37. *Zostera* beds

Figure A10.37.1. *Zostera marina* bed. © Sofia Sadogurska , Seagrass Zostera marina (Dzharylhach island) , CC BY 4.0

Background

There are two species of seagrass present in Irish waters, *Zostera marina* (common eelgrass) and *Nanozostera noltei* (dwarf eelgrass). Both species form beds in sheltered bays and lagoons, typically mud, sand, or sandy mud. In order to be classed as a seagrass bed, plant densities must provide at least 5% cover (OSPAR Commission, 2008). Both species can co-occur in an area but are usually separated zonally on the shore, with *N. noltei* found in the intertidal zone and *Z. marina* occurring from the lower shower down to four metres (or deeper depending on water clarity) (OSPAR Commission, 2008). Both species are clonal monoecious flowering plants that can reproduce sexually, and asexually via rhizomes (Orth et al., 1994). Vegetative asexual reproduction typically exceeds seedling recruitment, and the main form of dispersal is via resettlement of detached propagules (Berković et al., 2018). Seagrass beds are highly productive (2 g Carbon/m^2/day in growing season and up to 5 kg of biomass per m^2)(OSPAR Commission, 2008), and provide food for wildfowl and prosobranch molluscs. Seagrass leaves provide a substrate for epi-phytes and -fauna, such as algae, diatoms, anemones, stalked jellies, and amphipods. The beds provide important nursery areas and shelter for fishes and cephalopods, including pipefishes, seahorses, and common cuttlefishes (OSPAR Commission, 2008; d'Avack et al., 2022a). *Zostera* beds reduce water velocities, increasing sedimentation rates and reducing water turbidity. The rhizomes stabilise the sediment, protecting from coastal erosion and increasing carbon and nitrogen sequestration (Orth et al., 2020).

Rationale for spatial protection in the Celtic Sea

Zostera beds are listed by OSPAR with reference to their decline, ecological significance, sensitivity, and the threats to them. *Zostera* and *Nanozostera* are recognised as components of five of the EU Habitats Directive Annex I broadscale habitats (92/43/EEC) but are not explicitly listed as species for protection on Annex II of that directive. *Zostera* beds are included as an Annex II habitat under Article 5(1) and 5(2), restoration of marine habitats, (2022/0195/COD). They are considered suitable targets for spatial protection given their ecological importance as outlined above, and their importance in carbon sequestration and hence mitigation of climate change effects.

Sensitivity assessment

The sensitivity assessment was based on the two *Zostera* biotopes, as described under The Marine Habitat Classification for Britain and Ireland (JNCC, 2022), within the Celtic Sea, *Zostera (Zostera) marina* beds on lower shore or infralittoral clean or muddy sand (d'Avack et al.,2022a), and *Nanozostera noltei* beds in littoral muddy sand (d'Avack et al.,2022b). Although *Zostera* beds are species-rich habitats, all species residing within *Zostera* beds can be found outside *Zostera* beds, The *Zostera* beds are wholly formed by the seagrass species and are not dependent on associated species to create or modify habitat. The seagrass rhizomes stabilise sediments and thus reduce disturbance leading to higher infaunal biomass (Orth et al., 2020; d'Avack et al.,2022a). Therefore, the sensitivity assessments were based on sensitivities of *Zostera marina* and *Nanozostera noltei* as the habitat-forming species. The results of individual sensitivity assessments for both biotopes were identical.

***Zostera* 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 high sensitivity to physical loss to land or freshwater. Seagrasses are reliant on sandy/muddy sediments to grow. Physical change to another seabed type would make recovery impossible, meaning they have a high sensitivity to this pressure. Roots and rhizomes are buried no deeper than 20 cm, therefore an extraction of 30 cm of substratum (the benchmark) would remove all components of Zostera beds (High sensitivity). *Zostera* Beds are highly sensitive to changes in suspended solids (water clarity) and heavy smothering or siltation rate changes, as they require light to photosynthesize. Increased siltation will also increase the likelihood of anoxic sediments, damaging roots, and rhizomes. Although assessed as highly sensitive to synthetic compound contamination, most of the evidence for this pressure is from effects of herbicides, which are not relevant to either ORE, fisheries or shipping.

***Zostera* beds are sensitive to the pressures associated with the fishing sector.** Commercially important bivalves, e.g. surf clams, razor clams, and mussels, can be associated with *Zostera* beds. Harvesting of these bivalves can damage *Zostera* beds through penetration or disturbance of the substratum subsurface which removes the plants. *Zostera* Beds are highly sensitive to this pressure and to removal of non-target species. The beds have a medium sensitivity to abrasion of the surface substratum as recovery and regrowth are possible if the roots and rhizomes remain undisturbed. There is a medium sensitivity to the pressure caused by removal of target species. Removal of seeds and shoots can purposely be carried out for transplantation during seagrass bed restoration projects. This may become relevant if such projects are introduced within the Celtic Sea. *Zostera* Beds are highly sensitive to the introduction or spread of invasive non-indigenous species, a pressure associated with the fishing sector, ORE and shipping. Introduced algae, such *Codium fragile* subsp*. tomentosoides* and *Sargassum muticum* can smoother beds, while invasive invertebrates such as the tunicate *Didemnum vexillum* may also have a negative effect.

***Zostera* beds are sensitive to the pressures associated with shipping.** *Zostera* beds are highly sensitive to chemical pressure, synthetic compound contamination. It should be noted that many studies used pesticides of terrestrial origin introduced to the marine environment via runoff. Nonetheless, herbicides used in shipping antifouling paint have been found to reduce photosynthesis rates, reducing productivity and growth (Tyler-Walters et al., 2022). *Zostera* beds have a medium sensitivity to the chemical pressures 'synthetic compound contamination' and 'hydrocarbon & PAH contamination'.

Data sources available

Data sources for *Zostera* beds 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 A10.37.2. For information on how data were prepared for use in prioritization analyses, and for visualisations of layers used, see Appendix 5e, section 5e.4.

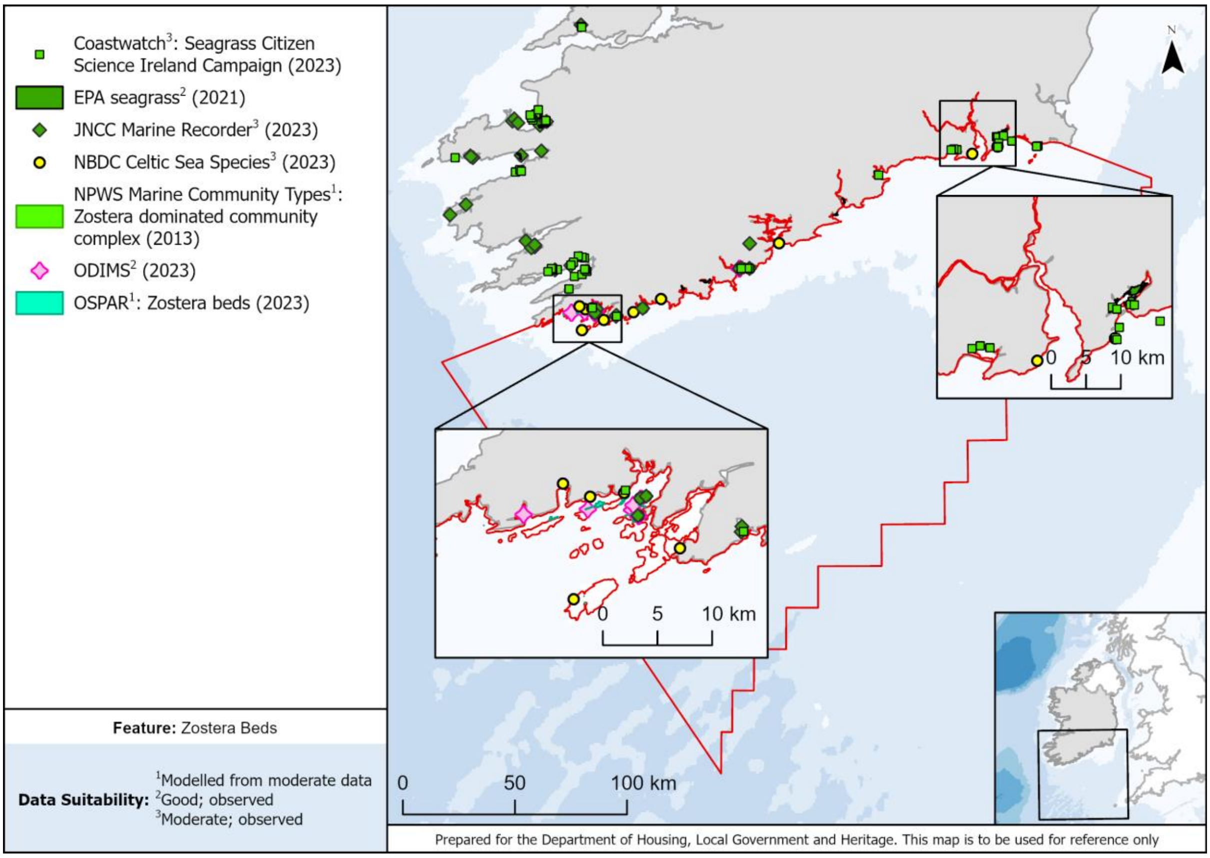

Figure A10.37.2. Data available for *Zostera* Beds in the Celtic Sea.

Further research needs

There has been little research into the distribution, status and ecological services provided by the *Zostera* beds within the Celtic Sea. Better evidence is needed into the species which inhabit beds, so the true biodiversity of the habit is known. The role of carbon and nitrate sequestration by seagrass beds has been shown to be substantial in other areas (Orth et al., 2020), but knowledge on this within Irish waters is lacking. Further research is needed into the sensitivity of seagrass beds to chemical pressures beyond hydrocarbons and herbicides.

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