33. Intertidal *Mytilus edulis* beds

Irish name: Diúilicín

Figure A10.33.1. *Mytilus edulis* in the intertidal on mixed sediment. © Andreas Trepte, CC BY-SA 2.5

Background

The common mussel *Mytilus edulis* is a bivalve mollusc which is abundant along the Irish coastline and is found in the high intertidal to around five metres deep. *Mytilus edulis* shells are roughly triangular, purple, or blue in colour, and range in length from 5 – 10 cm (although conditions can limit their size to only 2 cm or allow them to grow as large as 20 cm)(Tyler-Walters, 2008). Common mussels attach themselves to substrata using fibrous byssus threads. They have a lifespan of around 17 -24 years (Sukhotin, 2007).

Mytilus edulis can form dense aggregations on mixed sediments, sand and mud, on the mid and lower shore (OSPAR, 2015). Where mussels aggregate into beds, they are considered ecosystem engineers, as they bind sediments, increase habitat complexity, increase organic matter content within the sediments, and increase species richness and biomass through associated macroflora and -fauna (Tsuchiya & Nishihira, 1986). Associated species include barnacles (*Semibalanus balanoides, Balanus crenatus*), the shore crab *Carcinus maenas,* the dogwhelk *Nucella lapillus,* the anemone *Actinia equina*, gammarid amphipods, polychaetes such as *Nephtys* spp., the sand mason *Lanice conchilega*, the ragworm *Hediste diversicolor*, eelgrass *Zostera noltei,* and the wrack *Fucus vesiculosus.* The energy balance within the habitat is dependent on the functioning of live mussels as

they filter out plankton and organic particles from the water column and deposit them on underlying sediments (pelagic-benthic coupling), providing up to 30% of the energy demands of associated communities (Norling & Kautsky, 2007).

The occurrence, structure, and persistence of mussel beds varies from year to year, e.g., higher than normal water and air temperatures can cause mass mortality, dense populations can result in overcrowding and destabilization of beds, adult mussels can negatively impact juvenile recruitment, and storms can remove whole beds (Khaitov & Lentsman, 2016). In the Celtic Sea, lower than normal winter temperatures can trigger high levels of juvenile recruitment, possibly due to lower metabolic costs, and cause a reduction in crab numbers reducing predation (Little et al., 2024). In general, over the last three decades, mussel populations in the North Atlantic have been in decline, although there are areas of resilience (Baden et al., 2021). No single factor is responsible for the decline but rather a combination of pressures, such as changes in predation pressure, climate change (increased precipitation, higher water temperatures and increased extreme weather events), pollution, eutrophication, and exploitation through intensive harvesting (OSPAR, 2008; Baden et al., 2021).

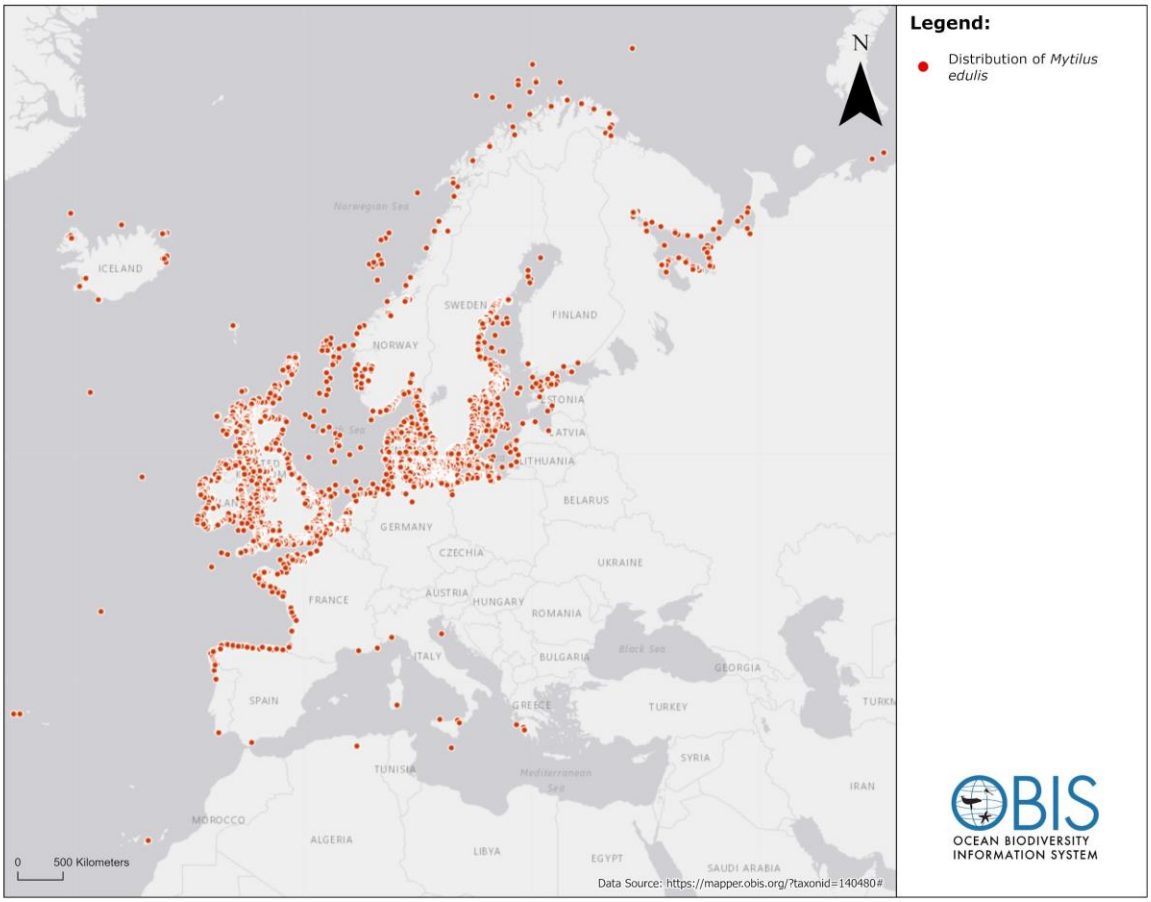

Figure A10.33.2. Distribution of *Mytilus edulis* in the Northeast Atlantic, Mediterranean, and Artic. Source. Ocean Biogeographic Information System, www.obis.org (https://mapper.obis.org/?taxonid=140480#)

Rationale for spatial protection in the Celtic Sea

Intertidal *Mytilus edulis* beds were included in the features list due to their ecological importance. As ecosystem engineers they provide several ecological services: they provide a complex habitat for associated species, increasing biomass and diversity; they provide a pelagic-benthic coupling service through the transfer of phytoplankton primary production and nutrients to benthic secondary production; and they increase carbon sequestration into the underlying sediment (Tsuchiya & Nishihira, 1986). Furthermore, they are listed as under threat and/or in decline in OSPAR region III (Celtic Seas).

Sensitivity assessment

Assessments of three intertidal mussel biotopes were considered: *Mytilus edulis* beds on littoral mixed substrata, *M. edulis* beds on littoral mud, and *M. edulis* beds on littoral sand (Tillin et al., 2023a, 2023b, 2023c). Sensitivities to all pressures were identical across all biotopes. Although there are a wide range of species associated with intertidal *Mytilus edulis* beds, none are considered obligate associates and all occur in a wide range of other habitats. Mussel beds are not dependent on any of their associated species to create/modify habitat, or to provide food/other resources. Thus, it is appropriate to base the sensitivity assessment on *Mytilus edulis* biotopes and only consider the sensitivity of associated species where they might augment any impact or cause secondary impacts.

Intertidal *Mytilus edulis* beds are highly sensitive to pressures associated with the construction and operation of offshore wind farms. All marine habitats and benthic species are considered to have a resistance of None to physical loss (to land or freshwater habitat) and to be unable to recover from a permanent loss of habitat (resilience is very low)(high confidence)(Tyler-Walters et al., 2018). Intertidal mussel beds are highly sensitive to habitat structural changes i.e., 'physical change (to another seabed type', 'physical change (to another sediment type)', 'habitat structure change-removal of substratum (extraction)'. Mussels can be found on a range of substrata and sediments, so a change in either would not necessarily exclude mussels or reduce the habitat quality for the individual, but it would alter individual mussel biotope classifications (Tillin et al., 2023a, 2023b, 2023c). Hence the resistance of biotopes is none, resilience is very low resulting in a high sensitivity to both physical change pressures. Extraction would remove entire mussel beds and the associated

community so sensitivity to this pressure is high. Intertidal mussel beds have a medium sensitivity to 'abrasion/disturbance of substratum surface or seabed', and 'penetration or disturbance of substratum subsurface'. Abrasion/disturbance, and penetration of the substratum can crush, dislodge, or remove large parts of a mussel bed. In addition, the damage can attract predators/scavengers, which could increase the predation pressure on intact *M. edulis* (Groenewold & Fonds, 2000). *Mytilus edulis* beds are highly sensitive to a number of the chemical pressures associated with the construction and operation of offshore wind farms. For example, long term exposure to 'transition elements & organometal contamination' will result in significant or severe mortality within a population (Tyler-Walters et al., 2022). Intertidal mussel beds are highly sensitive to the introduction or spread of invasive species. The American slipper limpet, *Crepidula fornicata,* can settle on mussel beds, and reach large densities. The slipper limpet competes for space, and can increase the drag on the bed, which increases the energy demands on the mussels, and increases the chance of dislodgement of the mussel bed (Thieltges, 2005).

Intertidal *Mytilus edulis* beds are highly sensitive to pressures associated with the fishing sector. As discussed above in relation to ORE, *M. edulis* beds are highly sensitive to the pressures 'physical change (to another seabed type)', 'physical change (to another sediment type)', 'transition elements & organo-metal contamination', 'hydrocarbon & PAH contamination', 'synthetic compound contamination', and 'introduction or spread of invasive non-indigenous species', which are also pressures associated with the fishing sector.

Intertidal *Mytilus edulis* beds are highly sensitive to the pressures associated with shipping. As discussed above in relation to ORE and fishing, *M. edulis* beds are highly sensitive to the pressures 'transition elements & organo-metal contamination', 'hydrocarbon & PAH contamination', 'synthetic compound contamination', and 'introduction or spread of invasive non-indigenous species', which are also pressures associated with shipping.

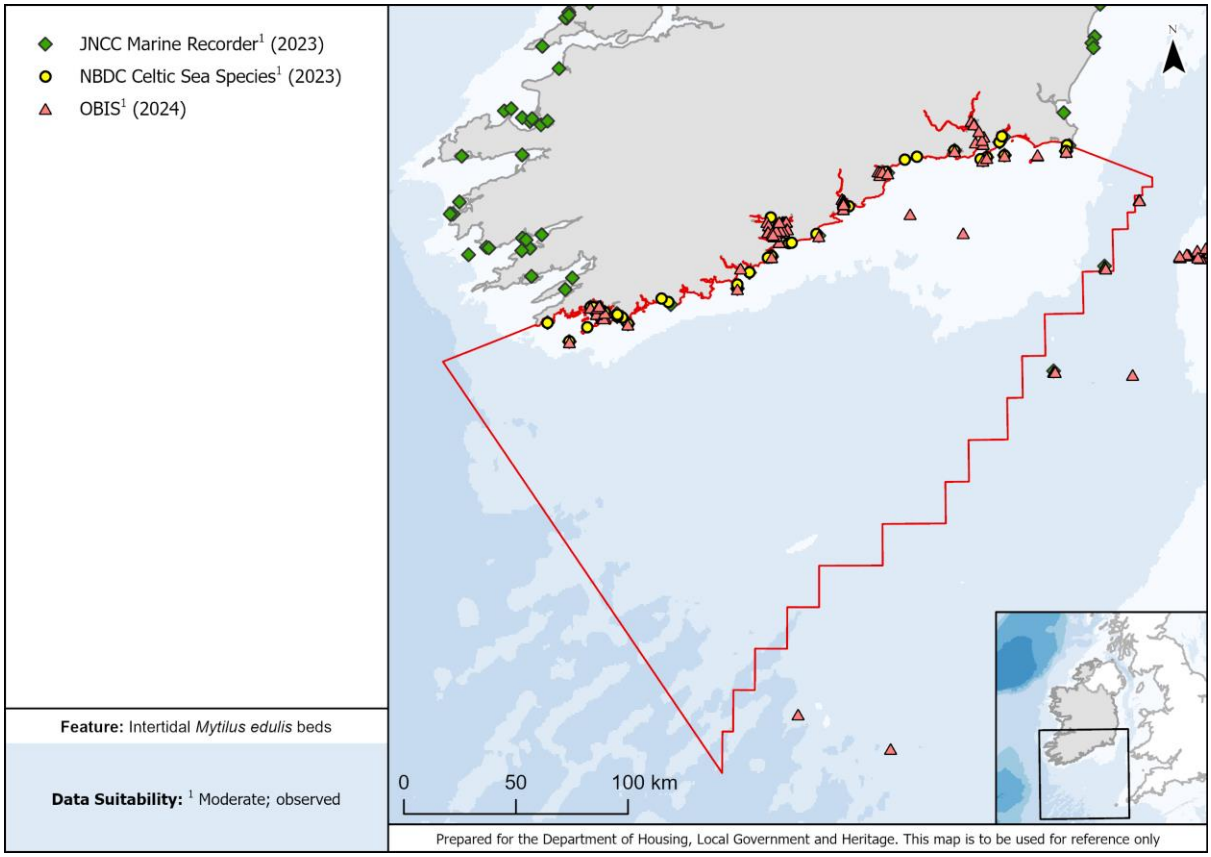

Fig. A10.33.3. Data available on the distribution of *Mytilus edulis* in the Celtic Sea

Data sources available

Data sources for *Mytilus edulis* in the Celtic Sea AOI that were available to the MPA Advisory Group, and the quality / suitability of those data for conservation prioritization analyses (See Table 3.2.1 Main Report), are shown in Figure A10.33.3. Data were not considered suitable for inclusion in prioritization analyses: data were not all intertidal (see Figure A10.33.3) but also were specimen-level records, such that any given record did not necessarily imply presence of a mussel bed. The MPA Advisory Group was not able to source any data pertaining specifically to intertidal mussel beds.

Further research needs

As a commercially important species, *Mytilus edulis* is particularly well studied for a marine invertebrate. However, almost no data were available on the distribution of intertidal mussel beds and they could not be included in conservation prioritization analyses as a consequence.

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