Nomination

Zostera beds, Seagrass beds
EUNIS Code: A2.611, A5.533 and A5.545
National Marine Habitat Classification for UK & Ireland code: LS.LMP.LSgr and SS.SMP.SSgr

Definition for habitat mapping

Two sub-types :
Zostera marina beds
Zostera noltii beds

i. ***Zostera marina***

Zostera marina forms dense beds, with trailing leaves up to 1m long, in sheltered bays and lagoons from the lower shore to about 4m depth, typically on sand and sandy mud (occasionally with an admixture of gravel). Where their geographical range overlaps, such as the Solent in the UK, *Z. marina* passes upshore to *Z. noltii*.

ii. ***Zostera noltii***

Z. noltii forms dense beds, with leaves up to 20cm long, typically in the intertidal region (although it can occur in the very shallow subtidal), on mud/sand mixtures of varying consistency.
To qualify as a *Zostera* 'bed', plant densities should provide at least 5% cover (although when *Zostera* densities are this low, expert judgement should be sought to define the bed). More typically, however, *Zostera* plant densities provide greater than 30% cover. Seagrass beds stabilise the substratum as well as providing a habitat for many other species. As well as an important source of organic matter, seagrass beds may also provide an important nursery habitat for juvenile fish (ICES, 2003).

Geographical extent

OSPAR Regions: I, II, III, IV
Biogeographic zones: 4, 6-9, 11-14
Region & Biogeographic zones specified for decline and/or threat: II & II for decline, threat in all areas

Seagrass beds develop in intertidal and shallow subtidal areas on sands and muds. They may be found in marine inlets and bays but also in other areas, such as lagoons and channels, which are sheltered from significant wave action. They can survive and reproduce under conditions of occasional inundation or total submergence with the different species found at different shore levels or on different substrata. *Zostera nolti* is generally found highest on the shore, often adjacent to lower saltmarsh communities. *Z.angustifolia* is more common further down the shore and *Z.marina* is essentially a sublittoral species extending from low water to depths of several metres (Gubbay, 1988). *Z.marina* is the most widespread of the genus, with a distribution that extends from the Arctic down to Gibraltar.

Where conditions are favourable *Zostera* may cover extensive areas, forming seagrass 'beds' or 'meadows'.

Application of the Texel-Faial criteria

Zostera beds were nominated by two Contracting Parties. The criteria common to both nominations were decline, ecological significance and sensitivity, with information also provided on threat.

Decline
There was mass die-back of *Z. marina* throughout western Europe and elsewhere during the 1920s and mid-1930s due to a wasting disease. More recently, declines have been also been reported in the Wadden Sea and the UK for both *Z. marina* and *Z. noltii* (Den Hartog & Polderman, 1975; Jones *et al.*, 2000; Davison and Hughes, 1998). Affected areas are slow to recovery.

Ecological significance

Seagrass stabilises the substratum as well as providing shelter and a substrate for many organisms. Where the habitat is well developed the leaves may be colonised by diatoms and algae, as well as stalked jellyfish and anemones. The infauna are generally similar to species occurring in shallow areas in a variety of substrata (e.g. amphipods, polychaete worms, bivalves and echinoderms), and can be rich within the bed. The shelter provided by seagrass beds makes them important nursery areas for flatfish and, in some areas, for cephalopods. The diversity of the species will depend on environmental factors such as exposure and density of the microhabitats, but it is potentially highest in the perennial, fully marine, subtidal communities and may be lowest in intertidal, estuarine, annual beds (Anon, 2000).

Seagrass beds are very productive (an estimated 2g C/m^2/day during the growing season in temperate areas) and often contain a large biomass (up to $5kg/m^2$) (Barnes & Hughes, 1982). The living plant is a major source of food for wildfowl, particularly Brent goose and widgeon but also for mute and whooper swans that congregate in areas where *Zostera* is abundant. Only about 5% of seagrass production is thought to be consumed directly and it may be that the dead plant is more important because it is an abundant source of organic matter for marine systems (Barnes & Hughes, 1982).

Sensitivity

The findings from many studies on the sensitivity of *Zostera* beds have been brought together in a review by Davison, & Hughes (1998) . They include the following information about sensitivity of *Zostera* to different factors.

Sensitivity to turbidity is considered to be high as prolonged increases in turbidity would reduce light penetration and prevent adequate photosynthesis by deeper populations of *Zostera marina*. There may also be a high sensitivity to oxygen depletion but no detailed information is available on this at the present time.

Zostera was considered to have an 'intermediate' sensitivity to other factors such as contamination by synthetic compounds and hydrocarbons, changes in nutrient levels and abrasion (Davison & Hughes, 1998).

Terrestrial herbicides have been found to inhibit growth and cause decline in *Zostera marina* (Delistraty & Hershner 1984). Some effects may be indirect. For instance *Zostera marina* readily takes up heavy metals and TBT (Williams *et al.* 1994). Whilst plants appeared unaffected, any loss of grazing prosobranchs due to TBT contamination in the leaves or externally would result in excessive algal fouling of leaves, poor productivity and possible smothering.

High nitrate concentrations have been implicated in the decline of *Zostera marina* by Burkholder *et al.* (1993). Such eutrophication may increase the cover of epiphytic algae and prevent photosynthesis of sea grass plants. Eutrophication may increase abundance of *Labrynthula macrocystis* however, nutrient enrichment may stimulate growth of *Zostera marina* (Fonesca *et al.* 1994)

Apparently healthy *Zostera marina* beds are known to exist in areas subject to low-level chronic hydrocarbon contamination (see, for instance, Howard *et al*., 1989). Smothering by stranded oil is likely to occur on lower shore populations but little is known of its long-term effects on seagrass beds.

Threat

Physical disturbance, nutrient enrichment, marine pollution, disease, increased turbidity, disease, introduction and competition from alien species and natural cycles, are all factors which affect *Zostera* beds and can threaten the extent and quality of this habitat (Anon, 2000).

Physical disturbance occurs on both intertidal and subtidal beds. It may be caused by trampling, dredging, the use of mobile fishing gear, anchoring, as well as land claim and adjacent coastal development. Zos*t*era is generally not physically robust. As the root systems are typically located within the top 20cm, of the sediment and can therefore be dislodged easily (Fonseca 1992). Increased turbidity is another threat, and Geisen *et al.* (1990) suggest that turbidity caused by eutrophication, deposit extraction and dredging activities were major factors in the decline of *Zostera* in the Wadden Sea.

Relevant additional considerations

Sufficiency of data

There are many studies on seagrass beds and both general and detailed mapping of their extent and of the associated communities has been carried out in particular locations. Despite this, there are still aspects for which there is a poor understanding. The precise triggers causing the major die-back of *Z.marina* from the wasting disease is one example which is possibly some combination of the occurrence of the fungus *Labyrinthula ma*crocystis, increased turbidity and environmental factors such as water temperature or water quality but this remains unclear (Short *et al.,* 1988)

Changes in relation to natural variability

The extent of seagrass beds may change as a result of natural factors such as severe storms, exposure to air and freshwater pulses. Grazing by wildfowl can have a dramatic seasonal effect with more than 60% reduction in leaf cover reported from some sites. Warm sea temperatures coupled with low level of sunlight may cause significant stress and die back of seagrass (Anon, 2002).

Expert judgement

There is good evidence of decline and threat to *Zostera* beds in particular locations within the OSPAR Maritime Area with the most detailed studies revealing the decline relating to the North Sea. Factors that threaten *Zostera* beds occur through the OSPAR Maritime Area.

ICES evaluation

ICES finds that there is good evidence of declines and threat to this habitat. However, they advise that the available literature only covers parts of Regions II and III; hence, a more robust classification might be to confine the classification to these regions rather than regions II and IV as originally proposed. ICES also note that given the long list of threats, the possibility of combined effects, and the long recovery time of affected beds, it seems reasonable

to expect a great vulnerability of *Zostera* beds in the future.

Threat and link to human activities

Cross-reference to checklist of human activities in OSPAR MPA Guidelines

A number of the threats to *Zostera* beds are directly linked to human activities. These are physical disturbance, increased turbidity, nutrient enrichment and marine pollution. The deliberate introduction of the alien species *Spartina anglica* no longer takes place but existing stands continue to spread.

Management considerations

Management considerations for seagrass beds could include establishment of protected areas, possible reintroduction or restoration, controlling inputs of pollutants from surrounding land. Promoting awareness of the importance of seagrass beds could assist in minimising trampling and anchor damage. Protected areas could be designated under the proposed OSPAR MPA programme although it should be noted that seagrass beds are covered by the EU Habitats Directive and could therefore be included in the *Natura 2000* network.

Further information

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