License Application for sustainable hand-harvesting of *Ascophyllum nodosum* in Kenmare Bay.

Appendix 10:

Assessment of fish, crustaceans and shellfish of commercial relevance in Kenmare Bay.

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Date of revision: 29/07/2025

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1. Introduction:

The aim of this assessment was to identify any potential effects of *A. nodosum* harvesting on fish, crustaceans and shellfish species of commercial relevance in Kenmare Bay. Data was obtained from the peer reviewed scientific literature and other recognised sources including a range of international databases, reports and documents commissioned by government agencies. The assessment focused primarily on peer reviewed scientific papers which address the distribution, spawning, nursery and feeding requirements of fish, crustaceans and shellfish. The study focused on species of fish and crustaceans/shellfish which are of most commercial relevance in Ireland (top 17 and top 6 respectively):

Fish

- Anglerfish/ monkfish *(Lophius piscatorus)*
- Atlantic herring *(Clupea harengus)*
- Black-bellied anglerfish *(Lophius budegassa)*
- Black Sole *(Solea solea)*
- Blue Whiting *(Micromesistius poutassou)*
- Boarfish nei (e.g. *Capros aper)*
- Cod Atlantic *(Gadus morhua)*
- Haddock *(Melanogrammus aeglefinus)*
- Hake European *(Merluccius merluccius)*
- Horse Mackerel nei *(Trachurus trachurus)*
- Mackerel Atlantic *(Scomber scombrus)*
- Megrim *(Lepidorhombus whiffiagonis)*
- Plaice *(Pleuronectes platessa)*
- Pollack *(Pollachius pollachius)*
- Sprat European *(Sprattus sprattus)*
- Tuna Albacore *(Thunnus alalunga)*
- Whiting *(Merlangius merlangus)*

Crustaceans and shellfish

- Nephrops/ Norwegian Lobster/ Dublin Bay prawn *(Nephrops norvegicus)*
- Edible Crab/brown crab (*Cancer Pagurus)*
- Great Atlantic Scallop *(Pecten maximus)*
- European Lobster *(Homarus gammarus)*
- Common Shrimp *(Crangon crangon)*
- Common prawn (a type of shrimp; *Palaemon serratus*)

The results of the impact assessment are provided in Tables 1 and 2 below. In addition to this document, Appendix 7 provides an assessment of sites of relevance for angling, fishing and charter boat activities in Kenmare Bay. No significant impacts on sites of interest have been identified.

2. Results:

(a) Overview:

(i) Fish of commercial relevance

- Fish of commercial relevance are not reliant on *A. nodosum* for spawning, nursery or feeding functions.
- Spawning mainly occurs in non-intertidal and non-*A. nodosum* areas.
- Nursery grounds are mainly located in non- *A. nodosum* areas.
- Feeding grounds are mainly located in non- *A. nodosum* areas.
- Commercially relevant fish primarily occur outside the *A. nodosum* zone and will not be affected by hand harvesting. A large proportion of these species occur offshore in deeper waters.

(ii) Crustaceans and shellfish of commercial relevance:

- Crustaceans of commercial relevance are not dependent on *A. nodosum* for nursery, spawning and feeding functions:
- Crustaceans mainly spawn in areas where *A. nodosum* does not grow.
- Crustaceans utilize a broad range of habitats including soft bottom areas, rocky shores, crevice & cobble substratum as nurseries.
- Crustaceans mainly feed in a broad range of areas including soft bottom and rocky shore areas.
- Shellfish of commercial relevance utilize non-*A. nodosum* areas as nursery, spawning and feeding grounds.
- Shellfish mainly utilize soft bottom substrate, where *A. nodosum* does not grow.

(b) Detailed results:

Table 1: Top 16 commercially relevant fish species

No	Species	Impact
1	**Albacore Tuna** *(Thunnus alalunga)*	**No Impact:** • **Distribution:** Found from shallow areas to over 600m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. Albacore spawn in deep waters. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Juveniles can feed at a range of depths up to ~200m • **Food source:** Not dependent on the *A. nodosum* zone.
2	**Anglerfish/ monkfish** *(Lophius piscatorius)*	**No Impact:** • **Distribution:** Found between 20-1000m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Nursery grounds are located along the outer reach of Kenmare Bay and extend into deeper waters. Juveniles occur in subtidal shallow (<30m) and deep water (>30m) areas. • **Food source:** Feeds on fish and birds.
3	**Atlantic Cod** *(Gadus morhua)*	**No impact:** **Distribution:** Found from the shoreline down to depths of 600m. **Spawning Area:** Spawning is pelagic and takes place offshore. The spawning areas of cod are not located in Kenmare. **Nursery Area:** ➢ The main nursery areas in Ireland are in southeastern and northeast regions. ➢ Nursery area are broad and includes gravel, pebbles, cobble, maerl, seagrass beds and rocky shores. ➢ Juvenile cod are most abundant in shallow, sheltered areas where the seabed is composed of gravel and pebbles that contain maerl. ➢ Juvenile cod show preference and occur at higher levels in gravel/pebble areas with maerl compared to boulder/cobble substrate containing algae. **Food source:** Juvenile cod feed on plankton which is not restricted to the intertidal zone.
4	**Atlantic herring** *(Clupea harengus)*	**No Impact:** • **Distribution:** Found from shallow areas to over 200m. • **Spawning Area:** ➢ Spawning areas for herring have little overlap with the intertidal *A. nodosum* zone. ➢ Spawning mainly requires substrate unsuited to *A. nodosum* growth, such as sand and gravel. ➢ Herring may spawn in a wide range of such as gravel, sand, broken rock, stones, broken, macroalgae, maerl, mussel beds, shell, flat rock, seagrass and rocky shore areas. • **Nursery Area:** The nursery area is shallow open waters, and is not restricted to the intertidal zone. Juveniles can occur at depths of 10 – 450m. • **Food source:** Not dependent on the intertidal zone. Herring feed on crustaceans which are present in a range of habitats. Juvenile herring feed on plankton which is not restricted to the intertidal zone.
5	**Atlantic Mackerel** *(Scomber scombrus)*	**No Impact:** • **Distribution:** Deep water fish ranging from shallow water to ~1000m • **Spawning Areas:** *A. nodosum* is not a spawning ground. Eggs are pelagic (i.e. float freely in the water column). • **Nursery Areas:** *A. nodosum* is not a nursery ground. Nursery is shallow open water. • **Food source:** *A. nodosum* is not a feeding ground. Mackerel have a varied diet and do not feed exclusively in intertidal areas.
6	**Black-bellied angler fish** *(Lophius budegassa)*	**No Impact:** • **Distribution:** Deep water fish ranging from shallow waters to 650 m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Nursery grounds are located in deeper waters beyond Kenmare River SAC. Juveniles occur in subtidal waters (>30m) with subtidal soft bottom and gravel coarse bottom. • **Food source:** *A. nodosum* is not a feeding ground. Black-bellied angler fish have a varied diet.
7	**Black Sole** *(Solea solea)*	**No Impact:** • **Distribution:** Found at depths of <60m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. Spawns in shallow open waters. Eggs are associated with sediment containing gravel.

No	Species	Impact
		• **Nursery Areas:** *A. nodosum* is not a nursery ground. The nursery ground is intertidal soft bottom substratum. • **Food source:** Wide and varied diet.
8	**Blue Whiting** *(Micromesistius poutassou)*	**No impact:** • **Distribution:** Found between 150-1000m. • **Spawning Area:** *A. nodosum* is not a spawning ground. Spawning areas are not located in Kenmare Bay. Spawning occurs at depths of 180m to 360m. • **Nursery Area:** *A. nodosum* is not a nursery ground. The blue whiting nursery areas are not located in Kenmare Bay. • **Food source:** Diet is varied and includes species in deep waters beyond the intertidal zone.
9	**Boarfish nei** (e.g. *Capros aper)*	**No impact:** • **Distribution:** Found between 100-300m. • **Spawning Area:** The boarfish spawning areas are not located in Kenmare Bay. • **Nursery Area:** The boarfish nursery areas are not located in Kenmare Bay. • **Food source:** Boarfish feed on plankton which is not restricted to the *A. nodosum* zone.
10	**European Hake** *(Merluccius merluccius)*	**No impact:** • **Distribution:** Found between 75-400m. • **Spawning Area:** *A. nodosum* is not a spawning ground. Spawning areas of European hake are not located in Kenmare Bay. • **Nursery Area:** *A. nodosum* is not a nursery ground. • **Food source:** *A. nodosum* is not a feeding ground.
11	**European Sprat** *(Sprattus sprattus)*	**No Impact:** • **Distribution:** Found from shallow areas to over 150m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. Sprat spawn near to the coast or up to 100 km out to sea. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Nursery ground includes: Intertidal soft bottom such as mud and sand flats. • **Food source:** Not dependent on the intertidal zone.
12	**Haddock** *(Melanogrammus aeglefinus)*	**No impact:** • **Distribution:** Found at depths ranging from 10m to 450 m. • **Spawning Area:** *A. nodosum* is not a spawning ground. The spawning areas for haddock are not located in Kenmare Bay. Haddock remains in deep water to spawn, usually in depths of 75-200m. • **Nursery Area**: The nursery areas for haddock are not located in Kenmare Bay. Juvenile haddock occupy sand and mud areas. • **Food source:** *A. nodosum* is not a feeding area.
13	**Horse Mackerel nei** *(Trachurus trachurus)*	**No Impact:** • **Distribution:** Found from shallow water areas to over 200m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. Spawning area is not located in Kenmare Bay, and is located off the coast. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Nurseries are observed to be widespread around Ireland and not localised to Kenmare Bay. • **Food source:** *A. nodosum* is not a feeding ground. Mackerel have a varied diet and do not feed exclusively in *A. nodosum* areas.
14	**Megrim** *(Lepidorhombus whiffiagonis)*	**No Impact:** • **Distribution:** Found between 100-700m. • **Spawning Areas:** *A. nodosum* is not a spawning ground. • **Nursery Areas:** *A. nodosum* is not a nursery ground. • **Food source:** Megrim occupies deep waters.
15	**Plaice** *(Pleuronectes platessa)*	**No Impact.** • **Spawning Areas:** *A. nodosum* is not a spawning ground**.** Eggs are pelagic. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Nursery is soft intertidal and subtidal areas and saltmarsh habitat. • **Food source:** Feeds in non *A. nodosum* areas such as subtidal mud, sand, and mixed sediment habitats.
16	**Pollack** *(Pollachius polachuis)*	**No Impact:** • **Distribution:** Found at >100 meters depth, either solitary or in small shoals. It is both an offshore pelagic or coastal benthic species found on the sea bed around rocks, wrecks and macroalgae**.** • **Spawning Areas:** *A. nodosum* is not a spawning ground. It spawns at ~100m depth. • **Nursery Areas:** The nursery grounds are broad and includes subtidal soft bottom, estuarine, seagrass areas, rock areas and macroalgae. • **Food source:** Juvenile diet includes crab, which are present in a range of non-*A. nodosum* habitats.

No	Species	Impact
17	**Whiting** *(Merlangius merlangus)*	**No impact.** • **Distribution:** 0-100m • **Spawning Areas:** *A. nodosum* is not a spawning ground. • **Nursery Areas**: The nursery ground is broad and preference is shown for sand and mud substratum. Larvae are observed offshore. • **Food source:** Whiting has a wide distribution including deep waters of >30m. Whiting is usually found near mud and gravel bottoms, but also above sand and rock. Juveniles mainly occupy deeper sand and mud areas.

Table 2: Top 6 commercially relevant species of crustaceans & shellfish.

No	Species	Impact
1	**Nephrops/ Norwegian Lobster/ Dublin Bay prawn** *(Nephrops norvegicus)*	**No Impact** • **Distribution:** found between 15 -800m in depth. • **Spawning Areas:** *A. nodosum* is not a spawning ground. The spawning ground is the muddy seabed. • **Nursery Areas:** *A. nodosum* is not a nursery ground. The nursery ground is the muddy seabed. • **Food source:** Norwegian Lobster has a varied diet and feed in the muddy seabed area, outside the *A. nodosum* zone.
2	**Edible Crab/brown crab** *(Cancer Pagurus)*	**No impact** • **Distribution:** found between 8-80m in depth. • **Spawning Area:** *A. nodosum* is not required as a spawning habitat. Females are ovigerous and larvae are released in the plankton in shallow and deepwater areas. • **Nursery Area:** The nursery habitat is broad and includes intertidal soft bottom areas and rocky shores. • **Food source:** Edible crab feed in a range of non-*A. nodosum* habitats, including subtidal, soft bottom areas.
3	**Great Atlantic Scallop** *(Pecten maximus)*	**No Impact** • **Distribution:** found between 10-110m in depth. Their habitat preference is soft bottom areas (coarse clean sand, fine clean sand, gravel/shingle, muddy sand). • **Spawning Areas:** *A. nodosum* is not a spawning ground. • **Nursery Areas:** *A. nodosum* is not a nursery ground. • **Food source:** They filter feed in subtidal soft bottom areas. Not dependent on the intertidal zone.
4	**European Lobster** *(Homarus gammarus)*	**No Impact:** • **Spawning Areas:** *A. nodosum* is not a spawning ground. The spawning ground is shallow open water. • **Nursery Areas:** Their nursery ground is broad and includes subtidal soft bottom areas and the rocky shores. Also occupy areas with crevice and cobble substratum. • **Food source:** Lobster feed in a range of habitats including subtidal soft bottom areas and the rocky shore.
5	**Common Shrimp** *(Crangon crangon)*	**No Impact:** • **Spawning Areas:** *A. nodosum* is not a spawning ground**.** Requires shallow open water. • **Nursery Areas:** *A. nodosum* is not a nursery ground. Requires seagrass, Intertidal soft bottom and saltmarsh. • **Food source:** Not dependent on the *A. nodosum* zone. Requires intertidal soft bottom, subtidal soft bottom, shallow open water and seagrass areas.
6	**Common prawn** (a type of shrimp; *Palaemon serratus*)	**No Impact:** • **Spawning Areas:** *A. nodosum* is not a spawning ground**.** Females are ovigerous and release planktonic larvae. • **Nursery Areas:** Varied and includes a range of habitats including intertidal soft bottom, subtidal soft bottom, macroalgae and seagrass. • **Food source:** They feed in intertidal soft mud areas and potentially other habitats. Their diet is varied and they are not reliant on *A. nodosum* as a feeding ground.

3. Mitigation Measures:

None of the species listed above are dependent on *A. nodosum* for fulfilment of life cycle functions. Nevertheless, steps must be taken to ensure that excess removal of *A. nodosum* due to overharvesting of resources does not occur. This ensures that any potential effects on species in the intertidal zone are avoided. 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, which in turn, prevents any potential negative effects on species that may reside in the intertidal zone.