



Rialtas na hÉireann
Government of Ireland

Public Consultation on the Marine Strategy Framework Directive 2008/56/EC

Article 17 update of the Assessment
(Article 8), Determination of Good
Environmental Status (Article 9) and
Environmental Targets (Article 10)

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Prepared by the Department of Housing, Planning and Local Government

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Abbreviations

BIM	Bord Iascaigh Mhara
CEMP	Coordinated Environmental Monitoring Programme
CFP	Common Fisheries Policy
CICES	Common International Classification of Ecosystem Services
CSO	Central Statistics Office
DAFM	Department of Agriculture Food and the Marine
DCCAE	Department of Communications, Climate, Action and Environment
DCF	Data Collection Framework
DCHG	Department of Culture, Heritage and the Gaeltacht
DHPLG	Department of Housing, Planning and Local Government
DIN	Dissolved Inorganic Nitrogen
DIP	Dissolved Inorganic Phosphorus
DTTAS	Department of Transport, Tourism and Sport
EC	European Commission
ED	Electoral District
EPA	Environmental Protection Agency
EU	European Union
EEZ	Exclusive Economic Zone
ESA	Economic and Social Analysis
EU	European Union
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GES	Good Environmental Status
GVA	Gross Value Added
HD	Habitats Directive
ICES	International Council for the Exploration of the Sea
IFI	Inland Fisheries Ireland
IMO	International Maritime Organisation
INFOMAR	Integrated Mapping for the Sustainable Development of Ireland's Marine Resource
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
MI	Marine Institute
MPAs	Marine Protected Areas
MSFD	Marine Strategy Framework Directive
MSP	Marine Spatial Planning
NIS	Non-Indigenous Species
NMPF	National Marine Planning Framework
NPWS	National Parks and Wildlife Service



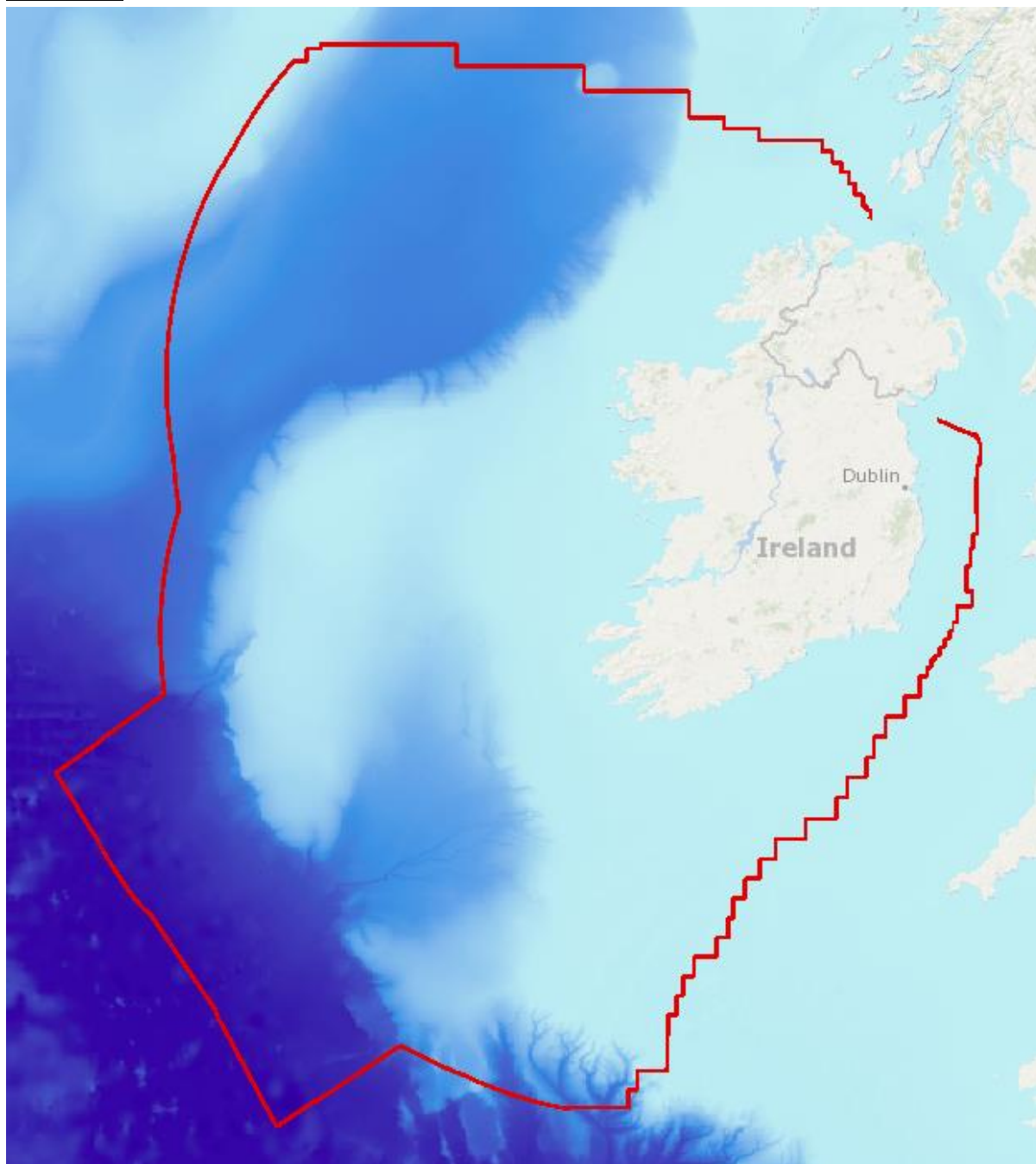
OSPAR	Convention for the Protection of the Marine Environment of the Northeast Atlantic
PAH	Polyaromatic Hydrocarbons
PBDE	Polybrominated diphenylethers
PCB	Polychlorinated biphenyls
ROV	Remotely Operated Vehicles
SAPS	Small Area Population Statistic
SEEA	System of Environmental-Economic Accounting
SEMUR	Socio-Economic Marine Research Unit
SEMS	Seafood Environmental Management System
SI	Statutory Instrument
SROCC	Special Report on the Ocean and Cryosphere in a Changing Climate
SWAN	Sustainable Water Network
TBT	Tributyltin
TG	Technical Group
UN	United Nations
WFD	Water Framework Directive



Introduction

The area covered by Ireland's Marine Strategy Framework Directive Assessment is 488,762 km². This is outlined in Figure 1 and it incorporates the Exclusive Economic Zone (EEZ) and an area of continental shelf that extends beyond 200 nautical miles into a region abutting the Porcupine Abyssal Plain.

Figure 1: Irelands MSFD Area.



<https://atlas.marine.ie/>

Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy known as the Marine Strategy Framework Directive was adopted on 17 June 2008 and it was transposed in to Irish law in May 2011 under



S.I. 249 of 2011. The Marine Strategy Framework Directive (MSFD) requires European Union member states, including Ireland, to achieve or maintain good environmental status (GES) in the marine environment by the year 2020 at the latest. Good environmental status in the marine environment means that the seas are clean, healthy and productive and that human use of the marine environment is kept at a sustainable level. In this way, the achievement of GES supports the objectives Marine Spatial Planning (MSP) and in particular, of the National Marine Planning Framework (NMPF) which is at public consultation until 28 February 2020. The assessment of the status of the marine environment, the determination of the characteristics of GES including threshold values and environmental targets inform decisions about how to use marine resources sustainably.

The Department of Housing, Planning and Local Government leads the preparation of the Marine Strategy for MSFD and the preparation of the National Marine Planning Framework (NMPF) on behalf of Government with input from other Departments and Agencies.

A set of eleven qualitative descriptors are outlined in Annex I of the Directive. These descriptors, listed in Table 1, are used in the determination of good environmental status (GES) under Article 9 of the Directive. These descriptors cover a range of pressures on and the state of the marine environment. The details of the predominant pressures and the human activities associated with them are set out in the annexes of the directive (as amended) and are included in this report. The descriptors and associated criteria play an important role in the development of environmental targets, monitoring programmes and the programme of measures.

Table 1: Qualitative descriptors for determining GES (from MSFD Annex I).

No.	Common name	MSFD Annex I text
D1	Biodiversity	Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.
D2	Non-indigenous species (NIS)	Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.
D3	Commercial fish and shellfish	Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.
D4	Food webs	All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.
D5	Eutrophication	Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.



No.	Common name	MSFD Annex I text
D6	Sea-floor integrity	Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.
D7	Hydrographical conditions	Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.
D8	Contaminants	Concentrations of contaminants are at levels not giving rise to pollution effects.
D9	Contaminants in seafood	Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.
D10	Marine Litter	Properties and quantities of marine litter do not cause harm to the coastal and marine environment.
D11	Energy, including underwater noise	Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.

The MSFD implementation cycle takes 6 years to complete and covers different stages every two years with a reporting commitment to the EU Commission. The different stages are set out in the Directive and covered by different articles, outlined below. Ireland undertook the first cycle of MSFD between 2011 and 2016 with the following outputs:

- April 2013: The Initial Assessment of the condition of the marine environment was completed and reported. This incorporated an Assessment of the Marine Environment (Article 8), Determination of Good Environmental Status (Article 9) and Establishing Environmental Targets and Indicators (Article 10)
- March 2015: The Monitoring Programmes (Article 11) was developed and reported.
- June 2016: The Programmes of Measures (Article 13) was developed and reported.

Each stage in the process involved publication of the proposals, stakeholder participation and a standstill public consultation process.

Public Consultation

Article 17 of the Directive requires that the elements of the marine strategy are reviewed every 6 years. This consultation process is part of the first step in the second implementation cycle of the Directive. Public consultation is an important part of the implementation of this Directive. Article 19 of the Directive requires that consultation with the public and interested parties is undertaken at various stages in the implementation cycle. The elements of the Directive which are now being consulted on are:

- Assessment of the Marine Environment (Article 8),
- Determination of Good Environmental Status (Article 9)
- Establishment Environmental Targets (Article 10)



As this second cycle of the Directive's implementation advances there will be separate opportunities for public consultation on the Monitoring Programs (Article 11) and the Programs of Measures (Article 13).

The Commission Decision

During the implementation of the first cycle of the MSFD the EU Commission recognised that it was necessary to improve coherence and consistency in delivery under the Directive. To this end and in consultation with the Member States the EU Commission developed a clearer, simpler, more concise, more coherent and comparable set of good environmental status criteria and methodological standards to ensure coherence and consistency of implementation.

The results of this work was the following documents:

- Commission Decision (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU. Referred to as the Commission Decision 2017/848.
- Commission Directive (EU) 2017/845 of 17 May 2017 amending Directive 2008/56/EC of the European Parliament and of the Council as regards the indicative lists of elements to be taken into account for the preparation of marine strategies

The result of the Commission Decision 2017/848 was the clearer definition across each of the descriptors of criteria, criterial elements, methodological standards and where appropriate threshold values. These criteria and methodological standards are used to determine a set of characteristics for good environmental status and the extent to which good environmental status is achieved or maintained.

The criteria outlined in Commission Decision 2017/848 are divided between primary criteria and secondary criteria.

- Primary criteria should be used to carry out updates of the assessments under Article 8 of the Directive. In situations where the primary criteria are not used the Member State must justify this approach.
- Secondary criteria should be used to compliment the primary criteria when the marine environment is at risk of not achieving or not maintaining good environmental status for that criteria.

Criteria: Distinctive technical features that are closely linked to the qualitative descriptors.

Criteria Elements: Are constituent elements of the ecosystem (species, habitats and their communities) or aspects of pressure on the marine



environmental (substances, litter, Non-indigenous Species) which are assessed under each criteria.

Environmental Target: is a qualitative or quantitative statement on the desired condition of the different components of, and pressures and impacts on, marine waters in respect of the marine region or sub region.

Threshold Values: A value or range of values that allows for an assessment of the quality level achieved for a particular criteria, there by contributing to the assessment of the extent to which good environmental status is being achieved. Threshold values can form one of the characteristics of GES but are not considered in themselves a definition of GES.

This Document

This document contains draft summaries of the assessments that have been prepared for each of the 11 qualitative descriptors. These summaries outline the following details for the descriptors

- the criteria assessed
- the targets against which Good Environmental Status is determined
- the threshold values, where applicable for these targets
- the current state of the marine environment
- the description of Good Environmental Status for Irelands MSFD area

The feedback received from this consultation process will be used inform the final report being prepared for submission to the EU Commission.

At this point in the preparation of the MSFD Article 17 update report all of the assessments and findings are in draft, thus the language used for describing the assessment of Good Environmental Status (GES) such as compatible with GES represents the current position. The feedback received from this public consultation process will inform the preparation of the final report and submission to the EU Commission. That final report will provide a clearer statement on GES for each descriptor as appropriate from the following options; 'GES achieved', 'GES expected to be achieved by 2020', 'GES expected to be achieved later than 2020', 'Not assessed', 'Not relevant' or 'Unknown'. In addition, the extent to which GES has been achieved for a feature as a proportion (of the area, contaminants or species) can also be expressed.



Regional Cooperation

The Directive requires Member States to use existing regional institutional cooperation structures, including those under the Regional Sea Conventions to achieve coordination in the implementation of the Directive. Ireland is a Contracting Party to the OSPAR Convention, the Regional Sea Convention for the North East Atlantic. Where OSPAR assessments or methodologies are relevant for the descriptors evaluated in this report, these have been incorporated into the assessments undertaken. Six of the descriptor assessments include OSPAR assessments or data Ireland reports to OSPAR; highlighting the importance of OSPAR for MSFD related work.

Approach to MSFD

One of the aims of the Directive is to provide coherence and integration between EU legislative measures that have an impact on the marine environment, these include:

- Urban Waste Water Treatment Directive 91/271/EEC
- Habitats Directive 92/43/EEC
- Water Framework Directive 2000/60/EC
- Environmental Information Directive 2003/4/EC
- Bathing Water Directive 2006/7/EC
- INSPIRE Directive 2007/2/EC
- Birds Directive 2009/147/EC
- Common Fisheries Policy
- Waste Framework Directive 2008/98/EC
- Invasive Alien Species EU Regulation 1143/2014
- Commission Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs

Where relevant, data and outputs from these Directives have been incorporated in the assessments used to prepare this public consultation report.

Climate Change

Climate change is one of many pressures that have an impact on marine ecosystems. The Special Report by the International Panel on Climate Change on Ocean and Cryosphere in a Changing Climate released in September 2019 makes it clear that further changes are ahead and public perception equates climate change to rising sea levels, warmer and more acidic seas and the disappearance of habitats and biodiversity. The MSFD aims to manage the pressures affecting the marine environment but is less clear on climate change. Climate change is considered in the



preamble to the directive and notes that the determination of GES “may have to be adapted over time in view of climate change” amongst others.

However, climate change is not listed as one of the uses and human activities in or affecting the marine environment to be assessed in the revised Annex III to the Directive. Although MSFD takes existing climatic factors into account, it does not integrate climate change or explain how climate change should be tackled in marine strategies. Further work is required to consider how this pressure can be integrated into the current or future revised versions of the directive.

Work on climate change has started at a global level through the following processes:

- Intergovernmental Panel on Climate Change (IPCC) Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC), approved in September 2019.
- Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment Report on Biodiversity and Ecosystem Services, published May 2019.

These processes and associated reports will help inform the how climate change is factored into future assessments.

Socio Economics

The Directive calls for an economic and social analysis of the use of the MSFD waters and an evaluation of the cost of degradation of the marine environment where relevant. The draft Economic and Social Assessment of the Irish MSFD area is included in this report.

How to Engage

The Department invites submissions from interested parties in writing or by email. The consultation period closes at midday on Friday, 28 February 2020. You can make a submission by:

Email to the following email address only:

msfd@housing.gov.ie

or

Writing to the following address:

MSFD Consultation,

Marine Environment Section,

Department of Housing, Planning and Local Government,

Newtown Road,

Wexford, Y35 AP90



Privacy Statement

The Department is committed to protecting and respecting your privacy. The Privacy Statement published alongside this document explains how the Department, as the Data Controller, will process the personal data provided to it in respect of submissions made during this public consultation; how that information will be used, and what rights you may exercise in relation to your personal data.

Acknowledgements

The delivery of this Report and the ongoing work in the development of the final Article 17 Report is the result active engagement and co-operation of the following organisations

- Department of Housing Planning and Local Government
- Department of Agriculture Food and Marine
- Department of Communications, Climate Action and Environment
- Department of Culture Heritage and the Gaeltacht - National Parks and Wildlife Service
- Department of Transport, Tourism and Sport – Irish Coast Guard
- Environmental Protection Agency
- Marine Institute
- Inland Fisheries Ireland
- Food Safety Authority of Ireland
- Bord Iascaigh Mhara
- Sustainable Water Network (SWAN)
- Socio-Economic Marine Research Unit (SEMRU)
- Coastwatch

Key Messages

The Key messages from this draft assessment of the Irelands Marine Environment are:

Biodiversity (Descriptor 1)

Notwithstanding existing human activities and associated pressures and impacts in Ireland's maritime area, in the main biological diversity is considered to be compatible with Good Environmental Status (GES). It is expected that additional work, methodological refinement, prudent management of human activities, and environmentally sustainable practices will be needed to further inform and maintain or improve on this position in future MSFD cycles.

Non-Indigenous Species (Descriptor 2)

Three newly introduced species have been identified in Irelands MSFD area during the assessment period 2013-2018. This figure is considered to be low based on



expert judgement and it is comparable with the numbers of new NIS described in the OSPAR Intermediate Assessment (2017)¹. The current state of the Irish marine environment with respect to the numbers of NIS newly introduced via human activity into the wild from 2013 to 2018, is compatible with Good Environmental Status.

Commercial Fish (Descriptor 3)

34 stocks are considered to be compatible with Good Environmental Status (GES), while 44 stocks are not. The compatibility of 99 stocks with GES is unknown. Overall, on balance, the status of commercial fish and shellfish stocks is not yet fully compatible with GES.

Marine Food Web (Descriptor 4)

Components of marine food webs are changing but it is not clear how they are affecting each other or the extent to which this is due to anthropogenic influence. The extent to which all elements of the marine food webs in Irish waters are compatible with Good Environmental Status (GES) is not clear.

Eutrophication (Descriptor 5)

The areas considered at risk of eutrophication are located inshore and predominantly along the eastern, south eastern and southern coasts of Ireland. The coastal and offshore areas show no indications of eutrophication and trend analysis shows no change in nutrient levels of Ireland's marine waters. Overall, in terms of extent, the proportion of Ireland's maritime area that is classified as a problem area with regard to eutrophication is small and restricted to estuarine and nearshore coastal waters. These areas fall under the remit of the WFD which has established programmes of measures to ensure that the environmental objectives that have been set for these waters are met.

The assessment of the criteria linked to eutrophication suggest that Ireland's MSFD water are compatible with Good Environmental Status.

Seafloor Integrity (Descriptor 6)

The assessed physical loss of seabed habitat across Ireland's MSFD area is lower than any potential threshold value. Loss of habitat in Irish waters-was calculated to be less than 2,440 km² or 0.5% of the total sea-floor area. The extent of habitat loss is compatible with Good Environmental Status (GES).

Results of analyses of physical disturbance - from international fishing-driven pressures that are currently quantifiable for the years 2010 to 2015 in OSPAR Region III only - showed disturbance to be widespread, occurring in 64,860 km² of Irish waters in OSPAR Region III or 13.29 % of the overall MSFD area. This assessment is limited to Irish waters in OSPAR Region III, it does not cover all of the

¹ <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/non-indigenous/>



Irish MSFD area and there are no threshold values for this criterion. Thus, it is not possible to determine compatibility with GES in the overall MSFD area.



OSPAR Region III is shown in Figure 2. It includes an area described as Region III, the Celtic Seas, extends between 60° N and 48° N and between 5° W and the west coast of Great Britain to the 200 m depth contour to the west of 6° W.

Figure 2: OSAPR Region III (OSPAR.org)

Hydrographical Conditions (Descriptor 7)

The level of activities causing hydrographical changes to the seabed and water column within Ireland's Marine Strategy Framework Directive area were very low overall during the assessment period of 2014-2018.

A key finding is that the hydrographical condition of the Irish marine environment is compatible with Good Environmental Status. It is expected that further work, methodological refinement and environmentally sustainable practices will be needed to maintain this position in future MSFD cycles.

Contaminants (Descriptor 8)

- Concentrations of priority substances in water in coastal and transitional water bodies are typically low and compliant with Environmental Quality Standards.
- Concentrations of contaminants in shellfish are generally above OSPAR background levels however, they are not at levels where adverse effects would be expected to occur.
- Although many legacy pollutants are highly persistent in the environment, where significant temporal trends in contaminant concentrations are evident, they are typically downwards.
- There has been a marked improvement in reproductive condition in dogwhelks following the banning of TBT as a marine antifoulant.



- Monitoring indicates a low impact of acute pollution events in the MSFD area.

A key finding is that the objectives of GES are largely achieved for concentrations of contaminants and biological effects assessed and for acute pollution events within Irelands MSFD area. Improved coherence of European and OSPAR assessment thresholds and new approaches to assessing risks associated with complex environmental mixtures would provide for a more robust assessment processes.

Contaminants in Seafood (Descriptor 9)

The key finding is that Descriptor 9 is compatible with Good Environmental Status (GES). Seafood sampled from shellfish growing waters and commercial fishing grounds around Ireland, between 2012 and 2017, shows a very high-level of compliance (99.7%) with Maximum Limits set in Commission Regulation 1881/2006 EC, as amended. This relates to mercury, cadmium, lead, indicator polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/Fs – dioxins), sum of PCDD/Fs and dioxin-like PCBs, and polyaromatic hydrocarbons (PAH).

Marine Litter (Descriptor 10)

The median number of litter items $\geq 2.5\text{cm}$ found on Irish beaches in quarterly surveys between 2013 and 2018 has decreased from 73.5 items per 100 metres in 2013, to 46 items per 100 metres in 2018 indicating that Descriptor 10 is compatible with the 2013 characteristics of GES.

Until agreed marine litter thresholds are established through cooperation at EU level and with other regional Member States it is not possible determine GES in relation to Commission Decision 2017/848 criteria.

Currently no scientifically agreed methodologies have been developed to monitor microlitter on the coastline, in seafloor sediments, nor on the surface of the water column.

Underwater Noise (Descriptor 11)

The level of impulsive underwater noise causing activities within Irelands designated Marine Strategy Framework Directive area were low overall during the assessment period of 2016-2018. The current state of the Irish marine environment is considered compatible with Good Environmental Status for spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources.

The Initial Assessment (2013) incorporated 29 environmental targets, these have been reviewed and this assessment is proposing 24 environmental targets which are focused improving coherence and consistency in accordance with the Commission Decision 2017/848.



The reduction in targets results from the alignment of targets with the Commission Decision criteria. Where targets from 2013 were not aligned with or compatible with these criteria these targets have not been brought forward.

The status of the descriptors in relation to Good Environmental Status is outlined in Table 2.

Table 2: Draft Environmental Status (compatibility with GES) of the Descriptors

Descriptor	Common name	Good Environmental Status
D1	Biodiversity	Some criteria compatible with GES
D2	Non-indigenous species (NIS)	Compatible with GES
D3	Commercial fish and shellfish	Some elements compatible with GES
D4	Food webs	Compatibility with GES not known
D5	Eutrophication	Compatible with GES
D6	Sea-floor integrity	Some criteria compatible with GES
D7	Hydrographical conditions	Compatible with GES
D8	Contaminants	Compatible with GES
D9	Contaminants in seafood	Compatible with GES
D10	Marine Litter	Some criteria compatible with GES
D11	Energy, including underwater noise	Compatible with GES

The draft Economic and Social Assessment of Irelands marine environment highlights the following:

- Ocean Economy turnover in 2018 €6.2 billion, of which €2.2 billion was direct gross value added.
- Employment in the marine sector in Ireland was 34,132 full time equivalents.
- Between 2012 and 2018 there has been a substantial increase in the economic contribution from the marine sector:
 - Turnover has increased by 31% over the period
 - GVA has increased by 78%
 - Employment has increased by 34%
- 4.47 million live within 50km of the shoreline, 94 % of the population.
- Ecosystem services benefits, estimated value per annum:



- Recreational services €1.683 billion
- Climate regulation €818.7 million
- Waste services €316.7 million
- Scientific and educational services € 11.5 million



Descriptor 1 – Biological Diversity

Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845.

In relation to Descriptor 1 - Biological diversity this has resulted in a more comprehensive assessment under MSFD Articles 8, 9 and 10, incorporating assessment information and proposed Environmental Targets for important representative species of marine birds, mammals, reptiles and non-commercially-exploited fish species.

A key finding is that, notwithstanding existing human activities and associated pressures and impacts in Ireland's maritime area, in the main biological diversity is considered to be compatible with Good Environmental Status (GES). It is expected that additional work, methodological refinement, prudent management of human activities, and environmentally sustainable practices will be needed to further inform and maintain or improve on this position in future MSFD cycles.



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Introduction

Ireland completed an Initial Assessment of its maritime area under the MSFD in October 2013. At the time, the assessment under biologically-orientated descriptors was largely restricted to (a) fisheries-related data for species and (b) broad-scale mapping data for habitats. In relation to biological diversity and



associated environmental targets and indicators under Descriptor 1 the 2013 assessment concluded that more work was required to develop and coordinate parameters, elements and methods that would contribute to a more effective evaluation of Ireland's marine environmental status.

Since then Ireland's approach, data collection and methods of assessment for this Descriptor under MSFD Articles 8, 9 and 10 have progressed considerably. This updated assessment considers elements of marine fauna that represent essential features and characteristics of biological diversity in Ireland's marine environment. It summarises (i) current knowledge of their environmental status, (ii) proposed environmental targets for each faunal element that Ireland has established in order to achieve/maintain Good Environmental Status (GES) and, where possible, (iii) environmental threshold values per element that are proposed in order to secure and support the maintenance of GES in the long term. It should be noted that marine plankton species are assessed under Descriptor 4 – Elements of marine food webs and benthic habitats are assessed under Descriptor 6 - Sea-floor integrity.

The objective of this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically Descriptor 1, i.e. that "biological diversity is maintained" and that "the quality and occurrence of habitats and the distribution abundance of species are in line with physiographic, geographic and climatic conditions" (Directive 2008/56/EC).

Drivers

The principal driver of changes to biological diversity, beyond what would constitute natural change, is human economic development. Based on Commission Directive 2017/845, the predominant thematic uses and human activities currently occurring in Ireland that may introduce significant pressures and impacts on biological diversity and species' populations in the marine environment are:

- Physical restructuring of rivers, coastline or seabed (restructuring of seabed morphology)
- Extraction of non-living resources (oil & gas)
- Extraction of living resources (fish and shellfish harvesting, marine plant harvesting)

Pressures

The predominant pressures identified in Commission Directive 2017/845, that are currently of known and/or potential significance to Descriptor 1 – Biological diversity in Ireland's MSFD area, are considered to be:

- Loss of, or change to, natural biological communities due to cultivation of animal or plant species
- Disturbance of species due to human presence
- Extraction of, or mortality/injury to, wild species (by commercial fishing, and/or recreational fishing and/or other activities)
- Physical disturbance to the seabed (temporary or reversible)
- Input of nutrients (diffuse and/or point sources, atmospheric deposition)
- Input of organic matter (diffuse sources and/or point sources)
- Input of other substances (e.g. synthetic/non-synthetic substances, diffuse and/or point sources, acute events)



<ul style="list-style-type: none"> • Cultivation of living resources (aquaculture) • Urban & industrial uses (waste management) • Transport (shipping) • Tourism and leisure (activities) <p>For numerous species of flora and fauna, including diadromous fish species, other human activities that are potentially important concerning the introduction of pressures on biological diversity include:</p> <ul style="list-style-type: none"> - Agriculture - Forestry - Physical alteration of water bodies - Hydroelectric power - Mixed source pollution to surface and ground waters - Abstraction of water - Interspecific biological interactions due to human activity <p>Climate change resulting from human economic practices, development and other activities, is also a significant driver with the potential to impact negatively on the marine environment. However, the evidence base that would warrant its inclusion as a known pressure source for biological diversity in Ireland's marine environment is insufficient at present. Considerable scientific research and development, and policy development at national and EU/international levels, would be required to effectively address and assess this driver in future MSFD cycles.</p>	<ul style="list-style-type: none"> • Input of litter (solid waste matter, including micro-sized litter) • Input of anthropogenic sound (impulsive, continuous) <p>Among the items listed above the most significant anthropogenic pressure on biological diversity in Ireland's maritime area is the extraction of fish and shellfish biomass (both commercial and non-commercial species) and associated disturbance introduced by human fishing activity. This occurs in the water column (e.g. pelagic trawling) and also close to or on the sea-floor (e.g. demersal trawling or set-nets, benthic dredging). It is prevalent all year round and in much of Ireland's EEZ, and is driven by a wide range of international, European Union and national fishing fleets that use diverse gear types, from jigging and long-lining to mobile nets and stationary pots. Fishing-derived pressure is, to a large extent, measurable and it is therefore supported by scientific evidence, monitoring and assessment, as well as EU and international regulation and management (e.g. through the EU Common Fisheries Policy).</p> <p>There are also significant human pressures that can carry with them significant adverse impacts on particular species and habitats within wider biological diversity; e.g. through the disturbance or deterioration of species' breeding habitats. For diadromous fish there are a number of other pressures that are as relevant as mortality from commercial fishing. The most important of these are: Dams and other modifications of hydrological conditions; Physical alteration of water bodies; Application of fertilisers on agricultural land; Mixed source pollution to surface and ground waters; Drainage for use as agricultural land; Aquaculture, including infrastructure; Recreational angling; Increases or changes in precipitation due to climate change; Freshwater fish and shellfish harvesting; Abstraction of water; and Interspecific relations. Many of these pressures relate to land-based human activities and industries, and are covered by other policy and legal provisions designed to protect the environment, for which there are assessment and reporting obligations (e.g. Water</p>
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	<p>Framework Directive, Nitrates Directive, Common Agricultural Policy).</p> <p>For larger marine vertebrate species, along with the potential pressures introduced by biomass removal, biological competition for prey resources and incidental mortality, the introduction of anthropogenic sound, disturbance of species and input of litter are considered to present the greatest secondary pressures after commercial fisheries extraction.</p>
<p>Environmental Targets</p> <p>Ireland's Initial Assessment (2013) described the characteristics of GES for biodiversity as follows:</p> <p>“Marine biodiversity is safeguarded in such a way that:</p> <ul style="list-style-type: none"> • Overall biodiversity is maintained or where appropriate restored; • Ecosystem structure and function is not compromised; • Abundance, distribution, extent and condition of key species and habitats (i.e. the area or environment where an organism or ecological community occurs) are in line with prevailing physiographic, geographic and climatic conditions; and • Species and habitats identified as needing protection under national or international agreements are effectively protected or conserved through the appropriate national, regional or international mechanisms.” <p>However environmental targets and associated indicators, to guide progress towards achieving GES in the marine environment, were under development in 2013; thus they were not proposed or established at that time.</p> <p>In the light of Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental targets for a set of essential faunal elements of biological diversity, namely:</p> <ol style="list-style-type: none"> a) Non-commercially-exploited species of fish b) Marine reptiles c) Marine birds d) Marine mammals <p>Proposed Environmental Target D1T1 The mortality rate per species from incidental by-catch is below levels which threaten the species, such that its long-term viability is ensured</p> <p>Proposed Environmental Target D1T2 The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured</p> <p>Proposed Environmental Target D1T4 The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions</p>	



Proposed Environmental Target D1T5

The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species

Threshold Values

For each faunal element listed above, at least one threshold value that is directly linked to these proposed Environmental Targets is currently under consideration. This process is taking account of existing requirements that relate to biological diversity, under the following:

- national legislation;
- EU Directives (e.g. Habitats Directive, Birds Directive) and policies (e.g. Common Fisheries Policy);
- regional seas conventions (e.g. OSPAR Convention);
- international agreements (e.g. UN Convention on Biological Diversity).

Criteria / Criterial elements included in the Assessment

The primary criteria from Commission Decision (EU) 2017/848 that are included in the current assessment are:

- D1C1 - The mortality rate per species from incidental by-catch is below levels which threaten the species, such that its long-term viability is ensured.
- D1C2 - The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured.
- D1C4 - The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions.
- D1C5 - The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species.

In all cases “Criteria elements” or the essential species groups listed in a) to d) above, are evaluated against each of these primary criteria. This work was conducted using a set of species considered to be representative of each group, and for which national monitoring/assessment programmes have been established, namely;

a) Non-commercially exploited species of fish:

A total of 56 species are covered by the assessment. They include species listed in Commission Implementing Decision (EU) 2016/1251, those on the OSPAR List of Threatened and/or Declining Species & Habitats, elasmobranch species prohibited from being caught in commercial fisheries under EU Common Fisheries Policy legislation, and those listed as in danger of extinction (endangered) on the IUCN European Red List of Marine Fishes (2015). Since D1C4 and D1C5 are solely primary criteria for species listed under the Habitats Directive (Directive 92/43/EEC), the assessment under these criteria was confined to four fish species: Atlantic salmon *Salmo salar*, River lamprey *Lampetra fluviatilis*, Sea lamprey *Petromyzon marinus* and Twaite shad *Alosa fallax*. In these cases, Ireland’s recent Habitats Directive Art.17 reporting (2019) helped to inform the assessments undertaken.

b) Marine reptiles:

Leatherback turtle *Dermochelys coriacea*

The most frequently recorded turtle species in Irish waters and the only turtle considered to use Irish waters as part of its natural range, mainly occurring in



summer-autumn. Listed in Annex IV of the Habitats Directive as a species in need of strict protection;

c) Marine birds:

Black-legged kittiwake *Rissa tridactyla*, Northern fulmar *Fulmarus glacialis*, Northern gannet *Morus bassanus*

Protected under the Birds Directive (Directive 2009/147/EC), all three are fully marine species that nest and breed in Ireland on islands and cliff-bound terrain that is **less vulnerable to** human interference and mammalian predators than the breeding habitat of other seabird species.

d) Marine mammals:

Bottlenose dolphin *Tursiops truncatus*, Harbour porpoise *Phocoena phocoena*, Grey seal *Halichoerus grypus*, Harbour seal *Phoca vitulina*

All four species occur in coastal and offshore waters of Ireland's maritime area and are listed in Annex II of the Habitats Directive as species whose conservation requires the designation of special areas of conservation. Both cetacean species are also listed in Annex IV.

[Note: While three key, comparatively well-studied species of marine bird and four species of marine mammal have been included in this assessment to represent important "Criteria elements" of marine biological diversity, there are of course many more species within each group occurring and/or breeding in Ireland's marine area. In time additional representative species may be added to future assessments of biological diversity as the scientific knowledge base, data quality and understanding of their ecology and role in our marine ecosystems improves.]

Exclusions

Primary criterion D1C3 arising from Commission Decision (EU) 2017/848 [i.e. The population demographic characteristics of the species (e.g. body size or age class structure, sex ratio, fecundity, and survival rates) are indicative of a healthy population which is not adversely affected due to anthropogenic pressures] was not included in the assessment. This selection decision was based on International Council for the Exploration of the Sea (ICES, 2017) advice for a related criterion under Descriptor 3 – Populations of commercially- exploited fish and shellfish (D3C3). In this ICES concluded that until proof-of-concept has been validated, D3C3 could not be considered operational for MSFD assessment purposes. In addition to the above exclusion, non-commercially-exploited species of cephalopods are not included as criteria elements in the current assessment due to limited scientific knowledge and data on the population biology and ecology of such species.

Primary criterion D1C6 (i.e. The condition of the habitat type, including its biotic and abiotic structure and its functions, is not adversely affected due to anthropogenic pressures) was also not assessed with regard to pelagic broad habitat types. This is due to limited knowledge and understanding of the correct and robust scientific basis and methodologies by which pelagic habitats can be reliably assessed. Instead habitat-linked assessments carried out under Descriptor 4 – Elements of the marine food webs, Descriptor 5 – Human-induced eutrophication and Descriptor 6 – Sea-floor integrity and other Descriptors (e.g. Properties and quantities of marine litter, Introduction of energy) go a considerable



way to inform the assessment of environmental status and condition of habitats in Ireland's marine area.

The OSPAR Intermediate Assessments (2017) is of relevance to biological diversity in Ireland's maritime area were evaluated but not formally included in the current assessment process under Descriptor 1. From Ireland's perspective the Intermediate Assessment (2017) has been superseded by other detailed assessment methods and more recent data which are available to this MSFD assessment process (e.g. via reporting under the Common Fisheries Policy or Ireland's 2019 reporting to the European Commission under Habitats Directive Art.17 and Birds Directive Art.12).

Impact

The parameters and characteristics specified in Commission Directive 2017/845 that are likely to be impacted upon by loss of biological diversity can be divided in to species impacts, habitat impacts and ecosystem/food-web impacts.

The species impacts are considered to operate via changes to: distribution and/or biomass; size, age and sex structure, reproductive potential, survival and mortality/injury; behaviour including movement and migration; habitat for the species (extent, suitability); and species composition within groups of species.

The main habitat impacts are considered to operate via changes to: species composition, abundance and/ or biomass (spatial and temporal variation); size and age structure of species; and physical, hydrological and chemical characteristics. The main ecosystem impacts are considered to operate via changes to: links between habitats and species of marine birds, mammals, reptiles, fish and cephalopods; pelagic-benthic community structure; and productivity.

The effects and consequences of the predominant pressures on biological diversity during the overall assessment period (2013-2018) and prior to that, if relevant, have been considered in the current assessment. For the marine vertebrates outlined above that have been included as criteria elements (i.e. eight reptile, bird and mammal species) this is primarily informed by Ireland's surveillance, assessments and reporting undertaken to meet requirements under the EU Habitats Directive and Birds Directive. In relation to the predominant pressures identified as known and/or of potential significance in Ireland's marine area, based on scientific evidence and knowledge of current human activity there are few such pressures that are considered to operate with potential population-level effects or consequences for these species in Ireland. Among them, however, are:

- Disturbance of species due to human presence
Certain species that avoid interaction with humans or animal predators may be highly vulnerable to human disturbance during times of the year that are critical for their populations and for survival (e.g. during migration, foraging, nesting, breeding or resting phases). Human presence may also mediate additional impacts that cause disturbance to the species' natural history, such as the introduction of problematic predators (e.g. mink at seabird breeding sites), disease or invasive species.



- Extraction of, or mortality/injury to, wild species (by commercial fishing, and/or recreational fishing and/or other activities)
 In addition to the loss of potentially significant food biomass from the marine environment through human extraction, this pressure can also have direct population consequences (e.g. via reduced survival to breeding age or impaired reproductive success) if the level of mortality or injury to wild species is not compensated for by natural factors such as productivity or immigration. [Note: Certain non-commercial fish species have been depleted by fishing in the past and are now on various lists of threatened and declining species. Although there are zero total allowable catches (TACs) or “prohibited” listings for some species, most remain vulnerable to existing fisheries. For example, some are caught as bycatch in mixed demersal trawl fisheries and gillnet fisheries, and deep-water sharks are caught in the mixed deep-water trawl fishery.]
- Physical disturbance to the seabed (temporary or reversible)
 The effect of this pressure, if it acts at a population-relevant scale, may be to deter or displace animals from their natural habitat or reduce foraging opportunities, for example, thereby influencing individual survival or reproductive performance.
- Input of other substances (e.g. synthetic/non-synthetic substances, diffuse and/or point sources, acute events)
 Several substances of industrial origin are known to be prevalent and persistent in coastal/marine environments, including being present in deposited sediments and in the tissues of prey species. Internationally, where their levels are high in the environment some synthetic organic compounds (e.g., PCBs) have been shown to impair the reproductive performance and immune function of affected individuals and, potentially, aggregations of animals (e.g. colonies, social groups).
- Input of litter (solid waste matter, including micro-sized litter)
 A number of vertebrate species appear to be vulnerable to ingestion of plastic and other litter in the marine environment. While active research into the effects of water-borne litter and its ingestion is ongoing, for species such as Leatherback turtle and other surface-feeding vertebrates, the impairment of natural nutritive physiology is a potential effect of this pressure.
- Input of anthropogenic sound (impulsive, continuous)
 Individual species (e.g. some marine mammals) and their populations may also be sensitive to certain types of underwater sound transmitted by human practices in the sea and ocean environment. This is an area under active research in relation to several anthropogenic sound sources and the individual or population-level consequences of disturbance or acoustically-driven injury.

Environment Status

Environmental status is assessed across each of the selected ‘Criteria elements’ as follows:

a) Non-commercially exploited species of fish:

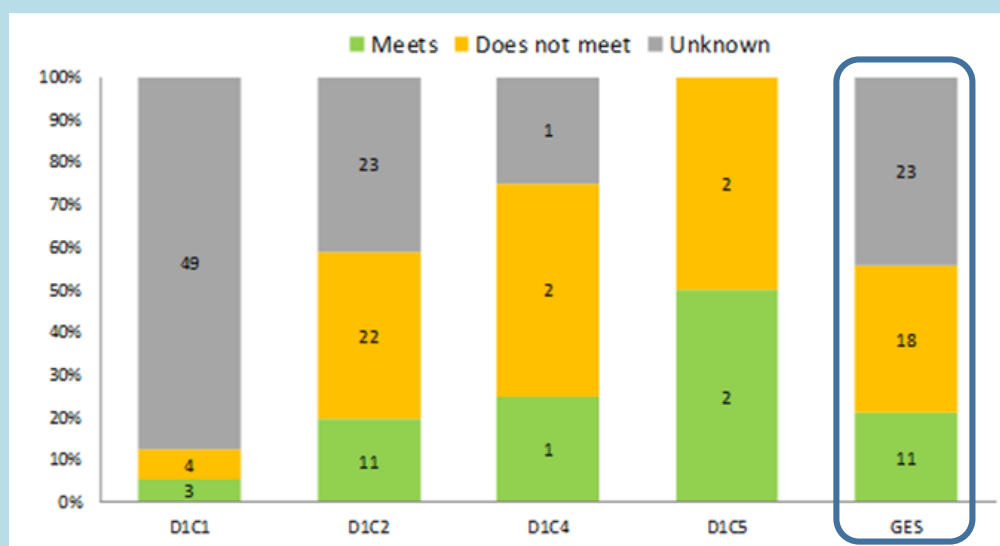
Among all 56 fish species considered in the assessment the status of 33 species is known, while the status of the remaining 23 species is unknown. Detailed assessments against the above primary criteria concluded that eleven (11) species



are in a good state. These consist of Blue ling, Mora, Bigeye, Rabbitfish, Black dogfish, Longnose velvet dogfish, Birdbeak dogfish, Deepwater lanternshark, Blackmouth catshark, Velvetbelly lanternshark and Turbot.

A total of 23 species are determined to be of Unknown status; these are River lamprey (Annex II species), Common thresher shark, Deep sea catsharks, Norwegian skate, Knifetooth shark, Tope, Mouse catshark, Sandy ray, Starry smoothhound, Sailfin roughshark, Thornback ray, Spotted ray, Deepwater ray, Wolffish, Alfonsino, Roundnose grenadier, Snub-nose spiny eel, Straightnose rabbitfish, Spiny scorpionfish and Bluefin tuna.

Among the 18 species found not to be in a good state are Atlantic salmon, Twaite shad, Sea lamprey (all of which are Annex II species), European eel, Leafscale gulper shark, Portuguese dogfish, Kitefin shark, Six-gill shark, Baird's smoothhead, Blackbelly rosefish, Orange roughy, Large-eyed rabbitfish, Basking shark, Shortfin mako shark, Undulate ray, Spurdog and Cod.



Numbers and percentages of assessed fish species meeting or not meeting proposed Environmental Targets D1T1, D1T2, D1T4 and D1T5 under the selected primary criteria; also regarding non-commercial fish species' compatibility with GES overall

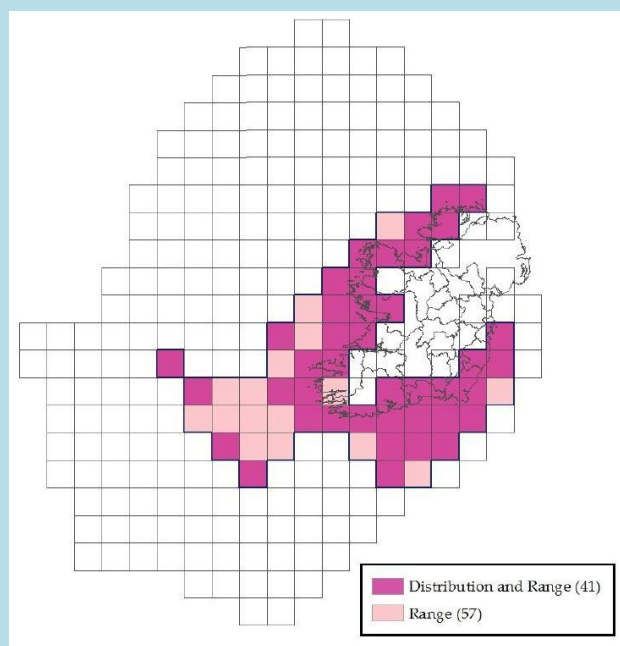
Taking the latest ICES advice (2018) regarding fish species of biodiversity concern, a threshold of 60% of species conforming to GES is considered to be indicative of whether GES is achieved overall. In the current assessment 11 species are evaluated as compatible with GES, while 18 are not compatible with GES. The status of 23 species is classified as Unknown. Overall the proportion of non-commercially-exploited fish species meeting compatibility with GES is 21%, which is below the lower threshold of 60% advised by ICES.

b) Marine reptiles: Leatherback turtle

With regard to the primary criteria and proposed Environmental Targets under this Descriptor, there are currently significant limitations associated with assessing and reporting on the status of this 'sea turtle' species. While some recent progress has



been made in data acquisition from Ireland and adjacent waters, the species' population ecology, range, habitat use and the pressures/impacts it faces in Irish waters and the wider North-East Atlantic, are not well understood.



Observed coastal and marine Distribution and Range of Leatherback turtle in Ireland's MSFD and Habitats Directive assessment area. The map covers all known records from 2000 to 2018 (n=198) collectively displayed as coloured 50km grid cells. Source: NPWS (2019).

Leatherback turtles that migrate through Irish waters mate and breed in the tropics. In the North Atlantic, incidental by-catch in fishing gear (e.g., drift-nets, long-lines) has generally been identified as a significant conservation concern. However, the impacts of leatherback turtle interactions with commercial fishing have not been comprehensively or robustly quantified. In a regional context there is little scientific evidence of by-catch by Irish-registered vessels fishing in the open ocean. In coastal waters however, a small number of individual animals have died or been injured as a result of entanglement in ropes associated with lobster and crab fisheries.

Providing even a rough estimate of the number of Leatherback turtles foraging within Irish waters is difficult since the area in question is very large and animal abundance in the wild could be extremely low. At present, population estimation is further complicated by inherent variability in turtle occurrence between years as a result of climate, long-term population cycles and intrinsic variation in their gelatinous zooplankton prey. With regard to population trends it is not possible to judge whether numbers are increasing, decreasing or stable.

Clearly targeted and collaborative international research is required on (a) the population ecology of Leatherback turtles in the North Atlantic and (b) the extent, severity and risk of impact from human activities on populations of this species. In the meantime, the overall status of this species in Irish waters is assessed as Unknown.

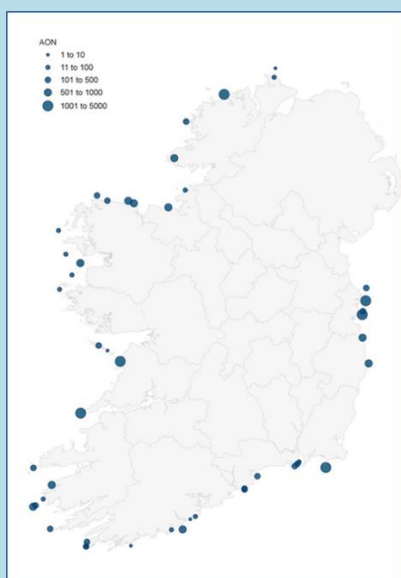
c) Marine birds:



Black-legged kittiwake

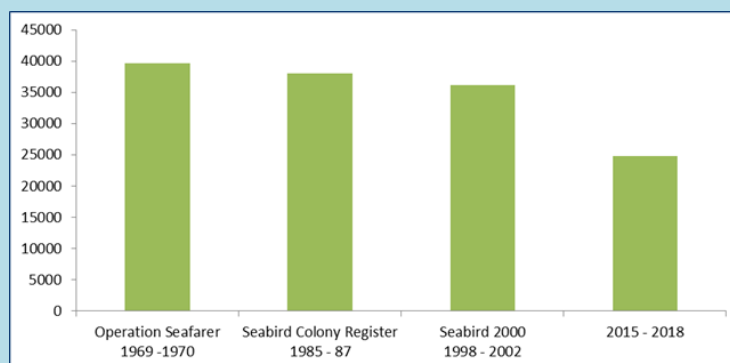
This is most numerous gull species globally and is the most oceanic in its habits, preferring to nest on vertical rocky sea-cliffs in colonies from a few pairs to several thousand pairs. In Ireland Kittiwake breeding sites are well distributed around the coast. Tracking studies in the Atlantic indicate that ca.80% of the adult population winters in waters west of the mid-Atlantic Ridge while birds from Ireland and Britain mainly occupy oceanic waters situated east of the Ridge.

Regarding the primary criteria and proposed Environmental Targets under this Descriptor, this species is not one considered to be at a significant risk of incidental by-catch, since it feeds primarily at the sea surface on small pelagic shoaling fish and invertebrates, and appears to prefer live fish, such as sandeels, sprat or juvenile herring, to discards. Therefore, based on current scientific knowledge and available fisheries monitoring data, it is considered unlikely that the species' long-term viability is threatened by incidental mortality in commercial fisheries.



Breeding Kittiwake abundance and distribution for the period 2015 – 2018. Figures are based on apparently occupied nests (AONs).

Source: NPWS; Cummins et al. (2019).



National breeding population estimates for Kittiwake from Operation Seafarer to the current National Seabird Monitoring Programme (2013-2018). Source: NPWS; Cummins et al. (2019).

In relation to population abundance, however, there are clear indications that national figures have decreased significantly over the past 20 years (i.e. 24,728 pairs in 2015-2018, a short-term decrease of 32% from 1998/2002). This is driven by acute short-term declines at some of the most important breeding colonies in Ireland (i.e. Horn Head, Co. Donegal, Cliffs of Moher, Co. Clare and Great Saltee Island, Co. Wexford). Monitoring data collected in 2015-2018 describe a near 20% reduction in breeding population estimates at Lambay Island, Co. Dublin alone,



which, owing to its relative colony size, significantly influenced the national population picture.

While there is evidence of a substantially wider distribution of breeding colonies around the coast than was known heretofore and surveys at sea describe (as expected) the species' occupancy of waters throughout Ireland's Exclusive Economic Zone (EEZ), there is nevertheless an underlying question concerning Kittiwake reproductive success and the extent and condition of its natural habitats, given the observed breeding population decline. Causes of the decline are unclear at present and some examples of potential factors involved are changes in food availability or prey distribution, or climate-related influences. Consequently the overall status of this species in Irish waters is assessed as Unknown, while (i) the species' population dynamics in the North-East Atlantic and (ii) the extent, severity and risk of impact from human activities on its populations, should be investigated further.

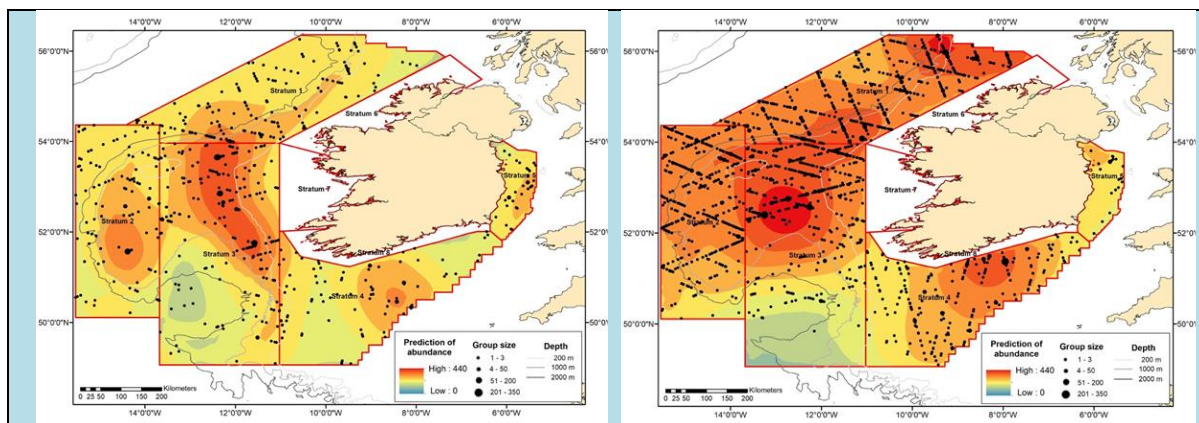
Northern fulmar

This distinctive large petrel species is a common sight around the Irish coast, particularly in the northwest, west and south of the country where it nests on steep vertical slopes and broad ledges near the top of vegetated cliffs. Fulmar breeding distribution was once mainly restricted to the Arctic but since the 1700s its range has expanded southwards from Iceland to the coasts of Britain, Ireland and France.

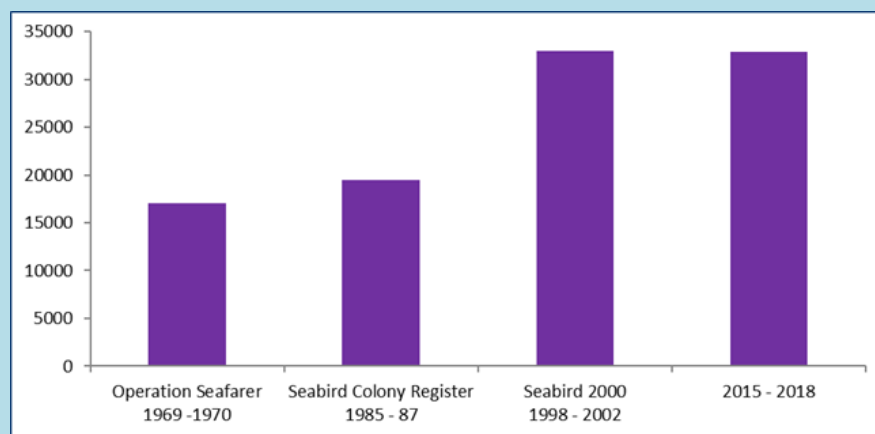
Although their close association with commercial fisheries and discarded offal or unwanted/incidental catches is well described, dietary studies indicate that Fulmars are very wide-ranging and feed on a wide variety of prey that occur near the sea surface including small pelagic fish, sandeels, squid, amphipods and copepods. Accidental by-catch interactions with certain fishing gears are known to occur in the North-east Atlantic (e.g. in long-lines and trawl nets). Yet the incidence of Fulmar by-catch by Irish-registered vessels would appear to be uncommon and may well be below levels that could threaten the species in the long-term. Actual mortality rates from by-catch require active scientific research, however, since more robust conclusions are difficult to determine at present.

The population abundance of this species in Ireland appears to be relatively stable since the 1990s (ca.33,000 pairs), having increased markedly from levels recorded in periodic surveys during 1969-70 and in the 1980s. Considerable variation in population trajectories between individual breeding colonies is noted however via the National Seabird Monitoring Programme and there is a need to continue scientific monitoring, at regional and national scales on land and at sea, in order to better understand the species' population dynamics and the role/influence (if any) of human activities and impacts on Fulmar reproductive success or abundance.

In consideration of the Environmental Targets outlined above, given that the available scientific evidence from Ireland shows a low by-catch incidence, an increasing breeding distribution, an extensive distributional range at sea and stable population figures nationally, it is concluded that the Fulmar's current status is compatible with GES.



Predicted summer distribution (top), winter distribution (bottom), relative densities and observed group sizes of Fulmar in Irish waters, modelled from aerial survey data gathered in 2015 and 2016. Source: Ireland’s ObSERVE Programme; Rogan et al. (2018a).



National breeding population estimates for Fulmar from Operation Seafarer to the current National Seabird Monitoring Programme (2013-2018). Figures are based on apparently occupied nests (AONs). Source: NPWS; Cummins et al. (2019).

Northern gannet

The Gannet is an iconic seabird species and the largest marine bird commonly inhabiting the North Atlantic. A wide-ranging pelagic forager, its breeding adults mainly occur in temperate waters and they are site-faithful, with most breeding colonies occupied by individual birds for decades or longer.

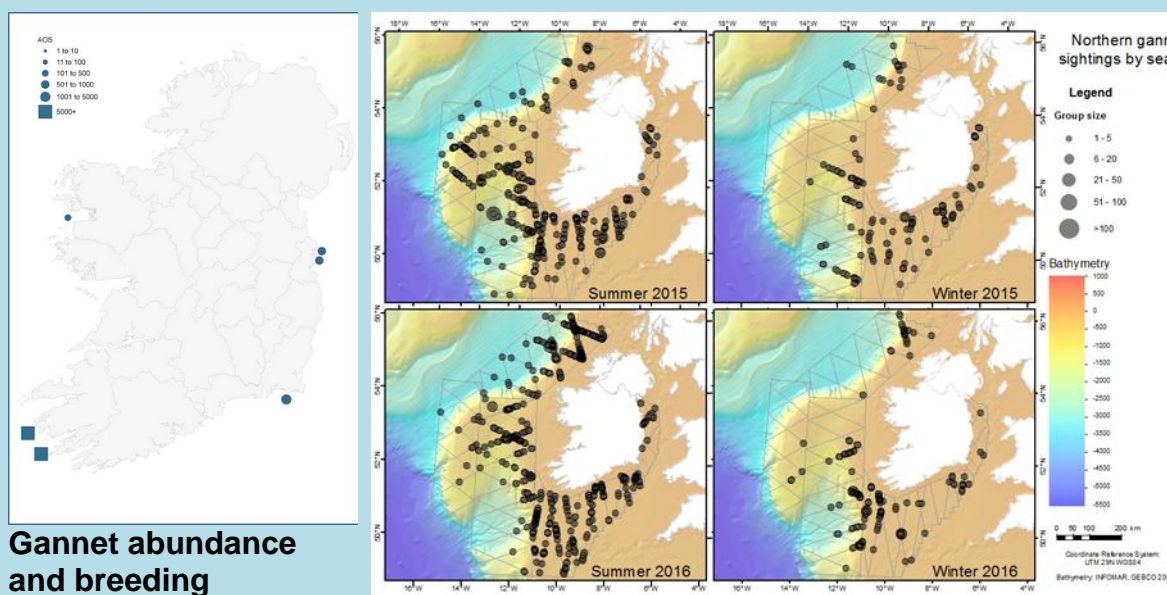
In a national context, Gannets breed gregariously on a few isolated sea stacks, small uninhabited islets and on occasion, inaccessible cliffs on larger islands (e.g., Ireland’s Eye and Lambay Island, off Co. Dublin).

With regard to the primary criteria and proposed Environmental Targets under this Descriptor, there is substantial evidence of this species interacting opportunistically with a wide range of commercial fisheries; for example, by feeding directly on retained catches at the surface as they are taken on board, by scavenging on discards or on drop-outs from vessels and associated gear. Gannets otherwise naturally forage at the surface and sub-surface where they



mainly target small shoaling fish (e.g. sandeels, mackerel, herring and other small- to mid-sized pelagic fish).

The acquired tendency to forage around fishing operations may help to explain why the Gannet is one of the seabird species recorded as incidental by-catch in fishing operations. Data currently available from limited monitoring aboard Irish-registered vessels suggests that the rate of Gannet mortality from by-catch in Irish waters is low, however. Improved observation effort at sea (e.g. a higher % and more representative sample of fishing vessels actively monitored), particularly around higher-risk fishing methods, is required to continually validate and further support this and future assessments.



Gannet abundance and breeding distribution in Ireland for the period 2013 – 2014. Figures are based on apparently occupied sites (AOSs). Source: NPWS; Cummins et al. (2019).

Distribution of Gannet sightings (black circles) from aerial surveys carried out in the summer (left) and winter seasons (right), 2015 & 2016. Grey lines indicate the survey track-lines. Circles are proportional to the number of birds recorded in each sighting. Source: Ireland's ObSERVE Programme; Rogan et al. (2018a).

In relation to its abundance, the Irish breeding population of Gannets has been surveyed on five census occasions since the late 1960s, along with the population in Britain and, where possible, the wider North Atlantic. The most recent breeding season census in Ireland took place primarily during 2013 and 2014. The data generated show that the Irish population has increased by an estimated 33% over a 10-year period to reach 47,946 pairs in 2014, and that its breeding distribution has expended accordingly (up 20% since 2004, up 50% since 1984/85). Regional populations at the traditional colonies have increased across the board such that, in historical terms, the population has increased by 121% since Operation Seafarer in 1969-70.

In consideration of the Environmental Targets outlined above, given that the available scientific evidence from Ireland shows a low by-catch incidence, an



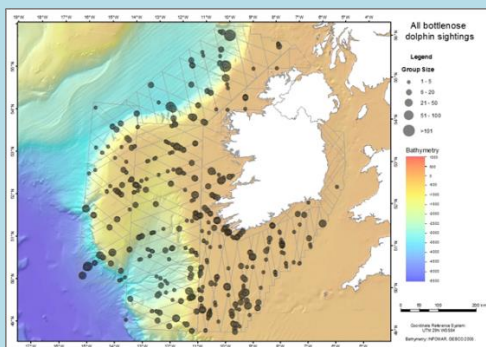
increasing breeding distribution, an extensive distributional range at sea and increasing population figures over more than a decade, it is concluded that the Gannet's current status is compatible with GES.

d) Marine Mammals:

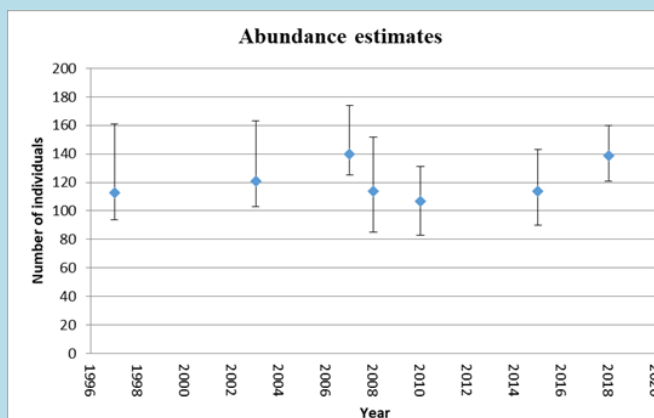
Bottlenose dolphin

This is one of the most frequently recorded and familiar cetaceans occurring in Ireland, with contemporary sighting records showing its wide occurrence throughout Irish coastal and offshore waters, from those overlying the continental shelf and continental slope to deeper ocean basins.

Regarding incidental by-catch, the available evidence from Irish-registered fishing vessels and from coastal strandings indicates that accidental catches of this larger dolphin are uncommon in Irish commercial fisheries and are therefore unlikely to threaten the species in Irish waters. However improved observation effort at sea (e.g. a higher % and more representative sample of fishing vessels actively monitored), particularly around higher-risk fishing methods, is required to continually validate and further support this and future assessments.



Observed coastal and marine Distribution and Range and group sizes of Bottlenose dolphin within Ireland's EEZ, covering 482 aerial sighting records from May 2015 to March 2017 (summer and winter only). Source: Ireland's ObSERVE Programme; Rogan et al. (2018a).



Estimates of population abundance (point estimate & 95% Confidence Intervals) for Bottlenose dolphins in the Lower River Shannon SAC (i.e. Shannon Estuary), from mark-recapture photo-identification surveys conducted since 1996. Source: NPWS; Rogan et al. (2018b).

Robust long-term data on Bottlenose dolphin population abundance and trends in Irish waters as a whole are not yet available. In a coastal context, high quality data collected from the Lower River Shannon, which comprises a Special Area of Conservation for this Annex II species, describe a relatively stable local population of ca. 120-160 individuals. Knowledge of the species' seasonal distribution and summer abundance in western European waters has improved significantly in recent decades. There has also been improved population abundance data from a large part of Ireland's EEZ, yielding substantial new estimates numbering 68,714-147,267 individuals and exceeding all previous figures for the region.

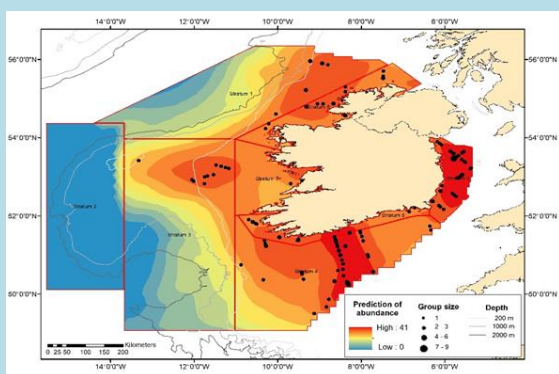


Although Bottlenose dolphins may be subject to a number of local and/or regional environmental pressures throughout their range, based on current spatial, temporal and ecological data none are considered to be of sufficient impact on the species to be causing a significant deterioration in overall range, distribution or habitat quality in Ireland from a status that is sufficient for long-term survival.

In consideration of the Environmental Targets outlined above, it is therefore concluded that this species' current status is compatible with GES.

Harbour porpoise

The Harbour porpoise is the smallest cetacean species occurring in Irish waters yet is one of the most frequently recorded, though this can be more difficult offshore due to its size and inconspicuous nature.

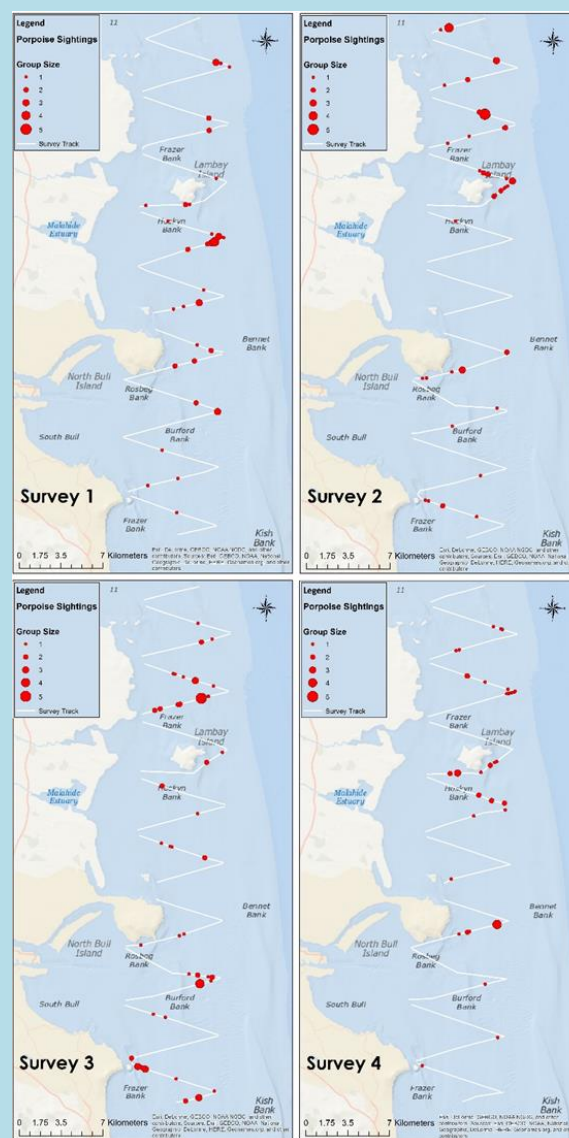


Predicted summer distribution and relative density of Harbour porpoises in Irish waters in the summer of 2016, modelled from high quality aerial survey data.

Source: Ireland's ObSERVE Programme; Rogan et al. (2018a).

Mapped survey tracks, Harbour porpoise sighting locations and corresponding group sizes (red circles) recorded during line-transect surveys of Rockabill to Dalkey Island SAC off the Co. Dublin coast in the summer of 2016.

Source: NPWS; O'Brien & Berrow (2016).



In relation to proposed Environmental Targets under this Descriptor, available evidence from Irish and non-Irish registered fishing vessels, and from coastal strandings, indicates that accidental catches of Harbour porpoise do occur in commercial operations, particularly in set-net gears (e.g. gill-nets). This detrimental interaction is complex and variable in space and time, and is currently difficult to



measure with scientific confidence. Yet it could constitute a pressure on the species, particularly in the Celtic Seas subregion of the North-east Atlantic, which includes southern Irish waters. Significantly improved observation effort at sea (e.g. a higher % and more representative sample of fishing vessels actively monitored), particularly around higher-risk fishing methods, is required to investigate this occurrence further and to support future assessments.

Knowledge of the species' seasonal distribution and summer abundance in western European waters has improved significantly in recent decades. There has also been improved population abundance data from a large part of Ireland's EEZ, yielding new estimates numbering 29,519-51,840 individuals and highlighting areas of apparent importance for the species (e.g. Irish Sea). In a coastal context, good quality data collected over the last decade from Ireland's three Special Area of Conservation for this Annex II species, describe relatively high densities during the summer months in which calving and initial nursing of young porpoises is known to occur.

Although Harbour porpoises may be subject to a number of local and/or regional environmental pressures throughout their range, based on current spatial, temporal and ecological data none are considered to be of sufficient impact on the species to be causing a significant deterioration in overall range, distribution or habitat quality in Ireland from a status that is sufficient for long-term survival. In consideration of the Environmental Targets outlined above, it is therefore concluded that this species' current status is compatible with GES.

Grey seal

In Ireland the Grey seal is the most abundant and most widely distributed seal species. Generally considered part of a larger population or meta-population that also inhabits adjacent jurisdictions (i.e. the UK and France at least), the species has undergone a general expansion in its numbers and occupancy of terrestrial/inter-tidal haul-out (resting) sites in Ireland since it first gained legal protection in 1976.

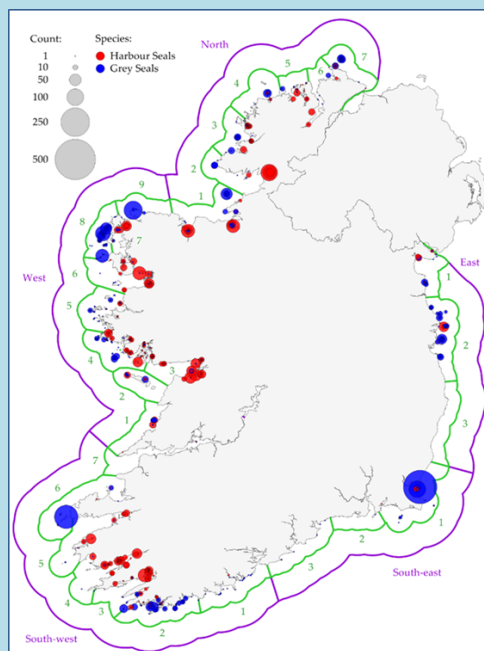
Grey seals may be subject to a number of local or regional environmental pressures and threats throughout their North Atlantic range and in Irish coastal/offshore waters. Among them, accidental by-catch interactions with certain fishing métiers are known to occur, particularly with set-net gears such as tangle-nets, trammel-nets and gill-nets that are commonly used for demersal fishing in coastal and/or offshore waters. With regard to mortality rates from incidental by-catch, active scientific research into the scale, reasons for and spatial/temporal extent of interactions is ongoing at present and definitive or robust conclusions are difficult to determine in the time-frame of this assessment.

It is noteworthy, however, that evidence from surveys carried out since the mid-1990s indicates that the all-age population of Grey seals has been growing in Ireland, driven largely by increases in pup production and recruitment to the population at each of the seven main breeding colonies. In this context the estimated 7,284-9,365 seals associated with breeding in Ireland (2013) is considered to be a minimum estimate, given that more recent surveys suggest ongoing growth at the main colonies. Growing Grey seal abundance is also



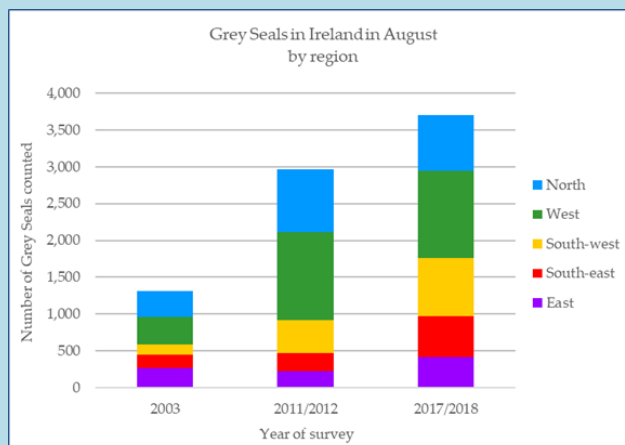
reflected in nationwide counts of this species in summer (August), underlining further a positive population status and trend.

Coupled with Habitats Directive assessment information (2019) which indicates that Grey seal range, distribution and habitat quality are in a favourable condition, it is concluded that the species' current status is compatible with GES.



Numbers and distribution of Grey seals (blue circles) and Harbour seals (red circles) recorded within labelled sub-regions in Ireland in August 2017 & August 2018. The displayed symbol size represents the recorded group size with count guides given in the Legend (top left)

Source: NPWS; Morris & Duck (2019).



Observed increases in the number of Grey seals counted during nationwide aerial thermal imaging surveys in 2003-2018.

Source: NPWS; Morris & Duck (2019).

Harbour seal

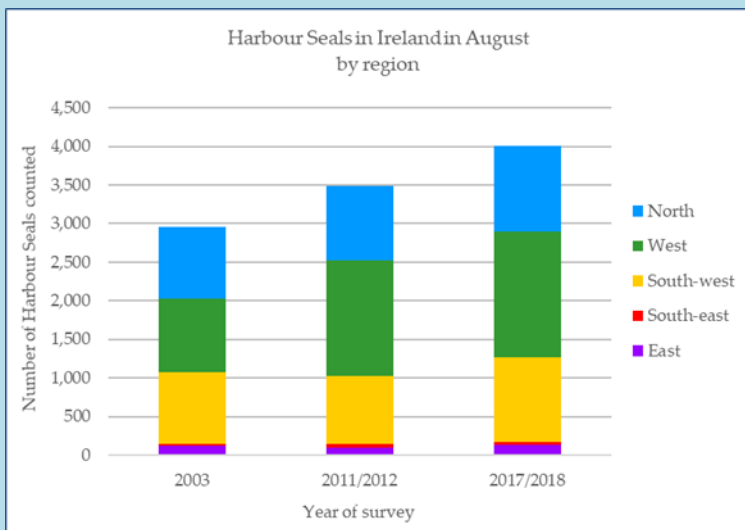
In Ireland Harbour seals occur in estuarine, coastal and fully marine areas and also occupy regular haul-out (resting) sites about which animals breed, moult, rest and engage in social activity, for example. In mainland Europe and the UK, substantial declines and die-offs have been recorded both historically and recently, including via viral disease. However, there has been little evidence of such occurrences on a broad regional or indeed local scale in Ireland.

Coupled with Habitats Directive assessment information (2019) which indicates that Harbour seal range, distribution and habitat quality are in a favourable condition, it is concluded that this species' current status is also compatible with GES.

Similarly to Grey seals, accidental by-catch interactions of Harbour seals with certain fishing gears are known to occur. However, the incidence of Harbour seal by-catch would appear to be less common than is evident for Grey seal. With regard to seal mortality rates from by-catch, active scientific research into the



scale, reasons for and spatial/temporal extent of interactions is ongoing and definitive, robust conclusions are difficult to determine at present.



Observed increases in the number of Harbour seals counted during nationwide aerial thermal imaging surveys in 2003-2018. Source: NPWS; Morris & Duck (2019).

In relation to population numbers occurring around Ireland, the available evidence from surveys carried out since the mid-1980s indicates that the all-age population of Harbour seals has been relatively stable over the last two decades and is possibly growing gradually. There are, however, some significant gaps in the knowledge of this species' population ecology, particularly in relation to its current breeding distribution and productivity. In this context the estimated 4,007 Harbour seals recorded in August 2017 and 2018 is a minimum estimate, being based on counts of seals at moulting haul-out sites only. It is nevertheless the highest abundance figure recorded in Ireland, suggesting both a positive population status and trend since comprehensive nationwide surveys began in 2003.

	D1T1 By-catch mortality rate	D1T2 Population abundance	D1T4 Distributional range	D1T5 Habitat extent & condition	GES Compatibility
Non-commercially-exploited fish (56 species)	Grey	Yellow	Yellow	Grey	Yellow
Reptiles (1 species)	Grey	Grey	Grey	Grey	Grey
Birds (3 species)	Green	Yellow	Grey	Grey	Grey
Cetaceans (2 species)	Grey	Green	Green	Green	Green
Seals (2 species)	Grey	Green	Green	Green	Green



Synopsis of the status of selected criteria elements assessed against proposed Environmental Targets for biological diversity D1T1, D1T2, D1T4 and D1T5; and also their compatibility with GES overall (presented within right-hand-side blue bordered column).

Green shading = assessed as favourable with respect to environmental status;
 Orange shading = assessed as unfavourable with respect to environmental status;
 Grey = unknown/indeterminate with respect to environmental status.

Linkages

Other primary criteria arising from Commission Decision (EU) 2017/848 that relate to this assessment of biological diversity are (paraphrased) as follows:

D2C1 - The number of non-indigenous species newly-introduced by human activities into the wild

D3C1 - Fishing mortality rate of populations of commercially-exploited species

D3C2 - Spawning Stock Biomass of populations of commercially-exploited species

D3C3 - Age & size distribution of individuals in populations of commercially-exploited species

D4C1 - The diversity of the trophic guild (species composition & relative abundance) is not adversely affected due to anthropogenic pressures

D4C2 - The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures

D5C1 - Nutrient concentrations are not at levels that indicate adverse eutrophication effects

D5C2 - Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment

D6C1 - Spatial extent & distribution of physical loss (permanent change) of the natural seabed

D6C2 - Spatial extent & distribution of physical disturbance pressures on the seabed

D6C3 - Spatial extent of each habitat type which is adversely affected by physical disturbance

D6C4 - The extent of loss of the habitat type, resulting from anthropogenic pressures

D6C5 - The extent of adverse effects from anthropogenic pressures on the condition of the habitat type

D8C1 - Concentrations of contaminants in coastal & territorial waters, and beyond territorial waters

D8C3 - The spatial extent & duration of significant acute pollution events

D10C1 - The composition, amount & spatial distribution of litter on the coastline, in the surface layer of the water column and on the seabed

D10C2 - The composition, amount & spatial distribution of micro-litter on the coastline, in the surface layer of the water column and in seabed sediment



D11C1 - The spatial distribution, temporal extent & levels of anthropogenic impulsive sound sources

D11C2 - The spatial distribution, temporal extent & levels of anthropogenic continuous low-frequency sound

Conclusion

Overall the assessment under Descriptor 1 – Biological diversity concludes that, on balance, non-commercially-exploited fish species are not compatible with GES. Ireland's only commonly occurring marine reptile species, the Leatherback turtle, is assessed as Unknown in this regard. However, of seven representative higher predator (vertebrate) species, six that consist of marine birds and mammals are considered to be in a status that is compatible with GES. The latter results are informed by favourable Birds Directive and Habitats Directive assessments undertaken and reported by Ireland in 2019.

In time additional representative species may be added to future assessments of biological diversity as the scientific knowledge base, data quality and understanding of their ecology and role in our marine ecosystems improves.



Descriptor 2 – Non-indigenous Species



Undaria pinnatifida, Wakame or Asian kelp, growing in Kilmore Quay, Co. Wexford
Photograph © Dr Stefan Kraan

Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in the Commission Decision (EU) 2017/848 and the amending Commission Directive (EU) 2017/845.

In relation to Descriptor 2 – Non-indigenous species (NIS) these new criteria and standards provide a basis for assessment. Descriptor 2 comprises of one primary criteria, the numbers of NIS, newly introduced via human activity into the wild per the assessment period 2013 to 2018, is minimised and where possible reduced to zero (D2C1) on which this assessment is based.

Three newly introduced species have been identified in Irelands MSFD area during the assessment period 2013-2018. This figure is considered to be low based on expert judgement and it is comparable with the numbers of new NIS described in the OSPAR Intermediate Assessment (2017)². The current state of the Irish marine environment with respect to the numbers of NIS newly introduced via human activity into the wild from 2013 to 2018, is compatible with Good Environmental Status.

Introduction

In 2013 Ireland completed an Initial Assessment of its maritime area. At the time the assessment concluded that it was not possible to assess the current status of non-indigenous species (NIS) and that work was on-going on how best to improve the understanding of the presence, distribution, trends and impacts of NIS in the Irish Assessment Area.

The Commission Decision (EU 2017/848) has led to developments in the methods of assessment for NIS.

² <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/non-indigenous/>



Since the initial assessment progress has been made in the assessment of NIS through various research projects focused on quantifying the numbers of NIS in Irish marine waters.

Developments have also been made in implementing management processes aimed at minimising new introductions, including the development of a comprehensive Alien Species work programme focused on the aquaculture sector.

A broad assessment has been carried out in respect of the number of NIS which are newly introduced via human activity into the wild per the assessment period 2013 to 2018 (D2C1); this assessment shows that three new NIS introductions have been recorded during the assessment period 2013 to 2018. In total 135 No marine NIS have been recorded in the wild, in records that date back as far as 1811. The three new introductions are:

- Undaria pinnatifida, Wakame or Asian kelp
- Schizoporella japonica, a bryozioan
- Perphora japonica, a colonial sea squirt

Drivers

The driver for the introduction of NIS in Irish marine waters is economic development. The following activities are listed in the Commission Directive 2017/845, as drivers associated with NIS:

- Shipping
- Tourism & Leisure
- Fish & Shellfish Harvesting and Processing Industries

Climate change effects may also drive NIS introductions. However, there is not enough known about climate change as a driver at this time.

Pressures

The pressures listed in the Directive associated with NIS are:

- Input or spread of non-indigenous species
- Input of genetically modified species and translocation of native species
- Loss of, or change to, natural biological communities due to cultivation of animal or plant species
- Disturbance of species (e.g. where they breed, rest and feed) due to human presence

Environmental Targets

Ireland's Initial Assessment (2013) describes the characteristic of Good Environmental Status (GES) for Descriptor 2 as follows:

“Good status is achieved when the risks and pathways from vectors which facilitate the introduction and spread of NIS as a result of human activities is significantly reduced by way of appropriate measures; and should they arrive, by applying, where feasible, practical and cost-effective means, to control or reduce their further spread”.

The following targets were adopted in the 2013 Initial Assessment:

Target 1: Effect a reduction in the risk of introduction and spread of non-native species through the prioritisation of species and improved management of high risk pathways and vectors.

Target 2: The development of action plans for key high-risk marine non indigenous species by 2020.



Recognising the requirements of the Commission Decision (EU) 2017/848 and the amended Commission Directive (EU) 2017/845 the following environmental target is proposed for the primary Criteria (D2C1):

Proposed Environmental Target D2T1

The number of NIS which are newly introduced via human activity into the wild is minimised and where possible reduced to zero.

Threshold Values

There are currently no threshold values associated with Descriptor 2. The development of regional and sub-regional threshold values for NIS have not been undertaken at this time.

Criteria / Critical elements included in the Assessment

The Criteria from the Commission Decision (2017/848 EC) considered in this assessment is

- The number of NIS which are newly introduced via human activity into the wild per the assessment period 2012 to 2018, is minimised and where possible reduced to zero (D2C1).

Exclusions

There is no current evaluation under the two secondary criteria for Descriptor 2 namely:

- Criteria D2C2 (Abundance and spatial distribution of established NIS, particularly of invasive species, contributing significantly to adverse effects on particular species groups or broad habitat types) and
- D2C3 (Proportion of the species group or spatial extent of the broad habitat type which is adversely altered due to NIS, particularly invasive NIS)

Secondary criteria, are used to complement the primary criteria when the marine environment is at risk of not achieving or not maintaining good environmental status for that criteria. In addition, there is currently insufficient data available on the abundance and spatial distribution of NIS in the Irish MSFD area.

Impact

The impacts of NIS in Irish marine waters include:

- Loss of native biodiversity, including hybridisation and loss of genetic integrity
- Loss of recreational value
- Loss of ecosystem services, for example directly in mariculture increased time taken to clean mussel lines of *Didemnum* and indirectly, through the loss of potential seed sources with the banning of importing seed mussels from high risk areas.
- Transfer of diseases, including the potential for the loss to both farmed and wild stock.

Environment Status

Linkages

Other Criteria and elements which relate to the D2C1 assessment are as follows:



The number of NIS currently recognised in Irish marine waters is 135. 3 No. species are assessed as newly introduced during the period 2013-2018.

Appropriate measures have been taken to control the vector risks and pathways described in the Initial Assessment (2013), including the development of a comprehensive Alien Species work programme focused on the aquaculture sector and research projects focusing on quantifying NIS in Irish marine waters. The Ballast Water Convention has entered in-to force internationally however; the direct legal provision is not yet in-force in Ireland. Internationally ships are required to comply with its provisions and do so when entering Irish ports.

The OSPAR Intermediate Assessment 2017³ outlines the numbers of new NIS recorded in OSPAR by region. This assessment highlights that for the 6-year period 2009 to 2014 the mean member of new NIS recorder per region was as follows:

- Greater North Sea (Region II) 7.67
- Celtic Seas (Regions III) 2.83
- Bay of Biscay & Iberian Coast (Region IV) 3.67

The 3 NIS newly recorded in the Irish MSFD area for the 6-year period 2013-2018 compares favourably with the OSPAR assessment figure for Region III (Celtic Seas).

Descriptor 1 Biodiversity

Criteria 2 Population abundance

Criteria 3 Population demographic characteristics

Criteria 6 Pelagic habitat condition

Descriptor 6 Sea Floor Integrity

Criteria 3 Spatial extent of habitat type

Criteria 4 Benthic habitat extent

Conclusion

Significant process has been made in identifying the number of NIS in Irish marine waters and three NIS have been recorded as newly introduced since 2013. Management processes aimed at minimising new introductions have been implemented. The current state of the Irish marine environment with respect to the numbers of NIS newly introduced via human activity into the wild from 2013 to 2018, is compatible with Good Environmental Status.

³ <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/non-indigenous/>



Descriptor 3 – Population of Commercial Fish/Shellfish

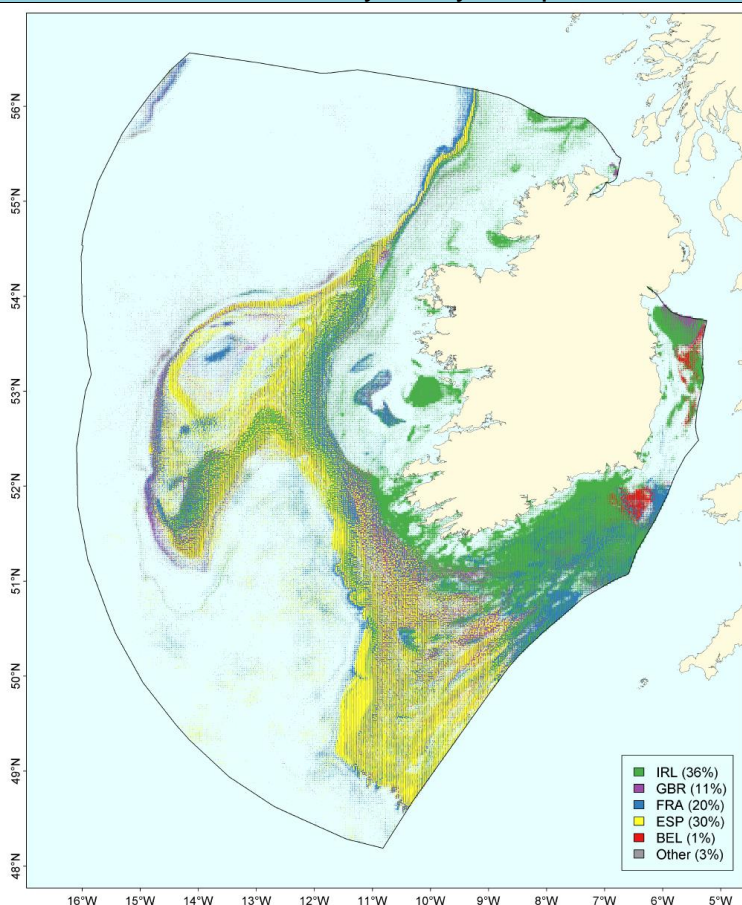
Key Messages

In 2013, Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845.

A key finding was there was a substantial improvement in D3C1, fishing mortality. Of the stocks assessed in both cycles, there was an 80% improvement in stocks in compatibility with Criterion D3C1.

In relation to Descriptor 3 – Populations of all commercially exploited fish and shellfish the status of 177 commercial fish and shellfish stocks within Ireland's designated MSFD area was assessed.

A key finding is that 34 stocks are considered to be compatible with Good Environmental Status (GES), while 44 stocks are not. The compatibility of 99 stocks with GES is unknown. Overall, on balance, the status of commercial fish and shellfish stocks is not yet fully compatible with GES.



▲ The nationality of vessels ≥15m fishing in the Irish EEZ (all gears combined). IRL = Ireland; GBR = United Kingdom; FRA = France; ESP = Spain; BEL = Belgium. The percentages in the legend refer to the share of the total effort inside the EEZ for each country.

Pressure Map of Fishing effort in Irish waters

(Marine Institute)

Introduction



In 2013, Ireland completed an Initial Assessment of its maritime area. At that time, the assessment concluded that the current status of fish and shellfish stocks, in terms of their contribution to the achievement of GES, could not be fully determined because a number of stocks had not been evaluated against specific Maximum Sustainable Yield (MSY) reference points. The European Commission Decision (EU) 2017/848 has led to revisions in how commercial stocks are to be assessed, and gives criteria for which all stocks that should be included in the assessment. An assessment has been carried out in respect of the criteria in this Commission Decision.

Fisheries in Irish MSFD waters are managed both under the EU's Common Fisheries Policy (CFP) and nationally for stocks not subject to the EU quota regime. This assessment covers stocks which are fished in Irish MSFD waters. Many of these stocks straddle the boundary between Ireland and other jurisdictions, while some are exploited in Irish waters but not by Irish vessels. The relevant criteria for inclusion of stocks in the assessment is based on Commission Decision 848/2017.

The objective of this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically Descriptor 3, individually and collectively for fish stocks being caught in Irish MSFD waters.

Drivers

Irish MSFD waters are a subset of the "Celtic Seas ecoregion" – as defined by the International Council for Exploration of the Sea (ICES) - and they share the general characteristics of that ecoregion. The Celtic Seas ecoregion supports some of the most productive fishing grounds in Europe. At least 8 major fishing nations currently have fisheries targeting the many marine stocks within this area. The greatest volume of landings is by Norway, UK, Ireland, the Netherlands and France. Lesser amounts are landed by Germany, Spain and Belgium.

These fisheries target a large number of stocks. The pelagic fisheries, which account for the largest catches (by weight) in the region are the mid-water trawl fisheries for blue whiting, mackerel, horse mackerel, herring, boarfish and sprat. The largest demersal fishery targets hake along the shelf edge using gill-nets and long-lines. There are also large mixed bottom-trawl fisheries targeting demersal and benthic species including Nephrops and gadoids. The species composition of these mixed fisheries tends to vary, depending on the area and the fishing fleets of countries involved in the fishery. In addition, there are many inshore fisheries which take place inside 6-12

Pressures

The predominant pressure exerted by fishing in Irish waters has been identified as extraction of or mortality/injury to wild species by commercial fishing. Such extraction of fish from a stock through fishing leads to fishing mortality on target species and also non-target species (i.e. incidental by-catch).

Other pressures from commercial fishing, which have been identified in Irish waters are abrasion, incidental loss of species and marine/coastal litter.



nautical miles from the coast and mostly use static fishing gears (i.e. gill-nets, trammel nets, tangle nets).

Landings from nations such as Ireland, Norway, the Netherlands, Germany and Denmark are dominated by pelagic species. Other nations within the EU target a combination of pelagic, demersal (including Nephrops), deep-water and shellfish species. France has the highest reported effort. Effort levels for most countries show declining trends, with the most pronounced decline seen in Spanish effort. In addition to the above, inshore fishing takes place inside 12 nm of the Irish coast, while fishing from the baselines to 6nm is limited to Republic of Ireland and Northern Ireland owned and operated vessels only.

Environmental Target

Ireland's Initial Assessment (2013) described the characteristic of Good Environmental Status (GES) for populations of commercial fish and shellfish as follows:

Populations of commercially exploited fish and shellfish are within safe biological limits. Stocks of commercially exploited fish and shellfish species are exploited at levels which ensure long term sustainability and maintenance of sufficient reproductive capacity. Populations exhibit a healthy composition with regard to age and size distribution. Consistency to be maintained in accordance with the progressing reform of the EU Common Fisheries Policy,

The associated targets outlined in the Initial Assessment (2013) were as follows:

- Target fishing mortality to be at levels which aim to restore and maintain populations of harvested species at least at levels which can produce the maximum sustainable yield, by 2015, where possible. Where stocks are managed within an agreed management plan, which is consistent with MSY in the long term, target fishing mortality as specified by the management plan should be adhered to;
- Target fishing mortality to be at levels which aim to restore and maintain populations of harvested species at least at levels which can produce the maximum sustainable yield, by 2020, for all stocks. Where stocks are managed within an agreed management plan, which is consistent with MSY in the long term, target fishing mortality as specified by the management plan should be adhered to;
- Spawning Stock Biomass (SSB) should be within the range of biomasses which would be expected under fishing mortality equal to or below FMSY in the medium to long term and incorporate scientific uncertainty and natural variability;
- Size and age structure as measured by selected indicators reflect populations which are sustainably fished in the medium to long term and incorporate scientific uncertainty and natural variability.



These environmental targets from the Initial Assessment have been updated in light of the Commission Decision (EU) 2017/848 amending Commission Directive (EU) 2017/845. Ireland now proposes the following environmental targets, based on the revised Common Fisheries Policy, Regulation (EU) 1380/2013, which stipulates that

“in order to reach the objective of progressively restoring and maintaining populations of fish stocks above biomass levels capable of producing maximum sustainable yield, the maximum sustainable yield exploitation rate shall be achieved by 2015 where possible and, on a progressive, incremental basis at the latest by 2020 for all stocks.”

Proposed Environmental Target D3T1

The Fishing mortality rate of populations of commercially exploited species is at or below levels which can produce the maximum sustainable yield (MSY).

Proposed Environmental Target D3T2

The Spawning Stock Biomass of populations of commercially-exploited species are above biomass levels capable of producing maximum sustainable yield (MSY).

Threshold Values

The threshold value for the proportion of stocks being compatible with GES is 100% following the Common Fisheries Policy Regulation (EU) 1380/2013.

Criteria / Criterial elements included in the Assessment

The Criteria from the Commission Decision (2017/848 EC) considered in this assessment are:

D3C1 - The Fishing mortality rate of populations of commercially-exploited species is at or below levels which can produce the maximum sustainable yield (MSY) Appropriate scientific bodies shall be consulted in accordance with Article 26 of Regulation (EU) No 1380/2013.

D3C2 - The Spawning Stock Biomass of populations of commercially-exploited species are above biomass levels capable of producing maximum sustainable yield (MSY). Appropriate scientific bodies shall be consulted in accordance with Article 26 of Regulation (EU) No 1380/2013

ICES advises that the aggregation of the assessment results for criteria D3C1 and D3C2 by stock should be done such that only if both criteria are met would GES be achieved for that stock.

Exclusions

Currently criterion D3C3 (i.e. the age and size distribution of individuals in the populations of commercially-exploited species is indicative of a healthy population) is not included in the assessment. This exclusion is based on ICES (2017) advice that until proof of concept has been validated, D3C3 could not be considered as operational for MSFD assessment purposes.

Impact

ICES has evaluated the main impacts of fishing on the marine environment as extraction, abrasion and smothering. Among the parameters and characteristics specified in Commission Directive 2017/845 that are likely to be impacted upon by fisheries are changes to:



- distribution and/or biomass;
- size, age and sex structure, fecundity, survival and mortality/injury;
- behaviour including movement and migration;
- habitat for the species (extent, suitability);
- species composition within groups of species.

Extraction of, or mortality/injury to, wild species by fishing and other activities impacts on food-webs, benthos, populations of fish, seabirds and mammals. Such extraction of fish or shellfish from a stock through fishing activities is measured as Fishing mortality and is denoted “F”.

Physical disturbance (abrasion and smothering) of the seabed by fishing impacts on marine habitats in general, on benthos and on marine productivity. Abrasion is associated with bottom-contacting mobile and set-net fishing activities, in particular scallop dredging, beam trawling, and otter trawling but also other activities such as anchoring and hydro-dynamic dredging. Smothering refers to activities contributing to changes in siltation on the seabed include dredging for shipping lanes and channels, disposal of materials to the seafloor, and commercial fishing.

Environment Status

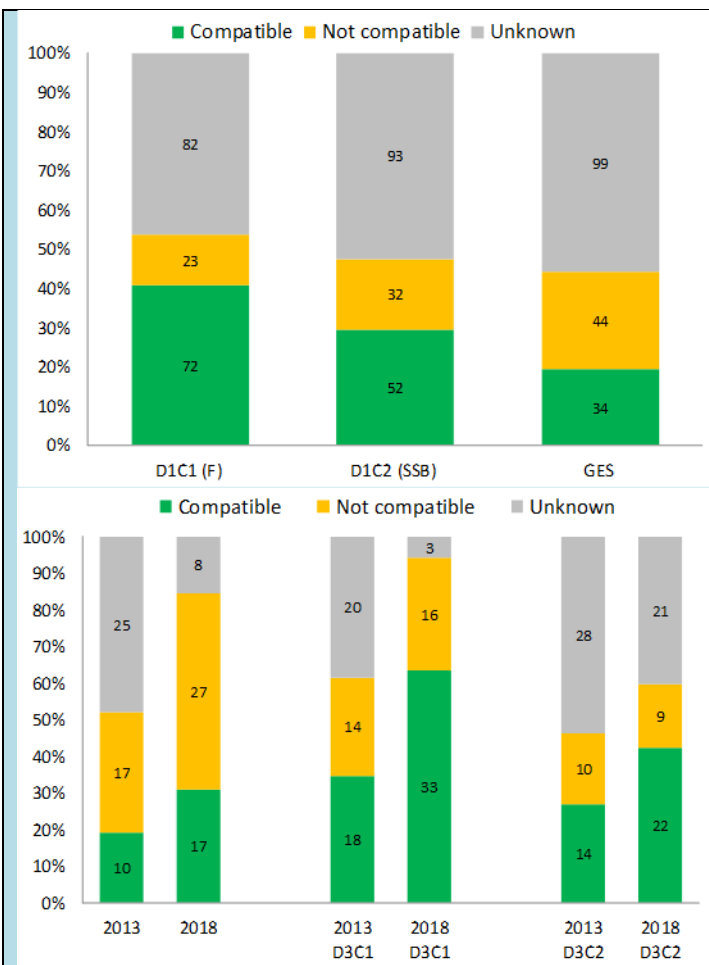
Almost 20% of assessed stocks are found to be compatible with GES, the same proportion of assessed stocks as in Ireland’s initial assessment (2013). About 25% of stocks are considered not compatible with GES, which is an improvement on the proportion (33%) in the initial assessment. Just over 50% of stocks were of unknown compatibility with respect to GES, a similar proportion to that in the initial assessment.

For pelagic fish, there stocks are compatible with GES, five are not compatible with GES and the compatibility of six stocks in relation to GES is unknown. For demersal fish 10 stocks are considered to be compatible with GES, 18 are not compatible with GES and the compatibility with respect to GES of 18 further stocks is unknown.

Of demersal shellfish stocks, 10 are compatible with GES, four are not considered compatible with GES and the compatibility of eight stocks in relation to GES is unknown. For coastal shellfish stocks, GES compatibility is observed for nine stocks, while 15 stocks are not compatible with GES and 23 stocks are considered unknown.

Of the elasmobranch stocks being commercially exploited, most are unknown with regard to GES (n=16), one stock is compatible with GES, while three others are not compatible with GES.

Among the remaining commercially-exploited stocks in Irish waters, the compatibility of all cephalopod stocks and coastal fish is unknown in relation to GES. This will require more work, particularly for the coastal fish species.



Percentage and number of stocks compatible with Criterion D3C1 (F at or below FMSY), with Criterion D3C2 (SSB above MSY Btrigger) and with GES overall in 2018. Stocks included in this assessment include those managed with Total Allowable Catches (TACs) and also those not managed with TACs.

Comparison of the percentage and the number of stocks compatible with GES overall (left), for D3C1 Middle) and D3C2 (right) in Ireland’s Initial Assessment (2013) and currently (2018) for the same stocks of commercially-exploited fish and shellfish.

A direct comparison with the initial assessment for the same 52 stocks considered in 2013 shows a 70% improvement in the number of stocks that are compatible with GES, with an almost 70% reduction in the number of stocks of unknown status. Comparing between criteria, an increase is shown in both the number of stocks being exploited sustainably (i.e. compatibly with criterion D3C1) and the associated stock sizes being sustainable at current fishing levels (i.e. compatibility with criterion D3C2). However almost 60% more stocks were found not to be compatible with GES.

Linkages

Other primary criteria arising from Commission Decision (EU) 2017/848 that relate to this assessment of commercially-exploited fish and shellfish populations are (paraphrased) as follows:

- D1C1 - The mortality rate per species from incidental by-catch is below levels which threaten the species
- D1C2 - The population abundance of the species is not adversely affected due to anthropogenic pressures
- D1C4 - The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions



D1C5 - The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species

D4C1 – The diversity of the trophic guild (species composition & relative abundance) is not adversely affected due to anthropogenic pressures

D4C2 – The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures

D6C1 – Spatial extent & distribution of physical loss (permanent change) of the natural seabed

D6C2 – Spatial extent & distribution of physical disturbance pressures on the seabed

D6C3 – Spatial extent of each habitat type which is adversely affected by physical disturbance

D6C4 – The extent of loss of the habitat type, resulting from anthropogenic pressures

D6C5 – The extent of adverse effects from anthropogenic pressures on the condition of the habitat type

D10C1 – The composition, amount & spatial distribution of litter on the coastline, in the surface layer of the water column and on the seabed

D11C2 - The spatial distribution, temporal extent & levels of anthropogenic continuous low-frequency sound

Conclusion

The status of 177 commercial fish and shellfish stocks within Ireland's designated MSFD area was assessed. A key finding is that the status of some but not all fish stocks in Irish MSFD waters is compatible with Good Environmental Status (GES). Thirty-four stocks are considered to be compatible with GES, while 44 stocks are not. The compatibility of 99 stocks in relation to GES is unknown. Overall, on balance, the status of commercial fish and shellfish stocks is not fully compatible with GES.

There was a substantial improvement in the metric for commercial fisheries D3C1, fishing mortality. Of the stocks assessed in both MSFD cycles, there was an 80% improvement in stocks in compatibility with Criterion D3C1.

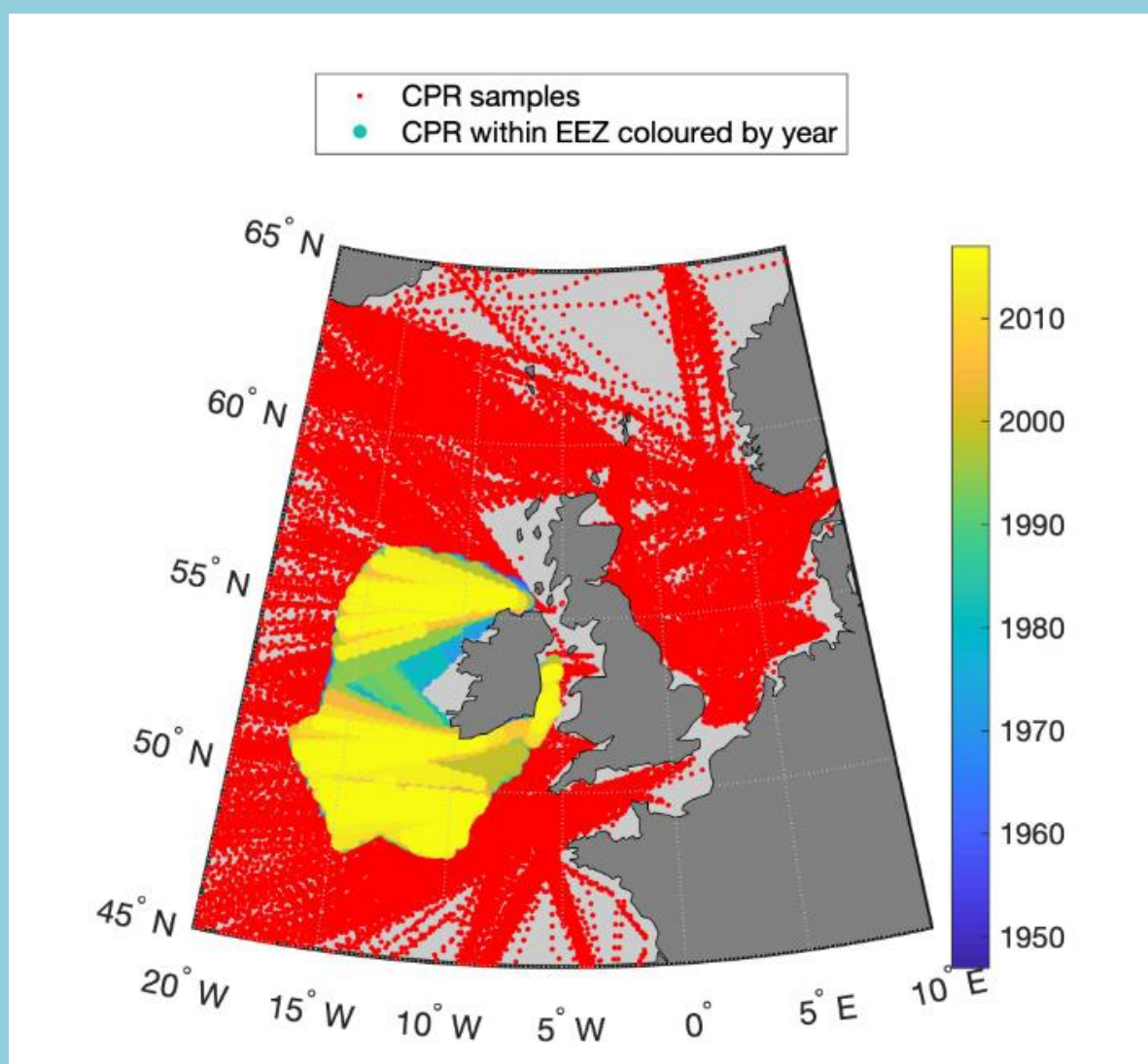


Descriptor 4 – Elements of Marine Food Webs

Key Messages

In 2013, Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845. In relation to Descriptor 4 – Elements of the marine food webs these criteria and standards provide a basis for assessment.

A key finding is that components of marine food webs are changing but it is not clear how they are affecting each other or the extent to which this is due to anthropogenic influence. The extent to which all elements of the marine food webs in Irish waters are compatible with Good Environmental Status (GES) is not clear.



Continuous Plankton Recording within Irish EEZ colour coded blue to yellow by year (Marine Institute / University of Plymouth)



Introduction

In 2013, Ireland completed an Initial Assessment of its maritime area. At that time, the habitat and species assessments produced were used as a starting point from which future assessments of food webs was planned. Commission Decision (EU) 2017/848 has led to changes in the criteria for assessing Good Environmental Status with regard to ecosystems, including elements of the marine food webs. An assessment has been carried out in respect of the criteria in this Commission Decision.

Marine food webs are complex and those in Irish marine waters particularly so. This is partly due to environmental and habitat variability, and changes in conditions in space and time. The relationships within the food web represent one of the most difficult descriptors of the MSFD to assess. There are currently no suitable indicators for the food web primary criteria D4C1 and D4C2 as defined in Commission Decision 2017/848.

The aim of this updated assessment is to evaluate marine ecosystems, including food webs, in the light of Commission Decision 2017/848. The objective is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically Descriptor 4, i.e. that “all elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity” (Directive 2008/56/EEC). The assessment is for the “Celtic Seas ecoregion” as a whole, as defined by the International Council for the Exploration of the Sea (ICES). This region is considered indicative of the Irish MSFD area, which is a sub-set of the wider ecoregion within the North-East Atlantic.

Drivers

The predominant human activity driving pressures on marine food webs, based on Commission Directive 2017/845 is the extraction of living resources (fish and shellfish harvesting). At least eight major fishing nations currently have commercial fisheries operations targeting the many stocks within this diverse area. Detailed descriptions of this driver are provided in the assessment undertaken for Descriptor 3 (i.e. populations of commercially-exploited fish and shellfish).

Other relevant activities acting as drivers of pressure on elements of marine food webs are the cultivation of living resources (e.g. by aquaculture, agriculture and forestry) and urban and industrial uses, such as waste treatment and disposal.

Pressures

The predominant pressure exerted on elements of marine food webs in Irish waters is the extraction of or mortality/injury to wild species by commercial fishing. This is defined as a pressure under Commission Directive 2017/845. Other relevant pressures, particularly in coastal waters, include input of nutrients and inputs of organic matter.

Environmental Targets

Ireland's Initial Assessment (2013) described the characteristics of Good Environmental Status (GES) for elements of marine food webs as follows:



- Abundance, distribution, extent and condition of key species is in line with prevailing physiographic, geographic and climate conditions or are indicative of sustainable exploitation;
- Age and size structure of key species is in line with prevailing physiographic, geographic and climate conditions or are indicative of sustainable exploitation;
- Vulnerable (long-lived, slowly reproducing) species populations are maintained in line with prevailing physiographic, geographic and climate conditions or are indicative of sustainable exploitation.

In the light of Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental targets for elements of marine food webs, namely:

Proposed Environmental Target D4T1

The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures

Proposed Environmental Target D4T1

The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures

While an updated assessment of environmental status has been undertaken on the basis of important elements of marine food webs, further work will be required nationally and internationally to underpin the ability to coherently and robustly assess key elements and trophic guilds against such targets into the future.

Threshold Values

There are currently no threshold values proposed for elements of marine food webs. The development of regional and sub-regional threshold values has not been undertaken at this time.

Criteria / Criteria elements included in the Assessment

The indicators selected for this assessment comply with Commission Decision 2017/848, that assessments should consider at least three trophic guilds. However, the assessment does not fully integrate across the selected guilds. The two primary criteria under Descriptor 4 that are dealt with in this assessment are follows:

D4C1 - The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures (D4C1). This was assessed for fish.

D4C2 - The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures (D4C2). This was assessed for phytoplankton and zooplankton.

Exclusions

This assessment covers primary criteria D4C1 (fish guild only) and D4C2 (phytoplankton and zooplankton only). This is because there are no agreed



international indicators or threshold values covering all of these elements for Irish waters, for any trophic guild. The assessment also does not include top predators. The time series for the fish assessment is quite short because survey time series in Irish waters are short. Considerable work is required to develop indicators covering both primary criteria for several trophic guilds. Secondary criteria D4C3 and D4C4 were not included.

Impact

The parameters and characteristics specified in Commission Directive 2017/845 that are likely to be impacted upon by anthropogenic pressures can be divided into species impacts, habitat impacts and ecosystem/food web impacts.

The main species impacts are changes to:

- distribution and/or biomass;
- behaviour including movement and migration;
- habitat for the species (extent, suitability);
- species composition within groups of species.

The main habitat impacts are changes to species composition, abundance and/or biomass (spatial and temporal variation).

The main ecosystem impacts can be summarised as changes to:

- links between habitats and species of marine birds, mammals, reptiles, fish and cephalopods;
- pelagic-benthic community structure;
- productivity.

Environment Status

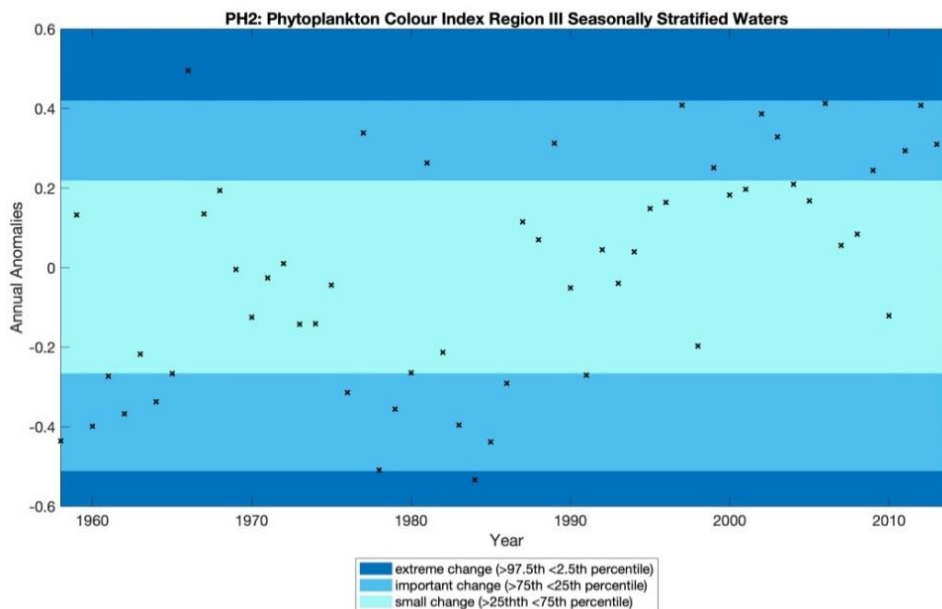
There has been an increase in phytoplankton and a decrease in zooplankton numbers (particularly the small copepods) in recent years compared with the 1960s. In the Celtic Seas as a whole, phytoplankton biomass showed variability across years with an increase since the mid 1980s. Zooplankton biomass has shown an overall decline throughout the time series, but particularly since the late 1980s. The assessment, although preliminary, shows that changes have occurred, highlighting potential issues for the wider marine ecosystem.

Within the plankton community there have been significant changes in community structure and energy flows. The strongest change was observed between small and large copepods and between non-carnivorous and carnivorous zooplankton, indicative of food web structure and energy flow between trophic groups. The holoplankton and meroplankton lifeform pair also experienced significant change, suggesting changes in linkage between the benthic and pelagic components of the ecosystem. The only non-significant change was in harmful algal bloom-causing diatoms and dinoflagellates, though further work needs to be done to refine this comparison.

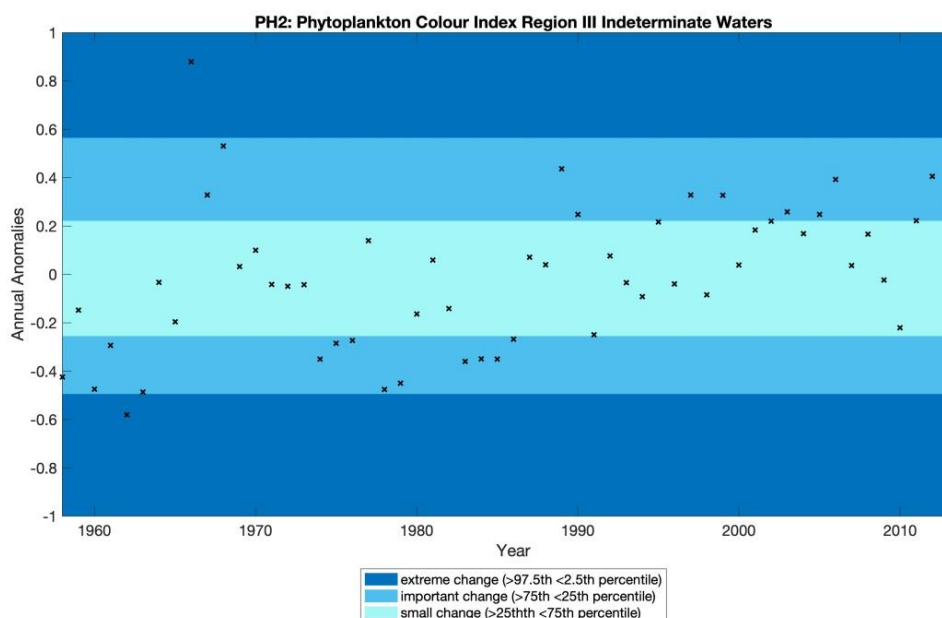
For fish there are local increases and decreases but for the greater part of Irish waters the situation is unclear. Demersal fish size decreased along the shelf edge waters to the west and near some coasts, but with increases to the south of



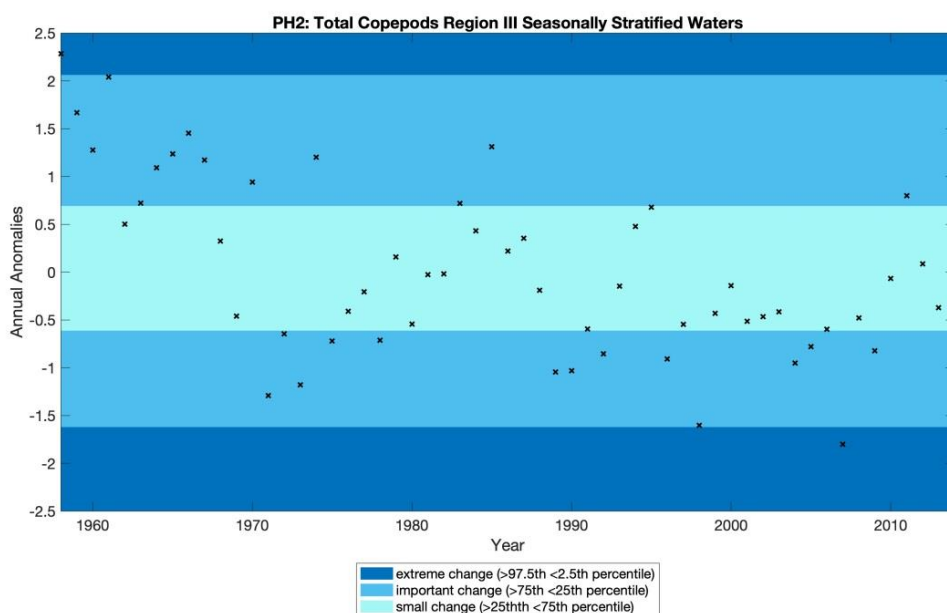
Ireland. For the pelagic fish community there were increases in the central Irish Sea and Celtic Sea.



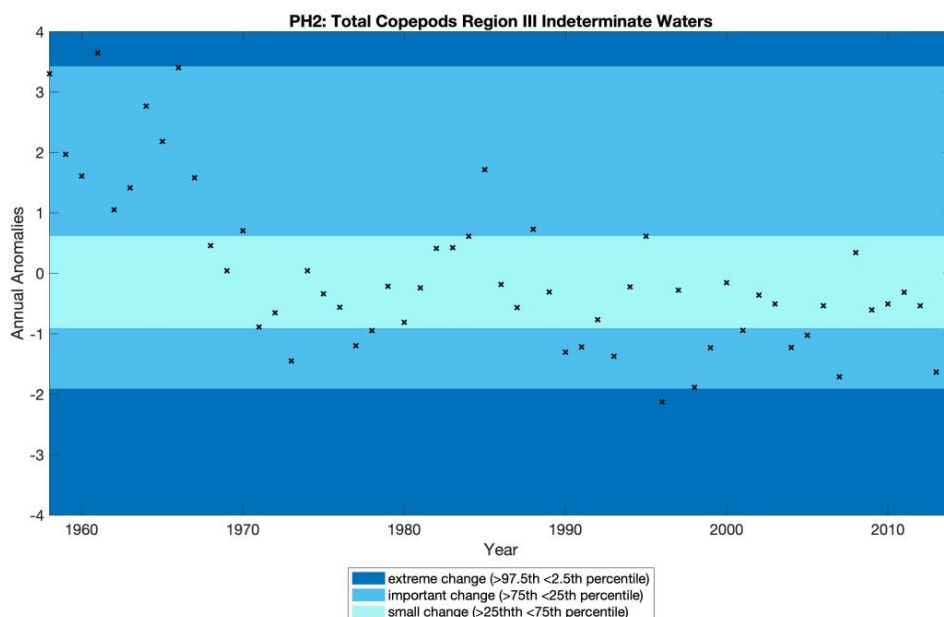
Annual anomalies for phytoplankton colour index for the Celtic Seas, for seasonally stratified waters, over the period 1958–2017.



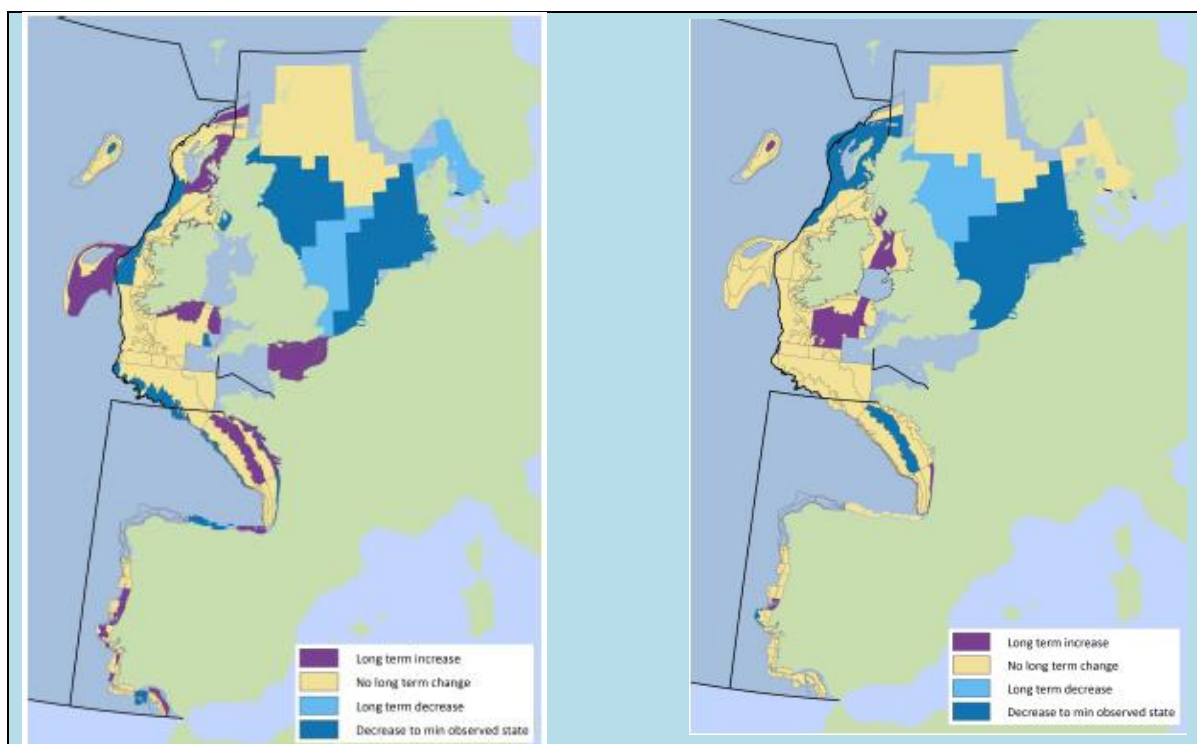
Annual anomalies for phytoplankton colour index for the Celtic Seas, for indeterminate waters, over the period 1958–2017.



Annual anomalies for zooplankton abundance (total copepods) for the Celtic Seas, for seasonally stratified waters, over the period 1958–2017.



Annual anomalies for zooplankton abundance (total copepods) for the Celtic Seas, for indeterminate waters, over the period 1958–2017.



Spatial patterns of mean maximum length of fish (left demersal fish, right pelagic fish).

Linkages

Other primary criteria arising from Commission Decision (EU) 2017/848 that relate to this assessment of elements of marine food webs are (paraphrased) as follows:

- D1C1 - The mortality rate per species from incidental by-catch is below levels which threaten the species
- D1C2 - The population abundance of the species is not adversely affected due to anthropogenic pressures
- D1C4 - The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions
- D1C5 - The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species
- D1C6 – The condition of the habitat type, including its biotic and abiotic structure and its functions

- D3C1 – Fishing mortality rate of populations of commercially-exploited species
- D3C2 – Spawning Stock Biomass of populations of commercially-exploited species
- D3C3 – Age & size distribution of individuals in populations of commercially-exploited species

- D5C1 – Nutrient concentrations are not at levels that indicate adverse eutrophication effects
- D5C2 – Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment



D6C1 – Spatial extent & distribution of physical loss (permanent change) of the natural seabed

D6C2 – Spatial extent & distribution of physical disturbance pressures on the seabed

D6C3 – Spatial extent of each habitat type which is adversely affected by physical disturbance

D6C4 – The extent of loss of the habitat type, resulting from anthropogenic pressures

D6C5 – The extent of adverse effects from anthropogenic pressures on the condition of the habitat type

Conclusion

While there are changes evident in food webs as demonstrated via plankton communities, the pressures driving changes in life-forms remain unclear. It would appear that prevailing physiographic conditions are the overall driver of change to complex systems such as marine food webs but a level of human influence cannot be discounted at this stage. For fish, the overall situation is unclear. Therefore, the overall conclusion of this assessment is that the compatibility with GES is unknown for this Descriptor.

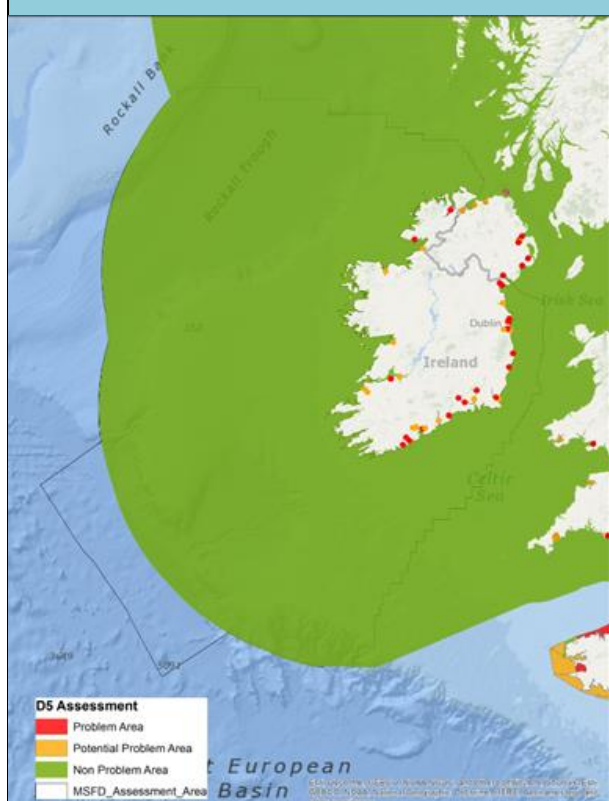


Descriptor 5 – Eutrophication

Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845.

The assessment of eutrophication in Ireland's MSFD waters is based on data from OSPAR and the Water framework directive (WFD) monitoring. This assessment has shown that the areas considered at risk of eutrophication are located inshore, and predominantly along the eastern, south eastern and southern coasts of Ireland. The coastal and offshore areas show no indications of eutrophication and trend analysis shows no change in nutrient levels of Ireland's marine waters. Overall, in terms of extent, the proportion of Ireland's maritime area that is classified as a problem area with regard to eutrophication is small and restricted to estuarine and nearshore coastal waters. These areas fall under the remit of the WFD which has established programmes of measures to ensure that the environmental objectives that have been set for these waters are met. The assessment of the criteria linked to eutrophication suggest that Ireland's MSFD water are compatible with Good Environmental Status.



OSPAR Eutrophication Assessment result in Irish Waters (2009-2014)

Introduction

In 2013 Ireland completed an Initial Assessment of its maritime area. At that time, the assessment concluded that for Descriptor 5 it was likely that the Irish MSFD were at GES. The Commission Decision (EU 2017/848) rationalised the targets



into a new set of criteria for assessing progress towards GES. These are broadly consistent with those used in the initial assessment.

Under the OSPAR convention, eutrophication is defined as, “The enrichment of water by nutrients causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned, and therefore refers to the undesirable effects resulting from anthropogenic enrichment by nutrients”. The OSPAR Common Procedure (OSPAR, 2005) uses a set of indicators to evaluate the eutrophic status of the maritime so that OSPAR countries can define ‘problem areas’, ‘potential problem areas’ and ‘non-problem areas’. For the most recent assessment (2009-2014), Ireland assessed 83 inshore areas using the full procedure and the larger offshore areas were screened to look for any indication of elevated nutrients. In nearshore and estuarine waters, assessments of nutrient and associated biological quality elements are undertaken for the WFD, the most recent of which covers the years 2013-2018 (EPA, 2019).

Drivers

The drivers of eutrophication are those which have the potential to impact on nutrient inputs into the marine environment.

Based on Commission Directive 2017/845 the human activities currently occurring in Ireland that drive the pressure causing eutrophication are

- Cultivation of living resources (agriculture & forestry)
- Urban and industrial uses (including waste treatment and disposal)

Most of these come from land based activities and in the most recent river basin management plan the most important drivers were identified as agriculture (53%), urban waste-water (20%), domestic waste-water (11%) and urban runoff (9%). While agriculture is the most prevalent pressure identified in the plan it is also the largest land use making it a key driver of eutrophication. Across the wider MSFD area, atmospheric depositions of nitrogen must also be considered, however modelling work undertaken by OSPAR have shown this to be low in the Celtic seas.

Pressures

Elevated nutrient concentrations (phosphorus and nitrogen) continue to be the most widespread water-quality problem in Ireland. Monitoring of nutrient inputs from 19 major Irish rivers to estuarine and coastal waters has been ongoing since 1990. Measuring these inputs provides a useful indicator of trends in the transfer of nutrients from land-based sources. The inputs are calculated based on nutrient concentrations, which are measured 12-times a year, and river flow, which is measured continuously.

Nutrient inputs from Irish rivers have varied over the 29 years since monitoring began. Loads of total nitrogen were highest in the 1990s, then decreased until 2013. The reductions indicated the success of national measures aimed at reducing the loss of nutrients from terrestrial sources to surface waters.

Since 2014 however, the trend has reversed and we are now seeing an increase in nutrient inputs to the marine environment. In recent years average total nitrogen in 2016–2018 has increased by 8,806 tonnes (16%) since 2012–2014. Average total phosphorus rose by 329 tonnes (31%) over the



	same period undoing improvements made over previous years.
<p>Environmental Targets</p> <p>Ireland's Initial Assessment (2013) describes the characteristic of Good Environmental Status (GES) for Descriptor 5 as follows:</p> <p>“Human induced eutrophication is minimised and nutrient levels do not cause an accelerated growth of algae or higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned”</p> <p>The environmental targets from the Initial Assessment have been updated in light of the Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental target based on the essential elements assessed:</p> <p>Proposed Environmental Target D5T1: Nutrient concentrations are not at levels that indicate adverse eutrophication effects</p> <p>This target aligns the 2013 target (Winter dissolved inorganic nitrogen and phosphorus concentration should not exceed the Environmental Quality Standard laid down in national legislation and the corresponding area specific assessment levels used by Ireland in the application of the OSPAR Common Procedure) with the Commission Decision Criterion D5C1.</p> <p>Proposed Environmental Target D5T2: Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment</p> <p>This target aligns the 2013 target (Median and 90%ile chlorophyll levels in Water Framework Directive defined coastal water bodies should not exceed the Environmental Quality Standards laid down in national legislation implementing the Water Framework Directive (SI 272 of 2009), with the Commission Decision Criteria D5C2.</p> <p>Proposed Environmental Target D5T3: The concentration of dissolved oxygen is not reduced, due to nutrient enrichment.</p> <p>This target aligns the 2013 target (For Water Framework Directive defined coastal water bodies, dissolved oxygen saturation should be consistent with the environmental quality standard specified in national legislation implementing the Water Framework Directive (SI 272 of 2009), except in the case of seasonally stratified waters, where the dissolved oxygen concentration (as a 5%ile) in bottom water should remain above area specific assessment levels (e.g. 5.0 to 6.0 mg/l)) with the Commission Decision Criteria D5C5.</p> <p>Threshold Values</p> <p>The threshold values proposed for these Targets are as follows:</p> <p>D5T1 Nutrient concentrations are not at levels that indicate adverse eutrophication effects</p>	



Nitrogen and Phosphorus concentrations are below the levels set for WFD assessments in inshore waters and estuaries (SI 77/2019) and those used in the OSPAR Intermediate Assessment 2017 for the wider MSFD area.

D5T2 Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment

Chlorophyll concentrations are below the levels set for WFD assessments in inshore waters and estuaries (SI 77/2019) and those used in the OSPAR Intermediate Assessment 2017 for the wider MSFD area.

D5T5 The concentration of dissolved oxygen is not reduced, due to nutrient enrichment

Oxygen concentrations are above the levels set for WFD assessments in inshore waters and estuaries (SI 77/2019) and those used in the OSPAR Intermediate Assessment 2017 for the wider MSFD area.

Criteria / Criteria Elements included in the Assessment

The assessment of Eutrophication is based on the following criteria as outlined in the Commission Decision (2017/848/ EC)

- D5C1: Nutrients in the water column: Dissolved Inorganic Nitrogen (DIN)
- D5C1: Nutrients in the water column: Dissolved Inorganic Phosphorus (DIP)
- D5C2: Chlorophyll a
- D5C5: Dissolved oxygen in the bottom of the water column

Exclusions

The 2013 initial assessment used targets which are now aligned with Secondary Criteria in the 2017 Commission Decision. The secondary criteria, listed below, are not included in this assessments as no evidence of nutrient enrichment impacts on the primary criteria were found to warrant their assessment:

- D5C3: The number, spatial extent and duration of harmful algal bloom events are not at levels that indicate adverse effects of nutrient enrichment.
- D5C4: The photic limit (transparency) of the water column is not reduced, due to increases in suspended algae, to a level that indicates adverse effects of nutrient enrichment.
- D5C6: The abundance of opportunistic macroalgae is not at levels that indicate adverse effects of nutrient enrichment.
- D5C7: The species composition and relative abundance or depth distribution of macrophyte communities achieve values that indicate there is no adverse effect due to nutrient enrichment.
- D5C8: The species composition and relative abundance of macrofaunal communities, achieve values that indicate that there is no adverse effect due to nutrient and organic enrichment. **Note:** this is a secondary criteria except when used as a substitute for D5C5.

Impact

Nutrient levels in the MSFD assessment areas are low with elevated concentrations only found in WFD transitional water areas. The current status of



nitrogen and phosphorus has been determined using the environmental quality standards (EQS) specified in national legislation implementing the Water Framework Directive, and the corresponding area-specific assessment levels used in the OSPAR Common Procedure. Secondary impacts and signs of undesirable disturbance such as lowered oxygen concentration or algal blooms are not found in the MSFD areas and are restricted to inshore waters.

A risk based approach has been applied to the Descriptor 5 assessments, primarily focussing on transitional and coastal waters as the pressures are predominantly terrestrial. Where problems are not detected in these waters and unless there is a specific risk factor from offshore sources then wider assessment is not necessary.

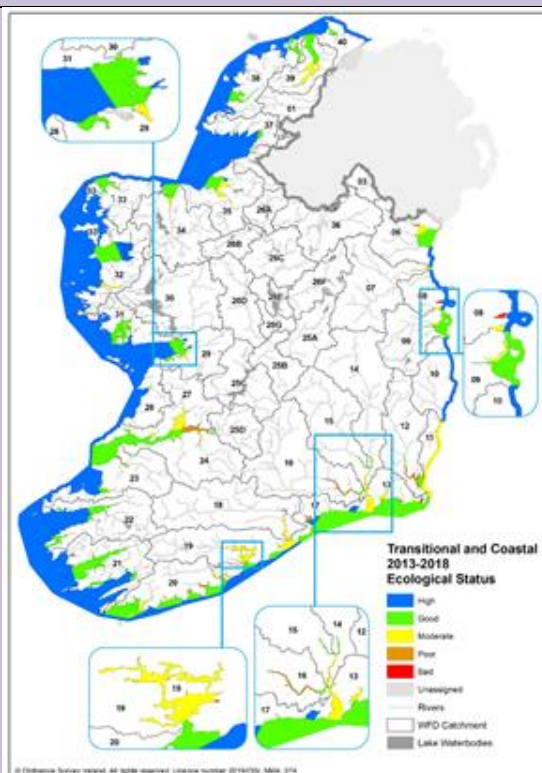


Figure 1: Status of Transitional and Coastal waters, assessment period 2013 to 2018 (EPA Water Quality in Ireland 2013-2018)

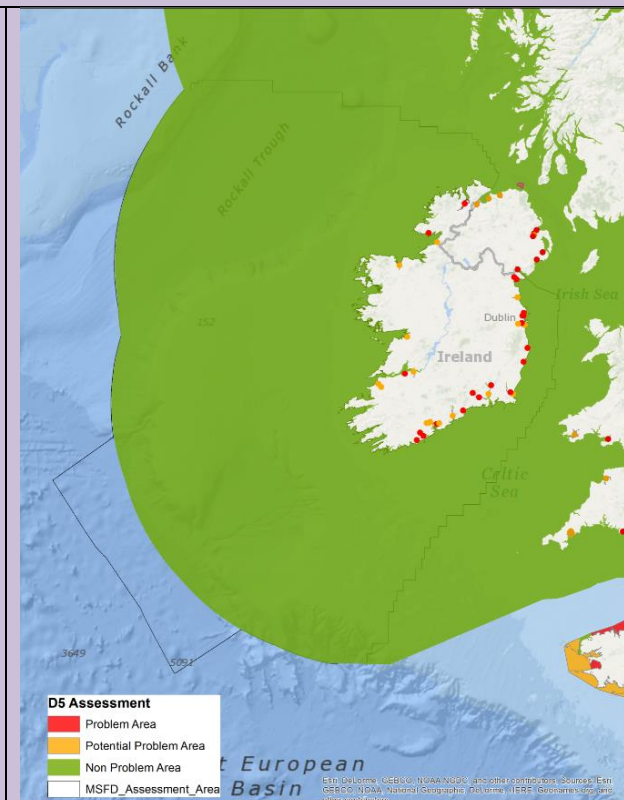


Figure 2: OSPAR eutrophication status assessment period 2009-2014 from third application of the OSPAR Common procedure

Note: Locations of problem areas and potential problem areas are illustrated with circles, because these assessed areas are too small to be seen if their actual area extent is mapped.

Environment Status

Nutrient concentration in the MSFD areas are below the OSPAR assessment thresholds. All coastal and offshore areas

Linkages

Integrated Monitoring programmes are in place for this descriptor and are closely linked to monitoring for contaminants in water and shellfish.



remain as non-problem areas and trend analysis shows no change in nutrient levels of Ireland's marine waters⁴. The WFD assessment of nearshore and estuarine waters shows that the effects of eutrophication are generally limited to estuarine waters⁵. Only 286km² of the WFD areas were considered as Problem or Potential Problem Areas. The assessment of the criteria linked to eutrophication suggest that Ireland's MSFD water are compatible with Good Environmental Status.

Programmes for WFD, MSFD, OSPAR and other related legislation are coordinated to optimise resources and prevent duplication. Other Criteria and elements which relate to the hydrographical conditions assessment under this assessment are as follows:

Descriptor 4 Food Webs
Criteria 2: The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures (D4C2).

Conclusion

Overall, in terms of extent, the proportion of Ireland's maritime area that is classified as a problem area with regard to eutrophication is small (0.05% of the MSFD area) and restricted to estuarine and nearshore coastal waters. These areas fall under the regime of the EU Water Framework Directive, which has established programmes of measures to ensure that the environmental objectives that have been set for these waters are met.

⁴ <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/eutrophication/third-comp-summary-eutrophication/>

⁵ EPA 2019. Water Quality in Ireland report, due to be published end November



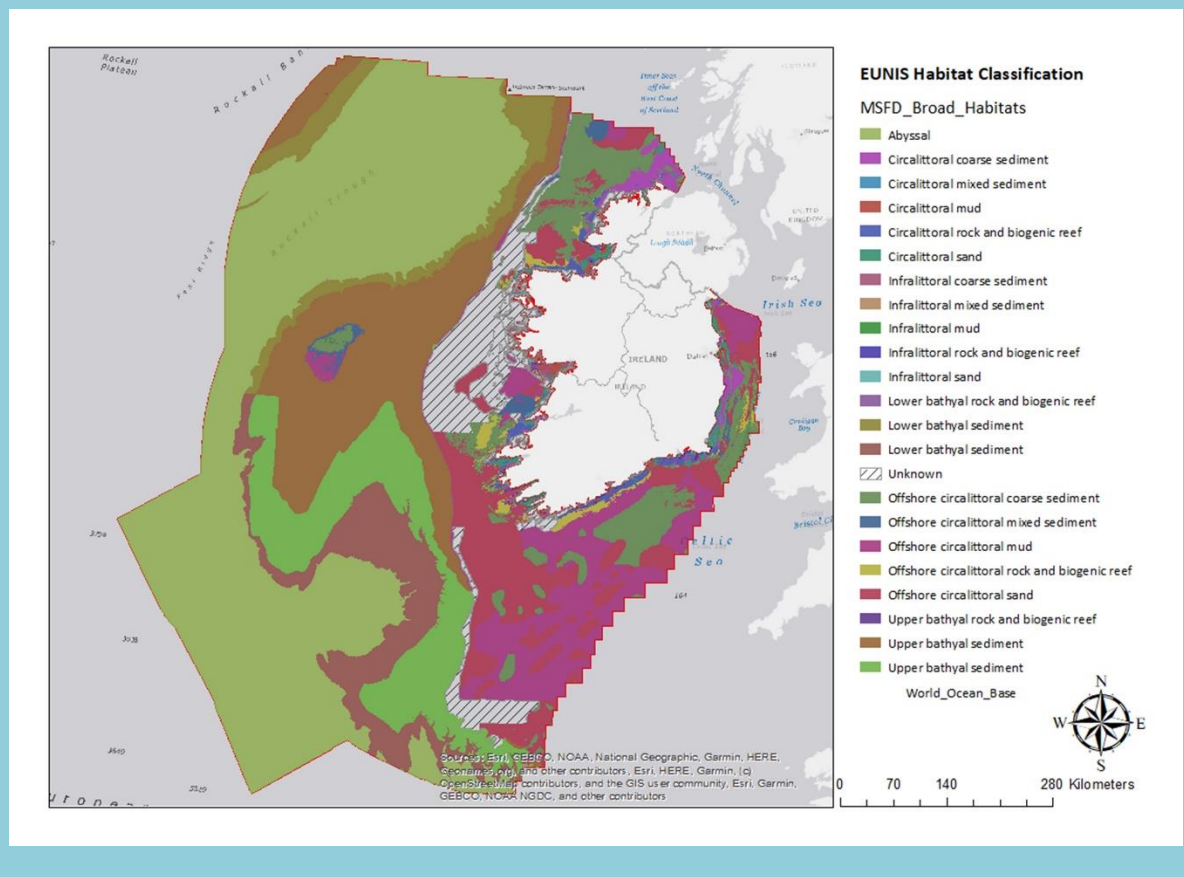
Descriptor 6 – Sea Floor Integrity

Key Messages

In 2013, Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and the amending Commission Directive (EU) 2017/845. In relation to Descriptor 6 – Sea-floor integrity, these criteria and standards provide a basis for assessment. Threshold values have yet to be established at Union level for this descriptor.

A key finding is that assessed physical loss of seabed habitat across Ireland’s MSFD area is lower than any potential threshold value. Loss of habitat in Irish waters-was calculated to be less than 2,440 km² or 0.5% of the total sea-floor area. The extent of habitat loss is compatible with Good Environmental Status (GES).

Results of analyses of physical disturbance - from international fishing-driven pressures that are currently quantifiable for the years 2010 to 2015 in OSPAR Region III only - showed disturbance to be widespread, occurring in 64,860 km² of Irish waters in OSPAR Region III or 13.29 % of the overall MSFD area. This assessment is limited to Irish waters in OSPAR Region III, it does not cover all of the Irish MSFD area and there are no threshold values for this criteria. Thus it is not possible to determine compatibility with GES in the overall MSFD area.





Benthic broad habitat types in the Irish MSFD waters, following MSFD habitat classifications (Marine Institute)

Introduction

In 2013 Ireland completed an Initial Assessment of its maritime area. At that time, the assessment concluded that seabed habitats in Ireland's Assessment Area are generally considered to be in a healthy condition. The amended Commission Directive (EU) 2017/845 and Commission Decision (EU) 2017/848 have led to revisions in how elements of the environment are to be assessed, and this has led to changes in the criteria for assessing Good Environmental Status.

Benthic habitats consist of marine organisms living on or within the sediment, on biological substrates (e.g. reef-forming organisms), or on rock. These organisms carry out essential ecological processes and functions that support healthy ecosystems. They are a key component of marine food webs, including commercial fish and shellfish species, and they provide a major source of shelter/refuge from, and food for, predators. The diversity of sea-floor habitats is shaped by factors such as depth, light penetration, substrate type, which in turn determines the flora and fauna communities that exist there. These create a huge variety of habitat types, with communities showing different levels of sensitivity to physical damage and physical disturbance. Some habitats are very sensitive (e.g. fragile maërl beds or coral gardens), whereas others are more robust (e.g. mobile sands and other sediments). In this regard, the amending Commission Directive 2017/845 provides a list of "benthic broad habitat types" for use in the assessment and determination of GES.

The aim of this updated assessment is to evaluate sea-floor integrity in Ireland's MSFD area in the light of Commission Decision 2017/848. The objective of this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically Descriptor 6 (Directive 2008/56/EC).

Drivers

The main human activities driving pressures on benthic habitats, based on Commission Directive 845/2017 are:

- extraction of living resources (fish and shellfish harvesting); transport;
- extraction of non-living resources;
- production of energy;
- cultivation of living resources (marine aquaculture);
- urban and industrial uses (including water treatment and disposal and industrial uses);
- physical restructuring of rivers, coastline or the seabed (watercourse modifications, dredging).

Pressures

The relevant pressures listed in Commission Directive 2017/845 of relevance to sea-floor integrity are:

- physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate);
- physical disturbance to the seabed;
- extraction of wild species (by commercial and recreational fishing and other activities);
- mortality/injury to wild species (by commercial and recreational fishing and other activities);
- abrasion; substrate loss;



	<ul style="list-style-type: none"> ▪ changes to hydrological conditions; ▪ inputs of nutrients and/or organic matter; ▪ input and spread of non-indigenous species.
<p>Environmental Targets</p> <p>Ireland's Initial Assessment (2013) described the characteristic of Good Environmental Status (GES) for sea-floor integrity as follows:</p> <ul style="list-style-type: none"> • The extent and diversity of sea-floor habitats is maintained in line with prevailing physiographic, geographic and climate conditions; • Sea-floor habitats (physically and structurally) are sufficiently productive and extensive to support natural functionality and a healthy and sustainable ecosystem for the long term, and; • Sea-floor habitats and their constituent species identified as needing protection under national or international agreements are effectively protected or conserved through the appropriate national, regional or international mechanisms. <p>However environmental targets and associated indicators, to guide progress towards achieving GES in the marine environment, were under development in 2013; thus they were not proposed or established at that time.</p> <p>In the light of Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental targets for sea-floor integrity as follows:</p> <p>Proposed Environmental Target D6T1 The spatial extent and distribution of physical loss (permanent change) of the natural seabed is at a level that ensures that the structure and functions of the ecosystems, and benthic ecosystems, in particular, are not adversely affected</p> <p>Proposed Environmental Target D6T2 The spatial extent and distribution of physical disturbance pressures on the seabed is at a level that ensures that the structure and functions of the ecosystems, and benthic ecosystems, in particular, are not adversely affected</p> <p>Proposed Environmental Target D6T4 The extent of loss of the habitat type, resulting from anthropogenic pressures, does not exceed a specified proportion of the natural extent of the habitat type in the assessment area</p> <p>Proposed Environmental Target D6T5 The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions, does not exceed a specified proportion of the natural extent of the habitat type in the assessment area</p> <p>Threshold Values</p>	



There are currently no threshold values proposed for sea-floor integrity. The development of regional and sub-regional threshold values has not been undertaken at this time but is a work in progress at a European member state level.

Criteria / Criteria elements included in the Assessment

The primary criteria from Commission Decision (EU) 2017/848 that are included in the current assessment are:

D6C1 - Spatial extent and distribution of physical loss (permanent change) of the natural seabed.

D6C2 - Spatial extent and distribution of physical disturbance pressures on the seabed.

D6C4 – The extent of loss of the habitat type, resulting from anthropogenic pressures.

D6C5 - The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions.

In the case of criteria 1 and 4 above, the entire MSFD area applicable to Ireland was assessed.

In the case of criteria 2 and 4 above only Irish water in OSPAR Region III was assessed.

Only Habitats Directive Annex I habitats were used to represent habitat type under criterion 5 above.

Exclusions

This assessment does not cover primary criterion D6C3 (i.e. spatial extent of each habitat type which is adversely affected, through change in its biotic and abiotic structure and its functions (e.g. through changes in species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), by physical disturbance). This is because agreed common indicators are not fully available for this criterion in OSPAR Region III or V or in a coordinated manner at EU member state level. The assessment also does not include information gathered under the provisions of the Water Framework Directive (WFD).

Impact

The predominant species impacts can be identified as changes to:

- distribution and/or biomass;
- size, age and sex structure, fecundity, survival and mortality/injury;
- behaviour including movement and migration;
- habitat for the species (extent, suitability);
- species composition within groups of species.

The main habitat impacts can be identified as changes to:

- habitat distribution and extent (and volume, if appropriate);
- species composition, abundance and/ or biomass (spatial and temporal variation);
- size and age structure of species (if appropriate);
- physical, hydrological and chemical characteristics.



The ecosystem impacts can be identified as changes to:

- turbidity (silt/sediment loads);
- seabed substrate and morphology;
- pelagic-benthic community structure;
- productivity.

Environment Status

The extent of assessed physical disturbance (D6C2, OSPAR Region III) and assessed physical loss (D6C1/D6C4) for the MSFD area per benthic broad habitat type is estimated as follows:

- **Offshore* circalittoral mud** occupies 32,014 km² of sea floor in the Irish segment of Region 3, within which 73% is highly disturbed and 0% not disturbed. Assessed physical loss <1%.
- **Offshore circalittoral rock and biogenic reef habitat** occupies 3,381 km² of sea floor in the Irish segment of Region 3, within which 72% is highly disturbed and 24% not disturbed. Assessed physical loss <1%.
- **Offshore circalittoral sand** occupies 38,953 km² of sea floor in the Irish segment of Region 3, within which 67% is highly disturbed and 3% has no disturbance. Assessed physical loss <1%.
- **Circalittoral rock and biogenic reef** occupies 3,011 km² of sea floor in the Irish segment of Region 3, of which: 44% is highly disturbed and 47% not disturbed. Assessed physical loss = 1.25%.
- **Offshore circalittoral coarse sediment** occupies 27,083 km² of sea floor in the Irish segment of Region 3, of which 39% highly disturbed and 29% not disturbed. Assessed physical loss <<1%.
- **Circalittoral mud** occupies 1,026 km² of sea floor in the Irish segment of Region 3, of which 30% is highly disturbed and 37% not disturbed. Assessed physical loss = 2.47%.
- **Circalittoral sand** occupies 2,563 km² of sea floor in the Irish segment of Region 3, of which 12% is highly disturbed 45% not disturbed. Assessed physical loss = 1.97%.
- **Offshore circalittoral mixed sediment** occupies 1,936 km² of sea floor in the Irish segment of Region 3, of which 11% is highly disturbed and 24% not disturbed. Assessed physical loss <<1%.
- **Infralittoral rock and biogenic reef** occupies 159 km² of sea floor in the Irish segment of Region 3, of which 10% is highly disturbed and 62% not disturbed. Assessed physical loss = 1.15%.
- **Circalittoral mixed sediment** occupies 147 km² of sea floor in the Irish segment of Region 3, of which 7% is highly disturbed and 61% not disturbed. Assessed physical loss = 0.57%.
- **Circalittoral coarse sediment** occupies 4,209 km² of sea floor in the Irish segment of Region 3 of which 5% is highly disturbed and 49% not disturbed. Assessed physical loss <1%.
- **Infralittoral coarse sediment** occupies 102 km² of sea floor in the Irish segment of Region 3, of which 3% is highly disturbed and 69% not disturbed. Assessed physical loss = 2.43%.



- **Infralittoral sand** occupies 236 km² of sea floor in the Irish segment of Region 3, of which 2% is highly disturbed and 76% not disturbed. Assessed physical loss = 2.49% lost.
- **Infralittoral mud** occupies 124 km² of sea floor in the Irish segment of Region 3, of which 1% is highly disturbed and 81% not disturbed. Assessed physical loss = 5.5%.
- **Infralittoral mixed sediment** occupies 20 km² of sea floor in the Irish segment of Region 3, of which 0% is highly disturbed and 51% not disturbed. Assessed physical loss = 2.73%.
- **Unknown habitat** occupies 28,333 km² or 19% of sea floor in the Irish segment of Region 3. Assessed physical loss = 0.38%. A large proportion of the unknown habitat was littoral habitat.

Habitats recording no physical loss at all were **Littoral rock and biogenic reef; Littoral sediment; Upper bathyal rock and biogenic reef, Lower bathyal rock and biogenic reef, and Abyssal habitat.**

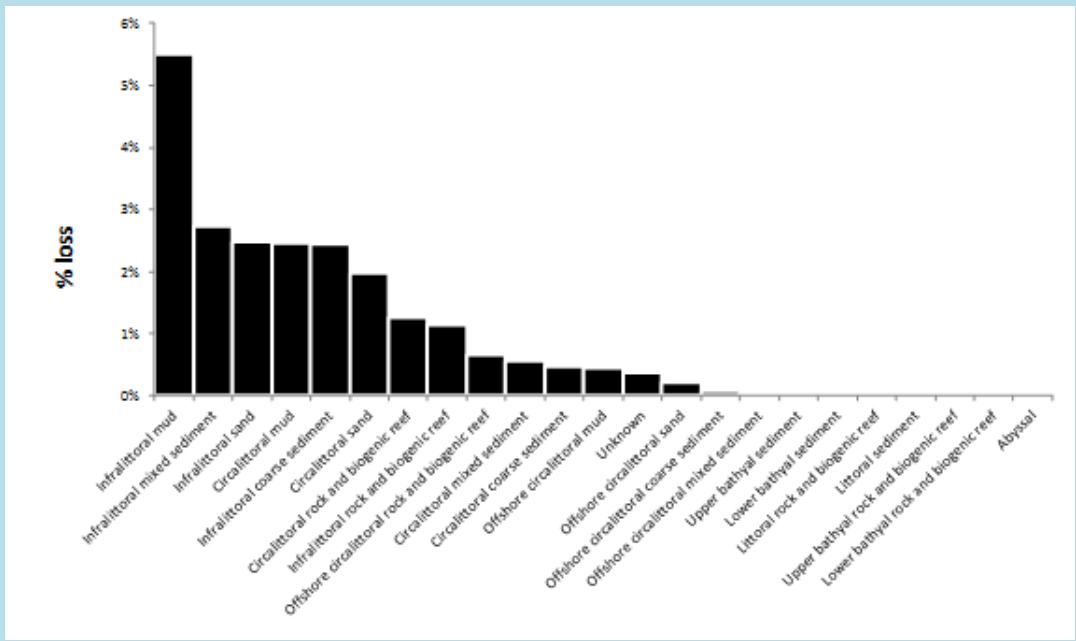
(Note: The term “offshore” associated with broad habitat types listed in the amending Commission Directive 2017/845 is based on the EUNIS classification system and is not linked to distance from the coast)

Of the above habitats that have been assessed, none has an extent of assessed physical loss which is larger than any potential threshold value. Total loss (D6C1 and D6C4 -sealed and unsealed) across the entire Irish MSFD area is determined to be 0.12%, almost all of which was sealed loss. Thus, for physical loss, all assessed habitats are considered to be compatible with GES.

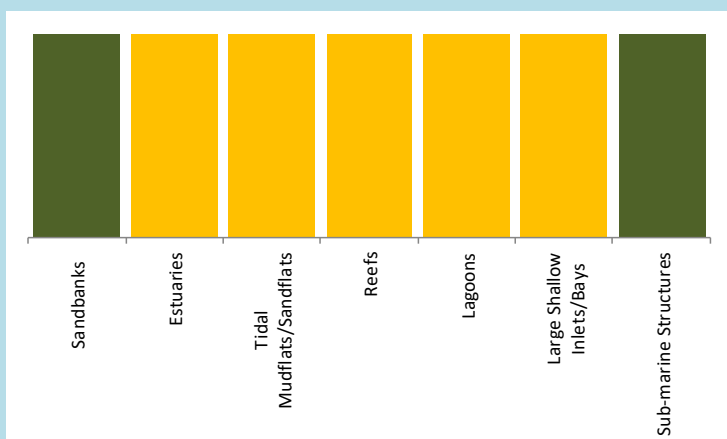
Of the same habitats, some have disturbance pressure levels which are above potential threshold values for GES, within OSPAR Region III. These include **offshore circalittoral mud, circalittoral sand, circalittoral rock and biogenic reef, offshore circalittoral sand, circalittoral rock and biogenic reef, offshore circalittoral coarse sediment and circalittoral mud.**

The assessment of disturbance does not extend to the entire Irish MSFD area, it is limited to Irish waters within OSPAR Region III, due to data availability, thus it is not possible to evaluate the extent of physical disturbance across the full MSFD area and compatible with Good Environmental Status is not known.

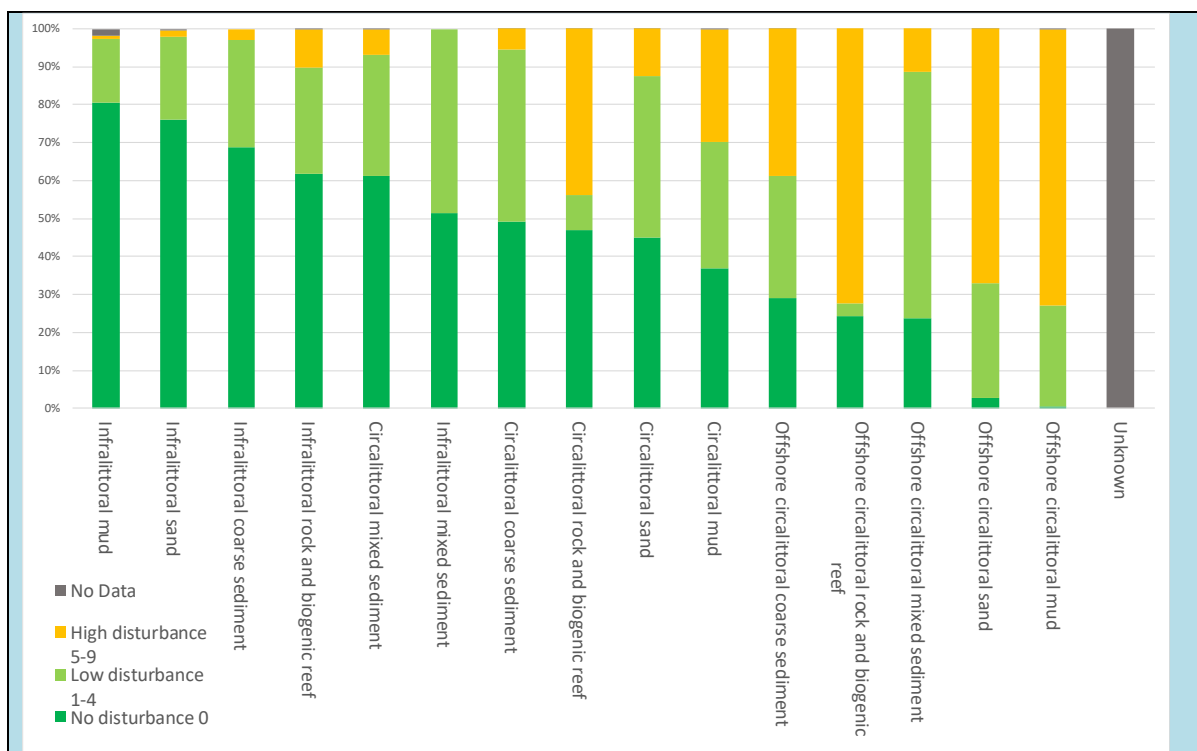
Regarding the extent of adverse effects on sea-floor habitat types (D6C5 – Habitats Directive Annex I habitats only considered), Sandbanks and Sub-marine structures are considered to be compatible with GES, while Estuaries, Tidal Mudflats/Sandflats, Reefs, Lagoons and Large Shallow Inlets/Bays are not compatible with GES. Annex I habitats of unknown status are Maërl Beds and Sea caves. This assessment is confined to some Annex I Habitat Directive habitats.



Bar graph showing percentage physical loss per MSFD benthic broad habitat type in the Ireland's MSFD area.



Extent of adverse effects on Habitats Directive Annex I habitats as summarised in Ireland's recent Habitats Directive assessment (2019). Status considered to be compatible with GES is denoted as green, and not compatible with GES is denoted as orange.



Physical disturbance (in percentage coverage) per MSFD benthic broad habitat type in Irish MSFD waters of OSPAR Region III.

Linkages

Other primary criteria arising from Commission Decision (EU) 2017/848 that relate to this assessment of elements of sea-floor integrity are (paraphrased) as follows:

- D1C1 - The mortality rate per species from incidental by-catch is below levels which threaten the species
- D1C2 - The population abundance of the species is not adversely affected due to anthropogenic pressures
- D1C4 - The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions
- D1C5 - The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species
- D1C6 – The condition of the habitat type, including its biotic and abiotic structure and its functions
- D3C1 – Fishing mortality rate of populations of commercially-exploited species
- D3C2 – Spawning Stock Biomass of populations of commercially-exploited species
- D3C3 – Age & size distribution of individuals in populations of commercially-exploited species
- D5C1 – Nutrient concentrations are not at levels that indicate adverse eutrophication effects
- D5C2 – Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment



D7C1 – Permanent alteration of hydrographical conditions to the seabed and water column, associated in particular with physical loss of the natural seabed.
D7C2 – Spatial extent of each benthic habitat type adversely affected due to permanent alteration of hydrographical conditions.


Conclusion

Assessed physical loss of seabed habitat in Irish MSFD waters is lower than any potential threshold value, with overall loss calculated to be less than 2,440 km² or 0.5% of the total area, implying that extent of habitat loss is compatible with Good Environmental Status.

Results of analyses of physical disturbance - from fishing pressures that are currently quantifiable for years 2010 to 2015 - showed disturbance to be widespread, occurring to some degree in 64,865 Km² in Irelands waters in OSPAR Region III, this represents 13.29 % of Irelands MSFD area. As this assessment is currently limited to OASPR Region III it is not possible to determine compatibility with GES in the overall MSFD area.



Descriptor 7 – Alteration of Hydrographical Conditions

 <p>INFOMAR mapping of Irelands Marine area seabed</p>	<p>Key Messages</p> <p>In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845.</p> <p>In relation to Descriptor 7 - Alteration of hydrographical conditions these criteria and standards provide a basis for assessment. The level of activities causing hydrographical changes to the seabed and water column within Irelands Marine Strategy Framework Directive area were very low overall during the assessment period of 2014-2018.</p> <p>A key finding is that the hydrographical condition of the Irish marine environment is compatible with Good Environmental Status. It is expected that further work, methodological refinement and environmentally sustainable practices will be needed to maintain this position in future MSFD cycles.</p>
<p>Introduction</p> <p>In 2013 Ireland completed an Initial Assessment of its maritime area. At that time, the assessment concluded that there was insufficient data and a lack of established methods to assess whether good environmental status had been achieved for hydrographical conditions. The Commission Decision (EU 2017/848) has led to developments in the methods of assessment for this hydrographical conditions. A broad assessment has been carried out in respect of the criteria, spatial extent and distribution of permanent alteration of hydrographical conditions to the seabed and water column, associated in particular with physical loss of the natural seabed (D7C1) from the EU Commission Decision 2017/848.</p> <p>Since then Ireland's approach, data collection and methods of assessment for this Descriptor under MSFD Articles 8, 9 and 10 have progressed. This assessment of changes in the hydrographical conditions considers the locations where permanent changes have been made to the seabed by large scale human activities including, dredging, the disposal of dredged material and offshore structures. The objective of this assessment is to evaluate the spatial extent and distribution of permanent alteration of hydrographical conditions e.g. changes in wave action, currents, salinity, temperature, both to the seabed and water column. During the period</p>	



2014 to 2018 there has been very little activity in the marine environment which impacts on hydrographical conditions.

The objective of this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically Descriptor 7, i.e. that “permanent alterations to hydrographical conditions does not adversely affect marine ecosystems” (Directive 2008/56/EC).

Drivers

The driver of hydrographical change in the Irish MSFD area is economic development which can result in the physical restructuring of coastline or seabed. The associated human activities outlined in Directive 2017/845 which impact on descriptor 7 are:

- dredging and deposition of material
- energy production
- cultivation of living resources
Aquaculture
- transport infrastructure
- wastewater treatment & disposal
- tourism activities and infrastructure

These are activities that have a localised impact on hydrographical conditions but will not cause hydrographical changes over extensive areas.

Pressures

Within the Irish MSFD area the pressures relating to hydrographical changes are:

- Physical disturbance to the seabed
- Physical loss due to permanent change of the sea bed
- Changes of hydrological conditions

These can result from the following activities:

- dredging and deposition of material
- offshore energy, both hydrocarbon and renewable as a result of structures

Environmental Targets

Ireland's Initial Assessment (2013) describes the characteristic of Good Environmental Status (GES) for Descriptor 7 as follows:

“Good status is achieved when the nature and scale of any permanent changes (individual and cumulative) to the prevailing hydrographical conditions, resulting from large-scale anthropogenic activities such as coastal defence works, damming of large rivers, land reclamation projects, and structures in open and coastal sea such as wind farms, ocean energy device arrays and large scale aquaculture facilities, do not lead to significant long term impacts on marine ecosystems, in particular those biological components considered under Descriptors, 1, 4 and 6.”

The environmental target from the Initial Assessment (2013) stated:

- All developments that may give rise to significant permanent changes in the hydrographical regime of currents, waves, or sediments must comply with the existing regulatory regimes and guidance should be followed to ensure that regulatory assessments are undertaken in a way that ensures the full consideration of any potential impacts, including cumulative effects at the most appropriate spatial scales, to ensure that GES is not compromised

This target has been updated to reflect the requirements of the Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845,



Ireland now proposes the following environmental target based on the essential elements assessed.

Proposed Environmental Target D7T1

The spatial extent and distribution of permanent alteration of hydrographical conditions to the seabed and water column, associated in particular with physical loss of the natural seabed is assessed for developments in the marine environment.

Threshold Values

There are currently no threshold values associated with hydrographical conditions. The development of regional and sub-regional threshold values for hydrographical conditions have not been undertaken at this time.

Criteria / Criterial elements included in the Assessment

The Criteria from the Commission Decision (2017/848 EC) considered in this assessment is:

- Spatial extent and distribution of permanent alteration of hydrographical conditions to the seabed and water column, associated in particular with physical loss of the natural seabed (D7C1).

Exclusions

No evaluation has been carried out for Criteria D7C2 around the spatial extent of each benthic habitat type adversely affected due to permanent alteration of hydrographical conditions due to the very small area in which hydrographical changes have been experienced during the assessment period.

Impact

During the assessment period 2014 to 2018 the levels of activity and development in the Irish Maritime area, which may cause permanent alterations of Hydrographical conditions were very limited, in both number and extent. In the context of the Irish MSFD area of **488,000 km²** the total area where hydrographical conditions were disturbed by human activities during the assessment period (2014-2018) is calculated at **533 km²** resulting from dredging activities and dredged spoil disposal. In total this represents **0.109%** of the Irish MSFD area indicating the low levels of disturbance to hydrographical conditions overall. Table 1 outlines the annual quantities of dredged material disposed during the assessment period. This data is reported to OSPAR and has contributed to the OSPAR Intermediate Assessment 2017⁶. It is acknowledged that the areas where dredging and spoil disposal takes place experience localised changes in hydrographical conditions but these areas are very small relative to the overall scale of the MSFD area.

Year	Material Disposed (Dry Tonnes)
2014	680,521
2015	644,018
2016	1,072,439
2017	1,361,656

⁶ <https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/dumping-and-placement-dredged-material/>



2018	1,244,196
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Table 1: Quantities of Dredge Spoil disposed 2014 - 2018

Cables pipelines and platforms can cause localised changes in hydrographic conditions these changes are not considered significant in the overall scale of the marine environment. The vast majority of development in Irish marine waters including ports harbours and jetties and their associated impact had taken place prior to the implementation of MSFD in 2008, it is not possible to evaluate the impact of these developments on hydrographical conditions.

Environment Status

This assessment has considered the activities, dredging and disposal of dredged spoil, which have caused permanent changes to the hydrographical conditions during the assessment period. The level of pressure from these activities causing hydrographical changes to the seabed and water column within Irelands MSFD area was very low overall between 2014 and 2018, at 533 km² or 0.109% of Irelands MSFD area. On this basis the hydrographical condition of the Irish marine environment is compatible with Good Environmental Status.

Linkages

Other Criteria and elements which relate to the hydrographical conditions assessment under this assessment are as follows:

- Descriptor 6: Sea-floor integrity
- Criteria 1 - Physical loss of the seabed: extent & distribution
- Criteria 2 - Physical disturbance of the seabed: extent & distribution
- Criteria 3 – Disturbed habitats: spatial extents

Conclusion

The permanent alteration of hydrographical conditions during the period 2014 to 2018 is limited to 0.109 % of the Irish Marine Strategy Framework Directive area. The impact from these alterations was localised with respect to hydrographical conditions and the short-term water quality impacts experienced during the dredging and disposal activities. The adverse impacts on the marine ecosystems are minimal from the very limited hydrographical changes which have occurred.



Descriptor 8 – Contaminants



Cadmium Levels in Water
OSPAR 2019 (<https://ocean.ices.dk/OAT/>)

Status (colour)

- below EQS
- above EQS

Trend (shape)

- ▼ downward trend
- no trend
- status assessment only
- informal status assessment
- ▲ upward trend

Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845.

The concentrations of contaminants, Descriptor 8, has been assessed in accordance with these requirements and it highlights the following:

- Concentrations of priority substances in water in coastal and transitional water bodies are typically low and compliant with Environmental Quality Standards.
- Concentrations of contaminants in shellfish are generally above OSPAR background levels however, they are not at levels where adverse effects would be expected to occur.
- Although many legacy pollutants are highly persistent in the environment, where significant temporal trends in contaminant concentrations are evident, they are typically downwards.
- There has been a marked improvement in reproductive condition in dogwhelks following the banning of TBT as a marine antifoulant.
- Monitoring indicates a low impact of acute pollution events in the MSFD area.

A key finding is that the objectives of GES are largely achieved for concentrations of contaminants and biological effects assessed and for acute pollution events within Ireland's MSFD area. Improved coherence of European and OSPAR assessment thresholds and new approaches to assessing risks associated



	<p>with complex environmental mixtures would provide for a more robust assessment processes.</p>
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Introduction

In 2013 Ireland completed an Initial Assessment of its maritime area. This assessment builds on that and is based on monitoring data collected under the Water Framework Directive (Dir 2000/60/EC) and OSPAR Coordinated Environmental Monitoring Programme. The objective of this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining Good Environmental Status, in this case specifically Descriptor 8, that “Concentrations of contaminants are at levels not giving rise to pollution effects” (Directive 2008/56/EC).

This updated assessment is based on these same programmes, for chemical contaminants the assessment period covered is 2012 to 2015, the dogwhelk imposex assessment is based on data spanning 1993 to 2018 and acute pollution events are based on data from 2014 to 2018. The assessment addressed the criteria established in Commission Decision 2017/848.

Risk Based Monitoring



The national monitoring for hazardous substances undertaken by the Marine Institute, is risk-based and primarily focussed on coastal waters as most sources are terrestrial and marine sources are generally more concentrated in coastal waters (e.g. shipping converging around ports). If problems are not detected in inshore waters, monitoring is not widely extended beyond Irish coastal waters (which in themselves can reach near full ocean salinity) unless there is a specific risk factor, such as specific offshore sources.

Drivers

The drivers of contaminants inputs to the marine environment as described in Commission Directive 2017/845 include:

- Urban and industrial uses, include waste treatment and disposal;
- Production of energy;
- Extraction of non-living resources;
- Transport.

Pressures

Within the Irish MSFD area the pressures relating to Descriptor 8 come from the following activities:

- Input of other substances (e.g. synthetic substances, non-synthetic substances) - diffuse sources, point sources, atmospheric depositions;
- Inputs may be from land-based sources (riverine, direct discharge or atmospherically transported) or sea-based sources;
- Some pollutants of concern such as many synthetic Persistent Organic Pollutants (POPs) are globally ubiquitous due to long-range transport.

Environmental Targets

Ireland's Initial Assessment (2013) describes the characteristic of Good Environmental Status (GES) for Descriptor 8 as follows:

“Concentrations of contaminants in the marine environment (i.e. in water, sediment and biota) are within agreed levels and adverse effects on organisms, populations, communities and biological processes do not occur.”

The environmental targets from the Initial Assessment have been updated in light of the Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental target based on the essential elements assessed:

Proposed Environmental Target D8T1a

Within coastal and territorial waters, the concentrations of contaminants do not exceed the threshold values set in accordance with Directive 2000/60/EC.

Proposed Environmental Target D8T1b

Concentration of contaminants in marine matrices assessed in accordance with OSPAR Coordinated Environmental Monitoring Programme (CEMP) do not exceed OSPAR Environmental Assessment Criteria (EAC) and concentrations are not increasing.



These targets (D8T1a & D8T1b) divided across water and biota align the 2013 target (Concentrations of selected substances identified within relevant legislation and under international obligations as relevant for the protection of the marine environment are within agreed levels at which adverse effects are unlikely to occur (e.g. are less than the Environmental Quality Standards applied within Water Framework Directive (2000/60EC) and Environmental Assessment Criteria applied within OSPAR) and concentrations are not increasing for the Assessment Area.) with the requirement of the Commission Decision Criterial D8C1.

Proposed Environmental Target D8T2

The degree of biological or ecological effects that can be specifically attributed to contaminants is below the agreed OSPAR criteria. At present, this is limited to evaluation of reproductive impairment in marine gastropods associated with tributyltin (TBT). This target remains unchanged from the 2013 target.

This aligns with the requirements of the Commission Decision Criteria D8C2 which requires the health of species and the condition of habitats are not adversely affected due to contaminants including cumulative and synergetic effects.

Proposed Environmental Target D8T3

Spatial extent and duration of significant acute pollution events are minimised.

This target aligns the 2013 target (Occurrence and extent of significant acute pollution events (e.g. slicks resulting from spills of oil and oil products, or spills of chemicals) and the impact on biota affected by this pollution is minimised through appropriate risk-based approaches) with the Commission Decision Criteria D8C3

Threshold Values

The threshold values applied to these targets for this assessment are as follows:

D8T1a: WFD Environmental Quality Standards for other surface waters (EQSw) established under the WFD Daughter Directive 2008/105/EC and relevant national standards for pollutants established under SI 272/2009.

D8T1b: OSPAR Environmental Assessment Criteria (EACs)⁷ for contaminants in shellfish (D8C1). Where an agreed OSPAR EAC is not available for a substance, OSPAR apply alternative criteria in lieu as part of their assessments (metals and PBDEs).

B8T2: OSPAR Environmental Assessment Criteria (EACs) for imposex in dogwhelks (D8C2).

B8T3: There is no threshold value for significant pollution events.

⁷ [https://ocean.ices.dk/oat/trDocuments/help_ac_biota_pah_\(parent\).html](https://ocean.ices.dk/oat/trDocuments/help_ac_biota_pah_(parent).html)



Note1: WFD Biota EQS (Dir 2013/39/EC) sets biota limits for fish for mercury, PBDEs. These are not applied currently in OSPAR assessments and more work is required to better align EQSbiota and OSPAR EACs to ensure assessments are consistent.

Note 2 OSPAR Background Assessment Criteria are used in this assessment but are not thresholds for GES.

Criteria / Critical elements included in the Assessment

The assessment of contaminants is based on the following criteria and criteria elements from the Commission Decision 2017/848:

D8C1 concentrations of contaminants

- Concentrations of contaminants in water (Priority Substances and other relevant pollutants) in transitional and coastal water bodies (TrACs) for monitoring cycle 2011 to 2015. In compliance with EQS as laid down in Directive 2000/60/EC.
- Concentrations of contaminants in shellfish (bivalve molluscs) as assessed in accordance with the OSPAR Coordinated Environmental Monitoring Programme (CEMP). Assessments are reported for
 - Trace metals: mercury cadmium, lead, copper and zinc;
 - Polychlorinated biphenyls (PCBs);
 - Polybrominated diphenylethers (PBDEs);
 - Polyaromatic Hydrocarbons (PAH).

D8C2: Health of species and the condition of habitats are not adversely affected due to contaminants including cumulative and synergetic effects

- Status and trends on the levels of imposex (as VDSI) in marine gastropods (*Nucella lapillus*).

Note: This is a secondary criteria, it is included in this assessment as it highlights the environmental recovery after the use of the contaminant TBT was discontinued.

D8C3 The spatial extent and duration of significant acute pollution events are minimised.

Exclusions

This assessment is limited to WFD Priority Substances and Relevant Pollutants substances in water and substances for which OSPAR has developed a common indicator and for which CEMP assessments for Irish data are available.

The risk-based focus of monitoring is on coastal/inshore waters. Results do not indicate a requirement to extend current monitoring into open marine waters.

Additional data from passive sampling studies, WFD 2016-2021 cycle, including additional WFD priority substances is not included as assessments are not currently available for these elements.

An assessment has not been carried out for the secondary criteria D8C4, the adverse effects of significant acute pollution events, as there have not been any significant acute pollution events recorded under Criteria D8C3.

Impact

Contaminants in shellfish from Irish Coastal waters are predominantly within the OSPAR thresholds (EAC or alternative assessment criteria applied by OSPAR



where an EAC does not exist) and concentrations of priority substances and other relevant pollutants in transitional and coastal waters comply with toxicity-based thresholds (EQSw) with few exceptions. Adverse effects on marine life would not be expected for exposure to these substances at the concentrations measured.

Levels of imposex in dogwhelks (*Nucella lapillus*) from around the Irish coast, associated with TBT contamination, have declined dramatically in recent years following the banning of TBT with few indications of significant impact remaining.

Extensive monitoring for acute pollution events has detected one oil spill from a ship in the assessment period 2014 to 2017, indicating a very low impact in the MSFD area. This monitoring was by surveillance flights and satellite imagery while there was no estimate of volume neither was there any reports of subsequent harm.

Environment Status

The objectives of GES are largely achieved for concentrations of contaminants and biological effects assessed and for acute pollution events within Ireland’s MSFD area. Where trends are detected, they are generally downwards, most notably for cadmium and PCBs.

Better alignment of European and OSPAR assessment thresholds for biota would lead to more robust assessments in respect to substances including mercury and PBDEs.

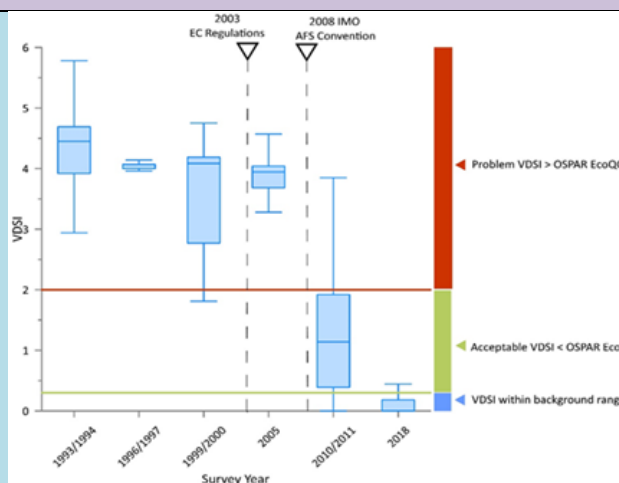


Figure 1: Box-plot (outliers not shown) of levels imposex in dogwhelk for periodic surveys undertaken since the early 1990s.

Note: Since 2005 a marked improvement in imposex status is evident. Dashed lines show timings of adoption of EC regulations and the ratification of the IMO Antifouling System Convention

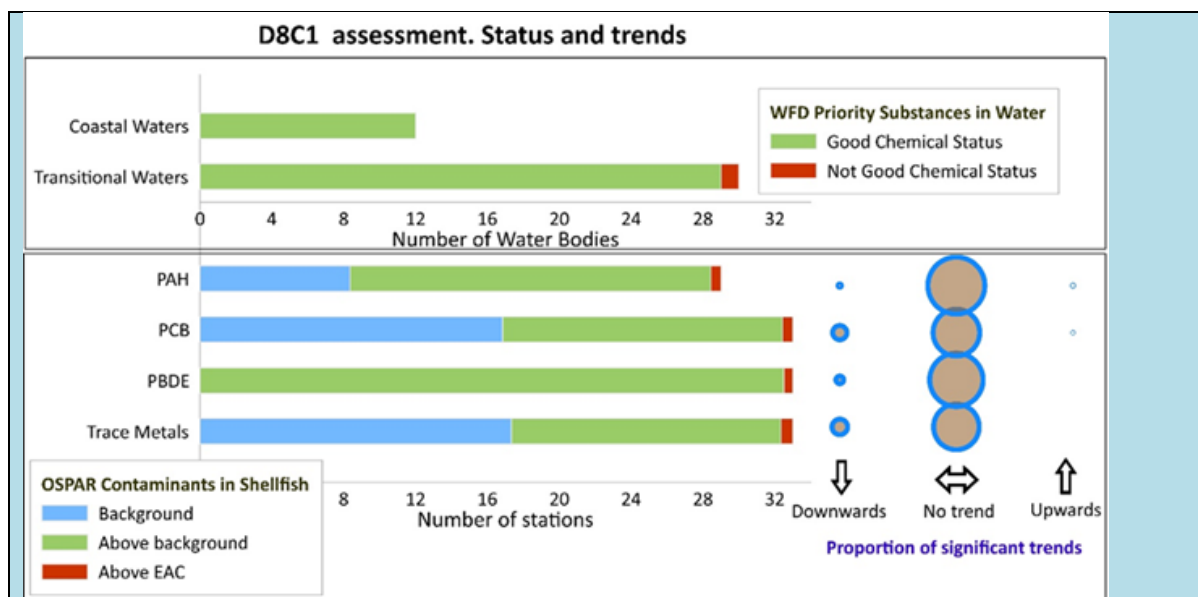


Figure 2: Top: Stacked bar chart of Chemical Status (Priority Substances in water) for Water Framework Directive coastal and transitional water - surveillance and operational monitoring 2012-2015.

Bottom: Stacked bar chart of status assessments for contaminants in shellfish (PAH, PCBs, PBDEs and trace metals (Cd, Pb, Hg)) and bubble plot showing the proportion of upward, downward and no trends observed for sites/parameters assessed.

Knowledge Gaps

Assessments are based on a limited number of substances and ecosystem components. The cumulative effect of exposure to complex combinations of contaminants are not considered in D8C1.

Linkages

Other criteria and elements which relate to the contaminants in this assessment are as follows:

Descriptor 9: Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards

Criteria 1 - The level of contaminants in edible tissues of seafood caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed levels listed in Regulation (EC) No 1881/2006

Conclusion

OSPAR assessments indicate that contaminants in shellfish from Irish Coastal waters are generally above background concentrations (OSPAR BAC) but predominantly within the OSPAR EAC thresholds. These imply adverse effects on marine life would not be expected. For the most part trends are not detected but where they do occur, they are typically in a downward direction, most notably for PCBs and cadmium. Concentrations of priority substances and other relevant pollutants in transitional and coastal waters comply with thresholds (WFD EQSw) with very few exceptions.



Levels of imposex in dogwhelks (*Nucella lapillus*), associated with TBT contamination, have decreased dramatically in recent years following the banning of TBT and are for the most part now within background range, with only very few indications of problems remaining (>OSPAR EAC).

New and improved assessment criteria and better alignment of OSPAR and EU criteria would enable more robust assessments. A number of knowledge gaps are highlighted including the challenge of assessing full ecosystem cumulative impacts of real-world combinations of contaminants.



Descriptor 9 – Contaminants in Fish and Other Seafood for Human Consumption



Mercury levels in Biota (Shellfish)
OSPAR 2019 (<https://ocean.ices.dk/OAT/>)

Status (colour)

- below BAC
- below EC food limit
- above EC food limit

Trend (shape)

- ▼ downward trend
- no trend
- status assessment only
- informal status assessment
- ▲ upward trend

Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845.

The key finding is that Descriptor 9 is compatible with Good Environmental Status (GES). Seafood sampled from shellfish growing waters and commercial fishing grounds around Ireland, between 2012 and 2017, shows a very high-level of compliance (99.7%) with Maximum Limits set in Commission Regulation 1881/2006 EC, as amended. This relates to mercury, cadmium, lead, indicator polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/Fs – dioxins), sum of PCDD/Fs and dioxin-like PCBs, and polyaromatic hydrocarbons (PAH).

Introduction

In 2013 Ireland completed an Initial Assessment of its maritime area. An updated assessment of concentrations of contaminants in seafood and compliance with relevant regulations for consumer protection has been undertaken for the period 2012 to 2017.

Commission Regulation (EC) 1881/2006, as amended, sets maximum limits for environmental contaminants, specifically, cadmium, lead, mercury, PCBs, dioxins and certain PAH, in foodstuffs including the edible tissues of seafood. The Marine Institute (MI) measures levels of these and other contaminants in Irish seafood to assess quality of Irish seafood and compliance with this regulation. A dataset covering fish and shellfish sampled during the period 2012 – 2017 was evaluated for this assessment. This includes bivalve molluscs from designated shellfish growing waters, and fish and crustaceans landed at Irish ports or sampled on-board fisheries surveys.



The objective of this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically Descriptor 9, “Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards” (Directive 2008/56/EC).

Drivers

The drivers of contaminants inputs to the marine environment as described in Commission Directive 2017/845 include:

- Urban and industrial uses, include waste treatment and disposal;
- Production of energy;
- Extraction of non-living resources;
- Transport.

Pressures

Within the Irish MSFD area the pressures relating to Descriptor 9 come from the following activities as described for Descriptor 8:

- Input of other substances (e.g. synthetic substances, non-synthetic substances) - diffuse sources, point sources, atmospheric depositions.
- Inputs may be from land based sources (riverine, direct discharge or atmospherically transported) or sea based sources.

Environmental Targets

Ireland's Initial Assessment (2013) describes the characteristic of Good Environmental Status (GES) for Descriptor 9 as follows:

“Concentrations of contaminants* in fish** and other seafood caught or harvested in Irish seas for human consumption do not exceed the relevant maximum levels listed in EU regulation 1881/2006 (as amended)”

The environmental target from the Initial Assessment (2013) stated:

Concentrations of contaminants in fish* and shellfish caught or harvested in Irish seas for human consumption show a high rate of compliance** with maximum limits listed in EU Regulation 1881/2006 (as amended).

* Excludes finfish aquaculture and also diadromous fish and other wild species or stocks that migrate beyond the Assessment Area

** Level of compliance to be defined.

This target has been reviewed to reflect the requirements of the Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental target based on the essential elements assessed.

Proposed Environmental Target D9T1

Levels of contaminants in fish* and shellfish caught or harvested in Irish seas for human consumption complies with maximum limits listed in EU Regulation 1881/2006 (as amended).

* Excludes finfish aquaculture

Note: the assessment has been carried out in accordance with the revised target and migratory/diadromous stocks were included in the assessment where data were available.



Threshold Values

The associated threshold values are the maximum limits for seafood established in Commission Regulation (EC) 1881/2006, as amended.

Criteria / Criterial elements included in the Assessment

The Criteria from the Commission Decision (2017/848 EC) considered in this assessment is (D9C1):

The level of contaminants in edible tissues (muscle, liver, roe, flesh or other soft parts, as appropriate) of seafood (including fish, crustaceans, molluscs, echinoderms, seaweed and other marine plants) caught or harvested in the wild (excluding fin-fish from mariculture) does not exceed:

- (a) for contaminants listed in Regulation (EC) No 1881/2006, the maximum levels laid down in that Regulation, which are the threshold values for the purposes of this Decision;

Exclusions

Only substances and seafood taxa for which maximum limits are established in the regulation are included in this assessment. Some seafood groups and tissues listed in the commission decision are not included as thresholds do not apply e.g. brown meat in crab.

Part b) of the criteria i.e. additional contaminants, not listed in Regulation (EC) No 1881/2006, threshold values, which Member States shall establish through regional or subregional cooperation. This is not applicable as these additional thresholds do not currently exist.

Farmed finfish are excluded from the assessment. Any source of contaminants in these fish would likely originate from feed and would not relate to marine environmental status.

Impact

The levels of contaminants in Irish seafood consistently comply with regulatory limits set in Regulation 1881/2006 as amended. Consequently, there is no impact and there is no requirement to withdraw Irish fisheries products/species from the market due to non-compliance with these limits.

Environment Status

The level of non-compliance for contaminants in seafood is extremely low and concentrations of these contaminants are generally well within the thresholds.

The current state of the Irish marine environment is evaluated as Good with respect Descriptor 9 with Good Environmental Status being achieved. An extensive monitoring program and a good dataset underpins this evaluation covering a broad range of fish and shellfish species.



	Lead	Cadmium	Mercury	Benzo(a)pyrene	Sum of 4 PAHs	Sum of IES6 PCBs	PCDD/Fs	PCDD/Fs + DL-PCBs
Fish	134 (100%)	134 (100%)	225 (100%)			54 (100%)	22 (100%)	22 (100%)
Bivalve	272 (100%)	272 (98%)	274 (100%)	214 (100%)	212 (100%)	272 (100%)		
Mollusc								
Cephalopod	4 (100%)	4 (100%)	4 (100%)					
Crustacean	24 (100%)	54 (96%)	21 (100%)	1 (100%)	1 (100%)	19 (100%)	18 (100%)	18 (100%)

Table 1: Summary table of compliance with maximum limits established in Commission Regulation 1881/2006/EC as amended for seafood sampled 2012 - 2017

Notes: the table shows the number of samples tested and the % compliance in brackets, with maximum limit. Green - 100% compliance. Amber <100% compliance

Linkages

Other Criteria and elements which relate to the Descriptor 9 are as follows:

Descriptor 8: Contaminants

Criteria 1 - Concentrations of contaminants are at levels not giving rise to pollution effects – measured concentrations of contaminants in the marine environment

Conclusion

Descriptor 9 is compatible with GES. Seafood sampled from shellfish growing waters and commercial fishing grounds around Ireland, between 2012 and 2017, shows a consistently very high level of compliance (99.7%) with Maximum Limits set in Commission Regulation 1881/2006 EC, as amended. This relates to the following contaminants; mercury, cadmium, lead, indicator polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/Fs – dioxins), sum of PCDD/Fs and dioxin-like PCBs, and polyaromatic hydrocarbons (PAH).

Out of 1422 individual test results for metals in all samples, an overall compliance of 99.5% was achieved. Organic substances show 100% compliance for 853 individual test results was recorded. The overall compliance rate was 99.7% for 2273 test results.

An extensive monitoring program and good dataset of results covering a broad range of fish and shellfish species underpins this assessment. On the very rare occasions of non-compliant results were detected these related to very local coastal issues or to other non-pollution related factors



Descriptor 10 – Marine Litter

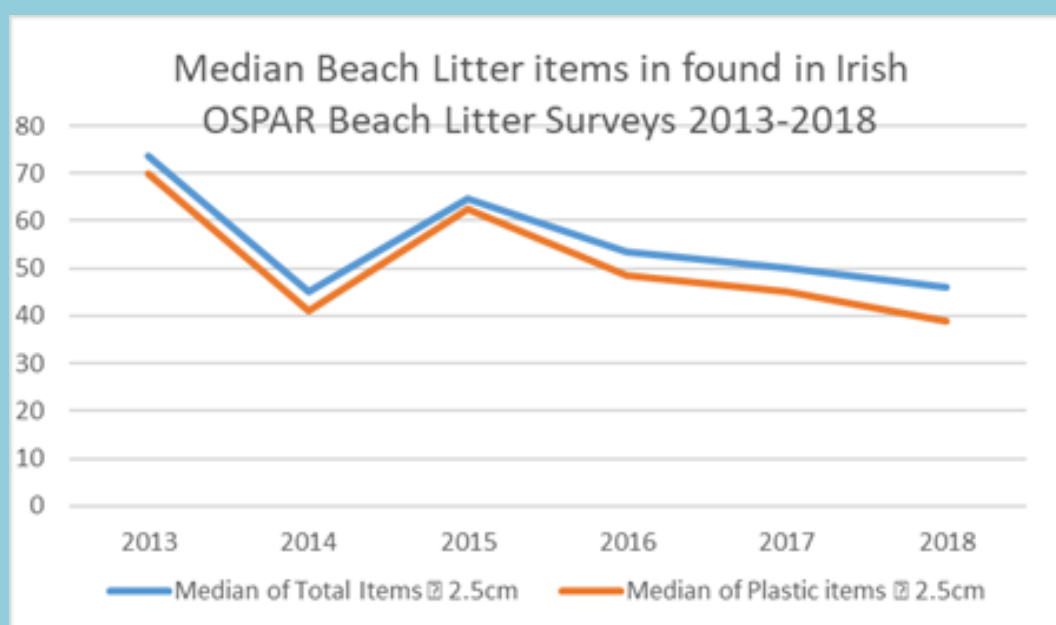
Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). Characterising GES as:

‘The amount of litter, and its degradation products’, on coastlines and in the marine environment is reducing over time and are at levels which do not result in harmful effects to the coastal or marine environment.’

The median number of litter items $\geq 2.5\text{cm}$ found on Irish beaches in quarterly surveys between 2013 and 2018 has decreased from 73.5 items per 100 metres in 2013, to 46 items per 100 metres in 2018.

The key message from this is: The amount of litter on coastlines recorded through the beach litter surveys has decreased during the period 2013 to 2018, indicating Descriptor 10 is compatible with the 2013 characteristics of GES.



Median beach Litter items - Ireland 2013-2018

The Commission Decision 2017/848 sets out two primary criteria for the assessment of marine litter, these are D10C1 (the composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment), which relates to litter 5mm and D10C2 (The composition, amount and spatial distribution of microlitter on the coastline, in the surface layer of the water column, and in seabed sediment, are at levels that do not cause harm to the coastal and marine environment.) which relates to microlitter, i.e. particles of $< 5\text{mm}$.

Currently no scientifically agreed methodologies have been developed to monitor microlitter on the coastline, in seafloor sediments, nor on the surface of the water column.



Member States are required to establish threshold values for litter and microlitter through cooperation at Union level, taking into account regional or sub-regional specificities". These threshold values are currently still under development. While monitoring and data sources exist for coastal and seabed litter (other than microlitter), at this time gaps remain in relation to monitoring and data analysis of the surface layer of the water column.

Until agreed marine litter thresholds are established through cooperation at EU level and with other regional Member States it is not possible determine GES in relation to Commission Decision 2017/848 criteria. In the interim, it is proposed to maintain the 2013 target of a decrease in the number of visible litter items within specific categories/types on coastlines.

Introduction

In 2013 Ireland completed the Initial Assessment of its maritime area under the Marine Strategy Framework Directive. At that time, the assessment concluded that there was lack of established evidence in relation to the environmental impacts of marine litter. It also concluded that insufficient survey data from beach litter surveys and seabed litter monitoring undertaken as part of International Bottom Trawl Surveys (IBTS⁸) to form a comprehensive analysis. Thus, it was not possible at that time to assess the status of the pressure and determine whether or not GES had been achieved.

The Commission Decision 2017/848 sets out comprehensive requirements for the determination of GES, these are:

- The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment.
- Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or sub -regional specificities.

The Decision classifies litter for consideration under D10C1 criteria in the following categories: artificial polymer materials, rubber, cloth/textile, paper/cardboard, processed/worked wood, metal, glass/ceramics, chemicals, undefined and food waste.

D10 C2 micro-litter is classified in the categories 'artificial polymer materials' and 'other'.

Since 2013, Ireland's data collection and methods of assessment in relation to coastal and seabed litter have progressed significantly. There is now consist longitudinal beach litter data available from Ireland's OSPAR beach litter surveys to indicate trends. This data may be used to meet assessment requirements as set

⁸ Seabed litter data gathered during groundfish surveys undertaken by the Marine Institute is uploaded to the International Council for the Exploration of the Sea (ICES) DATRAS database.



out under MSFD Article 8. However, at this time there is no established or agreed methodology for the assessment of the surface layer of the water column.

There are currently no agreed methodologies for the assessment of micro-litter although Ireland is currently working with other contracting parties to the OSPAR Convention to develop an indicator for micro litter in sediments.

Work to develop threshold values is underway at EU Level and this is being supported by work under regional sea conventions such as OSPAR.

Drivers

The drivers of marine litter in Irish marine from those listed in the revised directive 2017/845 are as follows:

- Urban and Industrial uses including waste treatment and disposal
- Tourism and leisure activities
- Transport

The primary sources of marine litter are the deliberate or accidental loss of materials into the environment through littering, mismanaged waste or accidental spillage and also in the case of micro-litter, through abrasion, wear and fragmentation. These include:

- Land based human activities generating litter in proximity to pathways to the marine environment, such as rivers, streams, drains, sewage and other wastewater outflows; or in proximity to coastal areas, in particular coastal urban conglomerations, recreational/ tourist areas, ports, harbours and marinas.
- Mismanaged municipal, industrial, service industry, agricultural or other waste or accidentally lost materials entering the environment in coastal areas or in proximity to pathways to the marine environment.
- Litter generated by maritime human activities within the Irish Exclusive Economic Zone, in particular fishing, aquaculture activities, shipping, offshore installations, or maritime recreational and tourist activities.
- Marine litter originating from landward or maritime activities beyond the national jurisdiction carried into the Irish maritime area by currents or winds.

Pressures

The 'Input of litter (solid waste matter, including micro-sized litter)' is the only pressure listed in the Commission Directive 2017/848 associated with marine litter.

Potential pressures may arise from litter deposition and accumulation in key habitats; large scale entanglements such as "ghost fishing" by lost or discarded fishing or aquaculture gear; and potential harm to species generated through large scale ingestion of plastics.

Environmental Targets

It is not proposed to set targets in relation to marine litter that meet the requirements Commission Decision 2017/848 and there are currently no threshold values established for marine litter. However, the expert EU Technical Working



Group on Marine Litter has commenced work on developing beach litter baseline and threshold values.

This work is being informed and supported by the OSPAR Marine Litter working group, ongoing OSPAR beach litter monitoring and the national seabed litter data reported to ICES. Ireland is actively engaged in all of these processes.

Interim target

Until baseline and threshold values are adopted at Union level, taking into account regional and subregional specificities it is proposed to continue using the 2013 target of a decrease in the number of visible litter items within specific categories / types on coastlines as an interim goal.

Criteria / Critical elements included in the Assessment

The Criteria from the Commission Decision 2017/848 sets out for the determination of GES in relation to this descriptor is as follows:

- The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment.
- Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional or subregional specificities.

Litter (excluding micro-litter) is classified in the following categories: artificial polymer materials; rubber; cloth/textile; paper/cardboard; processed/worked wood; metal, glass/ceramics; chemicals; undefined; and food waste.

There is also a facility that allows for EU Member States to add their own national sub - categories. Ireland is developing subcategories based on the most common items found in Irish beach litter surveys undertaken under the OSPAR Convention.

Impact

Harm caused by marine litter

Commission Decision 2017/848 states that the primary consideration for the determination of is that the “properties and quantities of marine litter do not cause harm to the coastal and marine environment”. However, this remains challenging to determine.

The EU Joint Research Council (JRC) report Harm caused by Marine Litter states that “the monitoring of impacts on biota is challenging, but there is clear evidence of harm to individuals and to a lesser extent assemblages of organisms and populations of some species.” Evidence exists that there are harmful effects of marine litter on individual organisms of many species and some populations. Linking evidence of harm to individuals to negative effects on populations has not been possible to date for most affected species. Marine litter, in combination with other anthropogenic stressors, may present additional challenges to marine biodiversity but this has not yet been established. As with many other anthropogenic pressures, quantifying the effects of marine litter in isolation on biodiversity is very challenging. Currently, it remains necessary to rely on the precautionary principle to develop policy in relation to marine litter.



Entanglement

There is evidence of harm to individuals from entanglement, especially birds, mammals, fish and turtles. There may be a particular risk from abandoned, lost or discarded fishing gear. However, the impact on overall populations remains inconclusive.

Ingestion

There is evidence that marine species (mammals, birds, fish and invertebrates) ingest plastic litter and that, in some populations, a large number may ingest it. While there is evidence from laboratory experiments of negative physical/mechanical impacts from ingestion of plastic on individual marine organisms from lower trophic levels, quantifying the extent of this harm to populations from this is not possible at this time.

Chemical transfer

Some plastics contain potentially harmful chemical additives. Plastics may also sorb and concentrate chemicals from seawater. There is evidence that plastic can transfer chemical contaminants to wildlife. However, there is considerable uncertainty about the relative importance of this pathway.

Marine Litter as a vector invasive species

Bacteria, algae, unicellular organisms, and invertebrates have been demonstrated to settle on floating or sea floor debris (i.e. "rafting"). Litter items have both similar and different characteristics to natural floating debris in facilitating transport, dispersion and potential colonisation. To date, it is hard to quantify the relative importance of rafting on anthropogenic versus natural debris.

Assemblages of species

The presence of marine litter can affect marine assemblages through smothering, direct physical damage, provision of a new habitats, modifying existing natural habitats, or transport chemical contaminants and invasive species. However, to date, evidence of effects comes from localised studies and cannot be extrapolated to larger spatial scales.

Prevalence

Beach Litter

The Draft Joint Research Council Technical reports *Marine Beach Litter Baselines* and *A European Beach Litter Threshold Value and Assessment Method* recommends that the median number of beach litter items of ≥ 2.5 cm should be considered rather than the arithmetic mean for the determination of baselines and threshold values. While the actual baselines and threshold values have yet to be agreed, this method for determining them is supportable as it helps to mitigate against statistical anomalies caused by outlier events.

The table and graph below outline the mean number of beach litter items ≥ 2.5 cm found on Irish beaches in Ireland's OSPAR beach litter surveys undertaken since Ireland's MSFD initial assessment was undertaken in 2013.



Year	Median of Total Items ≥2.5cm	Median of Plastic items ≥2.5cm	% Plastic relative to Total items
2013	73.5	70	95.24%
2014	45	41	91.11%
2015	64.5	62.5	96.90%
2016	53.5	48.5	90.65%
2017	50	45	90.00%
2018	46	39	84.78%

Table 1. Median Beach Litter items

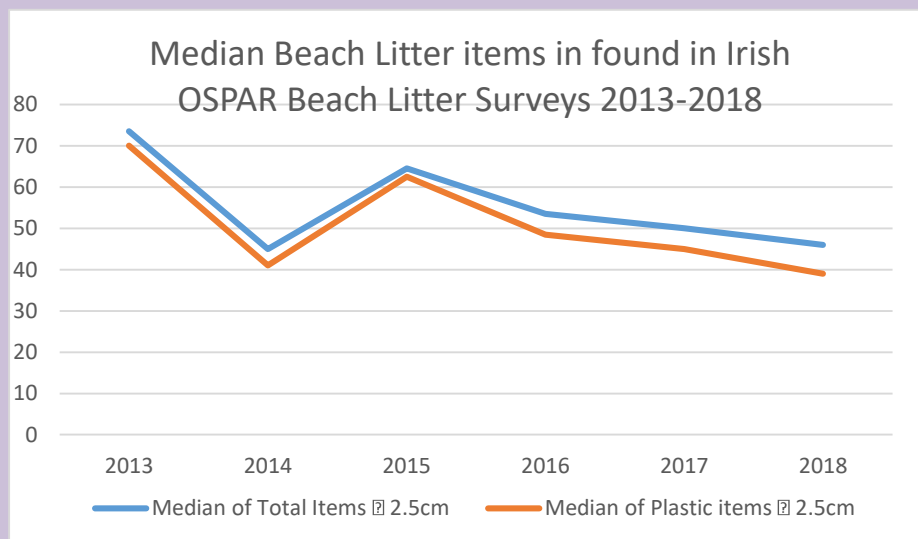


Fig. 1 Median beach Litter items - Ireland 2013-2018

This data illustrates that there has been an overall downward trend in the total number of beach litter items (including plastic items) being found in beach litter surveys during the period 2013 to 2018.

OSPAR Reference No	SUP ⁹ /Non-SUP	% of Total Beach Litter 2013-2018 (includes items excluded by TG-ML Baseline Report)
Plastic: String	Non-SUP	37.54%
Plastic: Plastic small fragments	Non-SUP	11.52%
Plastic: Crisp packets	SUP	10.25%
Plastic: Rope	Non-SUP	7.70%
Plastic: Small bags	SUP	4.16%
Plastic: Bottle Caps	SUP	3.73%
Plastic: Plastic large fragments	Non-SUP	2.89%
Plastic: Drinks bottles	SUP	2.76%
Plastic: Food packaging	SUP	1.37%
Plastic: Bags	SUP	1.32%

Table 2 Top 10 items found in Beach Litter surveys 2013-2018

⁹ SUP = Single Use Plastic



The JRC Technical Report – *A European Beach Litter Threshold Value and Assessment Method*, recommends that 2015-2016 is considered as possible reference years for the when setting European baselines for beach litter found in 100 metre surveys. The report states that the overall EU-wide median number of items found in 100m beach litter surveys in these years was 165 items. The Report found that there was an overall median value of 61 items per 100 metre beach litter on Irish beaches surveyed for OSPAR in the same period. This represents 36.97% of the corresponding EU-wide median value of 165. By this measure, Ireland's maritime area has the 7th lowest country sub-region out of 29 EU sub-regions in terms of beach litter. By end 2018, there had been a further 20% decrease (from 61 to 49 items) in the median number of beach litter items found on Irish beaches in OSPAR surveys

Seabed Litter

Seabed litter recovered during research trawls is undertaken as part of the International Bottom Trawl Surveys (IBTS). It operates at large regional scales and provides data standard protocols. This data is uploaded onto a central database hosted by ICES and is being used to develop monitoring of seabed litter for MSFD and regional seas conventions such as OSPAR. For example OSPAR is using data from seabed litter trawls to develop a seabed litter indicator which could be used for MSFD purposes.

Year	No. of trawls
2012	172
2013	176
2014	170
2015	47
2016	172
2017	149
2018	153
Total 2012-2018	1039

Table 3. Number of bottom trawls surveyed for litter in Irish marine waters

Surface of the Water Column

At this time there are no standardised methodologies established for monitoring of marine litter on the surface of the water column so data is not available to determine prevalence.

Micro-litter

There are no standardised methodologies for monitoring micro-litter in coastal areas, either on the surface of the water column or in seabed sediments. However, OSPAR ICG-ML is working to develop sediment monitoring methodologies and develop an indicator that may be used in seabed and coastal sediment sampling. If this is successfully adopted by the OSPAR Commission, such an indicator would be offered to MSFD –TGML as a template to inform the development of monitoring and assessment indicators under MSFD.



Fig. 2: Percentage of groundfish survey seabed trawls surveyed that contained litter between 2012-2018 in Irish marine waters

Ireland has commissioned research to analyse sediment samples taken from intertidal and sub-tidal sites around the coast. It is anticipated that this will help inform the development of an OSPAR microplastics in sediment indicator.

Environment Status

The characteristics of Good Environmental Status for marine litter set out in Ireland’s 2013 Initial Assessment (2013), were “the amount of litter, and its degradation products, on coastlines and in the marine environment is reducing over time and are at levels which do not result in harmful effects to the coastal or marine environment”.

The amount of litter on coastlines has decreased since 2013, this respect of the Initial Assessment 2013 characteristics is compatible with GES.

This has been superseded by the revised criteria for Descriptor 10 as set out in Commission Decision 2017/848. Which states that the “properties and quantities of marine litter do not cause harm to the coastal and marine environment”.

Clear evidence of environmental harm (as opposed to harm to individual organisms or localised communities) has yet to be identified. Additional data gaps exist in relation to the litter of all types on found on the surface of the water column and micro-litter generally. Finally, threshold values have not been determined for Descriptor 10.

Linkages

Other Criteria and elements which relate to the marine litter assessment are as follows:

Descriptor 1: Biodiversity
 Criteria 2 - Population abundance
 Criteria 3 - Population demographic characteristics

Descriptor 2: non-indigenous species.
 Criteria 1 - The number of non-indigenous species newly introduced via human activity

Descriptor 6: Sea-floor integrity
 Criteria 2 - Physical disturbance of the seabed: extent & distribution
 Criteria 3 – Disturbed habitats: spatial extents



Conclusion

The Initial Assessment (2013) described the characterising GES as *'The amount of litter, and its degradation products', on coastlines and in the marine environment is reducing over time and are at levels which do not result in harmful effects to the coastal or marine environment.'*

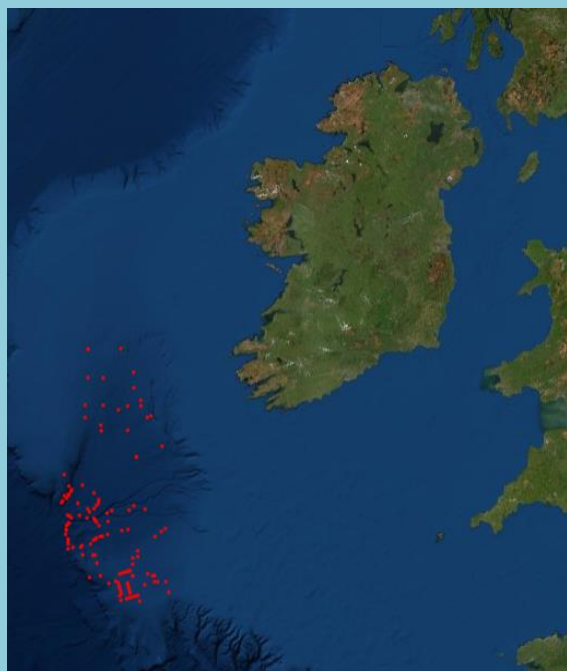
The amount of litter on coastlines recorded through the beach litter surveys has decreased during the period 2013 to 2018, indicating Descriptor 10 is compatible with GES.

It will be necessary in the future to change these characteristics of Good Environmental Status for Marine Litter to factor in the revised criteria set out in Commission Decision 2017/848.

However, to establish whether or not GES will be achieved in the future under the Commission Decision criteria requires that agreed methodologies and threshold values need to be determined. Data gaps will need to be addressed in relation to harm caused by marine litter. Micro-litter prevalence and trends in all specified aspects of the marine environment will have to be established as will prevalence and trends for all marine litter items on the surface of the water column. This will require the development of agreed monitoring protocols and indicators. Ireland will continue to work nationally and with our EU and OSPAR Convention partners to address these knowledge gaps will inform the assessment of GES and the setting of requisite environmental targets at the earliest opportunity.



Descriptor 11 – Introduction of Energy including Underwater Noise



Documented instances of impulsive noise from seismic surveys carried out under Licence during 2017 OSPAR 2018

Key Messages

In 2013 Ireland completed an Initial Assessment of its maritime area, under the 2008 Marine Strategy Framework Directive (MSFD). An updated assessment has now been carried out in respect of the original Directive and newly established criteria, elements and methodological standards as set out in the Commission Decision (EU) 2017/848 and amending the Commission Directive (EU) 2017/845.

In relation to Descriptor 11 – underwater noise these criteria and standards provide a basis for assessment. Descriptor 11 comprises of two primary criteria: D11C1 impulsive noise and D11C2 continuous noise. This assessment is based on the impulsive noise criteria. The continuous noise criteria (D11C2) has not been included in this assessment. Work is ongoing at a European level to develop methodologies for the assessment of continuous noise and its impact on marine animals.

The level of impulsive underwater noise causing activities within Ireland's designated Marine Strategy Framework Directive area were low overall during the assessment period of 2016-2018. The current state of the Irish marine environment is considered compatible with Good Environmental Status for spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources.

Introduction

In 2013 Ireland completed an Initial Assessment of its maritime area. At that time, the assessment concluded that there was insufficient information to determine the full extent of sound generating activities and the corresponding environmental status in Irish marine waters.

The revised Commission Decision (EU 2017/848) has led to developments in the methods of assessment for underwater noise.



The European Commission's Technical Sub-Group Noise (TG Noise) have made substantial progress in developing methodologies for the assessment of impulsive noise, however the assessment methodologies for continuous noise are less well developed.

A registry of impulsive noise has been developed by ICES to specifically support OSPAR contracting parties in providing information for regional assessments for MSFD descriptor 11. Ireland has reported data to this register for the years 2016, 2017 and 2018; this reporting is based on data from impulsive noise activity associated with petroleum exploration.

The objective of this assessment is to evaluate the spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources in Irish marine waters during 2016, 2017 and 2018.

The purpose for this updated assessment is to meet the requirements of MSFD Articles 8, 9 and 10 concerning qualitative descriptors for determining GES, in this case specifically the impulsive noise criteria of Descriptor 11, that the spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.

Drivers

The driver of underwater noise in Irish marine waters is economic development. The following activities are listed in the revised directive 2017/845 as drivers associated with underwater noise generation:

- Renewable energy generation
- Transport infrastructure
- The extraction of oil & gas (including petroleum exploration & production, and decommissioning)
- Transmission of electricity and communications (including laying of telecommunication cables)
- Research, survey & educational activities (including seafloor mapping)
- Military operations

Impulsive noise generating activities which took place in Irish waters, during the assessment period 2016 to 2018, are contained within the categories:

- The extraction of oil and gas (seismic/acoustic activity associated with petroleum exploration)
- Research, survey and educational activities.

Pressures

The 'Input of anthropogenic sound' is the only pressure listed in the Directive associated with underwater noise generation. However, links to the biological pressure 'disturbance of species (e.g. where they breed, rest and feed) due to human presence' is also relevant.

Environmental Targets

Ireland's Initial Assessment (2013) describes the characteristic of Good Environmental Status (GES) for Descriptor 11 as follows:

'Loud, low and mid frequency impulsive sounds and continuous low frequency sounds introduced into the marine environment through human activities do not have adverse effects on marine ecosystems:

- Human activities introducing loud, low and mid-frequency impulsive sounds into the marine environment are managed to the extent that no significant



long-term adverse effects are incurred at the population level, or specifically to vulnerable / threatened species and key functional groups.

- Continuous low frequency sound inputs do not pose a significant risk to marine life at the population level, or specifically to vulnerable / threatened species and key functional groups'

The environmental target from the Initial Assessment was the 'Establishment of a register of impulsive noise to determine the current level and trends in impulsive noise in the Irish Marine Environment'. This target has been achieved, through regional co-operation, by the continuing provision of impulsive noise data to the ICES/OSPAR noise register.

To address the requirements of the revised Commission Decision (EU) 2017/848 and amending Commission Directive (EU) 2017/845, Ireland now proposes the following environmental target based on the essential elements assessed for impulsive noise:

Proposed Environmental Target D11T1

The spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.

Threshold Values

There are currently no threshold values associated with underwater noise. TG Noise aim to produce advice on regional and sub-regional threshold values in 2020 and Ireland will develop threshold values in line with this advice when it is available.

Criteria / Critical elements included in the Assessment

The Criteria from the Commission Decision (2017/848 EC) considered in this assessment is:

- the spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals (D11C1).

Exclusions

There is no current evaluation under Criteria D11C2 (spatial distribution, temporal extent, and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals).

Work is ongoing at a European level to develop methodologies for the assessment of continuous noise and its impact on marine animals. The current TG Noise document 'Monitoring Guidance for Underwater Noise in European Seas' states that 'current ambient sound levels in European marine waters and their impact on the ecosystem are largely unknown'.

Impact

Underwater noise can interfere with key life functions of marine animals (e.g., foraging, mating, nursing, resting, migrating) by impairing hearing sensitivity,



masking acoustic signals, eliciting behavioural responses, or causing physiological stress.

There is considerable knowledge of the impacts of impulsive underwater noise on a selected number of individual marine species. These impacts can be quantifiable, like changes in behavior and/or death. Other impacts, such as hearing sensitivity reduction or physiological stress, can be more difficult to quantify.

The potential impacts of underwater noise on animal populations and/or ecosystems have yet to be developed.

TG Noise recognise these knowledge gaps in relation to impacts. The current advice document states that underwater noise is 'a relatively new topic, and at this stage, with the knowledge and information available, Member States should not expect to have full understanding of impacts of noise on populations and ecosystems in the near future, and defining internationally agreed threshold values is therefore difficult'.

The NPWS guidance document 'Guidance to Manage the Risk to Marine Mammals from Man-made Sound Sources in Irish waters'¹⁰ was first developed in 2007 and updated in 2014. This document provides the statutory method of mitigating lethal or sub-lethal injury of marine mammals from acoustic surveys and blasting in Irish waters. These guidelines are based on monitoring a prescribed mitigation zone around an acoustic source and are considered to be some of the most robust guidelines in Europe for the protection of marine mammals during acoustic surveys and blasting. Since these Guidelines were introduced in 2014, adherence to them has been a condition of any application for searching for petroleum with an acoustic noise element. All applications for offshore petroleum activities are submitted to the NPWS for their observations.

Environment Status

It is proposed not to change the characteristic of Good Environmental Status for Descriptor 11 as set out in Ireland's Initial Assessment (2013).

The primary anthropogenic impulsive sound source in Irish marine waters during this assessment period is associated with acoustic surveys carried out for petroleum exploration. The spatial distribution, temporal extent, and levels of seismic/acoustic survey activity in Irish marine waters during 2016, 2017 and 2018 have been assessed, using the data Ireland has reported to the OSPAR/ICES Noise Register.

Impulsive noise levels from 2016, 2017 and 2018, expressed as Pulse Block Days*, are summarised in Figure 1 from across the OSPAR Regions II, III and V. The OSPAR regions are as follows Region II - The Greater North Sea, Region III - The Celtic Seas and Region V - The Wider Atlantic. This assessment highlights that The Greater North Sea had by far the highest levels of anthropogenic impulsive noise when compared with the Celtic Seas and the Wider Atlantic. All

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https://www.npws.ie/sites/default/files/general/Underwater%20sound%20guidance_Jan%202014.pdf



Irish impulsive noise generating activities carried out between 2016 and 2018 occurred in the Wider Atlantic and no other parties documented impulsive noise generating activities in the Wider Atlantic during this period.

The levels of underwater noise causing adverse effect to populations of marine animals within Ireland's MSFD area is generally low and low in comparison with impulsive noise generating activity levels in neighbouring OSPAR Regions.

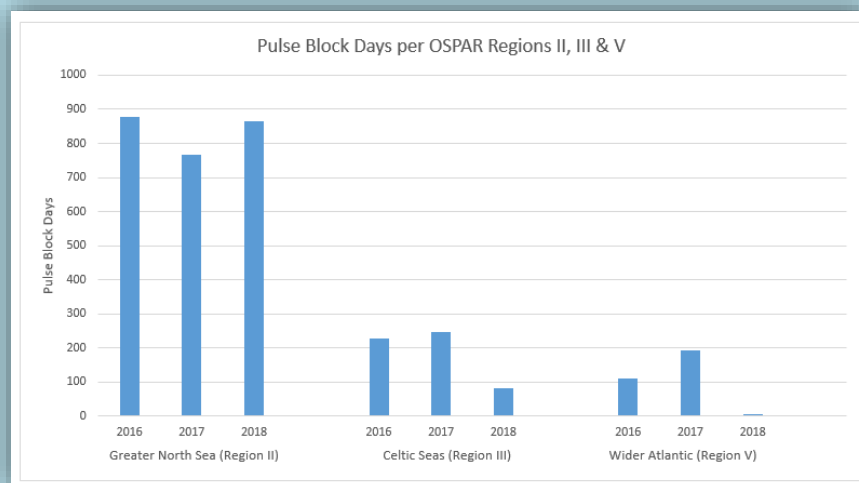


Figure 1: Impulsive noise pulse block days per OSPAR Regions II, III & V

* Where Pulse Block Days are the number of days within a specified spatial unit in which anthropogenic impulsive sources occurred in a given calendar year.

Linkages

Other Criteria and elements which relate to the D11C1 assessment are as follows:

Descriptor 1: Biodiversity

Criteria 2 - Population abundance

Criteria 3 - Population demographic characteristics

Criteria 6 - Pelagic habitat condition

Conclusion

Impulsive noise data, from activities carried out under licence, during 2016, 2017 and 2018 has been included in the ICES/OSPAR Impulsive Noise Register.

The extent and levels of impulsive noise generating activities in Irish marine waters for 2016, 2017 and 2018 were assessed and a comparison of Pulse Block days in OSPAR Regions II, III and V was carried out. This assessment highlights the limited activity and low levels of impulsive noise generated in the Irish MSFD area.

The current state of the Irish marine environment is compatible with Good Environmental Status for spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources.



Draft Economic and Social Assessment

This chapter outlines a draft economic and social analysis of the use of Irish waters addressing the following:

- The economic contribution made by various marine sectors and the numbers they employ.
- A socio-economic characterisation of population living in coastal Ireland.
- A review of the ecosystem service values generated from Irish waters and
- An indicative assessment of the cost of degradation of the Irish marine environment.

1. Goods and services provided by the Irish ocean economy

The marine water accounts method of analysis was used to estimate the goods and services provided by the Irish ocean economy. The ocean economy is defined as any economic activity that directly or indirectly uses the sea as an input or produces an output for use in a sea-specific activity. The marine water accounts method consists of four stages:

1. Define the marine sectors that are part of the Irish marine or ocean economy;
2. The marine industries for which there is publically available data were identified as were those sub-sectors where no publically available data was available;
3. For those activities that are only partially marine (e.g. cargo handling, tourism) the proportion of economic activity that is marine-based was estimated; and
4. The levels of turnover, employment, value-added (GDP), was recorded for each industry identified as forming part of the marine sector.

This report draws on data from the Central Statistics Office (CSO)'s Census of Industrial Production and Annual Service Enquiry databases. Additional targeted survey data from the Socio Economic Marine Research Unit (SEMURU) in NUI Galway, have been used to collect information on the smaller marine industries where publically available information is not available. The reference year is 2018 and this is compared to available data for 2012.

Ireland's ocean economy had a turnover of €6.2 billion in 2018, of which €2.2 billion was direct gross value added (GVA). The Irish marine sector employed 34,132 full time equivalents (FTEs). The direct GVA from marine economic activity is therefore approximately 1% of national output. The value of the ocean economy in terms of turnover and GVA is dominated by shipping and maritime transport, the seafood industry (wild capture fisheries, aquaculture and seafood processing combined), tourism, and leisure in marine and coastal areas (Table 1). Shipping and maritime



transport continues to be the largest contributor in terms of turnover and value added in 2018. Tourism and leisure in marine and coastal areas is the next largest category overall and is the largest contributor with regards to employment accounting for just over 51% of all employment in the ocean economy.

Table 1. Direct Turnover, GVA and Employment by industry, 2018

Marine Sector	Direct Turnover € Millions	Direct GVA € Millions	Direct Employment (FTEs)
Shipping and Maritime Transport	2,288.37	697.21	5,055
Marine Tourism and Leisure	1,253.73	648.44	18,107
International Cruise Industry	51.44	20.34	...
Marine Retail Services	167.03	74.53	927
Sea Fisheries	315.39	173	2,663
Marine Aquaculture	176	100.32	1,925
Seafood Processing	563.74	161.13	2,383
Oil and Gas Exploration & Production	819	106.47	154
Marine Manufacturing, Construction & Engineering	136.78	67.89	834
Advanced Marine Technology Products & Services	96.45	41.87	683
Marine Commerce	228.15	67.7	389
Marine Biotechnology & Bio-products	76.41	29.77	545
Marine Renewable Energy	57.59	37.19	467
Total	6,230.07	2,225.85	34,132

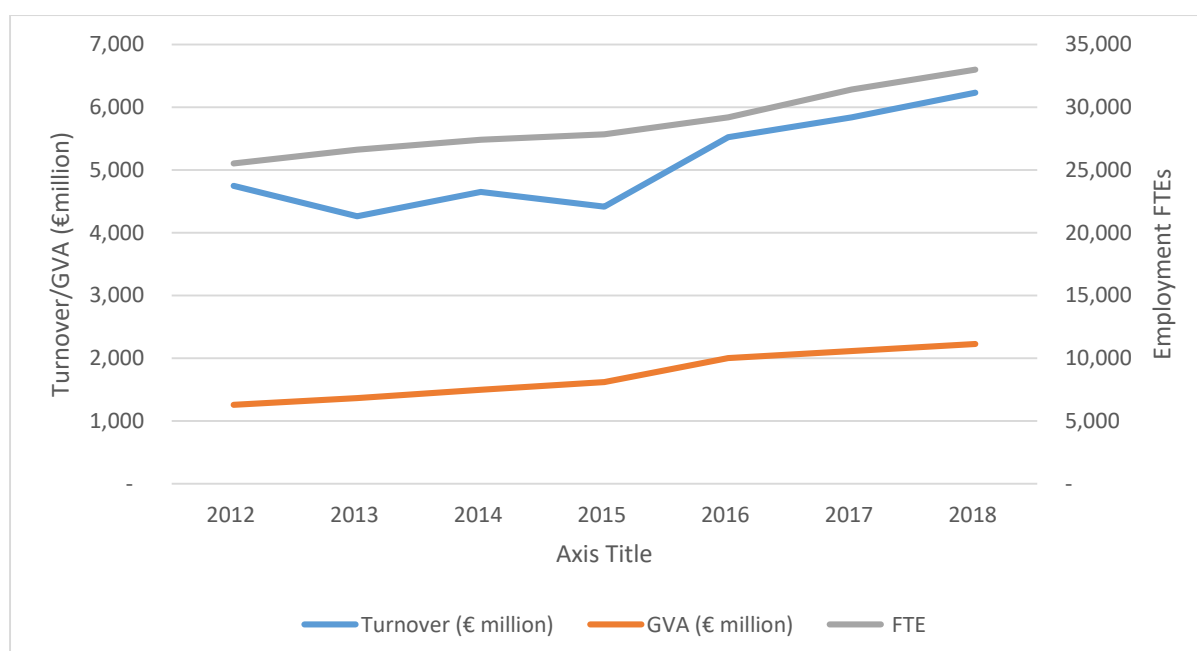


Figure 1. Direct Turnover, GVA and Employment by industry, 2012 to 2018

Figure 1 highlights the substantial increase in the economic contribution from the various marine industries and the numbers of people they employ since 2012.



Turnover has increased by 31% over the period, GVA has increased by 78% and employment has increased by 34% over this 7-year period.

The spatial distribution of enterprises and employment in Ireland's ocean economy is shown in Figures 2 and 3 respectively. While Dublin and Cork have the highest number of marine related enterprises, counties Donegal, Galway, Kerry and Wexford show the highest levels of employment along with Dublin and Cork. This indicates the importance of marine tourism in particular and also the seafood industry in employment in the ocean economy and these counties are some of the most popular tourism destinations and seafood areas in the country.

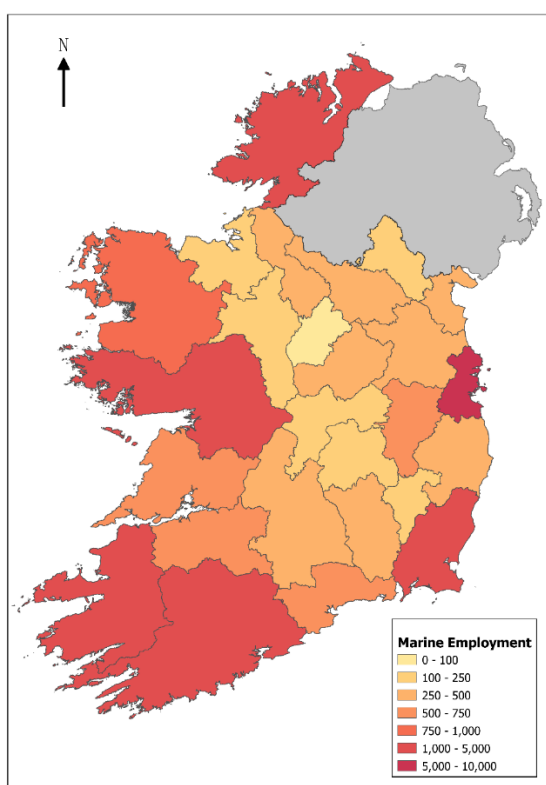


Figure 2. Spatial distribution of enterprises and employment in Ireland's Ocean Economy

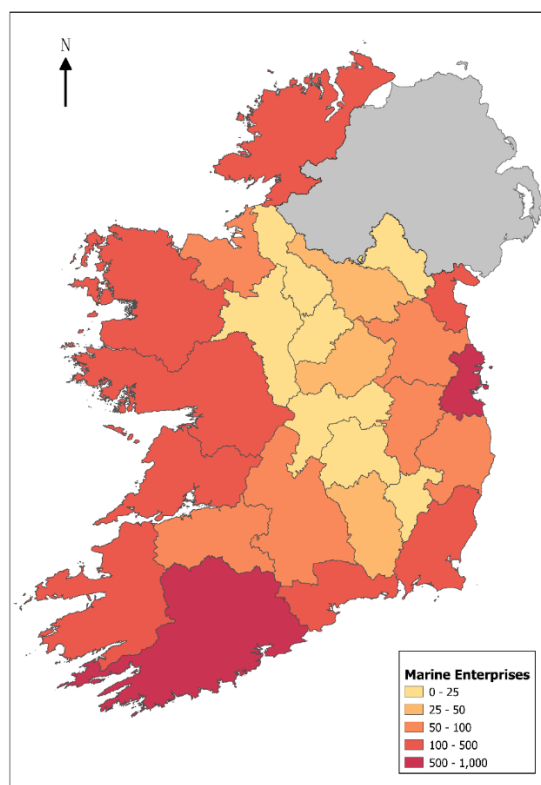


Figure 3. Spatial distribution of enterprises in Ireland's Ocean Economy

2. Pressures and associated activities in Irish seas

Table 2 provides a summary of the main anthropogenic pressures associated with each of the marine activities listed in Table 1 and uses the relevant pressures listed in Commission Directive 2017 / 845. The assessment of the top pressures in each case relies on expert judgement and the work of Pedreschi et al. (2019). Table 3 is not an exhaustive list of pressures from each activity on the Irish marine environment.

**Table 2.** Pressures from marine industrial activities in Irish waters.

	Key Pressure 1	Key Pressure 2	Key Pressure 3
Shipping and Maritime Transport	Input of anthropogenic sound (impulsive, continuous)	Input or spread of Non Invasive Species	Input of other substances (synthetic substances, acute events)
Marine Tourism and Leisure	Input of litter (solid waste matter, including micro-sized litter)	Disturbance of species (e.g. where they breed, rest and feed) due to human presence	Input or spread of Non Invasive Species
International Cruise Industry	Input of anthropogenic sound (impulsive, continuous)	Input of litter (solid waste matter, including micro-sized litter)	Input of other substances (synthetic substances, acute events)
Marine Retail Services	Secondary service to other marine industries so minimum direct pressure on marine environment		
Sea Fisheries	Extraction of, or mortality/injury to, wild species of fish and mammals (by commercial and recreational fishing and other activities)	Input of litter (solid waste matter, including micro-sized litter)	Disturbance of species (e.g. where they breed, rest and feed) due to human presence
Marine Aquaculture	Input of nutrients and input of organic material causing eutrophication	Input of litter (solid waste matter, including micro-sized litter)	Input or spread of Non Invasive Species
Seafood Processing	Input of nutrients and input of organic material	Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides) – diffuse sources, point sources, atmospheric deposition, and acute events.	Input of litter (solid waste matter, including micro-sized litter)
Oil and Gas Exploration and Production	Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate and physical disturbance to sea bed impacting benthic habitats	Input of other substances (synthetic substances, acute events	Input of anthropogenic sound (impulsive, continuous)
Marine Manufacturing, Construction and Engineering	Input of anthropogenic sound (impulsive, continuous)	Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate and physical disturbance to sea bed impacting benthic habitats	Disturbance of species (e.g. where they breed, rest and feed) due to human presence
Advanced Marine Technology Products and Services	Input of anthropogenic sound (impulsive, continuous)	Input of other forms of energy (including electromagnetic fields, light and heat affecting hydrographical conditions	Disturbance of species (e.g. where they breed, rest and feed) due to human presence



	Key Pressure 1	Key Pressure 2	Key Pressure 3
Marine Commerce	Secondary service to Shipping and Maritime Transport so minimum direct pressure on marine environment		
Marine Biotechnology and Bio-products	Extraction of, or mortality/injury to, wild species (by commercial and recreational fishing and other activities)	Physical disturbance to sea bed impacting benthic habitats	Disturbance of species (e.g. where they breed, rest and feed) due to human presence
Marine Renewable Energy	Disturbance of species (e.g. where they breed, rest and feed) due to human presence	Physical loss (due to permanent change of seabed substrate or morphology and to extraction of seabed substrate)	Input of other forms of energy (including electromagnetic fields, light and heat affecting hydrographical conditions)
Marine Research	Physical disturbance to sea bed impacting benthic habitats	Disturbance of species (e.g. where they breed, rest and feed) due to human presence	Input of anthropogenic sound (impulsive, continuous)
Naval Defence	Input of anthropogenic sound (impulsive, continuous)	Disturbance of species (e.g. where they breed, rest and feed) due to human presence	Input of other forms of energy (including electromagnetic fields, light and heat affecting hydrographical conditions)
Wastewater Treatment	Input of nutrients – diffuse sources, point sources, atmospheric deposition causing eutrophication	Input of nutrients – diffuse sources, point sources, atmospheric deposition impacting mammals, fish and benthic habitats	Input of other substances (e.g. synthetic substances, non-synthetic substances, radionuclides)

3. A socio-economic characterisation of Irish coastal population

Socio-economic data was obtained from existing national and European statistical portals. The marine social and economic indicators identified for the assessment are listed in Table 3 and a social analysis to supplement the economic analysis was also carried out as part of the ESA. This involved examining the socio-demographic profile of the Irish population living in coastal regions.

Small Area Population Statistics (SAPS) from Irish Census of Population were used to define what is referred to as the 'coastal economy'. SEMRU have previously defined such coastal regions that make up the coastal economy as:

Shoreline Electoral Districts: establishments or population located in an electoral district (ED) that is immediately adjacent to an ocean or sea, included estuaries and bays. Of the 3400 EDs in the country, 670 are Shoreline Electoral Districts

Coastal County: establishments or population located in a county that has a shoreline of any length adjacent to an ocean or sea, included estuaries and bays. 15 of the 26 counties in the Republic of Ireland are Coastal Counties.



European NUTS III Coastal Region: standard statistical regions (EU NUTS level 3), where at least half of the population is within 50 km of the shoreline. This is the Eurostat definition of a coastal region and for Irish case this includes 7 of the 8 NUTS 3 regions in Ireland, the Border, the West, Dublin, the Mid-East, the Mid-West, the South East and the South West. Only the four counties of the Midlands NUT 3 region are excluded from this definition.

The above definitions for coastal regions were outlined as such because a lot of data is collected in Ireland based on these different administrative and political jurisdictions.

Table 3 Average socio-economic characteristics of Irish coastal communities based on the 2016 Irish population census

	Coastal EDs	Coastal Counties	NUTS III Coastal
Population	1,302,144	3,557,125	4,469,564
Population Change 2011-2016	2.77%	2.67%	2.52%
Female Unemployment Rate (%)	11.92	10.77	10.84
Female Unemployment Change 2011-2016 (Percentage Points)	-3.18	-3.06	-3
Male Unemployment Rate (%)	14.8	13.22	13.09
Male Unemployment Change 2011-2016 (Percentage Points)	-0.3	-0.61	-0.75
Third Level Education (%)	33.83	31.98	31.24
Primary Level Education Only (%)	15.68	15.61	15.64
Semi- and Unskilled Manual Workers (%)	18.7	18.29	18.27
Higher and Lower Professionals (%)	35.57	35.8	35.53
Pobal Relative Affluent Index Score (%)	-1.04	-0.78	-1

Table 3 highlights that 1.3 million individuals live in coastal EDs, 3.56 million live in coastal counties and 4.47 million live in the Coastal NUTS3 (EU Coast) area. These represent 27%, 74% and 94% of the total population of the country for each coastal spatial scale respectively. The population in coastal EDs increased by 2.77% between 2011 and 2016. This increases the likely pressures from anthropogenic sources on the marine environment. Coastal EDs have a slightly higher unemployment rate (13.44%) than the national average (12.07%). Male unemployment rates are higher than female unemployment in coastal EDs. Female unemployment also saw a larger relative decrease between the census years 2011 and 2016.

Figure 5 also shows the distribution of male and female unemployment rates at the Coastal ED, County, and NUTS3 spatial scales.

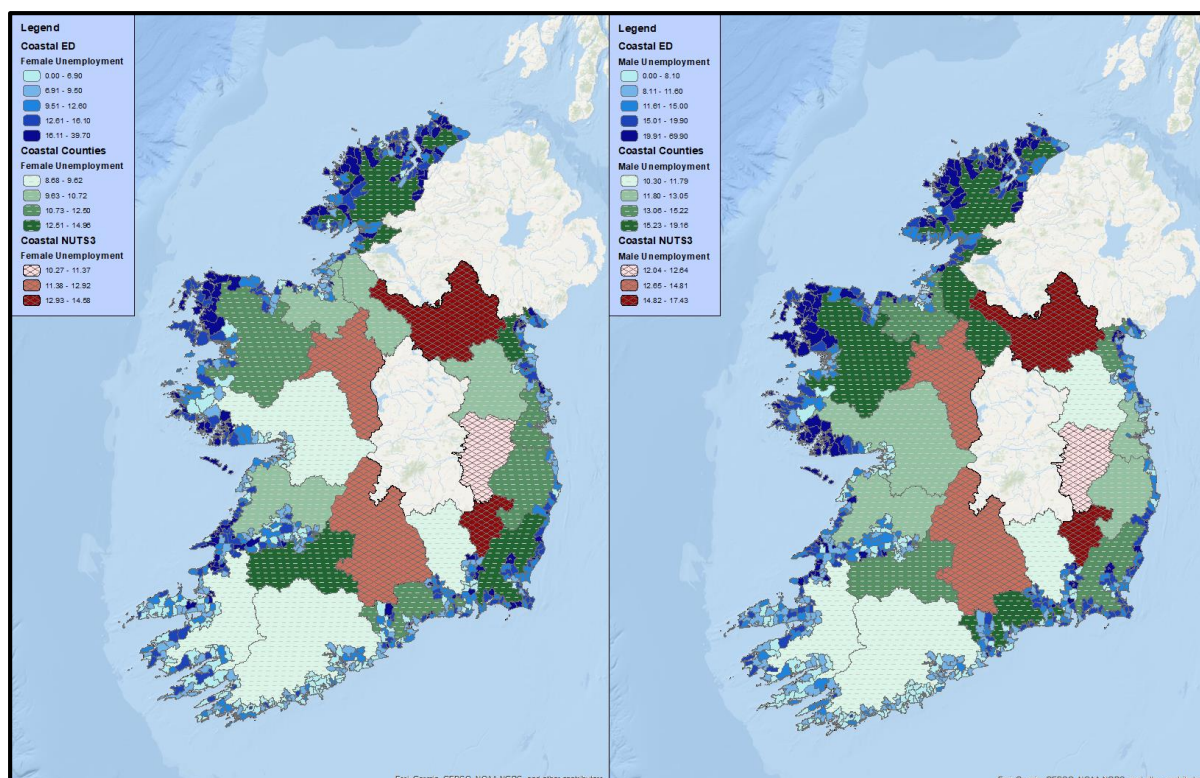


Figure 5. Male and Female Unemployment Rates at the Coastal ED, County, and NUTS3 spatial scales

Just over 33% of those living in coastal EDs have a third level education. In terms of social class, 18.7% of those living in coastal EDs are categorised as being semi- and unskilled manual workers and 35.6% are categorised as higher and lower professionals. Observing the Relative Affluent Index Scores, the average coastal ED has a score of -1.04, putting it “marginally below average” in terms of affluence.¹¹

Further information on the marine industry activities reviewed above and the coastal economy statistics, along with a detailed discussion of the methodologies used in each case, are available in the supporting report: [Ireland’s Ocean Economy Report](#).

4. An Assessment of marine ecosystem service values in Irish waters

There are many marine ecosystem services that generate benefit values to Irish society that go beyond the values obtained through the ocean economy industry activities reviewed in the previous section. These marine ecosystem services are “provided by the processes, functions and structure of the marine environment that directly or indirectly contribute to societal welfare, health and economic activities”. Research was carried out to determine the ecosystem service values from Irish marine waters.

¹¹ A full description of the Relative Affluent Index Score is available in Haase and Pratschke (2008).



In 2018 SEMRU published a study (Norton et al. 2018) that examined the ecosystem service benefits that society receives from Ireland's marine environment. The study used a framework called the UN Common International Classification of Ecosystem Services (CICES).

This approach provides a profile of the marine ecosystem services derived from Ireland's coastal, marine and estuarine natural resources and estimates the value to society of these marine ecosystem services. Table 4 outlines these ecosystem services and their associated value. It is important to note the following:

- Not all of the ecosystem services provided by the marine environment could be monetarized, the value of those that could was substantial
- Due to the different methods used to estimate the service benefit values, value estimates shown in Table 5 may not be directly comparable and should not be aggregated.

More research is needed to examine how Irish coastal and marine ecosystems provide these services and to examine how exactly Irish society value these services.

Table 4. Values of Irish Coastal and Marine Ecosystem Service Benefits

Ecosystem Service	CICES Classification	Quantity of ES per annum	Estimate of the Value of ES per annum
Provisioning ecosystem service			
Off shore capture fisheries	Wild Animals	469,735 tonnes	€472,542,000
Inshore capture fisheries	Wild Animals	14,421 tonnes	€42,113,000
Aquaculture	Animals - Aquaculture	39,725 tonnes	€148,769,000
Algae/ Seaweed harvesting	Wild Plants & Algae/ Plants & Algae from Aquaculture	29,500 tonnes	€3,914,000
Genetic materials	Genetic materials from biota	Not quantified	Not valued
Water for non-drinking purposes	Surface water for non-drinking purposes	1,189,493,326 m ³ of seawater used for cooling	Not valued
Regulating and maintenance ecosystem services			
Waste services	Mediation of waste, toxics and other nuisances	9,350,642 kg organic waste 6,834,783 kg nitrogen 1,118,739 kg phosphorous	€316,767,000
Coastal defence	Mediation of flows	179 km of coastline protected by saltmarsh	€11,500,000



Lifecycle & habitat services	Lifecycle maintenance, habitat & gene pool protection	773,333 ha protected through SAC's	Not valued
Pest & disease control	Pest & disease control	Not quantified	Not valued
Climate regulation	Atmospheric composition & climate regulation	42,647,000 tonnes CO ₂ absorbed	€818,700,000
Cultural services			
Recreational services	Physical & experiential interactions	96 million marine recreation trips per year	€1,683,590,000
Scientific & educational services	Scientific & educational	Marine education and training fees	€11,500,000
Marine heritage, culture & entertainment	Heritage, cultural & entertainment	Not quantified	Not valued
Aesthetic services	Aesthetic	Flow value of coastal location of housing	€68,000,000
Spiritual & emblematic values	Spiritual &/or emblematic	Not quantified	Not valued
Non-use values	Existence & bequest values	Not quantified	Not valued

In relation to cultural ecosystem services, information about use of the coastal and marine ecosystems by users is not captured routinely and is dependent on one off reports which use different methods. Valuation of these services is a developing area where research may be needed to demonstrate how to incorporate these values into decision making. The significant contribution that provisioning, regulation and maintenance, and cultural marine ecosystem services make to the welfare and economic activity of Ireland. On an annual basis, recreational services interacting with coastal, marine and estuarine ecosystems result in approximately 96 million marine recreation trips per year by Irish residents with an estimated annual value of €1.7 billion. Fisheries and aquaculture are estimated to be worth €664 million in terms of output value from Irish waters, carbon absorption services are valued at €819 million, waste assimilation services €317 million, scientific and educational services €11.5 million, coastal defence services of €11.5 million, seaweed harvesting €4 million and the added value per annum to housing stock of being close to the shore (aesthetic services) is valued at €68 million. Even though not all of the ecosystem services provided by the marine environment can be monetized, this research indicates that the value of those that can is substantial.

The full supporting report on “Valuing Ireland’s Blue Ecosystem Services” provides a detailed breakdown of the ecosystem service benefits analysed and discusses the alternative valuation methods used in generating the values reported in Table 5. The full supporting report is available to download [here](#).



5. Analysis of the indicative costs of degradation

There is no single methodological approach used in assessing costs of marine environmental degradation. The EU working group on Economic and Social Assessment (ESA) has facilitated taking stock of the various existing approaches in order to deal with this issue as effectively as possible. This draft assessment considers the costs incurred by society in avoiding degradation of the marine environment.

This analysis of the costs of degradation is carried out by studying the accounting costs, the costs associated with the various existing monitoring, prevention, avoidance and mitigation measures, taking into account the objectives of preserving the good ecological status of the marine waters concerned in a set of public policies, including the MSFD.

This approach has been used because of data availability, reliability and repeatability. The costs of avoiding degradation are considered and the calculation of such costs considers only the costs of measures aimed at preventing further degradation to the marine environment. The estimated costs are then used to infer how much the current state of the marine environment is valued by Irish society.

CSO has, through the implementation of the UN System of Environmental-Economic Accounting (SEEA), established a series of environmental accounts modules for Ireland. The SEEA is a statistical system that brings together economic and environmental information into a common framework to measure the condition of the environment, the contribution of the environment to the economy, and the impact of the economy on the environment.

The CSO have been generating accounts that examine the environmental subsidies and similar transfers paid by the Irish government to all sectors of the Irish economy and to international organisations, and environmental transfers paid by the EU to all sectors of the Irish economy. Annual figures are available from 2000-2016.

Where a programme has more than one objective and is not wholly aimed at environmental protection or resource management then the CSO only include a share of the programme funding based on available information on the amount of expenditure relating to the environmental objective under the programme.

While many of these transfers are at a high level of aggregation discussions with the governing bodies allow us to estimate the approximate share of the relevant transfers that are aimed at protecting the marine environment and that therefore constitute costs aimed at avoiding degradation. These costs are shown in Table 8 for the review period 2012 to 2017. Note the figures shown in Table 6 are the total costs



of the programmes while the final column indicates the estimated share of the total programme costs that are aimed at the protection and management of the marine environment in particular.

Table 6. Environmental Transfers for the Protection and Management of the Environment, 2012 - 2017 (€'000) (Source: CSO Environmental Accounts)

	2012	2013	2014	2015	2016	2017	Marine Protection / Management %
Programme for the Management of Wild Flora & Fauna							
Lobster V-Notching Scheme	71	86	253	320	336	342	100%
Marine Environment Protection Scheme	178	141	315	296	-	-	100%
Salmon Conservation Fund	641	195	595	267	557	252	100%
Sea Fisheries Protection Authority (fisheries conservation)	221	735	630	375	194	500	100%
Seafood Environmental Management Part A	34	51	9	16	-	-	100%
Seafood Environmental Management Part B	117	-	-	-	-	-	100%
Sustainable Fisheries Scheme	-	-	-	-	515	444	100%
Programme for Other Environmental Protection Activities							
UN Environment Fund	361	361	358	507	508	478	5-10%
Programme for the Protection of Biodiversity & Landscapes							
Marine Biodiversity Scheme	496	333	330	559	427	1,780	100%
Programme for Wastewater Management							
Wastewater Treatment Facilities (Local Authorities)	5,040	5,377	7,855	2,935	235	767	65-75%
Water Services Investment Programme (Wastewater)	150,363	124,396	-	-	-	-	65-75%
Capital Investment Plan (Wastewater)	-	-	150,000	168,000	199,000	229,000	65-75%
Rural Wastewater Plan (Capital)	5,304	6,307	777	1,146	212	199	65-75%
Totals	162,824	137,981	161,122	174,421	201,984	233,762	

Note: A dash indicates programme not in operation or no payments made.

The programmes presented in Table 6 do not cover all the costs associated with the protection of the marine environment as there will be other activities that have a broader remit with some element aimed at the marine environment. To get this full information a detailed analysis would be needed of the accounts of all the relevant bodies that are responsible for the prevention of degradation of the marine environment and this is a recommended area for further research.

An alternative approach to examining the costs of implementing programmes and measures to prevent degradation of the marine environment is to examine the expenditure of those institutes that have responsibility for such management and protection activities. The CSO Environmental Accounts series, breaks down



environmental subsidies and similar transfers by source of funding and administering body. Table 7 summarised these figures for the institutions that have a role in marine environment protection. The final column gives an indication of the share of the total figures that goes to marine rather than terrestrial environment protection and management. Some of these are unknown at this time and require further research to determine the

Table 7. Environmental Subsidies and Similar Transfers by Source of Funding and Administering Body, 2000-2017 (€'000) (Source: CSO Environmental Accounts)

Source of Funding	Program Admin	2012	2013	2014	2015	2016	2017	Marine %*
DAFM	BIM	218	139	289	316	425	391	100
	DAFM	109,125	96,038	60,640	40,611	63,531	101,847	3-5*
	IFI	641	195	595	267	557	252	5-10*
	MI	248	167	165	280	2,220	2,762	100
DCCAE	DCCAE	3,500	8,798	8,073	4,506	10,118	7,997	?*
	EPA	11,735	10,629	9,595	7,539	9,569	9,598	15-20*
	SEAI	49,621	30,358	34,618	37,830	39,770	57,836	2-3*
DCHG	DCHG	3,497	3,982	4,173	4,022	4,390	4,251	?*
	HC	739	911	896	933	1,209	1,130	?*
	NPWS	4,765	4,026	3,096	2,070	811	596	?*
DHPLG	DHPLG	1,314	965	472	110	723	715	100**
Env. Fund	DCCAE	8,467	4,419	4,153	4,234	1,922	1,990	?
EU	BIM	182	139	289	316	425	396	100
	DAFM	152,103	122,485	150,548	95,792	87,755	126,267	10-15*
	EU	1,193	1,230	2,071	2,941	3,392	4,082	?
	MI	248	167	165	280	3,352	3,870	100

Notes:

*indicates best available estimate of share.

** refers to the Department's expenditure on the marine related issues. Source Office of the Comptroller and Auditor General Appropriation Accounts 2018. Prior to 2016 this department was the Department of Environment, Community and Local Government.

? The Marine % Share is unknown at this time; further research is required.

6. Key Outputs

The key outputs from this draft Economic and Social Assessment of Ireland's marine environment are as follows:

- Ocean Economy turnover in 2018 €6.2 billion, of which €2.2 billion was direct gross value added.
- Employment in the marine sector in Ireland was 34,132 full time equivalents



- Between 2012 and 2018 there has been a substantial increase in the economic contribution from the marine sector:
 - Turnover has increased by 31% over the period
 - GVA has increased by 78%
 - Employment has increased by 34%
 - There is an extensive list of pressures from human activities in the marine environment
 - Depending on how the coast is defined a considerable proportion of the population live at or near the coast:
 - 1.3 million live in shoreline Electoral Districts, 27 % of the population
 - 3.56 million live in coastal counties, 74 % of the population
 - 4.47 million live within 50km of the shoreline, 94 % of the population
 - Marine ecosystem services make a substantial contribution to welfare, health and economic activities every year:
 - 96 million marine recreation trips per annum by Irish residents valued at €1.683 billion
 - Fisheries & aquaculture worth an estimated €664 million in terms of output value from Irish waters
 - Carbon absorption services are valued at €818.7 million
 - Waste assimilation services valued at €316.7 million
 - Scientific and educational services valued at €11.5 million
 - Coastal defence services valued at €11.5 million
 - Seaweed harvesting valued at €4 million
 - Aesthetic services, the added value per annum to housing stock of being close to the shore is valued at €68 million
 - The cost of degradation has been considered in two ways
 - Environmental Transfers for the Protection and Management of the Environment
 - Environmental Subsidies and Similar Transfers by Source of Funding and Administering Body
- Further consideration is needed for the cost of degradation calculations.

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