



Rialtas na hÉireann
Government of Ireland

Marine Strategy Framework Directive 2008/56/EC

Article 17 update to Ireland's Marine
Strategy Part 3: Programme of Measures
(Article 13)

December 2022

Prepared by the Department of Housing, Local Government and Heritage

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Article 13 Programme of Measures

This document is an update to Part 3 of Ireland's Marine Strategy: Programme of Measures (Article 13), under the Marine Strategy Framework Directive (MSFD).

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- Department of Housing, Local Government and Heritage (DHLGH)
 - Marine Environment Section
 - Water Advisory Unit
 - Marine Planning Policy and Legislation
 - National Parks and Wildlife Service
- Marine Institute (MI)
- Department of Agriculture, Food and the Marine (DAFM)
- Sea Fisheries Protection Authority (SFPA)
- Environmental Protection Agency (EPA)
- Department of Transport (DoT)
- Department of the Environment, Climate and Communications (DECC)
- Inland Fisheries Ireland (IFI)
- Food Safety Authority of Ireland (FSAI)
- Environmental non-Government Organisation (eNGO) representatives (Coastwatch and SWAN)
- An Bord Iascaigh Mhara (BIM)
- National Biodiversity Data Centre (NBDC)

Photo credit: The photos throughout this document were provided from the finalists of the An Taisce Love your Coast photography competition 2020.

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Acronyms

The acronyms below relate to this report and the associated figures and annexes.

Acronym	Description
ActivCultivAgri	Agriculture
ActivCultivAquaculMarine	Aquaculture – marine, including infrastructure
ActivResearch	Research, survey and educational activities
ActivRestrucCanalisation	Canalisation and other watercourse modifications
ActivRestrucCoastDef	Coastal defence and flood protection
BIM	Bord Iascaigh Mhara
BirdsBenthicFeeding	Benthic-feeding birds
BirdsGrazing	Grazing birds
BirdsPelagicFeeding	Pelagic-feeding birds
BirdsSurfaceFeeding	Surface-feeding birds
BirdsWading	Wading birds
C1	Criteria 1
CAP	Common Agricultural Policy
CephaCoastShelf	Coastal/shelf cephalopods
CephaDeepSea	Deep-sea cephalopods
CFP	Common Fisheries Policy
CharaChem	Chemical characteristics
CharaPhyHydro	Physical and hydrological characteristics
CLAMS	Coordinated Local Aquaculture Management Systems
C-POP	Stockholm Convention on persistent organic pollutants (POPs)
D1	Descriptor 1
DAFM	Department of Agriculture, Food and Marine
DAPSIR	Driver Activity Pressure State Impact Response
DECC	Department of the Environment, Climate and Communications
DHPLG	Department of Housing Planning and Local Government
DoT	Department of Transport
DPSIR	Drivers, Pressures, State, Impacts, Response
EC	European Commission
EcosysCoastal	Coastal ecosystems
EcosysOceanic	Oceanic/deep-sea ecosystems
EcosysShelf	Shelf ecosystems
EEZ	Exclusive Economic Zone
EIONET	European Environment Information and Observation Network
EMFAF	European Maritime Fisheries and Aquaculture Fund
eNGO	Environmental non-Government Organisation
EPA	Environmental Protection Agency
EU	European Union
EU-ALASA	Use of alien and locally absent species in aquaculture (Council Regulation (EC) No 708/2007)

EU-BD	Birds Directive
EU-BDS	EU Biodiversity Strategy
EU-BWD	Bathing Water Directive
EU-CFP	Common Fisheries Policy
EU-EIA	Environmental Impact Assessment Directive (2011/92/EU)
EU-FSR	Foodstuffs Regulation
EU-HD	Habitats Directive
EU-IASR	Prevention and management of the introduction and spread of invasive alien species (Regulation (EU) No 1143/2014)
EU-IED	Industrial Emissions Directive (2010/75/EU)
EU-MSP	Maritime Spatial Planning Directive
EU-ND	Nitrates Directive
EU-NEC	National Emission Ceilings Directive
EU-PRF	Port Reception Facilities Directive (2019/883/EU)
EU-REACH	Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (EC 1907/2006)
EU-Sev	Seveso Directive
EU-SPCE	EU Strategy for Plastics in a Circular Economy (COM(2018) 28 final)
EU-SUP	Single Use Items Directive (2019/904/EU)
EU-UWWTD	Urban Waste Water Treatment Directive
EU-WaFD	Waste Framework Directive
EU-WFD	Water Framework Directive
FishCoastal	Coastal fish
FishCommercial	Commercially exploited fish and shellfish
FishDeepSea	Deep-sea fish
FishDemersalShelf	Demersal shelf fish
FishPelagicShelf	Pelagic shelf fish
FMSY	Fishing mortality that maximises sustainable yield
FSAI	Food Safety Authority of Ireland
GES	Good Environment Status
HabBenBHT	Benthic broad habitats
HabBenOther	Other benthic habitats
HabPelBHT	Pelagic broad habitats
HabPelOther	Other pelagic habitats
HNS	Hazardous and Noxious Substances
ICES	International Council for the Exploration of the Sea
ICG	Intersessional correspondence group
ICG-MSFD	Intersessional correspondence group for the Marine Strategy Framework Directive
IFI	Inland Fisheries Ireland
IMO	International Maritime Organisation (all conventions)
IMO-MARPOL	International Convention for the Prevention of Pollution from Ships (IMO-MARPOL)

IMO-OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
INFOMAR	Integrated Mapping For the Sustainable Development of Ireland's Marine Resource
MamCetacBaleenWhales	Baleen whales
MamCetacDeepDiving	Deep-diving toothed cetaceans
MamCetacSmall	Small toothed cetaceans
MamSeals	Seals
MAPs	Multiannual Management Plans
MARA	Maritime Area Regularity Authority
MARPOL	International Convention for the Prevention of Pollution from Ships
MI	Marine Institute
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
MSY	Maximum Sustainable Yield

Executive Summary

The Marine Strategy Framework Directive (MSFD) aims to achieve Good Environment Status (GES) for all marine waters in Europe, and to protect the resource base for marine related economic and social activities.

Ireland’s Marine Strategy Part 1 (2020) identified the status of Ireland’s marine environment and the gaps to achieving GES. To close these gaps Ireland has revised its Marine Strategy Part 3: Programme of Measures (PoMs); first developed in 2015.

The updated PoMs includes 152 measures. This reflects the consolidation of 227 existing measures brought forward from 2015 to 112, the modification of 28 measures and the development of 12 new measures. New and/or updated measures have been included for all 11 descriptors of the MSFD.

Ireland’s PoMs is built on existing national, European and International policy frameworks.

At a national level, development of the PoMs included input from government departments

and agencies responsible for managing pressures on the marine environment and has incorporated developments in both policy and legislation aimed at protecting the marine environment.

Regional coherence of measures is crucial to successful action, as pressures are often transboundary in nature. Hence, several measures developed under OSPAR and MARPOL, and other international legislation, tackle regional issues at the appropriate scale.

The review of the MSFD programme of measures was informed by engagement with a number of key interested parties. This engagement included, oversight by the MSFD National Steering Group, a 12-week public consultation focused specifically on the measures Ireland intends to put in place to achieve GES, bi-laterals with key agencies and government departments and a series of workshops with key stakeholders, including a number of environmental non-government organisations (eNGOs).

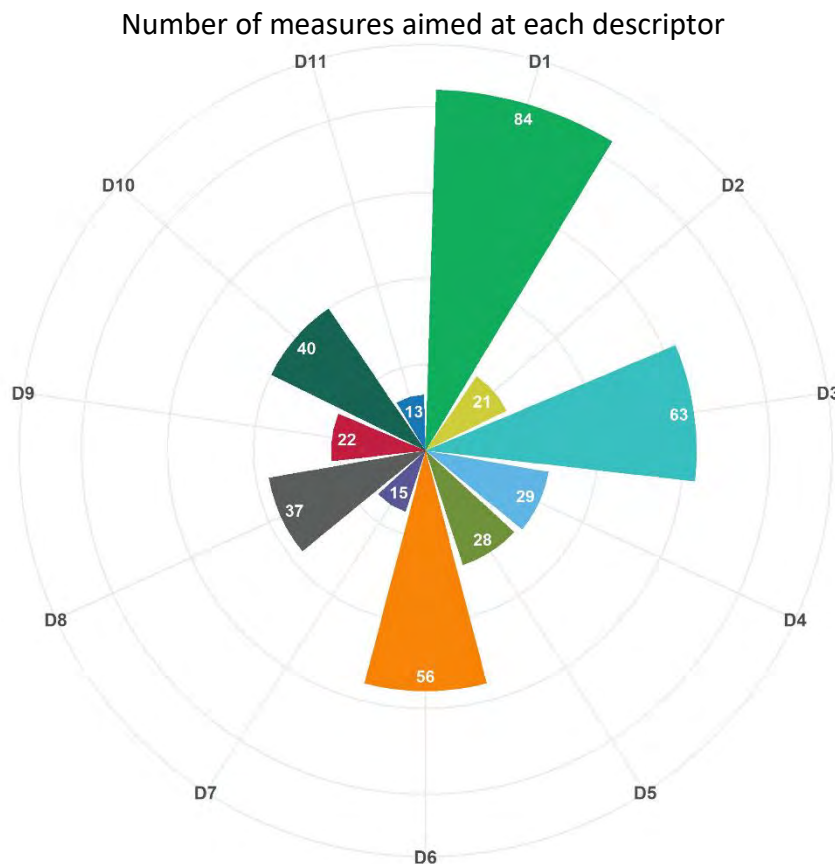


An Ecosystem Based Approach was applied in the development of the PoMs. This approach recognised that human social systems occur within, and are entirely dependent on, the ecosystems that contain them. As a result, the development and modification of measures considered human-social systems and environmental systems in tandem to ensure protection of the marine environment and the sustainable use of its resources are balanced.

The development of Ireland's updated Marine Strategy Part 3 (PoMs) includes, for the first time, the consideration of climate change. This was done through a number of processes including the integration of specific climate related measures (e.g. development of nature based solutions and Marine Protected Areas which will both consider carbon storage and the resilience of ecosystems to climate change and ocean acidification).

Modified and new measures reflect:

- Advances in National, European and International (e.g. OSPAR) policy and legislation.
- Actions to close identified gaps leading to some descriptors reaching partial GES.
- Consideration of future increases in human activities and associated pressures on the marine environment (e.g. offshore renewable energy and climate related pressures) and/or relevant cumulative effects.
- Measures to ensure the continued good status of descriptors already considered in GES.
- A focus on nature based solutions and specifically spatial protection and restoration measures.



Introduction

Introduction

The Marine Strategy Framework Directive (MSFD)

The MSFD aims to achieve Good Environment Status (GES) for all marine waters in Europe and to protect the resource base for marine related economic and social activities. To determine GES Member States must assess the status of their marine waters against 11 qualitative descriptors and associated national environmental targets (Annex 1). The descriptors can be divided into those that characterise the condition or 'State' of the marine environment (biodiversity, commercial fish and shellfish, food webs and sea-floor integrity) and those referring to 'Pressures' that come from human activities (non-indigenous species, eutrophication, hydrographical conditions, contaminants, contaminants in seafood, litter and energy, including underwater noise). Each descriptor has specific criteria¹ that further describe the characteristics of a healthy sea (known as GES). When considered together, the descriptors define what the marine environment will look like when GES has been achieved.

Marine Strategy Framework Directive Cycles

The MSFD is implemented in 6-year cycles, with reporting to the European Commission required sequentially every two years (Figure 1). Ireland is currently in the final stage of the second cycle of MSFD implementation. Member States are required to systematically assess the environmental status of their marine environment, provide a description of GES, develop environmental targets and associated indicators (Marine Strategy Part 1),

develop monitoring programmes (Marine Strategy Part 2) and put in place programmes of measures (Marine Strategy Part 3).



Figure 1. The Marine Strategy Framework Directive is implemented in 6-year cycles, with reporting required sequentially every two years. Ireland is currently in the final stage of the second cycle of implementation.

Ireland's Marine Strategy Part 1: Assessment

In 2020, Ireland assessed the marine environment, determined GES for the 11 descriptors of the Marine Strategy Framework Directive, and reported progress towards environmental targets and associated indicators. In that assessment, five of the 11 descriptors achieved or maintained GES. This included non-indigenous species, eutrophication, hydrographical conditions, contaminants and contaminants in seafood (Figure 2). GES was also achieved for certain primary criteria assessed under two

¹ [Commission Decision \(EU\) 2017/848](#)

descriptors; marine litter and noise. A lack of data and methodologies prevented assessment of the remaining primary criteria for these two descriptors. In addition, three descriptors partially achieved GES: biodiversity, commercial fish and shellfish and sea floor integrity. Some parts of the primary criteria for these descriptors did not achieve

GES and some elements were not assessed. This was due, among other things, to uncertainties in the appropriate methodology and defined thresholds or gaps in scientific information for some features (e.g. certain species or habitat types). In the case of food webs, it has not been possible to assess GES (Figure 2).

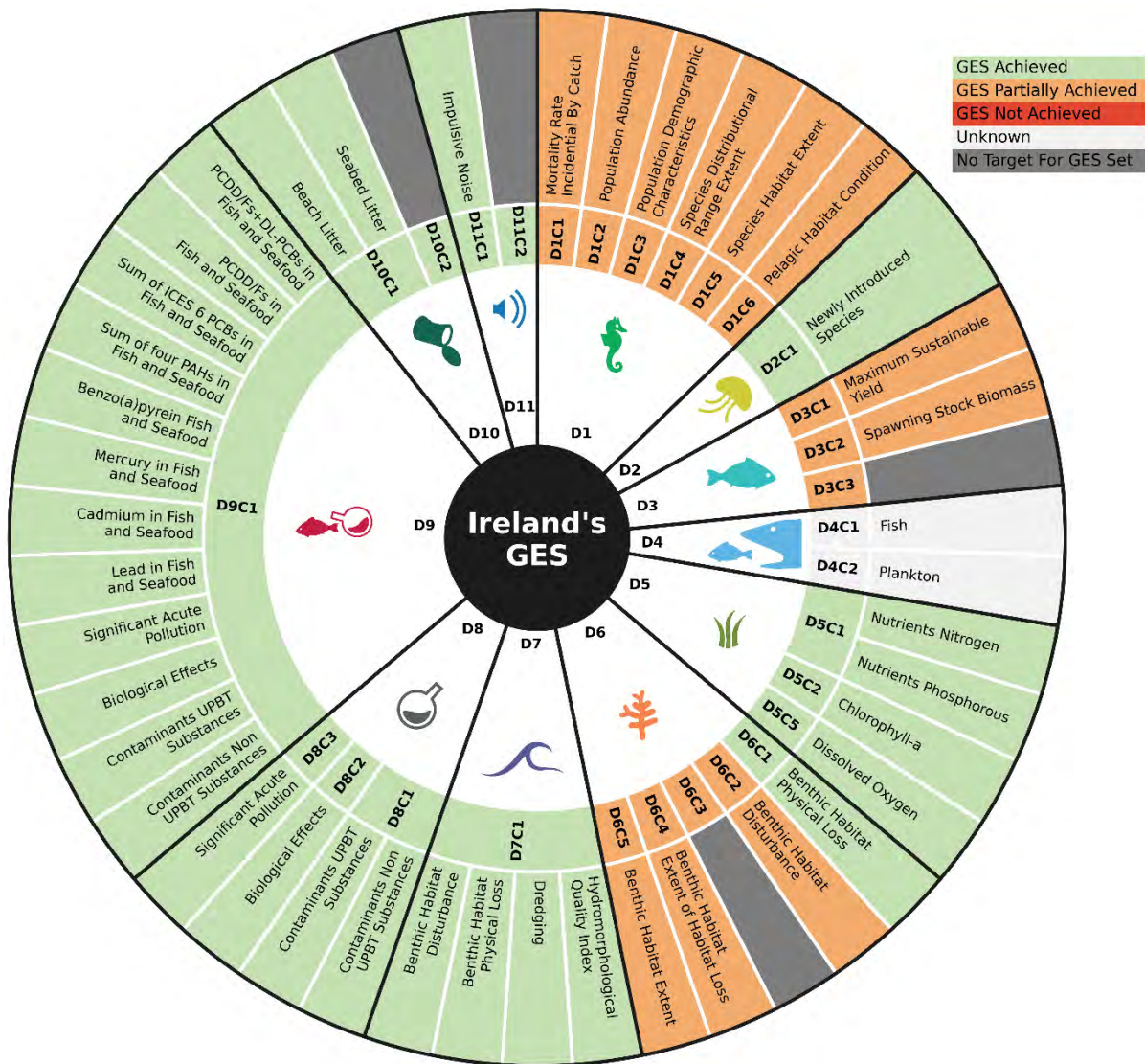


Figure 2. In 2020, Ireland assessed the status of the marine environment and determined Good Environmental Status (GES) for the 11 descriptors of the Marine Strategy Framework Directive.

The 2020 assessment allowed for the identification of 25 environmental targets (Annex 1) and associated indicators for Ireland. These targets describe how the marine environment is expected to function in order to achieve or maintain GES, allowing us to track the effectiveness of measures that have been undertaken to ensure this is the case.

Ireland's Marine Strategy Part 1: Art 8, 9 and 10 Assessment can be found [here](#).

Ireland's Marine Strategy Part 2: Monitoring Programmes

In 2021, Ireland reviewed its monitoring programmes for the 11 descriptors of the MSFD. The main purpose of these monitoring programmes is to gather scientific data and information to enable the ongoing assessment of Ireland's marine environment. The programmes provide the information used to track the progress in achieving all environmental targets and GES, to identify changes in the quality of Ireland's marine environment over time, and to assess the effectiveness of measures designed to improve environmental outcomes.

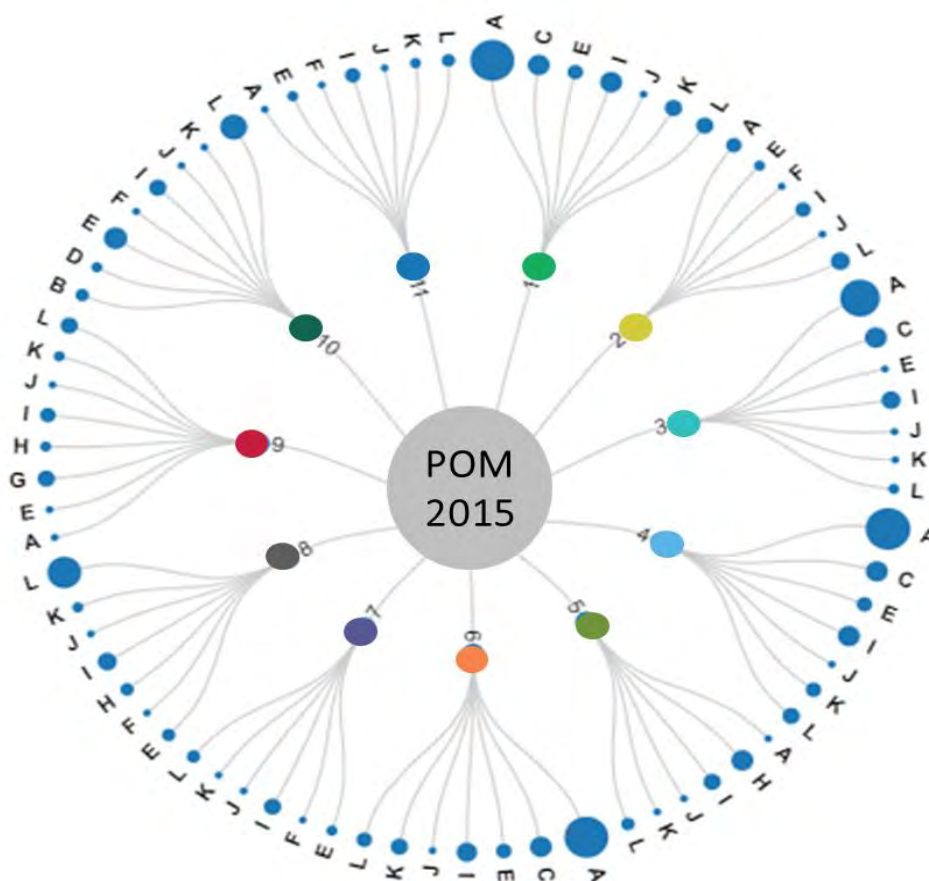
The newly revised monitoring strategy included 20 monitoring programmes and 36 surveys or campaigns. This included revisions to 5 existing monitoring programmes, or their associated assessments, and more than 10 new surveys or campaigns that were not captured in the first cycle.

Ireland's Marine Strategy Part 2: Monitoring Programmes can be found [here](#).

Ireland's Marine Strategy Part 3: Programme of Measures (PoMs)

In 2015, Ireland's initial PoMs was developed. The PoMs includes specific initiatives to ensure Ireland's marine environment reaches the environmental targets for each descriptor. The PoMs included measures targeting all 11 descriptors of the Directive (Figure 3). In the EU Commissions' 2018 assessment of the effectiveness of Member States' PoMs, 77 % of Ireland's measures were deemed appropriate, 23 % were partially appropriate, and no measures were labelled as insufficient.

This document contains an update to Ireland's PoMs 2022. Under each descriptor, the document details how Ireland has modified existing measures or developed new measures to improve the GES of Ireland's marine environment. The rationale for new or updated measures (highlighted in boxes throughout the document) and links to additional information on these measures, is also provided. These measures will allow Ireland ensure current GES status is maintained where it exists and identified gaps to achieving good status is closed where possible.



Types of measures in Ireland's 2015 Programme of Measures

- A Conservation of animal and plant species
- B Developing a circular economy
- C Enforcement of fisheries legislation
- D Enforcement of littering regulations
- E Guidance, training, best practice
- F Identify, minimise and mitigate environmental impacts of activities
- G Improve food quality
- H Improve water quality
- I Licensing and permitting
- J Marine spatial planning
- K Monitoring, reporting and knowledge development
- L Prevent and remediate environmental damage

Figure 3. Types of measures in Irelands original Programme of Measures 2015 and their link to each of the 11 descriptors. The size of each blue dot reflects the number of measures of Type A-L as defined in legend.

General Approach

Identification and selection of new measures in the second cycle

A "Measure" in the MSFD is any action on a national, regional, European or international level which is intended to help achieve or maintain GES and to achieve the environmental targets. While MSFD measures will primarily focus on changing the intensities of predominant pressures, activities to improve environmental status directly, such as restoration of habitats and reintroductions of species, are also defined as measures under the MSFD.²

Ecosystem Based Approach

The MSFD mandates an ecosystem-based approach to management. Synonymous with ecosystem-based management, the ecosystem approach is one "*which integrates the connections between land, air, water and all living things including human beings and their institutions*"³.

The ecosystem-based approach recognises that human social systems occur within, and are entirely dependent on, the ecosystems that contain them. As a result, the analysis of environmental problems for the purposes of the MSFD has long centred around the application of systems-approaches linking human social systems to environmental systems.

The most common conceptual frame for the application of such systems thinking in the context of the European environmental policy and the MSFD has been the DPSIR (Drivers, Pressures, State, Impacts, Response) framework, and its many successors⁴⁵⁶. Currently the most widely used conceptual framework is known as the Driver–Activity–Pressure–State–Impact–Response (DAPSIR) (Figure 4). The main aspects of the DAPSIR framework are described below.

Drivers are human needs, including biological and physiological; these include basic needs (e.g. food, drink, warmth, sleep), psychological needs (e.g. love, belonging, esteem) and self-fulfilment needs (e.g. seeking personal growth).

In order to meet these needs human beings carry out different **Activities**. These are human efforts intended to enhance human welfare. These can be conceptualised in terms of economic sectors and subsectors. For example, the activity of fishing to meet the basic human need of food can be split into several sub-sectors such as trawling, potting and long lining.

All human activities place **Pressures** on the environment. Pressures may be defined as the mechanisms by which human Activities cause

² [GD10-MSFD recommendations on measures](#)

³ Mee, L. D., Cooper, P. C., Gilbert, A. J., Kannen, A., & O'Higgins, T. (2015). Sustaining Europe's Seas as Coupled Social-Ecological Systems. *Ecology and Society*, 19(3). Retrieved from <https://doi.org/10.5751/ES-07143-200101>.

⁴ Borja, A., Galparsoro, I., Solaun, O., Muxika, I., Tello, E. M., Uriarte, A., & Valencia, V. (2006). The European Water Framework Directive and the DPSIR, a methodological approach to assess the risk of failing to achieve good ecological status. *Estuarine, Coastal and Shelf Science*, 66, 84–96.

⁵ Atkins, J. P., Burdon, D., Elliott, M., & Gregory, A. J. (2011). Management of the marine environment: Integrating ecosystem

services and societal benefits with the DPSIR framework in a systems approach. *Marine Pollution Bulletin*, 62, 215–226.

⁶ Knudsen, S., Zengin, M., & Koçak, M. H. (2010). Identifying drivers for fishing pressure. A multidisciplinary study of trawl and sea snail fisheries in Samsun, Black Sea coast of Turkey. *Ocean and Coastal Management*, 53, 252–269. <https://doi.org/10.1016/j.ocecoaman.2010.04.008>

Cooper, P. (2013). Socio-ecological accounting: DPSWR, a modified DPSIR framework, and its application to marine ecosystems. *Ecological Economics*, 94, 106–115. <https://doi.org/10.1016/j.ecolecon.2013.07.010>.

changes in the environmental state or deplete its resources.

State changes in turn are attributes of the natural environment that reflect its integrity as regards a specified issue.

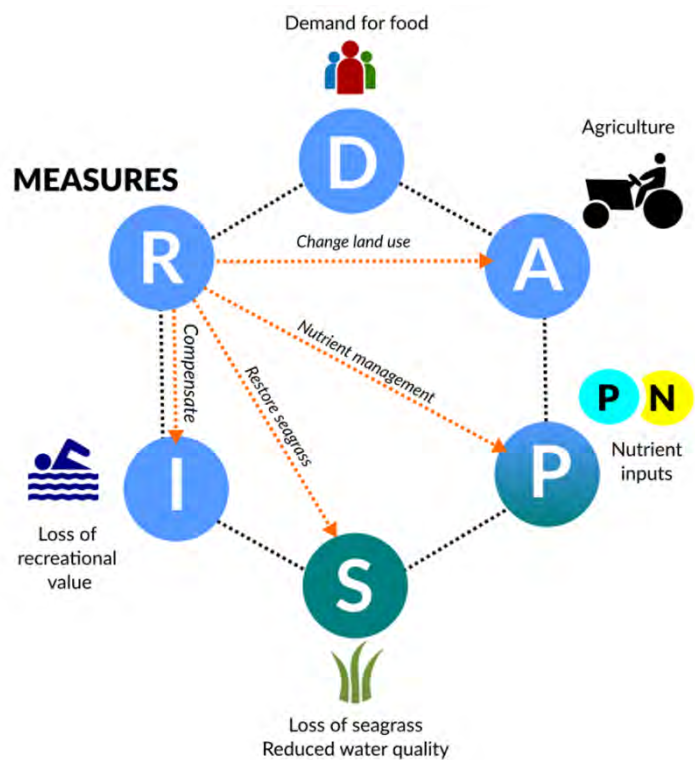
Impacts are the changes in human welfare caused by changes in the environmental state. These impacts are caused by changes in the flow or provisioning, regulating and cultural ecosystem services.

A **Response** to a particular environmental problem can be directed at any other element of the system. For example, responses may act on Drivers to moderate demand; they may act on Activities by permitting or banning or regulating certain activities (e.g. hunting of whales); they may act to reduce pressures

using technological means, altering the link between the activity and the level or pressure that results from it (e.g. changing mesh sizes of fishing gear). A Response may also act directly on the environment, through restoration efforts for example. Finally, responses may act on human welfare, through compensation for lost ecosystem services. Elliott and O’Higgins⁷ provide a fully detailed account of the DAPSIR framework along with some critiques.

Consideration was given to the DAPSIR framework during the development and update of Ireland’s measures for each descriptor to ensure that future measures are targeted as is outlined in the sections below.

Figure 4. An illustrative example of the Driver–Activity–Pressure–State–Impact–Response (DAPSIR) framework applied to the problem of eutrophication.



⁷ Elliott, M., & O’Higgins, T. G. (2020). From the DPSIR, the D(A)PSI(W)R(M) emerges... a butterfly- ‘protecting the natural stuff and delivering the human stuff’. In T. O’Higgins, M. Lago, & T. H. DeWitt (Eds.), *Ecosystem-based management, ecosystem services and aquatic biodiversity: Theory, tools and*

applications (pp. 61–86). Amsterdam: Springer. Return to ref 2020 in article

Coherence with other policy frameworks

The Marine Strategy Part 3 is built upon policy frameworks already in existence and the measures arising from these. Therefore, a significant part of all Member States' PoMs consists of various existing measures under other EU legislation and policies, as well as

national legislation. For example, reporting of all relevant Water Framework Directive measures, as defined under the River Basin Management Plan, is required as part of the cyclical PoMs update. Figure 5 below visualises the building blocks of measures derived from a wide range of existing legislation, policies and treaties.

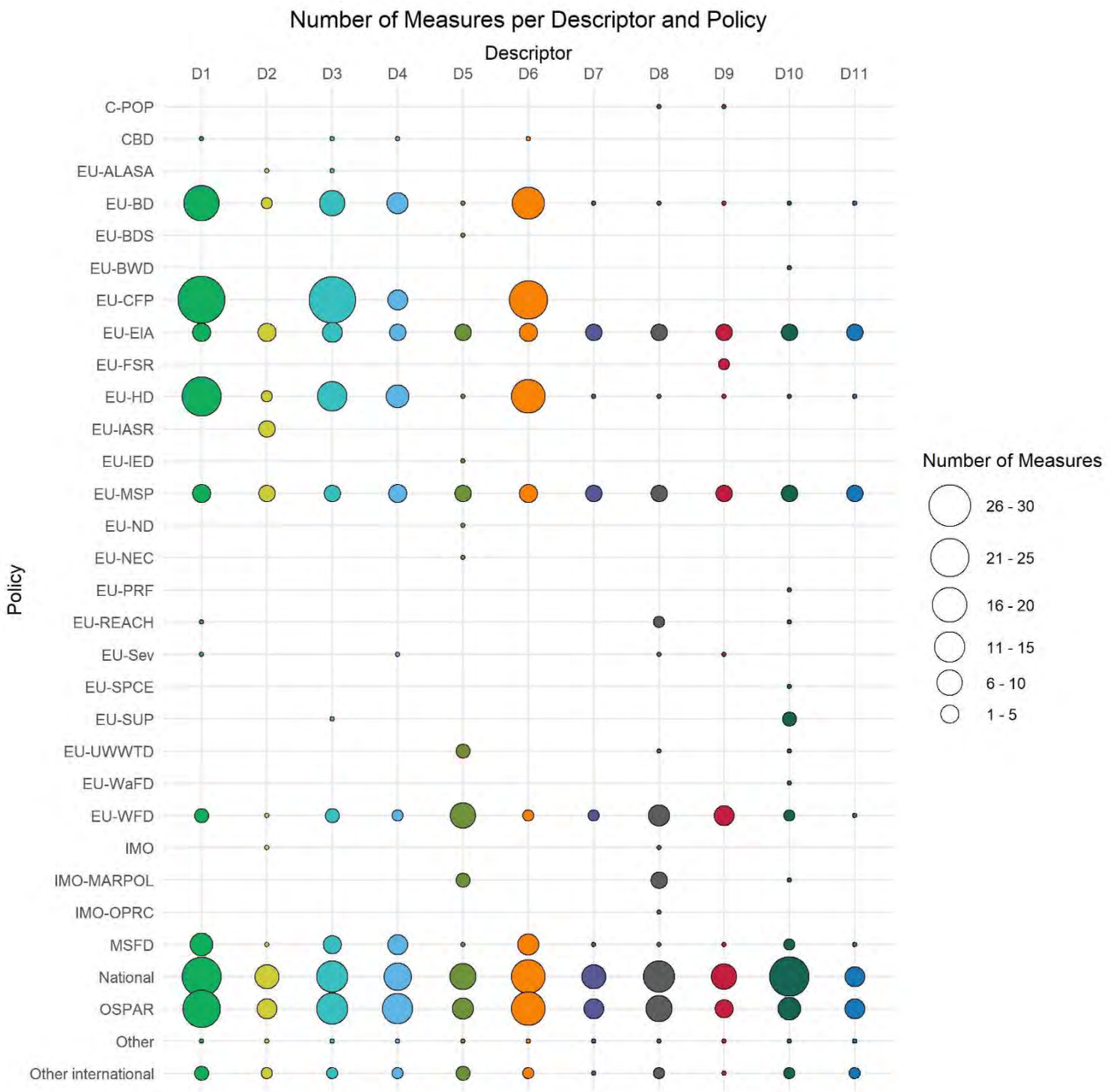


Figure 5. Ireland's 2022 Marine Strategy Part 3 includes measures arising from more than 30 EU, international and national policies, as shown above.

Regional coordination

Ireland's Marine Strategy Part 3 includes measures that are based on wider regional agreements. These include:

- The incorporation of the [OSPAR acquis](#) which includes Decisions, Recommendations and Other Agreements that constitute the accumulated body of OSPAR Convention measures and actions for protection of the marine environment of the North-East Atlantic.
- Coordination with other Contracting Parties to the OSPAR Convention through work in OSPAR's Intersession Correspondence Group on the MSFD (ICG-MSFD). This includes the exchange of information on overlapping actions and measures developed in this cycle and the development of coordinated environmental targets that will inform the future development of coordinated measures.
- Implementation of the OSPAR North-East Atlantic Environment Strategy (NEAES) 2030 agreed in 2021 by 15 countries of the North-East Atlantic and the European Union.
- Implementation of the Second OSPAR Regional Action Plan for Marine Litter.

Public consultation and participation

Central to the work of achieving Ireland's goal of GES is ensuring that interested parties (e.g. the public, stakeholders, maritime sectors and others) have the chance to participate in the process (Article 19, MSFD). Engagement with interested parties in the development of the updated Programme of Measures occurred through four processes:

1. Oversight, direction and guidance by the MSFD National Steering Group.

2. A 12-week [public consultation](#) that focused specifically on the measures Ireland intends to put in place to achieve GES.
3. Bilateral meetings with key agencies and Government Departments in the revision of the measures.
4. A series of workshops with key stakeholders, including a number of environmental Non-Government Organisations, on the further development of measures.
5. A public stakeholder seminar to communicate the outcomes of the public consultation and the programme of measures.

The public consultation on Ireland's Programme of Measures was launched on Monday 7 March 2022. In addition to the standard notification on its website, the Department disseminated the consultation information through the MSFD National Steering Group and posted regular tweets about the consultation. The public consultation invited interested parties to:

- Consider the predominant pressures in the Irish marine environment and propose any new measures or modification to existing measures.
- Provide any scientific, social, or economic evidence to support the measures or changes proposed.
- Suggest how the impacts of climate change can be considered in the Programme of Measures.

While the consultation asked key questions under each descriptor to gather people's views, it was not necessary to provide responses to all Descriptors.

A public consultation document, containing factsheets for each of the 11 descriptors of GES was provided. The factsheets outlined each descriptor, in terms of Ireland's environmental targets, current environmental status, the pressures on each descriptor and classification of measures. The full list of all measures reported in cycle 1 was also provided in an annex to the public consultation document. Ireland's MSFD Article 8, 9 and 10 report on the assessment of GES and Ireland's MSFD Article 11 Monitoring Programme report were also provided for context.

Responses to the public consultation were received from individuals, environmental Non-Government Organisations and agencies. In total 18 responses were received.

The responses included suggestions for all of the descriptors of the MSFD (Figure 6). A number of priority issues were raised in the public consultation. These included fisheries management, sea-floor integrity, protection and restoration of the marine environment, marine protected areas, spatial planning, underwater noise, contaminants, marine litter and climate change.

These priority issues were considered through collaboration with lead Government Departments and agencies in the formulation of the PoMs.

A review of the public consultation and details of its consideration in the development of the PoMs can be found [here](#).

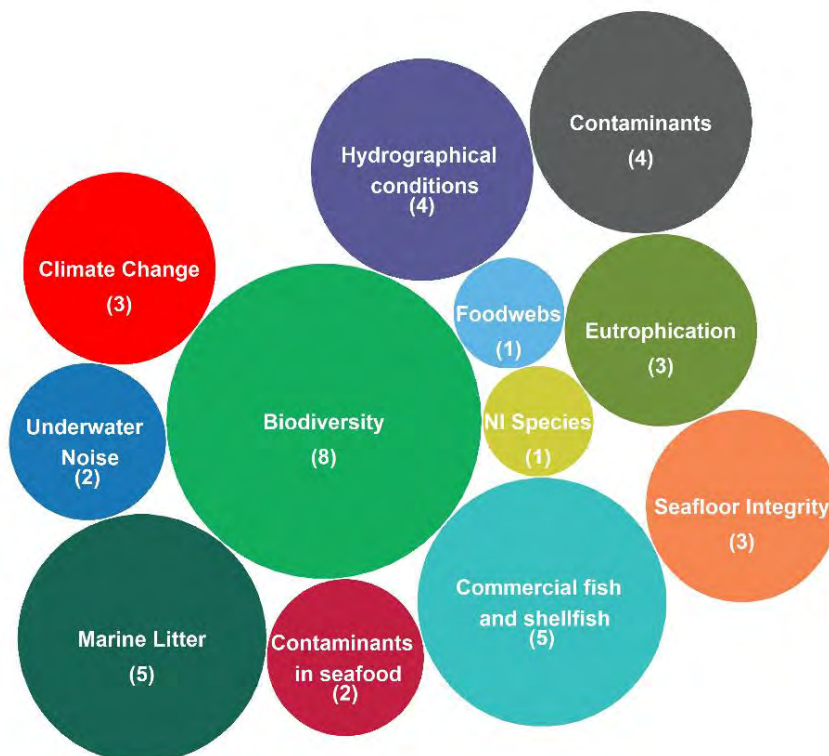


Figure 6. The number of respondents to the 2022 Programme of Measures public consultation who made a suggestion under each descriptor.

EIONET Reporting requirements

Under the MSFD, Member States are required to electronically report their update to Part 3 of the Marine Strategy: Programme of Measures (Article 13). This involves collating detailed information associated with each Measure originally reported in cycle 1. The information gathered for each measure includes, but is not limited to, progress on measure implementation, status on measure implementation, and the responsible competent authority for each measure. The information is submitted to the European Environment Agency data-reporting platform Reportnet. Subsequently the data is published on the [Wise - Marine](#) data portal.

Interaction with climate change

Climate change is modifying the oceanographic conditions that underpin the structure and functioning of marine ecosystems, causing fundamental and potentially irreversible changes to the marine environment. In Ireland's coastal and marine areas, a number of physical, chemical and biological ocean variables (e.g. temperature, salinity, pH, wave height, sea level rise, ocean currents, chlorophyll, plankton communities) are being altered due to climate change and these alterations are expected to continue into the future.

The shifting environmental baselines and detrimental effects introduced by climate change create significant new and ongoing challenges for the establishment of management goals to protect our marine areas and ensure the ecosystem services they provide are sustained.

The impacts of climate change are far reaching and are expected to affect the sustainable use of our seas and ocean (e.g. for fishing and aquaculture) and the measures we put in place to protect them. Hence, the development of Programmes of Measures under the MSFD should include adaptive management policies and considerations that integrate existing and predicted climate change impacts. This will enable maritime sectors, and marine protection efforts, to respond to future scenarios⁸.

The development of Ireland's updated Marine Strategy Part 3 (PoMs) includes, for the first time, the consideration of climate change through a number of processes, including:

- Through consideration in the development of new measures or updates to existing measures.
- Through targeted questioning in the public consultation process.
- Through the consideration of climate change during bilateral discussions with Government Departments and administrative bodies responsible for the implementation of measures.
- The integration of specific climate related measures such as the consideration of nature-based carbon storage and the potential resilience of ecosystems to climate change and ocean acidification in the criteria for identification of Marine Protected Areas (MPAs).
- Through active participation in the development of climate change related tasks for implementation via the OSPAR North East Atlantic Strategy (NEAES) 2030.

⁸ <http://dx.doi.org/10.1038/s41893-020-0513-x>

- Inclusions of Irelands National Climate Action Plan (CAP2021) as a measure and ensuring marine considerations are included in its development (M243).

Ireland is also currently developing a monitoring and assessment programme to assess the impacts of climate change and ocean acidification on our marine waters, for eventual reporting under the MSFD.



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Programme of Measures

State Descriptors

Descriptors 1, 3, 4 and 6 encompass a wide range of biological and ecological elements including species (e.g. fish, marine birds, marine mammals), habitats (e.g. water column

and seabed) and their biological communities. The measures for Descriptors 1, 3, 4 and 6 are presented together since the relationship between pressures, biological/ecological elements and measures are intrinsically linked.

D1 Biodiversity

What is biodiversity?

Biological diversity is the variety of life in the oceans and seas. It involves a multitude of species that inhabit the marine environment, stretching from the ocean floor and overlying waters to coastal habitats and the air-sea interface. In the MSFD this includes the assessment of birds, mammals, fish and reptiles.

Environmental Status

Ireland has partially achieved Good Environmental Status for biodiversity.

Ireland has achieved GES for some elements of biological diversity within its maritime area (e.g. the majority of larger marine vertebrates assessed in 2019). For other elements (e.g. marine reptiles and 41 % of non-commercial fish species assessed) the environmental status is currently unknown, while in the case of some elements (i.e. 18 of 56 non-commercial fish species assessed) GES has not been achieved.

D3 Commercial Fish and Shellfish

What are commercial fish and shellfish?

Ireland has more than 50 commercial fish and shellfish species in its waters. Examples include, but are not limited to: haddock, mackerel, monkfish, hake, herring, scallops, and oysters.

Environmental Status

Ireland has partially achieved Good Environmental Status for commercial fish and shellfish

A total of 34 fish stocks (18 %) have achieved GES, while the environmental status of 99 fish stocks (60 %) is currently unknown. In the case of 44 other stocks (22 %), GES has not been achieved.



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D4 Food webs

What are Food Webs?

Food webs consist of networks of feeding interactions between organisms at different trophic levels. Aggregations of species with similar diet compositions (e.g. plankton-feeding vertebrates or deep-sea scavenger species) are known as “trophic guilds”. Marine food web science and assessment can involve examining productivity and energy transfer, diet, interactions modelling and the investigation of ecosystem structure (e.g. size and abundance of individuals from different trophic groups).

Environmental Status

Ireland currently has an unknown Environmental Status for food webs.

While there are changes evident in Ireland's marine food webs, as demonstrated via plankton communities, the pressures driving changes in life forms remain unclear. Prevailing physiographic conditions and human influence are the overall driver of change to complex systems such as marine food webs. For fish, the situation is unclear. Therefore, the overall conclusion is that the status of food webs in Ireland's marine environment is currently unknown.

D6 Sea-floor Integrity

What is Sea-floor Integrity?

The integrity of the sea-floor reflects the characteristics and condition (physical, chemical and biological) of the sea-floor and its habitat types. These characteristics determine the type of marine ecosystems that exist at certain locations, especially for species and communities living on the sea-floor or in its various substrates (i.e. within benthic ecosystems).

Environmental Status

Ireland has not fully achieved GES for Sea-floor Integrity.

Ireland achieved GES for some elements of sea-floor integrity within its maritime area (e.g. under criteria for physical loss and physical disturbance of the seabed). For other elements (i.e. the extent of adverse effects on the sea-floor), the environmental status is unknown.



Photo courtesy of An Taisce Love your Coasts finalists 2020

Significant Pressures on D1/D3/D4

The most significant pressure on the state descriptors in Ireland's marine environment is the extraction of fish and shellfish biomass (both commercial and non-commercial) and associated disturbance of the sea-floor by human fishing activity. Extraction of fish and shellfish leads to fishing mortality of target species, and also non-target species (i.e. through incidental by-catch).

There are also pressures on populations and/or their habitats through the disturbance or deterioration of species' breeding or foraging habitats or prey resources, for example. Some of these pressures relate to land-based human activities and industries. The introduction of anthropogenic sound, disturbance of species and input of litter and other pollutants are considered secondary pressures on state descriptors after commercial fisheries extraction.

In coastal waters the input of nutrients and inputs of organic matter into the marine environment can impact on food webs and biodiversity.

Measures

The PoMs includes measures which focus on addressing, or compensating for, negative human impacts on the state descriptors including biodiversity (84 measures), commercial and non-commercial species (63 measures), food webs (29 measures) and sea-floor integrity (56 measures). These measures mostly focus on activities and state, with a lesser number focusing on drivers and pressures. The measures in Ireland's PoMs specifically focus on conservation, enforcement of fishing legislation, licencing/permitting and to a lesser extent remediation, monitoring, guidance and planning.

The full list of measures that Ireland has developed to address D1, D3, D4 and D6 can be found in Annex 3.

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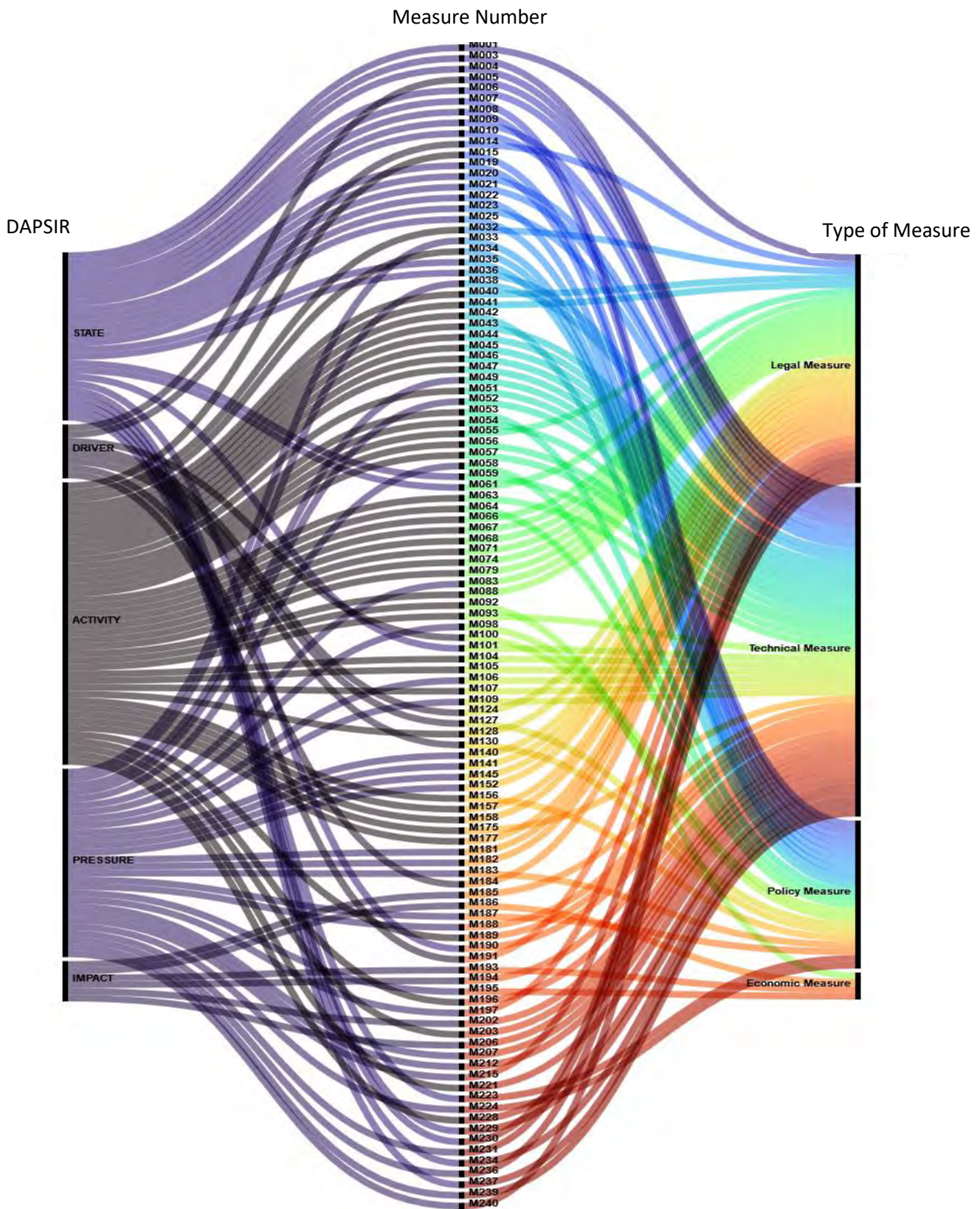


Figure 7. Measures in Ireland’s Programme of Measures aimed at the state descriptors broken down by, elements of the Driver–Activity–Pressure–State–Impact–Response (DAPSIR) approach and the type of measure.

Fisheries Management

Ireland's goals for sustainable fisheries are supported through the Common Fisheries Policy (CFP). The CFP provides the framework for the long-term conservation and sustainability of fish stocks around our shores and throughout EU waters.

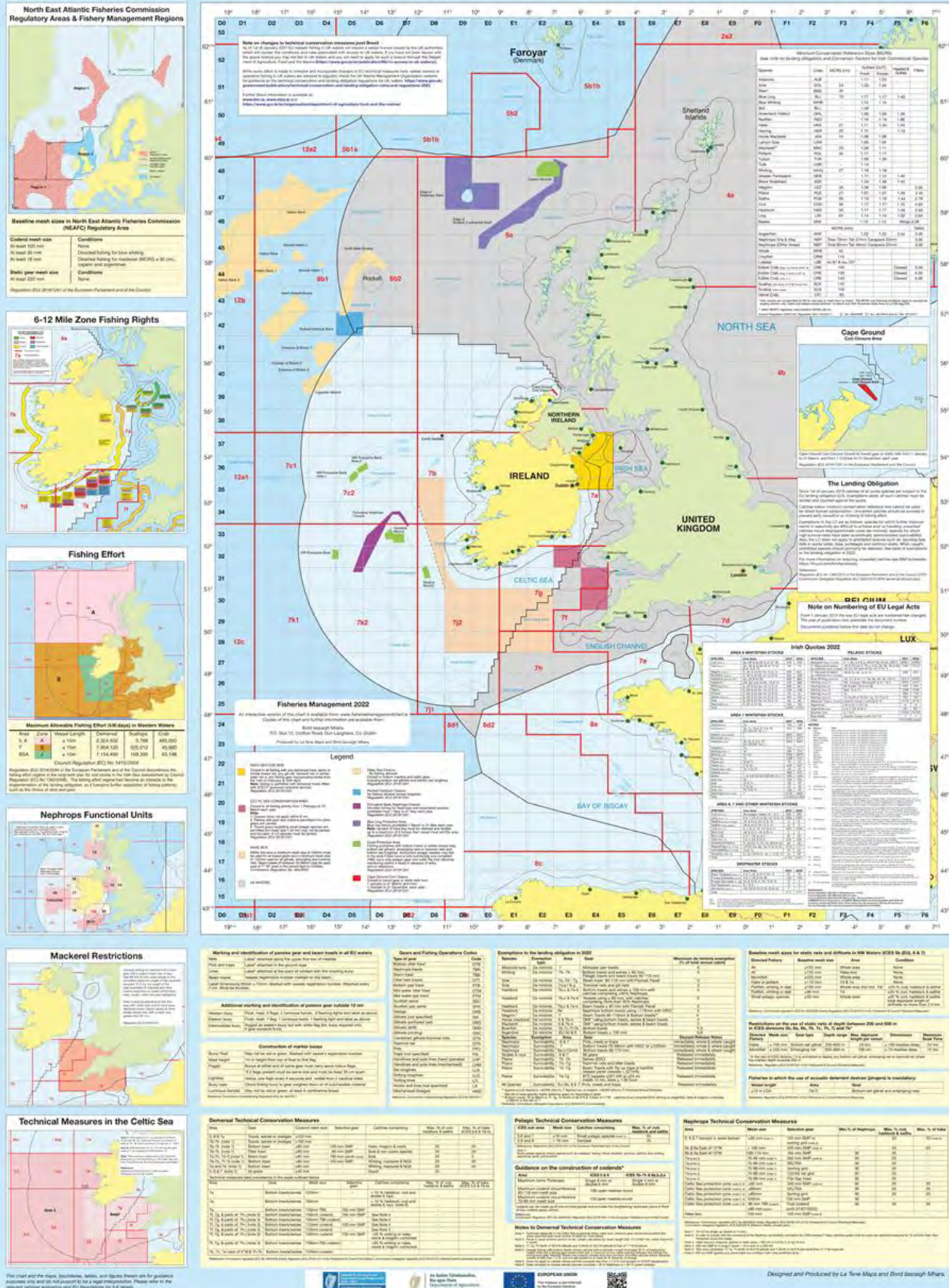
The National Common Fisheries Policy Review Group established by the Minister for Agriculture, Food and the Marine in February 2022 has considered the implementation of the Common Fisheries Policy (CFP) at length. The final report of the Group can be found [here](#). It is acknowledged that there is a need to eliminate overfishing (recommendation 21) and reduce the environmental impacts of fishing to environmentally sustainable levels. Considering an ecosystem based approach, an equitable balance is needed in implementing the CFP between biological (e.g., achieving fishing at Maximum Sustainable Yield), socio-economic and conservation objectives.

The CFP should ensure that fishing and aquaculture activities contribute to long-term environmental, economic, and social sustainability. The CFP should contribute to the supplying of highly nutritional food and foster direct and indirect job creation and economic development in coastal areas. There are a range of measures which are employed to ensure the conservation and sustainability of fish stocks in EU waters. In relation to setting Total Allowable Catches (TACs), the CFP provides that TACs and quotas are set in line with fishing at or below Maximum Sustainable Yield (MSY - which is the largest average catch or yield that can continuously be taken from a stock under existing environmental conditions).

The discards ban or [Landing Obligation](#) is another key element of the CFP, which was phased in over a number of years and has been fully implemented since 2019. Technical measures are also used to support sustainable fishing. Technical measures are rules on how, where and when fishers may fish and ways to deal with and avoid unwanted bycatches and improve the selectivity of fishing gear in order to reduce the bycatch of juvenile fish and vulnerable species like elasmobranchs. These measures will lead to healthy fish stocks, higher quotas for both Irish and EU fishers and to more sustainable fishing patterns. They form an integral part of the regulatory framework of most fisheries management systems including within Union waters.

In 2021, 47% of the stocks of interest to Ireland were fished at or below MSY - this increased from 34% in 2013. In 2009, at EU level only 5 stocks were fished at MSY. This shows that the many years of intensive, industry-led conservation measures are paying off.

Since 2005 BIM has annually produced the [Fisheries Management Chart](#) (map 1). This collates the numerous EU regulations regarding Technical Measures that the Irish Fishing Industry must comply with to ensure sustainable fishing.



Incidental bycatch

Incidental catches, or bycatch, refer to unwanted or discarded catches of fish, marine mammals, seabirds or other marine species due to direct operational interactions with mobile or static fishing gears. Bycatch will have a negative impact on species through direct harm to or mortality of individuals, but it can have population level impacts by contributing to the decline or preventing the recovery of a species' population.

On a larger scale, bycatch may have indirect negative impacts through removal of prey species from the food web that may have knock on ecosystem level consequences. EU and national legislation is in place to better understand the species and fishing gear at higher risk of bycatch, to help reduce the occurrence of bycatch, and to improve mitigation of the negative impacts.

To support the targeted reduction of bycatch, a measure is proposed.

M242. Measure for incidental bycatch

Ireland will continue to explore processes by which its environmental targets for incidental mortality can be supported.

Scientific advice for resource management

One of the CFP-related measures is M228, which describes how Ireland supports the continued implementation of the CFP and associated regulations in Ireland through the production of scientific evidence and advice on a national basis, and through work by the International Council for the Exploration of the Sea (ICES). ICES is an intergovernmental organization that provides advice on a range

of issues relating to marine policies and environmental and resource management.

An example of the success of the implementation of science-based fisheries management has been the recovery of the European hake stock. In the late 1990s and early 2000s the northern stock of European hake (*Merluccius merluccius*) was assessed by ICES as severely depleted. In 2000, ICES advised that a recovery plan be established. Emergency measures were brought in by the European Union to reduce catches and fishing mortality on hake.

Catches of hake are managed by Total Allowable Catches (TACs) in four separate TAC management areas (Map 2). The TAC has been set in line with the scientific advice provided by ICES in most years since 2009. Since 2009, the stock has been fished below F_{msy} (the level of fishing mortality that maximises sustainable yield). The biomass of the stock in the sea has increased almost five-fold compared to the levels observed before 2000 (Figure 8).

These measures have contributed towards a substantial reduction in fishing pressure for many northern European fish stocks in recent years and a reversal of stock declines for many stocks.

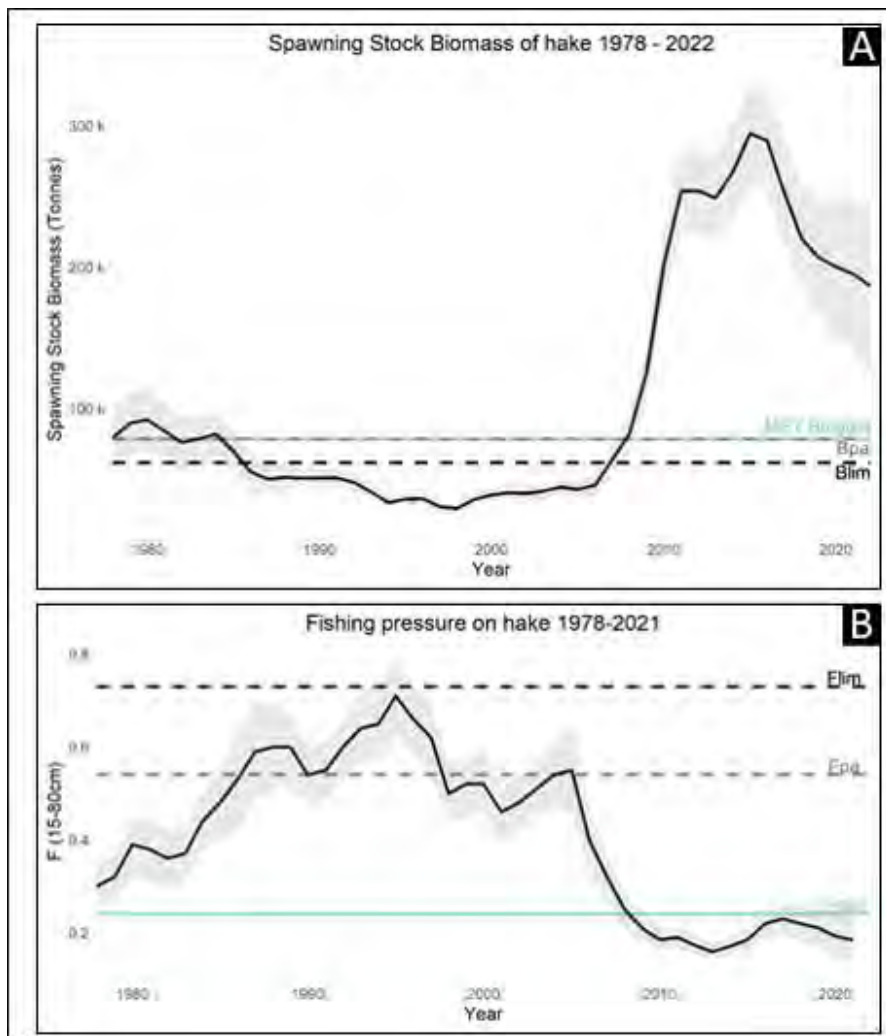
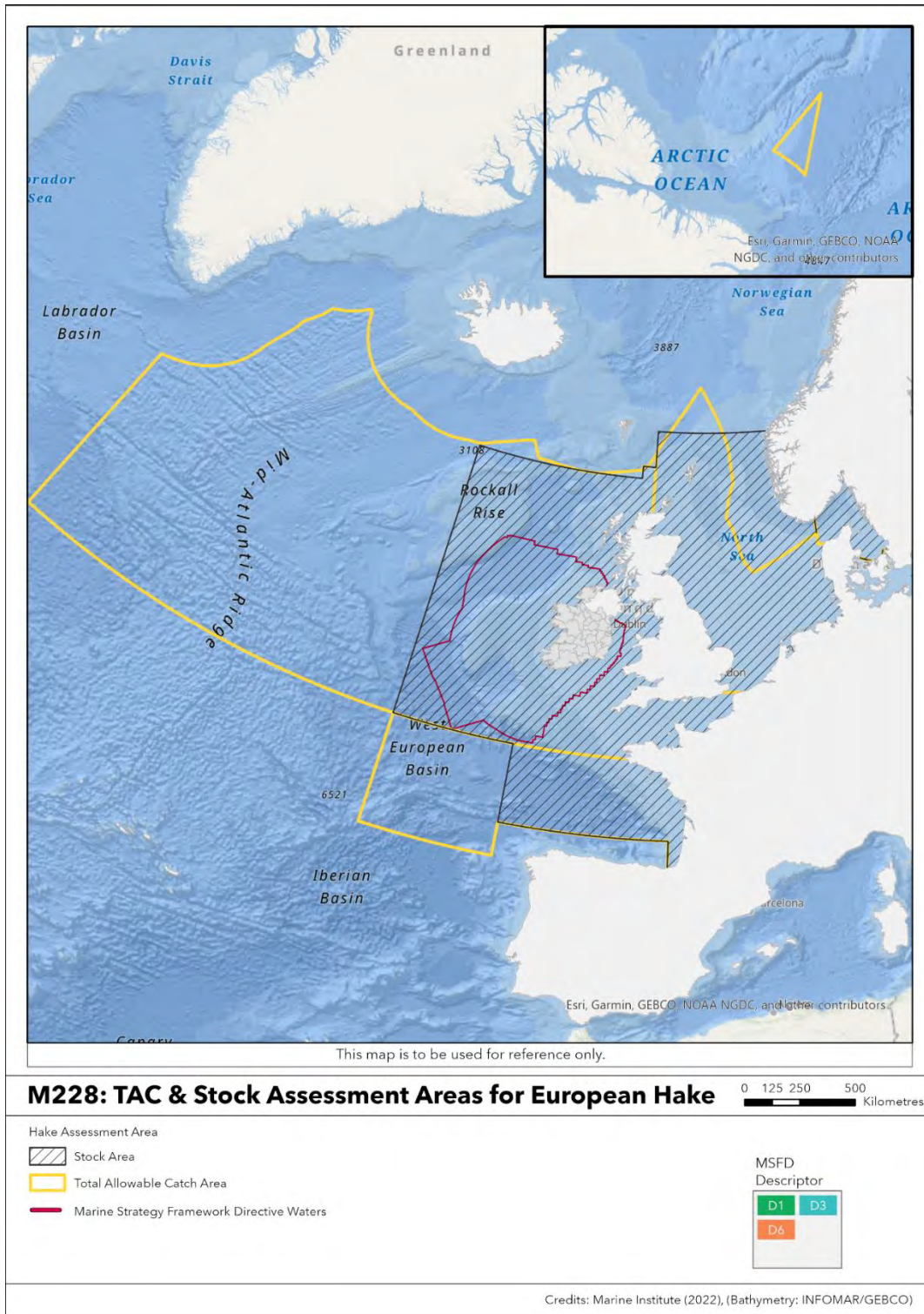


Figure 8. Trends in spawning stock biomass of European Hake (A) and the concurrent reduction in fishing pressure (B) under an improved management regime.

Spawning stock biomass (SSB) of hake, i.e. the proportion of mature fish, is now substantially higher, as is recruitment (the number of small fish coming into the population each year). In addition, catches from the fishery have almost doubled compared to the period when the

stock was over exploited. This was achieved through the management of catches using Total Allowable Catches (TACs) set in accordance with the best available scientific advice according to the CFP policy objective of MSY.



Map 2. The Total Allowable Catch (TAC) area and Stock Assessment Area for European Hake.

Spatial Protection Measure

Article 13(4) of the MSFD specifically requires the inclusion of spatial protection measures to achieve a desired environmental outcome. These can be focused on specific activities (e.g. fisheries closures, pollution management) or they can seek to coordinate and manage several activities within an area in order to deliver on a conservation objective, for example. Spatial protection measures can include marine protected areas, Special Areas of Conservation (SACs) under the EU Habitats Directive, Special Protection Areas (SPAs) under the EU Birds Directive, and Other Effective area-based Conservation Measures (OECMs).

Marine Protected Areas

The development of a well-managed, representative and connected network of protected areas in our seas and ocean will support and build ecological resilience to a variety of challenges in the marine environment, not least those brought about by human activities and climate change.

Ireland is committed to developing and expanding its network of Marine Protected Areas (MPAs) in accordance with international obligations under the MSFD and the EU Biodiversity Strategy for 2030, which seeks to increase MPA coverage to 30 % of EU marine waters by 2030.

Ireland is currently developing stand-alone legislation to enable the identification, designation and management of MPAs. In July 2022, the Government approved the development of a General Scheme of a Bill to provide for the designation and effective management of marine protected areas. A

final Bill is expected to be approved late 2022/early 2023.

The forthcoming MPA Bill will take a participatory, ecosystem-based approach to expand the focus of marine environmental protection, to include ecosystem services such as those provided by “Blue Carbon” habitats and important cultural assets or features. The Bill will also require the establishment of management plans for individual sites based on their conservation objectives. The process of designation of sites, and the development of management plans, will incorporate the best available scientific evidence.

M230. Marine Protected Areas

By 2023, Ireland will develop stand-alone legislation to deliver the designation and management of an expanded network of marine protected areas; thereby supporting the achievement and maintenance of good environmental status.

M233. Report MPA data and management updates to OSPAR

In 2022, and annually thereafter; report MPA data and management updates from Ireland to OSPAR's data and information management system (ODIMS); while augmenting Ireland's national contribution to the ongoing OSPAR network of MPAs.

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs)

The EU's Birds Directive (2009/147/EC) and Habitats Directive (92/43/EEC) and associated national regulations (European Communities (Birds and Natural Habitats) Regulations 2011,

as amended) have historically been the main mechanisms by which Ireland conserves biodiversity in the marine environment. This includes the regular monitoring and assessment of the conservation status of habitats and species and the designation and management of Ireland's network of SACs and SPAs as part of the EU's Natura 2000 network (Map 3).

Ireland is required under the terms of the Birds Directive (2009/147/EC) to designate SPAs for the protection of listed rare and vulnerable species, regularly occurring migratory species, and wetlands, especially those of international importance for birds.

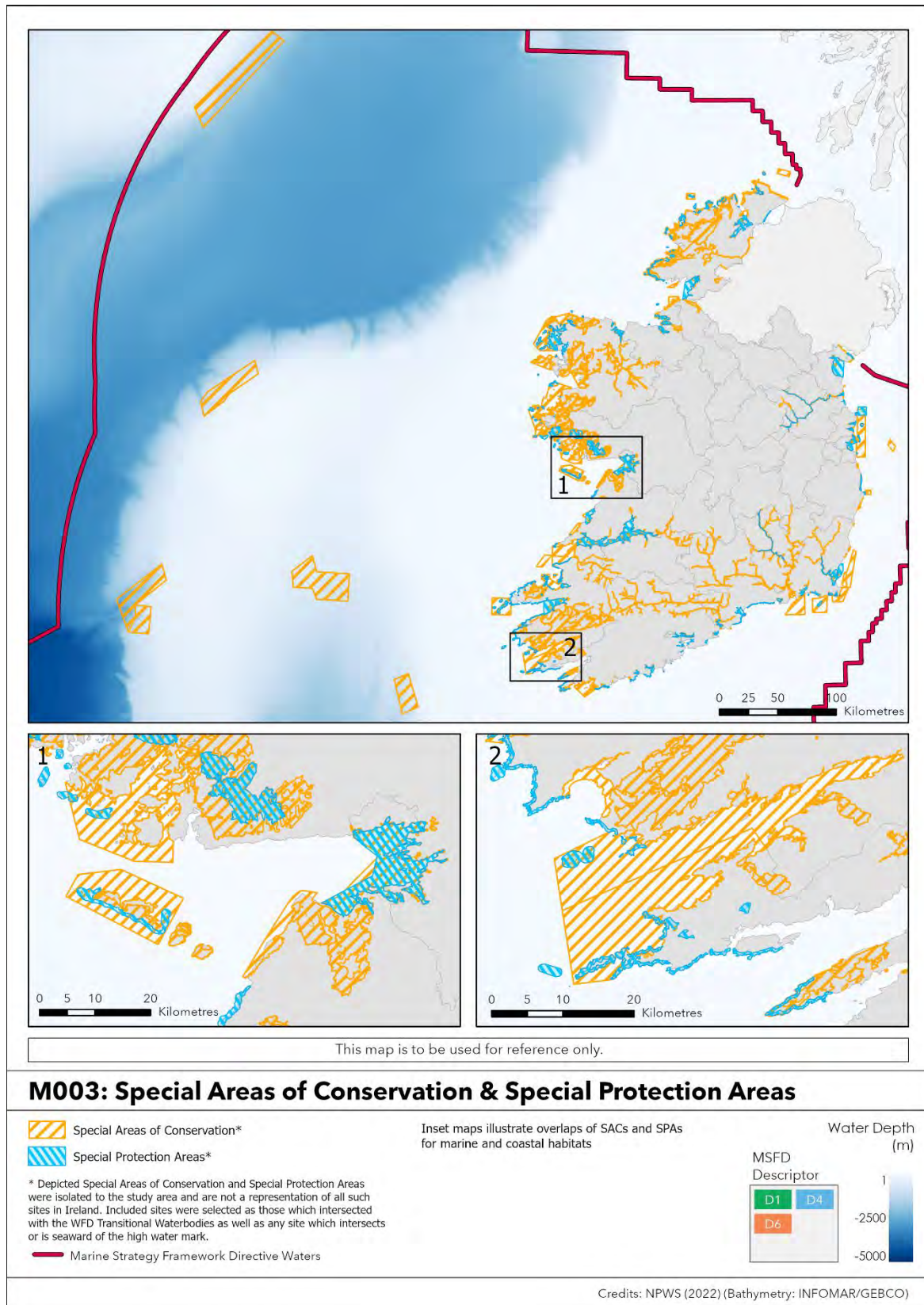
In tandem with SPA site designations, SACs are selected and designated under the EU Habitats

Directive that lists certain habitats and non-bird species that must be protected using area-based designation. Listed qualifying features for SACs include ([among others](#)) reefs, large shallow inlets and bays, sea caves, Atlantic Salmon, two Seal species and Bottlenose Dolphin.

At present, Ireland has a high proportion of its coastal and territorial waters designated for Habitats Directive qualifying interests, and also six offshore sites designated for sea-floor habitats (Map 3). Proposals for further designations of offshore reef SACs are currently at an advanced stage of development.



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Map 3. Map of Ireland's Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) designated under the EU Habitats Directive and Birds Directive, respectively.

Other Effective Area-based Conservation Measures (OECMs)

According to the UN Convention on Biological Diversity (CBD), the term “other effective area-based conservation measure” (OECM) is *“a geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values”*⁹

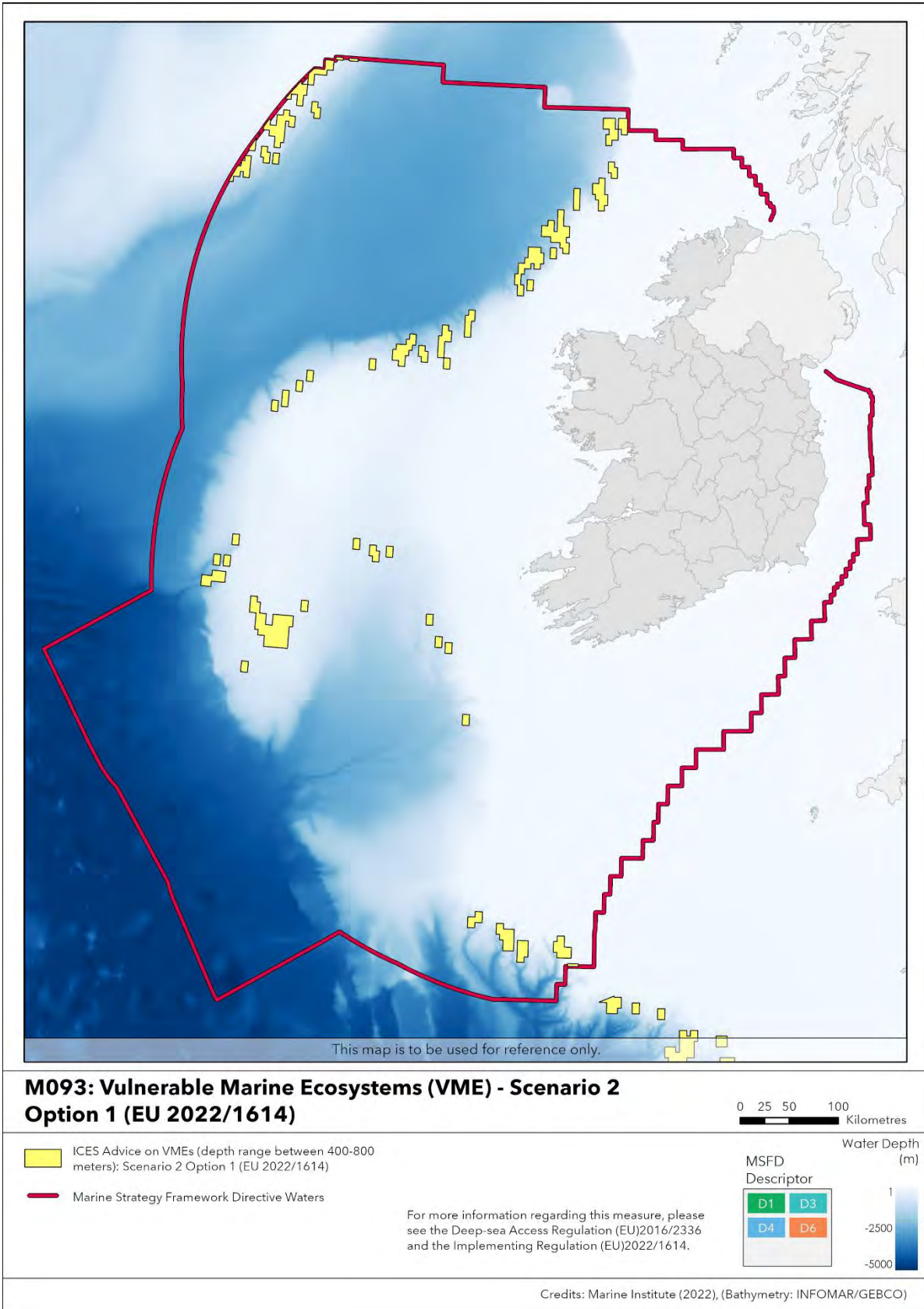
While interpretations of the OECM term can vary, depending on the managing authority or organisation involved, the EU's deep-water access regulation (EU, 2016/2336) is one example of a potential OECM (M093). Under this regulation, fishing with bottom trawls in waters deeper than 800m has been prohibited since 2016.

In 2022, measures introduced under the Deep-sea Access Regulation also sought to protect Vulnerable Marine Ecosystems (VMEs) in waters between 400-800m deep (Map 4). In the development of these measures, the European Commission requested scientific advice on VMEs from the International Council for the Exploration of the Sea (ICES). The resulting ICES advice listed areas where VMEs are known to occur or are likely to occur and described two scenarios, each with two options for the conservation of VMEs. Based on this advice, in September 2022 the Commission enacted an implementing regulation that closed 87 such areas between 400-800m depth to all bottom gears in the EU waters of the North-east Atlantic, including 42 areas in Irish waters. (EU, 2022/1614) (Map 4). These areas account for approximately 1.9 % of Ireland's MSFD area.



Photo courtesy of An Taisce Love your Coasts finalists 2020

⁹ <https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-08-en.pdf>



Map 4. Vulnerable Marine Ecosystems within Ireland's MSFD area protected under EU Regulation (EU) 2022/1614, for deep-sea stocks and vulnerable marine ecosystems (VMEs).

Conservation

Along with area-based conservation measures, biodiversity and protection measures are also undertaken under the Wildlife Acts (1976 and amendments) and the Birds and Natural Habitats Regulations (2011 and amendments). Such measures conserve coastal and marine flora and fauna, and include measures around disturbance, injury, hunting, licensing, possession and trading of specimens of flora and fauna.

The aims of the Wildlife Acts are to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of wild game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims.

The National Parks and Wildlife Service (NPWS) of the Department of Housing, Local Government and Heritage (DHLGH) recently commenced a project to review and update the Wildlife Acts, and it is expected to revise Ireland's Wildlife legislation by 2027 under the [draft 4th Biodiversity Action Plan](#) (Action 1E1).

M239. Revise Wildlife Legislation

By 2027, Ireland will complete a review of the wildlife legislation.

Wildlife Watching Codes of Conduct

Wildlife watching codes of conduct are an important tool to ensure that marine users act responsibly when encountering wildlife and to help minimise or eliminate the disturbance of protected species.

Codes of Conduct for wildlife watching of marine mammals (seals, whales and dolphins) and basking sharks are due to be further developed by the NPWS and completed in 2023.

M034. Codes of Practice

By 2023, Ireland will update and promote wildlife watching Codes of Practice to minimise risk of disturbance to marine wildlife including birds and mammals.

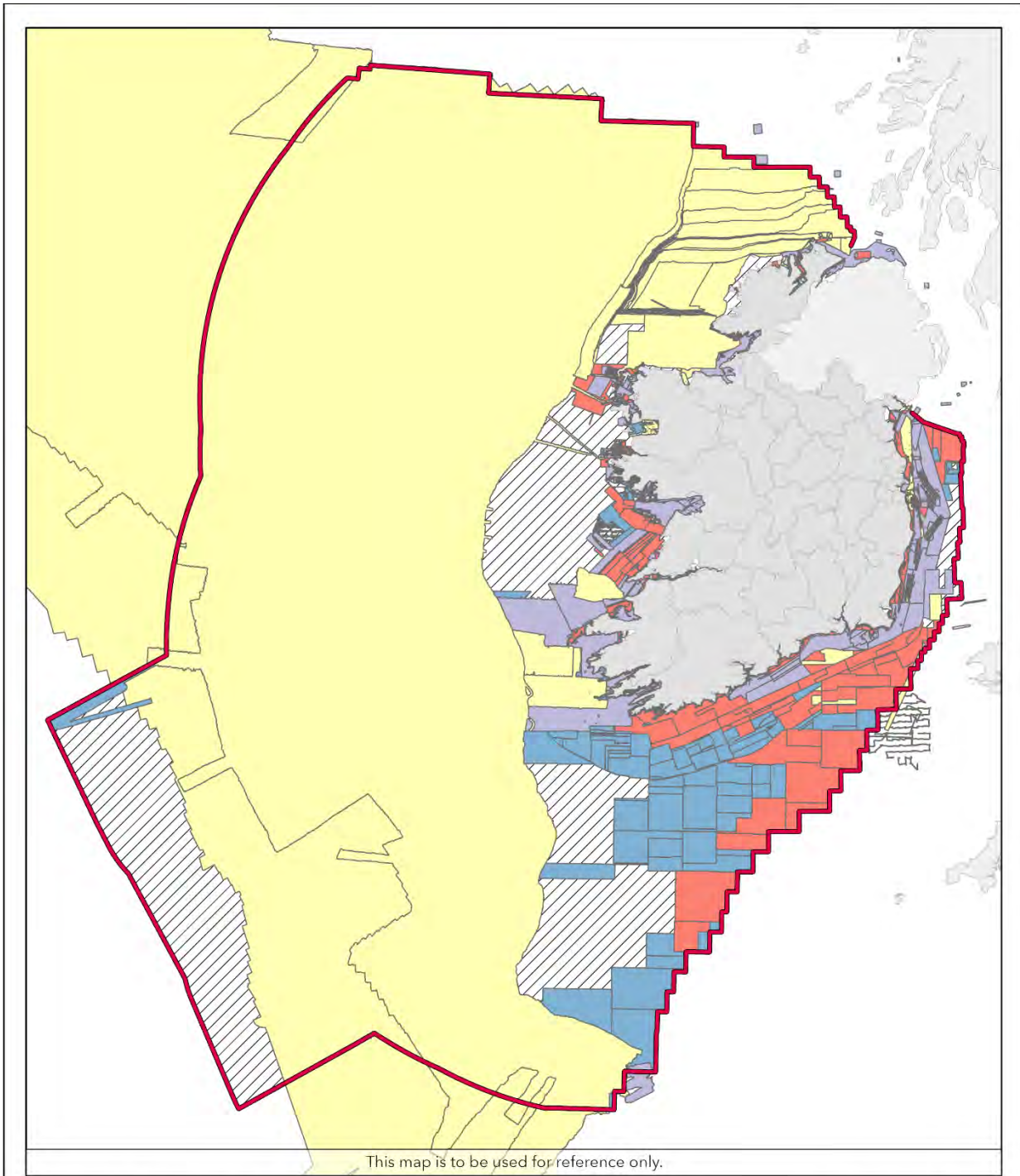
Dredging and Dumping at Sea

See D7 hydrographical conditions for more details.

Seabed Mapping

Ireland's seabed mapping programme aims to map Ireland's entire seafloor area by 2026. The Integrated Mapping for the Sustainable Development of Ireland's Marine Resource (INFOMAR) programme is a joint venture between the Geological Survey of Ireland and the Marine Institute (Map 5).

Over the last 20 years more than 700,000 km² of the seafloor within Ireland's marine jurisdiction (i.e. MSFD area approx.) and south/westwards beyond that into Ireland's extended Continental Shelf claim (Map 5), has been mapped in high resolution. Using this survey as a baseline it may be possible to identify further areas for protection, by including newly classified substrate data combined with other habitat descriptors to create a more detailed map of benthic broad habitats in Ireland's Maritime Area.



M009: INFOMAR Survey Coverage - Seabed Mapping

0 25 50 100 Kilometres

INFOMAR Surveys by Year *

- 1996 - 2005
- 2006 - 2012
- 2013 - 2018
- 2019 - 2022

Unmapped MSFD Areas

Marine Strategy Framework Directive Waters

* Survey coverage represents areas which have been mapped using multibeam systems on board Irish National Research Vessels. These include all available data collected from 1996 by PAD, Irish National Seabed Survey(2000-2005), INFOMAR programme (2006-2022) plus ad-hoc non-INFOMAR surveys.

MSFD Descriptor



Credits: INFOMAR (2022)

Map 5. [INFOMAR](#) survey coverage within and beyond Ireland's MSFD area since 1996, and planned until 2022.

Additional Measures

Management measures developed under other policy frameworks (e.g. Maritime Spatial Planning Directive, Water Framework Directive, and Invasive Species Regulations) will also directly contribute to reducing pressures on biodiversity and benthic and pelagic systems and communities. Additional information in this regard is provided below under Descriptors 2, 5 and 7.

International Developments

Nature Restoration Law

A new Nature Restoration Law is currently being negotiated by the European Union as part of initiatives to deliver on the EU's Biodiversity Strategy for 2030. The proposal aims to restore degraded ecosystems, habitats and species across the EU's land and sea areas. The current proposal, if agreed, will require that each Member State, including Ireland, develop its own National Restoration Plans.

Additional information on the proposed law can be found [here](#).

Development of thresholds for sea-floor protection and integrity

Ireland, along with other EU Member States, is currently developing agreed MSFD threshold values for sea-floor protection from physical disturbance and physical loss. These threshold values will set a minimum protection extent for different seabed habitat types.

Implementation of these thresholds will incorporate management measures to reduce pressures in certain areas, such as those associated with intensive fishing and other

activities that influence sea-floor ecosystems, e.g. offshore energy installations, coastal infrastructure and associated works.

OSPAR's North-East Atlantic Environment Strategy (NEAES) 2030

In October 2021, the OSPAR Commission adopted a new strategy for ongoing and enhanced protection of the marine environment of the North-East Atlantic, building on a high-level review of its previous strategy for the decade 2010-2020.

Containing 12 strategic objectives and 54 operational objectives designed to tackle the triple challenges facing the ocean: biodiversity loss, pollution including marine litter, and climate change, its implementation is part of OSPAR's contribution to the achievement of the United Nations 2030 Agenda for Sustainable Development and its Sustainable Development Goals.

The 16 Contracting Parties to the OSPAR Convention have developed an [implementation plan](#) to support the work of putting the NEAES into effect. The plan is a living document, setting out specific actions and tasks to achieve the NEAES objectives, and to record and assess progress with implementation of the strategy.

Implementation of the NEAES will help OSPAR, and Ireland as a Contracting Party, to deliver on the vision of a clean, healthy and biologically diverse North-East Atlantic Ocean that is productive, used sustainably and resilient to climate change and ocean acidification.

M237. OSPAR North-East Atlantic Environment Strategy 2030

Support the implementation the OSPAR North-East Atlantic Environment Strategy 2030; carrying out tasks, measures and actions designed to achieve its 54 operational objectives - to deliver clean, biologically diverse, healthy, productive and sustainably used seas; resilient to climate change and ocean acidification.



Photo courtesy of An Taisce Love your Coasts finalists 2020

Pressure Descriptors

D2 Non- Indigenous Species

What are non-indigenous species?

Non-indigenous species (NIS) are species introduced outside their natural past or present range, which might survive and subsequently reproduce. Some NIS are harmless, others can be invasive and harm native community composition. This can have long lasting impacts on biodiversity and ecosystem services.

Environmental Status

Ireland has achieved Good Environmental Status for non-indigenous species

There were three newly introduced species identified in Ireland's maritime area during the assessment period 2013-2018. While there are no established threshold values for this criterion at present, this number of introductions is considered low based on expert judgement and is comparable with the numbers of new NIS described in the [OSPAR Intermediate Assessment](#) (2017).

Significant Pressures

The introduction of NIS into Ireland's marine area through a number of identified pathways.

NIS may be introduced by maritime transport, either through the release of ballast waters or through fouling of ship hulls by non-indigenous organisms.

NIS may be introduced through the accidental transport and release of species. In the past, this has been associated with the accidental introduction of species through aquaculture.

Similarly, recreational activities can facilitate the introduction and spread of NIS, for example if recreational equipment is moved from location to location without proper decontamination.

Measures

The PoMs includes 21 measures that focus on non-indigenous species. These measures are mostly focus on activities and drivers with a lesser number focused on state processes. Specifically measures focus on licencing and permitting, preventing and remediating damage and conservation (Figure 9).

The full list of measures Ireland has developed to address D2 can be found in Annex 3.

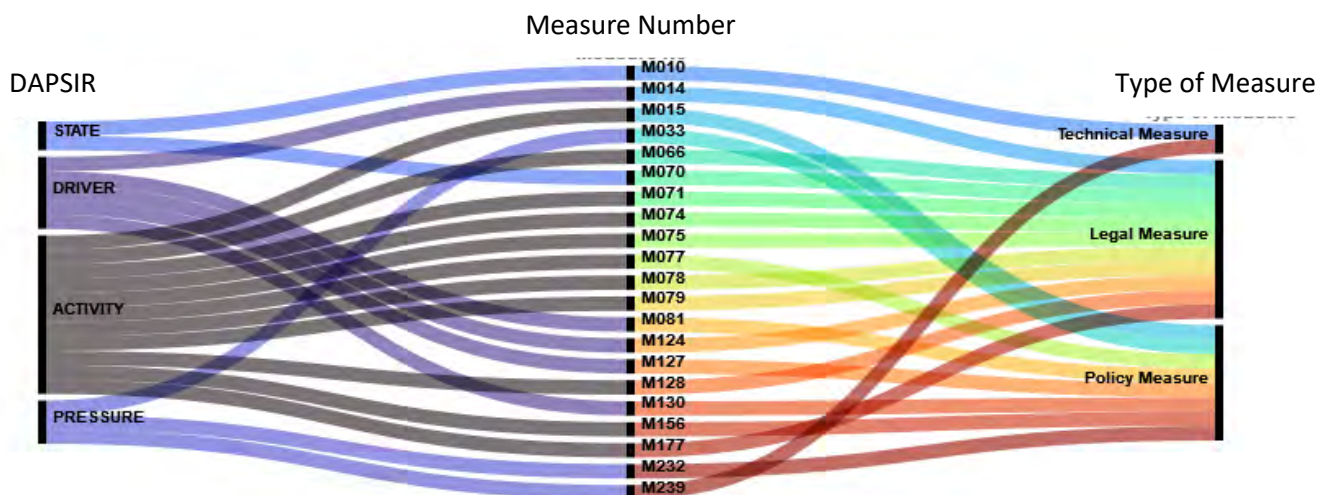


Figure 9. Measures in Ireland's Programme of Measures aimed at tackling non-indigenous species broken down using the Driver-Activity-Pressure-State-Impact-Response (DAPSIR) approach.

Transport

Ireland is currently in the process of ratifying the International Maritime Organization (IMO) Ballast Water Convention. Concurrently, Ireland will continue to apply IMO and OSPAR guidelines for the control and management of ship's ballast water to minimise the transfer of harmful aquatic organisms and pathogens.

Invasive alien species of concern

Ireland also implements EU Regulation (1143/2014) which deal with, among other things, keeping, breeding, transporting and placing on the market, species included on the list of invasive alien species of Union concern. Under the Regulation Member States are required to take further measures in time to provide for early detection and eradication of these species, and to manage those species that are already widely spread.

Aquaculture

The control of invasive species in the aquaculture industry is undertaken through a number of legislative and administration measures. These include the ongoing enforcement of the Birds and Habitats Directives, the application of Council Directive 2006/88/EC, and national regulations with regard to the movement of aquaculture species [European Communities (Health of Aquaculture Animals and Products) Regulations (S.I. No. 261 of 2008) as amended].

Management Strategy for Coastal and Marine Areas

The ecological impacts of invasive species can have significant economic consequences. The associated loss of ecosystem goods and services, along with efforts to manage and control biological invasions, incur substantial costs internationally and in Ireland. For marine and coastal environments, managing invasive

alien species is particularly challenging because marine ecosystems are highly connected across broad spatial scales. Defining alien invasive species in the marine environment can be difficult as many new marine species in Irish waters are undergoing range expansion due to climate change

To tackle the pressures associated with Descriptor 2 in a coherent way a non-indigenous species and invasive species management strategy for coastal and marine areas is being proposed. The strategy will provide a coordinated response to prioritise measures and species to deliver effective management, reduce the risk of impact on marine ecosystems and biodiversity, and minimise socio-economic impacts. The main steps of the strategy will include:

- Setting up of an expert group to begin national coordination of the marine and coastal NIS strategy and collate expert and stakeholder knowledge.
- Development of a literature review and undertaking of gap analysis of current strategies and concerns.
- The Identification of prevention and control actions for the different pathways and species identified in the gap analysis
- Development of guidance and best practise relating to the actions required

Additional information and the cost benefit analysis undertaken for this measure can be found in Annex 2.

M232. Management Strategy for Coastal and Marine Areas

By 2024 Ireland will develop, and by 2026 implement, an all-Ireland non-indigenous species and invasive species management strategy for coastal and marine areas.

D5 Eutrophication

What is Eutrophication?

Eutrophication occurs when there is an increase of nutrients, such as nitrogen and phosphorus, into an aquatic ecosystem. In the right conditions, the nutrients fuel excess growth of algae such as phytoplankton (measured as chlorophyll) or macroalgae. This in turn can change the balance of organisms and decrease the amounts of oxygen in bottom waters.

Environmental Status

Ireland has achieved Good Environmental Status for eutrophication within its maritime area

Within Ireland's marine area, inshore systems are considered at risk of eutrophication. Coastal ecosystems show low eutrophication levels, and offshore areas show no indications of eutrophication. Trend analysis shows no change in nutrient levels of Ireland's marine waters in recent years. Overall, 286 km² or 0.05 % of the maritime area is classified as a problem area with regard to eutrophication.

Significant Pressures

Nutrient pressures in coastal and marine ecosystems originate mostly from land-based sources. These include agriculture, urban

wastewater, urban run-off and Industry. Other pressures include hydromorphology, domestic wastewater and forestry. The scale of each pressure will depend on the land use in the catchment entering into the coastal or downstream marine ecosystem.

Additional information on the pressures on Ireland's inland transitional and coastal waterbodies can be found [here](#).

Pressures on outer marine areas can include those from waterborne sources (e.g. rivers) but also atmospheric deposition. In the North East Atlantic atmospheric deposition of Nitrogen can be as much as 50 % of the total Nitrogen load entering the region ([OSPAR QSR 2023](#), in progress).

Measures

The MSFD Programme of Measures has 28 measures which focus on Eutrophication. These measures are mostly focus on reducing pressures by improving water quality and preventing environmental damage. Some measures focus on the drivers through the implementation of licencing and permitting functions. Very few of the measures Ireland has focus on changing the activity or state (Figure 10).

The full list of measures Ireland has developed to tackle eutrophication can be found in Annex 3.

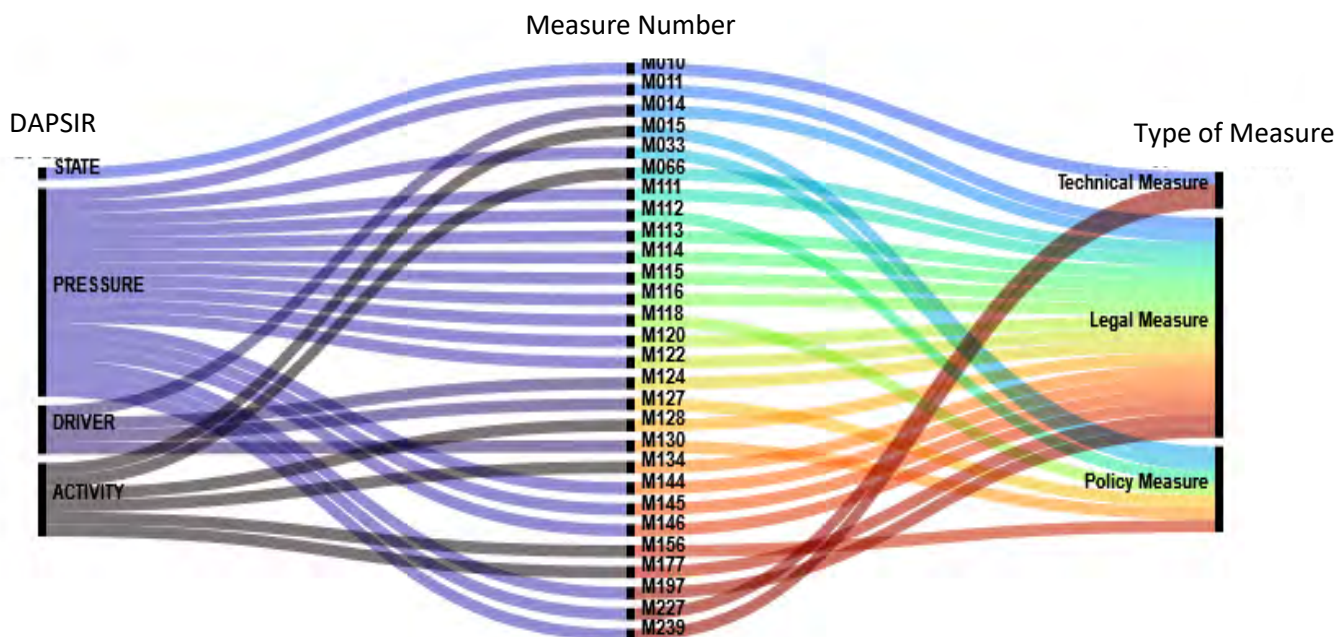


Figure 10. Measures in Ireland's Programme of Measures aimed at tackling eutrophication broken down using the Driver-Activity-Pressure-State-Impact-Response (DAPSIR) approach.

Water Framework Directive

Ireland's draft River Basin Management Plan (RBMP, 2022-2027) sets out the main measures Ireland plans to put in place to protect and restore water quality in Ireland's surface waters, from source through the catchment, to the coastal area. This has been developed through Ireland's implementation of the Water Framework Directive (2000/60/EEC). As stated above the Marine Strategy Part 3 is built on policy frameworks already in place and so all relevant WFD measures, as defined under the draft RBMP will be reported.

The measures in the draft RBMP are mainly directed at reducing pressures. They focus on areas such as agriculture, forestry, urban and domestic wastewater, runoff, aquaculture, land use planning, peat and hydromorphology.

Additional information on the draft RBMP can be found [here](#).

Measures related to Ireland's River Basin Management Plan include:

- **M146.** Introduce measures to tackle urban runoff pressures as outlined in Ireland's River Basin Management Plan.
- **M120.** Implement the Urban Wastewater Treatment Regulations and update the Nutrient Sensitive Areas designations
- **M112.** To continue to support the implementation of agricultural measures including the National Common Agricultural Policy (CAP) Strategic Plan and associated actions.
- **M144.** To continue to implement the requirements of the European Union Environmental Objectives (Surface waters) regulations S.I. No. 272/2009 as amended by S.I. No. 77/2019.
- **M111.** Develop Ireland's fifth Nitrates Action Programme which is given effect by the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2022 (S.I. No. 113 of 2022).

WFD Areas for Action

[Priority Areas for Action](#) include areas where focused activity may lead to water quality protection and improvement and require collaboration by local authorities, public bodies, and stakeholders as part of implementation of the EU WFD in Ireland. There are three Area for Action categories: Areas for Restoration, Areas for Protection, and Catchment Projects (Map 6).

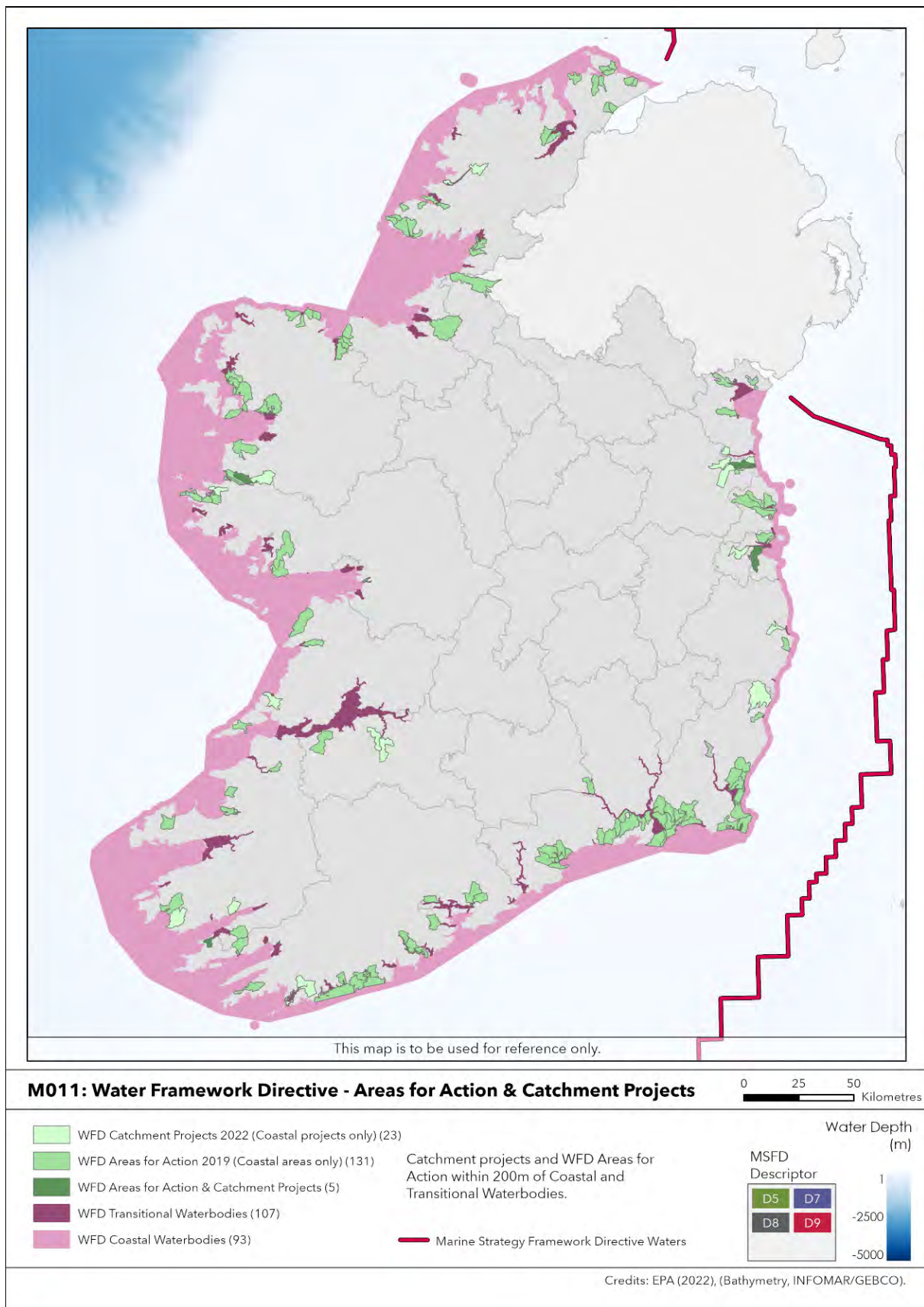
In the 2nd Cycle RBMP, 189 Areas for Action were selected through a technical feasibility assessment and Regional Workshops to identify potential Areas for Action. At these workshops, priority was given to selecting 'At

Risk' waterbodies that met the key priorities of the RBMP. In addition, the certain principles were considered for each suggested (e.g. Multiple pressures should be addressed together, build on existing programmes and community group initiatives where possible and a fair distribution of tasks between pressure owners, pressure types, bio-geophysical settings).

The Areas for Action have been reviewed for the third cycle RBMP and include a new framework for the latest selection process to capture the broad range of catchment management activities being undertaken.



Photo courtesy of An Taisce Love your Coasts finalists 2020



Map 6. Ireland's Areas for Action (2nd RBMP) and catchment projects (2022) under the Water Framework Directive River Basin Management Plan.

Nature Based Solutions

Nature based solutions to improve environmental conditions can play a key role in the conservation and restoration of estuarine, coastal and marine habitats. Nature based solutions can be cost-effective and simultaneously provide environmental, social and economic benefits while helping to build resilience to climate change.

They can provide multiple environmental co-benefits and ecosystem services. Examples include nutrient uptake, the natural sequestration of carbon, storm surge attenuation, and biodiversity protection and augmentation. In addition, over the long-term, salt marshes and wetlands may adapt to sea level rise.

Nature based solutions have also been considered in the development of Ireland's draft River Basin Management Plan. Specifically, Action 10 states: 'A multiagency group under the NTIG to continue a forum to co-ordinate efforts for implementation of Nature Based Catchment Management.'

A new measure focusing at improving the state of the environment is proposed which focuses action to improve both WFD ecological status and the GES of D5 in coastal areas.

This measure will involve a regional approach to the delivery of tasks under the [OSPAR NEAES](#) Objective S106¹⁰ to consider the application of nature based solutions to the sequestration of nutrients in coastal areas. In conjunction, the additional environmental co-benefits, as outlined above, will be explored. It

is envisaged that this measure will link with, and build upon existing Irish projects that are currently developing nature based solutions.

M236. Nature Based Solutions

By 2028, Ireland will develop nature-based solutions to reinstate and safeguard the natural capacity of ecosystems to supply regulating ecosystem services, including the sequestration of nutrients. This will be undertaken through a regional approach under OSPAR Objective S106.

Controlling Atmospheric Deposition

Emissions from industrial activities can have a large impact on the amount of atmospheric Nitrogen deposited in coastal and marine areas. Atmospheric emissions are regulated through the Gothenburg Protocol of the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution, which is implemented by EU Member States through the National Emissions Ceilings Directive (2016/2284/EU).

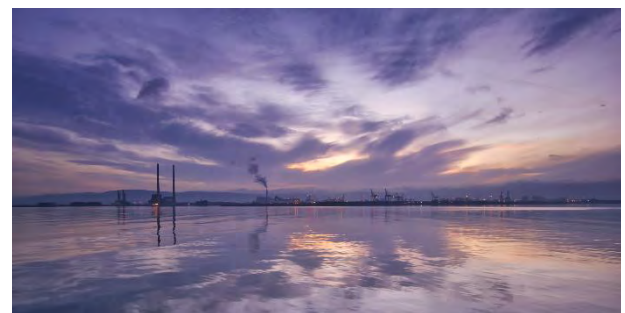


Photo courtesy of An Taisce Love your Coasts finalists 2020

¹⁰ S1.06: By 2030 OSPAR will develop and implement a regional approach to applying nature-based solutions to reinstate and safeguard the natural capacity of the

ecosystem to sequester nutrients through conservation and restoration of estuarine, coastal and marine habitats, where this is practicable.

D7 Hydrographical Conditions

What are hydrographical conditions?

Hydrographical conditions describe the physical parameters of the sea and include temperature, salinity, currents, tides, waves, depth and turbidity. Changes to these features due to human activities can cause permanent alterations to the seabed and/or water column and associated habitats. Climate change can also alter hydrographical conditions.

Environmental Status

Ireland has achieved Good Environmental Status for alteration of hydrographical conditions.

There are currently no threshold values associated with hydrographical conditions. However, the level of activities causing hydrographical changes to the seabed and water column within Ireland’s maritime area were very low overall during the last assessment period of 2014-2018.

Significant Pressures

Large-scale human activities that alter flows and depth, including offshore structures (e.g. hydrocarbon and renewable energy platforms), dredging and the disposal of dredged material, or construction and developments along the coast are considered the main pressures on hydrographical conditions. Currently these pressures do not cause significant issues.

Measures

Ireland has 15 measures that focus on hydrographical conditions. These measures are mostly focus on the drivers of pressures and the activity. These include measures focused on licencing and permitting or providing guidance and those aimed at protecting and remediating environmental damage (Figure 11).

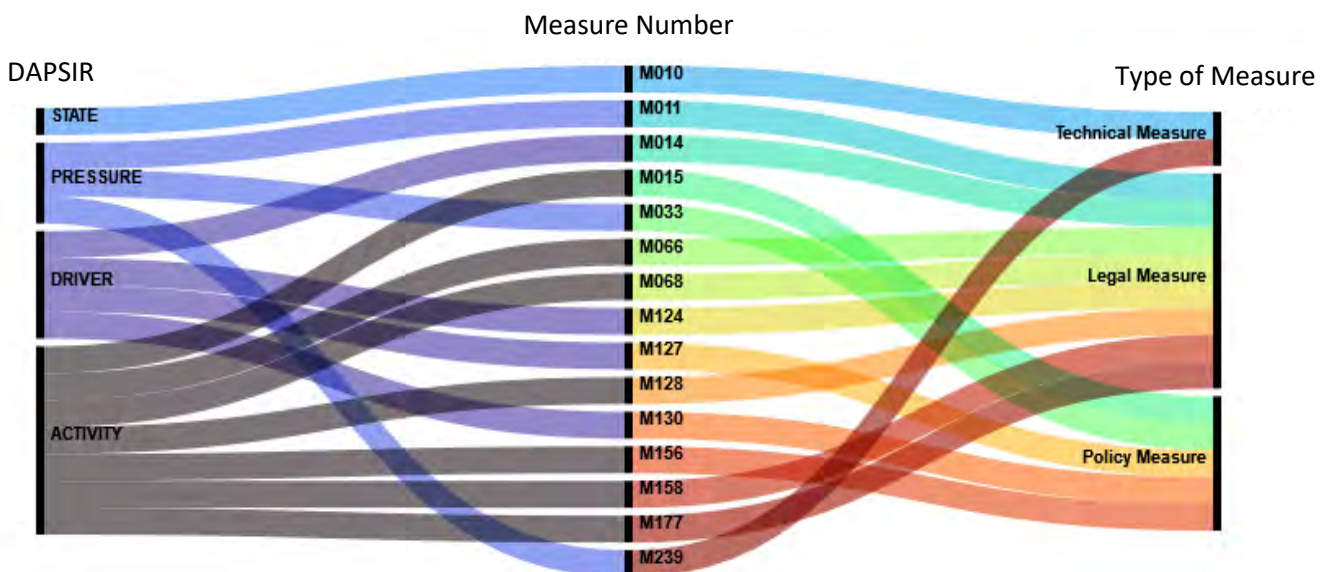


Figure 11. Measures in Ireland’s Programme of Measures aimed at hydrographical conditions broken down using the Driver–Activity–Pressure–State–Impact–Response (DAPSIR) approach.

The full list of measures Ireland has developed concerning hydrographical conditions can be found in Annex 3.

Marine Spatial Planning

As set out in the Maritime Spatial Planning (MSP) Directive (2014/89/EU), the MSFD is the environmental pillar of marine spatial planning in European seas. Consequently, the attainment the achievement/maintenance of GES, through consideration of Ireland's Environmental Targets, is embedded within the National Marine Planning Framework and its marine planning policies. Reaching or maintaining these specific targets will ensure that human activity in Ireland's maritime area is at sustainable levels and that the marine environment is protected from degradation due to human influences.

The enactment of relevant parts of the [Maritime Area Planning Act](#) and the establishment of the Maritime Area Regularity Authority (MARA) in Ireland will ensure that appropriate forms and levels of organisation governance are in place to support marine spatial planning and licencing of activities in Irish marine waters.

Offshore Renewable Energy (ORE) Guidance

In 2018, the European Parliament and the Council adopted the revised Renewable Energy Directive, setting a binding EU-level renewable energy target of at least 32 % by 2030, with possibilities to increase this percentage by 2023.

Ireland's Programme for Government includes ambitions of achieving 5GW capacity in offshore wind by 2030.

To ensure sustainable development during this energy transition, guidance on how best to ensure that wind energy developments are compatible with MSFD and other relevant Directives (e.g. Birds and Habitats Directive), during pre-construction, construction, operation and decommissioning, will be updated.

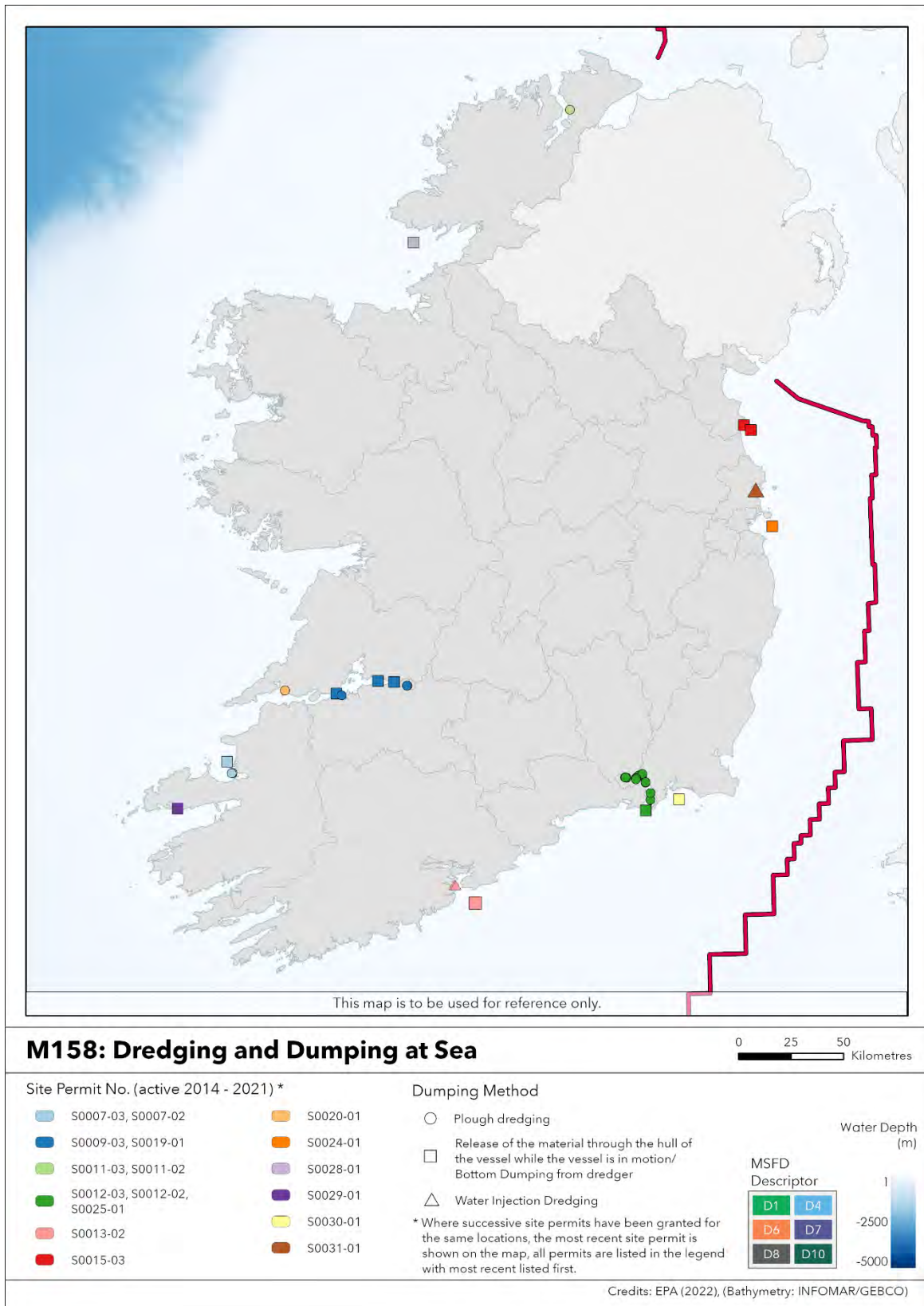
The guidance will focus on, but will not be limited to, the determination of likely effects, positive or negative of ORE, baseline conditions, dealing with uncertainty and cumulative effects. Existing regional (e.g. OSPAR and EU) and national guidance will be considered in the process.

M127. Offshore Renewable Energy Guidance

By 2024, Ireland will update national guidelines regarding environmental considerations for offshore renewable energy developments, giving consideration to existing regional guidance on ORE e.g. from the EU Commission and OSPAR.

Dredging and Dumping at Sea

The activities of dredging and dumping at sea can cause an increase in suspended matter and alterations to sediment deposition and morphology at both dredging and dump sites. Regulation of this activity includes the application of the Foreshore Acts 1933 to 2009 and associated legislation, licencing, permitting and enforcement of activities under the Dumping at Sea Act and the implementation of guidelines for the assessment of dredged material for disposal in Irish waters (Map 7).



Map 7. Sites in Ireland licenced for dredging and dumping at sea between 2014 and 2021.

D8 and D9 Contaminants and Contaminants in Seafood

What are contaminants?

Contaminants are substances such as industrial chemicals, pesticides, anti-foulants, pharmaceuticals and heavy metals which have properties that allow them to persist in the marine environment, bio-accumulate and potentially be of concern.

Environmental Status

Ireland has achieved GES for Contaminants and Contaminants in Seafood

Concentrations of contaminants in water and biota (shellfish) are generally low and compliant with standards. Concentrations of legacy pollutants are typically decreasing. Biological effects of contaminants, specifically reproductive impacts in dog whelks, have been reduced. The number and impact of acute pollution events is low.

Contaminants in seafood sampled from shellfish growing waters and commercial fishing grounds around Ireland, do not exceed Maximum Limits (threshold value compliance of 99.7 %) as set in Commission Regulation 1881/2006 EC (as amended). This specifically includes levels of cadmium, lead, mercury, Polychlorinated Biphenyls (PCBs), dioxins and certain Polycyclic Aromatic Hydrocarbons (PAHs), in foodstuffs including the edible tissues of seafood.

Significant Pressures

Hazardous substances originate from a wide range of common products and industrial processes. These include pesticides, pharmaceutical ingredients and other synthetic substances such as flame-retardants. These substances can be released to the marine environment through overland processes, storm water overflows or through existing wastewater treatment plants.

Other activities can also release chemicals directly into the marine environment such as dredging and dumping at sea, aquaculture, marine transport and offshore oil and gas operations.

Measures

Ireland has over 37 measures focused on contaminants and 22 measures focused specifically on contaminants in seafood. These measures mainly focus on activities such as licencing and permitting, preventing environmental damage and improving food quality. There are also measures focusing on pressures and drivers to improve water quality, develop knowledge and ensure best practise (Figure 12).

The full list of measures Ireland has developed to tackle contaminants can be found in Annex 3.

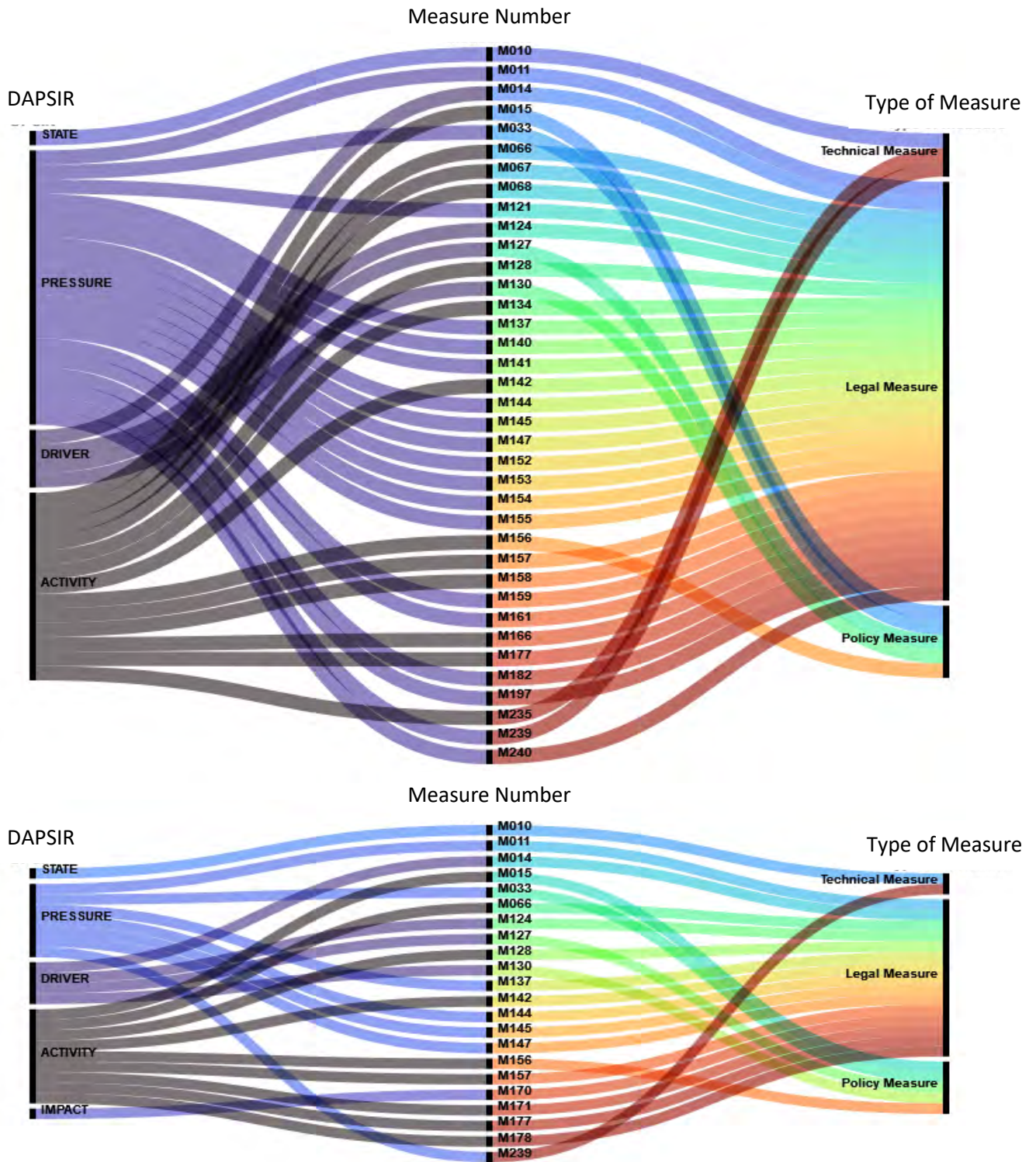


Figure 12. Measures in Ireland's Programme of Measures aimed at contaminants (top) and contaminants in seafood (bottom) broken down using the Driver–Activity–Pressure–State–Impact–Response (DAPSIR) approach.

Restrictions on Contaminants

Land Based Sources

Chemicals including pesticides are regulated, authorised and restricted in accordance with relevant EU and national legislation.

Restrictions on contaminants entering surface water from land include the enforcement of statutory codes of practice on the application and use of chemicals (e.g. good agricultural practice on agri-chemicals). The European Union Environmental Objectives (Surface waters) regulations S.I. No. 272/2009 as amended by S.I. No. 77/2019 also regulates contaminants in surface waters.

The enforcement of the ban on production, placing on the market and use (some limited exceptions) of intentionally produced Persistent Organic Pollutants (POPs) substances also limits the accumulation of these pollutants in the environment.

Sea based Sources

The release of contaminants from sea-based sources is regulated through a number of specific measures. The Sea Pollution Act 1991 ([revised 2021](#)) is Ireland's National legislation aimed at preventing pollution of the sea by oil and other substances.

The safety of offshore oil and gas operations within Irish legislation is undertaken through the Implementation of Directive 2013/30/EU. This ensures protection of the marine environment through implementation of safety measures/mechanisms for offshore oil and gas operations. OSPAR recommendation 2003/5 promoting the use and implementation of environmental

management systems by the offshore industry also ensures the control of this activity. OSPAR recommendations 2005/2, 2006/3, 2006/4 also provide environmental goals for substances and produced water discharged at sea. Details of all OSPAR recommendations can be found [here](#).

Significant acute pollution events

Ireland has developed a national framework and strategy to coordinate marine pollution preparedness and response, the National Maritime Oil and NHS¹¹ Spill Contingency Plan (NMOSCP). It addresses all oil and HNS pollution whether it originates from ships, harbours, offshore units or oil/HNS handling facilities and land-based sources. It covers waters in the Irish Exclusive Economic Zone (EEZ).

The NMOSCP ensures effective preparedness and response through a number of guidance documents and standard operating procedures. The Plan has given due regard to the International Conventions and EU Directives (including the MSFD) to which Ireland is party.

M234. Significant Acute Pollution Events

On an ongoing basis, implement the [National Maritime Oil and NHS Contingency Plan \(2020\)](#) and accompanying Standard Operating Procedure.

¹¹ Hazardous Noxious Substances

Restricting Lead in and around wetlands

In January 2021, the European Commission moved to restrict the use of lead gun ammunition in wetlands across all 27 EU member states. The ban is set to come into force from February 15 2023. Water birds can consume discarded lead shots, leading to death by poisoning. Lead can seep into the food chain causing secondary poisoning and lead can also be toxic to humans.

M238. Lead in and around wetlands

By 2023 Ireland will implement [EC regulations \(EC\) No 57/2021](#), restricting lead in and around wetlands.

Aquaculture

The activity of aquaculture is regulated through a number of measures. The first is the overarching implementation of Environment Management Systems on fish and shellfish farms, which regulates activity. These allow for a formalisation and standardisation of the consumption of resources and environmental impact of aquaculture.

One such example of this is the implementation of the CLAMS [Coordinated Local Aquaculture Management Systems](#) to ensure adequate supervision and management of shellfish practices, and to empower aquaculture operators to undertake voluntary improvements and facilitate them to recognise and report incidents.

Additional information on aquaculture initiatives can be found in Ireland's draft National Strategic Plan for Sustainable Aquaculture Development, 2030 [here](#), which includes consideration of climate change adaptation and mitigation.

Shellfish waters

The Shellfish Waters Directive was repealed in 2013 with the expectation that the Water Framework Directive (WFD, 2000/60/EEC) would maintain the same protection to shellfish waters as the original SWD. In Ireland, the national legislation relating to shellfish Waters needs to be reassessed and with it the associated monitoring, assessment and protection measures.

A roadmap to implementing a new legislative and management framework for shellfish waters in Ireland has been developed. This outlines the steps required to ensure the safety of shellfish waters is maintained. The framework will ensure the legislation developed, and the practicalities of its application, are fit for purpose and sit within the current framework of legislative activities in the aquaculture sphere.

M145. Shellfish waters

Ireland will implement a new legislative and management framework for shellfish waters in Ireland.

Aquaculture Information Management System

To better facilitate the licencing and management of aquaculture operations a new Aquaculture Information Management System ([AQUAMIS](#)) has been launched. It provides a platform for the availability of high quality marine data and information (Figure 13).

M240. AQUAMIS

Improve access to information through the launch of an online mapping viewer of licensed aquaculture sites in Ireland which will link licence information already available online.



Photo courtesy of An Taisce Love your Coasts finalists 2020

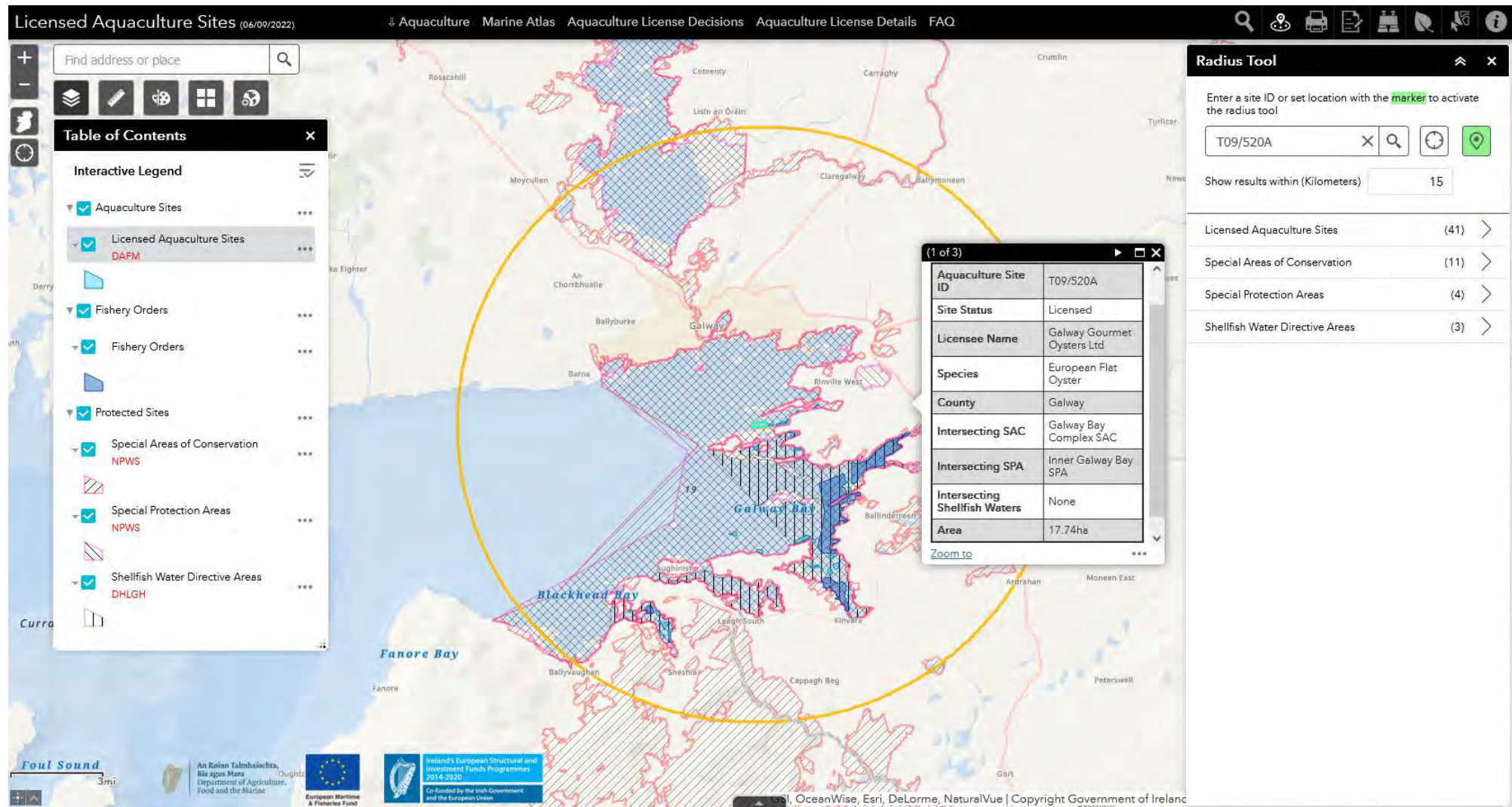


Figure 13. A snapshot of Ireland's new Aquaculture Information Management System ([AQUAMIS](#)).

Improving Food Quality

A number of activity-focused measures are directed at food law. These include EU and National Regulations to ensure general principals, specific hygiene rules and compliance with animal health and welfare rules are applied. The health of aquaculture animals is controlled through EC (Health of Aquacultures Animals and Products) Regulations 2008 (S.I. No. 261/2008) and Council Directive 2006/88/EC. One measure is focused on impact through the application of EU and national regulations setting maximum levels for specific contaminants in foodstuffs.

Dredging and Dumping at Sea

To ensure contamination from dredging and dumping at Sea activities are minimised ongoing implementation of guidelines for the assessment of dredged material for disposal in Irish waters, the application of the Foreshore Acts and the licensing, permitting and enforcement of activities under the Dumping at Sea Act will continue.

See descriptor 7 for more details on measures relating to this activity.



Photo courtesy of An Taisce Love your Coasts finalists 2020

D10 Marine Litter

Introduction

Marine litter is any persistent, manufactured or processed solid material that is discarded, disposed of, or abandoned in the marine and coastal environment. It may originate from many sources, causes environmental, economic, and health impacts. Macro or micro litter can enter the sea directly (accidentally or deliberately) or indirectly transported by rivers, sewage discharges, storm water runoff or wind. Plastic marine litter breaks down very slowly and is present on beaches, in the water column and seafloor. Larger pieces of litter may entangle marine mammals and birds. Smaller pieces may be ingested by marine species and cause harm.

Environmental Status

Ireland has achieved Good Environmental Status for marine litter, particularly beach litter under Descriptor 10

In the last assessment, Ireland achieved Good Environmental Status within its maritime area for the amount of litter on coastlines¹². The median number of litter items greater than or equal to 2.5 cm found on beaches in quarterly surveys between 2013 and 2018 decreasing from 73.5 items per 100 metres in 2013 to 46 items per 100 metres in 2018.

¹² Environmental Target: The composition, amount and spatial distribution of litter on the coastline and on the seabed, are at levels that do not cause harm to the coastal or marine environment.

¹³ D10C1: The composition, amount and spatial distribution of litter on the coastline, in the surface layer of the water column, and on

Excluding beach litter, it was not possible to determine GES in relation to Commission Decision 2017/848 for the primary criteria for marine litter (D10C1¹³) or micro-litter (D10C2¹⁴) during the last assessment. Thresholds are still in development, and there are still no scientifically agreed methodologies to monitor micro-litter.

Measures

There are 40 litter specific measures in the Programme of Measures, primarily national measures related to litter control and reduction measures.

These measures are mostly focus on activities and pressures, with a lesser number focused on drivers, impacts and state (Figure 14).

Many of Ireland's measures under D10 relate to the prevention and remediation of litter sources. This can relate to both land or sea-based sources and measures are also closely linked with development of a circular economy. Some examples are given below. The full list of measures Ireland has developed to address D10 can be found in Annex 3.

the seabed, are at levels that do not cause harm to the coastal and marine environment.

¹⁴ D10C2: The composition, amount and spatial distribution of micro-litter 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

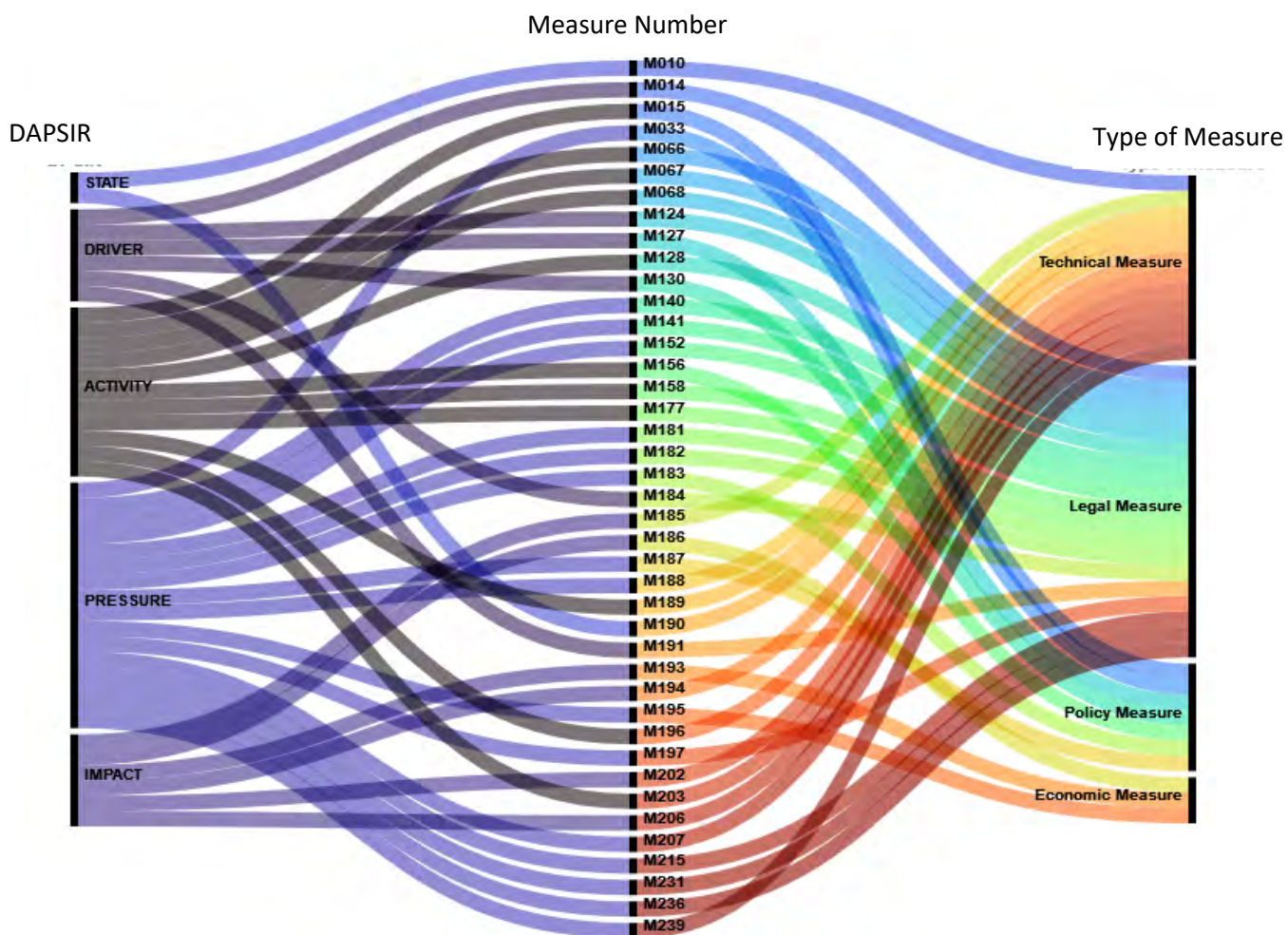


Figure 14. Measures in Ireland’s Programme of Measures aimed at tackling marine litter broken down using the Driver–Activity-Pressure–State-Impact-Response (DAPSIR) approach.

Reduction of Land-based Sources

Measures to reduce land-based sources of litter include:

- Enforcing the national Litter Pollution Acts (1997 to 2009), and any subsequent amendments, which make littering an offence.
- The provision of appropriate infrastructure for proper litter disposal and recycling including signage and bins.
- Reducing illegal dumping using a multi-faceted approach, which includes enforcement, reporting, public awareness and education through the [Anti-Dumping Initiative](#). The initiative is co-ordinated

through the Waste Enforcement Regional Lead Authorities (WERLAs).

Microbeads Prohibition Act

The Microbeads (Prohibition) Act was brought into law in December 2019 and provides for a prohibition of the manufacture, import, export or sale of products containing intentionally added plastic microbeads, to include “rinse-off” personal care products, detergents, and domestic and industrial abrasive cleaning products and scouring agents.

M231. Microbeads Prohibition Act (2019)

Ireland will continue to implement the Microbeads Prohibition Act (2019).

Single Use Plastics Directive

In 2021, Ireland partially transposed the European Union Single Use Plastics Directive (904/2019) in Irish law. This legislation forms part of the PoMs by tackling single-use plastic products (SUPs), which are more likely to send up in our seas than reusable items. A number of items are banned under the directive (e.g. cotton bud sticks, plastic cutlery, plates, straws and stirrers, balloon sticks, disposable cups, plastic bags, packets and wrappers, wet wipes and sanitary items).

Additional items included in the Directive are dealt with by the implementation of reduction measures (e.g. measures to reduce single use plastic containers like those used at large events or take away containers). Extended producer responsibility schemes are envisaged to manage other items in the Directive for which consultation with key stakeholders for their implementation is ongoing.

For more information on the phasing out of these items, see

<https://www.gov.ie/en/publication/ef24a-single-use-plastics/>.

The Deposit Return Scheme will incentivise the recycling of PET bottles and aluminium cans significantly reducing their presence in the coastline.

As part of this drive to remove SUPs from our environment, a Deposit Return Scheme (DRS) was approved in 2022 to maximise the recyclability of plastic bottles. This involves the application of a refundable deposit to incentivise consumers to return their beverage containers for recycling or reuse. The DRS aims to increase recycling rates and support the circular economy, as well as reduce litter caused by beverage containers.

The Directive also requires that Member States report data on fishing gear containing plastic and on waste fishing gear collected.

M235. Single Use Plastics Directive (2021)

By 2024, Ireland will fully implement the Single Use Plastics Directive.

Reduction of Sea-based Sources

Pressures associated with sea-based sources are reduced by among others:

- Implementing the MARPOL directive (Annexes I, III, V and VI) on ship-source pollution, enforced through the criminal penalties by Directive 2009/123/EC (as amended) and S.I. No's 542/2010, 313/2010 and 372/2013.
- Contributing to the implementation of the OSPAR Second Regional Action Plan on Marine Litter (2022-2030) which works to reduce marine litter at a Regional Sea scale.

- Implementing the OSPAR recommendation 2003/5 promoting the use and implementation of environmental management systems by the offshore industry.
- Implementing guidelines for the assessment of dredged material for disposal in Irish waters under the Dumping at Sea Act.

Develop a circular economy

Key to reducing both land and sea-based sources is continuing the development of a circular plastic economy. In July 2022 the [Circular Economy and Miscellaneous Provisions Act 2022](#) was signed into law in Ireland. This act, underpins Ireland's shift from a "take-make-waste" linear model to a more sustainable pattern of production and consumption, that retains the value of resources in our economy for as long as possible and that will also significantly reduce greenhouse gas emissions.

With this Act, over time, a range of single-use disposable products will also be phased out through the Single Use Plastics Directive (previous section). Among its targets is to make Ireland one of the first countries in the world to eliminate the use of disposable coffee cups, nearly half a million are currently sent to landfill or incineration every day, amounting to 200 million cups a year. The first levies on disposable coffee cups will be introduced towards the end of 2022.

M191. Utilising waste as a Resource

Implement the Circular Economy and Miscellaneous Provisions Act 2022.

Specific circular economy measures in Ireland's Programme of Measures include:

- Implement the Producer Responsibility Initiative (M215) to increase the recycling of batteries and accumulators; increase the recycling of farm plastic waste through the application of the farm plastics recovery scheme; increase the recycling of construction and demolition waste; increase the recycling of tyres; increase the recycling of end life vehicles; increase the recycling of packaging waste; and to continue to promote; co-ordinate and finance the collection and recovery of packaging waste in order to achieve the objectives set out in the Packaging Waste Directive.
- Encourage the reuse and recycling of waste and the reduction of the amount of waste destined for landfill through the application of Waste Management (Landfill Levy) Regulations 2002-2016.

Citizen Science and Sector Lead Initiatives

Ireland has a number of citizen science and sector lead initiatives which play the role of removing waste from the environment, recording amounts of litter found on our coastlines and seas and educating the public and industry on the protecting our environment. These are reflected in a number of the measures on marine litter, which focus on the state of the environment. Specific examples can be found below and in Map 8.

Clean Oceans Initiative

BIM (Ireland's Seafood Development Agency) plays a key role in supporting the Irish seafood sector and local communities through the Clean Oceans Initiative to ensure waste is

minimised and mitigation measures are developed. This includes the [Fishing for Litter](#) initiative, which encourages fishers to take litter they encounter while fishing ashore by providing bags and designated facilities for disposal.

Preventing waste from the fishing sector becoming marine litter in the first place is also a key goal by reducing SUPs and on-board initiatives such as [ECOPACT](#) and [Origin Green](#) to help ensure all potential sources of marine litter are accounted for.

Clean Coasts and Coastwatch

The Clean Coasts Programme (<https://cleancoasts.org/>) works with communities to help protect and care for Ireland's waterways, coastline, seas, ocean and marine life. Activities include organising beach cleans throughout the country to remove marine litter from the coastline, the extent of which can be seen in Map 8 below. Clean Coasts also leads on a number of related campaigns and initiatives such as "Think Before you Flush", the Green Coast Award and the #2minutebeachclean.

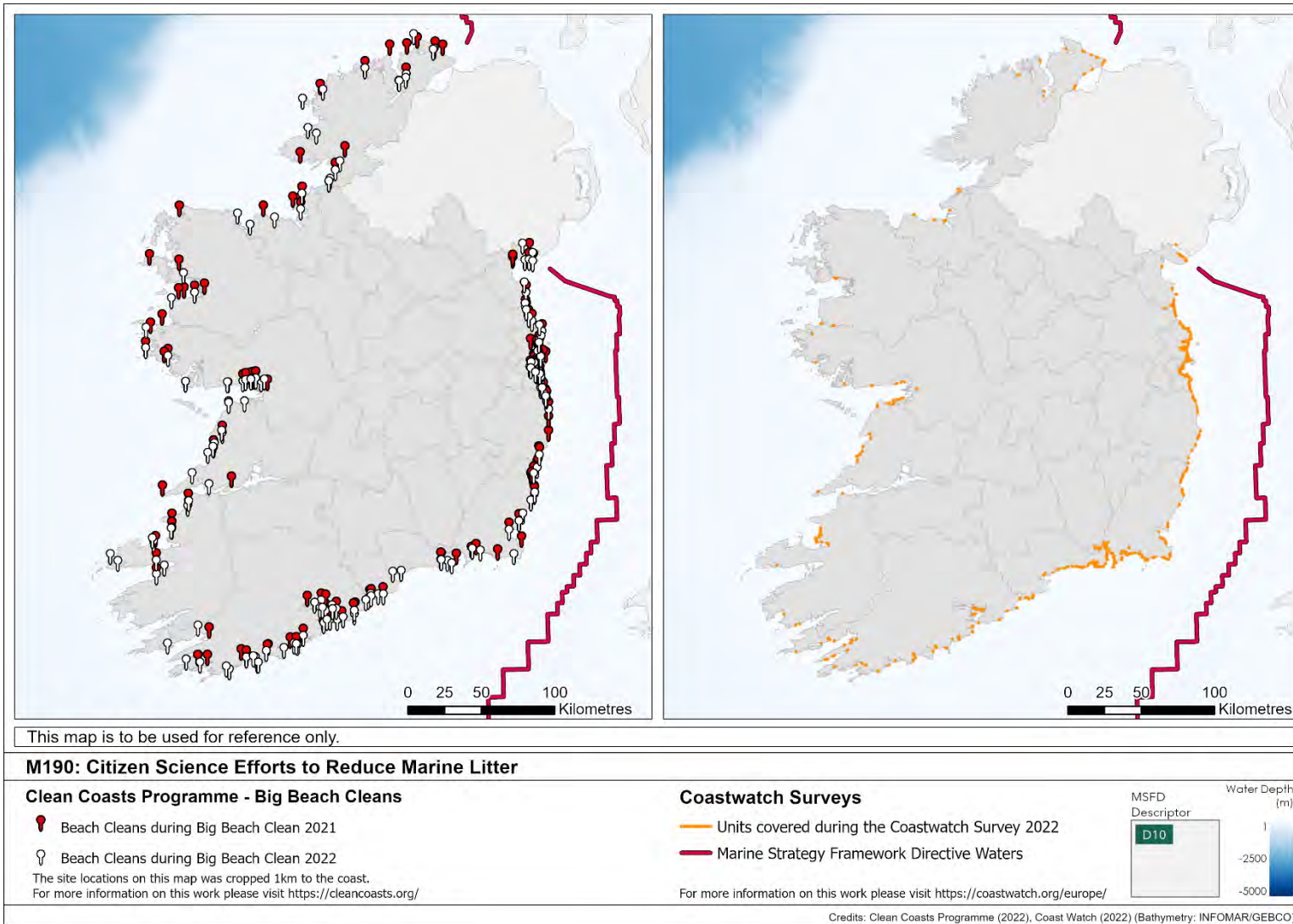
Coastwatch Ireland is part of a wider international network under Coastwatch Europe. Volunteers participate in the Coastwatch survey to give an overview of the state of the coast, including the amount of litter found on the coast, but also the presence of seaweed and seagrass (Map 8).

Coastwatch also implement site-specific citizen science and sector lead initiatives throughout Ireland. A number of examples of the organization's work are listed below:

- Carlingford: Work with aquaculture operators to reduce fishing glove litter. For more information, please see this [link](#).
- Waterford estuary: Local coordinated efforts to remove litter in inaccessible areas with coastal fishers. For more information, please see this [link](#).
- Cork Harbour: Collaboration between Coastwatch and Cork Harbour to remove EPS litter.
- Galway and Mayo: Public awareness raising initiative to highlight the impacts of plastics on wildlife with local artists. For more information, please see this [link](#).
- Donegal: Community research trial of clear plastic bottle collection.



Photo courtesy of An Taisce Love your Coasts finalists 2020



Map 8. Citizen Science efforts to reduce marine litter.

D11 Energy including Underwater Noise

Introduction

Descriptor 11 (D11) of the MSFD relates to anthropogenic sources of energy including underwater noise. The descriptor explicitly includes two criteria for underwater noise. The first criteria (D11C1¹⁵) relates to impulsive sources of noise and the second, continuous (D11C2¹⁶) underwater noise. For both the MSFD requires that the spatial distribution, temporal extent and levels of anthropogenic sounds, not exceed levels that adversely affect populations of marine animals.

Environmental Status

Ireland has achieved Good Environmental Status for the anthropogenic impulsive sound element of Descriptor 11

The level of impulsive underwater noise causing activities within Ireland's maritime area were low overall during the assessment period of 2016-2018. Continuous underwater noise causing activities were not assessed due to the lack of developed data and methodologies for the assessment of continuous noise and its impact on marine animals.

While the effects of impulsive noise on individual marine organisms are relatively well established (these may include loss of hearing sensitivity, physiological stress, changes in behaviour or even death), the population level effects are less well understood. For continuous noise, while there has been

considerable recent progress in the modelling of the temporal and spatial distribution of underwater noise there is less certainty about ecological consequences for populations of marine animals caused by these pressures.

At the time of writing, the EU Task Group on Noise (TG NOISE) is currently finalising work to establish spatial and temporal thresholds for C1 and C2 of descriptor 11 relating to the spatial and temporal extent as well as the sound pressure levels required to define Good Environmental Status.

Significant Pressures

In the marine environment, impulsive sounds are generated by human activities such as pile driving, geophysical surveying and naval sonar amongst others. The main anthropogenic source of continuous noise is from vessel traffic including such activities as maritime transport and fishing.

Measures

Ireland has over 13 measures focused on reducing underwater noise. These measures are mainly focused on activities and drivers such as licencing and permitting, preventing environmental damage, guidance and marine spatial planning. There are also measures focusing on pressures and state variables.

The full list of measures Ireland has developed to tackle underwater noise can be found in Annex 3.

¹⁵ D11C1: The spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.

¹⁶ D11C2: The spatial distribution, temporal extent and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals.

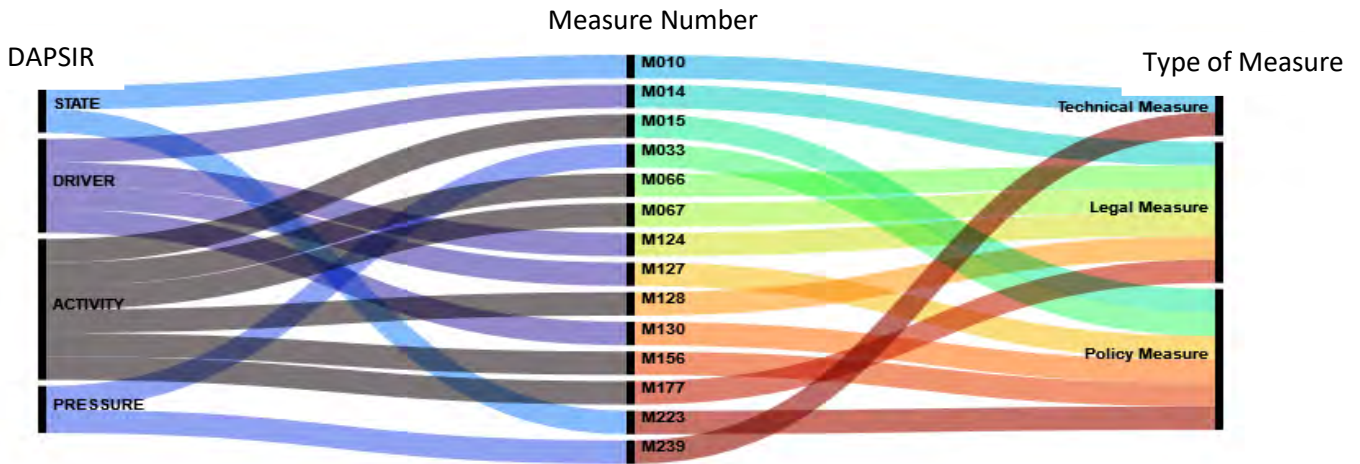


Figure 15. Measures in Ireland’s Programme of Measures aimed at tackling underwater noise broken down using the Driver–Activity-Pressure–State-Impact-Response (DAPSIR) approach.

Noise Guidance

In 2014 a guidance to manage the risk to marine mammals from man-made sound sources was developed. In consideration of the emerging noise thresholds being developed at a European level and the current national drive for the development of Offshore Renewable Energies there is a clear need to update this guidance to ensure modern best practice standards are met. An updated guidance document will be developed incorporating, current international best practices and standards along with the EU-wide and regional thresholds, on their establishment.

M224. Noise Guidance

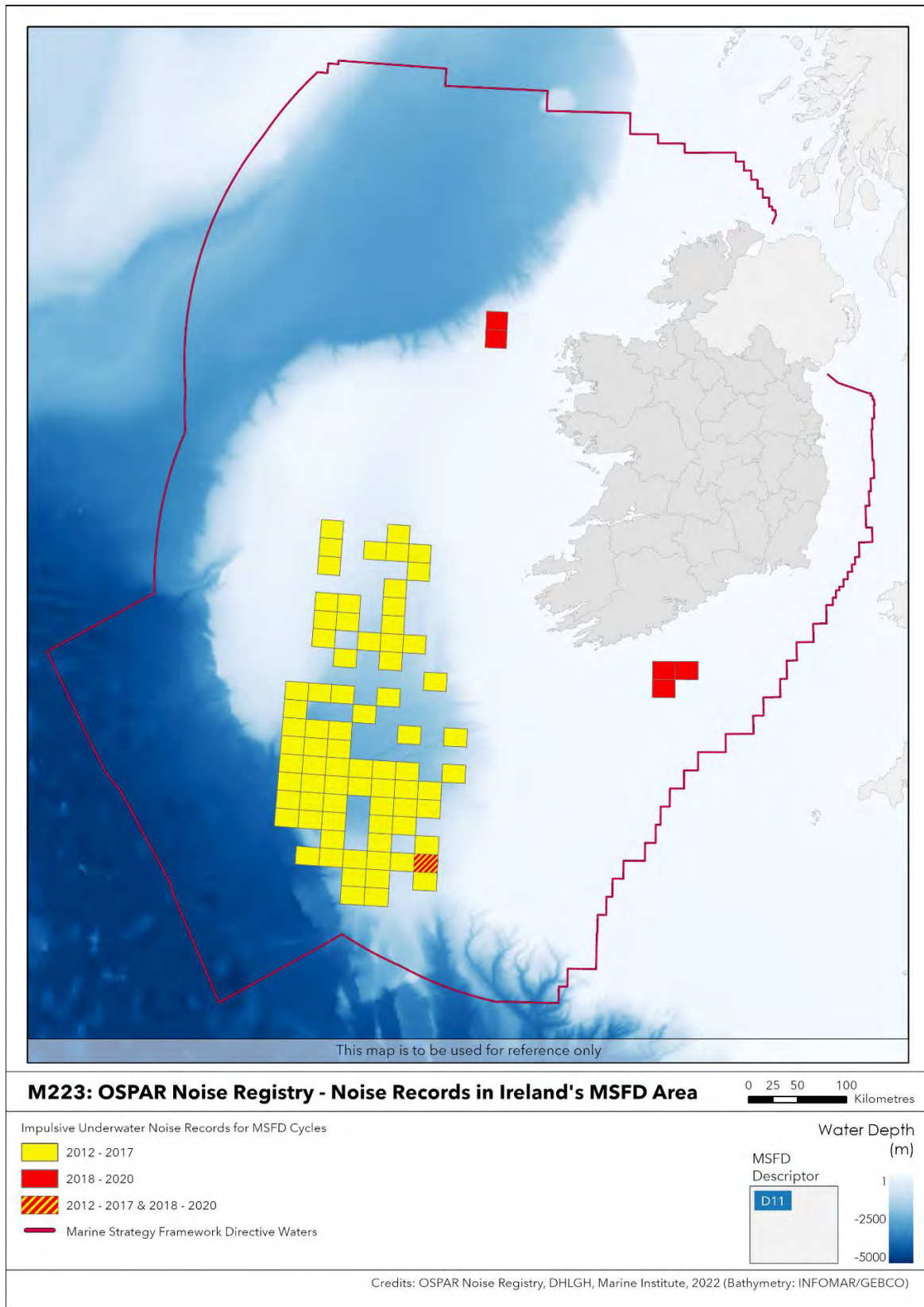
Update existing Guidance (NPWS, 2014) to manage the risk to marine mammals from manmade sounds taking into account existing and future activities.

OSPAR Noise Registry

Ireland has already established a register of noise in the Irish marine assessment area through provision of data to the OSPAR impulsive noise registry (Map 9). While in the past much of this data has been supplied by the National Petroleum Affairs Division, a moratorium on hydrocarbon prospecting means that this activity is currently begin phased out. By contrast, the emergence of the Offshore Renewable Energy Sector may lead to an increase in certain impulsive noise sources from site surveying as well as ORE installation. To account for this a new action under M223 to report impulsive Noise has been developed. As of September 2022, all new site exploration licensees will be required to report data on impulsive noise generated by these activities to the Department of Housing Local Government and Heritage.

M223. Impulsive Noise Reporting

On an ongoing basis establish and maintain a register of (impulsive) noise in the Irish Marine Assessment Area. Including the reporting of impulsive noise generated from site exploration, through the licencing process.



Map 9. OSPAR Noise Registry.

Summary

This document contains an update of Ireland’s Marine Strategy Part 3: Programme of Measures (PoMs); which was first developed in 2015.

Ireland’s assessment of environmental status (Marine Strategy Part 2; Art. 8) identified five descriptors that achieved GES, two descriptors that achieved GES for the primary criteria assessed and three descriptors that only partially achieved GES (biodiversity, commercial fish and shellfish and sea floor integrity). It was not possible to assess one descriptor, food webs.

The PoMs aims to maintain and, where necessary, improve the status of all 11

descriptors through the development of new measures and the improvement of existing measures.

The revised PoMs includes 152 measures. While new and/or updated measures have been included for all descriptors, the largest number of measures focus on the descriptors that only partially achieved GES (Figure 16).

Specifically, there are 84 measures focused on descriptor 1 biodiversity, 63 measures focused on D3 commercial fish and shellfish and 56 measures aimed at protecting D6 sea floor integrity.

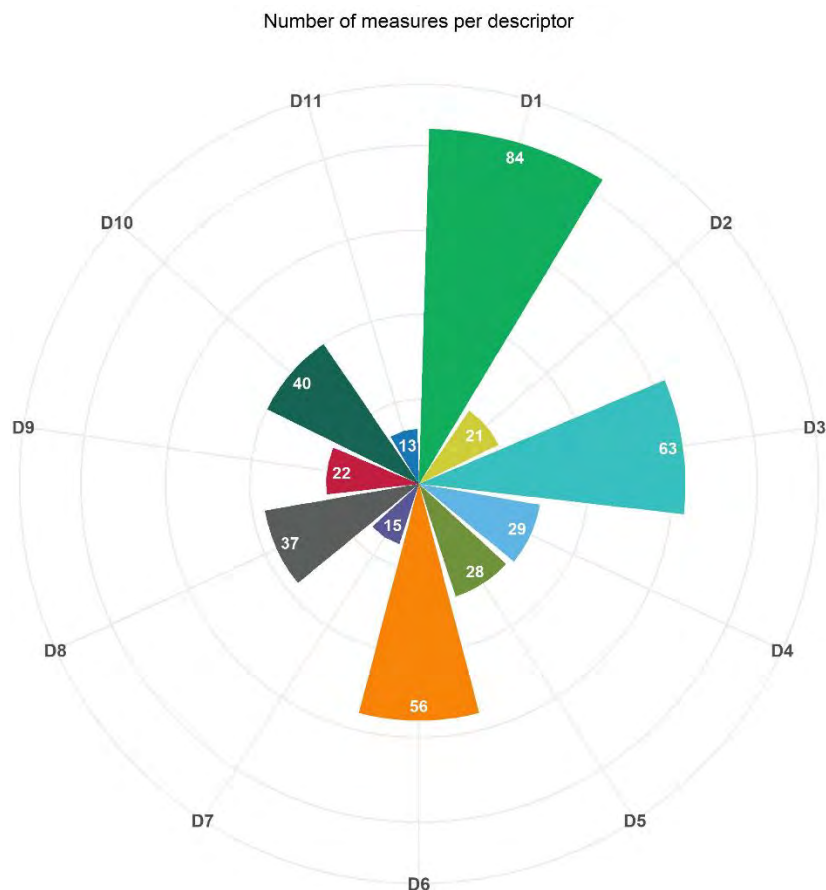


Figure 16. The number of measures in Ireland’s 2022 Marine Strategy Framework Directive Programme of Measures focused on each descriptor.

Under the MSFD state and pressure features¹⁷ have been prescribed which describe components of the marine environment relevant to the 11 descriptors (state and pressure). These features can be:

- ecosystem components,
- pressures and impacts on the marine environment,
- pressure inputs to the marine environment

- Uses and human activities.
- Consideration of these features is important in the development of monitoring programmes and measures. Ireland's PoMs specifically targets many of these features (Figure 17). Measures targeted at one feature may however also benefit other descriptors in the system (e.g. measures targeted at eutrophication may also benefit biodiversity)

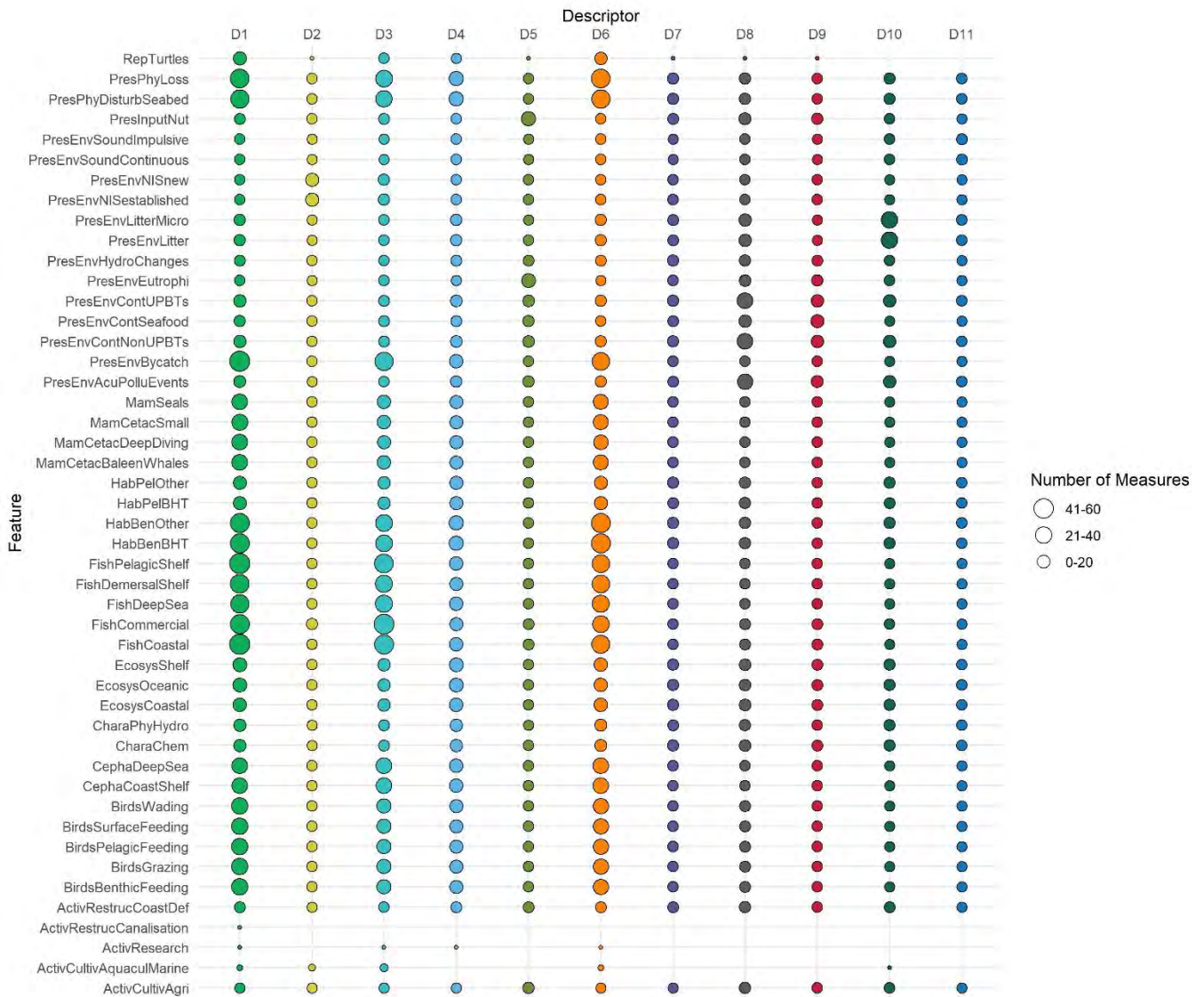


Figure 17. Measures in Ireland's MSFD Programme of Measures focused on specific features and descriptors (feature descriptions can be found in the table of acronyms).

¹⁷<https://cdr.eionet.europa.eu/help/msfd/MSFD%20AR>
T11

Implementation Instrument

In the MSFD process the implementation instrument for the measures can be either technical, legislative, policy driver or economic. Most of Ireland's PoMs were either legislative (41 %) or technical (38 %) measures.

Legislative measures include the implementation and adaptation of various National, European and international legal instruments including the Natura Directives, the Water Framework Directive, the Common Fisheries Policy and MARPOL and OSPAR.

Technical Measures focus on reducing the impact of pressures. In the case of fisheries management for example these can relate to measures such as those contained in the fisheries management chart or the implementation of Environmental Management Systems on fish and shellfish

farms. These measures can be seen, and measured in the field.

Policy driven measures can be economic incentives, but also other instruments, such as voluntary agreements with stakeholders, communication strategies, awareness raising, and education. Anti-litter campaigns and the educational work of An Taisce in the Clean Coasts and Green Schools programmes are policy driven measures.

Economic Measures provide financial motives to stimulate a desired behaviour or discourage an unwanted behaviour. This includes the use of the European Maritime Fisheries and Aquaculture Fund to support the effective delivery of the EU-CFP, or the charge for single use plastic bags.

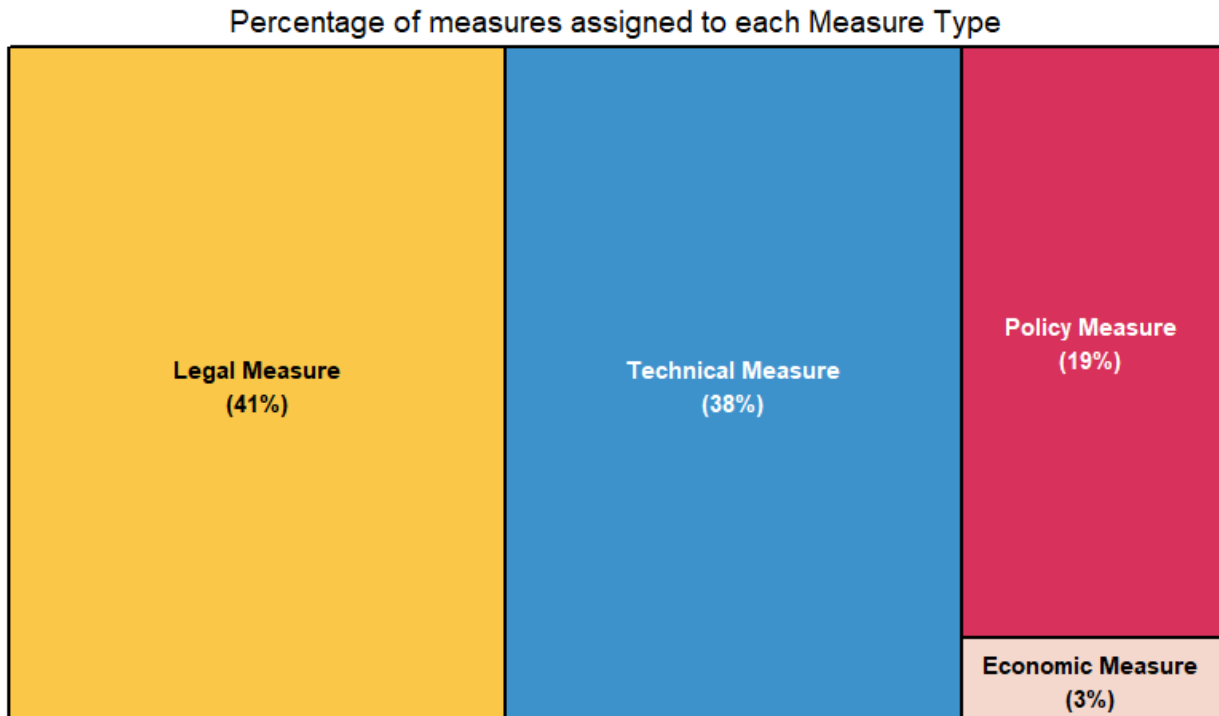


Figure 18. The percentage of measures assigned to each measure type: Technical, Legislative, Economic or Policy.

Existing, Modified and New Measures

The revised PoMs includes 108 existing measures, this reflects a consolidation of the 227 measures in the original PoMs. These were reported in 2015 and include measures that have been fully implemented, or measures where implementation is ongoing (Figure 19). These existing measures continue to contribute to the achievement of Ireland’s Environmental Targets and to achieving or maintaining GES. Ireland also has four measures that were not electronically reported in 2015 but were in existence at that time.

Further to this, Ireland has modified 28 existing measures and developed 12 new measures. Modified and new measures aim to close gaps in achieving Ireland’s Environmental Targets and reaching or maintaining GES for all descriptors.

These modified and new measures reflect:

- Advances in National, European and International (e.g. OSPAR) policy and legislation.
- Actions to close identified gaps leading to some descriptors reaching partial GES.
- Consideration of future increases in human activities and associated pressures on the marine environment (e.g. offshore renewable energy and climate related pressures) and/or relevant cumulative effects.
- Measures to ensure the continued good status of descriptors already considered in GES.
- A focus on nature based solutions and specifically spatial protection and restoration measures.

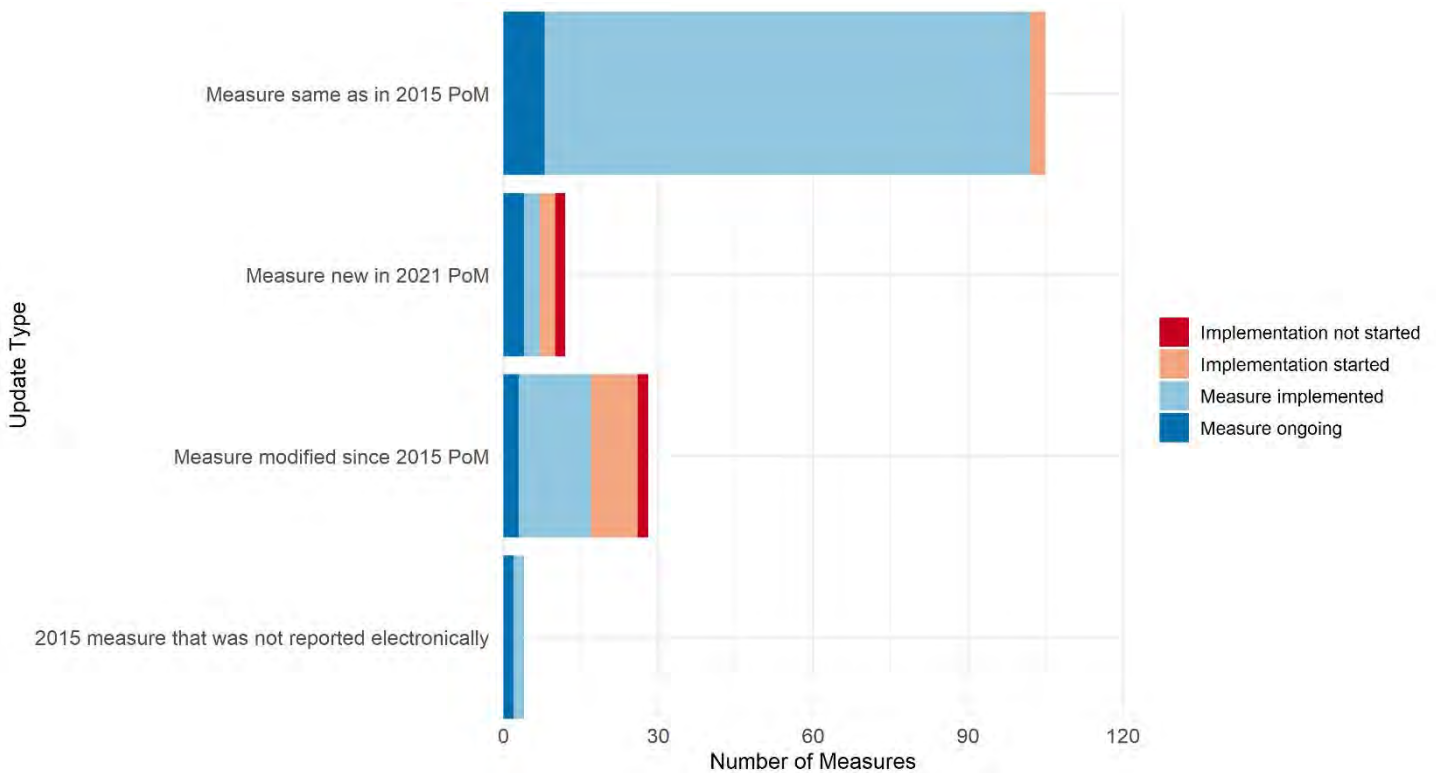


Figure 19. Existing, modified and new measures in Ireland’s Marine Strategy Part 3 and their implementation status.

Ecosystem Based Approach

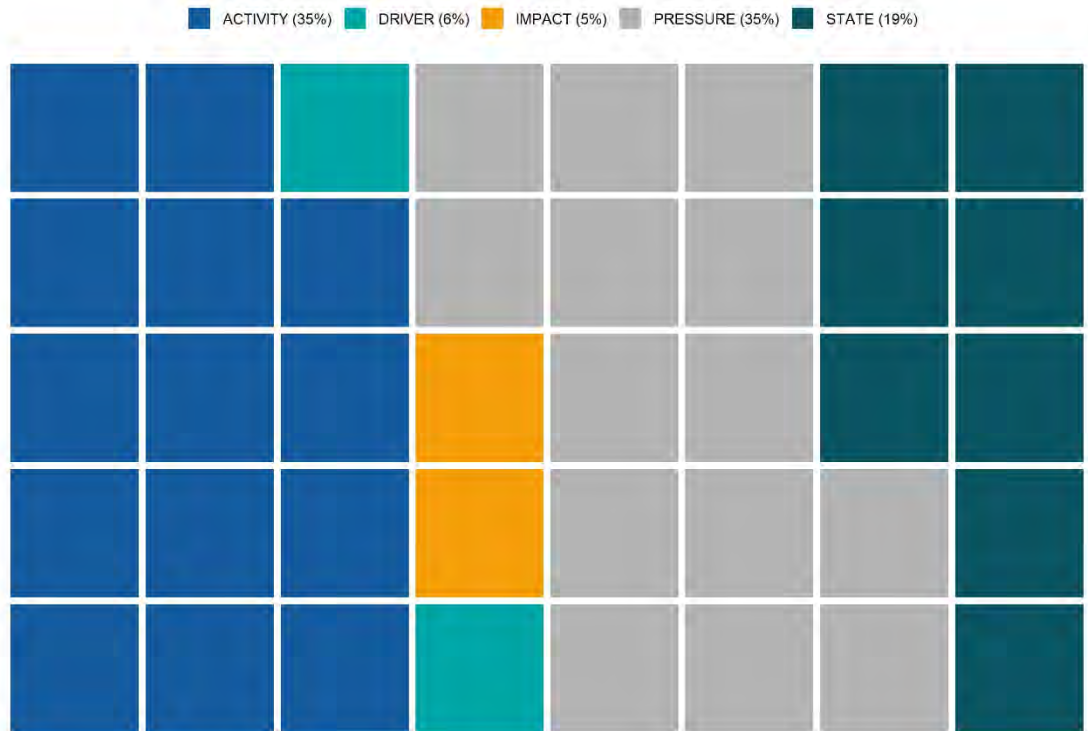
Through the development of the PoMs an ecosystem based approach linking human-social systems to environmental systems was used. Analyses of the final PoMs developed indicates that overall measures focused primarily on specific activities (35 %) that result in pressures on the marine environment and altering the resultant pressure (35 %) they impose (Figure 20). Fewer measures were focused on improving the state of the marine environment (19 %) and 5 % of measures focused on altering the impact and 6 % focus

on drivers. Impact related measures mainly focused on marine litter.

When considered within each descriptor the biodiversity related descriptors (D1, D3, D4, and D6) include the highest percentage of measures aimed at improving the state of the environment. This is reflective of the measures required to remediate the status of these descriptors (e.g. the application of measures relating to the Natura Directives, OSPAR recommendations and spatial protection measures).



Photo courtesy of An Taisce Love your Coasts finalists 2020



Number of measures for each Descriptor and DAPSIR

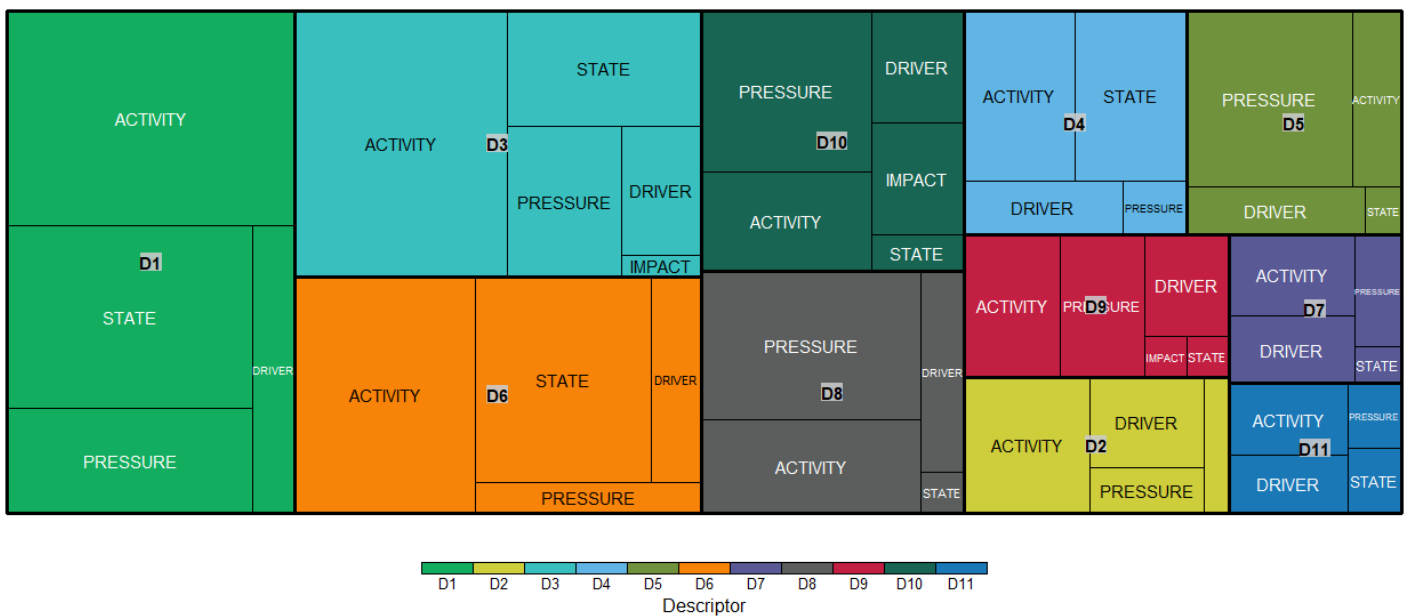


Figure 20. The percentage of measures broken down by the Driver–Activity–Pressure–State–Impact–Response (DAPSIR) approach for all measures (top) and for each descriptor (bottom).

Annexes

Annex 1. Ireland's Environmental Targets

Descriptor	Target Code	Target Description
1	IE-D1T1	The mortality rate per species from incidental by-catch is below levels which threaten the species, such that it's long-term viability is ensured.
	IE-D1T2	The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured.
	IE-D1T4	The species distributional range and, where relevant, pattern is in line with prevailing physiographic, geographic and climatic conditions.
	IE-D1T5	The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species.
2	IE-D2T1	The number of non-indigenous species which are newly introduced via human activity into the wild, per assessment period is minimised and where possible reduced to zero.
3	IE-D3T1	The Fishing mortality rate of populations of commercially exploited species is at or below levels which can produce the maximum sustainable yield (MSY).
	IE-D3T2	The Spawning Stock Biomass of populations of commercially exploited species are above biomass levels capable of producing maximum sustainable yield.
4	IE-D4T1	The diversity (species composition and their relative abundance) of the trophic guild is not adversely affected due to anthropogenic pressures.
	IE-D4T2	The balance of total abundance between the trophic guilds is not adversely affected due to anthropogenic pressures.
5	IE-D5T1	Nutrient concentrations are not at levels that indicate adverse eutrophication effects.
	IE-D5T2	Chlorophyll a concentrations are not at levels that indicate adverse effects of nutrient enrichment.
	IE-D5T3	The concentration of dissolved oxygen is not reduced due to nutrient enrichment.
6	IE-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 are safeguarded and that benthic ecosystems, in particular, are not adversely affected
	IE-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 are safeguarded and that benthic ecosystems, in particular, are not adversely affected.
	IE-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.
	IE-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.
7	IE-D7T1	The spatial extent and distribution of permanent alteration of hydrographical conditions to the seabed and water column, is at a level that ensures that the structure and functions of the ecosystems are safeguarded and that benthic ecosystems, in particular, are not adversely affected.
8	IE-D8T1a	Within coastal and territorial waters, the concentrations of contaminants do not exceed the threshold values set in accordance with Directive 2000/60/EC.

	IE-D8T1b	Concentration of contaminants in marine matrices are assessed in accordance with OSPAR Coordinated Environmental Monitoring Programme (CEMP) do not exceed OSPAR Environmental Assessment Criteria (EAC) and concentrations are not increasing.
	IE-D8T2	The health of species and the condition of habitats (such as their species composition and relative abundance at locations of chronic pollution) are not adversely affected due to contaminants including cumulative and synergistic effects.
	IE-D8T3	The spatial extent and duration of significant acute pollution events are minimised.
9	IE-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).
10	IE-D10T1a	The composition, amount and spatial distribution of litter in the coastline, and on the seabed, are at levels that do not cause harm to the coastal or marine environment.
	IE-D10T1b	In accordance with the provisions of Article 5 of Directive (EU) 2019/904 by year-end 2023 eliminate beach litter caused by the items prohibited from the market under that Directive. These items are; plastic cotton bud sticks, disposable plastic cutlery and plates, plastic straws, plastic beverage stirrers, plastic balloon sticks, expandable polystyrene fast food containers and expandable polystyrene beverage containers and cups.
11	IE-D11T1	The spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals.

Annex 2. Cost Benefit Analysis for Measure M232

Introduction

For the second implementation cycle of the Marine Strategy Framework Directive (MSFD, 2008/56/EC) Marine Strategy Part 3: Programme of Measures, the Department of Housing, Local Government and Heritage (DHLGH) identified a new measure as requiring an economic impact analysis under the directive. The new measure is related to Ireland's Environment target D2T1 under Descriptor 2: *'Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems'*. To ensure good environmental status under this descriptor, DHLGH has identified the following measure is needed:

'By 2024 Ireland will develop, and by 2026 implement, a non-indigenous species¹⁸ and invasive species¹⁹ management strategy for coastal and marine areas'

The measure is a national policy-driven, management coordination measure, which will identify more targeted prevention and control actions that will be introduced during implementation of such a management strategy. While the management strategy will examine both non-indigenous species and invasive species, this analysis is focused on invasive species only. As prevention and control actions are not yet currently identified, the analysis is limited to the development of the strategy up until the point of implementation.

The broad steps of developing the strategy²⁰ are expected to include the following:

- Set up an expert group to begin national coordination of the marine and coastal NIS strategy and collate expert and stakeholder knowledge.
- Undertake a literature review of national, regional and global concerns relating to marine and coastal NIS and invasive species prevention, control and management
- Carry out a gap analysis in terms of Ireland's current strategy.
- Identify prevention and control actions for the different pathways and species identified in the gap analysis.
- Develop guidance and best practise relating to the actions required.
- By 2026, ensure implementation.
- Review steps 2 -6 as required every 6 years.

Under Article 13 (3) of the MSFD there is a requirement for new measures to undergo a cost benefit analysis. However, many of the benefits expected from achieving good environmental status under the MSFD are not captured in existing markets as they have non-market values (Bertram and Rehdanz, 2013). Also, without knowledge of the actions arising from the management strategy, measuring its impact is difficult. Added to this difficulty is the limited knowledge linking the functioning of complex marine ecosystems to the socioeconomic impacts and human well-being impact of any actions arising from a management strategy, all of which makes a quantitative cost benefit analysis extremely difficult.

As noted by DG Environment (2014) a cost-benefit analysis does not necessarily have to be in

¹⁸ Non-Indigenous Species (NIS) are defined, the same as alien species, meaning any live specimen of a species, subspecies or lower taxon of animals, plants, fungi or microorganisms introduced outside its natural range; it includes any part, gametes, seeds, eggs or propagules of such species, as well as any hybrids, varieties or breeds that might survive and subsequently reproduce (Council Regulation (EU) No 1143/2014)

¹⁹ Invasive Alien Species (IAS) are a subset of established NIS which have spread, are defined as meaning an alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services (Council Regulation (EU) No 1143/2014).

²⁰ Steps provided by Department of Housing, Local Government and Heritage.

quantitative or in monetary terms and can be done at various levels. The approach taken here is a partial cost-benefit analysis where only a part of the costs and benefits can be quantified and monetised. Where costs cannot, qualitative impacts and contextual economic values are highlighted.

Background to Marine Invasive Species

Increased global trade and environmental change exacerbate the spread and intensity of marine biological invasions. Kelly et al. (2013) have showed that trends in introductions of invasive alien species have increased dramatically in Ireland since the beginning of the 20th century and has accelerated further in the start of the 21st century. Species risk assessment and horizon scan exercises undertaken at the all-island level since 2013 (Kelly et al., 2013, Minchin, 2014, Lucy et al, 2020), repeatedly have marine species in the top ranking of risk. However, it is also widely recognised that there is a paucity of information related to species in the marine environment such as native status, evidence of impact, and management options.

For marine and coastal environments, managing invasive alien species is particularly challenging because marine ecosystems are highly connected across broad spatial scales. Defining alien invasive species in the marine environment can be difficult as many new marine species in Irish waters are undergoing range expansion due to climate change.

Once introduced and established in the marine environment, the ability to eradicate or control an alien invasive species is extremely low given connectivity of the environment to facilitate natural dispersal, low feasibility of control measures, and risks of non-target impact of control measures.

Therefore, a focus on prevention, early detection and rapid response measures is needed. Such

measures should take account of the pathways and vectors of introduction, risk assessments, contingency planning, biosecurity measures, surveillance and monitoring systems, and risk management. This measure will enable prioritisation of actions based on their effectiveness, technical feasibility, social acceptance, impacts, and cost. It will also contribute towards the marine element of the Programme for Government's commitment to develop a new National Invasive Species Management (Irish Government, 2020).

Box 1 (below) gives examples of impacts associated with various marine and coastal invasive alien species that are either in Ireland, or that are risk at becoming established here. For some invasive alien species there are costs associated with their control and these costs are also noted.

Box 1: Species Case Examples

Chinese mitten crab (*Eriocheir sinensis*)

The Chinese mitten crab is a regulated invasive alien species of Union concern and was confirmed established in Waterford harbour in 2021. Unlikely to eradicate so will be obliged to manage populations to reduce impact. Potential impact on destabilising riverbanks, competition with the native crab *Carcinus maenas* in estuaries, and widespread impacts on native fish and invertebrates as there are no native freshwater crab in Ireland. The estimated cost of control in Germany is €80 million since 1912 (GISD, 2022).

Carpet sea-squirt (*Didemnum vexillum*)

This species was first discovered in Malahide marina in 2005 (Minchin & Sides, 2006). *Didemnum* has been of great concern globally because of its ability to rapidly overgrow and encapsulate other species leading to alterations in the diversity and structure of marine habitats and communities alongside significant impacts to shellfish aquaculture (Carman & Grunden 2010; Switzer et al. 2011; Fletcher et al., 2013). Eradication programmes in New Zealand and Wales have been estimated to cost \$650,000 (NZD) and £385,000 respectively (Coutts and Forrest, 2007; Holt and Cordingly 2011).

Wireweed (*Sargassum muticum*)

Since it was first recorded in Irish waters in 1995, wireweed has spread around the entire Irish coastline. Its prolific growth has been shown to compete with native macroalgae as well as significantly reducing primary production and species richness and diversity (Harries et al, 2007, Salvaterra et al., 2013). To date control measures have not proved effective or sustainable (Davidson, 2009).

Australasian Barnacle (*Austrominius modestus*)

First recorded in Cork in the 1950's, this Australasian species is now found around much of the Irish coast. It is known to outcompete native barnacle species in warmer and more sheltered conditions (Gallagher, 2017), while failing to do so elsewhere due to colder and more exposed conditions (Gallagher, 2015).

Blue crab (*Callinectes sapidus*)

In February 2021, the remains of a blue crab were discovered on Dollymount Strand in Dublin. Blue crabs are highly aggressive and can have devastating impacts on native marine fauna, as well as causing damage to fishing gear (Clavero et al. 2022, Guijarro-García, 2019). Once established, and in the absence of natural predators, fishing is the only option for control, an activity which itself can yield financial benefits for coastal fishers.

Clubbed or Stalked sea squirt (*Styela clava*)

One marine invasive species of concern that is already in Ireland is *Styela clava*, (Michin et al., 2006, Nunn and Minchin, 2009) also known as the Clubbed or Stalked sea squirt (Lucy et al., 2021). The species is originally native to the Northwest Pacific and has been known to cause declines in the production of the cultivated mussel *Mytilus edulis* in Canada through competition for space and food (Bourque et al. 2005). It has also been identified as a risk for shellfish production in France (Davis and Davis, 2010). Soliman and Inglis (2018) estimated direct economic impacts on producers of New Zealand green-lipped mussel *Perna canaliculus* from *Styela clava* of NZ\$ 23.9 million over 24 years.

Legislation and Policy

Ireland is committed to and obliged to take action to address the threats from invasive alien species in a suite of international, European, and national policy and legislation. Brief details on a selection of some of the more pertinent policy and legislation is given below:

The *Marine Strategy Framework Directive* [2008/56/EC] came into force on 17 June 2008. The Directive aims to achieve Good Environmental Status (GES) of the EU's marine waters to protect the resource base upon which marine-related economic and social activities depend. In order to achieve its goal, 11 high level descriptors of GES are set out with Descriptor 2 stating that non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems. Ireland's Initial Assessment (2013) describes the GES for Descriptor 2 as: "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". Combined with this Ireland's Environmental Threshold for Descriptor 2: 'Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems'.

The EU *Regulation on the prevention and management of the introduction and spread of invasive alien species* [1143/2014] is a binding legal tool for all Member States, that entered into force January 1st, 2015. The Regulation lays down rules to prevent, minimise and mitigate the adverse impacts of the introduction, and spread, both intentional and unintentional, of invasive alien species on biodiversity and the related ecosystem services, as well as other adverse impact on human health or the economy. Actions are centred around a core list of Invasive Alien Species of Union concern. Currently there are 88 species on

that list, with 7 of those associated with marine or brackish waters.

The *Wildlife Amendment Act (2000)* of *The Wildlife Act (1976)* made it an offence to cause or allow exotic species (plants and animals) to be released, escape, plant or grow in a wild state anywhere Ireland.

The *European Communities (Birds and Natural Habitats) Regulations 2011* [S.I. 477/2011] contain important provisions to address the problem of invasive species. A blacklist of unwanted species is set out in the Regulations. It is an offence without a licence, to release or allow to disperse or escape, to breed, propagate a schedule list of species under Regulation 49: Prohibition on introduction and dispersal of certain species. Fifteen Third Schedule species are associated with marine or brackish waters.

The *Ballast Water Management Convention* was adopted in 2004 to introduce global regulations to control the transfer of potentially invasive species and entered into force on 8th September 2017. Under the Convention, all ships in international traffic are required to manage their ballast water and sediments to a certain standard.

As noted above, the Programme for Government commits to develop a new National Invasive Species Management Strategy (Irish Government, 2020). The Measure proposed under the MSFD also align with a number of proposed actions outlined in the Ireland's 4th National Biodiversity Action Plan (DHLGH, 2022). The proposed outcomes "aim to prevent the arrival of invasive species in Ireland, and ensure a rapid response to new invasions where they occur. Actions are also proposed for the effective control of those invasive species already present in Ireland related to invasive alien species actions in Ireland".

Economic Impact of Marine Invasive Species

The ecological impacts of invasive species can have significant economic consequences. The associated loss of ecosystem goods and services, along with efforts to manage and control biological invasions, incur substantial costs internationally and in Ireland. Bax et al. (2003) identified the main economic impacts of invasive marine species as negative impacts on human health and decreases in economic production of activities dependent on marine environments including fisheries, aquaculture, tourism and activities dependent on marine infrastructure such as shipping and offshore energy production. Using the InvaCost project (Diagne et al., 2020) and Cuthbert et al. (2021), the global costs of aquatic invasive species was estimated to be at least US\$23 billion in 2020 (although marine invasive species only consisted of 1% of these costs based on their records). The authors noted a bias in cost reporting towards terrestrial systems.

In Europe, 11 % of the 12,000 introduced non-indigenous species are estimated to be invasive species (EU, 2014) causing damages of at least €12.7 billion per year in Europe (Kettunen et al, 2008). The latter study noted that marine species accounted for €93.4 million of damages; however this was based on only 5 species identified. The study again highlights that the environmental and economic impacts of invasive species in marine space can be less noticeable either due to lack of data or because they are harder to research (Chan and Briski, 2017).

In Ireland, there has been a limited number of studies undertaken to assess the costs associated with not controlling invasive species. Kelly et al. (2013) used value transfer to estimate the cost of invasive species in Republic of Ireland (ROI) and Northern Ireland. They estimated damages costed at €261 million per year for the island of Ireland and €202 million for the ROI. Focusing on the ROI, they estimated annual damages due to marine invasive species of €720,000 for aquaculture and €9.8 million for tourism and recreation, although

for the latter there is no further breakdown for marine and coastal tourism. More recently, Lucy et al. (2021) also used a value transfer exercise adjusting for GDP and using the InvaCost project (Diagne et al., 2020) to estimate the costs of incurred total invasion, both terrestrial and aquatic, of €2.1 billion in Ireland in 2020.

Norton and Hynes (2014) used a choice experiment to estimate the cost of degradation for not meeting good environmental status under the MSFD. One of the attributes in the choice experiment was invasive species entering Ireland impacting local marine ecosystems. The estimated cost of new invasive species entering Ireland (measured as the loss in welfare value to Irish society) was estimated at €25.30 per person.

Cost Effectiveness Analysis

Two alternatives have been identified:

Alternative 1 – The development of a Marine Non-Indigenous Species Strategy

Alternative 2 – 'No action' (i.e. business as usual) option,

Since only one positive action is being compared to the base case of no action, the cost benefit analysis below also acts as the cost effectiveness analysis for this measure.

Cost Benefit Analysis

Hanley and Roberts (2019) state that were the controls not to be implemented, the net economic benefits of a management strategy for invasive species are equal to the avoided costs of damages from invasive species less the costs of control and any benefits forgone following removal or reduction of invasive species. Where figures are given over a number of years, the Irish Public Spending Code for Cost Benefit Analysis in Ireland (DPER, 2012) are used to discount all future value estimates using the recommended discount rate of 4 %.

This partial cost-benefit analysis, where only certain costs and benefits are quantified and monetised and where they cannot, qualitative impacts and contextual economic values are highlighted. Following Hanley and Roberts (2019) the cost benefit analysis is broken down into the following sections:

Benefits

Direct costs

Benefits forgone

Net benefits.

Benefits

The benefits of a management strategy for invasive species is equal to the avoided costs of damages from invasive species. Therefore, we can examine the main sectors likely to suffer damage from invasive species. The benefits arising from the development and implementation of a management strategy are hard to identify without knowledge of the actions arising from such a strategy but some contextual economic values are outlined to highlight the likely economic contributions for sectors most likely to benefit from a management strategy, namely:

Aquaculture

Shipping and transport

Marine tourism

General public

Aquaculture

Aquaculture may paradoxically be a vector of new invasive species and be negatively impacted by invasive species (Murray, 2020). The overgrowth of stock and equipment by organisms known as biofouling, represents one of the most significant impacts in marine shellfish aquaculture. Invasive species can be the most dominant and disruptive organisms within biofouling communities. Biofouling causes substantial operational challenges and significant economic impacts to aquaculture and other marine industries globally.

Total aquaculture production in Ireland was valued at €175 million in 2021 with the industry employing 1,984 persons (BIM, 2022). The aquaculture sector is particularly important in rural coastal regions along the west coast of Ireland and any impact could have significant local community effects. Shellfish production (oyster and mussel) is responsible for €64 million of this output value. In Ireland, *Mytilus edulis* (cultivated mussel) is a significant economic species with production of 17,800 tonnes in 2021 (BIM, 2022). *Crepidula fornicate* (American slipper limpet) has been shown in experiments to cause a 28-30% mortality in mussels *Mytilus edulis* (Thieltges, 2005). Further expansion of *Crepidula fornicate*, *Styela clava*, or other similar invasive species, to production sites may pose a significant economic risk to the shellfish sector.

Currently, there is shellfish monitoring ongoing for invasive species for the mussel export market to the Netherlands (part funded by Dutch importers). This monitoring consists of surveys in key aquaculture bays and non-aquaculture bays around Ireland to contribute to the baseline species register and ongoing monitoring with risk assessments for key species of concern and is estimated to cost c. €110,000 per annum. This is weighed against exports valued at circa €11 million in 2021 to the Netherlands (Devine, 2022).

Shipping and transport

The transport of invasive species through global shipping is seen as one of the significant methods for marine invasive species to enter new marine environments via ballast water, hull attachment or other means. In Ireland, Miriman et al. (2019) estimated that 61% of marine invasive species were introduced through shipping. In addition to being vectors, invasive may also cause economic lost to the sector through increased fouling necessitating increased hull inspection, maintenance and cleaning in order to reduce drag costs.

Fernandes et al. (2015) estimated operational cost of non-indigenous species (NIS) mitigation measures could account for between 1.6 % and 4 % of the annual operational cost for a ship operating on European seas. Additionally, fouling by NIS may affect fuel consumption more than fouling by native species due to differences in species' life-history traits and NIS may have increased resistance to antifouling coatings and pollution relative to native species (Fernandes et al., 2015). In 2019, the Irish shipping and maritime transport sector had a turnover of €2.2 billion and employed 4,908 full time equivalents (FTE) (Hynes and Ahern, 2020).

Marine tourism

The marine tourism sector in Ireland is responsible for over half of all employment in Ireland's ocean economy (17,471 FTE) generating €1.2 billion in turnover (Hynes and Ahern, 2020). Again, similar to previous sectors, some marine tourism (e.g. boating) can act as vector for marine invasive species (Hall, 2015) and they can also have economic impact directly due to fouling of marine infrastructure and possible closure of beaches and bathing waters related to harmful algae blooms (Marampouti et al., 2021). However, even environmentally damaging marine invasive species can have mixed effects on tourism as shown by the

expanding range of the lionfish in the Caribbean (Malpica-Cruz et al, 2017).

Of particular concern is the impact on marinas with overgrowth on marina pontoons, mooring chains, ropes, jetties and breakwater walls. Many biofouling marine species are native, however it is often invasive alien biofouling species that are the fastest growing and contribute disproportionately to overall fouling biomass on artificial surfaces (Tyrrell and Byers, 2007). Keeping marina structures clear of fouling is also important for the reputation of the marina and the overall tourism product. Customers often factor this into decisions regarding where to moor their boats. Heavily fouled marinas can facilitate the accumulation of biofouling on boats more rapidly and require boat owners to carry out hull cleaning more frequently.

General public

Lowering the probability of invasive species establishing themselves in Ireland will lower the risk of ecosystem impacts and is linked to improved marine environmental status. Using the value of the implicit cost of new marine invasive species entering Irish waters (€25.30 per person, 2012 prices) from the choice experiment by Norton and Hynes (2014), the economic benefits of avoiding these costs for the Irish public can be estimated by adjusting for inflation and population growth.

For inflation, the Irish Consumer Price Index (CPI) is used (CSO, 2021) to adjust the above figure from 2012 to 2021. The rise in prices over this period based on the CPI is 4.25 %. Adjusting the figure to 2021 prices gives a value of €26.38 per person.

Data from the latest Irish census in 2022 broken down by age group was not available at the time of this report so estimates of population 15 years plus from the Population and Migration Estimates, April 2022 (CSO, 2022) are used. The totals between census and Population and Migration Estimates generally differ by less than 0.5%. The estimate is 4.016 million persons. Aggregating the

inflation adjusted figure by these numbers gives an estimate of €106 million in terms of benefits to the public if a Marine Non-Indigenous Species Strategy ensures no new marine invasive species are established Irish marine waters.

Direct costs

The main costs in the development of the strategy have been estimated by the DHLGH and are shown in table 1. These direct costs include the costs of labour, research and other administration costs that would cover the production of a final Marine Non-Indigenous Species Strategy document at the end of year 3.

Table 1. Estimated costs of development of a non-indigenous species and invasive species management strategy for coastal and marine areas for Ireland²¹

Year	Costs (€)
Year 1	€100,000
Year 2	€96,154
Year 3	<u>€138,683</u>
Estimated total costs	€334,837

Benefits foregone

As noted by Hanley and Roberts (2019) there may be some non-indigenous species that bring benefits. An example of a non-indigenous species already in Ireland that has positive benefits is the Pacific Oyster (*Magallana gigas*) which is farmed but has wild populations established also. The aquaculture production associated with the pacific oyster was estimated to be 10,122 tonnes output in 2018 with a value of €44.3 million (BIM, 2019). Without specific actions identified from a management strategy, it is not possible to measure the impact of any benefits foregone currently.

Net Benefits

Similar to above, the net benefits of this Measure are difficult to estimate as there are not enough specifics regarding the actions that will arise from this management strategy. However, if developing the strategy contributes to a reduction of even 1 % risk to the economic sectors most impacted by invasive marine species, then it is highly probable that the benefit cost ratio would be above unity, i.e. the benefits would exceed the costs of this management strategy.

Summary

Although it is not possible to undertake a full quantitative cost-benefit analysis of this new Measure, this report attempts to gather as much information to weigh the costs and benefits of a new measure for Ireland namely, ‘By 2024 Ireland will develop, and by 2026 implement, a non-indigenous species and invasive species management strategy for coastal and marine areas’. The above analysis demonstrates that there is considerable evidence that alien invasive species can cause significant damage to ecosystems, society and economic sectors. Creating a management strategy will create benefits equal to the avoided costs of damages from invasive species. Given the relatively low costs of developing the management strategy compared to the economic costs associated with possible damages of invasive alien species in Ireland’s coastal and marine areas shows that it is highly probable that this Measure’s benefits would exceed its costs.

²¹ Estimates based on correspondence with Department of Housing, Local Government and Heritage.

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