, 2011b, 2011c) identified that the permanent habitat area of the Clew Bay area within the SAC, including all Annex I habitats in the Bay, must be maintained at favourable conservation conditions to ensure stability of the permanent habitat area. This includes the presence of Annex I habitats not listed as individual qualifying interests of the SAC complex i.e., reef habitat. The conservation of 'Reef' habitat is identified as an individual objective with regard to the maintenance of 'Reef' communities (NPWS, 2011c). Table 3 contains a list of each Annex I habitat in the Clew Bay SAC and the area affected by hand harvest activities in BioAtlantis' application. The only habitats to be impacted by hand harvesting of *A. nodosum* are reef and shingle, at levels of 4.9% and 12.7% respectively per annum. These figures fall below the 15% limit for significant continuous or ongoing disturbance. The percentage of the reef and shingle which are Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160], that will be impacted each year is very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,189 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. The percentage of the total area of Large shallow Inlets and Bays [1160] that be utilized per annum during hand harvesting activities in the intertidal zone, is 1.54%.

The European Commission's Article 17 reporting framework notes that disturbance of greater than 25% of the area of an Annex I habitat represents unfavourable conservation status. NPWS takes the view that licensing of activities likely to cause continuous disturbance of each community type should not exceed an approximate area of 15%. Reef is one of several communities associated with Large shallow inlets and bays [1160] whilst also being an Annex 1 habitat (Reef [1170]), although not designated in its own right in the Clew Bay Complex SAC. Reef [1170] is categorised as being in a 'favourable conservation' condition in Ireland. This includes intertidal and subtidal reef areas (Scally *et al*., 2020). To ensure the 15% limit for significant continuous or ongoing disturbance is adhered to, all harvesting site locations and activities will be planned and recorded. Sites will be inspected prior to scheduled harvest to confirm sufficient biomass of *A. nodosum* is present and that it has recovered post-harvesting. Routine inspection of sites post-harvest will be undertaken to ensure compliance of harvesters with sustainable hand harvest methods. The status and quality of the *A. nodosum* habitat will be maintained by adhering to the sustainable harvesting methods and limits specified for the extent of these harvesting activities. *A. nodosum* harvesting will take place in intertidal reef areas, subject to compliance with mitigation measures listed in the Code of Practice associated with this application. This is required to ensure that Reef [1170] is maintained in 'favourable' conservation condition, in terms of area, structure and function and future prospects. Similarly, harvesters will ensure close compliance with mitigation measures when harvesting in areas that may contain shingle substratum.

It is noted that direct effects on other Annex 1 habitats will not occur, given that (a) there is no spatial overlap between harvest activities and these habitats and/or (b) there are mitigation measures in place to prevent direct interactions with these habitats during harvesting operations. Annex 1 habitats and community types that will not be affected directly by harvesting are as follows:

- Estuaries [1130]
- Mudflats and sandflats not covered by seawater at low tide [1140]
- Sandbanks which are slightly covered by sea water all the time [1110]
- Submerged or partially submerged sea caves [8330]
- Large shallow inlets and bays [1160]
  - *Zostera* community
  - Maerl dominated community
  - Fine sands dominated by *Nephtys cirrosa* community
  - Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex

A wide range of floral and faunal species are associated with the intertidal reef community. Previous assessments of the intertidal zone in Clew Bay calculated a total of 87 species, including 28 floral and 56 faunal. Typical floral species within the intertidal reef community include *Ascophyllum nodosum, Fucus spiralis, Fucus vesiculosis, F. serratus, Pelvetia canaliculata, Osmundea pinnatifida* and *Mastocarpus stellatus*. The typical faunal species include *Littorina* spp. (periwinkle), *Patella vulgata* (limpet) and *Semibalanus balanoides* (barnacle). The floral reef community beyond the intertidal zone in Clew Bay Complex SAC includes *Laminaria hyperborea*, *L. digitata, L. saccharina* and *Saccorhiza polyschides* which occur on hard reef substrate at depths of between 2m and14m. At depths of between 11m and 26m reef in Clew Bay is faunal dominated with the following species present: *Alcyonium digitatum* (soft coral), *Metridium senile* (plumose anemones), sea cucumbers *Aslia lefevrei* and *Pawsonia saxicola*, sponges *Cliona celata*, *Esperiopsis fucorum, Halichondria panicea* and *Myxilla fimbriata*, and hydroids (NPWS, 2011). Overall, the reef habitat in Clew Bay is considerably rich and must be maintained as such as required given its potential Annex I habitat status.

The targeted removal of *A. nodosum* from within the Annex I habitat 'Large shallow inlet and bays' has the potential to give rise to direct effects including: (a) excessive removal of vegetative material per individual plant, (b) excessive removal of *A. nodosum* density from an area and (c) complete or partial removal of *A. nodosum* holdfast material. Excessive removal of *A. nodosum* vegetative growth above the holdfast may directly impact on the rate of *A. nodosum* regrowth. Excess removal of *A. nodosum* biomass throughout a site may lead to a prolonging of the duration required for a particular site to recover post-harvest. Removal of holdfast material in its entirety directly results in *A. nodosum* mortality. The effects of partial removal of holdfast material are unknown and may give rise to direct mortality or reduced growth. *A. nodosum* substrate in Clew Bay is characterised by a heterogeneous mixture of small rocks, small stones & pebbles. The high degree of shelter afforded to the coastal areas of Clew Bay allows for extensive *A. nodosum* growth, even on such small, pebble-sized substrate. Inappropriate methods of harvesting *A. nodosum* on such substrate may give rise to further direct effects in the form of *A. nodosum* mortality, as small, friable substrate is known to increase the risk of holdfast by-catch (Ref: paragraph. 3, page 19, Vandermeulen *et al.*, 2013).

Table 3 List of marine community types in the Clew Bay SAC and the area affected by hand harvest activities.

Marine community types (Clew Bay SAC)	Total Area in Clew Bay SAC (m^2)	Area affected by harvest activities/ annum		Area of Large Shallow Inlets and Bays [1160] affected/annum
		(m^2)	(%)	
Zostera community	1,423,891	0	0	0
Shingle	1,855,000	235,549	12.7%	0.23%
Reef	26,870,000	1,331,699	4.9%	1.31%
Maerl dominated community	2,878,607	0	0	0
Fine sands dominated by *Nephtys cirrosa* community	2,950,308	0	0	0
Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex	7,817,100	0	0	0
Mudflats & sandflats not covered by seawater at low tide	12,541,069	0	0	0

The targeted removal of *A. nodosum* has the potential to give rise to direct effects by way of non-targeted capture, injury or removal of non-target species. This is particularly true in the case of *Fucus* sp. as these species grow alongside and often in close proximity to *A. nodosum*. Species include *F. vesiculosis* and *F. spiralis*. The likelihood of removing *Fucus* sp. is reduced as the species will not be targeted for harvest directly. As the species is considerably shorter than *A. nodosum*, the likelihood of inadvertent co-removal is also lowered. Further loss of fucoid canopy could have negative effects on understory species within the biotope, particular given that many species residing within the *A. nodosum* canopy also graze or seek shelter within *Fucus* canopies. However, the likelihood of removing *Fucus* sp. cannot be ruled out entirely as in some cases, *Fucus* can grow very close to *A. nodosum* and in rare cases can even grow directly on the *A. nodosum* itself.

It is highly unlikely that hand harvesting *A. nodosum* will lead to removal of other non-target algae species which are located at the base, low down or in proximity to the *Ascophyllum* canopy as their avoidance will be ensured by means of harvesting at low tide. Such species include: Red algae *M. stellatus* (Stackhouse) Guiry, *Chondrus crispus* Stackhouse, *Corallinaceae*; Ephemeral green algae (e.g., *Cladophora rupestris* (Linnaeus) Kützing, *Ulva* sp. Linnaeus and *Enteromorpha* sp.); other seaweed species (e.g., *Lomentaria articulata* (Hudson) Lyngbye & *Membranoptera alata* (Hudson) Stackhouse). It is highly unlikely that hand harvesting *A. nodosum* will lead to removal of *P. canaliculata*, as this small brown algae is located at the upper shore at the upper littoral zone, beyond the point where *A. nodosum* will be harvested.

Species present above the base and higher up in the *A. nodosum* canopy may be directly affected by hand harvesting *A. nodosum*. Periwinkles and limpets are important grazing species within the *A. nodosum* biotope and changes in canopy cover can lead to changes in the numbers of these species. *A. nodosum* canopy removal has been shown to cause: (a) reductions in the numbers of periwinkles *Littorina obtusata* (Black & Miller, 1991), and (b) alterations to limpet density (Davies *et al*., 2007 and references therein). In particular, the location of periwinkles within the canopy may vary according to the tide. *L. obtusata* tends to feed at high tide. At low tide, *L. obtusata* crawls into the algae canopy and remains dormant unless conditions are favourable, such as dampness, etc (Williams *et al*., 1990). This behaviour protects the organism from desiccation and temperature stress, whilst also preventing predatory attack by birds. Likewise, *L. littorea* actively feeds at high tide, seeking shelter within the canopy at low tide, in order to trap enough moisture to facilitate gaseous exchange (Karleskint *et al*. 2009).

As harvest will take place at low tide when periwinkles are less active, the likelihood of their removal is reduced considerably. *Fucus* also represents an important habitat for periwinkles. As *Fucus* will not be targeted for harvest, the likelihood of removal of periwinkles is further reduced. However, as small numbers of periwinkles may be active on *A. nodosum* at low tide, their co-removal cannot be ruled out entirely. *P. lanosa* (Linnaeus) Tandy is a small red algae which grows mainly on the tips of *A. nodosum* and in some cases, *P. lanosa* rhizoids penetrate *A. nodosum* largely for purposes of receiving structural support, thereby acting as an epiphyte. However, reciprocal exchange of photosynthetically fixed carbon compounds has been demonstrated, indicating the species is not an epiphyte in the strict definition of the term and a hemiparasitic relationship is implied (Ciciotte and Thomas, 1997). *P. lanosa* may also be found growing on *Fucus* sp. on rare occasions. It's location on *A. nodosum* fronds increases the likelihood of its co-removal. As spores from this species will continue to be released from unharvested areas, the settlement and survival of *P. lanosa* on *A. nodosum* will continue.

Hand harvesting *A. nodosum* can give rise to the potential for removal, capture or injury to other non-target species including mobile amphipods and isopods. The likelihood of their co-removal is reduced given that hand harvesting will take place at low tide, during which time their extent and movements throughout the rocky shoreline are more limited. In particular, the compositions of intertidal communities change in accordance with the tides. Fishes, decapods, crustaceans, and smaller invertebrates, such as amphipods, migrate into the intertidal zone on rising tide, with much of this behaviour relating to feeding requirements. Small or juvenile fish may also use the canopy at high tide. As harvest will take place at low tide when many of these mobile species are not present, the likelihood of their by-catch is reduced substantially. There is also the potential to disturb or displace marine fauna due to the targeted removal of *A. nodosum*. However, the likelihood of doing so is reduced as hand harvest will occur at low tide during which time, marine fauna will be present at lower levels. However, slow moving, sessile species and even some mobile species may not leave the rocky shoreline at low tide. Therefore, their co-removal, disturbance, or displacement during harvest, while unlikely, cannot be ruled out entirely.

The targeted removal of *A. nodosum* has the potential to give rise to direct effects by way of disturbance and displacement of species or substrate. *A. nodosum* can grow on almost any solid substrate provided that the coast is very sheltered. Examples include large boulders or small stony substrate (e.g., Clew Bay drumlin islands). The coastal substrate in Clew Bay is a heterogeneous mixture of small rocks, small stones & pebbles, all classified as reef by the NPWS with stated objectives for its maintenance. The high degree of shelter afforded to the coastal areas of Clew Bay allows for extensive *A. nodosum* growth, even on such small, pebble-sized substrate. Given the frequent occurrence of small substrate, hand harvesters will have full view of the cutting process and have adequate training, where necessary, to ensure that substrate is not disturbed. Increased removal of holdfast by-catch can also occur due to the presence of underlying friable substrate (ref: paragraph. 3, page 19, Vandermeulen *et al*., 2013), effects which may be exacerbated through use of inappropriate harvesting methods. In turn, this has potential to displace or impact on species which reside at the base of the canopy, such as periwinkles and limpets. This is particularly relevant for Clew Bay given the type of substrate in question, potential impacts which must be mitigated against. While effects of harvesting in the form of disturbance and displacement of substrate may occur, the risk of disturbing or displacing substrate during hand harvest with a sickle or knife in Clew Bay will be minimal, as harvesters will operate at low tide and have full control over activities.

As the proposed activities require use of a collection boat (if deemed applicable to the area) to pick up harvested *A. nodosum,* use of the harvester's boats to tow floating bags/nets containing harvested *A. nodosum* from the harvest site directly to the pick-up points or the landing of seaweed at pick up points by harvesters with existing harvesting rights, there is the potential for direct effects in terms of displacement or disturbance of reef and species therein, due to poor navigation. Besides *A. nodosum*, many other floral and faunal species associated with reef in the Clew Bay Complex SAC occur between 2m and 26m depth. The proposal does not include any activities within the upper shore, or coastal habitats identified as Annex I habitats that may be affected by the harvesting activities. All access to the shoreline will be by existing road and slipways, with islands accessed from the sea by boat. There is, therefore, no potential for direct impacts affecting the conservation status of the coastal and upper shore habitats listed as qualifying interests of the Clew Bay Complex SAC.

Specific control and mitigation measures have been included in the current proposal, integrated into the Harvest Management Plan and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC', to avoid the potential for significant direct impacts affecting the conservation status of the Annex I habitat 'Large shallow inlets and bays', with regard to Clew Bay as a whole. This includes specific impact assessments for certain habitats within the Large shallow inlets and bays complex of habitats. These measures are specified in detail in the proposed mitigations of the NIS.

5.1.2 Potential for direct impacts affecting Annex II species

As the proposal requires activities within the Clew Bay Complex SAC, which supports Annex II Common seal and Otter populations listed as qualifying interests of the site, there is the potential for direct impacts to arise with regard to human disturbance. Both the Common seal and the Otter utilise the shorelines and intertidal habitats of Clew Bay and the islands. Common seals require isolate shorelines, primarily on the islands, for important life-cycle stages: breeding, moulting and resting (haul-out). The proposed harvesting activities give rise to the potential for direct human disturbance including increased noise, habitat disturbance, and disturbance to foraging. The species is present during all aspects of its annual life cycle including breeding (approx. May – July), moulting (approx. August – September) and phases of non-breeding foraging and rest (approx. October – April). Harbour seals and their pups are vulnerable to disturbances during May – July, the time period just prior to and during the annual breeding season. This is due to the large amount of time spent in shallow waters or ashore.

There are many established breeding locations used in Clew Bay, most of which occur in the Northern part of this complex. There are several moult haul-outs in Clew Bay which are important sites for moulting, of which include: Inishdeashmore, Inishdeashbeg and adjacent skerries, Inishnakillew, Inisheeny, Carrickwee, Inishgowla South, Forillan, Finnaun Island, Carrickawart Island, Corillan, Carricknamore, Stony Island and adjacent skerries, the Green Islands and adjacent skerries. There are also several resting haul-out sites in Clew Bay, of which include: Inishdeashbeg and adjacent skerries, Inishtubrid, Inishcuill, Carrickawart Island, Stony Island and adjacent skerries, the Green Islands and adjacent skerries (NPWS, 2011c). Specific Conservation Objectives (NPWS, 2011c) for the Clew Bay Complex SAC with regard to the Common seal are:

- breeding sites should be maintained in a natural condition;
- moulting sites should be maintained in a natural condition;
- haul-out sites should be maintained in a natural condition; and
- human activities should occur at levels that do not adversely affect the harbour seal population at the site.

Specific control and mitigation measures have been included in the proposal, integrated into the Harvest Management Plan and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC', to avoid the potential for significant direct impacts affecting the conservation status of Common seal with regard to the Conservation Objectives of the Clew Bay Complex SAC. These measures are specified in detail in the proposed mitigations of the NIS.

Otter are recognised to rely more closely on the shoreline and were found to occur in good numbers within the Clew Bay area (Bailey and Rochford, 2006). According to the NPWS Conservation Objectives (2011c), otters utilise a wide number of habitats and areas within the SAC including the freshwater and estuarine reaches of rivers. Lough Furnace and the Burrishoole catchment area are identified as being of significant importance for otter populations, including a 10m buffer zone around the linear shoreline habitats. It is recognised that Otters can typically forage to within 80m of the shoreline; thus their extent is likely to encompass the entire SAC, including the islands. Commuting zones between islands and coastlines are also considered to be extensive; giving rise to the potential for direct impacts arising from human disturbance including noise and disturbance of resting and foraging habitats. The Conservation Objectives of the Clew Bay SAC (NPWS, 2011c) with regard to Otters are:

- No significant decline in distribution (i.e. & positive survey sites);
- No significant decline in extent of terrestrial habitat;
- No significant decline in extent of marine habitat;
- No significant decline in extent of freshwater (river) habitat;
- No significant decline in extent of freshwater (lake/lagoon) habitat;
- No significant decline in number of couching sites and holts (minimise disturbance);
- No significant decline in fish biomass available; and
- No significant increase in barriers to connectivity.

Specific control and mitigation measures have been included in the current proposal, integrated into the updated Licence Application (BioAtlantis, 2024) and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC' (see Addendum 4), to avoid the potential for significant direct impacts affecting the conservation status of Otter with regard to the Conservation Objectives of the Clew Bay Complex SAC. These measures are specified in detail in the proposed mitigations of the NIS.

5.1.3 Potential for indirect impacts affecting Annex I habitats

5.1.3.1 Large shallow inlets and bays

The 'Large shallow inlets and bays' qualifying interest of the SAC is composed of several constituent habitats including *Zostera* spp, reefs and shingle and impacts across these habitat types in the 'Large shallow inlets and bays' QI would not be uniform. Indirect impacts potentially affecting the Clew Bay Complex SAC, with regard to the Annex I habitat 'Large shallow inlets and bays' and taking cognisance of the complex of Annex I habitats and conservation objectives associated with this overall habitat area, are identified as follows:

- Hydrodynamics, erosion and water quality; and
- Alteration of the shoreline algal community and associated infauna, epifauna and fish community within these biotopes arising from the removal of *A. nodosum*.

These potential indirect impacts are discussed separately hereunder.

5.1.3.1.1 Hydrodynamics, erosion and water quality

It is considered, based on the low intensity of boat usage and the limited equipment (hand-harvesting), that there would be no potential for significant impacts affecting the water quality or overall habitat area of Clew Bay in this regard. Protocols are in place for the management of boats and boat access during the operational phase of the proposal and are included in the mitigation section of the NIS.

As the proposed activities require physical removal of *A. nodosum* material, there is the potential for indirect effects which could lead to increased scouring or erosion due to hydrodynamic forces associated with reduced *Ascophyllum* cover. In turn, this has potential to have impacts on settlement by animals within the biotope. This is most likely to occur due to inappropriate techniques being applied or extensive harvesting occurring, such as cutting close to the holdfast (Boaden and Dring, 1980). Excessive removal of *A. nodosum* may therefore, have impacts at a local level along the intertidal zone.

The influence of *A. nodosum* on hydrodynamics beyond the intertidal zone is likely to be more limited. *A. nodosum* itself is extremely sensitive to changes in hydrodynamic forces, having adapted to growing in highly sheltered environs and with substantial difficulty in remaining attached to hard substrate in less sheltered waters, wave swept conditions, or in areas where hydrodynamics are intense. In the event of increased wave exposure, the rate of *A. nodosum* mortality is also likely to be increased, particularly as the *A. nodosum* fronds grow to levels large enough to exert greater pressure on the holdfast to separate from substrate. It is unlikely that severe reductions in *A. nodosum* cover would impact on hydrodynamics to levels that would affect habitats with mud and sand components or marine community types 'Sandy mud with polychaetes and bivalve community complex' and 'Sandy mud with polychaetes and bivalves community complex'.

With respect to Annex I habitats, there is also potential for impacts via changes to sediment supply. Taking the habitat Atlantic salt meadows, where accretion and erosion are natural elements of such systems, maintaining the sediment supply is vital for the continued development and natural functioning of a saltmarsh system. Interruption to the sediment circulation through physical structures can starve the system and lead to accelerated erosion rates. The regular ebb and flow of the tide brings salinity, but also nutrients, organic matter and sediment, which are central to the development, growth and indeed survival of saltmarshes. It is considered that similar principles can also be applied to mudflat and sandflat habitats with respect to sediment supply. Excessive removal of *A. nodosum,* which is a significant primary producer within the Clew Bay Complex SAC could lead to reductions in organic matter cycling and of deposition of dead seaweed on Annex I habitats. However, it's impact on nutrient cycling rates is likely to be more limited given the low levels of nitrogen and exceptionally low levels of potassium and phosphorus present in this species.

As the proposed activities require physical removal of *A. nodosum* material, there is the potential for indirect effects which could lead to increasing negative impacts on already stressed *A. nodosum* growth. For example, severely polluted waters can have negative impacts on *A. nodosum* performance, epiphyte infestation, colonisation and competition by green algae (Hurd *et al*., 2014), This is particularly the case when *A. nodosum* growth occurs in proximity to sewage outfalls.

Specific control and mitigation measures have been included in the proposal, integrated into the Harvest Management Plan and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC' to avoid the potential for significant indirect impacts associated with hydrodynamics, erosion, or alterations to sediment supply or *A. nodosum* performance. These measures are specified in detail in the proposed mitigations of the NIS.

5.1.3.1.2 Intertidal community structure and biodiversity stasis

As the proposed activities require physical removal of *A. nodosum* material, there is the potential for indirect effects on community structure and biodiversity status, which could arise due to inappropriate techniques being applied or extensive harvesting occurring. Factors with potential to affect community structure include: the quantity harvested, the size of the areas harvested, the level of homogeneity of harvest and the type of equipment used (Kelly *et al*., 2001).

Severe forms of harvesting which require cutting 10 – 15cm (3.9 – 5.9 inches) have been shown to have damaging effects, including: increased *Fucus*, *Enteromorpha* and *Ulva; Cirratulus*, increased the polychaete *Cirratulu*s sp. Lamark, coarser sediment with increased crustacean meiofauna, decreased animals on undersides of boulders including mussels, barnacles and byrozoans, decreased *Cladophora* on the sides of boulders and decreases in *Halichondria, Hymeniacodon* and *Balanus* on under surfaces, and reductions in animal cover and number of species in habitable underside of boulders (Boaden and Dring, 1980, and references therein). The impact of severe cutting close to the holdfast was also found to reduce animals such as *L. obtusata*, amphipods and nemerteans but did not affect other crustaceans such as shore crab *Carcinus maenas* Linnaeus, the polychaete *Spirorbis* spp., or fish >25mm in length (Black and Miller, 1991).

Assessments of the effects of hand harvesting at an increased height of 20cm (7.87 inches) above the holdfast, demonstrated recovery of *A. nodosum* cover within 11 months in Clew Bay and 17 months in Galway. Effects on the biotope were also minimal with no effects on sessile animals such as sponges or bryozoans. Overall, these studies indicate that hand harvesting of *A. nodosum* close to the holdfast has significant effects on community structure, while effects appear to be lessened by cutting at slightly higher levels of 20cm (7.87 inches).

A reduction in *A. nodosum* plant numbers and density could allow for species such as *Fucus* sp. to grow in vacant areas which have been left, resulting in a change in the botanical community structure. Periwinkles and limpets are important grazer species within the *A. nodosum* biotope and changes in canopy cover can lead to changes in the numbers of these species. While tending to feed at high tide, *L. obtusata* crawls into the algae canopy at low tide, remaining dormant unless conditions are favourable, such as dampness, etc (Williams *et al.,* 1990). This behaviour protects the organism from desiccation and temperature stress, whilst also preventing predatory attack by birds. Likewise, *L. littorea* actively feeds at high tide, seeking shelter within the canopy at low tide, in order to trap enough moisture to facilitate gaseous exchange (Karleskint *et al*. 2009), thus highlighting the importance of the canopy to these species.

The removal of *A. nodosum*, at sustainable levels has been found to not affect the distribution or density of growth of this species. According to Kelly *et al.* (2001) sustainable hand-harvesting of *A. nodosum* does not affect the epifaunal or fish community within the intertidal habitat and would not lead to an alteration of the species composition within this habitat. There are no indirect impacts identified which would have the potential to significantly affect the sub-tidal and upper shore / coastal habitats listed as qualifying interests of the Clew Bay Complex SAC. However, specific control and mitigation measures have been included in the proposal, integrated into the Harvest Management Plan and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC', to avoid the potential for significant indirect impacts affecting the intertidal community structure and biostasis as a whole. These measures are specified in detail in the proposed mitigations of the NIS.

As a primary producer and canopy forming species, *A. nodosum* is well recognised as an important structuring species, modifying the physical environment through a range of biotic interactions (Gollety *et al*., 2008 and references therein). *A. nodosum* contributes to the organic deposition throughout the littoral zone and marine environment. However, the rocky shoreline by its very nature is not a closed system and organic matter will tend to transfer from the area into the wider marine environment. *A. nodosum* is low in protein content and its contribution to nitrogen, phosphorous and potassium levels in the ecosystem are minimal. However, as a primary producer located close to the back shore, there is potential that excessive loss in *A. nodosum* cover through inappropriate harvesting techniques may impact on nearby coastal habitats. From an assessment of scientific literature, there are two coastal habitats which have potential to be impacted indirectly by hand harvest activities, Atlantic salt meadows and Sand dune habitats (see below).

5.1.3.2 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)

Clew Bay is characterised by the presence of saltmarsh habitats at various sites throughout the complex. They tend to 'fringe' the intertidal zone of muddy or sandy coasts of estuaries and protected shores. Primary producers in salt marshes include: *Spartina, distichlis, Puccinellia, Salicornia, Carex, Juncus.* Loose fronds of *Ascophyllum* and *Fucus* can occur at the lower part of the intertidal belt (Valiela, 1995). Some species of cordgrass may be considered as invasive species. *S. anglica* species of cordgrass is relatively new having formed by hybridisation of *S. alterniflora* and *S. maritima* approximately 100 years ago (Stokes, O'Neill, and McDonald, 2006). This species was planted in Clew Bay in the vicinity of Westport House between 1929 and 1932 and while it not considered as posing a problem to mudflats in Clew Bay, significant swards are observed at Annagh Island sub-site (NPWS, 2011).

There is some evidence for interactions between *A. nodosum* and salt marsh environments in general. Studies have indicated an "*obligate occurrence of fucoid algae, primarily A. nodosum with Spartina alterniflora on the eastern coast of America*" (Callaway, 2007 and references therein). It has been hypothesised that this relationship may be due to the formation of stable algae mats by grass roots. A study by Gerard *et al*. (1999) identified lower levels of *S. alterniflora* biomass in areas where the *Ascophyllum nodosum scorpiodes* was removed. *A. nodosum scorpiodes* represents a free living, dwarf form of *A. nodosum*. It may arise due to deposition of *A. nodosum* fragments on sheltered areas such as salt marshes. Factors determining this morphological expression may include: physical, abiotic factors such as temperature and light-intensity during winter and spring months and/or salinity (Brinkhuis and Jones, 1976 and references therein). Further research by O'Connor *et al*., (2011) found no effects of macroalgal removal final cordgrass abundance. However, in order to ensure that *A. nodosum* harvest does not negatively impact on the Atlantic Salt Meadow (ASM) habitat in general, a mitigation measure is in place to ensure that *A. nodosum* will not be harvested at the fringes of ASM (see Code of Practice, Addendum 4).

Overall, the likelihood of hand harvesting impacting on Atlantic Salt Meadows is low, as rocky shorelines are the primary targeted area for *A. nodosum* harvest. However, as the proposed activities require physical removal of *A. nodosum* material, there is a low risk that inappropriate harvest activities could occur, in the form of harvesting algae along the fringes of salt marshes. Specific control and mitigation measures have been included in the current proposal, integrated into the Harvest Management Plan and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC' to avoid the potential for significant indirect impacts associated with harvesting *A. nodosum* along the fringes of ASM. These measures are specified in detail in the proposed mitigations of the NIS.

5.1.3.3 Sand dune habitats (Annual vegetation of drift lines, Embryonic shifting dunes, Shifting dunes along the shoreline with Ammophila arenaria)

Accumulation of organic matter is important for formation of coastal habitats such as sand dunes and for species which grow throughout these habitats. Some studies indicate that roots of *Ammophila brevilgulata* do not respond well to dead and decaying organic matter and in fact, the extension of roots of seedlings may be inhibited by the presence of decaying plant matter. However, further studies demonstrated that under experimental conditions, the addition of *A. nodosum* organic drift litter material was associated with increased left length compared to other types of debris. This may be associated with the stimulation of growth due to a C:N ratio of 15:1 in algae (Maun, 2009). *A. nodosum* organic drift litter may therefore contribute to the formation and integrity of sand dune habitats. As the proposed activities require physical removal of *A. nodosum* material, there is the potential for indirect effects on sand dune habitats, which could arise due to inappropriate techniques being applied or extensive harvesting occurring. Specific control and mitigation measures have been included in the current proposal, integrated into the Harvest Management Plan and the ‘Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC’ to avoid the potential for overharvesting which could have potential indirect impacts on sand dunes. These measures are specified in detail in the proposed mitigations of the NIS. This involves a management system with a high level of oversight to ensure that only sites which contain sufficient levels of *A. nodosum* biomass are harvested, using methodologies which will not result in extensive biomass removal.

5.1.3.4 Other Annex II habitats

It is deemed unlikely that *A. nodosum* harvesting will have any indirect impacts on other coastal habitats such as perennial vegetation of stony banks or coastal lagoons. The main lagoon within the Clew Bay SAC complex is Furnace Lough. Lough Furnace is out of bounds for *A. nodosum* harvesting in the proposal.

5.1.4 Potential for indirect impacts affecting Annex II species

Indirect impacts arising from the proposed harvesting of *A. nodosum* with regard to Annex II species are limited to the potential alteration of coastal and intertidal habitats supporting both Common seal and Otter. As set out above, a study by Kelly *et al*. (2001) found that hand-harvesting of *A. nodosum* at sustainable levels does not alter the species composition of the intertidal community, nor does it affect the fish species utilising the intertidal habitat. It is these fish species that are identified as being of particular importance for foraging Otter. There are no indirect impacts identified that would have the potential to affect the subtidal habitats or benthic and pelagic fish species upon which Common seal populations within Clew Bay rely. Furthermore, the proposal does not give rise to any interactions between the freshwater or anadromous salmonid populations identified as being of importance for Otter within the freshwater and estuarine component of the SAC.

5.1.5 Potential for Cumulative and In-combination Effects

When assessing cumulative and in-combination impacts it is necessary to consider the effect of other plans and proposals that, together with the current project, would have a cumulative impact on the qualifying interests and conservation objectives of the Clew Bay Complex SAC. It is possible that other activities, existing operations or planned operations, which are not part of the BioAtlantis plan to hand harvest *A. nodosum*, may contribute to increasing overall interactions with structure and function in Clew

Bay Complex SAC. Existing background pressures within Clew Bay are identified with regard to marine activities including aquaculture, fishing, tourism and leisure interests, along with a number of other stakeholders. Grazing by stock is considered heavy in the remaining area of dunes at Rossmurvagh, while the level of recreational activities is high at the Bartraw dune system. Erosion has occurred at both systems and restoration works are ongoing. It is essential to assess these factors to ensure that activities are within the 15% disturbance limit for the planned harvesting, as outlined above. Again, it is noted that no hand harvesting will take place in a habitat that is assessed as being 'Inadequate' conservation status or lower, unless mitigation measures are in place to ensure they are unaffected. In the context of this application, Estuaries [1130] are considered as 'unfavourable-inadequate' nationally and mitigation measures are in place to ensure that these areas are not impacted when operating in Clew Bay. While mudflats and sandflats not covered by seawater at low tide [1140] are in favourable condition in Clew Bay, they are considered as being in 'Unfavourable-Inadequate' condition on a national level. Harvesting will not take place in this habitat and measures are in place to ensure mudflats and sandflats are unaffected when travelling to and from sites. While 'submerged or partially submerged sea caves' [8330] and 'Sandbanks which are slightly covered by sea water all the time [1110]' are both in 'favourable' condition, harvesting will not take place in these areas.

Large shallow inlets and bays [1160] is a broad category with five attributes, encompassing seven habitats/community types: Sandy mud with polychaetes and bivalve community complex, Fine sand dominated by *Nephtys cirrosa* community, Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex, Shingle, and Reef. The overall conservation status of Large shallow inlets and bays, both on a national level and in Clew Bay Complex SAC, is considered as 'Unfavourable-Bad'. In the context of Clew Bay, the 'Unfavourable-Bad' conservation status has been attributed to impacts on *Zostera* spp. (Scally *et al*., 2020). *A. nodosum* harvesting will not take place in areas where *Zostera* spp. grows. In addition, *A. nodosum* harvesting will not take place in soft substratum areas (intertidal and subtidal mud/sandy mud areas) and mitigation measures are in place to ensure they are unaffected during travel to and from harvesting sites.

Reef is one of several communities associated with Large shallow inlets and bays [1160] whilst also forming an Annex 1 habitat (Reef [1170]), although not designated as a qualifying interest in this SAC. Reef [1170] in Ireland is categorised as being in a 'favourable conservation' condition (Scally *et al.* 2020). This includes intertidal and subtidal reef areas. *A. nodosum* harvesting will take place in intertidal reef areas, subject to close compliance with mitigation measures listed in Addendum 4 of this application. These measures are required to ensure that Reef [1170] is maintained in 'favourable' conservation condition, in terms of area, structure and function and future prospects. Similarly, harvesters will ensure close compliance with mitigation measures when harvesting in areas that may contain shingle substratum.

The European Commission's Article 17 reporting framework notes that disturbance of greater than 25% of the area of an Annex I habitat represents 'unfavourable' conservation status, and the NPWS takes the view that licensing of activities likely to cause continuous disturbance of each community type should not exceed an approximate area of 15%. It is noted BioAtlantis' activities fall below the 15% limit for significant continuous or ongoing disturbance of marine Annex I habitats. Measures are in place to avoid interactions with existing pressures in the complex such as, aquaculture, fishing, tourism and leisure interests. Measures are also in place to avoid sensitive sites and coastal habitats, particularly where there is an increased likelihood of interactions occurring. Harvesting quantities and locations will be planned and recorded and sites will be inspected pre- and post-harvesting.

Some activities may be considered potentially significant in the context of the proposed plan by BioAtlantis Ltd. These include current activities relating to the harvest of *A. nodosum* in the Clew Bay Complex SAC, current fisheries-related activities in proximity to shorelines used by Common seal as haul out, breeding and moulting sites, natural mortality, planned operations and non-native, invasive species. Cumulative effects are discussed hereunder.

5.1.3.5 Existing harvesting of A. nodosum (traditional, planned and casual)

The potential for cumulative and 'in combination' impacts on the Clew Bay Complex was assessed given that hand harvest activities have taken place in the region in recent years. However, harvest has been relatively low with approximately 500 – 900 dry weight tonnes (dwt) per annum of *A. nodosum* harvested in Clew Bay between 2005 and 2011 (Guiry & Morrison, 2013). Levels dropped further, to less than 400 dwt per annum between 2009 and 2011; this contrasts strongly with quantities from Kilkieran in Co. Galway which have approached almost 4,000 dwt per annum since 2008.

BioAtlantis aim to harvest *A. nodosum* in Clew Bay, in a manner which is sustainable and does not exceed 20% of the total yield from any one site. The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site per annum. In this context, the potential impact of other small-scale activities is likely to be minimal. The field surveys to inform the current Licence Application identified harvest activities in Clew Bay at levels higher than expected; moreover, cutting methods used were observed to vary. An estimation of existing unlicensed and traditional harvesting activities has been performed through consultations with stake holders in Clew Bay (August 2014).

It is estimated that there are approximately 10 to 20 part-time hand harvesters operating in Clew Bay at this time. Many of the harvesters have backgrounds in farming and fishing and the majority of work is undertaken part-time, with some individuals working full-time. It has been established that seaweed has been and continues to be supplied to unlicensed companies and individuals. The existing methodology involves transfer of seaweed to pick up points by harvesters using individual boats or the pick-up of seaweed from the shore using vehicles such as tractors.

Significant levels of *A. nodosum* are harvested in Clew Bay and supplied to commercial companies. Details as to the quantities harvested are unknown. There is a risk therefore, for in-combination effects of the proposed hand harvesting by BioAtlantis Ltd. and existing harvest activities. Also, there are risks for in-combination effects associated with local companies (e.g., hotels and health spas), who use seaweed as part of 'seaweed baths' and other health and beauty services. Some companies and individuals also offer "Seaweed harvesting discovery days", particularly in the Mulranny area. The potential in-combination effects of each of these activities must also be mitigated against. Mitigation measures listed have been included in the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC' (Addendum 4).

There are over 18 companies specialising in water sports-related activities in Clew Bay. Activities take place throughout the complex. There are also several important bases present. However, potential risks have been identified which include potential impacts on Annex II species and potential for increased anthropogenic disturbances along the intertidal zone. These are Annex II species & birdlife, Annex I habitats and species around Collanmore Island.

5.1.3.6 Annex II species and birdlife

The plethora of marine-based activities which can impact on Annex II species are well described by

NPWS scientists and others. In Clew Bay, such activities include: power boat trips, sea trampoline, sit-on-top kayaking, sea kayaking, dinghy sailing, stand up paddle boarding, and keel boat sailing. In some cases, this may even involve targeted visits by tourist companies to sites with known "seal colonies" and birdlife. There is therefore, potential for in-combination effects associated with hand harvest activities and existing human interactions with harbour seals and birdlife. Mitigation measures have been provided to reduce the potential for impacts.

5.1.3.7 Annex I habitats and species

There are many bases established by tourist companies in Clew Bay, varying in size and extent. Many utilise well-established bases which do not host intertidal *A. nodosum*. However, some smaller bases in more remote locations require transference of equipment into the water across substrate which can host intertidal seaweed. These activities can give rise to small patches which contain lower density of intertidal seaweed. An example of such an effect is Dinghy sailing activities which may be associated with small, localised reductions in seaweed cover. While the impact of such anthropogenic disturbances is relatively low, in and of itself, it raises the potential that in-combination effects associated with hand harvest activities could occur. This anthropogenic disturbance risk will be mitigated against.

5.1.3.8 Collanmore Island

Collanmore island is a very active destination for recreational tourists and there are many associated marine based activities. Collanmore is not considered a site for sensitive harbour seals or protected bird species and as such, the risk of affecting Annex II species is very low. However, by virtue of increased numbers of recreational tourists in general in Collanmore, there is an increased chance for anthropogenic disturbances during peak tourist season. Individuals may also rest equipment such as kayaks on shingle or rocky shorelines containing *A. nodosum* or transfer equipment from bases into the water across reef or shingle substrate. Overall, there is potential for in-combination effects associated with hand harvest activities and the increased human presence on Collanmore island and mitigation measures are provided.

5.1.3.9 Interactions with aquaculture and fisheries

There are several companies specialising in aquaculture in Clew Bay. Activities are diverse and include shellfish species (oyster, mussels, clams), culture of Atlantic Salmon and a fish hatchery (Marine Institute, 2019). Many aquaculture sites have been identified as predominating in mudflat and sandflat areas along northern and southern portions of the complex, with a number of new aquaculture applications filed. There are other sites located in north-central Clew Bay and along the eastern shoreline. In many cases, aquaculture sites are located in proximity to sites which are sensitive to Annex II species such as harbour seals and protected bird species. There are risks therefore, that such activities may interact with hand harvesting activities and such effects must be mitigated against. There are also risks that activities associated with hand harvesting could interact with existing impacts attributed to aquaculture in these areas.

Two studies by the Marine Institute (2014, 2019) assessed potential impacts of licensed and planned aquaculture activities on species and habitats in Clew Bay. The studies concluded that existing aquaculture activities are non-disturbing to harbour seals species or otter species, and that the overall the risk of such interactions is considered low. However, the Marine Institute could not rule out potential effects of aquaculture on seal behaviour at Inishcorky and potentially neighbouring sites: Inishdeashmore, Inishdeadbeag, unnamed neighbouring island off Inishdeadbeag and Inishnacross (pg.

78, Marine Institute, 2014). The licence application for Inishcorky island is for abalone culture. Hand harvesting of *A. nodosum* would require mitigation to prevent in-combination effects. The potential for cumulative or in-combination effects of the proposed BioAtlantis *A. nodosum* harvesting interacting with Harbour seal activities is evaluated as being low and not significant given that:

- Corrie Channel, Rosslaher, Mynah, Murrisk and Carraholly production areas do not represent documented haul-out sites for Harbour seals, nor do they lie in close proximity to haul out sites;
- The production site at Inishlaughil does not represent a haul out site, nor does it lie in close proximity to haul out sites. The nearest haul out site to Inishlaughil is over 200 meters away and is largely shielded from view/disturbance by the presence of Inishfeis and Inishpult; and
- There are two breeding sites located in very close proximity to Inishquirk. Harvest activities will not take place at these sites during breeding season between May and July. Between October and April, harvest activities will be undertaken according to the BioAtlantis Code of Practise (see Addendum 4), thus ensuring that any potential impact on seal behaviour is averted.

There are potential interactions between hand harvest activities and aquaculture, including (a) direct impact on reef due to removal of species and (b) impacts upon intertidal sediments due to travel across the shore to harvest sites (Marine Institute, 2019). The recent study by the Marine Institute (2019) concludes that is it unlikely that hand harvest of seaweed and intertidal shellfish culture will overlap in Clew Bay, given that reef is not considered suitable for culture of shellfish.

In relation to the potential impact of seaweed harvesting, the study also concludes that it is "*unlikely that the in-combination effects of transport routes across intertidal flats will give rise to persistent disturbance of >15% on intertidal mudflats and sandflats*". While the risks cited above are unlikely to give rise to in-combination effects, BioAtlantis have developed a Code of Practice (Addendum 4) which works to ensure such risks are mitigated against.

Designated Mollusc Production areas in Clew Bay (adapted from the Sea Fisheries Protection Authority, 2024) are presented in Table 4. Shellfish production activities in the Clew Bay Complex include designated Mollusc Production Areas for Oysters and Mussels at specific bed locations, including:

- Tieranaur Bay (Gigas Oysters): Area within a one nautical mile (1,852 M) radius of Roskeen Pt. (53º 53.46'N, 09º 40.10' W); and
- Corrie Channel and Rosslaher Beds (Mussels and Gigas Oysters): Area bounded to the west by a line from Mulranny Pier to Old Head and to the south east by 09º 35.37'W.

Fisheries Statistics for Clew Bay in 2003 (Ref: Newport Sewerage Scheme EIS, 2007) indicate removal of the following species from Clew Bay, at varying tonnages: edible crab, European lobster, velvet crab, Blue mussel, Pacific oyster, shrimp *Palaemonid nei* and Common periwinkle. As periwinkles and cockles are known to be hand gathered in parts of Clew Bay, the potential risk of in-combination effects with hand harvesting *A. nodosum* must be assessed. In-combination effects on other invertebrates is less likely.

Risks identified are provided below. Mitigation measures are also indicated and have been included in the Code of Practice for hand harvest activities (see Addendum 4). Appendix 7 of BioAtlantis' license application provides an up-to-date list of existing and planned aquaculture sites in Clew Bay, and associated mitigation measures.

5.1.3.9.1 Hand gathering of periwinkles

Hand gathering of periwinkle occurs within the intertidal zone of Clew Bay, on shores containing *A. nodosum* and *Fucus* sp. The precise spatial distribution and extent of periwinkle harvesting in Clew Bay has not been established but is likely to occur throughout the SAC and at varying levels. Potential risks associated with periwinkle harvesting are reductions in periwinkle population numbers due to the removal and anthropogenic disturbances caused by trampling.

There is potential for in-combination effects associated with *A. nodosum* hand harvest activities and existing periwinkle harvest activities. The standards developed as part of the Code of Practice (Addendum 4) reduce the likelihood of any in-combination effects associated with existing hand gathering of periwinkles activities.

5.1.3.9.2 Hand gathering of cockles

Cockles are known to occur on intertidal muddy sand shores east of Mulranny. Hand gathering may occur at a low scale. Commercial dredge fishery for cockles does not occur (Marine Institute, 2019). Potential impacts of cockle gathering include impacts on intertidal sedimentary communities (Mudflats and sandflats not covered by seawater at low tide [1140]). There is potential for in-combination effects associated with *A. nodosum* hand harvest activities and cockle hand gathering, as seaweed hand harvesting may involve activities along the rocky shoreline beyond mudflats and sandflats.

5.1.3.9.3 Other invertebrates

Other invertebrates are removed from Clew Bay, many of which are limited to deeper water, thus removing any risk of in-combination effects associated with hand harvesting activities. However, there is a risk that hand harvesting may impact on slow moving invertebrates in general given that bags/nets are used along the intertidal zone. Mitigation measures are provided to avoid impacts on other invertebrates.

5.1.3.10 Planned activities

The potential in-combination effects of planned operations in Clew Bay and hand harvesting of *A. nodosum* have been assessed and the potential for increased anthropogenic disturbance has been identified. The Mayo County Development Plan 2022-2028 sets out policies and objectives relating to physical, economic and social development including settlement planning, housing, town and village regeneration/renewal, rural development, economic development and social and community development. It is considered that any environmental assessments required for any plans affecting the Clew Bay Complex SAC by Mayo County Council will be subject to the appropriate environmental reporting. There is however, the potential for interactions between planned activities and hand harvesting (e.g., increased anthropogenic disturbances). Mayo County Council did apply for a foreshore lease and licence application for the construction of a new reinforced concrete slipway and installation of a floating pontoon, which will supplement proposals to develop a coastguard station in this area, located just north of Roman island. Mitigation for this includes that hand harvesters will not harvest at Roman Island between May and August, as well as not working within 50m of bases where equipment and vessels are manually introduced to the water, which will prevent any in-combination anthropogenic disturbances from occurring. Increased numbers of small bases may be developed at Roman Island for commercial recreation activities such as dinghies, and kayaks.

In some cases, transference of equipment from bases into the water may give rise to small patches which contain low density of intertidal seaweed, thus raising the potential for in-combination effects.

In relation to other planned activities, the Westport Tourism Organisation is preparing to put forward a case for the development of a marina at Westport Harbour and an overall plan for Clew Bay. The following recommendations have been made: construct a 250-berth marina, create a facility for Irish and international sailing boats, large sailing vessels and transport cruise ships to transport passengers further out along the bay, utilise all harbours, develop a direct ferry link, develop employment, tourism and revenue around all shores, create a safe harbour, sea angling, water sports and link greenways, blueways and harbours, create a lagoon on the south of Roman island, clubs, tuition, racing and festivals as well as a greenway. The BioAtlantis code of practise will be updated to include further mitigation measures for future and planned activities. Hand harvesters will not work at Roman island or Westport harbour between May and August, avoiding peak season. Further mitigation to avoid other activities relating to human disturbance and avoiding areas during certain times of the year are considered sufficient to avoid cumulative impacts relating to human disturbance.

Table 4 List of Classified Bivalve Mollusc Production Areas in Clew Bay 2024/2025 (adapted from Sea Fisheries Protection Authority, 2024).

Production Area	Species	Area boundary
Tieranaur Bay Inisquirk	Gigas Oysters	Area within a one nautical mile (1,852 M) radius of Roskeen Point (53° 53.46’N, 09° 40.10’ W)
Corrie Channel	Mussels Gigas Oysters	Area Bounded to the West by a line from Mulranny Pier to Old Head and to the South East by 09 ∘35.37' W and to the North East by a line due North and East respectively from the point at which 09 ∘37' W and 53 ∘ 52.60 N intersect.
Rosslaher	Mussels Gigas Oysters	
Mynah	Gigas Oysters	
Inishlaughill	Mussels	
Carrowholly/ Rossmalley PT	Gigas Oysters	
North	Native Oysters	
Murrisk	Oysters	

5.1.3.11 Natural mortality of Ascophyllum nodosum

The *A. nodosum* biotope is a major component of the Clew Bay Complex SAC. Natural causes of *A. nodosum* mortality include storms, which can detach *A. nodosum* from substrate, or both together. In addition, large or dense *A. nodosum* growth may become loose over time, leading to holdfast detachment. Therefore, as natural events can cause substantial *A. nodosum* mortality, it is critical that man-made harvest techniques do not cause any significant increase in mortality beyond natural background levels. Unregulated over-harvesting and inappropriate harvest methodologies are significant hazards in this regard, as both can cause significant increases in *A. nodosum* mortality due to holdfast removal. For example, it has been reported that 'rake cutter' methods potentially gives rise to >6% of harvest containing holdfast material (Ugarte, 2011). In real terms, holdfast removal could give rise to reductions in *A. nodosum* plant numbers and density. In turn, this could allow for species such as *Fucus* to grow in vacant areas which have been left. Unregulated over-harvesting and inappropriate harvest methodologies are significant hazards in this regard, as both can cause significant increases in *A. nodosum* mortality.

5.1.3.12 Functionality and sediment supply

With respect to Annex I habitats, there is also potential for impacts via changes to functionality and sediment supply. In relation to the habitat 'perennial vegetation of stony banks', interference with the natural coastal processes, through offshore extraction or coastal defence structures in particular, can interrupt the supply of sediment and lead to beach starvation. The target is to maintain, or where necessary restore, the natural circulation of sediment and organic matter, without any physical obstructions (NPWS, 2011b).

With regard to embryonic shifting dunes and marram dunes (white dunes), human interference is usually associated with changes in the sediment budget, either directly, through the removal of beach or inshore sediment, or indirectly, by impeding or altering sediment movement. Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Sediment supply is especially important in the embryonic dunes and mobile dunes, as well as the strandline communities where accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. The construction of physical barriers such as sea defences can interrupt longshore drift, leading to beach starvation and increased rates of erosion (NPWS, 2011b).

While excessive removal of *A. nodosum,* a primary producer within the Clew Bay Complex SAC, could lead to a level of reduction in organic matter cycling, it's impact on nutrient cycling rates is limited due to low levels of nitrogen, potassium, and phosphorus present in this species.

5.1.3.13 Non-native, invasive species

The introduction and spread of non-native, invasive species is identified as a potential threat, arising both as an indirect impact from the proposed activities, and in-combination with background commercial fishing / shellfish aquaculture and recreational use of the Clew Bay Complex. It is noted that non-native, invasive species are identified as a pressure or threat affecting the Annex I habitat 'Large, shallow inlets and bays', but not for the Annex II species Harbour seal and Otter, in the most recent NPWS Conservation Status reporting '*The Status of EU Protected Habitats and Species in Ireland*' (NPWS, 2019a and 2019b). Boats to be utilised in the proposed operation will be limited to local fishing boats and there will be no requirement for the transport of boats (and associated bilgewater) or equipment, to or from the Clew Bay Complex. This will effectively avoid the importation of non-native, invasive species into the Bay and will limit the potential for cumulative or in-combination effects.

Negative indicators on the Annex I habitat Embryonic shifting dunes include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat (NPWS 2011b). The introduction or spread of non-native Sea-buckthorn *Hippophae rhamnoides* would constitute a negative impact on this habitat type.

In the case of Clew Bay, an issue that has not occurred widely within the Large shallow inlet and bay habitat is that of invasive species. In particular, *Didemnum vexillum*, which is potentially a serious habitat modifying ascidian or sea-squirt, has become a cause of concern within this site. A colonial tunicate belonging to the genus Didemnum has recently been found in many temperate coastal regions throughout the world. It continues to spread rapidly and compete aggressively with native, hard substrate species (e.g., mussels, barnacles, bryozoans, other ascidians). In addition, it can form dense mats on deep water cobble-gravel substrates and influence the abundance and species composition of benthic epifauna and infauna. Thus, its ever-increasing presence is creating potentially severe detrimental economic and ecological impacts (Stefaniak *et al.,* 2009).

However, there is a potential risk for hand harvesting activities to contribute to the spread of invasive species, *Bonamia ostreae, Botrylloides violaceus, Caprella mutica, Crassostrea gigas, Crepidula fornicate, Didemnum vexillum, Perophora japonica, Sargassum muticum Spartina anglica* and *Styela clava,* as the collection boat (if deemed applicable to the area) may leave Clew Bay. Specific control and mitigation measures have been included in the current proposal, integrated into the Harvest Management Plan and the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC', to avoid the potential for hand harvesting activities from acting as a vector for the spread of *D. vexillum* and other species within the Clew Bay complex SAC. These measures include that boats will be painted once a year with appropriate anti-fouling paint. All bags/nets will be cleaned with appropriate cleaning agents or using other suitable methods on delivery to production facilities and returned to harvesters in a clean condition. Harvesters will also keep a distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures. Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and will ensure that inadvertent by-catch of other Animalia, algae or dead, drifting material/algae will be prevented and minimized.

5.1.3.14 Hydrodynamics and water quality

Water quality and tidal movements were previously examined in Westport Bay, in making provisions for disposal of waste and contaminated storm water from the Westport environment (Kirk McClure Morton, and MarEnCo, 2013). However, no such water treatment facilities have been provided for Newport and potentially, other parts of the complex. Negative effects that polluted water can have on *A. nodosum* include reduced performance, epiphyte infestation, colonisation and competition by green algae (Hurd *et al*., 2014). *A. nodosum* is adapted to growing in highly sheltered environs and as such, has difficulty remaining attached to hard substrate in less sheltered waters. As such, *A. nodosum* may have limited influences on hydrodynamics.

Table 5 Potential in-combination effects on Annex I habitats which could arise through hand harvesting *A. nodosum*.

<table>
<tr><th rowspan="3">Marine Community Types (Clew Bay SAC)</th><th rowspan="3">Total Area in Clew Bay SAC (m^2)</th><th colspan="2">Area Affected by Harvest Activities/annum</th><th>Area of Large Shallow Inlets and Bays [1160] affected/annum</th><th colspan="4">Potential In-combination Effects</th><th rowspan="3">Do Mitigation Measures Prevent In-Combination Effects? (Y/N)</th></tr>
<tr><th rowspan="2">(m^2)</th><th rowspan="2">(%)</th><th rowspan="2">(%)</th><th colspan="2">Existing Operations</th><th colspan="2">Planned Operations</th></tr>
<tr><th>Type</th><th>No. Risks</th><th>Type</th><th>No. Risks</th></tr>
<tr><td>Zostera community</td><td>1,423,891</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td>0</td><td>n/a</td></tr>
<tr><td>Shingle</td><td>1,855,000</td><td>235,549</td><td>12.7%</td><td>0.23%</td><td rowspan="2">• Recreation & tourism
• Existing harvest activities
• Existing aquaculture
• Invertebrate harvesting</td><td rowspan="2">2
3
0
3</td><td rowspan="2">• Recreation & Tourism
• Harvest activities
• Aquaculture
• Invertebrate harvesting</td><td rowspan="2">2
0
0
0</td><td rowspan="2">Yes. See Addendum 4, “Code of Practice”</td></tr>
<tr><td>Reef</td><td>26,870,000</td><td>1,331,699</td><td>4.9%</td><td>1.31%</td></tr>
<tr><td>Maerl dominated community</td><td>2,878,607</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>n/a</td></tr>
<tr><td>Fine Sands dominated by Nephtys cirrose community</td><td>2,950,308</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>n/a</td></tr>
<tr><td>Intertidal sandy mud with Tubificoides benedii and Pygospio elegans community complex</td><td>7,817,100</td><td>0</td><td>0</td><td>0</td><td>• Recreation & tourism
• Existing harvest activities
• Existing aquaculture
• Invertebrate harvesting</td><td>0
0
1
0</td><td>0</td><td>0</td><td>Yes. See Addendum 4, “Code of Practice”</td></tr>
<tr><td>Mudflats & sandflats not covered by seawater at low tide</td><td>12,541,069</td><td>0</td><td>0</td><td>0</td><td>• Recreation & tourism
• Existing harvest activities
• Existing aquaculture
• Invertebrate harvesting</td><td>0
0
1
0</td><td>0</td><td>0</td><td>Yes. See Addendum 4, “Code of Practice”</td></tr>
</table>

Table 6 Potential in-combination effects on Annex II species and protected bird species which could arise through hand harvesting *A. nodosum*.

Species	Potential In-combination Effects Identified				Mitigation Measures
	Existing operations		Planned Operations		Do measures prevent in-combination effects? (Y/N)
	Type	No. Risks	Type	No. Risks	
Harbour seals	• Recreation & Tourism • Existing harvest activities • Existing aquaculture • Invertebrate harvesting	• 1 • 0 • 0 • 0	• Recreation & Tourism • Harvest activities • Aquaculture • Invertebrate harvesting	• 0 • 0 • 1 • 0	Yes. See Addendum 4, "Code of Practice"
Protected bird species	• Recreation & Tourism • Existing harvest activities • Existing aquaculture • Invertebrate harvesting	• 1 • 0 • 0 • 0	• Recreation & Tourism • Harvest activities • Aquaculture • Invertebrate harvesting	• 0 • 0 • 1 • 0	Yes. See Addendum 4, "Code of Practice"
Otter	• Recreation & Tourism • Existing harvest activities • Existing aquaculture • Invertebrate harvesting	• 0 • 0 • 0 • 0	• Recreation & Tourism • Harvest activities • Aquaculture • Invertebrate harvesting	• 0 • 0 • 0 • 0	Not applicable, as no in-combination risk have been identified

6. MITIGATION MEASURES

6.1 Mitigation measures for the protection of Annex I habitats

The 'Code of Practice' for the harvesting of *A. nodosum*, prepared by BioAtlantis (2024) and included in the updated Licence Application, are included in Addendum 4 of the current report. The following measures are prescribed for the avoidance of significant impacts on this habitat complex and the communities it supports.

With regard to the Annex I habitat 'Large, shallow inlets and bays', which includes the Clew Bay Complex SAC as a whole, BioAtlantis will not interact with other existing and planned activities, to levels which would increase interactions beyond the stated 15% limit, The only habitats to be impacted by hand harvesting of *A. nodosum* are reef and shingle, at levels of 4.9% and 12.7% respectively per annum. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,189 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. The percentage of the total area of Large shallow Inlets and Bays [1160] that be utilized per annum during hand harvesting activities in the intertidal zone, is 1.54%.

To ensure that the area, structure and function, future prospects and conservation status of marine Annex I habitats is maintained, harvesters will ensure the following:

Harvesting must not take place in areas containing the following Annex I habitats and/or community complexes:

- Fine Sands areas (Dominated by *Nephtys cirrosa* community)
- Intertidal sandy mud areas (containing *Tubificoides benedii* and *Pygospio elegans* community complex)
- Maerl habitats
- Mudflats & sandflats not covered by seawater at low tide
- Sandbanks that are slightly covered by sea water all the time
- Submerged of partially submerged sea caves
- *Zostera* (seagrass) habitats

When travelling to harvest zones, harvesters will avoid impacts with the above habitats by adhering to Section 7 of the Code of Practice, "Environmentally safe navigation". Doing so will prevent disturbance to soft substratum areas and their associated communities and species.

When operating within the intertidal zone where *A. nodosum* is present (sheltered reef and shingle substratum areas), harvesters will ensure adherence to all aspects of the Code of Practice. This is required to ensure that (i) the habitat area is maintained and (ii) structure and function is maintained or improved. It is also required to ensure that the future prospects and conservation status of reef and shingle areas are maintained or enhanced, whilst also preventing in-combination effects with existing and planned activities.

Control measures are in place to ensure adequate training is provided to harvesters, where necessary, to ensure no removal of permanent habitat area (e.g. measures to prevent excessive removal of sand, shingle, pebbles, gravel, stones, *A. nodosum* holdfast, etc); this will avoid the removal or permanent impact on the shoreline and intertidal reef habitat within the bay complex. All hand-harvesting will sever the *A. nodosum* at 200 – 300mm (8 – 12 inches) above the holdfast, ensuring that the holdfast and associated substrate are left intact, allowing for re- growth and also avoiding permanent impacts to the intertidal habitat. The harvested seaweed will be inspected on collection, on the boat or at the pick-up point or processing facility by means of completion of the Goods Received Notes. If excessive sand, shingle or debris is observed in water separator or Mill, the harvester will be re-trained. Production Operators will inspect the incoming harvest via Goods Received Notes. Harvest which contains holdfast material will be considered as representing a severe non-conformance by BioAtlantis Management and could require corrective actions. Boat engines will be regularly maintained to avoid leaks of fuel or oil into the marine environment. Harvesters will receive training, where necessary, to ensure cleaning takes place in a manner which does not lead to wash off into the environment. As holdfast removal will be avoided, the potential for exposure of understory species to predators such as birds, will also be prevented. Inspections will also take place at production facilities to ensure no holdfast or other contaminants are present.

A mitigation measure is in place to ensure that harvest is limited to ≤20% of the total available *A. nodosum* biomass per site per annum. A cautious approach is taken to cut between 200 – 300mm (8 – 12 inches) above the holdfast which ensures that potential for further impacts are minimised. This measure effectively avoids over-harvesting which could impact on the ecosystem in general. It also prevents potential impacts on community structure, biodiversity stasis, hydrodynamics, functionality or sediment supply throughout the complex. Table 7 gives a revised maximum annual harvest of *A. nodosum* from the harvesting locations in Clew Bay, taking into account the requirement for maintaining conservation status of the designated site with regard to biomass reduction and disturbance.

A mitigation measure is in place to ensure that when cutting *A. nodosum*, at least 200 – 300mm (8 – 12 inches) of material must be left behind. This limit will be inspected by the Resource Manager as it is essential in order to:

- Avoid extensive removal of *A. nodosum* canopy coverage;
- Avoid dormant or resting species positioned at the base of the *A. nodosum* canopy, e.g., periwinkles;
- Prevent by-catch of benthic species;
- Prevent by-catch of slow moving, sessile species and even some mobile species that may not leave the rocky shoreline at low tide;
- Avoid occurrence of overharvesting which could impact on the ecosystem in general, e.g., animals resident in the intertidal zone, coastal habitats, etc;
- Avoid severe reductions in canopy coverage which could otherwise lead to changes in community structure or biodiversity stasis; and
- Prevent changes in hydrodynamics, functionality or sediment supply within and beyond the intertidal zone.

Harvest which contains holdfast material will be considered as representing a severe non- conformance by BioAtlantis management. A mitigation measure has been put in place to ensure that the technique employed in Clew Bay does not allow for greater than 1% mortality, i.e., complete removal of the entire *A. nodosum* plant and holdfast during harvest (see 'Code of Practice', Addendum 4). This process will be monitored and details recorded on the GRN. This 1% limit is essential in order to:

- Prevent mortality of *A. nodosum*;
- Prevent injury to *A. nodosum* holdfast;

- Prevent severe removal of habitat for understory species;
- Prevent exposure of understory species to predators such as birds;
- Avoid physical disturbance of dormant or resting species at the base of the canopy;
- Avoid occurrence of overharvesting which could impact on the ecosystem in general;
- Avoid occurrence of overharvesting which could impact on community structure, biodiversity stasis, hydrodynamics, functionality or sediment supply.

Harvest which contains *Fucus* sp. will be considered as representing a severe non-conformance by BioAtlantis Management. BioAtlantis Ltd. produce pure extracts of *A. nodosum* and as such, consider *Fucus* as a contaminant material. From an environmental perspective, by-catch of *Fucus* will not be acceptable by management, given as a ≤5% limit, as doing so could unnecessarily increase loss of fucoid canopy during harvest. With appropriate training where necessary, harvesters will focus on harvesting *A. nodosum* specifically with direct avoidance of *Fucus* co-harvest being a necessary requirement. This quality parameter will be assessed by the Resource Manager. A mitigation measure has been put in place that allows for no more than 5% *Fucus*. This process will be monitored on receipt of the harvested seaweed and details recorded on the GRN. As many species residing within the *A. nodosum* canopy also graze or seek shelter beneath *Fucus*, this mitigation measure prevents removal of an additional canopy source which supports periwinkles and other species.

It is critical that hand harvesting does not negatively impact on community structure on the foreshore in general. Central to achieving this aim will be to ensure that canopies are maintained at levels which provide adequate coverage of underlying substrate and prevent invasion by species such as *Fucus*. Traditional practices in Ireland involve cutting between ~150 – 180 or 200mm (Kelly *et al.,* 2001). To ensure that harvesting is carried out in a safe and practical manner, harvesters will be provided with a high level of training, where necessary, so as to inform them of the importance of cutting as high as possible. They will be required to cut at levels between 8 – 12 inches (200 to 300mm).

BioAtlantis will take an approach which prevents cutting less than 200mm (8 inches), which will represent a serious non-conformance (see Addendum 4 'Code of Practice'). This standard will be monitored by the Resource Manager and recorded on the Site Inspection (SIF) form. Harvest activities aimed at not reducing the height of *A. nodosum* below 200mm will avoid dramatic changes in biomass levels within the intertidal zone so significant hydrodynamic changes are unlikely to occur. Moreover, the long term effects of harvesting is minimised as sufficient photosynthetic tissue left behind which will allow for faster *A. nodosum* recovery post- harvest. Moreover, limiting the harvest to 20% of the total available biomass will ensure that sufficient biotope coverage remains.

The BioAtlantis approach will ensure that harvest will be carried out at low tide. This ensures:

- A. *nodosum* holdfast removal is avoided;
- *Fucus* by-catch is reduced;
- A lower incidence of by-catch of benthic invertebrates, as most species are relatively inactive at low tide, taking cover beneath the *A. nodosum* canopy;
- Understory species are not contacted as cutting occurs higher up along the *A. nodosum* plant.

A mitigation measure is in place to ensure that potential for anthropogenic impacts (e.g., intensity of trampling) on the biotope is avoided. As such, no more than 2 – 4 harvesters are permitted on small – medium sized sites. Medium to large islands may require between 4 – 6, while larger islands will likely require approximately 6 – 10 harvesters. The Resource Manager and other personnel may inspect sites for brief periods.

Other personnel are not permitted. Low numbers of individuals working along the foreshore in this way will ensure that potential for anthropogenic impacts are minimised. Hand harvesters will not work within 50m of bases where equipment or vessels are manually introduced in the water. This ensures that no in combination effects occur, such as exacerbation of anthropogenic disturbance which could give rise to lower density of intertidal seaweed and the associated biotope.

A mitigation measure is in place to monitor and ensure that substrate is not disturbed to the extent whereby it could enter into the harvested weed. The risk of disturbing or displacing substrate during hand harvest with a sickle or knife in Clew Bay will be minimal as harvesters will have full view of the cutting process and will receive training by BioAtlantis, where necessary, to take care not to disturb the substrate. This quality measure will be recorded on the GRN. This ensures that disturbance, displacement and potential co-harvesting or removal of non-target species or substrate does not occur. The traditional sickle/knife hand harvest method at low tide allows for necessary sufficient oversight over cutting. BioAtlantis consider a range of levels of *Fucus* exceeding 5% as being unacceptable (see 'Code of Practice', Addendum 4). A mitigation measure is also in place to monitor and ensure that substrate is not disturbed to the extent whereby it could enter into the harvested weed or give rise to holdfast in the harvested seaweed (see Addendum 4, 'Code of Practice'). This quality measure will be recorded on the GRN, along with checks at production facilities to ensure such contaminants are absent.

A mitigation measure is in place to ensure that by-catch is limited and when it occurs, is immediately returned to the water where possible i.e., any periwinkles, amphipods, isopods or other Animalia by-catch observed post-harvest, will be collected and returned to the water where possible (See Addendum 4, 'Code of Practice'). Harvesters are required to work to ensure that co-harvesting of other species does not occur, thus reducing the potential for trapping or co-removal.

A mitigation measure is in place which requires harvesters to actively avoid *A. nodosum* plants which contain substantial periwinkle egg masses. This is important to prevent harvest of viable eggs. The technique employed by BioAtlantis will ensure that harvest takes place at low tide when periwinkles are more likely to be dormant or covered. Harvest will not take place during the feeding stage at high tide when periwinkles are out of their shells. In addition, most periwinkles will reside low down within the canopy at low tide, thus reducing the chances inadvertent by-catch. It is important to note that periwinkles do not exclusively feed on *A. nodosum* and also graze and reside in canopies of *Fucus* species, including *Fucus vesiculosus* and *F. serratus*. BioAtlantis will not harvest *Fucus* species, thus ensuring that this portion of the periwinkle and limpet environment is unaffected. In terms of reproduction, *L. obtusata* lays white, oval eggs masses containing a large number of eggs, on *Ascophyllum, F. vesiculosus* and *F. serratus*. The egg masses are visible to the naked eye. Eggs may sometimes be laid on the surface of rocks.

As part of training on approaches to mitigate against risks of reducing *L. obtusata* numbers, harvesters will be provided with training, where necessary, to identify and avoid *A. nodosum* plants or fronds which contain substantial egg masses. Eggs may also be laid on the surface of rocks. In the case of *L. littorina*, eggs are released with the tide. Following development from a free-living form, it settles at the base of the *A. nodosum* canopy. Training will be provided to harvesters, where necessary, on approaches to mitigate against risks of reducing *L. obtusata* numbers and approaches to identifying and avoiding *A. nodosum* plants or fronds which contain eggs masses (see Addendum 4, 'Code of Practise'). In the case of *L. Littorina*, eggs are released with the tide. Following development from a free-living form, *L. Littorina* settles at the base of the *A. nodosum* canopy. Training will be provided to harvesters, where necessary, on approaches to avoiding disturbance by (a) cutting at low tide, (b) aiming to leave between

200 – 300mm (8 – 12 inches) of material behind and (c) under no circumstances cutting less than 200mm above the holdfast. By avoiding *Fucus vesiculosus* and *F. serratus*, harvesters can avoid *L. obtusata* eggs masses growing on these seaweed species. *L. littorina* present at the base of these canopies will likely be unaffected as biomass levels are maintained.

In order to ensure that *A. nodosum* harvest does not negatively impact on the Atlantic Salt Meadow habitat in general, a mitigation measure is in place which does not allow harvesters to remove *A. nodosum* at the fringes of ASM (see Code of Practice, Addendum 4).

BioAtlantis will not harvest beyond Rossmurvagh, thus avoiding much of the Mulranny area. Harvest will occur on Collanmore island only between September – April. Hand harvesters will not work at Roman Island or Westport harbour between May – August. This will prevent in-combination effects such as, exacerbation of anthropogenic disturbance which may occur during peak tourist/excursion season.

Hand harvest activities will not take place at harbour seal and bird sites at sensitive times of the year, thus preventing any in-combination effects from occurring.

BioAtlantis will not harvest in areas near sewage outfalls or other source of pollution. This will ensure that stressed *A. nodosum* growth is not exacerbated further by harvest activities. BioAtlantis will be recommending to the relevant authorities that they contribute to protecting the Clew Bay SAC by installing an effluent treatment system in Newport and requiring other large contributors to pollution in the area to also ensure compliance on this matter. To protect the SAC in Clew Bay, the relevant authorities should not allow this to continue.

BioAtlantis will be responsible for commercial harvesting of *A. nodosum*. A mitigation measure is in place to ensure that that if unlicensed large-scale harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. This is to ensure compliance with the conservation objectives for the site, and to ensure adequate record keeping, monitoring of the resource, and access to sensitive sites at particular times of the year. Any commercial user having small requirements of approximately 1 tonne per annum (e.g., hotels, health spas) will be identified and BioAtlantis will work to prevent in combination effects. In terms of casual harvesting, measures are in place to ensure that harvesting activities will not impact on other people who harvest small volumes of seaweed, edible seaweeds or invertebrates for their own personal use, e.g., dillisk, carrageenan, limpets, mussels, clams, periwinkles and scallops. Harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the PRAI, the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*.

Mitigation measures are in place to avoid the potential for hand harvesting activities from acting as a vector for the spread of *D. vexillum* and other species within the Clew Bay complex SAC. This will require the following:

- All boats will be painted once a year with appropriate anti-fouling paint;
- The harvesters boats will not leave Clew Bay. In the rare case that they do leave Clew Bay, harvesters are required to implement a cleaning measure on land which will involve cleaning with appropriate cleaning agents or using other suitable methods;
- Bags/nets are cleaned with appropriate cleaning agents or other using suitable methods on delivery to production facilities and returned to harvesters in a clean condition.;
- Harvesting will be limited to the *A. nodosum* zone and will not take place in subtidal areas,

exposed, or semi-exposed sites; and

- Harvesters will keep distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures.
- Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and will ensure that inadvertent by-catch of other Animalia, algae or dead, drifting material/algae will be prevented and minimized.

The potential for impacts affecting sublittoral and benthic habitats (including *Zostera* and maerl) and sandy mud intertidal areas are avoided, as these habitats do not overlap with the intertidal zone where the proposed harvesting will take place. In areas where mud / sand flats occur, boats shall only be operated at high tide or when the tide has begun to recede when attempting to reach rocky shores supporting the *A. nodosum* community beyond these areas. The Code of Practice ensures that harvesters do not disrupt these areas. In addition, the Code of Practice ensures the potential for displacement or disturbance of reef and species therein, due to poor navigation is avoided through use of a depth sounder device on the collection boat (if deemed applicable to the area).

To continually validate and improve the methodology, scientists and engineers at BioAtlantis will assess the potential impact of the hand harvesting system on understory species on an ongoing basis and on a long term basis throughout the life-time of the licence. This will ensure that scientific knowledge is increased beyond the time-frame undertaken by Kelly *et al.* (2001). This will be essential to ensure that conservation objectives are met continually into the future. Moreover, the harvesting system may be improved into the future as new datasets emerge from the NPWS and others.

Clew Bay has in excess of 90 islands and 100km of coastline that contain harvestable quantities of *A. nodosum*. For the effective management of this area BioAtlantis will create a database of the islands and coastal areas. This database will be used to:

- Determine sites which require a fallowing period to allow for adequate recovery from recent activities;
- Determine rotation requirements (i.e., extrapolation and calculation of the duration or fallowing period required prior to a particular areas being fit for re-harvest);
- Prevent harvest activities that would lead to a decline in yield; and
- Record the details of each harvest, how much, by whom & when.

As a general policy, hand harvesters will ensure the following:

Boats and Vessels:

- Maintain distance from other boats and vessels, such as power boats, cruise boats, kayaks, rib boats, row boats, fishing boats when travelling to sites, thus preventing any in-combination effects.
- Maintain distance from passenger ferries and cargo vessels and ensure no interactions with their routes and activities.

Site Avoidance:

- Avoid sites where sports, leisure activities, education excursions, retreats, seaweed foraging days, discovery tours or workshops are observed to be taking place. This will be determined on a case-by-case basis. Harvesters will not interact with people on the shore engaging in these activities.

Watersports:

- Harvesters and operators of boats must ensure caution when operating in the vicinity of floating watersports, yacht moorings and areas where other sports such as dinghy sailing, water skiing and jet skiing are taking place (e.g., in the vicinity of Mayo Sailing Club, the Sruhnameel Channel and Schoolhouse Bay). Ensure caution when operating in known areas of importance to swimmers and kayakers (e.g., Rosmindle pool).
- Harvesters and operators of boats must keep well clear of boats during training and racing and must observe 'power gives way to sail' conventions when appropriate.
- Respect the space of all recreational users when operating in the complex.

With reference to the conservation objectives of the Clew Bay Complex SAC, disturbance of each community type via licensed activities should not exceed an approximate area of 15%. Community types within the designated areas are provided in Map 4 of the site conservation objectives (NPWS, 2011b). The basis of this 15% recommended by the NPWS will rely on the current status of the habitat within the SAC. No hand harvesting will be undertaken in areas that are currently at 'Inadequate' conservation status, unless mitigation measures are in place to ensure they are unaffected. In the context of this application, Estuaries [1130] are considered as 'Unfavourable-inadequate' on a national level and mitigation measures are in place to ensure that these areas are not impacted when operating in Clew Bay. In addition, Estuaries [1130] are not a Qualifying Interest of the SAC. While mudflats and sandflats not covered by seawater at low tide [1140] are in 'favourable' condition in Clew Bay, they are considered as being in 'Unfavourable-Inadequate' condition on a national level. Mitigation measures are in place to ensure that harvesting will not take place in this habitat and measures are in place to ensure mudflats and sandflats are unaffected when travelling to and from sites. While 'submerged or partially submerged sea caves' [8330] and 'Sandbanks which are slightly covered by sea water all the time [1110]' are both in 'favourable' condition, harvesting will not take place in these areas.

Large shallow inlets and bays [1160] is a broad category with five attributes encompassing seven habitats/community types: Sandy mud with polychaetes and bivalve community complex, Fine sand dominated by *Nephtys cirrosa* community, Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex, Shingle, and Reef. Notably, Reef [1170] is an Annex I habitat under the EU Habitats Directive and therefore has been assessed as such here. It is not designated as its own habitat in the Clew Bay Complex SAC but is a constituent of the Large shallow inlets and bays [1160] habitat which is a qualifying interest in the SAC. The overall conservation status of Large shallow inlets and bays, both on a national level and in Clew Bay SAC, is considered as 'Unfavourable-Bad'. In the context of Clew Bay, the 'Unfavourable-Bad' conservation status has been attributed to impacts *Zostera* spp. (Scally et al., 2020). Mitigation measures are in place to ensure that harvesting will not take place in areas where *Zostera* spp. grows. In addition, mitigation measures are in place to ensure that harvesting will not take place in soft substratum areas (intertidal and subtidal mud/sandy mud areas). Mitigation measures are also in place to ensure that these areas are unaffected during travel to and from harvesting sites.

Reef is one of several communities associated with Large shallow inlets and bays [1160] whilst also representing an Annex 1 habitat (Reef [1170]) under the EU Habitats Directive although it is not designated itself in the SAC. Therefore, taking the precautionary principle in to account the reef habitat here will be assessed as potentially being an Annex I habitat. According to Scally *et al.* (2020), Reef [1170] is categorised as being in a 'favourable' conservation condition in Ireland. This includes intertidal and subtidal reef areas. *A. nodosum* harvesting will take place in intertidal reef areas, subject to compliance with mitigation measures listed in the Code of Practice. These measures are required to ensure that Reef [1170] is maintained in 'favourable' conservation condition, in terms of area, structure and function and future prospects. Similarly, harvesters will ensure close compliance with mitigation measures when harvesting in areas that may contain shingle substratum. Additional mitigation measures are outlined in the Code of Practice to prevent impacts that could negatively affect the conservation status of marine Annex I habitats.

The evidence from the literature suggests that the potential for effects to arise as a result of sustainable hand harvesting of *Ascophyllum nodosum*, are limited. For example, Kelly et al., 2001, shows that *A. nodosum* regenerates 11 to 17 months post harvesting. Kelly et al., 2001, also demonstrates that there are no impacts of harvesting on overall biodiversity, mobile epifauna and fish 11 to 17 months post-harvesting. A study by Lauzon-Guay et al., 2023, shows that harvest of *A. nodosum* (at sites with a 20 + year history of commercial harvesting) does not have long-term impact on the morphology of the algae or on the abundance of its main inhabitants. Therefore, It is considered unlikely that sustainable hand harvesting of *Ascophyllum nodosum* would give rise to any further effects on Large Shallow Inlets and Bays [1160] in Clew Bay. However, mitigation measures are in place to ensure that no further effects occur, particularly areas where harvesting will take place such as reef and shingle areas which are components of the Large Shallow Inlets and Bays [1160] It is noted that BioAtlantis' activities will fall below the 15% limit for significant continuous or ongoing disturbance outlined in the conservation objectives document for this SAC and the associated limits for conservation of structure and function in marine Annex I habitats. Adherence with these limits is ensured as harvesting site locations and activities will be planned and recorded. The status and quality of the *A. nodosum* habitat will be maintained by adhering to the sustainable harvesting methods and limits specified for the extent of these harvesting activities. It is noted that the holdfast of the *A. nodosum* will be left fully intact and attached to the underlying rock, stone or growth substrate so as to allow for recovery and re-growth in subsequent years. Furthermore, certain areas will be excluded from harvesting, thereby avoiding continuous disturbance (See Addendum 4 - Code of Practice for detailed harvesting times).

BioAtlantis are applying for a licence for commercial harvesting. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. This is to ensure compliance with the conservation objectives for the site, and to ensure adequate record keeping, monitoring of the resource and access to sensitive sites and particular times of the year. In terms of traditional or casual harvesting, measures are in place to ensure that harvesting activities must not impact on other people who harvest small volumes of seaweed, edible seaweeds or invertebrates for their own personal use. In terms of traditional harvesting activities, BioAtlantis aim to utilise the existing system and contract those with experience in the traditional hand cutting methodology. In addition, the hand cutting approach avoids holdfast removal and the harvesters have sufficient oversight on the cutting process and co-harvest of holdfast will be prevented. In effect, this avoids potential for *A. nodosum* mortality. BioAtlantis aim to get the best from the traditional approach but provide improvements which ensure better working conditions and compliance with the SAC objectives. Harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the PRAI, the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum.*

On approval to hand harvest in Clew Bay, BioAtlantis will work to identify all sites which have been harvested recently. These areas will then be designated as requiring a 3 – 5 year fallowing period, depending on the level and severity of harvest. This approach will ensure that BioAtlantis hand harvest activities will not occur in recently harvested sites, thus preventing any cumulative effects. BioAtlantis are applying for a licence for commercial harvesting. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded, and advice will be sought from the relevant authorities on how to proceed. This is to ensure compliance with the conservation objectives for the site, and to ensure adequate record keeping, monitoring of the resource and access to sensitive sites at particular times of the year. In terms of traditional or casual harvesting, measures are in place to ensure that harvesting activities must not impact on other people who harvest small volumes of seaweed, edible seaweeds or invertebrates for their own personal use. Any commercial user having small requirements of approximately 1 tonne per annum (e.g., hotels, health spas) will be identified and BioAtlantis will work to prevent in-combination effects. Appropriate action will be taken on a case-by-case basis.

In order to ensure that harvest activities are sustainable and not damaging to protected species and habitats, as specified by the NPWS, it is the aim of BioAtlantis to be granted a license to undertake hand harvest activities in the region. In such an event, BioAtlantis will commit to ensuring that all activities are monitored, controlled and recorded with full traceability. A pre-license survey study of Clew Bay has been undertaken by University College Dublin (UCD) on behalf of BioAtlantis. The study includes an assessment of *A. nodosum* biomass in Clew Bay and the extent of existing harvesting activities in the complex. The associated report was submitted with BioAtlantis' application. As outlined in the application, a pre-harvesting survey of an unharvested site will also be undertaken to assess the recovery *of A. nodosum* harvesting over the lifetime of the licence. The survey will be undertaken in an Annex I habitat (Large Shallow Inlets and bays) where *A. nodosum* grows, located within the proposed harvesting area and within the Reef and/or Shingle. This is outlined in Section 1.3.3 of the application (under "Operation/Activity 4: Long term assessment biomass and community structure") and Section 3.5.3 (under "The potential interaction effects of seaweed harvesting"). Parameters by which recovery will be assessed include rates of re-growth of *A. nodosum*, biomass (Kg/m^2) and numbers and/or density of *A. nodosum* plants per area (Sections 1.3.3 and Section 3.5.3 of the application). The programme of biological surveying efforts and monitoring will also include *Fucus* plants, and numbers of Animalia. Particular focus will be placed on assessing the numbers of key species such as periwinkles, limpets, barnacles and presence of red algae (Tandy) and ephemeral green algae. The survey will be employed to monitor the condition of the habitat following harvesting activities. The surveying programme will follow best practice approaches for conducting marine ecological surveys. The programme will be agreed with the relevant licensing authority and will include inputs from relevant expert public bodies where required. Furthermore, the monitoring programme will include a non-conformance reporting system and corrective actions. Coupled to this will be robust documented oversight in the form of regular, in depth, auditing of the harvesting system on a quarterly and annual basis. Management systems such as these represent the only practical means of guaranteeing that there are no significant risks either direct, indirect, isolated, interactive, cumulative, short term or long-term on this SAC site.

For the prevention of cumulative impacts caution will be required when approaching / operating near areas where planned and existing aquaculture sites are in relatively close proximity to Harbour seal breeding, moulting and resting sites and bird breeding and wintering sites. Ensure caution when travelling in the vicinity of defined aquaculture navigation routes. Do not impede workboat or tractor access to aquaculture sites along access routes, including but not limited to those associated with Clynish, Inishcottle Pier, Kilmeena, Knockmanus, Murrisk, Newfield (Mulranny), Roigh Pier (near Rockfleet Bay), Roskeen South (Carrowbeg), Roskeen South, Rosmoney Pier, Ross, Rosslaher, Rossmalley, Rossmoney, Rossymailley and Tiernaur, quays, piers, private laneways or routes or other pick up points. Do not interfere with aquaculture users who are licensed to harvest or grow seaweed. Ensure no aspects of *A. nodosum* harvesting gives rise to any physical interaction or contact with aquaculture production units, their structures or anchors.

For working in the vicinity of anglers and fisheries activities in relation to cumulative impacts, ensure that space of recreational/shore anglers is respected, particularly when competitions and festivals take place, e.g., during summer in areas including the following: Mallaranny Strand, Curraun, Lough Furnace Newport Pier, Newport Quay, Rossnakilly, Rossnakilly, Ross, Rossanrubble, Altapheebera and Whiteheather. Keep distance and do not interfere with licensed salmon draft fishermen who may cut back seaweed when using their nets. Ensure that seaweed harvesting only takes place in the intertidal *A. nodosum* zone and not in subtidal areas of relevance to fisheries activities such as potting (Lobster, crab, shrimp, whelk and nephrops), dredging (e.g., scallop, native oyster, cockle), trammel net fishing for bait, otter trawl, tangle net (crayfish), gillnet, mid-water trawl.

Activities in subtidal waters that are permitted include site visits, inspections, surveys, collection of harvested seaweed, transport and transfer to pick up points. Harvesters must avoid interactions with non-*A. nodosum* habitats which represent the broader habitat range of fish, shellfish, invertebrates and fisheries species during adult and early-life stages, including: seagrass, deep water areas, estuarine waters, saltmarsh, lagoons, maerl, subtidal gravel/coarse bottom, subtidal soft bottom areas, intertidal soft bottom areas, and exposed shores. Avoid soft substratum areas where bait digging for ragworm and lugworm is observed to be taking place. Harvesters will not cut *A. nodosum* in any areas where there are existing appurtenant rights or burdens in relation to the harvesting, gathering or removal of seaweed from the shore, without first obtaining permission from the person to which those rights belong. Where Profit-à-Prendre rights to harvest seaweed are successfully registered with the PRAI, the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. Harvesting activities must not impact on other people who harvest small volumes of edible seaweeds for their own personal use, e.g., dillisk and carrageenan. Harvesting activities must not impact on other individuals who harvest or collect invertebrates, e.g. limpets, mussels, clams, periwinkles and scallops.

6.2 Mitigation measures for the protection of Annex II species

6.2.1 Common seal

The potential for significant disturbance of Common seal populations within the Clew Bay Complex SAC during the periods of greatest sensitivity for this species (breeding, moulting and haul-out/resting) has been avoided with the measures included in the 'Code of Practice', as set out in the updated Licence Application (BioAtlantis, 2024), see also Addendum 4. Sensitive shorelines and islands of importance for Common seal and which would be subject to disturbance impacts have been identified and are to be avoided during the seasonal requirements of this species. These measures form part of the sustainable harvest management plan for the proposal. Hand harvest of *A. nodosum* will not involve the use of artificial physical barriers which would restrict or affect the species range of harbour seals in Clew Bay. The 'Code of Practice', with specific regard to Common seal ensure that harvesters:

- Have full knowledge of the sites in Clew Bay known to be relevant the harbour seal;
- Full knowledge of harbour seal sites which are out of bounds at relevant times of the year;
- Understand the steps required to ensure that all contact with seals is prevented from day to day; and
- Operate boats according to practises which minimise impact on harbour seal.

The 'Code of Practice' incorporated into the updated Licence Application (BioAtlantis, 2024) ensures that no disturbance events occur at Common seal breeding sites (i.e. no harvest between May – July) and includes navigation guidelines to ensure that seals are not disturbed resulting in entry or 'flushing' into the water. The probability of human presence or activities affecting Common seals at known moulting sites of Clew Bay is reduced given that harvesters cannot harvest at these sites during the moulting period (August – September). Measures to avoid human presence or activities affecting Common seals at known resting sites including Inishcorky are set out, where harvesters cannot harvest at these sites during the obligate resting period (October – April).

6.2.2 Otter

Specific mitigation measures have been included for the avoidance of significant impacts affecting Otter, with regard to the habitat requirements of this species and the conservation objectives of the Clew Bay Complex SAC: All linear habitats located beyond the intertidal zone will be avoided. All marine riparian areas beyond the foreshore will be avoided and only existing routes will be used. Freshwater habitats are excluded from all harvest activities. In addition, the Burrishoole catchment area will be excluded. The mouth of Lough Furnace and the Rosmurrevagh shoreline area will be also excluded from all harvest activity, thus preventing any impact on important otter populations within this area; these measures will further avoid impacts affecting the anadromous life-cycles of trout, eel or salmon which are an important food source for otters within these locations. BioAtlantis will never interfere with couching sites, holts, access paths / routes, that may be present near coastal areas, agricultural fencing, roads, slipways, access points or other areas. Large trees near coastal areas will be avoided as they can represent important otter breeding and resting sites. Any undisturbed areas (e.g., impenetrable scrub/reeds) will be avoided which are refuges for Otters. BioAtlantis will never interfere with, deliberately approach or disturb otters or their cubs that are resting, sleeping, hunting, feeding or foraging in water or on the shore during the daytime, dawn or dusk and will ensure caution during the periods of breeding, rearing or hibernation. If migrating / commuting otters are encountered in the water, do not obstruct their movement. Slow down the boat and give sufficient space to pass without ‘boxing’ them in, blocking narrow channels or acting as a barrier to commuting or connectivity. If otters are encountered on the shore, allow otters free access and ample opportunity to escape the water. Do not behave in a way that results in them moving away or fleeing human disturbance. To prevent in combination effects, adhere to the above measures at all times, particularly when working in areas known to exhibit signs of otter activity.

Harvest activities will not require construction of barriers which would affect access to sites of habitats. Linear habitats will not be damaged or blocked in anyway therefore ensuring that otter have undisrupted access to the marine zone and existing foraging locations, couching sites and commuting routes between holts and foraging areas. Harvest activities will take place in the *A. nodosum* intertidal zone and will not lead to any destruction of terrestrial habitat. The harvest of *A. nodosum* will not exceed 20% of the available biomass per site per annum, thus ensuring the maintenance of the *A. nodosum* habitat. Otter food supply will not be affected due to harvest activities in Clew Bay, where hand harvest is not associated with reductions in fish numbers within the *A. nodosum* biotope (Kelly et al., 2001). Harvesting activities will take place in the intertidal zone with transport along existing road and slipway access points and will not affect otter holts. Harvesting will not take place in areas outside the *A. nodosum* zone, as these habitats represent the broader habitat range of the otter’s prey during adult and early life stages, including: flowing and static freshwater areas (rivers, streams, canals, lakes, reservoirs, ponds), deep water subtidal areas (>30m), shallow subtidal areas (<30m), exposed areas, estuarine waters, brackish waters, subtidal gravel/coarse bottom substratum, intertidal soft bottom (sand or mud) and exposed waters in the vicinity of rocky cliffs. Harvesters will avoid exposed and non-sheltered areas that represent the otter’s broader habitat range, hunting ground and foraging area. Harvesters will avoid co-harvesting non-*A. nodosum* material near coastal habitats, near the shoreline or on the shore. In addition, harvesters will ensure that inadvertent by-catch of other algae, dead/senescing algae, amphipods, isopods or other *Animalia* or material is prevented and minimised. The holdfast of *A. nodosum* will not be removed by harvesters and care will be taken to avoid disturbance to rocky or crevice substratum.

Overall, BioAtlantis Ltd. will implement an 'Adaptive Management Approach' to ensure continual improvements to the harvesting plan during its implementation and its effectiveness into the future. This will include ongoing liaison with the NPWS regarding shoreline and island locations of importance to Common seal and Otter and will provide for the amendment and alteration of the Code of Practice in order to limit environmental impacts and ensure the sustainable strategy adopted by the company.

6.3 Mitigation measures for changes in community structure

The study by Kelly *et al.* (2001) examined the impact of hand harvesting over an 18 month period. While this study demonstrated recovery of *A. nodosum* biomass and relatively minimal impacts on understory species, the study has some deficiencies, primarily due the study's short duration, focus on macro-invertebrates and a lack of quantitative data in relation to species prevalence. Therefore, while conclusions can be made regarding the short-term impacts of hand harvesting in Clew Bay, there is a lack of evidence regarding long-term impacts on community structure.

BioAtlantis will build on the findings of Kelly *et al*., (2001) and continually assess the impact of *A. nodosum* harvesting over the lifetime of the licence. The experimental design will involve measurement of (a) rates of re-growth of *A. nodosum* post-harvest, and (b) associated biodiversity. An experimental site will be chosen which will allow for comparisons between non-harvested areas and harvested areas. Sections will be taken which are large enough to allow for sufficient numbers of replicates. A range of parameters will be measured, including numbers of *A. nodosum* plants, numbers of *Fucus* plants, and numbers of *Animalia*. Particular focus will be placed on assessing the numbers of key species such as periwinkles, limpets, barnacles and presence of red algae (Tandy) and Ephemeral green algae. Assessments will be performed on an annual basis to allow for monitoring over an extended time-period, preferable between 5 – 10 years. An initial pilot study has also already been performed.

This approach will allow scientists and engineers at BioAtlantis to continually validate and improve the methodology on an ongoing basis and on a long-term basis throughout the lifetime of the licence. This will ensure that scientific knowledge is increased beyond the timeframe assessed by Kelly *et al*., (2001). This will be important in ensuring that conservation objectives are met continually into the future.

A Code of Practice is in place to ensure environmentally safe navigation when operating mudflats and sandflat areas. This will prevent any impact on mudflats or sandflats or intertidal sedimentary communities therein. Crucially, it ensures that any existing negative effects associated with aquaculture are not exacerbated by hand harvest of *A. nodosum.* The environmentally safe navigation component of the Code of Practice also includes fine sand areas, single, reef and Atlantic Salt Meadows.

6.4 Mitigation measures to ensure recovery of harvested areas.

The potential for cumulative and in combination impacts are outlined in the application. This includes impacts associated with planned and existing activities such as seaweed harvesting. The proposed harvest levels in this application are considered sustainable and measures are in place to ensure that sites have recovered before harvesting takes place again.

In terms of fallowing periods, data will be entered in the database as described in Table 5 of BioAtlantis' application. The maximum harvest available from each island or coastal zone has been estimated and the nominal recovery time is will be 3-5 years from a complete harvest, or potentially within 11 to 17 months post-harvest given the post-harvest recovery rates reported by Kelly et al., 2001. BioAtlantis will harvest a maximum of 20% of the total available *A. nodosum* biomass per site per annum to ensure sustainability. The figure of 20% refers to the percentage of the total available biomass harvested per site per annum (the Maximum Annual Harvest). This is outlined in Section 1.3.3, of the main application document, under "Planning & scheduling of harvesting activities". If quota is exceeded, the Resource Manager will issue a Non-Conformance Report (NRC) to BioAtlantis management. Harvesters will be provided with training if necessary.

As *A. nodosum* biomass can potentially recover within 11 to 17 months (Kelly et al., 2002), it may be possible therefore to harvest year on year in certain locations; however this is subject to recovery being achieved. As outlined in the application, measures will be put in place to ensure that harvesting does not take place if a site has not recovered from the previous year, thus preventing cumulative effects from occurring: *"BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done via on-site assessments and updating the plan as necessary with the results of this analysis".* Cumulative effects will therefore be very limited.

As outlined in the application, harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the Property Registration Authority of Ireland (PRAI), the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. The Resource Manager will routinely inspect sites post-harvest to ensure compliance of harvesters with sustainable hand harvest methods. Harvest will be recorded using BioAtlantis Compliance and Record Forms.

A pre-license survey study of Clew Bay was undertaken by UCD and submitted with BioAtlantis' application. This study included an assessment of *A. nodosum* biomass and an assessment of the extent of existing harvesting activities. Key findings from the report included: (a) There was evidence of harvesting at 26 out of the 40 sampled sites. The intensity of harvesting varied across these sites, (b) Six, eight and twelve sites exhibited evidence of low, moderate and increased levels of harvesting respectively, and (c) There was no evidence of harvesting at 18 out of 40 sites sampled. The measures outlined above ensure the recovery of harvest areas and prevention of cumulative impacts with unlicensed harvesting, particularly in relation to appurtenant rights/burdens and Profit-à-Prendre rights.

A pre-harvesting survey of an unharvested site will be undertaken to assess the recovery of *A. nodosum* harvesting over the lifetime of the licence. This is outlined in Section 1.3.3 of BioAtlantis' application (under "Operation/Activity 4: Long term assessment biomass and community structure") and Section 3.5.3 (under "The potential interaction effects of seaweed harvesting"). Parameters by which recovery will be assessed include rates of re-growth of *A. nodosum*, biomass (Kg/m2) and numbers and/or density of *A. nodosum* plants per area (as outlined in Section 1.3.3 and Section 3.5.3 of the BioAtlantis application). These measures ensure that recovery will be assessed over the lifetime of the license.

Table 7 Harvesting locations and quantity estimates within the Clew Bay study area.

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Reef (m²)	Area in use / Per Year‡ Shingle (m²)
	Bartraw - Westport	CZ 1.1	61074	0	46%	0.0 T	0.0 T	0	0
		CZ 1.2	83288	0.7	100%	58.3 T	11.7 T	16658	0
		CZ 1.3	57560	0.7	98%	39.4 T	7.9 T	11260	252
		CZ 1.4	46890	0.7	100%	32.8 T	6.6 T	9378	0
		CZ 1.5	59466	0.7	70%	29.3 T	5.9 T	8365	3528
		CZ 1.6	32360	1.25	100%	40.4 T	8.1 T	6472	0
		CZ 1.7	47684	0.7	100%	33.4 T	6.7 T	9537	0
		CZ 1.8	77259	0	54%	0.0 T	0.0 T	0	0
		CZ 1.9	7961	0.7	100%	5.6 T	1.1 T	1592	0
		CZ 1.10	5559	1.25	100%	6.9 T	1.4 T	1112	0
		CZ 1.11	11271	1.25	100%	14.1 T	2.8 T	2254	0
		CZ 1.12	4254	1.25	100%	5.3 T	1.1 T	851	0
		CZ 1.13	136927	10.5	94%	1354.0 T	270.8 T	25790	1596
		CZ 1.14	76090	10.5	94%	751.9 T	150.4 T	14322	896
		CZ 1.15	37232	0.5	100%	18.6 T	3.7 T	7446	0
		CZ 1.16	35400	0.5	100%	17.7 T	3.5 T	7080	0
		CZ 1.17	35419	0.5	100%	17.7 T	3.5 T	7084	0
		CZ 1.18	6633	0.5	100%	3.3 T	0.7 T	1327	0
	Westport - Rosmoney	CZ 2.1	38658	0	82%	0.0 T	0.0 T	0	0
		CZ 2.2	5199	0	100%	0.0 T	0.0 T	0	0
		CZ 2.3	8889	0	100%	0.0 T	0.0 T	0	0
		CZ 2.4	35324	0	94%	0.0 T	0.0 T	0	0
		CZ 2.5	74945	0.55	98%	40.4 T	8.1 T	14693	296
		CZ 2.6	30076	0.8	100%	24.1 T	4.8 T	6015	0
		CZ 2.7	7831	0	57%	0.0 T	0.0 T	0	0
		CZ 2.8	6710	0	100%	0.0 T	0.0 T	0	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)†		Area in use / Per Year‡	
						Available Seaweed	Maximum Annual Harvest	Reef (m²)	Shingle (m²)
		CZ 2.9	125537	0.8	100%	100.4 T	20.1 T	25107	0
		CZ 2.10	109815	0.8	97%	85.0 T	17.0 T	21259	704
		CZ 2.11	9303	0	100%	0.0 T	0.0 T	0	0
		CZ 2.12	27612	0	91%	0.0 T	0.0 T	0	0
		CZ 2.13	328	0	100%	0.0 T	0.0 T	0	0
		CZ 2.14	22527	0	100%	0.0 T	0.0 T	0	0
		CZ 2.15	3842	0	94%	0.0 T	0.0 T	0	0
		CZ 2.16	6082	0	100%	0.0 T	0.0 T	0	0
		CZ 2.17	3636	0	0%	0.0 T	0.0 T	0	0
	Rosmoney - Moyna Strand	CZ 3.1	18865	0	50%	0.0 T	0.0 T	0	0
		CZ 3.2	40641	4.35	100%	176.8 T	35.4 T	8128	0
		CZ 3.3	97095	4.35	100%	422.4 T	84.5 T	19419	0
		CZ 3.4	12914	4.35	100%	56.2 T	11.2 T	2583	0
		CZ 3.5	9650	4.35	100%	42.0 T	8.4 T	1930	0
		CZ 3.6	78317	4.35	95%	323.9 T	64.8 T	14891	772
		CZ 3.7	117114	4.35	100%	509.4 T	101.9 T	23423	0
		CZ 3.8	8398	4.35	100%	36.5 T	7.3 T	1680	0
	Rostoohy Pt - Newport	CZ 4.1	84464	4.35	92%	339.0 T	67.8 T	15587	1305
		CZ 4.2	27181	4.35	100%	118.2 T	23.6 T	5436	0
		CZ 4.3	150517	4.35	100%	654.8 T	131.0 T	30103	0
		CZ 4.4	38351	4.35	99%	164.9 T	33.0 T	7580	90
		CZ 4.5	26354	0	96%	0.0 T	0.0 T	0	0
		CZ 4.6	6397	0	83%	0.0 T	0.0 T	0	0
		CZ 4.7	5572	0	100%	0.0 T	0.0 T	0	0
		CZ 4.8	6703	0	100%	0.0 T	0.0 T	0	0
		CZ 4.9	9671	0	100%	0.0 T	0.0 T	0	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg / m^2)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Reef (m^2)	Area in use / Per Year‡ Shingle (m^2)
		CZ 4.10	24594	0	64%	0.0 T	0.0 T	0	0
		CZ 4.11	117165	0.85	81%	80.2 T	16.0 T	18866	4567
		CZ 4.12	77555	0.85	100%	65.9 T	13.2 T	15511	0
		CZ 4.13	278265	0.85	79%	187.7 T	37.5 T	44163	11490
		CZ 4.14	110969	0.85	100%	94.3 T	18.9 T	22194	0
	Newport - Mallaranny Pier	CZ 5.1	61157	0	100%	0.0 T	0.0 T	0	0
		CZ 5.2	58948	3.5	79%	163.3 T	32.7 T	9334	2455
		CZ 5.3	105121	3.5	84%	310.9 T	62.2 T	17763	3261
		CZ 5.4	258002	3.5	92%	833.8 T	166.8 T	47644	3956
		CZ 5.5	82278	3.5	83%	240.2 T	48.0 T	13728	2728
		CZ 5.6	41272	3.5	100%	144.5 T	28.9 T	8254	0
		CZ 5.7	145329	3.5	89%	454.2 T	90.8 T	25955	3110
		CZ 5.8	84126	3.5	100%	294.4 T	58.9 T	16825	0
		CZ 5.9	8260	3.5	100%	28.9 T	5.8 T	1652	0
		CZ 5.10	17114	3.5	100%	59.9 T	12.0 T	3423	0
		CZ 5.11	4451	3.5	100%	15.6 T	3.1 T	890	0
		CZ 5.12	1689	3.5	100%	5.9 T	1.2 T	338	0
		CZ 5.13	29666	3.5	100%	103.8 T	20.8 T	5933	0
		CZ 5.14	3900	1.75	100%	6.8 T	1.4 T	780	0
		CZ 5.15	30450	1.75	100%	53.3 T	10.7 T	6090	0
		CZ 5.16	11735	1.75	100%	20.5 T	4.1 T	2347	0
		CZ 5.17	47890	1.75	79%	65.8 T	13.2 T	7524	2054
1	Forillan, Illanavrick	IS 11.1	40653	6	100%	243.9 T	48.8 T	8131	0
		IS 11.2	13763	10	100%	137.6 T	27.5 T	2753	0
2	Kid Isd East		3966	14	100%	55.5 T	11.1 T	793	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Reef (m²)	Area in use / Per Year‡ Shingle (m²)
3	Roslynagh		7990	0	0%	0.0 T	0.0 T	0	0
4	Illannambraher		57901	19	96%	1053.2 T	210.6 T	11086	494
5	Inishdasky		14818	18	100%	266.7 T	53.3 T	2964	0
6	Inishquirk		25206	15	82%	308.9 T	61.8 T	4119	922
7	Inishtubrid		45540	18	100%	819.7 T	163.9 T	9108	0
8	Inishlim		13308	16	100%	212.9 T	42.6 T	2662	0
9	 Beetle Isd North Inishbobunnan		41752	18	100%	75.1 T	15.0 T	8350	0
10 10 10	 Inishgowla Beetle Isd South		566589	16	27%	246.1 T	49.2 T	30775	82543
11	InishKeel	IS 11.1	16036	12.5	100%	200.5 T	40.1 T	3207	0
		IS 11.2	2083	16.75	100%	34.9 T	7.0 T	417	0
		IS 11.3	300	17.5	100%	5.3 T	1.1 T	60	0
		IS 11.4	5876	17.5	100%	102.8 T	20.6 T	1175	0
12	Black Rock		24348	2.5	100%	60.9 T	12.2 T	4870	0
13	Moynish More		0	0	0%	0.0 T	0.0 T	0	0
14	Moynish Beg		0	0	0%	0.0 T	0.0 T	0	0
15	Inisherkin		53097	18	41%	387.7 T	77.5 T	4308	6312
16	Inishnacross		46888	18.5	61%	525.0 T	105.0 T	5675	3702
17	Inishilra		36300	18	78%	507.0 T	101.4 T	5633	1627

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Reef (m²)	Area in use / Per Year‡ Shingle (m²)
18	Inishcooa		70929	12	57%	486.2 T	97.2 T	8104	6082
19	Roeillaun		77113	5	100%	385.6 T	77.1 T	15423	0
20	Inishdeashbeag		62555	0	100%	0.0 T	0.0 T	0	0
	Inishdeashmore								
21	Inishcorky		17912	18.75	100%	335.8 T	67.2 T	3582	0
22	Inishcarrick		34846	19	60%	397.3 T	79.5 T	4182	2787
23	Inishcoragh		24041	15	100%	360.6 T	72.1 T	4808	0
24	Muckinish		33800	19.25	100%	650.6 T	130.1 T	6760	0
25	Inishdaweel		22175	20	77%	342.8 T	68.6 T	3428	1007
26	Rabbit Isd		52391	8	58%	242.1 T	48.4 T	6053	4425
27	Illanascrraw		10411	18	100%	187.4 T	37.5 T	2082	0
28	Freaghillanlug gagh		23358	20	100%	467.2 T	93.4 T	4672	0
29	Inishkee		16398	19	100%	311.6 T	62.3 T	3280	0
30			15889	18	100%	286.0 T	57.2 T	3178	0
31	Freaghillan West		20456	19	50%	194.8 T	39.0 T	2050	2041
32	Innishcannon		8656	16	100%	138.5 T	27.7 T	1731	0
33	Carricklahan		0	0	0%	0.0 T	0.0 T	0	0
34	Carrickachorra		0	0	0%	0.0 T	0.0 T	0	0
35	Illanmaw		74045	0	66%	0.0 T	0.0 T	0	0
36	Freaghillan East		6422	18	100%	115.6 T	23.1 T	1284	0
37			1476	16	100%	23.6 T	4.7 T	295	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Reef (m²)	Area in use / Per Year‡ Shingle (m²)
38	Inishcuill West		82042	20.75	79%	1348.2 T	269.6 T	12995	3413
39	Mauherillan		14262	16.75	91%	217.5 T	43.5 T	2598	255
40	Inishfesh		54236	18	70%	685.8 T	137.2 T	7620	3228
41	Inishmolt		23618	18	100%	425.1 T	85.0 T	4724	0
42	Inishloy		36182	18.5	100%	669.4 T	133.9 T	7236	0
43	Inishdaff		70875	20.5	100%	1452.9 T	290.6 T	14175	0
44	Inishbollog		13201	20.75	100%	273.9 T	54.8 T	2640	0
45	Inishlaughil		55888	0	100%	0.0 T	0.0 T	0	0
46	Inishgowla		67983	16	22%	243.7 T	48.7 T	3046	10550
47	Inishoo		23072	0	13%	0.0 T	0.0 T	0	0
48	InishTurk	IS 48.1	56134	21	100%	1178.8 T	235.8 T	11227	0
		IS 48.2	10755	21	100%	225.9 T	45.2 T	2151	0
49	Illannaconney		17437	15	77%	201.6 T	40.3 T	2688	800
50	Inishakillew	IS 50.1	69800	21.75	100%	1518.1 T	303.6 T	13960	0
		IS 50.2	18583	21.75	100%	404.2 T	80.8 T	3717	0
51	Trawbaun		256815	19.5	89%	4468.7 T	893.7 T	45833	5530
	Carrigeenglass North								
	Moneybeg								
	Inishcottle								
52	Calf Island		30778	19.75	81%	490.3 T	98.1 T	4965	1190
53	Inishbee, Derrinish & Dernish West		200836	17.5	58%	2021.6 T	404.3 T	23104	17063
54	Freaghillan	IS 54.1	27454	19.75	66%	357.1 T	71.4 T	3616	1875
		IS 54.2	55101	20	90%	989.7 T	197.9 T	9897	1123

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area	Typical Density	Coverage	Harvest levels (Tonne)†		Area in use / Per Year‡	
			(m²)	(kg / m²)	%	Available Seaweed	Maximum Annual Harvest	Reef (m²)	Shingle (m²)
		IS 54.3	5995	21	100%	125.9 T	25.2 T	1199	0
55	Clynish		102154	18.5	77%	1463.2 T	292.6 T	15818	4612
56	Ilaunnamona		25370	16	95%	384.3 T	76.9 T	4804	270
57	Rabbit Island, Island More & Quinnsheen Island	IS 57.1	14757	19.5	100%	287.8 T	57.6 T	2951	0
		IS 57.2	92903	16	88%	1307.4 T	261.5 T	16342	2239
		IS 57.3	7894	17.5	100%	138.1 T	27.6 T	1579	0
		IS 57.4	9330	18	100%	167.9 T	33.6 T	1866	0
58	Collan More, Carrigeenglass South & Collan Beg	IS 58.1	501217	16.75	100%	8395.4 T	1679.1 T	100243	0
		IS 58.2	55220	18.75	100%	1035.4 T	207.1 T	11044	0
		IS 58.3	29858	19.5	100%	582.2 T	116.4 T	5972	0
59	Inishgort		64954	15.5	57%	571.7 T	114.3 T	7376	5614
60	Inishlyre		121285	5	57%	347.3 T	69.5 T	13891	10366
61	Illanataggart & Crovinish		442259	14	99%	6133.0 T	1226.6 T	87614	838
62	Ininhgowla South + Carrickwee		183389	15	100%	2750.8 T	550.2 T	36678	0
63	Forilan		30569	9.75	100%	298.0 T	59.6 T	6114	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Reef (m²)	Area in use / Per Year‡ Shingle (m²)
64	Carrickawart	IS 64.1	26696	16	100%	427.1 T	85.4 T	5339	0
64		IS 64.2	1276	14.25	100%	18.2 T	3.6 T	255	0
65	Inishlaghan		32314	14.5	83%	388.4 T	77.7 T	5358	1105
66	Dorinish More & Dornish Beag		27107	12.5	100%	338.8 T	67.8 T	2980	2441
67	Inishimmel		0	0	0%	0.0 T	0.0 T	0	0
68	Inishleauge		54366	8	77%	334.3 T	66.9 T	8358	2515
69	Inishdaugh		22949	6.5	72%	108.0 T	21.6 T	3322	1268
70	Inishraher		81224	14.7	85%	1014.1 T	202.8 T	13798	2447
71	Inisheeney		53625	16	85%	725.4 T	145.1 T	9068	1657
72	Finnaun Island		0	0	0%	0.0 T	0.0 T	0	0
73	Corillan	IS 73.1	6787	6.5	100%	44.1 T	8.8 T	1357	0
		IS 73.2	1016	6.5	100%	6.6 T	1.3 T	203	0
		IS 73.3	1737	6.5	100%	11.3 T	2.3 T	347	0
		IS 73.4	3001	6.5	100%	19.5 T	3.9 T	600	0
74	Carricknamore	IS 74.1	2436	6.75	100%	16.4 T	3.3 T	487	0
		IS 74.2	1393	6.75	100%	9.4 T	1.9 T	279	0
		IS 74.3	2640	6.75	100%	17.8 T	3.6 T	528	0
75		IS 75.1	0	6.75	100%	43.8 T	8.8 T	1299	0
		IS 75.2	0	6.75	100%	7.5 T	1.5 T	221	0
		IS 75.3	0	6.75	100%	36.9 T	7.4 T	1093	0
	Stony Island	IS 75.4	0	0	100%	0.0 T	0.0 T	0	0
		IS 75.5	0	5	100%	29.1 T	5.8 T	1164	0
		IS 75.6	0	6.5	100%	69.2 T	13.8 T	2130	0
		IS 75.7	0	6.5	100%	10.7 T	2.1 T	330	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (kg / m²)	Coverage %	Harvest levels (Tonne)† Available Seaweed	Maximum Annual Harvest	Area in use / Per Year‡ Reef (m²)	Shingle (m²)
		IS 75.8	0	6.5	100%	61.7 T	12.3 T	1899	0
76	Green Islands	IS 76.1	0	0	100%	0.0 T	0.0 T	0	0
		IS 76.2	0	0	100%	0.0 T	0.0 T	0	0
		IS 76.3	0	0	100%	0.0 T	0.0 T	0	0
77	Carricknacally		2860	6.5	100%	18.6 T	3.7 T	572	0
78	Monkellys Rock		4425	8.75	100%	38.7 T	7.7 T	885	0
79	Inishweela		24604	10	97%	238.7 T	47.7 T	4775	146
80	Illanroe		28522	14	100%	399.3 T	79.9 T	5704	0
81	Roeillan		16126	15	100%	241.9 T	48.4 T	3225	0
	Totals						11,018 T**		

** Harvesting Zone ID's were assigned by BioAtlantis as part of establishing the management system.*

*** Revised Total (BioAtlantis, 2024).*

† Maximum Annual Harvest (Tonnes) is calculated as 20% of the total available biomass per site. The figure of 20% refers to the percentage of the total available A. nodosum biomass harvested per site, per annum.

‡ Area in use per year was calculated using shapefile data obtained courtesy of NPWS.

§ Denotes the percentage of coastline which can support A. nodosum growth.

7. RESIDUAL IMPACTS

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. Favourable conservation status is defined for Annex I habitats and Annex II species in the Habitat Directive (1992):

Article 1 (e) Conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2.

The conservative status of a natural habitat will be taken as 'favourable' when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future.

Article 1 (i) Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2.

The conservation status will be taken as 'favourable' when: population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The Conservation Objectives of the Clew Bay Complex SAC are based on the generic conservation objectives for designated Natura 2000 sites; that is '*to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected*'. In the case of the Clew Bay Complex SAC, specific conservation objectives are set out for the designated site with regard to qualifying interests of the site (NPWS 2011a; NPWS, 2011b; NPWS, 2011c). From the results of the Screening Assessment and NIS impact assessment, it was determined that the potential for adverse effects arising from the BioAtlantis proposal is with regard to the Annex I habitat

'Large, shallow inlets and bays' and the Annex II species Common seal and Otter. It is considered that with the strict implementation of the mitigation measures proposed in this report, and also included in the Code of Practice and associated documents provided by BioAtlantis as part of the proposal, there will be no potential for residual impacts. The conservation objectives of the individual qualifying interests are discussed in more detail below, in relation to the potential for residual impacts.

7.1 Large shallow inlets and bays

Objective: To maintain the favourable conservation condition of Large shallow inlets and bays in Clew Bay Complex SAC.

Target: The permanent habitat area is stable or increasing, subject to natural processes. Maintain natural extent of *Zostera* and maerl dominated communities. Maintain the high quality of both *Zostera*-dominated and maerl-dominated communities. The following sediment communities should be maintained in a natural condition: Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex; Sandy mud with polychaetes and bivalve community complex; and Fine sand dominated by *Nephtys cirrosa* community, Shingle habitat and Reef habitat.

The Conservation Objectives for this habitat overlap significantly with those prescribed for the Annex I habitat 'Mudflats and sandflats not covered by seawater at low tide [1140]' and which are included within the Annex I 'Large, shallow inlet and bay' habitat complex with regard to the Clew Bay Complex SAC.

At a national level marine aquaculture and invasive species are identified with regard to pressures and threats on this Annex I Habitat (NPWS, 2019a). The national evaluation of the conservation status of this habitat is (NPWS, 2019a):

- Range: Favourable (FV);
- Area: Favourable (FV);
- Specific structures and functions (including Species): Bad U2;
- Future prospects: Bad U2; and
- Overall assessment of Conservation Status: Bad U2

It is considered that with the implementation of mitigation measures proposed in this NIS there would be no potential for residual impacts on this habitat.

7.2 Common seal Phoca vitulina

Objective: To maintain the favourable conservation condition of harbour seal (Annex II species) in Clew Bay Complex SAC with regard to the following targets:

- Species range should not be restricted by artificial barriers to site use. Harbour seals occupy aquatic and terrestrial habitats in Clew Bay, including intertidal shorelines. The species is present during all aspects of its annual life cycle including breeding (approx. May – July), moulting (approx. August – September) and phases of non-breeding foraging and rest (approx. Oct – April);
- Breeding sites should be maintained in a natural condition. Harbour seals and their pups are vulnerable to disturbances during May – July, the time period just prior to and during the annual breeding season;

- Moult-out sites should be maintained in a natural condition. There are several haul-outs in Clew Bay which are important sites for moulting: Inishdeashmore, Inishdeashbeg and adjacent skerries, Inishnakillew, Inisheeny, Carrickwee, Inishgowla South, Forillan, Finnaun Island, Carrickawart Island, Corillan, Carricknamore, Stony Island and adjacent skerries, the Green Islands and adjacent skerries;
- Resting haul-out sites should be maintained in a natural condition. There are several resting haul- out sites in Clew Bay: Inishdeashbeg and adjacent skerries, Inishtubrid, Inishcuill, Carrickawart Island, Stony Island and adjacent skerries, the Green Islands and adjacent skerries; and
- Human activities should occur at levels that do not adversely affect the harbour seal population at the site.

The main pressures and threats affecting Common seal are identified as marine fish and shellfish harvesting (professional, recreational) causing reduction of species / prey populations and disturbance of species, as well as geotechnical surveying are listed as threats and pressures affecting this species nationally (NPWS, 2019b). The national evaluation of the conservation status of this species is (NPWS, 2019b):

- Range: Favourable (FV);
- Area: Favourable (FV);
- Specific structures and functions (incl. species): Favourable (FV);
- Future prospects: Favourable (FV); and
- Overall assessment of Conservation Status: Favourable (FV).

It is considered that with the implementation of mitigation measures proposed in this NIS there would be no potential for residual impacts on this species.

7.3 Otter Lutra lutra

Objective: To restore the favourable conservation condition of Otter in Clew Bay Complex SAC with regard to the following targets:

- No significant decline in distribution (i.e., positive survey sites);
- No significant decline in extent of terrestrial habitat;
- No significant decline in extent of marine habitat;
- No significant decline in extent of freshwater (river) habitat;
- No significant decline in extent of freshwater (lake/lagoon) habitat;
- No significant decline in number of couching sites and holts (minimise disturbance);
- No significant decline in fish biomass available; and
- No significant increase in barriers to connectivity.

Otters are subject to pressures on land and in water (freshwater and marine). Impacts that reduce the availability or quality of, or cause disturbance to, their terrestrial or aquatic habitats are likely to affect otters. The national evaluation of the conservation status of this species is (NPWS, 2019b):

- Range: Favourable (FV);
- Area: Favourable (FV);
- Specific structures and functions (incl. species): Favourable (FV);

- Future prospects: Favourable (FV); and
- Overall assessment of Conservation Status Favourable (FV).

It is considered that with the implementation of mitigation measures proposed in this NIS there would be no potential for residual impacts on this species.

Based on the above Conservation Objectives, taking account of the data obtained and available for the assessments used to inform the current NIS and with regard to the sensitivities of the qualifying interests within the SAC, it is concluded that the proposed project will not cause an adverse effect on the integrity of the Clew Bay Complex SAC either alone or in-combination with other plans and projects. This evaluation is made with regard to residual impacts, taking account of specific and detailed mitigation measures set out in this NIS, the 'Code of Practice' developed by BioAtlantis Ltd. for the updated Licence Application (BioAtlantis, 2024 and associated appendices) and included as Addendum 4 to the current report.

8. CONCLUSION

The potential for impacts on the Clew Bay Complex SAC Natura 2000 site resulting from the proposed Foreshore Licence application for the sustainable hand-harvesting of *Ascophyllum nodosum* within Clew Bay are recognised. Appropriate mitigation measures are identified for implementation to ensure the habitats and species for which this site has been designated are maintained at a favourable conservation status (compliance with Article 6(1) of the EU Habitats Directive). The proposed operational management plans will also avoid damaging activities that could significantly disturb these species or deteriorate the habitats of the protected species or habitat types (compliance with Article 6(2) of the EU Habitats Directive).

The Clew Bay Complex SAC, within the activities area of the proposed Foreshore Licence Application was assessed with particular regard to potential impacts affecting qualifying interests of the designation, including Annex I habitats (large shallow inlets and bays) and Annex II listed mammal species. It is evaluated that the proposal will not have a significant adverse effect on this Natura 2000 site; with the implementation of prescribed mitigation measures. These mitigation measures are incorporated into the updated Foreshore Licence Application (BioAtlantis, 2024) and in particular, the associated 'Code of Practice' in order to ensure the avoidance of significant impacts on these sensitive receptors. There will therefore, be no long-term impact on the integrity of the Clew Bay Complex SAC site.

From examination of the information available, it is considered that as long as all mitigation measures listed in this NIS are adhered to, there will be no impacts on the integrity of the Clew Bay Complex SAC as a result of the proposed hand harvesting of *A. nodosum* in Clew Bay by BioAtlantis Ltd. This conclusion and the supporting evidence is provided in order to allow the Competent Authority to complete the Appropriate Assessment process for the proposed project.

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ADDENDUM 1 SCREENING FOR APPROPRIATE ASSESSMENT

SCREENING FOR APPROPRIATE ASSESSMENT

Sustainable Hand Harvesting of *Ascophyllum nodosum* at Clew Bay, Co. Mayo

21-02-24

ecofact
Environmental Consultants

[redacted]

EXECUTIVE SUMMARY

Project Name	Proposed Sustainable Hand Harvesting of *Ascophyllum nodosum* at Clew Bay, Co. Mayo
Project Description	BioAtlantis plan to undertake sustainable hand harvesting of *A. nodosum*, by contracting 16 full-time hand harvesters, to harvest up to a maximum of 11,018 tonnes per annum across various sites in Clew Bay.
Potentially Affected Natura 2000 Sites	Clew Bay SAC
Pathways for Significant Effects (Yes/No)	Yes
Source(s) of Potential Impacts	Hand Harvesting Activities
Pathway(s) for Potential Impacts	Proximity to qualifying interests
Receptor(s) for Potential Impacts	Mudflats and sandflats not covered by seawater at low tide; Large shallow inlets and Bays; Atlantic salt meadows; Otter; Harbour Seal
Pre-assessment Screening	Hand harvesting activities will take place within the range of qualifying interests of this SAC. There is the potential for direct disturbance impacts, from harvesters and boats, as well as habitat fragmentation from harvesting, and water quality issues that may arise from boats or activities themselves. Potential pathway for significant impacts has been identified. Mitigation will be required to offset potential significant effects. Mitigation cannot be provided in a screening for appropriate assessment report.
Mitigation Required (Yes/No)	Yes
Stage 2 (AA) is required (Yes/No) ***If Yes – a Natura Impact Statement must be prepared***	Yes

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Date	Revision	Status	Author	Reviewed By
21-02-24	1.3	Final	GW/WOC	WOC

1. INTRODUCTION

Ecofact Environmental Consultants Ltd. have been commissioned to carry out a Screening for Appropriate Assessment (AA) of proposed hand-harvesting of the seaweed *Ascophyllum nodosum* in a sustainable manner from Clew Bay, Co. Mayo. This screening assesses whether there is the possibility of significant effects on a Natura 2000 sites and, consequently, whether an NIS is required for the project.

Appropriate Assessment is required under Article 6 of the Habitats Directive (92/43/EEC), in instances where a plan or project may give rise to significant effects upon a Natura 2000 site. Natura 2000 sites are those identified as sites of European Community importance designated under the Habitats Directive (1992) (SACs) or the Birds Directive (2009) (SPAs). Screening is a pre-assessment procedure which considers whether an assessment (i.e. appropriate assessment) is required or not.

1.1 Legislation

Part XAB of the 2000 Act and SI. No 477 of 2011 transpose into Irish law, Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the Birds Directive) and Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). The 1997 Regulations were updated in 1998 by The European Communities (Natural Habitats) (Amendment) Regulations 1998 (S.I. No. 233/1998) to include the updated Council Directive 97/62/EC. The 1997 regulations were again updated in 2005, by The European Communities (Natural Habitats) (Amendment) Regulations 2005 (S.I. No. 378/2005). This amendment served to consolidate the main nature conservation legislation enacted in Ireland, meaning The Wildlife Act 1976, The Wildlife (Amendment) Act 2000, The European Communities (Natural Habitats) Regulations 1997, The European Communities (Natural Habitats) (Amendment) Regulations 1998, and to draw direct reference upon Council Directive (2009/147/EC) on the conservation of wild birds – '*The Birds Directive'*.

These Directives require Ireland to establish protected sites as part of a European wide network of sites (known in Ireland as European sites) for habitats and species that are of international importance for conservation. In Ireland, European sites include Special Areas of Conservation (SACs, including candidate SACs) and Special Protection Areas (SPAs). The Birds Directive (2009/147/EC) seeks to protect birds of special importance by the designation of Special Protection Areas (SPAs) whereas the Habitats Directive does the same for habitats and other species groups with Special Areas of Conservation (SACs). It is the responsibility of each member state to designate SPAs and SACs, both of which will form part of Natura 2000, a network of protected areas throughout the European Community.

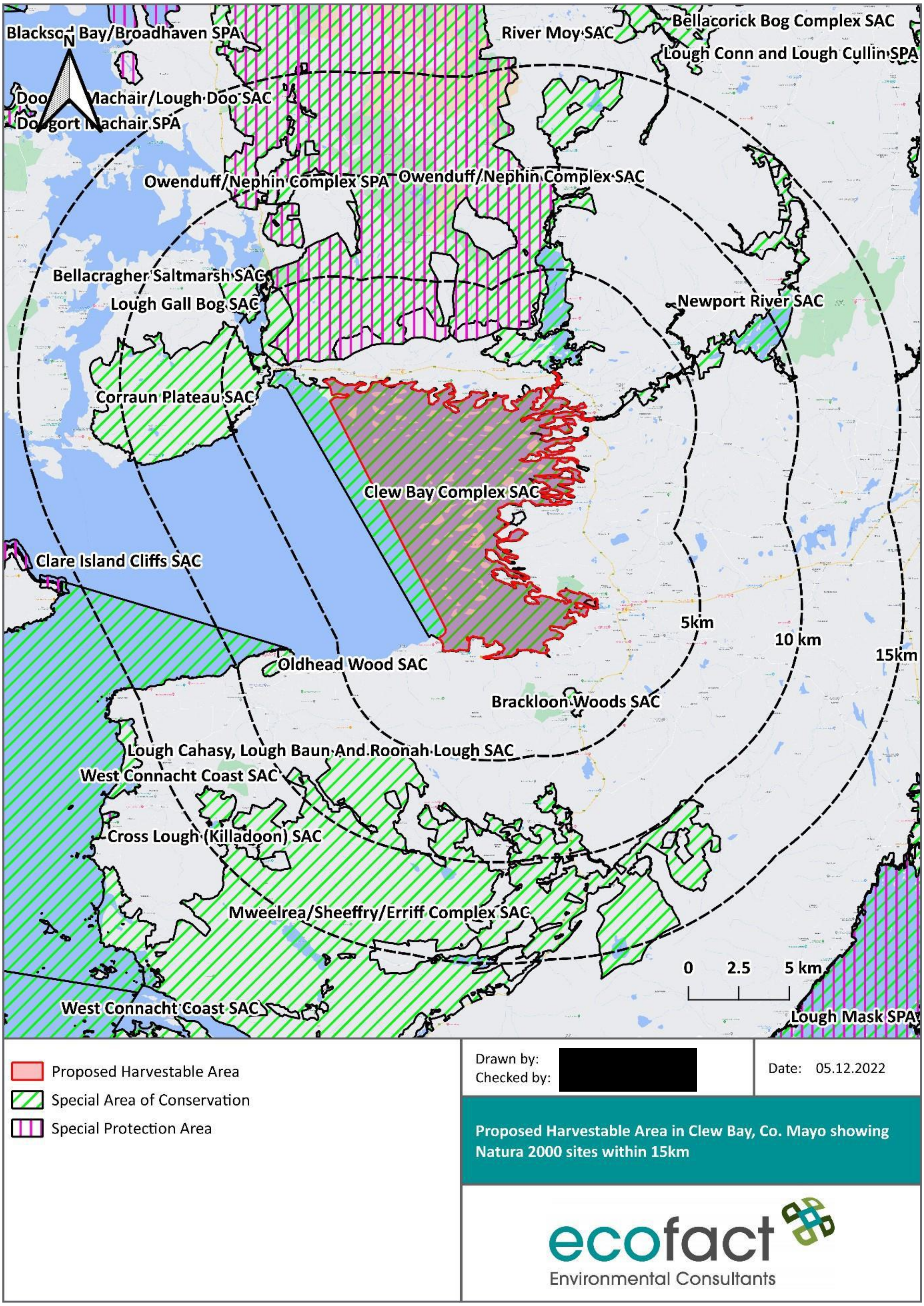

Figure 1 Proposed Harvestable Area in Clew Bay, Co. Mayo showing Natura 2000 sites within 15km.

2. METHODOLOGY

2.1 Screening for Appropriate Assessment

The current Screening for Appropriate Assessment follows this guidance as relevant:

- DoEHLG, (2010). *'Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities'*
- Office of the Planning Regulator, (2021). '*Appropriate Assessment Screening for Development Management*.'
- European Commission, (2001). '*Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.'*
- European Commission, (2007). '*Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC: Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interests, compensatory measures, overall coherence and opinion of the Commission.''*
- European Commission, (2018). '*Managing Natura 2000 Sites. The Provisions of Article 6 of the Habitats Directive 92/43/EEC.'*

The European Commission guidance (2001) prescribes a staged process and the need for each stage being dependent on the outcomes of the preceding stage. These stages are: (1) Screening for Appropriate Assessment; (2) Appropriate Assessment; (3) Assessment of Alternative Solutions and (4) Imperative Reasons of Overriding Public Interest test, and compensatory measures (EC, 2001).

According to DoEHLG (2010), Stage 1 Screening is the process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3) of the EU Habitats Directive: (1) Whether a plan or project is directly connected to or necessary for the management of the site, and; (2) Whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

A project or plan may only pass at the Screening stage if there is no reasonable scientific doubt remaining as to the absence of impacts on the Natura 2000 network. DoEHLG (2010) states that any Natura 2000 site within a likely zone of impact should be considered, with a distance of 15km recommended, but this is evaluated on a case-by-case basis with reference to the nature, size and location of the project, sensitivities of receptors and potential for in-combination effects. The threshold at the first stage is a very low one (as per Finlay Geoghegan J. in Kelly -v- An Bord Pleanála 2013/802 JR). Screening must be approached on a precautionary basis with the safeguards set out in Article 6(3) and (4) of the Habitats Directive triggered not by certainty - but by the possibility of significant effects.

DoEHLG (2010) outlines that there are 3 potential outcomes of a Screening for Appropriate Assessment, as outlined in Table 1 below.

Table 1 DoEHLG (2010) potential findings and outcomes for Screening for Appropriate Assessment.

Finding	Outcome
Project is directly connected to or necessary for the management of a designated site	Stage 2 (AA) is not required
No potential for significant effects	Stage 2 (AA) is not required
Potential for significant effects identified, or potential for impacts is uncertain	Stage 2 (AA) is required and a Natura Impact Statement will be prepared

2.2 Desk Study

A desktop study was undertaken to identify the extent and scope of the potentially affected designated Natura 2000 sites within the current study area. A full bibliography of information sources reviewed is provided in the reference section. Information sources reviewed include:

- National Parks and Wildlife Service (NPWS) site synopses
- NPWS Conservation Objectives and Natura 2000 Forms
- Protected species data on NPWS/National Biodiversity Data Centre (NBDC) online databases
- Environmental Sensitivity Mapping (ESM) Tool
- Environmental Protection Agency (EPA) mapping tools (including AAGeoTool)
- Catchments.ie
- Online aerial imagery (Bing, Google Satellite).

3. DESCRIPTION OF PROJECT

Clew Bay has in excess of 90 islands and 100km of coastline that contain harvestable quantities of A. nodosum. Given the ecological sensitivities identified within the Clew Bay area, harvesting must be carried out in a manner which does not negatively affect the biological environs. Utilising sustainable hand-harvesting technique and extraction (Kelly et al., 2001; Guiry & Morrison, 2013) and incorporating their use within a best practise approach, BioAtlantis have developed a sustainable model of seaweed harvesting in Clew Bay. Subject to obtaining a licence to harvest in Clew Bay, BioAtlantis will contract up to 16 full-time hand harvesters from the region, to harvest up to a maximum of 11,018 tonnes per annum. BioAtlantis will recruit harvesters with previous experience or whose families have farms or fishing interests in the area and will work with the harvesters to apply sustainable methods of harvesting, collection and conservation of the resource. In their proposal, BioAtlantis will explore the applicability of purchasing a boat for the area to collect the harvested *A. nodosum*, whilst also providing the option for harvesters to tow the floating bags/nets directly to pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

BioAtlantis will employ a site-specific management approach throughout the expanse of the Clew Bay SAC and throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited. Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of a collection boat (if applicable to the area) also ensures ease of access to sites in use. It also brings full traceability to the process, as quality of harvest for each location will be monitored and biomass will be weighed on the boat or pick-up point prior to issuing the harvesters with a Goods Received Note (GRN). This technique also frees up harvesters to spend less time, money and effort on hauling cut seaweed ashore, whilst avoiding the otherwise negative consequences associated with bringing cut seaweed ashore at inappropriate locations. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded. Hand-harvested *A. nodosum* will be transported to production facilities in Tralee, Co. Kerry for further processing.

3.1 Operational Phase

The BioAtlantis proposal for sustainable hand-harvesting of *A. nodosum* from Clew Bay will include an area extending from Rosmurrevagh point on the north of Clew Bay to Leckanvy Pier in the south, including the islands within the Bay. Through use of data obtained from the field studies and evaluation by BioAtlantis Ltd. (BioAtlantis, 2024 and associated appendices) and Hession *et al*. (1998) and maps and aerial photographs of the region, it is calculated that the current maximum yield of *A. nodosum* from Clew Bay to be of the order of 64,759 tonnes. BioAtlantis' original application estimated that there is a maximum annual sustainable harvest of ~12,900 Tonnes in Clew Bay. This figure was updated following assessments of the resource by UCD in 2016 and with the removal of areas from the harvesting plan where existing appurtenant seaweed harvesting rights were identified. The revised estimated annual sustainable harvest is 11,018 Tonnes, based on harvesting a maximum of 20% of the total available *A. nodosum* biomass per site per annum (BioAtlantis, 2024 and associated appendices). BioAtlantis will employ a site-specific management approach to the Clew Bay Complex SAC, throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited. BioAtlantis Ltd. will employ a Resource Manager or Project Manager to operate on site, preferably with relevant environmental qualifications, a marine ecology background and/or experience in the fishing / marine resources industry. This individual will be responsible for managing activities within the harvesting area and in ensuring sustainability of these activities. They will report directly to the company CEO, and work as part of the resource management team. The person tasked with assessing recovery post-harvesting will have a marine ecology background. Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally-appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of a collection boat (if deemed applicable to the area) ensures ease of access to the sites. This brings full traceability to the process, as the quality of harvest from each location is monitored and biomass is weighed on collection and recorded on a Goods Received Note (GRN; or other method), with sites also inspected post-harvest to ensure the sustainability of the methods employed (Site Inspection Form, SIF or other method). The benefits of this approach is that harvester's times is no longer spent hauling seaweed ashore and coastal damage that could be caused by bringing in large quantities of seaweed ashore at inappropriate locations is avoided. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded. Information recorded via GRN, SIF, etc., may alternatively be provided in other suitable formats by electronic or other means on site and/or at production facilities.

A key requirement in implementing and securing a functioning system for sustainably hand harvesting *A. nodosum*, are effective control measures, reporting and monitoring systems. These are set out in the Code of Practice document and form a key framework for managing and ensuring that the system is being adhered to in a precise, correct, seamless and traceable manner. A key component to ensuring that the systems are being adhered to, and at the levels set out in the Code of Practice, will be a strong and robust auditing system. BioAtlantis will conduct quarterly and annual audits covering the areas below:

(a) Quarterly Audit:

- Audit Part A: Records, Forms & Documents
  - Step 1: Forms: receipt of training & verification of understanding
  - Step 2: Completed Training Certs (obtained through training above.) Step 3: Records, forms & documents (general)

- Audit Part B: Quality Assessment (documentation)
  - Step 1. GRNs (Clew Bay), or other format/method.
  - Step 2. Production Logsheets (Production Facilities).
  - Step 3. Incident Reports
  - Step 4. Non-conformance Reports
  - Step 5. Software Systems
  - Step 6: Site Inspection forms or other format/method.

(b) Annual Audit (on-site):

- Step 1. Site Quality (inspection of harvested sites)
- Step 2. Harvest methods (inspection of techniques)
- Step 3. Delivery and collection methods (e.g. Collection boat, if deemed applicable to the area).

For more information on the auditing system and its contents, please consult Addendum 7 (Clew Bay Audit Forms – Appendix 8) of the main BioAtlantis licence application document. All control measures, action limits/non-conformance, analytical procedures, monitoring schedule, (frequency), corrective actions and verification are detailed in the licence application main text document. In addition, the harvesting system will be reviewed annually to assess and verify the control measures and determine areas in need of improvement.

3.1.1 Overview of Proposed Operational Phase

In carrying out the operational stage of the proposal, harvest will be recorded using BioAtlantis Compliance and Record Forms (see Addendum 4 in the current NIS). BioAtlantis has developed a management plan set out in the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC – Appendix 4',included as Addendum 5 in the current NIS. This includes the development of a database, to take account of the study area of Clew Bay including over 90 islands and 100km of coastline that contain harvestable quantities of *A. nodosum*. This database will be used to:

(a) Determine and manage sites which require a fallowing period to allow for adequate recovery from recent activities;
(b) Determine and manage rotation requirements (i.e. extrapolation and calculation of the duration or fallowing period required prior to a particular area being fit for re-harvest);
(c) Prevent harvest activities that would lead to a decline in yield;
(d) Record the details of each harvest, how much, by whom and when.

Moreover, this database represents a central, working component of the BioAtlantis best practice guidelines for harvesting *A. nodosum*, requiring:

(a) Development of pre-harvest plans in advance of harvest activities;
(b) A cap of 20% on the level of available biomass which can be harvested from a given site per annum;
(c) Limitations of a 200-300mm (8-12 inches) cutting height of *A. nodosum* stipe / frond.

Table 1 below sets out the islands and shore-line areas identified as being within the proposed harvesting area for the BioAtlantis project, with *A. nodosum* densities and coverage included. There are four main types of activities associated with the operational phase include:

Operation/Activity No. 1: Management & implementation;
Operation/Activity No. 2: Monitoring, recording & reporting;
Operation/Activity No. 3: Verification & analysis.
Operation/Activity No. 4: Long term assessment of biomass and community structure

All operations/activities are described in detail in the Code of Practice prepared by BioAtlantis, included in the Licence Application (BioAtlantis, 2024 and associated appendices) and presented in Addendum5 of this NIS. When planning future harvests some Islands will be marked as unavailable for certain times of the year, in order to ensure that known seal breeding, moulting and resting and bird breeding and wintering sites are avoided. The resource manager will be responsible for ensuring that these sites are avoided. The list of restricted sites is set out in the Code of Practice (Addendum 5); this will be updated to reflect ongoing consultation and data available from NPWS into the future; taking account of time of year and the presence of Common seals and breeding and wintering bird populations.

BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done by visiting each site and performing an assessment of the growth and density of *A. nodosum* on each and updating the production plan as necessary with the results of this analysis.

3.1.2 Management and implementation during operations

Management and implementation components include activities relating to:

1. *Planning and scheduling of harvesting activities*: In the initial stages, it is necessary to establish details of when each area was last harvested. This will be done by working closely with the existing local harvesters, and through analysis of derived datasets, the dates and quantities of the most recent harvests for each island and coastal zone can be established. This data can then be used to derive when a region will be next available for harvest. The nominal recovery time is generally accepted to be 3-5 years from a complete harvest; a maximum harvest of 20% of the total available biomass of seaweed is permitted per site per annum to ensure sustainability.
2. *Numbers of personnel to be managed and harvest rates:* Approximately 16 full time people, or 32 part-time, will be contracted to work for an average of 230 days/year, harvesting approximately 3.5 tonnes per day (rate of ~10.4Kg/M^2). The amounts harvested will be recorded to ensure adherence to licensing limits. The area harvested will be 26,923m^2 per day per 16 harvesters. This reflects a harvest rate of 20% of *A. nodosum* biomass per site per annum. This corresponds to an area occupied of 1,683m^2 per person/day or 0.4acres per person per day, for approximately 6-8 hours per day. Approximately 2-4 harvesters are permitted on small-medium sized sites. Medium to large islands may require between 4-6, while larger islands will likely require approximately 6-10 harvesters. Thus, the low number of people over a wide area reduces the potential for anthropogenic impacts (e.g. intensity of trampling) on the biotope. In fact, given that the BioAtlantis plan targets specific areas at specific times of the year, the low levels of trampling events will also be largely episodic in nature. It is unlikely therefore, that any significant change in the structure of *A. nodosum* assemblages will occur. Furthermore, as a policy against holdfast removal will be implemented, the incidence of *A. nodosum* mortality will be reduced considerably (see 'Code of Practice', Addendum 5). As such, the harvest level of 20% of the total available biomass represents a relatively constant figure and will not be exacerbated due to significant levels of A. *nodosum* mortality due to partial or complete holdfast removal.
3. *Exploitation Levels*: As a policy against holdfast removal will be implemented, *A. nodosum* mortality and whole plant removal will therefore be prevented. Hence, the harvest rate figure of 20% of the total available biomass will remain largely constant and will not be breached due to increased mortality

rates.

4. Once the re-harvesting date for each island is established, this information will be used to plan the next seasons harvesting. BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done by visiting each site and performing an assessment of the growth and density of *A. nodosum* on each, and updating the production plan as necessary with the results of this analysis;
5. *Data recording and analysis*: In their proposal, BioAtlantis will explore the applicability of purchasing a boat for the area to collect the *harvested A. nodosum,* piloted by the resource manager or other suitably trained employee. The seaweed collected from each point will be weighed and the details of the harvest recorded, at each collection point. The person or transport company in receipt of the harvested seaweed will complete a 'Goods Received Note' to record the harvest from each site. This also includes measurement of amount and quality of the harvested seaweed. Bag/nets will be weighted on the boat or at the pick-up point. Alternatively, where harvesters tow the floating bags/nets containing *A. nodosum* from the harvest site directly to the pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded.
6. The Resource Manager will inspect sites post-harvest to ensure the standards with respect to the sustainability of the methods employed (Site Inspection Form, SIF or other method). A second check will be completed on receipt of the harvested seaweed at BioAtlantis' factory in Tralee, with details recorded on a GRN or other method. Details from the GRNs will be uploaded into the main database. The quality of the supplied *A. nodosum* will be assessed by the quality control and/or production team and details of any deviations from the specified requirements recorded on the harvest record. Computerised data will be maintained of all harvest records and non-conformances;
7. *Access and Navigation at harvest sites*: The harvesters shall use their own boats to navigate to and from the island sites. In the case of coastal sites, the harvesters shall be responsible for access to and from the sites via existing access routes. The size of the shore area covered by an individual bag or net will be approximately $2m^2$ to $8m^2$. Harvest will occur at islands and shorelines as described in the harvest management plan. Floating nets or bags will then be picked up at each location in which harvest took place. Alternatively, harvesters may tow the floating nets or bags from the harvest site directly to the pick-up points.

   Final pick-up points will be at established piers and harbours, particularly in Westport and Newport. Access to the northern coastal area will be via the roads at Knockmanus road, Roskeen south Road, Carrowsallagh Rd, Keeloges Rd, and via boat. Access to the Milcum harvesting site will be via the Teevmore Road. The coast roads on Knockeeragh and Rosclave provide good access to the harvesting sites in this area. The harvesting site at Rosanrubble can be accessed by boat and from the road to Rosanrubble Point. The harvesting area between Bleanrosdooaun Strand and Monkelly can be accessed by road to Roslaher, Rostoohy Pier, Moyna Strand, Ardkeen Quay, Roscahil Rd, Rosmindle Rd, Castleaffy, Rosmoney, Rusheen, Carrowcally, Bawn Strand, &

Monkelly Strand. BioAtlantis will explore the applicability of purchasing a boat for the area, that will be approved by the Marine survey office (MSO) for use on the open waters of Clew Bay and used to collect the harvested *A. nodosum* from the designated sites; alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. The harvesters will be made aware that all harvested *A. nodosum* must be collected by BioAtlantis for weighing and processing, and the seaweed will only be collected from the sites or pick up points identified on the harvesting schedule or at sites which are approved by BioAtlantis. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

8. *Communication*: The number of harvesters involved in harvesting the requirements of BioAtlantis will be below ten initially, rising to sixteen over time. Communication of the harvesting plan will be done in advance each month/quarter via email or post. This will include information on sites that are to be harvested and the quantity and dates for each harvest site. Sites will be identified on a map and the anticipated quantities for each site indicated. Communications with the harvesters during harvesting activities will be either via a mobile phone or 2 way radios, as deemed appropriate and will be managed by BioAtlantis and the BioAtlantis Resource Manager;
9. *Hand-harvest methodology*: Training will be provided to harvesters, where necessary, to ensure competence in skills required to harvest *A. nodosum* in an environmentally friendly and sustainable manner. Activities will be carried out in accordance with a clearly defined protocol which will prevent any damage to the environment or underlying growth substrate, whilst also facilitating sufficient re- growth and re-generation of the vegetation post-harvest. The 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC' is set out in the Licence Application (BioAtlantis, 2024) and is included in Addendum 3 of the current report;
10. *Health and safety measures*: All harvesters will be provided with appropriate and certified Health & Safety Training. BioAtlantis will run regular training days for the harvesters, where necessary. The seaweed collection boat (if deemed applicable to the area) will be equipped with all necessary safety equipment as required by the marine survey office.

Table 1 Harvesting locations and quantity estimates within the Clew Bay study area.

			Total Harvestable Area	Typical Density	Coverage §	Harvest levels (Tonne)†	
Island No.	Name / Area	Harvesting Zone ID*	(m^2)	(Kg / m^2)	%	Available Seaweed	Maximum Annual Harvest
	Bartraw - Westport	CZ 1.1	61074	0	46%	0.0 T	0.0 T
		CZ 1.2	83288	0.7	100%	58.3 T	11.7 T
		CZ 1.3	57560	0.7	98%	39.4 T	7.9 T
		CZ 1.4	46890	0.7	100%	32.8 T	6.6 T
		CZ 1.5	59466	0.7	70%	29.3 T	5.9 T
		CZ 1.6	32360	1.25	100%	40.4 T	8.1 T
		CZ 1.7	47684	0.7	100%	33.4 T	6.7 T
		CZ 1.8	77259	0	54%	0.0 T	0.0 T
		CZ 1.9	7961	0.7	100%	5.6 T	1.1 T
		CZ 1.10	5559	1.25	100%	6.9 T	1.4 T
		CZ 1.11	11271	1.25	100%	14.1 T	2.8 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (Kg / m²)	Coverage § %	Harvest levels (Tonne)† Available Seaweed	Maximum Annual Harvest
		CZ 1.12	4254	1.25	100%	5.3 T	1.1 T
		CZ 1.13	136927	10.5	94%	1354.0 T	270.8 T
		CZ 1.14	76090	10.5	94%	751.9 T	150.4 T
		CZ 1.15	37232	0.5	100%	18.6 T	3.7 T
		CZ 1.16	35400	0.5	100%	17.7 T	3.5 T
		CZ 1.17	35419	0.5	100%	17.7 T	3.5 T
		CZ 1.18	6633	0.5	100%	3.3 T	0.7 T
	Westport - Rosmoney	CZ 2.1	38658	0	82%	0.0 T	0.0 T
		CZ 2.2	5199	0	100%	0.0 T	0.0 T
		CZ 2.3	8889	0	100%	0.0 T	0.0 T
		CZ 2.4	35324	0	94%	0.0 T	0.0 T
		CZ 2.5	74945	0.55	98%	40.4 T	8.1 T
		CZ 2.6	30076	0.8	100%	24.1 T	4.8 T
		CZ 2.7	7831	0	57%	0.0 T	0.0 T
		CZ 2.8	6710	0	100%	0.0 T	0.0 T
		CZ 2.9	125537	0.8	100%	100.4 T	20.1 T
		CZ 2.10	109815	0.8	97%	85.0 T	17.0 T
		CZ 2.11	9303	0	100%	0.0 T	0.0 T
		CZ 2.12	27612	0	91%	0.0 T	0.0 T
		CZ 2.13	328	0	100%	0.0 T	0.0 T
		CZ 2.14	22527	0	100%	0.0 T	0.0 T
		CZ 2.15	3842	0	94%	0.0 T	0.0 T
		CZ 2.16	6082	0	100%	0.0 T	0.0 T
		CZ 2.17	3636	0	0%	0.0 T	0.0 T
	Rosmoney - Moyna Strand	CZ 3.1	18865	0	50%	0.0 T	0.0 T
		CZ 3.2	40641	4.35	100%	176.8 T	35.4 T
		CZ 3.3	97095	4.35	100%	422.4 T	84.5 T
		CZ 3.4	12914	4.35	100%	56.2 T	11.2 T
		CZ 3.5	9650	4.35	100%	42.0 T	8.4 T
		CZ 3.6	78317	4.35	95%	323.9 T	64.8 T
		CZ 3.7	117114	4.35	100%	509.4 T	101.9 T
		CZ 3.8	8398	4.35	100%	36.5 T	7.3 T
	Rostoohy Pt - Newport	CZ 4.1	84464	4.35	92%	339.0 T	67.8 T
		CZ 4.2	27181	4.35	100%	118.2 T	23.6 T
		CZ 4.3	150517	4.35	100%	654.8 T	131.0 T
		CZ 4.4	38351	4.35	99%	164.9 T	33.0 T
		CZ 4.5	26354	0	96%	0.0 T	0.0 T
		CZ 4.6	6397	0	83%	0.0 T	0.0 T
		CZ 4.7	5572	0	100%	0.0 T	0.0 T
		CZ 4.8	6703	0	100%	0.0 T	0.0 T
		CZ 4.9	9671	0	100%	0.0 T	0.0 T
		CZ 4.10	24594	0	64%	0.0 T	0.0 T
		CZ 4.11	117165	0.85	81%	80.2 T	16.0 T
		CZ 4.12	77555	0.85	100%	65.9 T	13.2 T
		CZ 4.13	278265	0.85	79%	187.7 T	37.5 T
		CZ 4.14	110969	0.85	100%	94.3 T	18.9 T
	Newport - Mallaranny Pier	CZ 5.1	61157	0	100%	0.0 T	0.0 T
		CZ 5.2	58948	3.5	79%	163.3 T	32.7 T
		CZ 5.3	105121	3.5	84%	310.9 T	62.2 T
		CZ 5.4	258002	3.5	92%	833.8 T	166.8 T
		CZ 5.5	82278	3.5	83%	240.2 T	48.0 T
		CZ 5.6	41272	3.5	100%	144.5 T	28.9 T
		CZ 5.7	145329	3.5	89%	454.2 T	90.8 T
		CZ 5.8	84126	3.5	100%	294.4 T	58.9 T
		CZ 5.9	8260	3.5	100%	28.9 T	5.8 T
		CZ 5.10	17114	3.5	100%	59.9 T	12.0 T
		CZ 5.11	4451	3.5	100%	15.6 T	3.1 T
		CZ 5.12	1689	3.5	100%	5.9 T	1.2 T
		CZ 5.13	29666	3.5	100%	103.8 T	20.8 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (Kg / m^2)	Coverage § %	Harvest levels (Tonne)† Available Seaweed	Maximum Annual Harvest
		CZ 5.14	3900	1.75	100%	6.8 T	1.4 T
		CZ 5.15	30450	1.75	100%	53.3 T	10.7 T
		CZ 5.16	11735	1.75	100%	20.5 T	4.1 T
		CZ 5.17	47890	1.75	79%	65.8 T	13.2 T
1	Forillan, Illanavrick	IS 11.1	40653	6	100%	243.9 T	48.8 T
		IS 11.2	13763	10	100%	137.6 T	27.5 T
2	Kid Isd East		3966	14	100%	55.5 T	11.1 T
3	Roslynagh		7990	0	0%	0.0 T	0.0 T
4	Illannambraher		57901	19	96%	1053.2 T	210.6 T
5	Inishdasky		14818	18	100%	266.7 T	53.3 T
6	Inishquirk		25206	15	82%	308.9 T	61.8 T
7	Inishtubrid		45540	18	100%	819.7 T	163.9 T
8	Inishlim		13308	16	100%	212.9 T	42.6 T
9	Beetle Isd North Inishbobunnan		41752	18	100%	75.1 T	15.0 T
10							
10	Inishgowla		566589	16	27%	246.1 T	49.2 T
10	Beetle Isd South						
11	InishKeel	IS 11.1	16036	12.5	100%	200.5 T	40.1 T
		IS 11.2	2083	16.75	100%	34.9 T	7.0 T
		IS 11.3	300	17.5	100%	5.3 T	1.1 T
		IS 11.4	5876	17.5	100%	102.8 T	20.6 T
12	Black Rock		24348	2.5	100%	60.9 T	12.2 T
13	Moynish More		0	0	0%	0.0 T	0.0 T
14	Moynish Beg		0	0	0%	0.0 T	0.0 T
15	Inisherkin		53097	18	41%	387.7 T	77.5 T
16	Inishnacross		46888	18.5	61%	525.0 T	105.0 T
17	Inishilra		36300	18	78%	507.0 T	101.4 T
18	Inishcooa		70929	12	57%	486.2 T	97.2 T
19	Roeillaun		77113	5	100%	385.6 T	77.1 T
20	Inishdeashbeag Inishdeashmore		62555	0	100%	0.0 T	0.0 T
21	Inishcorky		17912	18.75	100%	335.8 T	67.2 T
22	Inishcarrick		34846	19	60%	397.3 T	79.5 T
23	Inishcoragh		24041	15	100%	360.6 T	72.1 T
24	Muckinish		33800	19.25	100%	650.6 T	130.1 T
25	Inishdaweel		22175	20	77%	342.8 T	68.6 T
26	Rabbit Isd		52391	8	58%	242.1 T	48.4 T
27	Illanascrraw		10411	18	100%	187.4 T	37.5 T
28	Freaghillanluggagh		23358	20	100%	467.2 T	93.4 T
29	Inishkee		16398	19	100%	311.6 T	62.3 T
30			15889	18	100%	286.0 T	57.2 T
31	Freaghillan West		20456	19	50%	194.8 T	39.0 T
32	Innishcannon		8656	16	100%	138.5 T	27.7 T
33	Carricklahan		0	0	0%	0.0 T	0.0 T
34	Carrickachorra		0	0	0%	0.0 T	0.0 T
35	Illanmaw		74045	0	66%	0.0 T	0.0 T
36	Freaghillan East		6422	18	100%	115.6 T	23.1 T
37			1476	16	100%	23.6 T	4.7 T
38	Inishcuill West		82042	20.75	79%	1348.2 T	269.6 T
39	Mauherillan		14262	16.75	91%	217.5 T	43.5 T
40	Inishfesh		54236	18	70%	685.8 T	137.2 T
41	Inishmolt		23618	18	100%	425.1 T	85.0 T
42	Inishloy		36182	18.5	100%	669.4 T	133.9 T
43	Inishdaff		70875	20.5	100%	1452.9 T	290.6 T
44	Inishbollog		13201	20.75	100%	273.9 T	54.8 T
45	Inishlaughil		55888	0	100%	0.0 T	0.0 T
46	Inishgowla		67983	16	22%	243.7 T	48.7 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (Kg / m²)	Coverage § %	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest
47	Inishoo		23072	0	13%	0.0 T	0.0 T
48	InishTurk	IS 48.1	56134	21	100%	1178.8 T	235.8 T
		IS 48.2	10755	21	100%	225.9 T	45.2 T
49	Illannaconney		17437	15	77%	201.6 T	40.3 T
50	Inishakillew	IS 50.1	69800	21.75	100%	1518.1 T	303.6 T
		IS 50.2	18583	21.75	100%	404.2 T	80.8 T
51	Trawbaun		256815	19.5	89%	4468.7 T	893.7 T
	Carrigeenglass North						
	Moneybeg						
	Inishcottle						
52	Calf Island		30778	19.75	81%	490.3 T	98.1 T
53	Inishbee, Derrinish & Dernish West		200836	17.5	58%	2021.6 T	404.3 T
54	Freaghillan	IS 54.1	27454	19.75	66%	357.1 T	71.4 T
		IS 54.2	55101	20	90%	989.7 T	197.9 T
		IS 54.3	5995	21	100%	125.9 T	25.2 T
55	Clynish		102154	18.5	77%	1463.2 T	292.6 T
56	llaunnamona		25370	16	95%	384.3 T	76.9 T
57	Rabbit Island, Island More &Quinnsheen Island	IS 57.1	14757	19.5	100%	287.8 T	57.6 T
		IS 57.2	92903	16	88%	1307.4 T	261.5 T
		IS 57.3	7894	17.5	100%	138.1 T	27.6 T
		IS 57.4	9330	18	100%	167.9 T	33.6 T
58	Collan More, Carrigeenglass South & Collan Beg	IS 58.1	501217	16.75	100%	8395.4 T	1679.1 T
		IS 58.2	55220	18.75	100%	1035.4 T	207.1 T
		IS 58.3	29858	19.5	100%	582.2 T	116.4 T
59	Inishgort		64954	15.5	57%	571.7 T	114.3 T
60	Inishlyre		121285	5	57%	347.3 T	69.5 T
61	Illanataggart & Crovinish		442259	14	99%	6133.0 T	1226.6 T
62	Ininhgowla South + Carrickwee		183389	15	100%	2750.8 T	550.2 T
63	Forilan		30569	9.75	100%	298.0 T	59.6 T
64	Carrickawart	IS 64.1	26696	16	100%	427.1 T	85.4 T
64		IS 64.2	1276	14.25	100%	18.2 T	3.6 T
65	Inishlaghan		32314	14.5	83%	388.4 T	77.7 T
66	Dorinish More & Dornish Beag		27107	12.5	100%	338.8 T	67.8 T
67	Inishimmel		0	0	0%	0.0 T	0.0 T
68	Inishleauge		54366	8	77%	334.3 T	66.9 T
69	Inishdaugh		22949	6.5	72%	108.0 T	21.6 T
70	Inishraher		81224	14.7	85%	1014.1 T	202.8 T
71	Inisheeney		53625	16	85%	725.4 T	145.1 T
72	Finnaun Island		0	0	0%	0.0 T	0.0 T
73	Corillan	IS 73.1	6787	6.5	100%	44.1 T	8.8 T
		IS 73.2	1016	6.5	100%	6.6 T	1.3 T
		IS 73.3	1737	6.5	100%	11.3 T	2.3 T
		IS 73.4	3001	6.5	100%	19.5 T	3.9 T
74	Carricknamore	IS 74.1	2436	6.75	100%	16.4 T	3.3 T
		IS 74.2	1393	6.75	100%	9.4 T	1.9 T
		IS 74.3	2640	6.75	100%	17.8 T	3.6 T
75		IS 75.1	0	6.75	100%	43.8 T	0.0 T
		IS 75.2	0	6.75	100%	7.5 T	0.0 T
		IS 75.3	0	6.75	100%	36.9 T	0.0 T
	Stony Island	IS 75.4	0	0	100%	0.0 T	0.0 T
		IS 75.5	0	5	100%	29.1 T	0.0 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (Kg / m²)	Coverage § %	Harvest levels (Tonne)† Available Seaweed	Maximum Annual Harvest
		IS 75.6	0	6.5	100%	69.2 T	0.0 T
		IS 75.7	0	6.5	100%	10.7 T	0.0 T
		IS 75.8	0	6.5	100%	61.7 T	0.0 T
76	Green Islands	IS 76.1	0	0	100%	0.0 T	0.0 T
		IS 76.2	0	0	100%	0.0 T	0.0 T
		IS 76.3	0	0	100%	0.0 T	0.0 T
77	Carricknacally		2860	6.5	100%	18.6 T	3.7 T
78	Monkellys Rock		4425	8.75	100%	38.7 T	7.7 T
79	Inishweela		24604	10	97%	238.7 T	47.7 T
80	Illanroe		28522	14	100%	399.3 T	79.9 T
81	Roeillan		16126	15	100%	241.9 T	48.4 T
	Totals						11,018 T**

* Harvesting Zone ID's were assigned by BioAtlantis as part of establishing the management system.
** Revised Total (BioAtlantis, 2024).
† Maximum Annual Harvest (Tonnes) is calculated as 20% of the total available biomass per site. The figure of20% refers to the percentage of the total available *A. nodosum* biomass harvested per site, per annum.
§ Denotes the percentage of coastline which can support *A. nodosum* growth.

3.1.3 Monitoring of the *A. nodosum* resource

The biomass of *A. nodosum* will be assessed according to standard methods. The general approach to assessing biomass levels is summarized below, and may be subject to change depending on the sites involved, the underlying analytical methodology and the parameters/statistical methods employed:

- Sites located and photographed as required;
- 1m² quadrants may provide more robust measures of biomass over a larger area than otherwise smaller 0.25m² units used by Kelly *et al*., (2001) and others. Typically, 4 replicates taken per site with a distance of approximately 3 meters between each quadrant, where possible. Where density is deemed relatively homogenous according to visual estimation scales, lower number of replicates may be used;
- Harvest *A. nodosum* from each quadrant and measure wet weight per unit area;
- Record all data in the database and ensure that site is not subjected to further harvest activities until *A. nodosum* density has recovered;
- Statistical analysis: Different regions of Clew Bay will have different rates of *A. nodosum* growth. Therefore, it will be important to calculate the level of variation of *A. nodosum* in as many regions as possible. The datasets will allow for high density mapping of the distribution of the resource within the complex. This will build upon the study by Hession *et al*., (1998) and provide a more detailed analysis of the extent of the resource in the area. Analysis will be performed using geospatial tools and/or by means of One-Way ANOVA, linear regression or similar tests using software such as GraphPad PRISM; Following the assigned fallowing period, repeat the steps outlined above, and where possible, 1m² quadrants will be assigned in the same location as previously. Alternatively, replicates may be assigned randomly if required. Harvest *A. nodosum* and record data as described above; Replicate size, type and number and statistical methods may be changed to enhance the accuracy of the assessment.

Immediately following harvest, *A. nodosum* will be bagged and weighed automatically on the boat or at the pickup point. Details will be recorded on arrival at the pier (via the GRN or other method), thus allowing for accurate recording of the locations and quantities of *A. nodosum* harvested per unit area. The resource manager will be responsible for uploading the data from the GRN forms to the harvest database. The maintenance of the database will be the responsibility of BioAtlantis staff. Other staff (e.g. scientific, production and quality personnel) will have access to the database as required for the correct implementation of their duties.

Locations and periods of harvest must be planned in a manner which ensures that (a) there is no damage incurred to the environs of this SAC region, (b) there is sufficient *A. nodosum* biomass available for harvest and (c) sufficient time has passed to allow for recovery. The most accurate means of ensuring that each of these goals are met is through the statistical analysis of datasets as they emerge. In this way, staff at BioAtlantis will make decisions which are informed by knowledge of the rates of *A. nodosum* re-growth and regeneration. Data relating to biomass levels, re-growth and re-generation will be incorporated into the harvest management database for use in planning harvest periods.

In terms of quality control, BioAtlantis, as a GMP+ certified company, must ensure full traceability to end users of the origin and location of the raw material used in the products manufactures. Therefore, the Quality Control system in BioAtlantis will play a key role in the management and monitoring of work relating to harvest of *A. nodosum* in Clew Bay. In brief, this will involve:

- Assessment of quality control checks on harvesting activities in Clew Bay to ensure conformance with quality and other requirements for the SAC.
- Assessment of quality control checks to ensure recording is conducted appropriately (Goods Received Notes (GRN), Site Inspection Form (SIF) etc., or other methods).
- Implementation of corrective actions where necessary. Liaise with BioAtlantis GMP+ Team on non-conformance issues should they arise;
- Utilisation of this knowledge in the preparation, scheduling and allocation of resources for harvesting;
- Assist in the implementation and training of personnel & contractors involved in hand harvesting activities in the Clew Bay area;
- Liaise with the BioAtlantis R&D Department regarding interpretation of data and on research and development related issues;
- Ensure customers have full traceability from point of harvest to the end product.

The potential for cumulative and in combination impacts are outlined in the application. This includes impacts associated with planned and existing activities such as seaweed harvesting. In terms of fallowing periods, data will be entered in the database as described in the application. The maximum harvest available from each island or coastal zone has been estimated and the nominal recovery time is will be 3-5 years from a complete harvest, or potentially within 11 to 17 months post-harvest given the post-harvest recovery rates reported by Kelly et al., 2001. The quota for each island is a sustainable harvest of 20% of *A. nodosum.* The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site per annum. If quota is exceeded, the Resource Manager will issue a Non-Conformance Report (NRC) to BioAtlantis management. Harvesters will be provided with training if necessary. As *A. nodosum* biomass can potentially recover within 11 to 17 months (Kelly et al., 2002), it may be possible therefore to harvest year on year in certain locations; however this is subject to recovery being achieved. As outlined in the application, measures will be implemented to ensure that harvesting does not take place if a site has not recovered from the previous year. Harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the Property Registration Authority of Ireland (PRAI), the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. The Resource Manager will routinely inspect sites post-harvest to ensure compliance of harvesters with sustainable hand harvest methods. Harvest will be recorded using BioAtlantis Compliance and Record Forms (see Addendum 4). As outlined in the application, measures will be put in place to ensure that harvesting does not take place if a site has not recovered from the previous year, thus minimizing or limiting the potential for cumulative effects to occur: *"BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done via on-site assessments and updating the plan as necessary with the results of this analysis".*

A pre-license survey study of Clew Bay was undertaken by UCD and submitted with this application. This study included an assessment of the extent of existing harvesting activities. Key findings from the report are as follows:

- There was evidence of harvesting at 26 out of the 40 sampled sites. The intensity of harvesting varied across these sites.
- Six, eight and twelve sites exhibited evidence of low, moderate and increased levels of harvesting respectively.
- There was no evidence of harvesting at 18 out of 40 sites sampled.

Measures will be in place, as outlined in the application, to prevent cumulative impacts with unlicensed harvesting, particularly in relation to appurtenant rights/burdens and Profit-à-Prendre rights.

A pre-harvesting survey of an unharvested site will be undertaken to assess the recovery of A. nodosum harvesting over the life-time of the licence. This is outlined in Section 1.3.3 of the application (under “Operation/Activity 4: Long term assessment biomass and community structure”) and Section 3.5.3 (under “The potential interaction effects of seaweed harvesting”). Parameters by which recovery will be assessed include: rates of re-growth of A. nodosum, biomass (Kg/m2) and numbers and/or density of A. nodosum plants per area (this is outlined in Section 1.3.3 and Section 3.5.3 of the application).

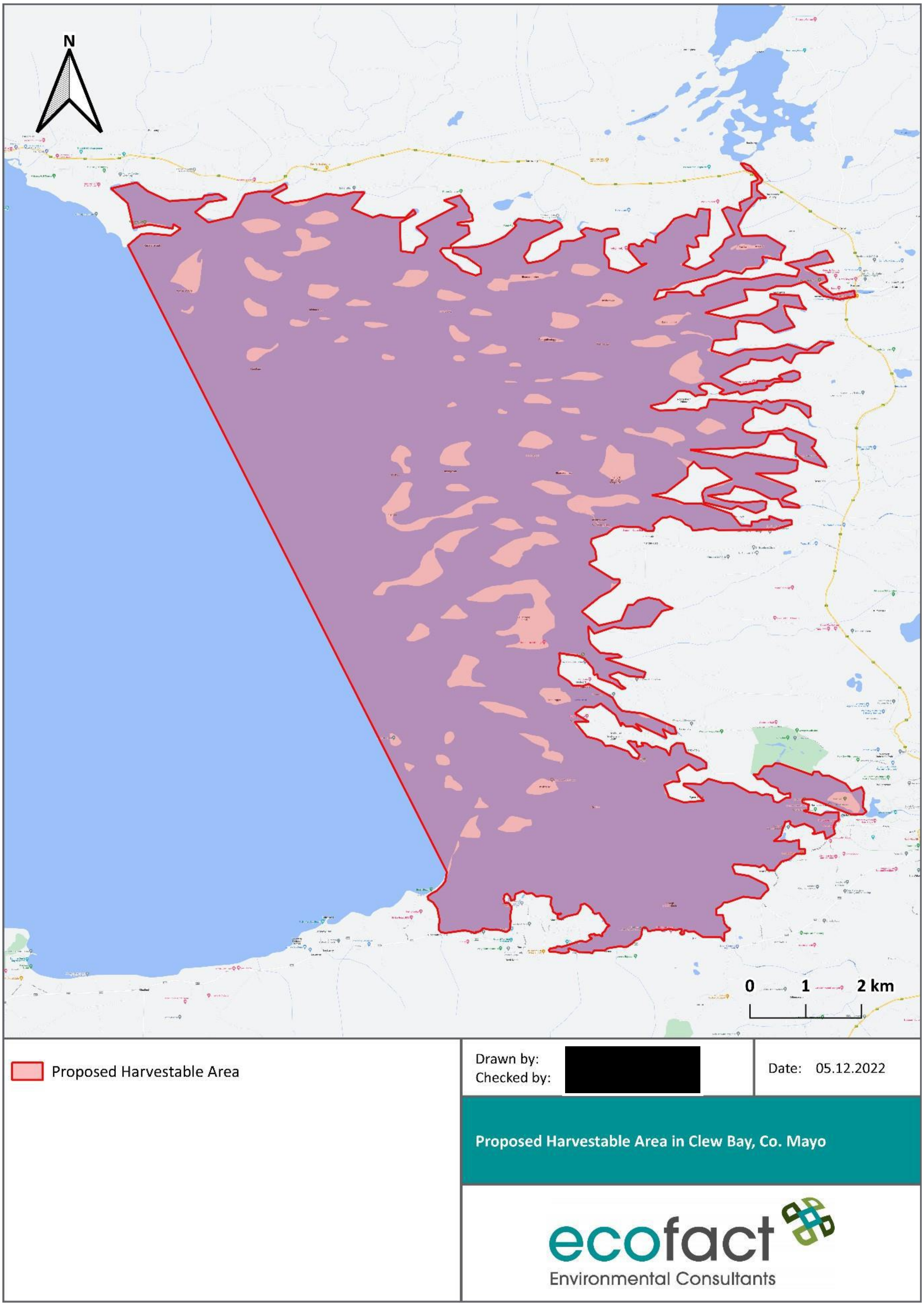

Figure 2 Proposed Harvestable Area in Clew Bay, Co. Mayo.

4. IDENTIFICATION OF RELEVANT NATURA 2000 SITES

The location of the proposed license area in the context of the Natura 2000 network is indicated in Figure 1 above. The SACs and SPAs within 15km of the proposed license area are considered in the current screening and are listed in Table 2. The proposed license site is located within the Clew Bay Complex SAC (001482).

Table 2 Designated Natura 2000 Sites within 15km of the proposed license site.

Natura 2000 Site	Distance (km)
Clew Bay Complex SAC (001482)	0km
Owenduff/Nephin Complex SAC (000534)	1.8km North-west
Corraun Plateau SAC (000485)	1km North-west
Newport River SAC(002144)	1.3km East
Brackloon Woods SAC (000471)	2km South
Mweelrea /Sheeffry / Erriff Complex SAC (001932)	5.5km South
Lough GallBog SAC (000522)	6.5km North-west
Bellacragher Saltmarsh SAC (002005)	7km North-west
Oldhead Wood SAC(000532)	7km West
West Connacht Coast SAC (002998)	8km West
River Moy SAC (002298)	10km North
Owenduff/Nephin Complex SPA (004098)	1.8km North
Clare Island SPA (004136)	15km West

4.1 Clew Bay Complex SAC

Clew Bay is a wide, west-facing bay on the west coast of Co. Mayo. It is open to the westerly swells and winds from the Atlantic, with Clare Island giving only a small amount of protection. This drumlin landscape was formed during the last glacial period when sediments were laid down and smoothed over by advancing ice. The sea has subsequently inundated the area, creating a multitude of islands. The geomorphology of the bay has resulted in a complex series of interlocking bays creating a wide variety of marine and terrestrial habitats. The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes): [1140] Tidal Mudflats and Sandflats [1150] Coastal Lagoons* [1160] Large Shallow Inlets and Bays [1210] Annual Vegetation of Drift Lines [1220] Perennial Vegetation of Stony Banks [1330] Atlantic Salt Meadows [2110] Embryonic Shifting Dunes [2120] Marram Dunes (White Dunes) [21A0] Machairs (* in Ireland) [91A0] Old Oak Woodlands [1355] Otter (*Lutra lutra*) [1365] Common (Harbour) Seal (*Phoca vitulina*). The juxtaposition within Clew Bay of a wide variety of habitats, including 10 listed on Annex I of the E.U. Habitats Directive, and the combination of important flora and fauna, including one Red Data Book plant and two animals listed on Annex II of the E.U. Habitats Directive, make this a site of considerable national and international importance.

5. POTENTIAL FOR EFFECTS

Table 3 Designated Natura 2000 Sites within 15km of the license site, the location of qualifying interests in relation to the license site, potential pathways for impacts and potential for significant impacts.

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
Clew Bay Complex SAC (001482)	Mudflats and sandflats not covered by seawater at low tide [1140]	Located throughout Clew Bay, with largest sections to the north and south of the bay according to the conservation objectives Map 2 (NPWS, 2011).	Yes	Disturbance	Water Quality	Disturbance; Water Quality	Hand harvesting activities will take place within the range of this habitat type. There is therefore the potential for direct disturbance impacts, from harvesters and boats, as well as habitat fragmentation from harvesting, and water quality issues that may arise from Boats or activities themselves. Potential pathway for significant Impacts has been identified. Mitigation will be required to offset Potential significant effects. Mitigation cannot be provided in a screening for appropriate assessment report.

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
	Coastal lagoons [1150]	Furnace Lough is outside of the proposed harvesting area, Claggan lagoon is located to the eastern side of the Bay near the shoreline, according to the conservation objectives map 5 (NPWS, 2011).	No	None	None	None	*Ascophyllum nodosum* does not grow within this habitat type. Therefore, there will be no interactions between the proposed hand harvesting activities and this habitat range in the SAC. No potential pathways for impacts have been identified.
	Large shallow inlets and bays [1160]	The entire area of Clew Bay is designated as this habitat type according to the conservation objectives Map 3 (NPWS, 2011).	Yes	Disturbance	Water Quality	Disturbance; Water Quality	Hand harvesting activities will take place within the range of this habitat type. There is therefore the potential for direct disturbance impacts, from Harvesters and boats, as well as habitat fragmentation from harvesting, and water quality issues that may arise from boats or activities themselves. Potential pathway for significant impacts has been identified. Mitigation will be

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
							required to offset potential significant effects. Mitigation cannot be provided in a screening for appropriate assessment report.
	Annual vegetation of drift lines [1210]	Full area extent unknown; dynamic habitat type present throughout the bay according to the conservation objectives (NPWS, 2011).	No	None	None	None	*Ascophyllum nodosum* does not grow within this habitat type. Therefore, there will be no interactions between the proposed hand harvesting activities and this habitat range in the SAC. No potential pathways for impacts have been identified.
	Perennial vegetation of stony banks [1220]	Full area extent unknown; Clew Bay known to have extensive shingle habitat throughout according to the conservation objectives (NPWS, 2011).	No	None	None	None	
	Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330]	Present in multiple locations throughout the bay, primarily north and south sides, according to the conservation objectives Map 6 (NPWS, 2011).	Yes	Disturbance	Water Quality	Disturbance; Water Quality	Hand harvesting activities will take place within the range of this habitat type. There is therefore the potential for direct disturbance impacts, from Harvesters and boats, as well as habitat fragmentation from harvesting, and

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
							water quality issues that may arise from boats or activities themselves. Potential pathway for significant impacts has been identified. Mitigation will be required to offset potential significant effects. Mitigation cannot be provided in a screening for appropriate assessment report.
	Embryonic shifting dunes [2110]	Full area extent unknown; Dynamic habitat found in multiple locations throughout the bay (NPWS, 2011).	No	None	None	None	*Ascophyllum nodosum* does not grow within this habitat type. Therefore, there will be no interactions between the proposed hand harvesting activities and this habitat range in the SAC. No potential pathways for impacts have been identified.
	Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120]	Full area extent unknown; Dynamic habitat found in multiple locations throughout the bay (NPWS, 2011).	No	None	None	None	
	Machairs (* in Ireland) [21A0]	This habitat type is shown to be present on the north-western extent of the bay according to the conservation objectives Map 7 (NPWS, 2011).	No	None	None	None	

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
	Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	Not listed in the conservation objectives document (NPWS, 2011). Known to occur in Keeloges Wood in the north-east corner of the bay.	No	None	None	None	
	Lutra lutra (Otter) [1355]	Present throughout the SAC – primarily focused around the coasts and islands according to Map 8 of the conservation objectives (NPWS, 2011)	Yes	Disturbance	Disturbance; Water quality; Food sources	Disturbance; Water Quality; Food sources	Hand harvesting activities will take place within the range of this habitat type. There is therefore the potential for direct disturbance impacts, from Harvesters and Boats, as well as habitat fragmentation from harvesting, and water quality issues that may arise from boats or activities themselves. Potential pathway for significant impacts has been identified. Mitigation will be required to offset potential significant effects. Mitigation cannot be provided in a screening for
	Phoca vitulina (Harbour Seal) [1365]	Habitat present throughout the SAC, with various breeding, moulting and resting sites on islands in the bay according to Map 9 of the conservation objectives (NPWS, 2011)	Yes	Disturbance	Disturbance; Water quality; Food sources	Disturbance; Water Quality; Food sources	

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
							appropriate assessment report.
Owenduff/ Nephin Complex SAC (000534)	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110]	Located c. 1.8km north-west of Clew Bay	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
	Natural dystrophic lakes and ponds [3160]						
	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]						
	Northern Atlantic wet heaths with Erica tetralix [4010]						
	Alpine and Boreal heaths [4060]						
	Juniperus communis formations on heaths or calcareous grasslands [5130]						
	Blanket bogs (* if active bog) [7130]						
	Transition mires and quaking bogs [7140]						
	Salmo salar (Salmon) [1106]						
	Lutra lutra (Otter) [1355]						
	Saxifraga hirculus (Marsh Saxifrage) [1528]						

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
	Hamatocaulis vernicosus (Slender Green Feather-moss) [6216]						
Corraun Plateau SAC (000485)	Northern Atlantic wet heaths with Erica tetralix [4010]	Located 1km north-west of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
	European dry heaths [4030]						
	Alpine and Boreal heaths [4060]						
	Juniperus communis formations on heaths or calcareous grasslands [5130]						
	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110]						
	Siliceous rocky slopes with chasmophytic vegetation [8220]						
Newport River SAC(002144)	Margaritifera margaritifera (Freshwater Pearl Mussel) [1029]	Located 1.3km east of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways
	Salmo salar (Salmon) [1106]						

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
							for significant effects.
Brackloon Woods SAC (000471)	Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	Located c. 2km south of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
Mweelrea / Sheeffry / Erriff Complex SAC (001932)	Coastal lagoons [1150] Annual vegetation of drift lines [1210] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120]	Located c. 5.5km south of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
	Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]						
	Atlantic decalcified fixed dunes (Calluno-Ulicetea) [2150]						
	Dunes with Salix repens ssp. argentea (Salicion arenariae) [2170]						
	Humid dune slacks [2190]						
	Machairs (* in Ireland) [21A0]						
	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110]						
	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea [3130]						
	Natural dystrophic lakes and ponds [3160]						
	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]						
	Northern Atlatic wet heaths with Erica tetralix [4010]						
	European dry heaths [4030]						

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
	Alpine and Boreal heaths [4060]						
	Juniperus communis formations on heaths or calcareous grasslands [5130]						
	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430]						
	Blanket bogs (* if active bog) [7130]						
	Transition mires and quaking bogs [7140]						
	Depressions on peat substrates of the Rhynchosporion [7150]						
	Petrifying springs with tufa Formation (Cratoneurion) [7220]						
	Alkaline fens [7230]						
	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) [8110]						
	Calcareous rocky slopes with chasmophytic vegetation [8210]						

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
	Siliceous rocky slopes with chasmophytic vegetation [8220]						
	Vertigo geyeri (Geyer's Whorl Snail) [1013]						
	Vertigo angustior (Narrow-mouthed Whorl Snail) [1014]						
	Margaritifera margaritifera (Freshwater Pearl Mussel) [1029]						
	Salmo salar (Salmon) [1106]						
	Lutra lutra (Otter) [1355]						
	Petalophyllum ralfsii (Petalwort) [1395]						
Lough Gall Bog SAC (000522)	Blanket bogs (* if active bog) [7130]	Located c. 6.5km north-west of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
	Depressions on peat substrates of the Rhynchosporion [7150]						

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
Bellacragher Saltmarsh SAC (002005)	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410]	Located c. 7km north-west of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
Oldhead Wood SAC (000532)	European dry heaths [4030] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	Located c. 7km west of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
West Connacht Coast SAC (002998)	*Tursiops truncatus* (Common Bottlenose Dolphin) [1349]	Located c. 8km west of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities.

Natura 2000 Site	Qualifying Interest	Location in relation to license site	Potential pathway for impacts (Yes/No)	Potential Impact & Source			Pre-assessment Screening
				Direct	Indirect	Cumulative	
							There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
River Moy SAC (002298)	Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [6510]	Located c. 10km north of Clew Bay at its closest point	No	None	None	None	This SAC is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SAC. There are no potential pathways for significant effects.
	Active raised bogs [7110]						
	Degraded raised bogs still capable of natural regeneration [7120]						
	Depressions on peat substrates of the Rhynchosporion [7150]						
	Alkaline fens [7230]						
	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]						
	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]						
	Austropotamobius pallipes (White-clawed Crayfish) [1092]						
	Petromyzon marinus (Sea Lamprey) [1095]						

Natura 2000 Site	**Qualifying Interest**	**Location in relation to license site**	**Potential pathway for impacts (Yes/No)**	**Potential Impact & Source**			**Pre-assessment Screening**
				Direct	**Indirect**	**Cumulative**	
	Lampetra planeri (Brook Lamprey) [1096] *Salmo salar* (Salmon) [1106] *Lutra lutra* (Otter) [1355]						
Owenduff/ Nephin Complex SPA (004098)	Merlin (*Falco columbarius*) [A098] Golden Plover (*Pluvialis apricaria*) [A140]	Located c. 1.8km north of Clew Bay at its closest point	No	None	None	None	This SPA is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SPA. There are no potential pathways for significant effects.
Clare Island SPA (004136)	Fulmar (*Fulmarus glacialis*) [A009] Shag (*Phalacrocorax aristotelis*) [A018] Common Gull (*Larus canus*) [A182] Kittiwake (*Rissa tridactyla*) [A188] Guillemot (*Uria aalge*) [A199] Razorbill (*Alca torda*) [A200] Chough (*Pyrrhocorax pyrrhocorax*) [A346]	Located c. 15km west of Clew Bay at its closest point	No	None	None	None	This SPA is located at a distance from Clew Bay and the proposed hand harvesting activities. There is significant geographical separation between the proposed activities and the qualifying interests of this SPA. There are no potential pathways for significant effects

6. Potential Significant Impacts

The potential for adverse effects on the qualifying interests and conservation objectives of the Natura 2000 sites potentially affected by the proposed project have been taken into account. Direct, indirect and cumulative impacts arising from the proposal for the sustainable hand- harvesting of *Ascophyllum nodosum* within the intertidal zone of Clew Bay are identified with regard to potential impacts affecting designated Natura 2000 sites as follows:

- disturbance / fragmentation of Annex I habitats;
- disturbance to Annex II species;
- impacts affecting the structure and function of the designated site;
- hydrological changes / water quality impacts.

From the initial screening of Natura 2000 sites within the study area only the Clew Bay Complex SAC is identified with regard to the potential for significant adverse effects, with regard to the conservation objectives of this site. The site synopsis for the Clew Bay Complex SAC is presented in Appendix 1. The main potential risks affecting sensitive ecological receptors, i.e. the qualifying interests of this site are primarily due to human disturbance; trampling and removal of *A. nodosum* material potentially affecting the community structure within the Annex I habitats of the intertidal zone and further human disturbance due to increased activity potentially affecting Annex II species: Otter and Common seal.

6.1 Direct Impacts

The proposal for the sustainable hand-harvesting of *A. nodosum* will require the transport of individual harvesters to the shoreline of Clew Bay and islands by small boat. Harvesters will work within the Bay and islands throughout the year. This work will require access to the shore at low tide from existing access roads and to islands before low tide to allow for harvesting at low tide. Therefore it is unlikely that significant impacts will arise that could affect the mudflats and sandflats habitat, or the Atlantic salt meadows habitat, annual vegetation of drift lines, perennial vegetation of stony banks, embryonic shifting dunes or white dunes.

The entirety of the proposed activities are within the Annex I habitat 'Large shallow inlets and bays [1160]'. These activities do not require the removal or disturbance to the sensitive littoral reef habitat or to Maerl or *Zostera* communities identified as important community biotopes within the Clew Bay [1160] Annex I habitat type. In terms of annex I habitats, the percentage area of Shingle and Reef to be impacted each year is 12.7% and 4.9% respectively. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,189 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31% (this is outlined in the Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC – Appendix 4',included as Addendum 5 in the current NIS). However, as the proposal requires activities within this habitat area, it is considered that there is the potential pathway for impacts on this habitat. Mitigation measures will be required. Mitigation cannot be provided in a Screening for Appropriate Assessment report.

The evidence from the literature suggests that the potential for effects to arise as a result of sustainable hand harvesting of *A. nodosum*, are limited. For example, Kelly *et al*., 2001, shows that *A. nodosum* regenerates 11 to 17 months post harvesting. Kelly *et al*., 2001, also demonstrates that there are no impacts of harvesting on overall biodiversity, mobile epifauna and fish 11 to 17 months post-harvesting. A study by Lauzon-Guay *et al*., 2023, shows that harvest of *A. nodosum* (at sites with a 20 + year history of commercial harvesting) does not have long-term impact on the morphology of the algae or on the abundance of its main inhabitants. Therefore, it is considered unlikely that sustainable hand harvesting of *A. nodosum* would give rise to any further effects on Large Shallow Inlets and Bays

[1160] in Clew Bay. However, mitigation measures will be required.

Both the Common seal *Phoca vitulina* and the Otter *Lutra lutra* are listed as Annex II qualifying interests of the Clew Bay Complex SAC. Both species utilise the shoreline of the bay, in addition to the islands within the study area. A number of these islands have been identified as important haul-out, breeding and moulting sites for Common seal. This gives rise to the potential for disturbance impacts affecting both species which may result in direct impacts affecting the availability of habitat and the range of these species within the SAC. It is therefore considered that there is the potential for impacts on both Common seal and Otter. Mitigation measures are required.

6.2 Indirect Impacts

The proposed activities within the Clew Bay Complex will require activities within the intertidal zone of the Annex I habitat 'Large shallow inlets and bays [1160]', the removal of *A. nodosum* biomass is considered to have the potential to give rise to an alteration in the intertidal biotope characterised as intertidal reef habitat; identified as an Annex I habitat within the Annex I [1160] habitat of the Clew Bay Complex SAC as a whole. Annex I habitats identified that may be indirectly affected by the proposed harvesting activities also include for saltmarshes and sand dune habitats due to possible changes in sediment supply. The potential pathway for impacts has been identified and mitigation is required. Mitigation cannot be provided in a Screening for Appropriate Assessment.

Additional indirect impacts may potentially occur due to a reduction in foraging area and displacement of common seal populations within the wider activities area leading to the requirement for further assessment within the context of the current NIS. Potential indirect disturbance arising from both human activity and wider noise impacts affecting both Common seal and Otter within the SAC are identified. This may include impacts relating to foraging and commuting in the wider context of the study area; in addition to indirect impacts affecting breeding success and energy expenditure resulting from disturbance. The potential pathway for impacts has been identified and mitigation is likely to be required. Mitigation cannot be provided in a Screening for Appropriate Assessment report.

6.3 Cumulative Impacts

Completed plans or projects, where they contribute to a potential cumulative effect are considered in that they have resulted in an impact upon the qualifying interests of a designated site and the continuing effect must be assessed in order to identify any pattern of continuing loss of integrity (English Nature, 2001). Potential cumulative impacts affecting species listed as conservation interests of designated Natura 2000 sites are identified with regard to the following:

- Disturbance and displacement effects of increased boat traffic;
- Disturbance and potential displacement due to noise and human disturbance at a background level during operation;
- Indirect effects through loss of, or changes to, habitat and prey species availability arising from an alteration to the intertidal biotope / community due to harvesting of *A. nodosum*.

The location of the proposal within the Clew Bay Complex SAC gives rise to the potential for direct and indirect impacts affecting Common seal and Otter populations listed as qualifying interests of this Natura 2000 site. The potential for disturbance impacts affecting these species are also recognised with regard to existing fishing boat activity, tourism and recreational activity within the Clew Bay area and pre-existing and ongoing seaweed harvesting activities; all of which would have the potential for cumulative and in-combination impacts arising from human disturbance impacts. Mitigation is likely to be required and cannot be provided in a Screening for Appropriate Assessment report.

7. CONCLUSION

Table 4 DoEHLG (2010) potential findings and outcomes for Screening for Appropriate Assessment with conclusions for proposed sustainable harvesting of *A. nodosum* in Clew Bay, Co. Mayo.

Finding	Potential Outcome	Conclusion
Project is directly connected to or necessary for the management of a designated site	Stage 2 (AA) is not required	
No potential for significant effects	Stage 2 (AA) is not required	
Potential for significant effects identified, or potential for impacts is uncertain	Stage 2 (AA) is required and a Natura Impact Statement will be prepared	✓

This screening report, based on the best available scientific information, finds that there is reasonable scientific certainty that the proposed license does pose a risk of significant adverse effects on the Natura 2000 network in view of their conservation objectives. The proposed license does require a Natura Impact Statement (Stage 2 Appropriate Assessment). Therefore it is concluded, in the absence of any consideration of mitigation measures or best-practice measures, that the proposed license may have a significant impact, individually or in combination with other plans or projects, on the Clew Bay SAC. Appropriate Assessment (NIS) is therefore required for the proposed hand harvesting of *A. nodosum* in Clew Bay.

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APPENDIX 1 NPWS SITE SYNOPSES

SITE NAME: CLEW BAY COMPLEX SAC
SITE CODE: 001482

Clew Bay is a wide, west-facing bay on the west coast of Co. Mayo. It is open to the westerly swells and winds from the Atlantic, with Clare Island giving only a small amount of protection. This drumlin landscape was formed during the last glacial period when sediments were laid down and smoothed over by advancing ice. The sea has subsequently inundated the area, creating a multitude of islands. The geomorphology of the bay has resulted in a complex series of interlocking bays creating a wide variety of marine and terrestrial habitats. The site is a Special Area of Conservation (SAC) selected for the following habitats and/or species listed on Annex I / II of the E.U. Habitats Directive (* = priority; numbers in brackets are Natura 2000 codes): [1140] Tidal Mudflats and Sandflats [1150] Coastal Lagoons* [1160] Large Shallow Inlets and Bays [1210] Annual Vegetation of Drift Lines [1220] Perennial Vegetation of Stony Banks [1330] Atlantic Salt Meadows [2110] Embryonic Shifting Dunes [2120] Marram Dunes (White Dunes) [21A0] Machairs (* in Ireland) [91A0] Old Oak Woodlands [1355] Otter (Lutra lutra) [1365] Common (Harbour) Seal (Phoca vitulina).

Within the shallow bay, subtidal sediments are characterised by typical bivalve communities in fine sand (Chamelea striatula and Ensis sp.), and by the polychaete worm Euclymene sp. and the bivalve Thyasira flexuosa in muddy sand. The intertidal sediment communities are characterised by polychaetes and bivalves in the mid shore and by the sand mason worm Lanice conchilega in the low shore. In areas where there is maerl debris with small amounts of live maerl, the infaunal community has a mixture of species characteristic of coarse sand (e.g. the bivalves Timoclea ovata, Spisula sp., and the polychaetes Nepthys cirrosa and Glycera lapidum) and medium sand (e.g., the bivalve Ensis sp. and the polychaetes Lanice conchilega, Scoloplos armiger and Sthenelais boa). The bivalves Timoclea ovata, Tapes rhomboides and the polychaetes Branchiomma bombyx and Glycera lapidum are typical of gravels and medium sands, whereas the bivalves Abra alba, Corbula gibba, Thyasira flexuosa and Mysella bidentata and the polychaete Euclymene are characteristic of muddy sands. Beds of live maerl of Lithothamnion corallioides are also present in a number of areas.

Around the edges of the inner part of the bay are shores of mixed boulders, cobbles, gravel with some sand and mud. They have a typical zonation of intertidal communities found on sheltered shores of mixed substratum. The shore at Murisk is unusual as a distinct zone characterised by archiannelids occurs above the sandhopper zone in the upper shore under the boulders and cobbles. This is an unusual habitat. In sheltered areas of shallow water with little sand scour a well-developed community of hydroids, sponges and solitary sea squirts is present. Where the sediments include gravel and mud the species richness in the area can be exceptionally high (180 species). A number of marine species that are rarely recorded are found in Clew Bay: the stalked jellyfish Lucernariopsis cruxmelitensis; the polycheates Anitides rosea, Clymenura clypeata, Pterosyllis formosa and Pionosylis sp. and the snail Clypterea chinensis.

Clew Bay is considered to have the most significant shingle reserves in the country, and has (on the islands) the only examples of incipient gravel barriers in Ireland. Associated with the shingle (and dunes) are good examples of annual vegetation of drift lines. Characteristic species found in these habitats include: Spear-leaved Orache (Atriplex prostrata), Red Fescue (Festuca rubra), Sea Sandwort (Honkenya peploides), Thrift (Armeria maritima), Common Scurvygrass (Cochlearia officinalis), Sea Mayweed (Matricaria maritima) and Sea Campion (Silene vulgaris subsp. maritima).

Lough Furnace is located at the north-eastern corner of Clew Bay. The lough is a good example of a deep, stratified, saline lake lagoon in a very natural state. Salinity levels can vary considerably here depending on rainfall and tides. The lake is one of the very few permanently stratified lakes known in Ireland and Britain. The lake is ringed by Common Reed (Phragmites australis) and Common Club-rush (Scirpus lacustris), with small patches of Great Fen-sedge (Cladium mariscus) and Bottle Sedge (Carex rostrata). Lough Furnace supports a relatively high faunal diversity (41 taxa recorded in a 1996 survey), including a number of important invertebrate species. The relict mysid species Neomysis integer, the isopods Jaera albifrons, J. ischiosetosa and J. nordmanni, and two rare amphipods (Lembos longipes and Leptocheirus pilosus) have all been recorded from the lake. Both Irish species of tasselweed (Ruppia maritima and R. cirrhosa) occur in the lagoon. Eel, Flounder and Mullet also occur in the lake waters. Mallard nest around the lough, while Saint's Island contains nesting Blackheaded Gull.

At the north-western end of Lough Furnace lie two associated lakes, Lough Napransky and Lough Navroony. A stream drains from the latter into the main lake. The area contains flush and quaking-mire vegetation, which is of interest as Irish Heath (Erica erigena) is found there, with bog mosses (Sphagnum spp.), Black Bogrush (Schoenus nigricans), Bog Asphodel (Narthecium ossifragum), Common Cottongrass (Eriophorum angustifolium) and Round-leaved Sundew (Drosera rotundifolia). Bog Orchid (Hammarbya paludosa), a species listed in the Irish Red Data Book and the Flora (Protection) Order, 2015, is also found in this area. Beyond the wet area there is a Hazel (Corylus avellana) dominated woodland growing over abandoned fields. Downy Birch (Betula pubescens), Hawthorn (Crataegus monogyna) and Holly (Ilex aquifolium) are common, with occasional Sessile Oak (Quercus petraea). The ground flora contains such species as Bluebell (Hyacinthoides non-scripta), Sanicle (Sanicula europaea) and Wood-sorrel (Oxalis acetosella).

Keeloges Wood is a medium-sized woodland on the north-east corner of Clew Bay. The woodland lies in a sheltered location between several drumlins and occurs on a shallow, moist, brown-earth soil with an organic-rich A horizon which is occasionally peaty. The soil is gleyed near streams and flushes. The woodland is dominated by Sessile Oak, with Downy Birch and occasional Ash (Fraxinus excelsior). Hazel, Holly and Hawthorn are the principal components of the shrub layer. In moister sites Rusty Willow (Salix cinerea subsp. oleifolia) and Alder (Alnus glutinosa) occur. The woodland is at the more fertile end of the spectrum of oak woodlands and is transitional to Ash woodland. Consequently the field layer is species-rich. Elements of oak woodland, e.g. Hard Fern (Blechnum spicant), Greater Stitchwort (Stellaria holostea), Great Wood-rush (Luzula sylvatica) and Honeysuckle (Lonicera periclymenum), are mixed with elements of Ash woodland, e.g. False Brome (Brachypodium sylvaticum), Lords-and-ladies (Arum maculatum), Enchanter's nightshade (Circaea lutetiana) and Wood Speedwell (Veronica montana), as well as indicators of poorly-drained soil, e.g. Tufted Hair-grass (Deschampsia cespitosa), Meadowsweet (Filipendula ulmaria) and Marsh Hawk's-beard (Crepis paludosa). The epiphyte Lobaria pulmonaria is also present, together with numerous other lichen and bryophyte species (including Usnea spp).

The wood was cut during the second World War so most of the trees are approximately 60 years old, but a few very much larger oaks occur, principally on the shoreline. There is a low but well-developed canopy with a well-developed shrub layer and often luxuriant field layer. There is good regeneration of trees. A most unusual feature is the juxtaposition of oak woodland with saltmarsh where the woodland borders the shoreline. The wood has been well-managed in recent times with occasional filling in of wind-blown coupes with trees derived from seed collected on-site. A stock-proof fence has been maintained along the land boundary. No invasive exotics were encountered during recent survey. The woodland appears on the 1st Edition Ordnance Survey map indicating that it is long-established and possibly ancient. The species-list also supports this contention with at least 14 species present here which have been found to be significantly more frequent in potentially ancient woodlands. This woodland is of particular significance in view of its location in the extreme north-west of the country where there is very little woodland, its position on the coast, its species-richness, excellent structure and its possible ancient status.

The Rosmurrevagh area in the north of Clew Bay displays a high diversity of habitats, from seashore to dunes, machair and coastal grassland, as well as saltmarsh, bog and fen. The sandy beach on the seaward side grades into dunes of Marram (Ammophila arenaria). Adjacent to this, the saltmarsh vegetation, which is approximately 5 m wide, comprises Thrift, Common Scurvygrass, Common Saltmarsh-grass (Puccinellia maritima) and 'turf fucoids' (diminutive forms of brown algae). These plant species are typical of Atlantic salt meadows. Similar saltmarshes occur scattered around the entire shoreline of the bay.

Next to the saltmarsh at Rosmurrevagh is an area of coastal grassland and machair. The majority of the machair grassland is relatively level and occurs on a fine sand substrate that is free draining. Small patches of damp machair are often found in conjunction with the saltmarsh or low-lying depressions where water from incoming high tides occasionally reaches. Many typical grassland species such as Festuca rubra (Red fescue), Bellis perennis (Daisy), and Plantago lanceolata (Ribwort plantain) are found on the machair. Autumn lady's-tress (Spiranthes spiralis) and Field Gentian (Gentianella campestris) are occasional in the grassland sward. Flushes introduce a species-rich bog/fen type vegetation. Yellow Iris (Iris pseudacorus), Soft Rush (Juncus effusus), Irish Heath, bog mosses, sedges, Water Mint (Mentha aquatica), Bog-myrtle (Myrica gale), Bog Asphodel and Cuckooflower (Cardamine pratensis) are also found.

A further dune system occurs at Bartraw in the south-west of the site. Here Marram and embryonic dunes occur along a shingle ridge which links a small island where dunes also occur. Embryonic dunes, characterised by the presence of Sand Couch (Elymus farctus), also occur on some of the islands in the bay.

Important populations of Otter and Common (Harbour) Seal are found in Clew Bay. A total of 95 Common Seals were recorded ashore within Clew Bay Complex SAC in August 2003 during a national aerial survey for the species. Continued land-based monitoring within the site recorded 121 seals of all ages ashore in August 2009 and 118 in August 2010. The snail species Vertigo geyeri, which is also listed on Annex II of the E.U. Habitats Directive, has been recorded from this site based on a finding of the species at the edge of a lagoon at Rosmoney, as reported in 2005. The Vertigo monitoring survey of 2008-2010 assessed the site as having very little suitable habitat and that this was a natural situation rather than due to loss of habitat. This was the only site for Vertigo geyeri in this SAC and no others have been found.

The Clew Bay Complex supports a good diversity of wintering waterfowl, with nationally important numbers of Red-breasted Merganser (average maximum of 70 in the winters 1995/96-1999/00) and Ringed Plover (average maximum of 142 in the winters 1995/96-1999/00). A population of Barnacle Goose (100-200 birds) frequents the islands during winter. Other species which occur in significant numbers include Great Northern Diver (14), Brent Goose (118), Shelduck (74), Wigeon (112), Teal (127), Mallard (64), Oystercatcher (250), Dunlin (450), Bar-tailed Godwit (73), Curlew (373), Redshank (172), Greenshank (10) and Turnstone (27) (all figures are average maxima for the winters 1995/95-1999/00). Species which breed in important numbers include Cormorant (115 pairs in 1985), Common Tern (20+ pairs in 2000/01), Arctic Tern (100+ pairs in 2000/01) and Little Tern (9 pairs in 2000). The various tern species, as well as Barnacle Goose, Great Northern Diver and Bar-tailed Godwit, are listed on Annex I of the E.U. Birds Directive.

The juxtaposition within Clew Bay of a wide variety of habitats, including 10 listed on Annex I of the E.U. Habitats Directive, and the combination of important flora and fauna, including one Red Data Book plant and two animals listed on Annex II of the E.U. Habitats Directive, make this a site of considerable national and international importance.

ADDENDUM 2 ARTICLE 12 (HABITATS DIRECTIVE) SCREENING

ARTICLE 12 (HABITATS DIRECTIVE) ASSESSMENT SCREENING

Sustainable Hand Harvesting of *Ascophyllum nodosum* at Clew Bay, Co. Mayo

21-02-24

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[redacted]

EXECUTIVE SUMMARY

Project Name	Proposed Sustainable Hand Harvesting of *Ascophyllum nodosum* at Clew Bay, Co. Mayo
Project Description	BioAtlantis plan to undertake sustainable hand harvesting of *A. nodosum*, by contracting 16 full-time hand harvesters, to harvest up to a maximum of 11,018 tonnes per annum across various sites in Clew Bay.
Annex IV Species occurring in Clew Bay	Otters, Leatherback Turtle, Loggerhead Turtle, Harbour porpoise, Bottlenose dolphin, Common dolphin, Striped dolphin, White-beaked dolphin, Cuvier's beaked Whale
Annex IV Species Likely to be Significantly affected	Otters
Potential Impacts	Disturbance; Reduction in Food Sources. Sustainable hand harvesting activities in Clew Bay have the potential to increase human disturbance . In general Otters frequent the intertidal zone, and along the shorelines of the many islands in Clew Bay. There is the potential for interactions with the species during the harvesting activities – further assessment will be required.
Requirement for further Annex IV species Impact Assessment	Yes – in relation to Otters

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Date	Revision	Status	Author	Reviewed By
21-02-24	1	Final	GW/WOC	WOC

1. INTRODUCTION

Ecofact Environmental Consultants Ltd. have been commissioned to carry out an Article 12 (Habitats Directive) Assessment Screening of proposed hand-harvesting of the seaweed *Ascophyllum nodosum* in a sustainable manner from Clew Bay, Co. Mayo. This screening assesses whether there is the possibility of effects on species listed under Annex IV of the Habitats Directive. Under Article 12, Annex IV species are afforded strict protection throughout their range, both inside and outside of designated protected areas.

1.1 Legislation

Article 12 of the Habitats Directive is aimed at the establishment and implementation of a strict protection regime for species listed in Annex IV within the whole territory of Member States (i.e. in locations outside protected areas as well as inside their boundaries).

Article 12 of the Directive states:

1. *"Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV (a) in their natural range, prohibiting: (a) all forms of deliberate capture or killing of specimens of these species in the wild; (b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration; (c) deliberate destruction or taking of eggs from the wild; (d) deterioration or destruction of breeding sites or resting places.*

2. For these species, Member States shall prohibit the keeping, transport and sale or exchange, and offering for sale or exchange, of specimens taken from the wild, except for those taken legally before this Directive is implemented.

3. The prohibition referred to in paragraph 1 (a) and (b) and paragraph 2 shall apply to all stages of life of the animals to which this Article applies.

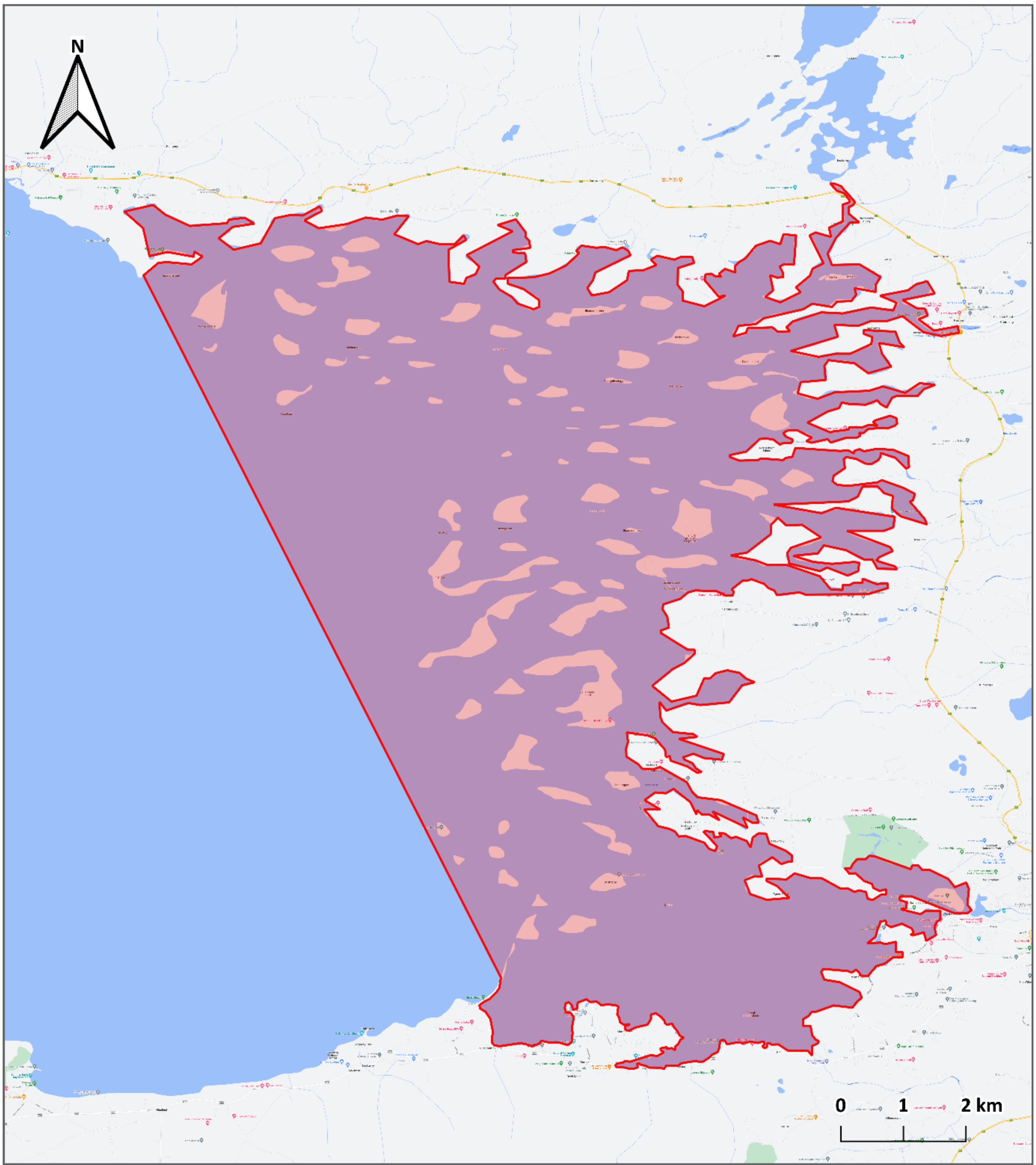
4. Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned."

Under Article 12 of the Habitats Directive, all species listed in Annex IV are afforded strict protection, prohibiting deliberate capture, disturbance and destruction of all life stages and deterioration or destruction of breeding sites or resting places. In addition, species listed in Annex II are afforded the same protection, even when not present in numbers which result in the designation of a Natura 2000 site.

As required by Article 12 of the Habitats Directive, the potential impact to species listed on Annex IV of the Directive must be assessed prior to a project receiving consent. The Article 12 assessment presented in Section 7 has been prepared with reference to the European Communities (Birds and Natural Habitats) Regulations 2011 and also to the '*Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC'* (EC, 2007b), which states that:

'The interpretation of Article 12 has to take into consideration the objective of Directive 92/43/EEC set out in Article 2, which applies, without distinction, to all Annexes. Consequently, strict protection measures adopted under Article 12 should aim to fulfil the main objective of the Directive by contributing to the maintenance or restoration, at favourable conservation status, of Annex IV (a) species of Community interest, while taking into account economic, social and cultural requirements and regional and local characteristics' (EC, 2007)'.

This report considers whether or not the proposed harvesting of *A. nodosum* will result in the deliberate disturbance or destruction of any of the species listed in Annex IV (a) of the Habitats Directive that may be present in the study area. The assessment takes into account the status and sensitivities of relevant Annex IV species to potential impacts associated with decommissioning activities. Sections 7 and 8 of this report provide information relevant to the screening for potential effects on Annex IV species, in accordance with Article 12 of the Habitats Directive.



Proposed Harvestable Area

Drawn by:
Checked by: [redacted]

Date: 05.12.2022

Proposed Harvestable Area in Clew Bay, Co. Mayo

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Figure 1 Proposed Harvestable Area in Clew Bay, Co. Mayo.

2. METHODOLOGY

2.1 Guidance

This report has been prepared with regard to:

- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. Office for Official Publications of the European Communities, Brussels (EC, 2001).
- Communication from the Commission on the Precautionary Principle, Office for Official Publications of the European Communities, Luxembourg (EC, 2000);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities. (Department of Environment, Heritage and Local Government, 2010).
- Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodical Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission Environment Directorate-General, 2001);
- Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC.

2.2 Desk Study

A desktop study was undertaken to identify the extent and scope of the potentially affected Annex IV species. A full bibliography of information sources reviewed is provided in the reference section. Information sources reviewed include:

- National Parks and Wildlife Service (NPWS) site synopses and conservation objectives,
- Protected species data on NPWS/National Biodiversity Data Centre (NBDC) online databases,
- Environmental Sensitivity Mapping (ESM) Tool,
- Irish Whale and Dolphin Group website
- Online aerial imagery (Bing, Google Satellite).

3. DESCRIPTION OF PROJECT

Clew Bay has in excess of 90 islands and 100km of coastline that contain harvestable quantities of A. nodosum. Given the ecological sensitivities identified within the Clew Bay area, harvesting must be carried out in a manner which does not negatively affect the biological environs. Utilising sustainable hand-harvesting technique and extraction (Kelly et al., 2001; Guiry & Morrison, 2013) and incorporating their use within a best practise approach, BioAtlantis have developed a sustainable model of seaweed harvesting in Clew Bay. Subject to obtaining a licence to harvest in Clew Bay, BioAtlantis will contract up to 16 full-time hand harvesters from the region, to harvest up to a maximum of 11,018 tonnes per annum. BioAtlantis will recruit harvesters with previous experience or whose families have farms or fishing interests in the area and will work with the harvesters to apply sustainable methods of harvesting, collection and conservation of the resource. In their proposal, BioAtlantis will explore the applicability of purchasing a boat for the area to collect the harvested *A. nodosum*, whilst also providing the option for harvesters to tow the floating bags/nets directly to pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

BioAtlantis will employ a site-specific management approach throughout the expanse of the Clew Bay SAC and throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited. Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of the collection boat (if deemed applicable to the area) also ensures ease of access to sites in use. It also brings full traceability to the process, as quality of harvest for each location will be monitored and biomass will be weighed on the boat or pick-up point prior to issuing the harvesters with a Goods Received Note (GRN). This technique also frees up harvesters to spend less time, money and effort on hauling cut seaweed ashore, whilst avoiding the otherwise negative consequences associated with bringing cut seaweed ashore at inappropriate locations. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. The site ID or GPS location of the harvest area will be recorded. Hand-harvested *A. nodosum* will be transported to production facilities in Tralee, Co. Kerry for further processing.

3.1 Operational Phase

The BioAtlantis proposal for sustainable hand-harvesting of *A. nodosum* from Clew Bay will include an area extending from Rosmurrevagh point on the north of Clew Bay to Leckanvy Pier in the south, including the islands within the Bay. Through use of data obtained from the field studies and evaluations by BioAtlantis Ltd. (BioAtlantis, 2021 and associated appendices) and Hession *et al*. (1998) and maps and aerial photographs of the region, it is calculated that the current maximum yield of *A. nodosum* from Clew Bay to be of the order of 64,759 tonnes. BioAtlantis' original application estimated that there is a maximum annual sustainable harvest of ~12,900 Tonnes in Clew Bay. This figure was updated following assessments of the resource by UCD in 2016 and with the removal of areas from the harvesting plan where existing appurtenant seaweed harvesting rights were identified. The revised estimated annual sustainable harvest is 11,018 Tonnes, based on harvesting a maximum of 20% of the total available *A. nodosum* biomass per site per annum (BioAtlantis, 2021 and associated appendices). BioAtlantis will employ a site-specific management approach to the Clew Bay Complex SAC, throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited. BioAtlantis Ltd. will employ a Resource Manager or Project Manager to operate on site, preferably with relevant environmental qualifications, a marine ecology background and/or experience in the fishing / marine resources industry. This individual will be responsible for managing activities within the harvesting area and in ensuring sustainability of these activities. They will report directly to the company CEO, and work as part of the resource management team. The person tasked with assessing recovery post-harvesting will have a marine ecology background. Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally-appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of a collection boat (if deemed applicable to the area) ensures ease of access to the sites. This brings full traceability to the process, as the quality of harvest from each location is monitored and biomass is weighed on collection and recorded on a Goods Received Note (GRN; or other method), with sites also inspected post-harvest to ensure the sustainability of the methods employed (Site Inspection Form, SIF or other method). The benefits of this approach is that harvester's times is no longer spent hauling seaweed ashore and coastal damage that could be caused by bringing in large quantities of seaweed ashore at inappropriate locations is avoided. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. The site ID or GPS location of the harvestarea will be recorded. Information recorded via GRN, SIF, etc may alternatively be provided in other suitable formats by electronic or other means on site and/or at production facilities.

A key requirement in implementing and securing a functioning system for sustainably hand harvesting *A. nodosum*, are effective control measures, reporting and monitoring systems. These are set out in the Code of Practice document and form a key framework for managing and ensuring that the system is being adhered to in a precise, correct, seamless and traceable manner. A key component to ensuring that the systems are being adhered to, and at the levels set out in the Code of Practice, will be a strong and robust auditing system. BioAtlantis will conduct quarterly and annual audits covering the areas below:

(a) Quarterly Audit:

- Audit Part A: Records, Forms & Documents
  - Step 1: Forms: receipt of training & verification of understanding
  - Step 2: Completed Training Certs (obtained through training above)
  - Step 3: Records, forms & documents (general)
- Audit Part B: Quality Assessment (documentation)
  - Step 1. GRNs (Clew Bay), or other format/method.
  - Step 2. Production Logsheets (Production Facilities).
  - Step 3. Incident Reports
  - Step 4. Non-conformance Reports
  - Step 5. Software Systems
  - Step 6: Site Inspection forms or other format/method.

(b) Annual Audit (on-site):

- Step 1. Site Quality (inspection of harvested sites)
- Step 2. Harvest methods (inspection of techniques)
- Step 3. Delivery and collection methods (e.g. Collection boat; if deemed applicable to the area).

For more information on the auditing system and its contents, please consult Addendum 7 (Clew Bay Audit Forms – Appendix 8) of the main BioAtlantis licence application document. All control measures, action limits/non-conformance, analytical procedures, monitoring schedule, (frequency), corrective actions and verification are detailed in the licence application main text document. In addition, the harvesting system will be reviewed annually to assess and verify the control measures and determine areas in need of improvement.

3.1.1 Overview of Proposed Operational Phase

In carrying out the operational stage of the proposal, harvest will be recorded using BioAtlantis Compliance and Record Forms (see Addendum 4 in the current NIS). BioAtlantis has developed a management plan setout in the 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC – Appendix 4',included as Addendum 5 in the current NIS. This includes the development of a database, to take account of the study area of Clew Bay including over 90 islands and 100km of coastline that contain harvestable quantities of *A. nodosum*. This database will be used to:

(a) Determine and manage sites which require a fallowing period to allow for adequate recovery from recent activities;

(b) Determine and manage rotation requirements (i.e. extrapolation and calculation of the duration or fallowing period required prior to a particular areas being fit for re-harvest);
(c) Prevent harvest activities that would lead to a decline in yield;
(d) Record the details of each harvest, how much, by whom and when.

Moreover, this database represents a central, working component of the BioAtlantis best practice guidelines for harvesting *A. nodosum*, requiring:
(a) Development of pre-harvest plans in advance of harvest activities;
(b) A cap of 20% on the level of available biomass which can be harvested from a given site per annum;
(c) Limitations of a 200-300mm (8-12 inches) cutting height of *A. nodosum* stipe / frond.

Table 1 below sets out the islands and shore-line areas identified as being within the proposed harvesting area for the BioAtlantis project, with *A. nodosum* densities and coverage included. There are four main types of activities associated with the operational phase include:

Operation/Activity No. 1: Management & implementation;
Operation/Activity No. 2: Monitoring, recording & reporting;
Operation/Activity No. 3: Verification & analysis.
Operation/Activity No. 4: Long term assessment of biomass and community structure

All operations/activities are described in detail in the Code of Practice prepared by BioAtlantis, included in the Licence Application (BioAtlantis, 2021 and associated appendices) and presented in Addendum 5 of this NIS. When planning future harvests some Islands will be marked as unavailable for certain times of the year, in order to ensure that known seal breeding, moulting and resting and bird breeding and wintering sites are avoided. The resource manager will be responsible for ensuring that these sitesare avoided. The list of restricted sites is set out in the Code of Practice (Addendum 5); this will be updated to reflect ongoing consultation and data available from NPWS into the future; taking account of time of year and the presence of Common seals and breeding and wintering bird populations.

BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done by visiting each site and performing an assessment of the growth and density of *A. nodosum* on each and updating the production plan as necessary with the results of this analysis.

3.1.2 Management and implementation during operations

Management and implementation components include activities relating to:

1. *Planning and scheduling of harvesting activities*: In the initial stages, it is necessary to establish details of when each area was last harvested. This will be done by working closely with the existing local harvesters, and through analysis of derived datasets, the dates and quantities of the most recent harvests for each island and coastal zone can be established. This data can then be used to derive when a region will be next available for harvest. The nominal recovery time is generally accepted to be 3-5 years from a complete harvest; a maximum harvest of 20% of the total availablebiomass of seaweed is permitted per site per annum to ensure sustainability.
2. *Numbers of personnel to be managed and harvest rates:* Approximately 16 full

time people, or 32 part-time, will be contracted to work for an average of 230 days/year, harvesting approximately 3.5tonnes per day (rate of ~10.4Kg/M^2). The amounts harvested will be recorded to ensure adherence to licensing limits. The area harvested will be 26,923m^2 per day per 16 harvesters. This reflects a harvest rate of 20% of *A. nodosum* biomass per site per annum. This corresponds to an area occupied of 1,683m^2 per person/day or 0.4acres per person per day, for approximately 6-8 hours per day. Approximately 2-4 harvesters are permitted on small-medium sized sites. Medium to largeislands may require between 4-6, while larger islands will likely require approximately 6-10 harvesters. Thus, the low number of people over a wide area reduces the potential for anthropogenic impacts (e.g. intensity of trampling) on the biotope. In fact, given that the BioAtlantis plan targets specific areas at specific times of the year, the low levels of trampling events will also be largely episodic in nature. It is unlikely therefore, that any significant change in the structure of *A. nodosum* assemblages will occur. Furthermore, as a policy against holdfast removal will be implemented, the incidence of *A. nodosum* mortality will be reduced considerably (see 'Code of Practice', Addendum 5). As such, the harvest level of 20% of the total available biomass represents a relatively constant figure and will not be exacerbated due to significant levels of A. *nodosum* mortality due to partial or complete holdfast removal.

3. *Exploitation Levels*: As a policy against holdfast removal will be implemented, *A. nodosum* mortality and whole plant removal will therefore be prevented. Hence, the harvest rate figure of 20% of the total available biomass will remain largely constant and will not be breached due to increased mortality rates.
4. Once the re-harvesting date for each island is established, this information will be used to plan the next seasons harvesting. BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done by visiting each site and performing an assessment of the growth and density of *A. nodosum* on each, and updating the production plan as necessary with the results of this analysis;
5. *Data recording and analysis*: BioAtlantis will explore the applicability of purchasing a boat for the area to be used for the collection of harvested *A. nodosum*. The boat will be piloted by the resource manager or other suitably trained employee. The seaweed collected from each point will be weighed and the details of the harvest recorded, at each collection point. The person or transport company in receipt of the harvested seaweed will complete a 'Goods Received Note' to record the harvest from each site. This also includes measurement of amount and quality of the harvested seaweed. Bag/nets will be weighted on the boat (if applicable to the area) or at the pick-up point or processing facility. Alternatively, where harvesters tow the floating bags/nets containing *A. nodosum* from the harvest site directly to the pick-up points. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded.
6. The Resource Manager will inspect sites post-harvest to ensure the standards with respect to the sustainability of the methods employed (Site Inspection Form, SIF or other method). A second check will be completed on receipt of the harvested seaweed at BioAtlantis' factory in Tralee, with details recorded

on a GRN or other method. Details from the GRNs will be uploaded into the main database. The quality of the supplied *A. nodosum* will be assessed by the quality control and/or production team and details of any deviations from the specified requirements recorded on the harvest record. Computerised data will be maintained of all harvest records and non-conformances;

7. *Access and Navigation at harvest sites*: The harvesters shall use their own boats to navigate toand from the island sites. In the case of coastal sites, the harvesters shall be responsible for access to and from the sites via existing access routes. The size of the shore area covered by an individualbag or net will be approximately 2m² to 8m². Harvest will occur at islands and shorelines as described in the harvest management plan. Floating nets or bags will then be picked up at each location in which harvest took place. Alternatively, harvesters may tow the floating nets or bags from the harvest site directly to the pick-up points.

   Final pick-up points will be at established piers and harbours, particularly in Westport and Newport.Access to the northern coastal area will be via the roads at Knockmanus road, Roskeen south Road, Carrowsallagh Rd, Keeloges Rd, and via boat. Access to the Milcum harvesting site will bevia the Teevmore Road. The coast roads on Knockeeragh and Rosclave provide good access to the harvesting sites in this area. The harvesting site at Rosanrubble can be accessed by boat andfrom the road to Rosanrubble Point. The harvesting area between Bleanrosdooaun Strand and Monkelly can be accessed by road to Roslaher, Rostoohy Pier, Moyna Strand, Ardkeen Quay, Roscahil Rd, Rosmindle Rd, Castleaffy, Rosmoney, Rusheen, Carrowcally, Bawn Strand, & Monkelly Strand. BioAtlantis will explore the applicability of purchasing a boat for the area, that will be approved by the Marine survey office (MSO) for use on the open waters of Clew Bay and used to collect the harvested *A. nodosum* from the designated sites; alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. The harvesters will be made aware that all harvested *A. nodosum* must be collected by BioAtlantis for weighing and processing, and the seaweed will only be collected from the sites or pick up points identified on the harvesting schedule or at sites which are approved by BioAtlantis. In some cases, individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

8. *Communication*: The number of harvesters involved in harvesting the requirements of BioAtlantiswill be below ten initially, rising to sixteen over time. Communication of the harvesting plan will be done in advance each month/quarter via email or post. This will include information on sites that are to be harvested and the quantity and dates for each harvest site. Sites will be identified on a map and the anticipated quantities for each site indicated. Communications with the harvesters during harvesting activities will be either via a mobile phone or 2 way radios, as deemedappropriate and will be managed by BioAtlantis and the BioAtlantis Resource Manager;

9. *Hand-harvest methodology*: Training will be provided to harvesters, where necessary, to ensure competence in skills required to harvest *A. nodosum* in an environmentally friendly and sustainable manner. Activities will be carried out in accordance with a clearly defined protocol which will prevent any damage

to the environment or underlying growth substrate, whilst also facilitating sufficient re- growth and re-generation of the vegetation post-harvest. The 'Code of Practice for *A. nodosum* harvest activities in Clew Bay Complex SAC' is set out in the Licence Application (BioAtlantis, 2021) and is included in Addendum 3 of the current report;

10. *Health and safety measures*: All harvesters will be provided with appropriate and certified Health & Safety Training. BioAtlantis will run regular training days for the harvesters where necessary. The seaweed collection boat (if deemed applicable to the area) will be equipped with all necessary safety equipment as required by the marine survey office.

Table 1 Harvesting locations and quantity estimates within the Clew Bay study area.

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg / m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
	Bartraw - Westport	CZ 1.1	61074	0	46%	0.0 T	0.0 T
		CZ 1.2	83288	0.7	100%	58.3 T	11.7 T
		CZ 1.3	57560	0.7	98%	39.4 T	7.9 T
		CZ 1.4	46890	0.7	100%	32.8 T	6.6 T
		CZ 1.5	59466	0.7	70%	29.3 T	5.9 T
		CZ 1.6	32360	1.25	100%	40.4 T	8.1 T
		CZ 1.7	47684	0.7	100%	33.4 T	6.7 T
		CZ 1.8	77259	0	54%	0.0 T	0.0 T
		CZ 1.9	7961	0.7	100%	5.6 T	1.1 T
		CZ 1.10	5559	1.25	100%	6.9 T	1.4 T
		CZ 1.11	11271	1.25	100%	14.1 T	2.8 T
		CZ 1.12	4254	1.25	100%	5.3 T	1.1 T
		CZ 1.13	136927	10.5	94%	1354.0 T	270.8 T
		CZ 1.14	76090	10.5	94%	751.9 T	150.4 T
		CZ 1.15	37232	0.5	100%	18.6 T	3.7 T
		CZ 1.16	35400	0.5	100%	17.7 T	3.5 T
		CZ 1.17	35419	0.5	100%	17.7 T	3.5 T
		CZ 1.18	6633	0.5	100%	3.3 T	0.7 T
	Westport - Rosmoney	CZ 2.1	38658	0	82%	0.0 T	0.0 T
		CZ 2.2	5199	0	100%	0.0 T	0.0 T
		CZ 2.3	8889	0	100%	0.0 T	0.0 T
		CZ 2.4	35324	0	94%	0.0 T	0.0 T
		CZ 2.5	74945	0.55	98%	40.4 T	8.1 T
		CZ 2.6	30076	0.8	100%	24.1 T	4.8 T
		CZ 2.7	7831	0	57%	0.0 T	0.0 T
		CZ 2.8	6710	0	100%	0.0 T	0.0 T
		CZ 2.9	125537	0.8	100%	100.4 T	20.1 T
		CZ 2.10	109815	0.8	97%	85.0 T	17.0 T
		CZ 2.11	9303	0	100%	0.0 T	0.0 T
		CZ 2.12	27612	0	91%	0.0 T	0.0 T
		CZ 2.13	328	0	100%	0.0 T	0.0 T
		CZ 2.14	22527	0	100%	0.0 T	0.0 T
		CZ 2.15	3842	0	94%	0.0 T	0.0 T
		CZ 2.16	6082	0	100%	0.0 T	0.0 T
		CZ 2.17	3636	0	0%	0.0 T	0.0 T
	Rosmoney - Moyna Strand	CZ 3.1	18865	0	50%	0.0 T	0.0 T
		CZ 3.2	40641	4.35	100%	176.8 T	35.4 T
		CZ 3.3	97095	4.35	100%	422.4 T	84.5 T
		CZ 3.4	12914	4.35	100%	56.2 T	11.2 T
		CZ 3.5	9650	4.35	100%	42.0 T	8.4 T
		CZ 3.6	78317	4.35	95%	323.9 T	64.8 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg / m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
		CZ 3.7	117114	4.35	100%	509.4 T	101.9 T
		CZ 3.8	8398	4.35	100%	36.5 T	7.3 T
	Rostoohy Pt - Newport	CZ 4.1	84464	4.35	92%	339.0 T	67.8 T
		CZ 4.2	27181	4.35	100%	118.2 T	23.6 T
		CZ 4.3	150517	4.35	100%	654.8 T	131.0 T
		CZ 4.4	38351	4.35	99%	164.9 T	33.0 T
		CZ 4.5	26354	0	96%	0.0 T	0.0 T
		CZ 4.6	6397	0	83%	0.0 T	0.0 T
		CZ 4.7	5572	0	100%	0.0 T	0.0 T
		CZ 4.8	6703	0	100%	0.0 T	0.0 T
		CZ 4.9	9671	0	100%	0.0 T	0.0 T
		CZ 4.10	24594	0	64%	0.0 T	0.0 T
		CZ 4.11	117165	0.85	81%	80.2 T	16.0 T
		CZ 4.12	77555	0.85	100%	65.9 T	13.2 T
		CZ 4.13	278265	0.85	79%	187.7 T	37.5 T
		CZ 4.14	110969	0.85	100%	94.3 T	18.9 T
	Newport - Mallaranny Pier	CZ 5.1	61157	0	100%	0.0 T	0.0 T
		CZ 5.2	58948	3.5	79%	163.3 T	32.7 T
		CZ 5.3	105121	3.5	84%	310.9 T	62.2 T
		CZ 5.4	258002	3.5	92%	833.8 T	166.8 T
		CZ 5.5	82278	3.5	83%	240.2 T	48.0 T
		CZ 5.6	41272	3.5	100%	144.5 T	28.9 T
		CZ 5.7	145329	3.5	89%	454.2 T	90.8 T
		CZ 5.8	84126	3.5	100%	294.4 T	58.9 T
		CZ 5.9	8260	3.5	100%	28.9 T	5.8 T
		CZ 5.10	17114	3.5	100%	59.9 T	12.0 T
		CZ 5.11	4451	3.5	100%	15.6 T	3.1 T
		CZ 5.12	1689	3.5	100%	5.9 T	1.2 T
		CZ 5.13	29666	3.5	100%	103.8 T	20.8 T
		CZ 5.14	3900	1.75	100%	6.8 T	1.4 T
		CZ 5.15	30450	1.75	100%	53.3 T	10.7 T
		CZ 5.16	11735	1.75	100%	20.5 T	4.1 T
		CZ 5.17	47890	1.75	79%	65.8 T	13.2 T
1	Forillan, Illanavrick	IS 11.1	40653	6	100%	243.9 T	48.8 T
		IS 11.2	13763	10	100%	137.6 T	27.5 T
2	Kid Isd East		3966	14	100%	55.5 T	11.1 T
3	Roslynagh		7990	0	0%	0.0 T	0.0 T
4	Illannambraher		57901	19	96%	1053.2 T	210.6 T
5	Inishdasky		14818	18	100%	266.7 T	53.3 T
6	Inishquirk		25206	15	82%	308.9 T	61.8 T
7	Inishtubrid		45540	18	100%	819.7 T	163.9 T
8	Inishlim		13308	16	100%	212.9 T	42.6 T
9			41752	18	100%	75.1 T	15.0 T
	Beetle Isd North						
	Inishbobunnan						
10			566589	16	27%	246.1 T	49.2 T
10	Inishgowla						
10	Beetle Isd South						
11	InishKeel	IS 11.1	16036	12.5	100%	200.5 T	40.1 T
		IS 11.2	2083	16.75	100%	34.9 T	7.0 T
		IS 11.3	300	17.5	100%	5.3 T	1.1 T
		IS 11.4	5876	17.5	100%	102.8 T	20.6 T
12	Black Rock		24348	2.5	100%	60.9 T	12.2 T
13	Moynish More		0	0	0%	0.0 T	0.0 T
14	Moynish Beg		0	0	0%	0.0 T	0.0 T
15	Inisherkin		53097	18	41%	387.7 T	77.5 T
16	Inishnacross		46888	18.5	61%	525.0 T	105.0 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg / m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
17	Inishilra		36300	18	78%	507.0 T	101.4 T
18	Inishcooa		70929	12	57%	486.2 T	97.2 T
19	Roeillaun		77113	5	100%	385.6 T	77.1 T
20	Inishdeashbeag Inishdeashmore		62555	0	100%	0.0 T	0.0 T
21	Inishcorky		17912	18.75	100%	335.8 T	67.2 T
22	Inishcarrick		34846	19	60%	397.3 T	79.5 T
23	Inishcoragh		24041	15	100%	360.6 T	72.1 T
24	Muckinish		33800	19.25	100%	650.6 T	130.1 T
25	Inishdaweel		22175	20	77%	342.8 T	68.6 T
26	Rabbit Isd		52391	8	58%	242.1 T	48.4 T
27	Illanascrraw		10411	18	100%	187.4 T	37.5 T
28	Freaghillanluggag h		23358	20	100%	467.2 T	93.4 T
29	Inishkee		16398	19	100%	311.6 T	62.3 T
30			15889	18	100%	286.0 T	57.2 T
31	Freaghillan West		20456	19	50%	194.8 T	39.0 T
32	Innishcannon		8656	16	100%	138.5 T	27.7 T
33	Carricklahan		0	0	0%	0.0 T	0.0 T
34	Carrickachorra		0	0	0%	0.0 T	0.0 T
35	Illanmaw		74045	0	66%	0.0 T	0.0 T
36	Freaghillan East		6422	18	100%	115.6 T	23.1 T
37			1476	16	100%	23.6 T	4.7 T
38	Inishcuill West		82042	20.75	79%	1348.2 T	269.6 T
39	Mauherillan		14262	16.75	91%	217.5 T	43.5 T
40	Inishfesh		54236	18	70%	685.8 T	137.2 T
41	Inishmolt		23618	18	100%	425.1 T	85.0 T
42	Inishloy		36182	18.5	100%	669.4 T	133.9 T
43	Inishdaff		70875	20.5	100%	1452.9 T	290.6 T
44	Inishbollog		13201	20.75	100%	273.9 T	54.8 T
45	Inishlaughil		55888	0	100%	0.0 T	0.0 T
46	Inishgowla		67983	16	22%	243.7 T	48.7 T
47	Inishoo		23072	0	13%	0.0 T	0.0 T
48	InishTurk	IS 48.1	56134	21	100%	1178.8 T	235.8 T
		IS 48.2	10755	21	100%	225.9 T	45.2 T
49	Illannaconney		17437	15	77%	201.6 T	40.3 T
50	Inishakillew	IS 50.1	69800	21.75	100%	1518.1 T	303.6 T
		IS 50.2	18583	21.75	100%	404.2 T	80.8 T
51	Trawbaun Carrigeenglass North Moneybeg Inishcottle		256815	19.5	89%	4468.7 T	893.7 T
52	Calf Island		30778	19.75	81%	490.3 T	98.1 T
53	Inishbee, Derrinish & Dernish West		200836	17.5	58%	2021.6 T	404.3 T
54	Freaghillan	IS 54.1	27454	19.75	66%	357.1 T	71.4 T
		IS 54.2	55101	20	90%	989.7 T	197.9 T
		IS 54.3	5995	21	100%	125.9 T	25.2 T
55	Clynish		102154	18.5	77%	1463.2 T	292.6 T
56	Ilaunnamona		25370	16	95%	384.3 T	76.9 T
57	Rabbit Island, Island More &Quinnsheen Island	IS 57.1	14757	19.5	100%	287.8 T	57.6 T
		IS 57.2	92903	16	88%	1307.4 T	261.5 T
		IS 57.3	7894	17.5	100%	138.1 T	27.6 T
		IS 57.4	9330	18	100%	167.9 T	33.6 T

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (kg / m^2)	§ (% Coverage)	Harvest levels (Tonne)†	
						Available Seaweed	Maximum Annual Harvest
58	Collan More, Carrigeenglass South & Collan Beg	IS 58.1	501217	16.75	100%	8395.4 T	1679.1 T
		IS 58.2	55220	18.75	100%	1035.4 T	207.1 T
		IS 58.3	29858	19.5	100%	582.2 T	116.4 T
59	Inishgort		64954	15.5	57%	571.7 T	114.3 T
60	Inishlyre		121285	5	57%	347.3 T	69.5 T
61	Illanataggart & Crovinish		442259	14	99%	6133.0 T	1226.6 T
62	Ininhgowla South + Carrickwee		183389	15	100%	2750.8 T	550.2 T
63	Forilan		30569	9.75	100%	298.0 T	59.6 T
64	Carrickawart	IS 64.1	26696	16	100%	427.1 T	85.4 T
64		IS 64.2	1276	14.25	100%	18.2 T	3.6 T
65	Inishlaghan		32314	14.5	83%	388.4 T	77.7 T
66	Dorinish More & Dornish Beag		27107	12.5	100%	338.8 T	67.8 T
67	Inishimmel		0	0	0%	0.0 T	0.0 T
68	Inishleauge		54366	8	77%	334.3 T	66.9 T
69	Inishdaugh		22949	6.5	72%	108.0 T	21.6 T
70	Inishraher		81224	14.7	85%	1014.1 T	202.8 T
71	Inisheeney		53625	16	85%	725.4 T	145.1 T
72	Finnaun Island		0	0	0%	0.0 T	0.0 T
73	Corillan	IS 73.1	6787	6.5	100%	44.1 T	8.8 T
		IS 73.2	1016	6.5	100%	6.6 T	1.3 T
		IS 73.3	1737	6.5	100%	11.3 T	2.3 T
		IS 73.4	3001	6.5	100%	19.5 T	3.9 T
74	Carricknamore	IS 74.1	2436	6.75	100%	16.4 T	3.3 T
		IS 74.2	1393	6.75	100%	9.4 T	1.9 T
		IS 74.3	2640	6.75	100%	17.8 T	3.6 T
75	Stony Island	IS 75.1	0	6.75	100%	43.8 T	0.0 T
		IS 75.2	0	6.75	100%	7.5 T	0.0 T
		IS 75.3	0	6.75	100%	36.9 T	0.0 T
		IS 75.4	0	0	100%	0.0 T	0.0 T
		IS 75.5	0	5	100%	29.1 T	0.0 T
		IS 75.6	0	6.5	100%	69.2 T	0.0 T
		IS 75.7	0	6.5	100%	10.7 T	0.0 T
		IS 75.8	0	6.5	100%	61.7 T	0.0 T
76	Green Islands	IS 76.1	0	0	100%	0.0 T	0.0 T
		IS 76.2	0	0	100%	0.0 T	0.0 T
		IS 76.3	0	0	100%	0.0 T	0.0 T
77	Carricknacally		2860	6.5	100%	18.6 T	3.7 T
78	Monkellys Rock		4425	8.75	100%	38.7 T	7.7 T
79	Inishweela		24604	10	97%	238.7 T	47.7 T
80	Illanroe		28522	14	100%	399.3 T	79.9 T
81	Roeillan		16126	15	100%	241.9 T	48.4 T
Totals							11,018 T**

***** Harvesting Zone ID's were assigned by BioAtlantis as part of establishing the management system.
** Revised Total (BioAtlantis, 2021).
† Maximum Annual Harvest (Tonnes) is calculated as 20% of the total available biomass per site. The figure of20% refers to the percentage of the total available *A. nodosum* biomass harvested per site, per annum.
§ Denotes the percentage of coastline which can support *A. nodosum* growth.

3.1.3 Monitoring of the A. nodosum resource

The biomass of *A. nodosum* will be assessed according to standard methods. The general approach to assessing biomass levels is summarized below, and may be subject to change depending on the sites involved, the underlying analytical methodology and the parameters/statistical methods employed:

- Sites located and photographed as required;
- 1m^2 quadrants may provide more robust measures of biomass over a larger area than otherwise smaller 0.25m^2 units used by Kelly *et al*., (2001) and others. Typically, 4 replicates taken per site with a distance of approximately 3 meters between each quadrant, where possible. Where density is deemed relatively homogenous according to visual estimation scales, lower number ofreplicates may be used;
- Harvest *A. nodosum* from each quadrant and measure wet weight per unit area;
- Record all data in the database and ensure that site is not subjected to further harvest activitiesuntil *A. nodosum* density has recovered;
- Statistical analysis: Different regions of Clew Bay will have different rates of *A. nodosum* growth.Therefore, it will be important to calculate the level of variation of *A. nodosum* in as many regions as possible. The datasets will allow for high density mapping of the distribution of the resource within the complex. This will build upon the study by Hession *et al*., (1998) and provide a more detailed analysis of the extent of the resource in the area. Analysis will be performed using geospatial tools and/or by means of One-Way ANOVA, linear regression or similar tests using software such as GraphPad PRISM; Following the assigned fallowing period, repeat the steps outlined above, and where possible, 1m^2 quadrants will be assigned in the same location as previously. Alternatively, replicates may be assigned randomly if required. Harvest *A. nodosum* and record data as described above; Replicate size, type and number and statistical methods may be changed to enhance the accuracy of the assessment.

Immediately following harvest, *A. nodosum* will be bagged and weighed automatically on the navigation boat (if deemed applicable to the area) or at the pickup point or processing facility. Details will be recorded on arrival at the pier (via the GRN or other method), thus allowing for accurate recording of the locations and quantities of *A. nodosum* harvested per unit area. The resource manager will be responsible for uploading the data from the GRN forms to the harvest database. The maintenance of the database will be the responsibility BioAtlantis staff. Other staff (e.g. scientific, production and quality personnel) will have access to the database as required for the correctimplementation of their duties.

Locations and periods of harvest must be planned in a manner which ensures that (a) there is no damage incurred to the environs of this SAC region, (b) there is sufficient *A. nodosum* biomass available for harvest and (c) sufficient time has passed to allow for recovery. The most accurate means of ensuring that each of these goals are met is through the statistical analysis of datasets as they emerge. In this way, staff at BioAtlantis will make decisions which are informed by knowledge of the rates of *A. nodosum* re-growth and regeneration. Data relating to biomass levels, re-growth and re-generation will be incorporated into the harvest management database for use in planning harvest periods.

In terms of quality control, BioAtlantis, as a GMP+ certified company, must ensure full traceability to end users of the origin and location of the raw material used in the products manufactures. Therefore, the Quality Control system in BioAtlantis will play a key role in the management and monitoring of work relating to harvest of *A. nodosum* in Clew Bay. In brief, this will involve:

- Assessment of quality control checks on harvesting activities in Clew Bay to ensure conformance with quality and other requirements for the SAC.
- Assessment of quality control checks to ensure recording is conducted appropriately (GoodsReceived Notes (GRN), Site Inspection Form (SIF) etc or other methods).
- Implementation of corrective actions where necessary. Liaise with BioAtlantis GMP+ Team on non-conformance issues should they arise;
- Utilisation of this knowledge in the preparation, scheduling and allocation of resources for harvesting;
- Assist in the implementation and training of personnel & contractors involved in hand harvesting activities in the Clew Bay area;
- Liaise with the BioAtlantis R&D Department regarding interpretation of data and on research and development related issues;
- Ensure customers have full traceability from point of harvest to the end product.

The quota for each island is a sustainable harvest of 20% of *A. nodosum.* The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site per annum. If quota is exceeded, the Resource Manager will issue a Non-Conformance Report (NRC) to BioAtlantis management. Harvesters will be provided with training if necessary. Harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person towhom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the Property Registration Authority of Ireland (PRAI), the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. The Resource Manager will routinely inspect sites post-harvest to ensure compliance of harvesters with sustainable hand harvest methods. Harvest will be recorded using BioAtlantis Compliance and Record Forms (see Addendum 4).

4. IDENTIFICATION OF ANNEX IV SPECIES

The area of Clew Bay is suitable habitat for a range of species that are protected under Annex IV of the Habitats Directive. Habitats Directive Annex IV species that could potentially occur in the study area are listed in Table 1 below.

Table 1 Annex IV Species potentially occurring in the study area.

Group	Species	Habitats Directive Annex (es)
Mammal	Otter *Lutra lutra*	Annex II, IV
Turtles	Leatherback Turtle *Dermochelys coriacea*	Annex II, IV
	Kemp's Ridley Turtle *Lepidochelys kempii*	Annex IV
	Loggerhead Turtle *Caretta caretta*	Annex IV
	Hawksbill Turtle *Eretmochelys imbricata*	Annex IV
Cetaceans	Harbour porpoise *Phocoena phocoena*	Annex II, IV
	Atlantic white-sided Dolphin *Lagenorhhynchus acutus*	Annex IV
	Bottlenose dolphin *Tursiops truncatus*	Annex II, IV
	Common dolphin *Delphinus delphis*	Annex IV
	Striped dolphin *Stenella coeruleoalba*	Annex IV
	White-beaked dolphin *Lagenorhynchus albirostris*	Annex IV
	Cuvier's beaked whale *Ziphius cavirostris*	Annex IV

4.1 Mammals

Otter are the only Annex IV mammal expected to be found in the study area. This species is listed under Annex II of the Habitats Directive as well, and designated as part of the Clew Bay Complex SAC. Otters are known to the area and the conservation objectives document for the Clew Bay Complex SAC show the commuting habitat for the species throughout the bay (NPWS, 2011). According to the online National Biodiversity Data Centre online maps, there are numerous records of Otter throughout Clew Bay, from 1980 to 2017.

4.2 Turtles

A total of 4 Annex IV species of Turtle are expected to occur in Ireland. These are the Leatherback turtle, Kemp's ridley turtle, Loggerhead turtle and the Hawksbill turtle. There is one record of a Leatherback turtle *Dermochelys coriacea* from Clew Bay in 2005. There are no records of the Kemp's ridley turtle *Lepidohchelys* in Clew Bay, but there are records immediately south from 1982. Similarly, there are no records of the Loggerhead Turtle *Caretta caretta* from Clew Bay, but there are records further west near the entrance to the bay, one from 1990 and one from 2008. There are no records of the Hawksbill turtle in the study area. This species is not commonly observed in Irish waters.

4.3 Cetaceans

According to the Irish Whale and Dolphin group records, the only cetacean recorded in the area is the Harbour porpoise *Phocoena phocoena*. However, according to the National Biodiversity online records, there are also records of Atlantic white-sided Dolphin *Lagenorhhynchus acutus* from 1998, Bottlenose dolphin *Tursiops truncatus* from 2020, Common dolphin *Delphinus delphis* from 2017, Striped dolphin *Stenella coeruleoalba* from 2019 and the White-beaked dolphin *Lagenorhynchus albirostris* from 2010.

Regarding whale species, there are records of Cuvier's beaked whale *Ziphius cavirostris* from 2015 within Clew bay.

5. SCREENING FOR IMPACTS ON ANNEX IV SPECIES

5.1 Direct Impacts

The proposal for sustainable hand harvesting in Clew Bay has the potential to result in disturbance impacts that may affect the Annex IV species present in Clew Bay. It is noted that the sustainable hand harvesting will take place within the intertidal zone of Clew Bay and the islands. Due to this, it is considered that Otter are the most likely to be affected, out of the Annex IV species present in Clew Bay as identified above in section 4. Otters are known to use the entire area of Clew Bay according to records, and will use the many islands (over 90) for commuting and rely closely on the shoreline. Bailey and Rochford (2006) note that Clew Bay supports good numbers of the species. Lough Furnace and the Burrishoole catchment area are noted to have significant importance for Otter populations In Clew Bay (NPWS, 2011). The increase in human disturbance caused by the proposal may result in significant impacts, although it is noted that the number of hand harvesters is relatively small in the context of the large bay. Regarding other Annex IV species and direct disturbance, it is considered less likely that hand harvesters would interact with habitats used by turtles or cetaceans during the harvesting in the intertidal zone, but disturbance may arise while commuting between sites. For turtles, records are not frequent or found throughout the entire bay and thus are not expected to be present in large numbers or all year round. Therefore this is not considered to be a high risk. For cetaceans, similarly, the Harbour porpoise and the Bottlenose dolphin appear to be the most commonly encountered. Again disturbance is likely to arise during commuting between sites, but this is unlikely to be significant in the context of the bay and the low numbers of harvesters.

5.2 Indirect Impacts

Indirect impacts on the Annex IV species present in Clew Bay primarily concern impacts to food sources. As the hand harvesting takes place within the intertidal zone, this is the habitat where many fish species reside, which are the food source for Otter, as well as cetaceans and some turtle species. If impacts on fish species, or molluscs, occur as a result of the hand harvesting this could create a knock on effect on Otters, cetaceans and turtles. In general, hand harvesting at sustainable levels has been found to not alter the species composition of the intertidal community, or fish species using the intertidal habitat, as long as it follows the sustainable practises (Kelly *et al*., 2001). Therefore no significant impacts regarding food sources is expected to arise.

5.3 Cumulative Impacts

Cumulative impacts on Annex IV species in Clew Bay, similar to direct impacts, primarily concerns disturbance. Disturbance impacts may arise through the sustainable hand harvesting of *A. nodosum* within Clew Bay due to the increase in human activity, and transportation between harvesting sites, as well as interactions between habitat types within the bay. These activities can act in-combination with existing plans and proposals within Clew Bay and result in significant effects. In general the existing background pressures within Clew Bay have been identified with regard to marine activities including aquaculture, fishing, tourism and leisure interests, along with a number of other stakeholders. BioAtlantis' proposal is designed to avoid interactions with existing pressures such as aquaculture, fishing, tourism and leisure interests, as well as to avoid sensitive sites and coastal habitats.

Furthermore, harvesting quantities and locations will be planned and recorded and sites will be inspected pre and post harvesting.

There is the potential for interactions with existing harvesting of *A. nodosum* in Clew Bay. It is noted that harvesting of *A. nodosum* in Clew Bay has been relatively low with approximately 500-900 dry weight tonnes (dwt) per annum between 2005 and 2011 (Guiry & Morrison, 2013). Levels have dropped further to less than 400 dwt per annum between 2009 and 2011, while Kilkieran have approached almost 4,000 dwt per annum since 2008. Regardless of this, BioAtlantis aim to harvest in a manner that is sustainable, which does not exceed 20% of the total biomass at any one site. This will be logged in a database of each site and is also noted to exclude any sensitive sites. Undertaking harvesting in this manner will ensure that interactions with other harvesting activities is minimal and each site will be assessed prior to harvesting. Mitigation measures are likely to be required however to ensure that interactions are minimized and interactions with existing marine based recreational activities is kept as low as possible.

6. CONCLUSION

The current Article 12 (Habitats Directive) Assessment screening of proposed hand harvesting of *A. nodosum* has assessed the possibility of effects on species listed under Annex IV of the Habitats Directive. Otters are protected under Annex II and Annex IV of the EU Habitats Directive and are found throughout Clew Bay, using the shorelines of the many islands. Leatherback turtle have been recorded in Clew Bay in 2005. Harbour porpoise, Bottlenose dolphin and Common dolphin have been frequently recorded in the Clew Bay area. As the proposed hand harvesting activities will take place within Clew Bay, there is the potential for direct, indirect and cumulative disturbance impacts to arise. There are multiple other activities taking place in the bay, from aquaculture to fishing and water sports, and the proposed hand harvesting may act in-combination with these existing activities. In general, the risk of impacts is considered significant regarding Otter populations, due to their range and strong presence in the bay. No significant impacts are considered likely to arise in relation to cetaceans or turtles, as the interactions are considered to be minimal and not significant. Therefore, it has been determined that an Annex IV species Impact Assessment is required in relation to Otters.

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ADDENDUM 3 BIOATLANTIS LICENCE APPLICATION

BioAtlantis

Nature Working Naturally™

Licence Application for Sustainable hand-harvesting of *Ascophyllum nodosum* at Clew Bay (SAC Site Code 1482).

In accordance with National Parks & Wildlife Service conservation objectives for marine and coastal habitats and species and EU Habitats Directive 92/43/EEC.

Prepared by: BioAtlantis Ltd.
Date of submission: 20/01/2014
Date of revision: 05/09/2024

[redacted]

Executive Summary

Contents:

(a) Overview:

BioAtlantis applied for a license to sustainably hand harvest *A. nodosum* in Clew Bay in 2014 (ref: FS006269). The application was updated to reflect issues raised by various stakeholders during public consultation. The revised application ensures the following:

- Traditional seaweed harvesting rights are fully respected, in line with clarification provided by the Attorney General in 2018 – this includes both appurtenant and Profit-à-Prendre rights to harvest seaweed. It is envisaged that a clause may be inserted into the license issued to reflect this.
- Provision of a sustainable income along the western seaboard for local hand harvesters and associated parties, consistent with other sectors of the economy and prices paid by competing companies. This can be in the form of a contractor relationship or direct employee of BioAtlantis.
- Provision of careers in the seaweed harvesting and processing industry that are attractive to young people, offering reliable and attractive primary or stand-alone incomes, rather than secondary incomes only.
- Genuine competition between plant biostimulant companies on the market, ensuring maximum return for harvesters.
- Hand harvesting will be undertaken in a sustainable, regenerative and traceable manner, and in line with traditional hand harvesting methods currently employed in the area.
- Employment of science-based seaweed resource management practices.
- Inclusion of a sustainability Code of Practice and mitigation measures to prevent impacts on Annex I and II marine and coastal habitats and species in the SAC, in line with national and European environmental legislation. This includes measures to protect harbour seals, otters, birds, and sensitive community types and habitats such as shingle, reef, seagrass, large shallow inlets and bays, mudflat, sandflats and Atlantic salt meadows.

- Prevention of in combination and cumulative effects with other businesses and marine and coastal activities, including seaweed harvesting, aquaculture, fisheries, angling, periwinkle collection, tourism, recreation and sport.
- BioAtlantis will cooperate with indigenous Irish companies in Co. Mayo and the west who are engaged in seaweed harvesting, drying or processing, with the view to building partnerships which benefit the local economy and increase job creation in these areas.
- Full alignment with EU and Irish Government plans and policies, in relation to environmental sustainability and development of the Irish marine Blue Bioeconomy and Circular Bioeconomy.
- Value will be added to the resource in Ireland, maximizing economic returns to the State.
- The harvested seaweed will be utilized to develop and manufacture organically certified products and technologies, with significant environmental and societal benefits, as follows:
    - Mitigating the effects of climate change: BioAtlantis has pioneered the development of a 'Molecular Priming' technology, which mitigates the effects of climate change in agriculture. For example, applying a key product from BioAtlantis' portfolio, SuperFifty® Prime, to a crop 3 to 5 days in advance of an adverse weather event, ensures that the crop will be protected for up to 15 days post-application.
    - Reducing agrichemical inputs in crop production: BioAtlantis has developed products that strengthen crops making them more resilient to disease, thus the requirement for agrichemicals on farms can be minimized. The company is also working on the development of a biopesticide to help crop growers transition from some agrichemicals.
    - Nutraceuticals: BioAtlantis is developing food supplements to improve human health.

(b) Reasons why BioAtlantis requires a license:

BioAtlantis commissioned a new production facility in 2019 at its base in Tralee, Co. Kerry, costing €19M. This is the largest SME-owned, fully automated seaweed extraction facility in Britain or Ireland, including technologies for seaweed intake, extraction, separation, purification and spray drying. To ensure continued growth and job creation, the company must take steps to secure a sustainable source of its essential raw material, the seaweed *Ascophyllum nodosum*. From the commencement of operations in 2006, BioAtlantis depended on supply of seaweed from an external supplier, Arramara Teoranta, Kilkieran, Co. Galway. The necessity of having our own raw material supply became a key issue in 2023 when Arramara (owned by Acadian SeaPlants) terminated our supply, creating immense challenges for the company. Anticipating this issue, the company took steps to secure an alternative source of raw material and applied for a license to harvest *A. nodosum* in 2014 (FS006269). Applying for a license in Kerry was not a viable option, as the majority of *A. nodosum* in Ireland (>90%) grows in Natura 2000 sites (SACs, SPAs), located in three counties: Galway, Mayo and Donegal (37,470, 16,600 and 16,430 sustainable annual tonnes respectively; Hession *et al.*, 1998, https://oar.marine.ie/handle/10793/202). BioAtlantis chose Clew Bay, Co. Mayo, as it has sufficient, sustainable quantities of *A. nodosum* necessary to secure the continued growth of the company. Clew Bay also has a well-established history of commercial seaweed harvesting since at least the 1970s, with hand harvesting of *A. nodosum* representing an established human activity in this SAC.

(c) Respecting legal rights of traditional hand harvesters:

BioAtlantis wish to work in partnership with local hand harvesters to create a vibrant and sustainable industry, whilst also ensuring that existing seaweed harvesting rights are respected. On the 28th of June 2018, Minister Damien English clarified the legal position around seaweed harvesting and applications received under the Foreshore Act, as advised by the Attorney General. In line with this, this application ensures that traditional seaweed harvesting rights are fully respected and measures are included to ensure the license has no impacts on existing harvesting rights in Clew Bay. BioAtlantis will not harvest in any area where existing appurtenant rights exist, without first obtaining permission from the owner of such rights. Where Profit-à-Prendre rights are successfully registered with the Property Registration Authority of Ireland, the harvesting plan will be adjusted to ensure that those individuals can continue to harvest. It is envisaged that a clause may be included in the licence issued to allow the harvesting of *A. nodosum*, stating that if a Profit-à-Prendre rights holder provides sufficient proof to their right, the licensee would be prohibited from harvesting in that area, without first obtaining permission from the owner of such rights. As confirmed by the Government, existing seaweed rights holders can continue to exercise their right to harvest seaweed and do not require consent under the Foreshore Act. However, requirements for operating in SACs and relevant national and European environmental legislation must be respected.

BioAtlantis will explore the potential of purchasing a boat for the area to collect/tow the harvested *A. nodosum* to pick up points, whilst also providing the option for local hand harvesters (including those with existing harvesting rights) to tow their harvested seaweed directly to pick-up points, as is currently the common practice employed by harvesters in the bay. The price paid for the harvested seaweed will be consistent with other sectors of the economy and prices paid by competing companies.

(d) Compliance with EU and Irish laws in relation to Special Areas of Conservation (SACs):

At any time, the current commercial harvesting of seaweeds underway in SACs along Ireland's coast may be stopped, as it is likely to be considered illegal under EU and Irish laws. To comply with EU laws in relation to commercial harvesting activities in SACs the activity must be regulated and licensed. This license application will bring increased traceability to harvesting, helping to ensure compliance with Irish and EU regulations for human activities operating in SACs. Central to this is a sustainable hand harvesting methodology which ensures rapid recovery and re-growth post-harvest, monitored by a Resource Management team and a Marine Ecologist. In line with the EU Birds and Habitats Directives, this application includes measures to prevent impacts on Large Shallow Inlets and Bays [1160] and Annex I and II marine and coastal habitats and species in the SAC. The application is supported by the development of a sustainable hand harvesting Code of Practice, which includes a range of measures to prevent impacts from occurring. This application is also supported by the following environmental reports:

- Supporting Information for Screening for Appropriate Assessment (SISAA).
- Natura Impact Statement (NIS).
- Risk Assessment for Annex IV Species.

Granting a license to BioAtlantis will allow for improved management of sustainable harvesting, as it:

- Improves traceability.
- Ensures sustainable harvesting and post-harvest recovery.
- Ensure that activities are in line with conservation objectives for the SAC.
- Prevents in combination or cumulative effects with other marine and coastal activities.
- Complies with European and Irish laws in relation to commercial activities in SACs.

(e) Preventing interactions with other operators, plans and activities:
Measures are in place to prevent in combination or cumulative effects with existing business and marine and coastal activities, including other seaweed harvesting activities, aquaculture, fisheries activities, angling, periwinkle collection, tourism, recreation and sport. This includes both existing and planned developments and activities. Measures are also in place to prevent interactions with other activities during the transfer and pick-up of harvested seaweed. Site-specific measures are in place to prevent interactions with specific sites and locations during certain times of the year, and a code of practice for environmentally safe navigation and other health and safety measures are also included.

(f) Alignment of this application with Government plans and policies:
This application aligns with several Government plans and policies listed below. In order for these plans and policies to be realised, it is imperative that the Government prioritise the marine biotech sector and in particular, the regulation and licensing of seaweed harvesting:

- National Marine Planning Framework (NMPF) and Marine Spatial Planning policies: This proposal is consistent with the NMPF’s aims to support sustainable harvesting of seaweed given its important economic and social contribution. Harvesting will be undertaken on a renewable and sustainable basis, without any negative interactions with other marine-based activities.

- Climate Action plan, 2024: As hand harvesting of *A. nodosum* is a sustainable and renewable activity, the proposal aligns with the Government's climate action plan in relation to the Marine Environment. BioAtlantis' products also provide a means of enhancing crop yields (10% increase) without increased use of fertilizer and agrichemicals, thus aligning closely with the action plan.
- National Adaptation Framework Planning for a Climate Resilient Ireland, 2024: Drought is listed as a sectoral impact associated with climate change, due to impacts on crop growth and soil. BioAtlantis has developed a 'Molecular Priming technology' (based on bioactive compounds from *A. nodosum)* that enhances crop tolerance to drought stress. This technology has been validated by the Max Plank Institute and the University of Potsdam in Germany and by the Center of Plant Systems Biology and Biotechnology (CPSBB), Bulgaria, as part of a number of EU Horizon research projects (ref: Rasul *et al.,* 2021. *International journal of molecular sciences*, *22*(3), p.1469).
- Ireland's National Biodiversity Action Plan 2023–2030: The application aligns with targets specifying requirements for a licence to harvest seaweed. The application is compatible with biodiversity policies, as harvesting will be undertaken sustainably and with ecological monitoring. Studies also show that hand-harvesting of *A. nodosum* has no impact on overall biodiversity.
- Bioeconomy Action Plan 2023-25: This proposal aligns with Government actions to support the development of the bioeconomy and steps needed to deliver on these actions, including facilitating opportunities for new high added-value biobased products and ensuring that enterprise, industrial and research policy support the goal of moving from research to industrial production with accelerated speed.
- The European Green Deal, EU Farm to Fork strategy (EC, 2020), EU biodiversity strategy for 2030 and EU soil strategy for 2030: The products developed by BioAtlantis are organically certified, listed by the Organic Materials Review Institute (OMRI), attested by EcoCert and are EU REACH compliant. These products provide a means of increasing yields (10%) with normal fertilizer and agrochemical use. The next step is to achieve the same yields with less agrichemical inputs. The products are safe to the environment, pollinators and humans alike. BioAtlantis has also developed a technology to restore soil health and function (MicroGrow®), thus aligning with relevant EU policies in this area.

(g) Blue Bioeconomy development along the western seaboard:

Coastal and marine areas along the west of Ireland face many challenges including:

- Rural population declines,
- Lack of economic opportunities,
- Lack of job creation,
- Challenges facing the Agri-sector,
- Increasing pressures associated with climate change and other environmental challenges.

These pressures are felt by communities and stakeholders throughout the western seaboard, and are experienced by people in a range of counties throughout the northwest, west and south west. However, the development of a thriving Blue Bioeconomy along the western seaboard has the potential to address some of these issues. Development of a Blue Bioeconomy, based on innovation, science and export of high value-added products, will require stakeholders from various counties along the western seaboard to work together to overcome these shared challenges. The indigenous Irish seaweed and marine biotechnology sectors are well established along the west of Ireland and have a proven track record in job creation and in stimulating economic growth in rural and coastal areas. BioAtlantis has been a key driver of this success and wishes to contribute further to sustainable growth in the Blue Bioeconomy in the west of Ireland, by expanding further and building strong relationships with local hand harvesters and other stakeholders in County Mayo.

BioAtlantis, a founding member the European Biostimulants Industry Council (EBIC), strives to position Ireland's seaweed industry as a global leader at the cutting edge of research and innovation, benefiting coastal communities and society by delivering highly innovative and sustainable applications. A stable supply of this essential raw material is required in order to maximise the potential of the industry and to create new jobs in the Blue Bioeconomy in rural, coastal and marine areas. A license granted to BioAtlantis will provide greater structure and opportunities to grow the harvesting industry and the Blue Bioeconomy, as it will:

- Provide sustainable quantities of renewable raw materials required to bring new environmentally friendly technologies to market, in the areas of crop, animal and human health.
- Facilitate investment in Ireland's indigenous harvesting sector, providing a sustainable income along the western seaboard, creating opportunities in coastal and rural communities in the process.
- Ensure responsible management of the sustainability of the resource, fostering collaboration between private and government interests to prevent impacts.
- Allow harvesters to be contracted or directly employed by BioAtlantis if they wish.

(h) About BioAtlantis:

BioAtlantis, an Irish-owned SME, was established with the vision of utilizing bioactive compounds sustainably derived from nature to solve significant environmental, societal and health problems. To realise this vision, the company had to invest in developing a cutting-edge R&D and engineering base, a highly automated be-spoke manufacturing facility and a technical sales and agronomy team to compete on the world market. BioAtlantis has become a leading innovator in the Irish bioeconomy, delivering environmentally friendly and sustainable solutions to its customers in over 30 countries worldwide. The company employs over 50 people in Ireland in a range of areas, including: science, engineering, skilled trades, sales, marketing and finance, and is committed to continuing its development as a major employer in the west of Ireland. A further 14 people are employed overseas in agronomy and technical sales, with subsidiary offices located in Brazil, China, India, Mexico and USA.

BioAtlantis has grown rapidly since 2004 and has developed an extremely strong scientific base. In line with its strong reputation as an innovator in the European biotechnology sector, BioAtlantis is a partner in a range of EU Horizon research projects and collaborates with over 20 universities worldwide. The company also collaborates with a range of universities in Ireland, co-funding scholarships in education, internships and graduate programs, and co-funding MSc and PhD students and Post Doctoral Researchers. BioAtlantis is part of the following organizations and groups: European Biostimulants Industry Council (EBIC), Circular Bioeconomy Cluster in south-west Ireland, Marine Ireland Industry Network, Marine Spatial Planning, Climate KIC – DAFM programme, Tech Industry Alliance and Kerry Sci-Tech.

BioAtlantis has invested heavily in its business and the foundations are in place to build a world-leading Irish biotechnology company based in the west of Ireland. BioAtlantis is well known in the Plant Biostimulant industry and has built a strong reputation as a company which prioritizes honesty and integrity. BioAtlantis has also taken the necessary steps to secure the protection of its intellectual property, with several international patents granted in the areas of crop, animal and human health. In recognition of the company's success, BioAtlantis' CEO, John T. O'Sullivan, was nominated for the EY Entrepreneur of the Year Awards, 2022, in the international entrepreneur category.

Bioactive compounds from seaweeds such as *A. nodosum* and *Laminaria* Spp., are essential components of BioAtlantis' products and technologies, which provide substantial societal and environmental benefits, as follows:

- **Crops:** The AgriPrime product portfolio is a range of biostimulant technologies developed to aid growers in both organic and non-organic agriculture. These proven tools nourish crops from soil to harvest and help them cope with a variety of stresses and growth limiting factors, allowing crops achieve their genetic potential. Key technologies include:
    - **Oxidative stress reduction:** BioAtlantis has pioneered the development of a 'Molecular Priming' technology which mitigates the effects of climate change. The company's main product, SuperFifty® Prime, is a novel 'oxidative stress inhibitor' that works by modulating gene expression and inducing stress tolerance mechanisms in treated crops. SuperFifty Prime, works by 'priming' and preparing crops to tolerate and respond more efficiently to future 'abiotic' stresses, including adverse weather events associated with climate change, such as cold, drought, heat and water logging. Trials in Ireland and UK show that SuperFifty® Prime provides an extra 10% yield to potato growers, without the

requirement for additional agrichemical inputs. SuperFifty Prime has been validated by the Max Plank Institute and University of Potsdam in Germany and by CPSBB, Bulgaria, as part of a number of EU Horizon projects, culminating in the publication of several research papers in high-impact international scientific journals. The technology was launched and featured in Irish Times on October 26th, 2023: ***"Science and seaweed combine to protect crops from climate change"*** (https://www.irishtimes.com/business/innovation/2023/10/26/science-and-seaweed-combine-to-protect-crops-from-climate-change/).

- **Soil Health:** MicroGrow® improves the soil microbiome and microbial activity, fostering growth of beneficial microorganisms. The product targets early crop establishment, improving rooting and shoot formation and increasing yield.
- **Fruit finishing and shelf-life:** AtlantiCal® improve fruit-finish and post-harvest shelf-life, with application at the fruit-sizing stage.

- **Animals**: BioAtlantis has developed a technology that modulates the immune system and gastrointestinal microbiome in animals. This pioneering product (LactoShield®) improves maternal immunity transfer to piglets, reducing the requirement for antibiotics and zinc oxide in the first six weeks of the piglet's life. Administered in the form of a feed supplement, this product provides a sustainable, effective and economical means of preventing infectious diseases and enhancing gastrointestinal health and performance, aligning with the Irish Government's *'One Health National Action Plan on Antimicrobial Resistance 2021-2025'.* Lactoshield's efficacy has been validated by world-leading scientific experts in the School of Agriculture and Food Science, University College Dublin, Ireland. A case study can be read as follows: https://www.ucd.ie/t4cms/CASE_STUDY11_John%20ODoherty.pdf
- **Humans**: BioAtlantis is developing nutraceuticals targeting immunological, metabolic and stress-related conditions in humans. This technology is based on natural compounds that modulate biological processes, with efficacy proven in a range of cohorts. Our flagship nutraceutical is based on a unique composition that addresses immunological and metabolic problems.

(i) Conclusions:

To continue to bring societal and environmental solutions to market, BioAtlantis must grow and expand. The company's main barrier to growth is a lack of security over raw material supply. Issues with licensing and a lack of security over raw material supply have also been identified in the *"Ireland's Ocean Economy"* report, 2022, as major barriers to the growth of the seaweed, marine biotechnology and bio-products industry. BioAtlantis requires the Government to take the necessary steps to regulate seaweed harvesting to ensure that it benefits all relevant stakeholders, including seaweed harvesters and indigenous Irish companies. Regulation and licensing is also necessary in order for the Government to meet its targets and goals in relation to environmental sustainability, climate mitigation and development of the blue bioeconomy. Granting a license to BioAtlantis will allow for improved management of sustainable harvesting, in line with EU and Irish environmental laws, whilst also helping to drive the development of the blue bioeconomy along the western seaboard of Ireland. A partnership approach with local hand harvesters in Clew Bay will be central to this, and as the technologies the company brings to the market are novel, BioAtlantis will be able to pay harvesters a competitive price for harvested seaweed.

The vision of BioAtlantis in 2004 was to research, produce and market products that enhance crop, animal and human health. The technologies are proven and can be produced at scale to fulfil market requirements for natural and safe products, equally as effective as synthetic chemicals. The only significant barrier to market entry is a sustainable supply of seaweed harvested in Ireland. This can be resolved by following the regulatory process and issuing a license for the sustainable harvesting of seaweed, as outlined in this application. BioAtlantis welcomes all comments regarding this proposal, and invites interested members of the public to contact the company directly if they wish to discuss any aspects of the proposal further.

Summary of Revisions (2020 - 2024)

This document has been updated following a public consultation period which took place between December 2014 and January, 2015 and to reflect further changes made between 2020 and 2024. The document was revised to account for:

- Appurtenant seaweed harvesting rights.
- Profit-à-Prendre seaweed harvesting rights.
- Additional planned and existing activities.
- Additional measures to prevent impacts on Annex I and II marine and coastal habitats and species.
- Additional measures to prevent in combination and cumulative effects.
- An assessment of *A. nodosum* and *Fucus vesiculosis* biomass levels by UCD.
- Other general and editorial changes.

A summary of the above changes and others are outlined as follows:

No	Document	Change/modification
1	**NIS**	• This Natura Impact Statement has been revised to account for changes to the application documents.
2	**Main text document**	• **Appurtenant rights to harvest or gather seaweed:** BioAtlantis has assessed the extent of appurtenant rights in relation to seaweed harvesting/gathering and have examined folios that have seaweed rights registered as a burden. These sites were identified and BioAtlantis will not engage in any harvesting activities in these areas, without first obtaining permission from the person to which those rights belong. This ensures that there is no overlap with any existing harvesting rights in Clew Bay. • **Profit-à-Prendre rights:** Where Profit-à-Prendre rights to harvest seaweed are successfully registered with the PRAI, the harvesting plan will be adjusted to ensure that those individuals can continue to harvest *A. nodosum.* It is envisaged that a clause may be inserted into the licence issued to allow the harvesting of *A. nodosum*, stating that if a Profit-à-Prendre right holder provides sufficient proof to their right, the licensee would be prohibited from harvesting in that area, without first obtaining permission from the owner of such rights. • **Maximum annual harvest of *A. nodosum*:** The maximum annual harvest was adjusted following an assessment of *A. nodosum* resources in Clew Bay by University College Dublin (UCD). Further adjustments were also made following the exclusion of areas with existing appurtenant rights to gather or remove seaweed and folios with burdens that relate to seaweed. The revised estimated annual harvest of *A. nodosum* in Clew Bay is 11,018 T. • **Other changes:** The main text document was updated where appropriate to reflect the changes outlined in the other appendix documents listed below.
3	**Appendix 1: Assessment of Resources**	This document is unchanged from the initial application. An additional survey was undertaken by UCD to verify the levels of *A. nodosum* in Clew Bay. This is provided as a separate report.
4	**Appendix 2: Maps**	The maps have been reviewed and updated. While sites containing appurtenant rights to harvest *A. nodosum* are not marked on these particular maps, such sites with appurtenant rights were identified and submitted in a separate report to the Department. BioAtlantis will not engage in any harvesting activities in these areas without first obtaining permission from the person to whom those rights belong.
5	**Appendix 3: Compliance & record forms**	This document was updated to include the limit of <5% for Fucus by-catch, amendment of the Goods Received Note (GRN) and creation of the Site Inspection Form (SIF), along with a number of other changes.
6	**Appendix 4: Code of practice**	This document was updated to include additional mitigation measures, particularly in relation to:

No	Document	Change/modification
		• Section 1.3: ➢ Existing appurtenant rights or burdens in relation to the harvesting. ➢ Avoiding congestion at pick up points. • Section 2.3: Otter *(Lutra lutra).* • Section 4: Working in the vicinity of tourism and recreation facilities. • Section 5: Working in the vicinity of aquaculture sites. • Section 6: Working in the vicinity of anglers and fisheries activities. • Section 7: Other harvesting activities. • Section 8: Preventing the spread of invasive species.
7	**Appendix 5: Risk Assessment**	This document was updated to include additional potential risks & in-combination effects.
8	**Appendix 6: Assessment of bird species**	This document was updated to include a wider range of bird species.
9	**Appendix 7: In-combination effects:**	This document was updated to account for activities and developments where in-combination effects may have the potential to impact on annex I and II species and habitats: • **Exiting activities:** ➢ Areas where there are existing rights to harvest, gather or remove seaweed, including areas where existing burdens or appurtenant rights exist. ➢ Existing aquaculture sites. • **New planned activities and developments in Clew Bay since 2014.** ➢ Planned floating pontoon just north of Roman Island and other developments. ➢ New aquaculture applications and fisheries activities. • **Other activities:** Information in relation to other activities was updated and expanded (e.g. planning, tourism, sport, recreation, fisheries, harvesting of edible seaweeds and invertebrates). A range of mitigations measures were put in place where necessary to prevent in combination effects between *A. nodosum* harvesting and the above activities and developments. The Code of Practice in Appendix 4 has been updated accordingly.
10	**Appendix 8**	This document was updated to include the limit of <5% for Fucus by-catch, amendment of the Goods Received Note (GRN) and creation of the Site Inspection Form (SIF), along with a number of other changes.
11	**New Document: Appendix 9: Assessment of fisheries species.**	An assessment was undertaken to examine the life-cycle requirements of commercial fisheries species, including fish, crustaceans and shellfish.
12	**New Document: Appendix 10: NMPF**	An assessment was undertaken to examine how the application secures and is consistent with the objectives of the National Marine Planning Framework (NMPF).
11	**New document: Biomass survey of Clew Bay**	A survey was undertaken by UCD to assess the levels of *A. nodosum* biomass in Clew Bay.
12	**New document: Assessment of appurtenant rights**	An assessment was undertaken to identify the nature and extent of existing seaweed harvesting rights in Clew Bay. Harvesting will not take place in areas where appurtenant rights to harvest seaweed exist.
15	**New Document:** Annex IV species	Supporting documentation for Risk Assessment for Annex IV Species (Article 12 Risk Assessment)
16	**New Document:** SISAA Report	Supporting Information for Screening on Appropriate Assessment (SISAA Report). This contains information required to carry out a Screening for an Appropriate Assessment.

Summary of changes (2014).

This application was originally submitted to the Dept. of the Environment Heritage and Local Government (DOEHLG) on 20/01/2014. The application was revised and re-submitted on 31/10/2014 following request from the Department and the National Parks and Wildlife Service (NPWS) for additional information (30/07/2014). BioAtlantis Ltd. has assessed the issues raised by NPWS in relation to cited deficiencies in the submitted Natural Impact Statement (NIS) and the additional information requested. The application was updated accordingly. The main points raised by NPWS are outlined in the table below. The locations in the revised NIS and main application documents where these points have been addressed are also provided.

No	NPWS points raised in letter on 30/07/14	Location in the revised document where points have been addressed	
		NIS	Application document
1	**Continuous disturbance must not exceed an approx. area of 15%.**	See foreword & associated sections.	• Section 3.4 of main document. Also: – Appendix 4 (revised)
2	**Holistic examination of the nature, extent & impact of harvesting**	See foreword & associated sections.	Main document: • Section 1.3.2 • Section 1.3.3 a(i), a(ii) • Also discussed in Section 3.5.2
	The spatial extent of harvesting techniques and activities:		
	(a) Management of expansive and prolonged operations		
	(b) Numbers of personnel and exploitation levels		
	The potential interaction effects of seaweed harvesting	See foreword and associated sections.	• Section 3.5.3 (a, b, c, d, e, f, g) of main document. • Appendix 4 (Code of Practice) has been updated accordingly.
	(a) Targeted removal of species		
	(b) Non-targeted removal of species		
	(c) Disturbance and displacement of species & habitats		
	(d) Changes in community structure		
	(e) Changes in hydrodynamics and water quality		
	(f) Potential disturbance of marine fauna		
	(g) Potential Interactions with coastal habitats		
3	**Cumulative and in Combination effects**	See foreword & associated sections. Also see: Appendix 7 of application.	• Section 3.6 of main document. Also: – Appendix 4 (revised) – Appendix 7 (new)
	Existing Operations		
	Planned Operations		
	Potential of harvest activities to spread invasive species		
No	**Clarification provided by NPWS during recent consultations between 26/08/14 and 30/10/14.**		
i	Importance of demonstrating that continuous disturbance of each community type does not exceed an approx. area of 15%.	As for No.1 above	As for No.1 above
ii	The importance of addressing the potential for cumulative effect on community types to ensure that interactions do not lead to effects exceeding the 15% figure.	As for No.3 above	As for No.3 above
iii	The importance of demonstrating how the Code of Practice will be secured and monitored.	• Section 3.1.1. Also: – Appendix 4 – Appendix 8 of application	• Section 1.3.3 (b & c) of main document. Also: – Appendix 4 (revised) – Appendix 8 (new)

Contents

Appendices

Other:

The following environmental reports are included with this application, as separate attachments:

- Supporting Information for Screening for Appropriate Assessment (SISAA).
- Natura Impact Statement (NIS).
- Risk Assessment for Annex IV Species.

Abbreviations:

AA	Appropriate Assessment
A. nodosum	*Ascophyllum nodosum*
ASM	Atlantic salt meadows
ANOVA	Analysis of variance
B	Biological hazard
C	Chemical hazard
Cert.	Certificate
cSAC	Candidate Special Area of Conservation
Dir.	Directive
DOEHLG	Dept. of the Environment Heritage and Local Government
E	East
e.g.	Example
FP7	EU's Seventh Framework Programme
GMP+	Good Manufacturing Practices
GRN	Goods Received Note
HWM	High water mark
IFI	Inland Fisheries Ireland
IRF	Incident Report Form
Isd	Island
I-WeBS	The Irish Wetland Bird Survey
kg	Kilograms
m^2	Meters squared
Mm	Millimetres
MSO	Marine Survey Office
N	North
NCR	Non-Conformance Report Form
No.	Number
NIS	Natura Impact Statement
NPWS	National Parks & Wildlife Service
OSM	Ordinance Survey Map
P	Physical hazard
pers. comm.	Personal communications
pg.	Page
Pt.	Point
QC	Quality Control
R&D	Research and Development
Rd	Road
Ref	Reference
S	South
SAC	Special Area of Conservation
SIF	Site Inspection Form
SISAA	Supporting Information for Screening for Appropriate Assessment
SOPS	Standard Operating Procedures
Sp.	Species
SPA	Special Protection Areas
T	Tonnes
W	West
~	Approximately
º	Degrees Latitude or Longitude

Section 1: Description of Plan/Project, and local site or plan area characteristics

1.1 Background

1.1.1 Purpose of the Plan

The Irish seaweed industry represents a rapidly growing exporting sector. Factors influencing the success of this industry include innovation, R&D and collaboration between academia and business. However, the growth of the industry is largely dependent on having control over the supply of high-quality raw materials. BioAtlantis Ltd. aims to sustainably develop the seaweed industry in the Clew Bay region of Co. Mayo, a county with the second largest reserves of *A. nodosum* in Ireland. The harvesting system is based on good environmental practices and management principals and is designed to prevent any significant effects on marine biodiversity in Clew Bay SAC. BioAtlantis has a long-term commitment to these goals.

A. nodosum is a large, intertidal brown seaweed which grows in abundance on sheltered and rocky shores. While sexual reproduction maintains *A. nodosum* genetic diversity, vegetative reproduction maintains population size by generating shoot growth and biomass. Frond growth continues for years while the holdfast can reproduce vegetatively for decades. To maintain population size it is essential to incorporate data on vegetative growth and regeneration rates into harvesting strategies. This proposal draws on studies such as Kelly *et al.*, (2001) which assessed the impact of hand harvesting on *A. nodosum* regeneration and biodiversity. BioAtlantis will implement a sustainable method requiring that no less than 200mm (8 inches) of material is left behind post-harvest. The method has minimal effects on *A. nodosum* and species within the biotope, allowing for shorter recovery periods post-harvest. Harvest will not exceed 20% of the available harvestable *A. nodosum* per site per annum, thus ensuring sustainability of harvesting year-on-year, and minimizing any potential impacts on this important SAC.

Ireland has the potential to sustainably yield >74,000 tonnes (T) of *A. nodosum* per annum, the majority found in Galway, Mayo and Donegal (Hession, *et al.*, 1998). It is estimated that 37,470, 16,600 and 16,430 potential wet tonnes/annum may be sustainably harvested from each respective county. However, the annualized potential yield has been under-harvested and the true potential of *A. nodosum* as a renewable resource in Ireland has not been realized. Provided that harvesting programmes allow for sufficient regeneration periods, hand-harvesting has an almost negligible impact on levels of cover and biodiversity. The regenerative ability and productivity of Irish *A. nodosum* beds post-hand harvest is well established. Baardseth (1949, 1955) determined that sustainable harvesting was possible once adequate levels of material is left behind (reviewed by Guiry & Morrison, 2013). Kelly et al., (2001) determined that sites at Clew Bay and Connemara demonstrated almost complete recovery of *A. nodosum* cover, 11 and 17 months post-hand harvest respectively. Provision of a 4-5 year window for recovery post-harvest remains the current consensus. In light of such studies, the cautious 3-5 year fallowing time-frame preferred by decision makers would appear quite sufficient to ensure recovery of *A. nodosum* in areas harvested. A scientific review of sustainability aspects to harvesting *A. nodosum* and its use as a renewable raw material resource has recently been published by Sujeeth *et al.* (2022). BioAtlantis will incorporate known rates of *A. nodosum* recovery in Clew Bay into a broader system of harvesting, based primarily with sustainability in mind. Central to this approach will be a harvesting methodology which is minimally invasive and ensures rapid recovery and re-growth of *A. nodosum* post-harvest.

1.1.2 Reasons for applying for a licence in Clew Bay

The reasons for applying for a license in Clew Bay are outlined in Section B of the Executive summary (see pages 3 and 4 of this document).

1.1.3 Status & Local Investment: Stand-alone plan Vs. larger program of development

Building a seaweed industry in Co. Mayo will have significant impacts on the local economy. At present, the only facility for drying and distribution of seaweed is located in Kilkieran in Galway some 80km from Clew Bay. Subject to obtaining a licence to harvest in Clew Bay, BioAtlantis will provide contracting opportunities for up to 20 local full-time harvesters in Clew Bay to service both the existing and future production requirements. This will include 16 full time or 32 part-time hand harvesters from the region (see Table 1). The harvesters will ideally be people who have previous experience or whose families have farms or fishing interests in the area. BioAtlantis will work with the harvesters to apply sustainable methods of harvesting, collection and conservation of the resource, paying close attention to the requirements as described by the NPWS (NPWS, 2011A and NPWS, 2011B). In addition, a Resource Manager will be directly employed or contracted to manage activities in the area. Three people with responsibility for transporting harvested seaweed will also be contracted. A Marine Ecologist will be directly employed or contracted for the purposes of measuring *A. nodosum* recovery and conducting ecological surveys. The employment of over 50 people currently working at BioAtlantis will also be secured. The licence will also allow for the expansion of the operation in the BioAtlantis factory and increased employment. The local investment will have immediate effects in terms of securing and creating employment. Given the sustainable design of the hand harvesting system, the investment in Clew Bay will have long term stability.

Year	BioAtlantis Total Requirement	No. of full-time hand harvesters
	Wet tonnes	
2024	7,000*	6
2025	9,000*	16
2026	11,018	16

Table 1: Projected harvesting of *A. nodosum* in the Clew Bay area.

* Over the first few years of harvesting in Clew Bay, the total harvest available may be lower as some areas that have been harvested in the recent past may require a recovery period.

1.2 Investigation / Development Phase

1.2.1 Size of the area to be directly impacted in this phase.

The most comprehensive study of *A. nodosum* resources in Clew Bay to date was published by Hession C, *et al.,* (1998). To verify the quantities of *A. nodosum* available in Clew Bay further, a number of sites in the complex were visited and studied by BioAtlantis' staff during the developmental phase (September, 2013). A detailed report describing the results and methods employed is attached as Appendix 1. The scope of the study area assessed included the following sites, either via direct measurements on the ground or by means of visual inspection from boat:

- Inishdaff
- Inishcottle
- Inishlyre
- Collan More
- Collan Beg
- Inishgort
- Inishbee
- Derrnish / Derrnish West
- Inishgowla
- Calf Island
- Inishlaughil
- Inishcuill
- Inishcoragh
- Illannambraher
- Illanmaw
- Inishfeis
- Rockfleet Bay / Raigh Pier

1.2.2 Operations/activities associated with the investigation/development phase.

There are five main components to the investigation/development phase:

1) Biomass Determination & Risk Assessment.
2) Development of Management & Implementation systems.
3) Development of monitoring systems.
4) Consultations.
5) Natura Impact Statement (NIS).

1. Biomass Determination & Risk Assessment:

Biomass levels were determined as follows:

- Desk study: The total available biomass in the area was calculated through use of the published reports of Hession C, *et al.*, (1998), Kelly L. *et al.,* 2001, combined with aerial photographs and satellite images.
- Direct measures in Clew Bay, as described in Appendix I.

Risk assessments of Clew Bay SAC were carried out by BioAtlantis Ltd. in order to develop the sustainable harvesting system, prior to seeking outside consultation. This is described in detail in Section 2 and 3 of this document. This was followed by a Natura Impact Statement (NIS) to inform Appropriate Assessment, carried out by Ecofact Environmental Consultants Ltd. Following consultations with NPWS between 26/08/14 and 30/10/14, further risk assessments were carried out by BioAtlantis Ltd. This was followed up with a revised NIS in 2014. The NIS was revised further in between 2020 and 2024 and is attached to this application as a stand-alone document. The objectives and methodology employed by BioAtlantis in conducting the risk assessments, are summarized as follows:

a) Literature review & data gathering.

- Objective: to assess peer-reviewed literature and datasets relating to:
  - *A. nodosum* biomass levels in Irish and other coasts of the North Atlantic.
  - Regional variability in *A. nodosum* biomass levels in Ireland.
  - Hand harvesting and its potential impact on *A. nodosum* regeneration and associated species within this biotope.
  - Communities and biological environments protected as part of the SAC (marine and coastal zones).
- Methods:
  - Mapping: Assessments of the admiralty chart, Ordinance Survey Discovery series map (OSM), NPWS Ariel photography and NPWS site synopsis.
  - Literature review: Study of environmental impact assessments and surveys of the area.

b) Electronic Mapping:

Electronic maps were created using the latest OSM of the region. These were inserted into Auto-Cad and the details of the harvest areas overlaid. Any additional information on the protected biological and environmental areas are identified on these maps. The length of the coastline of each island and the harvestable coastline of the mainland was measured from the maps. Satellite images, tidal information and aerial photographs were then used to estimate the coverage of each site. This data was then used to calculate the total biomass available from each site.

c) <u>Continuous disturbance of each community type</u>:

Continuous disturbance of each community type in Clew Bay should not exceed an approximate area of 15%. In order to assess adherence to these limits, BioAtlantis requested marine community type datasets for Clew Bay. The shapefile was provided by courtesy of NPWS and engineering personnel at BioAtlantis calculated (a) the total area (m^2) in Clew Bay SAC of each Annex I Habitat and (b) the area affected by harvest activities/annum

(m^2 and percentage). The results are presented in Section 3.4 and demonstrate adherence to these limits. The percentage of the reef and shingle which are Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160], that will be impacted each year was also calculated.

d) Visits to the site:

A study was undertaken on the 26/09/2013 with the aims of assessing the level of *A. nodosum* resources and associated biodiversity in Clew Bay SAC. The study was primarily qualitative in design and a preliminary test of the methods and procedures employed in order to evaluate important aspects such as feasibility, time, costs, and the underlying statistical variability involved. The pilot study was also deemed necessary to establish appropriate sample sizes and to determine ways in which to improve the experimental design, prior to up-scaling analysis during the operational phase. The report can be found in Appendix 1. A key finding from this study is that there is a level of *A. nodosum* harvest activities currently ongoing within the complex. Moreover, the techniques employed are quite variable in terms of extent and severity. A number of positive correlations between *A. nodosum* biomass and important canopy species were observed. This study provided an important source of data in which to develop the BioAtlantis Plan for hand harvesting in this area. A brief excerpt of the report is provided below with the document provided in full in Appendix 1.

Title: Assessment of *A. nodosum* resources & associated biodiversity in Clew Bay.

Abstract: The aim of this survey was to assess the levels of *A. nodosum* biomass within the Clew Bay complex and associated biodiversity within this biotope. In brief, measures were taken at eight sites within Clew Bay, including islands in the northern (Illannambraher, Inishcuil, Inishdaff), central (Inishcottle, Derrinish, Collan More) and southern (Inishlyre) regions of the complex, the entire survey taking place on the 26/09/2013 and analysis continuing over the following week. *A. nodosum* density was found to vary considerably between different sites, ranging from 1.34kg/m^2 in Inishcottle to 11.46kg/m^2 in Illannambraher. Evidence for recent hand harvest activities were found at several sites within the complex. Two harvest techniques appear to be employed which both involve the cutting of *A. nodosum* close to the holdfast and removal of (a) approximately 25% of plant or (b) >90% of the entire plant, the former representing the least invasive approach. *A. nodosum* density levels were lower than expected in a number of areas, including Collanmore. A trend towards reduced *A. nodosum* yield in areas of increased *Fucus sp*. cover was observed throughout the study, however this was not statistically significant (p-value = 0.106). Assessment of biodiversity demonstrates positive correlations between the quantity of *A. nodosum* and the numbers of winkles and limpets beneath the *A. nodosum* canopy per m^2 (p-values = 0.046* and 0.084$^{\#}$ respectively). In contrast, negative correlations between percentage *Fucus sp.* cover and winkle and limpet numbers were observed, however, these associations were not statistically significant (p-values = 0.058$^{\#}$ and 0.197 respectively). In conclusion, this study confirms the presence of substantial resources of *A. nodosum* in the Clew Bay complex, and points to a level of variability likely attributable to harvest activities which are currently ongoing in the area. In order to ensure maintenance of the complex relationships between *A. nodosum* and understory species, hand harvest activities must be performed in a manner which does not lead to extensive damage to the biotope.

e) **Risk assessment, control measures, monitoring & corrective actions:**
The following approach was taken by BioAtlantis staff in order to assess the potential risks associated with harvesting of *A. nodosum* in Clew Bay SAC (see Section 2 & 3 of for detailed description):

- Assessment of the extent of conservation requirements for species and habitats of qualifying interest.
- Identification of potential hazards (biological, chemical and physical).
- Risk of hazard occurring (probability 'X' severity), on a scale 1 – 25.
- Control measures to prevent hazards from occurring:
    - Exclusion of sites from harvest plan during sensitive times of the year (e.g. seal breeding, moulting and resting; bird wintering and breeding).
    - Mitigation measures:
        - High risk hazards which require mitigation (i.e. risk ≥15) and therefore, a Natura Impact Statement (NIS).
        - Low-moderate risk hazards (i.e. risk <15) requiring control measures, potentially mitigation and a NIS.
    - Determination of means in which to minimize impact on protected environs within the harvest areas, where applicable.
- Action limit/non-conformance: determine levels at which control measures are deemed to be breached or close to being in breach.
- Analytical procedure: determine methods used to determine whether or not action limits have been exceeded.
- Duties: personnel assigned with responsibility for assessing conformance with control measures and limits.
- Monitoring schedule: determine frequency at which conformance with control points and action limits are assessed.
- Corrective actions: determine means in which to counteract non-conformances or ensure that problems are not repeated.
- Verification: determine means of assessing the validity of control measures and associated analytical procedures and schedules in order to ensure that potential hazards are prevented from occurring.
- Natura Impact Statement (NIS): Assess whether or not an NIS is required in the event of not being able to rule out the risk of hazards affecting Annex I or Annex II species and habitats.

f) **Survey undertaken by University College Dublin.**
An additional survey was undertaken by University College Dublin to assess the levels of *A. nodosum* and *Fucus vesiculosis* in Clew Bay in 2016. The corresponding report is provided along with this current document.

2. Development of Management & Implementation systems.
Management:

- Defining the resource management team – See Figure 1 below:

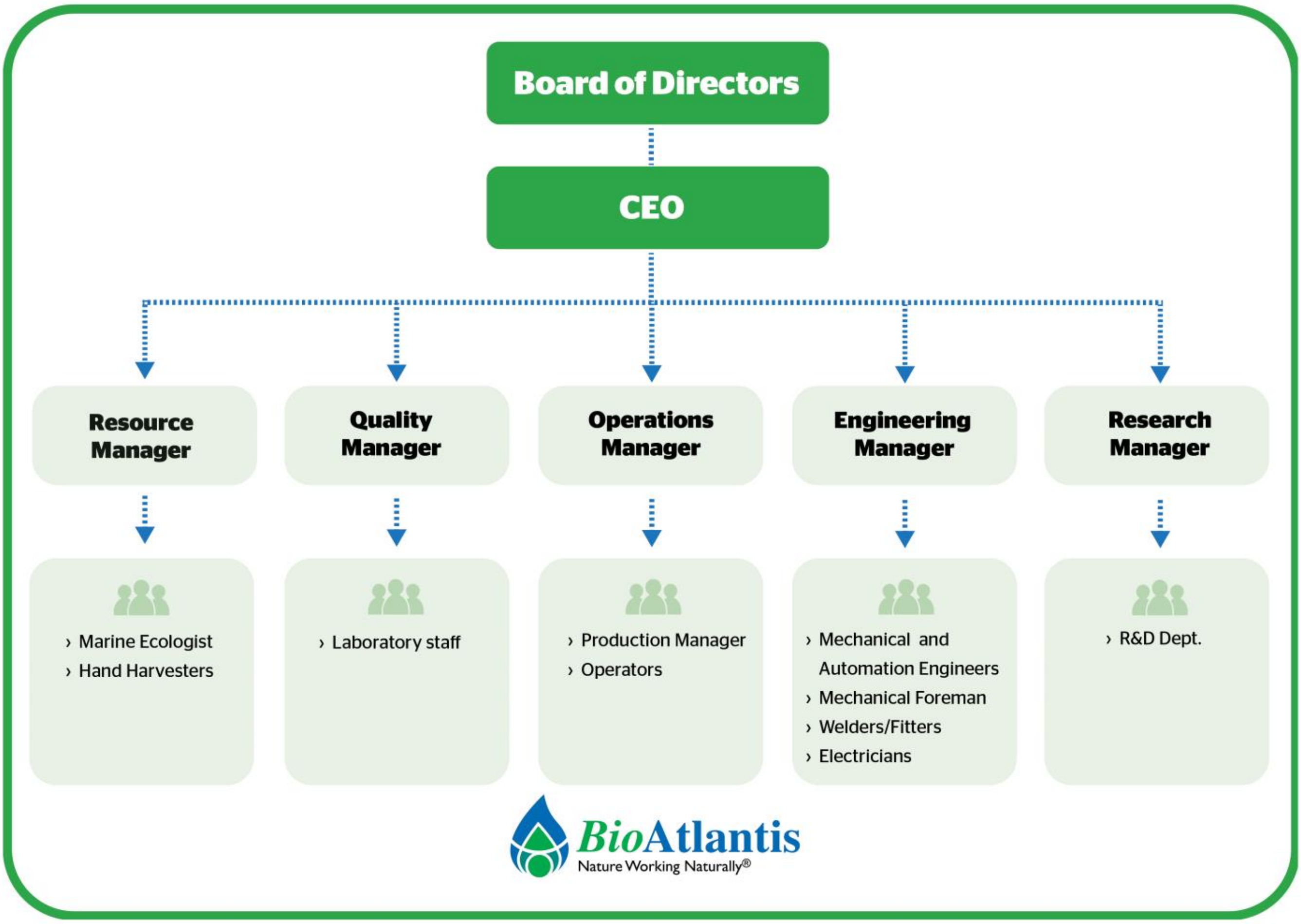

Figure 1 : Resource Management Team

Implementation Systems:

- Compliance and Record Forms (see Appendix 3): The following forms have been developed to ensure that systems are in place to assess harvest activities and report incidents and non-conformances on an ongoing basis:
  - Goods Received Note (GRN) form.
  - Site Inspection Form (SIF).
  - Non-Conformance Report (NCR) form (G012).
  - Incident Report (IRF), form (G008).
  - Information in the above may alternatively be provided in other suitable formats by electronic or other means on site and/or at production facilities.
- Code of Practice: Mitigation measures were developed by BioAtlantis (Appendix 4) to ensure that significant direct, indirect, in combination and cumulative effects on qualifying interests of Clew Bay SAC do not occur. These measures are considered effective by Ecofact Environmental Consultants Ltd (see NIS attached).
- Quarterly and annual audits: As part of the Code of Practice, regular audits will be required to monitor quality standards (see Appendix 8 for Clew Bay audit template).
- Standard Operating Procedures (SOPs) will be put in place to ensure that the harvest activities are carried out in a clearly defined manner which does not impact on the protected communities and species within the SAC region. Where necessary, these procedures will be implemented along with regular training, assessment and supervision by members of the Resource Management Team at BioAtlantis Ltd.

3. **Development of monitoring systems.**
   - Quantifying *A. nodosum*: Methods of quantifying the resource are required to ensure that harvesting takes place in a sustainable and controlled manner. During the developmental stage, a number of methods were under review, under optimisation or being trialled. One such trial was carried out on the 26/09/2013 and involved the development of visual and direct on-site measurement approaches, along with inspection of site quality (Appendix 1).
   - Fallowing and harvesting requirements: Measurements of *A. nodosum* biomass and/or site recovery will be incorporated into a functioning database which includes measures of biomass in calculations aimed at determining future fallowing and harvest requirements, on a site-by-site basis. See Tables 3 & 5 for details.

4. **Consultations:**

   From initial visits to Clew Bay, BioAtlantis has detected a considerable appetite and a level of enthusiasm for seaweed harvesting, primarily from a commercial and sustainable viewpoint. The region has a history of hand harvesting of *A. nodosum* and other seaweeds. The BioAtlantis plan will work to integrate in accordance with the needs and wishes of the Clew Bay region and provide important opportunities for those wishing to work in the area. To achieve these goals, BioAtlantis will engage with key groups including local hand harvesters, landowners, Mayo County Council and a number of local business interests in the area. Consultations such as these represent a key component of the BioAtlantis plan to develop the industry in Clew Bay. In this process, BioAtlantis will explain our objectives in an open, clear and approachable manner. In doing so, BioAtlantis hope to gain public, governmental and business approval for a management plan which we believe will provide a substantial economic benefit to the area, whilst also guaranteeing that the objectives for this SAC are met. Consultations have taken place with hand harvesters in Clew Bay in which BioAtlantis explained the plan and took on board all concerns and suggestions by the hand harvesters as to how the system could work for them. Consultations undertaken during the developmental phase are outlined below.

Meeting #1: Dept. of the Environment Heritage and Local Government (DOEHLG): Pre-application meeting (Wexford; 19_06_2013).

- In Attendance: representatives from DOEHLG and from BioAtlantis (Dr. Kieran Guinan, Research Manager, Mr. John T. O'Sullivan, CEO).
- Recommendations: advice on mechanism in which to construct and proceed with application.

Meeting #2: NPWS, Pre-application meeting (04/07/2013; Dublin)

- In Attendance: representatives from NPWS and from BioAtlantis (Dr. Kieran Guinan, Research Manager & Mr. John T. O'Sullivan, CEO).
- Recommendations: Develop application document further and sent document to NPWS for scoping comments, paying close attention to requirements for harbour seals.

Meeting #3: NPWS, Scoping Meeting (13/11/2013; Galway).

- In Attendance: representatives from NPWS, BioAtlantis (Dr. Kieran Guinan, Research Manager, Mr. Brian Fanning, Engineering Manager & Mr. John T. O'Sullivan, CEO) and Ecofact Environmental Consultants Ltd.
- Recommendations: Further amendments to be made to the application, including the incorporation of breeding and wintering bird data and re-structuring in order to ensure compliance with Natura format.

Inland Fisheries Ireland

A letter has been sent to Inland Fisheries Ireland (29/11/2013) outlining the plan. Acknowledgment of receipt was received on 05/12/2013. Official response and views of IFI received on 20/12/2013 (letters attached to this application).

Meeting #4: (08/07/2014; Houses of the Oireachtas)

BioAtlantis provided a submission document outlining our views to the committee on "Licensing and Harvesting of Seaweed in Ireland". BioAtlantis also prepared a powerpoint presentation to explain our plan to hand harvest in Clew Bay.

Meeting #5: Meeting with hand harvesters (28/07/2014; Newport)

In Attendance: Clew Bay hand harvesters and BioAtlantis (Dr. Kieran Guinan, Research Manager, Mr. Brian Fanning, Engineering Manager and Mr. John T. O'Sullivan, CEO).

NPWS: Consultations between 26/08/14 and 30/10/14

Consultations via email took place between NPWS and BioAtlantis between 26/08/14 and 30/10/14. This provided clarity on obligations for ensuring that key measures of conservation status are adhered to. Risk assessments were updated and the NIS and other application documents were revised accordingly.

5. **Natura Impact Statement:**
   The initial risk assessment carried out by BioAtlantis (described in Section 2 & 3) formed an important component in the development of the management plan. However, as a number of moderate risks were identified by BioAtlantis, it was deemed necessary to liaise with independent consultants, Ecofact Environmental Consultants Ltd., in order to assess whether or not a Natura Impact Statement (NIS) was required. The NIS was updated and enclosed as a separate stand-alone document with the application in 2014. The NIS was revised further between 2020 and 2024.

1.2.3 Locations & months in which operations/activities will take place.

Table 2 summarizes operations/activities undertaken during developmental phase, May 2013-Dec 2013. It also includes operations and activities taking place following initial submission of the application in January 2014. Updates have been made to include additional work undertaken between 2014 to 2021:

No.	Operation/activity	Details			
1.	**Biomass Determination & Risk Assessment**	**Date**	**Location**	**Status**	**Ref.**
(a)	Literature review & data gathering.	May –Aug. 2013 Updates between 2019 and 2024.	BioAtlantis Ltd.	Complete	n/a
(b)	Electronic Mapping:	May –Aug. 2013 Updates between 2019 and 2024.	BioAtlantis Ltd.	Complete	Appendix 2
(c)	Visits to the site	26/09/2013. Further site visits by UCD in 2016.	Clew Bay	Complete	Appendix 1
(d)	Risk assessment, control measures, monitoring & corrective actions	May-Dec. 2013. Updates between 2019 and 2024.	BioAtlantis Ltd.	Complete	Section 3 & Appendix 5, 6 & 7
(e)	Updates to the above as required by DOEHLG and based on NPWS comments	July-Oct 2014	BioAtlantis Ltd.	Complete	Current document, NIS & associated appendices
(f)	Assessment of *A. nodosum* biomass in Clew Bay by UCD	2016	Clew Bay	Complete	Stand-alone document
2.	**Development of Management & Implementation systems**	**Date**	**Location**	**Status**	**Ref.**
(a)	Defining the management team.	Oct 2013	BioAtlantis Ltd.	Ongoing	Figure 1
(b)	Compliance & Record Forms (GRN, NCR, SIF, IRF)	March, 2021. Updates between 2019 and 2024.	BioAtlantis Ltd.	Complete	Appendix 3
(c)	Code of Practice for protecting Clew Bay	May-Dec 2013. Updates between 2019 and 2024.	BioAtlantis Ltd.	Complete	Appendix 4
(e)	Standard Operating Procedures (SOPs).	Dec 2014	BioAtlantis Ltd.	Incomplete	---
(f)	Updates to the above as required by DOEHLG and based on NPWS comments	July-Oct 2014. Updates between 2019 and 2024.	BioAtlantis Ltd.	Complete	Current document, NIS & associated appendices
3.	**Development of monitoring systems**	**Date**	**Location**	**Status**	**Ref.**
(a)	General Systems	May-Oct. Updates between 2019 and 2024.	BioAtlantis Ltd. & Clew Bay	Complete	Section 1 & 3 & Appendix 4
(b)	Quantifying *A. nodosum*	May-Oct. Further assessment by UCD in 2016.	BioAtlantis Ltd.	Complete	Appendix 1
(c)	Fallowing and harvesting requirements	May-Oct 2014	BioAtlantis Ltd.	Complete	Section 1.3.2, Tables 4 & 5
(d)	Updates to the above as required by DOEHLG and based on NPWS comments	July-Oct 2014	BioAtlantis Ltd.	Complete	Current document, NIS & associated appendices

(e)	Monitoring the Code of Practice: Quarterly and annual auditing system	Oct 2014	BioAtlantis Ltd.	Complete	Current document, NIS & associated appendices
4.	**Consultations:**	**Date**	**Location**	**Status**	**Ref.**
(a)	Department of the Environment, Heritage and Local Government	19_06_2013	Wexford	Pre-application meeting	n/a
(b)	National Parks & Wildlife Service (NPWS)	04_07_2013	Dublin	Pre-application meeting	n/a
(c)	National Parks & Wildlife Service (NPWS)	13_11_2013	Galway	Scoping Meeting	n/a
(d)	National Parks & Wildlife Service (NPWS)	20th Nov – 3rd Dec, 2013	Via email	Datasets obtained & analysed	Appendix 6
(e)	BirdWatch Ireland	15 – 27th Nov 2013; June, 2020	Correspondence via email	Datasets obtained & analysed	Appendix 6
(f)	Inland Fisheries Ireland (IFI)	29/11/2013	Letter sent via email	Response received 20/12/2013	Letters enclosed with application
(g)	Ecofact Environmental Consultants Ltd.	Oct 2013 –Jan 2014. Updates between 2020 and 2024.	BioAtlantis & Clew Bay	NIS completed (09/01/2014). Revision in Oct 2014, 2020/21 and 2023/24	NIS attached to application
(h)	Houses of the Oireachtas: "Licensing and Harvesting of Seaweed in Ireland".	08/07/2014	Dublin	BioAtlantis Plan for Clew Bay explained to Committee	www.oireachtas.ie
(i)	Harvesters	28/07/2014	Newport	Explained plan to harvesters	n/a
(j)	DOEHLG DHLGH	30/07/2014. Further correspondence during updating of application, up to 2023.	Via email	Additional information requested	Application and NIS updated accordingly (Oct 2014)
(k)	National Parks & Wildlife Service (NPWS)	26/08/2014 - 30/10/2014	Via email	Recommendations taken on board. Application and NIS revised accordingly	Current document & associated appendices (Oct 2014)
(l)	Landowners	Dec 2024/25*	Not completed		
(m)	Mayo County Council & other parties	Dec 2024/25*			
5	**Seaweed harvesting rights**	**Date**	**Location**	**Status**	**Ref.**
(a)	• Assessment of existing burdens and appurtenant rights to harvest and gather seaweed in Clew Bay. • Further review of legal aspects in relation to seaweed harvesting.	2014-2021 2021-2024	BioAtlantis Ltd	Complete	n/a

Table 2 : Summary of operations/activities undertaken during developmental phase (May 2013-2024).

*Subject to the issuing of a hand harvesting license.

1.3 *Operational Phase*

1.3.1 Area to be directly impacted: Overview

BioAtlantis' *A. nodosum* harvesting plan has been designed based on sustainability. Based on our own assessment and findings from Hession, *et al.,* (1998), we propose to harvest *A. nodosum* from a region that extends from Rosmurrevagh point on north Clew Bay to White Strand in the south, including the islands within the Bay. This is identified in Appendix 2, Maps.

The study by Hession C, *et al.*, (1998) concluded that Co. Mayo has the potential to sustainable yield 16,600 wet tonnes of *A. nodosum* per annum, out of a maximum total of 66,400 tonnes per annum, the majority of which located in Clew Bay. Through use of data obtained from the studies of Guinan KJ *et al.,* (2013, Appendix 1), Hession C, *et al.,* (1998) and maps and aerial photographs of the region, we have calculated the current maximum yield *A. nodosum* from the Clew Bay to be of the order 65,060 wet tonnes. This equates to an annual sustainable harvest of wet 13,012 tonnes. Table 3 lists the sites that will be harvested and the estimated available biomass in each case. NOTE: The maximum annual harvest in this application was adjusted to account for the findings from a biomass survey undertaken by University College Dublin. The maximum annual harvest was also reduced to account for the identification of sites with existing appurtenant rights in relation to seaweed harvesting.

To manage the harvest activities, BioAtlantis will hire or contract an experienced person who has a captain's licence, preferably an environmental science degree, a marine ecology background and/or with previous experience in the fishing industry. This person will fulfil the role of Resource Manager and will be responsible for the management of the harvesting area and in ensuring the sustainability of hand harvesting activities. The Resource Manager will report directly to the CEO and work as part of the Resource Management Team. The person tasked with assessing recovery post-harvesting will have a marine ecology background.

Clew Bay has in excess of 90 islands and 100Km of coastline that contain harvestable quantities of *A. nodosum*. For the effective management of this area, BioAtlantis will create a database of the islands and coastal areas. This database will be used to:

(a) Determine sites which require a fallowing period to allow for adequate recovery from recent activities.
(b) Determine rotation requirements (i.e. extrapolation and calculation of the duration or fallowing period required prior to a particular area being fit for re-harvest).
(c) Prevent harvest activities that would lead to a decline in yield.
(d) Record the details of each harvest, how much, by whom & when.

Moreover, this database will represent a central, working component of the BioAtlantis Code of Practice (Appendix 4) for harvesting *A. nodosum* which requires:

(a) Development of pre-harvest plans in advance of harvest activities.
(b) A cap of 20% on the level of biomass which can be harvested from a given site per annum.
(c) *A. nodosum* cannot be cut below 200mm in height. At least 200-300mm (8-12 inches) material must be left behind.

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (Kg / m²)	Coverage§	Harvest levels (Tonnes)†		Area in use / Per Year‡	
						Available Seaweed	Maximum Annual Harvest	Reef (m²)	Shingle (m²)
	Bartraw - Westport	CZ 1.1	61074	0	46%	0.0 T	0.0 T	0	0
		CZ 1.2	83288	0.7	100%	58.3 T	11.7 T	16658	0
		CZ 1.3	57560	0.7	98%	39.4 T	7.9 T	11260	252
		CZ 1.4	46890	0.7	100%	32.8 T	6.6 T	9378	0
		CZ 1.5	59466	0.7	70%	29.3 T	5.9 T	8365	3528
		CZ 1.6	32360	1.25	100%	40.4 T	8.1 T	6472	0
		CZ 1.7	47684	0.7	100%	33.4 T	6.7 T	9537	0
		CZ 1.8	77259	0	54%	0.0 T	0.0 T	0	0
		CZ 1.9	7961	0.7	100%	5.6 T	1.1 T	1592	0
		CZ 1.10	5559	1.25	100%	6.9 T	1.4 T	1112	0
		CZ 1.11	11271	1.25	100%	14.1 T	2.8 T	2254	0
		CZ 1.12	4254	1.25	100%	5.3 T	1.1 T	851	0
		CZ 1.13	136927	10.5	94%	1354.0 T	270.8 T	25790	1596
		CZ 1.14	76090	10.5	94%	751.9 T	150.4 T	14322	896
		CZ 1.15	37232	0.5	100%	18.6 T	3.7 T	7446	0
		CZ 1.16	35400	0.5	100%	17.7 T	3.5 T	7080	0
		CZ 1.17	35419	0.5	100%	17.7 T	3.5 T	7084	0
		CZ 1.18	6633	0.5	100%	3.3 T	0.7 T	1327	0
	Westport - Rosmoney	CZ 2.1	38658	0	82%	0.0 T	0.0 T	0	0
		CZ 2.2	5199	0	100%	0.0 T	0.0 T	0	0
		CZ 2.3	8889	0	100%	0.0 T	0.0 T	0	0
		CZ 2.4	35324	0	94%	0.0 T	0.0 T	0	0
		CZ 2.5	74945	0.55	98%	40.4 T	8.1 T	14693	296
		CZ 2.6	30076	0.8	100%	24.1 T	4.8 T	6015	0
		CZ 2.7	7831	0	57%	0.0 T	0.0 T	0	0
		CZ 2.8	6710	0	100%	0.0 T	0.0 T	0	0
		CZ 2.9	125537	0.8	100%	100.4 T	20.1 T	25107	0
		CZ 2.10	109815	0.8	97%	85.0 T	17.0 T	21259	704
		CZ 2.11	9303	0	100%	0.0 T	0.0 T	0	0
		CZ 2.12	27612	0	91%	0.0 T	0.0 T	0	0
		CZ 2.13	328	0	100%	0.0 T	0.0 T	0	0
		CZ 2.14	22527	0	100%	0.0 T	0.0 T	0	0
		CZ 2.15	3842	0	94%	0.0 T	0.0 T	0	0
		CZ 2.16	6082	0	100%	0.0 T	0.0 T	0	0
		CZ 2.17	3636	0	0%	0.0 T	0.0 T	0	0
	Rosmoney - Moyna Strand	CZ 3.1	18865	0	50%	0.0 T	0.0 T	0	0
		CZ 3.2	40641	4.35	100%	176.8 T	35.4 T	8128	0
		CZ 3.3	97095	4.35	100%	422.4 T	84.5 T	19419	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m²)	Typical Density (Kg / m²)	Coverage§	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Island No.	Area in use / Per Year‡ Name / Area
		CZ 3.4	12914	4.35	100%	56.2 T	11.2 T	2583	0
		CZ 3.5	9650	4.35	100%	42.0 T	8.4 T	1930	0
		CZ 3.6	78317	4.35	95%	323.9 T	64.8 T	14891	772
		CZ 3.7	117114	4.35	100%	509.4 T	101.9 T	23423	0
		CZ 3.8	8398	4.35	100%	36.5 T	7.3 T	1680	0
	Rostoohy Pt - Newport	CZ 4.1	84464	4.35	92%	339.0 T	67.8 T	15587	1305
		CZ 4.2	27181	4.35	100%	118.2 T	23.6 T	5436	0
		CZ 4.3	150517	4.35	100%	654.8 T	131.0 T	30103	0
		CZ 4.4	38351	4.35	99%	164.9 T	33.0 T	7580	90
		CZ 4.5	26354	0	96%	0.0 T	0.0 T	0	0
		CZ 4.6	6397	0	83%	0.0 T	0.0 T	0	0
		CZ 4.7	5572	0	100%	0.0 T	0.0 T	0	0
		CZ 4.8	6703	0	100%	0.0 T	0.0 T	0	0
		CZ 4.9	9671	0	100%	0.0 T	0.0 T	0	0
		CZ 4.10	24594	0	64%	0.0 T	0.0 T	0	0
		CZ 4.11	117165	0.85	81%	80.2 T	16.0 T	18866	4567
		CZ 4.12	77555	0.85	100%	65.9 T	13.2 T	15511	0
		CZ 4.13	278265	0.85	79%	187.7 T	37.5 T	44163	11490
		CZ 4.14	110969	0.85	100%	94.3 T	18.9 T	22194	0
	Newport - Mallaranny Pier	CZ 5.1	61157	0	100%	0.0 T	0.0 T	0	0
		CZ 5.2	58948	3.5	79%	163.3 T	32.7 T	9334	2455
		CZ 5.3	105121	3.5	84%	310.9 T	62.2 T	17763	3261
		CZ 5.4	258002	3.5	92%	833.8 T	166.8 T	47644	3956
		CZ 5.5	82278	3.5	83%	240.2 T	48.0 T	13728	2728
		CZ 5.6	41272	3.5	100%	144.5 T	28.9 T	8254	0
		CZ 5.7	145329	3.5	89%	454.2 T	90.8 T	25955	3110
		CZ 5.8	84126	3.5	100%	294.4 T	58.9 T	16825	0
		CZ 5.9	8260	3.5	100%	28.9 T	5.8 T	1652	0
		CZ 5.10	17114	3.5	100%	59.9 T	12.0 T	3423	0
		CZ 5.11	4451	3.5	100%	15.6 T	3.1 T	890	0
		CZ 5.12	1689	3.5	100%	5.9 T	1.2 T	338	0
		CZ 5.13	29666	3.5	100%	103.8 T	20.8 T	5933	0
		CZ 5.14	3900	1.75	100%	6.8 T	1.4 T	780	0
		CZ 5.15	30450	1.75	100%	53.3 T	10.7 T	6090	0
		CZ 5.16	11735	1.75	100%	20.5 T	4.1 T	2347	0
		CZ 5.17	47890	1.75	79%	65.8 T	13.2 T	7524	2054
1	Forillan, Illanavrick	IS 1.1	40653	6	100%	243.9 T	48.8 T	8131	0
1		IS 1.2	13763	10	100%	137.6 T	27.5 T	2753	0
2	Kid Isd East		3966	14	100%	55.5 T	11.1 T	793	0
3	Roslynagh		7990	0	0%	0.0 T	0.0 T	0	0

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (Kg / m^2)	Coverage[§]	Harvest levels (Tonne)†		Area in use / Per Year‡	
						Available Seaweed	Maximum Annual Harvest	Island No	Name / Area
4	Illannambraher		57901	19	96%	1053.2 T	210.6 T	11086	494
5	Inishdasky		14818	18	100%	266.7 T	53.3 T	2964	0
6	Inishquirk		25206	15	82%	308.9 T	61.8 T	4119	922
7	Inishtubrid		45540	18	100%	819.7 T	163.9 T	9108	0
8	Inishlim		13308	16	100%	212.9 T	42.6 T	2662	0
9									
9	Beetle Isd North		41752	18	100%	75.1 T	15.0 T	8350	0
9	Inishbobunnan								
10									
10	Inishgowla		566589	16	27%	246.1 T	49.2 T	30775	82543
10	Beetle Isd South								
11	InishKeel	IS 11.1	16036	12.5	100%	200.5 T	40.1 T	3207	0
11		IS 11.2	2083	16.75	100%	34.9 T	7.0 T	417	0
11		IS 11.3	300	17.5	100%	5.3 T	1.1 T	60	0
11		IS 11.4	5876	17.5	100%	102.8 T	20.6 T	1175	0
12	Black Rock		24348	2.5	100%	60.9 T	12.2 T	4870	0
13	Moynish More		0	0	0%	0.0 T	0.0 T	0	0
14	Moynish Beg		0	0	0%	0.0 T	0.0 T	0	0
15	Inisherkin		53097	18	41%	387.7 T	77.5 T	4308	6312
16	Inishnacross		46888	18.5	61%	525.0 T	105.0 T	5675	3702
17	Inishilra		36300	18	78%	507.0 T	101.4 T	5633	1627
18	Inishcooa		70929	12	57%	486.2 T	97.2 T	8104	6082
19	Roeillaun		77113	5	100%	385.6 T	77.1 T	15423	0
20	Inishdeashbeag								
20			62555	0	100%	0.0 T	0.0 T	0	0
20	Inishdeashmore								
21	Inishcorky		17912	18.75	100%	335.8 T	67.2 T	3582	0
22	Inishcarrick		34846	19	60%	397.3 T	79.5 T	4182	2787
23	Inishcoragh		24041	15	100%	360.6 T	72.1 T	4808	0
24	Muckinish		33800	19.25	100%	650.6 T	130.1 T	6760	0
25	Inishdaweel		22175	20	77%	342.8 T	68.6 T	3428	1007
26	Rabbit Isd		52391	8	58%	242.1 T	48.4 T	6053	4425
26									
27	Illanascrraw		10411	18	100%	187.4 T	37.5 T	2082	0
28	Freaghillanluggagh		23358	20	100%	467.2 T	93.4 T	4672	0
29	Inishkee		16398	19	100%	311.6 T	62.3 T	3280	0
30			15889	18	100%	286.0 T	57.2 T	3178	0
31	Freaghillan West		20456	19	50%	194.8 T	39.0 T	2050	2041
32	Innishcannon		8656	16	100%	138.5 T	27.7 T	1731	0
33	Carricklahan		0	0	0%	0.0 T	0.0 T	0	0
34	Carrickachorra		0	0	0%	0.0 T	0.0 T	0	0

35	Illanmaw		74045	0	66%	0.0 T	0.0 T	0	0
			Total Harvestable Area	Typical Density		Harvest levels (Tonne)†		Area in use / Per Year‡	
Island No.	Name / Area	Harvesting Zone ID*	(m²)	(Kg / m²)	Coverage§	Available Seaweed	Maximum Annual Harvest	Island No.	Name / Area
36	Freaghillan East		6422	18	100%	115.6 T	23.1 T	1284	0
37			1476	16	100%	23.6 T	4.7 T	295	0
38	Inishcuill West		82042	20.75	79%	1348.2 T	269.6 T	12995	3413
39	Mauherillan		14262	16.75	91%	217.5 T	43.5 T	2598	255
40	Inishfesh		54236	18	70%	685.8 T	137.2 T	7620	3228
41	Inishmolt		23618	18	100%	425.1 T	85.0 T	4724	0
42	Inishloy		36182	18.5	100%	669.4 T	133.9 T	7236	0
43	Inishdaff		70875	20.5	100%	1452.9 T	290.6 T	14175	0
44	Inishbollog		13201	20.75	100%	273.9 T	54.8 T	2640	0
45	Inishlaughil		55888	0	100%	0.0 T	0.0 T	0	0
46	Inishgowla		67983	16	22%	243.7 T	48.7 T	3046	10550
47	Inishoo		23072	0	13%	0.0 T	0.0 T	0	0
48	InishTurk	IS 48.1	56134	21	100%	1178.8 T	235.8 T	11227	0
48		IS 48.2	10755	21	100%	225.9 T	45.2 T	2151	0
49	Illannaconney		17437	15	77%	201.6 T	40.3 T	2688	800
50	Inishakillew	IS 50.1	69800	21.75	100%	1518.1 T	303.6 T	13960	0
50		IS 50.2	18583	21.75	100%	404.2 T	80.8 T	3717	0
51	Trawbaun		256815	19.5	89%	4468.7 T	893.7 T	45833	5530
51	Carrigeenglass North								
51	Moneybeg								
51	Inishcottle								
52	Calf Island		30778	19.75	81%	490.3 T	98.1 T	4965	1190
53	Inishbee, Derrinish & Dernish West		200836	17.5	58%	2021.6 T	404.3 T	23104	17063
54	Freaghillan	IS 54.1	27454	19.75	66%	357.1 T	71.4 T	3616	1875
54		IS 54.2	55101	20	90%	989.7 T	197.9 T	9897	1123
54		IS 54.3	5995	21	100%	125.9 T	25.2 T	1199	0
55	Clynish		102154	18.5	77%	1463.2 T	292.6 T	15818	4612
56	llaunnamona		25370	16	95%	384.3 T	76.9 T	4804	270
57	Rabbit Island, Island More &Quinnsheen Island	IS 57.1	14757	19.5	100%	287.8 T	57.6 T	2951	0
57		IS 57.2	92903	16	88%	1307.4 T	261.5 T	16342	2239
57		IS 57.3	7894	17.5	100%	138.1 T	27.6 T	1579	0
57		IS 57.4	9330	18	100%	167.9 T	33.6 T	1866	0
58	Collan More, Carrigeenglass South & Collan Beg	IS 58.1	501217	16.75	100%	8395.4 T	1679.1 T	100243	0
58		IS 58.2	55220	18.75	100%	1035.4 T	207.1 T	11044	0
58		IS 58.3	29858	19.5	100%	582.2 T	116.4 T	5972	0

59	Inishgort		64954	15.5	57%	571.7 T	114.3 T	7376	5614

Island No.	Name / Area	Harvesting Zone ID*	Total Harvestable Area (m^2)	Typical Density (Kg / m^2)	Coverage§	Harvest levels (Tonne)† Available Seaweed	Harvest levels (Tonne)† Maximum Annual Harvest	Area in use / Per Year‡ Island No.	Area in use / Per Year‡ Name / Area
60	Inishlyre		121285	5	57%	347.3 T	69.5 T	13891	10366
61	Illanataggart & Crovinish		442259	14	99%	6133.0 T	1226.6 T	87614	838
62	Ininhgowla South + Carrickwee		183389	15	100%	2750.8 T	550.2 T	36678	0
63	Forilan		30569	9.75	100%	298.0 T	59.6 T	6114	0
64	Carrickawart	IS 64.1	26696	16	100%	427.1 T	85.4 T	5339	0
64		IS 64.2	1276	14.25	100%	18.2 T	3.6 T	255	0
65	Inishlaghan		32314	14.5	83%	388.4 T	77.7 T	5358	1105
66	Dorinish More & Dornish Beag		27107	12.5	100%	338.8 T	67.8 T	2980	2441
67	Inishimmel		0	0	0%	0.0 T	0.0 T	0	0
68	Inishleauge		54366	8	77%	334.3 T	66.9 T	8358	2515
69	Inishdaugh		22949	6.5	72%	108.0 T	21.6 T	3322	1268
70	Inishraher		81224	14.7	85%	1014.1 T	202.8 T	13798	2447
71	Inisheeney		53625	16	85%	725.4 T	145.1 T	9068	1657
72	Finnaun Island		0	0	0%	0.0 T	0.0 T	0	0
73	Corillan	IS 73.1	6787	6.5	100%	44.1 T	8.8 T	1357	0
73		IS 73.2	1016	6.5	100%	6.6 T	1.3 T	203	0
73		IS 73.3	1737	6.5	100%	11.3 T	2.3 T	347	0
73		IS 73.4	3001	6.5	100%	19.5 T	3.9 T	600	0
74	Carricknamore	IS 74.1	2436	6.75	100%	16.4 T	3.3 T	487	0
74		IS 74.2	1393	6.75	100%	9.4 T	1.9 T	279	0
74		IS 74.3	2640	6.75	100%	17.8 T	3.6 T	528	0
75		IS 75.1	0	6.75	100%	43.8 T	0.0 T	0	0
75		IS 75.2	0	6.75	100%	7.5 T	0.0 T	0	0
75		IS 75.3	0	6.75	100%	36.9 T	0.0 T	0	0
75	Stony Island	IS 75.4	0	0	100%	0.0 T	0.0 T	0	0
75		IS 75.5	0	5	100%	29.1 T	0.0 T	0	0
75		IS 75.6	0	6.5	100%	69.2 T	0.0 T	0	0
75		IS 75.7	0	6.5	100%	10.7 T	0.0 T	0	0
75		IS 75.8	0	6.5	100%	61.7 T	0.0 T	0	0
76	Green Islands	IS 76.1	0	0	100%	0.0 T	0.0 T	0	0
76		IS 76.2	0	0	100%	0.0 T	0.0 T	0	0
76		IS 76.3	0	0	100%	0.0 T	0.0 T	0	0
77	Carricknacally		2860	6.5	100%	18.6 T	3.7 T	572	0
78	Monkellys Rock		4425	8.75	100%	38.7 T	7.7 T	885	0
79	Inishweela		24604	10	97%	238.7 T	47.7 T	4775	146
80	Illanroe		28522	14	100%	399.3 T	79.9 T	5704	0
81	Roeillan		16126	15	100%	241.9 T	48.4 T	3225	0
						Estimated total	**12,900 T**		
						Revised Estimated total#	**11,018 T**		

Table 3 Areas & quantities to be harvested

* Harvesting Zone ID's were assigned by BioAtlantis as part of establishing the management system.

† Maximum Annual Harvest (Tonnes) is calculated as 20% of the total available biomass per site. The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site, per annum.

‡ Area in use per year was calculated using shapefile data obtained courtesy of NPWS.

§ Denotes the percentage of coastline which can support *A. nodosum* growth.

[#] The maximum annual harvest was adjusted following an assessment of *A. nodosum* resources in Clew Bay by UCD. This figure was adjusted further following the exclusion of areas with existing appurtenant rights to gather or remove seaweed and folios with burdens that relate to seaweed.

1.3.2 The spatial extent of harvesting: limiting disturbance levels to <15%.

NPWS recommend that continuous disturbance of each community type should not exceed an approximate area of 15%. Using marine community type dataset shapefiles obtained from NPWS, BioAtlantis has calculated (a) the total area (m2) in Clew Bay SAC of each Annex I Habitat and (b) the area affected by harvest activities/annum. The only areas to be affected are reef and shingle. As summarised in Table 4 below, these levels fall below the 15% limit. For further details on this analysis, see Section 3.4. The marine community types in the Clew Bay SAC that will be affected by hand harvesting activities are reef and shingle. The total area of shingle and reef affected annually by hand harvest activities is shown to be 12.7% and 4.9% respectively. It is considered therefore, that continuous disturbance of each of the community types does not exceed 15%, thereby complying with the requirements of the EU Commission. The BioAtlantis 'Code of Practice' for *A. nodosum* harvest activities in Clew Bay SAC has been developed to ensure that management work within these 15% limits (see Appendix 4). The percentage of the reef and shingle which are Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160], that will be impacted each year is also very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,188.5 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. In addition, BioAtlantis has assessed the potential for interactions with other existing and planned activities, to mitigate against interactions with potential to significantly increase disturbance beyond the 15% limit (Appendix 7). A detailed description of the results of this assessment and mitigation of risks, is provided in Section 3.6. A summary outlining the extent of different in-combination and cumulative effects on marine community types, Annex I and II species and habitats, are also provided in Tables 14 and 15.

Marine community type	Total Area in the Clew Bay SAC	Maximum Annual area affected by hand harvest activities (m^2)		Area of Large Shallow Inlets and Bays [1160] affected/annum
	(m^2)	(m^2)	%	%
Reef	26,870,000	1,331,699	4.96%	1.31%
Shingle	1,855,000	235,549	12.7%	0.23%

Table 4 Marine community types affected by hand harvesting in Clew Bay

1.3.3 Different types of operations/activities

There are four main types of activities associated with the operational phase, as follows:
a) Operation/Activity No. 1: Management and Implementation.
b) Operation/Activity No. 2: Monitoring, recording and reporting.
c) Operation/Activity No. 3: Verification & Analysis.
d) Operation/Activity No. 4: Long term assessment of biomass and community structure

These operations/activities are described in detail throughout this section.

(a) Operation/Activity No. 1: Management and Implementation

The sustainable harvest system consists of several key management and implementation components. These include activities relating to:
(i). Managing expansive and prolonged operations.
(ii). Managing personnel and exploitation levels.
(iii). Planning and scheduling of harvesting activities.
(iv). Data recording and analysis.
(v). Navigation to and from harvest sites.
(vi). Communication.
(vii). Hand-harvest methodology, guidelines and Codes of Practice.
(viii). Health and safety measures
(ix). Preventing spread of invasive species

The details of how BioAtlantis proposes to manage these activities are as follows:

(i). Managing expansive and prolonged operations

BioAtlantis will employ a site-specific management approach to the Clew Bay SAC, throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited. Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally-appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of a boat ensures ease of access by the Resource Manager to the sites. The Resource Manager will manage operations throughout the complex. This brings full traceability to the process, as the quality of harvest from each location is monitored and biomass is weighed on collection and recorded on a Goods Received Note (GRN), with sites also inspected post-harvest to ensure the sustainability of the methods employed (Site Inspection Form, SIF; Appendix 3). Harvesting at low tide and pick-up or towing of nets/bags at high tide avoids potential for coastal damage that could be caused by bringing in large quantities of seaweed ashore at inappropriate locations.

(ii). Managing personnel and exploitation levels

Approximately 16 full time people, or 32 part-time, will work for an average of 230 days/year, harvesting approximately 3.5 tonnes per day (rate of ~10.4Kg/M^2). The area harvested will be 26,923m^2 (2.69 Ha) per day per 16 harvesters. This reflects a harvest rate of 20% of *A. nodosum* biomass per site per annum. This corresponds to an area occupied of 1,683m^2 per person/day or 0.4 acres per person per day, for approximately 6-8 hours per day. Small-medium sized islands will require approximately 2-4 harvesters. Medium to large islands may require between 4-6, while larger islands will likely require approximately 6-10 harvesters. Thus, the low number of people over a wide area reduces the potential for anthropogenic impacts (e.g. intensity of trampling) on the biotope. In fact, given that the BioAtlantis plan targets specific areas at specific times of the year, the low levels of trampling events will also be largely episodic in nature. It is unlikely therefore, that any significant change in the structure of *A. nodosum* assemblages will occur. Furthermore, as BioAtlantis will implement a policy against holdfast removal, the incidence of *A. nodosum* mortality will be reduced considerably (see 'Code of Practice', Appendix 4). As such, the harvest level of 20% will represent a relatively constant figure and will not be exacerbated due to significant levels of *A. nodosum* mortality due to partial or complete holdfast removal.

(iii).Planning & scheduling of harvesting activities

During a recent survey of the region, evidence for a significant level of harvesting of *A. nodosum* within the SAC region of Clew Bay was observed (see Appendix 1 for associated report). To manage activities along extensive coastline of Clew Bay, BioAtlantis will create a database of all islands and coastal areas in the region. This will contain information as to the length of coastline, density of *A. nodosum* and coverage percentage, along with details of each harvest. In the initial stages, it is necessary to establish details of when each area was last harvested. This will be done by working closely with the existing local harvesters and through analysis of derived data, we can establish the dates and quantities of the most recent harvests for each island & coastal zone. This data can then be used to decide when a region will be next available for harvest.

Once the data from the most recent harvest has been established, this will be entered in the database as shown in Table 5, in the highlighted columns. The maximum harvest available from each island or coastal zone has been established from surveys and previous studies. The nominal recovery time is generally accepted to be 3-5 years from a complete harvest. BioAtlantis propose a maximum harvest of 20% of the total available *A. nodosum* biomass per site per annum to ensure sustainability. The figure of 20% refers to the percentage of the total available *A. nodosum* biomass harvested per site per annum. As *A. nodosum* biomass can potentially recover within 11 to 17 months (Kelly et al., 2002), it may be possible therefore to harvest year on year in certain locations; however this is subject to recovery being achieved. As outlined in this application, measures will be implemented to ensure that harvesting does not take place if a site has not recovered from the previous year.

Adaptive Management: BioAtlantis will implement an Adaptive Management Approach. This will ensure continual improvements to the harvesting plan during its implementation and ensuring its effectiveness into the future. For example, BioAtlantis will also work to include local knowledge as to best practice when approaching sites.

Number	Island Name	Total Seaweed on Island (Tonnes)	Maximum Annual Harvest per Island (Tonnes)	Date of Last Harvest (Sample dates used)	Quantity of Previous Harvest		Predicted Fallow Period (Years)	Date of Next Harvest
					Weight (Estimated for Table)	Percentage of Available Biomass		
31	Freaghillan West	194.8	39.0	August, 2020	34	17.45%	0.9	June, 2021
32	Innishcannon	138.5	27.7	September, 2020	27	19.49%	1.0	August, 2021
36	Freaghillan East	115.6	23.1	October, 2020	10	8.65%	0.4	March, 2021
37		23.6	4.7	November, 2020	0	0.00%	0.0	November, 2020
38	Inishcuill West	1348.2	269.6	December, 2020	200	14.83%	0.7	August, 2021
39	Mauherillan	217.5	43.5	January, 2021	42	19.31%	1.0	December, 2021
40	Inishfesh	685.8	137.2	February, 2021	137	19.98%	1.0	January, 2022
41	Inishmolt	425.1	85.0	March, 2021	20	4.70%	0.2	May, 2021
42	Inishloy	669.4	133.9	March, 2021	25	3.73%	0.2	May, 2021
43	Inishdaff	1452.9	290.6	March, 2021	100	6.88%	0.3	July, 2021
44	Inishbollog	273.9	54.8	April, 2021	25	9.13%	0.5	September, 2021

Table 5 : Planning of Harvest Activities

* The sample data entered above is for illustration purposes only.

Once the re-harvesting date for each island is established, this information will be used to plan the next seasons harvesting. When planning future harvests, some islands and sites will be marked as unavailable for certain times of the year. This is to ensure that known seal breeding, moulting, resting and sensitive bird breeding and wintering sites are avoided. It also ensures avoidance of a number of sites where significant in-combination effects could occur at certain times of the year. The Resource Manager will be responsible for ensuring that these sites are avoided. A complete list of sites and their exclusion requirements in accordance with time of year, the presence of seals, breeding and wintering bird populations and potential for in-combination effects in general, is provided in Table 8 of this document. The list of restricted sites and site-specific measures is described further in Appendix 4 and broken down on the basis of specific harbour seal and sensitive bird sites.

BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done via on-site assessments and updating the plan as necessary with the results of this analysis.

Duty: BioAtlantis Resource Management Team

Harvesting Flow Chart

The flow chart shown in Figure 2, describes the harvesting process and the pre- and post-harvest checks that are in place to ensure that the correct procedures are followed.

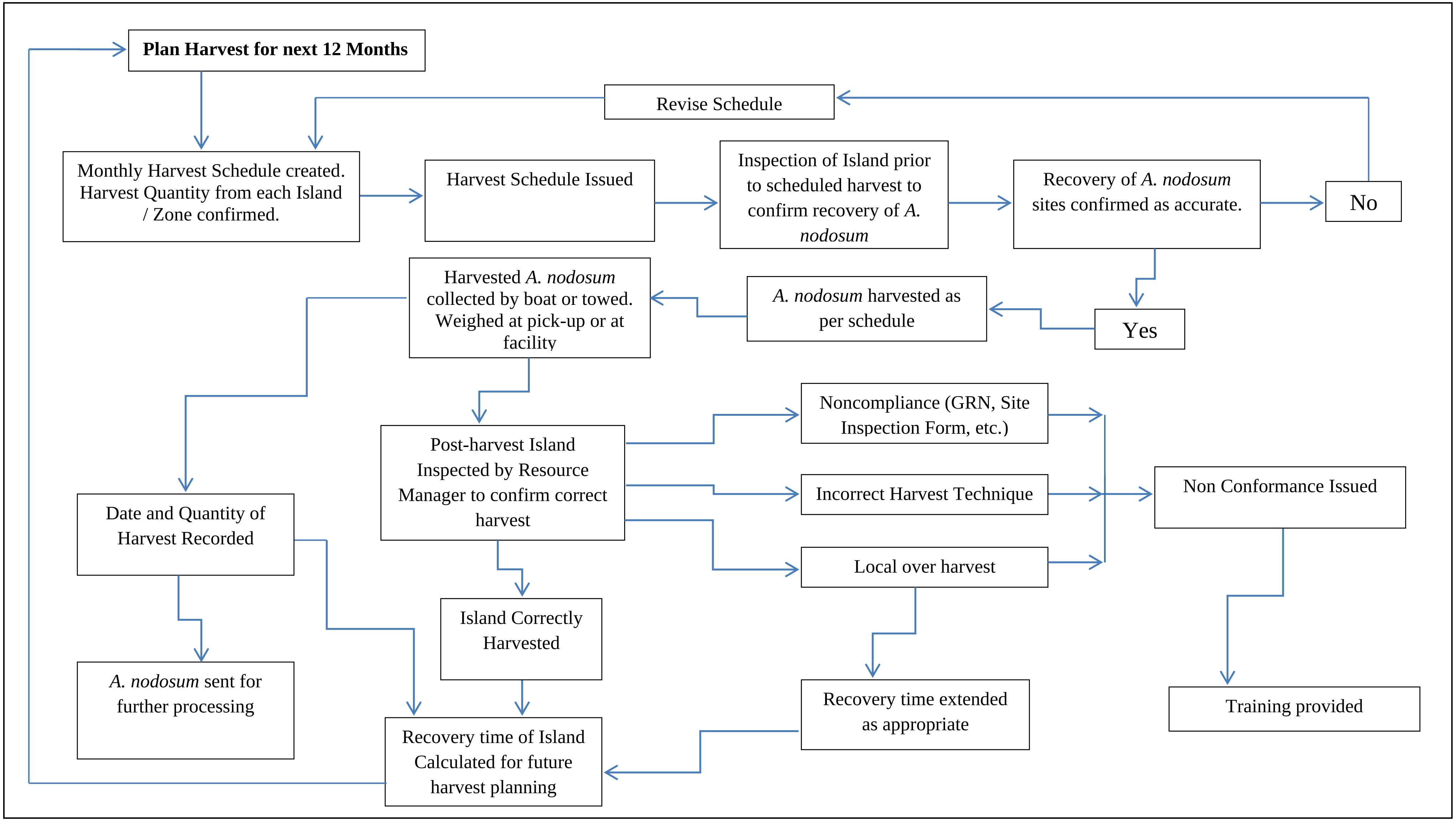

Figure 2: Harvesting Flow Chart

(iv). Data recording & analysis

BioAtlantis will explore the applicability of purchasing a boat for the area to be used for the collection of harvested *A. nodosum*. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up point. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed collected from each point will be weighed and the details of the harvest recorded at each collection point. The harvested seaweed may alternatively be weighed on delivery to the processing facility. The person or transport company in receipt of the harvested seaweed will complete a "Goods Received Notes" (GRN, see Appendix 3)" to record the harvest from each site. This will include the following data:

- Name of harvester.
- Date & time of harvest.
- Pick-up location.
- Location of site, name of island / coastal sector and if appropriate, zone or additional location information.
- Description of the site:
  - Quantity of harvest.
  - Quality of harvest: is seaweed free of the following:
    - Excessive levels of sand, shingle, gravel, pebbles stones or debris.
    - *A. nodosum* holdfasts.
    - Other species (e.g. *Fucus*).

The Resource Manager will inspect sites post-harvest using the "Site Inspection Form (SIF)" (Appendix 3) to confirm that harvesters have worked to ensure:

- Cutting of *A. nodosum* 200-300mm (8-12 inches) above holdfast.
- No more than 20% of the available *A. nodosum* biomass is harvested.
- Activities only take place at approved sites.
- Health and safety requirements are adhered to (applicable if harvesters are present during inspection).

After receipt of the *A. nodosum* in the factory, these details will be uploaded into the main database and a second GRN will also be completed. Alternatively, where the quality cannot be checked on collection, quality will be assessed by production staff and/or the QSE team and any deviations from the specified requirements will be recorded. Checks may be undertaken by random or specific quality inspections on bags/nets. Regular auditing of the harvest records (e.g. Site Inspection Form, GRN and production logsheets) will be carried out to ensure compliance with all BioAtlantis SOPs to ensure that communities and species within the Clew Bay SAC are protected. The procedures for reporting non-conformances are:

- Relevant personnel may be advised of the non-conformance and receive further training if necessary.
- Where there is continued/repeated non-conformances, management will decide on appropriate action, depending on the severity of the non-conformance.
  (See Appendix 3, for standard NCR Forms)

Computerised data will be maintained of all harvest records and non-conformances. Once the production planning and schedule for each year has been completed and prior to recommencing harvesting, each site will be visited by the Resource Manager to ensure the validity of the data relating to projected regeneration times and site recovery. Planned harvesting activities will be adjusted accordingly in the event of any inaccuracies in the projections.

Duty: Implementation, monitoring & analysis by BioAtlantis staff (e.g. Engineering, IT, Production, Quality personnel and Resource Manager).

(v). Navigation to and from harvest sites:

The harvesters shall use their own boats to navigate to and from the island sites. In the case of coastal sites, the harvesters shall be responsible for access to and from the sites using a boat or through use of existing routes. BioAtlantis will explore the applicability of purchasing a boat for the area that would be approved by the Marine survey office (MSO) for use on the open waters of Clew Bay, and used to collect the harvested *A. nodosum* from the designated sites. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. The harvesters will be made aware that all harvested *A. nodosum* must be collected by BioAtlantis for weighing and processing, and the seaweed will only be collected from the sites or pick up points identified on the harvesting schedule or as required by management. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

(vi). Communication

The number of harvesters contracted by BioAtlantis will be approximately 16 full time or 32 part-time. Communication of the harvesting plan will be done in advance each month/quarter via email or post. This will include information on sites that are to be harvested and the quantity and dates for each harvest site. Sites will be identified on a map and the anticipated quantities for each site indicated. Communications with the harvesters during harvesting activities will be either via a mobile phone or 2-way radios, as deemed appropriate. Duty: Communication by the BioAtlantis Resource Management Team. Implementation by hand harvesters.

(vii). Hand-Harvest methodology, Guidelines and Codes of Practice.

- **Selection of a harvest methodology suited to Clew Bay:**
  There are several different harvest methods employed throughout the world, including sickle/knife hand-harvesting and 'rake'-type methods. Each method has varying degrees of efficacy and safety and some may be better suited a particular environment than others. This is particularly the case in Clew Bay, whereby the coastal substrate is primarily a heterogeneous mixture of small rocks, small stones & pebbles, classified as reef by NPWS with stated objectives for maintenance. As

increased removal of holdfast by-catch can occur due to the presence of underlying friable substrate (ref: paragraph. 3, page 19, Vandermeulen *et al.*, 2013), it is critical that the harvest systems in Clew Bay mitigate against such effects. On assessment of the literature and by considering Clew Bay's unique *A. nodosum* substrate, management at BioAtlantis has selected a methodology which minimizes the risk of:
(a) Disturbing or displacing substrate during hand harvest.
(b) Damaging holdfast material.
(c) Removal of holdfast material and associated *A. nodosum* mortality.

The methodology involves use of the sickle/knife method at low tide which provides harvesters with full view of the cutting process, taking care not to disturb the substrate, not harvest too low or damage holdfast. For more details, please see Section 3.5.3 (c) and the Code of Practice in Appendix 4.

- **Guidelines and Codes of Practice:**

Harvesters will receive training, where necessary, on methods to harvest *A. nodosum* in an environmentally friendly and sustainable manner. Activities will be carried out in accordance with a clearly defined protocol which will prevent any damage to the environment or underlying growth substrate, whilst also facilitating sufficient re-growth and re-generation of the vegetation post-harvest. The Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC can be found in Appendix 4. SOPs will also cover the following areas:

- ➢ Environmentally sensitive navigation methods, i.e. to prevent damage to mudflats, sandflats, clean/fine sand areas. Navigation in these areas will be at high tide or when the tide has begun to recede.
- ➢ Determining suitability of harvest areas, i.e., fronds which are too short will not be harvested.
- ➢ Method for using sickle or knife to cut fronds of *A. nodosum* between 200-300mm (8-12 inches) above the base, without damaging holdfast or underlying substrate and method for bagging of cut *A. nodosum* in bags/nets.
- ➢ Method for automatic weighing and transfer of weed to boat (subject to being applicable to the area).
- ➢ Method for filling out GRN.
- ➢ Methods for loading and transporting of cut weed to BioAtlantis via suitable piers.
- ➢ Method for communicating with BioAtlantis.
- ➢ Method for reporting incidents to BioAtlantis.

Training will also be provided to ensure competence in navigation and use of electronic and health and safety equipment.

Duty: Training provided by BioAtlantis staff.

(viii). Health and Safety measures

All harvesters will be provided with appropriate and certified Health & Safety Training. BioAtlantis will run regular training days for the harvesters, where necessary. The seaweed collection boat, if deemed applicable to the area, will be equipped with all necessary safety equipment as required by the Marine Survey Office (MSO). Duty: Health and Safety Manager.

(ix). Preventing spread of invasive species

Hand harvesting has potential to act as a vector in the spread of invasive species. To ensure that harvest activities do not lead to the spread of *Bonamia ostreae, Botrylloides violaceus, Caprella mutica, Crassostrea gigas, Crepidula fornicate, Didemnum vexillum, Perophora japonica, Sargassum muticum Spartina anglica or Styela clava*, BioAtlantis require that any collection or harvester boats be painted once a year with appropriate anti-fouling paint. Harvester boats will not leave Clew Bay. In the rare case that they do leave Clew Bay, cleaning measures on land will be implemented which will involve cleaning appropriate cleaning agents or using other suitable methods on delivery to production facilities and returned to harvesters in a clean condition. Harvesting will be limited to the *A. nodosum* zone and will not take place in subtidal areas, exposed or semi-exposed sites. Harvesters will keep distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures. Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and will ensure that inadvertent by-catch of other Animalia, algae or dead, drifting material/algae will be prevented and minimized. Duty: Resource Manager, Production Manager & hand harvesters.

b) Operation/Activity No. 2: Monitoring, recording and reporting

The sustainable harvest system consists of several monitoring, recording and reporting components. These include:

(i). Core Requirements.
(ii). Monitoring the *A. nodosum* resource: initial and continual assessments.
(iii). Maintenance of Harvest Database.
(iv). Accurately plan harvest periods.
(v). Quality Control (QC).
(vi). Quotas.
(vii). Monitoring & reporting of other activities.
(viii). Quarterly and annual audits of the harvesting system.

Details of how BioAtlantis proposes to manage these activities are as follows.

(i). Core requirements

Activities in this region must be sufficiently monitored and recorded using appropriate techniques and reported in a manner which allows for continual assessments, statistical analyses and verification of controls measures which are in place. This includes continuous monitoring of the *A. nodosum* resource, maintenance of a non-conformance reporting system and maintenance of a database containing the following information:

- Harvester details: name, date and time of harvest.
- Location of harvest site and pick-up point.

- Quantity harvested at site.
- Quality parameters (i.e. contaminants such as sand, stones, holdfasts, debris, other species, etc).

Duty: The above information will be cross-checked by QC and Production staff at BioAtlantis Ltd. Maintenance of the database will allow for continuous monitoring and analysis of harvest of the *A. nodosum* resource.

(ii). Monitoring of the *A. nodosum* resource: initial and continual assessments

- Initial assessment: The Resource Manager will perform an initial assessment to verify the levels of biomass at each site in Clew Bay prior to conducting harvest. To do this, the Resource Manager will visit each site and verify the data by means of direct measurements or visual assessments. It is also necessary to determine which sites have been recently harvested and if necessary, assign sufficient fallowing periods to allow for biomass recovery at such sites.
- Continual Assessment: *A. nodosum* levels will be monitored on a continual basis as required to ensure that sites have sufficiently recovered prior to harvest taking place. This information will be recorded in the database to ensure that harvest activities are planned to ensure that harvest is limited to sites where *A. nodosum* density has recovered.

  Duty: BioAtlantis staff (e.g. Resource Manager), etc. A Marine Ecologist will be directly employed or contracted for the purposes of measuring *A. nodosum* recovery and conducting ecological surveys.

(iii).Maintenance of Harvest Database.

Immediately following harvest, *A. nodosum* will be bagged. The harvested seaweed will be weighed automatically on the collection boat (if applicable to the area), at the pickup point or at the processing facility. Details will be recorded on the GRN, thus allowing for accurate recording of the locations and quantities of *A. nodosum* harvested. The Resource Manager will be responsible for uploading the data forms to the harvest database. The maintenance of the database will be the responsibility of BioAtlantis staff. Scientific, production and quality personnel will have access to the database as required for the correct implementation of their duties.

(iv). Accurately plan harvest periods.

Locations and periods of harvest will be planned in a manner which ensures that (a) there is no damage to the environs of the SAC, (b) there is sufficient *A. nodosum* biomass available for harvest and (c) sufficient time has passed to allow for recovery. The most accurate means of ensuring that each of these goals are met are through analysis of datasets as they emerge. In this way, staff at BioAtlantis will make decisions which are informed by knowledge of the rates of *A. nodosum* regeneration and site recovery. Data relating to biomass levels and site recovery will be incorporated into the main database (see Tables 3 & 5) for use in planning harvest periods.

(v). Quality Control (QC):

BioAtlantis as a GMP+ certified company must ensure full traceability to end users of the origin and location of the raw material used in the products which we manufacture.

Therefore, the Resource Management and QC team in BioAtlantis will play a key role in the management and monitoring of work relating to harvest of *A. nodosum* in Clew Bay. This will involve:

- Assessment of quality control checks on harvesting activities in Clew Bay to ensure conformance with quality and other requirements for the SAC.
- Assessment of quality control checks to ensure recording is conducted appropriately (GRN, Site Inspection Form, etc).
- Implementation of corrective actions where necessary. Liaise with BioAtlantis Resource Management Team on non-conformance issues should they arise.
- Utilization of this knowledge in the preparation, scheduling and allocation of resources for harvesting.
- Assist in the implementation and training of personnel & contractors involved in hand harvesting activities in the Clew Bay area.
- Liaise with R&D Dept. regarding interpretation of data and on R&D related issues.
- Ensure customers have full traceability from point of harvest to the end product.
- Audits: assist in quarterly and annual audits on the harvesting system.

(vi). Quotas:

The quota for each island is a sustainable harvest of 20% of the available *A. nodosum* per site per annum (See Table 3 for estimation at each site). If quota is exceeded, a Non-Conformance Report (NCR) will be issued. Harvesters will be provided with training if necessary. The Resource Manager will routinely inspect sites post-harvest to ensure compliance with sustainable hand harvest methods. An NCR will be filed and training provided if necessary.

(vii). Monitoring & reporting of other activities:

In the event that harvesters contracted by BioAtlantis cut excess amounts of *A. nodosum* and/or sell material to unlicensed operators, BioAtlantis will investigate and if necessary take disciplinary procedures.

(viii). Quarterly and Annual audits of the harvesting system

A key requirement in implementing and securing a functioning system for sustainably hand harvesting of *A. nodosum*, are effective control measures, reporting and monitoring systems. BioAtlantis will conduct quarterly and annual audits of standards covering the areas below. The Clew Bay audit template is attached as Appendix 8.

(a) Quarterly Audit:

- Audit Part A: Records, Forms & Documents:
  Step 1: Forms: receipt of training & verification of understanding.
  Step 2: Completed Training Certs (obtained through training above).
  Step 3: Records, forms & documents (general).
- Audit Part B: Quality Assessment (documentation):
  Step 1. GRNs and Site Inspection Forms (Clew Bay).
  Step 2. Production Logsheets (Production Facilities).
  Step 3. Incident Reports.
  Step 4. Non-conformance Reports.
  Step 5. Software Systems.

(b) Annual Audit (on-site):

Step 1. Site Quality (inspection of harvested sites)

Step 2. Harvest methods (inspection of techniques)
Step 3. Collection boat (if applicable to the area)

c) Operation/Activity 3: Verification, Analysis and System updates

The harvest system must be continually assessed to ensure the validity, efficacy, fitness for purpose of its various components. Central to ensuring that the system works as a whole, there will be regular audits of all systems and robust follow-up to ensure that standards, codes of practice and mitigation measures are adhered to. The 3 key features of this system are as follows:

(i). Verification.
(ii). Analysis.
(iii). Updating the system.

Details of how BioAtlantis proposes to manage these activities are as follows.

(i). Verification

Control measures will be required in order to ensure that processes involved in harvesting are not detrimental to the Clew Bay SAC. The following systems will be put in place to verify the effectiveness of the systems and control measures:

- Annual review of the harvesting system.
- Assessment and confirmation of the conformance of harvesters to the sustainable hand harvesting system.
- Annual review of the QC system to ensure the company is operating according to the harvesting plan.
- Quarterly review of hand harvesting records (i.e. GRNs and Site Inspection Forms).
- Quarterly review of records for deviations and corrective actions.
- Validation of limits set for implementation of control measures and confirm that they are adequate to prevent any non-conformances.
- Validation of the Harvesting Plan, including on-site review.
- Review of any modifications to the Harvesting Plan.
- Verification of the accuracy and effectiveness of the system will be conducted:
    - ➢ Quarterly, in order to assure potential non-conformances are under control (i.e. via Internal Audit).
    - ➢ When concerns emerge regarding environmental non-conformances or damage.
    - ➢ To confirm that changes have been implemented correctly after the Harvesting Plan has been modified.
    - ➢ To assess whether the Harvesting System should be modified due to any changes in EU Law or Irish Law should they arise.

(ii). Analysis

- On-going and annual assessments of the validity of the current controls used to ensure protection of biological communities in the Clew Bay Complex.
- Analysis of data obtained during implementation of harvest by means of Mapping Software (e.g. CAD) or statistical methods.
- Utilization of this knowledge in the preparation, scheduling and allocation of resources for harvesting.

(iii). Updating the system

During regular quarterly and annual audits and meetings, it may be determined that improvements are necessary to refine the harvesting system. Any significant changes will be documented. For example, it may be necessary to avoid previously unknown sensitive sites. On review of quality checks on Goods Received Notes (GRNs), Site Inspection Forms (SIFs) and on review of incidents that arise on a week-by-week basis (Incident Report Forms), it may be necessary to improve systems or copper fasten mitigation measures to ensure maximum compliance with standards for protecting the SAC. It may also be necessary to allow certain sites extended re-growth periods, due to the potential for localised or regional variability in growth rates. This ‘Adaptive Management Approach’ will ensure the optimal performance of the system in the short and long term.

d) Operation/Activity 4: Long term assessment biomass and community structure

BioAtlantis has invested considerably in R&D throughout its history and is currently involved in several internationally recognised research collaborations (see Figure 3). This research focus will continue, with additional emphasis placed on assessing the long-term impact of hand harvesting on *A. nodosum* biomass recovery and community structure. BioAtlantis will build on the findings of Kelly *et al.*, (2001) and continually assess the impact of *A. nodosum* harvesting in Clew Bay, throughout the life-time of the licence. This approach will allow BioAtlantis to continually validate and improve the methodology on an ongoing basis and on a long-term basis throughout the life-time of the licence. This will ensure that scientific knowledge is increased over a longer time period beyond the relatively short timeframe assessed by Kelly *et al.*, 2001. This will be important in ensuring that conservation objectives are met continually into the future. For more details as to how assessments will be carried out, the experimental design and the parameters measured, please see below. Additionally, the potential impacts of hand harvesting on community structure are discussed in Section 3.5.3 (d).

Experimental design and methodology:

A pilot study to measure biodiversity was performed in Clew Bay (see Appendix 1). The experimental design will be further developed to include important parameters, techniques and measurements as summarised below:

- Designation of experimental sites to facilitate comparisons between non-harvested areas and harvested areas. The chosen control sites will not be subjected to commercial harvest activities. During assessment, personnel will divide the site into distinct sections, to include replicates where harvesting will take place and replicates where harvesting will not take place.
- Sections will be large enough to allow for sufficient numbers of replicates. A minimum of 4 x 1m^2 replicates will be required to compare harvest versus non-harvest areas. However, to ensure robust statistical analysis and to enhance the accuracy of the assessment, the number, size and type of replicates may be altered depending on the levels of variability between replicates and with respect to the individual

parameters assessed. Each quadrant will be spaced approximately 3 meters apart where possible. To accurately assess changes in biodiversity over time, replicates will be assigned to the same position every year, either as determined via GPS or through demarcation. Alternatively, replicates may be assigned randomly if required.

- Numbers and/or density of *A. nodosum* plants, numbers of *Fucus* plants, and numbers of *Animalia* will be measured. Density will be measured as wet weight per unit area. Numbers and/or density of periwinkles, limpets, barnacles will be measured. The presence/absence of red algae (Tandy) and Ephemeral green algae will also be assessed. For more details on the general methodology, see Appendix 1.
- Statistical analysis will be performed by research scientists and statisticians using geospatial tools and/or by appropriate statistical packages.
- Assessments will be performed on an annual basis to allow for monitoring over an extended time-period, ideally between 5-10 years.

The experimental design outlined above may be subject to change depending on the sites involved, the underlying analytical methodology and the parameters/statistical methods employed. Annual reports and datasets will be made available to NPWS and others if requested. This will be important in ensuring that conservation objectives are met continually into the future. Scientists at BioAtlantis have strong expertise in the biological sciences and excellent publication records. These levels of expertise will ensure that the assessments and analyses are carried out to high standards. This work will also ensure that scientific knowledge of the potential impact of hand harvesting in Clew Bay is increased beyond the timeframe assessed by Kelly *et al.,* 2001.

Duty: BioAtlantis staff (R&D personnel), etc. A Marine Ecologist will be directly employed or contracted for the purposes of *measuring A. nodosum* recovery and conducting ecological surveys.

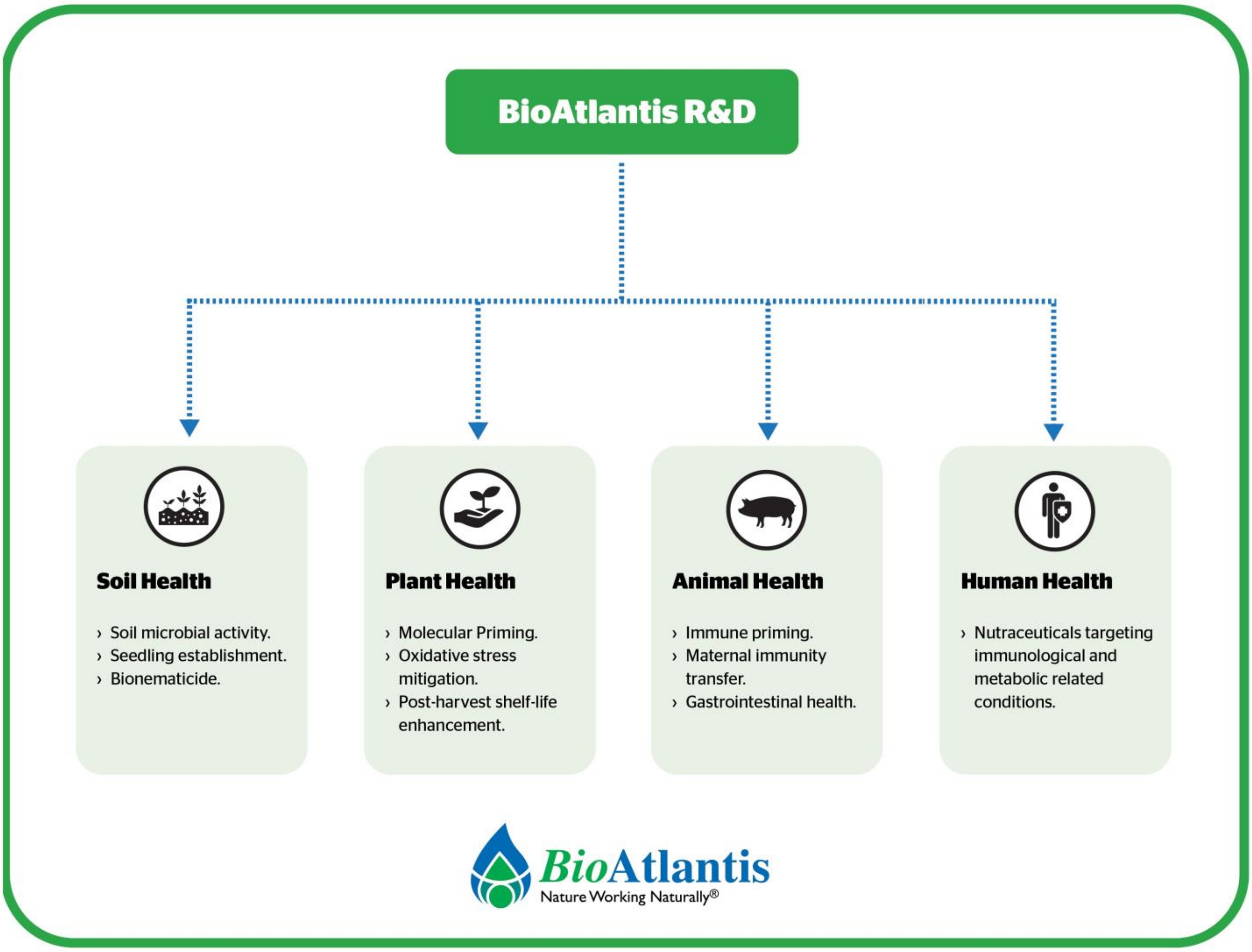

Figure 3: BioAtlantis - Research and Development

1.3.4 Locations in which operations/activities will take place.

1.3.4.1 Harvest zones

BioAtlantis will initially identify areas in Clew Bay which were subject to a substantial level of recent harvesting. These areas will be given an appropriate fallowing period to facilitate recovery. A duration of 3-5 years is generally considered a time-frame effective in ensuring re-growth of *A. nodosum* (Kelly L. *et al.*, 2001 and Guiry, M. and L. Morrison (2013). Overall, this approach will ensure that effects on fauna and microflora are minimized, whilst maintaining the regenerative capacity of the macroflora. The density of *A. nodosum* in Clew Bay ranges from 0.2 – 37 Kg/m^2 (Kelly L. *et al.*, 2001). Densities within other regions of the North Atlantic are given in Table 6 below. From our assessment, we estimate that an average density of 10.4Kg/m^2 for Clew Bay. From a total available harvest of 64,759 Tonnes (see Table 7) and based on the BioAtlantis sustainable harvest methodology of a 20% harvest per site per annum and cutting of 200-300mm (8-12 inches) above the holdfast, there is an annual sustainable harvest of ~12,900 Tonnes (Table 7). This figure was adjusted following on site assessments of *A. nodosum* resources in Clew Bay by UCD, and following the exclusion of areas with existing seaweed harvesting rights or burdens. The revised figure is an annual sustainable harvest of 11,018 Tonnes.

Region	**Yield(kg/m^2)**	**Reference**
Canada	7.1	Ugarte R & Sharp GJ (2011A)
Iceland	5.0 - 8.0	Valsdóttir P (2011)
Ireland (Clew Bay)	0.2 -37.0	Kelly L. *et al.*, (2001)
Norway	4.0 - 7.0	Steen H (2009)
Scotland (Western Isles)	4.6- 24.1	Minch Project (1995)

Table 6 : Yields of *A. nodosum* in five regions of the North Atlantic

***A. nodosum* Hand Harvesting Zone**	Average Seaweed Density (kg/m^2)	Total Available Harvest (Per Annum)		Sustainable Annual Harvest (Tonnes Per Annum)*
		Kg	Tonnes	
Coastline	1.83	8,752,817	8,753	1,751
Northern Islands	13.46	15,738,415	12,846	2,569
Mid Islands	16.96	29,302,494	29,302	5,860
Southern Islands	7.96	13,857,656	13,858	2,720
		Estimated total	**64,759 Total**	**12,900 Total**
		Revised Estimated total #	**55,090 Total**	**11,018 Total**

Table 7 : Available harvest of *A. nodosum* in designated zones of Clew Bay

* Harvest will not exceed 20% of the available harvestable *A. nodosum* per site per annum.

\# The maximum annual harvest was adjusted following an assessment of *A. nodosum* resources in Clew Bay by UCD. The figure was adjusted further following the exclusion of areas with existing appurtenant rights to gather or remove seaweed and folios with burdens that relate to seaweed.

1.3.4.2 Access to harvesting sites

Access to the islands will be by boat, according to methods which minimise potential impacts on the SAC (e.g. harbour seals, mudflats & sandflats, wintering and breeding birds, etc; see Appendix 4 for Code of Practise). Access to the coastline will be via existing routes or boats as required. Should a pick-up boat be deemed applicable to the area, launch to islands will be made from existing piers. Individual harvesters will access sites via existing methods. The harvested seaweed will be collected in nets or bags at the shoreline; these nets or bags will then be collected by the pick-up boat (if deemed applicable for the area) and delivered to a pier for onward transport. The size of the shore area covered by an individual net or bag will be approximately $2m^2$ to $8\ m^2$. Harvest will occur at islands and shorelines as described in the harvest management plan. Nets or bags will then be picked up at each location in which harvesting took place. Alternatively, harvesters may tow the floating nets or bags from the harvest site directly to the pick-up points. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. Final pick-up points will be at established piers and harbours, particularly in Westport and Newport. The following provides a summary of piers and quays which will be used as the main collection points for transport to the processing plant:

- Northern Islands & Northern coast — Rockfleet pier
- Mid Islands & Coastline — Ardkeen Quay
- Mid Islands & Coastline — Ardkeen Quay / Rosmoney Quay
- Mid and South Islands & coastline — Rosmoney Quay
- South Islands & South Coastline — Westport Harbour

Access to the northern coastal area will be via the roads at Knockmanus road, Roskeen south Road, Carrowsallagh Rd, Keeloges Rd, and via boat. Access to the Milcum harvesting site will be via the Teevmore Road. The coast roads on Knockeeragh and Rosclave provide good access to the harvesting sites in this area. The harvesting site at Rosanrubble can be accessed by boat and from the road to Rosanrubble Point. The Harvesting area between Bleanrosdooaun Strand and Monkelly can be accessed by road to Roslaher, Rostoohy Pier, Moyna Strand, Ardkeen Quay, Roscahil Rd, Rosmindle Rd, Castleaffy, Rosmoney, Rusheen, Carrowcally, Bawn Strand, & Monkelly Strand. Other established pick-up points not listed above may also be used.

Harvesting will be carried out in a manner which does not negatively impact on fishing and sea angling in the complex. Several sites which are documented to be of relevance to fisheries and sea angling have been identified and will not be negatively affected by harvest activities (see correspondence with IFI enclosed with this application). The operational areas of seven charter skippers in Clew Bay have also been identified and will not be impacted by harvest activities. Harvesters will work to ensure that angler’s space will be respected at all times.

1.3.4.3 Facilities to cope with biological and industrial waste

There will be no biological waste generated from this process. All of the material harvested will be transported to BioAtlantis' manufacturing facilities in Tralee, Co. Kerry where it will be used as raw material for extraction of bioactives for the plant, animal and human health sectors. BioAtlantis Ltd. production facilities are certified in the EU by GMP+ International B.V (www.gmpplus.org), granting the company permission to produce and trade seaweed extracts destined for use in highly regulated markets of Northern Europe. The production facilities are located in Tralee, Co. Kerry and are fully licensed and compliant with all necessary regulations.

1.3.5 Months in which operations/activities will take place.

Harvesting operations will take place all year round. Harvesters will work with the tide to ensure that they arrive in boats in appropriate conditions. Time-frames in which harvesters will work at islands will vary per site. Small-medium sized islands will require approximately 2-4 harvesters. Medium to large islands may require between 4-6, while larger islands will likely require approximately 6-10 harvesters. The known moulting & breeding sites of the harbour seals will be avoided during the months of May to September. In table 8, 'x' denotes the exclusion of a site at a particular time of year due to the presence of protected harbour seals and/or bird species of interest, thus ensuring that no negative impacts occur. See Appendix 4 for "Code of Practice" and site-specific details for protected seal and bird species. On the advice of NPWS, BioAtlantis will work to incorporate any islands currently unlisted as having relevance for harbour seals, e.g. unlisted moulting sites, etc. In addition, table 8 also incorporates sites known to be of relevance to protected avian species (*pers. comm. 03/12/2013).* Similar to harbour seals, these sites are avoided at sensitive times of the year, i.e. during breeding and wintering seasons. Further site-specific details for protected bird species are provided in Appendix 6. Sites where significant risks of seasonal in-combination effects due to potential interactions with existing operations or planned operations, will also be avoided as appropriate. For example, Collanmore exhibits substantial human activity during peak tourist season (May-August). Roman Island and Westport Harbour are being targeted by Mayo County Council for increased recreational tourism activity. These sites will also be avoided during peak tourist season between May-August (see Code of Practice for details).

Island No.	Name / Area	Harvesting Zone ID	Harvest Control Measures											
			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
	Bartraw - Westport	CZ 1.1	X	X	X							X	X	X
		CZ 1.2												
		CZ 1.3												
		CZ 1.4												
		CZ 1.5												
		CZ 1.6												
		CZ 1.7												
		CZ 1.8												
		CZ 1.9												
		CZ 1.10												
		CZ 1.11												
		CZ 1.12												
		CZ 1.13												
		CZ 1.14												
		CZ 1.15												
		CZ 1.16												
†	Roman Island, Westport Quay	CZ 1.17 †					X	X	X	X				
†		CZ 1.18 †					X	X	X	X				
†	Westport - Rosmoney	CZ 2.1 †					X	X	X	X				
		CZ 2.2												
		CZ 2.3												
		CZ 2.4												
		CZ 2.5												
	Pigeon Point	CZ 2.6	X	X	X							X	X	X
		CZ 2.7	X	X	X							X	X	X
		CZ 2.8												
		CZ 2.9												
		CZ 2.10												
		CZ 2.11												
		CZ 2.12												
		CZ 2.13												
		CZ 2.14												
		CZ 2.15												
		CZ 2.16												
		CZ 2.17												
	Rosmoney - Moyna Strand	CZ 3.1												
		CZ 3.2												
		CZ 3.3												
		CZ 3.4												
		CZ 3.5												

Island No.	Name / Area	Harvesting Zone ID	Harvest Control Measures											
			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
		CZ 3.6												
		CZ 3.7												
		CZ 3.8												
	Rostoohy Pt - Newport	CZ 4.1												
		CZ 4.2												
		CZ 4.3												
		CZ 4.4												
		CZ 4.5												
		CZ 4.6												
		CZ 4.7												
		CZ 4.8												
		CZ 4.9												
		CZ 4.10												
		CZ 4.11												
		CZ 4.12												
		CZ 4.13												
		CZ 4.14												
	Newport - Mallaranny Pier	CZ 5.1												
		CZ 5.2												
		CZ 5.3												
		CZ 5.4												
		CZ 5.5												
		CZ 5.6												
		CZ 5.7												
		CZ 5.8												
		CZ 5.9												
		CZ 5.10												
	Rosturk	CZ 5.11	X	X	X							X	X	X
		CZ 5.12	X	X	X							X	X	X
		CZ 5.13	X	X	X							X	X	X
		CZ 5.14	X	X	X							X	X	X
	Rossmurrevagh	CZ 5.15	X	X	X							X	X	X
		CZ 5.16	X	X	X							X	X	X
		CZ 5.17	X	X	X							X	X	X
1	Forillan, Illanavrick Etc	IS 1.1												
1		IS 1.2												
2	Kid Isd East													
3	Roslynagh						X	X	X					
4	Illannambraher													
5	Inishdasky						X	X	X					
6	Inishquirk													

Island No.	Name / Area	Harvesting Zone ID	Harvest Control Measures											
			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
7	Inishtubrid		X	X	X	X						X	X	X
8	Inishlim													
9														
9	Beetle Isd North													
9	Inishbobunnan													
10														
10	Inishgowla													
10	Beetle Isd South													
11	InishKeel	IS 11.1												
11		IS 11.2												
11		IS 11.3												
11		IS 11.4												
12	Black Rock													
13	Moynish More		X	X	X	X	X	X	X			X	X	X
14	Moynish Beg				X	X	X	X	X	X	X			
15	Inisherkin													
16	Inishnacross													
17	Inishilra						X	X	X					
18	Inishcooa													
19	Roeillaun				X	X	X	X	X	X	X			
20	Inishdeashbeag		X	X	X	X	X	X	X	X	X	X	X	X
20	Adjacent island/skerry		X	X	X	X	X	X	X	X	X	X	X	X
20	Inishdeashmore		X	X	X	X	X	X	X	X	X	X	X	X
21	Inishcorky				X	X	X	X	X	X	X			
22	Inishcarrick						X	X	X					
23	Inishcoragh													
24	Muckinish						X	X	X					
25	Inishdaweel						X	X	X					
26	Rabbit Isd													
26	Adjacent island/skerry													
27	Illanascrraw						x	x	x					
28	Freaghillanluggagh						X	X	X					
29	Inishkee													
30	Unnamed													
31	Freaghillan West													
32	Innishcannon													
33	Carricklahan													
34	Carrickachorra													
35	Illanmaw													
36	Freaghillan East													
37	unnamed													
38	Inishcuill & Inishcuill		X	X	X	X						X	X	X

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	West													
39	Mauherillan				X	X	X	X	X	X	X			

Island No.	Name / Area	Harvesting Zone ID	Harvest Control Measures											
			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
40	Inishfesh													
41	Inishmolt													
42	Inishloy													
43	Inishdaff													
44	Inishbollog													
45	Inishlaughil													
46	Inishgowla													
47	Inishoo													
48	InishTurk	IS 48.1												
48		IS 48.2												
49	Illannaconney													
50	Inishakillew	IS 50.1								X	X			
50	Adjacent island/skerry	IS 50.2								X	X			
51	Trawbaun													
51	Carrigeenglass North													
51	Moneybeg													
51	Inishcottle													
52	Calf Island													
53	Inishbee, Derrinish & Dernish West													
54	Freaghillan	IS 54.1												
54		IS 54.2												
54		IS 54.3												
55	Clynish													
56	llaunnamona													
57	Rabbit Island, Island More &Quinnsheen Island	IS 57.1												
57		IS 57.2												
57		IS 57.3												
57		IS 57.4												
58*	Collan More, Carrigeenglass South & Collan Beg	IS 58.1					X	X	X	X				
58		IS 58.2					X	X	X	X				
58		IS 58.3					X	X	X	X				
59	Inishgort													
60	Inishlyre													
61	Illanataggart & Crovinish													
62	Inishgowla South + Carrickwee						X	x	x	X	X			
63	Forilan									X	X			
64	Carrickawart	IS 64.1	X	X	X	X				X	X	X	X	X
64	Adjacent island/skerry	IS 64.2												
65	Inishlaghan													

66	Dorinish More & Dornish Beag				X	X	X	X	X	X	X			
67	Inishimmel				X	X	X	X	X	X	X			

Island No.	Name / Area	Harvesting Zone ID	Harvest Control Measures											
			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
68	Inishleauge													
69	Inishdaugh													
70	Inishraher													
71	Inisheeney		X	X	X							X	X	X
72	Finnaun Island						x	x	x	x	x			
73	Corillan	IS 73.1								x	x			
73	Adjacent island/skerry	IS 73.2												
73	Adjacent island/skerry	IS 73.3												
73	Adjacent island/skerry	IS 73.4												
74	Carricknamore	IS 74.1								x	x			
74	Adjacent island/skerry	IS 74.2												
74	Adjacent island/skerry	IS 74.3												
75	Adjacent island/skerry	IS 75.1	X	X	X	X	X	X	X	X	X	X	X	X
75	Adjacent island/skerry	IS 75.2	X	X	X	X	X	X	X	X	X	X	X	X
75	Adjacent island/skerry	IS 75.3	X	X	X	X	X	X	X	X	X	X	X	X
75	Stony Island	IS 75.4	X	X	X	X	X	X	X	X	X	X	X	X
75	Adjacent island/skerry	IS 75.5	X	X	X	X	X	X	X	X	X	X	X	X
75	Adjacent island/skerry	IS 75.6	X	X	X	X	X	X	X	X	X	X	X	X
75	Adjacent island/skerry	IS 75.7	X	X	X	X	X	X	X	X	X	X	X	X
75	Adjacent island/skerry	IS 75.8	X	X	X	X	X	X	X	X	X	X	X	X
76	Green Islands	IS 76.1	X	X	X	X	X	X	X	X	X	X	X	X
76	Adjacent island/skerry	IS 76.2	X	X	X	X	X	X	X	X	X	X	X	X
76	Adjacent island/skerry	IS 76.3	X	X	X	X	X	X	X	X	X	X	X	X
77	Carricknacally													
78	Monkellys Rock													
79	Inishweela													
80	Illanroe													
81	Roeillan													

Table 8 : Months in which Islands are unavailable for Harvest due to presence of sensitive species.

'X' denotes the importance of a site at a particular time of year to harbour seals, protected wintering or breeding bird species or sites with exceptionally high levels of recreational/tourism activity. See Code of Practice in Appendix 4 for details.

*denotes sites where interactions of harvesting with **existing operations** has potential to give rise to significant in-combination effects at times of the year indicated by 'X'. n

†denotes sites where interactions of harvesting with **planned operations** has potential to give rise to significant in-combination effects at times of the year indicated by 'X'.

1.4. Description of receiving environment

Clew Bay is a wide, relatively sheltered bay on the west coast of Co. Mayo. The Bay is characterised by a drumlin landscape which was formed during the last ice age as a result of sediment deposition and shaping by the advancing ice. Over 100 islands or 'drowned drumlins' were formed due to the subsequent rising sea levels, thus forming the unique 'basket of eggs' topography. The geomorphology of the area is quite complex with numerous interlocking bays of varying degrees of shelter and exposure giving rise to a high degree of variability in habitats and species for such a relatively small geographical area. As Clew Bay has been designated an important SAC (site Code: 001482), there are several conservation objectives specified for many of these habitats and species (see Section 2 of this document for details). An overview of the various habitats and species in Clew Bay is provided as follows, based largely on the site synopsis provided by the NPWS:

Shallow bays: Throughout the complex, there are many shallow bays with varying sediment substrate which are associated with a rich biodiversity, summarised as follows:

- Subtidal sediments
  - Fine sand: bivalve communities in fine sand (*Chamelea striatula* and *Ensis* sp.).
  - Muddy sand: polychaete worm *Euclymene* and the bivalve *Thyasira flexuosa.*

- Intertidal sediment communities:
  - Mid-shore: Polychaetes and bivalves in the mid-shore.
  - Low shore: sand mason worm *Lanice conchilega*.

- Infaunal communities in maerl areas: Areas which contain a substrate of dead maerl debris with low levels of live maerl, typically host a range of infaunal species which are characteristic of coarse sand and medium sand. This includes bivalves (*Timoclea ovata*, *Spisula* sp.), and polychaetes (*Nepthys cirrosa* and *Glycera lapidum)* associated with in coarse-type sand and bivalve (*Ensis* sp.) and polychaetes (*Lanice conchilega*, *Scoloplos armiger* and *Sthenelais boa)* associated with medium type sand. There are also beds of live maerl (*Lithothamnion corallioides)* in some areas.

- Gravels and medium sands areas: These areas are typified by *Timoclea ovata*, *Tapes rhomboids (bivalves)* and the *Branchiomma bombyx* and *Glycera lapidum* (polychaetes).

- Muddy sand areas: Characterised by *Abra alba*, *Corbula gibba*, *Thyasira flexuosa* and *Mysella bidentata (bivalves)* and *Euclymene* (polychaete).

Intertidal communities: These communities are present on sheltered shores along the edges of the inner part of Clew Bay, with habitats characterised by a mixed substratum of boulders, gravel, sand and mud. Communities of hydroids, sponges and solitary sea squirts are present in sheltered areas of shallow water of little sand scour. Diversity is notably high in gravel/mud mixed sediment areas.

Shingle: Reserves of shingle in Clew Bay are substantial. Shingle and sand dunes are widespread in the complex with annual vegetation of drift lines including several species: Common Scurvygrass *(Cochlearia officinalis)*, Red Fescue *(Festuca rubra)*, Sea Campion

(Silene vulgaris subsp. maritima), Spear-leaved Orache *(Atriplex prostrata)*, Sea Mayweed *(Matricaria maritima),* Sea Sandwort *(Honkenya peploides)* and Thrift *(Armeria maritime).*

Species of interest:
In addition to the important sub-tidal and intertidal species summarized above, Clew Bay is also host to several important populations of the harbour seals, otters, and range of important birds and wintering waterfowl. These species are listed on Annex II of the E.U. Habitats Directive and Annex I of the E.U. Birds Directive (2009/147/EC). A brief description of these species and their distribution and conservation requirements can be found in Section 2.2 and 2.4 of this document. Site-specific details relating to important breeding and wintering species of birds are described in Appendix 6 as provided by NPWS (*pers. comm*. 03/12/2013). This assessment in Appendix 6 was updated to include new data obtained from Birdwatch Ireland in 2020.

General areas of interest:
Lough Furnace is a rare example of a saline lagoon, located in the north-east of Clew Bay. This lake and others in the vicinity form an important component of the Burrishoole catchment area. The Rossmurrevagh area is located along the northern shore of Clew Bay and contains a diverse range of species within habitats including the seashore, dunes, coastal grassland, saltmarsh, bog and fen. For more details describing Lough Furnace and the Rossmurrevagh area, see Section 2.5 of this application.

The maps associated with this application highlight the area directly and indirectly impacted by the proposed plan or Project, summarized as follows:

- Location of plan relevant to the surrounding regional and local environment (inc. Maps).
- Likely location of Annex I habitats.
- Annex II (Harbour Seals) species hosted in the receiving area.
- Sites of relevance to wintering and breeding bird species (Annex I, E.U. Birds Directive)
- Operations/activities already existing in the receiving environment.

Section 2: Qualifying interest and conservation objectives (prepared by BioAtlantis Ltd.)

2.1. Introduction

This section describes several important aspects to the Clew Bay SAC, focusing primarily on the protected species, qualifying interests and conservation objectives of the NPWS. In addition, several other important aspects to the Clew Bay Complex are described including species and habitats within the region in general and those within the *Ascophyllum nodosum* biotope. Details of habitats and species and conservation objectives where applicable, are outlined throughout this section. On this basis, a risk assessment was carried out by personnel at BioAtlantis. This allowed for the development of a harvesting system which ensures minimal impact on protected species and habitats in the SAC. Details of this assessment and associated control measures, monitoring and corrective actions are provided in Section 3 As a number of moderate risks were identified, it was also deemed necessary to assess whether or not a Natura Impact Statement (NIS) and mitigation was required. The NIS was subsequently prepared by Ecofact Environmental Consultants Ltd and is attached as a stand-alone document to this application (updated in 2020 and 2021).

The conservation objectives for qualifying interests in Clew Bay as identified by BioAtlantis are summarized below, along with details for other relevant habitats and species.

1 **Protected species & habitats.**

In accordance with the NPWS and Annex I & II of EU Habitats Directive 92/43/EEC, there are 6 main conservation objectives and targets relevant to Clew Bay, covering both marine and coastal areas, summarised as follows:

Marine habitats and species.

- Objective 1: To maintain the large shallow inlets and bays in the Clew Bay Complex SAC (ref: pg. 12-13, NPWS, 2011A).
- Objective 2: To maintain the favourable conservation condition of Mudflats and Sandflats not covered by seawater at low tide (ref: pg. 14, NPWS, 2011A).
- Objective 3: To maintain the favourable conservation condition of harbour seal in Clew Bay Complex SAC (ref: pg. 15, NPWS, 2011A).

Coastal habitats.

- Objective 1: To maintain the favourable conservation condition of Perennial vegetation of stony banks (1220; ref: pg. 6, NPWS, 2011B).
- Objective 2: To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*; 1330; ref: pg. 9, NPWS, 2011B).
- Objective 3: To maintain and/or restore the conservation conditions of sand dune habitats (ref: pg. 15, NPWS, 2011B).
  a) Annual vegetation of drift lines (1210): To maintain the favourable conservation condition
  b) Embryonic shifting dunes (2110): To restore the favourable conservation condition.
  c) Shifting dunes along the shoreline with *Ammophila arenaria* (2120): To restore the favourable conservation condition.

Otters and birds:

Otter (Annex II of the E.U. Habitats Directive)

Several wintering and breeding bird species. (Annex I of the E.U. Birds Directive, 2009)

2 **Species & habitats of general interest.**
There are many important habitats and species of general interest in the Clew Bay Complex for which EU-specified conservation objectives may not specifically apply. Amongst these include the Rossmurrevagh area and Lough Furnace.

3 ***Ascophyllum nodosum* biotope and species therein**
The *Ascophyllum nodosum* biotope is species rich and contains many flora and fauna of interest, for which conservation objectives may not apply. These are described in detail in Section 2.6. The *A. nodosum* biotope is of considerable interest given its growth on intertidal reef substrate and that *A. nodosum* will be subject to harvest.

2.2 Conservation objectives: Protected Marine habitats and species.

This section provides a detailed description of the distribution, extent and conservations objectives for protected marine habitats and species in Clew Bay.

Objective 1: To maintain the large shallow inlets and bays in the Clew Bay Complex SAC.

1. **Permanent habitat area:** Encompasses all Annex I habitats in Clew Bay SAC.
   Conservation requirements: These areas must be maintained at favourable conservation conditions to ensure stability of the permanent habitat area (Ref: Target 1 of Objective 1, NPWS, 2011A, page 12)

2. **Zostera, Maerl:** there are extensive beds of eelgrass, *Zostera marina*, in the southern part of the Clew Bay Complex SAC, often occurring in combination with maerl (Merc Consultants, 2006, NPWS, 2011A). There are also a large number of species associated with *Zostera* dominated community, with much of the in-fauna species dominated by species within the order Amphipoda. Large patches are found from southern section to the south of Inishlyre, north and east of Crovinish and SE of Inishgort, with small patches located from Westport harbour between Green islands and Carricknamore (Figure 3a and 3c of NPWS, 2011A). Beds of live maerl, *Lithothamnion corallioides*, *Phymatolithon calcareum* are present in a number of areas, most notably within the southern part of the complex (Merc Consultants, 2006, NPWS, 2011A). Large patches of maerl are found from the main navigation channel leading into Westport Harbour. Other areas containing maerl include: East of Inishlyre and South of Inishraher, the Channel east of Inishleague, the channel leading to east of Inishgort lighthouse, Ilaanmore Harbour. Maerl also occurs in areas of strong current flow, e.g. between islands. Several species of Algae, sea anemones and crab also co-occur within Maerl dominated communities. Mearl typically occurs in the southeast of the site in coarse, mixed, sandy mud and sand sediments (NPWS, 2011A).
   Substrate: *Zostera* is found in sandy environs. Mearl is found in coarse, mixed, sandy mud and muddy sand sediments.

Conservation requirements: Maintain natural extent of *Zostera* & maerl dominated communities, high quality of *Zostera* dominated communities, and high quality of maerl dominated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13).

3. **Polychaetes and bivalves, *Nephtys cirrosa* and *Tubificoides benedii* and *Pygospio elegans* communities:** Polychaetes and bivalves community complex are widespread where soft sediment or sandy mud is present. This community occurs both intertidally and subtidally. The distribution of different species (e.g. *Melinna palmate, Thyasira flexuosa, Prionospio sp.* and *Mysella bidentata*) is quite variable between different regions such as in the North West, Westport and Newport bay. *Nephtys cirrosa* community typically occurs on fine and clean sand at the boundary of the Clew Bay site and the outer-reaches of Westport Bay to Inisheany, with associated communities including *Moerella donacina* and the amphipod *Bathyporeia guilliamsoniana*. *Tubificoides benedii* and *Pygospio elegans* community complex are found on intertidal sandy mud on shores from Trawoughter strand (northwest) to White strand (south). Recorded in Newport Bay, Westport Bay and Islands including Inishcottle, Inishbee and Clynish.

   Substrate: soft sediment(sandy mud), fine/clean sand and on Intertidal sandy mud.

   Conservation requirements: Maintenance of the following communities: Sandy mud with polychaetes and bivalves community complex; Fine sand dominated by *Nephtys cirrosa* community; Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).

4. **Reef and shingle:** Reef occurs intertidally on most coasts of the bay and most islands as a mixed substrata of pebbles and cobbles whilst occurring sub-tidally as boulders and cobbles (extensive in western margin with smaller patches at Newport Bay). Associated species in these areas include several fucoid species such as *Ascophyllum nodosum*. Characteristics of the *A. nodosum* biotope are described in greater detail in Section 2.6. Shingle occurs throughout the region and on the islands in particular and on the upper shore often behind fucoid dominated reef.

   Conservation requirements: Maintenance of the following communities: Shingle, reef (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).

Objective 2: To maintain the favourable conservation condition of Mudflats and Sandflats not covered by seawater at low tide.

1. **Mudflats and Sandflats:** These occur intertidally between mean low water mark and mean high water mark. Large expanses of sandflats occur on the North shore from Trawoughter Strand to Roskeen Pt. and also along shore of Westport. Small areas of mudflat and sandflat occur in Newport Bay and embayments on the eastern shore, while small patches are generally found around islands.

   Conservation requirements: The permanent habitat area is stable or increasing, subject to natural processes (Ref: Target 1 of Objective 2, NPWS, 2011A, page 14)

2. **Important sediment communities:**
   Fine sand dominated by *Nephtys cirrosa* community typically occurs on clean sand at the boundary of the Clew Bay site and the outer-reaches of Westport Bay to Inisheany, with associated communities including *Moerella donacina* and the amphipod *Bathyporeia guilliamsoniana*.
   Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complexes are found on shores from Trawoughter strand (northwest) to White strand (south). Recorded in Newport Bay, Westport Bay and Islands including Inishcottle, Inishbee and Clynish. Sandy mud with polychaetes and bivalves community is widespread where soft sediment is present. This community occurs both intertidally and subtidally. The distribution of different species (e.g. *Melinna palmate*, *Thyasira flexuosa*, *Prionospio* sp. and *Mysella bidentata*) is quite variable between different regions such as in the North West, Westport and Newport bay.
   Substrate: *Nephtys cirrosa* communities occur clean sand; *Tubificoides benedii* and *Pygospio elegans* community complex occur in intertidal sandy mud).
   Conservation requirements: Maintenance of *Nephtys cirrosa* community, *Tubificoides benedii* and *Pygospio elegans* community complex and polychaetes and bivalves community (Ref: Target 2 of Objective 2: NPWS, 2011A, page 14).

Objective 3: To maintain the favourable conservation condition of harbour seal (Annex II species) in Clew Bay Complex SAC.

1. **Species range:** Harbour seals occupy aquatic and terrestrial habitats in Clew Bay, including intertidal shorelines. The species is present during all aspects of its annual life cycle including breeding (approx. May-July), moulting (approx. August-September) and phases of non-breeding foraging and rest (approx. Oct-April).
   Conservation requirements: Species range should not be restricted by artificial barriers to site use (Ref: Target 1 of Objective 3, NPWS, 2011A, page 15).

2. **Breeding sites:** Harbour seals and their pups are vulnerable to disturbances during May-July, the time period just prior to and during the annual breeding season. This is due to the large amount to time spent in shallow waters or ashore. There are many established breeding locations used in Clew Bay, most of which occur in the Northern part of this complex.
   Conservation requirements: breeding sites should be maintained in a natural condition (Ref: Target 2 of Objective 3, NPWS, 2011A, page 15).

3. **Moulting sites:** There are several moult haul-outs in Clew Bay which are important sites for moulting, of which include: Inishdeashmore, Inishdeashbeg and adjacent skerries, Inishnakillew, Inisheeny, Carrickwee, Inishgowla South, Forillan, Finnaun Island, Carrickawart Island, Corillan, Carricknamore, Stony Island and adjacent skerries, the Green Islands and adjacent skerries.

Conservation requirements: moult-out sites should be maintained in a natural condition (Ref: Target 3 of Objective 3, NPWS, 2011A, page 15).

4. **Resting sites:** There are several resting haul-out sites in Clew Bay, of which include: Inishdeashbeg and adjacent skerries, Inishtubrid, Inishcuill, Carrickawart Island, Stony Island and adjacent skerries, the Green Islands and adjacent skerries.
   Conservation requirements: haul-out sites should be maintained in a natural condition (Ref: Target 4 of Objective 3, NPWS, 2011A, page 15).

5. **Human activities:** Man-made energy such as underwater noise or light, etc., or activities which deteriorate resources (e.g. water quality, feeding), can have a negative impact on natural behaviours and resources of harbours seals.
   Conservation requirements: human activities should occur at levels that do not adversely affect the harbour seal population at the site (Ref: Target 5 of Objective 3, NPWS, 2011A, page 16).

2.3 Conservation objectives: Protected Coastal habitats.

Coastal habitats also fall under the SAC status of Clew Bay. Similar to marine habitats and species, the NPWS have developed a set of standards to minimise human interference and damage these areas of Clew Bay (Ref: NPWS, 2011B). This covers the following four coastal habitats:

- Perennial vegetation of stony banks (1220)
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (1330)
- Annual vegetation of drift lines (1210)
- Embryonic shifting dunes (2110)
- Shifting dunes along the shoreline with *Ammophila arenaria* (2120)

Objective 1: To maintain the favourable conservation condition of Perennial vegetation of stony banks (1220; ref: pg. 6, NPWS, 2011B).
Defined as vegetation found at or above the mean high water spring tide mark on shingle beaches. Widespread in distribution both along the mainland and the islands of Clew Bay (Moore and Wilson, 1999; Ryle *et al.*, 2009)

Objective 2: To restore the favourable conservation condition of Atlantic salt meadows (ASM; *Glauco-Puccinellietalia maritimae*; 1330; ref: pg. 9, NPWS, 2011B).
ASM are stands of vegetation which occur along sheltered coasts. They are flooded periodically by the sea, restricted to an area between mid-neap tide level and high water spring tide level. Only one of the four types of salt marshes listed under Annex I of EU Habitats Directive (92/43/EEC), are listed as a "Qualifying Interest" for Clew Bay SAC, namely ASM. Salt marsh habitats are widespread in their distribution in Clew Bay, with ASM accounting for an estimated 38.86ha. Substrate: mud or sand.

Objective 3: To maintain and/or restore the conservation conditions of sand dune habitats (ref: pg. 15, NPWS, 2011B).

- **Annual vegetation of drift lines**: Distributed along the high tidal mark of Clew Bay and consists of a number of annual species. Contains tidal litter, including marine algae remains, faunal material and seeds.
- **Embryonic shifting dunes (2110):** Distributed above the strandline and represent a key primary stage of dune formation. Important species within this environment includes salt-tolerant sand couch (*Elytrigia juncea*) and lyme grass (*Leymus arenarius*).
- **Shifting dunes along the shoreline with *Ammophila arenaria* (2120):** Occurs in areas in which sand accumulates at a rapid rate. Marram grass (*Ammophila arenaria*) represents a key species in this biological environment, acting to invade and initiate transition of sand accumulation to mobile dunes. Growth of this species is actively stimulated by sand accumulation. These areas are dynamic and unstable.

2.4 Conservation objectives: Otters and Birds.

This section describes the distribution, extent and conservations objectives for otter and bird species in Clew Bay.

1. Otters *(Lutra lutra)*

Otters are widespread in Ireland in freshwater and coastal habitats. While the otter has declined in Ireland since the 1980s (NPWS, 2007), the species is still considered widespread and healthy compared to most European countries (current range covers 75 % of the total area of Ireland, Marnell *et al.*, 2011). Four out of five sites assessed from a total of 119.9km^2 area of river basin district in Clew Bay, were found to be positive for the presence of the otter (Bailey and Rochford 2006). Otters may feed to some extent on fish within the *A. nodosum* biotope (Kelly L. *et al.*, 2001). However, otters are more driven to habitats conducive to obtaining an adequate food source, for example, a positive relationship has been found between otter numbers and angling sites in Ireland (Bailey and Rochford, 2006). While otters are somewhat tolerant to human presence, the species is considered to be in decline in many parts of Europe with significant risks including roads, fishing nets and lobster pots (NPWS, 2007). Organochlorine pesticides are also widely accepted as having severely reduced otter population sizes in the UK (Jones and Jones, 2002). In terms of extent and distribution of the species in Clew Bay, otters utilize a wide number of habitats and areas (NPWS, 2011C), summarized as follows:

- **Freshwater aquatic & terrestrial:** Otters occupy freshwater rivers from source to estuary. There are several rivers, lakes and lagoons of relevance to the otter in Clew Bay including: Lough Furnace (inc. the mouth of the lake), four locations along the southern coast and three along the eastern coast. In addition, Inishgowla south contains a small freshwater terrestrial habitat, located towards the eastern shore of the island (NPWS, 2011C and references therein). The extent of freshwater habitats in Clew Bay typically include a 10m terrestrial buffer zone around the shoreline (above HWM and along river banks).
- Otter habitats typically develop in a linear fashion, with many habitats observed at river catchments. There are extensive linear habitats in the vicinity of Lough Furnace and the Burrishoole catchment area.
- **Marine aquatic and terrestrial:** Otters have potential to forage within 80m of the shoreline. Their extent is likely to encompass the entire SAC, including the islands. Commuting zones between island and coastlines are also considered to be extensive. Otters require that marine and freshwater habitats be maintained to levels which facilitate a broad array of biological imperatives including foraging, breeding and resting.

Conservation requirements:

In accordance with NPWS, 2011C, the conservation objectives for Otter (Lutra lutra; 1355) are to restore the favourable conservation condition of Otter in the Clew Bay Complex SAC, as defined by the following list of attributes and targets:

Target 1: No significant decline in distribution (i.e. positive survey sites).

Target 2: No significant decline in extent of terrestrial habitat.

Target 3: No significant decline in extent of marine habitat.
Target 4: No significant decline in extent of freshwater (river) habitat.
Target 5: No significant decline in extent of freshwater (lake/lagoon) habitat.
Target 6: No significant decline in number of Couching sites and Holts (minimize disturbance)
Target 7: No significant decline in fish biomass available.
Target 8: No significant increase in barriers to connectivity.

2. Birds:

Clew Bay SAC is not designated as a Special Protection Area (SPA). Nonetheless, it is important to assess the potential impact(s) associated with hand harvesting of *A. nodosum* on protected bird species in Clew Bay given that:
(a) the complex is known to support a number of breeding and wintering bird populations of national importance.
(b) there are a number of important SPAs located near to Clew Bay, including such as Owenduff/Nephin Complex SPA/SAC (site Code 000534) to the north and Clare island SPA (site code 004136) to the west.

Species listed on Annex I of the E.U. Birds Directive (2009/147/EC): the Common Tern, Arctic Tern, Little Tern, Barnacle Goose, Great Northern Diver and Bartailed Godwit (as indicated on NPWS Site Synopsis for Clew Bay).

Species which reach important numbers in Clew Bay: Red-breasted Merganser, Ringed Plover, Barnacle Geese (present on islands in winter), Great Northern Diver, Brent Goose, Shelduck, Wigeon, Teal, Mallard, Oystercatcher, Cormorant, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Turnstone (as indicated on NPWS Site Synopsis).

Distribution: Protected bird species and their distribution in Clew Bay is described in detail in Appendix 6. Datasets were obtained from the following sources:

- **The Irish Wetland Bird Survey (I-WeBS):** data describing the broad distribution of winter bird species within four subsites of Clew Bay (personal correspondence with BirdWatch Ireland, between 2013-2020).
- **NPWS:** data describing specific breeding and wintering sites of relevance to important bird species within Clew Bay (data obtained on 03_12_2013)

Conservation requirements: none specified by NPWS 2011A or 2011B. Clew Bay is not an SPA. However, there are a number of important sites in the complex which support protected species of breeding and wintering birds (NPWS, *pers. comm.* 03/12/2013). Site-specific details are outlined in Appendix 6.

2.5 Species & habitats of General Interest

This section describes the conservation requirements, where applicable, for species and habitats of general interest in Clew Bay.

1. Fish and fisheries species:
The Burrishoole Catchment area of Clew Bay represents an important habitat for migratory fish species such as trout and salmon, and is regarded as a major European and World Index site. In particular, sea trout and salmon smolts enter the sea at Clew Bay, while post-smolt and adult sea trout also feed within the bay. Other fish species may use *A. nodosum* zones for purposes which include feeding, reproduction or sheltering (Kelly L. *et al.*, 2001 and references therein). Marine fish, shellfish, invertebrates and fisheries species utilize a broad range of habitats during early and adult life stages, including: deep water areas, estuarine mud areas, saltmarsh, seagrass, lagoons, maerl, subtidal gravel/coarse bottom, subtidal soft bottom areas, intertidal soft bottom areas and exposed shores.
Conservation requirements: none specified by NPWS 2011A or 2011B.

2. Lough Furnace:
A rare deep, permanently stratified, saline lake lagoon located at the north-eastern corner of Clew Bay. Species on its exterior include: Common Reed (*Phragmites australis*), Common Club-rush (*Scirpuslacustris*), Small patches of Great Fen-sedge (*Cladium mariscus*) and Bottle Sedge (*Carex rostrata*). Other important flora and fauna within this environment includes: two rare amphipods (*Lembos longipes* and *Leptocheirus pilosus*), *Neomysis integer*, *Jaera albifrons*, *J. ischiosetosa* and *J. nordmanni*, Irish species of tasselweed (*Ruppia maritima* and *R. cirrhosa*), eel, flounder, mullet, mallard nest and black-headed Gull.
Conservation requirements: none specified by NPWS 2011A or 2011B.

3. The Rosmurrevagh area:

- Contains a diverse range of species within habitats including the seashore, dunes, coastal grassland, saltmarsh, bog and fen. These are summarized as follows: Bog/fen type vegetation: Bog Asphodel and Cuckooflower (*Cardamine pratensis*), Bog Mosses, sedges, Bog-myrtle (*Myrica gale*), Irish Heath, Soft Rush (*Juncus effusus*), Water Mint (*Mentha aquatica*) and Yellow Iris (*Iris pseudacorus*).
- Coastal grassland species: Common Ragwort (*Senecio jacobaea*), Daisy (*Bellis perennis*), Dandelion (*Taraxacum officinale*), Heath Wood-rush (*Luzula multiflora*), Ribwort Plantain (*Plantago lanceolata*) and Yarrow (*Achillea millefolium*).
- Saltmarsh vegetation (5 m wide): Common Saltmarsh-grass (*Puccinellia maritima*), Common Scurvygrass, Thrift and 'turf fucoids' (diminutive forms of brown algae).

Conservation requirements: salt marshes, sand dunes (NPWS 2011B)

2.6 A. nodosum Biotope and species therein

This section provides a summary of the species residing within the *A. nodosum* biotope. The *A. nodosum* biotope in Ireland supports a diverse epibiota including members of the Animalia, Plantae, Chromalveolata Families and several Phyla therein. This includes sessile epibiota attached to *A. nodosum*, mobile fauna and predatory animals (fish, birds, otters). The impact of hand harvesting of *A. nodosum* in Clew Bay on the biodiversity within the *A. nodosum* biotope has been assessed by Kelly L. *et al.,* (2001). This data provides a strong framework in which to assess the potential impacts of the plans by BioAtlantis to hand harvest *A. nodosum* on this biotope. The study by Kelly L. *et al.,* (2001), is detailed in its scope and includes the following:

- Kingdom *Animalia:*
  - Phylum Mollusca (Winkles, Limpets).
  - Phylum Arthropoda (Barnacles).
  - Phylum Cnidaria (Hydroid. e.g. *Dynamena pumila Linnaeus*).
  - Phylum Porifera (Sponges, e.g., *Leucosolenia sp. Bowerbank*, *Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu*).
  - Phylum Chordata (Sea squirts, e.g. *Ascidiella*).
  - Phylum Arthropoda (Amphipods, isopods crabs, *Chironomida*, *Halacaridae*, *Ostracoda*).
  - Phylum Platyhelminthes (e.g. *Turbellaria*).
  - Phylum Annelida.
  - Phylum Foraminifera.
  - Phylum Nematoda.

- Kingdom Plantae:
  Phylum Rhodophyta (Red algae, e.g.: *Polysiphonia lanosa (Linnaeus) Tandy*, *Mastocarpus stellatus (Stackhouse) Guiry*, *Chondrus crispus Stackhouse*, *Corallinaceae*; Ephemeral green algae, e.g. *Cladophora rupestris (Linnaeus) Kützing*, *Ulva sp.*, *Linnaeus* and *Enteromorpha* sp. Link); Other seaweed species: *Lomentaria articulata (Hudson) Lyngbye*; *Membranoptera alata (Hudson) Stackhouse*).

- Kingdom Chromalveolata:
  Phylum Heterokontophyta (*Ascophyllum nodosum*, *Fucus vesiculosis Linnaeus* and *Fucus serratus Linneaus*).

Summary of species residing within the *A. nodosum* biotope:

- Barnacles and limpets (e.g. Semibalanus balanoides *Linnaeus*, *Elminius modestus Darwin* and *Patella vulgata Linnaeus*).
- Periwinkles (e.g. *Littorina obtusata Linnaeus* and *Littorina littorea Linnaeus*; snails which graze some epiphytes from *A. nodosum* surface).
- Red algae *Polysiphonia lanosa (Linnaeus) Tandy* (epiphyte of *Ascophyllum nodosum*)
- *Fucus vesiculosis Linnaeus* and *Fucus serratus Linneaus* (occurs alongside *Ascophyllum*).
- Other seaweed species: *Lomentaria articulata* (Hudson) *Lyngbye* and *Membranoptera alata (Hudson) Stackhouse*, occur under tidal swept conditions.
- Hydroid (*Dynamena pumila Linnaeus*; may be found on tips of *A. nodosum*).

- Red algae *Mastocarpus stellatus (Stackhouse) Guiry*, *Chondrus crispus Stackhouse* and *Corallinaceae* (located beneath the canopy).
- Ephemeral green algae (e.g. *Cladophora rupestris (Linnaeus) Kützing*, *Ulva sp. Linnaeus* and *Enteromorpha* sp. Link; low densities).
- Sponges (e.g., *Leucosolenia* sp. *Bowerbank*, *Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu*; occur on steep surfaces and under boulders in areas of strong tidal currents).
- Ascidians (e.g. *Dendrodoa grossularia van Beneden* and *Ascidiella scabra O.F. Müller*; occur on steep surfaces and under boulders in areas of strong tidal currents).
- Mobile species: Amphipods, isopods crabs, *Annelida*, *Chironomida*, *Foraminifera*, *Halacaridae*, *Mollusca*, *Nematoda*, *Ostracoda*, *Turbellaria*.

Conservation requirements: As part of the SAC, it is important to assess the potential impacts that hand harvesting could have on the *A. nodosum* biotope, particularly given the presence of the biotope on intertidal reef substrate and that *A. nodosum* will be harvested.

2.7 Continual disturbance, broad, cumulative and in combinational effects and spread of invasive species.

From assessment of conservation requirements for Clew Bay and through consultations with NPWS, it has been established that greater details are required in order to assess the potential impacts of harvesting in terms of: continual disturbance levels, broader effects of harvesting, in combination and cumulative effects and potential spread of invasive species. Key aspects of these requirements are summarised below:

(a) Continual disturbance levels:

NPWS recommend that <u>continuous disturbance of each community type should not exceed an approximate area of 15% (NPWS 2011A)</u>, covering:

- Shingle.
- Reef.
- *Zostera* Community.
- Maerl Dominated community.
- Fine Sands Dominated by *Nephtys cirrosa* community.
- Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex.
- Mudflats & sandflats not covered by seawater at low tide.

(b) Broad, holistic examination of effects:

It is required that a broader, holistic examination of the effects of hand harvesting be carried out with respect to:

1. The spatial extent of harvesting techniques and activities:
    - Management of expansive and prolonged operations.
    - Numbers of personnel and exploitation levels.

2. The potential interaction effects of seaweed harvesting:
   - Targeted removal of species.
   - Non-targeted removal of species.
   - Disturbance and displacement of species and habitats.
   - Changes in community structure.
   - Changes in hydrodynamics and water quality.
   - Potential disturbance of marine fauna.
   - Potential interactions with coastal habitats.

(c) Cumulative and in-combinational effects

1. Existing Operations: Potential cumulative, in-combination effects and interactions:
   - Unlicensed, traditional and casual harvesting of seaweed.
   - Recreation & Tourism.
   - Aquaculture and fisheries activities.
   - Harvesting of invertebrates.

2. Planned Operations: Potential cumulative, in-combination effects and interactions:
   - Other planned harvest activities.
   - Recreation & Tourism.
   - Aquaculture and fisheries activities.
   - Harvesting of Invertebrates.

3. Vector potential of harvest activities in the spread of invasive species.

Section 3: Assessment of likely effects of the proposed plan (prepared by BioAtlantis Ltd.)

3.1 Identification of likely effects of proposed plan or project:

3.1.1 Introduction

The Impact Assessment described in this section was carried out by staff at BioAtlantis Ltd. rather than through use of outside consultants. This was to ensure that staff were fully informed of the potential risk(s) associated with hand harvesting of *A. nodosum* on Clew Bay. The initial assessment by BioAtlantis formed a key foundation in the development of the management plan and the harvesting Code of Practice (Appendix 4). In assessing the potential impacts of the plan to hand harvest *A. nodosum* on the conservation objectives of the Clew Bay SAC, BioAtlantis applied a conservative, precautionary approach and in the case of uncertainty, it was assumed that the effects have potential to be significant. This allowed for the development of a plan based on best scientific knowledge to ensure that any potentially negative impact(s) of hand harvesting of *A. nodosum* on the biological environs of this region are prevented or minimized. This assessment was also used to develop a management system with appropriate control measures, monitoring and corrective actions for potential hazards (see Tables 10, 11 and 12 in Section 3.3.6; Table 16 in Section 3.6.6).

On identification of a number of potential hazards, BioAtlantis proceeded to contact Ecofact Environmental Consultants Ltd. in order to assess whether or not a Natura Impact Statement (NIS) was required. The NIS is attached as a separate stand-alone document to this application and validates the mitigation measures and Code of Practice developed by BioAtlantis in ensuring that the sustainable harvest management plan does not negatively impact on species and habitats of the SAC. During this process, NPWS provided recommendations on 30th July 2014, as to areas in need of improvement in the NIS. The NIS and plan was updated accordingly. Following public consultation, the NIS was updated further between 2020 and 2024 and is provided along with this application.

3.1.2 Data sources:

Clew Bay is part of an ecological network of protected areas in the EU, known as ‘Natura 2000’. Article 6, EU habitats Directive (92/34/EEC), states:

“Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subjected to appropriate assessment of its implications for the site in view of the site’s conservation objectives”.

In accordance with NPWS requirements (NPWS, 2012) and EU Law, the likelihood of this plan affecting Clew Bay SAC must be assessed based on:

(a) preliminary consideration of the likely impacts of a proposed activity and

(b) determination of whether there is a risk that the effects identified could be significant.

In assessing the potential impact of hand harvesting of *A. nodosum* in Clew Bay, all direct, indirect and cumulative effects have been considered by BioAtlantis through use of all available information. This includes the peer-reviewed literature, existing datasets and environmental impact reports undertaken in the area. The biodiversity within Clew Bay and the impacts of hand harvesting of *A. nodosum* on these environs, has been examined extensively since the mid-1990s. In particular, Annex I and II of EU Habitats Directive 92/43/EEC Marine habitats and protected species and communities therein have been assessed in Clew Bay in several surveys and reports (BioMar, 1995, Dúchas, 1999, Anon, 2002, Merc Consultants, 2006, NPWS, 2011A). Data from early work in this area (BioMar, 1995, Dúchas, 1999) has been built upon and in some cases has also been used to identify and confirm holding species in sites of interest. Unlike Galway Bay and some other SAC complexes, a large amount of broadscale habitat mapping data is available for Clew Bay SAC via the Broadscale Mapping Project of this region (Anon, 2002). The data outputs derived from this work was built upon by Merc Consultants (2006) and this has provided a more accurate interpolation of the likely distribution and extent of these biological systems and species within the Clew Bay Complex SAC (Merc Consultants, 2006 and NPWS 2011A). A total of 1796 georeferenced data points were recorded in the site which constituted a significant amount of data in which to determine the distribution and extent of sensitive subtidal communities. Based on this and other data, the NPWS have developed a set of guidelines to minimise human interference and damage to important areas and species within this SAC (Ref: NPWS, 2011A).

In the case of Coastal Habitats, BioAtlantis has also assessed the requirements outlined by the NPWS (2011B). The many surveys/reports undertaken in these areas provide an important basis for the targets which have been set. These include the National Shingle BeachSurvey (NSBS; Moore & Wilson, 1999), the Saltmarsh Monitoring Project (SMP; McCorry, 2007; McCorry & Ryle, 2009) and the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009). This has allowed BioAtlantis to assess potential risks to relevant biological environments and to develop a plan which minimizes and prevents any potential negative impact of *A. nodosum* hand harvesting activities on this region. This is outlined in the following pages, with specific reference to the objectives, targets and attributes described by the NPWS, 2011B.

Otters are listed as Annex II protected species within this SAC and a detailed list of conservation objectives are outlined by (NPWS, 2011C). Close attention was placed by BioAtlantis on major sites of relevance to otters, in particular, the Burrishoole Channel and Lough Furnace and other fresh water environs associated with the complex. In addition, the life-cycle requirements and sensitivity of the otter to human disturbance was also considered closely. While not a SPA, Clew Bay is host to a number of Annex I species protected under the EU Birds Directive. Site-specific data describing sites of relevance to important wintering and breeding bird species in Clew Bay were provided to BioAtlantis, courtesy of the NPWS (*pers. comm.* 03/12/2013). Additional datasets were provided courtesy of BirdWatch Ireland (*pers. comm.,* 15 – 27th Nov 2013 and 2020).

3.1.3 Preliminary consideration of the likely impacts of a proposed activity:

With respect to NPWS requirements (NPWS, 2012) a number of potential effects which are relevant to the proposed plan have been identified and include:

1. Permanent habitat loss (e.g. sand, shingle, stones).
2. Displacement/exclusion of species (e.g. harbour seals).
3. Visual presence (e.g. harbour seals).
4. Noise disturbance (e.g. harbour seals).
5. Abrasion / Physical disturbance (e.g. *A. nodosum* growth substrate).
6. Selective extraction of target species (e.g. *A. nodosum*).
7. Selective extraction of nontarget species (e.g. *Fucus* sp.).
8. Suspended sediment (e.g. mudflats).
9. Changes in hydrodynamic regime*.
10. Changes in nutrient levels (*A. nodosum* as a source of carbon)*
11. Introduction of non-native species *(e.g. Didemnum vexillum)*†

*covered in Section 3.5.3, part (e) and (g) respectively.
†covered in Section 3.6.4.

Important potential effects which are deemed to have no relevance to this application include: Smothering, desiccation, changes in emergence regime, changes in water flow rate, changes in temperature, changes in turbidity, synthetic compound contamination, heavy metal contamination, hydrocarbon contamination, changes in salinity, changes in oxygenation, introduction of microbial, pathogens / parasites.

3.2. Risk Assessment (Scope & Methodology)

3.2.1. Scope of the Assessment

The scope of the risk assessment carried out by BioAtlantis Ltd. covers the following six categories:

- Impact on protected marine and coastal habitats & species in Clew Bay (according to Annex I & II of EU Habitats Directive 92/43/EEC; see Sections 3.3.1 – 3.3.3).
- Impact on species & habitats of general interest (Section 3.3.4).
- Impact on the *A. nodosum* biotope and species therein (Section 3.3.5).
- Continuous disturbance levels (not exceeding an area of 15%; see Section 3.4).
- Broad, holistic examination of the nature, extent and impact of hand harvesting (Section 3.5).
- Cumulative and in Combination Impacts (Section 3.6).
- Spread of invasive species (Section 3.6).
- The conservation status of marine Annex I habitats.
- Potential pressures on the marine environment.

3.2.2. Methodology employed

The initial risk assessment by BioAtlantis involved:

(a) the identification of the nature of the potential hazard (i.e. biological, chemical or physical),

(b) calculation of the probability of such hazards occurring and

(c) determination of the severity of a given hazard as measured by their impact on the conservation objectives for the SAC region.

The pre-cautionary principal was applied in each calculation, with significance measured by means of 5x5 risk evaluation matrices. Data and information used in this assessment included all relevant environmental impact assessments in the Clew Bay area, the peer-reviewed scientific literature, NPWS requirements and information generated from an on-site survey by BioAtlantis, as outlined in Appendix 1 (see also Section 2 & 3.1 for further details). Mitigation measures were deemed absolutely necessary for risk ratings exceeding a score of 15. For moderate risks of 8-12, control measures were deemed necessary to ensure sufficient control and oversight over potential hazards. In such cases, it was deemed necessary to proceed with working in conjunction with independent environmental consultants to determine whether or not a full NIS was required. Where low risks were identified (1-6), control measures were developed where appropriate. This approach provided a framework for developing a management system (Sections 1.2 & 1.3) with clearly specified action/non-conformance limits, monitoring schedules and analytical procedures, coupled with robust corrective actions and verification methods (see tables in Sections 3.3.6 & 3.6.6). A Code of Practice for protection of sensitive species in the SAC was also developed and is provided in Appendix 4. The risk evaluation system and decision tree employed are described in detail in Appendix 5.

3.3. Results of Risk Assessment (Direct and indirect impacts):

The following section describes the findings of the risk assessment undertaken by BioAtlantis (see Table 9 for brief results summary). Detailed tables are provided in Section 3.3.6 and 3.6.6, which outline the results of the associated risk assessments along with control measures, action limits and monitoring and verification methods where applicable (See Tables 10, 11, 12, 16). The decision matrices used in calculating probability, severity and risk are also provided in Appendix 5, along with detailed explanations as to the scientific reasoning behind each decision made and scores assigned. In brief, risk ratings have been grouped into three categories:

15 – 25 High risk, requiring mitigation measure; NIS required.
8 - 12 Moderate risk, establish control procedures; NIS may be required.
1 – 6 Low risk, establish control procedures if appropriate; NIS may be required.

The potential risk level associated with hand harvesting of *A. nodosum* on (i) protected species and habitats, (ii) general species and habitats of interest, and (iii) those within the *A. nodosum* biotope, are provided in summary format in Table 9 below. The table also includes results from analysis of (iv) extent of continual disturbance, (v) broad examination of impacts and (vi & vii) potential in combination and cumulative impacts and (viii) potential impacts on the spread of invasive species. See Table 10, 11, 12, 16 in Section 3.3.6 and 3.6.6 for a summary of control measures, monitoring & corrective actions. See Appendix 5 for details of the analysis.

No	(i) Marine & Coastal species & habitats (as protected under Annex I & II of EU Habitats Directive 92/43/EEC).	Risk
1	**Permanent habitat area**	Low- Moderate
2	**Seagrass, *Zostera* marina (and associated communities).**	Low
3	**Maerl Dominated communities**	Low
4	**Polychaetes & bivalves community complex (Sandy mud areas)** Distinguishing species: *Prionospio* sp., *Melinna palmate*, *Thyasira flexuosa*, *Mysella bidentata* Abra alba	Moderate
5	***Nephtys cirrosa* community (clean, fine sand areas)** Associated communities: *Moerella donacina* & the amphipod *Bathyporeia guilliamsoniana*	Moderate
6	***Tubificoides benedii* and *Pygospio elegans* community complex (Intertidal sandy mud areas)** Associated communities: *Tubificoides benedii*, *Pygospio elegans*, *Capitella* sp., *Nematoda* sp., *Hydrobia ulvae, Corophium volutator*	Moderate
7	**Shingle (pebbles and gravel)** Associated communities:Talitrid amphipods	Moderate
8	**Reef:** Associated communities: *Ascophyllum nodosum, Fucus vesiculosis, Laminaria hyperborea, Laminaria digitata, Alcyonium digitatum, Metridium senile, Esperiopsis fucorum, Myxilla fimbriata, Pelvetia canaliculata, Fucus spiralis, Laminaria saccharina, Saccorhiza polyschides, Cliona celata, Halichondria panicea, Aslia lefevrei, Pawsonia saxicola.* ***NOTE:*** *A. nodosum & associated communities were assessed separately in (iii) below.*	Moderate
9	**Mudflats and sandflats not covered by seawater at low tide.**	Moderate

	Associated communities: Not specified	
10	**Harbour seals: General**	Moderate
11	**Harbour seal:** Effects on Species range due restriction by artificial barriers to site use	n/a
12	**Harbour seal:** Breeding sites.	Moderate
13	**Harbour seal:** Moulting sites.	Moderate
14	**Harbour seal:** Resting sites.	Moderate
15	**Perennial vegetation of stony banks**	Low
16	**Atlantic salt meadows**	Low
17	**Sand dune habitats**	Low
18	**Otter *(Lutra lutra)***	Low
19	**Birds:** **Protected species:** Common Tern, Arctic Tern, Little Tern, Barnacle Goose, Great Northern Diver and Bartailed Godwit. **Unprotected species:** Red-breasted Merganser, Ringed Plover, Barnacle Geese (present on islands in winter), Great Northern Diver, Brent Goose, Shelduck, Wigeon, Teal, Mallard, Oystercatcher, Cormorant, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Turnstone.	Low
No	**(ii) Impact on general species & habitats of Clew Bay.**	**Risk**
1	**Fish (Burrishoole Catchment area of Clew Bay)**	Low
2	**Lough Furnace habitat:** **Associated communities:** • Species on its exterior include: Common Reed (*Phragmites australis*), Common Club-rush (*Scirpuslacustris*), Small patches of Great Fen-sedge (*Cladium mariscus*) and Bottle Sedge (*Carex rostrata*). • **Other important flora & fauna:** two rare amphipods (*Lembos longipes* and *Leptocheirus pilosus*), *Neomysis integer*, *Jaera albifrons*, *J.ischiosetosa* and *J. nordmanni*, Irish species of tasselweed (*Ruppia maritima* and *R. cirrhosa*), eel, flounder, mullet, mallard nest and black-headed Gull.	Low
3	**Rosmurrevagh habitat:** Diverse range of species: • **Bog/fen type vegetation:** Bog Asphodel and Cuckooflower (*Cardamine pratensis*), Bog Mosses, sedges, Bog-myrtle (*Myrica gale*), Irish Heath, Soft Rush (*Juncus effusus*), Water Mint (*Mentha aquatica*) and Yellow Iris *(Iris pseudacorus).* • **Coastal grassland species:** Common Ragwort *(Senecio jacobaea),* Daisy *(Bellis perennis),* Dandelion *(Taraxacum officinale),* Heath Wood-rush (Luzula multiflora), Ribwort Plantain *(Plantago lanceolata)* and Yarrow *(Achillea millefolium).* • **Saltmarsh vegetation** (5 m wide): Common Saltmarsh-grass *(Puccinellia maritima),* Common Scurvygrass, Thrift and 'turf fucoids' (diminutive forms of brown algae).	Low
No	**(iii) Impact on the *Ascophyllum nodosum* Biotope and species therein**	**Risk**
1a	***A. nodosum***	Moderate
1b	***Fucus vesiculosis Linnaeus* and *Fucus serratus Linneaus***	Low
2a	**Red algae:** *Polysiphonia lanosa (Linnaeus) Tandy*	Low
2b	**Red algae:** *Mastocarpus stellatus (Stackhouse) Guiry*, *Chondrus crispus Stackhouse* and *Corallinaceae*	Low
2c	**Ephemeral green algae** (e.g. *Cladophora rupestris (Linnaeus) Kützing*, *Ulva sp. Linnaeus* and *Enteromorpha* sp. Link)	Low
2d	**Other seaweed species:** *Lomentaria articulata* (Hudson) *Lyngbye* and *Membranoptera alata (Hudson) Stackhouse*)	Low
3a	**Winkles**: (e.g. *Littorina obtusata Linnaeus* and *Littorina littorea Linnaeus*).;	Moderate
3b	**Limpets**	Moderate
3c	**Barnacles**	Low
3d	**Hydroid** (*Dynamena pumila Linnaeus*)	Low

3e	**Sponges** (e.g., *Leucosolenia* sp. *Bowerbank*, H*alichondria panicea Pallas* and *Hymeniacidon perleve Montagu*)	Low
3f	**Sea squirts** (e.g. *Ascidiella*)	Low
3g	**Other mobile species:** (Phylum Arthropoda (Amphipods, isopods crabs, *Chironomida*, *Halacaridae*, *Ostracoda*), Phylum Platyhelminthes (e.g. *Turbellaria*), Phylum Annelida, Phylum Foraminifera, Phylum *Nematoda*)	Low
No	**(iv) Continuous disturbance**	Risk
D1	**Shingle**	Moderate
D2	**Reef**	Moderate
D3	***Zostera* Community**	Low
D4	**Maerl Dominated community**	Low
D5	**Fine Sands Dominated by *Nephtys cirrosa* community**	Low
D6	**Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex**	Low
D7	**Mudflats & sandflats not covered by seawater at low tide**	Moderate
No	**(v) Broad, holistic examination of the nature, extent and impact of hand harvesting.**	Risk
e1	**The spatial extent of harvesting techniques and activities.**	
(i)	**Management of expansive and prolonged operations**	Moderate
(ii)	**Numbers of personnel and exploitation levels**	Moderate
e2	**The potential interaction effects of seaweed harvesting**	
(i)	**Targeted removal of species**	Moderate
(ii)	**Non-Targeted removal of species**	Moderate
e3	**Disturbance and displacement of species and habitats**	
(i)	**Reef**	Moderate
(ii)	**Amphipods and isopods**	Low-Moderate
e4	**Changes in community structure**	Moderate
e5	**Changes in hydrodynamics and water quality**	Low
e6	**Potential disturbance of Marine Fauna**	Low
e7	**Potential interactions with coastal habitats**	
(i)	**Atlantic salt meadows (ASM)**	Low
(ii)	**Sand dune habitats**	Low
No	**(vi) Existing Operations: potential in-combination effects and interactions.**	Risk
f1	**Unlicensed, traditional and casual harvesting of seaweed.**	Moderate
f2	**Recreation and Tourism.**	Moderate
f3	**Aquaculture.**	Moderate
f4	**Harvesting of invertebrates.**	Moderate
No	**(vii) Planned Operations: potential in-combination effects and interactions.**	Risk
g1	**Planned and other harvest activities.**	None identified
g2	**Recreation and Tourism.**	Moderate
g3	**Aquaculture.**	Moderate
g4	**Harvesting of invertebrates.**	None identified
No	**(viii) Invasive species**	Risk
h1	***Bonamia ostreae, Botrylloides violaceus, Caprella mutica, Crassostrea gigas, Crepidula fornicate, Didemnum vexillum, Perophora japonica, Sargassum muticum Spartina anglica or Styela clava.***	Low

Table 9 : Summary of Results of Risk Assessment

3.3.1 Impact on protected marine habitats and species.

The results of the risk assessment, undertaken by BioAtlantis, on the potential impacts of hand harvesting on protected marine habitats and species is described in this section, along with the control measures where applicable.

Objective 1: To maintain the large shallow inlets and bays (habitat code 1160) in the Clew Bay Complex SAC (ref: pg. 12-13, NPWS, 2011A)

Permanent habitat area: Encompasses all Annex I habitats in Clew Bay Complex SAC

- Risk of affecting site/species: Low-moderate risk of biological, chemical and physical hazards (range rating of 3-10, see Table 10(1) and Appendix 5(a1)).
- Explanation:
  - Biological: The likelihood of sand and rocks being removed along with harvested *A. nodosum* is low given that:

    (a) such materials may damage production equipment and training will be provided, where necessary, to ensure that correct cutting and loading techniques are used.

    (b) harvested *A. nodosum* will be collected in floating nets/bags. This system ensures settlement to the seabed of any rarely occurring sand or other shore material that may be attached to the bottom or sides of the bag or in the netting containing the harvested weed.
  - Chemical: It is highly improbable that a chemical hazard will occur given that no chemicals will be carried on board a boat, except for small quantities of standard cleaning material and fuel oil. Fuel oil is unlikely to leak as boat engines will be regularly maintained.
  - Physical: hazards in the form of debris being inadvertently deposited into the environment are unlikely to occur, as harvesters will receive general cleaning, hygiene and waste disposal training.
- Control measures (if applicable): measures are in place to ensure adequate training is provided to harvesters, where necessary, to ensure no removal of permanent habitat area (e.g. measures are in place to prevent removal of excessive levels of sand, shingle, stones, pebbles, gravel, *A. nodosum* holdfast, etc). Harvested seaweed will be inspected on collection, on the boat, at the pick-up point and/or at the processing facility. Having the ability to trace the seaweed to a specific harvester will ensure that issues such as removal of excessive levels of sand, shingle or debris are identified and addressed effectively. Should excess material be observed in water, the separator or mill, additional training for harvesters will be provided where necessary. Production Operators will inspect the incoming harvest and record details as to the quality of the harvested seaweed on production logsheets, including the presence or absence of contaminants such as *Fucus* sp., sand, stones and holdfast material, etc. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(1) and Appendix 5(a1).

***Zostera* & Maerl**

- Risk of affecting site/species: Low risk of potential biological hazard in the form of removal of habitat of rare & endangered species (risk rating=5). No chemical or physical hazards have been identified (see table 10(2, 3) and Appendix 5(a2-3)).
- Explanation: It is highly improbable that the distribution, abundance, diversity or area occupied by *Zostera* or maerl will be affected due to harvesting of *A. nodosum* given that: (a) *Zostera* and maerl dominated communities exhibit little overlap with the rocky

shorelines in which *A. nodosum* will be harvested and (b) *Zostera* and maerl growth substrates are insufficient to support growth of *A. nodosum* and thus, will not be affected by harvest activities.

- Control measures (if applicable): Harvest will not occur in these areas. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(2-3) and Appendix 5(a2-3).

Polychaetes and bivalves communities (soft sediment/sandy mud areas):

- Risk of affecting site/species: Moderate risk of potential biological hazard in the form of removal of habitat of rare & endangered species (risk rating=10). No chemical or physical hazards have been identified (see table 10(4) and Appendix 5(a4)).
- Explanation: the probability of affecting the distribution, abundance, diversity or area of sandy mud occupied by polychaete & bivalve community complex due to harvesting of *A. nodosum* is reduced given that: (a) the sandy mud areas containing these communities exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested, (b) sandy mud areas are insufficient to support growth of *A. nodosum* and thus, will not be targeted for harvest activities and (c) accessing rocky shorelines that lie beyond mudflat/sandflat areas at low tide, is very difficult and would be avoided by harvesters by default.
- Control measures (if applicable):
  Boats shall only be operated at high tide or when the tide has begun to recede, when seeking to access rocky shorelines located beyond mudflat/sandflat areas. A code of practice will be put in place to ensure that under no circumstances will harvesters disrupt mudflat/sandflat areas, particularly in cases where harvest occurs in the Northern or Southern sections of Clew Bay (see Appendix 4). For details on action limits, analytical procedures monitoring and corrective actions, see table 10(4) and Appendix 5(a4).

***Nephtys cirrosa* community** (clean, fine sand areas)

- Risk of affecting site/species: Moderate risk of potential biological hazard in the form of removal of habitat of rare & endangered species (risk rating=10). No chemical or physical hazards have been identified (see table 10(5) and Appendix 5(a5)).
- Explanation: The probability of the distribution, abundance, diversity of fine sand communities dominated by *Nephtys cirrosa* being altered due to harvesting of *A. nodosum* is reduced given that: (a) the fine sand areas containing this community exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) fine sand areas are insufficient to support growth of *A. nodosum* and thus, will not be targeted for harvest activities and (c) accessing rocky shorelines that lie beyond fine sand areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
- Control measures (if applicable): In areas of the south-west where fine sand areas dominated by *Nephtys cirrosa* community occur, boats shall only be operated at high tide or when the tide has begun to recede when attempting to reach rocky shores beyond these areas. A code of practice will be put in place to ensure that under no circumstances will harvesters disrupt these clean, fine sand areas (see Appendix 4). For details on action limits, analytical procedures monitoring and corrective actions, see table 10(5) and Appendix 5(a5).

***Tubificoides benedii* and *Pygospio elegans* communities (intertidal sandy mud areas):**

- Risk of affecting site/species: Moderate risk of potential biological and physical hazards in the form of removal of habitat of rare & endangered species or disruption of intertidal sandy mud (risk rating=10 respectively). No physical or chemical hazards have been identified (see table 10(6) and Appendix 5(a6)).
- Explanation: The probability of the habitat and species from intertidal sandy mud areas in Clew Bay being altered due to harvesting of *A. nodosum* is reduced given that:

  (a) *A. nodosum* does not grow on intertidal sandy mud substrate, and therefore will not be subjected to harvest activities.

  (b) in most areas, intertidal sandy mud areas exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and

  (c) accessing rocky shorelines that lie beyond intertidal sandy mud areas at low tide in particular, is very difficult and will be avoided by harvesters by default.
- Control measures (if applicable): Boats shall only be operated at high tide or when the tide has begun to recede when seeking to access rocky shorelines located beyond intertidal sand mud areas. A code of practice will be put in place to ensure that under no circumstances will harvesters disrupt intertidal sandy mud, particularly in cases where harvest occurs in the Northern or Southern sections of Clew Bay (see Appendix 4). For details on action limits, analytical procedures monitoring and corrective actions, see table 10(6) and Appendix 5(a6).

Shingle:

- Risk of affecting site/species: Moderate risk of potential biological/physical hazards in the form of removal of habitat of rare & endangered species or (risk rating=10). No chemical hazards have been identified (see table 10(7) and Appendix 5(a7)).
- Explanation: It is unlikely that distribution, abundance, diversity or area of shingle will be altered due to harvesting of *A. nodosum* given that removal of shingle with seaweed would be considered contamination which would be detected on collection of harvest (i.e. GRN). Presence of contaminants such as shingle will also be assessed in production facilities as presence of shingle could damage extraction equipment.
- Control measures (if applicable): Training will be provided, where necessary, to ensure that harvesters are trained in safe boating and hand harvest techniques to ensure that holdfast, or friable, shingle-type substrate is not removed or disturbed. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(7) and Appendix 5(a7).

Reef:

- Risk of affecting site/species: Moderate risk of potential biological/physical hazard in the form of removal of habitat of rare & endangered species or disruption or damage to reef (risk rating=10). No chemical hazards have been identified (see table 10(8) and Appendix 5(a8)).
- Explanation: It is unlikely that distribution, abundance, diversity or area of reef will be altered due to harvesting of *A. nodosum* as:

  (a) the majority of the reef in Clew Bay is not found along the shores where *A. nodosum* occurs.

  (b) in cases where reef does occur along the shores, contact will automatically be avoided in order to prevent damage to the harvesters sickle/blade and underlying growth substrate.

  (c) removal of reef with seaweed would be considered contamination which would be detected on collection of harvest (i.e. GRN).

(d) damage to reef by boats is unlikely as harvesters boats will be small and any harvest collection boat will be fitted with a depth finding device to ensure that there is always sufficient water.

- Control measures (if applicable): Training will be provided, where necessary, to ensure that harvesters are trained in safe hand harvest and boating techniques along rocky shores (see Code of Practice, Appendix 4). For details on action limits, analytical procedures monitoring and corrective actions, see table 10(8) and Appendix 5(a8).

NOTE: *A. nodosum* and associated communities were assessed separately in Section 3.3.5 of this document, with results outlined in Table 12.

Objective 2: To maintain the favourable conservation condition of Mudflats and Sandflats not covered by seawater at low tide.

Mudflats and Sandflats:

- Risk of affecting site/species: Moderate risk of potential physical hazard in the form of disruption of intertidal sandy mud (risk rating=10). No biological or chemical hazards have been identified (see table 10(9) and Appendix 5(a9)).
- Explanation: the likelihood that mudflats and sandflats not covered by seawater at low tide will be physically affected due to harvesting of *A. nodosum* is low given that:
  (a) this substrate is not suitable for *A. nodosum* growth and will not be targeted for harvest activities and
  (b) in most areas, mudflats and sandflats exhibit little overlap with the rocky shorelines.
  (c) accessing rocky shorelines that lie beyond mudflats and sandflats at low tide in particular, is very difficult and would be avoided by harvesters.
- Control measures (if applicable): Boats shall only be operated at high tide or when the tide has begun to recede when attempting to reach rocky shores which lie beyond the mudflats and sandflats (e.g. northern and southern shores of complex). A code of practice will be put in place to ensure that under no circumstances will harvesters disrupt intertidal sandy mud areas (See Appendix 4). For details on action limits, analytical procedures monitoring and corrective actions, see table 10(9) and Appendix 5(a9).

Overall impact on important sediment communities (clean/fine and sediment/sandy mud areas):

- Risk of affecting site/species: Low.
- Explanation: The chances of altering the distribution, abundance, diversity or area occupied by these communities due to harvesting of *A. nodosum* are extremely low given that (a) the clean/fine sand and soft sediment/sandy mud areas containing these species exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) these substrates are insufficient to support growth of *A. nodosum* and thus, will not be affected by harvest activities.
  (c) access to these areas is difficult and in many cases can only be undertaken at high tide or when the tide has begun to recede.
- Control measures (if applicable): In exceptional circumstances where there is overlap between these areas and the rock shoreline containing *A. nodosum* (e.g. northern shores), control measures and a code of practice will be in place to ensure that boats do not damage these areas (see Appendix 4).

Objective 3: To maintain the favourable conservation condition of harbour seal (Annex II species) in Clew Bay Complex SAC.

Introduction

It is well established that harbour seals are highly sensitive to human behaviour. Disturbance events are caused by factors which result in alterations to seal behaviour, particularly during breeding, moulting and resting periods. This can culminate in significant numbers leaving haul-out sites during periods of time important to their life-cycle. Recent analysis of anthropogenic disturbances on seals in Clew Bay and other regions have provided an important platform in which to make informed management decisions which prevent harmful or potentially harmful activities from occurring. Assessments in Clew Bay are being undertaken by the NPWS on an ongoing basis as part of the "Harbour Seal Pilot Monitoring Project". The overall benefits of assessments of harbour seal behaviour is that they establish the impact of human activity on behavioural responses and in doing so, provide crucial practical information. In turn, they provide a platform for more informed management decisions which are based on both science and the practicalities of modern life. These studies often provide information relating to the:

1. Characterisation of human causes (human activities) and their effects on wildlife behaviour.
2. Characterisation of long-term biological significance of short-term responses.

BioAtlantis has developed a Code of Practice (Appendix 4) based on findings from the published peer-reviewed literature, NPWS guidelines and recommendations from organizations such as the Hampshire & Isle of Wight Wildlife Trust (Anon 2013, 2016). The Code of Practice in Appendix 4 ensures that harvesters are fully informed and equipped with best practice knowledge on how to ensure that disturbances of seal behaviour does not occur. Central to the Code of Practice are specific site-specific mitigation measures which are based knowledge of established breeding, moulting and resting sites, as determined by NPWS.

Important aspects of seal behaviour, sensitivity, tolerance, recovery and habituation are described as follows:

- **Sensitivity**

  The Harbour Seal Pilot Monitoring Project, 2010 (NPWS 2011C) has identified a number of activities which led to disturbance of the harbour seals in selected sites in Ireland, including: occupation of shorelines adjacent to hauled out seals (e.g. by shellfish harvesters), quad bike activity on sandflats, approach of a low-flying aircraft, wildlife tour vessels, sea kayak activity, presence of small inshore fishing vessels, people walking recreationally, passing small fishing/angling boats, horse riders and dogs. NPWS also recorded instances where even members of scientific survey teams impacted on seal behaviour. The effectiveness of reserves to prevent human-induced disturbances to harbour seal population were recently evaluated in the Anholt seal reserve of Denmark (Andersen et al., 2011 & 2012). In this study, harbour seals were found to be alerted by boats at a distance of 560–850m and pedestrians at a distance of

200–425m. Flight initiation was observed at 510–830m for boats and 165–260m for pedestrians. These studies highlight the sensitivity of harbour seals to human presence. However, harbour seal behaviour is highly complex and seals are known to exhibit varying levels of tolerance to human, depending on the nature of the contact and the time of year.

- **Varying levels of tolerance to human activities**

  Tolerance is defined as 'the intensity of disturbance that an individual tolerates without responding in a defined way' (Bejder et al., 2009 and references therein) and is measured over short term periods. Tolerance is distinct from processes of habituation or sensitisation which are only measurable over the long term. For example, during habituation, individual tolerance levels increase, while during sensitisation, tolerance levels will decrease (Bejder et al., 2009). Habituation may occur following repeated exposure to a specific stimulus. In the case of the harbour seal, several studies indicate varying levels of tolerance to human activities.

  Boat Traffic*:* Henry et al., (2001) demonstrated that boat traffic in Métis Bay area of Canada have only a temporary effect on the haul-out behaviour of harbour seals. Several studies point to slow moving or stopped vessels such as kayaks as causing the most severe disturbance to seals (Johnson et al., 2007, Allen et al., 1984, Suryan and Harvey 1999, Henry and Hammill 2001). In particular, Johnson et al., (2007) demonstrate that seals were disturbed by kayaks and by stopped powerboats at distances of >91m from haul out sites, while being unaffected by moving powerboats approaching as close as 39m. Effects of kayak activities have also been reported in Ireland by the NPWS (2011C). This data suggests tolerance to brief and passing presence of vessels which do not pay attention to the seals themselves (Johnson et al., 2007), while disturbances are mainly caused by vessels that linger or move at slow pace (e.g. kayaks and stalled boats) along haul out sites. These effects were reported by Allen et al., (1984), Suryan and Harvey, 1999, Henry and Hammill, 2001. These findings indicate that boating activities themselves will have minimal impacts on seal populations, provided that boats refrain from running at low speed for prolonged durations or stall.

  Seasonal tolerance: Henry et al., (2001) demonstrate that seals were less affected during August, potentially due to increased tolerance associated with hormonal and physiological changes which occur during moulting (Ashwell-Erickson et al., 1986). Greater motivation to remain hauled out was also observed during moulting periods. Seasonal tolerance was also observed in a study of the Anholt seal reserve of Denmark (Andersen et al., 2011 & 2012) in which an increased tendency to return to haul out sites following disturbance during the breeding season was identified. However, tolerance was not identified before or after the breeding period, therefore suggesting that the tolerance did not give rise to habituation. Harbour seals are also more sensitive to human activities during obligate resting periods (October to April).

Recovery: Data from Henry and Hammil, 2001, indicates a limited effect of disturbance on the recovery of seal numbers on haul out sites, to pre-disturbance levels. Johnson et al., 2007, also reported that seals quickly recover from disturbance, returning back to haul out sites in less than 1 hour. In only 21% of disturbance cases did seal numbers not reach pre-disturbance levels.

Habituation or site-specific tolerance:There is some evidence for habituation of harbour seals to high traffic levels. In a study by Osborn (1985), of an area close to a busy harbour in Elkhorn Slough, Monteret Bay, California, 74% flushing was observed with disturbance at <30m. While habituation may explain these observations, findings such as these may be attributed to increased tolerance to human activities, such as during the breeding season.

On the basis of this information and data on sites of relevance to harbour seals in Clew Bay, a risk assessment was carried out with respect to conservation objectives for the SAC. This is outlined below:

Human Activities (General):
- Risk of affecting site/species: Moderate risk of potential hazards in the form of human presence or related activities (e.g. 'flushing out' and entering the water of seals, man-made energy (Ariel or underwater noise), deterioration of resources such as water quality or food source; risk rating=10; (see table 10(10) and Appendix 5(a10)).
- Explanation: The probability of negatively effecting the harbour seal population in Clew Bay due to human activity is reduced given that breeding, moulting and resting sites are designated as out of bounds during relevant stages of the year. Boats will also operate in a manner known to least affect seal behaviour.
- Control measures (if applicable): As a control measure, BioAtlantis will issue the code of practice for the protection of the harbour Seal (See Appendix 4), to ensure that harvesters:
  (a) Have full knowledge of the sites in Clew Bay known to be relevant the harbour seal.
  (b) Full knowledge of harbour seal sites which are out of bounds at relevant times of the year.
  (c) Understand the steps required to ensure that all contact with seals is prevented from day to day.
  (d) Operate boats according to practises which minimise impact on harbour seals.

Species range:
- Risk of affecting site/species: Extremely low risk of potential physical hazard in the form of restriction of the harbour seal species range. No biological or chemical hazards have been identified (see table 10(11) and Appendix 5(a11)).
- Explanation: Hand harvest of *A. nodosum* will not involve the use of artificial physical barriers which would restrict or affect the species range of harbour seals in Clew Bay.
- Control measures (if applicable): not applicable. Physical barriers which could block access to harbour seals and site of importance to them will not be installed in Clew Bay.

Breeding Sites:
- Risk of affecting site/species: Moderate risk of potential biological hazard in the form of human presence or activities (risk rating=10 each respectively). No chemical or physical hazards have been identified (see table 10(12) and Appendix 5(a12)).

- Explanation: The probability of human presence or activities affecting harbour seals at known breeding sites of Clew Bay is reduced given that harvesters cannot harvest at these sites during the breeding period (May-July).
- Control measures (if applicable): As a control measure, the BioAtlantis code of practice for the protection of the harbour seal will be implemented (See Appendix 4) to ensure:
  - No disturbance events occur; e.g. no harvest at breeding sites during sensitive times of year, between May-July.
  - Navigation guidelines to ensure that seals are not disturbed to levels which would result in entry or 'flushing' into the water.

  For details on action limits, analytical procedures monitoring and corrective actions, see table 10(12) and Appendix 5(a12).

Moulting Sites:

- Risk of affecting site/species: Moderate risk of potential biological hazards in the form of human presence or activities (risk rating=10 each respectively). No chemical or physical hazards have been identified (see table 10(13) and Appendix 5(a13)).
- Explanation: The probability of human presence or activities affecting harbour seals at known moulting sites of Clew Bay is reduced given that harvesters cannot harvest at these sites during the moulting period (Aug-Sept).
- Control measures (if applicable): As a control measure, The BioAtlantis code of practice for the protection of the harbour seal will be implemented (See Appendix 4) to ensure:
  - No disturbance events occur; e.g. no harvest at breeding sites moulting sites during sensitive times of year, between Aug-Sept.
  - Navigation guidelines to ensure that seals are not disturbed to levels which would result in entry or 'flushing' into the water.

  Of note, a recent survey of Clew Bay during moulting season found that maintenance of a constant boat speed, approximately 60m away from a single hauled out seal, proved sufficient to prevent any behavioural changes (See Appendix 1). For details on action limits, analytical procedures monitoring and corrective actions, see table 10(13) and Appendix 5(a13).

Resting Sites:

- Risk of affecting site/species: Moderate risk of potential biological hazards in the form of human presence or activities (risk rating=10 each respectively). No chemical or physical hazards have been identified (see table 10(14) and Appendix 5(a14)).
- Explanation: The probability of human presence or activities affecting harbour seals at known resting sites of Clew Bay is reduced given that harvesters cannot harvest at these sites during the obligate resting period (Oct-April).
- Control measures (if applicable): As a control measure, the BioAtlantis code of practice for the protection of the harbour seal will be implemented (See Appendix 4) to ensure:
  - No disturbance events occur (e.g. no harvest at resting sites during sensitive times of year, between Oct-April).
  - Navigation guidelines to ensure that seals are not disturbed to levels which would result in entry or 'flushing' into the water.

For details on action limits, analytical procedures monitoring and corrective actions, see table 10(14) and Appendix 5(a14).

3.3.2 Impact on protected coastal habitats.

The results of the risk assessment, undertaken by BioAtlantis, on the potential impact of hand harvesting on protected coastal habitats is described in this section, along with the control measures where applicable.

Objective 1: To maintain the favourable conservation condition of Perennial vegetation of stony banks (1220; ref: pg. 6, NPWS, 2011B).

- Risk of affecting site/species: Low risk of potential biological or physical hazards in the form of removal of habitat of rare & endangered species or disruption and damage to vegetation (risk rating=5 respectively). No chemical hazards have been identified (see table 10(15) and Appendix 5(a15)).
- Explanation: It is highly improbable that Perennial vegetation of stony banks in Clew Bay will be affected due to harvesting of *A. nodosum* given that:
  (a) established piers will be required for unload/pick-up. Use of banks for this purpose will not occur,
  (b) *A. nodosum* does not grow in these locations, and therefore will not be subject to harvest activities,
  (c) contamination with other materials may result in damaged production equipment and end product and
  (d) harvested weed will not be stored in these areas. This ensures no inadvertent co-removal of protected species such as perennial vegetation.
  The probability of physically impacting upon perennial vegetation of stony banks is exceptionally low given that training will be provided to staff and harvesters to ensure that all transport activities will take place using established piers and roadways. Transport cannot occur in these areas.
- Control measures (if applicable): Neither harvest or transport activities will take place in these areas. All harvest and pick up locations will be recorded on GRNs. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(15) and Appendix 5(a15).

Objective 2: To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*; 1330; ref: pg. 9, NPWS, 2011BB).

- Risk of affecting site/species: Low risk of potential biological or physical hazards in the form of removal of habitat of rare & endangered species or disruption and damage to vegetation (risk rating=5 respectively). No chemical hazards have been identified (see table 10(16) and Appendix 5(a16)).
- Explanation: It is highly improbable that Atlantic salt meadows (ASM) in Clew Bay will be affected due to harvesting of *A. nodosum* given that:
  (a) Established piers will be required for unload/pick-up. Use of ASM regions will not occur,
  (b) *Ascophyllum nodosum* does not grow at high density in these locations, and therefore will not be subject to harvest activities,
  (c) contamination with other material may result in damaged production equipment and product and
  (d) harvested weed will not be stored in salt meadow areas. This ensures no inadvertent co-removal of protected species characteristic of Atlantic salt meadows.

The probability of physically impacting upon ASM is low given that staff and harvesters will be provided with training where necessary to ensure that all transport activities will take place using established piers and roadways. Transport cannot occur in these areas.

- Control measures (if applicable): as described above for perennial vegetation of stony banks. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(16) and Appendix 5(a16).

Objective 3: To maintain and/or restore the conservation conditions of sand dune habitats (ref: pg. 15, NPWS, 2011BB).

- Risk of affecting site/species: Low risk of potential biological or physical hazards in the form of removal of habitat of rare & endangered species or disruption and damage to annual vegetation of drift lines along the high tidal mark of Clew Bay, embryonic shifting dunes above the strandline or shifting dunes (risk rating=5). No chemical hazards have been identified (see table 10(17) and Appendix 5(a17)).
- Explanation: It is highly improbable that sand dune habitats in Clew Bay will be affected due to harvesting of *A. nodosum* given that:
  (a) Loading and transport activities will occur exclusively using established piers and road networks,
  (b) *Ascophyllum nodosum* does not grow at high density in these locations, and therefore will not be subject to harvest activities,
  (c) contamination with other material may result in damage to production equipment and end product and
  (d) harvested weed will not be stored in these areas. This ensures no inadvertent co-removal of protected species in sand dune habitats.
- Control measures (if applicable): as described above for perennial vegetation of stony banks and ASM. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(17) and Appendix 5(a17).

3.3.3 Impact on Otters and Birds.

The results of the risk assessment, undertaken by BioAtlantis, on the potential impact of hand harvesting on protected otter and bird species is described in this section, along with the control measures where applicable.

Otters *(Lutra, lutra):*

- Risk of affecting site/species: There is a low risk of potential biological hazard in the form of affecting the distribution, extent of terrestrial, marine and freshwater habitats, number of couching sites and holts. There is low risk of disturbance at couching sites and holts or other areas where they may be encountered. There will be no negative impacts upon available food resources such as species of fish (risk rating=5). There will be no barriers to connectivity. No chemical hazards have been identified (see table 10(18) and Appendix 5(a18)).
- Explanation:
  - Freshwater habitats are excluded from all harvest activities. In addition, the Burrishoole catchment area will be excluded. The mouth of Lough Furnace will be also excluded from all harvest activity.
  - Harvest activities will not require construction of barriers which would affect access to sites of habitats. Linear habitats will not be damaged or blocked in anyway therefore ensuring that otter have undisrupted access to the marine zone. Harvest activities will take place in the *A. nodosum* intertidal zone and will not lead to any destruction of terrestrial habitat. It is highly improbable that otter food supply will be depleted due to harvest activities in Clew Bay. In particular, Kelly L. *et al.*, (2001) indicate that hand harvest is not associated with reductions in fish numbers within the *A. nodosum* biotope. Human presence at sites will be temporary and will not give rise to significant disturbance of otter. Harvester activity will take place in the intertidal zone and will not affect otter holts.
- Control measures (if applicable):
  - Otters occupy both freshwater aquatic, marine aquatic and associated terrestrial habitats. An important requirement of otters is an adequate food supply and unrestricted access to sites and islands throughout Clew Bay. Harvest of *A. nodosum* beds will not exceed 20% of the available *A. nodosum* biomass per site per annum, thus ensuring the maintenance of the *A. nodosum* habitat. BioAtlantis will manage activities in a sustainable manner to prevent excessive removal of *A. nodosum* and in turn, circumvent any potentially negative effect*s* on species further along the food chain, e.g. fish & otters. In addition, no activities will take place in important areas of the Burrishoole catchment such as Lough Feeagh & Lough Furnace, thus preventing any impact on otter activity or important life-cycle stages of trout or salmon. A code of practise for protection of the otter is included in Appendix 4. This includes a wider range of measures to prevent disturbance to or interactions with otters and their dietary requirements and food supply. These measures are also listed below:

    (a) Otters may be sensitive to human presence and alterations of food source and supply. To avoid or prevent disturbance or interactions with otters, ensure the following:

    - All activities are maintained within the intertidal *A. nodosum* zone. Avoid linear habitats located beyond the intertidal zone or marine riparian areas beyond the foreshore. Only use existing routes.

- Never interfere with couching sites, holts, access paths/routes, that may be present near coastal areas, agricultural fencing, roads, slipways, access points or other areas.
- Avoid large trees near coastal areas as they can represent important otter breeding and resting sites. Avoid undisturbed areas (e.g. impenetrable scrub/reeds) which are refuges for otters.
- Do not behave in an obtrusive or noisy manner around otters.
- Never interfere with, deliberately approach or disturb otters or their cubs that are resting, sleeping, hunting, feeding or foraging in water or on the shore during the daytime, dawn or dusk. Ensure caution during the periods of breeding, rearing and hibernation.
- If migrating/commuting otters are encountered in water, do not obstruct their movement. Slow down the boat and give sufficient space to pass without "boxing" them in, blocking narrow channels or acting as a barrier to commuting or connectivity.
- If encountered on the shore, allow otters free access and ample opportunity to escape to the water/land. Do not behave in manner causing them to move away or flee human disturbance.
- To prevent in combination effects, adhere to the above measures at all times, particularly when working in areas known to exhibit signs of otter activity.

(b) To prevent impacts on the dietary and other requirements of otter, the following measures apply:

- Follow pre-planned schedules and harvest in areas defined by BioAtlantis. Harvesting is limited to 20% of the total available *A. nodosum* biomass per site per annum, to allow for sufficient regrowth.
- Harvesting must not take place beyond the *A. nodosum* zone, as these habitats represent the broader habitat range of the otter's prey during adult and early life stages, including: flowing and static freshwater areas (rivers, streams, canals, lakes, reservoirs, ponds), deep water subtidal areas (>30m), shallow subtidal areas (<30m), exposed areas, estuarine mud areas, brackish waters, subtidal gravel/coarse bottom substratum, intertidal soft bottom (sand/mud), lagoons, maerl, rock pools, saltmarsh habitats, seagrass, subtidal soft bottom (sand/mud) and exposed waters in the vicinity of rocky cliffs.
- Avoid exposed and non-sheltered areas that represent the otter's broader habitat range, hunting ground and foraging area.
- Avoid co-harvesting non-*A. nodosum* material near coastal habitats, near the shoreline or on the shore. Ensure that inadvertent by-catch of other algae, dead/senescing algae, amphipods, isopods or other *Animalia* or material is prevented and minimized.
- Do not remove the *A. nodosum* holdfast and take care not to disturb rocky/crevice substratum.
- Avoid all freshwater aquatic linear habitat and riparian environments including lakes and rivers and other areas (e.g. east side of InishGowla South).
- Harvesting cannot occur in fresh water habitats, including at the mouth of Lough Furnace or the Burishoole Catchment. This prevents potential impacts on salmon, trout and European eel, in turn preventing any impacts on otter.

For details on action limits, analytical procedures monitoring and corrective actions, see table 10(18) and Appendix 5 (a18).

Birds:

- Risk of affecting site/species: Low risk of potential biological hazard in the form of negative impacts on habitats relevant to species of bird or alteration to behaviour due to presence of humans (risk rating=5). No physical or chemical hazards have been identified (see table 10(19) and Appendix 6 for details).
- Explanation: Clew Bay supports a number of breeding and wintering bird populations of national importance. These species have important breeding, nesting, feeding and wintering requirements and activities during hand harvest of *A. nodosum* should be carried out in a manner which does not impact on their key biological imperatives. Species vary in their dietary requirements, habitats and sensitivity to human disturbance. As *A. nodosum* provides a habitat for marine life such as fish, some bird species may be attracted to *A. nodosum* beds when hunting for food. In the absence of appropriate systems of management, monitoring and verification, there is increased likelihood of excess removal of *A. nodosum* and in turn, increased chance of affecting birds who may use these zones for feeding purposes. For example, Brent Geese potentially use areas such as grassland or algae as a secondary food source in the absence of its primary food resource, eelgrass (ref: NPWS, 2013). In addition, human presence may negatively impact on bird behaviour, particularly during breeding season, which could lead to nest desertion. Unexpected human activity is also a risk factor as it can lead to flight events for some wintering species (e.g. Brent Geese; Phalan B & Nairn RGW 2007). However, it is highly improbable that species of bird will be affected by harvest activities in Clew Bay given the following:

  (a) **Harvest of *A. nodosum***: this will be undertaken sustainably and will not exceed 20% of the available biomass per site per annum, thus ensuring maintenance of the *A. nodosum* habitat. Therefore, the probability of affecting fish and in turn bird species in Clew Bay, is considerably reduced. Moreover, a range of other habitats of relevance too fish and fisheries species will not be subject to harvesting (see Appendix 9).

  (b) **Foraging behaviour and nesting requirements**: harvest will not take place during sensitive times at sites indicated by the NPWS (*pers. comm. 03/12/2013*) as being important during breeding season for the following species: Common Tern *(Sterna hirundo)*, Sandwich Tern *(Sterna sandvicensis)*, Arctic Tern, *(Sterna paradisaea)*, Black-headed Gull *(Larus ridibundus)*, Cormorant *(Phalacrocorax carbo)*, Common gull *(Larus canus)*, Greater Black-backed Gull *(Larus marinus)*. Likewise, sites indicated by NPWS as being of importance to wintering Brent Geese *(Branta bernicla hrota)* and Barnacle Geese *(Branta leucopsis)* will not be subjected to harvest activities during wintering the period (Oct –Mar). For species which utilize sandy beaches, sand dune and/or salt marsh habitats (Oystercatcher, *Haematopus ostralegus*; Ringed Plover, *Charadrius hiaticula*), these areas contain substrate which does not support dense growth of *A. nodosum* and therefore, these areas will be avoided (see Appendix 6 for details).

  (c) While several species of birds use the *A. nodosum* zone as a habitat for feeding, reproduction or sheltering purposes, none are exclusively dependent on the *A. nodosum* biotope (reviewed by Kelly L. *et al.,* 2001).

  (d) A Before-After Control-Impact experiment to assess the bottom-up effects of commercial *A. nodosum* harvest on a high trophic-level consumer group (birds) showed no evidence for strong bottom-up forcing of *A. nodosum* harvest on birds' site visitation (Johnston *et al*., 2024).

- Control measures (if applicable): Harvest of *A. nodosum* beds will not exceed 20% of the available biomass per site per annum, thus ensuring the maintenance of the *A. nodosum* habitat. BioAtlantis will manage activities in a sustainable manner to prevent excessive removal of *A. nodosum* and in turn, prevent any potentially negative effects on species further along the food chain, e.g. fish & birds. In addition, no activities will take place in important areas of the Burrishoole catchment such as Lough Feeagh & Lough Furnace, thus preventing any impact during important life-cycle stages of trout or salmon. Control measures are in place to ensure that harvest activities do not occur during sensitive times of year at sites indicated by NPWS as being important during breeding and wintering periods (*pers. comm. 03/12/2013*). See "Code of Practise" for protection of bird species in Appendix 4 for details. For details on action limits, analytical procedures monitoring and corrective actions, see table 10(19). For details on the distribution, biological requirements and control measures for avian species of interest in Clew Bay, see Appendix 6.

3.3.4 Impact on species & habitats of general interest.

In addition to protecting the sensitive communities and habitats specified as part of Clew Bay's SAC status, it is also important to consider the Clew Bay environment as a whole and the overall position of *A. nodosum* within the rocky shore ecosystem. During high tide, fronds of *A. nodosum* rise and form a forest which forms part of a habitat for species of fish and invertebrates. This can in turn, represent a hunting ground for some marine and terrestrial animals during periods of high tide. The potential risk of harvesting activities negatively impacting on the *A. nodosum* ecosystem is outlined as follows, paying close attention to important species identified by Merc Consultants in their detailed survey of Clew Bay in 2006.

Fish and fisheries species:

- Risk of affecting site/species: Low risk of potential biological hazards in the form of removal of zones important for feeding, reproduction and/or sheltering of fish species such as trout and salmon (risk rating=2). No physical or chemical hazards have been identified (see table 11(1) and Appendix 5(b1)).
- Explanation: In the absence of appropriate systems of management, monitoring and verification, there is increased likelihood of excess removal of *A. nodosum* which in turn, may impact upon species of fish who use these zones for feeding, reproduction and/or sheltering. However, it is highly improbable that fish numbers will be affected by harvest activities in Clew Bay given that:
  a) Harvest of *A. nodosum* will be undertaken sustainably and will not exceed 20% of the available biomass per site per annum, thus ensuring maintenance of the *A. nodosum* habitat.
  b) Important catchment areas of Burrishoole will be excluded from all harvest-related activities.
  c) Studies indicate that hand harvest of *A. nodosum* does not significantly affect fish and large mobile epifauna (Kelly L. *et al.*, 2001).

  Sustainable harvesting is also unlikely to impact on commercial fisheries species (fish, crustaceans and shellfish), their distribution, spawning areas, nursery areas and food sources (See Appendix 9 & 10).
- Control measures (if applicable): no requirements. Nonetheless, BioAtlantis will manage activities in a sustainable manner to prevent excessive removal of *A. nodosum* and in turn,

circumvent any potentially negative effects on species further along the food chain, e.g. fish, birds, otters. A wider range of mitigation measures are provided in the Code of Practice in Appendix 4. For details on action limits, analytical procedures monitoring and corrective actions, see table 11(1) and Appendix 5(b1).

Lough Furnace:

- Risk of affecting site/species: Low risk of potential biological hazards in the form of damage to a rare example of a permanently stratified lake environment (risk rating=4). No physical or chemical hazards have been identified (see table 11(2) and Appendix 5(b2)).
- Explanation: It is highly improbable that this environment and it's associated species will be affected by activities due to hand harvesting, as these areas are excluded from the current application.
- Control measures (if applicable): Not applicable, as this area and it's associated lakes such as Lough Napransky and Lough Navroony will be completely excluded from all harvest activities. For details on action limits, analytical procedures monitoring and corrective actions, see table 11(2) and Appendix 5(b2).

The Rosmurrevagh area:

- Risk of affecting site/species: Low risk of potential biological or physical hazards in the form of removal of habitat of rare & endangered species or disruption and damage to diverse environs (risk rating=5). No chemical hazards have been identified (see table 11(3) and Appendix 5(b3)).
- Explanation: It is highly improbable that the Rossmurrevagh area and it's associated species will be affected by activities due to hand harvesting given that:

  (a) *Ascophyllum nodosum* does not grow in these locations, and therefore will not be subject to harvest activities,

  (b) Contamination with material from this area may damage production equipment and end product,

  (c) Harvested weed will not be stored in this area. This ensures no inadvertent co-removal of protected species in the Rosmurrevagh area. Staff and harvesters will be provided with training where necessary to ensure that all transport activities will take place using established piers and roadways. Transport will not occur in these areas.
- Control measures (if applicable): Harvest and storage activities will not occur in these locations. For details on action limits, analytical procedures monitoring and corrective actions, see table 11(3) and Appendix 5(b3).

3.3.5 Impact on the *Ascophyllum nodosum* biotope and species therein

In addition to assessing the potential impact of hand harvesting of *A. nodosum* on the conservation requirements of Clew Bay SAC, this application has also assessed the impact of these activities on the *A. nodosum* biotope itself. This analysis is of relevance considering (a) the potential for impact on species further down the chain (i.e. fish, otters, birds, etc) and (b) *A. nodosum* grows within the intertidal zone on reef substrate and will be harvested.

***A. nodosum* species**

- Risk of affecting site/species: Moderate risk of potential biological hazards in the form of excess removal of *A. nodosum* habitat (risk rating=10). No physical or chemical hazards have been identified (see table 12 (1a) and Appendix 5(c1a))

  Explanation: Lauzon-Guay *et al.,* 2023, shows that harvest of *A. nodosum* (at sites with a 20 + year history of commercial harvesting) does not have long-term impact on the morphology of the algae or on the abundance of its main inhabitants. A scientific review of sustainability aspects to harvesting *A. nodosum* and its use as a renewable raw material resource has also recently been published by Sujeeth *et al.* (2022). A study by Kelly *et al.,* (2001) in particular has shown that the impact of hand harvesting of *A. nodosum* is influenced by a number of factors: the amount harvested, size of harvested area, homogeneity of the harvest and equipment used (Kelly L. *et al.*, 2001). Factors influencing the rate of regeneration of *A. nodosum* include: year of regeneration (higher the first year than successive years), harvesting regimes, age structure of the population, extent and pattern of branching and determined by the shore type/exposure, presence or absence of grazers (Baardseth E, 1955). Immediate effects of cutting of *A. nodosum* between 10-15cm (4-6 inches) above the holdfast are likely to include: removal of seaweed from the area, destruction of epifauna & flora, increase in desiccation, erosion and predation, potential settlement of other species and stimulation of bushy-type *Ascophyllum* growth (Boaden and Dring, 1980). Impacts of harvesting are considered to be similar to those occurring due to natural disturbances, i.e. removal of all or portions of populations and providing space for other species to initiate succession (Kelly L. *et al.*, 2001, and references therein). The structure of the *A. nodosum* population can change from a complex to a more uniform structure following harvest, which may cause alterations to community structure long term (Kelly L. *et al.,* 2001,and references therein). In the west of Ireland, harvesting has been found to be associated with alterations in *Fucus vesiculosis*, ephemeral algae and periwinkle *Littorina obtusata*, with *Fucus* found to be increased post-harvest in Clew Bay.

  Environmental impact assessments in modern times at Clew Bay and Connemara indicate almost complete recovery of *A. nodosum* cover following 11 and 17 months post-hand harvest respectively (Kelly L. *et al.*, 2001). Provision of a 4-5 year window for recovery of *A. nodosum* post-harvest remains the current consensus amongst decision makers. Recovery periods such as these are essential, as in the absence of oversight, there is increased probability that excessive removal of *A. nodosum* habitat may occur. This was particularly evident in a recent survey of Clew Bay during which areas previously characterised as having high density levels of *A. nodosum*, was found to have less coverage than expected (see Appendix 1). Some sites were characterised by an abundance of *A. nodosum* ‘stumps’, and evidence of two different types of recent harvest activities in the area. Moreover, *Fucus* sp. levels were notably dense within the *A. nodosum* zone, which may be consistent with studies by Kelly L. *et al.,* (2001) and others which show that *Fucus sp*. coverage can increase as a result of hand harvesting of *A. nodosum*.

Natural causes of *A. nodosum* mortality include storms, which can detach *A. nodosum* from substrate or both together. In addition, large or dense *A. nodosum* growth may become loose over time, leading to holdfast detachment. Therefore, as natural events can cause substantial *A. nodosum* mortality, it is critical that man-made harvest techniques do not cause any significant increase in mortality beyond natural background levels. Unregulated over-harvesting and inappropriate harvest methodologies are significant hazards in this regard, as both can cause significant increases in *A. nodosum* mortality due to holdfast removal. For example, the 'rake cutter' method can give rise to >6% of harvest containing holdfast material (Ugarte R, 2011B). In real terms, holdfast removal could give rise to reductions in *A. nodosum* plant numbers and density. In turn, this could allow for species such as *Fucus* to grow in vacant areas which have been left.

Significant levels of *A. nodosum* mortality may not be acceptable in an SAC such as Clew Bay. Harvest which contains holdfast material will be considered as representing a severe non-conformance by BioAtlantis Management and could lead to disciplinary procedures. A mitigation measure has been put in place to ensure that the technique employed in Clew Bay does not allow for greater than 1% mortality, i.e. partial or complete removal of the entire *A. nodosum* plant and holdfast during harvest (see 'Code of Practice', Appendix 4). This process will be monitored by the Resource Manager and details recorded on the GRN. Inspections will also take place at production facilities to ensure no holdfast or other contaminants are present (recorded on GRNs at intake and/or production logsheets). As holdfast removal will be avoided, the potential for exposure of understory species to predators such as birds, will also be prevented.

It is critical that hand harvesting does not negatively impact on community structure on the foreshore in general. Central to achieving this aim will be to ensure that canopies are maintained at levels which provide adequate coverage of underlying substrate and prevent invasion by species such as *Fucus*. Traditional practices in Ireland involve cutting between ~150-180 or 200mm (Kelly L. *et al.*, 2001). To ensure that harvesting is carried out in a safe and practical manner, harvesters will be provided with a high level of training, where necessary, so as to inform them of the importance of cutting as high as possible. They will be required to cut at levels between 8-12 inches. BioAtlantis will take an approach which prevents cutting less than 200mm (8 inches), which would represent a serious non-conformance (see Appendix 4 'Code of Practice'). This standard will be monitored by the Resource Manager and recorded on the Site Inspection Form (Appendix 3). These standards will also be assessed by means of quarterly and annual audits (Appendix 4 & 8).

- Control measures (if applicable):
  BioAtlantis will ensure that harvesting activities are monitored, recorded, controlled and limited to 20% harvest of the available biomass per site per annum. Moreover, the system will require that *A. nodosum* plants will not be cut below 200mm from the holdfast (see Appendix 4). Cutting will be applied throughout the area rather than within specific patches, thus ensuring no extensive loss in *A. nodosum* coverage. This will ensure that *A. nodosum* in harvested in a manner which minimizes any impact to the canopy and associated species, whilst maximizing rates of recovery. This level of regulation is in keeping with the GMP+ Certification status of BioAtlantis, Ltd. and thus will ensure that the probability of over-harvesting of *A. nodosum* resources in Clew Bay is lowered. Important components of the management system include:

- Harvest will be carried out at low tide. This ensures:
  - *A. nodosum* holdfast removal is avoided.
  - *Fucus* by-catch is reduced.
  - A lower incidence of by-catch of benthic invertebrates, as most species are relatively inactive at low tide, taking cover beneath the *A. nodosum* canopy.
  - Understory species are not contacted as cutting occurs higher up along the *A. nodosum* plant.
- Training: Training will be provided to harvesters, where necessary, to ensure competence in skills required to harvest *A. nodosum* in an environmentally friendly and sustainable manner.
- Protocols and schedules:
  Activities carried out according to clearly defined protocols to ensure that (a) no damage to the environment or underlying growth substrate, and (b) re-growth and re-generation of the vegetation post-harvest is sufficiently facilitated. Standard protocols and methods will include:
  - Site determination: identification of areas suitable for harvest, e.g. areas predominated by short *A. nodosum* fronds will not be harvested.
  - Harvest Methods: Use of sickle/knife to cut between 200-300mm (8-12 inches) above frond base, without damaging holdfast or underlying substrate.
  - Method for bagging of cut weed in nets/bags.
  - Methods of removal from islands and shores.
  - Method for communicating with BioAtlantis.
  - Method for reporting incidents to BioAtlantis.

Responsibility**:** Oversight, planning and training provided by BioAtlantis staff along with regular auditing to assess for compliance with procedures and for potential areas of improvement. The Resource Manager will also have responsibilities for several aspects of hand harvesting in Clew Bay. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(1a) and Appendix 5 (c1a). For further details, see *A. nodosum* hand harvest Code of Practice (Appendix 4).

Fucus (*Fucus vesiculosis Linnaeus* and *Fucus serratus Linneaus*)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to density of *Fucus* (risk rating=6). No physical or chemical hazards have been identified (see table 12(1b) and Appendix 5(c1b)).
- Explanation: The probability of inadvertent harvest of these fucoid species is low given that harvest will be limited to larger vegetative growth of *A. nodosum* fronds, approx. 200-300mm above the base. Otherwise, increases in the density of *Fucus* species may occur in the event of excessive hand harvesting of *A. nodosum* (Kelly L. *et al.*, 2001). Indeed, a recent survey of Clew Bay found evidence for high *Fucus* densities in areas found to have been subjected to recent harvest activities (See Appendix 1). In addition, *Fucus* sp. will be considered a contaminant during intake of harvested *A. nodosum*, and will be recorded as such on the GRN.
- Control measures (if applicable): as described for *A. nodosum* above.

Red algae, *Polysiphonia lanosa (Linnaeus) Tandy*

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to density of habitat important to epiphytes of *A. nodosum*, e.g. red algae, *Polysiphonia lanosa (Linnaeus) Tandy* (risk rating=4). No physical or chemical hazards have been identified (see table 12(2a) and Appendix 5(C2a)).
- Explanation*:* This species is hemiparasitic which predominantly uses *Ascophyllum nodosum* as a host (Guiry, M.D. & Guiry, G.M., 2013). This species is present throughout the north Atlantic in areas occupied by *A. nodosum* including Clew Bay SAC (Kelly L. *et al.,* 2001) It resides more rarely within other fucoid biotopes such as *Fucus vesiculosis*. Of note, a recent survey of Clew Bay found this species to be relatively well represented in the *A. nodosum* biotope, occurring in 5 out of 8 quadrants (1m2) were assessed (See Appendix 1). The risk of hand harvest activities affecting this species is considered low. This is due to the fact that spores from these species are highly successful in colonizing *A. nodosum*, and given the sustainable nature of the harvest system, effects are unlikely to be detrimental to the species.
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see Table 12(2a) and Appendix 5(C2a)).

Red algae *Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse* and *Corallinaceae*

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to density of these species (risk rating=2). No physical or chemical hazards have been identified (see table 12(2b) and Appendix 5(C2b)).
- Explanation: Kelly L. *et al.,* (2001) demonstrate that *Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse* are found to be present at low level beneath the *A. nodosum* canopy in Clew Bay, while *Corallinaceae* was not identified in this region (Kelly L. *et al.,* 2001). It is highly improbable that the density of these species will be altered due to harvesting of *A. nodosum* given that harvest of *A. nodosum* will be limited to larger vegetative growth of *A. nodosum* fronds, approx. 200-300mm above the base, generally above the contact level with these species. In addition, other species of seaweed will be considered as contaminants during intake of harvested *A. nodosum*, and this will be recorded as such on the GRN.
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(2b) and Appendix 5(C2b).

Ephemeral green algae (e.g. *Cladophora rupestris (Linnaeus) Kützing, Ulva sp. Linnaeus* and *Enteromorpha* sp. Link)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to density of ephemeral green algae (risk rating=3). No physical or chemical hazards have been identified (see table 12(2c) and Appendix 5(C2c)).
- Explanation: It is highly improbable that ephemeral green algae will be altered due to harvesting of *A. nodosum* given the findings of Kelly L. *et al.,* 2001, in which hand harvesting had no significant impact on ephemeral green algae over time. In addition, other species of seaweed will be considered as contaminants during intake of harvested *A. nodosum*, and this will be recorded as such on the GRN.

- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(2c) and App*endix 5(C2c).*

Other seaweed species (e.g. *Lomentaria articulata* (Hudson) *Lyngbye* & *Membranoptera alata (Hudson) Stackhouse*)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to density of other species of algae (risk rating=2). No physical or chemical hazards have been identified (see table 12(2d) and Appendix 5, (C2d)).
- Explanation: Kelly L. *et al.*, 2001, demonstrates an absence of *Lomentaria articulata* (Hudson) *Lyngbye* and *Lyngbye* and *Membranoptera alata (Hudson) Stackhouse* in Clew Bay despite being present at low numbers on Connemara. It is highly improbable that these species of seaweed will be altered due to harvesting of *A. nodosum* given that the frond length of these species generally does not exceed 200 mm and harvest will be limited to larger vegetative growth of *A. nodosum* fronds, approx. 200-300mm above the base. In addition, other species of seaweed will be considered as contaminants during intake of harvested *A. nodosum*, and this will be recorded as such on the GRN.
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(2d) and Appendix 5(C2d).

Periwinkles

- Risk of affecting site/species: Moderate risk of potential biological hazards in the form of alterations to density of periwinkles or removal of habitat important to periwinkles (risk rating=9). No physical or chemical hazards have been identified (see table 12(3a) and Appendix 5(C3a)).
- Explanation: *Littorina obtusata Linnaeus* and *Littorina littorea Linnaeus* are species of periwinkles which are widespread in the northwest Atlantic. They graze on other seaweeds besides *A. nodosum*, e.g. *Fucus*. These herbivorous species provide an important function in this ecosystem as they also graze certain epiphytes from the surface of *A. nodosum*. Studies also indicate that the polyphenols in *A. nodosum* serve as chemical defences to inhibit direct feeding by *Littorina littorea* (Geiselman, JA., and McConnell OJ, 1981), thus suggesting a complex relationship and co-evolution between these species. While Kelly L. *et al.*, (2001) demonstrates no evidence of change of *Littorina obtusata* agg. numbers after harvesting of *A. nodosum* in Clew Bay, a survey of Clew Bay found evidence for a positive correlation between *A. nodosum* density and periwinkle numbers (see Appendix 1). While the reasons are unclear, this may suggest a tendency towards increased periwinkle numbers in areas containing greater food resources. Alternatively, it may suggest that the reduction in numbers in areas of lower *A. nodosum* density may have arisen due to harvesting activities. For a more detailed description of habitat requirements and potential impacts of inadvertent, non-targeted removal of species such as periwinkles, please see Section 3.5.3. Overall, however, there is a reduced risk of harvesting activities negatively impacting upon periwinkles in Clew Bay given that:
  a) The harvest methodology employed by BioAtlantis will ensure that *A. nodosum* is cut 200-300mm (8-12 inches) above the *A. nodosum* holdfast, thus maintaining the canopy and allowing for sufficient re-growth.
  b) As periwinkles reside within other fucoid biotopes such as *Fucus* vesiculosis, the potential hazard of overharvesting of *A. nodosum* would not represent a detrimental threat to these populations.

c) Control measures are in place to ensure that canopy coverage is maintained, by-catch is limited and reproductive aspects are not affected (see Appendix 4 and below).

- Control measures (if applicable): as described for *A. nodosum* above. Additionally:
  - Reproduction: Harvesters will be trained, where necessary, to identify and avoid *A. nodosum* plants or fronds which contain visible *L. obtusata* egg masses.
  - Canopy damage:
    Harvesters will learn to avoid periwinkle disturbance by:
    (a) cutting at low tide, when species are more likely to be dormant/inactive.
    (b) aiming to leave between 200-300mm (8-12 inches) of material behind.
    (c) under no circumstances cutting less than 200 mm above the holdfast.
    (d) avoiding holdfast removal.
    (e) limiting harvest to 20% of the biomass per site per annum.
  - Other habitats: harvesters will be trained, where necessary, to avoid *Fucus vesiculosis* and *F. serratus*, which are additional habitats for periwinkles.
  - By-catch: any *Animalia* by-catch observed post harvest will be returned to the water, where possible.

For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3a) and Appendix 5(C3a).

Limpets

- Risk of affecting site/species: Moderate risk of potential biological hazards in the form of alteration to density of limpets and/or habitat important to limpets (risk rating=9). No physical or chemical hazards have been identified (see table 12(3b) and Appendix 5(C3b)).
- Explanation: Limpets are resident in fucoid canopies as grazers, playing important roles in the *A. nodosum* biotope. Kelly L. *et al.*, (2001) demonstrate that hand harvesting of *A. nodosum* can be associated with increases and decreases in limpet density and size. A trend towards increased limpet numbers in areas of increased *A. nodosum* biomass was also identified in a recent survey in Clew Bay (See Appendix 1). However, as these species also reside within other fucoid biotopes such as *Fucus vesiculosis*, the potential hazard of overharvesting of *A. nodosum* would not represent a detrimental threat to these species. The risk of lowering the density of these populations is further reduced as hand harvesting will be carefully managed and controlled to ensure no excess removal of the *A. nodosum* canopy, i.e. *A. nodosum* will not be cut less than 200mm above the holdfast
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3b) and Appendix 5(C3b). Additionally,
  - Canopy damage:
    Harvesters will learn to avoid limpet disturbance by:
    (a) cutting at low tide, when species are more likely to be dormant/inactive.
    (b) aiming to leave between 200-300mm (8-12 inches) of material behind.
    (c) under no circumstances cutting less than 200mm above the holdfast.
    (d) avoiding holdfast removal.
  - Other habitats: harvesters will be trained where necessary, to avoid *Fucus vesiculosis* and *F. serratus*.
  - By-catch: any *Animalia* by-catch observed post harvest will be returned to the water, where possible.

Barnacles

- Risk of affecting site/species: Moderate risk of potential biological hazards in the form of alteration to density of barnacles or habitat important to barnacles (risk rating=6). No physical or chemical hazards have been identified (see table 12(3c) and Appendix 5(C3c)).
- Explanation: Barnacles are resident in fucoid canopies as filter feeders. Some studies indicate that harvesting of *A. nodosum* can be associated with reduced cover of barnacles. These effects were not reported by Kelly L. *et al.*, 2001. As hand harvesting will be sustainable, there is a low risk of excess removal of *A. nodosum.* In turn, there is a low risk of potential negative effects on barnacle numbers.
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3c) and Appendix 5(C3c).

Hydroids (e.g. *Dynamena pumila Linnaeus*)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to density of Hydroid (*Dynamena pumila Linnaeus*) or habitat important to these species (risk rating=6). No physical or chemical hazards have been identified (see table 12(3d) and Appendix 5(C3d)).
- Explanation: The presence of hydroids on the tips of *A. nodosum* may increase the probability of altering their density during harvesting. However, there is no evidence from the study by Kelly L. *et al.*, (2001) that hand harvesting of *A. nodosum* in Clew bay is associated with alterations to density of hydroid species. In addition, hydroid numbers in the *A. nodosum* canopy of Clew Bay were found at low levels. *Dynamena pumila Linnaeus* also grow on other fucoid biotopes such as *Fucus*. Therefore, overharvesting of *A. nodosum* should it occur, would not represent a detrimental threat to these populations. The risk of altering hydroid density is further reduced as hand harvesting will be carefully managed and controlled to ensure no excess removal of the *A. nodosum* canopy.
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3d) and Appendix 5(C3d)).

Sponges (e.g. *Leucosolenia* sp. *Bowerbank*, *Halichondria panicea Pallas* & *Hymeniacidon perleve Montagu*)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alteration to density of Sponges (e.g., *Leucosolenia* sp. *Bowerbank*, *Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu*) (risk rating=4). No physical or chemical hazards have been identified (see table 12(3e) and Appendix 5(C3e)).
- Explanation: *Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu* are more widespread and occur in more deeper waters, occurring at low numbers in the *A. nodosum* canopy of Clew Bay (Kelly L. *et al.*, 2001). *Leucosolenia* sp. and Halichondria panicea are rarely found in upper or middle shores of Clew Bay where *A. nodosum* is found, while observed at low numbers increase in the lower zone (Kelly L. *et al.,* 2001). Likewise, *Hymeniacidon perleve* were found to be absent in the upper zone, at low levels in the middle zone while increasing into the lowers zone. While Boaden and Dring, (1980) identified changes in density of *Hymeniacidon* and *Halichondria* species due to harvest of *A. nodosum*, the harvest methodology involved was quite invasive and involved cutting between 10-15cm (4-6 inches). The predominance of these species in deeper waters will reduce the likelihood of impacts associated with potential overharvesting of *A. nodosum.*

- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3e) and Appendix 5(C3e).

Sea squirts (e.g. *Ascidiella*)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alteration to density of Sea squirts (e.g. *Dendrodoa grossularia van Beneden* and *Ascidiella scabra O.F. Müller*; risk rating=2). No physical or chemical hazards have been identified (see table 12(3f) and Appendix 5(C3f)).
- Explanation: Kelly L. *et al.*, 2001, demonstrate that *Ascidiella* occur at low levels in the *A. nodosum* zone of Clew Bay. The probability of negatively impacting on these species is likely to be low, as hand harvesting will be sustainable.
- Control measures (if applicable): as described for *A. nodosum* above. For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3f) and Appendix 5(C3f).

Other mobile species: (Phylum Arthropoda (Amphipods, isopods crabs, *Chironomida*, *Halacaridae*, *Ostracoda*), Phylum Platyhelminthes (e.g. *Turbellaria*), Phylum Annelida, Phylum Foraminifera, Phylum Nematoda)

- Risk of affecting site/species: Low risk of potential biological hazards in the form of alterations to the density of habitat important for mobile species (risk rating=4). No physical or chemical hazards have been identified (see table 12(3g) and Appendix 5(C3g)).
- Explanation: Kelly L. *et al.*, 2001 found no evidence that the mobile species listed above were affected by hand harvest activities. Low numbers of these species were found in the *A. nodosum* canopy of Clew Bay. This is in agreement with a recent survey in Clew Bay in which no mobile fauna were identified within test quadrants which were assessed (n=8, Appendix 1). As hand harvesting will be sustainable, there is a low risk of excess removal of *A. nodosum.* In turn, there is a low risk of potential negative effects on mobile species.
- Control measures (if applicable): as described for *A. nodosum* above. Also, measures are in place which ensure that any *Animalia* by-catch observed post harvest will be returned to the water, where possible. Harvesters will be required to work to ensure that co-harvesting of other species does not occur. Additional measures are outlined in the Code of Practice (Appendix 4).
- For details on action limits, analytical procedures monitoring and corrective actions, see table 12(3g) and Appendix 5(C3g).

3.3.6 Results of screening assessment & associated control measures, monitoring and corrective actions.

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats	**Distribution, extent & location**	**Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)**	**Decision matrix** Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
1	**Permanent habitat area**	Encompasses all Annex I habitats in Clew Bay Complex SAC	Areas must be maintained at favourable conservation conditions to ensure stability of the permanent habitat area (Ref: Target 1 of Objective 1, NPWS, 2011A, page 12)	B	2	5	10	M	Training where necessary to ensure: • No removal of permanent habitat area (i.e. preventing the removal of excessive levels of sand, shingle, pebbles, gravel, stone, etc.). • No removal of *A. nodosum* holdfasts which may carry sand, shingle, stone, etc.	• Non-conformance at in-take of raw material (i.e. presence of unacceptable levels of, shingle, stones, debris, or holdfasts).	• Visual inspection of harvested weed via Goods Received Notes (GRNs) and production logsheets • Inspection of GRNs and production logsheets	Resource Manager, production operators QC	Each batch of harvested seaweed. Quarterly audit	• Depending on the nature, source & extent of non-conformance, take the following steps: • Presence of excessive levels of sand, shingle/debris, etc: -Removal by sand filter and decanter and clarifier. • Presence of rocks/stones: -reductions in weed price • A Non-Conformance Report will be filed and sent to management where deemed necessary (see Appendix 3 for Non-conformance Report Form (NCR). • Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements
				C	1	5	5	L	• Routine maintenance of boat engines	Non-conformance during audit.	Regular Inspection of boat engines. Audit	Resource Manager	Ongoing basis		
				P	1	3	3	L	• Training where necessary, to ensure good general waste disposal practices.	Non-conformance during audit.	Hygiene audit	Resource Manager	Ongoing basis		
2	**Seagrass, *Zostera* marina (and associated communities).**	**Large patches:** From southern section to the south of Inishlyre, N and E of Crovinish and SE of Inishgort. **Small patches:** Westport harbour between Green islands and Carricknamore **Dept:** 3-8m	Maintain natural extent and high quality of *Zostera* dominated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13)	B	1	5	5	L	Harvest will not occur in these areas.	Unauthorized harvest in protected areas.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms.	Resource Manager QC	Routinely during harvest periods. Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Ensure that management instructions are adhered to. (b) Review communication system. (c) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
3	**Maerl Dominated communities**	**Large patches:** From main navigation	Maintain natural extent and high quality of	B	1	5	5	L	As above for seagrass *(Table 10(2)).*						

		channel leading into Westport harbour. **Other areas:** E of Inishlyre and S of Inishraher. Channel E of Inishleague channel leading to E of Inishgort lighthouse. Ilaanmore Harbour where current flow is strong e.g. between islands.	Maerl dominated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13)												
4	**Polychaetes & bivalves community complex** Distinguishing species: *Prionospio sp., M. palmate, T.flexuosa, M. bidentata, A. alba*	Widespread where soft sediment is present. Occurs Intertidally and subtidally (i.e. sandy mud areas) Differential distribution of species in the NW, Westport and Newport bay.	Maintain polychaete & bivalve community complex in Sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).	B	2	5	10	M	As below for *Table 10 (6) below* (i.e. *Tubificoides benedii* and *Pygospio elegans* community complex (Intertidal sandy mud areas).						
5	***Nephtys cirrosa* community** Associated communities: *Moerella donacina* & the amphipod *Bathyporeia guilliamsoniana*	Occurs on clean fine sand. SW boundary of the site. Out-reaches of Westport Bay to Inisheany	Maintain *Nephtys cirrosa* community in fine sand areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).	B	2	5	10	M	A code of practice will be in place to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond clean, fine sand areas in the south-west of the complex (see Appendix 4).	Unauthorized navigation at low tide to reach harvest sites located beyond clean, fine sand areas of the south-west.	• Record harvest location and pick-up points on GRNs. • Inspection of GRNs and Site Inspection Forms. • Check Incident reports.	Resource Manager QC	Routinely during harvest periods. Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
6	***Tubificoides benedii* and *Pygospio elegans* community complex (Intertidal sandy mud areas)** Associated communities: *T. benedii, P. elegans, Capitella sp., Nematoda sp., H. ulvae, C.volutator*	All shores from Trawoughter strand (northwest) to White strand (south), Newport Bay Westport Bay Islands: Inishcottle, Inishbee and Clynish.	Maintain *Tubificoides benedii* and *Pygospio elegans* community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).	B	2	5	10	M	A code of practice will be in place to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas, within which *Tubificoides benedii* and *Pygospio elegans* reside (see Appendix 4).	Unauthorized navigation at low tide to reach harvest sites located beyond mudflats or sandflats.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms. • Check Incident reports	Resource Manager QC	Routinely during harvest periods. Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
7	**Shingle (pebbles and gravel)** Associated communities: Talitrid amphipods	Throughout the region. Common on islands in particular and on the upper shore. Often occur behind fucoid dominated reef.	Maintenance of shingle habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).	B P	2 2	5 5	10 10	M M	Hand harvest techniques employed in shingle areas will ensure that *A. nodosum* is severed between 200-300mm (8-12 inches) above point of contact with underlying substrate (see Appendix 4).	Non-conformance during in-take of raw material (i.e. contamination with excessive levels of sand, shingle, shingle, stones, pebbles or holdfasts, etc).	• Visual inspection of harvested weed via Goods Received Notes (GRNs) and production logsheets.	Resource Manager, production operators	Each batch of harvested seaweed.	Depending on the nature, source & extent of non-conformance, take the following steps: • Presence of rocks/stones: -reductions in weed price • A Non-conformance Report will be	Operations meeting/ Harvest Meeting.

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											• Inspection of GRNs, Site Inspection Forms and production logsheets.	QC	Quarterly audit	filed and sent to management where deemed necessary (see Appendix 3 for Non-conformance Report Form (NCR). Harvester is provided with training if necessary.	
8	**Reef** Associated communities *A.nodosum, Fucus sp., L.hyperborea, L. digitata, A. digitatum, M. senile, E. fucorum, M. fimbriata, P. canaliculata, F. spiralis, L. saccharina, S. polyschides, C. celata, H. panicea, A. lefevrei, P. saxicola* **NOTE:** *A. nodosum and associated communities were assessed separately in, see Table 12 below.*	Intertidal: Occurs as mixed substrata of pebbles and cobbles All coasts of the bay. Most islands. Sub tidal: Boulders and cobbles. Extensive in Western margin. Smaller patches: Newport Bay. Hard substrate at: 2m and 14m. Faunal dominated reef at 11 and 26m.	Maintenance of reef habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).	B P	2 2	5 5	10 10	M M	Hand harvest techniques employed along rocky shores will ensure that *A. nodosum* is severed between 200-300mm (8-12 inches) above point of contact with underlying substrate (see Appendix 4).	Non-conformance during in-take of raw material (i.e. contamination with stones, pebbles or holdfasts).	• Visual inspection of harvested weed via Goods Received Notes (GRNs) and production logsheets. • Inspection of GRNs, Site Inspection Forms and production logsheets	Resource Manager, production operators QC	Each batch of harvested seaweed. Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: • Presence of rocks/stones: -reductions in weed price • A Non-conformance Report will be filed and sent to management where deemed necessary (see Appendix 3 for Non-conformance Report Form (NCR). Harvester is provided with training if necessary	Operations meeting/ Harvest Meeting.
				P	2	5	10	M	Harvest collection boat, if applicable to the area, will be fitted with a depth finding device to ensure that there is always sufficient water. Harvester boats will be small. Training will be provided where required to advise the harvesters of the risks involved.	Non-compliance with boating code of practice.	• Inspection of boat practices by audit.	QC	Annual	Harvester is provided with training if necessary	
9	**Mudflats & sandflats not covered by seawater at low tide.** Associated communities: Not specified	Intertidally: Between mean low water mark and mean high water mark. Large expanses of sandflat on N shore from Trawoughter Strand to Roskeen pt. Shore of Westport Small areas: Newport Bay, Embayments on eastern shore. Small patches: Around islands	The permanent habitat area is stable or increasing, subject to natural processes (Ref: Target 1 of Objective 2, NPWS, 2011A, page 14).	P	2	5	10	M	As above for *Table 10 (6) above* (i.e. *Tubificoides benedii* and *Pygospio elegans* community complex (Intertidal sandy mud areas).						
10	**Harbour seals: General**	Occupy aquatic and terrestrial habitats in Clew Bay, including intertidal shorelines.	Human activities should occur at levels that do not adversely affect the harbour seal population at the site (Ref: Target 5 of Objective 3, NPWS, 2011A, page 16)	B	2	5	10	M	• There will be no activities which cause of Ariel disturbance, nor any deterioration of water quality or food source. • No activities at haul out sites during sensitive times of year. • Boats will be operated using methods which have least effects on harbour seal (See Appendix 4 for Code of Practise).	Unauthorized harvest at haul out sites at sensitive times of year (e.g. breeding, moulting and resting periods).	• Record harvest location and pick-up points on GRNs. • Inspection of GRNs and Site Inspection Forms.	Resource Manager QC	Routinely during harvest periods. Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b) Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.

11	**Harbour seal: Effects on Species range due restriction by artificial barriers to site use**	Occupy aquatic and terrestrial habitats in Clew Bay, including intertidal shorelines.]Present during all aspects of life cycle incl. breeding (approx. May-July), moulting (approx. August-September) and phases of non-breeding foraging and rest].	Species range should not be restricted by artificial barriers to site use (Ref: Target 1 of Objective 3, NPWS, 2011A, page 15).	P	n/a	5	n/a	n/a	Hand harvesting activities will not include artificial barriers to site use.	n/a	n/a	n/a	n/a	n/a	n/a
12	**Harbour seal: Breeding sites.**	Vulnerable to disturbances between during May-July (annual breeding season). Est. sites: • North/north central: 15 • Central: 1 • South/South central: 5 • Total= 21	Breeding sites should be maintained in a natural condition (Ref: Target 2 of Objective 3, NPWS, 2011A, page 15)	B	2	5	10	M	• No harvest at sites between May-July. • Boats operated using methods which have least effects on harbour seals. • See BioAtlantis code of practise for protection of the harbour seal for details (Appendix 4)	Unauthorized harvest at breeding sites between May-July.	As above in Table 10 (10), i.e. harbour seals (general).				
13	**Harbour seal: Moulting sites.**	Est. sites: • North/north central: 3 • Central: 2 • South/South central: 13 Total= 18	Moult-out sites should be maintained in a natural condition (Ref: Target 3 of Objective 3, NPWS, 2011A, page 15)	B	2	5	10	M	• No harvest at sites between Aug-Sept. • Boats operated using methods which have least effects on harbour seals. • See BioAtlantis code of practise for protection of the harbour seal for details (Appendix 4).	Unauthorized harvest at breeding sites between Aug-Sept.	As above in Table 10 (10), i.e. harbour seals (general).				
14	**Harbour seal: Resting sites.**	Est. sites: • North/north central: 4 • Central: 0 • South/South central: 6 Total= 10	Haul-out sites should be maintained in a natural condition (Ref: Target 4 of Objective 3, NPWS, 2011A, page 15)	B	2	5	10	M	• No harvest at sites between Oct-April. • Boats operated using methods which have least effects on harbour seals. • See BioAtlantis code of practise for protection of the harbour seal for details (Appendix 4).	Unauthorized harvest at breeding sites between Oct-April.	As above in Table 10 (10), i.e. harbour seals (general).				
15	**Perennial vegetation of stony banks**	Found at or above the mean high water spring tide mark on shingle beaches. Widespread in distribution both along the mainland and the islands of Clew Bay	To maintain the favourable conservation condition (ref: Objective 1, NPWS, 2011B, pg. 6).	B P	1 1	5 5	5 5	L L	Harvest will not occur in these areas. Loading and transport will be by means of existing piers and road networks.	Unauthorized transport in these areas.	As above for seagrass *(Table 10(2))*.				
16	**Atlantic salt meadows**	Occur along sheltered coasts. Flooded periodically by the sea, restricted to an area between mid-neap tide level and high water spring tide level. Widespread distribution in Clew Bay, approx. 38.86ha.	To restore the favourable conservation condition (ref: Objective 2, NPWS, 2011B pg. 9)	B P	1 1	5 5	5 5	L L	Harvest will not occur in these areas. Loading and transport will be by means of existing piers and road networks	Unauthorized harvest in these areas.	As above for seagrass *(Table 10(2))*.				
17	**Sand dune**	• Annual vegetation of drift lines: Distributed along	To restore the	B	1	5	10	L	Harvest will not occur in these areas.	Unauthorized transport in	As above for seagrass *(Table 10(2))*.				

	habitats	the high tidal mark of Clew Bay. • Embryonic shifting dunes: Distributed above the strandline. • Shifting dunes along the shoreline with *Ammophila arenaria*: Occurs in areas in which sand accumulates at a rapid rate.	favourable conservation condition (ref: Objective 3, NPWS, 2011B, pg. 15).	P	1	5	10	L	Loading and transport will be by means of existing piers and road networks	these areas.	
18	**Otter**	Four out of five sites assessed from a total of 119.9km^2 area of river basin district in Clew Bay. Otters have access to most marine and freshwater areas within Clew Bay.	Species listed on Annex II of the EU Habitats Directive.	B	1	5	5	L	• There will be no activities which adversely affect the *A. nodosum* biotope and in turn, potential food supply of the otter. • All freshwater habitats are excluded from harvest activities • No activities in important areas of the Burrishoole catchment such as Lough Feeagh & Lough Furnace. No activity at the mouth of Lough Furnace. • The Code of Practice must be followed to (a) avoid or prevent disturbance or interactions with otters and (b) prevent impacts on food supply or dietary requirements. • A wider range of measures are outlined in the "Code of Practise" (Appendix 4).	As below for Table12 (1a; *A. nodosum)*	
19	**Birds:** **Protected species:** Common Tern, Arctic Tern, Little Tern, Barnacle Goose, Great Northern Diver and Bartailed Godwit. **Unprotected species:** Examples include Red-breasted Merganser, Ringed Plover, Barnacle Geese (present on islands in winter), Great Northern Diver, Brent Goose, Shelduck, Wigeon, Teal, Mallard, Oystercatcher, Cormorant, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Turnstone.	Wide-spread throughout Clew Bay	**Several Species listed on Annex I of E.U. Birds Directive.** **Clew Bay is not an SPA.** **No specifications published.** **Specifications provided by NPWS at Scoping Meeting (13/11/2013).** **See Appendix 6 for details.**	B	1	5	5	L	• There will be no activities which cause deterioration to the *A. nodosum* biotope and in turn, to food supply of relevant bird species. • Harvest at sites established by NPWS as important to important wintering and breeding species, will not be harvested at sensitive times of year. • See "BioAtlantis Code of Practise" for details (Appendix 4). See Appendix 6 for distribution, requirements and control measures for avian species of interest in Clew Bay.	Unauthorized harvest at breeding and wintering sites at sensitive times of year. See Appendix 6 for site-specific details along with the associated Appendix 4. See Appendix 5a(19) for summary of hazard scoring	As above in Table 10 (10), i.e. harbour seals (general).

Table 10 : Impact on protected marine habitats and species and coastal habitats in Clew Bay

No	Species/ Habitats	Distribution, extent & location	Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)	Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)	CONTROL MEASURES (if applicable)	Action Limit / non-conformance	Analytical Procedure	By	Monitoring Schedule (Frequency)	Corrective Action	Verification
	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)			Decision matrix						**MONITORING**				**CORRECTIVE ACTIONS**	
1	**Fish and fisheries species**	Burrishoole Catchment area of Clew Bay.	None	B	1	2	2	L	No harvest activities will take place in important areas of the catchment such as Lough Feeagh & Lough Furnace. There will be no activities which cause deterioration to quality of the environment of trout or salmon. A wider range of measures are outlined in the Code of Practice (Appendix 4).	As below for *Table 12 (1a; A. nodosum)*					
2	**Lough Furnace habitat:** **Associated communities:** • Species on its exterior include: Common Reed (*Phragmites australis*), Common Club-rush (*Scirpuslacustris*), Small patches of Great Fen-sedge (*Cladium mariscus*) and Bottle Sedge (*Carex rostrata*). • **Other important flora & fauna:** two rare amphipods (*Lembos longipes* and *Leptocheirus pilosus*), *Neomysis integer*, *Jaera albifrons*, J.ischiosetosa and *J. nordmanni*, Irish species of tasselweed (*Ruppia maritima* and *R. cirrhosa*), eel, flounder, mullet, mallard nest and black-headed Gull.	Saline lake lagoon located at the north-eastern corner of Clew Bay.	None	B	1	4	4	L	No harvest activities will take place in Lough Furnace.	n/a	n/a	n/a	n/a	n/a	n/a
3	**Rosmurrevagh habitat:** Diverse range of species: • **Bog/fen type vegetation:** Bog Asphodel and Cuckooflower (*Cardamine pratensis*), Bog Mosses, sedges, Bog-myrtle (*Myrica gale*), Irish Heath, Soft Rush (*Juncus effusus*), Water Mint (*Mentha aquatica*) andYellow Iris (Iris pseudacorus). • **Coastal grassland species:** Common Ragwort (Senecio jacobaea), Daisy (Bellis perennis), Dandelion (Taraxacum officinale), Heath Wood-rush (Luzula multiflora), Ribwort Plantain (Plantago lanceolata) and Yarrow (Achillea millefolium). • **Saltmarsh vegetation** (5 m wide): Common Saltmarsh-grass (Puccinellia maritima), Common Scurvygrass, Thrift and 'turf fucoids' (diminutive forms of brown algae).	Habitats including the seashore, dunes, coastal grassland, saltmarsh, bog and fen.	None	B P	1 1	5 5	5 5	L L	No harvest activities will take place in the Rosmurrevagh area.	n/a	n/a	n/a	n/a	n/a	n/a

Table 11 : Impact on general species & habitats of Clew Bay

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species within the *A. nodosum* biotope.	**Distribution, extent & location**	**Compliance requirements:** **(in accordance with EU Dir. 92/43/EEC & NPWS)**	**Decision matrix**						**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
				Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)							
1a	***A. nodosum***	*A. nodosum* grows in abundance intertidally on sheltered, rocky shores along the coast at islands.	None	B	2	5	10	L	*A. nodosum* will be harvested in a sustainable manner (see Appendix 4 for Code of Practice). This prevents: • Severe reductions in canopy coverage, thus ensuring sufficient habitat for active feeding stages and reproductive purposes of *Animalia*. ▪ It also prevents *Fucus* sp. harvest, an additional copy habitat for understory species	Non-conformance at any stage of harvest or management.	1)Harvest activities will be assessed for compliance at all levels including: • Planning & Scheduling of harvest activities. • Hand-Harvesting training records. • Goods received notes (GRNs) • Site Inspection Forms. 2)Monitoring the mass of *A. nodosum* resource harvested. 3)Monitoring levels of holdfast material	Resource Manager QC	Routinely during harvest periods & via: Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
1b	***Fucus vesiculosis Linnaeus* and *Fucus serratus Linneaus***	Occurs alongside *A. nodosum*.	None	B	2	3	6	L	As above for *A. nodosum*.						
2a	**Red algae:** *Polysiphonia lanosa (Linnaeus) Tandy*	An epiphyte of *A. nodosum*.	None	B	2	2	4	L	As above for *A. nodosum*.						
2b	**Red algae *Mastocarpus stellatus (Stackhouse) Guiry*, *Chondrus crispus Stackhouse* and *Corallinaceae***	Located beneath the *A. nodosum* canopy.	None	B	1	2	2	L	As above for *A. nodosum*.						
2c	**Ephemeral green algae** (e.g. *Cladophora rupestris (Linnaeus) Kützing*, *Ulva sp. Linnaeus* and *Enteromorpha* sp. Link)	Can occur at low densities in *A. nodosum* biotope.	None	B	1	3	3	L	As above for *A. nodosum*.						
2d	**Other seaweed species:** *Lomentaria articulata* (Hudson) *Lyngbye* and *Membranoptera alata (Hudson) Stackhouse*)	Occur under tidal swept conditions.	None	B	1	2	2	L	As above for *A. nodosum*.						
3a	**Periwinkles** : (e.g. *Littorina obtusata Linnaeus* and *Littorina littorea Linnaeus*).;	Snails which graze some epiphytes from *A. nodosum* surface.	None	B	3	3	9	M	*A. nodosum* will be harvested in a sustainable manner (see Appendix 4 for Code of Practice). A system is in place which	Non-conformance at any stage of harvest or management.	1)Harvest activities will be assessed for compliance at all levels including: • Hand-Harvesting training records. • Goods received notes	Resource Manager QC	Routinely during harvest periods & via Quarterly	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance	Operations meeting/ Harvest Meeting.

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species within the *A. nodosum* biotope.	**Distribution, extent & location**	**Compliance requirements:** **(in accordance with EU Dir. 92/43/EEC & NPWS)**	**Decision matrix** Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
									ensures that: •Severe reductions in canopy coverage will not occur, thus ensuring sufficient habitat for active feeding stages and reproductive purposes of *Animalia* such as periwinkles. •*A. nodosum* mortality will not occur at levels which otherwise could lead to reductions in habitat for *Animalia*. •By-catch: all *Animalia* observed post-harvest will be returned to water, where possible. Teaching harvesters to avoid fronds with visible periwinkle egg masses.		(GRNs). • Site Inspection forms. 2)Monitoring: • Levels of holdfast. • Harvest technique at sites		audit Annual audit	using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Annual Review of compliance requirements.
3b	**Limpets**	Throughout the biotope.	None	B	3	3	9	M	*A. nodosum* will be harvested in a sustainable manner (see Appendix 4 for Code of Practice). A system is in place which ensures that: •Severe reductions in canopy coverage will not occur, thus ensuring sufficient habitat for *Animalia* such as limpets. •*A. nodosum* mortality will not occur at levels which otherwise could lead to reductions in habitat for *Animalia*.	Non-conformance at any stage of harvest or management.	1)Harvest activities will be assessed for compliance at all levels including: • Hand-Harvesting training records. • Goods received notes (GRNs). • Site Inspection Forms. 2)Monitoring: • Levels of holdfast. • Harvest technique at sites	Resource Manager QC	Routinely during harvest periods & via Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species within the *A. nodosum* biotope.	Distribution, extent & location	Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)	Decision matrix: Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		Action Limit / non-conformance	Analytical Procedure	By	Monitoring Schedule (Frequency)	Corrective Action	Verification
									•By-catch: all *Animalia* observed post harvest will be returned to water, where possible.						
3c	**Barnacles**	Throughout the biotope.		B	3	2	6	L	As above for *A. nodosum*.						
3d	**Hydroid** (*Dynamena pumila Linnaeus*)	May be found on tips of *A. nodosum*.	None	B	3	2	6	L	As above for *A. nodosum*.						
3e	**Sponges** (e.g., *Leucosolenia* sp. *Bowerbank*, *Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu*)	Can occur on steep surfaces and under boulders in areas of strong tidal currents.	None	B	2	2	4	L	As above for *A. nodosum*.						
3f	**Sea squirts** (e.g. *Ascidiella*)	Can occur at the lower shore	None	B	1	2	2	L	As above for *A. nodosum*.						
3g	**Other mobile species:** (Phylum Arthropoda (Amphipods, isopods crabs, *Chironomida*, *Halacaridae*, *Ostracoda*), Phylum Platyhelminthes (e.g. *Turbellaria*), Phylum Annelida, Phylum Foraminifera, Phylum *Nematoda*)	Can occur amongst the seaweed.	None	B	2	2	4	L	•Harvesters will work to ensure that co-harvesting of other species does not occur. •By-catch: all *Animalia* observed post harvest will be returned to water, where possible.	Non-conformance at any stage of harvest or management.	Harvest activities will be assessed for compliance at all levels. This will include assessment of hand-harvesting training records and harvesting technique at sites	Resource Manager QC	Routinely during harvest periods & via Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.

Table 12 : Impact on the *Ascophyllum nodosum* Biotope and species therein

3.4 Ensuring continuous disturbance levels do not exceed an area of 15%.

Consultations between NPWS and BioAtlantis took place in September 2014. This provided clarity on obligations for ensuring that key measures of conservation status are adhered to. These are: Area, Range, Structure and Function. Future Prospects are also required when considering effects in SAC and SPA areas. As hand harvesting of *A. nodosum* does not give rise to permanent damage to the shore, it does not interact with the parameters of Area or Range (NPWS, personal correspondence). However, targeted removal of species has potential to result in alterations to Structure & Function. NPWS recommend that continuous disturbance of each community type should not exceed an approximate area of 15%. To measure the potential impact on structure and function in Clew Bay, BioAtlantis requested marine community type datasets for Clew Bay. The shapefile was provided by courtesy of NPWS in ESRI format (18/08/2014). Using AutoCAD software, engineering personnel at BioAtlantis calculated (a) the total area (m^2) in Clew Bay SAC of each marine community type and, (b) the area affected by harvest activities/annum (m^2 and percentage). A draft of Table 13 below was provided to NPWS (09/09/14) which contains a list of each marine community type in the Clew Bay SAC and the area affected by hand harvest activities. The only habitats to be impacted by hand harvesting of *A. nodosum* are reef and shingle, at levels of 4.9% and 12.7% respectively per annum. These figures fall below the 15% limit for significant continuous or ongoing disturbance outlined in the conservation objectives document for this SAC and the associated limits for conservation of structure and function, thereby complying with the EU Commission. Adherence with these limits is ensured as harvesting site locations and activities will be planned and recorded. The percentage of the reef and shingle which are Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160], that will be impacted each year is also very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,188.5 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. The status and quality of the *A. nodosum* habitat will be maintained by adhering to the sustainable harvesting methods and limits specified for the extent of these harvesting activities. The BioAtlantis ‘Code of Practice’ for *A. nodosum* harvest activities in Clew Bay SAC has been updated to ensure that management work within these 15% limits (see Appendix 4). For details on action limits, analytical procedures, monitoring and corrective actions, see Table 16(1) and Appendix 5(d).

To adhere with the EU Commission, NPWS also require that the operations by BioAtlantis do not interact with other existing and planned activities, to levels which would increase interactions beyond the stated 15% limit. These activities include aquaculture, recreational use, other harvesting of seaweed or invertebrates, etc. BioAtlantis has assessed these potential interactions in detail in Section 3.6 of this document. A number of potential interactions were identified and mitigation measures have been developed to ensure that cumulative and in-combination effects do not occur. This ensures that BioAtlantis work within the 15% limit set by NPWS and in turn, comply with the EU Commission. A summary of the extent to which in combination effects potentially interact with marine community types, Annex I and II habitats and species, and their mitigation, is provided in Tables 14 & 15. For a full, in depth assessment of in-combination effects, please consult Appendix 7.

Marine habitat type (Clew Bay SAC)	**Total Area in Clew Bay SAC (m^2)**	**Area affected by harvest activities/annum**		**Area of Large Shallow Inlets and Bays [1160] affected/annum**
		(m^2)	**(%)**	**(%)**
Zostera Community	1,423,891	0	0.0%	0.0%
Shingle	1,855,000	235,549	12.7%	0.23%
Reef	26,870,000	1,331,699	4.9%	1.31%
Maerl Dominated community	2,878,607	0	0.0%	0.0%
Fine Sands Dominated by *Nephtys cirrosa* community	2,950,308	0	0.0%	0.0%
Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex	7,817,100	0	0.0%	0.0%
Mudflats & sandflats not covered by seawater at low tide	12,541,069	0	0.0%	0.0%

Table 13: List of marine habitat types and the area affected by hand harvest activities

Figures of 0% are assigned to areas where *A. nodosum* does not grow or where BioAtlantis has specifically avoided in this application due to the sensitive nature of some of these areas.

3.5 Broad, holistic examination of the nature, extent and impact of hand harvesting.

3.5.1 Introduction

This section builds on findings from Section 3.3 (direct and indirect impacts), by providing holistic examination of the nature, extent and impact of hand harvesting in Clew Bay. This is required to examine the potential effects of hand harvesting in a broader context and if necessary, provide further mitigation where significant risks are identified. The scope of this examination includes:

- The spatial extent of harvesting techniques and activities:
  - Managing expansive and prolonged operations.
  - Managing personnel and exploitation levels.

- The potential interaction effects of seaweed harvesting:
  - Targeted removal of species
  - Non-targeted removal of species.
  - Disturbance and displacement of species and habitats.
  - Changes in community structure.
  - Changes in hydrodynamics and water quality.
  - Disturbance of marine fauna.
  - Coastal habitats.

For details on action limits, analytical procedures, monitoring and corrective actions for each risk identified, please see Table 16 and Appendix 5(e).

3.5.2 The spatial extent of harvesting techniques and activities

(a) Management of expansive and prolonged operations

BioAtlantis will employ a site-specific management approach to managing harvest activities in the Clew Bay SAC, throughout the entire year. This ensures that activities take place at appropriate locations and at appropriate times. Specifically, this allows for robust mitigation measures to be employed to ensure that sites designated as unavailable for harvest at a particular time due to presence of sensitive seal and bird species, are not visited (see 'Code of Practice', Appendix 4). Thus, while the total area of coastline in Clew Bay is quite large, the approach of selecting environmentally-appropriate sites, effectively narrows the focus to a small number of discrete locations at any given time. The use of a boat ensures ease of access to the sites. This brings full traceability to the process, as the quality of harvest from each location is monitored and biomass is weighed on collection and recorded on a Goods Received Note (GRN). The benefits of this technique is that harvester's times is no longer spent hauling seaweed ashore and coastal damage that could be caused by bringing in large quantities of seaweed ashore at inappropriate locations is avoided. Alternatively, harvesters may tow the floating bags/nets from the harvest site directly to the pick-up points. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points. The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility. The site ID or GPS location of the harvest area will be recorded.

A second GRN will also be completed on receipt of the harvested seaweed at BioAtlantis' factory in Tralee. The Resource Manager will inspect sites post-harvest to confirm that harvesters are operating as required (recorded on the SIF). For details on action limits, analytical procedures monitoring and corrective actions for risk associated with management or expansive and prolonged operations, please see Table 16(2) and Appendix 5(e1). All control measures have been included in the 'Code of Practice' (Appendix 4).

(b) Numbers of personnel and exploitation levels

Approximately 16 full time people, or 32 part-time, will work for an average of 230 days/year, harvesting approximately 3.5 tonnes per day (rate of ~10.4Kg/M^2). The area harvested will be 26,923m^2 per day per 16 harvesters. This reflects a harvest rate of 20% of *A. nodosum* biomass per site per annum. This corresponds to an area occupied of 1,683m^2 per person/day or 0.4acres per person per day, for approximately 6-8 hours per day. Thus, the low number of people over a wide area reduces the potential for anthropogenic impacts (e.g. intensity of trampling) on the biotope. In fact, given that the BioAtlantis plan targets specific areas at specific times of the year, the low levels of trampling events will also be largely episodic in nature. It is unlikely therefore, that any significant change in the structure of *A. nodosum* assemblages will occur. Furthermore, as BioAtlantis will implement a policy against holdfast removal, the incidence of *A. nodosum* mortality will be reduced considerably (see 'Code of Practice', Appendix 4). As such, the harvest level of 20% of biomass will represent a relatively constant figure and will not be exacerbated due to significant levels of *A. nodosum* mortality due to partial or complete holdfast removal (see below for more details). For details on action limits, analytical procedures, monitoring and corrective actions for risk associated with numbers of personnel and exploitation levels, please see Table 16(3) and Appendix 5(e1). All control measures have been included in the 'Code of Practice' (Appendix 4).

3.5.3 The potential interaction effects of seaweed harvesting

(a) Targeted removal of species

See Section 3.3.5, "Impact on the *Ascophyllum nodosum* biotope and species therein", for assessment of potential impact of targeted removal of *A.* species. For details on action limits, analytical procedures, monitoring and corrective actions, please see Table 16(4) and Appendix 5(e2). All control measures have been included in the 'Code of Practice' (Appendix 4).

(b) Non-targeted removal of species

Species with potential to be inadvertently co-removed during *A. nodosum* harvesting may include *Fucus* sp., periwinkles, limpets, Amphipods and isopods. The potential impact of hand harvesting on these species is outlined below. For details on action limits, analytical procedures, monitoring and corrective actions, please see Table 16(5) and Appendix 5(e2). All control measures have been included in the 'Code of Practice' (Appendix 4).

- ***Impact on Fucus***

  BioAtlantis Ltd. produce pure extracts of *A. nodosum* and as such, consider *Fucus* as a contaminant material. In addition, by-catch of *Fucus* is not acceptable as this could also lead to unnecessarily increases in loss of fucoid canopy. Further loss of fucoid canopy could have negative effects on understory species within the biotope, particular given that many species residing within the *A. nodosum* canopy also graze or seek shelter within *Fucus* canopies. In some cases, *Fucus* can be observed to be closely interspersed alongside *A. nodosum* and in rare cases can even grow directly on *A. nodosum* plants. Harvesters will be provided with sufficient training, where required, to ensure avoidance of *Fucus*. The traditional sickle/knife hand harvest method at low tide allows for necessary sufficient oversight over cutting. BioAtlantis consider a range of levels of *Fucus* exceeding 1-5% as being unacceptable (see 'Code of Practice', Appendix 4).

- ***Impact on Periwinkles and Limpets***

  Periwinkles and limpets are important grazing species within the *A. nodosum* biotope and changes in canopy cover can lead to changes in the numbers of these species. *A. nodosum* canopy removal has been shown to cause: (a) reductions in the numbers of periwinkles (*Littorina obtusata*, Black & Miller (1991) and (b) alterations to limpet density (Davies *et al.*, 2007 and references therein). To avoid alterations in numbers of species within the biotope, BioAtlantis will take an approach which prevents cutting below 8 inches and training will be provided to harvesters, where necessary, on measures to ensure that 8-12 inches of the crop is left behind post-harvest.

  Littorina obtusata tends to feed at high tide. At low tide, *L. obtusata* crawls into the algae canopy and remains dormant unless conditions are favourable, such as dampness, etc (Williams *et al.*, 1990). This behaviour protects the organism from desiccation and temperature stress, whilst also preventing predatory attack by birds. Likewise, *Littorina littorea* actively feeds at high tide, seeking shelter within the canopy at low tide, in order to trap enough moisture to facilitate gaseous exchange (Karleskint et al. 2009). The technique employed by BioAtlantis will ensure that harvest takes place at low tide when periwinkles are more likely to be dormant or covered by *A. nodosum* fronds. Harvesting will not take place during the feeding stage at high tide when periwinkles are out of their shells. Leaving 200-300mm (8-12 inches) of *A. nodosum* behind during harvest and preventing cutting below 200mm (8 inches), will ensure maintenance of the canopy (see Appendix 4, 'Code of Practice' and Appendix 3, Site Inspection Form). Holdfast removal is not acceptable. Since most periwinkles will reside low down within the canopy at low tide, the chances of their inadvertent by-catch is also reduced.

It is important to note that periwinkles do not exclusively feed on *A. nodosum* and also graze and reside in canopies of *Fucus* species, including *Fucus vesiculosis* and *Fucus* serratus. BioAtlantis will not harvest either of these species, thus ensuring that this portion of the periwinkle and limpet habitat is unaffected. BioAtlantis do not consider *Fucus* by-catch to be acceptable and will limit by-catch at 1-5%. This will be achieved through inspections by the Resource Manager (See Appendix 4, 'Code of Practice' and Appendix 3, GRN).

In terms of reproductive requirements, *L. obtusata* lays white, oval egg masses containing a large number of eggs, on *Ascophyllum*, *Fucus vesiculosis* and *F. serratus*. The egg masses are clearly visible to the naked eye. Eggs may sometimes be laid on the surface of rocks. As part of training on approaches to mitigate against risks of reducing *L. obtusata* numbers, harvesters will be provided with training, where necessary, to identify and avoid *A. nodosum* plants or fronds which contain substantial egg masses (see Appendix 4, 'Code of Practise'). In the case of *L. Littorina*, eggs are released with the tide. Following development from a free-living form, *L. Littorina* settles at the base of the *A. nodosum* canopy. Training will be provided to harvesters, where necessary, on approaches to avoiding disturbance by (a) cutting at low tide, (b) aiming to leave between 200-300mm (8-12 inches) of material behind and (c) under no circumstances cutting less than 200mm above the holdfast. By avoiding *Fucus vesiculosis* and *F. serratus*, harvesters can avoid *L. obtusata* egg masses growing on these seaweed species. *L. Littorina* present at the base of these canopies will likely be unaffected as biomass levels are maintained. As a mitigation measure, any periwinkles, amphipods, isopods or other *Animalia* by-catch observed post harvest, will be collected and returned to the water, where possible (See Appendix 4, 'Code of Practice').

- ***Impact on Amphipods and isopods.***
  Most amphipods and isopods are relatively inactive at low tide. Harvest at low tide therefore, avoids potential by-catch of species which would otherwise be active in the intertidal zone during high tide. The likelihood of displacement will be low as harvesters will have full view and control of their activities, and will receive training where necessary. Harvesters will work to ensure that co-harvesting of other species does not occur, thus reducing the potential for trapping. As with other species, any by-catch observed post-harvest will be collected and returned to the water, where possible (See Appendix 4, 'Code of Practise').

(c) Disturbance and displacement of species and habitats

Reef and understory *Animalia* and *Fucus* sp. have been identified as being potentially at risk of disturbance and displacement. This is outlined below. For details on action limits, analytical procedures, monitoring and corrective actions, please see Table 16(6&7) and Appendix 5(e3). All control measures have been included in the 'Code of Practice' (Appendix 4).

- ***Reef***
  A. nodosum can grow on almost any solid substrate provided that the coast is very sheltered. The coastal substrate in Clew Bay is a heterogeneous mixture of small rocks, small stones & pebbles, all classified as reef by NPWS with stated objectives for their maintenance. The high degree of shelter afforded to the coastal areas of Clew Bay allows for extensive *A. nodosum* growth, even on such small, pebble-sized substrate. Given the frequent occurrence of small substrate, hand harvesters will have full view of the cutting process and have adequate training, where necessary, to ensure that substrate is not disturbed. Increased removal of holdfast by-catch can also occur due to the presence of underlying friable substrate (ref: paragraph. 3, page 19, Vandermeulen *et al.*, 2013). This is particularly relevant for Clew Bay and must be mitigated against.

  The risk of disturbing or displacing substrate during hand harvest with a sickle or knife in Clew Bay will be minimal. The hand cutting method employed by BioAtlantis is more appropriate for the small, stony, friable, substrate of the drumlin islands of Clew Bay. In this process, harvesters operate at low tide and therefore, have full view of the cutting process, allowing them to take care not to disturb the substrate. In addition, the hand cutting approach avoids holdfast removal and the harvesters have sufficient oversight on the cutting process and co-harvest of holdfast is prevented. In effect, this avoids potential for *A. nodosum* mortality. For these reasons, BioAtlantis has chosen the hand harvest method over other methods such as rake cutters. A mitigation measure is also in place to monitor and ensure that substrate is not disturbed to the extent whereby it could enter into the harvested weed or give rise to holdfast in the harvested seaweed (see Appendix 4, 'Code of Practice'). This quality measure will be recorded on the GRN by the Resource Manager (Appendix 3), along with spot checks at production facilities to ensure such contaminants are absent.

- ***Understory Animalia and Fucus sp.***
  As described in (b) above, the potential for disturbance and displacement of understory *Animalia* such as periwinkles and limpets is reduced, as hand harvest will take place at low tide, when species are less active. Mitigation measures are also in place to ensure that by-catch observed post harvest is returned to the water, where possible. Algae species such as *Fucus* are also unlikely to be disturbed or displaced, as harvesters will receive training, where necessary, to avoid non-*A. nodosum* canopies.

(d) Changes in community structure

The study by Kelly *et al.*, (2001) examined the impact of hand harvesting over an 18 month period. While this study demonstrated recovery of *A. nodosum* biomass and relatively minimal impacts on understory species, the study has some deficiencies, primarily due the study's short duration, focus on macro-invertebrates and a lack of quantitative data in relation to species prevalence. Therefore, while conclusions can be made regarding the short term impacts of hand harvesting in Clew Bay, there is a lack of evidence regarding long term impacts on community structure.

BioAtlantis will build on the findings of Kelly *et al.*, (2001) and continually assess the impact of *A. nodosum* harvesting over the life-time of the licence. The experimental design will involve measurement of (a) rates of re-growth of *A. nodosum* post-harvest, (b) associated biodiversity. An experimental site will be chosen which will allow for comparisons between non-harvested areas and harvested areas. Sections will be taken which are large enough to allow for sufficient numbers of replicates. A range of parameters will be measured including numbers and/or density of *A. nodosum* plants, numbers of *Fucus* plants, and numbers of *Animalia*. Particular focus will be placed on assessing the numbers of key species such as periwinkles, limpets, barnacles and presence of red algae (Tandy) and Ephemeral green algae. Assessments will be performed on an annual basis to allow for monitoring over an extended time-period, preferable between 5-10 years. An initial pilot study has also already been performed as can be found in Appendix 1 to this application. Furthermore, a study by UCD was undertaken in 2016 to assess the *A. nodosum* resource in Clew Bay. In addition to estimating biomass levels for *A. nodosum*, the study assessed the levels of existing harvesting, estimated biomass of *F. vesiculosis* and characterised substrata at sampled sites.

For further details on the experimental design for future trials is provided in Section 1.3.3 (d). This approach will allow staff at BioAtlantis to continually validate and improve the methodology on an ongoing basis and on a long term basis throughout the life-time of the licence. This will ensure that scientific knowledge is increased beyond the timeframe assessed by Kelly *et al.*, 2001. This will be important in ensuring that conservation objectives are met continually into the future. For details on action limits, analytical procedures, monitoring and corrective actions associated with potential changes in community structure, please see Table 16(8) and Appendix 5(e4). All control measures have been included in the 'Code of Practice' (Appendix 4).

(e) Changes in hydrodynamics and water quality

Water quality and tidal movements were previously examined in Westport Bay, in making provisions for disposal of waste and contaminated storm water from the Westport environment (Kirk McClure Morton, and MarEnCo (2013)). However, no such water treatment facilities have been provided for Newport and potentially, other parts of the complex. Given the negative effects that polluted water can have on *A. nodosum* performance, epiphyte infestation, colonisation and competition by green algae (Hurd, CL *et al.*, 2014), BioAtlantis will be recommending that the relevant authorities contribute to protecting the Clew Bay SAC by installing an effluent treatment system in Newport and requiring other large contributors to pollution in the area to also ensure compliance on this matter. To protect the SAC in Clew Bay, the authorities should not allow this to continue. As a mitigation measure, BioAtlantis will not harvest within 50m of sewage outfalls or other sources of pollution (see Appendix 4, 'Code of Practice'). This will ensure that stressed *A. nodosum* growth is not exacerbated further by harvest activities.

A. nodosum is adapted to growing in highly sheltered environs and as such, has difficulty remaining attached to hard substrate in less sheltered waters. Therefore, *A. nodosum* is unlikely to exert a substantial influence on hydrodynamics. Harvest activities will not reduce height of *A. nodosum* below 200mm (8 inches) and harvesters will receive training, where necessary, to cut between 200-300mm (8-12 inches). Therefore, dramatic changes in biomass levels within the intertidal zone are unlikely to occur. For details on action limits, analytical procedures, monitoring and corrective actions associated with potential changes in hydrodynamics, please see Table 16(9) and Appendix 5(e5). All control measures have been included in the 'Code of Practice' (Appendix 4).

(f) Potential disturbance of marine fauna.

The technique employed during *A. nodosum* harvest, requires cutting at heights well above the holdfast, thus avoiding any fauna present at the base of the canopy. Harvest at low tide also prevents any immediate effects on marine fauna which are exclusively active around the area during high tide. By ensuring maintenance of sufficient canopy, marine fauna can still utilize the *A. nodosum* environment at high tide. Moreover, the long term effects of harvesting is minimized as sufficient photosynthetic tissue left behind which will allow for faster *A. nodosum* recovery post harvest. Limiting the harvest to 20% of the available biomass per site per annum will ensure that sufficient biotope coverage remains. For details on action limits, analytical procedures, monitoring and corrective actions associated with potential disturbance of marine fauna, please see Table 16(10) and Appendix 5(e6). All control measures have been included in the 'Code of Practice' (Appendix 4).

(g) Potential Interactions with coastal habitats:

- ***Introduction***

  As a canopy forming species, *A. nodosum* is well recognised as an important structuring species, modifying the physical environment through a range of biotic interactions (Gollety *et al.,* 2008 and references therein). *A. nodosum* contributes to the organic deposition throughout the littoral zone and marine environment. However, the rocky shoreline by its very nature is not a closed system and organic matter will tend to transfer from the area into the wider marine environment. It should be noted that *A. nodosum* is very low in protein content and its contribution to nitrogen levels in the ecosystem are minimal. However, as a primary producer located close to the back shore, it is essential that the potential impact of any loss of *A. nodosum* on nearby costal habitats is examined. From an assessment of scientific literature, there are two coastal habitats which have potential to be impacted indirectly by hand harvest activities, Atlantic salt meadows and Sand dune habitats. This is described as below. For details on action limits, analytical procedures, monitoring and corrective actions associated with potential interactions with coastal habitats, please see Table 16(11) and Appendix 5(e7). All control measures have been included in the 'Code of Practice' (Appendix 4).

- ***Atlantic salt meadows (Glauco-Puccinellietalia maritimae)***
  Clew Bay is characterised by the presence of saltmarsh habitats extending at various sites throughout the complex. They tend to 'fringe' the intertidal zone of muddy or sandy coasts of estuaries and protected shores. Primary producers in salt marshes include: *Spartina, distichlis, Puccinellia, Salicornia, Carex, Juncus*. Loose fronds of *Ascophyllum* and *Fucus* occur at the lower part of the intertidal belt (Valiela L, 1995). There is some evidence for interactions between *A. nodosum* and salt marsh environments in general. Studies have indicated an "obligate occurrence of fucoid algae, primarily *A. nodosum* with *Spartina alterniflora* on the eastern coast of America" (Callaway, R. M. 2007 and references therein). It has been hypothesized that this relationship may be due to the formation of stable algae mats by grass roots. A study by Gerard *et al.*, in 1999 identified lower levels of *S. alterniflora* biomass in areas where the *Ascophyllum nodosum Scorpiodes* was removed. *Ascophyllum nodosum Scorpiodes* represents a free living, dwarf form of *A. nodosum*. It may arise due to deposition of *A. nodosum* fragments on sheltered areas such as salt marshes. Factors that determine this morphological expression may include: physical, abiotic factors such as temperature and light-intensity during winter and spring months and/or salinity (Brinkhuis BH, Jones RF, 1976 and references therein). Further research by O'Connor *et al.,* (2011) found no effects of macroalgal removal on cordgrass abundance. However, in order to ensure that *A. nodosum* harvest does not negatively impact on the Atlantic Salt Meadow habitat in general, a mitigation measure is in place to ensure that *A. nodosum* will not be harvested at the fringes of ASM (see Code of Practice, Appendix 4).

  It should be noted that some species of cordgrass are considered as invasive species in Clew Bay and in other parts of Ireland. *S. anglica* species of cordgrass is relatively new having formed by hybridization of *S. alterniflora* and *S. maritima* approximately 100 years ago (Stokes K, O'Neill K, McDonald RA (2006)). This species was planted in Clew Bay in the vicinity of Westport House between 1929 and 1932 and while it not considered as posing a problem to mudflats in Clew Bay, significant swards are observed at Annagh Island sub-site (NPWS 2011).

- ***Sand dune habitats (Annual vegetation of drift lines, Embryonic shifting dunes, Shifting dunes along the shoreline with Ammophila arenaria)***
  Accumulation of organic matter is important for the formation of coastal habitats such as sand dunes and for species which grow throughout these habitats. Some studies indicate that roots of *Ammophila brevilgulata* do not respond well to dead and decaying organic matter and in fact, the extension of roots of seedlings may be

inhibited by the presence of decaying plant matter. However further studies demonstrated that under experimental conditions, the addition of *A. nodosum* organic drift litter material was associated with increased *Ammophila* leaf length compared to other types of debris. This may be associated with the stimulation of growth due to a C:N ratio of 15:1 in algae (Maun, 2009). *A. nodosum* organic drift litter may therefore contribute somewhat to the formation and integrity of sand dune habitats. As the proposed works require physical removal of *A. nodosum* material, there is the potential for indirect effects on sand dune habitats, which could arise due to inappropriate techniques being applied or extensive harvesting occurring. Mitigation measures are in place to ensure that the potential for overharvesting which could have potential indirect impacts on sand dunes, is avoided (Appendix 4). This involves a management system with a high level of oversight to ensure that only sites which contain sufficient levels of *A. nodosum* biomass are harvested, using methodologies which will not result in extensive biomass removal.

3.6 Cumulative and in Combination Impacts

3.6.1 Introduction

Clew Bay is characterised by a wide range of marine activities including aquaculture, fishing, tourism and leisure interests, along with a number of other stakeholders. It is important therefore, to assess the potential for in combination effects to emerge as result of interactions between hand harvesting and other operations in the complex. This is particularly important in ensuring that continuous disturbance does not exceed an approximate area of 15% and that marine community types are not impacted. The current section provides an overview of potential interactions with existing and planned operations in Clew Bay. This is based on an in depth analysis in Appendix 7 of the extent of these operations in Clew Bay. Each significant risk has been mitigated against to ensure the limit of disturbance of 15% is not exceeded. Table 14 and 15 summarises the extent of such effects with respect to marine community types, Annex I and II species and habitats and the use of mitigation measures to ensure the limit of 15% is not exceeded. For details on action limits, analytical procedures, monitoring and corrective actions associated with potential in cumulative and in combination, please see Table 16 (sub-sections 12-16) and Appendix 5 (sections, f, g & h). All control measures have been included in the 'Code of Practice' (Appendix 4). Areas covered by the current assessment is summarised below.

- Existing Operations:
  - Planned, unlicensed, traditional and casual harvesting of seaweed.
  - Recreation & Tourism.
  - Aquaculture.
  - Harvesting of invertebrates.
- Planned Operations:
  - Recreation & Tourism.
  - Other harvest activities.
  - Aquaculture.
  - Harvesting of Invertebrates.
- Vector potential of harvest activities: the spread of invasive species, e.g. *Didemnum vexillum*.
- Conclusions of potential in-combination effects

3.6.2 Existing Operations: Potential in-combination effects and interactions

It is possible that other activities, existing operations or planned operations, which are not part of the BioAtlantis plan to hand harvest *A. nodosum*, may contribute to increasing overall interactions with structure and function in Clew Bay SAC. It is therefore essential to assess these factors to ensure that activities are within the 15% limit for the planned harvesting, as outlined in Section 1 of this document. To assess these effects, data was taken from online resources to measure the extent of existing activities (see Appendix 7). Tourism and recreation companies typically advertise their services online. Information relating to aquaculture activities is also available online. Information on other harvesting activities or harvesting of invertebrates was largely obtained through word-of-mouth or as 'common knowledge'. A detailed assessment of potential in combination effects is provided in Appendix 7 to this application. Risk and mitigation measures which were identified for each type of existing operation are described below:

(a) Unlicensed, traditional and casual harvesting of seaweed.

(i).Overview

The potential for cumulative and 'in combination' impacts on the Clew Bay Complex was assessed given that hand harvesting activities have taken place in the region in recent years. The study by Hession C, *et al.,* (1998) concluded that Co. Mayo had the potential to sustainable yield 16,600 tonnes per annum, the majority of which is located in Clew Bay. Based on a 4 year regeneration cycle this is a maximum yield of 66,400 Tonnes per annum. Through use of data obtained from the on-site assessments (Appendix 1), data from Hession C, *et al.,* (1998) and maps and aerial photographs of the region, BioAtlantis has calculated the current maximum yield *A. nodosum* from the Clew Bay to be of the order 65,060 tonnes. This equates to an annual sustainable harvest of 13,012 tonnes.

As shown in Table 1 of this document, BioAtlantis aim to harvest ~11,018 wet tonnes of *A. nodosum* per annum in Clew Bay, in a manner which is sustainable and does not exceed 20% of the total available biomass from any one site per annum. In this context, the potential impact of other small-scale activities may be low. However, a recent survey has provided evidence that harvest activities are currently ongoing in Clew Bay (see Appendix 1). Moreover, the methods used can be quite severe and not in line with best practice. On approval to hand harvest in Clew Bay, BioAtlantis will work to identify all sites which have been harvested recently. These areas will then be designated as requiring an appropriate fallowing period, depending on the level and severity of harvest. This approach will ensure that BioAtlantis hand harvest activities will not occur in recently harvested sites, thus preventing any cumulative effects.

In order to ensure that harvest activities are sustainable and not damaging to protected species and habitats, as specified by the NPWS, it is the aim of BioAtlantis to be granted a license to undertake hand harvest activities in the region. In such an event, BioAtlantis will commit to ensuring that all activities under its control are monitored and recorded with full traceability. This will include a non-conformance reporting system and corrective actions. Management systems such as these represent the only practical means of guaranteeing that there are no significant risks either direct, indirect, isolated, interactive, cumulative or short term or long-term on this SAC site. As described in this assessment, the implementation of the BioAtlantis plan to hand harvest *A. nodosum* in Clew Bay will ensure that there are no significant effects on the extent, biodiversity or species richness at this site.

(ii). Preventing in-combination effects with current hand harvesting activities:
Significant levels of *A. nodosum* have been harvested in Clew Bay and supplied to commercial companies. Details as to the quantities harvested are unknown. There is a risk therefore, for in combination effects of the proposed hand harvesting by BioAtlantis Ltd. and existing harvest activities. Also, there are risks for in combination effects associated with local companies (e.g. hotels and health Spas), who use seaweed as part of 'seaweed baths' and other health and beauty services. Some companies and individuals also offer "Seaweed harvesting discovery days", particularly in the Mulranny area. The potential in combination effects of each of these activities must also be mitigated against. Mitigation measures listed below have been included in the Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC (see Appendix 4):

Management obligations: BioAtlantis will be responsible for commercial harvesting of *A. nodosum*. To ensure compliance with Clew Bay's conservation objectives and prevent in combination or cumulative effects, the following applies:

- **Burdens and appurtenant rights to harvest seaweed:** BioAtlantis will not harvest in areas where there are existing appurtenant rights or burdens in relation to the harvesting, gathering or removal of seaweed from the shore, without first obtaining permission from the owner of such rights.
- **Profit-à-Prendre rights:** Where Profit-à-Prendre rights to harvest seaweed are successfully registered with the PRAI, the harvesting plan will be adjusted to ensure that those individuals can continue to harvest *A. nodosum.* It is envisaged that a clause may be inserted into the licence issued to allow the harvesting of *A. nodosum*, stating that if a Profit-à-Prendre right holder provides sufficient proof to their right, the licensee would be prohibited from harvesting in that area, without first obtaining permission from the owner of such rights.
- **Small scale harvesting:** Harvesting activities will not impact on other people who harvest small volumes of seaweed, edible seaweeds or invertebrates for their own personal use, e.g. dillisk, carrageenan, limpets, mussels, clams, periwinkles and scallops.
- **Commercial harvesting:**
  - If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. BioAtlantis will not harvest in such areas until *A. nodosum* has regenerated and will work to ensure that any harvesting is limited to 20% of the total available biomass per site per annum and continuous disturbance of each community type does not exceed the required limit.
  - Any commercial user having small requirements of approximately 1 Tonne per annum (e.g. hotels, health Spas) will be identified and BioAtlantis will work to prevent in combination effects.
- **"Seaweed harvesting discovery days":** BioAtlantis will not harvest beyond Rossmurrevagh, thus avoiding much of the Mulranny area. This avoids in combination effects with excursions in the area.
- **Resource Database:** Clew Bay has in excess of 90 islands and 100Km of coastline that contain harvestable quantities of *A. nodosum*. For the effective management of this area

BioAtlantis will create a database of the islands and coastal areas. This database will be used to:

- Determine sites which require a fallowing period to allow for adequate recovery from recent activities.
- Determine rotation requirements (i.e. extrapolation and calculation of the duration or fallowing period required prior to a particular area being fit for re-harvest).
- Prevent harvest activities that would lead to a decline in yield.
- Record the details of each harvest, how much, by whom & when.

- **Traditional and casual harvesting:**
  In terms of traditional harvesting activities, BioAtlantis aim to utilize and improve the existing system and will contract those with experience in the traditional hand cutting methodology. BioAtlantis will contract traditional hand harvesters who will work within the BioAtlantis system. This will ensure that traditional hand harvest activities are incorporated seamlessly into a fully licensed system, thus protecting traditional methods, the harvesters themselves and the environment, in tandem. BioAtlantis aim to get the best from the traditional approach but provide improvements which ensure better working conditions and compliance with the SAC objectives.

(b) Recreation & Tourism

There are >18 companies specializing in watersports-related activities in Clew Bay. Activities take place throughout the complex. There are also several important bases present. In most cases, the potential risks associated with such activities are deemed insignificant (See Appendix 7). However, potential risks have been identified which include potential impacts on Annex II species and potential for increased anthropogenic disturbances at certain sites along the intertidal zone. Risks identified are described below. Mitigation measures are also indicated and are included in the Code of Practice for hand harvest activities (see Appendix 4):

- **Risk 1 (Annex II species & birdlife):** The plethora of marine-based activities which can impact on Annex II species are well described by NPWS scientists and others. In Clew Bay, such activities include: Power Boat Trips, Sea Trampoline, Sit-On-Top Kayaking, Sea Kayaking, Dinghy Sailing, Stand Up Paddle Boarding, Keel Boat Sailing. In some cases, this may even involve targeted visits by tourist companies to sites with known "seal colonies" and birdlife. There is therefore, potential for in-combination effects associated with hand harvest activities and existing human interactions with harbour seals and birdlife. This must be mitigated against.
  - Mitigation measure: hand harvest activities will not take place at harbour seal and bird sites at sensitive times of the year, thus preventing any in combination effects from occurring.

- **Risk 2 (Annex I habitats and species):**
  There are many bases established by tourist companies in Clew Bay, varying in size and extent. Many utilize well-established bases which do not host intertidal *A. nodosum*. However, some smaller bases in more remote locations require transference of

equipment into the water across substrate which can host intertidal seaweed. These activities can give rise to small patches which contain lower density of intertidal seaweed. An example of such an effect is Dinghy sailing activities which may be associated with small, localized reductions in seaweed cover. While the impact of such anthropogenic disturbances is relatively low, in and of itself, it raises the potential that in-combination effects associated with hand harvest activities could occur. This anthropogenic disturbance risk will be mitigated against (see Appendix 4, 'Code of Practice' and below).

- Mitigation measures: hand harvesters will not work within 50m of bases where equipment or vessels are manually introduced in the water. This ensures that no in combination effects occur, such as exacerbation of anthropogenic disturbance which could give rise to lower density of intertidal seaweed and the associated biotope.

- **Risk 3 (Collanmore island):**
  Collanmore island is a very active destination for recreational tourists and there are many associated marine based activities. Collanmore is not considered a site for sensitive harbour seals or protected bird species and as such, the risk of affecting Annex II species is very low. However, by virtue of increased numbers of recreational tourists in general in Collanmore, there is an increased chance for anthropogenic disturbances during peak tourist season. Individuals may also rest equipment such as kayaks on shingle or rocky shorelines containing *A. nodosum* or transfer equipment from bases into the water across reef or shingle substrate. Overall, there is potential for in-combination effects associated with hand harvest activities and the increased human presence on Collanmore and this will be mitigated against (see Appendix 4, 'Code of Practice' and below).
  - Mitigation measures: Harvest will only occur on Collanmore between Sept-April. This will prevent in combination effects such as exacerbation of anthropogenic disturbance which may occur during peak tourist season. Also, hand harvesters will not work within 50m of bases where equipment or vessels are manually introduced in the water, thus preventing further anthropogenic disturbance.

(c) Aquaculture and fisheries activities.

There are several companies specializing in aquaculture in Clew Bay. Activities are diverse and include shellfish species (oyster, mussels, clams), culture of Atlantic Salmon and a fish hatchery (Marine Institute, 2014). Many aquaculture sites have been identified as predominating in mudflat and sandflat areas along northern and southern portions of the complex. There are other sites located in north-central Clew Bay and along the eastern shoreline. In many cases, aquaculture sites are located in proximity to sites which are sensitive to Annex II species such as harbour seals and protected bird species. There are risks therefore, that such activities may interact with hand harvesting activities and such affects must be mitigated against. There are also risks that activities associated with hand harvesting could interact with existing impacts attributed to aquaculture in these areas. A recent study by the Marine Institute (2014) assessed potential impacts of licensed and planned aquaculture activities on species and habitats in Clew Bay. The study concluded that existing aquaculture activities are non-disturbing to harbour seals species or otter species. However, there is one potential exception with a licence to culture abalone which may have potential to impact on harbour seals (Marine Institute, 2014). Hand harvesting of *A. nodosum* would require mitigation to prevent in combination effects. There are potential interactions between hand harvest activities and aquaculture, including (a) direct impact on reef due to removal of species and (b) impacts upon intertidal sediments due to travel across the shore to harvest sites (Marine Institute, 2014). Studies by the Marine Institute (2014 and 2019) concludes that is it unlikely that hand harvest of seaweed and intertidal shellfish culture will overlap in Clew Bay, given that reef is not considered suitable for culture of shellfish. In relation to the potential impact of seaweed harvesting, the study also concludes that it is "unlikely that the in combination effects of transport routes across intertidal flats will give rise to persistent disturbance of >15% on intertidal mudflats and sandflats". While the risks cited above are unlikely to give rise to in combination effects, BioAtlantis has developed a Code of Practise (Appendix 4) which work to ensure such risks are mitigated against:

- Harbour seals: harvest will not take place at sites relevant to harbour seals during sensitive times of year (breeding, moulting, resting). This prevents in combination effects from occurring.
- Caution is required when approaching or operating near areas where existing aquaculture sites are known to be in relatively close proximity to harbour seal breeding sites (e.g. Inishcarrick, Inishcorky, Inishdasky, Inishilra), harbour seal moulting sites (e.g. Inisheeny), harbour seal resting sites (e.g. Inishtubrid), bird breeding sites (e.g. MoynishBeg, Inishcorky, Mauherillan) and bird wintering sites (e.g. Inisheeny).
- Mudflats and Sandflats: A code of practice is in place to ensure environmentally safe navigation when operating mudflats and sandflat areas. This will prevent any impact on mudflats or sandflats or intertidal sedimentary communities therein. Crucially, it ensures that any existing negative effects associated with aquaculture are not exacerbated by hand harvest of *A. nodosum* (See Appendix 4).
- Fishing and Angling: harvesters will respect angler's space and not impact on requirements of fisheries in the Complex.
- Adhere to all aspects of Section 10 of the Code of Practice and other relevant sections.

See Appendix 4 for a full range of measures to prevent interaction or in combination effects with aquaculture and fisheries activities.

(d) Harvesting of invertebrates

Fisheries Statistics for Clew Bay in 2003 (ref: Newport Sewerage Scheme EIS; 2007) indicate removal of the following species from Clew Bay, at varying tonnages: Crab Edible, Lobster European, Crab Velvet, Mussel Blue, Oyster Pacific, Shrimp Palaemonid nei, Periwinkle Common. As periwinkles and cockles are known to be hand gathered in parts of Clew Bay, the potential risk of in combination effects with hand harvesting *A. nodosum* must be assessed. In combination effects on other invertebrates is less likely. Risks identified are provided below. Mitigation measures are also indicated and have been included in the Code of Practice for hand harvest activities (see Appendix 4):

- **Risk 1: Hand gathering of periwinkles:**
  Hand gathering of periwinkle occurs within the intertidal zone of Clew Bay, on shores containing *A. nodosum* and *Fucus* sp. The precise spatial distribution and extent of periwinkle harvesting in Clew Bay has not been established, but is likely to occur

throughout the SAC and at varying levels. Potential risks associated with periwinkle harvesting are reductions in periwinkle population numbers due to removal and anthropogenic disturbances caused by trampling. There is potential for in-combination effects associated with *A. nodosum* hand harvest activities and existing periwinkle harvest activities. The standards developed as part of the Code of Practice (Appendix 4) reduce the likelihood of any in combination effects associated with existing hand gathering of periwinkles activities. These are described below and listed in Appendix 4:

- Mitigation measures:
  1. Harvest of *A. nodosum*: Harvesters will be taught to leave between 8-12 inches of the crop behind. Cutting below 8 inches will be avoided. This standard will be monitored by the Resource Manager. This approach:
     - Avoids extensive removal of *A. nodosum* canopy coverage and damage to the ecosystem and
     - Avoids interactions with or by-catch of dormant or resting periwinkles positioned at the base of the *A. nodosum* canopy and
     - Ensures that developing free-living forms of *L. Littorina* are able to settle and establish within intact canopies.
  2. *L. obtusata* eggs: Harvesters will work to avoid *A. nodosum* plants which contain visible *L. obtusata* egg masses. This is important to prevent harvest of viable eggs, thereby promoting maintenance of population size.
  3. Do not harvest *Fucus*: *Fucus* content of harvested *A. nodosum* will be limited to no more than 5%, thus preventing removal of an additional canopy source which supports periwinkles, their egg masses and other species.
  4. By-catch checks: Inadvertent co-removal of periwinkles identified as by-catch post-harvest will be collected and returned to the water, where possible.

See Appendix 4 for a full range of measures.

- **Risk 2: Hand gathering of cockles:**
  Cockles are known to occur on intertidal muddy sand shores east of Mullranny. Hand gathering may occur at a low scale. Commercial dredge fishery for cockles does not occur (Marine Institute, 2014, 2019). Potential impacts of cockle gathering include impacts on intertidal sedimentary communities (Mudflats and sandflats not covered by seawater at low tide [1140]). There is potential for in-combination effects associated with *A. nodosum* hand harvest activities and cockle hand gathering, as seaweed hand harvesting may involve activities along the rocky shoreline beyond mudflats and sandflats.
  - Mitigation measures: A code of practice is in place to ensure environmentally safe navigation when operating mudflats and sandflat areas. This will prevent any impact on intertidal sedimentary communities (See Appendix 4).

- **Risk 3: other invertebrates:**
  Other invertebrates removed from Clew Bay, are mainly limited to deeper waters, thus removing any risk of in-combination effects associated with hand harvesting activities. However, there is a risk that hand harvesting may impact on slow moving invertebrates in general given that nets/bags are used along the intertidal zone.

- Mitigation measures (also listed in Appendix 4):
  1. By-catch: A code of practice is in place requiring harvesters to ensure that co-harvesting of other species does not occur.
  2. Inadvertent co-removal of *Animalia* will be collected and returned to the water, where possible.

See Appendix 4 for a full range of measures.

3.6.3 Planned Operations: Potential in-combination effects and interactions

The potential in combination effects of planned operations in Clew Bay and hand harvesting of *A. nodosum* have been assessed (see Appendix 7). The planned operations have been identified are described below. For details on action limits, analytical procedures, monitoring and corrective actions associated with potential in cumulative and in combination, please see Table 16 (sub-sections 12-16) and Appendix 5(sections, f, g & h). All control measures have been included in the 'Code of Practice' (Appendix 4).

(a) Harvest activities:

No planned operations identified.

(b) Recreation & Tourism

- **Risk 1: Increased anthropogenic disturbances**

  Westport Towns and Environs Development Plan 2010-2016 targets Roman Island for considerable development in terms of marine-based activities and tourism (ref: Mayo County Council 2010), thus raising the potential for interaction between hand harvesting (e.g. increased anthropogenic disturbances). Increased numbers of small bases may be developed at Roman Island for commercial recreation activities such (Dinghy, Kayaks). In some cases, transference of equipment from bases into the water may give rise to small patches which contain low density of intertidal seaweed, thus raising the potential for in combination effects. Planning permission has also been granted for the construction of a new reinforced concrete slipway and installation of a floating pontoon just north of Roman Island. The development will supplement proposals to develop a coastguard station in this area, and a number of other recreational uses. Funding has been granted as part of the Mayo County Council 2014 Budget for new marine tourism/leisure infrastructure at Westport Harbour (ref: Hynes P, 2014), thus raising the potential for interaction between hand harvesting and increased tourism-related activities at Westport Quay (e.g. increased anthropogenic disturbances).

  - Mitigation:
    1. Hand harvesters will not work at Roman Island or Westport harbour between May and August. This prevents any in combination effects from occurring during peak tourist season.
    2. Hand harvesters will not work within 50m of bases where equipment or vessels are manually introduced in the water. This ensures that no in combination effects occur which could reduce seaweed cover.
    3. Adhere to all aspects of Section 8 of the Code of Practice.

(c) Aquaculture and fisheries activities:

Hand harvest activities may exacerbate existing effects attributed to licensed aquaculture activities, e.g. disturbance at sites relevant to harbour seals. Overall, the risk of such interactions is considered low (Marine Institute, 2014). However, care must be taken at Inishcorky and potentially neighbouring sites: Inishdeashmore, Inishdeasbeag, unnamed neighbouring island of Inishdeasbeag and Inishnacross (Marine Institute, 2014, 2019). The licence application for Inishcorky island is for abalone culture.

- Mitigation: Seasonal avoidance of sensitive harbour seal sites will be adhered to for all haul out sites, including Inishcorky. This will ensure that harbour seals are unaffected (Code of Practice, appendix 4).
- Caution is required when approaching or operating near areas where planned aquaculture sites are known to be in relatively close proximity to harbour seal breeding sites and bird breeding sites.

(d) Harvesting of Invertebrates

No planned operations identified.

3.6.4 Vector potential of harvest activities in the spread of invasive species.

To ensure that harvest activities to not lead to the spread of *Bonamia ostreae, Botrylloides violaceus, Caprella mutica, Crassostrea gigas, Crepidula fornicate, Didemnum vexillum, Perophora japonica, Sargassum muticum Spartina anglica and Styela clava,* BioAtlantis will ensure the follows:

- Boats will be painted once a year with appropriate anti-fouling paint.
- The harvesters boats will not leave Clew Bay. In the rare case that they do leave Clew Bay, harvesters are required to implement a cleaning measure on land which will involve cleaning with appropriate cleaning agents or using other suitable methods.
- All nets/bags must be cleaned with appropriate cleaning agents or using other suitable methods on delivery to production facilities and returned to harvesters in a clean condition.
- Harvesting will be limited to the *A. nodosum* zone and will not take place in subtidal areas, exposed or semi-exposed sites.
- Harvesters will keep distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures.
- Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and will ensure that inadvertent by-catch of other Animalia, algae or dead, drifting material/algae will be prevented and minimized.

3.6.5 Conclusions of potential in-combination effects assessment

Table 14 and 15 below summarise the type and number of potential in-combination effects which could arise through hand harvesting *A. nodosum*. As indicated, each type of potential interaction has been mitigated against in order to ensure that such interactions will not occur. On this basis, we conclude that areas of reef and shingle affected by harvest activities, will remain unchanged and will not exceed 15% required by NPWS. Risks and mitigation measures are described in the sections above and were initially identified as outlined in

Appendix 7. Mitigation measures have been incorporated in the BioAtlantis "Code of Practice" (see Appendix 4). For details on action limits, analytical procedures, monitoring and corrective actions associated with potential in cumulative and in combination, please see Table 16 (sub-sections 12-16) and Appendix 5(sections, f, g & h).

3.6.6 Holistic examination, cumulative & in-combination effects and continuous disturbance levels (<15%): control measures, monitoring & corrective actions.

Tables 14 and 15 summarise the potential in combination and cumulative effects of harvesting on marine community types, Annex I and II species & habitats in Clew Bay. The numbers of operations impacting on each area are indicated, as previously determined in the analysis in Appendix 7. The use of mitigation to ensure that areas continually affected by harvest does not exceed 15%, is indicated in the right-most column. "*No. of risks", refers to the number of different risks identified in Appendix 7. The figures of 0% are assigned for areas where *A. nodosum* does not grow or areas specifically avoided due to their sensitive nature.

<table>
<tr><th rowspan="3">Marine Community Type (Clew Bay SAC)</th><th rowspan="3">Total Area in Clew Bay SAC (m^2)</th><th colspan="2" rowspan="2">Area affected by harvest activities/annum</th><th colspan="4">Potential in-combination and cumulative effects identified</th><th rowspan="3">Do mitigation measures prevent in-combination effects? (Y/N)</th></tr>
<tr><th colspan="2">Existing Operations</th><th colspan="2">Planned Operations</th></tr>
<tr><th>(m^2)</th><th>(%)</th><th>Type</th><th>No. of risks*</th><th>Type</th><th>No. of risks*</th></tr>
<tr><td>Zostera Community</td><td>1,423,891</td><td>0</td><td>0.0%</td><td>0</td><td>0</td><td></td><td>0</td><td>n/a</td></tr>
<tr><td>Shingle</td><td>1,855,000</td><td>235,549</td><td>12.7%</td><td rowspan="2">• Recreation & Tourism
• Existing harvest activities
• Existing aquaculture
• Invertebrate harvesting</td><td rowspan="2">2
3
0
3</td><td rowspan="2">• Recreation & Tourism
• Harvest activities
• Aquaculture
• Invertebrate harvesting</td><td rowspan="2">2
0
0
0</td><td rowspan="2">Yes. See Appendix 4, "Code of Practice".</td></tr>
<tr><td>Reef</td><td>26,870,147</td><td>1,331,699</td><td>4.9%</td></tr>
<tr><td>Maerl Dominated community</td><td>2,878,607</td><td>0</td><td>0.0%</td><td>0</td><td>0</td><td>0</td><td>0</td><td>n/a</td></tr>
<tr><td>Fine Sands Dominated by Nephtys cirrosa community</td><td>2,950,308</td><td>0</td><td>0.0%</td><td>0</td><td>0</td><td>0</td><td>0</td><td>n/a</td></tr>
<tr><td>Intertidal sandymud with Tubificoides benedii and Pygospio elegans community complex</td><td>7,817,100</td><td>0</td><td>0.0%</td><td>• Recreation & Tourism
• Existing harvest activities
• Existing aquaculture
• Invertebrate harvesting</td><td>0
0
1
0</td><td>0</td><td>0</td><td>Yes. See Appendix 4, "Code of Practice".</td></tr>
<tr><td>Mudflats & sandflats not covered by seawater at low tide</td><td>12,541,069</td><td>0</td><td>0.0%</td><td>• Recreation & Tourism
• Existing harvest activities
• Existing aquaculture
• Invertebrate harvesting</td><td>0
0
1
0</td><td>0</td><td>0</td><td>Yes. See Appendix 4, "Code of Practice".</td></tr>
</table>

Table 14: Potential in-combination & cumulative effects with marine community types

Species	Potential in-combination and cumulative effects identified				Mitigation measures
	Existing Operations		Planned Operations		Do measures prevent in-combination effects? (Y/N)
	Type	No. of risks*	Type	No. of risks*	
Harbour seals	• Recreation & Tourism • Existing harvest activities • Existing aquaculture • Invertebrate harvesting	1 0 0 0	• Recreation & Tourism • Harvest activities • Aquaculture • Invertebrate harvesting	0 0 1 0	Yes. See Appendix 4, "Code of Practice
Protected bird species	• Recreation & Tourism • Existing harvest activities • Existing aquaculture • Invertebrate harvesting	1 0 0 0	• Recreation & Tourism • Harvest activities • Aquaculture • Invertebrate harvesting	0 0 1 0	Yes. See Appendix 4, "Code of Practice".
Otter	• Recreation & Tourism • Existing harvest activities • Existing aquaculture • Invertebrate harvesting	0 0 0 0	• Recreation & Tourism • Harvest activities • Aquaculture • Invertebrate harvesting	0 0 0 0	Not applicable, as no in-combination risk have been identified.

Table 15: Potential in-combination and cumulative effects with Annex II Species & birds.

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats/ parameter	**Distribution, extent & location**	**Compliance requirements:** (in accordance with EU Dir. 92/43/EEC & NPWS)	**Decision matrix** Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
1	Continuous disturbance limit for marine community types (<15%)	• Shingle • Reef • *Zostera* Community • Maerl Dominated community • Fine Sands • Intertidal sandymud	Continuous disturbance of each community type should not exceed an approximate area of 15% (NPWS 2011A)	B/P B/P B/P B/P B/P B/P	2 2 1 1 1 1	5 5 5 5 5 5	10 10 5 5 5 5	M M L L L L	Hand harvesting can only take place within the licence area to ensure that the marine community type areas affected by harvest activities/ annum does not exceed 15%. The only habitats to be impacted by hand harvesting of *A. nodosum* are reef and shingle, at levels of 4.9% and 12.7% respectively per annum, below the 15% limit for structure and function measures used for assessing conservation status	• Any activities taking place outside the licensed area.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms.	Resource Manager QC	Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management are aware of the non-conformance. (c) Review communication system.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements
2	Management of expansive and prolonged operations	Entire SAC	Protection of Clew Bay SAC	B	2	5	10	M	• Activities are planned in advance. • Site-specific management approach: Harvest locations, pick-up points, quantities, quality measures & personnel involved are recorded on a daily basis. See "Code of Practise" for details (Appendix 4).	• Any unplanned activities taking place without approval by BioAtlantis. • Any activity at inappropriate sites. • GRNs or Site Inspection Forms not been filled out correctly	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms, cross checking the appropriateness of locations.	Resource Manager QC	Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements
3	Number of personnel and exploitation levels	Entire SAC	Protection of Clew Bay SAC	B	2	5	10	M	• Activities are planned in advance. • Site-specific management approach: Harvest locations, pick-up points, quantities, quality measures & personnel involved are recorded on a daily basis. See "Code of Practise" for details (Appendix 4).	•Any unplanned activities taking place without approval by BioAtlantis. •Any activity at inappropriate sites. •Too many people on-site. •Excessive harvest levels •GRNs or Site Inspection Forms not been	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms, cross checking the appropriateness of locations.	Resource Manager QC	Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats/ parameter	**Distribution, extent & location**	**Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)**	**Decision matrix** Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
										filled out correctly					
4	Targeted removal of species (*A. nodosum*)	Intertidal zone	Protection of Clew Bay SAC	B	2	5	10	M	As per table 12 (1a) in Section3.3.6 above.						
5	Non-Targeted removal of species (e.g. *Fucus*, periwinkles, limpets, amphipods, isopods)	Intertidal zone	Protection of Clew Bay SAC	B P	3 3	3 3	9 9	M M	*A. nodosum* will be harvested in a sustainable manner (see Appendix 4 for Code of Practice). A system is in place which ensures that: •Harvest of *Fucus* sp. is not accepted. •Severe reductions in canopy coverage will not occur, thus ensuring sufficient habitat for active feeding stages and reproductive purposes of *Animalia* such as periwinkles. •*A. nodosum* mortality will not occur at levels which otherwise could lead to reductions in habitat for *Animalia*. •Harvesters will work to ensure that co-harvesting of other species does not occur. •By-catch: all *Animalia* observed post harvest will be returned to water, where possible.	Non-conformance at any stage of harvest or management.	1) Harvest activities will be assessed for compliance at all levels including: • Hand-Harvesting training records. • Goods received notes (GRNs). • Site Inspection Forms. 2) Monitoring: • Mass of harvest. • Presence of *Fucus* sp. • Presence of holdfast. • Harvest technique at sites	Resource Manager QC	Routinely during harvest periods & via quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
6	Disturbance and displacement of species and habitats: Reef	Intertidal zone	Protection of Clew Bay SAC	B P	2 2	5 5	10 10	M M	*As per Table 12 (1a, Ascophyllum nodosum)*						
7	Disturbance and displacement of species and habitats: Amphipods and isopods	Intertidal zone	Protection of Clew Bay SAC	B P	3 3	3 3	9 9	M M	*As per 5 above*						
8	Changes in community structure (long term impacts in *A. nodosum* community	Intertidal zone	Protection of Clew Bay SAC	B	2	5	10	M	The Code of Practice (Appendix 4) requires that BioAtlantis assess the impact of *A. nodosum* harvesting over the life-time of the licence. Key features: • Measurement of rates of re-growth of A. nodosum and biodiversity.	Annual assessment not being assessed according to plan.	• Assessment of annual scientific report, datasets and statistical analysis for quality and completeness.	Scientific personnel	Annually	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR,	Operations meeting/ Harvest Meeting. Annual Review of compliance

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats/ parameter	**Distribution, extent & location**	**Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)**	**Decision matrix** Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
	structure as a whole)								Experimental site: non-harvested Vs. harvested areas comparison. • Parameters measured: ➢ *A. nodosum* biomass, *Fucus* plants, *Animalia*. • Species assessed: periwinkles, limpets, barnacles, red algae, ephemeral green algae. • Assessments performed on an annually.		• Assessment of validity of any deviations from experimental design or measurements.			see Appendix 3). (b)Ensure that instructions by qualified scientific personnel, statisticians and other personnel are being adhered to.	requirements.
9	Changes in hydrodynamics and water quality (exacerbation of impacts of pollution and reduction in water quality; alterations to hydrodynamics)	Entire SAC	Protection of Clew Bay SAC	B	1	5	5	L	• Hand harvest techniques employed along rocky shores will ensure that *A. nodosum* is severed between 200-300mm (8-12 inches) above point of contact with underlying substrate and that no more than 20% of the total available biomass from a site is harvested per annum. (see Appendix 4). • Harvest cannot occur within 50m of sewage outfalls.	• *A. nodosum* harvest levels exceed agreed levels. • Harvesting in areas within 50m of sewage outfalls.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms.	Resource Manager QC	Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
10	Potential disturbance of marine fauna	Intertidal zone	Protection of Clew Bay SAC	B	1	3	3	L	• The code or practice (Appendix 4) requires: ➢ Harvest at low tide ➢ Harvest sustainably ➢ Prevent co-harvesting of other species. ➢ Return by-catch where possible	• Harvest is not being performed sustainably according to the code of practice.	• Assess GRNs. • Assess training records • Assess practices on-site (Site Inspection Forms)	QC	Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements
11	Potential interactions with coastal habitats	• Atlantic salt meadows • Sand dunes	Protection of coastal habitats	B	1	5	5	L	According to the Code of Practise (Appendix 4): • Harvest cannot take place at the fringes of Atlantic Salt Meadows. • Overharvesting cannot occur at levels which would reduce organic drift to levels which could impact on sand dune formation and other habitats.	• Harvest is not being performed sustainably according to the code of practice.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs. • Assess practices on-site (Site Inspection Forms)	Resource Manager QC	Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats/ parameter	Distribution, extent & location	Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)	Decision matrix: Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		Action Limit / non-conformance	Analytical Procedure	By	Monitoring Schedule (Frequency)	Corrective Action	Verification
														if necessary.	
12	In combination effects with other harvesting activities	• Entire SAC	Protection of Clew Bay SAC	B	2	5	10	M	• If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. BioAtlantis will not harvest in such areas until *A. nodosum* has regenerated and will work to ensure that any harvesting is limited to 20% of the total available biomass per site per annum and continuous disturbance of each community type does not exceed the required limit. • Approach any commercial user having small requirements of ~1 tonnes per annum (e.g. hotels, health Spas), and assess potential for in-combination effects. • Do not harvest in Mulranny area where excursions take place. • Do not harvest in areas where there are existing appurtenant rights or burdens in relation to the harvesting, gathering or removal of seaweed from the shore, without first obtaining permission from the person to which those rights belong. • Where Profit-à-Prendre rights to harvest seaweed are successfully registered with the PRAI, the harvesting plan must be adjusted to ensure that those individuals can continue to harvest *A. nodosum.*	• Quantities being removed exceed 1 tonne. • Other unlicensed companies continue their activities. • Harvesters not following the harvesting plan.	• Incidents are recorded on the Incident report Form (Appendix 3). This form is brought to the attention of BioAtlantis Management. • Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms.	Resource Manager QC	Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b)Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.. (e) Seek advice will from the relevant authorities on how to proceed.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements
13	In combination effects with Recreation and Tourism activities (impacts on harbour seal and bird sites, anthropogenic disturbance)	• Sensitive harbour seal and birds sites • Intertidal zone	Protection of Clew Bay SAC, in particular harbour seals and protected bird species.	B P	2 2	5 5	10 10	M M	The Code of Practice (Appendix 4) requires: • Seasonal avoidance of sensitive harbour seal and bird sites • 50m avoidance of bases where equipment or vessels are manually introduced into the water • Seasonal avoidance of Collanmore island, Roman Island and Westport harbour at peak tourist season (May-Aug).	Unauthorized harvest at protected sites at sensitive times of year (e.g. breeding, moulting and resting periods). Unauthorized harvest at Collanmore,	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms.	Resource Manager QC	Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b) Ensure that management instructions are being adhered to. (c) Review communication system.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.

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No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats/ parameter	**Distribution, extent & location**	**Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)**	**Decision matrix** Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		**Action Limit / non-conformance**	**Analytical Procedure**	**By**	**Monitoring Schedule (Frequency)**	**Corrective Action**	**Verification**
									• A range of other measures are outlined in the Code of Practice.	Roman island and Westport harbour				(d) Harvester is provided with training if necessary.	
14	In combination effects with aquaculture activities (impacts on harbour seal and bird sites, mudflats and sandflats)	• Sensitive harbour seal and birds sites • Mudflats and sandflats	Protection of Clew Bay SAC, in particular harbour seals and protected bird species and mudflats and sandflats.	B	2	5	10	M	The Code of Practice (Appendix 4) requires: • Seasonal avoidance of sensitive harbour seal and bird sites. • That harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas, within which *Tubificoides benedii* and *Pygospio elegans* reside (see Appendix 4). • Prevention of impacts on navigation routes or physical interaction with aquaculture units.	Unauthorized harvest at protected sites at sensitive times of year (e.g. breeding, moulting and resting periods). Unauthorized navigation at low tide to reach harvest sites located beyond mudflats and sandflats. Harvesters do not maintain sufficient distance from aquaculture units.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms. • Incident report forms	Resource Manager QC	Quarterly audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b) Ensure that management instructions are being adhered to. (b) Review communication system. (c) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
15	In combination effects with harvesting of invertebrates (periwinkles, cockles, other invertebrates)	Intertidal zone and mudflats and sandflats	Protection of Clew Bay SAC	B	2	5	10	M	The Code of Practice (Appendix 4) requires: • Sustainable harvesting to ensure maintenance of sufficient canopy coverage for periwinkles. • Avoidance of frond with visible periwinkle egg masses • Avoidance of *Fucus*, another habitat for periwinkles. • Environmentally safe navigation when operating mudflats and sandflat areas. • Use of harvesting methods that prevent co-harvesting of other species. • Return of inadvertent by-catch where possible.	Harvest is not being performed sustainably according to the code of practice. Unauthorized navigation at low tide to reach harvest sites located beyond mudflats and sandflats.	• Record harvest location and pick-up points on GRNs • Inspection of GRNs and Site Inspection Forms. • Inspection of training records. • Incident report forms • On-site inspections	Resource Manager QC	Quarterly audit Annual audit	Depending on the nature, source & extent of non-conformance, take the following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b) Ensure that management instructions are being adhered to. (b) Review communication system. (c) Harvester is provided with training if necessary.	Operations meeting/ Harvest Meeting. Annual Review of compliance requirements.
16	Invasive species (spread of	• Entire SAC	Protection of Clew Bay SAC	B	1	5	5	L	The Code of Practice (Appendix 4) requires:	Collection boat (if applicable to area)	• Check records for annual treatment	Resource Manager	Quarterly audit	Depending on the nature, source & extent of non-conformance, take the	Operations meeting/ Harvest

No	RISK ASSESSMENT SUMMARY (see Appendix 5 for further details)								CONTROL MEASURES (if applicable)	MONITORING				CORRECTIVE ACTIONS	
	Species/ Habitats/ parameter	Distribution, extent & location	Compliance requirements: (in accordance with EU Dir. 92/43/EEC & NPWS)	Decision matrix: Hazard (Bio,Chem,Phy)	Probability	Severity	Risk	Hazard level (L=Low, M=Med, H=High)		Action Limit / non-conformance	Analytical Procedure	By	Monitoring Schedule (Frequency)	Corrective Action	Verification
	Didemnum vexillum, *Styela clava*, etc).								• Boats will be painted once a year with appropriate anti-fouling paint. • The harvesters boats will not leave Clew Bay. In the rare case that they do leave Clew Bay, harvesters are required to implement a cleaning measure on land which will involve cleaning with appropriate cleaning agents or using other suitable methods. • All nets/bags must be cleaned with appropriate cleaning agents or using other suitable methods on delivery to production facilities and returned to harvesters in a clean condition. • Harvesting will be limited to the *A. nodosum* zone and will not take place in subtidal areas, exposed or semi-exposed sites. • Harvesters will keep distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures. • Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and will ensure that inadvertent by-catch of other Animalia, algae or dead, drifting material/algae will be prevented and minimized.	not being painted. Harvesters not adhering to cleaning procedures when leaving Clew Bay. Nets/bags not being cleaned in production facilities. Unauthorized navigation.	with anti-fouling paint. • Check cleaning records in production facilities. • On-site inspections. • Incident report forms	QC	Annual audit	following steps: (a) Report non-conformance using Non-conformance Report Form (NCR, see Appendix 3). (b) Ensure that management instructions are being adhered to. (c) Review communication system. (d) Harvester is provided with training if necessary.	Meeting. Annual Review of compliance requirements.

Table 16 : Broad examination of impacts of harvesting, potential in combination effects and continuous disturbance

3.6.7 The conservation status of marine Annex I habitats in Clew Bay Complex SAC.

A national conservation assessment indicates that shallow inlets and bays [1160] in Ireland is classified as 'unfavourable-bad' (Scally et al., 2020). The 'area' conservation attribute is classified as 'favourable', while 'structure & functions' and 'future prospects' are considered as 'unfavourable-bad' and 'unfavourable-inadequate' respectively. Clew Bay is categorized as 'unfavourable-bad' for three attributes: 'structure & functions' and 'future prospects' and 'overall site assessment'. In their report, Scally et al., (2020) assessed the status of community distribution in Large shallow inlets and bays in Clew Bay. Their study included an assessment of three community/habitats: (a) Sandy mud with polychaetes and bivalves community, (b) Fine sand dominated by Nephtys cirrosa community and (c) Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community. Sampling took place in subtidal and intertidal sediment areas and in mudflat/sandflat habitats. The unfavourable status of Clew Bay was attributed to the loss of eelgrass beds, a significant decrease in the abundance of eelgrass shoots within a bed and an increase in negative indicators, e.g. epiphytic algal cover on eelgrass leaves, the presence of opportunistic species and invasive alien species. In terms of 'area', Clew Bay SAC is classified as favourable. At a national level, the conservation status of Reef in Ireland has been assessed as 'Favourable' in terms of Area, Structure and function, future prospects. This includes both inshore and offshore reef areas (Scally et al., 2020).

As outlined in Appendix 5 (i), measures are in place to ensure that the conservation status of Annex I habitats in Clew Bay SAC are maintained, encompassing the following major categories where relevant:

(1) Sandbanks which are slightly covered by sea water all the time [1110]
(2) Estuaries [1130]
(3) Mudflats and sandflats not covered by seawater at low tide [1140]
(4) Reefs [1170]
(5) Submerged or partially submerged sea caves [8330].
(6) Large shallow inlets and bays [1160]

Harvesting will not take place in areas categorized as unfavourable, unless mitigation measures are in place to ensure they are unaffected. While Mudflats and sandflats not covered by seawater at low tide [1140] are in favourable condition in Clew Bay, they are considered as being in Unfavourable-Inadequate condition on a national level. Harvesting will not take place in this habitat and measures are in place to ensure mudflats and sandflats are unaffected when travelling to and from sites (see Appendix 4 and 5). While 'submerged or partially submerged sea caves' [8330] and 'Sandbanks which are slightly covered by sea water all the time [1110]' are in favourable condition, harvesting will not take place in these areas. Mitigation measures are in place to ensure that harvesting does not impact on Estuaries (1130) which are categorized as Unfavourable-Inadequate at national level.

Large shallow inlets and bays [1160] is a broad category with 5 attributes encompassing 7 habitats/community types: Sandy mud with polychaetes and bivalves community complex, Fine sand dominated by *Nephtys cirrosa* community, Intertidal sandy mud with Tubificoides benedii and *Pygospio elegans* community complex, Shingle, Reef. The overall conservation status of Large shallow inlets and bays, both on a national level and in Clew Bay SAC, is considered as ‘Unfavourable-Bad’. In the context of Clew Bay, the ‘Unfavourable-Bad’ conservation status has been attributed to impacts *Zostera* spp. (Scally et al., 2020). *A. nodosum* harvesting will not take place in areas where *Zostera* spp. grows. In addition, *A. nodosum* harvesting will not take place in soft substratum areas (intertidal and subtidal mud/sandy mud areas) and mitigation measures are in place to ensure they are unaffected during travel to and from harvesting sites.

Reef represents a subcategory of Large shallow inlets and bays [1160] whilst also forming a stand-alone Annex 1 habitat category (Reef [1170]). According to Scally et al. (2020), Reef [1170] in Ireland is categorized as being in a ‘favourable conservation’ condition. This includes intertidal and subtidal reef areas. *A. nodosum* harvesting will take place in intertidal reef areas, subject to close compliance with mitigation measures listed in Appendix 4 of this application. This will ensure that Reef [1170] is maintained in favourable conservation condition in terms of area, structure and function and future prospects.

The percentage of the reef and shingle which are Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160], that will be impacted each year is very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,188.5 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area, while percentage of reef to be impacted annually is 1.31%. The evidence from the literature suggests that the potential for effects to arise as a result of sustainable hand harvesting of *Ascophyllum nodosum*, are limited. For example, Kelly et al., 2001, shows that *A. nodosum* regenerates 11 to 17 months post harvesting. Kelly et al., 2001, also demonstrates that there are no impacts of harvesting on overall biodiversity, mobile epifauna and fish 11 to 17 months post-harvesting. A study by Lauzon-Guay et al., 2023, shows that harvest of *A. nodosum* (at sites with a 20 + year history of commercial harvesting) does not have long-term impact on the morphology of the algae or on the abundance of its main inhabitants. Therefore, It is considered unlikely that sustainable hand harvesting of *Ascophyllum nodosum* would give rise to any no further effects on Large Shallow Inlets and Bays [1160] in Clew Bay. However, mitigation measures are in place to ensure that no further effects occur, particularly areas where harvesting will take place such as reef and shingle areas.

3.6.8 Potential pressures on the marine environment.

An independent expert group recently issued a report which identified a range of potential pressures in Ireland’s marine environment resulting from human activity (See Marine Protected Area Advisory Group, 2020 and references therein). Based on the information provided in this report, an additional hazard analysis was undertaken (see Appendix 5(j)) to identify and mitigate against any potential effects of *A. nodosum* harvesting on the marine environment. The potential for interactions, in combination effects and cumulative effects (due to *A. nodosum* harvesting and other human activities), were also assessed and mitigation measures put in place where required (see Appendix 7).

3.6.9 Ensuring recovery of harvested areas.

The potential for cumulative and in combination impacts are outlined in this application. This includes impacts associated with planned and existing activities such as seaweed harvesting. The proposed harvest levels in this application are considered sustainable and measures are in place to ensure that sites have recovered before harvesting takes place again.

In terms of fallowing periods, data will be entered in the database as described in Table 5. The maximum harvest available from each island or coastal zone has been estimated and the nominal recovery time is will be 3-5 years from a complete harvest, or potentially within 11 to 17 months post-harvest given the post-harvest recovery rates reported by Kelly et al., 2001. BioAtlantis will harvest a maximum of 20% of the total available *A. nodosum* biomass per site per annum to ensure sustainability. The figure of 20% refers to the percentage of the total available biomass harvested per site per annum (the Maximum Annual Harvest). This is outlined in Section 1.3.3, of this document, under "Planning & scheduling of harvesting activities". If quota is exceeded, the Resource Manager will issue a Non-Conformance Report (NRC) to BioAtlantis management. Harvesters will be provided with training if necessary.

As *A. nodosum* biomass can potentially recover within 11 to 17 months (Kelly et al., 2002), it may be possible therefore to harvest year on year in certain locations; however this is subject to recovery being achieved. As outlined in this application, measures will be put in place to ensure that harvesting does not take place if a site has not recovered from the previous year, thus preventing cumulative effects from occurring. BioAtlantis will be required to verify that each site has fully recovered prior to re-harvesting. This will be done via on-site assessments and updating the plan as necessary with the results of this analysis. Cumulative effects will therefore be very limited.

As outlined in this application, harvesting will not take place in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong. Where Profit-à-Prendre harvesting rights are successfully registered with the Property Registration Authority of Ireland (PRAI), the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. It is envisaged that a clause may be inserted into the licence issued to allow the harvesting of *A. nodosum*, stating that if a Profit-à-Prendre right holder provides sufficient proof to their right, the licensee would be prohibited from harvesting in that area, without first obtaining permission from the owner of such rights. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. The Resource Manager will routinely inspect sites post-harvest to ensure compliance of harvesters with sustainable hand harvest methods. Harvest will be recorded using BioAtlantis Compliance and Record Forms.

A pre-license survey study of Clew Bay was undertaken by UCD and submitted with this application. This study included an assessment of *A. nodosum* biomass and an assessment of the extent of existing harvesting activities. Key findings from the report included: (a) There was evidence of harvesting at 26 out of the 40 sampled sites. The intensity of harvesting varied across these sites, (b) Six, eight and twelve sites exhibited evidence of low, moderate and increased levels of harvesting respectively, and (c) There was no evidence of harvesting at 18 out of 40 sites sampled. The measures outlined above ensure the recovery of harvest areas and prevention of cumulative impacts with unlicensed harvesting, particularly in relation to appurtenant rights/burdens and Profit-à-Prendre rights.

A pre-harvesting survey of an unharvested site will be undertaken to assess the recovery of *A. nodosum* harvesting over the life-time of the licence. This is outlined in Section 1.3.3 of BioAtlantis' application (under "Operation/Activity 4: Long term assessment biomass and community structure") and Section 3.5.3 (under "The potential interaction effects of seaweed harvesting"). Parameters by which recovery will be assessed include: rates of re-growth of *A. nodosum*, biomass (Kg/m2) and numbers and/or density of *A. nodosum* plants per area (as outlined in Section 1.3.3 and Section 3.5.3 of the BioAtlantis application). These measures ensure that recovery will be assessed over the lifetime of the license.

3.7. Conclusions of Risk Assessment

The risk assessment described in Section 3 of this document was undertaken by staff at BioAtlantis in order to identify risks which would affect qualifying interests in the SAC. This assessment has a strong scientific basis and involved the undertaking of detailed hazard risk assessments and decision-making based on current best practice and knowledge, incorporating findings emerging from previous impact assessments in Clew Bay and the peer-reviewed literature. This allowed for the development of management system with appropriate control measures, monitoring and corrective actions for potential hazards, thus ensuring no impact on qualifying interests in the SAC.

Following the initial assessment by BioAtlantis staff, a screening assessment was subsequently undertaken by Ecofact Environmental Consultants Ltd, in accordance with Article 6(3) of the Habitats Directive, to determine whether a full appropriate assessment was required for activities relating to sustainable hand harvesting of *A. nodosum* in Clew Bay SAC by BioAtlantis Ltd. According to the guidance published by the DoEHLG (2009) , the Screening Assessment to inform the Appropriate Assessment process can identify that a Natura Impact Statement (NIS) is not required in circumstances where a project / proposal is directly related to the management of the designated site. Alternatively, the Screening Assessment has the potential to conclude that there is no potential for significant impacts affecting the Natura 2000 network; or that significant effects are certain, likely or uncertain i.e. the project must either proceed to a NIS or be rejected. On submission of the application to the Department of the Environment in January 2014, additional information was requested by NPWS on 30th July 2014. This was required in order to address deficiencies in the NIS and areas not covered in the application. The NIS and application were re-worked and further mitigation measures developed as required. Following a period of public consultation, the application and NIS were revised further between 2020 and 2024.

The revised Screening Statement prepared by Ecofact Environmental Consultants Ltd to inform the Appropriate Assessment has identified that the proposed sustainable harvesting of *Ascophyllum nodosum* within the intertidal habitats of the Clew Bay Complex cSAC gives rise to the potential for direct, indirect and cumulative impacts which may be significant with regard to the qualifying interests of this Natura 2000 designation. Based on the information provided, the Screening Assessment has therefore determined that a Natura Impact Statement (NIS) for the proposal is required. The Clew Bay Complex cSAC is identified as the only designated Natura 2000 site potentially affected by the proposal and which will be subject to further assessment in the NIS. The updated NIS was prepared by Ecofact Environmental Consultants Ltd. between 2020 to 2024 and is enclosed as a separate stand-alone document with this application. The NIS concludes, beyond reasonable scientific doubt, that the proposed project, with the implementation of the prescribed mitigation measures, will not give rise to direct, indirect or cumulative impacts that would adversely affect the integrity of Clew Bay SAC.

Section 4: Concluding remarks.

In this current application, BioAtlantis Ltd. has provided details of (a) the importance of the Clew Bay region as a source of *A. nodosum* raw material to the Irish seaweed sector, (b) our assessment of the potential impact of hand harvesting of this resource on the Clew Bay environs and control measures therein, (c) our plan for harvesting and its potential benefits and (d) our system for securing and managing the 'Code of Practice' for protecting the SAC.

The enclosed NIS prepared by Ecofact Environmental Consultants Ltd. concludes:

"The potential for impacts on the Clew Bay Complex SAC Natura 2000 site resulting from the proposed Foreshore Licence application for the sustainable hand-harvesting of Ascophyllum nodosum within Clew Bay are recognised. Appropriate mitigation measures are identified for implementation to ensure the habitats and species for which this site has been designated are maintained at a favourable conservation status (compliance with Article 6(1) of the EU Habitats Directive). The proposed operational management plans will also avoid damaging activities that could significantly disturb these species or deteriorate the habitats of the protected species or habitat types (compliance with Article 6(2) of the EU Habitats Directive).

The Clew Bay Complex SAC, within the activities area of the proposed Foreshore Licence Application was assessed with particular regard to potential impacts affecting qualifying interests of the designation, including Annex I habitats (large shallow inlets and bays) and Annex II listed mammal species. It is evaluated that the proposal will not have a significant adverse effect on this Natura 2000 site; with the implementation of prescribed mitigation measures. These mitigation measures are incorporated into the updated Foreshore Licence Application (BioAtlantis, 2024) and in particular, the associated 'Code of Practice' in order to ensure the avoidance of significant impacts on these sensitive receptors. There will therefore, be no long-term impact on the integrity of the Clew Bay Complex SAC site.

From examination of the information available, it is considered that as long as all mitigation measures listed in this NIS are adhered to, there will be no impacts on the integrity of the Clew Bay Complex SAC as a result of the proposed hand harvesting of A. nodosum in Clew Bay by BioAtlantis Ltd. This conclusion and the supporting evidence is provided in order to allow the Competent Authority to complete the Appropriate Assessment process for the proposed project."

This document describes the nature and extent of BioAtlantis' application, including a range of effective measures to prevent impacts from occurring. On gaining the approval by the Department of Housing, Local Government and Heritage, BioAtlantis will work towards implementing the sustainable hand harvesting system and is committed to ensuring that activities will have no impacts which would affect the integrity of this SAC. BioAtlantis has already benefited from consultations with the NPWS, IFI and Clew Bay hand harvesters and wish to extend consultations further. The system is ready to be implemented with substantial mitigation measures positioned at the heart of this plan in order to ensure no impacts(s) on marine community types, Annex I and Annex II species and habitats within Clew Bay. Overall, this represents an excellent opportunity in which to improve the management of sustainable harvesting, in line with EU and Irish environmental laws, whilst also helping to drive the development of the blue bioeconomy along the western seaboard of Ireland.

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ADDENDUM 4 CODE OF PRACTICE FOR HARVEST ACTIVITIES IN CLEW BAY COMPLEX SAC

License Application for Sustainable hand-harvesting of *Ascophyllum nodosum* at Clew Bay (SAC Site Code 1482). In accordance with National Parks & Wildlife Service conservation objectives for marine and coastal habitats and species, and the EU Habitats Directive 92/43/EEC.

Appendix 4:
Code of Practice for *A. nodosum* harvest activities in Clew Bay SAC.

Prepared by: BioAtlantis Ltd.
Date of submission: 20/01/2014
Date of revision: 21/02/2024

[redacted]

21/02/2024

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21/02/2024

SECTION 1: Introduction

Clew Bay is a wide, sheltered western facing bay located in Co. Mayo, at a distance of approximately 16 km from east to west and 11 km from north to south. Clew Bay's drumlin landscape was formed during the last glacial period and is characterised by a large number of islands containing mixed substrata. Notably, the bay has in excess of 90 islands and 100Km of coastline that contains harvestable quantities of the intertidal seaweed, *Ascophyllum nodosum*. Clew bay supports a diverse range of human activities spanning fisheries, aquaculture, tourism, recreation, sport and hand harvesting of invertebrates and algae. The site is a Special Area of Conservation (SAC) selected for a range of habitats and species listed on Annex I and II of the E.U. Habitats Directive.

BioAtlantis Ltd. aim to sustainably develop the seaweed industry in Co. Mayo. The company has applied for a license to sustainably hand harvest 11,018 Tonnes of *A. nodosum* in Clew Bay annually, in a manner that minimises and prevents any potential effects on species and habitats in the Complex, whilst also providing sustainable work to hand harvesters. BioAtlantis has developed this **Code of Practice** to ensure that harvesting is undertaken in a sustainable manner and works closely in-line with conservation objectives specified for the SAC for a range of Annex I and II habitats and species. Key measures outlined in this **Code of Practice** include:

Methods to ensure *A. nodosum* is harvested in a sustainable manner:

- Implementation of sustainable harvesting techniques to ensure regeneration post harvesting.
- Management to limit harvesting to ≤20% of the total *A. nodosum* biomass per site per annum.
- Full traceability: harvest location, quality and quantity of harvested seaweed and persons involved.
- Continuous disturbance of Annex I marine community types cannot exceed recommended levels.

Environmentally safe navigation techniques:

- Use of a collection boat (if deemed applicable to the area) to pick up floating bags/nets at high tide, preventing impacts on the foreshore, or harvesters towing floating bags/nets from harvest sites to pick-up points (in some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points).
- Prevent impacts on mudflats, sandflats, intertidal sandy mud, estuarine mud, fine-sand, salt meadows, shingle and reef areas.

Methods to prevent impacts on relevant wildlife and animal species:

- Harbour Seals, Birds , Otters.

Requirements to prevent interactions and in-combination effects with the following:

- Tourism, sport and recreation.
- Aquaculture, angling and fisheries activities.
- Other seaweed and invertebrate harvesting activities.
- Spread of invasive species.

The Code of Practice has been developed based on the peer reviewed literature, best scientific knowledge, risk assessments and previous surveys in Clew Bay (see Application documents and appendices). The Code of Practice must be adhered to by all staff and harvesters supplying *A. nodosum* to BioAtlantis and management within the company, to ensure that the objectives for protecting the Clew Bay SAC are adhered to in an effective manner.

Note: *This document was updated following a public consultation between Dec 2014 and Jan, 2015 and includes additional planned and existing activities and mitigation measures where required.*

SECTION 2: Securing the Code of Practice during the operation phase

2.1. Step 1: On-site survey & schedule (Start date: Month 1. Duration: 1-2 weeks).
Following on-site surveys by University College Dublin and an additional assessment and exclusion of areas with existing seaweed harvesting rights, the estimated maximum annual harvest of *A. nodosum* was revised to 11,018 Tonnes. These assessments will form the basis of developing the production plan. To verify the accuracy of the plan, time will be spent on the ground for approximately 1-2 weeks, to identify recently harvested sites which require a fallowing period to recover. A schedule will then be agreed with the harvesters to meet SAC and production requirements.

2.2. Step 2: Recruitment of personnel (Completed by end of month 1).
Most personnel will be in place by the end of month 1. Hand harvesters will be contracted and the harvesting system and plan will be explained. A Resource Manager and some staff/sub-contractors involved in transport will be hired or contracted during this time.

2.3. Step 3: Training (Start date: month 1. Duration: 3 months)
On completion of the on-site survey above, figures will be verified and revised accordingly. From here, training will be provided to harvesters where necessary. This will initially involve theoretical training (1-2 days) to explain the system and requirements of the harvesters on the ground to ensure that the SAC is protected according to the Code of Practice. Training will be carried out by staff in BioAtlantis, along with local personnel using detailed training material. Once theoretical training is complete, practical on-site training will take place. This will involve harvesters performing harvesting tasks according to the harvesting schedule. BioAtlantis will monitor and assess the technique employed to verify that the correct technique is in use and that the correct steps are being taken. In the event that hand harvesters encounter any difficulties, BioAtlantis staff will provide further training. Harvesters will finally receive certification to confirm that they have received training and are verified in having a full understanding of the system.

2.4. Step 4: Verification of systems (Start date: month 1. Duration 3 months)
During the initial 3 months of the operational phase, all software, communications, transport and quality systems will be optimized and verified as being effective. This will ensure that systems are fully operational and in place when commercial harvesting begins.

2.5. Step 5: Full implementation (Start date: month 4. Duration: lifetime of the licence)
Once staff and harvesters are verified as having sufficient training and understanding of the system, commercial hand harvesting will begin in accordance with the schedule. This will be managed by the Resource Manager who will report directly to BioAtlantis management. A key requirement in implementing and securing a functioning system for sustainable *A. nodosum* harvesting, are effective control measures, reporting and monitoring systems. These are set out in this Code of Practice document and form a key framework for managing and ensuring that the system is adhered to in a precise, correct, seamless and traceable manner. A key component to ensuring this will be a strong and robust auditing system. BioAtlantis will conduct audits covering the items listed below:

(a) Quarterly Audit:

- Audit Part A: Records, Forms & Documents.

Step 1: Forms: receipt of training & verification of understanding.
Step 2: Completed Training Certs (obtained through training above).
Step 3: Records, forms & documents (general).

- Audit Part B: Quality Assessment (documentation):
  Step 1. GRNs (Clew Bay).
  Step 2. Production Logsheets (Production Facilities).
  Step 3. Incident Reports.
  Step 4. Non-conformance Reports.
  Step 5. Software Systems.
  Step 6: Site Inspection forms.

(b) Annual Audit (on-site):
Step 1. Site Quality (inspection of harvested sites).
Step 2. Harvest methods (inspection of techniques).
Step 3.Collection boat (if deemed applicable to the area).

The Audit form is attached (Appendix 8). Additionally, see Tables 10, 11, 12 and 16 of the application for details on: Control Measures, Action Limits/non-conformance, Analytical Procedures, Monitoring Schedule, Corrective Actions and Verification. The harvesting system will be a reviewed annually to assess and verify the control measures and determine areas in need of improvement.

Section 3: Sustainable hand harvesting of *A. nodosum*

3.1. Management of harvesting activities:
BioAtlantis will be responsible for managing commercial harvesting activities. To prevent in combination effects from occurring, the following will apply:

- Harvesters will not cut *A. nodosum* in any areas where there are existing appurtenant rights or burdens in relation to the harvesting, gathering or removal of seaweed from the shore, without first obtaining permission from the person to whom those rights belong.
- Where Profit-à-Prendre rights to harvest seaweed are successfully registered with the PRAI, the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum.*

3.2. Resource Database
For the effective management of the Clew Bay area, BioAtlantis will create a database of the islands and coastal areas. This database is required to:

- Determine sites that require fallowing to allow for adequate recovery from recent activities.
- Determine rotation requirements (i.e. extrapolation and calculation of the duration or fallowing period required prior to a particular area being fit for re-harvest).
- Prevent harvest activities that would lead to a decline in yield.
- Record the details of each harvest, how much, by whom & when.

3.3. Certificate and training
Harvesters receiving training in methods which ensure *A. nodosum* recovery and regeneration post-harvest can supply *A. nodosum* to BioAtlantis. Training will be provided by BioAtlantis where necessary, and a certificate of training will be provided.

3.4. Navigation to harvest sites

Harvesters must follow pre-planned harvest schedules. Schedules will be provided by BioAtlantis in advance of harvest to ensure no entry into protected areas at times inappropriate or damaging to species and habitats. Should any confusion arise, the Resource Manager must be contacted.

3.5. Health and Safety

Harvesters must comply with H&S requirements and relevant Maritime Legislation. Essential H&S requirements and key equipment include:

- An efficient marine outboard engine capable of manoeuvring boat safely ahead and astern, and steering the boat at its maximum speed in the fully loaded condition within the limits of the intended area of operation; an anchor with rope of length at least equal to four times the length of the boat; a permanently rigged suitable painter (rope) not exceeding the length of the boat and which may also be used as a tow rope.
- Adequate seating or thwarts, pair of oars and rowlocks, bailer, hand-held distress flares or a portable horn, boat hook, waterproof torch, approved lifejacket or personal flotation device for each person on boat, communication device(s), navigation maps and compass.
- Mobile phone, sharp blade cutters, measuring tape, binoculars (to assess presence/absence of seals or mudflats, sandflats or intertidal sandy mud areas), harvest bags/nets and hi visibility buoys.
- Pick up of bags/nets: ensure that bags/nets containing seaweed are located away from piers or typical boating routes. These must be made visible using buoys etc., and be hauled for pick-up when transport is scheduled.
- Pick up of loose harvested seaweed: Where certain individuals with existing seaweed harvesting rights wish to land seaweed in loose form at pick up points, those individuals involved in harvesting or pick-up must park appropriately and not block access to the road, coast or marine area for other users.
- Lifting of harvested seaweed: Follow all standard operating procedures to manage the lifting of bag/nets or loose harvested seaweed.
- Temporary storage of bags: Follow all standard operating procedures to manage temporary storage of bag/nets or loose harvested seaweed.

3.6. Harvest Records:

The Goods Received Note (GRN) must be completed by the person or transport company in receipt of the harvested seaweed. Alternatively, such information may be provided in other suitable formats by electronic or other means on site and/or at BioAtlantis' production facilities. Without a completed GRN, harvested *A. nodosum* may not be accepted. A second GRN will also be completed on receipt of the seaweed at BioAtlantis' factory. Where quality cannot be checked on collection, assessments will be undertaken by production/QC staff by random or specific inspections.

3.7. Accident and Incident Reporting:

Sites must be harvested according to the schedule. This ensures that sensitive sites (e.g. seal and bird sites), sandflats or intertidal sandy mud areas are avoided. All accidents, incidents and near misses must be recorded immediately and reported to the Resource Manager who will complete an Incident Report Form (Appendix 3). Incidents which should be reported include:

- Health and safety accidents or near misses.
- Incidents relating to disturbance of seals during navigation (e.g. , e.g. flushing into the water).
- Incidents of disturbance or damage to any mudflat, sandflat, intertidal sandy mud, fine sand areas.

3.8. Harvesting of *A. nodosum*:

When harvesting *A. nodosum*, the following is required:

- Once a site is approved according to the schedule, harvest can take place. Harvest can only occur at sites containing a high density of *A. nodosum* and which have been approved by BioAtlantis' personnel. On arrival, harvesters will determine whether or not the site is suitable for harvest. They will be receive training by BioAtlantis on the criteria required to make this determination, if necessary.
- Date & time of harvest, site name and location within the site (required for completing the GRN).
- When cutting *A. nodosum*, ensure that a minimum of 200mm (8 inches) of material is left behind. This limit will be inspected by the Resource Manager as it is essential in order to:
  - Avoid overharvesting or extensive removal of *A. nodosum* canopy coverage, which could otherwise lead to changes in community structure or biodiversity stasis or could impact the ecosystem in general, e.g. animals resident in the intertidal zone, coastal habitats, etc.
  - Avoid dormant/resting species at the canopy base (e.g. periwinkles) and ensure sufficient biomass coverage to allow free living forms of *L. littorea* and other species settle and establish at the base.
  - Avoid plants containing periwinkle egg masses, thus preventing harvest of viable eggs.
  - Prevent by-catch of benthic, sessile, slow moving/mobile species present on the shore at low tide.
- *A. nodosum* holdfast must be left fully intact and attached to substrate to allow for recovery. Holdfast bycatch exceeding >1% will represent a severe non-conformance (inspected on the GRN). The Production Manager will perform spot checks on harvested seaweed for evidence of stones and holdfast, as such contaminants may damage production equipment. Non-conformances may be issued depending on the severity of the incident. This limit on holdfast content is essential to:
  - Prevent mortality of *A. nodosum* and prevent injury to *A. nodosum* holdfast.
  - Prevent severe removal of habitat for understory species.
  - Avoid physical disturbance of dormant or resting species at the base of the canopy.
  - Avoid occurrence of overharvesting which could impact on the ecosystem in general.
- Ensure that no other types of seaweed other than *A. nodosum* are harvested and/or placed into harvest bags/nets. Inspections will be carried out at the pick-up point in Clew Bay and at production facilities in Tralee, Co. Kerry. The presence of contaminants may result in potential corrective actions, depending on the severity of the non-conformance. Harvesters must limit *Fucus* content of harvested *A. nodosum* to no more than 5%, thus preventing removal of an additional canopy source which supports periwinkles, limpets and other species.
- When cutting the weed and filling the bags/nets, ensure that excessive levels of sand, shingle, pebbles, stones or holdfasts are not inadvertently included. In the event of non-conformances, training may be provided to harvesters where necessary.
- Harvest must be limited to 20% of the total available *A. nodosum* biomass per site per annum, in order to allow for sufficient regrowth. The limitation at 20% avoids overharvesting which could impact on the ecosystem in general, and reduces the removal of species such as hemiparasitic *Polysiphonia lanosa* (Linnaeus) *Tandy*, which commonly grows on *A. nodosum.*
- To reduce potential for anthropogenic impacts (e.g. intensity of trampling) on the biotope, the numbers of harvesters are limited to: 2-4 per small-medium sized sites, 4-6 per medium to large islands and 6-10 on larger islands. The Resource Manager and other staff may inspect sites for brief

periods. Low numbers of individual working along the foreshore in this way, will ensure that BioAtlantis work within the limit of 15% disturbance limit.

- Harvest must not take place in areas within 50m of sewage outfalls or other source of pollution. This will ensure that stressed *A. nodosum* growth is not exacerbated further by harvest activities.
- Ensure that there are no physical interactions with biogenic reef in the rare event that it is encountered on the shore (e.g. honeycomb structures or mussels).

3.9. Completion of harvest, subsequent pick-up and quality check:

- The following must be recorded on the GRN: Date, Harvester Name / No., Pick-up location, Harvest Location (site name, Region, e.g. northern shore).See Appendix 3 for a copy of the GRN.
- Quality checks must be conducted to confirm that the seaweed is free of the following: (a) Sand, gravel, stones or debris, (b) *A. nodosum* holdfasts. and (c) other species (e.g. *Fucus, 1-5% max.*).
- The seaweed will be weighed by BioAtlantis at pick up points and/or on delivery to the processing facility.

3.10. Assessment of harvest operations:
The Resource Manager will inspect sites post-harvest to confirm that harvesters are operating as specified to ensure:

1. Cutting of *A. nodosum is* >200mm above holdfast .
2. No more than 20% of the total available biomass per site per annum is harvested.
3. Activities only take place at approved sites.
4. Health and safety requirements are adhered to.

See Appendix 3, "Site Inspection Form", for further details.

3.11. By-catch:
Take care not to co-harvest other species. Co-removal of amphipods, isopods, periwinkles or other Animalia identified post-harvest must be collected and returned to the water, where possible.

3.12. Harvest Quantity and batch code
Quantity of harvest (no. bags/nets, weight per bag/net, time and date of harvest), Inspection check (pass: Y/N).

3.13. Communicating with BioAtlantis:
Harvesters must keep in regular contact and report their activities to BioAtlantis. In most cases reporting will be via the Resource Manager and GRN. However, harvest plans will be communicated regularly over the phone or via email or post to designated harvesters by the Resource Manager.

3.14. Prevent interactions:
Follow pre-planned harvest schedules in order to avoid potential congestion at pick up points such at piers that may be busy at certain times.

SECTION 4: Marine and coastal habitats.

To ensure that the area, structure and function, future prospects and conservation status of marine and coastal habitats is maintained, harvesters will ensure the following:

(a) Harvesting is not permitted in the following areas:

- Fine Sands areas (Dominated by *Nephtys cirrosa* community).

- Intertidal sandy mud areas (*Tubificoides benedii* and *Pygospio elegans* community complex).
- Maerl habitats.
- Mudflats & sandflats not covered by seawater at low tide.
- Sandbanks that are slightly covered by sea water all the time.
- Submerged of partially submerged sea saves.
- Zostera (seagrass) habitats.
- Coastal habitats beyond the *A. nodosum* zone.

(b) When travelling to harvest zones, avoid impacts with the above habitats by adhering to Section 7 of the Code of Practice, “Environmentally safe navigation”. Doing so will prevent disturbance to soft substratum areas and their associated communities and species.

(c) When operating in the intertidal zone where *A. nodosum* is present (sheltered reef and shingle substratum areas), adhere to all aspects this Code of Practice. This will ensure that (i) the habitat area is maintained and (ii) structure and function is maintained or improved. It also ensures that the future prospects and conservation status of reef and shingle areas are maintained or enhanced, whilst also preventing in combination effects with existing and planned activities.

(d) BioAtlantis must ensure that continuous disturbance of each community type does not exceed an approximate area of 15% (recommended by NPWS to ensure adherence to the EU commissions' requirements). Working within this limit is critical to ensure compliance with the European Commission Article 17 reporting framework which considers disturbances of >25% of an area in an Annex I habitat to represent an unfavourable conservation status. The area affected by harvest activities/annum is provided in Table 1. To adhere with these limits, harvesting locations and activities must be planned and recorded. Sites will be inspected prior to scheduled harvest to confirm sufficient biomass of *A. nodosum* is present and recovery post harvesting. Inspection of sites post-harvest will be undertaken to ensure compliance with sustainable hand harvest methods. The status and quality of the *A. nodosum* habitat must be maintained by adhering to the sustainable harvesting methods and limits specified for the extent of these harvesting activities.

Table 1: List of marine habitat types in the Clew Bay SAC and the area potentially affected.

Marine community types (Clew Bay SAC)	Total Area in Clew Bay SAC (m^2)	Area affected by harvest activities/ annum		Area of Large Shallow Inlets and Bays [1160] affected/annum
		(m^2)	(%)	(%)
Zostera Community	1,423,891	0	0.0%	0.0%
Shingle	1,855,000	235,549	12.7%	0.23%
Reef	26,870,000	1,331,699	4.9%	1.31%
Maerl Dominated community	2,878,607	0	0.0%	0.0%
Fine Sands Dominated by *Nephtys cirrosa* community	2,950,308	0	0.0%	0.0%
Intertidal sandymud with *T. benedii* and *P. elegans* community complex	7,817,100	0	0.0%	0.0%
Mudflats & sandflats not covered by seawater at low tide	12,541,069	0	0.0%	0.0%

21/02/2024

SECTION 5: Harbour Seals and Birds.

5.1. Introduction

As harbour seals are highly sensitive to human behaviour, the key objective of the Code of Practise is to ensure that "Disturbance events" do not occur. In addition, certain species of breeding and wintering birds can be disturbed by human presence and may be sensitive to alterations in food supply. Therefore, this Code of Practise also works to ensure that behaviour and food supply to these protected species is unaffected by harvest activities.

The following rules and guidelines were developed based on findings from the published peer-reviewed literature, NPWS guidelines and recommendations from organizations such as the Hampshire & Isle of Wight Wildlife Trust (Anon 2016). Harvesters will be provided with training on seal behaviour and requirements of birds by staff at BioAtlantis. Similar training will also be provided in relation to Otter. The requirements are explained as follows:

5.2. General Measures:

Seasonality: Harbour seals are present throughout the year in aquatic and terrestrial habitats, including intertidal shorelines. Equal emphasis will be placed on not disturbing the behaviour throughout the year. Important aspects of the annual life cycle includes:

- Breeding (May-July approx.)
- Moulting (August-September approx.)
- Outside the breeding and moulting seasons (i.e., from October-April, 'resting sites').

Several species of breeding and wintering birds must not be disturbed at established sites during sensitive times. Harvesters will operate based on known locations of established breeding, moulting and resting sites of harbour seals (NPWS, 2011A) and sites of relevance to important bird species.

Requirements in relation to seasonality:

- Harvesting is prohibited at moulting sites between Aug-Sept, while permitted between Oct-July.
- Harvesting is prohibited at breeding sites between May-July, and permitted between Aug-April.
- Sites not used by seals during breeding/moulting seasons may be accessed between May-Sept.
- Harvesting is prohibited at resting sites between Oct-April, and permitted between May-Sept.
- Where sites serve dual functions (e.g. breeding & moulting), avoidance times may be prolonged.
- Sites serving triple functions (breeding, moulting & resting) must be avoided all year around.
- Harvest boats must not enter within 100m of breeding and moulting sites during sensitive times. In addition, certain bird sites may not be entered at sensitive times of the year.

Locations and Sites: The location of haul out sites are identified on the maps. In cases where haul out sites occur together in numbers, they may be distinguished and defined further by their geographical names or grouped together into single units. Bird wintering and breeding sites are also indicated.

Data Recording: Harvest boats cannot land at breeding or moulting sites between May-July and Aug-Sept respectively. Harvest location and pick-up points will be recorded on GRNs (Appendix 3). GRNs will be checked by audit to ensure compliance. Harvesters must report incidents of seal disturbance to the Resource Manager who will record it on the Incident Report Form. Similar measures are in place to ensure avoidance of bird breeding and wintering sites at sensitive times of the year.

Navigation: To minimise the effects of boats on seal behaviour, best practice for boating activities will require that harvesters (a) work according to pre-planned schedules and (b) avoid stalling/slowing down unnecessarily en route to harvest locations or pick up points (pier, etc), as these behaviours can lead to alterations in seal behaviour (flushing etc.). This is particularly relevant when operating within 100m of haul out sites. These measures will reduce the risk of being noticed by seals at haul out sites, not subject to harvest activities at a given time.

5.3. Site Specific measures:

- **Inisherkin:** There are a number of breeding/moulting sites (e.g. Inishgowla, Inishnacross and Inishcooa) in close proximity to resting sites at Inisherkin. Between Oct-April, seals will be resting at Inisherkin. Thus, harvest activities at nearby breeding/moulting sites could potentially impact on resting behaviour. To prevent impacts, the boat cannot be <100m of resting sites at Inishskerkin.
- **Inishcull:** Several islands (Inishpult, Inishfeis, Freaghhillaun-luggagh) and breeding sites surround a resting site at Inishcull. Between Oct-April navigation is not be permitted within 100m of Inishcull.
- **Inishturbid-Inishquirk:** Between these two islands lies an important resting site for harbour seals. Navigation between Oct to April will not be permitted within 100m of this resting site.
- **Additional sites:** A breeding site lies between Derrynish, Lanhoney, and Inishbarnagh. Access to islands surrounding this site is not permitted within 100m during the breeding season. Several islands are important for breeding and wintering birds (pers. comm. NPWS) and are listed in Table 2. Similar to harbour seals, they sites will be avoided at sensitive times of the year.

5.4. Other requirements:

Harbour Seals:

- Always follow pre-planned harvest schedules provided by BioAtlantis. When navigating within 100m of haul out sites, harvesters should observe sites from a distance with binoculars. If avoidance/disturbed behaviour is observed (e.g. rapid changes in direction away from the boat), increase distance between the boat and the site if possible.
- Never approach seals in a 'bow on' manner. When in proximity to their sites approach from the side and maintain a constant speed. If a seal is observed in open water, slow down (<5knts) or no-wake speed. To minimise disturbance, ensure movements are steady and in parallel to the animal.
- If a seal is encountered, ensure an escape route is provided. Avoid 'boxing-in' the animal or blocking narrow channels. If a mother and pup are encountered, leave the vicinity immediately and slowly.
- Navigation is not permitted within 100m of sites where harvesting is prohibited due to the presence of seals
- In the event that seal disturbance is observed, the event must be reported to the Resource Manager, who will record the details in the Incident Report Form.
- Noise must be kept to a minimum, for example, avoid revving of engines or shouting.
- On rare occasions, seals can display curiosity towards humans. If seals approach boats, maintain the course at constant speed or remain stationary. Do not approach the seal.
- If you encounter seals on a site not recognised as a haul-out site, leave the area promptly and quietly and report to the Resource Manager who will record the event in the Incident Report Form.

Birds (Breeding and Wintering)

- Always follow pre-planned harvest schedules provided by BioAtlantis.

- Harvesting is prohibited at important breeding sites during Spring/Summer periods. Harvesting is prohibited at important wintering sites during Autumn/Winter periods (table 2).
- Sites which are out of bounds are indicated in Table 2 below.
- To minimise disturbance, ensure activities on islands are maintained in the intertidal *A. nodosum* zone.
- Avoid estuarine areas containing soft mud or marsh at the mouths of rivers between Sept-April. Ensure caution if in the vicinity of these areas between May-Aug.
- Avoid approaching, chasing, scaring or putting birds to flight at any time, including roosting or feeding birds.
- If approaching shore at high tide, move slowly and keep distance from groups of resting birds.

Preventing interactions with tourism & recreation:
Harvesting cannot take place at seal/bird sites at sensitive times of the year, thus preventing in combination effects with tourism and recreation activities (e.g. Power Boat Trips, Sea Trampoline, Sit-On-Top Kayaking, Stand up Paddling, Sea Kayaking, Dinghy Sailing, Stand Up Paddle Boarding, Keel Boat Sailing).

Island/site No.	Site Name	Harbour seals			Birds		Control measures	
		Breeding Site	Moulting Site	Resting Site	Breeding site	Wintering site	Avoidance	Attendance
3	Roslynagh	Yes					May to July	Aug to April
5	Inishdasky	Yes					May to July	Aug to April
7	Inishtubrid			Yes			Oct to April	May to Sept
13	Moynish More	Yes				Yes	Oct-July	Aug to Sept
14	Moynish Beg (L865938)				Yes		March to Sept	Oct to Feb
17	Inishilra	Yes					May to July	Aug to April
19	Roeillaun (L875930)				Yes		March to Sept	Oct to Feb
20	Inishdeashbeag	Yes	Yes	Yes			Avoid all year round	
20	Inishdeashmore	Yes	Yes				May to Sept	Oct to April
21	Inishcorky	Yes			Yes		March to Sept	Oct to Feb
22	Inishcarrick	Yes					May to July	Aug to April
24	Muckinish	Yes					May to July	Aug to April
25	Inishdaweel	Yes					May to July	Aug to April
27	Illanascrraw	Yes					May to July	Aug to April
28	Freaghillanluggagh	Yes					May to July	Aug to April
38	Inishcuill			Yes			Oct to April	May to Sept
39	Mauherillan (L920919)				Yes		March to Sept	Oct to Feb
50	Inishakillew		Yes				Aug, Sept	Oct to July
63	Forilan		Yes				Aug, Sept	Oct to July
62	Inishgowla South		Yes				Aug, Sept	Oct to July
62	Carrickwee	Yes	Yes				May to Sept	Oct to April
64	Carrickawart Island		Yes	Yes			Aug to April	May to July
66	Dorinish (L9086)				Yes		March to Sept	Oct to Feb
67	Inishimmel (L908857)				Yes		March to Sept	Oct to Feb
71	Inisheeny (L920845)		Yes			Yes	Aug to March	April to July

Island/site No.	Site Name	Harbour seals			Birds		Control measures	
		Breeding Site	Moulting Site	Resting Site	Breeding site	Wintering site	Avoidance	Attendance
72	Finnaun Island	Yes	Yes				May to Sept	Oct to April
73	Corillan		Yes				Aug, Sept	Oct to July
74	Carricknamore		Yes				Aug, Sept	Oct to July
75	Stony Island		Yes	Yes	Yes		Avoid all year round	
76	Green Islands	Yes	Yes	Yes	Yes		Avoid all year round	
Cz 2.6	Pigeon Pt. (L949850).					Yes	Oct to March	April to Sept
Cz 5.13	Rosturk (L869956),					Yes	Oct to March	April to Sept
Cz 5.17	Rosmurrevagh (L852958)					Yes	Oct to March	April to Sept
-	Mulranny Saltmarsh (L827963)					Yes	Outside of licence application area. No harvest will take place here.	
-	Carrowholly (L956850)					Yes	Oct to March	April to Sept
-	Bertraw (L903834).					Yes	Oct to March	April to Sept
-	Carrickwee (NE Clew Bay)	Yes					May to July	Aug to April
-	Burrishoole Channel						Avoid all year round to ensure no impact on catchment, connected lakes, fish and otters.	
-	Estuarine areas containing soft mud or marsh at the mouths of rivers.					Yes	Sept-April	Ensure caution if in the vicinity of these areas between May-Aug.

Table 2: Sensitive ecological receptors within the study area and control measures implemented for mitigation.

SECTION 6: Otters

Otters may be sensitive to human presence and alterations of food source and supply. To avoid or prevent disturbance or interactions with otters, ensure the following:

- All activities are maintained within the intertidal *A. nodosum* zone. Avoid linear habitats located beyond the intertidal zone or marine riparian areas beyond the foreshore. Only use existing routes.
- Never interfere with couching sites, holts, access paths/routes, that may be present near coastal areas, agricultural fencing, roads, slipways, access points or other areas.
- Avoid large trees near coastal areas as they can represent important otter breeding and resting sites. Avoid undisturbed areas (e.g. impenetrable scrub/reeds) which are refuges for otters.
- Do not behave in an obtrusive or noisy manner around otters.
- Never interfere with, deliberately approach or disturb otters or their cubs that are resting, sleeping, hunting, feeding or foraging in water or on the shore during the daytime, dawn or dusk. Ensure caution during the periods of breeding, rearing and hibernation.
- If migrating/commuting otters are encountered in water, do not obstruct their movement. Slow down boat and give sufficient space to pass without "boxing" them in, blocking narrow channels or acting as a barrier to commuting or connectivity.
- If encountered on the shore, allow otters free access and ample opportunity to escape to the water/land. Do not behave in manner causing them to move away or flee human disturbance.
- To prevent in combination effects, adhere to the above measures at all times, particularly when working in areas known to exhibit signs of otter activity.

To prevent impacts on the dietary and other requirements of otter, the following measures apply:

- Follow pre-planned schedules and harvest in areas defined by BioAtlantis. Harvesting is limited to 20% of the total available *A. nodosum* biomass per site per annum, to allow for sufficient regrowth.
- Harvesting must not take place beyond the *A. nodosum* zone, as these habitats represent the broader habitat range of the otter's prey during adult and early life stages, including: flowing and static freshwater areas (rivers, streams, canals, lakes, reservoirs, ponds), deep water subtidal areas (>30m), shallow subtidal areas (<30m), exposed areas, estuarine mud areas, brackish waters, subtidal gravel/coarse bottom substratum, intertidal soft bottom (sand/mud), lagoons, maerl, rock pools, saltmarsh habitats, seagrass, subtidal soft bottom (sand/mud) and exposed waters in the vicinity of rocky cliffs.
- Avoid exposed and non-sheltered areas that represent the otter's broader habitat range, hunting ground and foraging area.
- Avoid co-harvesting non-*A. nodosum* material near coastal habitats, near the shoreline or on the shore. Ensure that inadvertent by-catch of other algae, dead/senescing algae, amphipods, isopods or other *Animalia* or material is prevented and minimized.
- Do not remove the *A. nodosum* holdfast and take care not to disturb rocky/crevice substratum.
- Avoid all freshwater aquatic linear habitat and riparian environments including lakes and rivers and other areas (e.g. east side of InishGowla South).
- Harvesting cannot occur in fresh water habitats, including at the mouth of Lough Furnace or the Burishoole Catchment. This prevents potential impacts on salmon, trout and European eel, in turn preventing any impacts on otter.

SECTION 7: Environmentally safe navigation:

7.1. Introduction:

The following rules and guidelines have been developed on the basis of NPWS's objectives for ensuring protection of mudflat, sandflat, intertidal sandy mud, fine-sand and Atlantic Salt Meadow environs of Clew Bay. These guidelines must be adhered to by all harvesters supplying *A. nodosum* to BioAtlantis.

7.2. Protecting mudflat, sandflat, intertidal sandy mud, estuarine mud, fine-sand, Atlantic Salt Meadow, shingle and reef areas.

Harvesting *A. nodosum* along rocky shorelines located beyond mudflat, sandflat, intertidal sandy mud, estuarine mud or fine-sand areas requires that work be done in a manner that prevents impacts with these substratum areas. Training will be provided, where necessary, to ensure that harvesters are aware of requirements for protecting these areas and species residing within these habitats in the SAC. Important aspects to the code of practice are as follows:

- Advanced preparations will be necessary in advance of work in these locations. Always adhere to clearly defined harvesting schedules provided by BioAtlantis.
- It is essential not to enter into mudflat, sandflat, intertidal sandy mud, estuarine mud or fine-sand areas during low tide. Entry into these areas at low tide will cause physical damage to these environs and the associated species. These areas will be indicated clearly in the maps provided. Access by boat to rocky shores located beyond these areas must be undertaken at high tide or when the tide has begun to recede.
- If mudflat, sandflat, intertidal sandy mud, estuarine mud or fine-sand areas are entered into inadvertently, promptly leave and inform the Resource Manager of the incident who will record the incident.
- When approaching coastal areas in small boats, ensure that contact with reef, shingle or estuarine mud is minimal. This will ensure no damage is inflicted on boat or on reef or shingle habitat.
- In smaller boats, always approach the shore at slow pace so as to avoid intertidal reef (i.e. mixed substrate of pebbles and cobbles) or shingle. Along the western margin of Clew Bay there are small patches of subtidal boulders and cobbles which must be avoided.
- The harvest collection boat (if deemed applicable to the area) will be fitted with a depth sounder to ensure that contact with the reef is avoided. Hard substrate will be encountered between 2-14m and should be avoided. The sonar depth sounder must be in working order during all collection activities. This measure will ensure that displacement or disturbance of reef and species therein does not occur.
- To ensure that *A. nodosum* harvesting does not negatively impact on the Atlantic Salt Meadow (ASM) habitat in general, *A. nodosum* must not be harvested at the fringes of these areas.

SECTION 8: Tourism, sport and recreation

Tourist, sport and recreation activities may cause anthropogenic disturbances and disturb sensitive harbour seals and bird species. To prevent interactions with these activities, the following is required:

- As a general policy, hand harvesters will avoid sites where tourism, sport and recreation activities are observed to be taking place. This will be determined on a case-by-case basis.

- Harvesters must not work within 50m of bases where tourism and recreation-related equipment or vessels are manually introduced in the water (e.g. kayaks). This ensures that no in combination effects occur, such as exacerbation of anthropogenic disturbance which could give rise to localized reductions in density of intertidal seaweed and the associated biotope.
- Harvest may occur on Collanmore Island between Sept-April. This will prevent in combination effects such as exacerbation of anthropogenic disturbance during peak tourist season (May-Aug).
- Harvest will not occur at Mulranny.
- Hand harvesters will not work at Roman Island or Westport harbour between May and August. This prevents any in combination effects from occurring during peak season.
- Harvesting will not take place on the east side of Inishraher where a retreat centre is located.
- As a general policy, hand harvesters must ensure the following:
  - **(a) Boats and vessels:**
    - Maintain distance from other boats or vessels, such as power boats, cruise boats, kayaks, rib boats, row boats, rib boats, fishing boats when travelling to sites, thus preventing any in combination effects.
    - Maintain distance from passenger ferries and cargo vessels and ensure no interactions with their routes and activities.
  - **(b) Site avoidance:** Avoid sites where sports, leisure activities, education excursions, retreats, seaweed foraging days, discovery tours or workshops are observed to be taking place. This will be determined on a case-by-case basis. Harvesters must not interact with people on the shore engaging in these activities.
  - **(c) Water sports:** Harvesters and operators of boats must ensure caution when operating in the vicinity of floating water sports, yacht moorings and areas where other sports such as dinghy sailing, water skiing and jet skiing are taking place (e.g. in the vicinity of Mayo Sailing Club, the Sruhnameel Channel and Schoolhouse Bay). Ensure caution when operating in known areas of importance to swimmers and kayakers (e.g. Rosmindle Pool).
  - **(d)** Harvesters and operators of boats must keep well clear of boats during training and racing and must observe "power gives way to sail" conventions when appropriate.
  - **(e)** Respect the space of all recreational users when operating in the complex.
  - **(f)** If operating near causeways and connected sites, adhere closely to this Code of Practice to prevent disturbance to wildlife such as birds or otters (e.g. causeway linking Claggan and Inishnakillew).

SECTION 9: Aquaculture

To ensure that hand harvest activities do not exacerbate any negative effects associated with aquaculture in Clew Bay, the following is required:

- Harvest activities cannot take place at breeding, resting or moulting sites during sensitive times of the year. Similar approaches must be taken with Inishcorky and other islands in close proximity to Inishcorky, namely Inishdeashmore, Inishdeasbeag, unnamed neighbouring island off Inishdeasbeag and Inishnacross (Marine Institute, 2014 and 2019).
- Caution is required when approaching/operating near areas where planned and existing aquaculture sites are in relative proximity to seal sites and bird breeding/wintering sites.

- The requirements for environmentally safe navigation must be followed to ensure no in combination effects which could damage mudflats/sandflats, where aquaculture sites are located.
- Ensure caution when travelling in the vicinity of defined aquaculture navigation routes. Do not impede workboat or tractor access to aquaculture sites along access routes, including but not limited to those associated with Clynish, Inishcottle, Inishcottle Pier, Kilmeena, Knockmanus, Murrisk, Newfield (Mulranny), Roigh Pier (near Rockfleet bay), Roskeen South (Carrowbeg), Roskeen south, Rosmoney Pier, Ross, Rosslaher, Rossmalley, Rossmoney, Rossymailley and Tiernaur, quays, piers, private laneways or routes or other pick up points.
- Do not interfere with aquaculture users who are licensed to harvest or grow seaweed.
- Ensure that no aspects of *A. nodosum* harvesting give rise to any physical interaction or contact with aquaculture production units, their structures or anchors.

SECTION 10: Angling and fisheries activities.

- There are several sites of relevance to fisheries and sea angling in Clew Bay. Harvesters must work to ensure that the space of fishermen and sea angler's is respected at all times.
- Ensure that the space of recreational/shore anglers is respected, particularly when competitions and festivals take place, e.g. during summer in areas including the following: Mallaranny Strand, Curraun, Lough Furnace Newport pier, Newport Quay, Rossnakilly, Rossnakilly, Ross, Rossanrubble, Altapheebera and Whiteheather.
- Keep distance and do not interfere with licensed salmon draft fishermen who may cut back seaweed when using their nets.
- Seaweed harvesting may only take place in the intertidal *A. nodosum* zone and not in subtidal areas of relevance to fisheries activities such as potting (lobster, crab, shrimp, whelk, nephrops), dredging (e.g. scallop, native oyster, cockle), trammel net fishing for bait, otter trawl, tangle net (crayfish), gillnet, Mid-water trawl. Activities in subtidal waters permitted include site visits, inspections, surveys, collection of harvested seaweed, transport and transfer to pick up points.
- Avoid interactions with non-*A. nodosum* habitats which represent the broader habitat range of fish, shellfish, invertebrates and fisheries species during adult and early-life stages, including: deep water areas, seagrass, estuarine mud areas, saltmarsh, lagoons, maerl, subtidal gravel/coarse bottom, subtidal soft bottom areas, intertidal soft bottom areas and exposed shores.
- Avoid soft substratum areas where bait digging for ragworm/lugworm is observed to be taking place.

SECTION 11: Other seaweed harvesting activities

BioAtlantis is responsible for commercial harvesting of *A. nodosum*. To ensure compliance with Clew Bay's conservation objectives and prevent in combination or cumulative effects, the following applies:

- Harvesting is not permitted in areas with existing appurtenant rights/burdens in relation to seaweed, without first obtaining permission from the person to whom those rights belong.
- Where Profit-à-Prendre harvesting rights are successfully registered with the PRAI, the harvesting plans must be adjusted to ensure that those individuals can continue to harvest *A. nodosum.*
- If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. BioAtlantis will not harvest in such areas until *A. nodosum* has regenerated and will work to ensure that any harvesting is

limited to 20% of the total available biomass per site per annum and continuous disturbance of each community type does not exceed the required limit.

- Any commercial user having small requirements of approximately 1 tonne per annum (e.g. hotels, health Spas) will be identified and BioAtlantis will work to prevent in combination effects.
- BioAtlantis will not harvest beyond Rossmurrevagh, thus avoiding much of the Mulranny area. This avoids in combination effects with tourism/recreational excursions in the area, which may be focused on seaweed, e.g." "Seaweed harvesting discovery days".
- Harvesting activities must not impact on other people who harvest small volumes of seaweed, edible seaweeds or invertebrates for their own personal use, e.g. dillisk, carrageenan, limpets, mussels, clams, periwinkles and scallops.

SECTION 12: Invasive species

To ensure that harvest activities to not act as a vector and lead to the spread of the invasive species, such as *Bonamia ostreae, Botrylloides violaceus, Caprella mutica, Crassostrea gigas, Crepidula fornicate, Didemnum vexillum, Perophora japonica, Sargassum muticum Spartina anglica* and *Styela clava,* BioAtlantis will ensure the following:

- Boats will be painted once a year with appropriate anti-fouling paint.
- The harvesters boats will not leave Clew Bay. In the rare case that they do, harvesters must implement appropriate cleaning measures on land.
- All bags/nets must be cleaned with appropriate cleaning agents or other suitable methods on delivery to production facilities and returned to harvesters in a clean condition.
- Harvesting will be limited to the *A. nodosum* zone and will not take place in subtidal areas, exposed or semi-exposed sites.
- Harvesters must keep distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures.
- Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and of other *Animalia,* algae or dead, drifting material/algae will be prevented and minimized.

REFERENCES

Anon (2016). Code of Conduct. Hampshire & Isle of Wight Wildlife Trust in partnership with Chichester Harbour Conservancy. Accessed 02/03/2021

ADDENDUM 5 BIOATLANTIS IMPACT ASSESSMENT

License Application for Sustainable hand-harvesting of *Ascophyllum nodosum* at Clew Bay (SAC Site Code 1482). In accordance with National Parks & Wildlife Service conservation objectives for marine and coastal habitats and species and the EU Habitats Directive 92/43/EEC.

Appendix 5: Impact Assessment of *A. nodosum* harvesting activities on Clew Bay SAC

Prepared by: BioAtlantis Ltd.
Date of submission: 20/01/2014
Date of revision: 21/02/2024

[redacted]

Contents

Introduction

Overview: The section describes the scoring, decisions and results obtained during the hazard analysis of *A. nodosum* harvesting in Clew Bay.

Site Name: Clew Bay Complex (Site Code 1482)

Activity under assessment: Harvesting *A. nodosum* in Clew Bay. Assessor: BioAtlantis Ltd.

Scope of current assessment:

a) Marine & Coastal species & habitats (as protected under Annex I & II of EU Habitats Directive 92/43/EEC).
b) Species & habitats of general interest.
c) *Ascophyllum nodosum* biotope and species therein.
d) Continuous disturbance
e) Broad, holistic examination of the nature, extent and impact of hand harvesting.
f) Existing Operations: potential in-combination effects and interactions.
g) Planned Operations: potential in-combination effects and interactions.
h) Invasive species

NOTE:

- For a summary of the findings of this hazard analysis, please consult Section 3 and Tables 10-16 of the main text document.
- For more detailed analysis of risks associated with protected bird species, please consult Appendix 6.
- For more detailed analysis of risks associated with existing and planned operations, please consult Appendix 7.

Methodology employed:

This system outlined on the following was used in determining which hazard(s) require control measures. Identification of control measures was based on a 5x5 risk analysis matrix. Risk scores are calculated on basis of probability of hazard occurring multiplied by severity by which the respective hazard imposes on the species/habitat under assessment. High risk hazards (i.e. $\geq$15) automatically require a Natura Impact Statement (NIS). In the event of moderate risks being identified, it was deemed necessary to assess whether or not an NIS was required, through working with independent environmental consultants.

Note: This document has been updated following a public consultation period which took place between December 2014 and January, 2015. This analysis includes additional planned and existing activities in Clew Bay, along with additional mitigation measures where required.

Likelihood of Hazard Occurring:

1. Highly Improbable
2. Probable - annually
3. Infrequent - 2-3 times/year
4. Occasional - monthly
5. Frequent – weekly

Severity of Consequences:

1. Low
2. Low to moderate
3. Moderate
4. Moderate to high
5. High

Risk Rating = Probability x Severity

SEVERITY

PROBABILITY	5	4	3	2	1
5	25	20	15	10	5
4	20	16	12	8	4
3	15	12	9	6	3
2	10	8	6	4	2
1	5	4	3	2	1

Risk Ratings are grouped into three categories

15 – 25: High risk, requiring mitigation measure;
8 - 12: Moderate risk, establish control procedures;
1 - 6: Low risk, establish control measures if appropriate.

Figure 1: Risk Calculation

Figure 2: Decision Tree

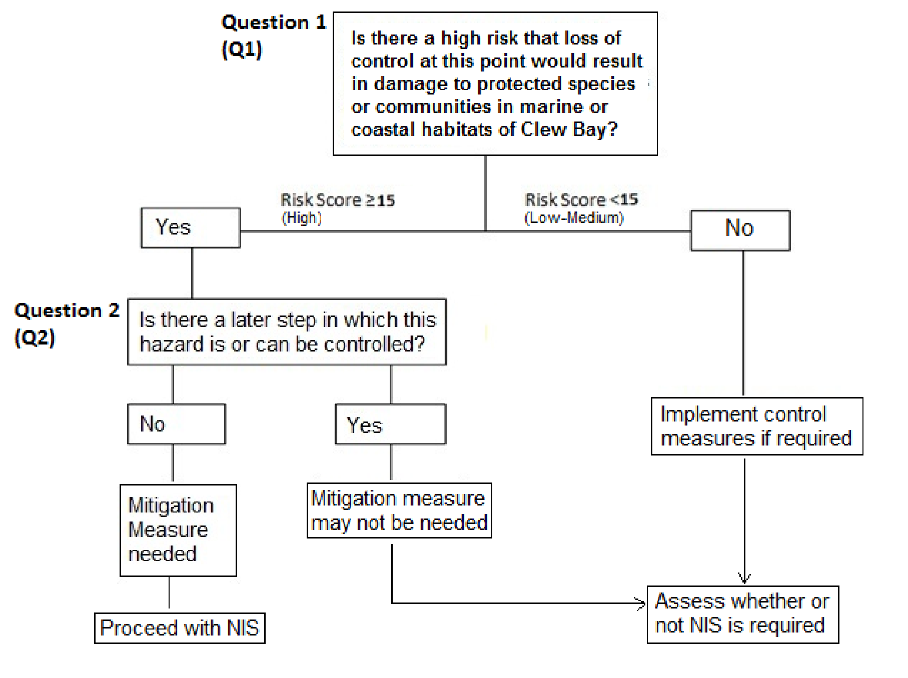

Figure 2 : Decision Tree

Results & Control measures

(a) Marine & Coastal species & habitats (as protected under Annex I & II of EU Habitats Directive 92/43/EEC).

(1) Permanent habitat area

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species	Non-conformance with harvest procedures leading to inadvertent removal of habitats, e.g. excessive removal of sand, shingle, stones, pebbles, rock, debris, holdfasts).	2	5	A	no	n/a	yes	• Harvesters are provided with training, where necessary, to ensure that no removal of permanent habitat occurs, i.e. ➢ No removal of excessive levels of sand, shingle, stone, pebbles, gravel, etc. ➢ No removal of *A. nodosum* holdfasts that could carry sand, shingle, stone, etc. • Resource Manager will inspect the harvest on collection or during the washing bagging operation on the collection boat (if deemed applicable for the area). ➢ If excessive sand, shingle or debris etc is observed, the harvester will be provided with training. • Checks will be recorded on the Goods Received Notes (GRNs, See Appendix 3). • Production Operators will also inspect incoming harvested seaweed on production logsheets. The following will apply: ➢ If excessive levels of sand, shingle or debris is present in harvested weed: -Removal by sand filter and decanter and clarifier. -Harvester provided with training, where necessary ➢ If stones or rocks are present: Harvester provided with training, where necessary. Non-conformance is reported, particularly in the serious event of *A. nodosum* holdfasts being present.	EU Dir. 92/43/ EEC & NPWS Target 1 of Objective 1, NPWS, 2011A, page 12. MSFD targets (2016)

Chemical: Synthetic and naturally occurring substances, cleaning residues, oil/grease, fuel, etc.	Fuel oil leak from harvest recovery/collection boat caused by engine malfunction, fuel line rupture, etc. Non-conformance with procedures for storing and cleaning of boat.	1	5	A	no	n/a	yes	Routine maintenance of boat engine, etc Harvesters provided with training, where necessary, to ensure cleaning takes place in a manner which does not lead to wash off of cleaning agents into the environment, e.g. use of designated washing bays where available.	
Physical: Heat, cold, noise, vibration. mechanical hazards, ionising radiation (e.g. X-rays) and non-ionising radiation (e.g. microwaves), solar radiation. Presence of foreign matter (rubber, plastic, sand, stones, glass, metal, organic material)	Debris from the boat may inadvertently be deposited into the environment	1	3	A	no	n/a	yes	Appropriate removal of rubbish, debris or other foreign matter when at port.	

Hazard	Probability	Severity	Reason for Decision
Biological	**2**		Likelihood of sand and rocks being removed along with harvested *A. nodosum* is low. Given that such materials may damage production equipment and end product, harvesters will be required to ensure such materials are not included in the bags/nets. The collection of bags/nets at high tide or as high tide approaches also reduces the likelihood of excessive levels of sand or other material being removed from the foreshore. In addition, A. nodosum will be harvested no less than 200mm above the holdfast. This reduces the likelihood of holdfasts being removed, which could otherwise, inadvertently lead to removal of attached pebbles or stones (see Appendix 4 for Code of Practise)
		5	In accordance with EU Dir. 92/43/EEC & NPWS, areas must be maintained at favourable conservation conditions to ensure stability of the permanent habitat area (Ref: Target 1 of Obj. 1, NPWS, 2011A). Removal of habitat may contravene this directive (e.g. removal of excessive levels of sand or rock).
Chemical	**1**		It is highly improbable that a chemical hazard will occur given that no chemical wills be carried on board of boats, except for standard cleaning and hygiene equipment.
		3	Severity associated with chemical hazards coming in contact with the permanent habitat of Clew Bay could be significant, particularly to marine life which are sensitive to chemical toxins and could contravene Target 1 of Objective 1, NPWS, 2011A, page 12.
Physical	**1**		It is highly improbable that debris will inadvertently be deposited into the environment, as harvesters will be provided with training, where necessary in general hygiene best practises and means of disposing of general and mechanical waste associated with boats.
		3	Severity associated with physical waste is potentially significant as it could lead to damage to the permanent habitat area.

(2) Zostera Seagrass (and associated communities).

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required. .
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Regulatory Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Zostera Seagrass and associated communities).	Unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	• Harvest of *A. nodosum* in these areas will not take place.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**1**		It is highly improbable that the distribution, abundance, diversity or area occupied by Zostera Seagrass (and associated communities) will be altered due to harvesting of *A. nodosum* given that: (a) these areas and communities exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) the sandy substrate supporting Zostera growth are insufficient to support *A. nodosum* and thus, will not be affected by harvest activities.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of Zostera Seagrass and associated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13). Harvest activities in these areas could significantly damage these areas.
Chemical /Physical			n/a
			n/a

(3) Maerl Dominated communities

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Maerl Dominated communities)	Unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	• Harvest of *A. nodosum* in these areas will not take place.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**1**		It is highly improbable that the distribution, abundance, diversity or area occupied by maerl and associated communities will be altered due to harvesting of *A. nodosum* given that: (a) these areas and communities exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) the coarse, mixed, sandy mud and muddy sand sediment substrates which support maerl growth are insufficient to support *A. nodosum* and thus, will not be targeted for harvest activities.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of maerl and associated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13). Harvest activities in these areas could significantly damage maerl and associated communities
Chemical /Physical			n/a
			n/a

(4) Polychaetes & bivalves community complex (Intertidal and sub-tidal Sandy mud areas)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Sandy mud with polychaetes & bivalves community complex)	Unauthorized harvest in mudflat/sandflat areas during low tide.	2	5	A	no	n/a	yes	• Ensure implementation of code of practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflats and sandflats (see Appendix 4)	EU Dir. 92/43/ EEC & NPWS Maintain polychaete & bivalve community complex in Sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**2**		It is unlikely that the distribution, abundance, diversity or area of sandy mud occupied by polychaete & bivalve community complex will be altered due to harvesting of *A. nodosum* given that: (a) the intertidal sandy mud areas containing these communities exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) sandy and muddy areas are insufficient to support growth of *A. nodosum* and thus, will not be targeted for harvest activities. (c) accessing rocky shorelines that lie beyond mudflat/sandflat areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of polychaete & bivalve community complex in Sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).). Harvest activities in these areas could significantly damage these community complexes.
Chemical /Physical			n/a
			n/a

(5) *Nephtys cirrosa* community (clean, fine sand areas)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Fine sand dominated by *Nephtys cirrosa* community)	Unauthorized harvest in these protected areas during low tide.	2	5	A	no	n/a	yes	• Ensure implementation of Code of Practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond clean, fine sand areas in the south west of the complex (see Appendix 4)	EU Dir. 92/43/ EEC & NPWS Maintain *Nephtys cirrosa* community in fine sand areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	**2**		The probability of *Nephtys cirrosa* communities and their habitat (clean, fine sand area) being altered due to harvest activities in Clew Bay is relatively low given that: (a) the fine sand areas containing this community exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) fine sand areas are insufficient to support growth of *A. nodosum* and thus, will not be targeted for harvest activities. (c) accessing rocky shorelines that lie beyond clean, fine sand areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of the *Nephtys cirrosa* community in fine sand areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes.
Chemical /Physical			n/a
			n/a

(6) *Tubificoides benedii* and *Pygospio elegans* community complex (Intertidal sandy mud areas)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Damage to or removal of habitat required by *Tubificoides benedii* and *Pygospio elegans* communities (i.e. Intertidal sandy mud)	Use of boats to access rocky shorelines which lie beyond mudflats at low tide.	2	5	A	no	n/a	yes	• Ensure implementation of code of practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas, within which *Tubificoides benedii* and *Pygospio elegans* reside (see Appendix 4)	EU Dir. 92/43/ EEC & NPWS Maintain *Tubificoides benedii* and *Pygospio elegans* community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		The probability of *Tubificoides benedii* & *Pygospio elegans* species and their habitat (intertidal sandy mud) being altered due to harvest activities in Clew Bay is relatively low given that: (a) *A. nodosum* does not grow on intertidal sandy mud substrate, and therefore will not be subjected to harvest activities. (b) in most areas, intertidal sandy mud areas exhibit little overlap with the rocky shorelines. (c) accessing rocky shorelines that lie beyond intertidal sandy mud areas at low tide in particular, is very difficult and would be avoided by harvesters by default.
		5	EU Dir. 92/43/EEC & NPWS, requires maintenance of *Tubificoides benedii* and *Pygospio elegans* community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes and/or their habitat.
Chemical : none identified			n/a
			n/a
Physical:			n/a
			n/a

(7) Shingle (pebbles and gravel)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Shingle (pebbles and gravel)	• Potential removal of small quantities of stones, rocks, etc. • Small, stony, friable substrate occurs frequently in Clew Bay.	2	5	A	no	n/a	yes	A system is in place which ensures that: • Hand harvest techniques employed along shingle areas will ensure that *A. nodosum* is severed above point of contact with underlying substrate. See "Code of Practise" for details (Appendix 4). • Levels of disturbance or displacement that could give rise to presence of shingle, friable substrate and/or associated holdfast material, will be monitored and recorded via 'Goods received Notes' (GRN) and also at production facilities. • Site Inspection Forms will be used to • Sites will be inspected post harvest to check the sustainability of the methods employed and the harvest locations (Site Inspection Form, SIF, Appendix 3).	EU Dir. 92/43/ EEC & NPWS Maintenance of shingle habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption or disturbance of shingle.	• Impact by boats • Disturbance or displacement may occur with inappropriate technique, lack of training or oversight	2	5	A	no	n/a	yes	• A code of practice will be implemented to ensure that harvesters employ good boating practices, particularly when landing on shores (See Appendix 4). • Training provided to harvesters, where necessary, to ensure that reef or shingle is not disturbed or displaced. • Levels of disturbance or displacement that could give rise to presence of such material in the harvested seaweed, will be monitored and recorded via 'Goods received Notes' (GRN) and also at production facilities.	

Hazard	Probability	Severity	Reason for Decision
Biological	**2**		It is unlikely that distribution, abundance, diversity or area of shingle will be altered due to harvesting of *A. nodosum* given that shingle is considered contaminant material and will not be removed during harvest.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of shingle habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13). Harvest activities in these areas could significantly damage these community complexes.
Chemical /Physical	**2**		It is unlikely that shingle areas will be damaged due to harvesting of *A. nodosum* given that: (a) harvesters will be using small boats to land on islands and coastal areas. Care will be taken in order to ensure that contact with shingle and reef is minimal, therefore avoiding any damage being inflicted on boats. It is unlikely that significant levels of disturbance or displacement of shingle will occur. This is due to the fact that the hand harvest methodology involves working at low tide and harvesters have full view of the cutting process, allowing them to take care not to disturb the substrate.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of shingle habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13). Harvest activities in these areas could significantly damage these community complexes.

(8) Reef

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
• Removal of habitat (i.e. reef) • Removal with or without holdfast material	• Potential removal of small quantities of stones, rocks, etc. • Small, stony, friable substrate occurs frequently in Clew Bay.	2	5	A	no	n/a	yes	A system is in place which ensures that: • Hand harvest techniques employed along rocky shores will ensure that *A. nodosum* is severed above point of contact with underlying substrate. See “Code of Practise” for details (Appendix 4). • Levels of disturbance or displacement that could give rise to presence of reef and/or associated holdfast material, will be monitored and recorded via ‘Goods received Notes’ (GRN) and also at production facilities. • Sites will be inspected post harvest to check the sustainability of the methods employed and the harvest locations (Site Inspection Form, SIF, Appendix 3).	EU Dir. 92/43/ EEC & NPWS Maintenance of reef habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption or disturbance of reef.	• Impact by boats • Disturbance or displacement may occur with inappropriate technique, lack of training or oversight	2	5	A	no	n/a	yes	• A code of practice will be implemented to ensure that harvesters employ good boating practices, particularly when landing on shores (See Appendix 4). • Harvesters provided with training, where necessary, to ensure that reef is not disturbed or displaced. • Levels of disturbance or displacement that could give rise to presence of such material in the harvested seaweed, will be monitored and recorded via ‘Goods received Notes’ (GRN) and also at production facilities.	

Hazard	Probability	Severity	Reason for Decision
Biological	**2**		It is unlikely that distribution, abundance, diversity or area of reef will be altered due to harvesting of *A. nodosum*. While *Ascophyllum nodosum* may be harvested in from rocky shores which contain reef as underlying substrate, the hand harvesting technique used ensures that *A. nodosum* vegetative growth is severed well above the point of contact with reef. Contact with reef would also lead to damage to the harvesters sickle/blade, thus, reef will always be avoided. It is unlikely that significant levels of disturbance or displacement would occur, to levels which would lead to co-removal of reef with or without holdfast material. This is due to the fact that the hand harvest methodology involves working at low tide and harvesters have full view of the cutting process, allowing them to take care not to disturb the substrate.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of reef in a natural condition (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).
Chemical:			
			n/a
Physical:	**2**		It is unlikely that reef will be damaged due to harvesting of *A. nodosum* given that: (a) harvesters will be using small boats to land on islands and coastal areas. Care will be taken in order to ensure that contact with reef is minimal, therefore avoiding any damage being inflicted on boats. (b) The harvest collection boat (if deemed applicable to the area) will be fitted with a depth can device to ensure that contact with the reef is avoided as it will damage both the reef and the boat. It is unlikely that significant levels of disturbance or displacement of reef will occur. This is due to the fact that the hand harvest methodology involves working at low tide and harvesters have full view of the cutting process, allowing them to take care not to disturb the substrate.
		5	EU Dir. 92/43/EEC & NPWS, requires the maintenance of reef in a natural condition (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).

(9) Mudflats and sandflats not covered by seawater at low tide.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	EU Dir. 92/43/ EEC & NPWS The permanent habitat area is stable or increasing, subject to natural processes (Ref: Target 1 of Objective 2, NPWS, 2011A, page 14).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: disruption of intertidal sandy mud.	Use of boat during low tide to access rocky shorelines which lie beyond mudflat or sandflats.	2	5	A	no	n/a	yes	• Ensure implementation of Code of Practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas (see Appendix 4)	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological: none identified			n/a
			n/a
Chemical: none identified			n/a
			n/a
Physical: Disruption of intertidal sandy mud.	**2**		The probability of mudflats and sandflats being altered due to harvest activities in Clew Bay is relatively low given that: (a) this substrate is not suitable for *A. nodosum* growth will not be targeted for harvest activities and (b) in most areas, mudflats and sandflats exhibit little overlap with the rocky shorelines. (c) accessing rocky shorelines lie beyond mudflats and sandflats at low tide in particular, is very difficult and would be avoided by harvesters.
		5	EU Dir. 92/43/EEC & NPWS, requires maintenance of *Tubificoides benedii* and *Pygospio elegans* community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes and/or their habitat.

(10) Harbour seals: General population.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Human activities Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and entering the water, man-made energy (Ariel or underwater noise), deterioration of resources such as water quality or food source	Unauthorized presence of harvesters at haul out sites or activities known to cause seals to 'flush out' and enter the water.	2	5	A	no	n/a	yes	BioAtlantis will issue the "Code of Practice" for the Protection of the Harbour Seal (Appendix 4), to ensure that harvesters: • Have full knowledge of the sites in Clew Bay known to be relevant the harbour seal. • Full knowledge of harbour seal sites which have been excluded from this application. • Understand the steps required to ensure that all contact with seals is prevented from day to day. • Understand best practises for dealing with contact with seals should it occur and methods of reporting such incidents should they arise. • In rare cases where contact occurs, harvesting will cease immediately and harvesters will move to new location. • Harvesters follow clearly defined routes according to pre-planned schedules. • Engines will run at a constant rate in areas important to the harbour seal during sensitive times of the year, e.g. haul out sites and not enter within 100m of these sites at sensitive times of the season. • Avoid stalling or slowing down unnecessarily en route to harvest locations or pick up points (pier, etc). See Appendix4 for details of the "BioAtlantis Code of Practice" for the Protection of the Harbour Seal along with site-specific measures and general measures. For details on action limits, analytical procedures monitoring and corrective actions, see Table 10 of main text.	EU Dir. 92/43/ EEC & NPWS Human activities should occur at levels that do not adversely affect the harbour seal population at the site (Ref: Target 5 of Objective 3, NPWS, 2011A, page 16)

Hazard	**Probability**	**Severity**	**Reason for Decision**
Human Activities	**2**		Contact with harbour seals at haul out sites will be minimal as harvest cannot take place at haul out sites during sensitive times of year. Boats will also operate in a manner known to least affect seal behaviour (see Appendix 4 for details).
		5	EU Dir. 92/43/EEC & NPWS, requires that human activities should occur at levels that do not adversely affect the harbour seal population at the Clew Bay site (Ref: Target 5 of Objective 3, NPWS, 2011A, page 16). Seals are very sensitive to the presence of humans and activities in boats, which can lead to alterations in important behavioural activities such as 'flushing out' into water or leaving haul out sites.

(11) Harbour seals: species range

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	EU Dir. 92/43/ EEC & NPWS Species range should not be restricted by artificial barriers to site use (Ref: Target 1 of Objective 3, NPWS, 2011A, page 15).
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Restriction of the harbour seal species range.	Presence of artificial barriers.	n/a	5	n/a	n/a	n/a	n/a	Physical barriers which could block access to harbour seals and site of importance to their species will not be installed in Clew Bay.	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:			n/a
			n/a
Chemical:			n/a
			n/a
Physical:	**n/a**		It is highly improbable that hand harvest of *A. nodosum* will restrict or affect the species range of harbour seals in Clew Bay due to the use of artificial physical barriers and no such barriers will be used in operations.
		5	EU Dir. 92/43/EEC & NPWS, requires that human activities should not involve the use of artificial barriers to site use, which could affect the range of the harbour seal species (Ref: Target 1 of Objective 3, NPWS, 2011A, page 15). Restrictions on the range of harbour seals could have significantly negative effects on this protected species which would contravene EU Law.

(12) Harbour seals (Breeding sites)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and entering the water).	Unauthorized presence of harvesters in areas important to the harbour seal during breeding (between May-July)	2	5	A	no	n/a	yes	• No harvest at breeding sites between May-July. • Boats operated using methods which have least effects on harbour seals. See "BioAtlantis Code of Practice" for protection of the harbour sea" for details (Appendix 4)	EU Dir. 92/43/ EEC & NPWS Breeding sites should be maintained in a natural condition (Ref: Target 2 of Objective 3, NPWS, 2011A, page 15)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Noise	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	**2**		As above in table A10 (i.e. Harbour seals: General population.)
		5	EU Dir. 92/43/EEC & NPWS, requires that breeding sites should be maintained in a natural condition (Ref: Target 2 of Objective 3, NPWS, 2011A, page 15). Human contact is a known risk factor which can negatively impact upon harbour seal breeding and activities which take place on thereafter.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(13) Harbour seals (Moulting sites)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and enter the water).	Unauthorized presence of harvesters in areas important to the harbour seal during moulting (between Aug-Sept)	2	5	A	no	n/a	yes	• No harvest at moulting sites between Aug-Sept. • Boats operated using methods which have least effects on harbour seals. See "BioAtlantis Code of Practise" for protection of the harbour seal for details (Appendix 4).	EU Dir. 92/43/ EEC & NPWS Moult out sites should be maintained in a natural condition (Ref: Target 3 of Objective 3, NPWS, 2011A, page 15)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		As above in table A10 (i.e. Harbour seals: General population.)
		5	EU Dir. 92/43/EEC & NPWS, requires that Moult-out sites should be maintained in a natural condition (Ref: Target 3 of Objective 3, NPWS, 2011A, page 15). Human contact is a known risk factor which can negatively impact upon harbour seal behaviour during times of moult.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(14) Harbour seals (Resting sites)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Presence of humans and/or their activities can alter the behaviour of harbour seals (e.g. 'flushing out' and enter the water).	Unauthorized presence of harvesters in areas important to the harbour seal during resting (between Nov-April)	2	5	A	no	n/a	yes	• No harvest at resting sites between Oct-April. • Boats operated using methods which have least effects on harbour seals. See "BioAtlantis Code of Practise" for protection of the harbour seal for details (Appendix 4).	EU Dir. 92/43/ EEC & NPWS Resting Haul-out sites should be maintained in a natural condition (Ref: Target 4 of Objective 3, NPWS, 2011A, page 15)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		As above in table A10 (i.e. Harbour seals: General population.)
		5	EU Dir. 92/43/EEC & NPWS, requires that Resting Haul-out sites should be maintained in a natural condition (Ref: Target 4 of Objective 3, NPWS, 2011A, page 15). Harbour seal spend much of their time scanning their surrounding area during times of rest. Human contact can have negative impacts upon harbour seal resting behaviour, and can lead to seals leaving the area.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

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(15) Perennial vegetation of stony banks

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Perennial veg. of stony banks).	Removal of habitat due to harvest and/or storage of material in these areas.	1	5	A	no	n/a	yes	Harvest, storage and transport activities will not take place in these locations. Harvest must occur along rocky shorelines followed by immediate collection and transfer from nets/bags to the boat or towing of nets/bags from harvest sites for pick up via existing pier and road networks. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points.	EU Dir. 92/43/ EEC & NPWS To maintain the favorable conservation condition (ref: Objective 1, NPWS, 2011B, pg. 6).
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to vegetation found at or above the mean high water spring tide mark on shingle beaches.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	• Training: Harvesters provided with training, where necessary, to ensure that all transport activities take place using existing piers and roadways. • Location of harvest and pick-up points will be recorded on GRNs (See Appendix 3). • Inspection of GRNs and Site Inspection Forms (SIFs) by QC at BioAtlantis.	

Hazard	**Prob-ability**	**Severity**	**Reason for Decision**
Biological	**1**		It is highly improbable that Perennial vegetation of stony banks in Clew Bay will be affected due to harvesting of *A. nodosum* given that: (a) piers will be required for upload/pick-up - use of banks for this purpose will not occur, (b) *A. nodosum* does not grow in these locations, and therefore will not be subject to harvest activities, (c) contamination with other materials may result in damage production equipment and end product and (d) harvested weed will not be stored in these locations. This ensures no inadvertent co-removal of protected species such as perennial vegetation.
		5	EU Dir. 92/43/EEC & NPWS, requires that Perennial vegetation of stony banks are maintained in favourable condition (ref: Obj. 1, NPWS, 2011B, pg. 6). Any activities which would lead to removal of biological material could significantly damage these areas and would contravene this directive.
Chemical:			n/a
			n/a
Physical:	**1**		The probability of physically impacting upon Perennial vegetation of stony banks is exceptionally low given that: (a) *A. nodosum* does not grow in these environs and thus will not be subjected to harvest activities and (b) Harvesters provided with training, where necessary, to ensure that all transport activities will take place using established piers and roadways. Transport cannot occur in these areas.
		5	Severity associated with disruption and damage to this environment is potentially significant as it could lead to damage to the permanent habitat area.

(16) Atlantic salt meadows

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Atlantic salt meadows)	Removal of habitat due to harvest and/or storage of material in these areas.	1	5	A	no	n/a	yes	Harvest, storage and transport activities will not occur in these locations. Harvest must occur along rocky shorelines rather than in the areas of mud or sand substrate which is required for Atlantic salt meadow environs & associated species.	EU Dir. 92/43/ EEC & NPWS To restore the favourable conservation condition (ref: Objective 2, NPWS, 2011B, pg. 9)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to stands of vegetation which occur along sheltered coasts.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	• Training: Harvesters provided with training, where necessary, to ensure that all transport activities take place using existing piers and roadways. • Locations of harvest and pick-up points will recorded on GRNs (See Appendix 3). • Inspection of GRNs by QC personnel at BioAtlantis HQ	

Hazard	**Prob-ability**	**Sever-ity**	**Reason for Decision**
Biological:	**1**		It is highly improbable that Atlantic salt meadows in Clew Bay will be affected due to harvesting of *A. nodosum* given that: (a) established piers will be required for upload/pick-up - use of Atlantic salt meadow areas for this purpose will not occur, (b) *Ascophyllum nodosum* does not grow at high density in these locations, and therefore will not be subject to harvest activities, (c) contamination will other material may result in damage production equipment and end product and (d) harvested weed will not be stored in these locations. This ensures no inadvertent co-removal of protected species characteristic of Atlantic salt meadows.
		5	EU Dir. 92/43/EEC & NPWS, requires that the favourable conservation condition of Atlantic salt meadows be restored (ref: Objective 2, NPWS, 2011B, pg. 9). Any activities which would lead to removal of biological material could significantly damage these areas and would contravene this objective.
Chemical:			n/a
			n/a
Physical:	**1**		It is highly improbable that Atlantic salt meadows in Clew Bay will be altered due harvesting of *A. nodosum* given that: (a) *A. nodosum* does not grow at high density on intertidal sandy mud substrate in these environs and thus will not be subjected to harvest activities and (b) Harvesters provided with training, where necessary, to ensure that all transport activities will take place using established piers and roadways. Transport cannot occur in these areas.
		5	Severity associated with disruption and damage Atlantic Salt meadows is potentially significant as it could lead to damage to the permanent habitat area.

(17) Sand dune habitats

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species (i.e. Sand dune habitats)	Removal of habitat due to harvest and/or storage of material in these areas.	1	5	A	no	n/a	yes	Harvest , storage and transport activities will not occur in these locations. Harvest must occur along rocky followed by immediate collection and transfer from nets/bags to boat or towing of nets/bags from harvest sites to pick up points. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points.	EU Dir. 92/43/ EEC & NPWS To restore the favourable conservation condition. (ref: Objective 3, NPWS, 2011B, pg. 15).
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to: Annual vegetation of drift lines along the high tidal mark of Clew Bay. Embryonic shifting dunes above the strandline. Shifting dunes.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	• Training: Harvesters provided with training, where necessary, to ensure that all transport activities take place using existing piers and roadways. • Location of harvest and pick-up points will be recorded on GRNS (See Appendix 3). • Inspection of GRNs by QC at BioAtlantis.	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**1**		It is highly improbable that sand dune habitats or species therein will be affected due to harvesting of *A. nodosum* given that: (a) Loading and transport activities will occur exclusively using established piers and road networks, (b)*Ascophyllum nodosum* does not grow in these locations, and therefore will not be subject to harvest activities, (c) contamination with other material may result in damage to production equipment/end product and (d) harvested weed will not be stored in these locations. This ensures no inadvertent co-removal of protected species in sand dune habitats.
		5	EU Dir. 92/43/EEC & NPWS, requires the favourable conservation condition of sand dune habitats be restored (ref: Objective 3, NPWS, 2011B, pg. 15). Any activities which would lead to removal of biological material could significantly damage these areas, thus contravening these objectives.
Chemical:			n/a
			n/a
Physical:	**1**		It is highly improbable that sand will be physically damaged due to harvesting of *A. nodosum* given that: (a) *A. nodosum* does not grow on in these environs and thus will not be subjected to harvest activities and (b) harvesters will be provided with training, where necessary, to ensure that all transport activities will take place using established piers and roadways. Transport cannot occur in these areas.
		5	Severity associated with disruption and damage to sand dune habitats is potentially significant as it could lead to damage to the permanent habitat area.

(18) Otter *(Lutra lutra)*

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Negative impacts: • Distribution of positive survey sites • Extent of terrestrial habitat • Extent of marine habitat • Extent of freshwater (river) habitat. • Extent of freshwater (lake/lagoon) habitat. • Number of couching sites and holts • Decline in fish biomass • Increase in barriers to connectivity	• Damage to freshwater habitats • Damage to marine habitats. • Damage to fish resources. • Blocking access to sites	1	5	A	no	n/a	yes	It is highly unlikely that otters will be affected by sustainable *A. nodosum* harvesting. Taking a pre-cautionary approach however, the following measures have added to the Code of Practice and will be implemented to ensure that impacts do not occur, either directly or indirectly. • Always follow pre-planned harvest schedules provided by BioAtlantis. Harvest areas are defined by BioAtlantis. • To avoid or prevent disturbance or interactions with otters, ensure the following: ➢ All activities are maintained within the intertidal *A. nodosum* zone. Avoid all linear habitats located beyond the intertidal zone. ➢ Avoid marine riparian areas beyond the foreshore. Only use existing routes. ➢ Never interfere with couching sites, holts, access paths/routes, that may be present near coastal areas, agricultural fencing, roads, slipways, access points or other areas. ➢ Avoid large trees near coastal areas as they can represent important otter breeding and resting sites. ➢ Avoid undisturbed areas (e.g. impenetrable scrub/reeds) which are refuges for otters. ➢ Do not behave in an obtrusive or noisy manner around otters. ➢ Never interfere with, deliberately approach or disturb otters or their cubs that are resting, sleeping, hunting, feeding or foraging in water or on the shore during the daytime, dawn or dusk. Ensure caution during the periods of breeding, rearing and hibernation. ➢ If migrating/commuting otters are encountered in water, do not obstruct their movement. Slow down the boat and give sufficient space to pass without “boxing” them in, blocking narrow channels or acting as a barrier to commuting or connectivity. ➢ If encountered on the shore, allow otters free access and ample opportunity to escape to the water or land. Do not behave in manner that results in them moving away or fleeing human disturbance. ➢ To prevent in combination effects, adhere to the above measures at all times, particularly when working in areas known to exhibit signs of otter activity. • To prevent impacts on the dietary requirements of otter, the following mitigation measures will apply: ➢ Harvesting must be limited to 20% of the total available *A. nodosum* biomass per site per annum, in order to allow for sufficient regrowth. ➢ Harvesting must not take place in areas outside the *A. nodosum* zone, as these habitats	EU Dir. 92/43/ EEC The Wildlife Acts, 1976 and 2000 (Rep. of Ireland)

Hazard *(What can go wrong)*	Cause *(Why did it go wrong?)*	Risk assessment			Decision Tree			Control Measure *(What can I do about it?)*	Compliance Requirements
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
								represent the broader habitat range of the otter's prey during adult and early life stages, including: flowing and static freshwater areas (rivers, streams, canals, lakes, reservoirs, ponds), deep water subtidal areas (>30m), shallow subtidal areas (<30m), exposed areas, estuarine mud areas, brackish waters, subtidal gravel/coarse bottom substratum, intertidal soft bottom (sand or mud), lagoons, maerl, rock pools, saltmarsh habitats, seagrass, subtidal soft bottom (sand or mud) and exposed waters in the vicinity of rocky cliffs. ➢ Avoid exposed and non-sheltered areas that represent the otter's broader habitat range, hunting ground and foraging area. ➢ Harvesting cannot occur at the mouth of Lough Furnace or the Burishoole Catchment to ensure that potential impacts on salmon, trout and European Eel. ➢ All freshwater aquatic linear habitat and riparian environments must be avoided at all times including lakes and rivers and other areas (e.g. east side of InishGowla South). ➢ Avoid co-harvesting non-*A. nodosum* material near coastal habitats, near the shoreline or on the shore. Ensure that inadvertent by-catch of other algae, dead/senescing algae, amphipods, isopods or other *Animalia* or material is prevented and minimized. ➢ Do not remove the *A. nodosum* holdfast and take care not to disturb rocky or crevice substratum. See "BioAtlantis Code of Practise" for details (Appendix 4).	
Chemical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none identified	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	**1**		Otters are associated with a wide variety of habitats including land habitats, flowing freshwater (i.e. rivers, streams and canals), static freshwater (lakes, reservoirs, ponds), brackish water habitats, estuarine areas, exposed shores, semi-exposed shores, sheltered shores, rocky areas, boggy areas, tidal mudflats, sandflats, lagoons, saltmarsh habitats and sand dune habitats. The distribution of the otter has previously been examined in Clew Bay and surrounding areas. The species is identified as occurring in a range of habitats within the complex. This includes freshwater, marine, aquatic and terrestrial areas, and within both sheltered and exposed coastal locations that extend towards the outer reaches of the bay. In coastal areas of the west of Ireland and Mayo, the otter's diet is highly variable, consisting of a range of fish species, crustaceans and molluscs, amphibians, invertebrates and birds. Given the variable nature of the otter's prey species, the potential impact of sustainable hand harvesting of *A. nodosum* on the otter's dietary requirements is very low. While some components of the otter's prey species can occur within the intertidal zone, they are also known to be associated with a wide range of non- *A. nodosum* habitats during adult and early life stages, including: freshwater areas (rivers, streams, canals, lakes, reservoirs, ponds), deep water marine areas (>30m), shallow subtidal water marine areas (<30m), exposed areas, estuarine mud areas, brackish waters, subtidal gravel/coarse bottom substratum, intertidal soft bottom, lagoons, maerl, rock pools, saltmarsh, seagrass, subtidal soft bottom and exposed waters in the vicinity of rocky cliffs. The spatial overlap between these habitats and *A. nodosum* harvesting is extremely low and in many cases is absent. Therefore, it is highly unlikely that the dietary requirements of otter will be affected by

			sustainable *A. nodosum* harvesting. Kelly et al., (2001), indicate that hand harvesting is not associated with reductions in fish numbers within the *A. nodosum* biotope. In terms of potential direct effects on otters, recent assessments indicate that there are no significant relationships between the percentage occurrence of otters and human disturbance in SACs in Ireland (Bailey and Rochford 2006). Moreover, there are no differences in the occurrence of otters between sites within and outside of SACs. Hand harvesting of *A. nodosum* will occur in the intertidal zone with no activities in freshwater habitats. Hand harvesters will not engage in activities which would block sites of relevance to otters, including holt sites. There will be no barriers to block access to otters to and from and between sites. Based on the information above, it is concluded that it is highly unlikely that the otter's food supply will be affected due to sustainable *A. nodosum* harvesting activities.
		5	Otters are listed as a protected species under EU directives. Any activities which would negatively impact and contribute to the decline of this species would be severe. Otters are deemed to be in decline in many parts of Europe with risks including roads, fishing nets and lobster pots (NPWS 2007). Organochlorine pesticides are widely accepted as having severely reduced otter population sizes in the UK (Jones and Jones, 2002).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(19) Birds

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Y/N		
Biological: Negative impacts on habitats relevant to species of bird and their behaviour	This may occur due to: • Excess removal of *A. nodosum* habitat, which constitutes part of the wider feeding, requirements of some bird species in Clew Bay. • Potential impact on algae as secondary food source (ref: NPWS 2013). • Human disturbance at nesting colonies can lead to abandonment of nest or chicks. • Human presence may lead to trampling of nests. • Disturbance leading to flight events.	1	5	A	no	n/a	yes	BioAtlantis will manage harvesting in a sustainable manner to ensure that excessive removal of *A. nodosum* does not occur and is limited to 20% of the total available biomass per site per annum (see Table C1a, "*A. nodosum*", for details). Harvest at sites established by NPWS as important to important wintering and breeding species (data obtained from NPWS, pers. comm. 03/12/2013) will not be harvested at sensitive times of year (see Appendix 6). See "BioAtlantis Code of Practise" for protection of bird species for more details (Appendix 4).	Annex I of the E.U Birds Directive
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**1**		Contact with breeding and wintering birds at sites specified by NPWS (pers. comm. 03/12/2013) will be minimal. Harvest cannot take place at these sites during sensitive times of year. See Appendix 6 for detailed description of the distribution, requirements and control measures for avian species of interest in Clew Bay. See Appendix 4 for Code of Practice. There is no evidence for strong bottom-up forcing of *A. nodosum* harvesting on birds' site visitation (Johnston, Elliot M., *et al.* 2024. Estuarine, Coastal and Shelf Science).
		5	Protected species listed on Annex I of the E.U Birds Dir. include: Common Tern, Arctic Tern, Little Tern, Barnacle Goose, Great Northern Diver, Bar tailed Godwit. Activities which would negatively impact on these species would be severe and contravene EU regulations. Other species reaching important numbers in Clew Bay: Red-breasted Merganser, Ringed Plover, Barnacle Geese (present on islands in winter), Great Northern Diver, Brent Goose, Shelduck, Wigeon, Teal, Mallard, Oystercatcher, Cormorant, Dunlin, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Turnstone.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(b) Species & habitats of general interest.

(1) Fish

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of zones important for feeding, reproduction and/or sheltering of fish species such as trout and salmon.	Excess removal of habitat in the form of *A. nodosum* due to mismanagement and overharvesting of resources.	1	2	A	no	n/a	yes	• BioAtlantis Ltd. will manage harvesting activities in a sustainable manner to ensure that excessive removal of *A. nodosum* does not occur and is limited to 20% of the total available biomass per site per annum (see Table C1a, "*A. nodosum*", in the next section for details). In addition, no activities will take place in important areas of the Burrishoole catchment such as Lough Feeagh & Lough Furnace, thus preventing any impact during important life-cycle stages. • Ensure that the space of recreational/shore anglers is respected at all times, particularly when competitions and festivals are taking place, particularly during summer in areas including the following: Mallaranny Strand, Curraun, Lough Furnace Newport pier, Newport Quay, Rossnakilly, Rossnakilly, Ross, Rossanrubble, Altapheebera and Whiteheather. • Ensure that the space of fishermen and sea anglers is respected at all times. • Keep distance and do not interfere with licensed salmon draft fishermen who may cut back seaweed when using their nets. • Ensure that seaweed harvesting only takes place in the intertidal *A. nodosum* zone and not in subtidal areas of relevance to fisheries activities such as potting (Lobster, crab, shrimp, whelk and nephrops), dredging (e.g. scallop, native oyster, cockle), trammel net fishing for bait, otter trawl, tangle net (crayfish), gillnet, Mid-water trawl. Activities in subtidal waters that are permitted include site visits, collection of harvested seaweed, transport and transfer to pick up points. • Avoid interactions with non-*A. nodosum* habitats which represent the broader habitat range of fish, shellfish, invertebrates and fisheries species during adult and early-life stages, including: deep water areas, seagrass, estuarine mud areas, saltmarsh, lagoons, maerl, subtidal gravel/coarse bottom, subtidal soft bottom areas, intertidal soft bottom areas & exposed shores. • Avoid soft substratum areas where bait digging for ragworm and lugworm is observed to be taking place.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**

<table>
<tr>
<td>Biological</td>
<td>1</td>
<td></td>
<td>In the absence of appropriate systems of management, monitoring and verification, there is increased likelihood of excess removal of A. nodosum which in turn, may impact upon species of fish who use these zones for feeding, reproduction and/or sheltering. However, it is highly improbable that fish numbers will be affected by harvest activities in Clew Bay given that:
(a) Harvest of A. nodosum will be undertaken sustainably and will not exceed 20% of the total available biomass per site per annum thus ensuring maintenance of the A. nodosum habitat.
(b) Important catchment areas such as Burrishoole will be excluded from all harvest-related activities.
(c) Studies indicate that hand harvest of A. nodosum does not significantly effect fish and large mobile epifauna (Kelly et al., 2001).
It is highly improbable that fish numbers will be affected by harvest activities in Clew Bay given that the spatial overlap between A. nodosum harvesting and fisheries activities is relatively low and absent in many cases (see below):
<table>
<tr><th>Type</th><th>Description/extent/location of fisheries activity</th></tr>
<tr><td>Potting for shrimp</td><td>Mainly located along the outer reaches of the complex (overlap with BioAtlantis’ proposed license area is low).</td></tr>
<tr><td>Potting for prawns</td><td>Mainly located along the outer reaches of the complex (overlap with BioAtlantis’ proposed license area is low).</td></tr>
<tr><td>Potting (crab, lobster)</td><td>Mainly located along the outer reaches of the complex (overlap with BioAtlantis’ proposed license area is low).</td></tr>
<tr><td>Potting for whelk</td><td>In 2013, a new pot fishery for whelk began (2 vessels; 400 pots each) in an area from Newport River Estuary to deeper waters and on subtidal habitats. It is unclear if this fishery is still in operation.</td></tr>
<tr><td>Tangle netting for crayfish</td><td>Mainly located along the outer reaches of the complex (overlap with BioAtlantis’ proposed license area is low).</td></tr>
<tr><td>Gill netting (pollack) and other netting</td><td>Mainly located along the outer reaches of the complex (overlap with BioAtlantis’ proposed license area is low).</td></tr>
<tr><td>Dredging for scallop</td><td>Scallop occurs in subtidal waters of 10-20m in depth on gravel/cobble substrates, within the inner reaches of the complex and beyond the SAC.</td></tr>
<tr><td>Dredging for oyster</td><td>Oysters are fished from <10m vessels using fixed toothed dredges.</td></tr>
<tr><td>Bottom trawling for mixed demersal fish</td><td>Outside license area (no overlap with BioAtlantis’ proposed license area).</td></tr>
<tr><td>Mid-water trawling for pelagic fish</td><td>Outside license area (no overlap with BioAtlantis’ proposed license area).</td></tr>
<tr><td>Hook and line fishing (mackerel, pollack)</td><td>This fishery uses trolling and bottom set lines operated in a mechanized and manual manner (approx. 16 vessels use trolling/jigging gears).</td></tr>
<tr><td>Draft net fishing for salmon</td><td>Newport river estuary and Bunowen River.</td></tr>
<tr><td>Trammel net fishing for bait</td><td>Mainly located along the outer reaches of the complex (overlap with BioAtlantis’ proposed license area is low).</td></tr>
<tr><td>Hand gathering of periwinkle and cockle</td><td>Periwinkle fishing takes place in the inner reaches of Clew Bay on semi exposed shores on the mainland and on islands. Cockles are abundant east of Mullranny on intertidal muddy sand shores and are hand gathered.</td></tr>
</table>
Sustainable harvesting is unlikely to impact on commercial fisheries species (fish, crustaceans and shellfish), their distribution, spawning areas, nursery areas and food sources (See Appendix 9 & 10).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>While there are no conservation requirements for fish or fisheries species in the Clew Bay complex, the Burrishoole Catchment area of Clew Bay represents an important habitat for migratory fish species such as trout and salmon, and is regarded as a major European and world index site. Post</td>
</tr>
</table>

			smolt and adult sea trout feed within the Clew bay area and along with some other fish species, may use *A. nodosum* zones to a certain extent for purposes which include feeding, reproduction or sheltering (Kelly et al., 2001 and references therein).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2) Lough Furnace

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Damage to a rare example of a permanently stratified lake environment.	Human activities in this area may damage this environment.	1	4	A	no	n/a	yes	Not applicable, as this area and its associated lakes will be completely excluded from all harvest activities.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**1**		It is highly improbable that this environment and it's associated species will be affected by activities due to hand harvesting, as these areas are excluded from the current application.
		4	Lough Furnace represents a rare deep, permanently stratified saline lake lagoon, located at the north-eastern corner of Clew Bay. Species on its exterior include: Common Reed *(Phragmites australis)*, Common Club-rush *(Scirpuslacustris)*, small patches of Great Fen-sedge *(Cladium mariscus)* and Bottle Sedge *(Carex rostrata)*. Other important flora and fauna within this environment includes: two rare amphipods *(Lembos longipes* and *Leptocheirus pilosus)*, *Neomysis integer*, *Jaera albifrons*, *J.ischiosetosa* and *J. nordmanni*, Irish species of tasselweed *(Ruppia maritima* and *R. cirrhosa)*, eel, flounder, mullet, mallard nest and black-headed Gull. As this habitat is so rare, the potential impact of human activities on these environs and associated species are given a severity score of 4.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3) The Rossmurrevagh area

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Removal of habitat of rare & endangered species	Removal of habitat due to harvest and storage of material.	1	5	A	no	n/a	yes	Harvest and storage activities will not occur in these locations. Harvest must occur along rocky shorelines followed by immediate collection and transfer from nets/bags to boat or towing of nets/bags from harvest sites to pick up points. In some cases, certain individuals with existing seaweed harvesting rights may prefer to land seaweed at pick up points.	none
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: Disruption and damage to diverse environs.	Unauthorized transport in these areas.	1	5	A	no	n/a	yes	• Training: Harvesters provided with training, where necessary, to ensure that all transport activities take place using existing piers and roadways. • Location of harvest and pick-up points will recorded on GRNs (see Appendix 3). • Inspection of GRNs by QC personnel at BioAtlantis HQ	

Hazard	**Prob-ability**	**Severity**	**Reason for Decision**
Biological	**1**		It is highly improbable that the Rossmurrevagh area and it's associated species will be affected by activities due to hand harvesting given that: (a) *A. nodosum* does not grow in these locations, and therefore will not be subject to harvest activities, (b) Contamination with other material may damage production equipment and end product, (c) Harvested weed will not be stored in these locations. This ensures no inadvertent co-removal of protected species in the Rosmurrevagh area.
		5	The Rossmurrevagh area includes a diverse range of habitats along the seashore, dunes, coastal grassland, saltmarsh, bog and fen. This includes: • Bog/fen type vegetation: Bog Asphodel and Cuckooflower *(Cardamine pratensis)*, Bog Mosses, sedges, Bog-myrtle *(Myrica gale)*, Irish Heath, Soft Rush *(Juncus effusus)*, Water Mint *(Mentha aquatica)* andYellow Iris *(Iris pseudacorus)*. • Coastal grassland species: Common Ragwort *(Senecio jacobaea)*, Daisy *(Bellis perennis)*, Dandelion *(Taraxacum officinale)*, Heath Wood-rush *(Luzula multiflora)*, Ribwort Plantain *(Plantago lanceolata)* and Yarrow *(Achillea millefolium)*. • Saltmarsh vegetation (5 m wide): Common Saltmarsh-grass *(Puccinellia maritima)*, Common Scurvygrass, Thrift & 'turf fucoids'. A number of species and locations within Rossmurrevagh are protected (e.g. dunes) and therefore, a severity score of 5 has been assigned.
Chemical:			n/a
			n/a
Physical:	**1**		Low probability of physical damage as harvesters will be provided with training, where necessary, to ensure that all transport activities will take place using established piers and roadways. Transport cannot occur in these areas.
		5	Disruption and damage to the physical environs of this region may negatively impact upon biodiversity in the area. As certain aspects to this are protected under EU Law (e.g. dunes), a severity score of 5 has been assigned to potential hazards to the biology of this area.

(c) Ascophyllum nodosum biotope and species therein.

(1a) *A. nodosum* seaweed.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Y/N		
Biological: Excess removal of *A. nodosum* habitat. • Removal of holdfast material and potential *A. nodosum* mortality. • Canopy is cut too short	Mismanagement and/or lack of oversight of activities relating to hand harvest of *A. nodosum*. • Inappropriate technique • Lack of training • Lack of oversight	2	5	A	no	n/a	yes	BioAtlantis will manage harvesting in a sustainable manner to ensure that excessive removal of *A. nodosum* does not occur and is limited to 20% of the total available biomass/site/annum. The technique will involve cutting no less than 200mm above the holdfast. Important components of the management system include: • **A system is in place which ensures:** ➢ Training harvesters to cut between 200-300mm (8-12 inches) above the holdfast, this ensuring sufficient canopy coverage. Sites will be inspected post harvest to check the sustainability of the methods employed and the harvest locations (SIF, Appendix 3). ➢ Training of harvesters to ensure holdfast is not removed. ➢ Check for the presence of holdfast via GRN and quality checks in production facilities. ➢ Sites are inspected post harvest to check the sustainability of the methods employed and the harvest locations (Site Inspection Form, SIF, Appendix 3). • **Training:** Harvesters will be provided with training, where necessary, to ensure competence in skills required to harvest *A. nodosum* in an environmentally friendly and sustainable manner. • **Protocols and schedules:** Activities carried out according to clearly defined protocols to ensure that (a) no damage to the environment or underlying growth substrate, and (b) re-growth and re-generation of the vegetation post-harvest is sufficiently facilitated. Standard protocols and methods will include: ➢ Site determination: identification of areas suitable for harvest, e.g. areas predominated by short *A. nodosum* fronds will not be harvested. ➢ Harvest Methods: Use of sickle/knife to cut 200-300mm above frond base, without damaging holdfast or underlying substrate. ➢ Method for bagging of cut weed, communicating with HQ, Incident reporting **Responsibility:** Oversight, planning and teaching provided by BioAtlantis staff along with regularly auditing to assess for compliance with procedures and for potential areas of improvement.	None specified by NPWS or EU regulations. However, *A. nodosum* grows intertidally on reef substrate.

Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological:	**2**		In the absence of oversight, the probability of excessive removal of *A. nodosum* habitat may occur. This was particularly evident in a recent survey of Clew Bay during which an area previously characterised as having high density levels of *A. nodosum*, was found to have less cover than expected (see Appendix 1). The sites were characterised by an abundance of *A. nodosum* 'stumps', and evidence of two different types of harvest recent activities in the area was present. Moreover, *Fucus* sp. levels were notably dense within the *A. nodosum* zone, which may be consistent with studies by Kelly et al., (2001) and others which show that *Fucus* sp. coverage can increase as a result of hand harvesting of *A. nodosum*. To ensure that excessive removal of *A. nodosum* does not occur in Clew Bay, BioAtlantis will put a system in place which ensures that harvest activities are monitored, recorded, controlled and limited to 20% of the total available biomass per site per annum. This level of regulation is in keeping with the GMP+ Certification status of BioAtlantis, Ltd. and thus will ensure that the probability of over-harvesting of *A. nodosum* resources in Clew Bay is lowered. It is unlikely that significant levels of *A. nodosum* mortality will arise as harvesters will work when the tide is out, thereby having full view of the harvesting process and actively working to ensure that holdfast removal does not occur. This process also requires harvesters to target cutting between 200-300mm (8-12 inches) above the holdfast.
		5	Unregulated over-harvesting and inappropriate harvest methodologies could increase *A. nodosum* mortality to levels beyond background levels. Significant levels of *A. nodosum* mortality are unlikely to acceptable in an SAC such as Clew Bay.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(1b) *Fucus* (*Fucus vesiculosis Linnaeus* and *Fucus serratus Linneaus*)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of *Fucus*	Overharvesting of *A. nodosum* and/or inadvertent harvest of nearby species of *Fucus*.	2	3	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		Increases in the density of *Fucus* species may occur due to hand harvesting of *A. nodosum* (Kelly et al., 2001). Indeed, a recent survey of Clew Bay found substantial evidence for high *Fucus* densities in areas found to have been subjected to recent harvest activities (See Appendix 1). However, the probability of inadvertent harvest of these fucoid species is low, given that: Harvest will be limited to larger vegetative growth of *A. nodosum* fronds, approx. 200-300mm above the base. *Fucus* is considered a contaminant and will be recorded as such in the GRN.
		3	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* or inadvertent harvest of these species is reduced to reside within the range of 1-4. However, a severity score of 3 was assigned given the important role of these species within the *A. nodosum* canopy and their presence in the Clew Bay complex (Kelly et al., 2001). A higher score of 4-5 is unjustified. This is due to the fact that overharvesting of *A. nodosum* is not detrimental to these species. In fact, harvest of *A. nodosum* has been found to be associated with increased cover of *Fucus vesiculosis* in the Clew Bay region (Kelly et al., 2001).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2a): Red algae *(e.g. Polysiphonia lanosa (Linnaeus) Tandy)*

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Role of *Polysiphonia lanosa (Linnaeus)* Tandy within the *A. nodosum* canopy:
In brief, *Polysiphonia lanosa (Linnaeus)* Tandy is a hemiparasitic species, predominantly using *Ascophyllum nodosum* as a host and more rarely, *Fucus vesiculosis* (Guiry, M.D. & Guiry, G.M. 2013). This species is present throughout the north Atlantic in areas occupied by *A. nodosum* including Clew Bay SAC (Kelly et al., 2001).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of habitat important to epiphytes of *A. nodosum*, e.g. red algae, *Polysiphonia lanosa (Linnaeus) Tandy*	Overharvesting of *A. nodosum*	2	2	A	no	n/a	yes	As above in Table C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		As above in Section C1a (*A. nodosum*).
		2	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. However, a low-moderate severity score of 2 was assigned given the role of these species within the *A. nodosum* canopy and their presence in the Clew Bay complex (Kelly et al., 2001; see below for details). A higher score of 3-5 is unjustified. This is due to the fact that spores from these species are highly successful in colonizing *A. nodosum,* and given the sustainable nature of the harvest system, effects are unlikely to be detrimental to the population. In addition, a recent survey of Clew Bay found this species to be relatively well represented in the *A. nodosum* biotope, occurring in 5 out of 8 1m^2 quadrants which were assessed (See Appendix 1). As spores from this species will continue to be released from unharvested areas, the settlement and survival of *P. lanosa* on *A. nodosum* will continue.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2b): Red algae *(e.g. Mastocarpus stellatus (Stackhouse) Guiry)*

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Red algae *Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse* and *Corallinaceae*	Overharvesting of *A. nodosum*	1	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**1**		It is highly improbable that Red algae, *Mastocarpus stellatus (Stackhouse) Guiry*, *Chondrus crispus Stackhouse* will be altered due harvesting of *A. nodosum* given that: (a) The rare occurrence of these species within the *A. nodosum* canopy. (b) Harvest of *A. nodosum* will be limited to larger vegetative growth of *A. nodosum* fronds, approx. 200-300mm above the base, generally above the contact level with these species.
		2	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. A low severity score of 2 was assigned in the scenario of over-harvesting of *A. nodosum*. A higher score of 3-5 is unjustified as Red algae *Mastocarpus stellatus (Stackhouse) Guiry, Chondrus crispus Stackhouse* and *Corallinaceae* growth are not known to be affected by *A. nodosum* harvesting.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2c): Ephemeral green algae

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Ephemeral green algae (e.g. *Cladophora rupestris (Linnaeus) Kützing, Ulva sp. Linnaeus* and *Enteromorpha sp. Link;*	Overharvesting of *A. nodosum*	1	3	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**1**		It is highly improbable that ephemeral green algae will be altered due harvesting of *A. nodosum* given the findings of Kelly et al., 2001, in which hand harvesting has no significant impact on ephemeral green algae over time. Also, species besides *A. nodosum* are considered as contaminants and will be recorded as such in the GRN.
		3	As these species are not protected under EU regulations the severity associated with overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. A moderate severity score of 3 was assigned given the important role of Ephemeral green algae in this zone. While occurring at low densities in *A. nodosum* biotope, alterations to ephemeral algae may lead to further alterations in herbivorous littorinid fauna (Kelly et al., 2011 and references therein). In turn, this has potential to decrease re-establishment of the fucoid canopies at the germling stage. However, vegetative reproduction rather than sexual reproduction is considered the most important mechanism in which the density of the *A. nodosum* population is maintained, most notably by generating shoot growth and subsequent increases in biomass for years thereafter.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

BioAtlantis

(2d): Other seaweed species

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
Role of *Lomentaria articulata (Hudson) Lyngbye* and *Membranoptera alata (Hudson) Stackhouse*, within the *A. nodosum* biotope:
Can occur on rocks and stones in pools, lower intertidal and subtidal (Guiry, M.D. & Guiry, G.M. 2013).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of other seaweed species: *Lomentaria articulata (Hudson) Lyngbye* and *Membranoptera alata (Hudson) Stackhouse,*	Overharvesting of *A. nodosum* and/or inadvertent harvest of nearby species of *Lomentaria articulata (Hudson) Lyngbye* and *Membranoptera alata (Hudson) Stackhouse,*	1	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**1**		It is highly improbable that these species of seaweed will be altered due harvesting of *A. nodosum* given that: (a) Kelly et al., 2001, demonstrates an absence of *Lomentaria articulata (Hudson) Lyngbye* and *Membranoptera alata (Hudson) Stackhouse* in Clew Bay despite being present at low numbers on Connemara. (b) The frond length of these species generally does not exceed 200 mm and harvest will be limited to larger vegetative growth of *A. nodosum* fronds, approx. 200-300mm above the base. (c) Species besides *A. nodosum* are considered as contaminants and will be recorded as such in the GRN.
		2	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* or inadvertent harvest of these species, is reduced to reside within the range of 1-4.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3a): Periwinkles

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of winkles or removal of habitat important to periwinkles.	• Overharvesting of *A. nodosum* • Inappropriate technique • Lack of training	3	3	A	no	n/a	yes	• **As above in Section C1a (*A. nodosum*).** • **Additionally:** ➢ Reproduction: Harvesters will be provided with training, where necessary, to identify and avoid *A. nodosum* plants or fronds which contain visible *L. obtusata* eggs masses. ➢ Canopy damage: Harvesters will learn to avoid periwinkle disturbance by (a) cutting at low tide, (b) aiming to leave between 200-300mm (8-12 inches) of material behind, (c) under no circumstances cutting less than 200mm above the holdfast, (d) avoiding holdfast removal. ➢ Other habitats: Harvesters provided with training, where necessary, to avoid *Fucus vesiculosis* and *F. serratus*, which are additional habitats for periwinkles. ➢ By-catch: any *Animalia* by-catch observed post-harvest must be returned to the water, where possible.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**3**		**Removal of habitat:** As outlined in Section C1a above, there is low risk of excess removal of *A. nodosum* through hand harvesting. In addition, while Kelly et al (2001) show that reductions in number were observed in winter months, harvesting did not have an impact on the size distribution of *Littorina obtusata* at Clew Bay. However, positive correlations between *A. nodosum* density and winkles numbers were identified in the survey prepared in this application Clew Bay (Appendix 1). Therefore, there is potential for alterations in winkle numbers should overharvesting occur. The risk however, is reduced as the harvesting system does not allow for overharvesting.

			Non-targeted removal: *Littorina obtusata* tends to feed at high tide. At low tide, *L. obtusata* crawls into the algae canopy and remains dormant unless conditions are favourable, such as dampness, etc. *Littorina littorea* actively feeds at high tide, seeking shelter within the canopy at low tide. The technique employed by BioAtlantis ensure that harvest takes place at low tide when periwinkles are more likely to be dormant or covered by *A. nodosum* fronds. Harvest will not take place during the feeding stage at high tide when periwinkles are out of their shells. Hence, the probability of removal of periwinkles as non-target species is reduced considerably. **Reproduction:** *L. obtusata* lays white, oval eggs masses contain a large number of eggs, on Ascophyllum, *Fucus vesiculosis* and *F. serratus*. The eggs masses are clearly visible to the naked eye. Hand harvesting could lead to reductions in eggs numbers by removing frond containing egg masses. In the case of *L. Littorina*, eggs are released with the tide. Following development from a free-living form, *L. Littorina* settles at the base of the *A. nodosum* canopy. Severe reductions in canopy could affect settlement of free-living form, *L. Littorina*. The risk for negatively affecting reproductive requirements is reduced as the harvesting system requires avoidance of egg masses and ensure that overharvesting of the canopy does not occur.
		3	As these species are not specifically protected under EU regulations the severity associated overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. However, a moderate severity score of 3 was assigned given the important position of winkles in the *A. nodosum* biotope and the apparent seasonal reductions of *Littorina obtusata* observed by Kelly et al., 2001. A higher severity score of 4-5 would be unjustified. This is due to the fact that that winkles also reside within other fucoid biotopes such as *Fucus vesiculosis*, and thus, the hazard of overharvesting of *A. nodosum* would not represent a detrimental threat to these populations.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3b): Limpets

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of limpets and/or habitat important to limpets.	Overharvesting of *A. nodosum*	3	3	A	no	n/a	yes	As above in Section C1a (*A. nodosum*). Additionally: ➢ Canopy damage: Harvesters will learn to avoid limpet disturbance by (a) cutting at low tide, (b) aiming to leave between 200-300mm (8-12 inches) of material behind (c) under no circumstances cutting less than 200mm above the holdfast. (d) avoiding holdfast removal ➢ By-catch observed post-harvest must be returned to the water, where possible.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**3**		As outlined Section C1a above, there is low likelihood of excess removal of *A. nodosum* through hand harvesting. As Kelly et al., (2001) demonstrate that hand harvesting of *A. nodosum* can be associated with increases and decreases in limpet density and size, a probability rating of 3 has been assigned for this potential hazard. While not statistically significant, a recent survey of Clew Bay (Appendix 1) also found a trend towards a positive correlation between *A. nodosum* density and limpet numbers (p=0.084). Therefore, there is likely to be some potential for alterations in winkle numbers should overharvesting occur.
		3	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. However, a moderate severity score of 3 was assigned given the important role of these species within the *A. nodosum* canopy and their presence in the Clew Bay complex (Kelly et al., 2001; see below for details). A higher score of 4-5 is unjustified. This is due to the fact that that these species also reside within other fucoid biotopes such as *Fucus vesiculosis*, and thus, the hazard of overharvesting of *A. nodosum* would not represent a detrimental threat to these species.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3c): Barnacles

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of barnacles or habitat important to Barnacles	Overharvesting of *A. nodosum*	3	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**3**		Boaden and Dring, 1980 reported a reduction in barnacle numbers due to *A. nodosum* harvest when *A. nodosum* was cut at low levels between 10-15cm (4-6 inches) above the holdfast. These effects were not reported by Kelly et al., 2001. As outlined Section C1a above, there is a low likelihood of excess removal of *A. nodosum* through hand harvesting. This reduces the potential for negative effects on barnacle numbers.
		2	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. However, a low-moderate severity score of 2 was assigned as these species are widespread on rock substrate in the intertidal zone. A higher score of 3-5 is unjustified as these species also reside within other fucoid biotopes such as *Fucus vesiculosis*, and thus, the hazard of overharvesting of *A. nodosum* would not represent a detrimental threat to these populations.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3d): Hydroid

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Hydroid *(Dynamena pumila Linnaeus)* or habitat important to these species.	Overharvesting of *A. nodosum*	3	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**3**		As outlined Section C1a above, there is a low likelihood of excess removal of *A. nodosum* through hand harvesting. There is no evidence from the study by Kelly et al., (2001) that hand harvesting of *A. nodosum* in Clew bay is associated with alterations to density of hydroid species. However, their presence on the tips of *A. nodosum* increases the probability of altering their density.
		2	As these species are not protected under EU regulations the severity associated overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. A low-moderate severity score of 2 was assigned given their presence and potential growth on tips of *A. nodosum* (Kelly et al., 2001; see below for details). A higher score of 3-5 is unjustified as Dynamena pumila Linnaeus species typically grows on other fucoid biotopes such as *Fucus serratus*. Hence , the overharvesting of *A. nodosum* should it occur, would not represent a detrimental threat to these populations.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3e): Sponges

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Sponges *(e.g., Leucosolenia sp. Bowerbank, Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu)*	Overharvesting of *A. nodosum*	2	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		Numbers of these species in the *A. nodosum* biotope in Clew Bay generally are generally low (Kelly et al., 2001). While Boaden and Dring (1980) identified changes in density of *Hymeniacidon* and *Halichondria* species due to harvest of *A. nodosum*, the harvest methodology involved was quite invasive and involved cutting between 10-15cm (4-6 inches).
		2	As these species are not protected under EU regulations the severity associated with overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. A low-moderate severity score of 2 was assigned. While overharvesting or inappropriate hand harvesting of *A. nodosum* may be associated with reductions in sessile animals such as sponges, *Halichondria panicea Pallas* and *Hymeniacidon perleve Montagu* are more widespread and occur in more deeper waters. *Leucosolenia sp.* and *Halichondria panicea* were not found in upper or middle shores of Clew Bay where *A. nodosum* is found, while observed at low numbers increase in the lower zone (Kelly et al., 2001). Likewise, *Hymeniacidon perleve* were absent in the upper zone, at low levels in the middle zone while increasing into the lowers zone.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3f): Sea squirts

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Alteration to density of Sea squirts *(e.g. Dendrodoa grossularia van Beneden* and *Ascidiella scabra O.F. Müller)*	Overharvesting of *A. nodosum*	1	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*).	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**1**		Kelly et al., 2001, demonstrate that *Ascidiella* occur at low levels in the *A. nodosum* zone of Clew Bay.
		2	Since seasquirts such as *Ascidiella* are not protected under EU regulations, the severity associated with overharvesting of *A. nodosum* is reduced to reside within the range of 1-4. A low-moderate severity score of 2 was assigned.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(3g): Species/Habitat: Other Mobile species

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

In the study by Kelly et al., 19 mobile animals were identified. However, in some cases, numbers were insufficient to allow for robust statistical analysis of the potential impact of hand harvesting of *A. nodosum*. Harvesting of *A. nodosum* did not have any significant effects on fish and other large mobile epifauna.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Potential Alteration to density of or habitat important for Mobile species (Phylum Arthropoda (*Amphipods, isopods crabs, Chironomida, Halacaridae, Ostracoda*), Phylum Platyhelminthes (e.g. *Turbellaria*), Phylum Annelida, Phylum Foraminifera, Phylum Nematoda.	• Overharvesting of *A. nodosum.* • Non-return of by-catch	2	2	A	no	n/a	yes	As above in Section C1a (*A. nodosum*). By-catch: any *Animalia* by-catch observed post-harvest must be returned to the water, where possible.	None specified by NPWS or EU regulations.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		The probability of overharvesting *A. nodosum* is outlined in Section C1a above. A higher score of 3-5 was unjustified as there is no evidence for alterations of these species in Clew Bay due to hand harvesting of *A. nodosum*. Of note, there was no recorded mobile species found in a recent survey of Clew Bay, either in dense or recently harvested areas (See Appendix 1). Most amphipods & isopods are relatively inactive at low tide. Harvest at low tide avoids potential by-catch of species which would be active in the intertidal zone during high tide. The likelihood of displacement will be low and harvesters will have full view and control of their activities. Harvesters will work to ensure that co-harvesting of other species does not occur, thus reducing potential for trapping. Any by-catch observed post-harvest will be collected and returned to the water, where possible (See Appendix 4, 'Codes of Practice').
		2	These species are not protected in EU or Irish Law, thus, the severity score is assigned between 1-4.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(d) Continuous Disturbance:

In accordance with EU Law, NPWS recommend that continuous disturbance of each community type should not exceed an approximate area of 15%. To measure the potential impact on structure and function in Clew Bay, BioAtlantis were provided with the marine community type datasets shapefile from NPWS in ESRI format (18/08/2014). Using AutoCAD software, the following was calculated: (a) the Total Area (m^2) in Clew Bay SAC of each Annex I Habitat, (b) the Area affected by harvest activities/annum (m^2 and percentage) and (c) the total area of Large Shallow Inlets and Bays [1160] affected/annum.

(1) Shingle

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Continuous disturbance of shingle exceeds an approximate area of 15%.	Harvest activity taking place on >15% of shingle community type	2	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the "Code of Practise" (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical:	2		There is a low probability that continuous disturbance of shingle will exceed an approximate area of 15%. Calculations performed using shape file data from NPWS indicate that the shingle area affected by harvest activities/annum represents 12.7% of the total shingle community type in the SAC (see below). The percentage of shingle which is Marine Community Types of Large shallow Inlets and Bays [1160] that will be impacted each year is very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,188.5 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of shingle to be impacted annually is 0.23% of this area.
		5	Continuous disturbance of shingle over an approx. area greater > 15% per annum would represent unfavorable conservation status for the SAC.
Chemical:			n/a
			n/a

Annex I Habitat (Clew Bay SAC)	**Total Area in Clew Bay SAC (m^2)**	**Area affected by harvest activities/annum**		**Area of Large Shallow Inlets and Bays [1160] affected/annum**
		(m^2)	**(%)**	**(%)**
Shingle	1,855,000	235,549	12.7%	0.23%

(2) Reef

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Continuous disturbance of reef exceeds an approximate area of 15%.	Harvest activity taking place on >15% of reef community type	2	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the "Code of Practise" (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

<table>
<tr><th>Hazard</th><th>Probability</th><th>Severity</th><th>Reason for Decision</th></tr>
<tr><td rowspan="2">Biological/ physical:</td><td>2</td><td></td><td>There is a low probability that continuous disturbance of reef will exceed an approximate area of 15%. Calculations performed using shape file data from NPWS indicate that the reef area affected by harvest activities/annum represents 4.9% of the total reef community type in the SAC (see below). The percentage of the reef which is Marine Community Types of the Annex I habitat, Large shallow Inlets and Bays [1160] that will be impacted each year is very low. The overall area of Large shallow inlets and bays [1160] in Clew Bay is 10,188.5 hectares (https://eunis.eea.europa.eu/sites/IE0001482). The percentage of reef to be impacted annually is 1.31%.of this area.
<table>
<tr><th rowspan="2">Annex I Habitat (Clew Bay SAC)</th><th rowspan="2">Total Area in Clew Bay SAC (m^2)</th><th colspan="2">Area affected by harvest activities/annum</th><th>Area of Large Shallow Inlets and Bays [1160] affected/annum</th></tr>
<tr><th>(m^2)</th><th>(%)</th><th>(%)</th></tr>
<tr><td>Reef</td><td>26,870,000</td><td>1,331,699</td><td>4.9%</td><td>1.31%</td></tr>
</table>
</td></tr>
<tr><td></td><td>5</td><td>Continuous disturbance of reef over an approx. area greater than 15% per annum would represent unfavorable conservation status for Clew Bay SAC.</td></tr>
<tr><td rowspan="2">Chemical:</td><td></td><td></td><td>n/a</td></tr>
<tr><td></td><td></td><td>n/a</td></tr>
</table>

(3) Zostera Community

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Complian ce Requirem ents**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological/Physical: Continuous disturbance of Zostera Community exceeds an approximate area of 15%.	Harvest activity taking place on >15% of Zostera Community type.	1	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the “Code of Practise” (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical:	**1**		There is a very low probability that continuous disturbance of Zostera Community will exceed an approximate area of 15%. Calculations performed using shape file data from NPWS indicate that the Zostera Community area affected by harvest activities/annum represents 0% of the total Zostera community type in the SAC (see below). The figure of 0% is assigned to areas where *A. nodosum* does not grow or where BioAtlantis have specifically avoided in this application due to the sensitive nature of some of these areas, in this case, Zostera Community.
		5	Continuous disturbance of Zostera Community over an approx. area greater than 15% per annum would represent unfavorable conservation status for Clew Bay SAC.
Chemical:			n/a
			n/a

Annex I Habitat (Clew Bay SAC)	**Total Area in Clew Bay SAC (m^2)**	**Area affected by harvest activities/annum**	
		(m^2)	**(%)**
Zostera Community	1,423,891	0	0.0%

(4) Maerl Dominated community

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Continuous disturbance of Maerl Dominated community exceeds an approximate area of 15%.	Harvest activity taking place on >15% of Maerl Dominated community type	1	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the "Code of Practise" (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

<table>
<tr><th>Hazard</th><th>Probability</th><th>Severity</th><th>Reason for Decision</th></tr>
<tr><td rowspan="2">Biological/ physical:</td><td>1</td><td></td><td>There is a very low probability that continuous disturbance of Maerl Dominated community will exceed an approximate area of 15%. Calculations performed using shape file data from NPWS indicate that the Maerl Dominated community area affected by harvest activities/annum represents 0% of the total Maerl Dominated community type in the SAC (see below). The figure of 0% is assigned to areas where A. nodosum does not grow or where BioAtlantis have specifically avoided in this application due to the sensitive nature of some of these areas, in this case, Maerl dominated Community.
<table>
<tr><th rowspan="2">Annex I Habitat (Clew Bay SAC)</th><th rowspan="2">Total Area in Clew Bay SAC (m^2)</th><th colspan="2">Area affected by harvest activities/annum</th></tr>
<tr><th>(m^2)</th><th>(%)</th></tr>
<tr><td>Maerl Dominated community</td><td>2,878,607</td><td>0</td><td>0.0%</td></tr>
</table></td></tr>
<tr><td></td><td>5</td><td>Continuous disturbance of Maerl Dominated community type over an approx. area greater than 15% per annum would represent unfavorable conservation status for Clew Bay SAC.</td></tr>
<tr><td rowspan="2">Chemical:</td><td></td><td></td><td>n/a</td></tr>
<tr><td></td><td></td><td>n/a</td></tr>
</table>

(5) Fine Sands Dominated by *Nephtys cirrosa* community

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Continuous disturbance of Fine Sands Dominated by *Nephtys cirrosa* community exceeds an approximate area of 15%.	Harvest activity taking place on >15% of Fine Sands Dominated by *Nephtys cirrosa* community type	1	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the “Code of Practise” (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

<table>
<tr><th>Hazard</th><th>Probability</th><th>Severity</th><th>Reason for Decision</th></tr>
<tr><td rowspan="2">Biological/ physical:</td><td>1</td><td></td><td>There is a very low probability that continuous disturbance of this community will exceed an approximate area of 15%. Calculations performed using shapefile data from NPWS indicate that the area of this community type affected by harvest activities/annum represents 0% of the total Fine Sands Dominated by Nephtys cirrosa community type in the SAC (see below). The figure of 0% is assigned to areas where A. nodosum does not grow or where BioAtlantis have specifically avoided in this application due to the sensitive nature of some of these areas, in this case, Fine Sands Dominated by Nephtys cirrosa community.
<table>
<tr><th rowspan="2">Annex I Habitat (Clew Bay SAC)</th><th rowspan="2">Total Area in Clew Bay SAC (m^2)</th><th colspan="2">Area affected by harvest activities/annum</th></tr>
<tr><th>(m^2)</th><th>(%)</th></tr>
<tr><td>Fine Sands Dominated by Nephtys cirrosa community</td><td>2,950,308</td><td>0</td><td>0.0%</td></tr>
</table>
</td></tr>
<tr><td></td><td>5</td><td>Continuous disturbance of Fine Sands Dominated by Nephtys cirrosa community over an approx. area greater than 15% per annum would represent unfavorable conservation status for Clew Bay SAC.</td></tr>
<tr><td rowspan="2">Chemical:</td><td></td><td></td><td>n/a</td></tr>
<tr><td></td><td></td><td>n/a</td></tr>
</table>

(6) Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		*P**	*S**	*A/UA*	Q1	Q2	Control Measures? Yes / No		
Biological: Continuous disturbance of Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex exceeds an approximate area of 15%.	Harvest activity taking place on >15% of Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex	1	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the "Code of Practise" (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical:	**1**		There is a very low probability that continuous disturbance of this community will exceed an approximate area of 15%. Calculations performed using shapefile data from NPWS indicate that the area of this community type affected by harvest activities/annum represents 0% of the total Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex type in the SAC (see below). The figure of 0% is assigned to areas where *A. nodosum* does not grow or where BioAtlantis have specifically avoided in this application due to the sensitive nature of some of these areas, in this case, Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex.
		5	Continuous disturbance of Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex over an approx. area greater than 15% per annum would represent unfavorable conservation status for Clew Bay SAC.
Chemical:			n/a
			n/a

Annex I Habitat (Clew Bay SAC)	**Total Area in Clew Bay SAC (m^2)**	**Area affected by harvest activities/annum**	
		(m^2)	**(%)**
Intertidal sandymud with *Tubificoides benedii* and *Pygospio elegans* community complex	7,817,100	0	0.0%

(7) Mudflats & sandflats not covered by seawater at low tide

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Continuous disturbance of mudflats & sandflats not covered by seawater at low tide exceeds an approximate area of 15%.	Harvest activity taking place on >15% of mudflats & sandflats not covered by seawater at low tide	1	5	A	no	n/a	yes	Management are aware of obligations for ensuring disturbance does not exceed approx. 15% of the area. This requirement is listed in the “Code of Practise” (Appendix 4).	NPWS 2011A.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical:	**1**		There is a very low probability that continuous disturbance of this community will exceed an approximate area of 15%. Calculations performed using shapefile data from NPWS indicate that the area of this community type affected by harvest activities/annum represents 0% of the total mudflats & sandflats not covered by seawater at low tide in the SAC (see below). The figure of 0% is assigned to areas where *A. nodosum* does not grow or where BioAtlantis have specifically avoided in this application due to the sensitive nature of some of these areas, in this case, mudflats & sandflats.
		5	Continuous disturbance of Mudflats & sandflats over an approx. area greater than 15% per annum would represent unfavorable conservation status for Clew Bay SAC.
Chemical:			n/a
			n/a

Annex I Habitat (Clew Bay SAC)	**Total Area in Clew Bay SAC (m^2)**	**Area affected by harvest activities/annum**	
		(m^2)	**(%)**
Mudflats & sandflats not covered by seawater at low tide	12,541,069	0	0.0%

(e) Broad, holistic examination of the nature, extent and impact of hand harvesting.

(1): The spatial extent of harvesting techniques and activities.

(i) Management of expansive and prolonged operations

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Harvest activities are mis-managed, with low traceability or oversight.	It is difficult to manage, harvest activities over such as large area.	2	5	A	no	n/a	yes	A system is in place which ensures that: • Activities are planned in advance. • Site-specific management approach: Harvest locations, pick-up points, quantities, quality measures & personnel involved are recorded on a daily basis. A full-time Resource Manager is responsible and the system will be regularly monitored and assessed via quarterly and annual audits. • See “Code of Practise” for details (Appendix 4).	Ensuring protection of the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		There is a low probability of mismanagement. This is because the BioAtlantis harvesting system ensures full control over all aspects of the harvesting activities. It has been designed to be automated and with full oversight and traceability from point of harvest to production. The system also ensures robust follow-up, with corrective actions and measures being issued where applicable, in the event that non-conformances or incidents occur. A higher score of 3-5 was unjustified as BioAtlantis have a proven track record in implementing and managing high quality systems (e.g. GMP+), which require high levels of traceability, oversight and responsibility.
		5	Without full control over harvest activities, it would not be possible to verify that the systems for protecting the SAC are being adhered to.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(ii) Numbers of personnel and exploitation levels

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: • Mismanagement of personnel. • Overexploitation • Increased anthropogenic impacts	• Poor management • Lack of oversight • To many people in site	2	5	A	no	n/a	yes	A system is in place which ensures that: • Activities are planned in advance. • Site-specific management approach: Harvest locations, pick-up points, quantities, quality measures & personnel involved are recorded on a daily basis. A full-time Resource Manager is responsible and the system will be regularly monitored and assessed via quarterly and annual audits. • See "Code of Practice" for details (Appendix 4).	Ensuring protection of the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological:	**2**		• There is a low probability of mismanagement of personnel or overexploitation. This is because the BioAtlantis system requires full control over where harvesters work and the quantities of harvest involved via the GRN. The full time Resource Manager must inspect and verify on the Site Inspection Form that no more than 20% of the total available biomass per site per annum is harvested, thus monitoring potential for overharvesting on a regular basis. • Increased anthropogenic impacts due to increases numbers of harvesters is unlikely. Approx.3 people will work per hectare, for approximately 6-8 hrs per day. No more than 2-4 harvesters are permitted on small-medium sized sites. Medium to large islands may require between 4-6, while larger islands will likely require approximately 6-10 harvesters. The low number of people over a wide area reduces the potential for anthropogenic impacts (e.g. intensity of trampling) on the biotope. In fact, given that the BioAtlantis plan targets specific areas at specific times of the year, the low levels of trampling events will also be largely episodic in nature.
		5	Mismanagement and overexploitation could damage the SAC.
Chemical:			n/a
			n/a
Physical:			n/a

(2): The potential interaction effects of seaweed harvesting

(i) Targeted removal of species

See C1(a) above for analysis of targeted removal of *A. nodosum*

(ii) Non-Targeted removal of species

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological/ physical: Removal of: • *Fucus* • Periwinkles & Limpets • Amphipods & isopods	• Inappropriate technique • Lack of training • Lack of oversight	3	3	A	no	n/a	yes	A system is in place which ensures that: • Harvest of *Fucus* sp. is not accepted. • Severe reductions in canopy coverage will not occur, thus ensuring sufficient habitat for active feeding stages and reproductive purposes of *Animalia*. • *A. nodosum* mortality does not occur which otherwise could lead to reductions in habitat for *Animalia*. • Harvesters will work to ensure that co-harvesting of other species does not occur. • By-catch: all *Animalia* observed post-harvest will be returned to water, where possible. ❖ For more information on the above, see section C3a (periwinkles), C3b (limpets), C1b (*Fucus*) and C3g (Amphipods and isopods). ❖ All control measures are listed in the "Code of Practise" for details (Appendix 4).	Ensuring protection of the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological /physical:	**3**		The likelihood of hand harvesting directly affecting non-target species is reduced as systems are in place to ensure that harvesting takes place at low tide when most *Animalia* (periwinkles, amphipods and isopods, etc) are dormant or inactive and located low down in the canopy, thereby preventing their by-catch. Additionally, systems are in place to ensure than sufficient canopy remains post harvest and that holdfasts are not removed, thus ensuring the viability of the biotope for non-target species. *Fucus*, an additional habitat of some *Animalia*, will not be targeted for harvesting, thus preventing further by-catch related impacts and preventing further reductions in total habitat.
		3	While these species are not specifically protected , they form important components of SAC community structures.
Chemical:			n/a
			n/a

(3): Disturbance and displacement of species and habitats:

(i) Reef

See Section A8 above

(ii) Amphipods and isopods:

See section E2(ii) and Section C(3g) above.

(4): Changes in community structure:

Hazard *(What can go wrong)*	Cause *(Why did it go wrong?)*	Risk assessment ***P****	 ***S****	 ***A/UA***	Decision Tree Q1	 Q2	 Control Measures? Yes / No	Control Measure *(What can I do about it?)*	Compliance Requirements
Biological: Long term impacts on *A. nodosum* community structure as a whole	While short term impacts of *A. nodosum* hand harvesting on community structure in Clew Bay have been found to be relatively minimal by Kelly et al., (2001), the study is limited by its short duration.	2	5	A	no	n/a	yes	• BioAtlantis will assess the impact of *A. nodosum* harvesting over the life-time of the licence. The experimental design will involve measurement of: (a) rates of re-growth of *A. nodosum* post-harvest, and (b) associated biodiversity. • An experimental site will be chosen for non-harvested Vs. harvested area comparisons • Sections will be large enough to allow for sufficient numbers of replicates. • A range of parameters will be measured including: ➢ numbers of *A. nodosum* plants, numbers of *Fucus* plants, numbers of *Animalia*. • Species assessed: periwinkles, limpets, barnacles, red algae, ephemeral green algae. • Assessments performed on an annually, ideally covering a 5-10 year period. The plan above is included in the "Code of Practise" for details (Appendix 4), as a means of ensuring that BioAtlantis continually validate and improve the methodology on an ongoing basis and on a long term basis throughout the life-time of the licence. This will ensure that scientific knowledge is increased beyond the timeframe assessed by Kelly et al., 2001. This will be important in ensuring that conservation objectives are met continually into the future.	Ensuring protection of the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	**2**		The study by Kelly et al., (2001) demonstrated limited impacts of hand harvesting in Clew Bay in the short term. However, long terms impacts of hand harvesting are unknown, as harvesting by its nature may vary in intensity and severity due to factors such as: unregulated harvesting, over-harvesting, inappropriate techniques. This could give rise to significant changes in the ecosystem (e.g. invasion of *Fucus* and associated impacts). In the absence of unregulated harvesting or over-harvesting, other natural factors such as slow changes over time in abundance and type of *Animalia* species could also occur. The probability of long term impacts on the community structure is reduced, as the BioAtlantis harvesting system has been developed to ensure that over-harvesting and inappropriate techniques are not used in Clew Bay. This ensures that some of the biggest threats to community structure are avoided. A higher probability of 3-5 is unjustified as the proposed system is minimally invasive and therefore, less likely to cause long term impacts.
		5	A high severity rating is assigned, as significant changes to community structure could have negative consequences of the intertidal zone.
Chemical/ Physical:			n/a
			n/a

(5): Changes in hydrodynamics and water quality:

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment			Decision Tree			Control Measure (What can I do about it?)	Compliance Requirements
		P*	S*	A/UA	Q1	Q2	Control Measures? Yes / No		
Biological/Chemical Exacerbation of impacts of pollution and reductions in water quality	Harvesting in areas near sewage outfalls	1	5	A	no	n/a	yes	BioAtlantis will not harvest in areas near sewage outfalls or other sources of pollution. See "Code of Practise" for details (Appendix 4).	Ensuring protection of the Clew Bay SAC.
Physical: Alteration to hydrodynamics	Excessive removal of *A. nodosum*	1	5	A	no	n/a	yes	The harvest system is designed with sustainability at the forefront and dramatic alterations to biomass levels will not occur. Harvest activities will not reduce height of *A. nodosum* below 200mm (8 inches). See "Code of Practise" for details (Appendix 4).	

Hazard	Probability	Severity	Reason for Decision
Biological /Chemical	**1**		Polluted water can have negative impacts on *A. nodosum* performance, epiphyte infestation, colonisation and competition by green algae. However, harvest activities will not give rise to significant increase in pollution (see Section A1 above). The probability of exacerbating existing impacts of pollution are low, as hand harvesting in proximity to sewage outfalls, etc, will not occur.
		5	A high severity rating is assigned, as alterations to water quality could have significant impacts on the SAC in broad terms.
Physical:	**1**		It is unlikely that *A. nodosum* harvesting will impact on overall hydrodynamics in the complex. *A. nodosum* is adapted to growing in highly sheltered environs and as such, has difficulty remaining attached to hard substrate in less sheltered waters. Therefore, *A. nodosum* is likely to exert a minor influence on hydrodynamics. The harvesting system is designed to ensure that dramatic changes in biomass levels within the intertidal zone will not occur.
		5	Alterations to hydrodynamics could potentially have significant impacts on other Annex I and II habitats in the complex.

(6): Potential disturbance of Marine Fauna:

Hazard *(What can go wrong)*	Cause *(Why did it go wrong?)*	Risk assessment ***P****	 ***S****	 ***A/UA***	Decision Tree Q1	 Q2	 Control Measures? Yes / No	Control Measure *(What can I do about it?)*	Compliance Requirements
Biological: Physical disturbance of marine fauna	• Inappropriate technique • Lack of training • Lack of oversight	1	3	A	no	n/a	yes	The “Code of Practise” (Appendix 4) will be implemented which ensures that marine fauna are unaffected, i.e.: • Harvest at low tide, • Harvest sustainably, • Return by-catch, where possible.	Ensuring protection of the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical:	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	**1**		The technique employed during *A. nodosum* harvest requires cutting at heights well above the holdfast, thus avoiding any fauna present at the base of the canopy. Harvest at low tide also prevents any immediate effects on marine fauna which are otherwise exclusively active around the area during high tide. By ensuring maintenance of sufficient canopy, marine fauna can still utilize the *A. nodosum* environment at high tide. Moreover, the long term effects of harvesting is minimized as sufficient photosynthetic tissue left behind which will allow for faster *A. nodosum* recovery post harvest. Moreover, limiting the harvest to 20% of the total available biomass will ensure that sufficient biotope coverage remains.
		3	While most marine fauna in Clew Bay are not protected under EU Law, they occupy an important position within the overall ecosystem.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(7): Potential interactions with coastal habitats:

A. nodosum contributes to the organic deposition throughout the littoral zone and marine environment. The rocky shoreline by its very nature is not a closed system and organic matter will tend to transfer from the area into the wider marine environment. As a primary producer located close to the back shore, the potential impact of any loss of *A. nodosum* on nearby coastal habitats must be examined. From an assessment the scientific literature, there is potential for impacts on Atlantic salt meadows and Sand dune habitats. No potential impacts are identified for other coastal habitats. The hazard assessment for Atlantic salt meadows and Sand dune habitats is presented below.

(i) Atlantic salt meadows (ASM)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Levels of *S. alterniflora* are reduced due to harvesting	Harvesting *A. nodosum* along the fringes of Atlantic Salt Meadows.	1	5	A	no	n/a	yes	Harvest along the fringes of Atlantic Salt Meadows will not occur "Code of Practise" (Appendix 4)	EU Dir. 92/43/ EEC & NPWS To restore the favourable conservation condition (ref: Objective 2, NPWS, 2011B, pg. 9)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Prob-ability**	**Sever-ity**	**Reason for Decision**
Biological:	**1**		Harvesting *A. nodosum* along the fringes of Atlantic Salt Meadows could give rise to reductions in cordgrass, *S. alterniflora*. Harvesting cannot take place at Atlantic Salt Meadows.
		5	EU Dir. 92/43/EEC & NPWS, requires that the favourable conservation condition of Atlantic salt meadows be restored (ref: Objective 2, NPWS, 2011B, pg. 9).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(ii) Sand dune habitats

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Reduction in organic drift litter levels to an extent which would negatively affect *Ammophila* plant growth, and in turn, sand dune formation and integrity.	Over harvesting of *A. nodosum* to levels which significantly reduce total organic drift litter in the Clew Complex.	1	5	A	no	n/a	yes	The management system requires that over-harvesting, which could have potential indirect impacts on organic matter levels and in turn potentially sand dunes, will not occur. See "Code of Practise" (Appendix 4) for details.	EU Dir. 92/43/ EEC & NPWS To restore the favourable conservation condition. (ref: Objective 3, NPWS, 2011B, pg. 15).
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**1**		Some studies indicate that *A. nodosum* organic drift litter material can increase Ammophila leaf length potentially due to a C:N ratio of 15:1 in algae (Maun, 2009). As such, *A. nodosum* organic drift litter may contribute to the formation and integrity of sand dune habitats. As the hand harvesting system ensures that over-harvesting does not take place and that *A. nodosum* mortality is mitigated against, the likelihood of over harvesting of *A. nodosum* to levels which significantly reduce total organic drift litter in the Clew Complex, is low.
		5	EU Dir. 92/43/EEC & NPWS, requires the favourable conservation condition of sand dune habitats be restored (ref: Objective 3, NPWS, 2011B, pg. 15).
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(f) Existing Operations: potential in-combination effects and interactions.

(1): Unlicensed, traditional and casual harvesting of seaweed.

For a detailed analysis of risks associated with other harvest activities, please see Appendix 7 to this application.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Y/N		
Biological: Negative impacts on: Protected Fauna: ➢ Annex II harbour seals & protected bird species Annex I habitats: ➢ Intertidal zone	This may occur due to cumulative and in combination impacts due to interactions with existing hand harvesting activities: • Other commercial companies • Traditional or casual harvesting & small-scale harvesting for personal use • Seaweed harvesting “discovery days” in Mulranny.	2	5	A	no	n/a	yes	• BioAtlantis will be responsible for commercial *A. nodosum* harvesting. If unlicensed large-scale commercial harvesting is observed to occur, this will be recorded and advice will be sought from the relevant authorities on how to proceed. BioAtlantis will not harvest in such areas until *A. nodosum* has regenerated and will work to ensure that any harvesting is limited to 20% of the total available biomass/site/annum and continuous disturbance of each community type does not exceed the required limit. • Commercial users with small requirements of ~1 tonne per annum (e.g. hotels, health Spas) will be identified and BioAtlantis will work to prevent in combination effects. • BioAtlantis will not harvest beyond Rossmurvagh, thus avoiding much of the Mulranny area. This avoids in combination effects with excursions in the area (e.g. Seaweed harvesting “discovery days”. • Harvesting cannot occur in areas where there are existing appurtenant rights or burdens in relation to the harvesting, gathering or removal of seaweed from the shore. • Where Profit-à-Prendre rights to harvest seaweed are successfully registered with the PRAI, the harvesting plans will be adjusted to ensure that those individuals can continue to harvest *A. nodosum*. • Harvesting activities must not impact on other people who harvest small volumes of seaweed, edible seaweeds or invertebrates for their own personal use, e.g. dillisk, carrageenan, limpets, mussels, clams, periwinkles and scallops. The above measures are included in the “Code of Practise” (Appendix 4). For detailed analysis of risks associated with other harvest activities, see Appendix 7.	Protecting the Clew Bay SAC.
Chemical:none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	**2**		There is a risk of cumulative and in combination impacts due to interactions between existing hand harvesting activities. However, the likelihood of such hazards occurring are reduced significantly as the BioAtlantis will be responsible for large scale commercial harvesting within the complex. Other commercial, large-scale, unlicensed harvesting activities will be recorded and advice will be sought from the relevant authorities on how to proceed. Small scale harvesting of <1 tonnes will have minimal impacts and does not significantly increase the probability of significant in combination effects with the BioAtlantis plan. Harvesting will not take place in areas where there are existing appurtenant rights or burdens in relation to the harvesting, gathering or removal of seaweed from the shore, thus lowering the likelihood of harvesting at inappropriate locations. Likewise, harvesting plans will be revised in the event of Profit-à-Prendre rights to harvest seaweed being successfully registered with PRAI.
		5	In combination effects due to presence of more than one large-scale harvesting operator within the same area, would be detrimental to the integrity of the Clew Bay SAC.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(2): Recreation and Tourism.

For a detailed analysis of risks associated with recreation and tourism, please see Appendix 7 to this application.
KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological/ Physical: Negative impacts on: Protected Fauna: ➢ Annex II harbour seals & protected bird species Annex I habitats: ➢ Intertidal zone	This may occur due to cumulative and in combination impacts associated with interactions of harvesting with recreation and tourism-related activities: ➢ In vicinity of seal and bird sites ➢ Involving transfer of equipment across the intertidal zone ➢ At Collanmore island during peak tourist season	2	5	A	no	n/a	yes	• **Activities in vicinity of seal and bird sites: Hand harvest will not take place at harbour se**al and bird sites at sensitive times of the year, thus preventing any in combination effects. • **Activities involving transfer of equipment across the intertidal zone:** Hand harvesters will not work within 50m of bases where equipment or vessels are manually introduced in the water. This ensures that no in combination effects occur. • **Activities at Collanmore island during peak tourist season:** Harvest will only occur on Collanmore between Sept-April. This prevents any in combination effects associated with increased anthropogenic disturbances which may occur at peak summer season (May-Aug) due to increased numbers of tourists on the island. The measures are included in the "Code of Practise" (Appendix 4), along with a range of additional measures to prevent interactions with these activities. For a detailed analysis of risks associated with recreation and tourism, please see Appendix 7.	Protecting the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical	**2**		There is a risk of cumulative and in combination impacts due to interactions between existing recreation and tourism activities. However, the likelihood of such hazards occurring are reduced significantly as BioAtlantis have measures in place to (a) avoid seal/bird sites at sensitive times, avoid (a) Collanmore at peak tourist season (May-Aug) and avoid sites near active tourism bases.
		5	In combination effects with recreation and tourism activities could be detrimental to the integrity of the Clew Bay SAC.
Chemical:			n/a
			n/a

(3): Aquaculture.

For a detailed analysis of risks associated with aquaculture, please see Appendix 7 to this application.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.

*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological/physical : Negative impacts on: • Protected Fauna: ➢ Annex II harbour seals & protected bird species • Annex I habitats: ➢ mudflats and sandflats • Direct impact on reef due to removal of species	Exacerbation of effects by existing aquaculture: ➢ At sites located in vicinity of seal and bird sites could cause disturbance ➢ At sites located in vicinity of mudflats and sandflats may cause damage. ➢ Direct impact on reef due to removal of species	2	5	A	no	n/a	yes	• The BioAtlantis harvesting systems requires seasonal avoidance of protected seal and bird sites See "BioAtlantis Code of Practise" for protection of harbour seals and bird species for more details (Appendix 4). • Ensure implementation of Code of Practice to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas (see Appendix 4). • Caution is required when approaching or operating near areas where existing aquaculture sites may be in relatively close proximity to harbour seal breeding sites (e.g. Inishcarrick, Inishcorky, Inishdasky, Inishilra), harbour seal moulting sites (e.g. Inisheeny), harbour seal resting sites (e.g. Inishtubrid), bird breeding sites (e.g. MoynishBeg, Inishcorky, Mauherillan) and bird wintering sites (e.g. Inisheeny). • Follow the Code of Practice to prevent impacts on navigation routes or physical interactions with aquaculture units. For a detailed analysis of risks associated with aquaculture, please see Appendix 7 to this application.	Protecting the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Proba bility**	**Sever ity**	**Reason for Decision**

Biological	**2**		Contact with harbour seal and breeding and wintering birds at protected sites will be minimal. Harvest cannot occur at these sites during sensitive times of year. A study by the Marine Institute (2014) assessed potential impacts of licensed aquaculture activities on species and habitats in Clew Bay and made the following conclusions: • Existing aquaculture activities are non-disturbing to harbour seals species or otter species. • Unlikely that hand harvest of seaweed and intertidal shellfish culture will overlap in Clew Bay, as reef is not considered suitable for culture of shellfish. • It is “unlikely that the in combination effects of transport routes across intertidal flats will give rise to persistent disturbance of >15% on intertidal mudflats and sandflats”.
		5	In combination effects with protected Annex II harbour seals & protected bird species or Annex I habitats could have negative effects on the conservation status of Clew Bay SAC.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

BioAtlantis

(4): Harvesting of invertebrates.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment** ***P****	***S****	***A/UA***	**Decision Tree** Q1	Q2	Control Measures? Yes / No	**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
Biological/physical : Negative impacts on: • Periwinkle populations • Cockle populations • Other invertebrates	Exacerbation of effects by existing harvesting of invertebrates: ➢ Periwinkles, cockles and other invertebrates	2	5	A	no	n/a	yes	**Periwinkles:** • Harvesters will leave between 8-12 inches of the crop behind. This approach avoids: ➢ Extensive removal of *A. nodosum* canopy coverage and damage to the ecosystem and ➢ Interactions with or by-catch of dormant/ resting winkles positioned at the base of the *A. nodosum* canopy ➢ Ensures that developing free-living forms of *L. Littorina* are able to settle and establish within intact canopies. • *L. obtusata* eggs: Harvesters will work to avoid *A. nodosum* plants which contain visible *L. obtusata* egg masses. This is important to prevent harvest of viable eggs, thereby promoting maintenance of population size. • Do not harvest *Fucus*: *Fucus* content of harvested *A. nodosum* will be limited to <5%, thus preventing removal of an additional canopy source which supports periwinkles and other species. • By-catch: co-removal of periwinkles identified as by-catch post-harvest will be returned to the water, where possible. **Cockles:** A code of practice is in place to ensure environmentally safe navigation when operating mudflats and sandflat areas. This will prevent any impact on intertidal sedimentary communities (See Appendix 4). **Other invertebrates:** • Harvesters will work to ensure that co-harvesting of other species does not occur. • Inadvertent co-removal of Animalia identified post-harvest will be collected and returned to the water, where possible. The above measures are included in the “BioAtlantis Code of Practise” (Appendix 4).	Protecting the Clew Bay SAC.
Chemical: none	n/a	na	na	na	na	na	n/a	n/a	

Hazard	**Prob-ability**	**Sev-erity**	**Reason for Decision**
Biological/ physical	**2**		**Periwinkles:** Hand gathering occurs within the intertidal zone. Risks include reductions in periwinkle population numbers due to the removal and anthropogenic disturbances caused by trampling. While there is potential for in-combination effects associated with *A. nodosum* hand harvest activities and existing periwinkle harvest activities, the standards developed as part of the Codes of Practice (Appendix 4) reduce the likelihood. **Cockles:** There is potential for in-combination effects associated with *A. nodosum* hand harvest activities and cockle hand gathering, as seaweed hand harvesting may involve activities along the rocky shoreline beyond mudflats and sandflats. Cockles occur on intertidal muddy sand shores east of Mullranny. Hand gathering may occur at a low scale. Potential impacts of cockle gathering include impacts on intertidal sedimentary communities (Mudflats and sandflats not covered by seawater at low tide [1140]). The Codes of

			Practice reduce the likelihood that navigation will impact on these environs, a navigation into these areas will occur exclusively at high tide or when the tide begins to recede. **Other invertebrates:** Other invertebrates are removed from Clew Bay, many of which are limited to deeper water, thus removing any risk of in-combination effects associated with hand harvesting activities. However, there is a low risk that hand harvesting may impact on slow moving invertebrates in general given that nets/bags are used along the intertidal zone. The likelihood of such impacts occurring is low as nets/bags will take up a small area and harvesters will be required to ensure that co-harvesting other species does not occur.
		5	Mudflats and sandflats have stated objectives for their conservation. EU Dir. 92/43/EEC & NPWS, requires maintenance of *Tubificoides benedii* and *Pygospio elegans* community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes and/or their habitat.
Chemical:			n/a
			n/a

(g) Planned Operations: potential in-combination effects and interactions.

(1): Harvest activities.

No planned operations identified.

(2): Recreation and Tourism.

For a detailed analysis of risks associated with planned recreation and tourism, please see Appendix 7. KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required. *probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological/ Physical: Anthropogenic disturbances at: • Roman Is. • Wesport harbour	Mayo County Council plan to increase tourism and recreation at these sites. This could involve or give rise to: ➢ Impacts associated with transfer of equipment across intertidal zone ➢ Increases no.s of people at the intertidal zone	2	5	A	no	n/a	yes	• **Activities involving transfer of equipment across the intertidal zone:** Harvesters will not work within 50m of bases where equipment or vessels are introduced in the water. This ensures that no in combination effects occur. • **Activities at Roman Island or Westport harbour during peak tourist season:** Hand harvesters will not work at Roman Island or Westport harbour between May and August. This prevents any in combination effects from occurring during peak season. Measures are included in the "BioAtlantis Code of Practise" (Appendix 4). For a detailed analysis of risks associated with planned recreation and tourism, please see Appendix 7 to this application.	Protecting the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Prob-ability**	**Severity**	**Reason for Decision**
Biological /physical	**2**		Westport Towns & Environs Development Plan 2010-2016 targets Roman Is. for development of marine-based activities and tourism (ref: Mayo County Council 2010), thus raising potential for interactions with harvesting (e.g. anthropogenic disturbances). Increased no.s of bases may be developed for recreation activities. Transference of equipment from bases into the water may give rise to small patches with low density of seaweed, thus raising potential for in combination effects. Funding is granted as part of the Mayo County Council 2014 Budget, for new marine tourism/leisure infrastructure at Westport Harbour (ref: Hynes, 2014), thus raising potential for interaction between harvesting & increased tourism-related activities at Westport Quay (e.g. anthropogenic disturbances). However, the likelihood of interactions are reduced as BioAtlantis will avoid Roman Is. or Westport harbour at peak tourist season(May-Aug) and avoid sites near active bases.
		5	In combination effects with recreation and tourism activities could be detrimental to the integrity of the Clew Bay SAC.
Chemic al: none			n/a
			n/a

(3): Aquaculture.

For a detailed analysis of risks associated with aquaculture, please see Appendix 7 to this application.
KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Negative impacts on: • Protected Fauna: ➢ Annex II harbour seals at Inishcorky	There is currently a licence application for abalone culture in the vicinity of Inishcorky island (ref: (pg. 78, Marine Institute (2014). Hand harvesting could interact to impact on harbour seals.	2	5	A	no	n/a	yes	• The BioAtlantis harvesting systems requires seasonal avoidance of protected seal and bird sites See "BioAtlantis Code of Practise" for protection of harbour seals and bird species for more details (Appendix 4). • Seasonal avoidance of sensitive harbour seal sites must be adhered to for all haul out sites, including Inishcorky. Caution is required when approaching or operating near areas where planned aquaculture sites may be in relatively close proximity to harbour seal breeding sites (e.g. Inishilra) and bird breeding sites (e.g. Mauherillan). • Follow Code of Practice to prevent impacts on navigation routes or physical interactions with aquaculture units. For a detailed analysis of risks associated with aquaculture, please see Appendix 7 to this application.	Protecting the Clew Bay SAC.
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological	**2**		Hand harvest activities may exacerbate existing effects attributed to licensed aquaculture activities, e.g. disturbance at sites relevant to harbour seals. Overall the risk of such interactions is considered low (Marine Institute, 2014). Impacts on Otter (*Lutra lutra*) is deemed not significant. However, the Marine Institute cannot rule out potential effects of aquaculture on seal behaviour at Inishcorky and potentially neighboring site: Inishdeashmore, Inishdeasbeag, unnamed neighbouring island of Inishdeasbeag and Inishnacross (pg. 78, Marine Institute, 2014). A number of additional aquaculture license applications have recently been filed (Marine Institute, 2019 and Department of Agriculture. Food and the Marine).The risk of in combination effects with hand harvesting are reduced as the BioAtlantis harvesting systems requires seasonal avoidance of protected seal sites.
		5	In combination effects with protected Annex II harbour seals could have negative effects on the conservation status of Clew Bay SAC.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(4): Harvesting of invertebrates.

No planned operations identified.

(h) Invasive species

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Biological: Spread of *Didemnum vexillum, Styela clava, etc.*	Due to harvest activities functioning as a vector, e.g. adherence of species to underside of boats.	1	5	A	no	na	yes	• The main collection boat (if deemed applicable to the area), will be painted once a year with appropriate anti-fouling paint. • The harvester's boats will not leave Clew Bay. In the rare case that they do leave Clew Bay, harvesters are required to implement a cleaning measure on land which will involve cleaning with appropriate cleaning agents or using other suitable methods. • All nets/bags must be cleaned with appropriate cleaning agents or using other suitable methods on delivery to production facilities and returned to harvesters in a clean condition. • Harvesting will be limited to the *A. nodosum* zone and will not take place in subtidal areas, exposed or semi-exposed sites. • Harvesters will keep distance from aquaculture units to prevent the spread of any species that may be associated with artificial structures. • Harvesters will prevent disturbance to rocky substratum, will avoid co-harvesting non-*A. nodosum* material and will ensure that inadvertent by-catch of other *Animalia*, algae or dead, drifting material/algae will be prevented and minimized.	Protecting the Clew Bay SAC. MSFD targets (2016)
Chemical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Physical: none	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Hazard	Probability	Severity	Reason for Decision
Biological	**1**		**Non-indigenous species previously reported in Clew Bay: Cercozoa:** *Bonamia ostreae.* **Cordgrass:** *Spartina anglica,* **Crustaceans:** *Caprella mutica,* **Molluscs:** *Crepidula fornicate, Crassostrea gigas,* **Sea Squirts (Tunicata):** *Perophora japonica, Botrylloides violaceus, Styela clava, Didemnum vexillum,* **Seaweed:** *Sargassum muticum.* • ***Bonamia ostreae:*** Parasitic to the oyster *Ostrea edulis* (direct transmission). Measures are in place in this application to avoid non-*A. nodosum* habitats, thus reducing the potential for interactions. • ***Botrylloides violaceus:*** Associated with hard natural and artificial substrates, pontoons, shellfish beds, marine floating structures (e.g. those used for mussel culture), ropes and hulls and boats in marinas. Mainly found in submerged habitats. Can be found in habitats containing *Didemnum vexillum*. It has been reported in Clew Bay (ref: Shellfish Associated Species Inventory (SASI) Surveys, 2018 - 2022). Measures are in place in this application to prevent interactions with aquaculture activities in the bay, thus reducing the potential spread of this species. • ***Caprella mutica:*** Primarily a fouling organism that may associated with fish farms, aquaculture sites/structures, hulls or ships, recreational boats and artificial man-made objects, structures and materials. It has been reported in Clew Bay (ref: Shellfish Associated Species Inventory (SASI) Surveys, 2018 - 2022). Spreads on hulls and potentially by rafting on drifting material including drifting algae. This application does not involve the harvesting of drift weed or free-drifting macroalgae. Measures are also in place to avoid co-harvesting non-*A. nodosum* material and prevent inadvertent by-catch of other algae or dead, drifting material/algae, thus reducing the potential for interactions. • ***Crassostrea gigas**:* Farmed in Clew Bay. Reported as occurring on Bertra Beach, Westport, Mayo. Measures are in place in this application to prevent interactions with aquaculture activities in the bay, thus reducing the potential spread of this species. • ***Crepidula fornicata*****:** There were accounts of specimens of *C. fornicata* in Clew Bay in the 1960s, however none were found in subsequent searches. The population may have been transient or may have been purged/died out due to the 1962/63 winter and frosts (ref: O'Rourke E and O'Flynn C, 2014). • ***Didemnum vexillum*****:** An invasive species which can smother marine life. It has been identified in Clew Bay and other parts of Ireland and may be spread by boats. It has also been reported to be associated with aquaculture units such as oyster bags on trestle installations. Measures are in place in this application to prevent interactions with aquaculture activities in the bay, thus reducing the potential spread of this species. • ***Perophora japonica:*** Can occur on artificial substrata in harbours and marinas and under boulders and stones on the lower shore in sheltered, silty areas. Colonies were identified at Annagh Island in southern Clew Bay on the lower shore under boulders & on *Fucus serratus* (ref: Minchin D *et al.*, 2016). As measures are already in place to prevent disturbance to rocky substratum, the likelihood of interactions with *P. japonica* are very low. Measures are also in place to prevent harvesting of other species such as *F. serratus*, thus reducing the potential for interactions to occur. • ***Sargassum muticum*****:** An invasive seaweed that grows in semi-exposed areas, primarily in rock pools. This species has been reported in exposed areas where *A. nodosum* does not grow, such as Clare Island. It has also been reported in Clew Bay (ref: Shellfish Associated Species Inventory (SASI) Surveys, 2018 - 2022). As *S. muticum* does not thrive in highly sheltered areas within the *A. nodosum* zone, the likelihood of occurring post-harvest is very low. Measures are also in place to prevent harvesting of other non-*A. nodosum* material or other algae species such as *S. muticum*, should they occur, thus reducing the potential for interactions. • ***Spartina anglica:*** Some species of cordgrass are considered as invasive species in Ireland. Measures are in place to avoid interactions in sensitive areas such as Atlantic salt meadows or other areas such as tidal flats where *S. anglica* may potentially occur. • ***Styela clava*****:** Club tunicate, leathery tunicate, fouls ship hulls and aquaculture infrastructure. Can be found in shallow water on hard surfaces, occurs in warm sheltered waters, docks and harbour installations (ref: https://invasives.ie/ and https://www.marlin.ac.uk/). Recently observed to occur in Clew Bay. While *S. clava* can occur in sheltered areas, it is a low tidal to subtidal species; therefore the potential overlap with *A. nodosum* is likely to be very low.

			The probability of these species being spread by harvesting, harvester boats or nets/bags is reduced, as the Code of Practice has been developed to ensure that appropriate precautionary measures are in place. **Other non-indigenous species of relevance, not identified in Clew Bay:** • **Annelida:** Marenzellaria viridis, • **Bryozoans:** *Schizoporella_cf_japonica, Smittoidea_prolifica,* • **Chordata:** Neogobius *melanostomus, Pseudorasbora parva,* • **Comb Jellyfish:** *Mnemiopsis leidyi,* • **Crustaceans:** *Amphibialanus amphitrite, Balanus trigonus, Eriocheir sinensis, Hemigrapsus sanguineus, Hemigrapsus takanoi, Dikerogammarus haemobaphes, Dikerogammarus villosus, Hemigrapsus sanguineus, Hemigrapsus takanoi, Hesperibalanus fallax,* • **Ctenophora:** *Mnemiopsis leidyi,* • **Dermocystida:** *Sphaerothecum destruens,* • **Dinoflagellates:** *Alexandrium catenella, Alexandrium tamarense,* • **Endomyxa:** *Marteilia refringens,* • **Molluscs:** *Ensis leei, Ocinebrellus inornatus, Rapana venosa, Urolsalpinx cinerea, Corbicula fluminalis, Corbicula fluninea, Dreissena bugensis, Ocenebra inornate,* • **Negarnaviricota:** *Infectious haematopoietic necrosis virus, Infectious salmon anaemia virus,* • **Ochrophyta:** *Heterosigma akashiwo,* • **Peploviricota:** *Ostreid herpesvirus 1-microvariant,* • **Platyhelminthes:** *Gyrodactylus salaris,* • **Porifera:** *Celtodoryx ciocalyptoides,* • **Pseudomonadota:** *Vibrio cholorae,* • **Seaweed:** *Caulacanthus okamurae, Grateloupia turuturu, Undaria pinnatifida, Laminaria ochroleuca,* • **Tunicata:** *Corella eumyota*. The probability of these species being introduced or spread by harvesting, harvester boats or nets/bags is reduced, as they are not currently identified as present in Clew Bay. The Code of Practice has also been developed to ensure that appropriate precautionary measures are in place to prevent the spread of invasive species into the future. Information sources are outlined below: • https://bim.ie/invasivespecies • https://invasives.ie/ • www.biodiversityireland.ie • National Invasive Species Database • BIM and Dutch Shellfish Importers - Shellfish Associated Species Inventory (SASI) Surveys, 2018 - 2022 • https://www.marlin.ac.uk/ • Lucy FE, Davis E, Anderson R, Booy O, Bradley K, Britton JR, Byrne C, Caffrey JM, Coughlan NE, Crane K, Cuthbert RN. Horizon scan of invasive

			alien species for the island of Ireland. Management of Biological Invasions. 2020;11(2):155-77. • Minchin D *et al.*, 2016. The most nothern records of the exotic ascidian Perophora japonica Oka, 1927 (Ascidiacea: Perophoridae) in the north-east Atlantic. BioInvasions records 5, no. 3 (2016): 139-142.). • Minchin D. Risk assessment of non-indigenous marine species, Ireland: including those expected in inland waters. The Centre for Environmental Data and Recording (CEDaR), Department of Natural Sciences, National Museums, Northern Ireland (NMNI) and the Department of Arts, Heritage and the Gaeltacht, Ireland. 2014;64:16. • O'Rourke E and O'Flynn C, 2014. Risk Assessment of *C. fornicata*. A joint project by Inland Fisheries Ireland and the National Biodiversity Data Centre to inform risk assessments of non-native species for the European Communities (Birds and Natural Habitats) Regulations 2011, supported by the National Parks and Wildlife Service. • Schoenrock KM, O'Callaghan T, O'Callaghan R, Krueger-Hadfield SA. First record of *Laminaria ochroleuca* Bachelot de la Pylaie in Ireland in Béal an Mhuirthead, County Mayo. Marine Biodiversity Records. 2019 Dec;12(1):1-8.
		5	Spread of the above species in Clew Bay could negatively impact on the conservation objectives for this SAC.
Chemical:			n/a
			n/a
Physical:			n/a
			n/a

(i) The conservation status of marine Annex I habitats in Clew Bay Complex SAC.

(1) Sandbanks which are slightly covered by sea water all the time [1110]

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*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on: • Area. • Structure and function. • Future prospects.	Damage to sublittoral soft sediment communities with a limited range of species and sediment types (e.g. potentially due to installation of physical structures or dredging; ref: Scally et al., 2020).	1	3	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. In relation to sandbanks, harvesting will not occur in these areas.	EU regulations.

Hazard	**Proba bility**	**Sever ity**	**Reason for Decision**
Biological/ physical/ chemical	**1**		*A. nodosum* harvesting has no spatial overlap with this habitat. This habitat is mainly found along the east coast of Ireland but also occurs in the Shannon Estuary and off the Donegal coast. It is not listed as a protected habitat in Clew Bay SAC. Potential threats may include: Wind energy infrastructure in the vicinity of the habitat and benthic dredging from commercial fishing vessels (Scally et al., 2020)
		3	As this habitat is not protected under EU regulations in Clew Bay the severity associated with impacts is reduced to reside within the range of 1-4. Conservation assessments show that this habitat is in favourable condition nationwide in terms of (a) area, (b) structure and function and (c) future prospects (Scally et al., 2020).

(2) Estuaries [1130]

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes/No		
Impacts on: • Area. • Structure and function. • Future prospects.	Damage associated with increased sediment input and/or sediment mobilization (e.g. may be caused by factors related to agriculture, maintenance dredging, urbanization; ref: Scally et al., 2020).	1	3	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** • Measures are in place to ensure that hand harvesting does not impact on estuary habitat, either directly or indirectly, and that no cumulative or in combination effects occur. In particular, harvesting will be limited to the *A. nodosum* zone. • Adherence to environmentally safe navigation techniques is required to prevent disturbance of soft substratum areas. Harvesting can take place within the *A. nodosum* zone at suitable sites located within Westport Bay and Newport River Estuary areas, subject to adherence to the code of practice in relation to environmentally safe navigation, thus ensuring sea-floor and water column integrity. • Estuarine areas containing soft mud or marsh at the mouths of rivers will be avoided between Sept-April to avoid impacts on breeding or wintering bird species. Caution must be ensured if in the vicinity of these areas between May-Aug. See Appendix 4, Code of Practice.	EU regulations.

Hazard	**Proba bility**	**Sever ity**	**Reason for Decision**
Biological/ physical/ chemical	**1**		As estuaries [1130] are not listed as a protected habitat in Clew Bay SAC, interactions with protected forms of these habitats will not occur. The spatial overlap between the *A. nodosum* zone and estuarine waters is low and in many cases is absent. *A. nodosum* also grows at low levels in muddy estuarine areas. In addition, measures are in place to ensure that hand harvesting does not impact on estuary habitat.
		3	The conservation status of estuaries is deemed 'Unfavourable-Inadequate' at a number of sites in Ireland: (Lough Swilly SAC, Dundalk Bay SAC and Lower River Shannon SAC; (Scally et al., 2020). As this habitat is not protected under EU regulations in Clew Bay the severity associated with impacts is reduced to reside within the range of 1-4.

(3) Mudflats and sandflats not covered by seawater at low tide [1140]

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures ? Yes / No		
Impacts on: • Area, • Structure and function • Future prospects	**General:** Damage caused by increase in alien invasive species on *Zostera noltei* beds *(e.g. Spartina anglica)*, change in sediment composition, increased sediment loads from activities upstream of rivers, discharge of untreated effluent and intensive agriculture causing disruption of sandy mud habitat in intertidal areas (Scally et al., 2020). ***A. nodosum* harvesting:** Use of boats during low tide to access rocky shorelines which lie beyond mudflat or sandflats.	2	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. In relation to mudflats and sandflats, harvesting will not occur in these areas. Harvesters will also ensure the implementation of Code of Practice to ensure that they do not navigate at low tide to rocky shorelines located beyond mudflat/sandflat areas (see Appendix 4)	EU Dir. 92/43/ EEC & NPWS The permanent habitat area is stable or increasing, subject to natural processes (Ref: Target 1 of Objective 2, NPWS, 2011A, page 14).

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical/ chemical	**2**		The probability of mudflats and sandflats being altered due to harvest activities in Clew Bay is relatively low given that: (a) this substrate is not suitable for *A. nodosum* growth and will not be targeted for harvest activities and (b) in most areas, mudflats and sandflats exhibit little overlap with the rocky shorelines. (c) accessing rocky shorelines lie beyond mudflats and sandflats at low tide in particular, is very difficult and would be avoided by harvesters. (d) harvesting has no impact on sedimentation rates. (e) mitigation measures are in place to prevent the spread of invasive species. While *Z. noltei* beds may be susceptible to increases in *S anglica*, neither species are reported to occur in Clew Bay.
		5	The overall conservation status of Mudflats and sandflats not covered by seawater at low tide in Ireland has been assessed as Unfavourable-Inadequate. In Clew Bay, the conservation status is favourable in terms of Area, Structure and function, future prospects, and the site's overall status (Scally et al., 2020). EU Dir. 92/43/EEC & NPWS, requires maintenance of *Tubificoides benedii* and *Pygospio elegans* community complex in intertidal sandy mud areas (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13 and Target 2 of Objective 2: NPWS, 2011A, page 14). Harvest activities in these areas could significantly damage these community complexes and/or their habitat.

(4) Reefs [1170]

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on: • Area, • Structure and function • Future prospects	**Pressures on reef may arise as follows (ref: Scally et al., 2020):** • **General:** Physical impacts on geogenic reef. • **Intertidal reef habitat:** Increase in invasive alien species and effects on intertidal marine algae potentially associated with harvesting. • **Sublittoral reef habitats:** examples of pressures include loss of fishing gear and the use of tangle nets and potentially the harvesting of macroalgae. • **Biogenic reefs:** Intertidal: honeycomb worm *(Sabellaria spinulosa), Mytilus edulis;* Subtidal: polychaete worm *(Serpula vermicularis).* ***A. nodosum* harvesting:** • Removal of habitat (i.e. reef): Potential removal of small quantities of stones, rocks, etc. • Removal with or without holdfast material: Small, stony, friable substrate occurs frequently in Clew Bay. • Disruption or disturbance of reef: Impact by boats or disturbance or displacement may occur with inappropriate technique, lack of training or oversight.	2	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. When operating within the intertidal zone where *A. nodosum* is present (sheltered reef and shingle substratum areas), harvesters will ensure adherence to all aspects this Code of Practice. This will ensure that the habitat area is maintained and that structure and function is maintained or improved. It also ensures that future prospects and conservation status of reef and shingle areas are maintained or enhanced, whilst also preventing in combination effects with existing and planned activities. Key aspects of the Code of Practice and the harvesting system include but are not limited to the following: • Hand harvest techniques employed along rocky shores will ensure that *A. nodosum* is severed above point of contact with underlying substrate (see Appendix 4). • Levels of disturbance/displacement that could give rise to presence of reef and/or associated holdfast material, will be monitored and recorded via 'Goods received Notes' (GRN) and also at production facilities. • A code of practice will be implemented to ensure that harvesters employ good boating practices, particularly when landing on shores (See Appendix 4). • Harvesters provided with training, where necessary, to ensure that reef is not disturbed or displaced. • Ensure that there are no physical interactions with biogenic reef in the rare event that it is encountered on the shore (e.g. honeycomb structures or mussels).	EU Dir. 92/43/ EEC & NPWS Maintenance of reef habitats and species therein (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).

Hazard	Probability	Severity	Reason for Decision
Biological / physical/ chemical	**2**		It is unlikely that the Area, Structure & function and Future prospects of Reef [1170] will be altered due to harvest activities in Clew Bay given that: • ***A. nodosum* harvesting:** ➢ It is unlikely that distribution, abundance, diversity or area of reef will be altered due to harvesting of *A. nodosum.* While *A. nodosum* may be harvested in from rocky shores which contain reef as underlying substrate, the hand harvesting technique used ensures that *A. nodosum* vegetative growth is severed well above the point of contact with reef. Contact with reef would also lead to damage to the harvester’s sickle/blade, thus, reef will always be avoided. ➢ It is unlikely that significant levels of disturbance or displacement would occur, to levels which would lead to co-removal of reef with or without holdfast material. This is due to the fact that the hand harvest methodology involves working at low tide and harvesters have full view of the cutting process, allowing them to take care not to disturb the substrate. ➢ It is unlikely that reef will be damaged due to harvesting of *A. nodosum* given that: (a) harvesters will be using small boats to land on islands and coastal areas. Care will be taken in order to ensure that contact with reef is minimal, therefore avoiding any damage being inflicted on boats. (b) The collection boat (if deemed applicable to the area) will be fitted with a depth can device to ensure that contact with the reef is avoided as it will damage both the reef and the boat. ➢ Measures are in place to prevent impacts of harvesting and impacts on any associated species. See above and section A (8) and C (1a to 3g). • **Intertidal reef habitat:** ➢ **Increase in invasive alien species:** Mitigation measures are in place to prevent the spread of invasive species. See Section H above. ➢ **Effects of harvesting intertidal marine algae:** See above. In addition, measures are in place to prevent impacts of *A. nodosum* harvesting and impacts on any associated species. See above and section A (8) and Section C (1a to 3g). • **Sublittoral reef habitats:** Harvesting in subtidal areas will not take place. • **Geogenic reef:** Geogenic reef is unlikely to be vulnerable to change in Area due to the hard rock substrates from which they are formed. Other than minor alteration of the rock face due to the effects of natural erosion, habitat loss is highly unlikely (ref: Scally et al., 2020). It is unlikely that *A. nodosum* harvesting will impact on overall hydrodynamics as *A. nodosum* is adapted to growing in highly sheltered environs and as such, has difficulty remaining attached to hard substrate in less sheltered waters. Therefore, *A. nodosum* is likely to exert only a minor influence on hydrodynamics. The harvesting system is designed to ensure that dramatic changes in biomass levels within the intertidal zone will not occur. • **Biogenic reefs:** ➢ Honeycomb worm *(Sabellaria spinulosa):* It is unlikely that *Sabellaria* sp. will be affected due to harvesting as it mainly occurs in sublittoral zones in areas with moderate exposure, typically outside the *A. nodosum* zone. *S. spinulosa* is rare in Ireland and is not reported to occur in Clew Bay. ➢ Polychaete worm *(Serpula vermicularis)* occurs between the intertidal zone to depths down to 100 m. It has a broad depth range and is not reported to occur in Clew Bay. ➢ *Mytilus edulis:* occurs in exposed and non-exposed areas and occurs in a range of non-*A. nodosum* habitats. As such, it is unlikely to be impacted by *A. nodosum* harvesting activities.
		5	The overall conservation status of Reef in Ireland has been assessed as Favourable in terms of Area, Structure and function, future prospects. This includes both inshore and offshore reef areas (Scally et al., 2020). EU Dir. 92/43/EEC & NPWS, requires the maintenance of reef in a natural condition (Ref: Target 5 of Objective 1, NPWS, 2011A, page 13).

(5) Submerged or partially submerged sea caves [8330].

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*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment** *P**	*S**	*A/UA*	**Decision Tree** Q1	Q2	Control Measures? Yes / No	**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
Impacts on: • Area, • Structure and function • Future prospects	• Alteration of the rock face due to natural erosion and loss of area (Scally et al., 2020). • Removal of cave habitat or human activities that would influence community structure of seacaves. • Unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. In relation to submerged or partially submerged areas, harvesting will not occur in these areas.	EU Directives.

Hazard	Probability	Severity	Reason for Decision
Biological/ physical/ chemical	**1**		Sea caves in Ireland are formed from hard rock. Other than minor alteration of the rock face due to the effects of natural erosion, loss of area is highly improbable. The inaccessible nature of sea caves makes them less vulnerable to anthropogenic impacts (Scally et al., 2020). The probability of the Area, Structure and function or Future prospects of sea caves and their habitat being altered due to harvest activities is low given that: (a) Intertidal *A. nodosum* zone is largely confined to unexposed, sheltered areas and will not occur in the vicinity of seacaves. (b) There will be no activities which will negatively affect key resources to sea caves, including water quality.
		5	The overall conservation status of submerged or partially submerged sea caves in Ireland has been assessed as Favourable in terms of Area, Structure and function, future prospects (Scally et al., 2020).

(6) Large shallow inlets and bays [1160]

Target 1: Permanent habitat area.

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on habitat area	Non-conformance with harvest procedures leading to inadvertent removal of habitats, e.g. excessive removal of sand, shingle, stones, pebbles, rock, debris, holdfasts).	1	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. Addition measures are outlined below in relation to permanent habitat area. • Harvesters will be provided with training, where necessary, to ensure that no removal of permanent habitat occurs, i.e. ➢ No removal of excessive levels of sand, shingle, stone, pebble, gravel, etc. ➢ No removal of *A. nodosum* holdfasts that could carry sand, shingle, stone, etc. • Resource Manager will inspect the harvest on collection or during the washing bagging operation on the collection boat, if deemed applicable for the area. ➢ If excessive sand, shingle or debris is observed, the harvesters will be provided with training, where necessary. • Checks will be recorded on the Goods Received Notes (GRNs, Appendix 3). • Production Operators will also inspect incoming harvested seaweed on production logsheets. The following will apply: ➢ If excessive levels of sand, shingle or debris etc is present in harvested weed: -Removal by sand filter and decanter and clarifier. - Harvesters provided with training, where necessary. ➢ If stones or rocks are present: - Harvesters provided with training, where necessary. • Non-conformance is reported, particularly in the serious event of *A. nodosum* holdfasts being present.	EU Dir. 92/43/EEC & NPWS Target 1 of Obj. 1, NPWS, 2011A, pg. 12

Hazard	Probability	Severity	Reason for Decision
Biological/ physical/ chemical	**1**		The likelihood of impacting on habitat area is very low and substratum will not be removed or altered. In addition, the sustainable hand harvest method employed ensures regeneration of *A. nodosum* post harvesting. The likelihood of sand and rocks being removed along with harvested *A. nodosum* is low as. Given that sand and rocks may damage production equipment and end product, harvesters will be required to ensure such materials are not included in the bags/nets. The collection of floating bags/nets at high tide or as high tide approaches also reduces the likelihood of excessive levels of sand or other material being removed from the foreshore. This system ensures settlement to the seabed of any rarely occurring sand or other foreshore material that may be attached to the bottom or sides of the bag or in the netting. In addition, *A. nodosum* will be harvested no less than 200mm above the holdfast. This reduces the likelihood of holdfasts being removed, which could otherwise, inadvertently lead to removal of attached pebbles or stones (see Appendix 4 for Code of Practise).
		5	• The national conservation assessment indicates that shallow inlets and bays [1160] in Ireland are classified as ‘unfavourable-bad’ (Scally et al., 2020). The 'area' conservation attribute is classified as ‘favourable’, while ‘structure & functions’ and ‘future prospects’ are considered as ‘unfavourable-bad’ and ‘unfavourable-inadequate’ respectively. Clew Bay is categorized as ‘unfavourable-bad’ for three attributes: ‘structure & functions’ and ‘future prospects’ and ‘overall site assessment’. In terms of ‘area’, Clew Bay SAC is classified as favourable. The unfavourable status of Clew Bay has been attributed to the loss of eelgrass beds, a significant decrease in the abundance of eelgrass shoots within a bed and an increase in negative indicators, e.g. epiphytic algal cover on eelgrass leaves, the presence of opportunistic species and invasive alien species. • The overall conservation status of Reef in Ireland has been assessed as Favourable in terms of Area, Structure and function, future prospects. This includes both inshore and offshore reef areas (Scally et al., 2020). In accordance with EU Dir. 92/43/EEC & NPWS, areas must be maintained at favourable conservation conditions to ensure stability of the permanent habitat area (Ref: Target 1 of Obj. 1, NPWS, 2011A, pg. 12). Removal of habitat may contravene this directive (e.g. removal of excessive levels of sand or rock).

Target 2: Community extent (*Zostera* and maërl dominated communities)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required. *probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2). NOTE: The *A. nodosum* biotope has been assessed in Section C of this document.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on Community extent	Removal of habitat of rare & endangered species (i.e. *Zostera* Seagrass and associated communities; Maerl Dominated communities), potentially due to unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. In relation to *Zostera* and maerl, harvest of *A. nodosum* will not take place in these areas.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical/ chemical	**1**		It is highly improbable that the distribution, abundance, diversity or area occupied by *Zostera* Seagrass (and associated communities) will be altered due to harvesting of *A. nodosum* given that: (a) these areas and communities exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) the sandy substrate supporting *Zostera* growth are insufficient to support *A. nodosum* and thus, will not be affected by harvest activities. It is highly improbable that the distribution, abundance, diversity or area occupied by maerl and associated communities will be altered due to harvesting of *A. nodosum* given that: (a) these areas and communities exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) the coarse, mixed, sandy mud and muddy sand sediment substrates which support maerl growth are insufficient to support *A. nodosum* and thus, will not be targeted for harvest activities.
		5	• The national conservation assessment indicates that shallow inlets and bays [1160] in Ireland are classified as 'unfavourable-bad' (Scally et al., 2020). The 'area' conservation attribute is classified as 'favourable', while 'structure & functions' and 'future prospects' are considered as 'unfavourable-bad' and 'unfavourable-inadequate' respectively. Clew Bay is categorized as 'unfavourable-bad' for three attributes: 'structure & functions' and 'future prospects' and 'overall site assessment'. In terms of 'area', Clew Bay SAC is classified as favourable. The unfavourable status of Clew Bay is due in part to the loss of eelgrass beds, a significant decrease in the abundance of eelgrass shoots within a bed and an increase in negative indicators, e.g. epiphytic algal cover on eelgrass leaves, the presence of opportunistic species and invasive alien species. • EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of Zostera Seagrass and associated communities and maerl and associated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13). Harvest activities in these areas could significantly damage these areas and associated communities. • EU Dir. 92/43/EEC & NPWS, requires the maintenance of the natural extent of maerl and associated communities (Ref: Targets 2-4 of Objective 1, NPWS, 2011A, pages 12, 13). Harvest activities in these areas could significantly damage maerl and associated communities

Target 3: Shoot density *(Zostera)*

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on *Zostera* shoot density (shoots per m2)	Removal of habitat of rare & endangered species (i.e. Zostera Seagrass and associated communities), potentially due to unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. In relation to *Zostera*, harvest of *A. nodosum* will not take place in these areas.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical/ chemical	**1**		As above for target 2
		5	As above for target 2

Target 4: Community Structure (Maerl)

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on community structure (maerl)	Removal of habitat of rare & endangered species (i.e. Maerl Dominated communities), potentially due to unauthorized harvest in these protected areas.	1	5	A	no	n/a	yes	**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. In relation to maerl, harvest of *A. nodosum* will not take place in these areas.	EU Dir. 92/43/ EEC & NPWS Targets 2-4 of Obj.1, NPWS, 2011A, pg:12,13

Hazard	**Probability**	**Severity**	**Reason for Decision**
Biological/ physical/ chemical	**1**		As above for target 2
		5	As above for target 2

Target 5: Community distribution

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).
NOTE: The *A. nodosum* biotope has been assessed in Section C of this Appendix.

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk Assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Impacts on community distribution:								**The conservation status of marine Annex I habitats:** The Code of Practice (Appendix 4) provides a range of measures that will be undertaken to ensure that the conservation status of marine Annex I habitats is maintained or improved. Addition measures are outlined below. **Sandy mud (polychaetes and bivalves), fine sand *(Nephtys cirrosa)* and intertidal sandy mud (*Tubificoides benedii* and *Pygospio elegans*):** • Ensure implementation of the Code of Practice (Appendix 4) to ensure that harvesters do not attempt to navigate at low tide to rocky shorelines located beyond ➢ Mudflats and sandflats. ➢ Clean, fine sand areas in the south west of the complex. **Shingle:** • A system is in place which ensures that: ➢ Hand harvest techniques employed along shingle areas will ensure that *A. nodosum* is severed above point of contact with underlying substrate. ➢ Levels of disturbance or displacement that could give rise to presence of shingle, friable substrate and/or associated holdfast material in the harvested seaweed, will be monitored and recorded via 'Goods received Notes' (GRN) and also at production facilities. ➢ A code of practice will be implemented to ensure that harvesters	EU Dir. 92/43/ EEC & NPWS
Sandy mud with polychaetes and bivalves community complex	Unauthorized harvest in mudflat/sandflat areas during low tide.	2	5	A	No	n/a	Yes		
Fine sand dominated by *Nephtys cirrosa* community	Unauthorized harvest in these protected areas during low tide.	2	5	A	No	n/a	Yes		
Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex	Use of boats to access rocky shorelines which lie beyond mudflats at low tide.	2	5	A	No	n/a	Yes		
Shingle	• Potential removal of small quantities of stones, rocks, etc. Small, stony, friable substrate occurs frequently in Clew Bay. • Impact by boats • Disturbance or displacement may occur with inappropriate technique, lack of training or oversight	2	5	A	No	n/a	Yes		

Reef	As per Section i(4) above and Section C of this Appendix.	2	5	A	No	n/a	Yes	employ good boating practices, particularly when landing on shores. ➢ Harvesters provided with training, where necessary, to ensure that reef or shingle is not disturbed or displaced. See "Code of Practise" for details (Appendix 4). **Reef:** As per Section i(4) above and Section C of this Appendix. Control measures in relation *A. nodosum* and species associated with this biotope are outlined in Section 1 (1a to 3g).	

Hazard	Probability	Severity	Reason for Decision
Biological/ physical/ chemical	**2**		**Polychaetes and bivalves community complex:** The probability of polychaetes and bivalves community complex and their habitat (sandy) being altered due to harvest activities in Clew Bay is relatively low given that: (a) sandy mud areas containing this community exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested and (b) sandy mud areas are insufficient to support growth of *A. nodosum* and thus, will not be targeted for harvest activities. (c) accessing rocky shorelines that lie beyond sandy mud areas at low tide in particular, is very difficult and would be avoided by harvesters by default. ***Nephtys cirrosa* communities:** The probability of *Nephtys cirrosa* communities and their habitat (clean, fine sand area) being altered due to harvest activities in Clew Bay is relatively low given that: (a) the fine sand areas containing this community exhibit little overlap with the rocky shorelines in which *A. nodosum* will be harvested (b) fine sand areas are insufficient to support growth of *A. nodosum* and thus, will not be targeted for harvest activities. (c) accessing rocky shorelines that lie beyond clean, fine sand areas at low tide in particular, is very difficult and would be avoided by harvesters by default. ***Tubificoides benedii* & *Pygospio elegans:*** The probability of *Tubificoides benedii* & *Pygospio elegans* species and their habitat (intertidal sandy mud) being altered due to harvest activities in Clew Bay is relatively low given that: (a) *A. nodosum* does not grow on intertidal sandy mud substrate, and therefore will not be subjected to harvest activities. (b) in most areas, intertidal sandy mud areas exhibit little overlap with the rocky shorelines. (c) accessing rocky shorelines that lie beyond intertidal sandy mud areas at low tide in particular, is very difficult and would be avoided by harvesters by default. **Shingle:** • It is unlikely that distribution, abundance, diversity or area of shingle will be altered due to harvesting of *A. nodosum* given that shingle is considered contaminant material and will not be removed during harvest. • It is unlikely that shingle areas will be damaged due to harvesting of *A. nodosum* given that harvesters will be using small boats to land

			on islands and coastal areas. Care will be taken in order to ensure that contact with shingle and reef is minimal, therefore avoiding any damage being inflicted on boats. • It is unlikely that significant levels of disturbance or displacement of shingle will occur. This is due to the fact that the hand harvest methodology involves working at low tide and harvesters have full view of the cutting process, allowing them to take care not to disturb the substrate. **Reef:** • It is unlikely that distribution, abundance, diversity or area of reef will be altered due to harvesting of *A. nodosum.* While *A. nodosum* may be harvested in from rocky shores which contain reef as underlying substrate, the hand harvesting technique used ensures that *A. nodosum* vegetative growth is severed well above the point of contact with reef. Contact with reef would also lead to damage to the harvesters sickle/blade, thus, reef will always be avoided. • It is unlikely that significant levels of disturbance or displacement would occur, to levels which would lead to co-removal of reef with or without holdfast material. This is due to the fact that the hand harvest methodology involves working at low tide and harvesters have full view of the cutting process, allowing them to take care not to disturb the substrate. • It is unlikely that reef will be damaged due to harvesting of *A. nodosum* given that: (a) harvesters will be using small boats to land on islands and coastal areas. Care will be taken in order to ensure that contact with reef is minimal, therefore avoiding any damage being inflicted on boats. (b) The harvest collection boat, if deemed applicable for the area, will be fitted with a depth can device to ensure that contact with the reef is avoided as it will damage both the reef and the boat.
		5	• **EU Dir. 92/43/EEC and NPWS conservation requirements:** The following communities should be maintained in a natural condition: Sandy mud with polychaetes and bivalves community complex; Fine sand dominated by *Nephtys cirrosa* community; Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community complex; shingle and reef (Ref: NPWS, 2011A) • **National assessment:** The national conservation assessment indicates that shallow inlets and bays [1160] in Ireland are classified as ‘unfavourable-bad’ (Scally et al., 2020). The 'area' conservation attribute is classified as ‘favourable’, while ‘structure & functions’ and ‘future prospects’ are considered as ‘unfavourable-bad’ and ‘unfavourable-inadequate’ respectively. • **Clew Bay:** Scally et al., (2020) assessed status of community distribution in Large shallow inlets and bays in Clew Bay. In their study, three community/habitats were assessed: (a) Sandy mud with polychaetes and bivalves community, (b) Fine sand dominated by *Nephtys cirrosa* community and (c) Intertidal sandy mud with *Tubificoides benedii* and *Pygospio elegans* community. Sampling took place in subtidal and intertidal sediment areas and on mudflat/sandflat habitats. Clew Bay was categorized as ‘unfavourable-bad’ for three attributes: ‘structure & functions’ and ‘future prospects’ and ‘overall site assessment’. The unfavourable status of Clew Bay has been attributed to the loss of eelgrass beds, a significant decrease in the abundance of eelgrass shoots within a bed and an increase in negative indicators, e.g. epiphytic algal cover on eelgrass leaves, the presence of opportunistic species and invasive alien species. In terms of ‘area’, Clew Bay SAC is classified as favourable. • **Reef:** The overall conservation status of Reef in Ireland has been assessed as Favourable in terms of Area, Structure and function, future prospects. This includes both inshore and offshore reef areas (Scally et al., 2020).

(j) Potential pressures on the marine environment.

(1) Hydrological

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*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Requirements**
		*P**	*S**	*A/UA*	Q1	Q2	Control Measures? Y / N		
Hydrological pressures/hazards:								The harvest system is designed with sustainability at the forefront and dramatic alterations to biomass levels will not occur. Harvest activities will not reduce height of *A. nodosum* below 200mm (8 inches). See "Code of Practise" for details (Appendix 4).	None specified.
Ocean acidification	No potential effects of *A.nodosum* harvesting.	0	5	A	no	n/a	No		
Sea level rise		0	5	A	no	n/a	No		
Increased UV		0	5	A	no	n/a	No		
Emergence regime changes (tidal level)		0	5	A	no	n/a	No		
Salinity change		0	5	A	no	n/a	No		
Temperature changes		0	5	A	no	n/a	No		
Water flow (tidal current) changes	Over-harvesting.	1	5	A	no	n/a	yes		
Wave exposure changes		1	5	A	no	n/a	yes		
Deoxygenation		1	5	A	no	n/a	yes		

Hazard/ Pressure	**Prob-ability**	**Severity**	**Reason for Decision**
Hydro-logical	**0 to 1**		• Seaweed harvesting is not considered as an activity that gives rise to the following hydrological pressures: ocean acidification, sea level rise, increased UV, emergence regime changes (tidal level), salinity change, temperature changes (ref: Marine Protected Area Advisory Group, 2020 and references therein). • It is highly unlikely that *A. nodosum* harvesting will impact on water flow (tidal current) changes or wave exposure changes. *A. nodosum* is adapted to growing in highly sheltered environs and as such, has difficulty remaining attached to hard substrate in less sheltered waters. Therefore, the potential influence of *A. nodosum* on hydrodynamics, water flow and wave exposure (if any) is likely to be minor. As the harvesting system is designed to ensure that dramatic changes in biomass levels within the intertidal zone will not occur, the likelihood of such effects arising is further reduced. • Dissolved oxygen enters water via two mechanisms: (a) entry directly from the air leading to aeration of water; e.g. either through slow diffusion of air across water surfaces or from quick mixing via wind, waves and other related factors and (b) as a byproduct of photosynthesis. The contribution of seaweed to oxygenation via photosynthesis is relatively minor. In particular, marine macrophytes account for low levels of global net primary production (NPP) of carbon per annum (<1%) compared to other sources, e.g. the combined category of land sources (e.g. land plants, forestry, crops) and marine phytoplankton together account for 99% of global NPP of carbon per annum (Field *et al.*, 1998). NPP is the total amount of carbon fixed in the process of photosynthesis (the conversion of carbon dioxide, water and light energy into glucose and oxygen) by plants in an ecosystem [Gross Primary Production] minus respiration. As hand harvesting of *A. nodosum* (a renewable resource) will be undertaken in a sustainable manner to allow regeneration of the resource, net primary production of carbon and production of oxygen as a by-product of photosynthesis will not be significantly affected.
		5	Alterations to hydrodynamics, water flow (tidal current) changes, wave exposure changes and deoxygenation could potentially have impacts on the Clew Bay Complex and its conservation requirements.

(2) Chemical

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*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Yes / No		
Chemical pressures/hazards:					no	n/a		• BioAtlantis will not harvest in areas near sewage outfalls or other sources of pollution. • The management system requires that over-harvesting does not occur. • Routine maintenance of boat engine, etc. • Harvesters will be provided with training, where necessary, to ensure cleaning takes place in a manner which does not lead to wash off of cleaning agents into the environment, e.g. use of designated washing bays where available. See "Code of Practise" (Appendix 4) for details.	None specified.
Nutrient enrichment	• Harvesting near sewage outfalls. • Over-harvesting.	1	5	A	no	n/a	Yes		
Organic enrichment	• Harvesting near sewage outfalls. • Over-harvesting.	1	5	A	no	n/a	Yes		
Radionuclide contamination	• No potential effects of harvesting.	0	5	A	no	n/a	n/a		
Synthetic compound contamination	• Fuel oil leak from harvest recovery/collection boat caused by engine malfunction, fuel line rupture, etc. • Non-conformance with procedures for storing and cleaning of boat.	1	5	A	no	n/a	Yes		
Non-synthetic compound contamination	• Harvesting near sewage outfalls	1	5	A	no	n/a	Yes		

Hazard/ Pressure	**Probability**	**Severity**	**Reason for Decision**
Chemical	**0-1**		• Seaweed harvesting is not considered an activity that gives rise to radionuclide contamination or synthetic compound contamination (ref: Marine Protected Area Advisory Group, 2020 and references therein). • BioAtlantis Ltd. will manage harvesting in a sustainable manner to ensure that excessive removal of A. nodosum does not occur and is limited to 20% of the total available biomass per site per annum and that *A. nodosum* mortality is mitigated against. This reduces the likelihood of any potential effects occurring in terms of nutrient and organic enrichment and ensures that substantial levels of unharvested *A. nodosum* remain in situ post-harvesting. • It is highly unlikely that *A. nodosum* harvesting will give rise to chemical pressures such as nutrient enrichment, organic enrichment or non-synthetic compounds contamination. In particular, harvest activities will not give rise to significant increases in pollution (see Section A1 above). It has been suggested that seaweeds may reduce the impact of anthropogenic mediated nutrient-enrichment of marine waters and in turn, the

Hazard/ Pressure	Probability	Severity	Reason for Decision
			removal of seaweed could potentially exacerbate the impacts of pollution. However, *A. nodosum* is low in protein content and its capacity absorb nitrogen and nutrients is minimal. Polluted water can also have negative impacts on *A. nodosum* performance, epiphyte infestation, colonisation and competition by green algae. As such, *A. nodosum* is a species that is susceptible to the effects of pollution. The likelihood of exacerbating existing impacts of pollution are also low as hand harvesting in proximity to sewage outfalls, etc, will not occur. • It is highly unlikely that nutrient cycling in marine and coastal areas will be affected by sustainable harvesting, as *A. nodosum* is typically low in nutrient content and has a low capacity to absorb nitrogen. The sustainable nature of the harvesting plan ensures that the likelihood and magnitude of any effects are low. • It is highly unlikely that harvesting of *A. nodosum* will have any impacts on the level of detritus, drift litter, dissolved organic matter (DOM), organic enrichment or secondary production in sandy beach locations or other areas. *A. nodosum* is mainly restricted to sheltered rocky/shingle substratum areas and rarely accumulates at high levels in sandy beach locations or other exposed coastal areas. Furthermore, as the plan requires harvesting to take place on a sustainable basis in terms of the nature, scale, intensity and duration of the activity, the likelihood or magnitude of any effects are low. As the hand harvesting system ensures that over-harvesting does not take place and that *A. nodosum* mortality is mitigated against, the likelihood of over harvesting of *A. nodosum* to levels which significantly reduce total organic drift litter, detritus or organic matter in the Clew Complex, is low. • Contamination with non-synthetic compounds will not occur due to harvesting, as the harvesting plan ensures appropriate removal of any rubbish, debris, waste or other foreign matter when at port.
		5	A high severity rating is assigned, as alterations to water quality due to chemical pressures/hazards could have significant impacts on the SAC in broad terms.

(3) Physical

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Y/N		
Physical pressures/hazards:								As per Sections A (7) and A (8), a system is in place to ensure: • Hand harvest techniques employed along rocky shores and shingle areas will ensure that *A. nodosum* is severed above point of contact with underlying substrate. Sites will be inspected post harvest to check the sustainability of the methods employed and the harvest locations (Site Inspection Form, SIF, Appendix 3). • Levels of disturbance or displacement of substratum that could give rise to presence of reef, shingle, friable substrate and/or associated holdfast material, will be monitored and recorded via 'Goods received Notes' (GRN) and also at production facilities. • Harvesters will employ good boating practices, particularly when landing on shores. • Harvesters will be provided with training, where necessary, to ensure that reef and shingle is not disturbed or displaced. • Levels of disturbance or displacement that could give rise to presence of substratum material in the harvested seaweed, will be monitored and recorded via 'GRN and at production facilities.	None specified.
Habitat structure changes - removal of substratum (extraction)	• Removal of habitat (i.e. reef, Shingle, pebbles and gravel): Potential removal of small quantities of stones, rocks, etc. • Removal with or without holdfast material: Small, stony, friable substrate occurs frequently in Clew Bay. • Disruption or disturbance of reef or shingle: Impact by boats, disturbance or displacement may occur with inappropriate technique, lack of training or oversight.	2	5	A	no	n/a	Yes		
Disturbance of the substrate		2	5	A	no	n/a	Yes		
Physical change to seabed or sediment type	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Physical loss (to land or freshwater habitat)	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Barrier to species movement	• No potential effects of harvesting.	na	5	A	no	n/a	No	Not required as proposal does not include artificial barriers. However, the Code of Practice includes measures to prevent barriers to commuting or connectivity of Annex II species.	
Changes in suspended solids (water clarity)	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	

Hazard (What can go wrong)	Cause (Why did it go wrong?)	Risk assessment P*	S*	A/UA	Decision Tree Q1	Q2	Control Measures? Y/N	Control Measure (What can I do about it?)	Compliance Require-ments
Death or injury by collision	• H&S not adhered to. • Physical contact with or disturbance to Annex II species and Annex I habitats.	1 2	5 5	A A	no no	n/a n/a	Yes Yes	• Ensure that all necessary H&S equipment is maintained. Adherence to H&S practices will be checked by the Resource Manager and noted in the site Inspection Form, if applicable. • Ensure suitable use of bags/nets and implement steps to minimize co-harvesting other species or by-catch of other *Animalia*. • Follow measures to prevent interactions or disturbance with Annex II species in the water (harbour seals and otters). • Ensure adherence to environmentally safe navigation requirements to prevent impacts on Annex I habitats. See Appendix 4 for details.	
Electromagnetic changes	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Light pollution	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Introduction of other substances (solid, liquid or gas)	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Litter	• Debris from the boat may inadvertently be deposited into the environment.	1	3	A	no	n/a	Yes	Appropriate removal of rubbish, debris or other foreign matter when at port.	
Smothering and siltation rate changes	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Noise pollution	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Vibration	• No potential effects of harvesting.	0	5	A	no	n/a	No	N/A	
Visual disturbance	• No potential effects of harvesting.	2	5	A	no	n/a	Yes	See Sections A10, 11, 12, 13, 14 and 19 of this document for measures to prevent disturbance of Annex I species (otter and harbour seals) and birds and Appendix 4 for the associated Code of Practice.	

(4) Biological

KEY: P=Probability. S=Severity. UA=Unacceptable Risk (Risk>15), NIS and mitigation required. A= Risk may be acceptable (Risk<15), NIS may be required.
*probability and severity determined based on risk assessment matrix (Fig. 1) and decision tree (Fig. 2).

Hazard *(What can go wrong)*	**Cause** *(Why did it go wrong?)*	**Risk assessment**			**Decision Tree**			**Control Measure** *(What can I do about it?)*	**Compliance Require-ments**
		P*	***S****	***A/UA***	Q1	Q2	Control Measures? Y/N		
Biological pressures/hazards:								See Section H of this document. See Section E(2)(ii) of this document. See Section C1(a) of this document	None specified.
Genetic modification and translocation of indigenous species.	No potential effects of harvesting.	0	5	A	no	n/a	no		
Introduction of microbial pathogens.	No potential effects of harvesting.	0	5	A	no	n/a	no		
Introduction or spread of invasive non-indigenous species (INIS).	See Section H of this document.	1	5	A	no	n/a	yes		
Removal of non-target species.	See Section E(2)(ii) of this document.	3	3	A	no	n/a	yes		
Removal of target species.	See Section C1(a) of this document	2	5	A	no	n/a	yes		

Hazard/ Pressure	**Probability**	**Severity**	**Reason for Decision**
Biological	**0-3**		Seaweed harvesting is not considered as an activity that gives rise to any of the following: Genetic modification and translocation of indigenous species, introduction of microbial pathogens. (ref: Marine Protected Area Advisory Group, 2020). The likelihood of occurrence of the other biological pressures listed above are relatively low (see Sections H, E(2)(ii) and C1(a) of this document for details).
		3-5	Medium to high severity scores are assigned, as biological pressures may have the potential to significantly impact on the SAC in broad terms. See Sections H, E(2)(ii) and C1(a) of this document for details.

(5) Other Marine-related Activities

See Section 3(c) of Appendix 7.

ADDENDUM 6 BIOATLANTIS COMPLIANCE AND RECORD FORMS FOR CLEW BAY

License Application for Sustainable hand-harvesting of *Ascophyllum nodosum* at Clew Bay (SAC Site Code 1482). In accordance with National Parks & Wildlife Service conservation objectives for marine and coastal habitats and species and the EU Habitats Directive 92/43/EEC.

Appendix 3:
Compliance & Record forms.

Prepared by: BioAtlantis Ltd.
Date of submission: 20/01/2014
Date of revision: 21/02/2024

[redacted]

Contents

Document No. GRN/14/001

Goods Received Note (GRN)

GRN No. :

Date: ______________________

Harvested By: ____

____

____

____

Site Code	Time of Collection	Tidal conditions at time of collection	Bag tag No.	Weight (Kg)	Batch Code No.	Inspection Check Pass (Y/N)

Quality Check

Is seaweed free of the following:	**Yes**	**No**
Excessive levels of sand, shingle, gravel, pebbles, stones or debris	☐	☐
A. nodosum holdfasts	☐	☐
Other species (e.g. Fucus, ≤5% max.)	☐	☐

In the event of failure of quality check:

a) Non-conformance is reported to: ______________________

b) Management decide the appropriate action depending on the severity of the non-conformance.

Comments:____

____

____

Comments/Incidents:

____

____

____

____

Goods Received By: ____________________________ **Checked By:** ________________________________

Please attach delivery docket and send to main office

OFFICE USE ONLY

Payment approved: Yes ☐ No ☐ Payment date & Ref. no.: ________________

[redacted]

Document No: SIF/001

BioAtlantis

Site Inspection Form (SIF)

Form No. : ___________

Site Code	Date	Time	Inspection Check	
			Pass (Y/N)	Provide details in event of failure

Inspection Check

Have harvesters worked to ensure:

	Yes	No
• Cutting of *A. nodosum* >200mm above holdfast	☐	☐
• ≤ 20% of the total available biomass is harvested	☐	☐
• Activities only take place at approved sites	☐	☐
• Health and safety requirements are adhered to (Applicable if harvesters are present during inspection)	☐	☐

In the event of failure of inspection check:

a) Non-conformance is reported to:

____

b) Management decide the appropriate action depending on the severity of the non-conformance.

Comments:___________________________________

____

____

____

____

Other comments/incidents:

____

____

____

____

Assessor/inspector signature: ______________________________ **Date:** __________________________

[redacted]

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Non-Conformance Report (NCR) Form (G012)

Date: ____________________

Time of incident: ____________________

Time incident reported: ____________________

Reported by: ______________________________________

Description of Incident: ____

Cause of Incident: ____

____

____

____

Corrective Action? ____

____

Preventative Action? ____

____

Reported By: ______________________________ Date: ______________

Incident Complete: ______________________________ Date: ______________

Resource Manager: ______________________________ Date: ______________

[redacted]

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Incident Report Form (IRF, G008)

Date: ___________________

Time of incident: ___________________

Time incident reported: ___________________

Reported by: _____________________________________

Description of Incident: ____

Cause of Incident: ____

____

____

____

Corrective Action? ____

____

Preventative Action? ____

____

Reported By: _____________________________ Date: ______________

Incident Complete: _____________________________ Date: ______________

Resource Manager: _____________________________ Date: ______________

[redacted]

ADDENDUM 7 BIOATLANTIS AUDIT FORMS FOR CLEW BAY

License Application for Sustainable hand-harvesting of *Ascophyllum nodosum* at Clew Bay (SAC Site Code 1482). In accordance with National Parks & Wildlife Service conservation objectives for marine and coastal habitats and species, and the EU Habitats Directive 92/43/EEC.

Appendix 8:
Audit forms for Clew Bay.

Prepared by: BioAtlantis Ltd.
Date of submission: 04/11/2014
Date of Revision: 21/02/2024

[redacted]

Table of Contents

Quarterly Audit Part A: Records, Forms & Documents

Audit number and Date: (e.g. 1st Quarter)		**Note: For documents to be up-to-date, they must (a) be appropriately revised, (b) be present in both electronic & paper format, (c) be completed correctly and in full.**
Audit performed by:		
Time-frame assessed:		Yes, Y; No, N; not determined, ND; not applicable, NA.

Document Records	Electronic Records	---					
	Hard Copy	---			Follow-up section		
Document type/subset	**Documents up-to-date (Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Are corrective actions closed out?**		
1. Forms: receipt of training & verification of understanding					**Explanation**	**Y/N**	**Date**
Training/Teaching Material: SAC requirements, sustainable hand harvesting methods, the Code of Practice, H&S, communicating with BioAtlantis, etc.							
Forms: cert of attendance at training (sustainable harvesting methods; health & safety, other requirements, etc)							
Verification Forms: Verifying harvester's understanding of training and requirements for protecting the SAC.							
2. Completed Training Certs (obtained through training above.)	**Documents up-to-date (Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Explanation**	**Y/N**	**Date**
Training Certs							
Safety Certs							
Verification of training and understanding of requirements for working in SAC.							

3. Records, forms & documents	Documents up-to-date (Y/N?)	Description / Corrective Action	Responsibility	Due Date	Explanation	Y/N	Date
Codes of Practice							
Standard Operating Procedures (SOPS)							
Goods Received Notes (Clew Bay & Tralee), Site Inspection Forms, Incident Reports forms, Non-conformance reports.							
Log of additional compliance measures (Painting of boats, cleaning of nets/bags).							
Have nets/bags been cleaned in production facilities and returned clean to harvesters (see production log sheets).							
If YES to all of the above, Documentation is up-to-date			QC				
If NO to any of the above, system is not up-to-date and must be amended immediately			QC				

Quarterly Audit Part B: Quality Assessment (Documentation)

Audit number and Date:		**Note: For documents to be up-to-date, they must (a) be appropriately revised, (b) be present in both electronic & paper format, (c) be completed correctly and in full.**
Audit performed by:		
Time-frame assessed:		Yes, Y; No, N; Not determined, ND; Not applicable; NA.

Question	**(Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	Follow-up section: **Are corrective actions closed out?**		
Step 1. GRNs and Site Inspection Forms; SIFs (Clew Bay)					**Explanation**	**Y/N**	**Date**
Have all GRNs and Site Inspection Forms been completed since last audit?							
Have GRNs and SIFs been completed in full, i.e. Net/Bag tag No., Weight of harvest, Batch Code, etc.							
Have all inspection checks been completed?							
On failure of quality check, non-conformance was reported?							
On failure of quality check, have Management decided the appropriate action?							
Excessive levels of sand, shingle, gravel, pebbles, stones, debris contamination is absent?							
Holdfast contamination is absent?							
Fucus contamination does not exceed 5%?							
Cutting of *A. nodosum* is >200mm above holdfast ?							

Has no more than 20% of the available biomass been harvested?							
Have activities only take place at approved sites (cross-check with schedule and sensitive site list)?							
Have health & safety requirements are adhered to?							
If YES to all of the above, control measures are effective.							
If NO to any of the above, then control measures are deemed ineffective.							
If ineffective, corrective actions have been taken.							
Corrective actions, if ineffective, have been documented.							
Introduction of further corrective actions, if any, have been documented.							
Step 2. Production Logsheets (Production Facilities)	**(Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Explanation**	**Y/N**	**Date**
Have all Production Logsheets been completed since last audit?							
Have Production Logsheets been completed in full?							
Have all inspection checks been completed?							
On failure of quality check, the non-conformance was reported.							
On failure of quality check, have Management decided the appropriate action.							
All GRNs are signed by production staff							
There is no evidence of excessive levels of sand, shingle, gravel, pebbles,							

stones, debris?							
Holdfast contamination is absent?							
Fucus contamination is at ≤5%?							
Have nets/bags been cleaned in Production Facilities and returned clean to harvesters (see production log sheets).							
If YES to all of the above, control measures are effective.							
If NO to any of the above, then control measures are deemed ineffective.							
If ineffective, corrective actions have been taken.							
Corrective actions, if ineffective, have been documented.							
Introduction of further corrective actions, if any, have been documented.							
Step 3. Incident Reports	**(Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Explanation**	**Y/N**	**Date**
Have all Incident Reports been accounted for (numerical sequence)?							
Has the cause of the incident been established?							
Have all corrective or preventative actions been completed?							
Step 4. Non-conformance Reports	**(Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Explanation**	**Y/N**	**Date**
Have non-conformances reports (if any) been completed in full?							
Has the cause of the NCR been established?							

Have all corrective or preventative actions been completed?							
Step 5. Software Systems	**(Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Explanation**	**Y/N**	**Date**
Is harvesting database up-to-date?							
Is harvesting schedule up-to-date?							
Is hand harvesting taking place according to the schedule?							
Does software pass all checks (i.e. no errors)?							
If YES to all of the above, the system has passed compliance checks.							
If NO to any of the above, system has failed compliance checks and urgent corrective actions are required.							

Annual Audit: Quality Assessment (on-site)

Audit number and Date:		
Audit performed by:		
Time-frame assessed:		Yes, Y; No, N; Not determined, ND; Not applicable; NA.

					Follow-up section		
Question	**(Y/N?)**	**Description / Corrective Action**	**Responsibility**	**Due Date**	**Are corrective actions closed out?**		
Step 1. Site Quality (inspection of harvested sites)					**Explanation**	**Y/N**	**Date**
Has hand harvesting taken place according to the schedule?							
Has seaweed at the sites been cut 200-300mm above the holdfast?							
Has harvesting been limited to no more than 20% of the available biomass?							
There is no evidence of disturbance or damage to reef or shingle?							
If YES to all of the above, control measures are effective.							
If NO to any of the above, then control measures are deemed ineffective.							
If ineffective, corrective actions have been taken.							
Corrective actions, if ineffective, have been documented.							
Introduction of further corrective actions, if any, have been documented.							

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Step 2. Harvest methods (inspection of techniques)					Explanation	Y/N	Date
Are harvester blades and equipment sharp enough and fit-for-purpose?							
Are harvesters working on approved sites, according to schedule?							
Are harvesters cutting of *A. nodosum* is >200mm above holdfast ?							
Is harvesting being limited to no more than 20% of the available biomass?							
Holdfast contamination is absent?							
Fucus contamination does not exceed 5%?							
Is harvested seaweed free of shingle, stone, etc.?							
Are harvesters using clean, approved nets/bags of appropriate size?							
Are harvesters actively avoiding fronds with high levels of periwinkle egg masses?							
Are harvesters actively avoiding by-catch during harvesting?							
Is by-catch being returned to the water where possible?							
Are health & safety requirements being adhered to?							
Are there a maximum of 3 harvesters per site?							
If YES to all of the above, control measures are effective.							
If NO to any of the above, then control measures are deemed ineffective.							
If ineffective, corrective actions have been taken.							
Corrective actions, if ineffective, have been documented.							
Introduction of further corrective actions, if any, have been documented.							

Step 3.Boats	(Y/N?)	Description / Corrective Action	Responsibility	Due Date	Explanation	Y/N	Date
Is collection boat (if applicable to the area) travelling according to schedule and within the bay?							
Are calibration and maintenance schedules in place?							
Are calibration and maintenance logs up-to-date?							
Does the Resource Manager have access to Incident Reports, Site Inspection Forms & GRN forms?							
Are communication systems in working order?							
Are health & safety requirements being adhered to?							
Has collection boat (if applicable to the area) been painted with anti-fouling agents this year?							
Have harvester boats been painted with anti-fouling agents this year?							
If YES to all of the above, control measures are effective.							
If NO to any of the above, then control measures are deemed ineffective.							
If ineffective, corrective actions have been taken.							
Corrective actions, if ineffective, have been documented.							
Introduction of further corrective actions, if any, have been documented.							