



4th National Biodiversity Action Plan

The benthic habitats within the proposed MUL area predominantly comprise rocky intertidal zones interspersed with patches of shallow sublittoral rock, sand, and biogenic reef habitats that support diverse epibenthic communities. These habitats, characteristic of sheltered and semi-exposed coastal areas in the western seaboard of Ireland, provide a unique and varied ecological substrate. The nature of Arramara Teo's seaweed harvesting activities, which focus on sustainable practices and avoid disturbances to sensitive habitats, is designed to limit impacts on these critical benthic ecosystems.

The harvest of *Ascophyllum nodosum* has been extensively examined in Canada, the United States, and across Europe, with Nova Scotia having a significant history of research over the last 80 years. It is well established that *Ascophyllum nodosum* beds recover swiftly after harvest (Ugarte et al., 2006; Johnston et al., 2023). Long-term investigations have found no effect of the harvest on the biomass and structure of *Ascophyllum nodosum*, even after 20 years of uninterrupted commercial harvesting (Lauzon-Guay et al., 2021, 2023). Given the quick recovery and the absence of long-term alterations in the structure or biomass of *Ascophyllum nodosum*, impacts on associated communities are highly unlikely. Short-term assessments examining the effects of the harvest on ichthyoplankton (Van Guelpen and Pohle, 2014) or invertebrates (Fegley, 2001; Hamilton and Nudds, 2003; Trott and Larsen, 2012; Phillippi et al., 2014) have found either no or only brief impacts from the harvest. In a review for the Maine Department of Marine Resources' Rockweed Working Group, Beal (2015) concluded that "any adverse effects on habitat and invertebrate densities due to rockweed removal are short-lived or not statistically significant" and that, based on the available data, "there is no reason to adopt a precautionary approach." As shown above, and based on all available research, the proposed harvest and management of *Ascophyllum nodosum* in Ireland is sustainable and serves as a model for sustainable management used by other regions.

Seabirds

Arramara Teo's harvesting operations, limited to marine environments, do not interact with terrestrial ecosystems. Seabird species that have the potential to breed in the area, such as Fulmar (*Fulmarus glacialis*) [A009], Gannet (*Morus bassanus*) [A016], Guillemot (*Uria aalge*) [A199], Kittiwake (*Rissa tridactyla*) [A188], Leach's Storm-Petrel (*Hydrobates leucorhous*) [A207], Manx Shearwater (*Puffinus puffinus*) [A009], Puffin (*Fratercula arctica*) [A013], Razorbill (*Alca torda*) [A016], and Storm Petrel (*Hydrobates pelagicus*) [A009], rely on nearby cliffs and offshore islands for nesting and foraging. Given these locations, they remain unaffected by the intertidal harvesting activities.

Seabird species that frequently or intermittently forage in rocky intertidal zones include Black-headed Gull (*Chroicocephalus ridibundus*) [A179], Common Gull (*Larus canus*) [A182], Cormorant (*Phalacrocorax carbo*) [A017], Herring Gull (*Larus argentatus*) [A184], Lesser Black-backed Gull (*Larus fuscus*) [A183], Shag (*Gulosus aristotelis*) [A017], Arctic Tern (*Sterna paradisaea*) [A194],



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Common Tern (*Sterna hirundo*) [A193], Little Tern (*Sternula albifrons*) [A195], Roseate Tern (*Sterna dougallii*) [A193], and Sandwich Tern (*Thalasseus sandvicensis*) [A191]. See accompanying SISAA Reports for additional information.

Mitigation Measures:

Seasonal Awareness: Harvesting plans consider sensitive seasons (e.g. seabird breeding) to avoid disturbances, particularly in intertidal zones with known foraging activity.

Operational Limitations: Continued use of Arramara Teos small, quiet, and infrequent motorised boats limits both underwater noise and physical disturbance, preserving habitat integrity for benthic, avian, and marine mammal species.

Other Waterbirds and Waders

Bird species that utilise the rocky intertidal habitats along Ireland's western seaboard encompass various foragers, divers, and waders, each with unique habitat preferences and feeding behaviours. Notably, shallow-diving birds such as the Sandwich Tern (*Sterna sandvicensis*), Red-throated Diver (*Gavia stellata*), and Slavonian Grebe (*Podiceps auritus*) feed in the intertidal zone primarily when areas are submerged. Harvesting operations will be scheduled to avoid these times, ensuring minimal overlap with their feeding activities. Further detailed information on shorebirds throughout the proposed MUL is found in the SISAA.

Sandwich Terns (*Thalasseus sandvicensis*) typically nest in colonies on coastal ground areas like shingle spits, dunes, and islands, usually above the high-water mark, keeping their breeding habitats safely outside harvesting zones (Raynor et al., 2012, Valle & Scarton, 2023).

Species like the Great Northern Diver (*Gavia immer*), Red-breasted Merganser (*Mergus serrator*), and Common Scoter (*Melanitta nigra*), which are deeper divers, do not utilise the rocky intertidal zone for feeding (Jarrett et al., 2021). Their diets involve diving to greater depths, meaning Arramara Teo's harvesting activities in the intertidal zone will not interfere with their feeding or nesting habits. Red-breasted Mergansers, for example, breed on inland lakes and rivers, while the Common Scoter's small breeding population is primarily restricted to large inland lakes in the west (Heffernan & Hunt, 2022), both far removed from the coastal intertidal harvesting areas.

Certain intertidal feeders like the Light-bellied Brent Goose (*Branta bernicla hrota*), Ringed Plover (*Charadrius hiaticula*), Sanderling (*Calidris alba*), Bar-tailed Godwit (*Limosa lapponica*), Curlew (*Numenius arquata*), and Dunlin (*Calidris alpina schinzii*) are more likely to be affected by harvesting activity. However, the potential disturbance to these species is minimal, as birds within approximately 50 meters of harvesters will simply move to nearby shore sections. Harvesting activities are highly localised and cover only small shoreline sections at a time, minimising disruptions.

Breeding habitats for these intertidal-feeding birds typically lie away from the coast. For instance, Ringed Plovers prefer nesting on beaches above the high-tide line or in wetlands, while Dunlins



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favour coastal wetlands, bogs, and wet grasslands (O'Hara & Carr, 2017, Conway et al., 2019). Even when breeding sites are coastal, such as Ringed Plovers on shingle and sandy beaches or Curlews in bogs and wet grasslands, these locations remain sufficiently distant from the rocky intertidal to prevent disturbance from harvesting. Furthermore, while Red-Breasted Mergansers may nest in coastal lagoons or vegetated areas, they do not nest within the intertidal harvesting zones.

Mitigation measures have been identified to further protect bird species within sensitive areas. Although seaweed harvesting is not expected to impact bird species significantly, the following measures will be implemented to mitigate any potential disturbance:

Mitigation Measures:

Seasonal and tidal timing of harvest activities: Scheduling harvesting operations to avoid peak feeding times of shallow-diving species.

Marine Mammals

Marine mammals, including Bottlenose Dolphins (*Tursiops truncatus*) [1349], Common Porpoises (*Phocoena phocoena*) [1351], Grey Seals (*Halichoerus grypus*) [1364], Otter (*Lutra lutra*) [1355], and Common Seals (*Phoca vitulina*) [1365], may be observed within Inner Galway Bay South (SACs in the vicinity of the MUL designated to protect marine mammal species are found in the accompanying SISAA Report). Although the operational presence of harvesting vessels can potentially induce transient disturbances to these cetaceans, mustelids and pinnipeds, the seaweed harvesting boats operated by Arramara Teo mitigate such impacts. These vessels are characterised by their small size and quiet operation, remaining idle during harvesting activities and only utilising their small motors during transit. This operational strategy significantly reduces acoustic noise and minimises behavioural disruptions. Furthermore, adherence to area-based management protocols ensures that harvesting activities are conducted in a manner that preserves the ecological integrity of marine mammal populations. Consequently, the likelihood of significant disturbances to these marine mammals is substantially reduced, maintaining the resilience and stability of their populations within the MUL marine ecosystems.

There is expected to be no disturbance to marine mammals from traditional hand harvesting of seaweed.

Mitigation Measures:

Buffer Zones: Establish a 200m buffer around known seal haul-out sites to minimise any potential disturbance from vessel operations.

Restricted Motor Use: Boat motors are operated only during transit to and from harvest sites, reducing acoustic impacts in ecologically sensitive zones.



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Nursery/Spawning Fish

The west coast of Ireland supports a range of fish nurseries for Black-bellied Monkfish (*Lophius budegassa*), Blue whiting (*Micromesistius poutassou*), Herring (*Clupea harengus*), Haddock (*Melanogrammus aeglefinus*), Mackerel (*Scomber scombrus*), Cod (*Gadus morhua*), white-bellied anglerfish (*Lophius piscatorius*), Hake (*Merluccius merluccius*), Megrim (*Lepidorhombus whiffiagonis*), Whiting (*Merlangius merlangus*) and Horse mackerel (*Trachurus trachurus*).

Nursery grounds for species such as Black-bellied Monkfish, Blue whiting, Haddock, Hake, and Megrim are distant from the MUL area and unaffected by seaweed harvesting activities. Moreover, nursery grounds for species closer to the MUL area, including Herring, Mackerel, Cod, White-bellied Anglerfish, Whiting, and Horse mackerel, span extensive stretches along Ireland's western coastline. The limited geographical footprint and low-intensity nature of harvesting in the intertidal zone ensure that migration patterns and population health remain unaffected.

Additionally, important offshore spawning grounds for Herring, Haddock, Megrim, Hake, Mackerel, Cod, Horse mackerel, and Blue whiting are distant from the harvesting area and thus remain unaffected. Species with spawning grounds that may overlap the MUL area, such as Whiting, inhabit extensive portions of the Irish coast and are resilient to the low-impact intertidal harvesting of seaweed (see Figures 1 to 11).

The infrequent, localised nature of harvesting, in conjunction with the expansive distribution of nursery and spawning habitats, collectively minimises the likelihood of disturbance to fish populations. The area-based management plan employed by Arramara Teo further ensures that sediment dynamics are unaffected, with any disturbances caused by harvesting vessels being brief and localised. Thus, no substantial adverse impacts are expected on fish populations within the MUL area, safeguarding the ecological integrity of marine ecosystems in the region.

Mitigation Measures:

None required.



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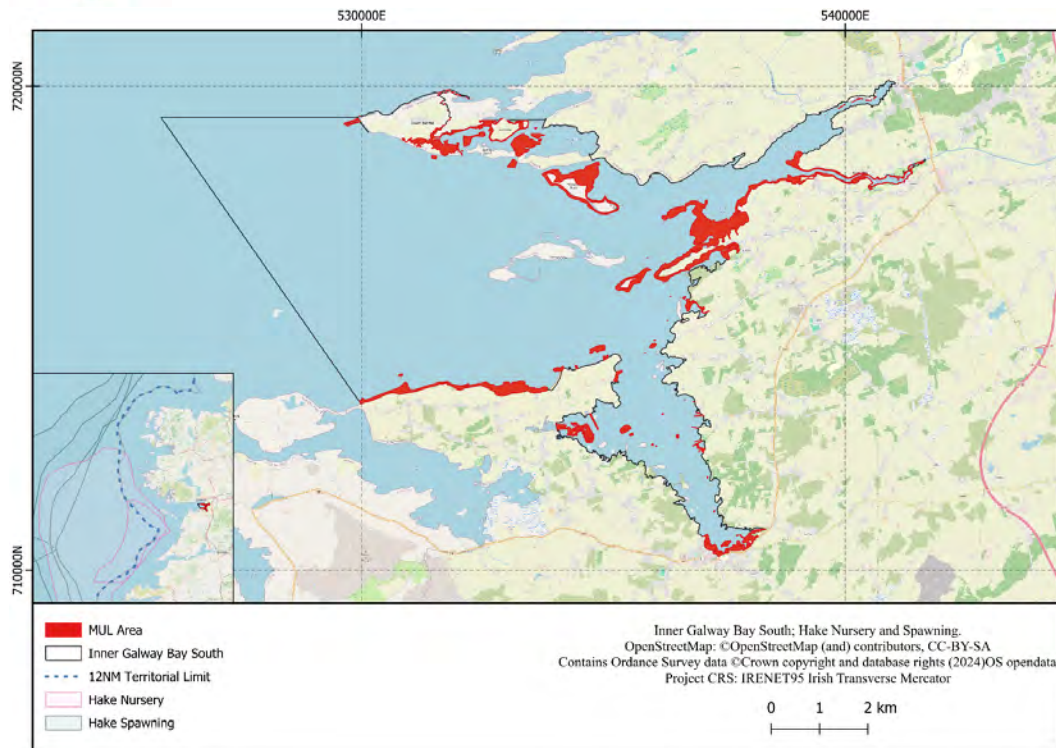


Figure 1 - Hake Nursery and Spawning Grounds

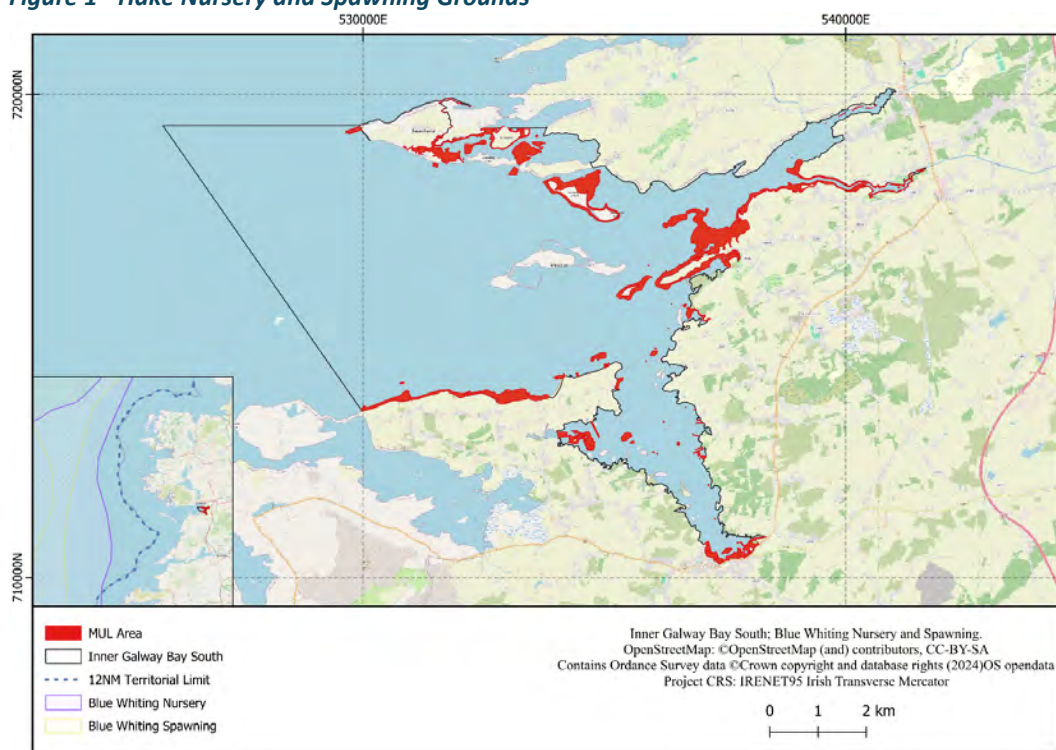


Figure 2 - Blue Whiting Nursery and Spawning Grounds



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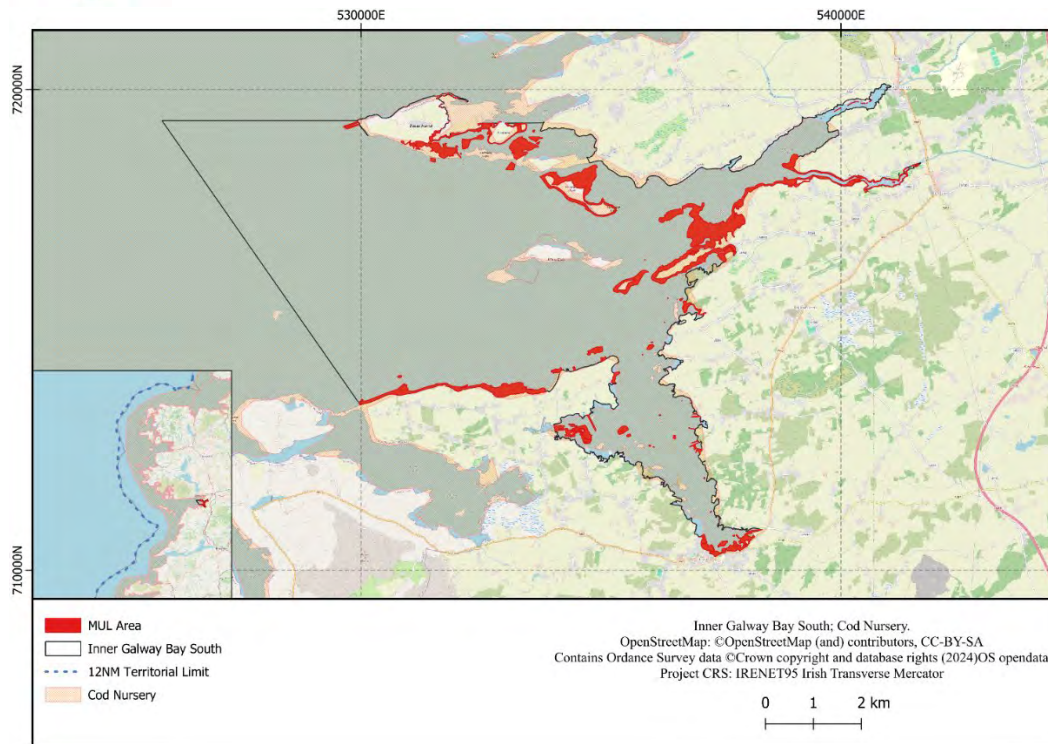


Figure 3 - Cod Nursery

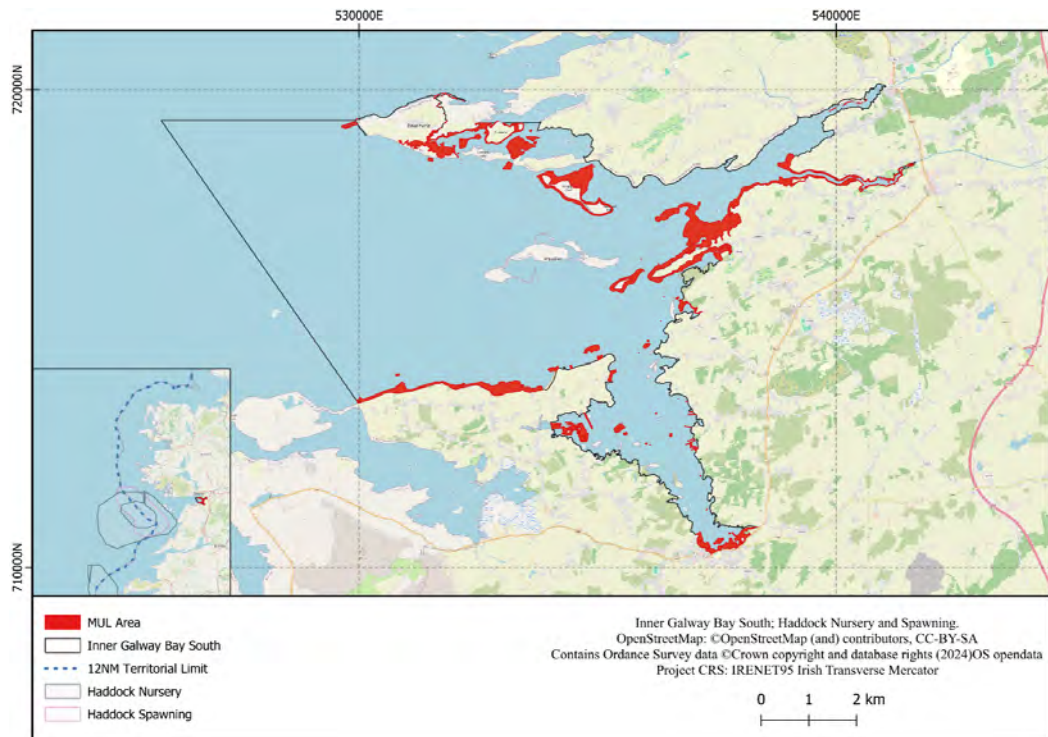


Figure 4 - Haddock Nursery and Spawning Grounds



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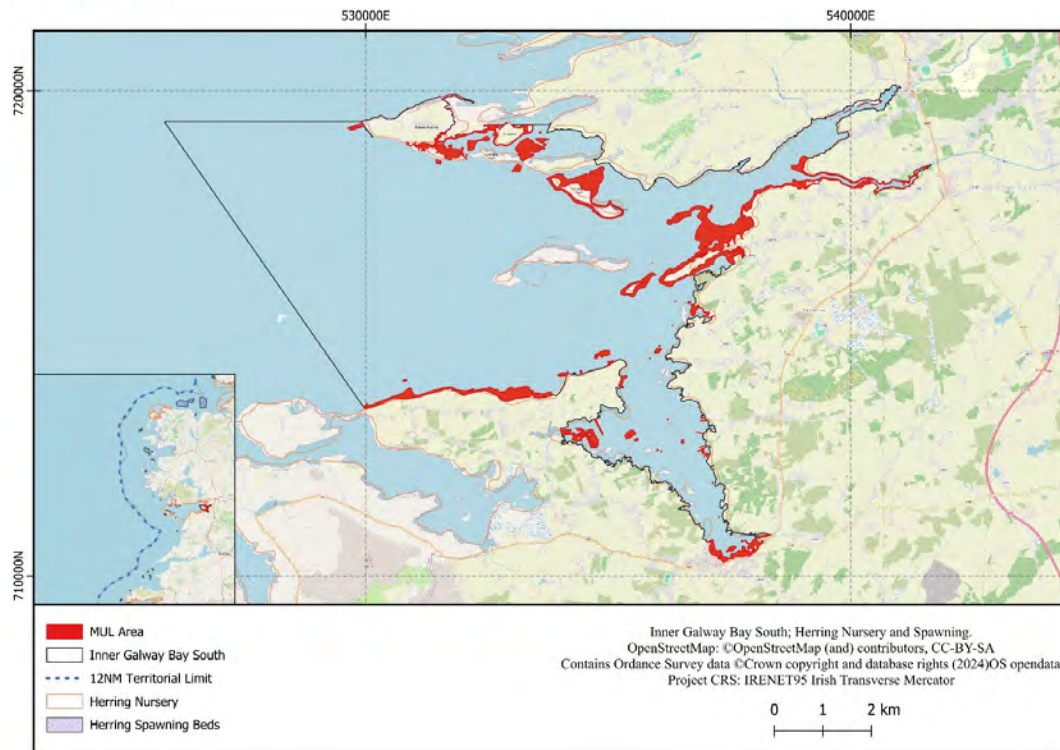


Figure 5 - Herring Nursery and Spawning Grounds

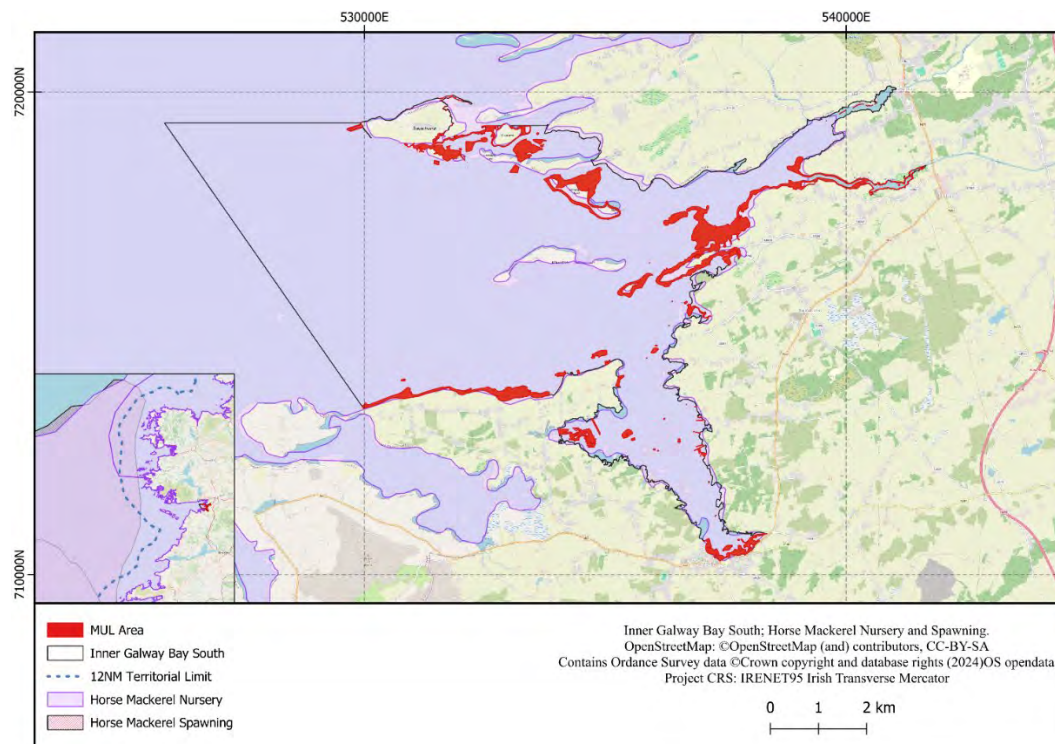


Figure 6 - Horse Mackerel Nursery and Spawning Grounds



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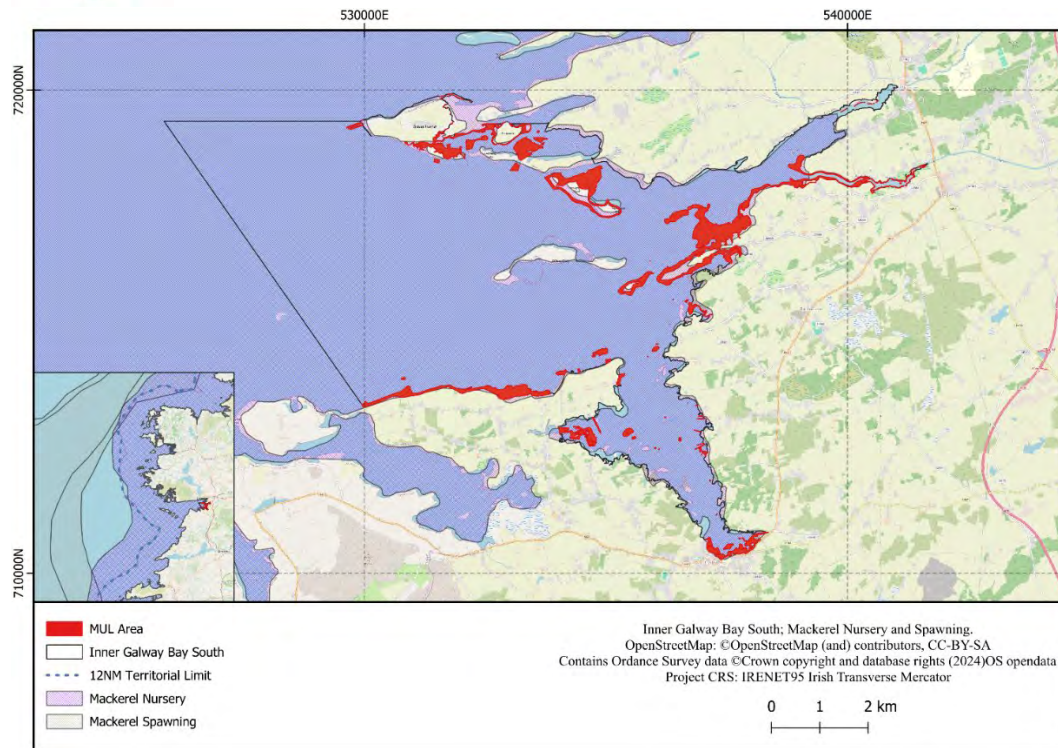


Figure 7 - Mackerel Nursery and Spawning Grounds

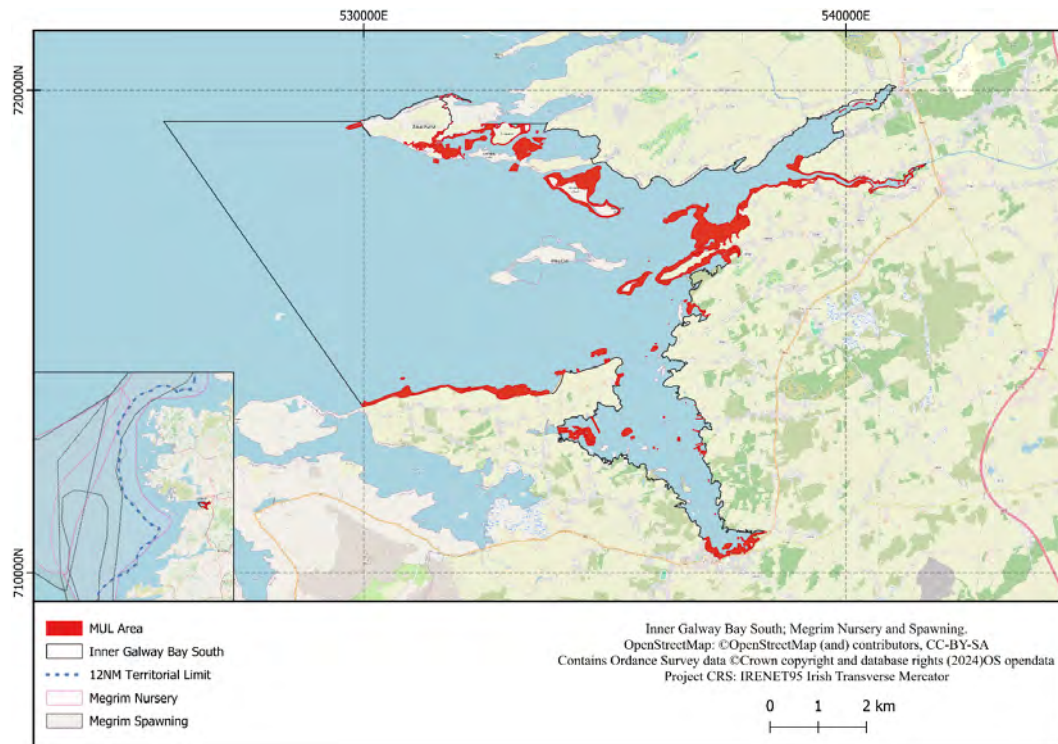


Figure 8 - Megrim Nursery and Spawning Grounds



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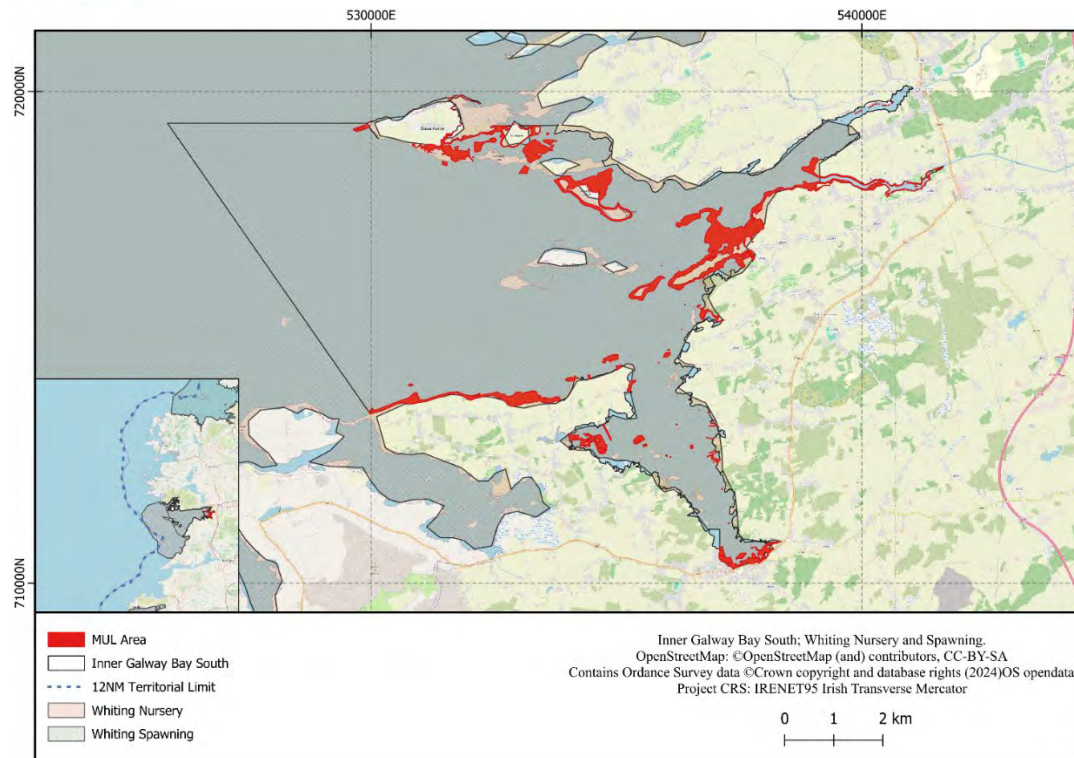


Figure 9 - Whiting Nursery and Spawning Grounds

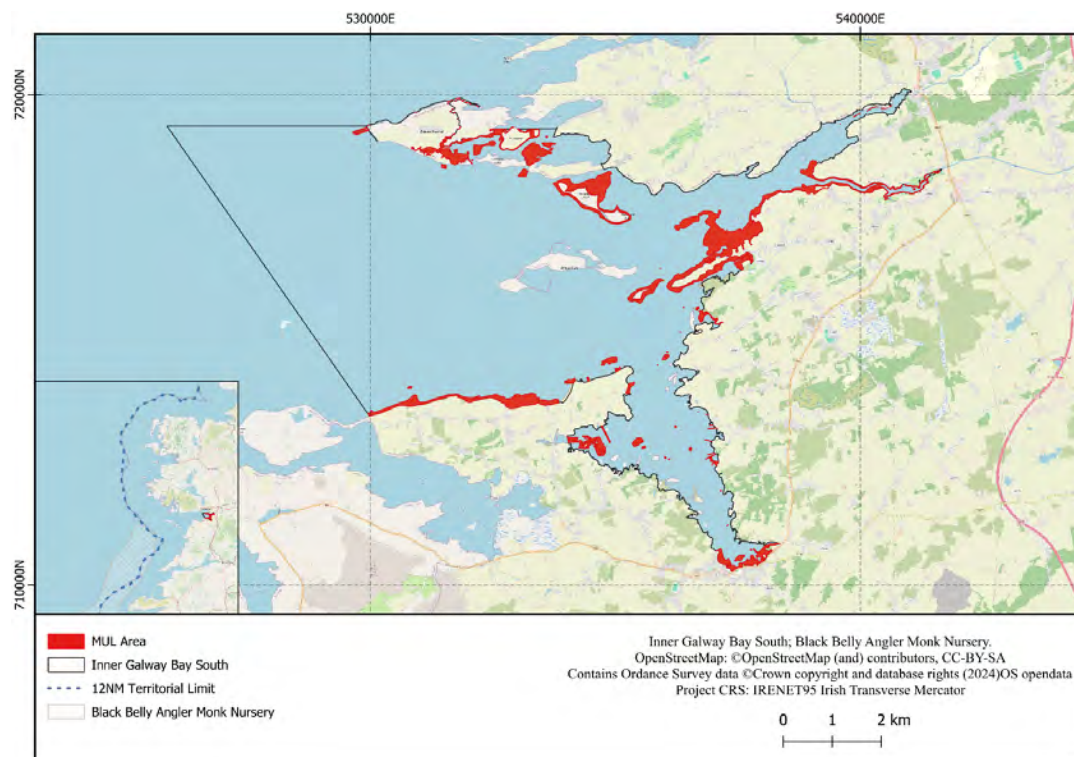


Figure 10 - Black Belly Angler Monk Nursery and Spawning Grounds



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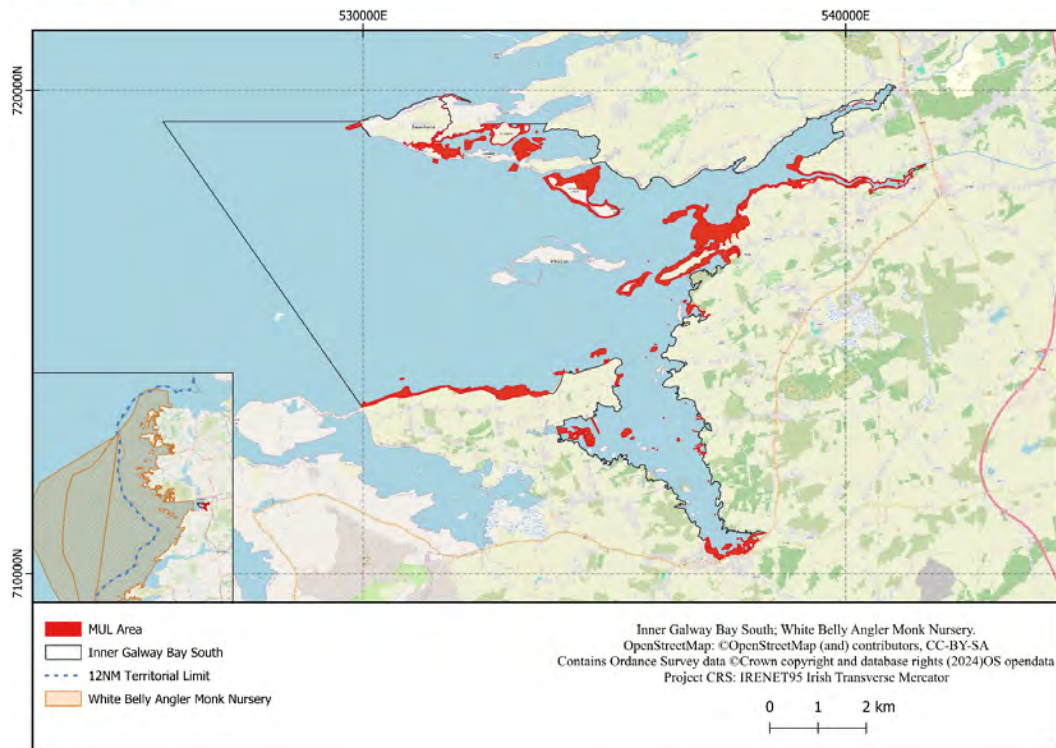


Figure 11 - White Belly Angler Monk Nursery and Spawning Grounds



Migratory Fish

Several migratory marine fish species are present on Ireland's western seaboard (Table 1).

Species	Habitat description
Atlantic salmon (<i>Salmo salar</i>)	Atlantic salmon (<i>Salmo salar</i>) are present in Irish waters as they migrate from oceanic habitats back to freshwater rivers and streams to spawn. They generally arrive in Irish coastal and estuarine waters from spring through autumn, with peak migration occurring between May and October. This movement primarily takes place in coastal areas and estuaries before they ascend rivers to complete their spawning cycle (McCarthy et al., 2008).
Sea lamprey (<i>Petromyzon marinus</i>)	Sea lamprey (<i>Petromyzon marinus</i>) are found in Irish waters as part of their anadromous migratory cycle, where they move from the ocean to freshwater rivers for spawning. They typically enter Irish estuaries and coastal waters in late spring to early summer, with peak migration occurring between April and July before they move into rivers to spawn (King & Roche, 2008).
River lamprey (<i>Lampetra fluviatilis</i>)	River lamprey (<i>Lampetra fluviatilis</i>) are present in Irish waters as part of their migratory life cycle, moving from estuarine and coastal environments into freshwater rivers to spawn. They typically migrate upstream in late autumn and winter, with peak movement occurring between November and February (King & Linnane, 2004).
Twaite shad (<i>Alosa fallax</i>)	Twaite shad (<i>Alosa fallax</i>) are present in Irish waters as they undertake their annual migration from the sea to freshwater rivers to spawn. They typically enter estuaries and coastal waters in late spring, with peak migration occurring from April to June, before moving into rivers to complete their spawning cycle (Maitland & Hatton-Ellis, 2003).
Allis shad (<i>Alosa alosa</i>)	Allis shad (<i>Alosa alosa</i>) are found in Irish waters as they migrate from marine environments into freshwater rivers to spawn. They typically enter coastal and estuarine waters in the spring, with peak migration occurring between April and May, before moving upriver to complete their spawning cycle (Aprahamian & Lester, 2001).

Table 1 – Migratory Marine Fish Species present on Ireland's Western Seaboard

The west coast of Ireland supports essential migratory routes and spawning habitats for key fish species, including Atlantic salmon (*Salmo salar*), Sea lamprey (*Petromyzon marinus*), Twaite shad (*Alosa fallax*), and Allis shad (*Alosa alosa*). The sustainable harvesting practices proposed by Arramara Teo, which are limited to the rocky intertidal zone, are designed to avoid significant interaction with these migratory fish populations. Harvesting occurs in the intertidal in geographically specific areas that do not interfere with the main migratory pathways or spawning grounds of these species, which generally occupy estuarine and freshwater systems during critical life stages.

The small-scale and limited nature of the harvesting activities, coupled with the avoidance of heavy equipment, minimises the risk of disturbing these species' natural behaviours, migration routes, or habitat use. Additionally, sediment disturbances caused by using in-transit boat motors are minimal, localised, and temporary, with sediments resettling shortly after operations, thus



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ensuring that these activities do not adversely affect water quality or habitat conditions vital for migratory fish.

In summary, the sustainable seaweed harvesting plan, with its low intensity and confined operational footprint within the intertidal zone, is expected to have negligible impacts on migratory fish populations such as Atlantic salmon, Sea lamprey, Twaite shad, and Allis shad. This approach preserves the ecological functionality of the region's coastal habitats, thereby ensuring the stability and resilience of these species within the MUL area, even in the absence of additional mitigation measures.

Mitigation Measures:

None required.