A5.53 Seagrass beds on Atlantic infralittoral sand (non-Macaronesian)

Summary

Seagrass beds play an important role in the trophic status of marine and estuarine waters, acting in sediment stabilization as well as an important conduit or sink for nutrients. The beds of seagrass occur in shallow sublittoral sediments. These communities are generally found in sheltered embayments, marine inlets, estuaries and lagoons, with weak tidal currents. Wasting disease in the 1930s has been the most significant threat leading to substantial loss of this habitat. Historically *Zostera* was also of great commercial value, being harvested for use in dikes, World War I trenches, insulation and mattresses. Current pressures and threats come from coastal development, dredging, shellfisheries, eutrophication and localised damage from mooring. Conservation and management measures include the regulation of fisheries and waste water treatment (to reduce the risk of eutrophication) and reduction in suspended sediments.

Synthesis

This habitat has a large natural range in the North East Atlantic region, as it is present in locations as widely separated as the Atlantic coast of Portugal, the Isles of Scilly in the UK, and the Channel coast of France. There was a substantial reduction in the quantity and quality in the 1930s, which resulted in 100% loss in the Netherlands and most likely the same in Germany. In Denmark the decline between 1901 and 2000 is estimated to have been 92%. There have been some increases in recent years but this habitat has not recovered to its previous extent. Because of the substantial historical loss and continuing declines in this habitat it has been assessed as Critically Endangered for both the EU 28 and EU 28+.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Critically Endangered	A3, C/D3	Critically Endangered	A3, C/D3

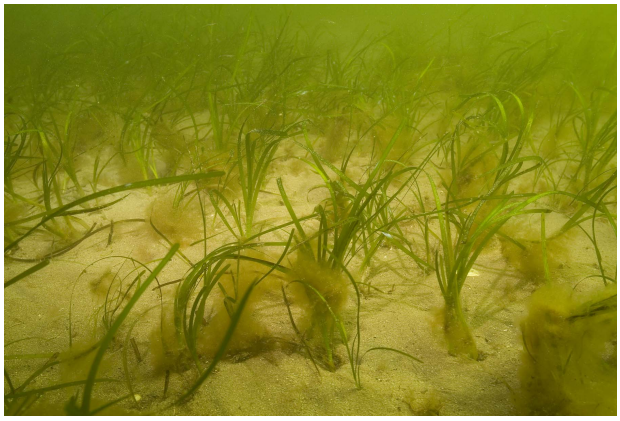
Sub-habitat types that may require further examination

Z. marina beds and those dominated by either *Ruppia* spp. or *Cymodocea* should be assessed separately as these species respond in different ways to pressures and threats.

Habitat Type

Code and name

A5.53 Seagrass beds on Atlantic infralittoral sand (non-Macaronesian)



Zostera marina seagrass bed on sand. Gruinard Bay, Scotland, UK (© G.Saunders).

Habitat description

This habitat type covers beds of submerged marine angiosperms in the genera *Zostera*, *Ruppia*, and *Cymodocea*, adjacent to mainland coasts of the North East Atlantic region. The Iberian coast is a transitional zone where *Zostera* dominated seagrass beds reach their southern limit and *Cymodocea* dominated seagrass beds reach their northern and western limits. *Ruppia* beds are restricted to brackish environments, where *Zostera* may be interspersed. Seagrass beds play an important role in the trophic status of marine and estuarine waters, acting in sediment stabilization as well as an important conduit or sink for nutrients and consequently some examples of *Zostera marina* beds have markedly anoxic sediments associated with them. It is a spawning area and it harbours increased densities of juvenile and medium sized fish species.

This habitat occurs in shallow sublittoral sediments, generally in sheltered embayments, marine inlets, estuaries and lagoons, with weak tidal currents and under conditoins of low, variable and full salinity. Whilst generally found on muds and muddy sands, particularly marine examples of *Zostera* communities may also occur in coarser sediments. Whilst the seagrass may be considered an epibiotic overlay of established sedimentary communities it is likely that its presence will modify the community offering living space and feeding ground for epibionts and phytal specialists. For example, *Zostera* beds in the south-west of Britain may contain conspicuous and distinctive assemblages of Lusitanian fauna such as *Laomedea angulata*, *Hippocampus* spp. and Stauromedusae. These subtidal beds of *Zostera* contain the specific perennial variant of *Zostera marina*. *Cymodocea nodosa* forms large and dense patches with green leaves that can reach 100 cm long and 8 mm wide in well shorted fine sands or on superficial muddy sands in sheltered waters and depths of 1-30 meters. Frequently it is mixed with other habitat forming phanerogams *Zostera noltei* (formerly known as *Z.noltii or Z.nana)* and *Zostera marina* on muddy sands rich in organic nutrients. Shallow meadows of *Cymodocea* and *Zostera* are usually found in sheltered bays close to harbours or in areas subject to human impact.

Indicators of Quality

Both biotic and abiotic indicators have been used to describe marine habitat quality. These include: the presence of characteristic species as well as those which are sensitive to the pressures the habitat may face; water quality parameters; levels of exposure to particular pressure, and more integrated indices which describe habitat structure and function, such as trophic index, or successional stages of development in habitats that have a natural cycle of change over time.

The overall quality and continued occurrence of this habitat is, largely dependent on the presence of *Zostera marina,* which creates the biogenic structural complexity on which the characteristic associated communities depend. The density and the maintenance of a viable population of this species is a key indicator of habitat quality, together with the visual evidence of presence or absence of physical damage. Seasonal and annual variations in shoot densities and canopy height can be used to evaluate

habitat quality as well as acting as a proxy measure of habitat complexity and refuge capability. The vertical depth limit of submerged seagrass is used in several countries as a Water Framework Directive parameter for assessing ecological status. Other countries use area indices and/or density indices. Seagrass tissue nutrients have also been used as indicators of environmental change in these important ecosystems.

Characteristic species

For the genus *Zostera*, *Zostera marina* is the dominating species for submersed beds. It is current consensus that *Z. angustifolia*, which is often described in older literature is simply an ecotype of *Z. marina*; following recent genetic studies, *Z. angustifolia* is no longer accepted as a separate species and is represented as *Z. marina* L. (WoRMS, 2014). Other biota present are grazing snails, hydrozoans, infaunal species such as *Ensis* spp., *Cerastoderma* spp. and *Echinocardium cordatum*. For *Ruppia* either *Ruppia maritima* or *Ruppia cirrhosa* may occur. In submerged beds of brackish seas, sea inlets, estuaries, permanent pools of mud or sand flats, and coastal lagoons of Atlantic, North Sea and Baltic coasts of boreal and temperate Europe *Zannichellia palustris*, *Chara* spp., *Lamprothamnium papulosum* and *Tolypella nidifica* can be associated with *Ruppia* and/or *Zostera*. These beds may be populated by fish such as *Gasterosteus aculeatus,* which is less common on filamentous algal-dominated sediments. Seaweeds such as *Chaetomorpha* spp., *Enteromorpha* spp., *Cladophora* spp., and *Chorda filum* are often present in addition to occasional fucoids. Infaunal and epifaunal species may include mysid crustacea, the polychaete *Arenicola marina*, the gastropod *Hydrobia ulvae*, the amphipod *Corophium volutator* and oligochaetes such as *Heterochaeta costata*. For *Cymodocea* beds, *Cymodocea nodosa* is the only species represented.

Classification

EUNIS (v1405):

Level 4. A sub-habitat of ‘Sublittoral macrophyte-dominated sediment’ (A5.5).

Annex 1:

1110 Sandbanks slightly covered all the time

1160 Large shallow inlets and bays

MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal

MSFD:

Shallow sublittoral coarse sediment

Shallow sublittoral sand

Shallow sublittoral mud

Shallow sublittoral mixed sediment

EUSeaMap:

Shallow sands

Shallow muds

Shallow coarse or mixed sediments

IUCN:

9.9 Seagrass (submerged)

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?
Yes

Regions
Atlantic

Justification
This habitat occurs across the regional sea where there are suitable conditions. It is present as far south as estuaries of Atlantic Spain, as far west as the west coast of Ireland and east to Kattegat.

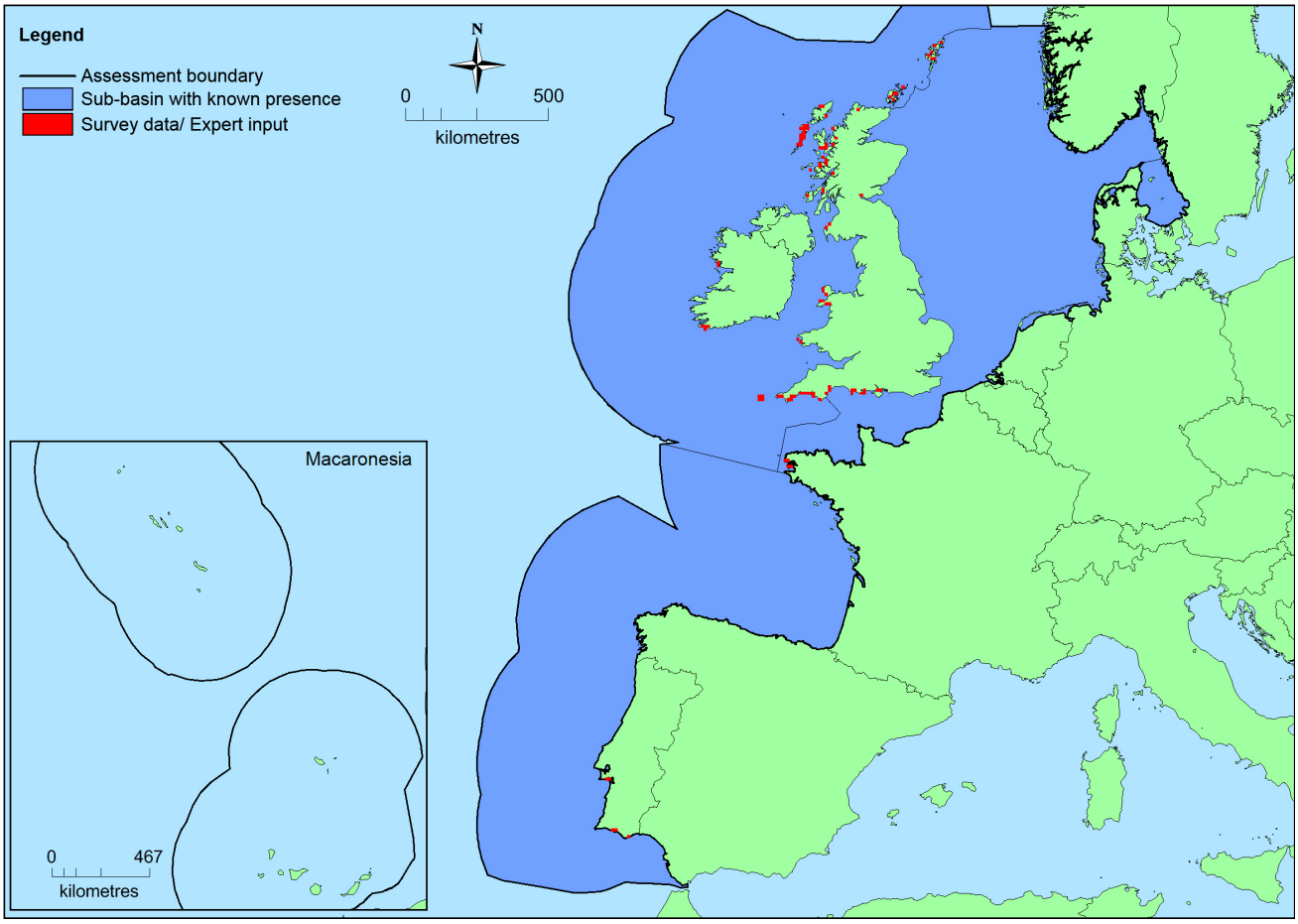
Geographic occurrence and trends

Region	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
North-East Atlantic	Bay of Biscay and the Iberian Coast: Present Celtic Seas: Present Kattegat: Present Greater North Sea: Present	Unknown Km^2	Decreasing	Decreasing

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	1,026,236 Km^2	115	Unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.
EU 28+	>1,026,236 Km^2	>115	Unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.

Distribution map



There are insufficient data to provide a comprehensive and accurate map of the distribution of this habitat. This map has been generated using EMODnet data from modelled/surveyed records for the North East Atlantic (and supplemented with expert opinion where applicable) (EMODnet 2010). EOO and AOO have been calculated on the available data presented in this map however these should be treated with caution as expert opinion is that this is not the full distribution of the habitat.

How much of the current distribution of the habitat type lies within the EU 28?

This habitat is present in Norway where a review of data up to 2010 estimated there to be more than 3,300 meadows with a total cover of 50km^2 on the Skagerrak coast of Norway. In comparison the habitat covered more than 1,680km^2 in Denmark in 2004 so it is likely that more than 95% is hosted by EU 28.

Trends in quantity

There was a substantial reduction in the quantity of this habitat following the wasting disease, which affected subtidal seagrass beds in northern Europe in the 1930's. In the Netherlands and Germany 100% of the habitat was lost. In Denmark the decline between 1901 and 2000 is estimated to have been 92% and the deep eelgrass beds have never recovered to their previous extent. The depth limits along open coasts averaged 7-8 m around 1900, they presently average 4-5 m. Depth limits have continued to decrease over this period despite a general reduction in nutrient loading and a stabilization in nutrient concentrations in coastal waters.

Whilst there has been some local recovery this habitat has not recovered to its previous extent. There are also variations across the region. In the Swedish Skagerrak, for example there has been a 60% decline since the mid-1980's while the small beds in the Chausey Archipelago, France are showing some increases after the mid-1950's.

The situation in Norway (EU 28+) is that there has been recovery in the 1950's and 1960's except for a

temporary decrease in the late 1980's.

- Average current trend in quantity (extent)
  EU 28: Decreasing
  EU 28+: Decreasing
- Does the habitat type have a small natural range following regression?
  No
  Justification
  This habitat has a large natural range, as it is present in locations as widely separated as the Atlantic coast of Portugal, the Isles of Scilly in the UK, and the Channel coast of France.
- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  This habitat has a large natural range, as it is present in locations as widely separated as the Atlantic coast of Portugal, the Isles of Scilly in the UK, and the Channel coast of France.

Trends in quality

There has been a substantial historical decline in the quality of this habitat associated with wasting disease in the 1930's. More recently there have been different trends in different locations but overall quality is still considered to be decreasing. In the British Isles, for example, a recent study clearly indicates that many seagrass meadows are under anthropogenic stress and probably in a poor state of health, many of which are in sites of apparent conservation protection.

- Average current trend in quality
  EU 28: Decreasing
  EU 28+: Decreasing

Pressures and threats

Wasting disease in the 1930's has been the most significant threat leading to substantial loss of this habitat. Historically *Zostera* was also of great commercial value, being harvested for use in dikes, World War I trenches, insulation and mattresses. Current pressures and threats come from coastal development, dredging, shellfisheries, eutrophication and localised damage from mooring.

List of pressures and threats

Urbanisation, residential and commercial development

Urbanised areas, human habitation

Human intrusions and disturbances

Outdoor sports and leisure activities, recreational activities
Motorized nautical sports
Other human intrusions and disturbances
Shallow surface abrasion/ Mechanical damage to seabed surface

Pollution

Nutrient enrichment (N, P, organic matter)

Conservation and management

The protection of this habitat is often incorporated into to legislation aimed at protection of seagrass beds. These range from local by-laws and regulations, to cross border agreements as in the case of the Wadden

Sea. Protected areas and management measures include the regulation of fisheries and, waste water treatment (to reduce the risk of eutrophication) and reduction in suspended sediments.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality

Measures related to marine habitats

Restoring marine habitats

Measures related to hunting, taking and fishing and species management

Regulation/Management of fishery in marine and brackish systems

Conservation status

Annex 1:

1110: MATL U2

1160: MATL U2.

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

Recovery requires the removal of threats in the first instance. Recoverability rates can vary with shelter, light levels, depth and substratum but also depends on scale of damage and whether there have been changes in the environmental conditions (e.g. water flow, substrate type). Regeneration from root systems is slow and recovery of entire beds, with characteristic structure and associated species will take much longer than re-establishment of the seagrass species. Anchoring rhizome fragments appears to be more successful than using seeds. Transplantation experiments have had limited success to date although recent analysis of restoration projects suggests the successful regrowth appears to required a minimum threshold of reintroduced introduced individuals so a critical mass is important. Recovery also appears to be more likely when transplantation is close to donor beds. Partial recovery is only likely to occur after about 10 years and full recovery may take over 25 years, or never occur.

Effort required

10 years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	25-30 %	unknown %	unknown %	>90 %
EU 28+	25-30 %	unknown %	unknown %	>90 %

There has been a substantial historical decline in the quantity of this habitat. For example in the German part of the greater North Sea all known locations were destroyed and have not recovered since the 1930's and the same is true for the Netherlands sublittoral seagrass beds. Danish sublittoral eelgrass meadows declined by around 92% between 1901 and 2000 and the deep eelgrass beds and have never recovered to their previous extent. The depth limits along open coasts averaged 7-8 m around 1900, they presently average 4-5 m. Depth limits have continued to decrease over this period despite a general reduction in nutrient loading and a stabilization in nutrient concentrations in coastal waters.This habitat has therefore

been assessed as Critically Endangered under criterion A for both the EU 28 and EU 28+.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	>50,000 Km^2	Yes	Yes	No	>50	Yes	Yes	No	No
EU 28+	>50,000 Km^2	Yes	Yes	No	>50	Yes	Yes	No	No

This habitat has a large natural range in the North East Atlantic region as it is present in locations as widely separated as the Atlantic coast of Portugal, the Isles of Scilly in the UK, and the Channel coast of France. The precise extent is unknown however as EOO >50,000 km^2 and AOO >50, this exceeds the thresholds for a threatened category on the basis of restricted geographic distribution. The current trend is declining in quanty and quality although the distribution of the habitat is such that the identified threats are unlikely to affect all localities at once. This habitat has therefore been assessed as Least Concern under criteria B for both the EU 28 and EU 28+.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	>90 %	extreme reduction %
EU 28+	unknown %	unknown %	unknown %	unknown %	>90 %	extreme reduction %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown%	unknown %	unknown%	>90 %	extreme reduction%
EU 28+	unknown %	unknown%	unknown %	unknown%	>90 %	extreme reduction%

In the last 50 years there have been improvements as well declines in quality of this habitat in the North East Atlantic. Overall a substantial decline in quality is believed to have occurred historical given the substantial losses (>90%) of this habitat. This habitat has therefore been assessed as Critically Endangered under criteria C/D3 for both the EU 28 and EU 28+.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	unknown

Criterion E	Probability of collapse
EU 28+	unknown

The risk exists but no quantitative data or estimates of risk of collapse can be made at the present time.

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	NT	DD	DD	CR	LC	LC	LC	DD	DD	CR	DD	DD	DD	DD	DD	DD	DD
EU28+	NT	DD	DD	CR	LC	LC	LC	DD	DD	CR	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Critically Endangered	A3, C/D3	Critically Endangered	A3, C/D3

Confidence in the assessment
Medium (evenly split between quantitative data/literature and uncertain data sources and assured expert knowledge)

Assessors
S.Gubbay.

Contributors
North East Atlantic Working Group: N. Sanders, N. Dankers, J. Forde, K. Fürhaupter, S. Gubbay, R. Haroun Tabraue, F. Otero-Ferrer, G. Saunders and H. Tyler-Walters.

Reviewers
K. Fürhaupter.

Date of assessment
06/08/2015

Date of review
18/12/15

References

Baden, S., Gullstrom, M., Lunden, B., Phil, L. & Rosenberg, R. 2003. Vanishing Seagrass (Zostera maria, L.) in Swedish coastal waters. *Ambio* 32(5): 374-377.

Bostrom, C. et al. 2014. Distribution, structure and function of Nordic eelgrass (Zostera marina) ecosystems: implications for coastal management and conservation. *Aquatic conservation* 24(3): 410-434.

Borum, J., Duarte, C. M, Krause-Jensen, D & Greve, T. M. (Eds). 2004. *European seagrasses: an introduction to monitoring and management. EU project Monitoring and Managing of European Seagrasses* (M&MS). Available at: http://www.seagrasses.org/handbook/european_seagrasses_high.pdf. (Accessed: 12/02/2016).

Connor, D.W., Allen, J.H., Golding, N. *et al.* 2004. The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC. [online] Peterborough: ISBN 1 861 07561 8. Available at: http://jncc.defra.gov.uk/pdf/04_05_introduction.pdf. (Accessed: 30/08/2014).

Cunha, A. H. & Serrão, E. A.2011Tools for seagrass conservation and management in Portugal. *Ecologia*: 322-34.

de Jonge, V. N. & Ruiter, J. F. 1996. How subtidal were the subtial beds of Zostera marina L. before the occurrrence of the wasting disease in the early 1930's?Netherlands. *J.Aquatic Ecology* 30(2-3): 99-106.

Dennison, W. C. & Kirkman, H. 1996. Seagrass survival model. *Seagrass Biology: Proceedings of an International Workshop* p341-344.

Dolch, T., Buschbaum, C., Reise, K.2009. *Seegras-Monitoring im Schleswig-Holsteinischen Wattenmeer* 2008. Forschungsbericht zur Bodenkartierung ausgewählter SeegrasbeständeMonitoring report for the Federal Authority for Agriculture, Environment and Rural Areas of Schleswig-Holstein (LLUR). Available at: http://www.schleswig-holstein.de/DE/Fachinhalte/M/meeresschutz/Downloads/Seegras_Bericht_2008.pdf. (Accessed: 12/02/2016).

European Environment Agency, (2014) EUNIS habitat type hierarchical view. Available at: http://eunis.eea.europa.eu/habitats-code-browser.jsp. (Accessed: 22/08/2014).

Frederiksen, M., Krause-Jensen, D. Holmer, M. & Laursen, J.S. 2004. Long term changes in area distribution of eelgrass (Zostera marina) in Danish coastal waters. *Aquatic Botany* 78: 167-181.

Garcíia-Marin, P. Cabaço, S. Hernández, I. et al. 2013. Multi-metric index based on seagrass Zostera noltii (ZoNI) for ecological quality assessment of coastal and estuarine systems in SW Iberian Peninsula. *Marine Pollution Bulletin* 15(68):46-54.

Godet, L., Fournier, J., van Katwijk, M. M., Olivier, F., Le Mao, P., and Retière, C. 2008. Before and after wasting disease in common eelgrass Zostera marina along the French Atlantic coasts: a general overview and first accurate mapping. *Diseases Aquatic Organisms* 79:249-255.

Goodwin, C. et al. 2011. Rathlin Island - A survey Report from the Nationally Important Marine Features Project 2009-2011. *Northern Ireland Environment Agency Research & Development Series* No.11/03.

Hiscock, K., Marshall, C., Sewell, J. & Hawkins, S.J. 2006. The structure and functioning of marine ecosystems: an evironmental protection and management perspective. *English Nature Research Reports.* No.699.

James, B. 2004. *North-west Scotland subtidal seagrass bed survey 2004*. Inverness: Scottish Natural Heritage Commissioned Report No. 076 (ROAME No.F04LB05).

Jones, B.L., Unsworth, R.K.F. 2016. The perilous state of seagrass in the British Isles. *R.Soc.open.sci* 3: 2054-5703.

van Katwijk, M.M, Thorhaug, A., Marba, N. et al. 2015. Global analysis of seagrass restoration: the importance of large-scale planting. *J.Applied Ecology* 53(2): 567-578.

Marine Institute. 2015. Irelands Marine Atlas. Available at: http://www.marine.ie/Home/site-area/data-services/interactive-maps/irelands-marine-atlas. (Accessed: 08/12/2015).

Martin, P. et al. 2010. Long-term evolution (1988-2008) of Zostera spp. meadows in Arcachon Bay (Bay of Biscay). *Est.Coastal & Shelf Sci* 87(2): 357-366.

OSPAR. 2009. *Background Document for Zostera beds, Seagrass beds*. Southampton: OSPAR Biodiversity Series, p.36.

OSPAR. 2010. *Background Document for Cymodocea meadows*. Southampton: OSPAR Biodiversity Series, p.30.

Quintas, P., et al. 2012. Checkist of molluscs and polychaetes associated to the Zostera marina and Zostera noltei meadows in Ensenada de O Grove (Galicia, NW spain). *Biol.R.Soc.Esp.Hist.Nat.Sec.Biol* 106: 113-126.

WoRMS. 2014. World Register of Marine Species. Available at: http://www.marinespecies.org. (Accessed: 12/12/2015).