WORKING GROUP ON BYCATCH OF PROTECTED SPECIES (WGBYC)

January 2024: Report updated with the correct list of WGBYC 2023 meeting participants (in Annex 1)

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i Executive summary

The Working Group on Bycatch of Protected Species (WGBYC) was established in 2007 and collates and analyses information from across the Northeast Atlantic and adjacent sea areas (Baltic, Mediterranean and Black Seas) related to the bycatch of protected, endangered and threatened (PET) species, including marine mammals, seabirds, turtles and sensitive fish species in commercial fishing operations.

WGBYC seeks to describe and improve understanding of the likely impacts of fishing activities on affected populations, to inform on the suitability of existing at-sea monitoring programmes for assessing sensitive species bycatch, and to collate information on bycatch mitigation efforts. In 2023, the WG met in hybrid format and addressed eight Terms of Reference.

The report provides an overview of data collection activities during 2022 including details of reported monitoring and fishing effort data, and bycatch records that were submitted to the WGBYC database in 2023 following a formal data call. Data were requested from 17 of the 20 ICES countries, six EU Mediterranean countries and two EU Black Sea countries. 23 of the 25 contacted countries submitted data.

WGBYC further expanded the BEAM approach which was first developed in 2022 and is designed for evaluating and quantitatively assessing population impacts of bycatch across the full range of relevant taxa by considering various criteria, including data availability, quality and representativity, within group expertise and the existence of management/conservation thresholds or reference points. The BEAM approach underpins the requirement of the agreement between ICES and DGMARE for the provision of annual advice on bycatch. Estimated bycatch mortality ranges, by ecoregion and gear type, were produced for several mammal, seabird, turtle and fish species listed on the EU priority species list and the ICES Roadmap for Bycatch Advice ecoregion species list.

In 2023 WGBYC developed a new semi-quantitative and repeatable methodology for evaluating bycatch risk for high priority data limited species for which reliable quantitative assessments cannot currently be carried out using the BEAM approach. WGBYC proposed a process where taxa specific experts contribute biological, demographic and distribution data to metadata tables which are combined with bycatch and fishing effort data to inform risk matrices to evaluate bycatch risk by species, gear type, area and potential population impact.

A risk-based approach to highlight potential monitoring gaps and inform coordinated sampling designs was further developed and expanded and provides useful insights into which métiers may currently be under-sampled by existing at-sea data collection programmes with respect to PET species bycatch.

WGBYC prepared tables and plots describing data reporting in 2022, multi-annual bycatch rates and estimates, and prepared draft text to contribute to the 2023 recurrent advice drafting process.

ii Expert group information

Expert group name	Working Group on Bycatch of Protected Species (WGBYC)
Expert group cycle	Annual
Year cycle started	2023
Reporting year in cycle	1/1
Chair(s)	Allen Kingston
	Gudjon Sigurdsson
Meeting venue(s) and dates	18-22 September 2023 Sukkarieta, Spain (36 total participants)

1 Introduction

The ICES Working Group on Bycatch of Protected Species (WGBYC) met by hybrid meeting (in person and remotely using Microsoft Teams) from 18 – 22 September 2023. The meeting was attended by 42 scientists (formal members and chair-invited experts) from ICES and/or EU member states, one observer from the European Commission and two ICES staff members.

The group addressed eight Terms of Reference (ToR):

a) Review and summarize information submitted through the annual bycatch data call and other means for assessment of protected/sensitive species bycatch;

b) Collate and review information from WGFTB national reports, other ICES WGs and recent published documents relating to implementation of protected/sensitive species bycatch mitigation measures and summarize recent and ongoing bycatch mitigation trials;

c) Consider the quality of data available for use in the estimation of bycatch rates of protected species through a Bycatch Evaluation and Assessment Matrix, BEAM, to underpin assessments on the bycatch range (minimum/maximum) as appropriate, and where possible, to identify likely conservation level threats;

d) For high priority species, for which the bycatch rates and associated markers of sustainability are unavailable, highlight the types of fishing gears and fishing activities which pose the greatest risk to these species;

e) Review ongoing monitoring of different taxonomic groups in relation to spatial bycatch risk and fishing effort to inform coordinated sampling plans;

f) Coordinate with other ICES WGs to ensure complete compilation of data on protected species bycatch from multiple sources and to develop and improve on methods for bycatch monitoring, research and assessment as outlined in the ICES Roadmap for bycatch advice on protected, endangered and threatened species (Intersessional);

g) Continue, in cooperation with the ICES Data Centre to develop, improve, populate and maintain the WGBYC and RDBES databases on bycatch monitoring and fishing effort in ICES and Mediterranean waters through formal data calls (Intersessional).

h) Produce first drafts of the advice for the i) recurrent advice request from the European Commission, and ii) relevant ICES Fisheries Overviews (Intersessional).

The meeting followed the standard WGBYC format of plenary based task agreement and allocation on the first day, then subgroup working with short daily plenary sessions, and a longer plenary session on the final day to agree text (including conclusions and recommendations), draft 2024 resolutions and decide the 2024 meeting venue. In addition to the work carried out to address the groups ToRs described in Sections 3 to 10 of this report, several presentations were also made by WGBYC members and invited guests on a range of topics of direct relevance to bycatch monitoring, mitigation and assessment. Presentation abstracts are provided below.

The report contains a number of acronyms, abbreviations, and initialisms. These can be found through the ICES vocabulary website here: https://vocab.ices.dk/ and in Annex 10.

Update on the CIBBRiNA project.

Marije Siemensma, CIBBRiNA co-lead WP2, on behalf of the Ministry of Agriculture, Nature and Food Quality.

The EU LIFE CIBBRiNA project was granted in July 2023. It runs from September 2023 until September 2029. It has officially started with the Kick-off meeting in 7 and 8 September in Amsterdam. CIBBRiNA – The *Coordinated Development and Implementation of Best Practice in Bycatch Reduction in the North Atlantic, Baltic and Mediterranean regions – has the overall aim to work together with fishers, authorities and other relevant stakeholders to minimise - and, where possible, eliminate – incidental bycatch of priority Endangered, Threatened and Protected (ETP) marine species. This will be done by optimising, developing and evaluating proven and promising mitigation methods as well as support tools and processes, such as monitoring and assessment, and working to ensure their long-term implementation. There are 35 beneficiary partners and 10 associated partners. ICES is one of the associated partners. Fundamental principles of CIBBRiNA are: Creating trust. Mutual respect and understanding of the different perspectives of all partners involved is essential; Creating a 'safe environment' to work together is a vital part of CIBBRiNA; All project partners have agreed to set of key values and project principles. These include among others: To work jointly with fishers, scientists, policymakers and NGO's; To have an open minds towards possible solutions; To work on solutions that are suitable for use by fishers and applicable for multiple gears, regions and species. To generate a safe working space for co-production, data sharing, testing and assessing tools and measures; To build upon existing work to avoid repetition, while remaining sensitive to possible limitations of earlier approaches.*

Several members of WGBYC have a significant role in CIBBRiNA. This should enhance cooperation and prevents duplication of effort. Within CIBBRiNA case studies will be carried out in cooperation with the industry on different gear types such as gillnets, longlines, bottom trawl and pelagic trawl fisheries.

WP2 focuses on stakeholder engagement with the aim to engage and seek cooperation of all stakeholders through the development of a common language and shared strategy on incidental bycatch solutions, in which understanding different perspectives and approaches is essential; to achieve active participation of fishers involved in fisheries in the North-East Atlantic (including the Baltic Sea) where there is a risk of incidental bycatch of priority marine protected species. Also a participatory toolkit that includes capacity building, creating a safe cooperation environment, peer to peer exchange, implementing expertise exchange groups is part of WP2.

CIBBRiNA WP4 is of relevance for WGBYC as it aims to develop a mitigation toolkit, and WP5 as well, that focuses on data collection by estimating fishing effort in case studies, improving bycatch monitoring in the case studies and looking at stranding data as an alternative source of bycatch data. WP6 aims to develop a framework to assess the conservation and socio-economic implications of bycatch.

Next steps within CIBBRiNA are to review and map out interactions with other stakeholders and initiatives and to find the right routes of cooperation with working groups such as WGBYC.

For more information contact CIBBRiNA: CIBBRiNA@minlnv.nl

Action plan to reduce bycatch in French waters.

Helene Peltier, Pelagis Observatory, University of La Rochelle.

The French plan outlining spatio-temporal measures to reduce unintentional captures of small cetaceans in the Bay of Biscay for the years 2024, 2025, and 2026 has been presented. At the time of the WGBYC meeting, the associated decree was undergoing a public consultation process.

The decree considers the ICES opinion of January 24, 2023 encourages France to continue testing to find sustainable technical solutions to this problem, particularly for gillnetters. It also considers the objectives of reducing incidental catches in the Bay of Biscay, acquiring knowledge about interactions between fishing gear and small cetaceans, and the large-scale testing of technical solutions for the gillnet fleet and the reduction of incidental catches in the Bay of Biscay, as set out in the European Commission's reasoned opinion of July 15, 2022 and the Council of State's decision of March 20, 2023.

The decree bans fishing gear that risks bycatch of small cetaceans (OTM, PTM, PTB, GNS and GTR) in ICES subareas 8abcd from January 22 to February 20 inclusive for the years 2024 to 2026. For the year 2024, the ban does not apply to vessels equipped with active technical devices to reduce bycatches or an active remote electronic observation system (list of devices to be published, not available at the time of the WGBYC meeting).

Ships that have committed to being equipped as per the provisions of this decree but are unable to complete the equipment due to material or technical constraints before January 15, 2024, will face the following restrictions:

1. A fixed 10-day period from January 22 to February 1, 2024, inclusive.

2. Two separate periods of 10 consecutive days, as determined by the shipowner, between January 15 and March 31, 2024. These two periods must not overlap with the fixed period.

The presentation of the decree has raised several questions and concerns. The overall structure of the ban lacks comprehensive details regarding its objectives (no proposed targets for reducing bycatch) and includes elements in its implementation that may hinder the assessment of its effectiveness. For instance, the unrestricted selection of bycatch reduction devices (left to the discretion of the shipowner) and the numerous exemptions from the ban make it difficult to establish a clear sampling plan that could be used for a scientific assessment of the ban's impact. Given this context, it is advisable to limit the use of bycatch reduction devices to those that have already been tested through scientific protocols and have demonstrated sufficient effectiveness, especially for common dolphins in the north-east Atlantic.

Furthermore, the 10-day window for simultaneous banning of vessels not yet equipped in 2024 does not align with any of the scenarios proposed by ICES in 2023. It closely resembles scenarios I (PTB/PTB pingers all year + 4-week closure for all other métiers) and K (PTB/PTM pingers all year). None of these scenarios appears to enable the achievement of the objective of reducing bycatches below the PBR. In light of these considerations, the potential of the action plan to effectively reduce bycatch remains questionable.

Bycatch in the Black Sea

Dimitar Popov, Green Balkans.

In Bulgaria (Black Sea region), on-board monitoring program for the bycatch of marine mammals in turbot bottom set gillnet fishery has been carried out by Green Balkans NGO in the period 2019-2023. The program was funded by various projects and donors (CeNoBS, ACCOBAMS, New England Aquarium, OceanCare). It has included varying number of vessels (3 to 6) fishing turbot (a quota species) that represent 2.4-4.3% of licensed boats. The focus of the monitoring is cetaceans and the largest share is that of Black Sea harbour porpoise. In total 275 cetaceans were recorded as bycatch: 259 porpoises, 13 bottlenose dolphins and 3 common dolphins. Turbot gillnet fishery in Bulgarian waters typically operates in two seasons: spring (before 15 April) and summer (after 15 July). During the conducted monitoring higher average bycatch rates were observed in summer compared to spring with only exception being in 2022, probably related to the on-going war of Russia in Ukraine.

In addition, trials of different pingers were made with the aim to mitigate bycatch. Three models were tested: Future Oceans 10 kHz, Future Oceans 70 kHz and PAL Wideband pinger. Only the PAL Wideband has shown significant reduction of bycatch: 86 % ($p<0.05$, u-test).

Collected data was used to estimate total bycatch by Bulgarian turbot fishing fleet and compare that with relative abundance in Bulgarian territorial and shelf waters in the Black Sea. Annual bycatch total of porpoises varied between 593 and 2515 ind. accounting for 8.6 to 38.4% of abundance estimates. Data for the period 2019-2021 was used for basin estimation of Black Sea harbour porpoise bycatch rates in light of new abundance estimates derived from CeNoBS aerial survey in summer 2019 that covered more than 60% of the Black Sea (Popov et al., 2023).

Building a comprehensive pipeline to estimate bycatch among fleets: a case study in the Bay of Biscay common dolphins (*Delphinus delphis*)

[1]Mathieu Brevet, [2]Laurent Dubroca, [1]Matthieu Authier. [1]Pelagis Observatory, University of La Rochelle. [2]IFREMER.

Accidental bycatch is a major cause of marine megafauna decline worldwide. However, obtaining precise estimates of bycatch rates often turns out to be difficult due to scarce data, sometimes being non-randomly acquired and, therefore, partly unrepresentative of reality. We aim here to tackle such an issue by building a comprehensive framework that, from standardized data on fishing vessels' activity and bycatch on a specific species, classifies vessels into strategy clusters (depending on their fishing behaviours), and estimates their bycatch probability along each year in a robust way. For the latter part, we relied both on the phenomenological Bayesian framework developed by Authier et al. (2021), specifically designed to estimate bycatch from potentially non-representative data accurately, and on random forest approaches. In the case of common dolphins' bycatch, this method is applied to the French fishery operating in the Bay of Biscay to model how the different fishing strategies vary in their probability of bycatching dolphins during the most recent years (2019-2022) and which fishing behaviours were the most associated with bycatch risk. A particularly high level of bycatch was observed for strategies targeting soles with trammel nets, hakes and gadoids with gillnets, and pelagic pair trawling targeting sardines or tuna. A side-project on the relationship between bycaught dolphins' phenotype and fishing activities was also presented, revealing that, on average, larger dolphins were caught when using larger mesh size / trawling gear / with the presence of repellent devices / when targeting sole or hake.

Recent analytical improvements to EM video review.

Developments in Electronic monitoring

Lotte Kindt-Larsen, Gildas Glemarec, Abdullah Muhammad

In WGBYC 2023, Lotte Kindt-Larsen from DTU Aqua in Denmark presented the current status of Electronic Monitoring (EM) for ETP species. Denmark has been actively engaged in EM since 2009. In 2011, however, a dedicated monitoring program was initiated specifically for ETP species in Gillnet fisheries. EM systems have been installed on 17 Danish gillnet vessels since then, with monitoring durations varying from several months to years. Since 2013, a system known as Black Box (developed by Anchorlab, Denmark; http://www.anchorlab.dk/) has been utilized. The Black Box systems comprise a control unit connected to a position sensor (GPS) and at least two waterproof CCTV (closed-circuit television) cameras recording fishing activities. These cameras are strategically positioned to capture (by)catch items from different angles—enabling observation as the net emerges from the water and at the sorting table. This approach maximizes the chances of accurately identifying bycatch of ETP species.

Reviewing video footage is a time-consuming process, DTU Aqua has thus commenced transforming their review procedure into automatic picture recognition of ETP species. The initial step involves adapting the analysis software to function seamlessly with AI models (an ongoing process). In collaboration with Anchorlab, DTU has developed new software that includes:

1) A high-speed tool for framing pictures of ETP species (essential for building the picture bank required for AI models).
2) An AI result line integrated into the results overview.
3) An output sheet detailing all AI results for human verification.

With these enhanced tools, DTU aims to implement AI in the analysis tool for monitoring ETP species by 2024. However, human review of EM data will continue until the AI models achieve a level of reliability where no bycatches are overlooked.

Interactions of seabirds and coastal fisheries in Southern Portugal -evaluation, monitoring and mitigation

Marçalo, A., Carvalho, F., Frade, M., Gonçalves, J.M.S. University of the Algarve.

Negative interactions between marine birds and Portuguese fisheries (Division 27.9.a) occur at highest levels mainly in the purse seine and bottom set-net fisheries. Purse seine shows problems especially with the critically endangered Balearic shearwater (*Puffinus mauritanicus*) and bottom-set nets with balearic shearwaters and northern gannet (*Morus bassanus*). To account for a better evaluation, monitoring and mitigation of marine bird bycatch in the Portuguese Southern Eastern coastal waters (off Algarve), work is being performed under the project Life + Ilhas Barreira (2019-2023). Monitoring was performed using harbour interviews and validated with onboard observations. Data on 901 harbour interviews obtained quarterly for more than 2 years to skippers, indicated that the northern gannet and the cormorant (*Phalacrocorax carbo*) are the most captured species in static net fisheries (GNS and GTR). Higher bycatch rates for both species are observed in small local vessels (≤ 9m) compared to larger vessels. The purse seine fishery has greater conflicts with gulls (*Larus sp.).* In both fisheries higher bycatch rates are observed in fall and winter months. Onboard observation based on more than 200 trips, indicated that bycatch events are rare, but when occurring may include the bycatch of several animals in one set. Mitigation approaches were tested during the fishing operations that are considered more problematic, namely net setting and hauling. A visual device (scary bird) and an acoustic device (megaphone) were tested in GNS and GTR fisheries. No bycatch was observed during the mitigation trials but differences in marine bird approach to the vessels was not significant between controls (no device used) and treatment (with devices) for both devices. While onboard, observations indicated that good practices and fisher behaviour changes, such as not discarding or releasing fish viscera to the water during fishing operations (net setting and hauling), could be tested as mitigation tools in this area of study. These good practice chances were tested and provided very promising preliminary outputs with reduced abundance of animals during fishing operations. Foreseen work includes the production of a manual of good practices and a video promoting these good practices to be delivered to the fishing sector in participatory meetings with fishers and other stakeholders.

2 ToR A: Review and summarize information submitted through the annual bycatch data call and other means for assessment of protected sensitive species bycatch

2.1 Legislation concerning the bycatch of protected, endangered and threatened species (PETS)

The work of WGBYC from 2021 onwards is primarily driven by the current agreement between ICES and DG-Mare. Following this agreement ICES *"**will provide**, on the basis of data provided by Member States and any other relevant data sources, **annual estimates of the numbers of specimens of sensitive species** (as defined in Article 6(8) of Regulation (EU)2019/1241) **caught incidentally in fishing activities**, disaggregated **by sea area and type of fishing gear**. These estimates shall be accompanied with evaluations or estimates of their **accuracy where possible**. They shall be provided by December each year and shall cover incidental catches made until 31 December of the previous year. ICES shall progressively accompany these estimates with calculated values of potential biological removal (PBR), or alternative markers of sustainability where appropriate"*. In addition, ICES is asked to *"provide **warnings** of any **serious threats** (i.e., if there is at this moment, **a threat to the abundance posing a risk so serious that it would be unwise to postpone action**) from fishing activities alone or in conjunction with any other relevant activity to local ecosystems or species **as soon as ICES is aware of such threats**"*.

Regulation 812/2004 was repealed and replaced by Regulation (EU) 2019/1241 (hereafter referred to as Reg.2019/1241) of the European Parliament and of the Council *on the conservation of fisheries resources and the protection of marine ecosystems through technical measures (Technical Conservation Measures Regulation)*. The objectives of the new Regulation are:

i) to minimise, and where possible eliminate, incidental catches of sensitive species so that fishery-related mortality does not represent a threat to their conservation status,
j) to minimise negative impacts of fishing on marine habitats and
k) to put in place management measures for the purposes of complying with the Habitats, Birds, Water Framework and Marine Strategy Framework Directives.

These measures shall ensure that bycatches of sensitive species do not exceed levels in Union legislation and international agreements. Member States are required to take the necessary steps to collect data on the relevant species. Provisions on vessel sizes, areas and fishing gears for mitigation and monitoring measures contained in Regulation 812/2004 are retained. Measures to monitor, manage and mitigate bycatches of sensitive species (including but not limited to cetaceans, seabirds and turtles) are subject to regional management through Joint Recommendations to the European Commission prepared by Member States.

Technical descriptions of Acoustic Deterrent Devices (ADDs) carried over from Regulation 812/2004 are contained in the Commission Implementing Regulation (EU) 2020/967 of 3 July 2020 *laying down the detailed rules on the signal and implementation characteristics of acoustic deterrent devices as referred to in Part A of Annex XIII of Regulation (EU) 2019/1241 of the European Parliament and of the Council on the conservation of fisheries resources and the protection of marine ecosystems through technical measures.* This Implementing Regulation mandates that ADDs be functional during the whole duration of the fishing operation, not only at the time when nets are set. It also allows Member States '*to authorise the use of acoustic deterrent devices that do not fulfil the technical specifications or conditions of use defined in the Annex, provided that such devices are at least equally effective in the reduction of incidental catches of cetaceans as the acoustic deterrent devices with the technical specifications or conditions defined in the Annex, and this has been duly documented*'.

There are several other legislative instruments in ICES Member Countries, Regional Fisheries Management Organisations (RFMOs) and other European Union law concerning bycatch of PETS. For an overview of the main pieces of legislation see the section "Introduction to legislative background" of the *Roadmap for ICES bycatch advice on PETS*.

ICES obtains data on PETS bycatch through an annual data call. These data are mainly collected during at-sea observations carried out for the purposes of fisheries monitoring in accordance with the EU Data Collection Framework Regulation 2017/1004 (DCF). While the collection of protected species bycatch data through the DCF as part of the Multiannual Plan (DC-/EU-MAP) may facilitate targeted sampling of métiers of concern, inadequate data collection protocols **may lead to downward bias in the number of recorded events** (see ICES 2015).

There are many other obligations to monitor and introduce measures to reduce protected species bycatch within legislation specific to fisheries and the Common Fisheries Policy. As examples, MS have obligations under Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'). The revised Commission Decision 2017/848 relating to the implementation of the MSFD specifies a primary criterion for the assessment of Good Environmental Status (GES) linked to the assessment of bycatch, Primary criterion: D1C1, through the estimation of mortality rate per species due to incidental fisheries bycatch. Specific to seabirds is the European Commission's 'Action Plan for reducing incidental catches of seabirds in fishing gears' (EU-POA) which was published in 2012. It seeks to provide a management framework to minimise seabird bycatch to as low levels as are practically possible. Robust data pertaining to fishing effort and bycatch monitoring data are required by MS to assess the impact of bycatch and work towards meeting the various legislative requirements and commitments.

2.2 Monitoring data submitted - Overview

ICES/WGBYC requested data from 25 countries (17 ICES member states and 8 EU non-ICES states) through the 2023 data call. 23 countries responded and submitted data on fishing and sampling effort, and bycatch observations, for 2022. Romania and Slovenia did not report any data. All other countries reported fishing effort and monitoring effort data for 2022. Malta was the only country that did not report bycatch records for 2022. A data submission was considered achieved if at least a single value was reported in the fishing effort and/or monitoring effort tables. For bycatch events, only the presence of data was considered, as zero values (e.g., absence of bycatch events) is not clearly defined in the data call. The submission status for 2017-2023 by country are summarized in Table 2.

The quality and scope of the information provided in the ICES WGBYC data call is variable but has steadily improved over the last five years since formal annual data calls have been issued. Consistent with the content of WGBYC reports from previous years the most recent data call has been reviewed for:

1. Implementation of monitoring of PETS bycatch and observation schemes.
2. Information on PETS bycatch, including records of individual bycatch events and levels of monitoring coverage.
3. Other relevant issues emanating from the data call (e.g., exploration of monitoring methods and monitoring programmes reported).

2.3 Monitoring, observed PETS specimens, total and observed effort obtained from the ICES WGBYC data call by ecoregion.

Prior to the WGBYC 2022 meeting, an ICES WGBYC data call (link) requesting 2022 PETS bycatch data from dedicated (e.g. pilot projects or dedicated monitoring programmes) and non-dedicated/multi-purpose (e.g. DCF) monitoring programmes was issued to EU Member States and non-EU ICES Member States with coastal areas in the European Atlantic (e.g., Iceland, Norway and the UK), and EU Member States from the Mediterranean Sea and Black Sea.

The data call requested information on fishing effort, monitoring effort and bycatch of marine mammals, birds, turtles and fish species. For ICES waters, species reference lists for each taxa and ecoregion were provided to data submitters. For GFCM waters, data on all marine mammals, seabirds and sea turtles were requested. For both regions (ICES & GFCM) the EU priority list of species was also provided to data submitters.

This section summarizes all data obtained through the 2023 data call (i.e., 2022 data) which have been extracted from the WGBYC database (see section 8, ToR G). Any issues or inconsistencies associated with submitted data are discussed in the data summary sections below as necessary and in further detail in Section 8 (ToR G).

The total number of specimens and/or number of bycatch incidents of marine mammal, seabird, fish, and marine turtles, total fishing effort and observed effort aggregated by gear type (métier level 3), monitoring method, ecoregion and ICES Division or GFCM Geographic Sub-Area (GSA) for 2021 are summarized in Annex 3. Information for strata with monitoring effort but no reported bycatch incidents are provided (link to WGBYC GitHub). Data were aggregated by ICES Division/GFCM GSA and Ecoregion for consistency across taxa and to improve the accessibility or transferability of these data to other ICES Working Groups (WGs).

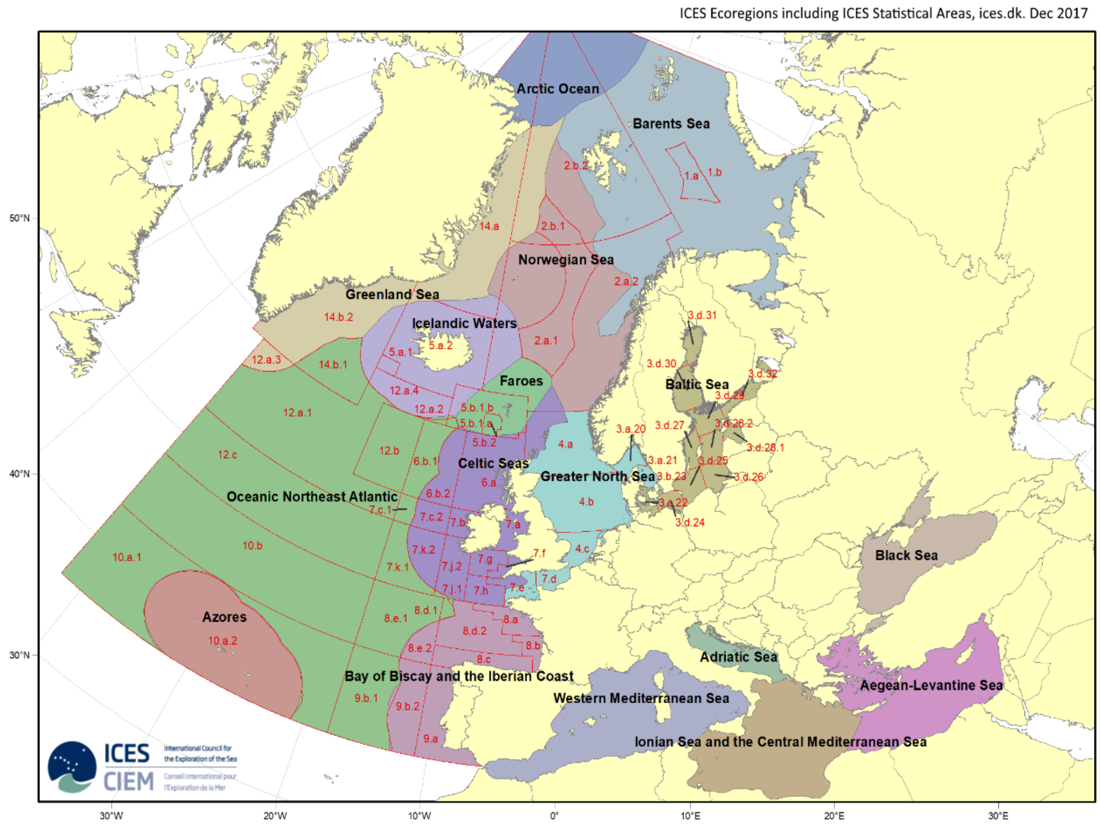

Figure 2.1 Map of ICES and Mediterranean Ecoregions including ICES Statistical Areas, ices.dk

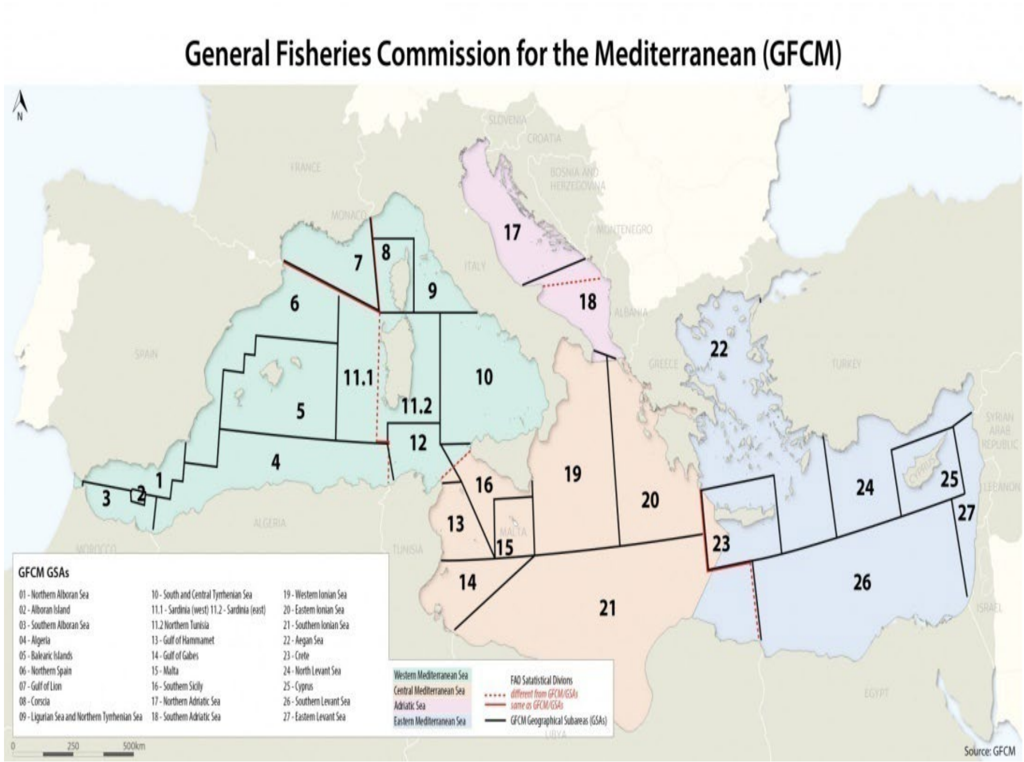

Figure 2.2 Map of Mediterranean Ecoregions including GFCM Statistical Areas.

It should be noted that some issues with data were flagged during the quality control (QC) of the data submitted by countries; in a number of cases some metiers have higher reported number of monitoring days than fishing effort days, some metiers have reported bycatch incidents but not number of specimens and vice versa, and some electronic monitoring does not have associated effort, please see ToR G (section 8) for details of data issues.

Aggregated data for metiers with reported bycatch are presented by ecoregion in Table 2.2 and Annex 3, and are summarized briefly below.

Fishing effort and monitoring effort for metiers with no reported bycatch is available online at this link: https://github.com/ices-eg/wg_WGBYC/tree/master/2023/WGBYC2TAF/output

In the **Adriatic Sea** ecoregion, 3 mammals (1 species), 1 bird, 157 turtles (1 species) and 188 elasmobranchs (7 species) were reported from 1573 monitoring days at sea (Table 2.2).

In the **Aegean-Levantine Sea** ecoregion, 1 marine mammal, 2 birds (2 species), 13 turtles (3 species), 327 teleost records (7 species) and 20 incidents of elasmobranch catches were reported (unknown number of individuals/species) from at total of 1972 days at sea (Table 2.2).

In the **Azores** ecoregion, 1 marine mammal, 3 birds (2 species), 1 turtle, 213 elasmobranchs (6 species) and 721 teleost individuals (5 species) were recorded from 814 days at sea (Table 2.2).

In the **Baltic Sea** ecoregion, 148 marine mammals (8 species), 763 birds (19 species), 33 elasmobranchs (2 species), 1884 teleost individuals (3 species), 3 chondrosteians (1 species) and 673 lamprey (1 species) were recorded from 132604 days at sea (Table 2.2).

In the **Bay of Biscay and the Iberian Coast** ecoregion, 256 marine mammals (7 species), 1030 birds (19 species), 1 turtle, 5474 elasmobranchs (21 species), 105552 teleosts (21 species), and 1875 deep sea holocephalians (1 species) were recorded from 12178 days at sea (Table 2.2).

In the **Black Sea** ecoregion, 3 marine mammals (1 species) and 2 chondrosteians (1 species) were recorded from 100 days at sea (Table 2.2).

In the **Celtic Seas** ecoregion, 155 marine mammals (5 species), 125 birds (1 species), 4280 elasmobranchs (27 species), 42452 teleosts (17 species) and 319 deep sea holocephalians (1 species) were reported from 1443 days at sea (Table 2.2).

In the **Greater North Sea** ecoregion, 416 marine mammals (6 species), 175 birds (17 species), 8657 elasmobranchs (24 species), 219075 teleosts (27 species), 2 lamprey (2 species) and 782 deep sea holocephalians (1 species) were reported from 3595 days at sea (Table 2.2).

In the **Greenland Sea** ecoregion, 619 elasmobranchs (6 species), 33445 teleosts (12 species) and 22 deep sea holocephalians (2 species) were reported from 76 days at sea (Table 2.2).

In the **Icelandic Waters** ecoregion, 40 marine mammals (2 species), 82 birds (7 species), 4040 elasmobranchs (14 speices), 3913 telosts (4 species) and 1872 holocephalians (3 species) were reported from 520 days at sea (Table 2.2).

In the **Ionian Sea and the Central Mediterran Sea** ecoregion, 1 turtle, 310 elasmobranchs (13 speices) and 168 telosts (4 species) were reported from 567 days at sea (Table 2.2).

In the **North West Atlantic** ecoregion, 6 marine mammals (2 species) were reported from 431 days at sea (Table 2.2).

In the **Norwegian Sea** ecoregion, 133 mammals (2 species), 415 elasmobranchs (3 species), 625949 teleosts (12 species) and 1 deep sea holocephalian were reported from 1633 days at sea (Table 2.2).

In the **Oceanic Northeast Atlantic** ecoregion, 2 turtles (1 species) and 5 elasmobranchs (1 species) were reported from 8 days at sea (Table 2.2).

In the **Western Mediterranean Sea** ecoregion, 4 marine mammals (4 species), 102 birds (5 species), 36 turtles (1 species) and 124 elasmobranchs (12 species) were reported from 4068 days at sea (Table 2.2).

In total (all ecoregions combined), 1166 marine mammals (12 species), 2283 seabirds (22 species) and 211 marine turtles (3 species) were recorded as bycatch during 2022. Records of 126 fish species from the ICES fish bycatch reference list were also reported, totalling just over 1 million specimens.

In this report section, WGBYC has not calculated bycatch rates or bycatch estimates due to uncertainties associated with data reported from some monitoring methods, incomplete spatial/temporal monitoring coverage, and total fishing effort data as reported to WGBYC. However, detailed bycatch assessments are carried out by WGBYC under ToR C (see Section 4).

There is insufficient detail in the submitted data to provide separate and robust information on observed cetacean bycatch according to AcousticDetterrentDevices (ADD) functionality and/or presence/absence. Consequently, all observed bycaught cetacean specimens are combined (fishing operations with or without ADD) to provide overall numbers of reported bycatch by stratum.

Table 2.1 Summary table of countries providing data submissions to ICES WGBYC with data on fishing effort, observer effort (either days at sea or other measure-ment, e.g. effort per haul or set), and bycatch records. Green = Data submission received, White = no data received. The year of submission is also provided. Romania and Bulgaria were requested data in 2021, 2022 and 2023. Romania has not yet submitted data in response to the ICES-WGBYC data calls.

	Fishing Effort (D1 table)						Monitoring Effort (D2 table)						Bycatch Events (D3 table)					
Year of data	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022
Belgium	2019	2020,2021	2021	2021	2022	2023	2019	2020,2021	2021	2021	2022	2023	2019	2020			2022	2023
Bulgaria			2023	2023	2023	2023			2023	2023	2023	2023			2023			2023
Croatia	2019				2022	2023	2019	2019			2022	2023	2019	2019			2022	2023
Cyprus		2020	2021	2021	2022	2023		2020	2021	2021	2022	2023		2020	2021	2021	2022	2023
Denmark	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Estonia	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023			2021	2021	2022	2023
Finland	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
France	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023	2023
Germany	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021		2022	2023
Greece	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Iceland	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Ireland	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Italy	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Latvia	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Lithuania	2019	2019	2022	2021	2022	2023	2019	2019	2022	2021	2022	2023						2023
Malta			2021	2021	2022	2023			2021	2021	2022	2023			2021			
Netherlands	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Norway	2021	2021	2021	2021	2022	2022,2023	2021	2021	2021	2021	2022	2023	2021	2021	2021	2021	2022	2023
Poland	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021		2022	2023
Portugal	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
Slovenia	2019	2020	2021	2021	2022		2019	2019,2020	2021	2021	2022		2019	2019,2020	2021	2021		
Spain	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2022,2023	2019	2020	2021	2021	2022	2022,2023
Sweden	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023
United Kingdom		2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023	2019	2020	2021	2021	2022	2023

Table 2.2 Summary of reported fishing and monitoring days (for metiers with reported bycatch only) and number of bycaught specimens and incidents by taxon in 2022, provided through the ICES WGBYC 2023 data call by ecoregion for all reported species. Extended summary of reported data is provided in Annex X.

Ecoregion	Fishing Effort (das)	Total Observed Effort (das)	Monitoring Coverage (%)		Mammals	Birds	Reptiles	Elasmobranchii	Teleostei	Chondrostei	Petromyzonti	Holocephali
Adriatic Sea	562337.39	1573.00	0.28	Incidents	3	1	121	71				
				Individuals	3	1	157	188				
				Species	1	1	1	7				
Aegean-Levantine Sea	1017900.00	1972.00	0.19	Incidents	1	2	11	20	142			
				Individuals	1	2	13		327			
				Species	1	2	3		7			
Azores	40404.00	814.00	2.01	Incidents	1	3	1	28	34			
				Individuals	1	3	1	213	721			
				Species	1	2	1	6	5			
Baltic Sea	246829.50	132604.00	53.72	Incidents	110	301		5	114	2	21	
				Individuals	148	763		33	1884	3	673	
				Species	8	19		2	3	1	1	
Bay of Biscay and the Iberian Coast	777883.88	12178.46	1.57	Incidents	172	108	1	327	1671			75
				Individuals	256	1030	1	5474	105552			1875
				Species	7	19	1	21	21			1
Black Sea	17460.00	100.00	0.57	Incidents	3					2		

				Individuals	3					2		
				Species	1					1		
Celtic Seas	220027.57	1442.65	0.66	Incidents	117	40		548	1722			48
				Individuals	155	125		4279.9	42451.6			319
				Species	5	1		27	17			1
Greater North Sea	526147.78	3595.47	0.68	Incidents	161	108		1212	2322		2	72
				Individuals	416	175		8657.4	219075		2	782
				Species	6	17		24	27		2	1
Greenland Sea	650.00	76.00	11.69	Incidents				114	305			15
				Individuals				619	33445			22
				Species				6	12			2
Icelandic Waters	14983.00	520.00	3.47	Incidents	34	38		456	256			210
				Individuals	40	82		4040	3913			1872
				Species	2	7		14	4			3
Ionian Sea and the Central Mediterranean Sea	620652.90	567.00	0.09	Incidents			1	59	47			
				Individuals			1	310	168			
				Species			1	13	4			
North West Atlantic	2849.00	431.00	15.13	Incidents	6							
				Individuals	6							

				Species	2							
Norwegian Sea	50634.32	1633.00	3.23	Incidents	58			92	357			2
				Individuals	133			415	625949			1
				Species	2			3	12			1
Oceanic North-east Atlantic	4142.14	8.00	0.19	Incidents			2	5				
				Individuals			2	5				
				Species			1	1				
Western Mediterranean Sea	779839.41	4068.00	0.52	Incidents	4	29	18	49				
				Individuals	4	102	36	124				
				Species	4	5	1	12				

Data for 2022 consisted of monitoring information collected by several different methods (at-sea-observers, electronic monitoring, port observers, vessel crew observers, and logbooks). Overall, there has been a temporal change in the proportions of 'monitoring method' data reported to WGBYC, from primarily at-sea-observers in 2017, to vessel crew observers in 2019, and to logbook data in 2021 and 2022 (Figure 2.3). This change in monitoring methods reported is country specific (Figure 2.4) and may at least in part be linked to covid restrictions on sampling (see ICES 2022), or to changes in available technologies such as electronic monitoring which was reported by 3 countries in 2022.

In 2023 (2022 data), most submitted data (DaS monitoring effort) was reported as logbook data. Excluding logbooks, the majority of data is reported as recorded by port-observers and at-sea-observers (Figure 2.3). In 2022, 4 countries submitted logbook data (Figure 2.4), a specific 'Monitoring Methods' category was included in the data call to enable countries to correctly identify data obtained from logbooks. The inclusion of logbook data has resulted in very high "observed" effort days for a number of Ecoregions (including the Baltic and Barents Seas Ecoregions) and metiers (Table 2.2, Table A Annex 3). As such caution is needed when interpreting observed effort in these ecoregions and metiers. Monitoring coverage for most ecoregions/metiers remains low, except for those where logbook data are reported (Table A, Annex 3).

Although logbooks represent the greatest proportion of monitored data in 2022, the majority of bycatch incidents for all species groups, except turtles, were recorded by at-sea-observers or electronic monitoring methods. Turtle species were recorded most often by port observers in 2022 (Figure 2.5). A small proportion of marine mammal and seabird bycatch incidents were reported from logbooks, including 2 species of seal (ringed seal and grey seal), and 8 species of bird (Figure 2.5). Consistently between 2017 and 2022, the majority of elasmobranch and other fish species bycatch incidents were reported by at-sea-observers. Marine mammal and seabird bycatch records have come from a variety of sources over the years but are increasingly primarily coming from at-sea-observers and electronic monitoring programmes (Figure 2.5). Although turtle bycatch is consistently reported by at-sea-observers between 2017 and 2022, these incidents are increasingly being reported by port observers (Figure 2.5).

Definitions of the different monitoring methods are provided in Table 2.3 along with each data type's suitability for inclusion in detailed bycatch analyses as currently considered by WGBYC.

Data from 2022 submitted through the 2023 WGBYC data call consisted of information from multiple monitoring programmes (DCF, Reg 812, DCF/Reg 812, EU-MAP, Research Pogrammes, and other) (Figure 6). 16 countries reported data from DCF or DCF/Reg 812, and 5 countries reported data from research programmes in 2022 (Figure 6). 10 countries reported data from more than one monitoring programme type (Figure 6).

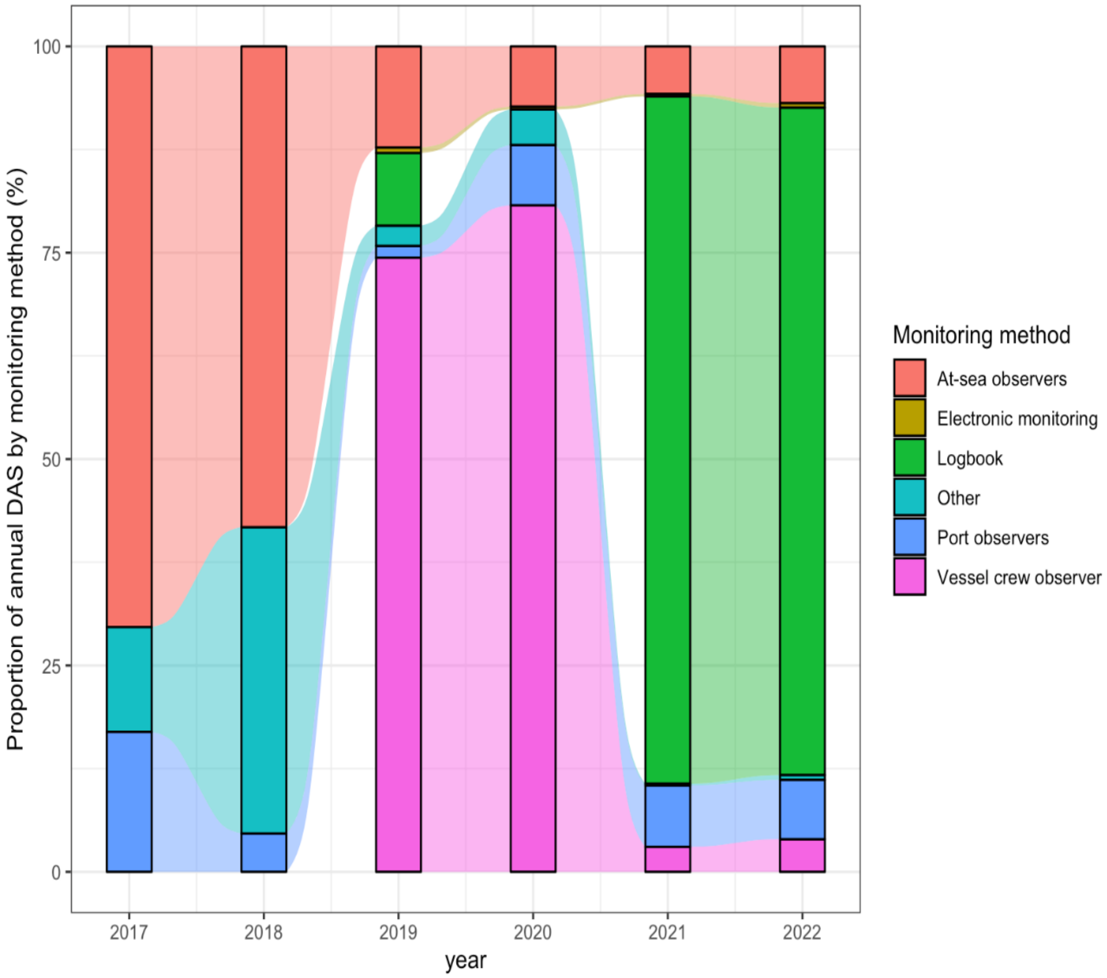

Figure 2.3 Total monitored (observed) days at sea reported per monitoring method (2017-2022) at-sea-observers, electronic monitoring, port observers, and vessel crew observers, logbooks, other.

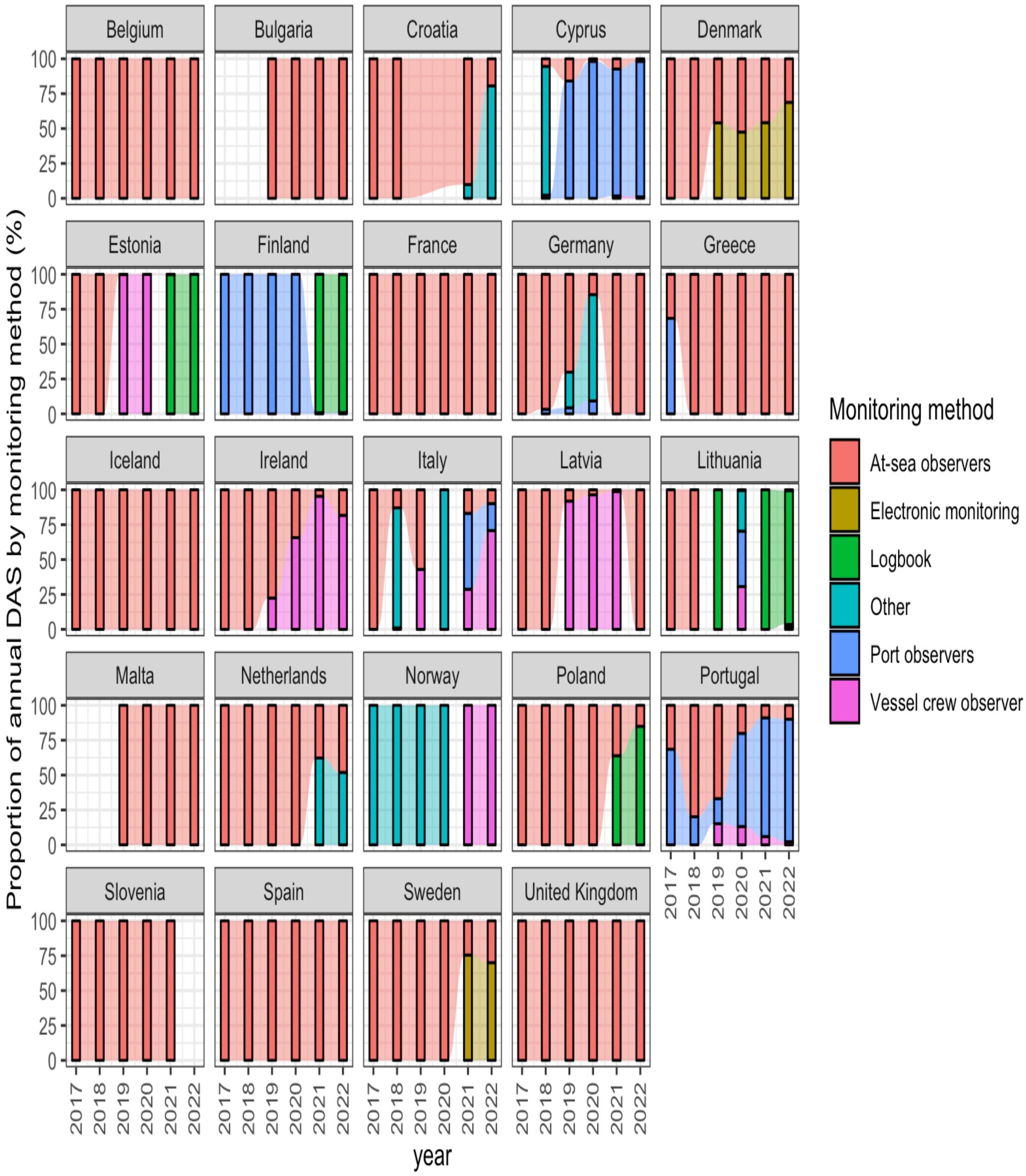

Figure 2.4 Total monitored (observed) days at sea reported by each country for each monitoring method (2017-2022); at-sea-observers, electronic monitoring, port observers, vessel crew observers, logbooks, other.

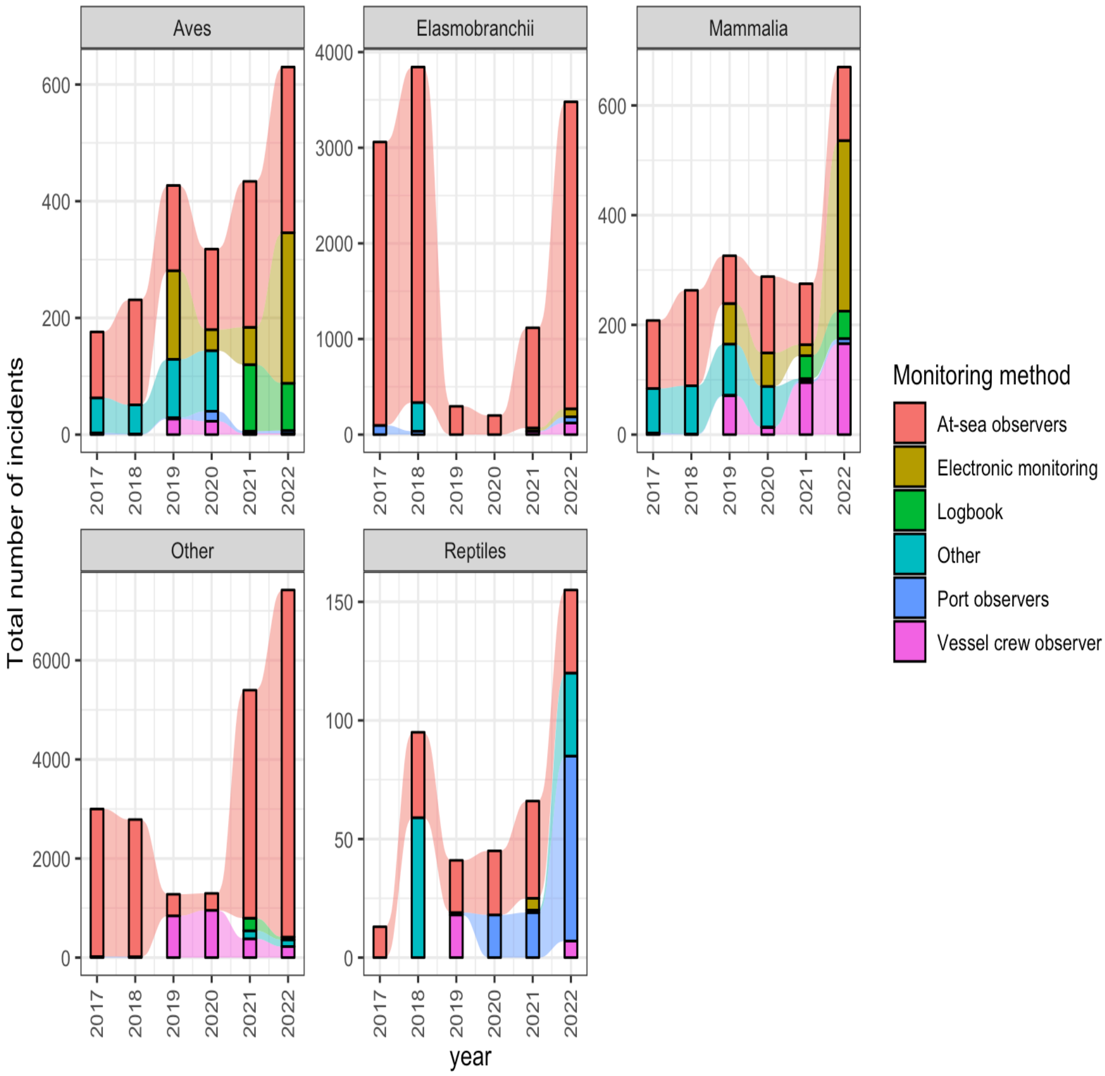

Figure 2.5 Total number of bycatch incidents for each taxon (birds, elasmobranchs, mammals, other fish species, and reptiles) reported by each monitoring method (2017-2022) at-sea-observers, electronic monitoring, port observers, and vessel crew observers, logbook, other.

Table 2.3 Monitoring methods provided in the 2023 data call template and their suitability for bycatch estimations

	Monitoring Method	Summary
SO	At-Sea Observer	Data collected by independent observers using appropriate protocols for quantifying bycatch are currently considered by WGBYC to be the most reliable source of data for the calculation of bycatch rates across the full range of sensitive taxa for inclusion in detailed bycatch assessments.
PO	Port Observer	Data collected by independent observers in port are not currently considered reliable enough by WGBYC for the calculation of bycatch rates for inclusion in detailed bycatch assessments, though they may have value for highlighting bycatch occurrence in fisheries with no other monitoring.
EM	Electronic Monitoring	Data collected with electronic monitoring systems with appropriately placed cameras and suitable species identification methods are currently considered by WGBYC to be reliable for calculating bycatch rates for inclusion in detailed bycatch assessments.
VO	Vessel Crew Observer	Data collected by fishers following specific sampling protocols are currently considered by WGBYC to be moderately reliable for calculation of bycatch rates, particularly if data accuracy can be validated against independent monitoring data from the same fishery.
LB	Logbooks	Data recorded by fishers as part of mandatory bycatch reporting in official logbooks are currently considered by WGBYC to be unreliable for calculation of bycatch rates and inclusion in detailed bycatch assessments (see Basran& Már Sigurðsson 2021). Logbook data may have value for highlighting bycatch occurrence in fisheries with no other monitoring and/or for sensitive fish species that are permitted for sale.
OTH	Other	Other unspecified monitoring methods, e.g., interviews with fishers, are currently considered by WGBYC to be generally unsuitable for the calculation of bycatch rates for inclusion in detailed bycatch assessments as underlying biases are difficult to evaluate and estimate.

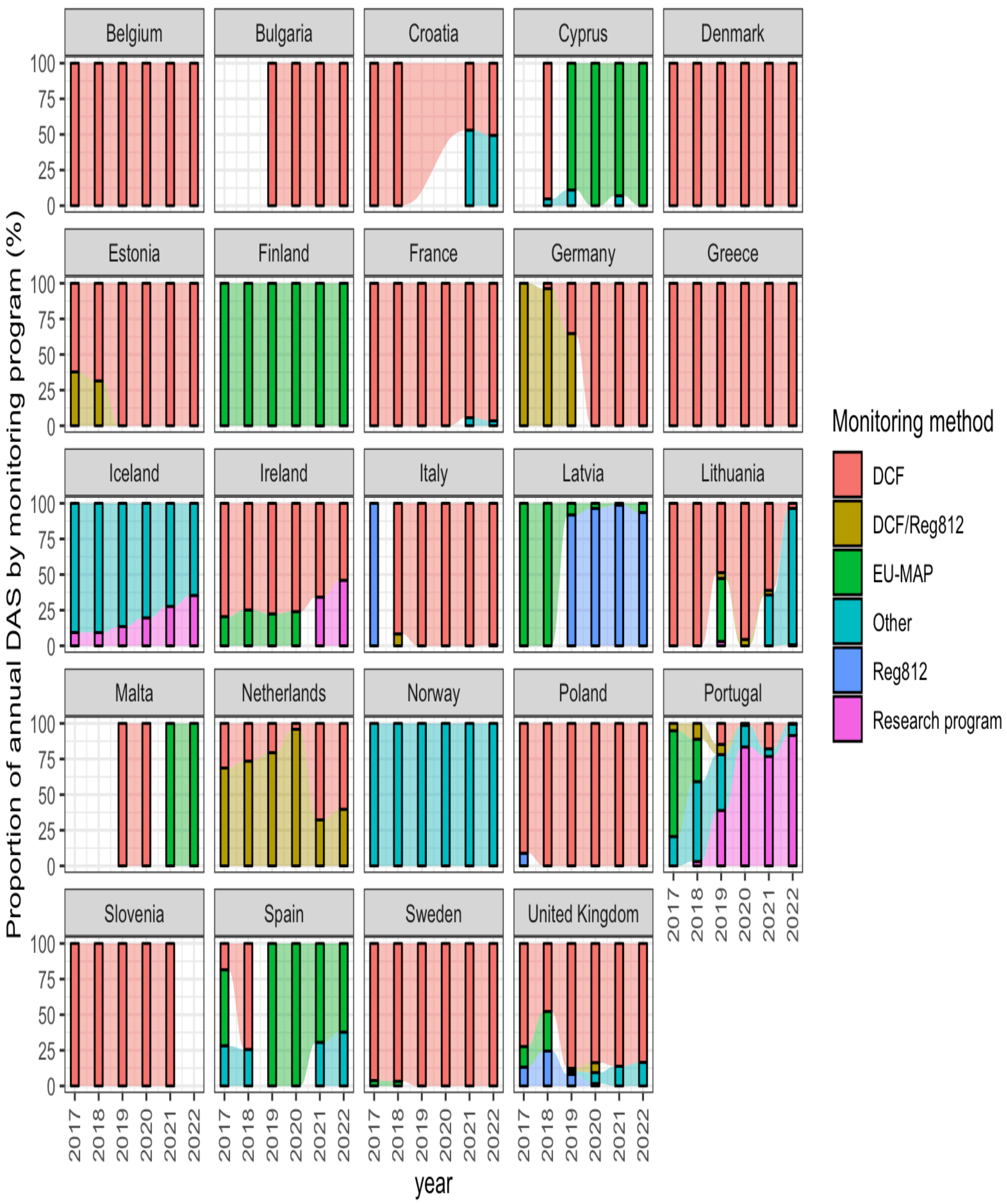

Figure 2.6 Total monitored (observed) days at sea reported by each country for each monitoring programme (2017-2022).

2.4 Other monitoring programmes or additional projects to monitor bycatch of PETS and associated bycatch estimates

In **Spain**, an onboard sampling program for monitoring the bycatch of marine mammals and other PETS is carried out by the Spanish General Secretariat for Fisheries of the Ministry of Agriculture, Fisheries and Food (SGP-MAPA) with the support of the Spanish Institute of Oceanography (IEO). It is focused on the observation of the Spanish bottom gillnet and pair trawl fleets in waters of the Cantabrian-Northwest national fishing ground (ICES divisions 27.8.c and 27.9.a) and French waters of the Bay of Biscay (ICES Division 27.8.a.b.d).

The objective of this specific onboard observation program for marine mammals was two-fold; Firstly, to establish a program specifically aimed at monitoring the bycatch of vulnerable species, adding other species to cetaceans (elasmobranchs, turtles, birds and invertebrates) to optimize the investment required in the execution of the program. Secondly, to obtain data that can be compared with those collected by DCF monitoring program to statistically determine the possible discrepancy between the two, so that it allows determining the appropriate methodological changes and/or increase in the coverage necessary for the onboard observation program to properly estimate bycatch.

The initial duration of this first pilot program was 1 year, starting in October 2020. The data collected in this program during 2020 were included in the Spanish data submitted to WGBYC in 2021. The first pilot program was extended and continued without gaps from August 2021 at least until 2023. In this second phase the observation coverage was increased by 50% and extended to new sampling. The 2021 and 2022 data of this programme were sent to WGBYC in the 2022 and 2023 data calls, respectively.

The NAMMCO Scientific Committee (SC21) established a Bycatch Working Group in 2014. The WG has met 7 times and will meet next in October 2023. The Terms of Reference (ToR) of the working group (WG) as defined by SC21 are:

1. Identify all fisheries with potential bycatch of marine mammals;
2. Review and evaluate current bycatch estimates for marine mammals in NAMMCO countries;
3. If necessary, provide advice on improved data collection and estimation methods to obtain best estimates of total bycatch over time.

So far, the WG has reviewed bycatch estimates provided by its members. It has endorsed estimates of marine mammal bycatch for the Icelandic lumpsucker fishery for the period 2014-2018 (BCWG 2020), estimates of harbour seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) bycatch in Norwegian commercial coastal gillnet fisheries for the period 2006-2020 (BCWG 2021) and estimates of harbour porpoise (*Phocoena phocoena*) bycatch in Norwegian commercial coastal gillnet fisheries 2006-2018 (BYCWG 2021).

The WG is now tasked to progress in its assessments of the bycatch risk in the other fisheries for which bycatch rates have not been reported yet (Faroe Islands and Greenland: all fisheries, Iceland: all other fisheries than the cod and Greenland halibut (*Reinhardtius hippoglossoides*) fisheries and including foreign fisheries, Norway: all fisheries other than the commercial coastal gillnet fisheries, including recreational fisheries and foreign fisheries). The WG's first step was to conduct an initial scope of the fisheries data available (i.e., resolution of the data, type of effort data available, statistical area of reporting, time period available in the data, and how best to define a "fishery"). It will prepare a data call to the fishery departments of the NAMMCO Parties at its next meeting. With this data, the BYCWG will be able to map the fishing effort to visualize its scale in relation with marine mammal distribution/abundance and identify whether and where enhancing monitoring efforts were needed.

OBSCAMe is a **French** scientific program based on REM observation with the following objectives:

a) to reinforce the observation of incidental bycatch of marine mammals, while diversifying the methods of data collection,
b) to test the scientific contributions of REM observation to better understand the interactions between gillnetters and marine mammals in the Bay of Biscay,
c) to evaluate the cost/benefit ratio of these devices for the monitoring of marine mammal bycatch.

This project is coordinated by the French biodiversity agency (OFB), in partnership with French fishers representatives' organizations, the scientific collaboration of IFREMER and Observatoire Pelagis La Rochelle University-CNRS and political supervision of the Ministries in charge of the environment and fisheries.

After a first phase in 2021 that validated the feasibility of the system on French gillnetters in the Bay of Biscay (with 5 voluntary vessels), and a second one with 20 vessels in total, the project ended in summer 2023. From 2021 to February 2023, over 4,450 days at sea and 14,000 fishing operations (hauling) have been observed with REM system (the involvement and the fishing activity of the 20 vessels fluctuated during the project). As this is a voluntary program (vessels are volunteers), the data may not be representative of the diversity of the Bay of Biscay gillnet fleet. The coverage represents around 4 to 5% of the fishing effort of French gillnetters in the Bay of Biscay, but not all metiers are covered, and some areas are over-sampled (particularly the area off Capbreton where several vessels are equipped). However, the data do bring several contributions of the system to improving our knowledge of bycatch:

- REM systems can be used on gillnetters to provide information on marine mammal bycatch, as well as on the fishing effort of gillnetters (number of fishing operations, soaking time, net length, etc.)[1].
- More than 250 marine mammals were recorded in nets (common dolphin (*Delphinus delphis*) – 63%, and harbour porpoise – 19%: a relatively high proportion for this species compared to stranding data or at-sea observations data).
- REM system allows continuous monitoring (unless malfunctions or interruption of the device) which responds to the difficulty of rare events such as bycatch.
- REM system provides complementary information to the at-sea observation program (ObsMer) at a lower cost per day at sea (however, OBSCAMe project focuses on bycatch and does not provide detailed information on commercial catches).
- The camera records what may not always be observed on board (21% of marine mammals fell into the water and were not brought back on board).

A next stage of the project (OBSCAMe+) is planned as part of the French action plan to reduce cetacean bycatch inf the Bay of Biscay.

In 2022 **Sweden** initiated an extended monitoring program targeted towards observations of bycatch of sensitive species such as marine mammals and seabirds. The overall aim is to cover 5% of the gillnet and trammelnet effort in area 27.3.a.21-d.20-29 by monitoring with either observers or cameras. The area (27.3.a.21-d.20-29) covered by this program is divided into five sub-areas (Figure 2.7) identified on the basis of bycatch risk for harbor porpoises allowing sampling effort to be weighted towards sub-areas with assumed higher risk of bycatch of porpoises and sub-areas where potential bycatch of porpoises cause a larger risk to the population. The design is based on the risk of bycatch of porpoises but all catches of all species for all catch fractions (including catch damaged by predators) are recorded. The design, and assessment of performance of the program, is dependent on effort data with sufficient spatial resolution. Swedish fishing vessels not carrying logbooks are obliged to report effort in a monthly report.

1 Soaking time and net length are estimated, data need to be consolidated.

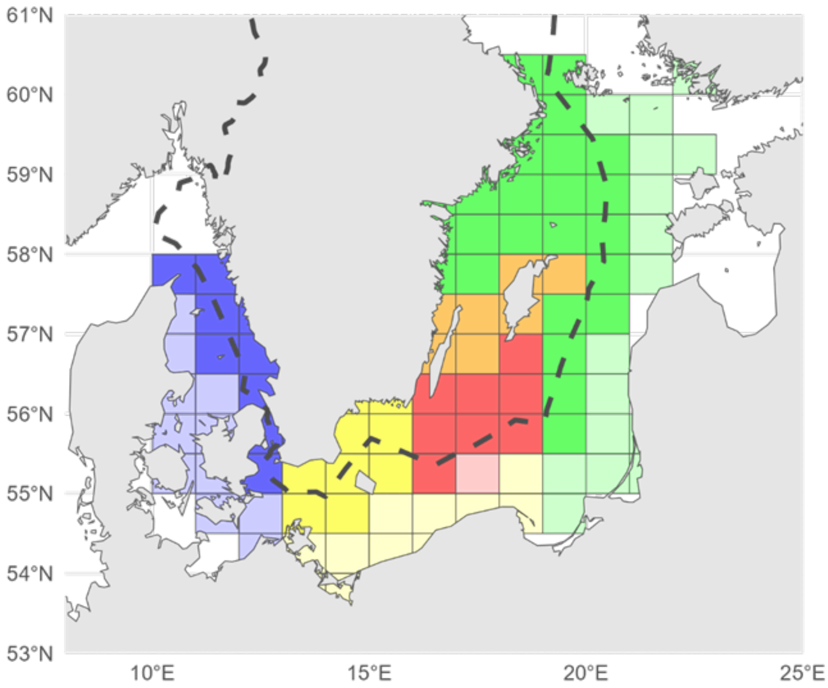

Figure 2.7 Sub-areas (five different dark-shaded colors) that constitute the different spatial strata.

Observer trips to be monitored are randomly selected and non-responses are recorded. Cameras are deployed on vessels on a voluntary basis. The acceptance for the camera monitoring is better than expected. In 2022 cameras were deployed on 14 vessels, while 20 vessels participated in 2023.

In the **UK**, Clean Catch UK (https://www.cleancatchuk.com/) is a collaborative research programme between fishers, NGOs, academia, and government. In 2021, the programme released a self-reporting app which is currently being trialled by fishers in the southwest of England to collect data on bycatch of all species. The app has been extended to include additional fishing gear categories and improvements were made to streamline data submission workflows. Clean Catch UK uses remote electronic monitoring (REM) on vessels where skippers are self-reporting bycatch events to assess the quality of these data types for monitoring bycatch. Due to the high resource requirements to analyse the REM data, the project continues to collate images and contribute to collaborative databases required for training AI. Clean Catch UK has also deployed an acoustic array in the southwest UK which is being used to examine localised spatial and seasonal patterns of cetacean density with approximately 928 days of data collected so far.

Another project, Insight360, is developing and producing a cetacean bycatch electronic monitoring system. This project began in 2021 and is due to deliver in 2024. Five vessels have the system installed to collect image and voice records. Research is continuing to improve software and hardware features such as the automatic haul detection and speech to text tools.

For elasmobranchs, the Spurdog (*Squalas acanthias*) Bycatch Management Programme operated in the Celtic Sea (Hetherington et al., 2022) between 2016 and 2022. The project developed a real-time bycatch reporting and mapping tool for spurdog, allowing fishers to self-report the presence or absence of spurdog bycatch during normal fishing activity every 24 hours. Information was then fed back to participating fishers using a bycatch advisory map, to highlight areas of low, medium and high risk of spurdog bycatch to allow informed decision-making when fishing. In 2023 the management of spurdog changed and there is now a TAC for the North Sea and Western Waters for individuals less than 100cm in length (catches of individuals greater than 100cm in length are still prohibited). The self-reporting app developed for the Spurdog Bycatch

Management Programme is now being updated to accommodate the management changes so accurate data collection can continue.

Other projects looking at reducing unwanted fish catches that were ongoing in 2022 include BATmap, a bycatch avoidance tool being trialled on the west coast of Scotland (Marshall et al., 2021). This project developed an app for Scottish skippers to share real-time information about the location of hotspots of fish species that are choke species (cod, *Gadus morhua*) or of conservation interest (spurdog) with other participating skippers.

In **Finland**, different fishery-independent bycatch data collection methods are currently (2022-2024) being tested. The tested methods include an onboard observer program in pelagic trawl fisheries, an onboard observer program in coastal trapnet fisheries, and electronic monitoring (EM) technologies using cameras.

The onboard observer study was tested in trawl vessels in 10 trips and in nine coastal trapnet fishing trips in 2022. The National Resources Institute Finland conducted all trapnet observer trips and seven of the trawl vessel trips, and a private consulting company was hired to complete three of the trawl vessel trips. The same company was also hired to do all observer trips in 2023. Preliminary test using cameras as an electronic monitoring technology were also conducted during observation trips. Testing of the EM method will continue in 2023-2024 and all results will be available at the end of the pilot study.

In **Bulgaria** (Black Sea region), an onboard monitoring program for the bycatch of marine mammals in the turbot (*Scophthalmus maximus*) bottom set gillnet fishery has been carried out by Green Balkans NGO in the period 2019-2023. The program was funded by various projects and donors (CeNoBS, ACCOBAMS, New England Aquarium, OceanCare). It has included varying number of vessels (3 to 6) targetting turbot (a quota species) and represents 2.4-4.3% of licensed boats. The focus of the monitoring is cetaceans, and the largest proportion of bycatch is of Black Sea harbour porpoise. In total 275 cetaceans were recorded as bycatch: 259 porpoises, 13 bottlenose dolphins (*Trusiops truncatus*) and 3 common dolphins. The turbot gillnet fishery in Bulgarian waters typically operates in two seasons: spring (before 15 April) and summer (after 15 July). During the conducted monitoring higher average bycatch rates were observed in summer compared to spring with the only exception being in 2022, possibly related to the ongoing conflict in Ukraine.

Collected data were used to estimate total bycatch by the Bulgarian turbot fishing fleet and compare that with relative abundance in Bulgarian territorial and shelf waters in the Black Sea. Annual bycatch total of porpoises varied between 593 and 2515 and accounted for 8.6% to 38.4% of best abundance estimates. Data for the period 2019-2021 was used for wider estimation of Black Sea harbour porpoise bycatch rates in light of new abundance estimates derived from CeNoBS aerial survey in summer 2019 that covered more than 60% of the Black Sea (Popov et al., 2023).

In **Portugal**, in 2022 significant observer effort was provided by work within several dedicated projects. For monitoring of interactions of cetaceans and fisheries in the southern coast of the country (Algarve) the work was performed under CetAMBICion (2021-2023). For marine birds there is one project running to evaluate bycatch in the southern coast (Life + Ilhas Barreira, 2019-2023), while in the western coast, bycatch of birds was reported from work within projects Anzol + and Life+ PanPuffinus. Tasks regarding bycatch in the southern coast are led by the University of Algarve and the Center of Marine Studies (CCMAR) and in the western coast by the Portuguese Society for the Study of Birds (SPEA). All the projects use the same sampling methodology such as harbour enquiries, onboard observations and vessel crew paper logbooks filled by trained fishers. The contribution of these dedicated projects, especially with at sea observers and vessel crew entries, significantly increased the observation effort with hundreds of trips being monitored, allowing the report of incidental catches of different PET taxa (cetaceans, marine turtles, marine birds and fish).

In 2022, CCMAR declared that 60-day trips with nets (GNS) were observed (36 with at-sea observers and 24 with vessel crew registrations) in vessels 12-15 m in length. 2 cetaceans (2 bottlenose dolphins), 24 marine birds (20 *Ardenna gravis*, 3 *Morus bassanus* and 1 *Larus sps*), 6 elasmobranchs (3 *Mustelus mustelus*, 1 *Cetorhinus maximus*, 1 *Isurus oxyrinchus*, 1 *Alopias superciliosus*) and 210 teleost (all *Mola mola*) were observed dead when hauled. Fishers reported all cetacean bycatches, while bycatches of other taxa were reported by at-sea observers.

2.5 Auxiliary data (i.e., strandings, interviews) indicative of the impact of bycatch

Strandings networks to inform on marine mammal bycatch

The analyses of strandings are an important source of biological data, species composition, and distribution, but also contribute to knowledge on cause of death, including bycatch. When deployment of observers can be challenging and observation effort is low or non-existent, examination of stranded animals can provide relevant information on impact of fisheries activities on marine megafauna. They can be considered as another view of the bycatch process.

Please note that only species including individuals presenting bycatch evidence were considered here.

In **Belgium**, the Royal Belgian Institute of Natural Sciences (RBNIS) organises the collection of strandings. In cooperation with the University of Liège, a single database can be consulted online (http://www.marinemammals.be/).

Along the coasts of **Denmark,** the stranding network is run by the Danish Nature Agency in collaboration with the Fisheries and Maritime Museum and the Zoological Museum, Natural History Museum of Denmark.

Along **French** coasts, 400 trained volunteers or employees constitute the French stranding network (Réseau National Echouage), coordinated by the Joint Service Unit *Observatoire Pelagis*, UMS 3462 University of La Rochelle/CNRS. It is funded by the Ministry in charge of the environment and the French Office for Biodiversity. The network collects standardized data following a common protocol, and a database can be consulted online (http://pelagis.in2p3.fr/public/histo-carto/index.php). Since the origin of the network in the 1980's, thousands of marine mammals have been recorded with high numbers, especially of common dolphins reported in recent years.

In **Germany**, strandings are collected by National Park rangers who control the coastline throughout the year. Carcasses are collected and transported to the University of Veterinary Medicine in Hannover, where marine mammals are necropsied by official veterinarians.

In **the Netherlands,** the strandings network consists of a consortium of several organizations and volunteers. The observation effort is unequal along Dutch coasts (approaching 100% in Western coasts, but very low in uninhabited Frisian islands and Wadden Sea). Approximately 10 to 20% of carcasses are necropsied every year at the Faculty of Veterinary Medicine of Utrecht University.

The **Portuguese mainland** stranding network is coordinated by the National Institute of Conservation of Nature and Forests (ICNF). Three dedicated 24/7 on-call strandings teams covering about 75% of the coast were operating almost in full since 2021 obtaining information on cetaceans and marine turtles. One local team is responsible for the northwestern coast and coordinated by an NGO (Portuguese Wildlife Society) and the other two teams operate in the South-western coast (Alentejo) and Southern coast (Algarve), being coordinated respectively by the University of Évora and University of Algarve. Each team has dedicated biologists to assess carcasses and perform analysis on bycatch evidence and sampling.

Along **Spanish** coasts, the NGO CEMMA is in charge of the coordination of the Galician stranding network since the early 1990s. Since 1999, the Ministry of Environment-Xunta de Galicia provide financial support and grant administrative authorizations to cover the 1,190km of the coast of Galicia.

The collaborative Cetacean Strandings Investigation Programme (CSIP) in the **United Kingdom** is a consortium of partner organizations (Zoological Society of London, Scottish Rural University College (Inverness), the Natural History Museum and Marine Environmental Monitoring) funded by Defra and the UK Devolved Governments of Scotland and Wales. The CSIP is collectively tasked with recording information on all cetaceans, marine turtles and basking sharks that strand around UK shores each year and with the routine investigation of causes of mortality through necropsy of suitable strandings. Stranding network was recently divided into two independent structures: Scottish Marine Animal Strandings Scheme operating along Scottish shore, and CSIP covering the rest of UK.

Eleven strandings networks in eight countries reported strandings to WGBYC in 2022 (Table 2.4). Harbour porpoises were the most detected species, from Denmark to southern Portugal. The proportion of porpoises considered to be bycaught ranged from 4% in German waters, to 100% along the coasts of Galicia (but only for 7 carcasses). The high proportion of bycaught porpoises in the Bay of Biscay and Iberian Peninsula highlighted an important pressure of fishing activities on porpoises from the management units of Celtics Seas and Iberian Peninsula. Common dolphin is the second most frequently found stranded species, and high levels of bycatch evidence was found on stranded dolphins (40% in UK to 81% in Galicia/Spain).

Correcting strandings occurences by drift conditions and the probability of sinking (following Peltier et al., 2016) provided bycatch estimates of common dolphins and harbour porpoises in 2022 in the Bay of Biscay and Western Channel inferred from French data. The drift conditions during winter 2022 were very unfavourable to stranding, as prevailing eaterly winds tend to move the drifting carcasses away from the coast. During the period 2016-2020 between January and March, the highest probability of stranding (probability that a dead animal would reach the coast) covered 36% of the Bay of Biscay and the Western Channel. In 2022, this probability was calculated as 16% of the Bay of Biscay only, meaning that strandings could be used to infer mortality from a narrow coastal fringe of the French waters. Bycatch was estimated at 2396 (CI95% [1797;3382]) common dolphins and 70 (CI95% [52;98]) harbour porpoises. The analyses of drift conditions is a major element to consider when interpreting strandings and inferred mortality using reverse drift modelling method.

Table 2.4 Strandings of marine mammals, number of examinations on fresh and slightly decomposed carcasses, and proportion of examined stranded animals with evidence of fishery interaction (carcasses with bycatch evidence/examinations) reported for 2022 (Atl = Atlantic coasts, Med = Mediterranean coasts)

Species	Country	Strandings (n)	Examinations on fresh or slightly decomposed carcasses (n)	Bycatch evidence / examinations (%)
Phocoena phocoena	Belgium	45	17	2/17 (12%)
	Denmark	250	23	10/23 (43%)
	France (Atl)	180	58	18/58 (31%)
	Germany	225	123	5/123 (4%)
	Netherlands	422	57	6/57 (11%)
	Portugal	42	20	11/20 (55%)
	Spain (Galicia)	13	7	7/7 (100%)
	United Kingdom	413	33	2/33 (6%)
Delphinus delphis	France (Atl)	746	361	244/361 (68%)
	Portugal	196	95	73/95 (77%)
	Spain (Galicia)	172	42	34/42 (81%)
	United Kingdom	246	25	10/25 (40%)
Stenella coeruleoalba	France (Atl)	19	11	2/11 (18%)
	France (Med)	36	17	1/17 (6%)
	Portugal	4	3	2/3 (66%)
Tursiops truncatus	France (Atl)	30	10	3/10 (30%)
	France (Med)	10	6	2/6 (33%)
	Portugal	12	8	5/8 (63%)
	Spain (Galicia)	29	3	2/3 (66%)
	United Kingdom	14	5	2/5 (40%)
Grampus griseus	France (Atl)	7	1	1/1 (100%)
	United Kingdom	14	2	1/2 (50%)
Megaptera novaeangliae	Portugal	1	1	1/1 (100%)
Balaenoptera acutorostrata	Portugal	17	9	5/9 (55%)
Halichoerus grypus	France (Atl)	234	89	4/89 (4%)

Phoca vitulina	France (Atl)	116	36	1/36 (3%)

Bottlenose dolphins also presented high levels of interactions with fisheries, as 30% (French Atlantic waters) to 66% (Galicia) of examined carcasses presented evidence of death in fishing gears. In French waters, the proportion of bycaught striped dolphins remained below 20% whereas it reached 66% in Portuguese waters.

Large whales with evidence of bycatch were observed in Portuguese waters (five Minke whales (*Balaenoptera acutorostrata*) and one humpback whale (*Megaptera novaeangliae*)).

Both grey seals and harbour seals were recorded along French Atlantic coasts, but the proportion of animals with bycatch evidence remained very low (respectively 4% and 3%). Please note that due to their fur, bycatch evidence based on external examination can be hard to detect.

2.6 Conclusions

- The quality and scope of the information provided through the ICES WGBYC data call for 2022 was variable, although WGBYC consider that the data quantity and quality have been steadily improving since the first data call in 2018.
- In total (all ecoregions combined), 1166 marine mammals, 2283 seabird specimens, 211 marine turtles, and over 1 million fish specimens were reported as bycaught in 2022 based on data submitted to WGBYC as part of the 2023 data call.
- Most countries continue to rely on the DCF sampling programme to monitor marine mammal and other protected species bycatch. The DCF sampling program has been shown to underestimate bycatch events in some metiers, however, several countries have been running research projects or dedicated programs to monitor bycatch of PETS to generate improved bycatch rate estimates. In the last three years there has been an increase in the submission of data from indirect monitoring methods, i.e., logbook data and port observers. This presents additional challenges when interpretating levels of reported bycatch across fisheries or Ecoregions.
- Relying exclusively on observations carried out under the DCF may lead to underestimation or at worst non-detection of bycatch events in some metiers. WGBYC are aware of improvements to monitoring protocols within the DCF but reiterate that further consideration could be given to sampling designs and protocols moving forward to data collection driven by the EU-MAP and the Technical Conservation Measures Regulation.
- A variety of monitoring methods are reported annually to ICES as part of the data call, each with differing strengths and weaknesses. At-sea-observers and electronic monitoring are currently considered by WGBYC to be the most reliable source of data for the calculation of bycatch rates across a range of sensitive taxa for inclusion in detailed bycatch assessments. These methods also represent the source of most bycatch records reported. Logbook data is increasingly being reported to WGBYC, and although they contribute only a relatively small number of bycatch records, these records do include some species of conservation concern. Future data calls should highlight the value of at-sea-observers and electronic monitoring and encourage the reporting of monitoring from these sources, along with other methods.
- The use of strandings data highlighted probable bycatch between 10 species and fishing gear (8 cetacean species and 2 seal species) combinations reported by 9 countries. In certain areas, when corrected by physical parameters such as drift conditions, strandings can provide bycatch mortality estimates. However, in all cases, these data constitute an overview of an often scarcely observed process and direct data collection should be encouraged. 5 cetacean species were reported as bycaught in 2022 through the strandings

data while these species were not reported through at-sea monitoring schemes in the same period.

- WGBYC expect that the consistency of bycatch data at a regional scale will be improved through EU-MAP and thereby ICES will be able to provide more comprehensive advice on the impact of fisheries on protected and vulnerable species. However, this will only be achieved if countries' take full account of the necessary sampling protocols for PETS and carry out bycatch monitoring in the relevant métiers with sufficient observer coverage.

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3 ToR B: Collate and review information from WGFTB national reports, other ICES Working Groups and recent published documents relating to implementation of protected/sensitive species bycatch mitigation measure sand summarize recent and ongoing bycatch mitigation trials.

Introduction

This year the working group collected information on mitigation efforts from member states and other countries by reviews of the national reports to the Working Group on Fishing Technology and Fish Behaviour (WGFTFB) and from members from WGBYC. We also provide summary information about mitigation studies from the wider literature indicating the taxa, geographic scope, approach, and results (Section 3.4), mitigation regulations or a list of direct and indirect technical or spatial management measures with potential effects on bycatch by taxa in course for each ICES Ecoregion (Table 3.9). Finally, this section included a first approach highlighting gaps on mitigation pilot trials being underway in certain eco regions with high bycatch rates for all taxa.

3.1 Cooperation with WGFTFB (Working Group on Fishing Technology and Fish Behaviour)

As mentioned, member states each year summarize national projects on fishing technology to WGFTFB. In 2023, 18 national reports were submitted to WGFTFB from Argentina, Belgium, Canada, China, Denmark, England, France, Germany, Iceland, Ireland, Italy, Japan, The Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom (England, Scotland, Northern Ireland) and the United States of America. The 2023 report of WGFTFB refers to projects carried out in 2022. An overview of PETs related mitigation work from these reports is listed below.

WGBYC further links to WGFTFB through the "Passive group" under WGFTFB. The passive group works as a 3-year subgroup under WGFTFB focusing on passive fishing gears including gillnets, pots, longlines and fyke nets. The work focuses on increasing catch rates and reduction of bycatch. However, as this year meeting was held in a reduced format the work of the passive group has been postponed to 2023.

3.2 Summaries from national reports submitted to WGFTFB

Argentina

There is an ongoing study in Argentina (from June 2020 – July 2024) to reduce catches TOR B: Collate and review information from WGFTB national reports, other ICES WGs and recent published documents relating to implementation of protected/sensitive species bycatch mitigation measures and summarize recent and ongoing bycatch mitigation trials.

of sharks and rays (chondrichthyans) in the common hake trawl fishery. A maximum landing limit per species was introduced and "finning" and "fishhooks" to handle individuals are no longer allowed. A bycatch reduction device (BRD) was designed in the shape of a selective grid to reduce the bycatch of sharks and rays. The first trawls showed however a significant loss of marketable fish. New modifications to the grid and whether it improved its ability to deselect sharks and rays are not reported yet.

Belgium

The "LED there be light" project began in 2022. The project aims to develop and optimize innovations in different Belgian fisheries (both active and passive) to reduce bycatch and/or become more selective for commercially targeted species. In this way, the project will assist the sector in dealing with the EU landing obligation.

The first part tests innovative ideas for the beam trawl sector, such as preventing choke species and other bycatches (hereunder elasmobranch) from entering the net, facilitate escape of these species after entering the net, and increase catches of target species. The second part evaluated the use of luminescent netting, LEDs, and other light sources in different net designs in different fishing techniques practiced within the Belgian sector (beam trawl, otter trawl, flyshoot, and passive fishing gear to reduce by-catches and/or optimize commercial catches.

Canada

In response to government regulations requiring all fixed passive fishing gear to be whale safe by 2024, the feasibility of weak links to reduce whale entanglement project (August 2019 to July 2021), and two whale safe fishing gear projects (timespans January 2021 to March 2023, and January 2022 to 2025) are ongoing. These three projects focus on developing and testing gear modifications falling across two broad categories: (1) gear with break-away or cut away design (e.g. weak ropes, links, and sleeves, alongside time-tension cutters), making it easier for entangled whales to free themselves and reduce the risk of serious injury, and (2) systems that negate the need for vertical lines in the water, using either rope-on-command/demand systems that, for example, stow buoy lines on the sea floor or in inflatable bag systems until release via acoustic signal sent from a fishing vessel on retrieval of gear. A whale safe gear adoption fund has been established to support Canadian manufacturing of commercially ready whale safe gear.

The minimising groundfish bycatch in the redfish fishery project (April 2018-March 2021) ran a series of side-by-side trawls comparisons to test modifications (e.g. semi pelagic doors vs standard bottom doors) to reduce unwanted groundfish bycatch while maintaining catch rates of targeted redfish species. Mid-water trawls were also concurrently conducted to determine redfish catch rates relative to those from bottom trawl gear. Initial results suggest comparable catch rates between the three set-ups. The techniques tested have potential relevance to gear selectivity to avoid PETS (e.g. demersal elasmobranchs and rays).

The detecting and recovering lost crab pots project (Sept 2019 to March 2023) aims to develop and test methods to detect and recover snow crab pots lost or abandoned by fishers (ghost gear). Two recovery gears have thus far been designed and manufactured, including a circular model that can cover a large surface of the seabed while minimising bottom impacts. Further detection and recovery technologies continue to be developed, and campaigns using these gears will be conducted in target areas. Ghost gear can be an issue for PETS bycatch.

China

Four projects indirectly address bycatch reduction of PETS through the usage of electronic monitoring. These projects are "*Acetes chinensis* quota fishing based on electronic monitoring", "*Engraulis japonicu*s fishing based on electronic monitoring", "Tuna longline fishing based on electronic monitoring", and "S*comber japonicus* fishing based on electronic monitoring". The projects all aim at protecting marine diversity by improving the monitoring of the working status and quota realization.

The *Acetes chinensis* quota fishing based on electronic monitoring project improved insight in the working status of fishing vessels by making use of the Acetes3DNet neural network. The *Engraulis japonicus* fishing project and Tuna longline fishing project both made use of the YOLOv5 algorithm, while the *Scomber japonicus* fishing project added long short-term memory (LSTM) network and attention (including CBAM and SE) to the network.

These experimental implementation of cameras and deep learning neural networks improved performance of target identification and behaviour recognition and show potential for improving the management of intelligent fishery vessels.

Denmark

There are ongoing efforts to combine the use of computer vision, camera technology, and video processing for real-time monitoring of (by)catches both during the fishing and on-board handling phases. Some of this technology is used to monitor any interactions between protected species (PETS) and fisheries. Results and technological advancements such as in-trawl camera systems and automated, camera-based catch profiling systems from the SMARTFISH, TECHNOFISH, AUTOCATCH projects will be used in upcoming projects to monitor and mitigate PET species bycatches. A joint project by DTU Aqua and Aarhus University investigates the impact of mainly grey seal depredation on longline and gillnet fisheries catches, explores depredation mitigation options, and also includes some estimation of drop-out rates of bycaught marine mammals. As part of the IMBAF project interactions between fisheries and PET species are being investigated and various mitigation options are being tested in gillnets to prevent bycatch of seabirds, such as LED lights, bird scarers. For marine mammals, mitigation trials concern thin twine types and reflective gillnets to prevent bycatch of harbour porpoise.

France

The project InseR (Selectivity Indicators; Dec 2022 to Dec 2023) aims to develop a R package that calculates a set of selectivity indicators to evaluate the selectivity performance of devices tested. The project PACMAN (Planning Human Activity over the Grande Vasiere; Nov 2020 to Oct 2022) aims to develop a framework for prioritizing placement of offshore windfarms and marine protected areas using a systematic conservation prioritization decision support tool that accounts for incompatibility between activities and varying ecosystem impacts. The project LEARN (Machine Learning Application to Fish Behaviour; Oct 2021 to Oct 2024) will produce a review article on applications of artificial intelligence to fish behaviour and how these may improve fishing gear selectivity. In addition, laboratory experiments will test seabass response to light stimuli (infrared, red, green, blue, and white). GoT S2 (Game of Trawls S2; Jan 2022 to June 2023) will continue the work of GoT, where remote imaging and automated computer algorithms are used to detect, in real time, species entering a trawl, and send this information directly to the skipper through an acoustic link so the trawl can be automatically controlled (potentially allowing species, including PETS, to escape through a remotely operated device/hatch etc).

The project PECHDAUPHIR (Interactions between common dolphin and fishing activity in the Maine Natural Park Iroise and the Bay of Audierne; 2021 to end 2023) aims to understand more about static-net behaviour sub-surface to gain insight into the conditions and/or types of gear most likely to cause accidental catches in common dolphins. To achieve this, sensors (pressure, temperature) will be integrated into several gears for which accidental captures have been recorded (sole trammel nets, hake nets, monkfish trammel nets, etc). The project DELMOGES (Delphinus Mouvements Gestion; 2022 to 2025) will use passive acoustic triangulation to track the sub-surface movements of common dolphins around different vessels and fishing gears (gillnets), to gain insight of fine scale interactions between dolphins and fisheries.

Germany

Project worked on bycatch reduction directly and indirectly through two main strategies, namely by focussing on the trawl selectivity and by working towards bycatch reduction of marine mammals and birds in gill nets.

The STELLA2 project directly aimed at PETS bycatch reductions through implementing gillnet modifications, fish pots and pontoon traps in a commercial setting in continuation of the work from the previous STELLA project (2020-2022).

Pearl nets were constructed by equipping gillnets with acrylic glass spheres to improve detectability by the echolocation of harbour porpoise. Initial results were promising, but a catch comparison in trial study in autumn 2022 did not show significant differences in catches between standard gillnets and pearl nets, though further analysis is ongoing. Next steps aim to scale up these mitigation trials, in both pearl net coverage and deployment locations. For fish pots, STELLA2 continued the work of STELLA1 by constructing "ideal" pots aimed catching flatfish and by implementing trial studies in the autumn of 2022 and spring of 2023. The STELLA project showed the influence of fish attraction and catchability, and a bait experiment is continued to find the ideal bait. The STELLA2 project further aims to implement fish pots on a larger, commercial scale. Lastly, STELLA2 aims to develop a pontoon trap with modifications for making it suitable for rougher environments, different target species (herring, garfish, cod, flatfish) and a modular design (in 2023).

A mini seine system has been developed by DTU-Aqua (Denmark) in 2018 and has several advantages, including reduced expected bycatch, ghost nets, and catch loss due to seals. In 2022, the Mini Seine project of the Thünen Institute of Baltic Sea Fisheries deployed the mini seine system in collaboration with commercial gillnetters in the German part the Baltic Sea, and the initial response was very positive.

Iceland

The Project FISHSCANNER (Dec 2018 to Dec 2023) aims to develop and test a lightweight and user-friendly device that provides real time information on the catch composition. It is mounted as a circular frame in front of the cod end containing stereo cameras and light, which scans all fish before they enter the cod end and uses artificial intelligence to perform real-time processing via an onboard computer. Information is then transmitted via a cable to the vessel. The system has the potential to be used in the identification of bycaught PETS.

Ireland

The New guide on Fisheries Conservation Solutions (2022) is a document providing advice on how to reduce unwanted catch's in Irish fisheries. It comprises one-page summaries of 22 gear modifications, survival exemptions, and technical tools developed in close collaboration with the fishing industry, to aid landing obligation requirements, fishing sustainability, and marine biodiversity (by decreasing juvenile catches, over-quota and non-target species).

The project Artificial Light on Raised Fishing Line (2022) assesses the use of lights mounted on and off raised fishing lines targeting demersal fish species in the Celtic Sea. Results suggest a 65% reduction in low-quota cod on lines with lights, with possible assessment of catch reduction of skates and rays. However, reductions in target fish species catches combined with increases fuel prices suggest lights were not commercially viable at the time of trial. The Modified Rigging in Nephrops Fishery project (2022-2023) tests a modified rigging with escape gap in Nephrops trawls and demonstrated reductions in catches of large fish such as skates and rays, alongside dogfish. In tandem, increased Nephrops catches were noted, possibly due to improved bottom contact associated with the new rigging. In response to this, skippers operating in the trial and the Irish sea have continued to use the rigging. Further assessment of bycatch and energy reduction benefits is planned in 2023. The project Assessment of Pair Fishing for Demersal Species (2022) aimed to improve energy efficiency of whitefish fishing and assess potential impacts on unwanted catches. Pair vessels reduced fuel use by 40% and increased catch rates by 29 with minimal impact on unwanted catches. The project Cod Survival in Seine-net Fishery (2022) assesses cod survival in seine net fishery using pop-up satellite archival tags. Tag deployments ranged from 2 to 21 days with an average survival period of 10 days. A minimum survival probability of 50% after 15 days or more is required for a survival exemption case, which was not met here likely due to barotrauma when hauling the net from depth. Measure to mitigate barotrauma are currently commercially unviable in the Irish Seine Net Fishery.

Italy

The Life DELFI project (2020-2024) aims at reducing interactions between bottlenose dolphins (*Tursiops truncatus)* and fishing activities through technical, management and socio-economic measures. Mitigation measures to be trialled include the use of pots as dolphin-safe and alternative gears to the passive nets; testing deterrent devices, such as interactive pingers (DiD-01 by STM) and visual deterrents (LEDs), both in set nets and trawl fisheries. The ELIFE project has been set up to improve the conservation of elasmobranch species (sharks and rays) by promoting best conservation practices by training Italian and Greek fishers on how to avoid incidental captures of sharks and rays. Another project called co-developing Data Collection, Analysis and Decision Support System for Small Scale Fisheries has the potential to collect data about fishing effort and bycatch events among small-scale vessels.

Japan

From 2014 until 2022, the “monitoring of Kuril harbour seal invading a salmon setnet with rope grid to reduce fish damage from seals” project was initiated to continuously monitor salmon set-nets with underwater cameras. In 2016, Dyneema rope grids were introduced at the entrance of the bag-net and over the period from 2017 until 2022, underwater image data of the project showed a decrease in seal occurrences and individuals reappearing over the years.

The Netherlands

Several projects have been ongoing in 2023 with an aim of increasing fuel efficiency and gear selectivity. Project such as “Helix ticklers”, “SepCran” and “StimTech” implement and test modifications that improve selectivity of the gear. Projects such as “GoPro downrigger”, “MASENRO 2.0” and “Fully Documented Fisheries” similarly aim at reducing bycatch, by enabling identification through live images or automatic recognition software of catch during the fishing or processing, which has the potential to significantly improve selectivity.

Norway

Several projects that recently started in Norway investigate whale and seabird bycatch in purse seine fisheries and elasmobranch bycatch.

The project ‘By-catch of seabirds in purse seine fisheries’ (May 2022 – April 2024), aims to get a better understanding of bycatch incidents of seabirds in the coastal purse seine fishery for Norwegian spring spawning herring. The aim is to estimate how often bycatch incidents occur, what factors are associated with bycatch events and to identify and test existing mitigations measures (e.g. light, sound, visual objects).

The project ‘By-catch of whales in purse seine fisheries’ (2021 – June 2023), aims to use sound to deter the whales from interacting with a coastal purse seine fisheries targeting herring. The aim is to test and develop sound that elicit the autonomous reflexes associated with the flight response. The first task was to tag killer and humpback whales and monitor their startle responses to different sound signals under controlled conditions.

A project dedicated towards demersal fish, tunas and various shark species bycatch mitigation is called ‘Selectivity in pelagic and industrial trawls’ (2021-2023). This project will develop knowledge and technology that can help reduce unwanted bycatch in pelagic and industrial trawls. This project will focus on solid and flexible selection systems, with a special focus on excluder devices. Other projects with mitigation potential are: SFI Dsolve (2020-2028) – biodegradable netting materials to reduce bycatch from ghost fishing for example, or the project 'Catching efficiency and species selectivity in the demersal seine fishery for flatfish' (2022-2024). In this project, a shorter or longer wing element was tested mainly to avoid the capture of cod or haddock, but it also reduced bycatches of skates.

Another project which may have ancillary outcomes for PET species is the project 'Development of selectivity systems for gadoid trawls (2020-2023)' which compares the size selectivity of a 55 mm sorting grid section (Sort-V type) to that of an identical section with a bar spacing of 45 mm. Although these grids are designed for improving selectivity for whitefish species, larger spacings may also promote the release of protected fish species.

Spain

The HOPNEXT project aims to design and test PET species bycatch release devices in tropical tuna purse seine fisheries (March 2022 – December 2022) to improve the survival rate of bycaught threatened species like sharks and mobulid rays in tuna purse seiners. Bycatch release devices (BRD) were developed such as mobulid ray sorting grids, shark velcros and chute systems.

The MITICET project, started in 2022, aiming to test acoustic active deterrent devices (pingers) for dolphins, with the main objective of comparing the incidental bycatch of dolphins by implementing an alternate hauls experimental design (with and without pingers) of the pair trawl unit. To record the incidental bycatches, both vessels were equipped with Electronic Monitoring Systems (EMS), which allows to visualize any cetacean bycatch onboard in all the fishing hauls. Results in 2022 showed a reduction of 92.2% in the proportion of hauls with bycatch of common dolphin and a 95% in the number of specimens per haul with bycatch.

Sweden

The project 'Secretariat for selective fishing gear (2014-2022) brought forward 50 projects with a great diversity ranging from the gentle handling of salmon in traps in the northern Baltic Sea to large grids excluding saithe in the industrial pelagic trawl-fishery of herring in the Skagerrak and experiment with pelagic trawl doors in the demersal trawl fishery. In the National report it is not clearly stated which were about mitigating bycatch interactions. The Swedish lobster programme (SWELOB) includes a monitoring component where possibly bycatches of PET species are being registered.

United Kingdom

England

The project Fisher Behaviour towards Light in a Controlled Laboratory Setting (May 2021 to Aug 2021) reported that lights on nets in a controlled laboratory setting were found to impact the behaviours of elasmobranchs and flatfish, with flashing lights leading to more active behaviours, suggesting that flashing lights may be more aversive than continuous (for which elasmobranchs showed a general interest). Habituation to lights tended to occur over time. The work is built upon in the project Assessing whether Flashing LEDs can Reduce Elasmobranch Bycatch (April 2023 to July 2023), where flashing lights are to be put on the headline of an otter trawl to see if less elasmobranchs are caught than in a control net.

Scotland

The project CodSElect (Using Light to Improve Cod Selectivity in North Sea Nephrops Trawl Gears; Nov 2022 to March 2024) is based on previous laboratory trials suggesting cod display a constant and strong aversion to blue and green artificial light, and will assess, using further tank based trials, if this response can modify cod behaviour within a trawl to swim up rather than remaining low (as is typical) so as to increase encounter rates with a square mesh escape panel and increase escape rates (reducing the likelihood of cod becoming a choke species). The project Marine Scotland Gear Development Trials (Aug 2022 ongoing) supplements this work, investigating i*n-situ* whether artificial green light can influence fish behaviour and direct individuals to escape meshes on the top of Nephrops trawls. Methods use a sensor rigged system alongside video footage to monitor light, turbidity, and fish behaviour, in Nephrops trawls with control and test trials run when artificial light sources are turned off or on. Catch composition (species, weight, and length) of control and test trials were sorted and recorded and will be compared.

Northern Ireland

The Northern Ireland Gear Trials (NIGT; Feb 2017 to March 2023 onwards) have been testing, over the last 6 years, various selective methods to improve the Nephrops Trawls fishery to reduce unwanted catch that is difficult to avoid. This includes lights attached to square mesh panels, to the bottom panel of SELTRA box sections, luminous netting on the bottom panel of the SELTRA box section, lights attached to an inclined net grid, replacement of netting with diamond netting, and trawls with the front cover removed in addition to other modifications. Parallel tows were performed with sets of experimental and control gears. No fronts cover and larger mesh top sheets appeared to perform well and reduce bycatch of minimum conservation reference sizes of several whitefish, particularly larger individuals (e.g. cod, and haddock). These approaches also led to reduced fuel consumption and emissions.

United States of America

The project Gear-based Hook and Line Catch Protection from Depredation (Nov 2021 to Oct 2023) implements a two-step approach, first working directly with fishers and gear manufacturers effective methods for protecting hook captured flatfish from whale depredation, and second developing and conducting a pilot test trial on some simple low cost catch protection designs that can be deployed on vessels currently operating in the Northeast Pacific. Two catch protection designs were tested: (1) an underwater shuttle, and (2) a branch-line gear with sliding shroud system. These two devices are currently being manufactured and will be tested to investigate (1) the logistics of setting, fishing, and hauling the two pilot catch protection designs, and (2) the basic performance of the gear on catch rates and fish size compared to non-protected gear.

The project Sea Turtle Encounters (May 2022 – June 2023) assesses the use of Turtle Excluder Devices (TEDs) in the southeastern United States shrimp trawl industry (which are required by law). Here, TEDs work as a large metal grid on the end of a trawling net that allow shrimp and small fish to enter the trawl but forces larger animals (turtles) out through an escape opening. Acoustic recordings of turtles interacting with the TED grid, alongside video recorders are being used to estimate turtle encounters with the device and its effectiveness (e.g. turtles that may drown in the trawl anyway but are then lost through the escape and unobserved).

The project Machine Learning and Electronic Monitoring (Jan 2021 – Dec 2023) aims to develop a new automated discard system with integrated cameras to automatically identify, count, measure, and estimate volume/weight of sub-legal groundfish that are to be discarded in real-time, with the method developed having potential applications to PETS bycatch mitigation.

The project Continued Development and Deployments of Active Selection (ActSel) Systems (May 2022 – Feb 2024) uses technology developed in a previous project that allows skippers to trigger the release of unwanted fish (bycatch) when they are observed in real-time video from their trawl. Here, the technology is provided to trawling vessels to assess practicability of use and adjust the system and its components where needed.

The project Ropeless Fishing Prototypes (July 2018 to Oct 2022) evaluates the potential for implementing ropeless pot fishing to reduce entanglement of, in particular, North Atlantic right whale. The project uses collaborative trials with fishes to test ropeless systems using acoustic releases. A GIS analysis determined where best to set trials of ropeless systems and controls. Deployment times of the ropeless systems were similar to controls, but ropeless systems suffer higher snag rates than controls. Ropeless gear held up well under varying oceanographic conditions, but still needs to be tested in deeper water (> 80 m).

The project Computer Modelling of Whale Entanglement (July 2019 – Oct 2022) developed a computer model using *Orcaflex* software that simulates large whale entanglements in vertical crustacean pot lines. The objective of this work was to determine loads on lines under different entanglement scenarios (e.g. pot configurations, depths, haul speed, whale contact points etc). Emphasis was on identifying scenarios in which ropes of reduced breaking strength might still be fished practically while parting under contact with large baleen whales.

3.3 Studies in progress within the group

Denmark has ongoing test of pingers for reduction of bycatch of harbour porpoise. The trials include tests of pinger different pinger spacing and pingers with increased sound sources. The pingers used are FISHTEK- Banana pingers, spaced with 200m and 500m. Furthermore, a re-design of the FISHTEK-Banana pinger was made with an increased SPL. All data is collected and will be analyzed in the near future. As mentioned last year also, Denmark has tested if a thinner twine size, can reduce bycatch of both seabirds, porpoises and seals. The results are in a reporting phase but showed no effects. The power was, however, low due to the few numbers of porpoises. The results from the pearl bead trials reported last year, testing if acrylic glass beads changed catch rates of target species, are likewise in the report phase, however the results showed that there were no changes in the catches of cod and flatfish when acrylic glass spheres are attached to the gillnets.

Since 2018, several projects have been set up in **France** to develop and test acoustic mitigation devices for pelagic trawlers and gillnetters. These projects and devices developed and tested were already described in the last WKEMBYC2 report (ICES 2023). A suite of French partners (fishers with their organizations, scientists, companies, administration) have consistently continued to be involved to test and improve the use of mitigation devices. The final objectives are to reduce as much as possible the accidental catches of the common dolphin *D. delphis*, as well as find operational devices onboard for the gillnetters practices.

About reflectors on the net (rope(s) along the net, i.e. passive acoustic), the main work has been to find improvements and solutions to integrate this device by suppliers as easily as possible into the gillnet. Part of this work was to discuss with net designers and net suppliers. More trials are made in 2023 during the PECHDAUPHIR project. Trials will also continue in 2024 under the French national Marine Mammals Action Plan.

About DOLPHINFREE beacons (bio-inspired acoustic beacon, i.e. active acoustic) directly set along the net, trials with 10 gillnetters were made in 2021 and 2022. In 2022, 228 days at sea were surveyed by observers onboard 8 vessels, representing about 1000 fishing operations (FOs). 2 individuals were caught in 2 FOs using nets without beacons. No bycatch of *D. delphis* was observed during FOs correctly operated and equipped with acoustic beacons, while 3 individuals were caught in 3 mal-operated FOs. These results are available in details here in Lehnhoff et al. (2022), as well as regarding behavioral responses of common dolphins to the bio-inspired signal. More data are needed to statistically test the efficiency of the device to limit *D. delphis* bycatch. In 2023, a huge work was made to explore recharge of these beacons by induction to facilitate easier handling by fishers. Moreover, a new version of the beacon has been developed (V3), aiming to improve its ergonomy, autonomy, faithfulness of the emitted signal and interactivity of the beacon (ie. emission when dolphins are detected – part developed in the LICADO project), for the best daily use of this device onboard. The grant of the project finished in June 2023, and, as for reflectors, trials of the new beacon version are made in 2023 during the PECHDAUPHIR project, and more trials will continue in 2024 under the French national Marine Mammals Action Plan.

For pingers set on the vessel hull (PIFIL device emitting the LICADO repulsive signal), the experiment, started in 2021, has continued in 2022 and 2023. For 2022, 27 vessels participated in trials of this device. The analyses carried out by the University of Pau concern 2846 FOs for which 37 had bycatch of *D. delphis*. For 2022, the rate of FOs with common dolphin bycatch was lower with the pinger activated during the set up (0.010) than without (0.015). These first data confirm that incidental catches are rare events and show that too few FOs and catches have been observed to allow a statistical conclusion to be drawn on the efficiency of pingers.

Moreover, a multivariate analysis was made, aiming to prioritize the importance of the factors according to the accidental catches of *D. delphis*. The first results of this analysis show that the pinger is the most important criterion for explaining the absence of catch. To explain the catch, the soak time is the main factor that emerges from this analysis. However, the soak time was mostly correlated with the "metier" (combination gear/target species) practiced. A more detailed analysis has to be conducted metier by metier to confirm, or not, the first results.

For all trials on static gillnets, a very low rate of accidental catches was recorded with or without the devices. These bycatch rates are consistent with bycatch rates from onboard observations, but it is difficult to evaluate the efficiency of different devices due to low sample size. Trials with the several devices are still in progress and need to be continued.

Finland

In Finland, acoustic seal deterrent devices (ADDs) were tested and further developed for keeping seals away from the immediate vicinity of coastal gillnets and fykenets. In order to increase the effective range of single devices, three different approaches have been taken: 1) a mobile ADD that can operate continuously for multiple days and can be easily moved to a new location, 2) autonomously moving seal deterrent device that can operate, as an example, around a fyke net, and 3) creating areas that are closed for seals completely by placing ADDs to e.g., rivers or straits. The operation success of the devices in the tests has varied depending on, e.g., location, time, and target species of the fisheries. However, as an example, the Atlantic salmon (*Salmo salar*) catches have been higher in trap nets that were equipped with a mobile ADD compared to nets without an ADD.

Germany

In Germany, the PAL-CE Project ("Porpoise ALert (PAL) use in German waters – Current Efficiency and mode of operation") investigates whether the proven effect of PALs of reducing habour porpoise (*Phocoena phocoena*) bycatch persist over longer periods of time. Said PALs are being used on a voluntary basis by German fishers in Schleswig-Holstein since 2017. To study if habituation has occurred, the behaviour of the already exposed harbour porpoises in Germany is compared with the behaviour of naïve harbour porpoises in the Danish Belt Sea. The data for the comparisons on their behavior and reaction to PAL is being collected through land-based observations methods (theodolite, drones, and protocols) as well as passive acoustic monitoring equipment and counts with the participation of fishers in both countries. The project is funded by the Bundesamt für Naturschutz (2021-2024) and is led by the Deutsches Meeresmuseum.

Greece

In Greece, the project entitled "Addressing the interaction between small-scale fisheries and marine megafauna in Greece" ("InCa"), with a total duration of 2 years (July 2020-July 2022), was implemented under the coordination of WWF Greece in collaboration with the Ichthyology Laboratory of the Biology Department of the Aristotle University of Thessaloniki (AUTh), the Institute of Marine Biological Resources and Inland Waters of the Hellenic Center for Marine Research (HCMR) and other expert bodies.

The aim of the InCa project was to collect robust data at the national level in order to:

- determine and document the magnitude of the loss of income of small-scale fishers, due to the damage of fishing gear and catch loss by marine megafauna, and
- measure the magnitude of incidental catch and the mortality of marine megafauna species (marine mammals, sea turtles, seabirds, and elasmobranchs).

According to the results of this project marine megafauna showed very low overall incidental catch rates in the fishing gears and in the areas studied during which on-board surveys were carried out. The main species for which incidental catches were recorded, at low rates, were sea turtles, seabirds, and elasmobranchs, while for marine mammals (cetaceans and Mediterranean monk seal) there were zero incidents recorded. Additionally, within the framework of the project, WWF Greece and its partners (AUTh and HCMR) have formulated a series of proposals, such as specific technical, management and financial measures, that if adopted and implemented, will significantly contribute to mitigating the loss of income for small-scale fishers and the incidental catch and mortality of marine megafauna in Greece.

The use of pingers or LED lights on fishing gears to mitigate mainly the incidental catches of sea turtles in Greece (elasmobranchs and monk seals were caught in low numbers during this study) have been proposed to be used in sensitive areas where *Caretta caretta* is nesting, feeding, and reproducing; however, there is no obligation today to use these techniques for the mitigation of PET bycatches.

The measures that are currently taken in Greece concern mostly areas belonging to NATURA 2000 (MPAs), to mitigate the incidental catches of marine megafauna; these include banning of bottom trawling in areas with PETs (such as monk seals, sea turtles, dolphins) and in some cases limitations concerning specific gears of the small-scale fisheries (SSF).

Moreover, the efforts of the Hellenic Society for the Study and Protection of the Monk Seal in Greece have focused on the interaction of SSF and the monk seals' conflict based on raising awareness towards fishers and local communities, for almost 25 years in Greek waters. The seals are not commonly entangled in the nets (usually the juveniles are affected), but are found shot when stranded, due to the damage they cause in the nets and the fish. Therefore, modifications on the fishing gears have not been tested, neither light-emitting devices, since the main reason for the death of monk seals in Greece has been reported to be deliberately killing.

Iceland

In Iceland, there were several projects on mitigation trials for marine mammals and seabirds over the last five years. After a successful test of PALs with a modified pinger signal, these studies are currently on hold but might resume next year through participation in the EU funded projects CIBBRiNA and MarineBeacon. Results of one of the unsuccessful trials that attempted to use LEDs to reduce seabird bycatch was published in 2023, where the results suggest a slight increase in bycatch of surface- and plunge feeding seabirds while no difference in the bycatch of diving seabirds was observed (Sigurdsson 2023).

Ireland

In Ireland work continues under SEAFICS (SEals And FIsheries Coexisting Sustainably; MSCA Fellowship based at University College Cork in collaboration with The Irish Marine Institute and National Parks and Wildlife Service). Here, trials have been conducted and data is being analyzed to assess the effectiveness of new targeted acoustic technology at deterring seals from static-net fisheries, with an aim to reduce depredation and by association bycatch of grey seals.

Work also continues under the Crayfish Data and Management Services (Irish Marine Institute, funded by the Irish Government and the European Maritime Fisheries Fund and European Maritime Fisheries and Aquaculture Fund). Here a sustainable fishery management plan is being developed to minimize interactions between set-net fisheries (primarily the crayfish fishery of west Ireland) and protected species bycatch. This includes the assessment of the use of alternate fishing gears such as pots, alongside seal deterrent devices such as targeted acoustic technology.

Norway

In Norway in 2021-2022 there has been a joint research project working on mitigating bycatch of whales (killer whales and humpback whales) and gulls in the purse seine fishery for herring, exploring combinations of different types of deterrent mechanisms (e.g., pingers and light). The project also explores drivers of the variation in seabird bycatch rates (e.g., weather patterns, specific fishing operations and areas) to understand where and when these mitigation actions should be implemented.

Since 2021, Norway has required vessels fishing in Vestfjorden (a chunk of ICES Area 2.a.2) in January-April to use pingers on all gillnets. Preliminary analyses suggest that compliance is stable around 60%, and that harbour porpoise bycatch rates have been reduced by on average about 20%. Norway plans to conduct further mitigation trials with pingers on gillnets in the same area, starting in early 2024. Norway has also progressed with its EM monitoring on fishing vessels, to the point where a system suited for Norwegian vessels has been developed and will be put in use on one vessel by the end of 2022.

Portugal

In Portugal, during 2022, mitigation trials using DDD´s and DiD´s (Dolphin deterrent devices, STM Industrial Electronics, Italy) continued within one specific task in the CetAMBICion project, coordinated by the University of Algarve and the Center of Marine Sciences (CCMAR). Testing occurred in gillnets (GNS) and were monitored with at sea observers and vessel crew observers (trained skippers) filling information in paper logbooks. On the overall, 107 hauls for DiD testing (61 control and 46 with alarms) and 47 hauls for DDD-03N testing (24 control and 23 with alarms) were analysed for boats larger or smaller than 12 m. Incidental captures of 2 bottlenose dolphins, *Tursiops truncatus*, were observed in gillnets in control hauls (DiD trial) only. Mitigation in nets is also used to decrease depredation from bottlenose dolphins, which has been increasingly reported mostly in southern Portuguese waters. The use of acoustic deterrent devices showed significant reduction of depredation for both alarm models, especially in gears targeting European hake, *Merluccious merluccious*, and red mullet *(Mullus surmuletus).*

Since 2019 that the beach seine fishery operating in the Portuguese central western coast was equipped with pingers as the fishery was enforced by law in 2017 (Portaria nº 172/2017 of May 25th) to use deterrents in areas with high bycatch evidence of harbour porpoises and common dolphins. However, the application and functioning of the pingers and their effectiveness has never been monitored.

On the Portuguese coast, the project LIFE + Ilhas-Barreira (2019-2023) funded by the EU´s LIFE program, aims to improve knowledge on the bycatch assessment of seabirds in coastal southern Portuguese fisheries, and also test mitigation measures to decrease bird bycatch. In 2022, trials were performed in gillnets led by the partner CCMAR/University of Algarve using an acoustic (megaphone) device and a visual device (scary bird repeller). Results provided evidence that onboard best practices and fisher behaviour changes, such as not discarding or releasing fish viscera to the water during fishing operations (net setting and hauling), could be used as mitigation tools. Preliminary results of these trials were presented during the meeting (see section 1).

Spain

Spain is carrying out during 2023 the pilot trials of the Project "MERMA CIFRA" (Monitoring, Assesment and Reduction of Accidental Mortality of Cetaceans due the Interactions with the Spanish Fleet – Review and Action). coordinated by the IIM-CSIC, also includes a WP focused on mitigation: "Technical measures for the reduction of accidental capture of cetaceans in Spanish fisheries in the Atlantic-Northwest national fishing ground" led by the IEO, which comprises 3 subtasks: a) to evaluate the technical fishing measures available to reduce the accidental capture of cetaceans in Spanish fisheries in the Atlantic-northwest national fishing ground; b) to carry out experimental reduction tests in the fisheries with the highest catch rate (trawl and gillnet); and c) to propose the most appropriate technical measures for the fisheries and the fishing ground based on the results and the best available scientific information. Pilot trials were conducted in gillnet fisheries and purse seine fisheries of galician waters (NW Spain), evaluating the effectiveness of pingers (Marexi, Net Guard and DDD) from different commercial brands. Currently, a campaign is underway to further test cetacean exclusion devices and pingers onboard bottom trawlers and pair trawlers.

As part of the "DESCARSEL" project, led by IEO-CSIC and focused on the "Study of strategies for reducing discards and unwanted species selectivity, and survival in trawl fishing", one of its objectives is to test devices for mitigation the accidental capture of cetaceans. Testing of the trawl net prototype with the Cetacean Exclusion Device (CED) is ongoing, and in the 2023 in the experimental survey onboard an oceanographic vessel new system such as LED lights was tested.

MITICET project continues, with the same experimental scheme, but with a different model of pinger. This model of pinger will be used in a pair bottom trawler, with the same experimental scheme to test the effectiveness of pingers. The difference between the two pingers is that the new one is less powerful, emitting the signal with less intensity so the acoustic impact in the environment is smaller. Moreover, the battery life is much higher, and it does not need to be recharged every 2-3 days, so the usability in a commercial fishery is much easier. Preliminary results show that the effectiveness is much lower than the DDD pingers tested in the previous year.

In the gillnet fisheries of the Basque Country, remote electronic monitoring systems have been installed to identify the bycatch level of PETs species. In case of bycatch, the next step will be to use pingers or any other mitigation measure to reduce it.

In the tuna purse seine fishery, experimental sea trials will continue to reduce the mortality rate of bycaught threatened species, mainly elasmobranch.

Sweden

In 2015, SLU Aqua initiated a project within ICES Subdivisions 3.a.21 and 3.a.23 with the aim of introducing pingers voluntarily into the lumpfish and cod fisheries. Following consultations with fishers, they opted for high-frequency Banana pingers as part of the project. Fishermen found the Banana pingers to be user-friendly and report their catches, fishing efforts, and incidental catches. By 2022, there was no more funding for additional pingers in the project. Nonetheless, participating fishers continue to utilize the pingers provided and continue reporting data to SLU Aqua. Notably, in Swedish Natura 2000 areas, the use of pingers became mandatory in 2022. Consequently, in that year, the Swedish Fishermen's Association secured funding through the EFF to procure pingers for fishers operating within Natura 2000 areas.

In small-scale coastal fisheries in Sweden, there is a constant drive towards innovating alternative fishing equipment. Pontoon traps, an alternative fishing gear, originally designed for catching salmon, whitefish, trout, and vendace, are now in use in commercial fisheries in the northern Baltic region. In the year 2022, a smaller type of the pontoon trap was developed targetting the multispecies fishery of the southern Baltic. The results from these developments reveal that, at specific times, the catches of cod, turbot, and other species can be notably substantial.

The main reason behind the development of the fishing gear is the seal inflicted damages to fishing gear and catch, which threatens an otherwise economically viable gillnet fishery. Several studies have been undertaken to evaluate the catch efficiency of different cod and lobster pots and what factors affect it (Hedgärde *et al*., 2016; Ljungberg *et al*., 2016; Nilsson, 2018). This is done partly by studying the behaviour of cod in relation to cod pot models and other fisheries related factors such as soak-time. The rate of cod entering pots gives an indication on the catch efficiency of the pots and by studying the entry rate in relation to factors such as cod pot model, number of fish inside the pot, and current strength, one gains information on what factors are affecting catchability. An alternative to both trawl and gillnet fisheries is bottom seine netting, such as Danish Bottom Seine. Bottom seines are generally considered less damaging than bottom trawls, and well-managed seine fisheries generally have minor ecosystem impacts (Morgan and Chuenpagdee, 2003). In 2022, SLU Aqua continued to develop a seine net modified for small open boats and tested it in pelagic and demersal species as a possible alternative to gillnet fisheries. The development is still under progress and the upcoming years there will be a focus on evaluating the seines environmental impact on the benthic habitat. Currently also pots, trap-nets and fyke-nets are being developed in cooperation with small-scale fishers.

United Kingdom

Several bycatch mitigation studies were ongoing or completed in the **UK** during 2022 for a range of sensitive taxa.

For cetaceans (mainly common dolphins), trials of lights, pingers (two models) and combinations of lights and pingers, were undertaken in a small-scale inshore net fishery under the Clean Catch UK programme which is managed by CEFAS. Results so far are inconclusive. Participating fishers found the experimental design challenging to implement in the field and some reliability issues were encountered with the lights and one of the pinger models. Consequently, the experimental design has been reconsidered and going forward will focus on the one model of pinger which so far proved the most reliable. Bycatch rates during the trial period were also lower than seen in a short baseline period of approximately one year before the trial began. To try and reduce the trial duration additional vessels have been recruited and phase 2 of the trial will also be conducted over a wider area to try and address inherent variability of bycatch rates associated with a very localised study on a highly mobile species.

Work on developing a passive acoustic reflector (PAR) device has been underway through Clean Catch UK since 2019 and a prototype that can replace standard gillnet floats has been manufactured. The final PAR prototype is due to be tested by local net riggers to identify best practises for deployment on commercial gill nets, after which practicality and efficacy trials will be undertaken.

For seabirds, work has been carried out in longline and gillnet fisheries. In offshore longline fisheries work during 2022 focussed on reanalysis of existing monitoring data to understand how different operational and environmental factors may influence bycatch rates, a literature review of longline mitigation methods to help inform industry of potential mitigation options, questionnaires to skippers to obtain their views on bycatch mitigation in the fishery and synthesis of observer notes from over 10 years of data collection in the fishery. This work is described in Kingston *et al*, 2023.

The Cornwall Bycatch Project is a partnership between the Royal Society for the Protec-tion of Birds (RSPB), Birdlife International, Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA), Natural England (NE), and Cornish gillnet fishers. This project trialled above water deterrents called looming eyes buoys and predator shaped kites on gillnets. The project will run across two winters, including in 2022, and the results are expected in 2023.

For elasmobranchs, the Spurdog Bycatch Management Programme operated in the Celtic Sea (Hetherington et al., 2022) between 2016 and 2022. The project developed a real-time bycatch reporting and mapping tool for spurdog, allowing fishers to self-report the presence or absence of spurdog bycatch during normal fishing activity every 24 hours. Information was then fed back to participating fishers using a bycatch advisory map, to highlight areas at low, medium and high risk of spurdog bycatch to allow informed decision-making when fishing. Other projects looking at reducing unwanted fish catches that were ongoing in 2023 include BATmap, a bycatch avoidance tool being trailed on the west coast of Scotland (Marshall et al., 2021). This project developed an app for Scottish skippers to share real-time information about the location of hotspots of fish species that are choke species (cod) or of conservation interest (spurdog) with other participating skippers.

3.4 Mitigation studies from published literature 2022

To locate recent, peer-reviewed journal articles on bycatch mitigation approaches both a google scholar and scopus search was done. The google scholar search included the following search terms: birds (seabird, bycatch, mitigation, 2022), small cetacean (cetacean, bycatch, mitigation, 2022), Large cetaceans and whales (whales, large cetacean, bycatch, mitigation, 2022), Turtles (sea turtles, cetacean, bycatch, mitigation, 2022), Elasmobranchs (sharks, rays, bycatch, mitigation, 2022) other literature was also added if known to the group. The scopus search string was defined as follows: TITLE-ABS-KEY ((("bycatch" OR "by-catch" OR "by-caught" OR discard*) AND (fish*) AND ("mitigation" OR "reduction" OR "elimination" OR "bycatch mitigation"))) AND PUBYEAR = 2022.

Table 3.1 Small cetaceans.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Lehnhoff, L. et al., (2022). Behavioural Responses of Common Dolphins Delphinus delphis to a Bio-Inspired Acoustic Device for Limiting Fishery By-Catch. Sustainability, 14(20), 13186.	Small cetaceans	common dolphin ‘Delphinus delphis’	Gillnets	Bay of Biscay	2020-2021	Bio-inspired acoustic beacon, emitting returning echoes from the echolocation clicks of a common dolphin	Visual surface observations showed attentive behaviours of dolphins, which kept a distance of several metres away from the emission source before calmly leaving.
Sarah, J. et al., (2022). The individual welfare concerns for small cetaceans from two bycatch mitigation technique. Marine Policy, Volume 143, 2022, 105126, ISSN 0308-597X, https://doi.org/10.1016/j.marpol.2022.105126.	Small cetaceans	dolphins, porpoises and small odontocete whales	static nets and trawl nets	Worldwide	2022	Bycatch Reduction Devices (BRDs) and Acoustic Deterrent Devices (ADDs, ‘pingers’)	Effectiveness of the devices is reviewed, as well as their effect in the cetacean's welfare. They conclude that cetacean welfare considerations should become an integral part of decision-making in relation to bycatch globally
Kratzer I. et all (2022) Angle-dependent acoustic reflectivity of gillnets and their modifications to reduce bycatch of odontocetes using sonar imaging. Fisheries Research DOI: 10.1016/j.fishres.2022.106278	Small cetaceans	Harbour porpoise	Gillnets	Baltic Sea	2022	Gillnets modification by add spheres increasing acoustic reflectivity of the nets	The acoustic image (echogram) of the gillnet with spheres demonstrates a distinct highly visible acoustic pattern, potentially rendering the spheres an effective way to reduce bycatch of small cetaceans.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Guidino, et al., (2022). Pingers Reduce Small Cetacean Bycatch in a Peruvian Small-Scale Driftnet Fishery, but Humpback Whale (Megaptera novaeangliae) Interactions Abound. Aquatic Mammals. 48. 117-125.	Small cetacean		small-scale gillnet	Peru		Acoustic alarms (pingers)	small cetacean bycatch per unit effort (BPUE) was reduced by 83%
Fu, W., Song, Z., Wang, T., Gao, Z., Li, J., Zhang, P., Zhang, Y.(2022) Acoustic deterrence to facilitate the conservation of pantropical spotted dolphins (Stenella attenuata) in the Western Pacific Ocean (2022) Frontiers in Marine Science, 9, art. no. 1023860	Small cetacean	Pantropical spotted dolphins (Stenella attenuata)	Gillnet, tuna purse seine fisheries	China	2019	Acoustic deterrent system (ADS) was tested during 30-day research survey	Dolphins departed the area and the number of dolphins in sight declined to zero after the deployment of the system. Additional evidence was reflected in acoustic recordings, showing the number of clicks emitted by dolphins decreased from 1,502 to 136 per minute after the ADS was activated.
Paitach et al. (2022) Assessing effectiveness and side effects of likely “seal safe” pinger sounds to ward off endangered franciscana dolphins (Pontoporia blainvillei). Marine Mammal Science	Small cetacean	Franciscana dolphins (Pontoporia blainvillei)	No fishery - independent tests	Babitonga Bay, southern Brazil,	2022	Test the efficiency of a seal safe pinger using a pinger deployed within a grid of CPODs.	Presence of dolphins decreased by 19.4% at pinger, 15.4% at 100 m from pinger. No avoidance response was seen at 400 m. No habituation was noted.
Wu et al. (2022). Bycatch mitigation requires livelihood solutions, not just fishing bans: A case study of the trammel-net	Small cetacean	Humpback dolphin	Trammel net fishery	Beibu Gulf, China	2018-2021	Transect surveys of trammel net fishing effort; interviews with fishers;	Fishing-gear modification, an ad hoc training program focusing on sustainable ecotourism, motivating and mobilizing local people in MPA monitoring and , management, and integration of traditional ecological

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
fishery in the northern Beibu Gulf, China, Marine Policy Marine Policy. Volume 139, May 2022, 105018						overlap analysis with dolphin habitat	knowledge into livelihood diversification programs are critical components to deal with the complexity of this issue
Dolman, S.J., Breen, C.N., Brakes, P., Butterworth, A., Allen, S.J. The individual welfare concerns for small cetaceans from two bycatch mitigation techniques (2022) Marine Policy, 143, art. no. 105126 DOI: 10.1016/j.marpol.2022.105126	Small cetacean	tucuxi (Sotalia guianensis); killer whales (Orcinus orca); common bottlenose dolphins (Tursiops truncatus) and false killer whales (Pseudorca crassidens; white-beaked dolphins (Lagenorhynchus albirostris); Indo-Pacific bottlenose dolphins (T. aduncus), melon-headed whales (Peponocephala electra) and short-finned pilot whales (Globicephala macrorhynchus) and Indo-Pacific humpback ; dolphins (Sousa chinensis)	Multiple gears	in southeastern Brazil; in the Strait of Gibraltar; in Hawai'ian waters; North-East England; Mayotte in the northern Mozambique Channel ;Xiamen, China	2022	(i) Bycatch Reduction Devices (BRDs), in the form of exclusion grids and escape hatches in trawl fishing gear; and (ii) Acoustic Deterrent Devices (ADDs, or pingers), as used in gillnets (and some trawls). Review: synthesis of existing studies of these mitigation methods and discuss the associated welfare issues, where poor welfare negatively impacts an individual's physical or mental state.	welfare considerations should become an integral part of decision-making in relation to bycatch globally

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Bonizzoni, S., Hamilton, S., Reeves, R.R., Genov, T., Bearzi, G. Odontocete cetaceans foraging behind trawlers, worldwide (2022) Reviews in Fish Biology and Fisheries, 32 (3), pp. 827-877.	Small cetaceans	Odontocete	trawlers	worldwide	2022	We also review knowledge gaps, the effects on odontocete ecology, distribution, behavior and social organization, the main mitigation options, and some management avenues that could help reduce incidental mortality.	Foraging behind trawlers increase the risk of bycatch. To take into account in bycatch mitigation strategies
Berninsone, L.G., Jiménez, S., Forselledo, R., Laporta, M., Werner, T.B. Alternative fishing methods, the potential use of “pingers,” and other solutions to reduce the bycatch of franciscana dolphins (Pontoporia blainvillei) (2022) The Franciscana Dolphin: On the Edge of Survival, pp. 349-362.	Small cetacean	franciscana dolphins (Pontoporia blainvillei)	gillnet	Brazil, Uruguay, and Argentina	2022	“pingers”, bottom longlines	Acoustic deterrent devices, “pingers”, were shown to be one of the most effective bycatch mitigation method. Bottom longlines were tested as alternative fishing gear and resulted in reduced bycatch but fishers found them difficult to implement. Gillnets modified to be acoustically reflective and have greater stiffness were ineffective for reducing bycatch.

Table 3.2 Large cetaceans

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome

Alkire, C. et al. (2022). Decline in on-demand fishing gear costs with learning. Frontiers in Marine Science.	Large cetacean	*Eubalaena glacialis*	Traps	United States and Canada	2022	On-demand fishing systems or ropeless	Injury and mortality of right whales in federal fisheries is to be reduced to a level to ensure the likelihood of survival and recovery of the species by 2030.

Table 3.3 Pinnipeds

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Lehtonen E. et all (2022) Feasibility and effectiveness of seal deterrent in coastal trap-net fishing – development of a novel mobile deterrent. Fisheries Research	Seals	Grey seal	Coastal trap-net for Baltic Salmon	Northern Baltic Sea	2022	Test of mobile acoustic deterrent device, attached to raft mounted system in vicinity of fishing gear.	Increase of 64% of salmon catch with ADD.
Ljungberg et all (2022) An evolution of pontoon traps for cod fishing (*Gadus morhua*) in the southern Baltic Sea. Frontiers in Marine Science	Seals and others		Alternative gear – pontoon trap nets	Baltic Sea	2022	Test of one of alternative to eg. gillnets gears like pontoon trap net	Alternative gear test
Goldsworthy et al. (2022) Assessment of Australian Sea Lion bycatch mortality in a gillnet fishery, and implementation and evaluation of an effective mitigation strategy. Frontiers in Marine Science.	Seals	Australian Sea Lion (*Neophoca cinerea*)	Demersal gillnet fishery targeting sharks.	South Australia	2022	Bycatch assessment carried out using combined fisheries observer data and species distribution modelling. To reduce bycatch mortality the Australian Sea Lion Management strategy was implemented	Significant reductions in gillnet fishing effort and reported bycatch of sea lions, with an estimated 98% reduction in sea lion bycatch mortality from gillnet interactions over the following decade. There was an almost complete transition in the fishery from gillnets to longlines.

						that included an independent observer program (100% electronic monitoring), permanent gillnet closures around all sea lion breeding sites, bycatch mortality limits that triggered 18-month closures, and incentives for fishers to switch to other methods (e.g. longline).	

Table 3.4 Turtles

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Nguyen, K. Q., et al. (2022). A comparison of catch efficiency and bycatch reduction of tuna pole-and-line fisheries using Japan tuna hook (JT-hook) and circle-shaped hook (C-hook). *Marine and Freshwater Research*, *73*(5), 662-677.	Turtles	Logger head, green turtle	Pole-and-line	Vietnam	2020	Above-water lights (PL) fisheries using a Japan tuna hook (JT-hook) and a circle-shaped hook (C-hook)	Results suggest that the use of C-hooks in the PL fishery is beneficial to protected endangered sea turtle species
Rose, S. et al. (2022). Characterizing sea turtle bycatch in the recreational hook and line fishery in southeastern Virginia, USA. *Chelonian Conservation and Biology: Celebrating 25 Years as the World's Turtle and Tortoise Journal*, *21*(1), 63-73.	Turtles	Kemp's ridley (*Lepidochelys kempii*), loggerheads (*Caretta caretta*), green turtles (*Chelonia mydas*)	Rod and wheel	Virginia	2014-2018	Looking at relations between bait and turtle interactions	Bloodworm and artificial bait had less frequently turtle interactions.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Ochi, D., et al., (2022). Multi-faceted effects of bycatch mitigation measures on target/non-target species for pelagic longline fisheries and consideration for bycatch management. bioRxiv, 2022-07.	Sea turtles and elasmobranch	*Prionace glauca*, *Isurus oxyrinchus*, *Caretta caretta*	LLS	Japan	2002-2010	The effects of using circle hooks and whole fish bait to replace squid bait on the fishing mortality of target and non-target fishes, and also bycatch species	The hook shape and bait type—both considered as effective bycatch mitigation measures for sea turtles—have extremely multifaceted effects for teleost fishes
Gautama., et al., (2022). Reducing sea turtle bycatch with net illumination in an Indonesian small-scale coastal gillnet fishery. Front. Mar. Sci. 9:1036158. doi: 10.3389/fmars.2022.1036158	Sea turtles	Green sea turtles (*Chelonia mydas*), Olive ridley sea turtles (*Lepidochelys olivacea*) and Hawksbill sea turtles (*Eretmochelys imbricata*)	Gillnet	Indonesia	2014-2017	Controlled experiments of using net illumination to reduce sea turtle bycatch in a coastal gillnet fishery.	Results indicated that net illumination significantly reduced multi-species sea turtle bycatch by 61.4% and specifically green sea turtles by 59.5%, while the CPUE of total catch and target species remained similar.
Lee, M.K., Kwon, Y., Lim, J.-H., Ha, Y., Kim, D.N. (2022) International community's efforts to mitigate sea turtle bycatch and status of implementing relevant measures by Korean tuna longline fishery. Fisheries and Aquatic Sciences, 25 (12), pp. 589-600.	Sea turtles	Not specified	Deep-set longline fishery (100–300 m)	South Korea	2022	Scientific observer data collected from Korean tuna longline fleets operated in the Pacific, Atlantic and Indian Oceans were used to figure out the current status of implementing measures such as using circle hook and bait type. – Lastly, a questionnaire survey (contents to seek information and opinions from fishers on whether to implement conservation	According to the scientific observer data collected, the ratio of circle hooks over the total hooks used in the Korean tuna longline fishery during 2018–2020 were 95% in the Pacific Ocean and 78% in the Indian and Atlantic Oceans. In the case of the Pacific Ocean, mostly 14 and 15 sized circle hooks (C14, C15) were used, with C14 being the largest proportion (71%) and C15 for 10%. C13 accounted for 9%, and both mixed use of circle hooks (C14 & C15) and circle hook (C14) and Japanese tuna hook accounted for 5%, respectively. In the case of the Indian and Atlantic Oceans, C15 accounted for the largest proportion (40%). Both C14 and mixed use of circle hooks (C14 & C15) accounted for 19% over the total, respectively. All hooks other than the circle hooks used were Japanese tuna hooks, which accounted for 22%, and notably, in the Atlantic Ocean, fishing vessels targeting Atlantic bluefin tuna used 100% Japanese tuna hooks. There was no J hook used

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
						measures and the efficiency of mitigation measures of ecologically related species including sea turtles.) was conducted for captains of Korean tuna longline fleets who participated in a training program during 2018.	in the Korean tuna longline fishery since 2018. - using both circle hooks and whole fin-fish/squid baits in the ICCAT Convention area. These vessels also have on board graphic materials for the safe handling and release of sea turtles adopted by WCPFC and sea turtle handling and release posters issued by NIFS
Baldi, G., Salvemini, P., Attanasio, A.P., Mastrapasqua, T., Pepe, A.M., Ceriani, S.A., Oliverio, M., Casale, P. (2022) Voluntary fishing logbooks are essential for unveiling unsustainable bycatch levels and appropriate mitigating measures: The case of sea turtles in the Gulf of Manfredonia, Adriatic Sea. Aquatic Conservation: Marine and Freshwater Ecosystems, 32 (5), pp. 741-752.	Sea turtles	Loggerhead sea turtle (*Caretta caretta*)	Trawler	Adriatic Sea, Italy	2015-2020	Analysis of fishing logbook and effort data to determine contributing factors to bycatch events	Seasonal effort restrictions, when turtles concentrate in shallow areas (needs monitoring); adopting TEDs or other measures only in the season of high turtle bycatch).
Dodge, K.L., Landry, S., Lynch, B., Innis, C.J., Sampson, K., Sandilands, D., Sharp, B. (2022)	Sea turtles	leatherback sea turtle (*Dermochelys coriacea*)	Fixed gear (nets and pots/traps)	Massachusetts, USA	2005-2019	Analysis of long-term entanglement dataset	Some recommendations were made for mitigation: reductions in the number of buoy lines allowed (e.g. replace single sets with trawls), seasonal and area closures targeted to reduce sea turtle–gear interaction, and encourage the development of

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Disentanglement network data to characterize leatherback sea turtle Dermochelys coriacea bycatch in fixed-gear fisheries (2022) Endangered Species Research, 47, pp. 155-170.							emerging technologies such as 'ropeless' fishing.

Table 3.5 Seabirds

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Rouxel, Y., et al. (2022) Slow sink rate in floated-demersal longline and implications for seabird bycatch risk. PLOS ONE 17(4): e0267169.	Seabirds	Several species	Demersal longline	Celtic Sea	2020	Analysis of sinking speed with Time Depth Recorder devices at different points of the gear.	Results indicate that hooks from floated-demersal longlines sink slowly and are therefore a clear bycatch risk. Reduction of the sink rate is proposed to reduce bycatch
Gilman, E., et al. (2022) Investigating weighted fishing hooks for seabird bycatch mitigation. Sci Rep 12, 2833 (2022).	Seabirds	Albatross	tuna longline	US North Pacific	2021	weighted hooks	Experimental hooks sank to 85 cm ca. 1.4 times faster than control hooks potentially reducing seabird bycatch. There was a significant 53% decrease in retained species' catch rates on experimental hooks, indicating an unacceptable economic cost.
Anderson, O.R.J., Thompson, D., & Parsons, M. 2022. Seabird bycatch mitigation: evidence base for possible UK application and research. JNCC Report No. 717, JNCC, Peterborough. ISSN 0963-8091.	seabirds	Several species	Offshore demersal longline and static nets	UK	2022	Line-weighting, night setting and bird-scaring lines for the offshore demersal long-line and suggestions on mitigation for pilots on static nets.	Document provides a list of different devices or methods to be used in UK offshore and static net fisheries in the UK in the future.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
McGrew, K. A., et al. (2022). Underwater hearing in sea ducks with applications for reducing gillnet bycatch through acoustic deterrence. J Exp Biol. 2022 Oct 15;225(20):jeb243953.	Seabirds	Long-tailed duck (*Clangula hyemalis*), surf scoter (*Melanitta perspicillata*) and common eider (*Somateria mollissima*)	Gillnet	Laurel, MD, USA	2016-2018	Research underwater hearing in sea duck species to increase knowledge of underwater avian acoustic sensitivity and to assist with possible development of gillnet bycatch mitigation strategies that include auditory deterrent devices.	Psychoacoustic results demonstrated that all species tested share a common range of maximum auditory sensitivity of 1.0-3.0 kHz. These results are applicable to the development of effective acoustic deterrent devices or pingers in the 2-3 kHz range to deter sea ducks from anthropogenic threats.
Kuepfer, A. et al. (2022). Strategic discarding reduces seabird numbers and contact rates with trawl fishery gears in the Southwest Atlantic. Biological Conservation, 266, 109462.	Seabirds	Several species	Trawl fishery	Southwest Atlantic, Falkland Islands	2022	Discards management to prevent seabird collision with trawl gear	zero-discarding prevented seabird collisions with trawl gears, and batch-discarding significantly reduced collisions, particularly when discards were stored between batches
Melvin, E.F., Wolfaardt, A., Crawford, R., Gilman, E., Suazo, C.G. (2022). Bycatch reduction (2022) Conservation of Marine Birds, pp. 457-496.	Seabirds	Several species	demersal longline and trawl fisheries; pelagic longline fisheries; coastal pursue seine	Global			reviews methodological approaches to determine the bycatch-related risk posed to seabirds from fisheries and recommends best practice mitigation to reduce bycatch in longline, trawl, gillnet, and purse seine fisheries. five case studies of fisheries in which seabird bycatch was dramatically reduced and guidelines
Jiménez, S., Páez, E., Forselledo, R., Loureiro, A., Troncoso, P., Domingo, A. (2022)	Seabirds	Petrels, shearwaters, albatross species	Trawl fisheries	Uruguay	2019	During observer programme, trials with bird scaring lines (BSL) (paired observations, of 20 min	One BSL reduced collisions and heavy collisions by 89%, and the associated mortality by 94%.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Predicting the relative effectiveness of different management scenarios at reducing seabird interactions in a demersal trawl fishery Biological Conservation, 267, art. no. 109487						with a BSL and 20 min without a BSL, where seabird collisions with the warp cables were quantified.	
Good, T.P., Jannot, J.E., Somers, K.A., Ward, E.J. Using Bayesian time series models to estimate bycatch of an endangered albatross (2022) Fisheries Research, 256, art. no. 106492,.	Seabird	Short-tailed albatross	U.S. west coast groundfish fisheries	U.S. West Coast	2022	Bayesian time series modelling. The best model used a constant bycatch rate and inferred annual expected bycatch and variability using a Poisson distribution, given specified levels of observed effort	The Bayesian model-based approach avoids assumptions inherent in ratio estimators and proxy methods; it incorporates uncertainty, reduces volatility, and enables comparisons of bycatch estimates to management thresholds. This analytical approach offers natural resource managers a framework for estimating bycatch in data-limited contexts, which can result in better guidance for management actions and mitigation strategies.
Zhou, C., Liao, B. Assessing the Uncertainty of Total Seabird Bycatch Estimates Synthesized from Multiple Sources with a Scenario Analysis from the Western and Central Pacific (2022) Birds, 3 (3), pp. 260-276.	Seabirds	Migratory species - Not specified	General bycatch	Western and Central Pacific	2022	Management Scenario analysis-estimating the uncertainty associated with a regional/global seabird bycatch estimate for management. - simulate multiple spatially distant separately managed areas with relatively low levels of observer coverage, based on bycatch data from the Western and Central Pacific Fisheries Commission convention area.	The results show that assuming a completely synchronized variation produced the most conservative uncertainty estimate and it also missed an opportunity to improve the precision. Simplified correlation structures also failed to capture the complex dynamics of bycatch rates among spatially distant areas. It is recommended to empirically estimate the correlation of bycatch rates between each pair of sources based on bycatch rate time series.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Dasnon, A., Delord, K., Chaigne, A., Barbraud, C. Fisheries bycatch mitigation measures as an efficient tool for the conservation of seabird populations (2022) Journal of Applied Ecology, 59 (7), pp. 1674-1685.	Seabird	White-chinned petrel	Pelagic fisheries targeting tuna species in South Atlantic and Indian Oceans, and in demersal longline fisheries practices targeting Patagonian toothfish, *Dissostichus eleginoides*, in South Indian Ocean and in Southern Ocean. Trawl fisheries in their subtropical wintering areas and in subantarctic waters until the mid-1990s	Possession Island (southern Indian Ocean	2022	Built multi-event capture–recapture models to estimate the demographic parameters of a population over 30 years, (b) assessed the effect of climate and fishery covariates on demographic parameters, (c) built a population matrix model to estimate stochastic growth rate according to the management in fisheries bycatch and (d) estimated changes in breeding population density using distance sampling data	Holistic approach to assess the effects of management measures by analysing datasets from sampling methods commonly employed in seabird studies.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Zhou, C.A.N., Brothers, N. Seabird bycatch vulnerability in pelagic longline fisheries based on modelling of a long-term dataset (2022) Bird Conservation International, 32 (2), pp. 259-274.	Seabird	Soft plumaged petrel, Cape Petrel, Shearwater, Flesh -footed shearwater, Black petrel, grey petrel, Great-winged Petrel, White-chinned Petrel, Subantarcti Skua, Black-footed Albatross, Yellow-nosed Albatross, Extra- large -sized, Large -sized Buller's Albatross, Laysan Albatross, Grey-headed Albatross, Light-mantled Sooty Albatross, Sooty Albatross, Black-browed Albatross, Giant Petrel, Salvin's Albatross, Shy Albatross, Northern Royal Albatross, Wandering Albatross,	Pelagic longline	in four geographical regions: Indian Ocean, Coral Sea, Southern Ocean, and Central Pacific	2022	Capture risk of fishery interactions by seabirds - To illustrate how to estimate and analyse bycatch vulnerability, a case study based on a long-term dataset of seabird interactions and capture confirmation is provided. Bayesian modelling and hypothesis testing were conducted to identify important bycatch risk factors.	Competition was found to play a central role in determining seabird bycatch vulnerability. More competitive environments were riskier for seabirds, and larger and thus more competitive species were more at risk than smaller sized and less competitive species. Species foraging behaviour also played a role. - Bycatch vulnerability is recommended as a replacement for the commonly used bycatch rate or carcass retrieval rate to measure the capture risk of an interaction. Combined with a normalized contact rate, bycatch vulnerability offers an unbiased estimate of seabird bycatch rate in pelagic longline fisheries.

Table 3.6 Elasmobranchs

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Doherty et al 2022. Efficacy of a novel shark bycatch mitigation device in a tuna longline fi shery. Current Biology, 32, R1245–R1261.	Elasmobranchs	Sharks	Tuna longline fishery	Southern France	2022	Electric field designed to overstimulate electroreceptors to reduce frequency of hook interaction.	Hooks fitted with electric field significantly reduced catch rates of blue sharks and pelagic stingrays.
Fakıoğlu, Y. E., Özbilgin, H., Gökçe, G., & Herrmann, B. (2022). Effect of ground gear modification on bycatch of rays in mediterranean bottom trawl fishery. Ocean & Coastal Management, 223, 106134.	Elasmobranchs	Guitarfish, common stingray, spiny buttefly ray	OTB	Turkey	2017	Modification of ground gear	Increased the attempt of two species (guitarfish and stingrays) to escape through the gap that is created in the modified ground gear
Murua, J., (2022). Developing bycatch reduction devices in tropical tuna purse seine fisheries to improve elasmobranch release. Collect. Vol. Sci. Pap. ICCAT, 79(5), 212-228.	Elasmobranch	Sharks and mobulids	Tuna perse seine	Atlantic Ocean		Use of various new BRDs that can assist fishers return elasmobranchs and other non-target species back to sea in a more effective and safe manner.	Of all BRDs examined, hoppers with ramps and mechanisms to control the flow of its contents, show the greatest potential to reduce elasmobranch and other non-target species mortality.
Doherty, P. et al. (2022). Efficacy of a novel shark bycatch mitigation device in a tuna longline fishery. Current Biology, 32(22), R1260-R1261.	Elasmobranch	Prionace glauca, Pteroplatytrygon violacea	LLS	Southern France	2021	3D pulsed electric field designed to overstimulate electroreceptors to reduce frequency of hook interaction	Hooks fitted with SharkGuard significantly reduced catch rates of blue sharks and pelagic stingrays decreasing standardised catch per unit effort by an average 91.3% and 71.3%, respectively

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Mytilineou, C., et al . (2022). Impacts on biodiversity from codend and fisher selection in bottom trawl fishing. Frontiers in Marine Science, 9, 1021467.	Elasmobranch	Sharks, skates, and rays	OTB	South Aegean Sea	2015	three different meshes in the trawl codend (40mm-40D and 50mm-50D diamond meshes, and 40 mm-40S square meshes)	Some species such as Mustelus mustelus, Scyliorhinus canicula and Squalus baeivnillei, might escape in specific codents; however, skates and rays get caught more often in all studied sizes.
Senko, J. F., (2022). Net illumination reduces fisheries bycatch, maintains catch value, and increases operational efficiency. Current Biology, 32(4), 911-918.	Elasmobranch and sea turtles	sharks, skates and rays and Caretta caretta	Gillnets	Mexico's Baja, California		Illuminated Gillnets with LED lights	Illuminated gillnets reduce total discarded fisheries bycatch biomass, including sea turtles and elasmobranch.
Pillans et al. (2022) Bycatch of a Critically Endangered Shark Glyphis glyphis in a Crab Pot Fishery: Implications for Management Front. Mar. Sci Volume 9 - 2022	Sharks	speartooth shark (Glyphis glyphis)	Pots	Queensland, Australia	2013-2020	Acoustic tagging data, fishing effort logbooks, experimental BPUE crab potting bycatch study	No explicit testing of mitigation approaches, but the study suggested gear modifications or spatial closures are required to ensure the viability of critically endangered shark population.
Madigan, D.J., Devine, B.M., Weber, S.B., Young, A.L., Hussey, N.E. Combining telemetry and fisheries data to quantify species overlap and evaluate bycatch mitigation strategies in an emergent Canadian Arctic fishery	Elasmobranchs	Greenland shark, (Somniosus microcephalus), and Arctic skate, (Amblyraja hyperborea)	longline	Cumberland Sound, Artic, Canada (summer fishery for Greenland halibut)		Combined popup satellite archival tags (PSATs) and fisheries data to assess habitat overlap and catch trends across these 3 species.	Combined tagging and fisheries data suggest that targeting specific seasonal habitat will not decrease bycatch, and inshore summer longline fisheries should be evaluated in the context of potentially high elasmobranch mortality, with enforced bycatch handling practices and alternative mitigation measures (e.g. gear modification or reduced soak times) required

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
(2022) Marine Ecology Progress Series, 702, pp. 1-17.							
Jubinville, I., Shackell, N.L., Worm, B. From policy to practice: Addressing bycatch for marine species-at-risk in Canada (2022) Marine Policy, 146, art. no. 105300,	Elasmobranchs	Winter skate Leucoraja ocellata, thorny skate Amblyraja radiata, and smooth skate Malacoraja senta	Bottom Trawler	Scotian Shelf, Canada	2022	Spatiotemporal modelling of fisheries-independent survey data to predict high-risk regions	When closures are precisely targeted on high-bycatch risk areas, relative costs to industry are minimal by affected fishing area (1.25 ± 0.62 % total area) or displaced landings (0.28 ± 0.14 % by weight of catch). To reduce bycatch risk by 50 % for all three vulnerable skates, less than 10 % of landed catch weight is displaced.
Alonso-Fernández, A., Mucientes, G., Villegas-Ríos, D. Discard survival of coastal elasmobranchs in a small-scale fishery using acoustic telemetry and recapture data (2022) Estuarine, Coastal and Shelf Science, 276, art. no. 108037, . Cited 2 times.	Elasmobranchs (coastal)	Small-spotted catshark, (Cyliorhinus canicular), undulate ray, (Raja undulata), thornback ray, (Raja clavate) and blonde ray (Raja brachyura).	small-scale fisheries.	North East Atlantic, Galicia,NW Spain	2022	Acoustic telemetry and mark-recapture data to estimate discard survival of coastal elasmobranch species at multiple temporal scales.	The overall survival rate was 90% on the short term and 85.7% on the long term, but it varied among species. Survival rates of R. clavata and S. canicula on the short term were 70% and 100%, respectively, and 66.7% and 92.9% on the long term, respectively. All the individuals of R. brachyura and R. undulata survived on the long term. Our results are critical to support the application of survival exemption in small scale fisheries.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Massey, Y., Sabarros, P.S., Bach, P. Drivers of at-vessel mortality of the blue shark (Prionace glauca) and oceanic whitetip shark (Carcharhinus longimanus) assessed from monitored pelagic longline experiments (2022) Canadian Journal of Fisheries and Aquatic Sciences, 79 (9), pp. 1407-1419.	Elasmobranchs	Blue shark (Prionace glauca) and oceanic whitetip shark (Carcharhinus longimanus)	pelagic longline fisheries	French Polynesia	2022	Data collected during monitored longline fishing experiments conducted in French Polynesia were used to (i) estimate AVM for each species based on bootstrapped samples and (ii) to assess AVM drivers using multivariate logistic regression models	At Vessel Mortality varies widely between species. These results indicate that to reduce the AVM of these two species, the vertical distribution of hooks and soak duration should be considered as mitigation measures related to pelagic longlining.
Scott, M., Cardona, E., Scidmore-Rossing, K., Royer, M., Stahl, J., Hutchinson, M. What's the catch? Examining optimal longline fishing gear configurations to minimize negative impacts on non-target species (2022) Marine Policy, 143, art. no. 105186,	Elasmobranchs	Oceanic whitetip (C. longimanus) and silky (Carcharhinus falciformis) shark	Pelagic longline	US Pacific, Hawai	2022	Potential options to optimize fishing gear configurations. Using breaking strength and wire and monofilament leader materials to maintain target catch rates whilst reducing bycatch mortality, injury, and harm.	Switching from wire to monofilament leaders reduced the catch rate of sharks by approximately 41%, whilst maintaining catch rates of target species (Bigeye tuna, Thunnus obesus). However, trailing gear composed of monofilament did not break apart even after 360 days. In contrast, branchlines with wire leaders began to break at the crimps after approximately 100 days. Additionally, the breaking strength of soaked fishing hooks was greater for larger, forged hooks composed of stainless steel

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Wambiji, N., Kadagi, N.I., Everett, B.I., Temple, A.J., Kiszka, J.J., Kimani, E., Berggren, P. Integrating long-term citizen science data and contemporary artisanal fishery survey data to investigate recreational and small-scale shark fisheries in Kenya (2022) Aquatic Conservation: Marine and Freshwater Ecosystems, 32 (8), pp. 1306-1322. DOI: 10.1002/aqc.3829	Elasmobranchs	Sharks belonging to the families Carcharhinidae, Triakidae, and Sphyrnidae	Small-scale and recreational fisheries. Longlines drift gillnets and bottom-set gillnets	Kenya	2022	Data from three sources were used to assess the composition of shark landings in these fisheries in Kenya: boat-based recreational fishery tagging 1987–2016; observed landings from the Bycatch Assessment and Mitigation in the Western Indian Ocean Fisheries Project 2016–2017; and Catch Assessment Surveys landings data 2017–2020.	Findings from this study highlight the importance of citizen science by recreational fishers in increasing awareness around the risks and threats to shark populations.
Haque, A.B., Cavanagh, R.D., Spaet, J.L.Y. Fishers' tales—Impact of artisanal fisheries on threatened sharks and rays in the Bay of Bengal, Bangladesh (2022) Conservation Science and Practice, 4 (7), art. no. e12704.	Elasmobranchs	Sharks and rays	Elasmobranch fisheries (though not bycatch but targeted)	Bay of Bengal, Bangladesh	2022	Socio-ecological study to characterize elasmobranch fisheries and evaluate their impact on threatened species.	The results demonstrate that several globally threatened elasmobranch species are frequently captured, and some of them have experienced substantial population declines (e.g., wedgefishes, sawfishes, large carcharhinid sharks) over the past decade.

Table 3.7 Multitaxa

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Poisson, F.,et al. (2022). New technologies to improve bycatch mitigation in industrial tuna fisheries. Fish and Fisheries, 23(3), 545-563.	Multitaxa	multitaxa	Longline	all	-	Decision tool	Improve our understanding of factors that influence capture, escape and stress of caught species. how past fishery interactions affect responses to fishing gear should be taken into account when developing technical mitigation measures.
Lucas and Bergreen 2022. A systematic review of sensory deterrents for bycatch mitigation of marine megafauna	Multitaxa	Multitaxa	Several taxa ((marine mammals, sea turtles, seabirds and Elasmobranchs)	All		Review- a systematic review of 116 papers, plus 25 literature reviews published between 1991 and 2022, to investigate potential for sensory deterrents to mitigate bycatch across four marine megafauna taxonomic groups	It is difficult to make generalisations about the efficacy of sensory deterrents and their ability to deliver consistent bycatch reductions. The efficacy of each method is context dependent, varying with species, fishery and environmental characteristics.
Senko et al 2022. Net illumination reduces fisheries bycatch, maintains catch value, and increases operational efficiency. Current Biology, 32, 911–918.e1–e2	Turtles and Elasmobranchs	Loggerhead turtles and general elasmobranchs	Gillnets	Pacific coast of Baja California Sur, Mexico		Use of green LED lights to reduce turtle, elamobranch and finfish bycatch	Significantly reduced mean rates of total discarded bycatch biomass by 63%, which included significant decreases in elasmobranch (95%), Humboldt squid (81%), and unwanted finfish (48%). Moreover, illuminated nets significantly reduced the mean time required to retrieve and disentangle nets by 57%.
Pons, M., et al. (2022). Trade-offs between bycatch and target catches in static versus dynamic fishery closures	all	All bycatch	All fisheries combined	Global		Static spatial and temporal closures	Spatial dynamic ocean management can be 3.6 times more effective than a static approach (such as a classic no-take area) when the main goal is to avoid bycatch. However, when the goal is to protect a critical habitat,

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
							a static biodiversity hot spot, or a unique feature, a static area closure could be more effec- tive and easier to enforce.
Ayers, A.L., Leong, K. (2022) Focusing on the human dimensions to reduce protected species bycatch Fisheries Research, 254, art. no. 106432,	Seabirds, marine mammals, and other endangered or threatened marine species	Not specified, leatherback sea turtles,	Hawai longline fleet. A small set of vessels target swordfish using shallow-set longline gear, while a majority of vessels target bigeye tuna using deep-set longline gear. hallow- and deep-set fisheries deploy a monofilament mainline that is 3.2–4.0 mm in diameter. Different branch line and bait	Hawai	2022	Sociotechnical solutions.	Fleet communication and crew training are two practical and convenient sociotechnical solutions that appear to provide operational and economic advantages but have not been widely adopted and implemented across the fleet. Barriers: competitivity> data confidentiality issues, lack of crew training

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Barnes, T.C., Broadhurst, M.K., Johnson, D.D. Fleet-wide acceptance of escape gaps and their utility for reducing bycatch in south-eastern Australian *Portunus armatus* traps (2022) Fisheries Management and Ecology, 29 (6), pp. 841-850. DOI: 10.1111/fme.12586	Crostaceans and teleosts	Undersized blue swimmer crabs, *Portunus armatus*, giant mud crabs, *Scylla serrata* and yellowfin bream, *Acanthopagrus australis*	Collapsible netted cylindrical (or “round”) traps	South-eastern Australia.	2022	An observer-based study was used to assess the adoption and effectiveness of the most common escape gaps across two estuaries responsible for >70% of all harvest. Five observers collected data from 5710 deployments of round traps over 116 days.	Compared with round traps with no escape gaps, traps with a rectangular design consistently retained fewer undersized *P. armatus* (by up to 54%); similar to earlier, manipulative experiments. However, unlike previous observations, escape-gap performance did not significantly improve with increasing catches of *P. armatus*. Eventual 100% adoption of escape gaps should enable large numbers of undersized *P. armatus* to escape traps and avoid discarding each year in south-eastern Australia.
Alexandre, S., Marçalo, A., Marques, T.A., Pires, A., Rangel, M., Ressurreição, A., Monteiro, P., Erzini, K., Gonçalves, J.M. Interactions between air-breathing marine megafauna and artisanal fisheries in Southern Iberian Atlantic waters: Results from an interview survey to fishers (2022) Fisheries Research, 254, art. no. 106430	Air-breathing marine megafauna – cetaceans, seabirds, and marine turtles		Longlines, pots and traps, bottom set-nets, and purse seine	Coastal waters off Western Iberia- Portuguese mainland Southern coast (Algarve)	2022	Assess fishery interactions through face-to-face interviews to fishers of the local and 32 coastal artisanal fisheries fleets in the landing sites. - The main goal was to identify and evaluate problematic interactions known to cause 34 bycatch or economic loss through depredation.	Bycatch is a concern for all marine megafauna groups, but depredation problems are mostly associated with cetaceans. The fishing gears of most concern were purse seine and coastal bottom set-nets. Purse seine showed problems associated with important bycatch numbers, especially of common dolphins, *Delphinus delphis*, while bottom set-nets have considerable bycatch of all animal groups and depredation was highly associated with bottlenose dolphins, *Tursiops truncatus*. Bycatch and depredation were found to be species, gear, area, and vessel size dependent. Economic loss caused by depredation led to catch and gear damage and was widely reported by bottom set-net fishers, ranging from 7-21% of their revenue. - active participation of fishers provides improved localized knowledge on interactions between local and coastal fisheries and marine megafauna, allowing for the definition of specific management and mitigation strategies.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Rose, C.S., Barbee, D. Developing and testing a novel active-selection (ActSel) bycatch reduction device to quickly alternate trawls between capture and release configurations with real-time triggering (2022) Fisheries Research, 254, art. no. 106380,	Potentially across taxa	Tested on Salmon in Alaska pollock and Pacific hake fishery	Trawl	Western North Atlantic	2022	ActSel, BRD system. Net panel: selection panel. -Panel-movement device: Strip kite angle is adjusted with two control lines (one above the kite and one below it) run through pulleys attached to two plastic tube loops on the forward edge of the kite, and the center of the aft edge of the kite. -Electromechanical actuator	In combination with real-time, on-net video, this device provides an ability to selectively exclude bycatch species.
Fauziyah, Eka Putri, W.A., Arianti, D., Agustriani, F., Rozirwan, Ningsih, E.N., Purwiyanto, A.I.S. Discarded Species in Artisanal Fisheries South Sumatra, Indonesia: Case Study on Crab Gill Nets (2022) Sains Malaysiana, 51 (9), pp. 2745-2756.	Multi-taxa	Arthropoda, Chordata, and Mollusca	Crab gillnet for targeting the blue swimming crab Portunus pelagicus	Banyuasin estuarine of South Sumatra, Indonesia	2022	Mitigation options offered include captive breeding of horseshoe crabs, the release of protected species when caught, and fishing gear modification.	The fishing gear yielded the discarded catch about 12% (25.68 kg) of the total catch in weight (212.68 kg). For the discarded catch, 703 individuals represented 18 species from 3 phyla (Arthropoda, Chordata, and Mollusca).
Cazé, C., Réveillas, J., Danto, A., Mazé, C. Integrating fishers' knowledge contributions in Marine Science to tackle bycatch in the Bay of Biscay	Small cetacean and Seabirds		Multiple gears	Bay of Biscay	2022	The fieldwork combines several types of materials: archives, ethnographic interviews with a diverse set of stakeholders, observations in professional gatherings, participation in scientific conferences, and	The knowledge co-creation process for bycatch reduction in the Bay of Biscay is hindered by several, interrelated factors of tension constraining collective learning and limiting the capacity of actors to come up with shared solutions. – Reform cannot be driven only by providing evidence that the current status quo has to change. Acknowl-

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
(2022) Frontiers in Marine Science, 9, art. no. 1071163,						social science analyses (actor mapping, epistolary analysis, etc.) – Data collection entailed the experiences of by-catch, the interactions between actors within and without the stakeholder group, the roles in the decision making processes, and the perception of the different measures for by-catch reduction.	edging the presence of conflicts between the stakeholders and understanding their roots and their impact on the co-design process is essential.
Roberson, L., Wilcox, C., Boussarie, G., Dugan, E., Garilao, C., Gonzalez, K., Green, M., Kark, S., Kaschner, K., Klein, C.J., Rousseau, Y., Vallentyne, D., Watson, J.E.M., Kiszka, J.J. Spatially explicit risk assessment of marine megafauna vulnerability to Indian Ocean tuna fisheries (2022) Fish and Fisheries, 23 (5), pp. 1180-1201.	Multi taxa	Sea turtles, elasmobranchs, and cetaceans	Tuna fisheries, purse seines, longlines, and drift gill nets	Indian Ocean	2022	Productivity Susceptibility Analysis tool designed for data- poor contexts to present the first spa-tially explicit estimates of by-catch risk	Our results indicate that current by-catch mitigation measures, which focus on safe- release practices, are unlikely to adequately reduce the substantial cumulative fishing impacts on vulnerable species. Preventative solutions that reduce interactions with non-target species (such as closed areas or seasons, or modifications to gear and fishing tactics) are crucial for alleviating risks to megafauna from fisheries.
Akbari, N., Bjørndal, T., Failler, P., Forse, A., Taylor, M.H., Drakeford, B.	Multi taxa	General	Fisheries management	UK's North Sea Scottish Fisheries	2022	Sustainability framework. The contributions of this study are threefold including (i) collecting and ana-	This study provides insight for the UK's fisheries sector, and scientific advisory groups for the enhanced implementation of sustainable fisheries management policies.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
A Multi-Criteria Framework for the Sustainable Management of Fisheries: a Case Study of UK's North Sea Scottish Fisheries (2022) Environmental Management, 70 (1), pp. 79-96.						lysing primary data gathered from a diverse group of stakeholders in the Scottish fishery sector and scientific community, (ii) prioritising a diverse range of criteria in terms of importance in decision making from industry and scientific community perspectives, (iii) elaboration of the key management objectives in this region within the context of sustainable management of fisheries in the UK.	
Naimullah, M., Lee, W.-Y., Wu, Y.-L., Chen, Y.-K., Huang, Y.-C., Liao, C.-H., Lan, K.-W. Effect of soaking time on targets and bycatch species catch rates in fish and crab trap fishery in the southern East China Sea (2022) Fisheries Research, 250, art. no. 106258,	Multi-taxa	Portunus *sanguinolentus, P. pelagicus,* and *Charybdis feriatus; Kuroshio Dentex, hypselosomus, Evynnis cardinalis*	Fish and crab traps	Taiwan Strait	2022	Determining the catch rates and bycatch species as well as the effect of the soaking time (SKT) of fish and crab traps for management strategies for trap fisheries	The optimal target species catch rates were achieved for a SKT of 48 h, regardless of the trap type. The bycatch rates were found to be higher when the SKT was longer than 48 h for crab traps, whereas the bycatch rates for fish traps were unaffected by the SKT.
Gilman, E., Hall, M., Booth, H., Gupta, T., Chaloupka, M., Fennell, H., Kaiser,	Multi-taxa	Cetaceans, hard shelled Turtles, leatherback Turtles, Rays, Seabirds	All gear type	broad	2022	A decision tool to enable stakeholders to evaluate alternative bycatch man-	The proposed decision tool therefore enables stakeholders to develop bycatch management frameworks

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
M.J., Karnad, D., Milner-Gulland, E.J. A decision support tool for integrated fisheries by-catch management (2022) Reviews in Fish Biology and Fisheries, 32 (2), pp. 441-472.		, Sharks epipelagic, mesopelagic Sharks, Teleosts				agement strategies' efficacy at meeting specific and measurable objectives for mitigating the catch and mortality of bycatch and for costs from multi-species conflicts, economic viability, practicality and safety, while accounting for the fishery-specific feasibility of compliance monitoring of alternative by-catch management measures.	that provide precautionary protection for the most vulnerable populations with acceptable tradeoffs.
Jenkins, L.D. Power, politics, and culture of marine conservation technology in fisheries (2022) Conservation Biology, 36 (3), art. no. e13855,	Multi-taxa		All gear types	Worldwide	2022	A framework to address the use of technology in bycatch mitigation based on Society's values system	This framework melds key concepts from the socioecological systems framework and science and technology studies. Such a framework incorporates broader understanding, so that the values and concerns of society are more effectively addressed in the creation and implementation of marine conservation technologies and technological marine conservation systems.
Campello, T.H.P., Comassetto, L.E., Gomes Hazin, H., Pacheco Dos Santos, J.C., Kerstetter, D., Hazin, F.H.V. Comparative analysis of three bait types in deep-set pelagic longline gear in the Equatorial Atlantic Ocean [Análise comparativa de três	Multi-taxa	Blue shark (*Prionace glauca, istiophorid*) billfishes, wahoo (*Acanthocybium solandri*), skipjack tuna (*Katsuwonus pelamis*), common dolphinfish (*Coryphaena hippurus*), ocean sunfish	deep-set pelagic longline	Equatorial Atlantic Ocean	2022	Most efficient bait for the pelagic longline fishing operation. Not much about bycatch but rather on efficacy of the bait for targeted species	Yellowfin tuna catch rates were higher with the use of squid as bait, while the catch of bigeye tuna was higher with the use of sardine and mackerel (small teleosts). Counterintuitively, the catch rate of yellowfin tuna was higher at deeper layers, the opposite behavior observed in bigeye tuna.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
diferentes tipos de isca utilizados no espinhel pelágico de profundidade no Oceano Atlântico Equatorial] (2022) Boletim do Instituto de Pesca,		(*Mola sp.*) crocodile shark (*Pseudocarcharias kamoharai*), shortfin mako (*Isurus oxyrhinchus*), thresher shark (*Alopias sp.*), and sea turtles.					
Suuronen, P. Understanding perspectives and barriers that affect fishers' responses to bycatch reduction technologies (2022) ICES Journal of Marine Science, 79 (4) DOI: 10.1093/icesjms/fsac045	Multi-taxa	All species	All gears	Theoretical	2022	To reduce bycatch it is not only important to boost mitigation technology but also to reflect on compliance and get in the fishers perspective	When there is a need to enforce a regulation on bycatch reduction technology, it is important to understand that the motivation of each individual fisher strongly affects the potential degree of compliance. Several factors may influence motivation, including market pressures, status of fisheries resources, and feeling of fairness. Solutions proposed must be meaningful in the socioeconomic context of a given fishery. Besides, there should be a follow-up monitoring of these consequences
Rodrigues, L.D.S., Kinas, P.G., Cardoso, L.G. Optimal setting time and season increase the target and reduce the incidental catch in longline fisheries: a Bayesian beta mixed regression approach	Multi-taxa	Shortfin mako shark and loggerhead turtles	Pelagic longline	Southwest South Atlantic Ocean	2022	We used Bayesian beta mixed regression models to describe the effects of setting times and seasonality on catches	Targeted species are typically captured in fully nocturnal sets (started between 16 and 00 h), whereas shortfin mako shark and loggerhead turtles are typically captured during partially nocturnal sets (started between 00 and 04 h)

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
(2022) ICES Journal of Marine Science, 79 (4), pp. 1245-1258.							
Papageorgiou, M., Hadjioannou, L., Jimenez, C., Georgiou, A., Petrou, A. Understanding the Interactions Between Cetaceans and Other Megafauna with the Albacore Tuna Fishery: A Case Study From the Cyprus' Pelagic Longline Fishery (2022) Frontiers in Marine Science, 9, art. no. 868464,	Multi-taxa	Common bottlenose dolphin and striped dolphin. Neon flying squid, the shortfin mako shark and the Risso's dolphin	Pelagic longline	Exclusive Economic Zone of the Republic of Cyprus, in the marine areas off Larnaca Bay and Paphos – Limassol (southeastern and western coasts of Cyprus)	2022	Information collected from fisher's logbooks, interviews and onboard observations. Depredation rate and economic loss were estimate by using simple calculations including the number and weight of depredated fish, landings and fishing effort.	The study also identified depredation hotspots and possible depredation mitigation measures. Depredation increases the risk of bycatch
Eryaşar, A.R. grid-net design that successfully reduces discarded catch and damage to benthic species in the veined rapa whelk beam trawl fishery (2022) Marine Biology Research, 18 (5-6),	Multi-taxa	Beam trawl bycatch species	Veined rapa whelk beam trawl fishery	South-eastern Black Sea	2022	A grid-net design (GND) with three different bar spacings was compared with the commercial beam trawl. In the grid-net design, a rectangular metallic grid positioned 6 cm off the ground substituted half of the codend to allow the escape of discard species.	22 mm GND was the most successful design among the tested gears in minimizing commercial product loss and reducing the discarded catch amount.

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Jacques, N., Pettersen, H., Cerbule, K., Herrmann, B., Ingólfsson, Ó.A., Sistiaga, M., Larsen, R.B., Brinkhof, J., Grimaldo, E., Brćcićc, J., Lilleng, D. Bycatch reduction in the deep-water shrimp (*Pandalus borealis)* trawl fishery by increasing codend mesh openness (2022) Canadian Journal of Fisheries and Aquatic Sciences, 79 (2), pp. 331-341.	Multi taxa	Polar cod and juvenile American Plaice. Juvenile shrimp	Deep-water Shrimp trawl	Barents Sea	2022	Effect of applying different codend modification was explored, each aimed at affecting codend mesh openness and thereby selectivity.	Changing from a 4-panel to a 2-panel construction of the codend did not affect size selectivity. Shortening the lastridge ropes of a 4-panel codend by 20% resulted in minor reductions for juvenile fish bycatch, but a 45% reduction of undersized shrimp was observed. Target-size catches of shrimp were nearly unaffected. When the codend mesh circumference was reduced while simultaneously shortening the lastridge ropes, the effect on catch efficiency for shrimp or juvenile fish bycatch was marginal compared to a 4-panel codend design with shortened lastridge ropes.
Ceyhan, T., Tosunoğlu, Z. Relationship Between by Catch Ratio of Sardine-Anchovy Targeted Purse Seine and Some Environmental Factors Based on a General Addictive Model in the Aegean Sea (2022) Aquatic Sciences and Engineering, 37 (1), pp. 1-7.	Multi-taxa	Small Pelagic species	Pursue seine net	Izmir bay, Mediterranen Sea	2022	we used generalized additive models (GAM) to by the catch ratio of purse seine fishery to determine the effects of environmental variables.	In terms of habitat of by catch species, the total ratios of benthopelagic, demersal and pelagic species were 52% , 28% and 20%, respectively. Significant interactions observed indicate that the fluctuations in by catch ratios differed by depth and sea surface temperature, whereas the quarters of year and the moon phases were not found to affect by catch ratios significantly.

Table 3.8 Teleosts

Literature	Group of species	Species	Gear	Area	Year	Method	Outcome
Larsen, R.B., Herrmann, B., Sistiaga, M., Brinkhof, J., Cerbule, K., Grimaldo, E., Lomeli, M.J.M. Effect of the Nordmøre grid bar spacing on size selectivity, catch efficiency and bycatch of the Barents Sea Northern shrimp fishery (2022) PLoS ONE, 17 art. no. e0277788 doi=10.1371/journal.pone.0277788		Cod (*Gadus morhua*) and American plaice (*Hippoglossoides platessoides*)	Shrimp trawls,- mandatory selective gear of a Nordmøre grid with 19 mm bar spacing combined with a35 mm mesh size diamond mesh codend.	ordmøre grid	2022	Estimated and compared the size selectivity of Nordmøre grids with bar spacings of 17 and 21 mm. Further, the effect of applying these two grids on trawl size selectivity was predicted and compared to the legislated gear configuration.	Reducing bar spacing can significantly reduce fish bycatch while only marginally affecting catch efficiency of Northern shrimp
Araya-Schmidt, T., Bayse, S.M., Winger, P.D., Santos, M.R. Juvenile redfish (*Sebastes* spp.) behavior in response to Nordmøre grid systems in the offshore northern shrimp (*Pandalus borealis*) fishery of Eastern Canada (2022) Frontiers in Marine Science, 9, art. no. 920429	teleosts	Juvenile redfish (*Sebastes* spp.)	Shrimp bottom trawler	Eastern Canada	2022	Nordmøre grids.- A total of 10.3 h of useable underwater video was collected during commercial fishing conditions, which yielded individual observations of 931 redfish. Generalized linear models (GLMs) and behavioral trees were used to analyze the data.	We observed that 52.5% of all redfish passed through the bar spacings and were retained. The duration of the selection process was relatively short (~1.9 s mean), and 57.8% of redfish reacted to the grids by swimming upwards, forward, or towards with respect to the grids. Behaviors exhibited by redfish and redfish retention were similar for both grids. GLM results suggested that as time in front of the grid increased and redfish had upwards or steady grid reactions, retention was drastically reduced.

3.5 Mitigation regulations - Live list direct and indirect technical or spatial management measures with potential effects on bycatch by taxa.

Table 3.9 Summary of current legislation regarding mitigation measures.

ICES Ecoregion	Legal act	Area	Regulation
All EU waters	REGULATION (EU) 2019/1241	All EU waters (except Baltic Sea)	Driftnets longer then 2,5 km are prohibited
Baltic Sea	REGULATION (EU) 2019/1241	Whole Baltic Sea	All driftnets are prohibited.
Baltic Sea	REGULATION (EU) 2019/1241	Baltic Sea Area delimited by a line running from the Swedish coast at the point at longitude 13° E, thence due south to latitude 55° N, thence due east to longitude 14° E, thence due north to the coast of Sweden; and, Area delimited by a line running from the eastern coast of Sweden at the point at latitude 55°30' N, thence due east to longitude 15° E, thence due north to latitude 56° N, thence due east to longitude 16° E thence due north to the coast of Sweden	For vessels 12m and more, when using bottom-set gill net or entangling net “active acoustic deterrent devices” are mandatory.
Baltic Sea	REGULATION (EU) 2019/1241	Baltic Sea sub-division 24 (except for the area covered above)	For vessels 12m and more, when using bottom-set gill net or entangling net “active acoustic deterrent devices” are mandatory
Baltic Sea	REGULATION (EU) 2019/1241	In the West and East of the “sandbank Ryf Mew” (Inner and Outer Puck Bay, within and outside the Natura 2000 site “Zatoka Pucka Półwysep Helski” (PLH220032)	For all vessels using static gear “active acoustic deterrent devices” are mandatory
Baltic Sea	REGULATION (EU) 2019/1241	In the Natura 2000 site “Sydvästskånes utsjövatten” (SE0430187), from 1 May to 31 October.	For all vessels using static gear “active acoustic deterrent devices” are mandatory
Baltic Sea	REGULATION (EU) 2019/1241	“Northern Midsea Bank” Area enclosed by sequentially joining with rhumb lines the following coordinates: — 56,241°N — 17,042°E — 56,022°N — 17,202°E — 56,380°N — 17,675°E — 56,145°N — 17,710°E	Fishing permitted only with pots, fish traps and longlines
Baltic Sea	REGULATION (EU) 2019/1241	Natura 2000 site “Hoburgs bank och Midsjöbankarna” (SE0330308) “Southern Midsea Bank”	Fishing with all types of static nets is prohibited

ICES Ecoregion	Legal act	Area	Regulation
		The Southern Midsea Bank is defined as the Swedish part of the Southern Midsea Bank, covering all waters between the Natura 2000 site "Hoburgs bank och Midsjöbankarna" (SE0330308) and the Swedish-Polish border. Polish waters are delimited as the area within the following coordinates: — 55,377°N — 16,589°E — 55,466°N — 17,538°E — 55,797°N — 18,037°E	
Baltic Sea	REGULATION (EU) 2019/1241	Natura 2000 site "Adler Grund and Rønne Banke" (DK00VA261) Natura 2000 site "Adlergrund" (DE1251301) Natura 2000 site "Westliche Rönnebank" (DE1249301) Natura 2000 site "Pommersche Bucht mit Oderbank" (DE1652301) Natura 2000 site "Greifswalder Boddenrandschwelle und Teile der Pommerschen Bucht" (DE1749302) Natura 2000 site "Ostoja na Zatoce Pomorskiej" (PLH990002) The marine part of the Natura 2000 site "Wolin i Uznam" (PLH320019) Natura 2000 site "Pommersche Bucht" (DE1552401)	Fishing with all types of static nets is prohibited from 1 November to 31 January
Baltic Sea	REGULATION (EU) 2019/1241	Natura 2000 site "Sydvästskånes utsjövatten" (SE0430187)	Fishing with all types of static nets is prohibited from 1 November to 30 April
Greater North Sea, Celtic Seas	REGULATION (EU) 2019/1241	ICES sub-area 4 and ICES division 3a	From 1 August to 31 October – for vessels 12m and more, when using bottom-set gill net or entangling net, or combination of these nets, the total length of which does not exceed 400 m and when using any bottom-set gillnet or en-

ICES Ecoregion	Legal act	Area	Regulation
			tangling net ≥ 220 mm "active acoustic deterrent devices" are mandatory
Greater North Sea	REGULATION (EU) 2019/1241	ICES divisions 7d, 7e,	For vessels 12m and more, when using bottom-set gill net or entangling net "active acoustic deterrent devices" are mandatory
Celtic Seas	REGULATION (EU) 2019/1241	ICES divisions 7f, 7g, 7h and 7j	For vessels 12m and more, when using bottom-set gill net or entangling net "active acoustic deterrent devices" are mandatory
Bay of Biscay and Iberian coast	Orden APA/1200/2020 (Spanish national regulation)	ICES area 8a, 8b, 8d and Cantabrian Spanish national waters	"active acoustic deterrent devices" are mandatory for vessels using bottom trawl gears
Bay of Biscay and Iberian coast	Orden APA/1200/2020 (Spanish national regulation)	ICES area 8a, 8b, 8d and Cantabrian Spanish national waters	Move on rule: When bottom trawlers capture 3 or more individuals of cetaceans or some individual in 2 consecutive hauls, the vessel should move at least 5 miles to another point.
Bay of Biscay and Iberian coast	Portaria nº 172/2017, of May 25th (Portuguese national regulation)	ICES area 9a	active acoustic deterrent devices are mandatory for vessels using beach seine gears
Bay of Biscay and Iberian coast	Despacho nº 19/DG/2020 of August 4th (Portuguese national regulation)	ICES area 9a	Determines the characteristics of the acoustic deterrent devices in beach seines, their application in the gear and areas excluded to use deterrents based of no report of incidental cetacean catches.
Bay of Biscay	Arrêté du 27 novembre 2020	ICES areas 8a, 8b, 8c, 8d	to make mandatory the use of acoustic deterrent devices by pelagic and bottom-pair trawls
Icelandic waters	Reglugerð nr. 288/2021 (Icelandic national regulation)	14 areas within the coastal area of the Icelandic EEZ as defined in paragraph 11 of the regulation	Fishing with lumpsucker bottom set gillnets is prohibited
Icelandic waters	Reglugerð nr 456/2017 (Icelandic national regulation)	Icelandic EEZ	All porbeagle, basking shark, and spurdog is to be released if possible.

ICES Ecoregion	Legal act	Area	Regulation
"Non ICES" waters	REGULATION (EU) 2019/1241	Union waters in the Indian Ocean and the West Atlantic	Turtle excluder device is mandatory for any shrimp trawl
Mediterranean and Black Seas	REGULATION (EU) 1343/2011	GFCM (General Fisheries Commission for the Mediterranean) Agreement area	Fishing vessels using longlines and bottom-set gillnets shall carry on board safe-handling, disentanglement and release equipment designed to ensure that sea turtles are handled and released in a manner that maximises the probability of their survival

3.6 Mitigation measures on GFCM (General Fisheries Commission for the Mediterranean) Agreement area (Mediterranean and Black Seas).

Currently no bycatch mitigation measures based on EU Regulations nor GFCM are in force (except one at Table 3.9). We took note that several GFCM Recommendations oblige contracting parties and cooperating non-contracting parties (countries) to adopt at least two bycatch mitigation measures for every group of animals covered by every Recommendation in the coming years. Also, all GFCM actions foreseen on bycatch has been compiled into a Regional Plan of Action on Vunerable Species (RPOA-VUL) creating a work plan for the 2024-2030.

3.7 A general comment on the routine implementation of technical mitigation approaches in commercial fisheries.

The increasing profile of PET species bycatch, the wide array of mitigation trials being conducted across a range of sensitive taxa (see Tables 2.1–2.8) and the development of bycatch mitigation Action Plans (e.g., as described by Peltier in a presentation to WGBYC, see section 1 for an abstract) suggests that routine implementation of technical mitigation approaches in commercial fisheries is likely to increase into the future.

Consequently, we strongly recommend that the widescale use of any technical mitigation measures is limited to the general approaches and specific devices that have been shown to be effective through rigorous scientific study for the species and metiers where mitigation is being implemented, and that the routine use of any mitigation measures meets accepted operational standards to ensure that bycatch rates will be effectively and consistently reduced.

3.8 Gaps between registered bycatch and mitigation trials and/or regulations

In 2023 the ToR B subgroup started to look at possible mitigation research gaps in areas and métiers where bycatch might affect population status. As an initial trial and exploratory exercise, that could be expanded to other species in future, we used the WGBYC 2022 data to identify and select one cetacean species, the harbour porpoise, and three at-risk populations (Baltic, Black Sea, Iberian) where there is evidence of bycatch.

In 2022, the Baltic Sea areas 22, 23, 24 had 12, 13, and 1 reported bycaught in demersal trammel and gillnet fisheries. In the Black Sea 3 porpoises were reported bycaught from area 29 in demersal gillnets. In area 8c of Iberia 3 porpoises were reported bycaught in demersal gillnets.

In addition, porpoise bycatches of 328, 119 and 31 were also reported from the North Sea (4b), Norwegian sea (2.a.2) and Icelandic waters (5a), respectively.

In relation to mitigation efforts Iceland, Denmark, Sweden, Norway, Germany, and Bulgaria reported to WGBYC that they are doing mitigation trials, including of pingers and other less well developed solutions such as attaching acrylic pearls to net meshes.

In Iberian waters the project CetAMBICion involved trials of mitigation measures in Portugal and Spain to reduce cetacean bycatch. Acoustic alarms were tested in static net fisheries operating in the south of Portugal where the harbour porpoise abundance is typically very low. The species is found in higher densities in the north-central Iberian coast where bycatch is mostly recorded in static nets. No mitigation trials have been undertaken in static net fisheries in that area which indicates an important research gap considering the Iberian harbour porpoise population is isolated from other porpoise populations and is currently classed as critically endangered isolated. In Portugal, the beach seine fishery is obliged to operate with pingers, but no monitoring of their effectiveness or use has been undertaken.

3.9 Conclusions

For the third-year information on ongoing mitigation projects was collected from national reports submitted to WGFTFB. This new approach has shown to be very useful with many countries submitting reports to WGFTFB in 2022. Although, the reports mainly containing information regarding mitigation targeting fish species other than PETS, the reports still contain useful information for mitigation on PETS.

According to the literature from 2022, mitigation approaches trialled for small cetaceans included different models of acoustic deterrent devices, the use of acrylic spheres, and a bio-inspired acoustic beacon emitting returning echoes from the echolocation clicks of common dolphins. The acrylic glass spheres show some promise for reducing bycatch, however more studies are needed to confirm this as the initial analysis is based on very few bycatch incidents. The acoustic beacon showed attentive behaviours of dolphins, which kept a distance of several metres away from the emission source before calmly leaving, however it was an initial trial and is also in need of more study.

For large cetaceans specifically, for the pot fishery, elimination of surface ropes with on-demand or ropeless gear has been presented as a potential solution. However, high costs of these new components may be an obstacle to widespread adoption of these measures.

In relation to pinnipeds rope grids in funnels, exclusion devises in trawls, time area interactions and gear switches have shown promising results in terms of mitigation of pinnipeds.

As with last year, mitigation tools for turtle and seabird bycatch have shown some promising results. Time area solutions, lights and turtle excluder devises have shown significant results for turtles in some gear types, while tori lines, increased sinking rates of hooks, above water scaring devices and seasonal management have shown potential to reduce seabird bycatch in a variety of fisheries.

This year literature on sensitive fish mitigation targeted mainly elasmobranchs (sharks and rays). Here LED lights and handling procedures have shown promising results.

For the second year, the group collected information on the mitigation regulations in place in different ICES regions. This list may still be incomplete with regards to local/national legislation, as each Member State may implement specific rules for their national fisheries.

For the first time WGBYC looked at possible mitigation gaps in areas and métiers where bycatch is high and potentially affecting high-risk populations. Three populations of one cetacean species were selected for the exercise: the Baltic, Black Sea and Iberian porpoise populations. Although some mitigation trials are under way in some regions where these populations occur, the Regulations in Table 3.1 shows that not all the relevant fisheries are covered and mitigation trials are absent from some high-risk area/gear combinations.

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4 ToR C: Consider the quality of data available for use in the estimation of bycatch rates of protected species through a Bycatch Evaluation and Assessment Matrix, BEAM, to underpin assessments on the bycatch range (minimum/maximum) as appropriate, and where possible, to identify likely conservation level threats.

Introduction

In 2022, WGBYC developed a new approach, a 'Bycatch Evaluation and Assessment Matrix' (BEAM v.1) to address ToR C and to provide improved information to underpin the various requirements of the new ICES/DGMARE agreement (ICES 2022a). The main objective of BEAM is to provide a systematic methodology using standardised fishing effort data, monitoring effort data and bycatch data obtained through annual ICES data calls (stored in the WGBYC and RDB databases which are maintained by the ICES Data Centre (see ToR-G for further details on the WGBYC data call)), combined with information on available mortality thresholds and a judgement on within group Subject Matter Expertise (SME) to provide an evaluation of the likely reliability and utility of bycatch assessments for different areas and species. The long-term goal is to use this approach to all relevant species to provide a comprehensive overview and assessment of data quality issues, likely bycatch threats and inform on where improvements to various elements of the matrix (such as data collection, markers of sustainability, etc.) are required. Therefore, in 2023 the BEAM (BEAM 2.0) was further developed improving the systematic methodology as well as carrying out systematic assessments of species defined as priority species. The species that were assessed within ToR C where the priority species are defined in the EU action plan[†] as well as species defined in the road map for ICES bycatch advice on protected endangered and threatened species (ICES, 2022).

4.1 Data preparation: Bycatch monitoring and bycatch events

In the BEAM analyses, data on bycatch monitoring effort and bycatch event for 2018-2022 submitted to ICES through bycatch data calls were used. We used fishing effort data for the year 2022 submitted through the ICES data call to WGBYC in 2023. The data were extracted from the WGBYC database (see ToR-G for details of the data and quality checks). The ToR C subgroup agreed that the monitoring and bycatch data should only include what is considered the most reliable data collection methods, i.e. at-sea observers, electronic monitoring and vessel crew observers (Basran and Sigurdsson 2021). Thus, data collected by logbooks or port observers were excluded from the analyses. In addition, Estonian data reported as collected by vessel observers were excluded. The group concluded that, since the monitored data matched the reported fishing

[†] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0102

effort data in terms of quantity, and no protected species were reported in any of the fisheries, it is highly likely that the data in question was from logbooks, which are typically excluded. However, data collected by a reference fleet or by crew observers where the sampling designs main focus is to collect data on bycatch have been included (specifically, logbook data from crew observers in Portugal and the monitoring method “other” from Norway were included, Moan et al., 2020). For future reference, it may be worth noting that missing values in the number of bycaught individuals were occasionally reported as -9. In the data call, vessel length was reported as ranges. The ranges were categorized into a binary variable: below and above 12 meters. Note that some length ranges included 12 meters (0-15, 8-15 meters). In the analyses, these ranges were set to below 12 meters. The number of bycaught individuals in a fishing event was calculated as the sum of individuals caught in gear with and without pingers.

For the first set of BEAM analyses, the bycatch monitoring effort was summed by ecoregion, country, year, metier 4, metier 5, vessel length category (below or above 12m), bycatch monitoring method, bycatch sampling protocol (in general, the taxa monitored; it could also be group of species which includes several taxa, i.e. “Protected species”). The number of individuals bycaught was calculated using the same set of grouping variables, as well as species.

Through the data call, actual bycatch events and monitored effort were recorded. That is, fishing events where no individuals of a certain species were caught do not appear however there is monitored effort with zero bycatches. However, in the BEAM analyses, also events with zero bycatch of a focal species are needed explicitly in the data. To add rows of zero bycatch to the data, we created a list of relevant species in each ecoregion, mainly using a list of the priority species defined in the EU action plan as well as species defined by the the road map for ICES bycatch advice. This complete set of relevant Species * Ecoregion combinations was used to expand the aggregated bycatch data, to also include rows with explicit zero bycatch. In a second step, the expanded bycatch data were filtered to only include rows where the focal taxa actually had been monitored (as described in the sampling protocol variable). Thus, rows where the taxa monitored were “All” or “Protected species” (which includes all taxa), or rows where taxa of the focal bycatch species were the same as the taxa monitored for bycatch (for example the sampling protocol is for fish and the focal species is a fish species), were kept for further BEAM analyses.

4.2 Development of the Bycatch Evaluation and Assessment Matrix (BEAM) – a traffic light approach.

Similar to BEAM 1.0 (ICES 2022a), the same eight original criteria were retained in BEAM 2.0. However, modifications were made to some criteria methods and/or definitions (Table 4.1). All criteria are further described below. The BEAM was applied to species across all four taxonomic groups informed by 1) a list of prioritized species provided to WGBYC by the DGMARE and 2) the ICES Roadmap for providing advice on bycatch of protected species and 3) species from these two lists that were recorded as bycaught the past 5 years in the WGBYC database.

Table 4.1 The Bycatch Evaluation and Assessment Matrix (BEAM) 2.0. The BEAM framework applies a traffic light approach across eight criteria that evaluate the status of inputs required to assess the impact of bycatch on sensitive species populations, by ecoregion and metier level 4 (https://vocab.ices.dk/?ref=1498)

Criterias of the BEAM Framework and the input defining the status of the criteria

1	BPUE Data Quality & Analysis	BPUE== homogenous | BPUE == heterogeneous (e.g. covariate effects present among nations, years, metierL5, vessel size) & represented in effort databases. A pooled or weighted average BPUE is estimated.	**Unexplained partial heterogeneity**	BPUE = Substantial heterogeneity found & effort data not availability at the same scale of BPUE heterogeneity. BPUE can't be pooled or weights not available or no incidental bycatch reported.
2	Effort (Days at Sea)	Yes=Total Effort can be sourced from one or more ICES databases.	Not Applicable (NA) or only partial effort data available	No= Total Effort not available at the same level as the BPUE
4	Population/Stock Abundance Estimate	Yes=there is a published estimated	Not Applicable (NA)	No=there is no published abundance estimate
5	Bycatch Reference point (T)	Yes=there is published bycatch reference point	**Not Applicable (NA) | TBD (to be determined) = May be possible for WGBYC to calculate reference points or proxy threshold based on published formulas**	No=there are no published or ICES accepted bycatch removal reference point

Criterias of the BEAM Framework and the input defining the status of the criteria

6	Bycatch Mortality > Bycatch Reference point	No=Bycatch mortality estimate is less than Bycatch Reference point	**Bycatch mortality is in the vicinity of Bycatch Reference point**	Yes = Bycatch mortality estimate is greater than bycatch Reference point
7	Subject Matter Expertise (SME)	Yes=SME available across relevant ecoregion, metier L4 and species combinations	**Only partial SME available among relevant ecoregion, metier L4 and species combinations.**	No=missing SME across relevant ecoregion, metier L4 and species combinations
8	Population impact Assessment	Yes = Can assess impact of bycatch to population	**Partial assessment (high variation in assessment or limited information in reference point)**	No = Can't assess impact of bycatch to population

4.2.1 Criteria 1: Development of a procedure to evaluate the representativeness of BPUE estimates

The working group engaged with this year's data to further refine methods in the BEAM. One key focus was to further develop a procedure to appraise the representativeness of BPUE estimates. BPUE is estimated by collating observed bycatch events during the deployment of multiple monitoring schemes. These monitoring schemes can vary by observation method, the fishing gear deployed within the métier observed, the year in which they took place and the nation. The latter can mean that the area covered in ecoregions can differ between nations. The challenge therefore is to understand how to pull this information together to get a unique BPUE estimate for a species observed interacting with a given Métier Level 4 in a given ecoregion. Pooling BPUE estimates that are different can lead to lack of representativeness of that estimate for the Ecoregion and Metier level 4 for many reasons. For example, monitoring is not necessarily stratified by effort at the level at which BPUE heterogeneity occurs. Lack of representativeness can lead to a biased BPUE estimate and therefore an inappropriate representation of bycatch. WGBYC (2022) used two estimates of BPUE and compared them to assess the representativeness of BPUE: the view then was that if BPUE observations are homogeneous, the two means of estimating BPUE should retrieve a similar, representative BPUE estimate. It was deemed then that a 10% relative difference between these two BPUE estimates indicated circumstances where heterogeneity between BPUE observations was likely and therefore warranted further appraisal of the source of this heterogeneity before a BPUE estimate could be produced. This value of 10% was informed from expected departure in circumstances where the pooled BPUE estimate would be biased using a simulation platform (Simulations for Characterising Optimal Monitoring Implementations (SCOTI; ICES 2022a, Lusseau et al. 2023).

In 2023, WGBYC ToR C continued the development of methods to understand heterogeneity in BPUE observations and tried to account for sources of this variance heterogeneity. We used a meta-analytic approach (Harrer *et al.* 2021) to explicitly assess i) whether between BPUE variance heterogeneity could be detected and, ii) if so, whether this heterogeneity in variance could be explained by factors attributable to the design of monitoring programmes.

We used the data submitted through ICES data calls submitted to WGBYC. We used fishing effort data for the year 2022 submitted through the ICES datacall to WGBYC in 2023 and bycatch events and monitoring effort data reported for 2018-2022 to estimate BPUE for each Species, Ecoregion pairs on the priority lists and for each Metier level 4. To do so we first subset the data for each combination of Ecoregion, Metier level 4, and Species, accumulating monitoring effort (as Days at Sea, DaS) and the number of incidental catches of individuals for each combination of: year, reporting nation, metier level 5, observation method, sampling protocol and vessel size (a 2 level categorical variable: vessel <12m or ≥12m). We therefore obtained a varying number of replicate BPUE observations (number of individuals per Days at Sea) for each Ecoregion, Metier Level 4, Species combination. If no incidental captures were observed in this subset, we did not proceed with analysis for that combination of Ecoregion, Metier level 4, and Species.

If BPUE variance estimates are homogeneous between these monitoring factors, then we would expect the BPUE observations to be "close to each other" in value. We estimated *a pooled BPUE* by fitting to these BPUE observations an intercept-only generalized linear model where samples were the BPUE observations, the response variable was the number of incidentally caught individuals for each observation, an offset was included of log10 DaS monitored and the assumption was that residuals would be following a negative binomial distribution. Models were implemented using glmmTMB in R. We chose this approach instead of a meta-regression (using meta in R) to be able to assume this negative binomial distribution.

We then tested for between-study heterogeneity by refitting the model using a generalized linear model approach to meta-analysis assuming an incidence rate model where the number of bycatch events was estimated given the number of DaS monitored. We used Cochran's Q derivation suitable for this glm approach (Wald-type test statistic) to test for between-BPUE observation heterogeneity. These tests statistics, particularly when the number of studies considered is small (less than 20), can be quite approximate (Harrer et al. 2021). In the future we aim to develop our own test statistic distribution, based on SCOTI simulations, to assess the significance of observed Cochran's Q like statistics that can be calculated for bycatch observations.

If the Wald test statistics was significant (at 0.05 level), the BPUE observations were deemed to be heterogeneous.

We also fitted models with all possible combinations of crossed random effects based on the level of replication we blocked in the data compilation for each given Ecoregion, Metier level 4 and Species combination (year, nation, metier level 5, observation methods, sampling protocol, and vessel size). We then selected the more parsimonious model (including the intercept only glm as a candidate model) using AIC.

At the end of this statistical modelling exercise, we therefore had a pooled BPUE estimate, whether it emerged from heterogeneous BPUE observations, and heterogeneity could be attributed to recorded factors associated with monitoring. In the latter case, the pooled BPUE estimate was not helpful, however, we had an appropriate BPUE estimate for each level of the factors to which variance between BPUE observations could be attributed. In this instance, we used the random intercept for each of those levels.

We could then proceed to estimate total bycatch if: 1) BPUE observations were homogeneous (using the pooled BPUE estimate), or 2) if the BPUE observations were heterogeneous but recorded factors could explain this heterogeneity *and* fishing effort was available for all monitored levels for these factors. For example, if sampling protocol emerged as a source of variation in BPUE estimate, we could not estimate total bycatch. If nation emerged as a source of variance in the BPUE estimate and five nations were monitored but only three of those reported fishing effort, we could not estimate total bycatch.

If between-year heterogeneity was detected in the BPUE estimate, we only used the 2022 BPUE estimate to calculate total bycatch given the 2022 fishing effort. In this instance, it is worth noting that while we only used the 2022 intercept estimate, the model made use of the five years of monitoring data in the 2022 random intercept estimation process; hence we did indeed make us of the five years of monitoring data to inform the 2022 total bycatch estimate.

Finally, we applied a further check that for each Ecoregion, Metier level 4 and Species combination, the sampling protocol matched the species concerned; i.e. that bycatch estimates for fish emerged from monitoring where observers looked for fish (rather than e.g. birds or mammals only).

4.2.2 Criteria 2: Effort (days at sea)

The fishing effort submitted through the ICES WGBYC data call was compared to the fishing effort submitted to the RDB. The group evaluated that the fishing effort submitted to ICES WGBYC was more complete and thereby used in the BEAM evaluation. If a measure of total fishing, measured as total days at sea, can be summed over relevant ecoregion, country, metier level 4 and vessel length (>12 meters or < 12 meters) combinations (i.e., relevant for BPUE estimates under criteria 1), the total fishing effort are reported as green. This, however, does not indicate that the summed fishing days is exhaustive for the focal BPUE estimated under criteria 1, but rather that there are numbers of reported fishing days available in the database for the specific ecoregion, country, metier level 4 and vessel length combination in the ICES WGBYC data call. The total fishing effort will be reported as red if there is no fishing effort available at the same level as the BPUE estimate. We did not consider a yellow color (partly available fishing effort) for the current version of the BEAM.

4.2.3 Criteria 3: Bycatch mortality (Bm)

Once a BPUE has been estimated, a total bycatch can be estimated if fishing effort is available which can be related to the monitoring effort is available. In the instance when no heterogeneity was detected in the BPUE estimate, the total bycatch could be estimated in a straightforward manner by predicting the number of bycaught individuals for the fishing effort. In instances when some heterogeneity in BPUE was detected, a total bycatch could only be estimated if the fishing effort was available for all levels of the variable identified as source of heterogeneity. For example, if there is between-country heterogeneity and four nations report monitoring, but six nations are identified as contributing to fishing effort, then a total bycatch cannot be estimated. Also, if between-vessel size heterogeneity is identified, both small and large vessels are monitored but only large vessels report fishing effort, then a total bycatch cannot be estimated. While so far, we have focussed on bycatch estimate accuracy, we make a distinction on the usefulness of the Bm depending on its precision as well here. SCOTI will inform in the future the level of precision which can be used to make useful inferences about Bm, in this intermediate step, we simply looked at the orders of magnitude between the lower and upper confidence intervals of the Bm estimate. If we had more than 3 orders of magnitude difference in those intervals, the Bm was flagged as yellow (use with caution). This is a conservative estimate, it does not mean that others (green) are precise enough, it simply means that those are so unprecise that we need more data to make sense of Bm. In addition, in instances where between-year variability in BPUE was detected, we also flag that Bm must be treated with caution (yellow) because they represent Bm for the reported year and have limited usefulness to understand Bm beyond that year.

4.2.4 Criteria 4: Abundance Population Estimate

The availability of an abundance estimate will be reported in green, if it corresponds to the population in the ecoregion in which the species is distributed. The abundance estimate will be reported in yellow for species whose distribution spans more than one ecoregion or for species with several populations within an ecoregion and for which the abundance estimate is only available for a portion of the population or populations. Red will be used to report species that do not have availability estimates of abundance at either the local or ecoregional level or higher.

4.2.5 Criteria 5: Bycatch Removal Threshold

For the BEAM, only published mortality threshold levels are reported and indicated with a green colour while unknown values or not formally accepted values are indicated by a red colour. For many species and ecoregions mortality threshold levels are missing. Nevertheless, methods to calculate them in a harmonized manner across taxa are under development for several ICES areas and species (BirdLife, 2022, CIBBRINA 2023). A general recommendation for seabirds for incidental bycatch was proposed at 1% of the natural annual adult population (BirdLife, 2019).

This bycatch reference point was nevertheless not considered or calculated for the present estimations. PBR was used by WGBYC las year (2022) for marine mammals.

4.2.6 Criteria 6: Bycatch Mortality > Bycatch Reference point

This criterion compares the estimated bycatch mortality to the Bycatch reference point. If the estimated total bycatch is below the Bycatch Reference point, the colour will be green indicating that the negative impact due to bycatch is low. If the Bycatch mortality is in the vicinity of the Bycatch reference point, the colour will be yellow indicating that the Bycatch mortality can have a negative impact. Finally, if the Bycatch mortality is higher than the Bycatch reference point than the colour red will appear which indicates that there is likely a negative impact on the population caused by bycatch.

4.2.7 Criteria 7: Subject Matter Expertise

Members of the WGBYC embodies expertise in the biology, abundance, distribution, and bycatch among all 4 taxonomic groups: marine mammals, seabirds, sea turtles and sensitive (non-commercial) fish. However, this does not mean that WGBYC has all the relevant expertise for the entire spatial distribution of the species being assessed (e.g. seabirds with complex migratory routes, species bycatch across multiple gear types and ecoregions). Consequently, the subject matter expertise (SME) traffic lights were updated to reflect the dynamic nature of bycatch events for some sensitive species. SME is coded green if the WGBYC has expertise that covers all ecoregions and metier level 4 gears for the subject species applied to the BEAM. Alternatively, SME is coded yellow if there is partial expertise among all the ecoregion and metier level 4 combinations or coded red if there is no expertise for a subject species that been applied to the BEAM. It is possible for yellow cases to move to green if there are other ICES working groups that do have the required SME and can assist WGBYC with informing advice for such cases. Similarly, it may be possible for red cases to move to yellow or green in a similar manner.

4.2.8 Criteria 8: Population Impact Assessment

The last criteria, population impact assessment (PIA) is a final determination on whether a PIA can be made. For PIA to be green, most of the other seven criteria must be also green. When PIA is yellow, there is variability among the other criteria traffic lights, but a partial PIA may be possible. Finally, if PIA is red, it generally reflects a data poor situation among several of the criteria. It is important to note that when PIA is green or yellow, at this stage of the BEAMs development, WGBYC does not provide any definitive statements or conclusion on population impacts due to bycatch. The PIA criteria simply identifies if a determination of impact to a sensitive species population due to bycatch is possible, partially possible, or not possible.

4.3 Results: Assessing Population Risk – Bycatch Evaluation and Assessment Matrix (BEAM)

4.3.1 Bycatch Estimates Beam Output

Here we are presenting a conservative list of BPUE-BEAM outcomes which is based on our prioritisation of ecoregion x species pairs based on the required the request priorities. More BPUE and Bm could be estimated but are not currently presented as we focussed this year on continuing to develop the procedures of BEAM so that we can move towards benchmarking the method.

We estimated BPUE for 584 Ecoregion x Metier level 4 x Species combinations for which some bycatch was detected in monitoring (Annex 4).

The BPUE and total Bycatch mortality for the 165 combinations of ecoregion, metier level 4 and species for which BPUE were representative and thereby could be estimated is available in Annex 5. We rejected combinations for which BPUE heterogeneity could not be explained (Annex 6), when there was not sufficient observation of BPUE (Annexes 7 and 8), or when the Sampling protocol was not focussing on the species of interest (Annex 9).

It is also possible that the model predicting BPUE included a term for which we did not have a procedure defined yet on how to use the BPUE to estimate Bm. For example, when the model retained Monitoring Protocol as a variance component, a procedure needs to be developed next year on how to handle such instances.

There is variability in the number of species on which we chose to focus for which we could estimate total bycatch (Figure 4.1). There is also variability between Métier level 4, with some metiers, which perhaps have a less complex set of bycaught species (e.g. OTM), receiving better outcomes than others which may have more complex bycatching patterns (e.g. GNS) (Figure 4.2).

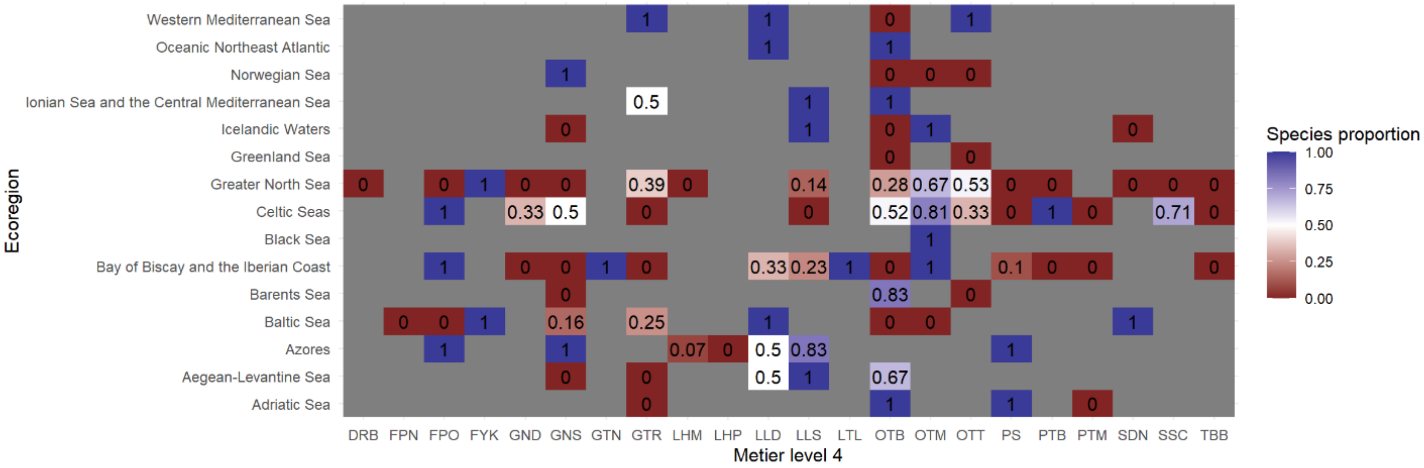

Figure 4.1 The proportion of Species monitored for which a total bycatch estimate could be drawn out of all species monitored for each combination of Ecoregion and Metier level 4. A gray cell means that a metier was not monitored in an ecoregion.

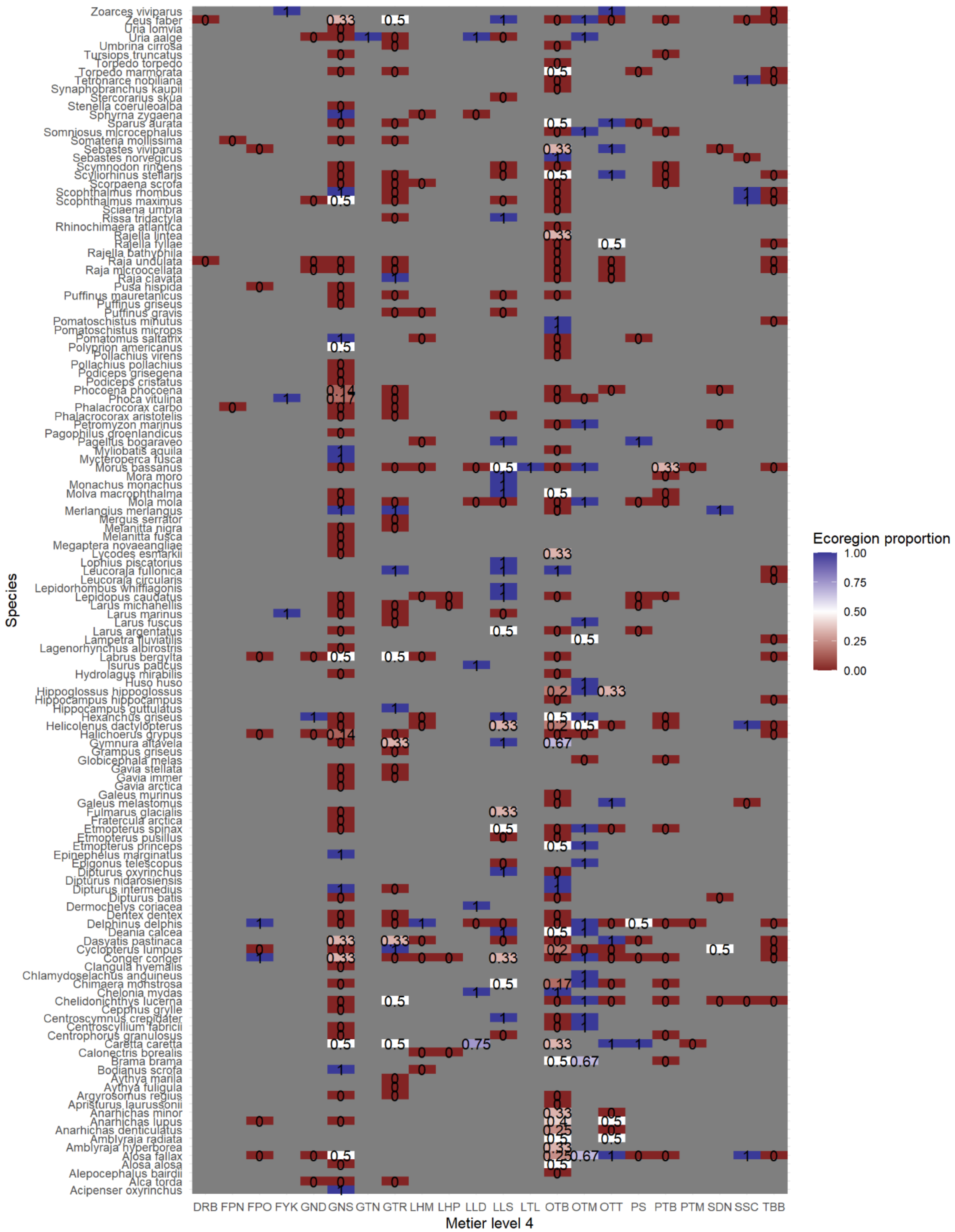

Figure 4.2 The proportion of Ecoregion monitored for which a total bycatch estimate could be drawn out of all ecoregions monitored for each combination of Species and Metier level 4.

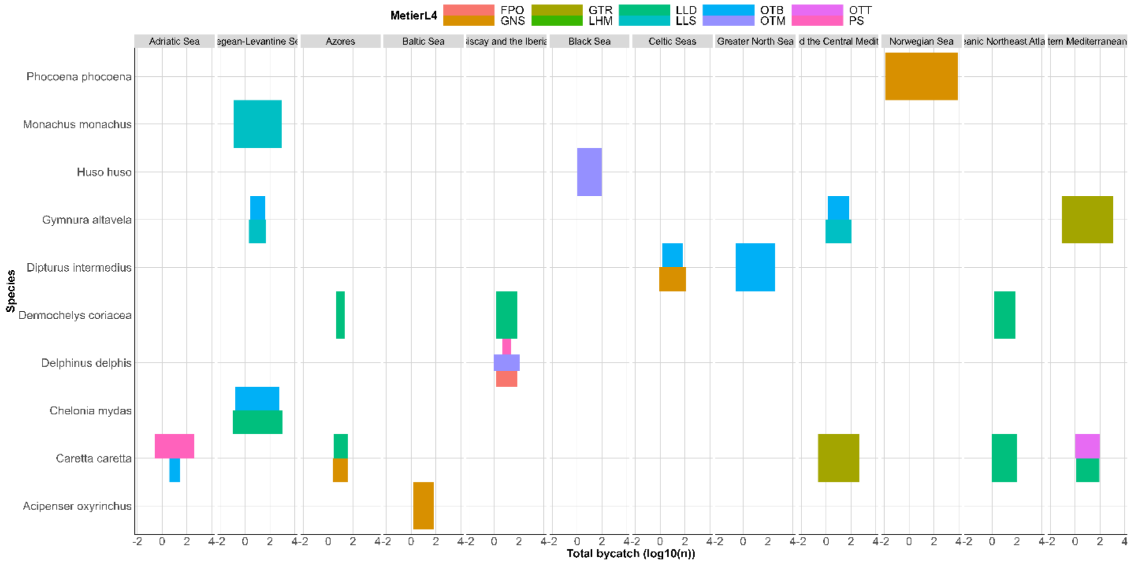

Figure 4.3 Range (estimated 95% confidence intervals, on log10 scale) of total bycatch estimates for the DGMARE protected species list for which total bycatch could be estimated. Color bars represent different types of metiers (at level 4), and panes represent different ecoregions.

Total bycatch estimates are available in Annex 5 (in log 10 scale). Here we visualize the confidence intervals of these estimates on a relevant scale for interpretation for priority species (Figure 4.3), mammals (Figure 4.4), birds (Figure 4.5), reptiles (Figure 4.6) and fish (Figure 4.7).

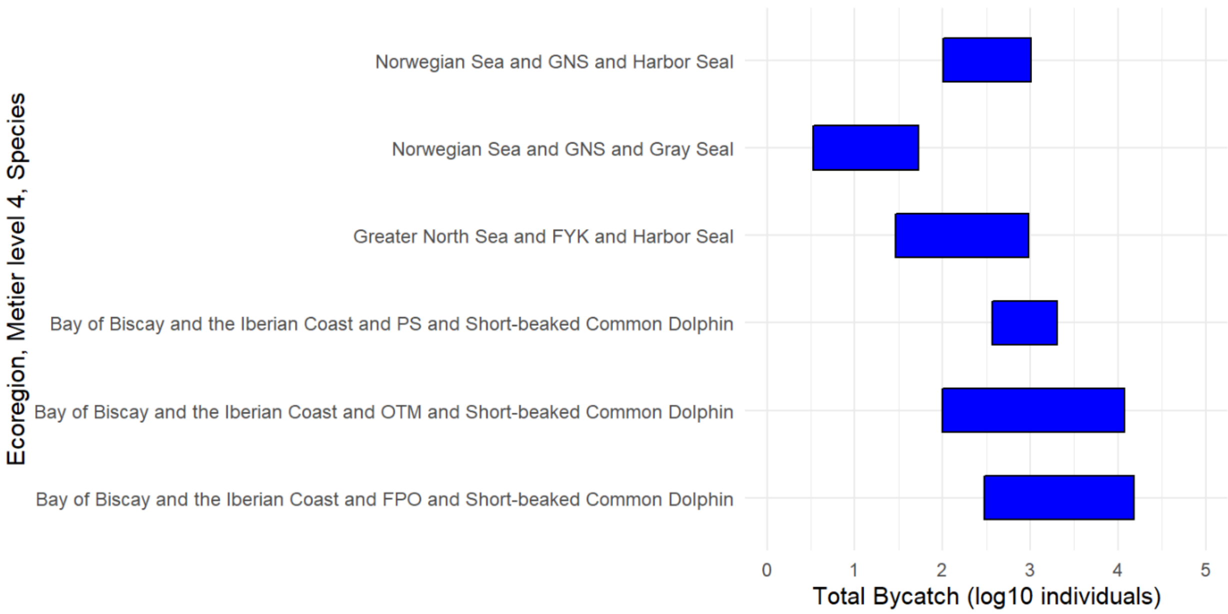

Figure 4.4 Range (estimated 95% confidence intervals, on log10 scale) of total bycatch estimates for the mammal species for which total bycatch could be estimated.

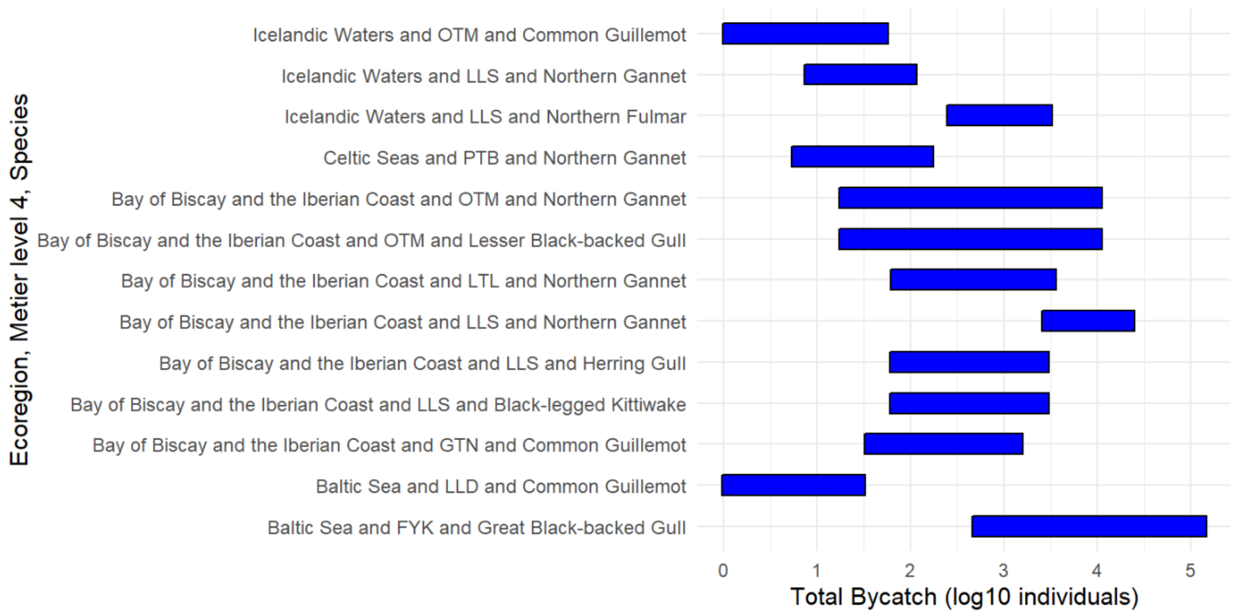

Figure 4.5 Range (estimated 95% confidence intervals, on log10 scale) of total bycatch estimates for the bird species for which total bycatch could be estimated.

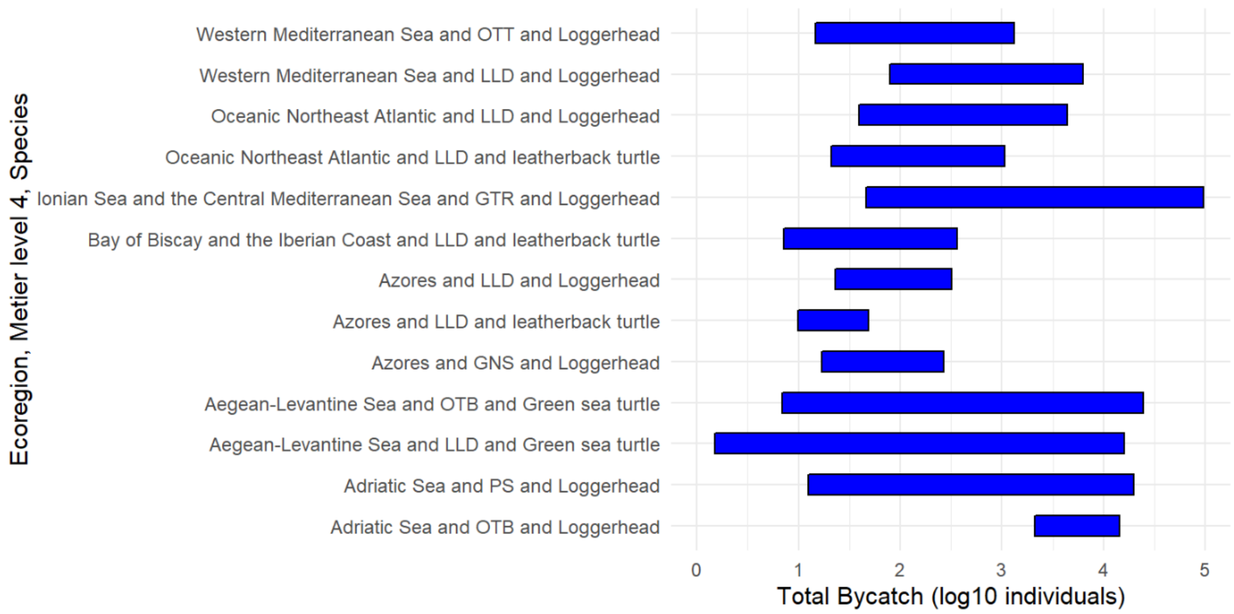

Figure 4.6 Range (estimated 95% confidence intervals, on log10 scale) of total bycatch estimates for the rep-tile species for which total bycatch could be estimated.

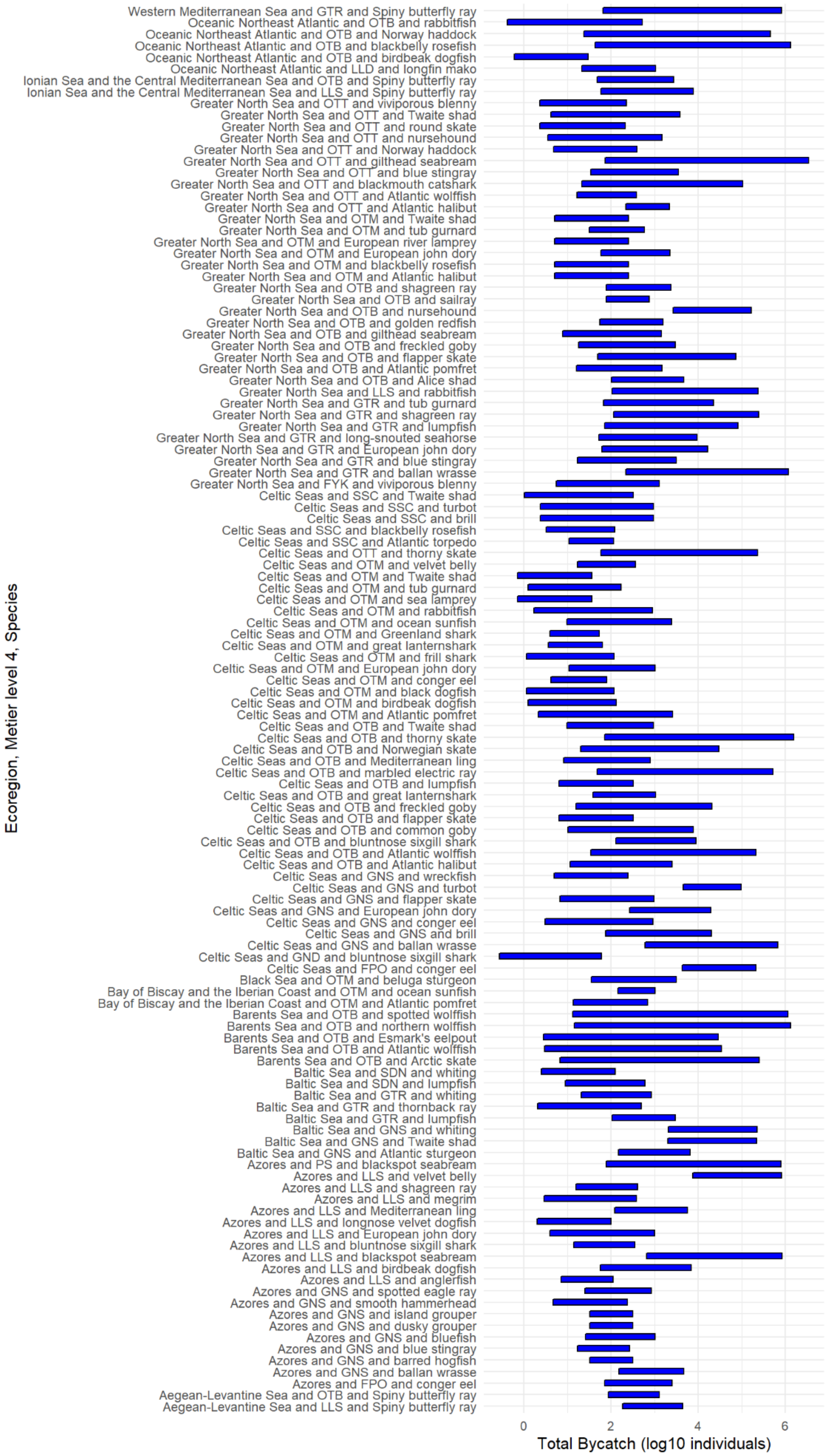

Figure 4.7 Range (estimated 95% confidence intervals, on log10 scale) of total bycatch estimates for the fish species for which total bycatch could be estimated.

4.3.2 Bycatch Estimates BEAM Output

The group chose to focus on the species listed in the list of priority species defined by the DGMARE Action plan. In addition, some species listed in the ICES roadmap and where we do have bycatch records in the database were also evaluated. However not all species listed in the Roadmap were evaluated due to time constraints. Table 4.3 shows the priority species that did pass the first criteria and thereby got a BPUE estimate and a total estimate. Table 2 do list the BPUE for additional species which have gone through the full BEAM process but are only listed on the ICES Roadmap.

While we now have BPUE values for all species in Table 2, a complete BEAM evaluation would only be feasible for *Delphinus delphis* in the Bay of Biscay and the Iberian Coast ecoregion and *Phocoena phocoena* in the Norwegian Sea. Most species lack abundance estimates and, except for *Delphinus delphis* and *Phocoena phocoena*, bycatch reference points are unavailable, preventing us from proceeding to criteria 7, Subject Matter Expertise.

Within WGBYC, there is marine mammal expertise, and discussions about bycatch reference points in relation to the total Bm have been initiated. Regarding *Delphinus delphis*, the group noted that the abundance estimates encompass the entire population, and the bycatch reference point have not been reviewed by ICES or any other authority. It was also discussed whether the bycatch reference point actually means that the population does not increase to carrying capacity within the time frame suggested by the underlying goal of the bycatch reference point. Since part of this discussion involves actual management goals, the group felt that finalizing the BEAM approach and criteria 7 for was not possible for both *Delphinus delphis* in the Bay of Biscay and *Phocena phocena* in the Norweigen sea.

In addition, it can also be concluded that the estimated range of total Bycatch mortality for *Delphinus delphis* in métier FPO (Bm 302 to 15 136) and *Phocena phocena* in GNS in the Norwegian sea (Bm from 2 to 162 1810 bycaught porpoises) along with BPUE for other species (*Caretta caretta* in métier GTR in Ionian Sea and the Central Mediterranean Sea) is very large. Therefore, while in BEAM we are content with the likely accuracy of the BPUE estimates, monitoring effort is too low to have precise estimates.

Table 4.2 BEAM traffic light indicators for each combination of ecoregion, species listed as a priority by DG Mare and métier (level 4) based on 2018-2022 monitoring data and WGBYC effort reporting.

Ecoregion	Metier level 4	Taxon	Species	Roadmap (R) DG Mare (DG)	Monitoring effort (DaS, 2018-2022)	Fishing effort (Das, 2022)	Number of bycaught individuals	BPUE [95% confidence interval] BEAM Table inc	2.5% confidence limit	97.5% confidence limit	Abundance_Population	Bycatch Reference Point	Ref_Abundance_Population
Baltic Sea	GNS	Fish	Acipenser oxyrinchus	DG	1604	145119	4	0.00685 [0.0010301 ; 0.0455203]	148	6607	No	No	
Adriatic Sea	OTB	Reptiles	Caretta caretta	DG	406	119497		0.04627 [0.0177156 ; 0.1208686]	2138	14454	34200 (CIs=28900-40400)	No	ACCOBAMS 2021
Adriatic Sea	PS	Reptiles	Caretta caretta	DG	384	21697		0.02281 [0.0005731 ; 0.9076427]	12	19498		No	ACCOBAMS 2021
Azores	GNS	Reptiles	Caretta caretta	DG	72	2428	2	0.02778 [0.0069472 ; 0.1110677]	17	269	5 187 (2 170 to 12 399 95% CI)	No	Saavedra et al., 2018
Azores	LLD	Reptiles	Caretta caretta	DG	338	1243	29	0.06863 [0.0183568 ; 0.2565697]	23	316		No	Saavedra et al., 2018
Ionian Sea and the Central Mediterranean Sea	GTR	Reptiles	Caretta caretta	DG	656	239886		0.00884 [0.0001946 ; 0.4018868]	47	95499	166650 (CI=155840-178200)	No	ACCOBAMS 2021
Oceanic Northeast Atlantic	LLD	Reptiles	Caretta caretta	DG	25	3762	2	0.11060 [0.0105274 ; 1.1619122]	40	4365	No	No	
Western Mediterranean Sea	LLD	Reptiles	Caretta caretta	DG	1470	35466		0.01990 [0.002244 ; 0.1764095]	79	6310	102000 (CI=94000-110750)	No	ACCOBAMS 2021
Western Mediterranean Sea	OTT	Reptiles	Caretta caretta	DG	382	26620		0.00523 [0.000551 ; 0.0496363]	15	1318		No	ACCOBAMS 2021
Aegean-Levantine Sea	OTB	Reptiles	Chelonia myd	DG	634	37118		0.01119 [0.0001877 ; 0.6674613]	7	24547	0.26–2.21 million; WM~ICM~AD~AL~AZ~ONA~BI~CS~NrS	No	Casale, P., & Heppell, S. 2016
Aegean-Levant	LLD	Reptiles	Chelonia myd	DG	84	1924		0.08013 [0.0007784 ; 8.2499001]	2	15849		No	
Azores	LLD	Reptiles	Dermochelys c	DG	338	1243	6	0.01775 [0.007975 ; 0.0395126]	10	49	No	No	
Bay of Biscay	LLD	Reptiles	Dermochelys c	DG	105	5394	1	0.00951 [0.0013397 ; 0.0675799]	7	363		No	
Oceanic North	LLD	Reptiles	Dermochelys c	DG	25	3762	1	0.04000 [0.0056343 ; 0.2839736]	21	1072		No	Wallace et al., 2013
Azores	LHM	Mammals	Delphinus delphis	DG	2312	0	2	0.00086 [0.0003511 ; 0.0020956]	1	1	634286 (95% CI 352227–1142213)	985	Hammond et al., 2021
Bay of Biscay and the Iberian Coast	FPO	Mammals	Delphinus delphis	DG	96	205877	1	0.01039 [0.0014633 ; 0.073751]	302	15136	634286 (95% CI 352227–1142213)	985	Hammond et al., 2021
Azores	LLD	Reptiles	Dermochelys coriacea	DG	338	1243	6	0.01775 [0.007975 ; 0.0395126]	10	49	No	No	Wallace et al., 2013
Bay of Biscay and the Iberian Coast	LLD	Reptiles	Dermochelys coriacea	DG	105	5394	1	0.00951 [0.0013397 ; 0.0675799]	7	363	No	No	Wallace et al., 2013
Oceanic Northeast Atlantic	LLD	Reptiles	Dermochelys coriacea	DG	25	3762	1	0.04000 [0.0056343 ; 0.2839736]	21	1072	No	No	Wallace et al., 2013
Celtic Seas	GNS	Fish	Dipturus intermedius	DG	1100	38381	2	0.00212 [0.0001747 ; 0.0256605]	7	977	No	No	Bache-Jeffreys et al., 2021
Celtic Seas	OTB	Fish	Dipturus intermedius	DG	2665	121922	1	0.00038 [5.29e-05 ; 0.0026638]	6	324	No	No	Bache-Jeffreys et al., 2021
Greater North Sea	OTB	Fish	Dipturus intermedius	DG	3562	289177	111	0.00664 [0.0001724 ; 0.2557409]	50	74131	No	No	Bache-Jeffreys et al., 2021
Aegean-Levantine Sea	LLS	Fish	Gymnura altavela	DG	905	205325		0.00442 [0.0009002 ; 0.0217005]	186	4467	No	No	
Aegean-Levantine Sea	OTB	Fish	Gymnura altavela	DG	634	37118		0.00899 [0.002331 ; 0.0346999]	87	1288	No	No	
Ionian Sea and the Central Mediterranean Sea	LLS	Fish	Gymnura altavela	DG	231	158304		0.00433 [0.0003747 ; 0.0500114]	59	7943	No	No	
Ionian Sea and the Central Mediterranean Sea	OTB	Fish	Gymnura altavela	DG	272	67183		0.00544 [0.0007192 ; 0.0411204]	48	2754	No	No	
Western Mediterranean Sea	GTR	Fish	Gymnura altavela	DG	364	344748		0.02121 [0.0001895 ; 2.3730005]	66	812831	No	No	
Black Sea	OTM	Fish	Huso huso	DG	110	18622		0.01818 [0.0019157 ; 0.1725611]	35	3236	No	No	
Aegean-Levant	LLS	Mammals	Monachus mo	DG	905	205325		0.00128 [1.54e-05 ; 0.1070825]	3	21878	187-240 mature individuals; AL~ICM	No	Karamanlidis et al., 2019
Norwegian Sea	GNS	Mammals	Phocoena phocoena	DG	7426	49831	260	0.03957 [0.0136069 ; 0.1150707]	2	1621810	70314/24526	700	IMR-NAMMCO 2018/ Hammond et al 2016

***OSPAR QSR2023**

**** IMR-NAMMCO 2018**

Table 4.3 BEAM traffic light indicators for each combination of ecoregion, species listed by ICES Roadmap and métier (level 4) based on 2018-2022 monitoring data and WGBYC effort reporting.

Ecoregion	Metier level 4	Taxon	Species	Roadmap (R) DG Mare (DG)	Monitoring effort (DaS, 2018-2022)	Fishing effort (Das, 2022)	Number of bycaught individuals	BPUE [95% confidence interval] BEAM Table inc	2.5% confidence limit	97.5% confidence limit	Abundance_Population	Bycatch Reference Point	Ref_Abundance_Population
Celtic Seas	OTM	Fish	Centroscyllium fabricii		725	3728	3	0.00316 [0.00	1	120	No	No	Kulka, et a., 2020
Azores	LLS	Fish	Centroscymnus crepidater		345	4897	1	0.00290 [0.00	2	100	No	No	
Celtic Seas	OTM	Fish	Centroscymnus crepidater		725	3728	1	0.00138 [0.00	0	#VALUE!	No	No	Kulka, et a., 2020
Baltic Sea	SDN	Fish	Cyclopterus lumpus		8	143	7	0.51517 [0.06	9	617	No	No	BirdLife International, 2023
Icelandic Waters	LLS	Bird	Fulmarus glacialis		140	4130	77	0.21668 [0.05	245	3311	1200000	NA	Icelandic red list 2018
Bay of Biscay and the Iberian Coast	LLS	Bird	Larus argentatus		340	146540	1	0.00294 [0.00	60	3090	1590000-183	No	BirdLife International, 2021
Bay of Biscay and the Iberian Coast	OTM	Bird	Larus fuscus		39	3793	1	0.11613 [0.00	17	11220	1200000-140	No	BirdLife International, 2015
Baltic Sea	FYK	Bird	Larus marinus		55	57077	2	0.14300 [0.00	457	147911	360000-4000	No	BirdLife International, 2015
Icelandic Waters	LLS	Bird	Morus bassanus		140	4130	1	0.00714 [0.00	7	117	37000	No	Icelandic red list 2018
Bay of Biscay and the Iberian Coast	LLS	Bird	Rissa tridactyla		340	146540	1	0.00294 [0.00	60	3090	17000-20000	No	Bird Reporting (Portugal), 2019
Bay of Biscay and the Iberian Coast	GTN	Bird	Uria aalge		9	2000	1	0.11349 [0.01	32	1622	2350000-306	No	BirdLife International, 2015
Icelandic Waters	OTM	Bird	Uria aalge		258	993	2	0.00754 [0.00	1	58	693000	No	Icelandic red list 2018

4.4 Conclusions

This is the second iteration of the BEAM development process. We have now implemented a modelling approach which aims, within the constraints of the data available, to appraise whether an accurate BPUE can be estimated and to identify likely source of heterogeneity in BPUE. The latter is important not only to obtain an accurate BPUE estimate (by accounting for these sources of variance) but also to inform monitoring programmes about the variables that are important to consider when stratifying sampling. We plan on finalising the BEAM development process in 2024 by using SCOTI simulations to develop the likely distribution of test statistics of heterogeneity when no heterogeneity is present which can replace the common test statistics distribution for Cochran's Q.

We now have an analytical pipeline that can produce estimates and appraisal of accuracy for all components of the BEAM at scale. There is clear variability between ecoregions and between species in the ability to estimate BPUE accurately. This is likely indicating conditions under which the probability of bycatch for an individual is affected by several factors which need to be investigated further. The BEAM approach does create many BPUE estimates. However, the precision of these estimates needs to be taken into consideration to assess whether we have precise enough estimates to make inference about the significance of bycatch for the population concerned.

It should also be mentioned that even though all criteria in the BEAM analysis shows as green, and estimates are produced, the validity and representability of those estimates are still very much reliant on the validity and representability of the data available for the BEAM. For example, the total fishing effort corresponding to a specific BPUE-estimate will be treated as green in the BEAM if there are data available for the combination in the database, but it does not mean that the total fishing effort in the data base necessarily are fully representative of actual total fishing effort in field.

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5 ToR D: For high priority species, where bycatch rates and associated markers of sustainability are unavailable, highlight the types of fishing gears and fishing activities, which pose the greatest risk to these species.

5.1 Introduction

This ToR was established in 2023 to explore and develop robust and repeatable methodologies for evaluating bycatch risk for species identified as "high priority" for which data are lacking or insufficient to be quantitatively analysed within the BEAM context as carried out under ToR C.

Following detailed subgroup discussions, a two-part sequential methodology was proposed to support the requirements of this ToR into the future:

1. A metadata table to collect relevant background information (species and ecoregion specific), and
2. Risk estimation matrices to summarise and visualize available knowledge on potential risks.

Figure 5.1 below provides a conceptual overview of the proposed methodology.

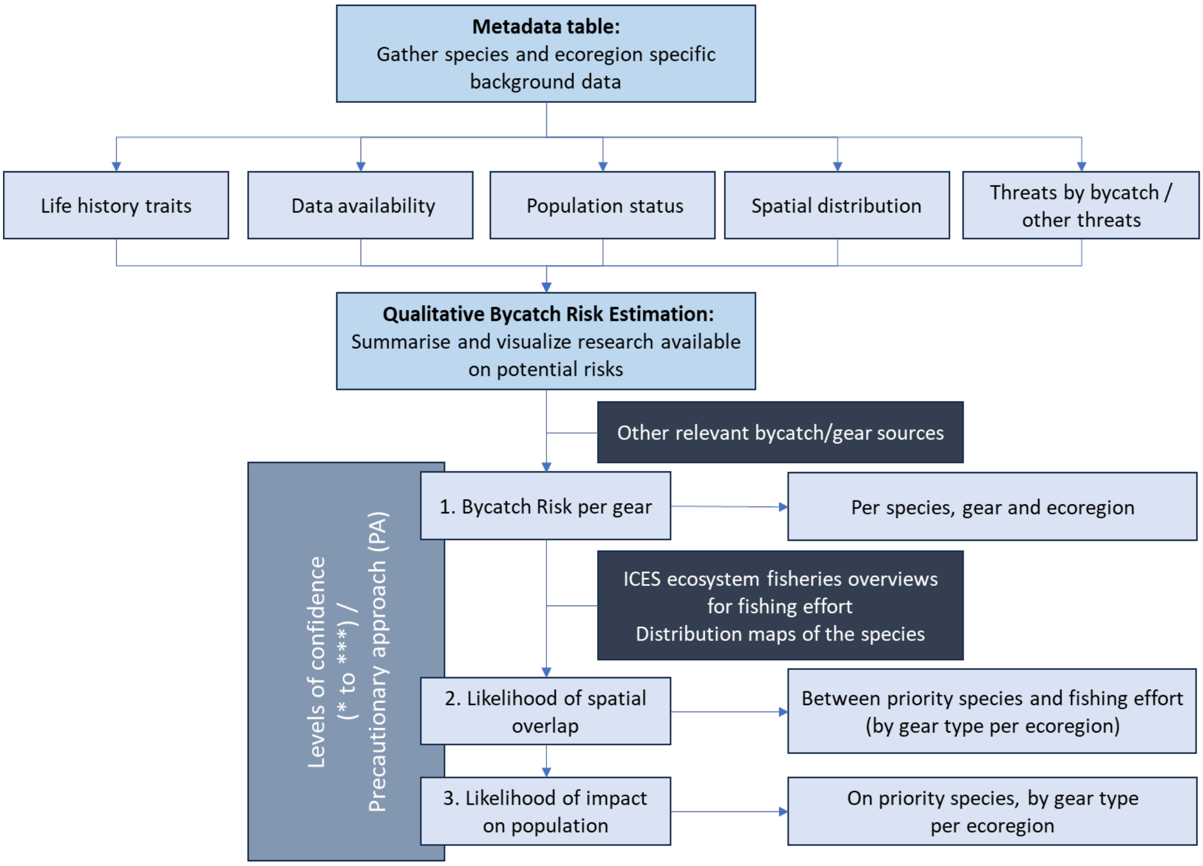

Figure 5.1 Strategy and interlinkage of the methodology developed to estimate risks for ToR D

The first step, represented by a metadata table, serves to gather and centralize information that will be used in the subsequent provisional risk estimations. The second part comprises three distinct tables or matrices estimating the perceived level of hazard associated with different gear types, the spatial and temporal overlap between each fishing activity and the species distribution, and the perceived impact at the population level of those species. Each table includes an indicator for confidence levels.

Recognizing that existing knowledge of bycatch varies widely based on species, gear type and ecoregion, the group proposed to create a framework that will require a structured collaboration with appropriate subject matter experts. The framework aims to provide a mainly qualitative objective assessment for species of conservation concern when there is very limited or no bycatch data available.

Because of the nature of this task, in most, if not all cases, data or other evidence may be missing and thus in these cases the process necessarily relies to an extent on expert judgement. Therefore, it is important from the outset to ensure that participating experts have the appropriate expertise to properly inform this exercise.‡

To ensure sufficient quality in the process, the following points and recommendations should be followed:

- Emphasize quantitative (or semi-quantitative) rigour:

‡ Paragraph added after ADGBYC 2023

Recommendation: Strengthen the quantitative rigour of the process as much as possible. Exercise extra caution when making estimations if the available data and information do not fulfil a set of agreed criteria. §

Strive to enhance the quantitative aspects of the estimation to the greatest degree possible and set objective rules for the interpretation of quantitative information.

- Incorporate ground truthing steps:
  Recommendation: Consider adding ground truthing steps to enhance the method's accuracy and reliability.
- Evaluate data sources for relevance:
  Recommendation: Encourage experts to carefully evaluate data or evidence in relation to its age and recurrence to avoid potential issues with outdated and unsupported information or with extreme or peculiar events.
- Tailor gear classification to regional context:
  Recommendation: Acknowledge the variability in gear usage and quality of fishing effort data within and between ecoregions and recommend tailoring gear classifications to account for possible regional differences in impacts.
- Account for regional variation in external conditions that can affect species' susceptibility to bycatch:
  Recommendation: Recognize that external conditions vary significantly among ecoregions and suggest adjusting estimations to account for these variations. For example, the oceanographic conditions in the Atlantic differ significantly from those in the Mediterranean, which may affect the probability of bycatch for the same species/gear combination. Similarly, the local abundance of the species and nature of available prey resources may vary between regions affecting the behaviour of the high priority species and their susceptibility to bycatch.
- Assess required expertise:
  Recommendation: The procedure should be a collaborative effort between WGBYC and other experts. Expertise on species biology/conservation status may not be available within WGBYC for all taxa/ecoregion combinations. In those cases expertise should be sought from other ICES working groups and/or from other relevant external organisations with acknowledged scientific expertise. §Clarify terminology and structure:

Recommendation: Clarify terminology and the structure of the estimation process to avoid confusion. A comprehensive "risk assessment" should encompass more than just looking at the evidence of risk related to susceptibility, and it should include the possibility of there being no evidence of risk (a "zero" risk option).

The framework developed during 2023 to address the requirements of this ToR is an initial proposal and further developments will be continued in 2024 along with some usability testing of the procedure with selected species. **

§ Paragraph modified after ADGBYC 2023

** Paragraph added after ADGBYC 2023.

5.2 Metadata table

The structure of the metadata table was constructed to centralize and summarize information that will be used to produce qualitative [or semi-quantitative] risk estimation matrices in the following steps. Data collected in the metadata table aim at providing sufficient information for executing the subsequent risk estimating steps. Furthermore, life-history traits may vary spatially, which is why it was decided to detail them by ecoregion, as much as possible. The background information should be as detailed and reliable as possible, so the ToR D subgroup suggests that this information should be provided by acknowledged experts, such as members of taxa specific ICES working groups or other external experts as appropriate.

The metadata table is set up to collate available information about the presence of a species by ICES ecoregion, as well as providing any available data and information about life history traits (e.g., avg. age at maturity, avg. max. age, fecundity/offspring, reproductive strategy and pattern, % recruitment success, estimated natural mortality, size at maturity, trophic level, female breeding cycle, population structure and population growth rate (k)), bycatch data availability (WGBYC database presence, survey data, and other bycatch data sources), information on population status and abundance (e.g., from IUCN, OSPAR QSR 2023), distribution (e.g., based on species distribution models) and likely threats (fisheries, gears, and others).

Furthermore, this metadata table has the additional advantage that it can be used to check and ensure that the provided information is accurate. If it is noticed that sources are sporadic, inaccurate, or outdated they can be flagged and considered for further evaluation. However, incomplete or partially biased data can be systematically considered to avoid discarding any potentially useful information that might be informative to some degree for bycatch risk estimation in highly data limited situations. This precautionary approach is complemented by expert knowledge to better assess its relevance.

The metadata table contains the base information for informing the risk matrices so it will be periodically updated depending on available information.

During future activities under this ToR, we propose that initially the species on the EU Priority list of species for the ICES recurrent advice on bycatch of protected, endangered, and threatened species to DGMARE will be considered. Subsequently, species of relatively high conservation concern from the ICES Ecoregion lists should be included. In both cases only those species/gear/ecoregion combinations that are not being assessed through the BEAM approach (which is a more quantitative assessment carried out under ToR C) should be dealt with under ToR D. The list of species suitable for BEAM is updated annually at the WGBYC meeting so, as a general rule to improve efficiency we suggest that the list of species not suitable for BEAM from the previous year is used as the basis for species selection for ToR D in the subsequent year. Although this approach will create an annual lag, it is considered a more efficient approach because the ToR D subgroup will not have to wait for the outputs from ToR C each year before proceeding with their work. In cases where a species/gear/ecoregion combination becomes suitable in a particular year for the more detailed BEAM approach, it can simply be removed from ToR D as that becomes apparent. This will avoid the situation of having different forms of information being produced to support advice on a particular assessment unit and ensure that advice is based on the most robust assessment method available.

5.3 Qualitative bycatch risk estimations

To begin comprehensive risk estimations, matrices for different gear types causing bycatch of particular species and ecoregions, and information and literature collated in the metadata table will be consulted.

This information is then used to construct three risk estimation matrices, namely:

Figure 5.1 - bycatch risks of species associated with specific fishing gear types,

Figure 5.2 - the likelihood of spatial and temporal overlap between that fishing effort and species occurrence, and

Figure 5.3 - consideration of the likelihood of impact on the relevant population.

Within each table[††], the confidence of the estimation will be indicated by making use of one to three asterisks, with "*" indicating low confidence and "***" indicating a high confidence level for the result of the estimation in a certain cell. These confidence levels should be estimated based on the amount of information available, its quality (e.g., is it outdated, applicable to the specific region studied, how the survey is conducted, etc.) and the quality of the experts' knowledge for each case. The usage of external resources will also be documented throughout the process for each table, using asterisks.

The creation of each 'matrix' and 'data layer' needs to be:

Validated by showing the **actual data in support** of the given "perceived/estimated risk".

The **timeframe of the source of information** needs to be clearly shown and, when using data spanning several decades, a check needs to be made on potential variations in conditions related to fishing practices, fishing gears and species distribution.

Scales for grading the level of danger of different gears, the quantity and quality of background information, etc. **This should always have a zero/absent/null category**.

Figure 5.1 (example below), on bycatch risks associated with a specific fishing gear type, is then assigned a score of 0, 1, 2, or 3, reflecting the level of evidence regarding bycatch risk for the particular species, populations or Management Units. Ideally, **ecoregions** should have their own specific **matrices** and **layers**, including one on the perceived level of hazard caused by each gear type, which should be built considering the following aspects:

For the same type of gear, the "vulnerability" and "susceptibility" of species may vary due to different use (fishing practice), oceanographic features (tides, sea current strength, etc.), ecology of the species (habitat and prey preferences), and other external factors (e.g., displacement caused by other anthropogenic activites or natural extreme phenomena).

The "animal behaviour" factor can further influence the "susceptibility" of a species (e.g., bycatch happening as a result offorgaing practises or social behaviours)[‡‡] . Some species may have an unwanted active role in the bycatch event, others do not.

[††] Mentioning of Precautionary Approach removed from the text and from Tables 5.1, 5.2 and 5.3 after ADGBYC 2023

[‡‡] Sentence modified after ADGBYC 2023

Table 5.1 (example): bycatch risks of species associated with specific fishing gear types. [§§]

Species	Pelagic Trawls (PTM, OTM)	Bottom Trawls (PTB, OTB, OTT, TBB)	Dredges (DRB, DRH, DRM)	Purse Seines (PS, LA)	Bot-tom Seines (SDN, SPR, SSC)	Gill nets (GNS, GTR, GNC, GTN)	Drift nets (GND)	Long lines (LLS, LLD)	Pots & Traps (FPO, FPN)
Species 1	1*	1***	0**	1*	1**	3*	2*	1*	2***
Species 2	2**	1*	2*	2*	1**	2**	1*	3***	1*
Species 3	2PA	1***	1**	1*	1***	3**	3***	2**	1*

Notes: 0 = no evidence of risk; 1 = low evidence of risk; 2 = moderate evidence of risk; 3 = high evidence of risk
*** = low confidence; ** = medium confidence; *** = high confidence.**

This scoring system distinguishes between gear types based on the strength of evidence, classifying them as having no evidence, little evidence, moderate evidence, or high evidence of causing bycatch. This approach is designed to account for the variability in the available literature, recognizing that some species are more commonly encountered and documented, while others are rarer and less frequently observed, or that behaviour and subsequent risks can vary between ecoregions. This requires essential expert judgment to weigh the evidence, or even to give some expert opinions when data are absent or scarce. Scores should therefore be assigned based on expert knowledge and information available in the literature, considering quantitative data where available (e.g., by using meta-analysis methods on all data from grey and peer-reviewed literature). This table could be supplemented with additional information on how fishing activity (fishing depth, fishing period, etc.) might impact bycatch risk, and whether there is a part of the population more at risk (for example, a specific habitat, age class or species phenotype associated with bycatch).

After the relative risk is associated with different gear types, the likelihood of spatial and temporal overlap between those fishing activities and the density distributions of each species is estimated in Table 2 (see example below). This analysis is conducted specifically for gear types that have been scored as having a medium or high risk of bycatch, so that no estimation is done for gears with a low perceived risk. For the likelihood of overlap, a similar scoring system of 1, 2, or 3 is used and these indicate if the extent of the overlap is small, moderate or large. In cases where either fishing effort data or species density distribution data are missing, the best available information will be used, drawing from resources such as the ICES ecoregion fisheries overviews for the fishing effort by gear type and general distribution (i.e., perimeter) maps of the species, again supported by expert elicitation. Co-occurrence estimates between bycatch species and the main commercial target species in a given fishery could also provide useful guidance for risk estimation, where such data are available. When alternative resources are used during the process, such as fisheries overviews, confidence levels for these estimations are further considered. High confidence is associated with regions where both fishing effort and species density distributions have been accurately mapped, medium confidence when one of these datasets exists but not the other, and low confidence when rudimentary spatial information is available for both.

Table 5.2 (example): Likelihood of spatial and temporal overlap between fishing effort and species occurrence (only for gear types considered moderate or high evidence of risk for that species). [***]

Species 2

[§§] Precautionary Approach (PA) reference removed from Table 5.1 after ADGBYC 2023

[***] Precautionary Approach (PA) reference removed from Table 5.2 and Table 5.3 after ADGBYC 2023

Gear Type of Moderate or High Risk	Arctic Ocean	Azores	Baltic Sea	Barents Sea	Bay of Biscay & Iberian Coast	Celtic Seas	Faroes	North Sea	Greenland Sea	Iceland	Norwegian Sea	Oceanic North Atlantic
Pelagic trawls		2^{**}			3^{**}	1^{***}		1^{**}				2^{***}
Purse seines		1^{***}			3^{***}	1^{*}		1^{*}				1^{***}
Gill nets		1^{**}			3^{**}	2^{***}		1^{*}				1^{***}
Long lines		2^{***}			3^{**}	2^{*}		1^{*}				2^{**}

Notes: blank = no overlap; 1 = low, 2 = moderate, 3 = high estimated overlap
* = low confidence; ** = medium confidence; *** = high confidence;

After this step, the likelihood of bycatch impact on the population of priority species within each ecoregion and gear type will be estimated in Figure 5.3 (see example below). This estimation could be carried out using the information collated in the metadata table, such as bibliographic and specialized knowledge of population parameters (demographic trend, effective population size, dispersal rate, etc.) and/or the species' life history traits (generation length, fecundity, etc.). Similar to the previous steps, a scoring system of 1, 2, or 3 is used to classify the likelihood of population impact, with scores indicating a small, medium, or high level of potential impacts. This step enables the estimation of potential harm caused by bycatch for particular species in different ecoregions and different gear types.

Table 5.3 (example): Estimation of the likelihood of impact on the species (population) by gear type per ecoregion (only for gear types considered moderate or high evidence of risk for that species).***

Species 3

Gear Type of Moderate or High Risk	Arctic Ocean	Azores	Baltic Sea	Barents Sea	Bay of Biscay & Iberian Coast	Celtic Sea	Faroes	North Sea	Greenland Sea	Iceland	Norwegian Sea	Oceanic North Atlantic
Pelagic trawls		1^{***}			2^{**}	2^{*}		1^{**}				1^{***}
Purse seines		1^{***}			2^{*}	2^{***}		1^{**}				1^{*}
Gill nets		1^{***}			2^{*}	2^{**}		1^{**}				1^{**}
Long lines		1^{***}			3^{**}	2^{PA}		1^{**}				2^{PA}

Notes: blank = no overlap; 1 = low, 2 = moderate, 3 = high estimated overlap
*** = low confidence; ** = medium confidence; *** = high confidence;**

During the first test exercises, it quickly became evident that various components of the proposed methodology serve additional useful purposes for uncovering and elaborating on knowledge gaps. The metadata table functions as a centralized repository for all pertinent information and can also serve as a tool to identify potential data gaps and issues. A comprehensive examination of the cited sources can reveal flawed procedures, biased estimations, reliance on outdated resources, and more general data deficiencies. Identifying these issues is crucial in preventing inaccuracies during risk estimation. If necessary, corrective actions can be taken to address such concerns. Research recommendations can help bridge knowledge gaps for future assessments.

As ToR D deals with species where sufficient data and information (e.g., on bycatch rates or fishing effort) are missing or unreliable, the outputs could be used to indicate where improved monitoring is most urgently needed. Coordination with the work carried out under ToR E on informing sampling plans will be useful.

Similarly, risk estimation matrices serve the purpose of exposing and detailing issues related to high-priority species. When data are absent, these gaps become readily apparent in the tables. Similarly, bycatch risk estimation with lower levels of confidence can underscore the need for more in-depth studies.

5.4 Way forward

The intention was to focus on developing test cases, specifically for those high priority species for which information is currently lacking in the WGBYC database. However, this may not be feasible for all species at this time due to the lack of available taxon specific biological knowledge within WGBYC. To complete the task of completing the metadata table and the subsequent estimation tables, it is imperative that biological experts are closely involved in the process. One way could be to forward related requests to other ICES expert groups such as WGMME, JWGBIRD, and WGEF to harness their taxon specific expertise, especially for collecting information about the biology, ecology parameters and indicators. Where appropriate, this should be extended to other external experts.

Alternatively, to accelerate progress, experts could be invited to participate in intersessional work conducted online, especially for those high priority species. This approach allows for targeted collaboration in smaller groups. In addition, we could plan dedicated workshops that include invited experts. These workshops can provide a structured platform for in-depth discussions and data filling. However, these approaches depend very much on the availability of experts and their resources, including their available working time.

5.5 Glossary

To avoid misunderstanding and ensure transparency in the risk profiling procedure, it is crucial to establish a clear and comprehensive overview of the used terminology. Clarifying terms, concepts and methodologies further increases the reproducibility and subsequent changes for the success of the procedure.

Whereas this needs to be done by those experts who run through this exercise, a first, incomplete list is given here that should be amended based on the terms used.

- Markers of sustainability
- Risk
- Risk assessment/risk estimation
- Evidence of risk
- When is a risk “high”, “medium” or “low”?
- Vulnerability
- Susceptibility
- Exposure
- Co-occurrence
- Level of confidence

5.6 Conclusions

In 2023, WGBYC developed a framework to provide a repeatable and transparent appraisal of which gears and fishing activity may pose the highest risks to high priority but extremely bycatch data-limited species.

This procedure should first be applied to those species on the EU high priority list, before being extended to species of high conservation concern from the ICES ecoregion species lists and then potentially to species of less conservation concern.

6 ToR E: Reviewing ongoing monitoring of different taxonomic groups in relation to spatial bycatch risk and fishing effort to inform coordinated sampling plans.

Introduction

In 2022 WGBYC produced a series of maps describing fishing effort (Days at Sea) at metier level 3, sampling effort (Days at Sea observed) and sampling coverage (Observed effort coverage %) to provide a visual representation of fishing effort and data collection activities in the ICES area, and from EU member states with fisheries operating in the GFCM area. These maps were considered a useful addition to the work of WGBYC because:

- They highlighted some data reporting discrepancies that might otherwise not have been identified,
- They provided an informative picture of area and gear combinations with relatively lower and higher monitoring coverage, and
- They indicated that apparently high levels of monitoring coverage in some areas were due to data collection approaches that are not considered by WGBYC to be reliable methods for quantifying PETs bycatch rates (see ToR A, Section 1.3 for details).

During the 2023 WGBYC meeting the ToR E subgroup agreed to reproduce the same maps with 2022 data obtained through the 2023 data call. Monitoring data obtained via vessel logbooks and port observers were omitted (as was done in WGBYC 2022), to present a more accurate picture of monitoring levels appropriate for bycatch recording across the Northeast Atlantic, Baltic Sea, Mediterranean and Black Sea.

The maps of 2022 data are presented and described in Section 6.1.

In 2023, the ToR E subgroup also further developed a method for indicating which broad metiers are relatively under-sampled with respect to PETs bycatch to help inform sampling plans. This followed on from work by WGBYC in 2020, 2021 and 2022 that used metier specific risk index scores produced within the fishPi project (Mugerza *et al.*, 2017) and data on fishing and monitoring effort from the WGBYC database to provide an overview of how sampling coverage is related to the fishPi relative risk scores (see ICES 2020; ICES 2021, ICES 2022).

Following the previous analyses undertaken by WGBYC, the WG agreed that this was a useful general approach that could be informative for highlighting métiers that may be of relatively higher risk in relation to PETs bycatch, but which are currently relatively under-sampled and vice versa. Consequently, the approach first developed in 2020 was maintained and expanded in 2023, to inform future sampling designs and is presented and described in Section 5.2.

Some issues that were highlighted in 2022 were addressed, including:

- The calculation of the final risks-cores by metier and Division were further developed following previous work by WGBYC. Previously, the final risk-scores were calculated by multiplying fishing effort, the risk-score, and the inverse of monitoring coverage. The scale of these variables were very different. This resulted in high final risk-scores being driven largely by high fishing effort. In 2023 the variable values were normalized (combination of metier and Ecoregion to produce a fishPi risk-score between 0-100 and a value on fishing effort between 0-100). This means that the risk-scores get the same weight as the fishing effort in the production of the final score. Sampling coverage was removed from the calculation and is shown independently beside the final risk-score variable.

- The list of functional species groups, for which the fishPi risk-scores are given, was expanded to also include deep water sharks, demersal sharks, pelagic sharks and skates / rays and sturgeons.
- Some risk-scores for some functional groups and metiers (e.g., PTB and dolphins) were updated based on more recent knowledge.
- Risk-scores for the generic fish functional group were removed from the calculations because it was unclear what this score related to.
- All subareas of the ICES region were included in the analysis.

Further details on the changes made to improve the methodology and a discussion on the resulting comparative table are provided in Section 6.2.

6.1 Maps of fishing effort, monitoring effort and monitoring intensity (% coverage)

Figures 5.1 to 5.3 show the 2022 metier level 3 fishing effort (DaS), monitoring effort (DaS) and monitoring coverage (%) by ICES/GFCM Division, based on data contained in the WGBYC database. Data on monitoring effort obtained from vessel logbooks and collected by port observers are not presented because WGBYC do not consider these to be reliable methods for consistent and accurate bycatch reporting (see ToR A section 2 and Basran, C.J., Sigurdsson &, G.M. 2021). The monitoring data used in the analysis include data collected by at-sea observers, electronic monitoring, and by vessel crew observers (crew members tasked with collecting data specifically on behalf of a scientific institution).

This section provides an overview of sampling activities by monitoring types that WGBYC consider reliable for the quantification of PETs bycatch. It does not consider the specific data collection protocols used within different monitoring programmes, some of which may be more, or less, appropriate for consistent and accurate recording of PETs bycatch.

A table of 2022 fishing effort and monitoring effort in Days at Sea (DaS) by Metier Level 3 and ICES/GFCM Division was produced and used to calculate a % monitoring coverage for each metier and Division.

The maps were produced in ArcGISPro, using shapefiles available for the ICES Area and Mediterranean Sea from the ICES (https://gis.ices.dk/sf/) and the GFCM (http://www.fao.org/gfcm/data/maps/gsas/es/) websites. This year the scale used in the observer coverage maps (Figure 5.3) was changed from previous reports to better indicate differences between areas as the coverage in many areas is ≤2%. In the areas with >2% coverage, the coverage was rarely >25%. See ICES WGBYC (2022) for 2019 and 2021 maps.

Note: the scale change on the monitoring coverage maps means the 2022 maps should not be directly compared against the coverage maps produced in previous WGBYC reports. The scales for total fishing effort and monitoring effort remain the same as previous years.

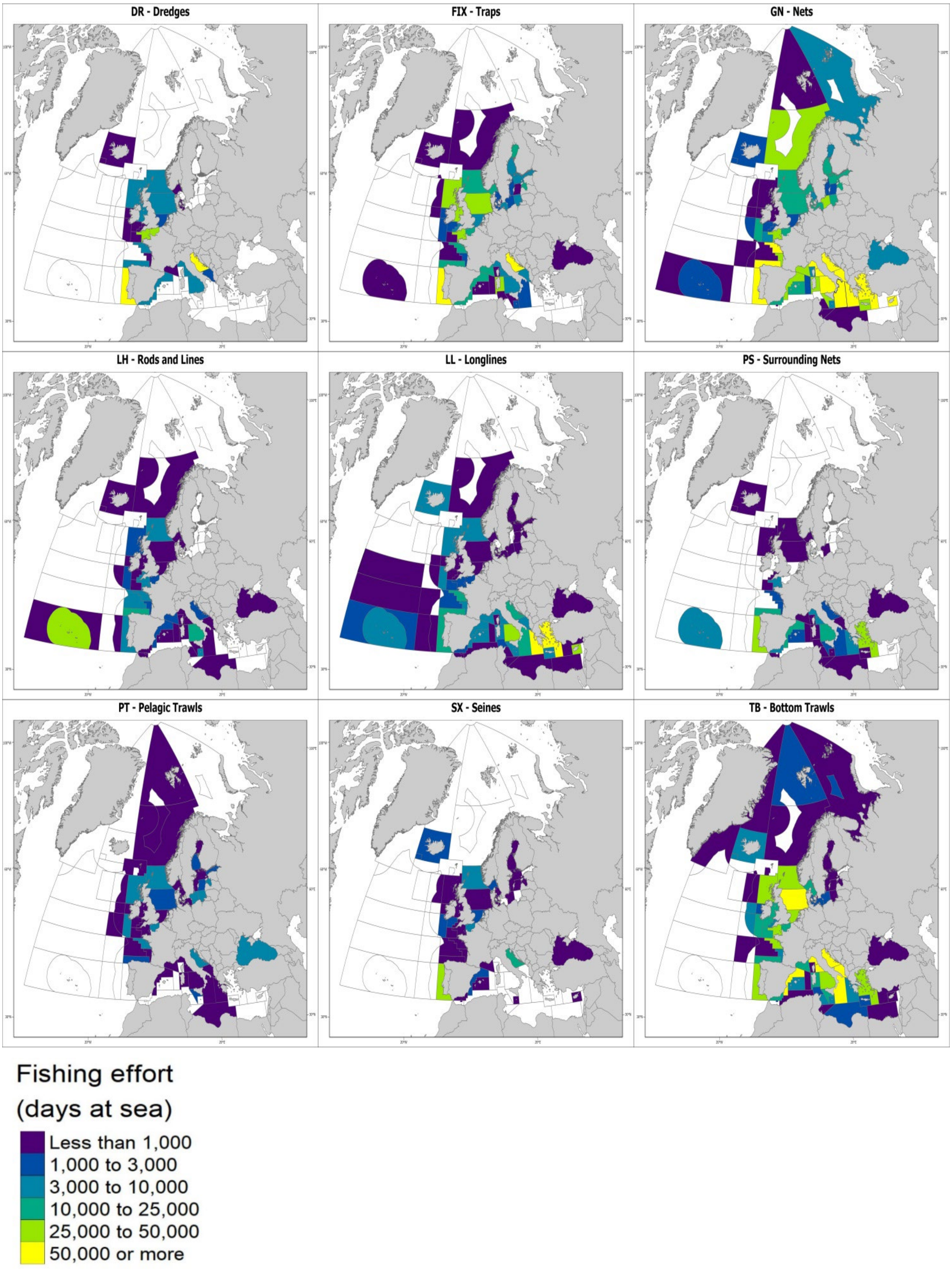

Figure 6.1 2022 Metier Level 3 fishing efforts (Days at Sea) submitted to the WGBYC database.

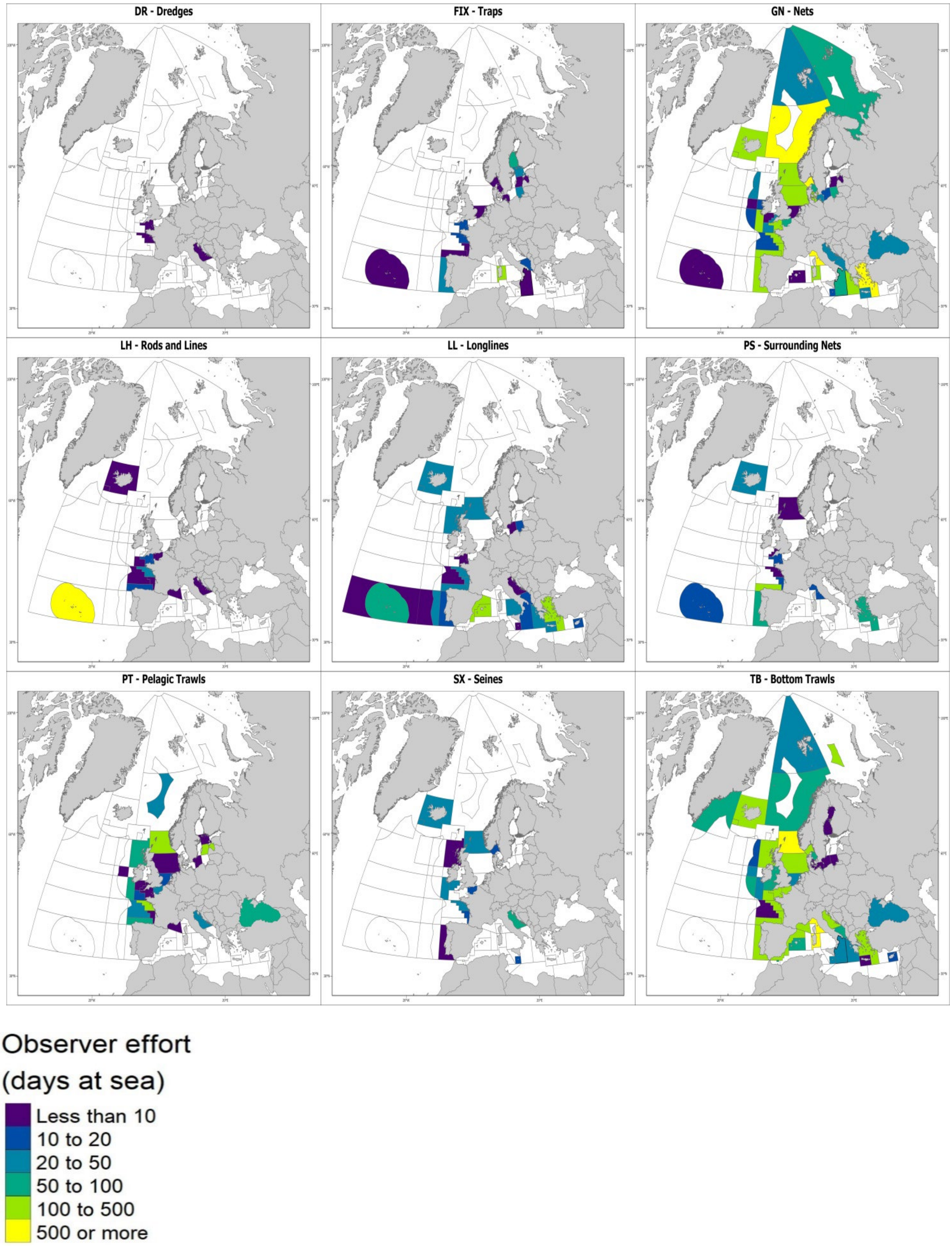

Figure 6.2 2022 Metier Level 3 monitoring effort (Days at Sea) submitted to the WGBYC database.

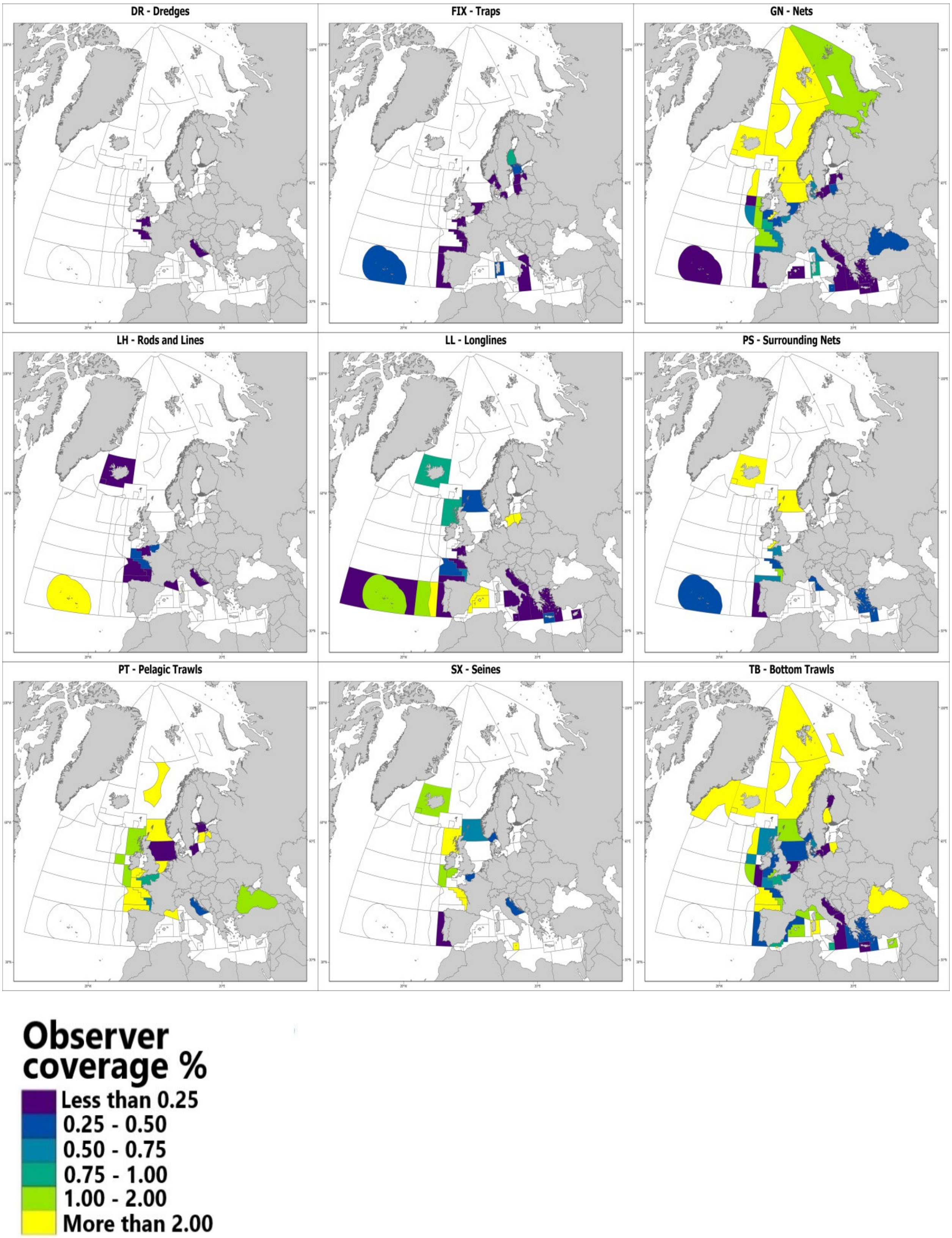

Figure 6.3 2022 monitoring coverage (%) calculated on data submitted to the WGBYC database and presented in Figures 5.1 and 5.2.

Based on the available fishing effort data and viewed at the scale of ICES/GFCM Division it is evident that some broad gear types are used more widely and at higher levels than others within the ICES and GFCM areas. Bottom trawls and nets are used in most Divisions and at relatively high levels in some areas. Traps, longlines and dredges are also quite widely used and exhibit high effort levels in some Divisions. Rod and line, surrounding nets, pelagic trawls and seines are less widespread and are typically associated with lower overall effort than the other gear types. The broad patterns of reported fishing effort in 2022 was similar to previous years (see ICES WGBYC 2021).

Monitoring effort is most widespread in bottom trawl and net fisheries. Less monitoring is carried out in all other gear types with dredges, trap fisheries, pelagic trawls, and surrounding net fisheries generally having patchy and comparatively low monitoring coverage.

As in 2022, the main effect of removing the Vessel Logbook and Port Observer data from this analysis appears to be a reduction in monitoring coverage in the Baltic Sea (see ICES WGBYC 2021 for comparison).

The maps provide an overview of fishing and data collection activity across the ICES Areas but are not informative in terms of which metiers might be suitable candidates for increased monitoring that would incrementally improve the data available for future bycatch assessments. The following Section 5.2 describes a methodology developed within WGBYC to inform that subsequent step.

As new data are collected every year and because there is a need to examine fishing and monitoring effort at various temporal and spatial levels, an interactive map tool would be a useful addition to this section in the future. This would allow projecting the data using seasons or months and focusing in on different areas and therefore assist in understanding the finer scale overlap between fishing effort and densities of species as they vary seasonally. It would also allow data from multiple years to be easily combined.

In addition, to increase the resolution of the data, it would be useful to work together with other working groups for this interactive map tool. As an example, the effort data maps produced by the Working Group on Spatial Fisheries Data (WGSFD) would increase the spatial resolution of the effort data significantly compared to the effort data currently available to WGBYC. Additionally, fishing effort is currently presented by Days at Sea, the lowest common denominator across various datasets. This metric does not necessarily properly reflect the actual exposure to risk for protected species for all gear types.

6.2 Identifying candidate metiers for increased monitoring with respect to PETs bycatch quantification.

During the 2023 meeting, the ToR E subgroup worked to further develop a method to broadly identify fishery metiers (Metier Level 4 and ICES Division) that are relatively under-sampled with respect to PETs bycatch, as a way of informing coordinated sampling plans. Incremental development of the method has been undertaken by WGBYC annually since 2020 (see ICES 2020; ICES 2021, ICES 2022 for full details).

The basic concept behind the method is to combine fishing effort data, monitoring effort data and information on the perceived risk of bycatch by different metiers across a range of sensitive taxa to produce a tabulated risk-score. Previously this had been done by a simple calculation to produce a “final score” for each metier by multiplying 1. fishing effort in Days at Sea, 2. the inverse of the monitoring coverage, and 3. an estimated risk score. However, the relative scales of the variables are very different. This meant that high final risk-scores were largely associated with high fishing effort metiers. In 2023 the variables were normalized (to produce a risk-score of between 0-100 and a value on fishing effort of between 0-100). This meant that the risk-scores and fishing effort get equal weighting in subsequent calculations of the combined risk score (fishing effort x risk score). In 2023 the sampling coverage was removed from the calculations and are instead shown separately alongside the combined risk-score.

Additional ICES Subareas and Divisions were also included in the 2023 analysis.

An important but sensitive part of the analysis is the quantification of the perceived risk. This largely followed the procedure developed within the fishPi project (fishPi 2016). Within this procedure species are grouped into "functional groups". The groups identified by fishPi and included in previous WGBYC analysis, were lampreys, roundfish, turtles, diving birds, surface birds, seals, dolphins, harbour porpoise and large whales.

In 2023 WGBYC applied the same scoring procedure as fishPi to also include deep water sharks, demersal sharks, pelagic sharks, skates and rays, and sturgeons. Each functional group gets a score (1-3, where 3 is the highest) for each metier (level 4) based on data or knowledge from any ecoregion. The underlying hypothesis is that the risk of interaction with each fishing gear is independent of area provided the bycatch species/group are present in that area. This risk-score is therefore multiplied by an area dependent absent/present indicator (0 or 1). Risk scores for all functional groups are then summarised to get a "final risk score fishPi". An area/gear combination will get a high combined risk-score if species from many functional groups are present and if the gear is known to interact with those species in any region.

In the 2023 analysis the scores that came from the functional group "roundfish" were removed. This is a group that contains many fish species (excluding sharks, rays & skates) coming from a preliminary list of fish species that were considered at risk in the different ecoregions. Some of these species are also commercial species targeted by the different metiers. It is a functional group that is essentially a legacy from the fishPi project, but which is not entirely relevant to the work of WGBYC because of the inclusion of commercial species. After discussion within the ToR E subgroup, it was agreed that the inclusion of this group only adds noise to the analysis and therefore it was removed. Fish species groups or individual fish species can be added in the future if their inclusion is considered essential. This would require the production of new functional groups and associated risk scores.

The table with results of combined risk-scores was sorted in descending order and is presented in Table 6.1. The table consists of data relating to fishing activities from 2022 which were submitted to the WGBYC database through the ICES/WGBYC 2023 data call as well as the output from the risk analysis.

Metiers positioned towards the top of the table will generally consist of a combination of high fishing effort and high perceived risk of bycatch. It is important to have these metiers sufficiently monitored for bycatch. If that is not the case, these are potential candidates for increased monitoring.

This analysis is designed to provide a general guide, through a structured, reproducible, and relatively quick analytical process, on where additional monitoring might best be targeted to help improve our overall understanding of patterns of sensitive species bycatch and bycatch assessments. It is not intended to answer detailed questions about optimal sampling levels to produce bycatch estimates with targeted levels of statistical precision, the appropriateness of sampling protocols for bycatch in different programmes, and it does not provide detail on which specific fisheries within each metier level 4 category should or should not be monitored more intensively.

Table 6.1 shows the full list of metiers (Metier level 4) with reported fishing effort in ICES Divisions from 11 Ecoregions: Azores, Baltic Sea, Barents Sea, Bay of Biscay and Iberian Coast; Celtic Seas; Faroes; Greater North Sea, Greenland Sea, Icelandic Waters, Norwegian Sea and Oceanic

Northeast Atlantic, based on data from the WGBYC database. Five more Ecoregions were included in the analysis in 2023 compared to WGBYC 2022 (which had covered Subareas 5 to 9) meaning the analysis is becoming increasingly comprehensive. However, risk scores were not yet determined for Oceanic Northeast Atlantic Ecoregion, as well as for some metier level 4 (GN, GNC, HMD) but could be considered in future. In addition, the assignment of risk scores to some ICES Divisions which are in (or between) two Ecoregions also deserves attention in the future, especially when significant biogeo-graphical changes in species distributions occur (e.g. 27.7.3 - Celtic Seas / Greater North Sea, 27.3.b – Greater North Sea / Baltic Sea). [†††]

[†††] Paragraph modified after ADGBYC 2023 when an error in the code was discovered and corrected. Table 6.1. was also updated accordingly.

Table 6.1 Comparison of fishPi 1 risk scores (scaled 0 to 100), fishing effort (scaled 0 to 100), monitoring coverage (%) and the calculated combined score (scaled 0 to 100) based on 2022 data. This Table was modified after ADGBYC when an error in the code was discovered and corrected. The full table can be downloaded at: https://doi.org/10.17895/ices.pub.24659484

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Bay of Biscay and Iberian coast	GNS	9	27.9.a	2022	89.4737	85.4421	100	0.2404
Baltic Sea	GNS	3	27.3.d	2022	55.2632	100	72.2884	0.068
Norwegian Sea	GNS	2	27.2.a	2022	78.0702	36.8168	37.5979	2.9141
Bay of Biscay and Iberian coast	OTB	9	27.9.a	2022	73.6842	26.5652	25.6047	0.3866
Bay of Biscay and Iberian coast	FPO	9	27.9.a	2022	26.3158	69.6975	23.992	0.0488
Bay of Biscay and Iberian coast	GTR	9	27.9.a	2022	84.2105	20.4436	22.5194	0.4228
Greater North Sea	OTB	3	27.3.a	2022	63.5965	22.9371	19.0811	0.4026
Bay of Biscay and Iberian coast	DRB	9	27.9.a	2022	15.7895	85.5385	17.667	0
Greater North Sea	OTB	4	27.4.a	2022	63.5965	18.7208	15.5736	1.6521
Greater North Sea	OTB	4	27.4.b	2022	63.5965	18.1196	15.0735	0.6136
Greater North Sea	OTB	7	27.7.e	2022	73.6842	14.7654	14.2316	0.4384
Bay of Biscay and Iberian coast	OTB	8	27.8.a	2022	73.6842	14.0343	13.5269	0.4923
Bay of Biscay and Iberian coast	GTR	8	27.8.c	2022	84.2105	11.6086	12.7873	0.0509
Bay of Biscay and Iberian coast	GTR	8	27.8.a	2022	84.2105	11.4438	12.6058	1.2391
Greater North Sea	TBB	4	27.4.b	2022	39.4737	22.599	11.6689	0.3949
Celtic Seas	FPO	6	27.6.a	2022	26.3158	32.4027	11.154	0
Bay of Biscay and Iberian coast	PS	9	27.9.a	2022	31.5789	26.4883	10.9417	0.2231
Celtic Seas	OTB	6	27.6.a	2022	73.6842	11.304	10.8953	1.4032
Bay of Biscay and Iberian coast	GNS	8	27.8.a	2022	89.4737	9.263	10.8413	0.979
Baltic Sea	FYK	3	27.3.d	2022	19.7368	41.9291	10.8249	0.0811
Greater North Sea	GNS	7	27.7.e	2022	89.4737	9.1535	10.7131	0.551
Greater North Sea	OTB	7	27.7.d	2022	63.5965	12.775	10.6274	0.5254
Bay of Biscay and Iberian coast	OTT	8	27.8.a	2022	52.6316	14.8408	10.2173	0.232
Greater North Sea	FPO	7	27.7.e	2022	26.3158	27.5992	9.5005	0.026
Greater North Sea	TBB	4	27.4.c	2022	39.4737	18.3055	9.452	0.5812
Bay of Biscay and Iberian coast	GNS	8	27.8.c	2022	89.4737	7.8819	9.2248	3.0556
Bay of Biscay and Iberian coast	LLS	8	27.8.c	2022	63.1579	11.0629	9.1396	0.1536
Bay of Biscay and Iberian coast	LLS	8	27.8.a	2022	63.1579	10.1252	8.365	0.2024
Bay of Biscay and Iberian coast	LLS	9	27.9.a	2022	63.1579	9.4201	7.7824	0.0157
Bay of Biscay and Iberian coast	GTR	8	27.8.b	2022	84.2105	6.7742	7.462	1.0969
Greater North Sea	GNS	3	27.3.a	2022	78.0702	7.2924	7.4471	7.5911
Baltic Sea	OTM	3	27.3.d	2022	39.4737	14.3826	7.4264	2.3731
Greater North Sea	FPO	4	27.4.b	2022	20.1754	28.0662	7.4069	0
Celtic Seas	FPO	7	27.7.a	2022	26.3158	20.9039	7.1958	0
Celtic Seas	OTB	7	27.7.a	2022	73.6842	7.0294	6.7752	0.3069
Celtic Seas	OTB	7	27.7.j	2022	73.6842	6.7636	6.5191	0.2949
Bay of Biscay and Iberian coast	PS	8	27.8.c	2022	31.5789	15.4143	6.3673	0.508
Greater North Sea	GNS	4	27.4.b	2022	78.0702	5.9467	6.0729	5.3098
Celtic Seas	OTB	7	27.7.g	2022	73.6842	5.7357	5.5283	0.1391
Bay of Biscay and Iberian coast	OTB	8	27.8.b	2022	73.6842	5.57	5.3686	0.7486
Bay of Biscay and Iberian coast	OTB	8	27.8.c	2022	73.6842	5.4061	5.2106	2.3232
Greater North Sea	GTR	7	27.7.d	2022	73.2456	5.3182	5.0954	0.7363
Greater North Sea	GTR	7	27.7.e	2022	84.2105	4.4258	4.8752	0.5605

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Celtic Seas	GNS	7	27.7.j	2022	89.4737	4.0977	4.7959	0.1082
Bay of Biscay and Iberian coast	TBB	9	27.9.a	2022	47.3684	7.6405	4.7342	0
Bay of Biscay and Iberian coast	FPO	8	27.8.c	2022	26.3158	13.4495	4.6297	0.0055
Bay of Biscay and Iberian coast	GNS	8	27.8.b	2022	89.4737	3.9425	4.6142	0.8858
Greater North Sea	FPO	4	27.4.a	2022	20.1754	16.7282	4.4147	0
Bay of Biscay and Iberian coast	LLS	8	27.8.b	2022	63.1579	5.0948	4.2091	0.4042
Greater North Sea	DRB	7	27.7.e	2022	15.7895	20.0386	4.1387	0.0101
Baltic Sea	GNS	3	27.3.c	2022	55.2632	5.6413	4.078	1.6239
Barents Sea	GNS	1	27.1.b	2022	78.0702	3.8926	3.9752	1.7195
Bay of Biscay and Iberian coast	FPO	8	27.8.a	2022	26.3158	11.5427	3.9733	0.0831
Greater North Sea	TBB	7	27.7.e	2022	47.3684	6.3779	3.9518	1.9228
Celtic Seas	LLS	7	27.7.j	2022	63.1579	4.7794	3.9485	0
Greater North Sea	GNS	4	27.4.a	2022	78.0702	3.8238	3.9049	5.5103
Icelandic waters	OTB	5	27.5.a	2022	73.6842	4.036	3.8901	4.8691
Greater North Sea	GNS	7	27.7.d	2022	78.0702	3.6642	3.7419	0.3428
Greater North Sea	FPO	7	27.7.d	2022	20.1754	13.6162	3.5934	0
Celtic Seas	OTB	7	27.7.h	2022	73.6842	3.6363	3.5048	0.7607
Celtic Seas	OTB	7	27.7.k	2022	73.6842	3.6054	3.475	1.2349
Greater North Sea	LLS	4	27.4.a	2022	53.9474	4.4789	3.1606	0.3629
Bay of Biscay and Iberian coast	SDN	9	27.9.a	2022	21.0526	11.3484	3.1252	0
Greater North Sea	DRB	7	27.7.d	2022	10.5263	21.9733	3.0255	0
Greater North Sea	OTT	3	27.3.a	2022	44.2982	4.9364	2.8604	0.9429
Azores	LHP	10	27.10.a	2022	10.5263	20.4658	2.818	2.5449
Bay of Biscay and Iberian coast	GND	8	27.8.b	2022	100	2.1272	2.7825	0.2648
Celtic Seas	OTB	7	27.7.c	2022	73.6842	2.8637	2.7602	1.1282
Bay of Biscay and Iberian coast	GND	9	27.9.a	2022	100	2.0427	2.672	0
Bay of Biscay and Iberian coast	PTB	8	27.8.c	2022	52.6316	3.8747	2.6676	3.9087
Azores	LLS	10	27.10.a	2022	53.9474	3.6178	2.553	0.2042
Azores	LLD	10	27.10.a	2022	63.5965	3.0349	2.5247	2.0204
Icelandic waters	LLS	5	27.5.a	2022	63.1579	3.0512	2.5208	0.8232
Greater North Sea	FPO	3	27.3.a	2022	20.1754	9.4148	2.4847	0.0785
Celtic Seas	GNS	7	27.7.g	2022	89.4737	2.0736	2.4269	0.3207
Celtic Seas	OTT	6	27.6.a	2022	52.6316	3.5223	2.425	0.7761
Celtic Seas	OTT	7	27.7.h	2022	52.6316	3.0031	2.0675	0.8782
Celtic Seas	LLS	6	27.6.a	2022	63.1579	2.4569	2.0298	0.8419
Bay of Biscay and Iberian coast	PTM	8	27.8.a	2022	68.4211	2.2506	2.0143	2.8175
Azores	GNS	10	27.10.a	2022	78.0702	1.7941	1.8322	0.1647
Greater North Sea	PTB	4	27.4.a	2022	44.2982	3.1597	1.8309	0.7014
Greater North Sea	OTB	4	27.4.c	2022	63.5965	2.1869	1.8193	0.4292
Celtic Seas	OTB	7	27.7.b	2022	73.6842	1.8216	1.7557	0
Greater North Sea	OTT	4	27.4.a	2022	44.2982	2.9656	1.7184	1.968
Icelandic waters	GNS	5	27.5.a	2022	89.4737	1.4584	1.7069	5.7244

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Greater North Sea	OTM	7	27.7.d	2022	58.7719	2.1222	1.6315	1.029
Greater North Sea	LLS	7	27.7.e	2022	63.1579	1.93	1.5945	0.2424
Greater North Sea	OTM	4	27.4.a	2022	58.7719	2.0734	1.594	3.6701
Celtic Seas	GNS	7	27.7.f	2022	89.4737	1.3241	1.5497	2.1537
Baltic Sea	OTB	3	27.3.d	2022	43.4211	2.7028	1.5351	0.246
Baltic Sea	GTR	3	27.3.c	2022	51.3158	2.2489	1.5096	0.2628
Celtic Seas	TBB	7	27.7.g	2022	47.3684	2.435	1.5088	1.9331
Celtic Seas	GTR	7	27.7.h	2022	84.2105	1.3656	1.5043	0.9075
Greater North Sea	TBB	7	27.7.d	2022	39.4737	2.7118	1.4002	1.3782
Bay of Biscay and Iberian coast	DRB	8	27.8.c	2022	15.7895	6.6476	1.373	0
Celtic Seas	OTB	7	27.7.f	2022	73.6842	1.4157	1.3645	0
Celtic Seas	FPO	7	27.7.f	2022	26.3158	3.9035	1.3437	0
Bay of Biscay and Iberian coast	PTB	9	27.9.a	2022	52.6316	1.909	1.3143	3.2508
Greater North Sea	GNS	4	27.4.c	2022	78.0702	1.2721	1.2991	0.2904
Celtic Seas	GNS	7	27.7.k	2022	89.4737	1.088	1.2734	0.7469
Greater North Sea	FPO	4	27.4.c	2022	20.1754	4.6446	1.2258	0
Bay of Biscay and Iberian coast	LTL	8	27.8.d	2022	31.5789	2.924	1.2078	0.2067
Celtic Seas	DRB	7	27.7.a	2022	15.7895	5.6789	1.1729	0
Bay of Biscay and Iberian coast	LHM	8	27.8.c	2022	15.7895	5.5852	1.1536	0.0926
Baltic Sea	GNS	3	27.3.b	2022	55.2632	1.5703	1.1351	6.7749
Greater North Sea	OTM	4	27.4.b	2022	58.7719	1.4741	1.1333	0.1002
Greater North Sea	LHP	7	27.7.e	2022	15.7895	5.4833	1.1325	0.0894
Celtic Seas	GNS	7	27.7.h	2022	89.4737	0.9672	1.132	0.6328
Bay of Biscay and Iberian coast	PTM	8	27.8.c	2022	68.4211	1.2298	1.1007	3.244
Greater North Sea	OTT	4	27.4.b	2022	44.2982	1.8887	1.0944	0.8997
Celtic Seas	PTM	7	27.7.j	2022	68.4211	1.1052	0.9892	1.5819
Bay of Biscay and Iberian coast	LLS	8	27.8.d	2022	63.1579	1.1764	0.9719	0
Bay of Biscay and Iberian coast	LHP	8	27.8.a	2022	15.7895	4.5025	0.9299	0.3735
Norwegian Sea	OTB	2	27.2.b	2022	63.5965	1.0815	0.8997	3.2107
Greater North Sea	LLS	7	27.7.d	2022	53.9474	1.2613	0.8901	0
Greater North Sea	PS	7	27.7.e	2022	31.5789	2.1266	0.8784	0.6427
Bay of Biscay and Iberian coast	GND	8	27.8.a	2022	100	0.6494	0.8495	0.2275
Celtic Seas	LLS	7	27.7.h	2022	63.1579	1.0135	0.8373	0
Baltic Sea	OTB	3	27.3.c	2022	43.4211	1.4495	0.8233	0.2548
Celtic Seas	TBB	7	27.7.f	2022	47.3684	1.3044	0.8082	3.3091
Azores	PS	10	27.10.a	2022	25	2.4697	0.8076	0.329
Bay of Biscay and Iberian coast	LHM	9	27.9.a	2022	15.7895	3.7139	0.7671	0
Celtic Seas	OTT	7	27.7.j	2022	52.6316	1.0849	0.7469	0
Icelandic waters	OTM	5	27.5.a	2022	68.4211	0.7336	0.6566	6.143
Baltic Sea	PTM	3	27.3.d	2022	39.4737	1.2581	0.6496	0.2349
Baltic Sea	LLS	3	27.3.d	2022	35.5263	1.3914	0.6466	0.0531
Celtic Seas	TBB	7	27.7.a	2022	47.3684	1.0352	0.6414	3.2441

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Celtic Seas	PTM	6	27.6.a	2022	68.4211	0.7128	0.638	2.9018
Barents Sea	OTB	1	27.1.a	2022	63.5965	0.734	0.6106	14.0909
Celtic Seas	LTL	7	27.7.j	2022	31.5789	1.2707	0.5249	0
Greater North Sea	OTT	7	27.7.e	2022	52.6316	0.7578	0.5217	0.8775
Celtic Seas	OTT	7	27.7.g	2022	52.6316	0.7083	0.4876	0
Bay of Biscay and Iberian coast	PS	8	27.8.a	2022	31.5789	1.1523	0.476	0.2885
Bay of Biscay and Iberian coast	LHP	8	27.8.c	2022	15.7895	2.2959	0.4742	0
Greater North Sea	SSC	4	27.4.a	2022	15.3509	2.3534	0.4726	0.6906
Greater North Sea	GTR	4	27.4.c	2022	73.2456	0.4886	0.4681	0.3024
Celtic Seas	LHP	7	27.7.f	2022	15.7895	2.2529	0.4653	0
Bay of Biscay and Iberian coast	DRB	8	27.8.a	2022	15.7895	2.2313	0.4608	0.0184
Celtic Seas	DRB	6	27.6.a	2022	15.7895	2.2142	0.4573	0
Celtic Seas	FPO	7	27.7.g	2022	26.3158	1.3216	0.4549	0
Celtic Seas	FPO	7	27.7.b	2022	26.3158	1.3058	0.4495	0
Bay of Biscay and Iberian coast	PS	8	27.8.b	2022	31.5789	1.0788	0.4456	1.1642
Celtic Seas	FPO	7	27.7.j	2022	26.3158	1.2774	0.4397	0
Celtic Seas	OTM	6	27.6.a	2022	68.4211	0.4831	0.4324	4.1294
Greater North Sea	SSC	7	27.7.d	2022	15.3509	2.1244	0.4266	0.1391
Bay of Biscay and Iberian coast	LTL	8	27.8.a	2022	31.5789	1.0007	0.4134	0.8509
Bay of Biscay and Iberian coast	LTL	8	27.8.b	2022	31.5789	0.9814	0.4054	0.0493
Celtic Seas	GNS	7	27.7.a	2022	89.4737	0.3399	0.3978	0
Bay of Biscay and Iberian coast	LLD	9	27.9.b	2022	73.6842	0.3975	0.3831	5.0186
Celtic Seas	LLS	7	27.7.c	2022	63.1579	0.4615	0.3813	0
Celtic Seas	LHP	6	27.6.a	2022	15.7895	1.8445	0.381	0
Greenland Sea	OTB	14	27.14.b	2022	63.5965	0.4566	0.3798	8.2524
Bay of Biscay and Iberian coast	LLD	8	27.8.a	2022	73.6842	0.3883	0.3743	0.5708
Celtic Seas	GNS	7	27.7.c	2022	89.4737	0.3131	0.3664	0.1226
Bay of Biscay and Iberian coast	GNS	8	27.8.d	2022	89.4737	0.3108	0.3638	3.3273
Bay of Biscay and Iberian coast	LTL	8	27.8.c	2022	31.5789	0.8688	0.3589	0.5411
Celtic Seas	LLS	7	27.7.f	2022	63.1579	0.428	0.3536	0
Bay of Biscay and Iberian coast	LLD	8	27.8.b	2022	73.6842	0.3619	0.3488	2.6832
Celtic Seas	OTB	6	27.6.b	2022	73.6842	0.3605	0.3475	2.5273
Bay of Biscay and Iberian coast	FPO	8	27.8.b	2022	26.3158	0.9496	0.3269	0.1773
Greater North Sea	DRB	4	27.4.b	2022	10.5263	2.3447	0.3228	0
Celtic Seas	TBB	7	27.7.h	2022	47.3684	0.5203	0.3224	5.6153
Greater North Sea	DRB	4	27.4.a	2022	10.5263	2.3205	0.3195	0
Greater North Sea	OTT	7	27.7.d	2022	44.2982	0.5352	0.3101	0.9663
Greater North Sea	GND	3	27.3.a	2022	87.7193	0.269	0.3087	0
Greater North Sea	SDN	3	27.3.a	2022	15.3509	1.4382	0.2888	0.565
Celtic Seas	SSC	7	27.7.g	2022	21.0526	1.0223	0.2815	2.3606
Bay of Biscay and Iberian coast	PTB	8	27.8.b	2022	52.6316	0.4083	0.2811	14.1144
Greater North Sea	OTM	7	27.7.e	2022	68.4211	0.3112	0.2785	1.5786

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Bay of Biscay and Iberian coast	TBB	8	27.8.c	2022	47.3684	0.4484	0.2778	0
Bay of Biscay and Iberian coast	LLD	9	27.9.a	2022	73.6842	0.2829	0.2727	3.1332
Baltic Sea	FPN	3	27.3.d	2022	3.9474	5.143	0.2656	0.8619
Icelandic waters	SDN	5	27.5.a	2022	21.0526	0.9501	0.2616	1.7107
Greater North Sea	SSC	4	27.4.c	2022	15.3509	1.2926	0.2596	0
Celtic Seas	GNS	7	27.7.b	2022	89.4737	0.2151	0.2517	0
Norwegian Sea	GNS	2	27.2.b	2022	78.0702	0.2463	0.2515	6.6877
Norwegian Sea	OTM	2	27.2.a	2022	58.7719	0.3223	0.2478	10.3162
Greater North Sea	OTM	4	27.4.c	2022	58.7719	0.3189	0.2452	2.1366
Celtic Seas	OTT	7	27.7.a	2022	52.6316	0.3347	0.2304	0
Bay of Biscay and Iberian coast	PTM	8	27.8.d	2022	68.4211	0.2573	0.2303	3.1585
Bay of Biscay and Iberian coast	OTT	8	27.8.b	2022	52.6316	0.3326	0.229	1.1106
Baltic Sea	GTR	3	27.3.b	2022	51.3158	0.3321	0.2229	0
Greater North Sea	SDN	7	27.7.d	2022	15.3509	1.1071	0.2223	0.911
Greater North Sea	LHP	4	27.4.a	2022	10.5263	1.5413	0.2122	0
Faroes	OTB	5	27.5.b	2022	73.6842	0.2202	0.2122	0
Bay of Biscay and Iberian coast	OTM	8	27.8.a	2022	68.4211	0.2285	0.2045	5.957
Norwegian Sea	OTT	2	27.2.b	2022	44.2982	0.3511	0.2034	0
Celtic Seas	LLS	7	27.7.a	2022	63.1579	0.2435	0.2012	0
Greater North Sea	PTM	7	27.7.e	2022	68.4211	0.2236	0.2001	0
Celtic Seas	OTM	7	27.7.j	2022	68.4211	0.2234	0.1999	15.5456
Bay of Biscay and Iberian coast	PTM	8	27.8.b	2022	68.4211	0.2205	0.1973	1.0053
Celtic Seas	LLS	7	27.7.k	2022	63.1579	0.2343	0.1936	0
Greater North Sea	GND	4	27.4.c	2022	87.7193	0.1669	0.1915	0
Baltic Sea	PTB	3	27.3.d	2022	27.6316	0.5205	0.1881	0
Bay of Biscay and Iberian coast	GTN	8	27.8.b	2022	86.8421	0.1648	0.1872	0
Greater North Sea	FYK	3	27.3.a	2022	34.6491	0.3956	0.1793	0
Greater North Sea	GTR	3	27.3.a	2022	73.2456	0.1865	0.1787	0
Bay of Biscay and Iberian coast	SDN	8	27.8.a	2022	21.0526	0.6442	0.1774	2.9274
Greater North Sea	LLS	4	27.4.c	2022	53.9474	0.2471	0.1744	0
Bay of Biscay and Iberian coast	LHP	8	27.8.d	2022	15.7895	0.8439	0.1743	0
Barents Sea	OTB	1	27.1.b	2022	63.5965	0.2046	0.1702	0
Greater North Sea	LHP	7	27.7.d	2022	10.5263	1.2345	0.17	0.2992
Greater North Sea	LLS	4	27.4.b	2022	53.9474	0.2235	0.1577	0
Celtic Seas	SSC	7	27.7.j	2022	21.0526	0.5716	0.1574	3.9207
Celtic Seas	PTM	7	27.7.b	2022	68.4211	0.1747	0.1564	0
Greater North Sea	DRB	4	27.4.c	2022	10.5263	1.1355	0.1563	0
Bay of Biscay and Iberian coast	LLD	8	27.8.c	2022	73.6842	0.1603	0.1545	0.9217
Celtic Seas	OTM	7	27.7.c	2022	68.4211	0.1711	0.1531	2.159
Greater North Sea	GND	7	27.7.d	2022	87.7193	0.1287	0.1477	5.7388
Celtic Seas	PTM	7	27.7.a	2022	68.4211	0.1583	0.1417	0
Bay of Biscay and Iberian coast	SDN	8	27.8.c	2022	21.0526	0.5071	0.1396	0

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Greater North Sea	TBB	3	27.3.a	2022	39.4737	0.269	0.1389	0
Baltic Sea	FPO	3	27.3.d	2022	7.8947	1.313	0.1356	1.5754
Celtic Seas	OTM	7	27.7.k	2022	68.4211	0.1511	0.1352	0
Icelandic waters	LHM	5	27.5.a	2022	15.7895	0.6331	0.1308	0.1167
Greater North Sea	PTM	7	27.7.d	2022	58.7719	0.1665	0.128	0.1479
Celtic Seas	FPO	7	27.7.h	2022	26.3158	0.3693	0.1271	0
Bay of Biscay and Iberian coast	PTB	8	27.8.a	2022	52.6316	0.1819	0.1252	14.6192
Bay of Biscay and Iberian coast	TBB	8	27.8.b	2022	47.3684	0.1994	0.1236	6.5341
Azores	FPO	10	27.10.a	2022	20.1754	0.4588	0.1211	0.4831
Greater North Sea	PTM	4	27.4.a	2022	58.7719	0.153	0.1176	2.4148
Baltic Sea	GTR	3	27.3.d	2022	51.3158	0.1739	0.1167	0.4249
Norwegian Sea	OTB	2	27.2.a	2022	63.5965	0.136	0.1131	10.2156
Celtic Seas	LLS	7	27.7.g	2022	63.1579	0.1322	0.1092	0
Greater North Sea	SSC	4	27.4.b	2022	15.3509	0.5214	0.1047	0
Bay of Biscay and Iberian coast	OTT	8	27.8.d	2022	52.6316	0.1488	0.1024	2.4707
Greater North Sea	GTN	7	27.7.e	2022	86.8421	0.0901	0.1023	0
Bay of Biscay and Iberian coast	LHP	8	27.8.b	2022	15.7895	0.4768	0.0985	0.2324
Celtic Seas	GTR	7	27.7.j	2022	84.2105	0.089	0.098	202.4296
Greater North Sea	LTL	7	27.7.e	2022	31.5789	0.2328	0.0962	0.1587
Celtic Seas	OTM	7	27.7.h	2022	68.4211	0.1053	0.0942	11.2296
Greater North Sea	LHM	4	27.4.a	2022	10.5263	0.667	0.0918	0
Bay of Biscay and Iberian coast	SDN	8	27.8.b	2022	21.0526	0.3329	0.0917	3.9635
Greater North Sea	PTM	4	27.4.c	2022	58.7719	0.1187	0.0913	1.66
Celtic Seas	PTM	7	27.7.h	2022	68.4211	0.099	0.0886	0
Greater North Sea	PTB	4	27.4.b	2022	44.2982	0.1498	0.0868	0
Celtic Seas	LLS	7	27.7.b	2022	63.1579	0.1031	0.0852	0
Greater North Sea	OTM	3	27.3.a	2022	58.7719	0.1093	0.084	0
Bay of Biscay and Iberian coast	GND	8	27.8.c	2022	100	0.0628	0.0821	0
Greater North Sea	PTM	4	27.4.b	2022	58.7719	0.1065	0.0819	0
Icelandic waters	PS	5	27.5.a	2022	31.5789	0.198	0.0818	8.5821
Bay of Biscay and Iberian coast	OTM	8	27.8.d	2022	68.4211	0.0909	0.0814	12.1922
Bay of Biscay and Iberian coast	OTM	8	27.8.b	2022	68.4211	0.0886	0.0793	0
Greater North Sea	LTL	3	27.3.a	2022	25	0.2172	0.071	0
Celtic Seas	GNS	6	27.6.b	2022	89.4737	0.0606	0.0709	48.147
Bay of Biscay and Iberian coast	GTN	8	27.8.a	2022	86.8421	0.0584	0.0663	2.9226
Celtic Seas	GNS	6	27.6.a	2022	89.4737	0.0558	0.0653	0
Celtic Seas	LLD	7	27.7.j	2022	73.6842	0.0665	0.0641	0
Celtic Seas	OTT	7	27.7.f	2022	52.6316	0.0926	0.0638	0
Celtic Seas	PTM	7	27.7.c	2022	68.4211	0.0702	0.0628	0
Bay of Biscay and Iberian coast	LLD	8	27.8.e	2022	73.6842	0.0643	0.062	6.8966
Celtic Seas	OTM	7	27.7.a	2022	68.4211	0.0676	0.0605	0
Celtic Seas	OTM	7	27.7.b	2022	68.4211	0.0665	0.0595	0

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Celtic Seas	OTT	7	27.7.k	2022	52.6316	0.0858	0.0591	0
Celtic Seas	LHP	7	27.7.h	2022	15.7895	0.2857	0.059	0.4166
Greater North Sea	TBB	4	27.4.a	2022	39.4737	0.1087	0.0561	0
Celtic Seas	PTB	6	27.6.a	2022	52.6316	0.0794	0.0547	0
Greater North Sea	LTL	7	27.7.d	2022	25	0.1638	0.0536	0
Greater North Sea	LLS	3	27.3.a	2022	53.9474	0.0746	0.0526	0
Celtic Seas	GTR	7	27.7.g	2022	84.2105	0.0475	0.0523	0
Celtic Seas	LTL	7	27.7.h	2022	31.5789	0.1257	0.0519	0
Celtic Seas	LLD	7	27.7.h	2022	73.6842	0.051	0.0492	0
Greater North Sea	LHP	4	27.4.b	2022	10.5263	0.3551	0.0489	0
Baltic Sea	FYK	3	27.3.b	2022	19.7368	0.1873	0.0484	0
Bay of Biscay and Iberian coast	FPO	8	27.8.d	2022	26.3158	0.1369	0.0471	0
Greater North Sea	GND	7	27.7.e	2022	100	0.0358	0.0468	14.433
Celtic Seas	DRB	7	27.7.g	2022	15.7895	0.2165	0.0447	0
Norwegian Sea	OTT	2	27.2.a	2022	44.2982	0.0756	0.0438	45.9244
Celtic Seas	OTT	7	27.7.c	2022	52.6316	0.0635	0.0437	0
Baltic Sea	FPN	3	27.3.c	2022	3.9474	0.8393	0.0433	0
Greater North Sea	FPN	3	27.3.a	2022	15.3509	0.212	0.0426	0
Celtic Seas	PTM	7	27.7.g	2022	68.4211	0.0476	0.0426	3.1029
Greater North Sea	FPN	4	27.4.b	2022	15.3509	0.2061	0.0414	0
Norwegian Sea	PTM	2	27.2.a	2022	58.7719	0.0539	0.0414	0
Azores	LTL	10	27.10.a	2022	25	0.126	0.0412	0
Bay of Biscay and Iberian coast	DRB	8	27.8.b	2022	15.7895	0.1988	0.0411	0
Bay of Biscay and Iberian coast	OTB	8	27.8.d	2022	73.6842	0.0412	0.0397	0
Bay of Biscay and Iberian coast	TBB	8	27.8.a	2022	47.3684	0.0641	0.0397	7.3192
Bay of Biscay and Iberian coast	FYK	8	27.8.b	2022	42.1053	0.0703	0.0387	0
Celtic Seas	PS	7	27.7.f	2022	31.5789	0.0916	0.0378	7.2581
Faroes	OTM	5	27.5.b	2022	68.4211	0.0416	0.0372	0
Barents Sea	OTT	1	27.1.b	2022	44.2982	0.0543	0.0315	0
Greater North Sea	GTN	7	27.7.d	2022	75.6579	0.0292	0.0289	0
Greater North Sea	SSC	3	27.3.a	2022	15.3509	0.144	0.0289	0
Barents Sea	TBB	1	27.1.a	2022	39.4737	0.0529	0.0273	0
Celtic Seas	LHP	7	27.7.a	2022	15.7895	0.1289	0.0266	0
Greater North Sea	SDN	4	27.4.c	2022	15.3509	0.1326	0.0266	0
Greater North Sea	LHP	3	27.3.a	2022	10.5263	0.1916	0.0264	0
Greater North Sea	LLD	7	27.7.d	2022	63.5965	0.0313	0.026	0
Greater North Sea	LTL	4	27.4.c	2022	25	0.0786	0.0257	0
Celtic Seas	LHM	7	27.7.j	2022	15.7895	0.1204	0.0249	0
Celtic Seas	GND	7	27.7.f	2022	100	0.0188	0.0246	0
Greater North Sea	OTT	4	27.4.c	2022	44.2982	0.0379	0.022	0
Baltic Sea	FPO	3	27.3.c	2022	7.8947	0.2083	0.0215	0
Greater North Sea	FYK	4	27.4.b	2022	34.6491	0.0473	0.0214	0

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Bay of Biscay and Iberian coast	LTL	9	27.9.a	2022	31.5789	0.0517	0.0214	0
Baltic Sea	LLD	3	27.3.d	2022	43.4211	0.0332	0.0189	46.6667
Bay of Biscay and Iberian coast	GTR	8	27.8.d	2022	84.2105	0.017	0.0187	0
Celtic Seas	GTR	7	27.7.b	2022	84.2105	0.0162	0.0178	50
Barents Sea	TBB	1	27.1.b	2022	39.4737	0.0345	0.0178	0
Celtic Seas	OTM	7	27.7.f	2022	68.4211	0.0198	0.0177	18.6415
Celtic Seas	LLD	7	27.7.g	2022	73.6842	0.0177	0.0171	0
Greater North Sea	SSC	7	27.7.e	2022	21.0526	0.0605	0.0167	0
Celtic Seas	OTM	7	27.7.g	2022	68.4211	0.0184	0.0165	20.0492
Greater North Sea	SDN	4	27.4.b	2022	15.3509	0.0784	0.0157	0
Celtic Seas	FPO	6	27.6.b	2022	26.3158	0.0451	0.0155	0
Celtic Seas	GTR	7	27.7.f	2022	84.2105	0.014	0.0154	2.1151
Celtic Seas	PTM	7	27.7.f	2022	68.4211	0.0172	0.0154	0
Bay of Biscay and Iberian coast	FYK	8	27.8.a	2022	42.1053	0.0259	0.0143	0
Greenland Sea	OTB	14	27.14.a	2022	63.5965	0.017	0.0141	0
Celtic Seas	OTM	6	27.6.b	2022	68.4211	0.0151	0.0135	0
Baltic Sea	FYK	3	27.3.c	2022	19.7368	0.051	0.0132	0
Baltic Sea	FPN	3	27.3.b	2022	3.9474	0.2541	0.0131	0
Greater North Sea	LHP	4	27.4.c	2022	10.5263	0.0889	0.0122	0
Greater North Sea	FYK	4	27.4.c	2022	34.6491	0.0267	0.0121	5.5392
Greater North Sea	LLD	4	27.4.c	2022	63.5965	0.0134	0.0111	0
Faroes	PTB	5	27.5.b	2022	52.6316	0.0154	0.0106	0
Celtic Seas	SSC	7	27.7.h	2022	21.0526	0.0375	0.0103	0
Celtic Seas	LHM	7	27.7.b	2022	15.7895	0.0488	0.0101	0
Celtic Seas	SSC	7	27.7.a	2022	21.0526	0.0355	0.0098	0
Greater North Sea	SB	3	27.3.a	2022	15.3509	0.0473	0.0095	0
Celtic Seas	LLD	7	27.7.a	2022	73.6842	0.0096	0.0093	0
Greater North Sea	LTL	4	27.4.a	2022	25	0.0284	0.0093	0
Celtic Seas	DRB	7	27.7.b	2022	15.7895	0.0443	0.0091	0
Celtic Seas	FPO	7	27.7.c	2022	26.3158	0.0251	0.0086	0
Celtic Seas	GND	7	27.7.a	2022	100	0.0066	0.0086	0
Greater North Sea	DRB	3	27.3.a	2022	10.5263	0.0584	0.008	0
Baltic Sea	PS	3	27.3.d	2022	11.8421	0.0517	0.008	0
Greater North Sea	PTM	3	27.3.a	2022	58.7719	0.0103	0.0079	0
Greater North Sea	GND	4	27.4.b	2022	87.7193	0.0066	0.0076	0
Celtic Seas	SSC	6	27.6.a	2022	21.0526	0.0275	0.0076	21.4699
Celtic Seas	PTM	7	27.7.k	2022	68.4211	0.0067	0.006	0
Greater North Sea	PS	4	27.4.b	2022	25	0.0177	0.0058	0
Baltic Sea	SSC	3	27.3.d	2022	3.9474	0.1116	0.0058	0
Celtic Seas	DRB	7	27.7.f	2022	15.7895	0.0252	0.0052	0
Greater North Sea	LLD	7	27.7.e	2022	73.6842	0.0054	0.0052	0
Bay of Biscay and Iberian coast	LHM	8	27.8.b	2022	15.7895	0.0237	0.0049	0

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Celtic Seas	LTL	7	27.7.a	2022	31.5789	0.0111	0.0046	0
Celtic Seas	LHM	6	27.6.a	2022	15.7895	0.0217	0.0045	0
Bay of Biscay and Iberian coast	LLD	8	27.8.d	2022	73.6842	0.0046	0.0044	80.5546
Baltic Sea	SDN	3	27.3.d	2022	3.9474	0.085	0.0044	0
Norwegian Sea	OTM	2	27.2.b	2022	58.7719	0.0052	0.004	0
Greater North Sea	PS	4	27.4.a	2022	25	0.0118	0.0039	18.75
Bay of Biscay and Iberian coast	PTB	8	27.8.d	2022	52.6316	0.0057	0.0039	39.1872
Greenland Sea	OTT	14	27.14.b	2022	44.2982	0.0066	0.0038	0
Greater North Sea	LHM	4	27.4.c	2022	10.5263	0.0263	0.0036	0
Greater North Sea	SDN	7	27.7.e	2022	21.0526	0.0122	0.0034	0
Greater North Sea	SPR	7	27.7.d	2022	15.3509	0.0171	0.0034	0
Celtic Seas	DRB	7	27.7.j	2022	15.7895	0.0155	0.0032	0
Celtic Seas	SSC	7	27.7.b	2022	21.0526	0.0118	0.0032	0
Azores	GTR	10	27.10.a	2022	73.2456	0.0029	0.0028	0
Greater North Sea	LHM	7	27.7.e	2022	15.7895	0.0133	0.0027	47.2222
Greater North Sea	PS	3	27.3.a	2022	25	0.0081	0.0026	0
Celtic Seas	DRB	7	27.7.h	2022	15.7895	0.0121	0.0025	0
Faroes	FPO	5	27.5.b	2022	26.3158	0.0074	0.0025	0
Greater North Sea	LHM	4	27.4.b	2022	10.5263	0.0182	0.0025	0
Baltic Sea	OTB	3	27.3.b	2022	43.4211	0.0044	0.0025	0
Bay of Biscay and Iberian coast	LLS	9	27.9.b	2022	63.1579	0.0029	0.0024	0
Icelandic waters	FPO	5	27.5.a	2022	26.3158	0.0066	0.0023	0
Bay of Biscay and Iberian coast	GTN	8	27.8.d	2022	86.8421	0.0019	0.0022	0
Celtic Seas	LHP	7	27.7.j	2022	15.7895	0.01	0.0021	0
Baltic Sea	LLS	3	27.3.c	2022	35.5263	0.0044	0.002	0
Baltic Sea	OTM	3	27.3.c	2022	39.4737	0.0037	0.0019	0
Greater North Sea	PTB	7	27.7.e	2022	52.6316	0.0027	0.0019	0
Celtic Seas	LHM	7	27.7.a	2022	15.7895	0.0089	0.0018	0
Celtic Seas	GTR	7	27.7.a	2022	84.2105	0.0015	0.0017	0
Celtic Seas	GTN	7	27.7.h	2022	86.8421	0.0013	0.0015	0
Celtic Seas	LHP	7	27.7.g	2022	15.7895	0.0074	0.0015	0
Faroes	OTT	5	27.5.b	2022	52.6316	0.0022	0.0015	0
Celtic Seas	LHM	7	27.7.g	2022	15.7895	0.0066	0.0014	0
Celtic Seas	OTT	7	27.7.b	2022	52.6316	0.002	0.0014	0
Celtic Seas	TBB	7	27.7.j	2022	47.3684	0.0022	0.0014	0
Celtic Seas	SDN	7	27.7.j	2022	21.0526	0.0049	0.0013	0
Greater North Sea	GTR	4	27.4.b	2022	73.2456	0.0011	0.0011	0
Celtic Seas	LHP	7	27.7.k	2022	15.7895	0.0052	0.0011	0
Baltic Sea	SDN	3	27.3.c	2022	3.9474	0.0207	0.0011	0
Bay of Biscay and Iberian coast	LHM	8	27.8.a	2022	15.7895	0.0049	0.001	0
Bay of Biscay and Iberian coast	OTB	8	27.8.e	2022	73.6842	0.001	0.001	0
Celtic Seas	TBB	6	27.6.a	2022	47.3684	0.0016	0.001	0

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Bay of Biscay and Iberian coast	LHP	9	27.9.a	2022	15.7895	0.0044	0.0009	0
Celtic Seas	LHM	7	27.7.h	2022	15.7895	0.0037	0.0008	0
Bay of Biscay and Iberian coast	LHP	9	27.9.b	2022	15.7895	0.0037	0.0008	0
Celtic Seas	SSC	6	27.6.b	2022	21.0526	0.0029	0.0008	0
Greater North Sea	GTR	4	27.4.a	2022	73.2456	0.0007	0.0007	0
Bay of Biscay and Iberian coast	SDN	8	27.8.d	2022	21.0526	0.0025	0.0007	0
Baltic Sea	FPO	3	27.3.b	2022	7.8947	0.0059	0.0006	0
Bay of Biscay and Iberian coast	OTT	8	27.8.c	2022	52.6316	0.0008	0.0006	0
Celtic Seas	PTM	6	27.6.b	2022	68.4211	0.0007	0.0006	0
Greater North Sea	SDN	4	27.4.a	2022	15.3509	0.0031	0.0006	0
Icelandic waters	DRB	5	27.5.a	2022	15.7895	0.0022	0.0005	0
Bay of Biscay and Iberian coast	GNS	8	27.8.e	2022	89.4737	0.0004	0.0005	0
Norwegian Sea	LLS	2	27.2.a	2022	53.9474	0.0007	0.0005	0
Norwegian Sea	PTB	2	27.2.a	2022	44.2982	0.0008	0.0005	0
Baltic Sea	SB	3	27.3.d	2022	3.9474	0.0096	0.0005	0
Greater North Sea	SB	7	27.7.d	2022	15.3509	0.0024	0.0005	0
Celtic Seas	PS	6	27.6.a	2022	31.5789	0.0009	0.0004	0
Celtic Seas	SSC	7	27.7.f	2022	21.0526	0.0015	0.0004	0
Bay of Biscay and Iberian coast	LHM	8	27.8.d	2022	15.7895	0.0015	0.0003	0
Celtic Seas	LTL	7	27.7.k	2022	31.5789	0.0007	0.0003	0
Norwegian Sea	FPO	2	27.2.a	2022	20.1754	0.0007	0.0002	0
Celtic Seas	PS	7	27.7.h	2022	31.5789	0.0004	0.0002	0
Bay of Biscay and Iberian coast	SSC	8	27.8.b	2022	21.0526	0.0007	0.0002	0
Celtic Seas	GTN	7	27.7.f	2022	86.8421	0.0001	0.0001	0
Norwegian Sea	LHP	2	27.2.a	2022	10.5263	0.0007	0.0001	0
Greater North Sea	SPR	7	27.7.e	2022	21.0526	0.0005	0.0001	0
Baltic Sea	DRB	3	27.3.c	2022	0	0.2955	0	0
Baltic Sea	LHP	3	27.3.b	2022	0	0.0063	0	0
Baltic Sea	LHP	3	27.3.c	2022	0	0.0118	0	0
Baltic Sea	LHP	3	27.3.d	2022	0	0.1034	0	0
Baltic Sea	SSC	3	27.3.c	2022	3.9474	0.0007	0	0
Greater North Sea	GN	4	27.4.c	2022		0.0002		0
Greater North Sea	GNC	4	27.4.b	2022		0.0089		0
Greater North Sea	GNC	4	27.4.c	2022		0.0172		0
Greater North Sea	GNC	7	27.7.e	2022		0.1197		0
Celtic Seas	GNC	7	27.7.f	2022		0.1891		0
Bay of Biscay and Iberian coast	GNC	8	27.8.a	2022		0.0806		0
Bay of Biscay and Iberian coast	GNC	8	27.8.b	2022		1.8452		1.8524
Greater North Sea	HMD	4	27.4.b	2022		0.0436		0
Greater North Sea	HMD	4	27.4.c	2022		0.034		0
Celtic Seas	HMD	6	27.6.a	2022		0.0199		0
Greater North Sea	HMD	7	27.7.d	2022		0.0074		0

Ecoregion_FishPi	MetierL4	ICESSubarea	ICESDivision	Year	RiskFactorFishPi_scaled_0to100	FishingEffort_scaled_0to100	CombinedScore_scaled_0to100	MonitoringCoverage_%
Bay of Biscay and Iberian coast	HMD	9	27.9.a	2022		6.0026		0
Oceanic Northeast Atlantic	LLD	10	27.10.b	2022		0.3073		0
Oceanic Northeast Atlantic	LLD	12	27.12.c	2022		0.0192		0
Norwegian Sea	MIS	2	27.2.a	2022		0.0001		0
Greater North Sea	MIS	3	27.3.a	2022		0.195		0
Baltic Sea	MIS	3	27.3.c	2022		0.0015		0
Baltic Sea	MIS	3	27.3.d	2022		0.0074		0
Greater North Sea	MIS	4	27.4.a	2022		0.0154		0
Greater North Sea	MIS	4	27.4.b	2022		0.007		0
Greater North Sea	MIS	4	27.4.c	2022		0.2465		0
Celtic Seas	MIS	6	27.6.a	2022		0.003		0
Celtic Seas	MIS	7	27.7.a	2022		0.0007		0
Celtic Seas	MIS	7	27.7.b	2022		0		0
Celtic Seas	MIS	7	27.7.c	2022		0		0
Greater North Sea	MIS	7	27.7.d	2022		1.4413		0
Greater North Sea	MIS	7	27.7.e	2022		3.8411		0
Celtic Seas	MIS	7	27.7.f	2022		0		0
Celtic Seas	MIS	7	27.7.g	2022		0.0022		0
Celtic Seas	MIS	7	27.7.h	2022		0.0751		0
Celtic Seas	MIS	7	27.7.j	2022		0.0042		0
Celtic Seas	MIS	7	27.7.k	2022		0.0179		0
Bay of Biscay and Iberian coast	MIS	8	27.8.a	2022		6.7718		0.0055
Bay of Biscay and Iberian coast	MIS	8	27.8.b	2022		2.7578		0
Bay of Biscay and Iberian coast	MIS	8	27.8.c	2022		0.0029		0
Bay of Biscay and Iberian coast	MIS	8	27.8.d	2022		0		0
Bay of Biscay and Iberian coast	MIS	9	27.9.a	2022		0.0007		0
Bay of Biscay and Iberian coast	MIS	9	27.9.b	2022		0.0018		0

6.3 Discussion

The comparison of fishPi (and newly developed WGBYC) risk scores, fishing effort, and monitoring coverage is undertaken to determine where high risk fisheries occur but monitoring coverage would benefit from being strengthened. The approach provides a broad overview on the overall risk of bycatch in different metiers and across taxa in relation to the distribution of monitoring effort. Understanding how monitoring effort corresponds to general bycatch risk is meaningful for informing the overall picture of which metiers are relatively under-sampled and how we might guide sampling effort to get the best overall result given the complexity of the multitude of bycatch species and their associated risk of bycatch. However, it should be noted that this approach is a simplification of a potentially highly complex reality of patterns of bycatch of those species contained within the functional groups. Nonetheless, there are some further developments that could be made that would further improve the utility of this approach and which should be considered when interpreting the current tabulated outputs results:

- The functional groups should be reviewed and revised as necessary. Within fishPi, risk scores are added up between functional groups. However, those groups vary in terms of the number of species from one (e.g., harbour porpoise) to several (26 species in the case of dolphins, although not all in every ecoregion). This can affect the weighting given to any resulting risk score. Furthermore, some functional groups combine species with different foraging ecologies which would likely expose them to different risk at the metier level.
- Fishing effort is currently aggregated by ICES Division. The overlap between fishing effort at the metier level and the occurrence & densities of a species may vary considerably particularly where a Subarea encompasses more than one broad habitat type. In the longer-term, the approach would therefore benefit from finer scale spatial aggregation.
- The assignment of risk scores to some ICES Divisions which are in (or between) two Ecoregions also deserves attention in the future, especially when significant biogeographical changes in species distributions occur (e.g. 27.7.3 - Celtic Seas / Greater North Sea, 27.3.b – Greater North Sea / Baltic Sea).[‡‡]
- Examining fishing and monitoring effort at finer temporal scales would be useful because relative risk can vary seasonally.
- Fishing effort is currently presented by Days at Sea, the most widely available effort metric. However, it does not necessarily accurately account for relative exposure to risk for some gear types. Net lengths and soak times for static gear and swept areas for trawls would improve this metric. In addition, in some ecoregions, small vessels form an important element of the fleet, and yet are not monitored by VMS. The use of a combination of VMS, AIS, logbooks, etc, would help arrive at a measure that is closer to actual risk. It would be beneficial for the WGCATCH, WGSFD & RCG ISSG PETS groups to review and improve upon the effort data available to WGBYC.
- Gear types have been aggregated to metier level 4 meaning it is likely that fisheries with different risk profiles are being grouped.

Despite the possible improvements listed above, the information contained in Table 6.1 provides potentially useful initial insights. The procedure results in high fishing effort / high risk metiers ranking towards the top of the table because they are both used in the calculation of the combined score. The associated monitoring coverage can then be viewed against the combined score as a way of identifying broad metiers that may be relatively under-sampled with respect to bycatch.

[‡‡] Paragraph added after ADGBYC 2023.

This overview could be used to inform closer inspection of how monitoring might best be allocated and carried out within any under-sampled metiers. That would best be done by national or regional collaboration.

Further improvements can be made to the analytical approach undertaken here, but this will take time and would be better undertaken as a series of inter-sessional tasks by WGBYC or perhaps more efficiently through a dedicated workshop/s, if the conceptual basis for this approach is considered useful.

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7 ToR F: Coordinate with other ICES Working Groups to ensure complete compilation of data on protected species bycatch from multiple sources and to develop and improve on methods for bycatch monitoring, research and assessment as outlines in the ICES Roadmap for bycatch advice on protected endangered and threatened species (Intersessional)

In previous annual reports under ToR F WGBYC collated and presented information on the bycatch related work carried out by different ICES WG's listed under the Roadmap for ICES bycatch advice on protected species and other relevant non-ICES groups such as the Regional Coordination Groups (RCGs). Note that a Table with the acronyms used in this section is provided in Annex 10.

7.1 Revision of the Roadmap for ICES bycatch advice and how to improve cooperation

The Roadmap for ICES bycatch advice on protected species will be revised in 2024. Among other changes, the lists of species of bycatch relevance will be updated and reviewed.

WGBYC considered how to improve cooperation with other international organizations currently mentioned in the Roadmap (i.e. with ACCOBAMS, ASCOBANS, GFCM, HELCOM, NAMMCO, NEAFC, OSPAR, RCGs). It was suggested to add STECF, IWC and potentially another RFMOs such as ICCAT to the list of relevant organizations. WGBYC experts that could act as links for ASCOBANS, NAMMCO, HELCOM and RCGs were identified.

WGBYC suggested that dedicated workshops between chairs/experts of various organizations could be useful to explore synergies and collaboration in specific subjects.

It was also suggested that, in advance of WGBYC meetings, ICES can ask the different organizations listed in the roadmap to provide a summary of current/future activities that may be of relevance to WGBYC.

WGBYC considered **the role of the supporting expert groups currently mentioned** in the Roadmap and how they could contribute to WGBYC tasks and the delivery of bycatch assessments. WGMIXFISH, WGRFS and WGTIFD may be added to the roadmap as supporting expert groups. During the second workshop on Fisheries Overviews (WKFO2), WGMIXFISH members suggested to use its quality assured fishing effort dataset as input data for bycatch assessments. WGTIFD addresses best practices for Electronic Monitoring under one of its ToRs, which is of interest to WGBYC. It was also suggested that WGRFS may be added to the supporting groups to start quantifying bycatch of protected species from marine recreational fisheries.

Several proposals were made in terms of how the WGs within the roadmap can contribute to the work of WGBYC:

- WGFTFB regularly forward their annual reports to WGBYC where relevant mitigation measures and trials by member country are listed and described.

- WGCATCH and WGBYC have a joint session during WGCATCH annual meetings. WGCATCH has been tasked with updating the inventory of monitoring programmes of bycatch of protected endangered and threatened species initiated by WKPETSAMP and updated in 2022 (ICES, 2022).
- If feasible, WGSFD could provide quality assured data layers at different spatial scales. These data layers can be used as input data in bycatch risk assessments (ToR D) as well as to extrapolate bycatch rates to total fishing effort (ToR C). However, since no concrete request for WGSFD was agreed at WGBYC, this potential task still needs to be agreed and developed in the future.
- No specific WG for turtles exists currently in ICES, other WGs more biology/ecology/abundance focus (e.g. WGEF, JWGBIRD, WGMME) can provide annual input to WGBYC. Indeed, the Advice Drafting Group bycatch (2022) recommended to WGBYC, WGMME, JWGBIRD, WGEF and WGDEEP to continue developing criteria/methods for highlighting which species/populations are currently most at risk of serious or irreversible impacts from bycatch. These collaborations could be anchored in the new version of the Roadmap. WGBYC suggests that WGEF, JWGBIRD, WGMME could:

  - Provide guidance on species prioritization.
  - Develop priority scores as input information for the bycatch risk analyses as developed under ToRs D and E.
  - Review the results from WGBYC 2023 on ToR C (BEAM analyses) and ToR D (methodology for species/populations for which bycatch rates are unavailable).
  - Provide population abundance estimates to inform population level impacts of bycatch. It was noted that WGMME already provides this information in their annual report. After the BEAM analyses are completed (ToR C), it will be apparent for which species abundance information is lacking and, thus, WGMME, JWGBIRD and WGEF could focus on those species/populations.
  - Provide information on bycatch thresholds/reference points. This includes methods to estimate reference points as well as information on existing agreed thresholds.
  - In addition to the ICES WGs, the Regional Coordination Groups (RCGs) as responsible for the implementation of the EU Data Collection Framework Regulation at regional level, and under the specific intersessional group dedicated to bycatch data collection issues, can act as a bridge between the data needs identified by WGBYC, and promote such data collection coordination at regional level between the different Member States involved.

7.2 Information recently provided by other ICES expert groups

WGHARP, Working Group on harp and hooded seals

The WGHARP 2023 report (ICES, 2023a) includes a section on bycatch of harp seals, *Pagophilus groenlandicu*s, in the NW Atlantic. Estimated numbers of bycaught seals in the NW Atlantic are presented in Annex 7, Table 8 of the WGHARP report. Bycatch was low until the early 1990s due to limited effort in the fishery, in the mid-1990s effort increased dramatically and catches rose to over 45,000 seals. Between the late 1990s and early 2000s number of bycaught harp seals varied widely between around 2,000 seals to more than 35,000 seals per year. Since 2010, bycatch has remained low (<2,000 selas per year). In 2022 it was estimated to be 1898 seals.

Numbers of bycaught harp seals are also reported in Norway (Annex 7, Table 3, WGHARP report) until 1990. A peak was reported for 1987 (56,222 bycaught seals). The last two years fo the time series <400 seals were reported as bycaught.

JWGBIRD, OSPAR/HELCOM/ICES working group on seabirds

JWGBIRD was tasked to review the lists of seabirds of bycatch relevance as currently included in the ICES Roadmap. Besides checking for potential errors, the WG was asked to i) consider current inclusion/exclusion criteria such as the exclusion of taxa that are thought to be at low risk of bycatch, notably storm petrels and terns. Also, coastal ducks are currently excluded from the lists while data on bycatch form these taxa have been reported in response to the ICES-WGBYC data call and ii) review whether the species listed as of "conservation concern" are indeed of concern in all Ecoregions for which they are listed.

WGMME, Working Group on Marine Mammal Ecology

WGMME had a ToR dedicated to marine mammal-fisheries interactions (ToR D; ICES ,2023b). The WG report includes a section on strandings as a tool to inform individual cause of death and population health status. Also, WGMME report cetacean species/regional populations at bycatch risk in poorly monitored fisheries (Table 4.3., ICES, 2023b).

WGMME has been tasked to review (in their 2024 meeting) the lists of mammals of bycatch relevance as currently included in the ICES Roadmap. Besides checking for potential errors or inconsistencies, the WG was asked to consider current inclusion/exclusion criteria such as excluding species when they are very rarely encountered in a particular ecoregion unless there is justification because of their conservation status.

WGEF, Working Group on Elasmobranch Fisheries

The list of elasmobranch species, by Ecoregion, for which data is asked through the ICES-WGBYC data call was shared with WGEF. This includes elasmobranch priority species under the EU Action Plan: Protecting and restoring marine ecosystems for sustainable and resilient fisheries. WGEF members have provided feedback on the species that were covered in WGEF. The species list was categorized into three groups: 1) assess and advise on, 2) review data and report on, and 3) not considered within WGEF. Two species on the list are assessed and advised on in WGEF. Furthermore, in relation to the EU Action plan priority list, the elasmobranch species which are included in WGEF are angel shark (*Squatina squatina, S. aculeata, S. oculata*) and common skate (*Dipturus batis and D. intermedius*).

WGSFD, Working Group on Spatial Fisheries Data

The WGSFD recently shifted attention towards small scale fisheries and also the passive gear effort and has advanced considerably in defining concepts and methods to better describe the passive gear effort. AIS data are available in a patchy non-consistent manner across the ICES region and the WGSFD concluded that AIS data should be included in the WG workflow to utilize the metier specificities of gears and effort. This seems particularly important for the passive gears since the fleet coverage is low on SSF but also due to the large variations in soak time and/or gear dimensions between target species groups, which requires a coupling between logbooks and geopositional data.

Trawling effort is part of the yearly ICES VMS data call but there are still considerable challenges on how to move regional case studies into a general framework for future data calls.

All this work will be of direct benefit for the WGBYC although developments are slow. The spatial resolution of fisheries data for smaller vessels (<12m) is still limited.

WGCATCH, Working Group on Commercial Catches

WGCATCH experts were heavily involved in the development of the "EU request on the inventory of Member States' monitoring programmes of bycatch of protected, endangered, and threatened species under the service of EC DG ENVIRONMENT" (ICES, 2022). WGCATCH has been tasked to update such inventory in a regular manner and make its contents available to potential stakeholders. In addition, both WGs are working in the improvement of standardized protocols in the different at-sea monitoring programmes for the collection of bycatch data on protected species. The incorporation of bycatch data into the RDBES is another task on which the two WGs are working together.

Recommendations from the ToR F subgroup:

- Add STECF, IWC and potentially and other RFMOs such as ICCAT to the list of relevant organizations with which to cooperate
- Organize a dedicated workshop between chairs/experts of various organizations, which could be useful to explore synergies and collaboration in specific subjects.
- In advance of WGBYC meetings, ICES should ask the different organizations listed in the roadmap to provide a summary of current/future activities that may be of relevance to WGBYC.
- Revise the **roles of the supporting expert groups included in the** Roadmap for ICES bycatch advice in consultation with relevant WG chairs.

References

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8 ToR G: Continue in cooperation with the ICES Data Centre to develop, improve, populate and maintain the WGBYC and RDBES databases on bycatch monitoring and fishing efforts in ICES and Mediterranean waters through formal data calls (Intersessional)

Introduction

European Council Regulation 812/2004 was officially repealed on the 13th of August 2019. Many of the monitoring and mitigation requirements of Regulation 812/2004 were transposed into Regulation (EU) 2019/1241 (hereafter termed the Technical Measures Regulation / TMR) which came into force on 20 June 2019.

The repeal of Regulation 812/2004 was expected for some years by WGBYC and so, since 2017, the group had been preparing for transitioning away from using Member States' annual Regulation 812/2004 reports as the main source of bycatch data as these would no longer be available after the repeal of Regulation 812/2004. The first step in this transition was the development and issuing of an informal ICES/WGBYC data call in 2017 to obtain data on fishing effort, monitoring effort and bycatch records from EU and other ICES Member States. These data were held in a standalone WGBYC database. Formal ICES/WGBYC data calls have been issued on an annual basis since 2018.

A subgroup within WGBYC, the Database Subgroup (DbSg), was established in 2016 to develop the first data call and maintains an active role in all of WGBYCs activities related to data acquisition, preparation and quality checks. The DbSg is comprised of several long-term members of WGBYC and has significant support from staff at the ICES secretariat and ICES data centre. Much of the DbSg's work is carried out intersessionally, to prepare and where necessary modify the annual data call. The group also meets prior to the WGBYC meeting each year to review and check the national annual data submissions to ensure that the working group have a clean dataset to work with during the meeting.

This section provides a summary of the 2022 data call and describes some minor changes that were made to the data format since the 2021 data call.

A summary of the issues that were found in the submitted data is also provided. Many of these were identified and corrected prior to the WGBYC 2023 meeting. Some other minor issues were identified and resolved during the meeting. Some issues could not be addressed during the meeting but were recorded and will be addressed before the next WGBYC data call is issued in spring 2024.

At the 2023 meeting, members of the DbSg also undertook tasks to compare fishing effort data from multiple sources and carried out some basic exploratory work to compare bycatch data contained in the WGBYC database with bycatch data submitted in test uploads to the developing Regional Database and Estimation System (RDBES). The results from this work are also presented in this section.

8.1 ICES WGBYC data call

On 18 May 2023 ICES issued an official data call[§§§] for the sixth time in support of the work of WGBYC .

The data call aimed to obtain data describing total fishing effort, monitoring/sampling effort and protected species bycatch records for marine mammals, seabirds, turtles and fish species of relevance to bycatch advice.

The data obtained through the annual data calls support ICES annual advice on the impact of bycatch on a range of protected or sensitive marine species/taxa, to answer a standing request from the European Commission for advice on the impacts of fisheries on the marine environment.

Data were formally requested from 17 of the 20 ICES member countries (all except Russia, USA and Canada). In addition, six EU Mediterranean non-ICES countries were included in the call (Croatia, Cyprus, Greece, Italy, Malta, and Slovenia) and two EU Black Sea non-ICES countries (Bulgaria and Romania). Two countries, France and Spain, have fisheries operating in ICES and GFCM (Mediterranean and Black Seas) areas and data were provided by each country for both regions.

Most of the contacted countries submitted data (23 of 25 countries; Romania and Slovenia did not submit any data). The consistency of the data provided by different countries continues to improve, possibly reflecting better instructions within the data call text, and a growing familiarity of data submitters with the required format. However, some countries only provided partial data related to specific gear types, and others included vessel self-reporting requirements for bycatch as part of their submission. In most cases the accuracy of self-reported records cannot be independently verified and so these are generally considered by WGBYC to be of lower value for inclusion in detailed assessments, but they may flag the occurrence of bycatch in gears/fisheries that are not monitored by more reliable methods.

WGBYC reiterates that to facilitate efficient data submission, processing and analysis, it is recommended that each nation strictly adheres to the specified data call format and nominates a single organization to coordinate and provide data in future ICES WGBYC data calls. The data submission template includes fixed/mandatory vocabularies for several data fields, which facilitates efficient data collation across countries but can give rise to submission challenges, particularly for nations that submit data for the first time, and for which tailored vocabularies may be needed. For a summary of data submissions by country from the 2023 data call see Table 8.1.

Table 8.1 Summary of the data submissions

Country	Number of fishing effort entries	Fishing effort days at sea	Number of monitoring effort entries	Monitoring effort days at sea	Number bycatch events reported (not individuals)
BE	311	12933	42	228	131
BG (2019 data)	135	22375	22	62	2
BG (2020 data)	136	22831	20	65	0

[§§§] https://ices-library.figshare.com/articles/report/WGBYC_Data_call_2023_Bycatch_of_protected_species_for_ICES_advisory_work/23530935

Country	Number of fishing effort entries	Fishing effort days at sea	Number of monitoring effort entries	Monitoring effort days at sea	Number bycatch events reported (not individuals)
BG (2021 data)	130	23040	19	64	0
BG (2022 data)	124	17460	26	100	5
CY	114	104162	74	978	9
DE	1262	34523	50	250	219
DK	3117	77661	173	814	213
EE	232	63830	205	63189	32
ES	4664	706050	442	2428	533
FI	514	61592	662	62246	58
FR (2017 data)	7607	480176	664	2119	33
FR (2018 data)	7474	482679	654	1972	46
FR (2019 data)	7386	472859	647	2104	41
FR (2020 data)	7223	432002	312	872	26
FR (2021 data)	7223	441759	627	1721	73
FR (2022 data)	7072	432864	924	1817	147
GB	7288	326893	209	1027	896
GR	563	1286127	236	1207	347
HR	43	222920	186	909	10
IE	1609	43738	83	554	165
IS	258	14935	63	520	57
IT	4241	1025978	496	4081	126
LT	147	6209	188	6490	14
LV	374	10260	49	480	10
MT	490	20846	29	64	0
NL	814	40246	93	435	98
NO	263	61690	69	2719	24

Country	Number of fishing effort entries	Fishing effort days at sea	Number of monitoring effort entries	Monitoring effort days at sea	Number bycatch events reported (not individuals)
PL	1050	60155	43	525	9
PT (mainland)	553	173966	445	9684	199
PT (Azores)	113	39353	56	879	58
SE	1923	49122	163	444	146

8.2 Changes to the 2023 data call

There were two minor changes to the data to report in relation to the 2022 ICES-WGBYC data call. The main changes are:

- Updated ecoregion species reference lists, that can be found in "Annex 1 WGBYC_Species_per_Ecoregion" (available at: https://doi.org/10.17895/ices.pub.23530935).
- Priority fish species, as described in the EU action plan: Protecting and restoring marine ecosystems for sustainable and resilient fisheries, were been added in 2023 for the Mediterranean and Black Sea.

8.3 Data issues found and addressed

As is customary since the data calls began, the first step in data quality control is a data submission screening program that rigorously examines the data prior to submission. To be accepted into the database the data must adhere to a specific format, all mandatory fields must be completed and the appropriate vocabularies are used.

In addition to the format and vocabulary assessments, a total of 34 other quality control checks are then carried out when it has been confirmed that the data conforms to the specified format. The list of the quality checks can be found here: http://datsu.ices.dk/web/rptChk.aspx?Dataset=128

If the data successfully clear the screening process without any errors, the submitter is able to upload the file to the database.

After the data call submission deadline (11 August 2023) further checks on the submitted data were then carried out by members of the DbSg in a series of meetings and through individual review of each country's data. This second stage of quality checks is undertaken through data mining by experts who have worked extensively with fishing effort, monitoring effort and bycatch data, and were instrumental in the development of the data call. This exercise also found various possible issues in the submitted data which are, where possible, corrected before WGBYC meet. These issues are listed in Table 8.2 below.

Note: it is not possible for WGBYC to identify data entries that are incorrect but plausible.

Table 8.2 Data issues discovered during data checks by the DbSg.

Issue	Correction	Comment

One or more of the following fields are unknown: IndividualsWithPingers, IndividualsWithoutPingers, IncidentsWithPingers, IncidentsWithoutPingers and they were reported with values representing unknown information such as 99999999	The fields were set empty (NULL)	A country is lodging a complaint, stating that the fields are mandatory. However, the country has information only for one of the fields and is hesitant to report a value of 0 in this field because it does not accurately represent their lack of information regarding that particular field.
IndividualsWithPingers, IndividualsWithoutPingers had the same values	The country resubmitted the correct data	This was detected when the DbSg ran quality checks.
Monitoring type was wrong	WGBYC changed the monitoring type	The country was queried about these values and they responded that the values were more appropriate in a different monitoring type, but did not resubmit the data
No data reported for small vessels (lengths below 12m)	No correction	Countries were queried about the lack of small fleet.
Missing metier level 6	No correction, the field is not mandatory	
Some metiers have higher monitoring effort days than fishing effort days reported	No correction	WGBYC considers this to be because there are more than one monitoring method for the same metier. This can be highlighted as a warning in the quality check process.
Vessel length unknown	No correction	
Only bycatch of birds and mammals provided even though sampling method targets all taxa	No correction	
Fishing effort reported for FAO Major Fishing Area 48	Area corrected	
Overlapping vessel size ranges	No correction	
Only the genus was provided for some species	No correction	
Number of fishing trips is higher than the days at sea	No correction	
Missing fields VesselsF	No correction	Field is not mandatory
One country informed ICES that there were no relevant fisheries that needed reporting in response to the ICES-WGBYC data call	No correction	WGBYC to check that the country has no commercial marine fisheries

8.4 Species reported that were not included in the reference lists of species of bycatch relevance as specified in the data call.

ICES has compiled ecoregion lists of species to be reported in the data call as indicated in the Roadmap for ICES bycatch advice[****] . In 2023 ICES also included with the data call a further list of high priority species from the EU Action Plan: Protecting and restoring marine ecosystems for sustainable and resilient fisheries. These reference lists of species provide a minimum guide for data submitters, but some countries have also reported species that were not included these lists. For completeness, species reported but which are not included in the reference lists annexed to the data call are shown in Table 8.3.

Table 8.3 Species for which bycatch incidents were reported but that were not specifi-cally requested under the ICES-WGBYC 2023 data call[††††]

Species	AphiaID	Vernacular
Aetomylaeus bovinus	871951	
Alopias superciliosus	105835	bigeye thresher
Anas crecca	158943	common teal
Apristurus aphyodes	105806	white ghost catshark
Bathyraja brachyurops	271509	blonde ray
Centroscymnus coelolepis	105907	Portuguese dogfish
Corallium rubrum	125416	precious coral
Galeorhinus galeus	105820	sweet william
Heptranchias perlo	105832	sharpnose sevengill shark
Isurus oxyrinchus	105839	Atlantic mako shark
Lamna nasus	105841	(common) Atlantic mackerel sha
Lutra lutra	137076	Eurasian otter
Mustelus mustelus	105822	smooth hound
Mustelus punctulatus	105823	blackspotted smoothhound
Prionace glauca	105801	
Pteroplatytrygon violacea	158540	pelagic stingray

[****] https://ices-library.figshare.com/arti-cles/report/ICES_Roadmap_for_bycatch_advice_on_protected_endangered_and_threat-ened_species/19657167; see annex 1 and 2

[††††] *Puffinus yelkouan*, Mediterranean shearwater, removed from the Table after ADGBYC. This species was not specifically mentioned in Annex 1 of the data call. However data on all bird species from the Mediterranean region were requested under the ICES-WGBYC 2023 data call.

Raja asterias	105881	Mediterranean starry ray
Raja montagui	105887	homelyn ray
Raja polystigma	105888	speckled ray
Raja radula	105889	rough ray
Rostroraja alba	105896	white skate
Spondyliosoma cantharus	127066	Black Sea-bream
Squalus acanthias	105923	picky dog
Xiphias gladius	127094	swordfish

8.5 Comparison of effort data from different sources

ToR G's work involved comparing fishing effort data reported by various countries in four ICES databases: WGBYC, RDB, RDBES, and MIXFISH. The discrepancies in data structure and information details, such as varying country codes and different resolutions for ICES areas, guided the approach to conducting the checks. All data were aggregated based on ICES subarea, year, and country, with the total days at sea serving as the effort proxy. The results of this comparison are presented in Figure 8.1. Despite some missing information, due to the limited information available in the recent database (e.g. 2021 only data in RDBES) or the lack of official authorization provided by countries (e.g. the MIXFISH data was provided by only two countries) the effort data appear to be consistent across the different databases.

In Figure 8.2, effort levels are compared within the same database, segmented by ICES area. Despite some countries lacking data, the overall totals appear consistent across regions and timeframes, keeping in mind the logarithmic scale of the figures.

A more detailed examination of the disparities between total days at sea reported in the WGBYC database and the other three effort datasets is presented in Figure 8.3. The percentage differences are more pronounced than those in Figure 8.2, and the uncertainty regarding data completeness (e.g., missing countries) makes it challenging to draw definitive conclusions regarding the most precise and reliable source of effort information.

In its current state and considering the relatively strong agreement in recent years' effort data, as depicted in Figure 8.1 and 7.2, WGBYC's effort data seems to be the most comprehensive and suitable for meeting the data needs of WGBYC.

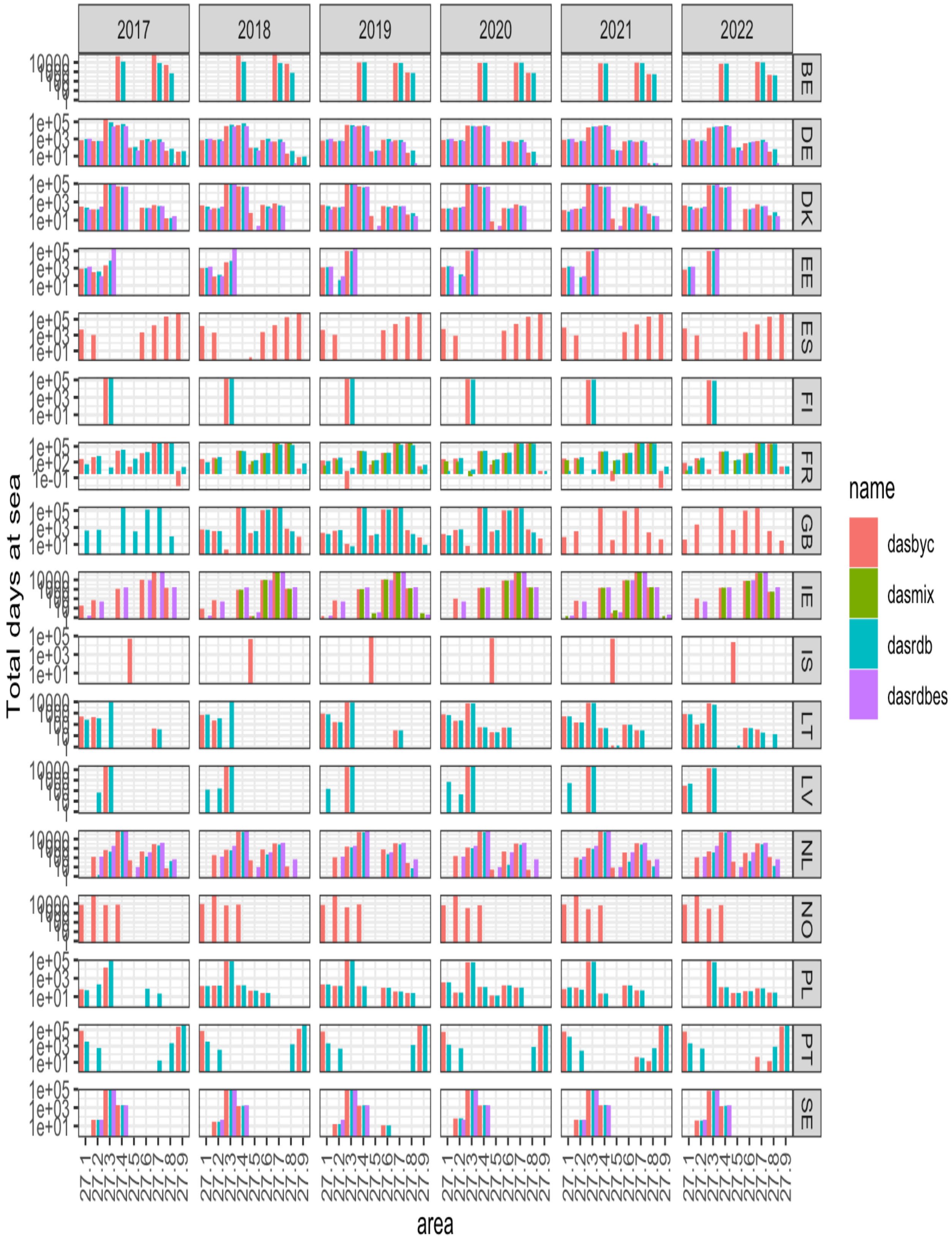

Figure 8.1 effort comparison by country and year. The labels used are as follows: "Dasbyc" represents the WGBYC database, "Dasmix" stands for the MIXFISH effort file, "Dasrdb" corresponds to the RDB extraction, and "Dasrdbes" pertains to the RDBES extraction. The Y-axis has been log10 transformed for better visualization.

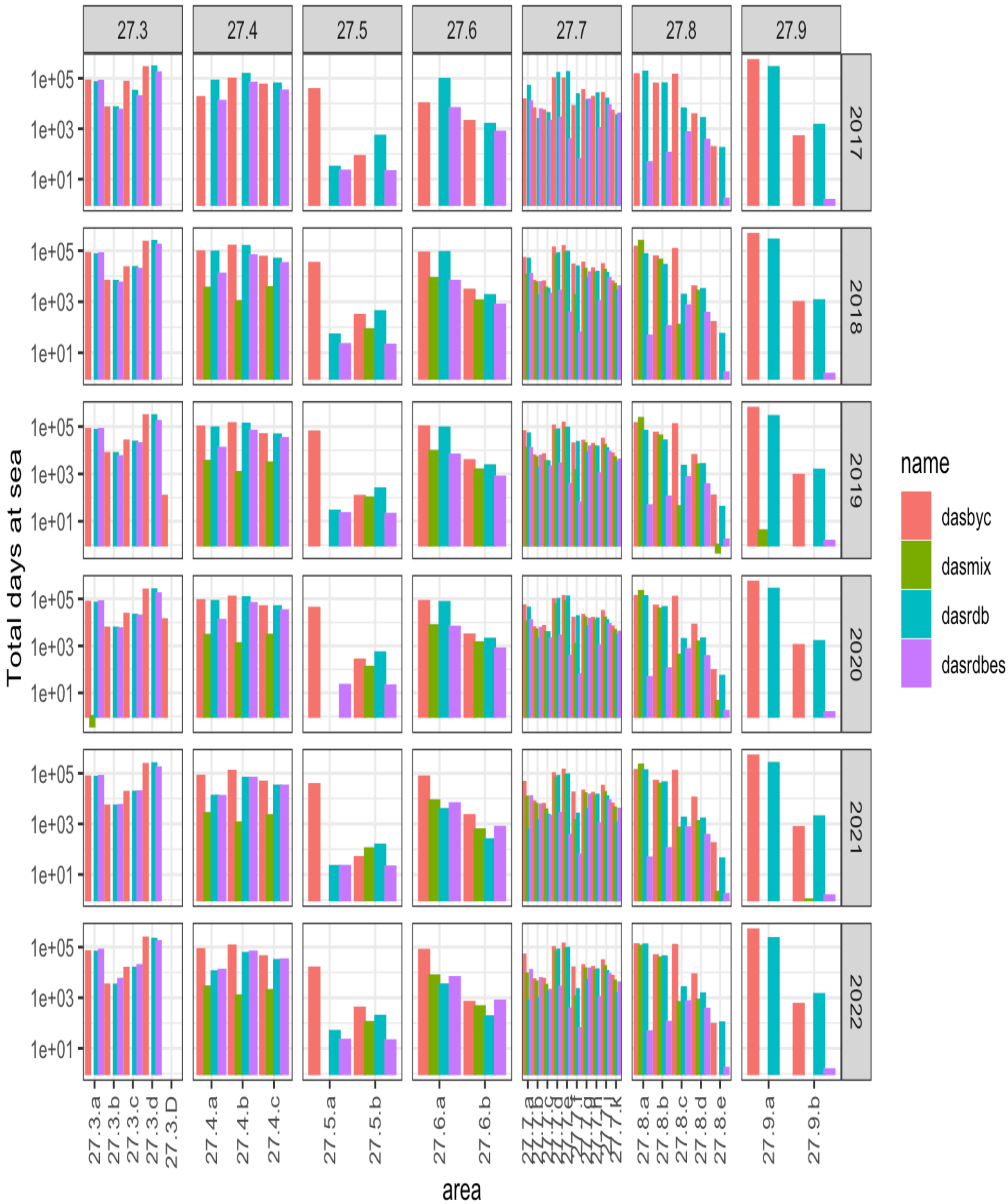

Figure 8.2 effort by ICES area, year and database. The labels used are as follows: "Dasbyc" represents the WGBYC database, "Dasmix" stands for the MIXFISH effort file, "Dasrdb" corresponds to the RDB extraction, and "Dasrdbes" pertains to the RDBES extraction. The Y-acis has been log10 transformed for better visualization.

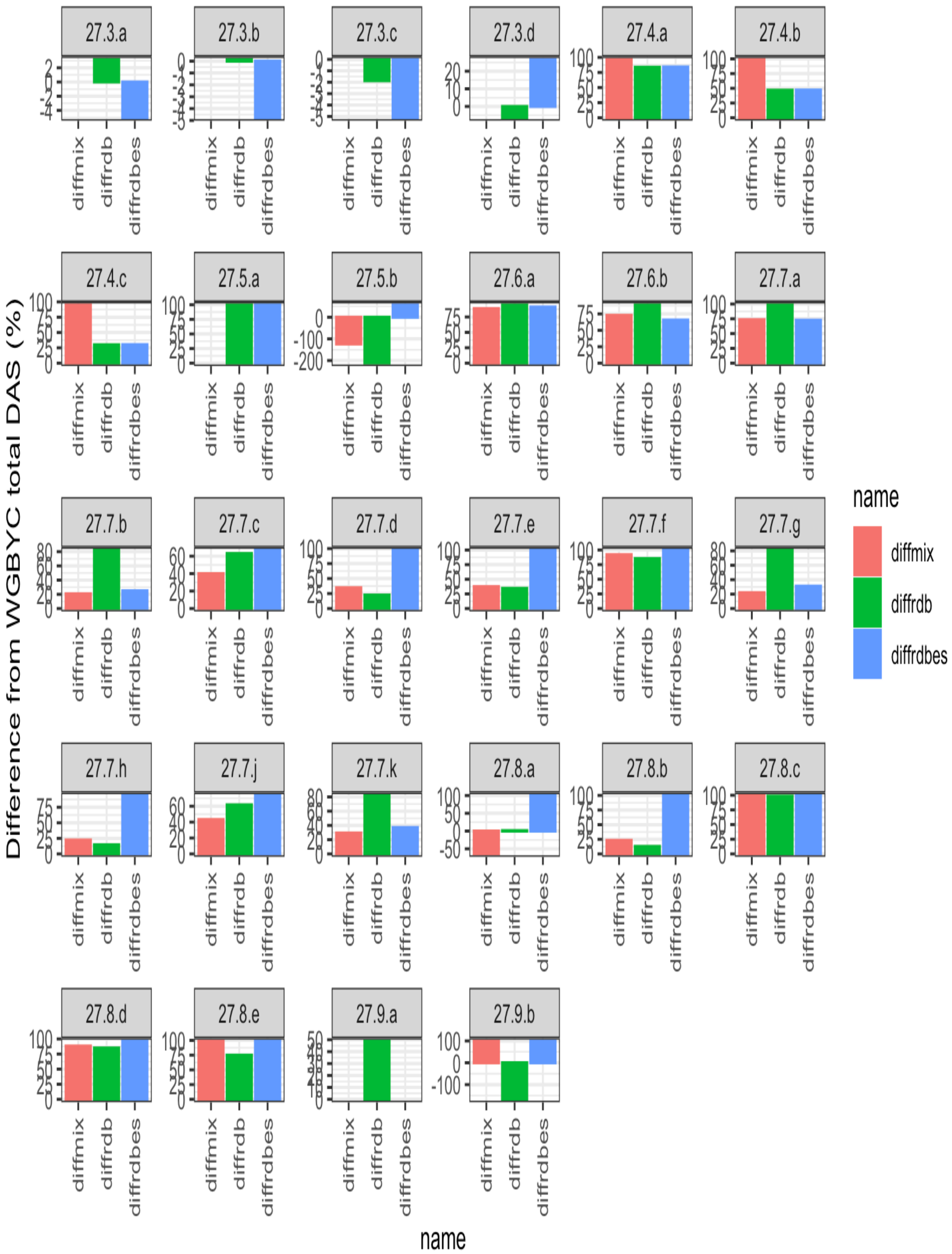

Figure 8.3 difference in percentage between the WGBYC total DAS and the MIXFISH (diffmix), RDB (diffrdb) and RDBES (diffrdbes) effort for the year 2021 for selected ICES areas.

8.6 Preliminary comparison of bycatch data from the WGBYC database and the RDBES.

In 2021, some members of the WGBYC DbSg began work with the RDBES core group to evaluate if the RDBES model contained the necessary fields for the types of bycatch assessments carried out by WGBYC and some adjustments to the RDBES format were made accordingly. Work between WGBYC and the core group continued in 2022 with further refinement of vocabularies and a small test data submission. In 2023 the DbSg reviewed the latest RDBES data fields and fed back to the core group and also agreed to make some preliminary comparisons of test bycatch data for 2021 that was submitted to the RDBES by different member states, with equivalent data from the WGBYC database.

Permission was requested for WGBYC to use the RDBES data for this task to all countries submitting data to RDBES and several countries (approximately 10) agreed. The ICES data centre subsequently made a data extraction and all members of the DbSg signed the data use agreement.

Due to significant time constraints at the WGBYC meeting only a short preliminary comparison was undertaken and various initial issues were found that need further exploration to understand properly but related to inconsistencies in the reported number of bycaught specimens and some issues with records being labelled as weights instead of individuals. It should be noted that the RDBES submissions for 2021 were test submissions and only 2 countries uploaded any bycatch data which also restricted the scope for comparisons, but the work highlighted some aspects that need closer examination intersessionally and which have been relayed to the data centre/core group.

9 ToR H. Produce first drafts of the advice for the i) recurrent advice request from the European Commission, and ii) relevant ICES Fisheries Overviews.

ICES will not update the Fisheires Overviews in 2023 due to limited resources. Therefore WGBYC produced a first draft for the recurrent advice to the European Commission. An initial advice template was agreed by the ICES Advisory Commitee in March 2023 incuding, among others, the following sections:

- Estimates of the numbers of specimens taken as bycatch with precision
- Multiannual bycatch rates
- Species and areas of particular bycatch concern
- Suggestions
- Basis for the advice
- Mitigation measures to reduce impacts
- Monitoring coverage by metier
- Strandings information

WGBYC produced draft text for each of the sections. In addition, BPUE (specimens per monitored day-at-sea) of combinations of species, ecoregion, and metier level 4 for which BPUE were representative were plotted into standard Figures (Figures 9.1 to 934 below‡‡‡).

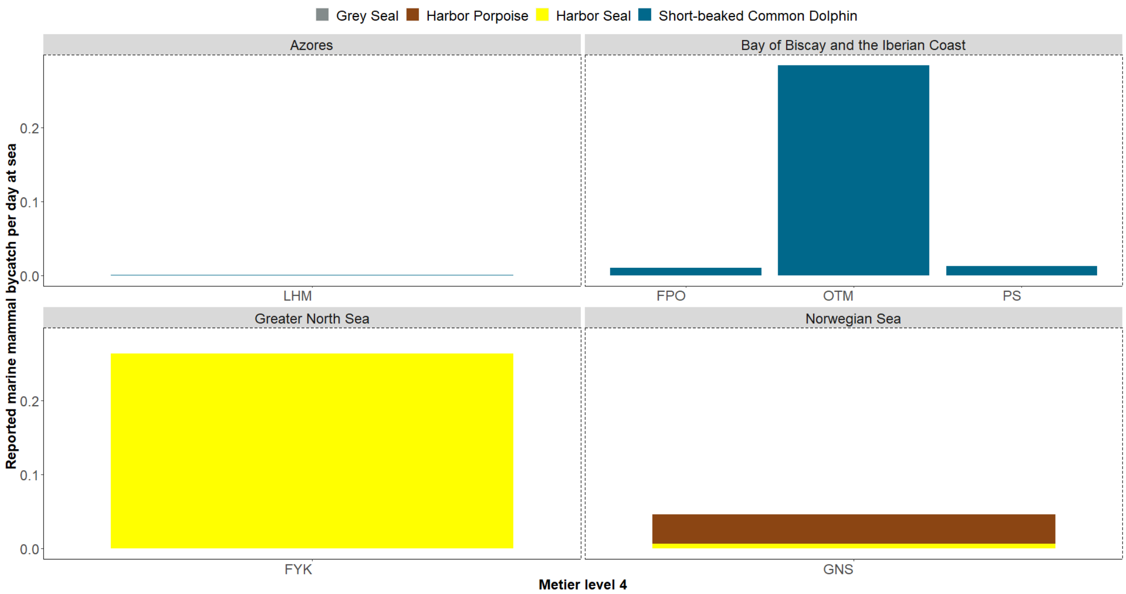

Figure 9.1 BPUE (specimens per monitored day-at-sea) of combinations of marine mammal species ecoregion, and metier level 4 for which BPUE were representative and bycatch mortality could be estimated. A description of métiers can be found at https://vocab.ices.dk/?ref=1498

‡‡‡ The Figures were updated at ADGBYC in November 2023 and the updated Figures are the ones included in this report.

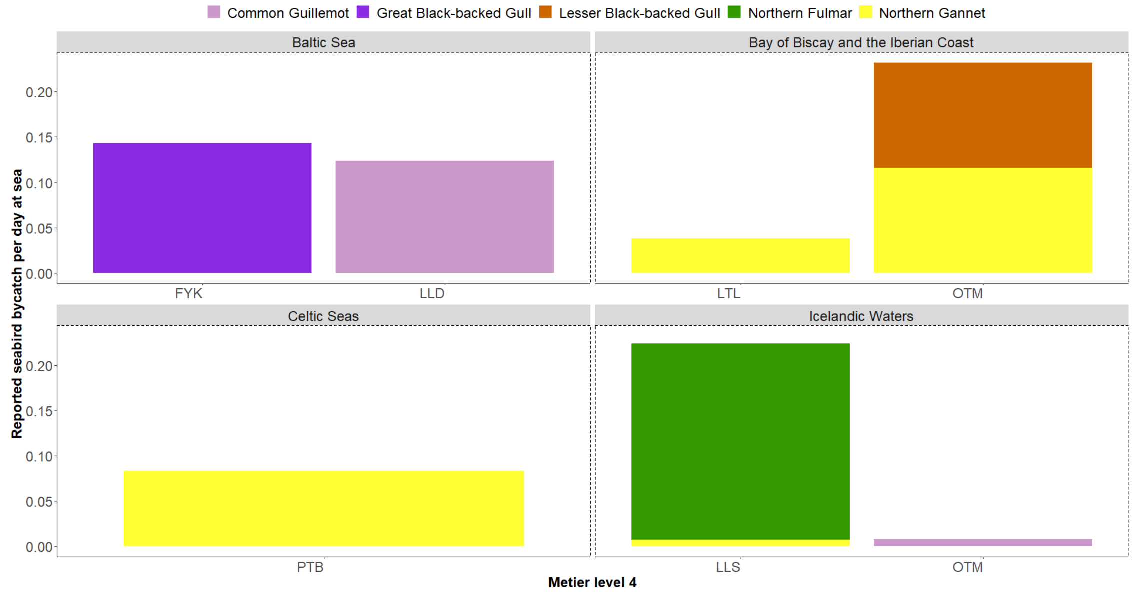

Figure 9.2 BPUE (specimens per monitored day-at-sea) of combinations of seabird species ecoregion, and metier level 4 for which BPUE were representative and bycatch mortality could be estimated. A description of métiers can be found at https://vocab.ices.dk/?ref=1498

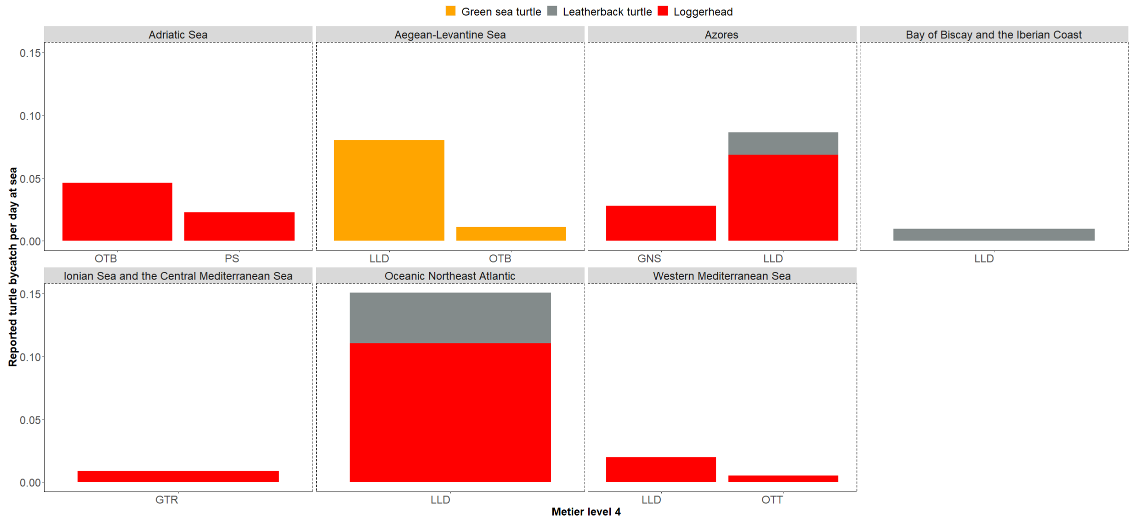

Figure 9.3 BPUE (specimens per monitored day-at-sea) of combinations of marine turtle species ecoregion, and metier level 4 for which BPUE were representative and bycatch mortality could be estimated. A description of métiers can be found at https://vocab.ices.dk/?ref=1498.

Annex 1: List of participants

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Annex 2: Resolutions

WGBYC – Working Group on Bycatch of Protected Species

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert's country can attend this Expert Group.

2022/OT/HAPISG01 The **Working Group on Bycatch of protected species (WGBYC)**, chaired by Allen Kingston, UK, and Guðjón Már Sigurðsson, Iceland, will meet at AZTI, Sukarrieta, Spain, on 18-22 September 2023 to:

a) Review and summarize information submitted through the annual bycatch data call and other means for assessment of protected/sensitive species bycatch;
b) Collate and review information from WGFTB national reports, other ICES WGs and recent published documents relating to implementation of protected/sensitive species bycatch mitigation measures and summarize recent and ongoing bycatch mitigation trials;
c) Consider the quality of data available for use in the estimation of bycatch rates of protected species through a Bycatch Evaluation and Assessment Matrix, BEAM, to underpin assessments on the bycatch range (minimum/maximum) as appropriate, and where possible, to identify likely conservation level threats;
d) For high priority species, for which the bycatch rates and associated markers of sustainability are unavailable, highlight the types of fishing gears and fishing activities which pose the greatest risk to these species;
e) Review ongoing monitoring of different taxonomic groups in relation to spatial bycatch risk and fishing effort to inform coordinated sampling plans;
f) Coordinate with other ICES WGs to ensure complete compilation of data on protected species bycatch from multiple sources and to develop and improve on methods for bycatch monitoring, research and assessment as outlined in the ICES Roadmap for bycatch advice on protected, endangered and threatened species [§§§§] (Intersessional);
g) Continue, in cooperation with the ICES Data Centre to develop, improve, populate and maintain the WGBYC and RDBES databases on bycatch monitoring and fishing effort in ICES and Mediterranean waters through formal data calls (Intersessional).
h) Produce first drafts of the advice for the i) recurrent advice request from the European Commission, and ii) relevant ICES Fisheries Overviews (Intersessional).

WGBYC will report by 25 October 2023 for the attention of ACOM.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem effects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority. The activities of the WG are essential to use in answering part of the European Commission annual request for advice on estimates of the annual total numbers of specimens of sensitive species taken as bycatch.
Scientific justification	ToRs a-f) Bycatch monitoring and assessment is fundamental to the work of the expert group and forms the basis to answer the recurrent advice request from the

[§§§§] https://ices-library.figshare.com/articles/report/ICES_Roadmap_for_bycatch_advice_on_protected_endangered_and_threatened_species/19657167

	European Commision. Recent changes in legislation have resulted in prioritization of sensitive species and also impacted monitoring programs for PETS bycath, which both require the regular evaluation of input data and resulting bycath assessments; ToR g) Operational databases allow for more efficient response to future advice requests and an audit trail for information used in the Group's reports. By remaining intersessional, it will increase effeciency for WGBYC; ToR h) Operational input is required to consolidate the existing advice templates as new information and methodologies become available.
Resource requirements	None beyond usual Secretariat facilities
Participants	15–25
Secretariat facilities	Secretariat support with data call and meeting organization, database maintenance, and final editing of report.
Financial	No financial implications.
Linkages to advisory committees	ACOM
Linkages to other committees or groups	JWGBIRD, WGFTFB, WGMME, WGEF, WGCATCH, WGSFD, WGHARP, WGCEAM, WGFTFB, HAPISG, WKPETSAMP2, WKPETSAMP3, WKBB, SCICOM
Linkages to other organizations	NAMMCO, ASCOBANS, ACCOBAMS, GFCM, OSPAR, HELCOM, RCGs, IWC

Annex 3: Reported fishing and monitoring days

Table A: Reported fishing and monitoring days (only for those metiers that reported bycatch) and number of bycaught specimens and incidents in 2022 provided through the ICES WGBYC 2023 data call by ecoregion for all reported species. Note: some metiers have higher reported number of monitoring days than fishing effort days, some electronic monitoring does not have associated DaS, while some ecoregions reported incidents but not number of specimens and vice versa, please see ToR G for further details of data issues identified.

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Adriatic Sea	17	Nets	188995.00	OTH	153.00	0.081	Reptile	*Caretta caretta*	1	1
Adriatic Sea	17	Rod and lines	1466.00	OTH	91.00	6.207	Reptile	*Caretta caretta*	2	2
Adriatic Sea	17	Longlines	16083.00	OTH	78.00	0.485	Reptile	*Caretta caretta*	9	9
Adriatic Sea	17	Pelagic trawls	9262.00	PO	207.00	2.235	Reptile	*Caretta caretta*	37	25
Adriatic Sea	17	Pelagic trawls	9262.00	PO	207.00	2.235	Elasmobranchii	*Pteroplatytrygon violacea*	29	10
Adriatic Sea	17	Pelagic trawls	9262.00	PO	207.00	2.235	Mammals	*Tursiops truncatus*	2	2
Adriatic Sea	17	Pelagic trawls	9262.00	SO	34.00	0.367	Reptile	*Caretta caretta*	2	2
Adriatic Sea	17	Pelagic trawls	9262.00	SO	34.00	0.367	Elasmobranchii	*Myliobatis aquila*	5	2
Adriatic Sea	17	Pelagic trawls	9262.00	SO	34.00	0.367	Elasmobranchii	*Pteroplatytrygon violacea*	6	4
Adriatic Sea	17	Seines	22086.00	OTH	130.00	0.589	Reptile	*Caretta caretta*	8	8
Adriatic Sea	17	Bottom Trawl	101841.00	OTH	248.00	0.244	Reptile	*Caretta caretta*	15	15
Adriatic Sea	17	Bottom Trawl	101841.00	PO	250.00	0.245	Reptile	*Caretta caretta*	75	51
Adriatic Sea	17	Bottom Trawl	101841.00	PO	250.00	0.245	Birds	*Phalacrocorax carbo*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Adriatic Sea	17	Bottom Trawl	101841.00	PO	250.00	0.245	Elasmobranchii	*Pteroplatytrygon violacea*	111	41
Adriatic Sea	17	Bottom Trawl	101841.00	PO	250.00	0.245	Mammals	*Tursiops truncatus*	1	1
Adriatic Sea	17	Bottom Trawl	101841.00	SO	100.00	0.098	Reptile	*Caretta caretta*	6	6
Adriatic Sea	17	Bottom Trawl	101841.00	SO	100.00	0.098	Elasmobranchii	*Myliobatis aquila*	2	2
Adriatic Sea	17	Bottom Trawl	101841.00	SO	100.00	0.098	Elasmobranchii	*Pteroplatytrygon violacea*	22	3
Adriatic Sea	18	Nets	59707.00	SO	1.00	0.002	Elasmobranchii	*Dasyatis tortonesei*	3	1
Adriatic Sea	18	Nets	59707.00	VO	48.00	0.080	Reptile	*Caretta caretta*	1	1
Adriatic Sea	18	Nets	59707.00	VO	48.00	0.080	Elasmobranchii	*Dasyatis pastinaca*	1	1
Adriatic Sea	18	Nets	59707.00	VO	48.00	0.080	Elasmobranchii	*Dasyatis tortonesei*	1	1
Adriatic Sea	18	Longlines	4764.00	VO	14.00	0.294	Elasmobranchii	*Heptranchias perlo*	1	1
Adriatic Sea	18	Longlines	4764.00	VO	14.00	0.294	Elasmobranchii	*Prionace glauca*	1	1
Adriatic Sea	18	Bottom Trawl	26781.00	SO	9.00	0.034	Elasmobranchii	*Dasyatis pastinaca*	3	1
Adriatic Sea	18	Bottom Trawl	26781.00	SO	9.00	0.034	Elasmobranchii	*Leucoraja circularis*	1	1
Adriatic Sea	18	Bottom Trawl	26781.00	VO	48.00	0.179	Reptile	*Caretta caretta*	1	1
Adriatic Sea	18	Bottom Trawl	26781.00	VO	48.00	0.179	Elasmobranchii	*Dasyatis tortonesei*	2	2
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Aetomylaeus bovinus*	6	4
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Teleostei	*Alosa fallax*	9	8

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Dasyatis pastinaca*	69	24
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Dasyatis tortonesei*	32	10
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Teleostei	*Epinephelus marginatus*	2	2
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Galeorhinus galeus*	1	1
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Gymnura altavela*	1	1
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Teleostei	*Hippocampus guttulatus*	1	1
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Teleostei	*Hippocampus hippocampus*	3	2
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Leucoraja naevus*	1	1
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Mustelus mustelus*	27	14
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Myliobatis aquila*	37	7
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Birds	*Phalacrocorax aristotelis*	1	1
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Raja clavata*	45	16

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Raja radula*	325	54
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Teleostei	*Sciaena umbra*	106	44
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Elasmobranchii	*Squalus blainville*	3	1
Aegean-Levantine Sea	22	Nets	635984.00	SO	532.00	0.084	Teleostei	*Umbrina cirrosa*	45	16
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Dasyatis pastinaca*	7	4
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Dasyatis tortonesei*	3	2
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Teleostei	*Epinephelus marginatus*	14	9
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Gymnura altavela*	1	1
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Mammals	*Monachus monachus*	1	1
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Mustelus mustelus*	7	5
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Birds	*Phalacrocorax carbo*	1	1
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Raja asterias*	2	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Raja clavata*	42	9
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Raja radula*	16	12
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Teleostei	*Sciaena umbra*	13	10
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Elasmobranchii	*Squalus blainville*	14	1
Aegean-Levantine Sea	22	Longlines	166466.00	SO	146.00	0.088	Teleostei	*Umbrina cirrosa*	1	1
Aegean-Levantine Sea	22	Surrounding nets	31422.00	SO	86.00	0.274	Elasmobranchii	*Raja radula*	1	1
Aegean-Levantine Sea	22	Surrounding nets	31422.00	SO	86.00	0.274	Teleostei	*Xiphias gladius*	2	1
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Aetomylaeus bovinus*	5	4
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Teleostei	*Alosa fallax*	94	33
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Reptile	*Caretta caretta*	4	5
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Anthozoa	*Corallium rubrum*	10	1
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Dasyatis pastinaca*	26	8

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Dasyatis tortonesei*	10	5
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Dipturus oxyrinchus*	129	31
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Gymnura altavela*	4	4
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Leucoraja naevus*	53	10
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Mustelus mustelus*	39	17
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Mustelus punctulatus*	17	7
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Myliobatis aquila*	3	3
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Oxynotus centrina*	2	2
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Prionace glauca*	1	1
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Raja asterias*	77	11
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Raja clavata*	803	135
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Raja radula*	124	47

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Rostroraja alba*	1	1
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Squalus acanthias*	352	14
Aegean-Levantine Sea	22	Bottom Trawl	34384.00	SO	159.00	0.462	Elasmobranchii	*Squalus blainville*	299	15
Aegean-Levantine Sea	23	Nets	35209.00	SO	41.00	0.116	Elasmobranchii	*Dasyatis pastinaca*	16	7
Aegean-Levantine Sea	23	Nets	35209.00	SO	41.00	0.116	Teleostei	*Epinephelus marginatus*	6	5
Aegean-Levantine Sea	23	Nets	35209.00	SO	41.00	0.116	Elasmobranchii	*Leucoraja naevus*	2	2
Aegean-Levantine Sea	23	Nets	35209.00	SO	41.00	0.116	Elasmobranchii	*Myliobatis aquila*	1	1
Aegean-Levantine Sea	23	Nets	35209.00	SO	41.00	0.116	Teleostei	*Sciaena umbra*	5	3
Aegean-Levantine Sea	23	Nets	35209.00	SO	41.00	0.116	Teleostei	*Umbrina cirrosa*	1	1
Aegean-Levantine Sea	23	Longlines	7306.00	SO	25.00	0.342	Elasmobranchii	*Dasyatis pastinaca*	14	6
Aegean-Levantine Sea	23	Longlines	7306.00	SO	25.00	0.342	Teleostei	*Epinephelus marginatus*	25	6
Aegean-Levantine Sea	23	Longlines	7306.00	SO	25.00	0.342	Elasmobranchii	*Raja clavata*	24	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Aegean-Levantine Sea	23	Bottom Trawl	2212.00	SO	5.00	0.226	Elasmobranchii	*Dasyatis pastinaca*	2	1
Aegean-Levantine Sea	23	Bottom Trawl	2212.00	SO	5.00	0.226	Elasmobranchii	*Dipturus oxyrinchus*	4	2
Aegean-Levantine Sea	23	Bottom Trawl	2212.00	SO	5.00	0.226	Elasmobranchii	*Raja clavata*	83	4
Aegean-Levantine Sea	23	Bottom Trawl	2212.00	SO	5.00	0.226	Elasmobranchii	*Squalus blainville*	25	2
Aegean-Levantine Sea	25	Nets	69858.00	PO	827.00	1.184	Reptile	*Chelonia mydas*	1	1
Aegean-Levantine Sea	25	Nets	69858.00	PO	827.00	1.184	Reptile	*Cheloniidae*	2	1
Aegean-Levantine Sea	25	Nets	69858.00	PO	827.00	1.184	Elasmobranchii	*Gymnura altavela*	1	1
Aegean-Levantine Sea	25	Nets	69858.00	PO	827.00	1.184	Elasmobranchii	*Rhinobatos rhinobatos*	1	1
Aegean-Levantine Sea	25	Nets	69858.00	PO	827.00	1.184	Elasmobranchii	*Squatina squatina*	1	1
Aegean-Levantine Sea	25	Longlines	33424.00	SO	14.00	0.042	Reptile	*Caretta caretta*	1	1
Aegean-Levantine Sea	25	Longlines	33424.00	SO	14.00	0.042	Reptile	*Chelonia mydas*	5	3
Azores	27.10.a.2	Traps	621.00	SO	3.00	0.483	Teleostei	*Conger conger*	2	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Azores	27.10.a.2	Nets	2428.00	SO	4.00	0.165	Teleostei	*Labrus bergylta*	1	1
Azores	27.10.a.2	Rod and lines	27872.00	SO	705.00	2.529	Birds	*Calonectris borealis*	1	1
Azores	27.10.a.2	Rod and lines	27872.00	SO	705.00	2.529	Teleostei	*Conger conger*	1	1
Azores	27.10.a.2	Rod and lines	27872.00	SO	705.00	2.529	Birds	*Larus michahellis*	2	2
Azores	27.10.a.2	Rod and lines	27872.00	SO	705.00	2.529	Teleostei	*Lepidopus caudatus*	7	3
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Elasmobranchii	*Bathyraja brachyurops*	21	3
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Reptile	*Caretta caretta*	1	1
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Elasmobranchii	*Centrophorus granulosus*	1	1
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Teleostei	*Conger conger*	71	9
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Elasmobranchii	*Deania calceus*	18	3
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Mammals	*Delphinus delphis*	1	1
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Elasmobranchii	*Etmopterus pusillus*	7	2
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Elasmobranchii	*Etmopterus spinax*	148	5
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Teleostei	*Helicolenus dactylopterus*	583	9
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Elasmobranchii	*Isurus oxyrinchus*	18	14
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Teleostei	*Lepidopus caudatus*	54	8
Azores	27.10.a.2	Longlines	6140.00	SO	91.00	1.482	Teleostei	*Molva macrophthalma*	2	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Alca torda*	2	2
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Alcidae*	2	2
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Elasmobranchii	*Amblyraja radiata*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Anatidae*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Aves*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Cepphus grylle*	2	2
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Elasmobranchii	*Elasmobranchii*	32	4
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Gaviidae*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Mammals	*Mammalia*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Melanitta fusca*	4	4
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Phalacrocorax carbo*	22	19
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Mammals	*Phoca vitulina*	7	7
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Mammals	*Phocoena phocoena*	13	12
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Mammals	*Pinnipedia*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Somateria mollissima*	369	106
Baltic Sea	27.3.b.23	Nets	2575.00	EM	371.00	14.408	Birds	*Uria aalge*	52	36
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Teleostei	*Cyclopterus lumpus*	161	18

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Birds	*Mergus serrator*	1	1
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Teleostei	*Merlangius merlangus*	31	13
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Birds	*Phalacrocorax carbo*	8	8
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Mammals	*Phoca vitulina*	2	2
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Birds	*Somateria mollissima*	4	3
Baltic Sea	27.3.b.23	Nets	2575.00	SO	38.00	1.476	Birds	*Uria aalge*	14	5
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Birds	*Gavia arctica*	1	1
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Mammals	*Halichoerus grypus*	1	1
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Birds	*Larus argentatus*	2	1
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Birds	*Melanitta fusca*	6	3
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Birds	*Phalacrocorax carbo*	3	3
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Mammals	*Phoca vitulina*	2	2
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Mammals	*Phocoena phocoena*	12	11
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Birds	*Somateria mollissima*	5	4
Baltic Sea	27.3.c.22	Nets	10680.00	EM	115.00	1.077	Birds	*Uria aalge*	2	2
Baltic Sea	27.3.c.22	Nets	10680.00	SO	17.00	0.159	Teleostei	*Cyclopterus lumpus*	54	6
Baltic Sea	27.3.c.22	Nets	10680.00	SO	17.00	0.159	Teleostei	*Merlangius merlangus*	24	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.c.22	Nets	10680.00	SO	17.00	0.159	Birds	*Phalacrocorax carbo*	1	1
Baltic Sea	27.3.c.22	Nets	10680.00	SO	17.00	0.159	Mammals	*Phoca vitulina*	2	2
Baltic Sea	27.3.c.22	Bottom Trawl	1962.00	SO	5.00	0.255	Teleostei	*Merlangius merlangus*	3	1
Baltic Sea	27.3.d.24	Nets	11302.50	EM	19.00	0.168	Birds	*Alca torda*	2	2
Baltic Sea	27.3.d.24	Nets	11302.50	EM	19.00	0.168	Mammals	*Halichoerus grypus*	2	1
Baltic Sea	27.3.d.24	Nets	11302.50	EM	19.00	0.168	Mammals	*Phoca vitulina*	1	1
Baltic Sea	27.3.d.24	Nets	11302.50	EM	19.00	0.168	Mammals	*Phocidae*	4	4
Baltic Sea	27.3.d.24	Nets	11302.50	EM	19.00	0.168	Birds	*Uria aalge*	6	4
Baltic Sea	27.3.d.24	Nets	11302.50	SO	21.00	0.186	Chondrostei	*Acipenser oxyrinchus*	3	2
Baltic Sea	27.3.d.24	Nets	11302.50	SO	21.00	0.186	Mammals	*Phocoena phocoena*	1	1
Baltic Sea	27.3.d.24	Bottom Trawl	1414.00	SO	2.00	0.141	Teleostei	*Merlangius merlangus*	3	3
Baltic Sea	27.3.d.25	Nets	13179.83	EM	8.00	0.061	Mammals	*Halichoerus grypus*	2	2
Baltic Sea	27.3.d.25	Nets	13179.83	EM	8.00	0.061	Mammals	*Phoca vitulina*	2	2
Baltic Sea	27.3.d.25	Nets	13179.83	EM	8.00	0.061	Mammals	*Phocidae*	3	3
Baltic Sea	27.3.d.25	Nets	13179.83	SO	7.00	0.053	Teleostei	*Alosa fallax*	2	1
Baltic Sea	27.3.d.25	Pelagic trawls	4096.63	LB	448.00	10.936	Teleostei	*Cyclopterus lumpus*	87	10
Baltic Sea	27.3.d.26	Traps	8992.17	LB	2201.00	24.477	Teleostei	*Alosa fallax*	1130	23

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.d.26	Traps	8992.17	LB	2201.00	24.477	Petromyzonti	*Lampetra fluviatilis*	640	14
Baltic Sea	27.3.d.26	Traps	8992.17	SO	22.00	0.245	Teleostei	*Alosa fallax*	11	3
Baltic Sea	27.3.d.26	Traps	8992.17	SO	22.00	0.245	Mammals	*Halichoerus grypus*	1	1
Baltic Sea	27.3.d.26	Nets	23581.83	LB	2312.00	9.804	Teleostei	*Alosa fallax*	65	8
Baltic Sea	27.3.d.26	Nets	23581.83	SO	68.00	0.288	Teleostei	*Alosa fallax*	309	22
Baltic Sea	27.3.d.26	Nets	23581.83	SO	68.00	0.288	Birds	*Clangula hyemalis*	1	1
Baltic Sea	27.3.d.28	Nets	299.50	SO	4.00	1.336	Birds	*Phalacrocorax carbo*	1	1
Baltic Sea	27.3.d.28	Nets	299.50	SO	4.00	1.336	Birds	*Somateria mollissima*	1	1
Baltic Sea	27.3.d.28.1	Traps	11607.22	LB	10055.00	86.627	Mammals	*Halichoerus grypus*	14	10
Baltic Sea	27.3.d.28.1	Traps	11607.22	LB	10055.00	86.627	Birds	*Phalacrocorax carbo*	20	13
Baltic Sea	27.3.d.28.1	Pelagic trawls	3995.00	SO	153.00	3.830	Teleostei	*Alosa fallax*	2	2
Baltic Sea	27.3.d.28.1	Pelagic trawls	3995.00	SO	153.00	3.830	Teleostei	*Cyclopterus lumpus*	1	1
Baltic Sea	27.3.d.28.1	Pelagic trawls	3995.00	SO	153.00	3.830	Petromyzonti	*Lampetra fluviatilis*	33	7
Baltic Sea	27.3.d.28.2	Pelagic trawls	2552.00	SO	297.00	11.638	Teleostei	*Alosa fallax*	1	1
Baltic Sea	27.3.d.29	Traps	7140.00	LB	7044.00	98.655	Birds	*Anatidae*	1	1
Baltic Sea	27.3.d.29	Traps	7140.00	LB	7044.00	98.655	Mammals	*Halichoerus grypus*	9	7
Baltic Sea	27.3.d.29	Traps	7140.00	LB	7044.00	98.655	Mammals	*Lutra lutra*	3	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.d.29	Traps	7140.00	LB	7044.00	98.655	Birds	*Phalacrocorax carbo*	69	26
Baltic Sea	27.3.d.29	Traps	7140.00	LB	7044.00	98.655	Birds	*Somateria mollissima*	1	1
Baltic Sea	27.3.d.29	Nets	24049.00	LB	22939.00	95.384	Birds	*Bucephala clangula*	2	2
Baltic Sea	27.3.d.29	Nets	24049.00	LB	22939.00	95.384	Birds	*Melanitta fusca*	7	1
Baltic Sea	27.3.d.29	Nets	24049.00	LB	22939.00	95.384	Birds	*Mergus*	1	1
Baltic Sea	27.3.d.29	Nets	24049.00	LB	22939.00	95.384	Birds	*Mergus serrator*	2	2
Baltic Sea	27.3.d.29	Nets	24049.00	LB	22939.00	95.384	Birds	*Somateria mollissima*	2	1
Baltic Sea	27.3.d.29	Bottom Trawl	1.00	PO	13.00		Mammals	*Halichoerus grypus*	1	1
Baltic Sea	27.3.d.30	Traps	8976.33	LB	8274.00	92.176	Mammals	*Halichoerus grypus*	17	9
Baltic Sea	27.3.d.30	Traps	8976.33	LB	8274.00	92.176	Birds	*Phalacrocorax carbo*	3	2
Baltic Sea	27.3.d.30	Traps	8976.33	LB	8274.00	92.176	Mammals	*Pusa hispida*	5	3
Baltic Sea	27.3.d.30	Traps	8976.33	SO	77.00	0.858	Birds	*Somateria mollissima*	1	1
Baltic Sea	27.3.d.30	Nets	16356.17	LB	13213.50	80.786	Birds	*Clangula hyemalis*	2	2
Baltic Sea	27.3.d.30	Nets	16356.17	LB	13213.50	80.786	Mammals	*Halichoerus grypus*	6	2
Baltic Sea	27.3.d.30	Nets	16356.17	LB	13213.50	80.786	Birds	*Mergus*	2	1
Baltic Sea	27.3.d.30	Nets	16356.17	LB	13213.50	80.786	Birds	*Mergus merganser*	5	2
Baltic Sea	27.3.d.30	Nets	16356.17	LB	13213.50	80.786	Mammals	*Pusa hispida*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.d.30	Nets	16356.17	PO	42.00	0.257	Birds	*Mergus serrator*	1	1
Baltic Sea	27.3.d.30	Nets	16356.17	PO	42.00	0.257	Birds	*Phalacrocorax carbo*	1	1
Baltic Sea	27.3.d.30	Pelagic trawls	2552.88	PO	25.00	0.979	Mammals	*Halichoerus grypus*	2	1
Baltic Sea	27.3.d.30	Bottom Trawl	34.00	PO	32.00	94.118	Mammals	*Halichoerus grypus*	4	3
Baltic Sea	27.3.d.31	Traps	11324.83	LB	9659.00	85.290	Mammals	*Halichoerus grypus*	7	7
Baltic Sea	27.3.d.31	Traps	11324.83	LB	9659.00	85.290	Birds	*Larus argentatus*	1	1
Baltic Sea	27.3.d.31	Traps	11324.83	LB	9659.00	85.290	Birds	*Mergus*	4	2
Baltic Sea	27.3.d.31	Traps	11324.83	LB	9659.00	85.290	Birds	*Phalacrocorax carbo*	50	4
Baltic Sea	27.3.d.31	Traps	11324.83	LB	9659.00	85.290	Mammals	*Pusa hispida*	17	4
Baltic Sea	27.3.d.31	Traps	11324.83	PO	30.00	0.265	Birds	*Larus marinus*	1	1
Baltic Sea	27.3.d.31	Nets	9905.67	LB	7992.50	80.686	Birds	*Anas crecca*	3	1
Baltic Sea	27.3.d.31	Nets	9905.67	LB	7992.50	80.686	Birds	*Bucephala clangula*	3	2
Baltic Sea	27.3.d.31	Nets	9905.67	LB	7992.50	80.686	Birds	*Melanitta fusca*	2	2
Baltic Sea	27.3.d.32	Traps	5795.00	LB	5795.00	100.000	Mammals	*Halichoerus grypus*	4	4
Baltic Sea	27.3.d.32	Traps	5795.00	LB	5795.00	100.000	Birds	*Phalacrocorax carbo*	1	1
Baltic Sea	27.3.d.32	Traps	5795.00	PO	122.00	2.105	Birds	*Phalacrocorax carbo*	1	1
Baltic Sea	27.3.d.32	Nets	19427.00	LB	19427.00	100.000	Birds	*Anatidae*	25	6

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Baltic Sea	27.3.d.32	Nets	19427.00	LB	19427.00	100.000	Birds	*Cepphus grylle*	2	1
Baltic Sea	27.3.d.32	Nets	19427.00	LB	19427.00	100.000	Birds	*Mergus*	2	1
Baltic Sea	27.3.d.32	Nets	19427.00	LB	19427.00	100.000	Birds	*Phalacrocorax carbo*	30	3
Baltic Sea	27.3.d.32	Nets	19427.00	LB	19427.00	100.000	Birds	*Somateria mollissima*	4	2
Baltic Sea	27.3.d.32	Bottom Trawl		PO	8.00		Mammals	*Halichoerus grypus*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	EM			Mammals	*Delphinus delphis*	59	41
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	EM			Mammals	*Halichoerus grypus*	4	4
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	EM			Mammals	*Phocoena phocoena*	15	13
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Birds	*Alca torda*	2	2
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Mammals	*Delphinidae*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Mammals	*Delphinus delphis*	6	6
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Birds	*Gavia immer*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Mammals	*Halichoerus grypus*	6	6
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Birds	*Larus marinus*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Birds	*Phalacrocorax aristotelis*	2	2
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Birds	*Phalacrocorax carbo*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Mammals	*Phocoena phocoena*	3	3
Bay of Biscay and the	27.8.a	Nets	29095.42	SO	318.99	1.096	Mammals	*Tursiops truncatus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.a	Nets	29095.42	SO	318.99	1.096	Birds	*Uria aalge*	73	44
Bay of Biscay and the Iberian Coast	27.8.a	Longlines	14230.86	SO	30.73	0.216	Birds	*Larus argentatus*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Longlines	14230.86	SO	30.73	0.216	Birds	*Morus bassanus*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Longlines	14230.86	SO	30.73	0.216	Birds	*Rissa tridactyla*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Pelagic trawls	3355.71	SO	104.26	3.107	Mammals	*Delphinus delphis*	2	1
Bay of Biscay and the Iberian Coast	27.8.a	Pelagic trawls	3355.71	SO	104.26	3.107	Teleostei	*Mola mola*	4	2
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Teleostei	*Chelidonichthys lucerna*	10	10

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Teleostei	*Conger conger*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Mammals	*Delphinus delphis*	22	6
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Teleostei	*Mola mola*	10	6
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Teleostei	*Scophthalmus maximus*	0	2
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Elasmobranchii	*Torpedo marmorata*	4	3
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Elasmobranchii	*Torpedo torpedo*	1	1
Bay of Biscay and the Iberian Coast	27.8.a	Bottom Trawl	39417.67	SO	182.48	0.463	Teleostei	*Zeus faber*	12	19
Bay of Biscay and the	27.8.b	Nets	20105.97	EM			Mammals	*Delphinus delphis*	35	32

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	EM			Mammals	*Globicephala melas*	1	1
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	EM			Mammals	*Phocoena phocoena*	28	26
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	EM			Mammals	*Tursiops truncatus*	3	3
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	SO	201.74	1.003	Mammals	*Delphinus delphis*	1	1
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	SO	201.74	1.003	Birds	*Melanitta nigra*	1	1
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	SO	201.74	1.003	Birds	*Rissa tridactyla*	1	1
Bay of Biscay and the Iberian Coast	27.8.b	Nets	20105.97	SO	201.74	1.003	Birds	*Uria aalge*	56	18

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Alosa fallax*	5	3
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Chelidonichthys lucerna*	69	69
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Conger conger*	7	12
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Mammals	*Delphinus delphis*	9	7
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Helicolenus dactylopterus*	1	1
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Elasmobranchii	*Hexanchus griseus*	4	3
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Mola mola*	10	9
Bay of Biscay and the	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Molva macrophthalma*	6	6

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Birds	*Morus bassanus*	17	9
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Scophthalmus maximus*	0	15
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Scophthalmus rhombus*	0	22
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Scorpaena scrofa*	2	2
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Elasmobranchii	*Torpedo marmorata*	7	6
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Elasmobranchii	*Torpedo torpedo*	1	1
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Mammals	*Tursiops truncatus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.b	Bottom Trawl	8812.18	SO	157.08	1.782	Teleostei	*Zeus faber*	21	27
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Alosa fallax*	8	4
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Centrophorus granulosus*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Chelidonichthys lucerna*	9	9
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Holocephali	*Chimaera monstrosa*	61	16
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Conger conger*	6	6
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Dasyatis pastinaca*	1	1
Bay of Biscay and the	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Deania calceus*	9	4

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Mammals	*Delphinus delphis*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Etmopterus spinax*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Helicolenus dactylopterus*	144	8
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Hexanchus griseus*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Labrus bergylta*	4	4
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Birds	*Larus marinus*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Mola mola*	23	21

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Molva macrophthalma*	25	6
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Birds	*Morus bassanus*	7	3
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Mammals	*Phocoena phocoena*	3	3
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Polyprion americanus*	4	2
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Birds	*Puffinus mauretanicus*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Scophthalmus maximus*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Scophthalmus rhombus*	1	1
Bay of Biscay and the	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Scorpaena scrofa*	15	15

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Scyliorhinus stellaris*	4	3
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Scymnodon ringens*	3	2
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Elasmobranchii	*Torpedo marmorata*	17	14
Bay of Biscay and the Iberian Coast	27.8.c	Nets	26466.95	SO	334.00	1.262	Teleostei	*Zeus faber*	22	18
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Holocephali	*Chimaera monstrosa*	4	3
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Teleostei	*Conger conger*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Elasmobranchii	*Dasyatis pastinaca*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Elasmobranchii	*Deania calceus*	3	2
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Elasmobranchii	*Etmopterus spinax*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Elasmobranchii	*Isurus oxyrinchus*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Teleostei	*Mola mola*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Elasmobranchii	*Scyliorhinus stellaris*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Longlines	15191.48	SO	25.00	0.165	Elasmobranchii	*Scymnodon ringens*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Surrounding nets	20864.50	SO	106.00	0.508	Elasmobranchii	*Dasyatis pastinaca*	1	1
Bay of Biscay and the	27.8.c	Surrounding nets	20864.50	SO	106.00	0.508	Mammals	*Delphinus delphis*	2	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.c	Surrounding nets	20864.50	SO	106.00	0.508	Teleostei	*Mola mola*	14	13
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Alosa fallax*	108	20
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Brama brama*	3	3
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Chelidonichthys lucerna*	38	10
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Holocephali	*Chimaera monstrosa*	1609	47
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Conger conger*	1202	58
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Elasmobranchii	*Deania calceus*	24	8

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Mammals	*Delphinus delphis*	3	1
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Elasmobranchii	*Etmopterus spinax*	1299	39
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Mammals	*Globicephala melas*	1	1
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Helicolenus dactylopterus*	37271	269
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Elasmobranchii	*Hexanchus griseus*	283	39
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Lepidopus caudatus*	46	8
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Mola mola*	67	12
Bay of Biscay and the	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Molva macrophthalma*	13533	104

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Birds	*Morus bassanus*	6	1
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Polyprion americanus*	2	2
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Scophthalmus maximus*	50	28
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Scorpaena scrofa*	156	27
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Elasmobranchii	*Scyliorhinus stellaris*	7	2
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Elasmobranchii	*Scymnodon ringens*	5	2
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Elasmobranchii	*Somniosus microcephalus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.8.c	Bottom Trawl	13170.33	SO	375.00	2.847	Teleostei	*Zeus faber*	1376	124
Bay of Biscay and the Iberian Coast	27.8.d.2	Nets	446.39	EM			Mammals	*Delphinus delphis*	1	1
Bay of Biscay and the Iberian Coast	27.8.d.2	Nets	446.39	SO	14.00	3.136	Elasmobranchii	*Centroselachus crepidater*	1	1
Bay of Biscay and the Iberian Coast	27.8.d.2	Nets	446.39	SO	14.00	3.136	Holocephali	*Chimaera monstrosa*	177	7
Bay of Biscay and the Iberian Coast	27.8.d.2	Nets	446.39	SO	14.00	3.136	Elasmobranchii	*Deania calceus*	21	8
Bay of Biscay and the Iberian Coast	27.8.d.2	Nets	446.39	SO	14.00	3.136	Mammals	*Delphinus delphis*	2	1
Bay of Biscay and the Iberian Coast	27.8.d.2	Nets	446.39	SO	14.00	3.136	Elasmobranchii	*Etmopterus spinax*	5	2
Bay of Biscay and the	27.8.d.2	Pelagic trawls	456.34	SO	26.00	5.698	Teleostei	*Brama brama*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.8.d.2	Pelagic trawls	456.34	SO	26.00	5.698	Mammals	*Delphinus delphis*	2	1
Bay of Biscay and the Iberian Coast	27.8.d.2	Bottom Trawl	263.67	SO	7.98	3.025	Mammals	*Delphinus delphis*	1	1
Bay of Biscay and the Iberian Coast	27.8.e.2	Longlines		SO	6.00		Reptile	*Dermochelys coriacea*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Traps	94341.00	PO	2691.00	2.852	Mammals	*Balaenoptera acutorostrata*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Traps	94341.00	PO	2691.00	2.852	Mammals	*Delphinus delphis*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Traps	94341.00	PO	2691.00	2.852	Birds	*Larus*	4	0
Bay of Biscay and the Iberian Coast	27.9.a	Traps	94341.00	PO	2691.00	2.852	Birds	*Morus bassanus*	4	0

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.9.a	Traps	94341.00	SO	46.00	0.049	Mammals	*Delphinus delphis*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Traps	94341.00	SO	46.00	0.049	Elasmobranchii	*Prionace glauca*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Alca torda*	30	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Alcidae*	93	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Mammals	*Delphinidae*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Mammals	*Delphinus delphis*	26	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Larus*	192	0
Bay of Biscay and the	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Melanitta nigra*	13	0

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Morus bassanus*	228	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Phalacrocoracidae*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Mammals	*Phocoena phocoena*	3	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Puffinus*	15	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Puffinus mauretanicus*	63	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	PO	3477.00	2.380	Birds	*Uria aalge*	102	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Elasmobranchii	*Alopias superciliosus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Elasmobranchii	*Cetorhinus maximus*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Teleostei	*Chelidonichthys lucerna*	2	2
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Teleostei	*Helicolenus dactylopterus*	10	4
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Elasmobranchii	*Isurus oxyrinchus*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Birds	*Larus*	4	4
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Birds	*Larus fuscus*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Teleostei	*Mola mola*	244	13
Bay of Biscay and the	27.9.a	Nets	146089.57	SO	167.00	0.114	Birds	*Morus bassanus*	4	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Elasmobranchii	*Mustelus mustelus*	3	3
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Birds	*Puffinus gravis*	20	4
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	SO	167.00	0.114	Birds	*Puffinus mauretanicus*	3	3
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	VO	228.00	0.156	Birds	*Larus*	5	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	VO	228.00	0.156	Birds	*Larus michahellis*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	VO	228.00	0.156	Birds	*Melanitta nigra*	2	0
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	VO	228.00	0.156	Birds	*Morus bassanus*	19	0

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	VO	228.00	0.156	Mammals	*Tursiops truncatus*	2	2
Bay of Biscay and the Iberian Coast	27.9.a	Nets	146089.57	VO	228.00	0.156	Birds	*Uria aalge*	13	0
Bay of Biscay and the Iberian Coast	27.9.a	Rod and lines	5103.00	PO	162.00	3.175	Birds	*Calonectris borealis*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Longlines	13133.79	PO	672.00	5.117	Birds	*Morus bassanus*	3	0
Bay of Biscay and the Iberian Coast	27.9.a	Longlines	13133.79	SO	14.00	0.107	Elasmobranchii	*Heptranchias perlo*	3	1
Bay of Biscay and the Iberian Coast	27.9.a	Longlines	13133.79	SO	14.00	0.107	Elasmobranchii	*Isurus oxyrinchus*	6	6
Bay of Biscay and the Iberian Coast	27.9.a	Longlines	13133.79	SO	14.00	0.107	Birds	*Morus bassanus*	4	2
Bay of Biscay and the	27.9.a	Surrounding nets	24554.00	PO	1155.00	4.704	Mammals	*Delphinus delphis*	1	0

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	PO	1155.00	4.704	Birds	*Larus*	10	0
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	PO	1155.00	4.704	Birds	*Melanitta nigra*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	PO	1155.00	4.704	Birds	*Phalacrocoracidae*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	PO	1155.00	4.704	Birds	*Puffinus*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	PO	1155.00	4.704	Birds	*Puffinus mauretanicus*	1	0
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	SO	61.00	0.248	Teleostei	*Lepidopus caudatus*	38	4
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	SO	61.00	0.248	Teleostei	*Pomatomus saltatrix*	319	7

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.9.a	Surrounding nets	24554.00	SO	61.00	0.248	Elasmobranchii	*Torpedo marmorata*	2	2
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	PO	1110.00	2.271	Mammals	*Delphinus delphis*	3	0
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	PO	1110.00	2.271	Birds	*Morus bassanus*	15	0
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Alosa alosa*	202	8
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Alosa fallax*	3194	96
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Argyrosomus regius*	70	8
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Brama brama*	4	2
Bay of Biscay and the	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Chelidonichthys lucerna*	1278	10

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Holocephali	*Chimaera monstrosa*	6	2
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Conger conger*	14110	224
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Deania calceus*	1	1
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Mammals	*Delphinus delphis*	3	3
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Etmopterus pusillus*	148	2
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Etmopterus spinax*	257	3
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Helicolenus dactylopterus*	28710	150

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Hexanchus griseus*	5	2
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Hippocampus hippocampus*	142	8
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Lepidopus caudatus*	594	26
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Mola mola*	2	1
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Molva macrophthalma*	708	8
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Birds	*Morus bassanus*	2	1
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Myliobatis aquila*	196	8
Bay of Biscay and the	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Polyprion americanus*	2	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Iberian Coast										
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Pomatomus saltatrix*	644	46
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Sciaena umbra*	26	4
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Scophthalmus rhombus*	14	14
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Scorpaena scrofa*	15	6
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Sparus aurata*	92	4
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Torpedo marmorata*	3108	132
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Elasmobranchii	*Torpedo torpedo*	19	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Umbrina cirrosa*	46	6
Bay of Biscay and the Iberian Coast	27.9.a	Bottom Trawl	48884.05	SO	223.00	0.456	Teleostei	*Zeus faber*	792	32
Bay of Biscay and the Iberian Coast	27.9.b.2	Longlines	179.00	SO	21.00	11.732	Elasmobranchii	*Isurus oxyrinchus*	8	6
Bay of Biscay and the Iberian Coast	27.9.b.2	Longlines	179.00	SO	21.00	11.732	Elasmobranchii	*Lamna nasus*	1	1
Bay of Biscay and the Iberian Coast	27.9.b.2	Longlines	179.00	SO	21.00	11.732	Teleostei	*Mola mola*	4	3
Bay of Biscay and the Iberian Coast	27.9.b.2	Longlines	179.00	SO	21.00	11.732	Elasmobranchii	*Sphyrna zygaena*	1	1
Black Sea	29	Nets	7636.00	SO	30.00	0.393	Mammals	*Phocoena phocoena*	3	3
Black Sea	29	Pelagic trawls	3557.00	SO	50.00	1.406	Chondrostei	*Huso huso*	2	2
Celtic Seas	27.6.a	Longlines	3325.66	SO	28.00	0.842	Birds	*Fulmarus glacialis*	87	22

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.6.a	Longlines	3325.66	SO	28.00	0.842	Teleostei	*Helicolenus dactylopterus*	186	3
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Elasmobranchii	*Centroscyllium fabricii*	3	3
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Holocephali	*Chimaera monstrosa*	2	2
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Elasmobranchii	*Chlamydoselachus anguineus*	3	3
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Teleostei	*Conger conger*	3	3
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Teleostei	*Cyclopterus lumpus*	1	1
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Elasmobranchii	*Deania calceus*	8	6
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Elasmobranchii	*Etmopterus spinax*	17	6
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Teleostei	*Helicolenus dactylopterus*	39	13
Celtic Seas	27.6.a	Pelagic trawls	1618.76	SO	37.00	2.286	Elasmobranchii	*Somniosus microcephalus*	1	1
Celtic Seas	27.6.a	Seines	37.26	SO	8.00	21.470	Elasmobranchii	*Dipturus batis*	5	1
Celtic Seas	27.6.a	Seines	37.26	SO	8.00	21.470	Elasmobranchii	*Galeorhinus galeus*	1	1
Celtic Seas	27.6.a	Seines	37.26	SO	8.00	21.470	Elasmobranchii	*Raja clavata*	7	2
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Elasmobranchii	*Amblyraja radiata*	14	1
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Teleostei	*Chelidonichthys lucerna*	1	1
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Holocephali	*Chimaera monstrosa*	31	23
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Elasmobranchii	*Dipturus nidarosiensis*	29	12

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Elasmobranchii	*Galeus melastomus*	9	4
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Teleostei	*Helicolenus dactylopterus*	47	43
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Teleostei	*Molva macrophthalma*	2	2
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Elasmobranchii	*Raja clavata*	107	15
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Teleostei	*Scophthalmus maximus*	1	1
Celtic Seas	27.6.a	Bottom Trawl	20178.17	SO	216.70	1.074	Teleostei	*Zeus faber*	24	3
Celtic Seas	27.6.a	Bottom Trawl	20178.17	VO	35.00	0.173	Teleostei	*Chelidonichthys lucerna*	10	5
Celtic Seas	27.6.a	Bottom Trawl	20178.17	VO	35.00	0.173	Holocephali	*Chimaera monstrosa*	20	2
Celtic Seas	27.6.a	Bottom Trawl	20178.17	VO	35.00	0.173	Teleostei	*Conger conger*	1	1
Celtic Seas	27.6.a	Bottom Trawl	20178.17	VO	35.00	0.173	Teleostei	*Helicolenus dactylopterus*	134	17
Celtic Seas	27.6.a	Bottom Trawl	20178.17	VO	35.00	0.173	Mammals	*Phocidae*	1	1
Celtic Seas	27.6.a	Bottom Trawl	20178.17	VO	35.00	0.173	Teleostei	*Zeus faber*	1	1
Celtic Seas	27.6.b.2	Nets	82.00	SO	39.48	48.147	Birds	*Fulmarus glacialis*	37	17
Celtic Seas	27.6.b.2	Nets	82.00	SO	39.48	48.147	Elasmobranchii	*Lamna nasus*	1	1
Celtic Seas	27.6.b.2	Nets	82.00	SO	39.48	48.147	Elasmobranchii	*Raja undulata*	22	3
Celtic Seas	27.6.b.2	Nets	82.00	SO	39.48	48.147	Teleostei	*Scophthalmus maximus*	60	18
Celtic Seas	27.6.b.2	Bottom Trawl	353.00	SO	12.33	3.494	Teleostei	*Anarhichas lupus*	24	4

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.6.b.2	Bottom Trawl	353.00	SO	12.33	3.494	Teleostei	*Helicolenus dactylopterus*	929	22
Celtic Seas	27.6.b.2	Bottom Trawl	353.00	SO	12.33	3.494	Elasmobranchii	*Raja clavata*	3	1
Celtic Seas	27.6.b.2	Bottom Trawl	353.00	SO	12.33	3.494	Teleostei	*Scophthalmus maximus*	1	1
Celtic Seas	27.6.b.2	Bottom Trawl	353.00	SO	12.33	3.494	Teleostei	*Scophthalmus rhombus*	1	1
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Elasmobranchii	*Bathyraja brachyurops*	2	2
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Conger conger*	8	3
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Helicolenus dactylopterus*	1	1
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Elasmobranchii	*Leucoraja naevus*	1	1
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Pomatoschistus microps*	2	2
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Pomatoschistus minutus*	4	1
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Elasmobranchii	*Raja clavata*	284	38
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Scophthalmus maximus*	67	100
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Scophthalmus rhombus*	269	124
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Elasmobranchii	*Scyliorhinus stellaris*	7	3
Celtic Seas	27.7.a	Bottom Trawl	11369.09	SO	68.46	0.602	Teleostei	*Zeus faber*	0	3
Celtic Seas	27.7.a	Bottom Trawl	11369.09	VO	6.20	0.055	Teleostei	*Chelidonichthys lucerna*	13	3
Celtic Seas	27.7.b	Nets	313.20	VO	11.00	3.512	Elasmobranchii	*Dasyatis pastinaca*	4	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.b	Nets	313.20	VO	11.00	3.512	Elasmobranchii	*Dipturus intermedius*	2	2
Celtic Seas	27.7.b	Nets	313.20	VO	11.00	3.512	Mammals	*Halichoerus grypus*	4	3
Celtic Seas	27.7.b	Nets	313.20	VO	11.00	3.512	Teleostei	*Scophthalmus maximus*	4	4
Celtic Seas	27.7.b	Nets	313.20	VO	11.00	3.512	Elasmobranchii	*Squatina squatina*	1	1
Celtic Seas	27.7.c.2	Nets	423.84	SO	0.52	0.123	Birds	*Fulmarus glacialis*	1	1
Celtic Seas	27.7.c.2	Pelagic trawls	326.59	SO	5.00	1.531	Elasmobranchii	*Etmopterus princeps*	1	1
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	SO	26.00	0.656	Holocephali	*Chimaera monstrosa*	200	4
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	SO	26.00	0.656	Elasmobranchii	*Dipturus batis*	140	11
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	SO	26.00	0.656	Elasmobranchii	*Etmopterus spinax*	100	2
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	SO	26.00	0.656	Teleostei	*Helicolenus dactylopterus*	34970	78
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	SO	26.00	0.656	Elasmobranchii	*Hexanchus griseus*	2	2
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	VO	17.73	0.448	Holocephali	*Chimaera monstrosa*	4	3
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	VO	17.73	0.448	Elasmobranchii	*Etmopterus princeps*	1	1
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	VO	17.73	0.448	Elasmobranchii	*Etmopterus spinax*	1	1
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	VO	17.73	0.448	Teleostei	*Helicolenus dactylopterus*	108	8
Celtic Seas	27.7.c.2	Bottom Trawl	3962.22	VO	17.73	0.448	Elasmobranchii	*Hexanchus griseus*	2	2
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Elasmobranchii	*Bathyraja brachyurops*	170	14

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Teleostei	*Conger conger*	1	1
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Mammals	*Delphinus delphis*	2	2
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Elasmobranchii	*Dipturus intermedius*	2	2
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Mammals	*Halichoerus grypus*	3	3
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Teleostei	*Labrus bergylta*	233	39
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Elasmobranchii	*Leucoraja naevus*	1	1
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Elasmobranchii	*Raja microocellata*	80	21
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Elasmobranchii	*Raja undulata*	2	2
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Teleostei	*Scophthalmus maximus*	1	1
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Elasmobranchii	*Scyliorhinus stellaris*	14	7
Celtic Seas	27.7.f	Nets	1836.81	SO	39.00	2.123	Teleostei	*Zeus faber*	34	10
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Elasmobranchii	*Bathyraja brachyurops*	95.8	24
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Teleostei	*Conger conger*	12	21
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Elasmobranchii	*Dipturus batis*	3	2
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Elasmobranchii	*Leucoraja naevus*	105.26	30
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Elasmobranchii	*Raja clavata*	27	7
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Elasmobranchii	*Raja microocellata*	6	5

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Teleostei	*Scophthalmus maximus*	46	87
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Teleostei	*Scophthalmus rhombus*	88.6	93
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Elasmobranchii	*Scyliorhinus stellaris*	1	1
Celtic Seas	27.7.f	Bottom Trawl	3807.25	SO	58.42	1.535	Teleostei	*Zeus faber*	139	86
Celtic Seas	27.7.g	Nets	2871.05	SO	9.00	0.313	Elasmobranchii	*Dipturus batis*	1	1
Celtic Seas	27.7.g	Nets	2871.05	SO	9.00	0.313	Elasmobranchii	*Galeus melastomus*	5	4
Celtic Seas	27.7.g	Nets	2871.05	SO	9.00	0.313	Elasmobranchii	*Scyliorhinus stellaris*	11	3
Celtic Seas	27.7.g	Nets	2871.05	SO	9.00	0.313	Teleostei	*Zeus faber*	32	14
Celtic Seas	27.7.g	Seines	1383.83	SO	9.20	0.665	Teleostei	*Alosa fallax*	1	1
Celtic Seas	27.7.g	Seines	1383.83	SO	9.20	0.665	Teleostei	*Chelidonichthys lucerna*	56	15
Celtic Seas	27.7.g	Seines	1383.83	SO	9.20	0.665	Teleostei	*Scophthalmus maximus*	2	2
Celtic Seas	27.7.g	Seines	1383.83	SO	9.20	0.665	Teleostei	*Scophthalmus rhombus*	1	1
Celtic Seas	27.7.g	Seines	1383.83	SO	9.20	0.665	Elasmobranchii	*Tetronarce nobiliana*	1	1
Celtic Seas	27.7.g	Seines	1383.83	SO	9.20	0.665	Teleostei	*Zeus faber*	23	5
Celtic Seas	27.7.g	Seines	1383.83	VO	23.47	1.696	Teleostei	*Chelidonichthys lucerna*	2	2
Celtic Seas	27.7.g	Seines	1383.83	VO	23.47	1.696	Teleostei	*Zeus faber*	4	2
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Elasmobranchii	*Bathyraja brachyurops*	8.27	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Teleostei	*Chelidonichthys lucerna*	22	6
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Teleostei	*Conger conger*	12	35
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Elasmobranchii	*Dipturus batis*	19	6
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Teleostei	*Helicolenus dactylopterus*	1	1
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Elasmobranchii	*Leucoraja naevus*	148.09	29
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Elasmobranchii	*Raja clavata*	13	6
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Elasmobranchii	*Raja microocellata*	1	1
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Teleostei	*Scophthalmus maximus*	20	96
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Teleostei	*Scophthalmus rhombus*	51	96
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Elasmobranchii	*Scyliorhinus stellaris*	4	4
Celtic Seas	27.7.g	Bottom Trawl	12018.42	SO	52.71	0.439	Teleostei	*Zeus faber*	50	63
Celtic Seas	27.7.g	Bottom Trawl	12018.42	VO	21.80	0.181	Teleostei	*Chelidonichthys lucerna*	15	5
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Elasmobranchii	*Bathyraja brachyurops*	1	1
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Elasmobranchii	*Dipturus batis*	84	4
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Mammals	*Halichoerus grypus*	3	2
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Elasmobranchii	*Leucoraja fullonica*	54	5
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Elasmobranchii	*Leucoraja naevus*	25	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Mammals	*Phocoena phocoena*	1	1
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Elasmobranchii	*Prionace glauca*	1	1
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Elasmobranchii	*Raja clavata*	1	1
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Teleostei	*Scophthalmus maximus*	111	6
Celtic Seas	27.7.h	Nets	3159.50	SO	31.06	0.983	Teleostei	*Scophthalmus rhombus*	3	1
Celtic Seas	27.7.h	Pelagic trawls	276.43	SO	16.00	5.788	Teleostei	*Brama brama*	4	2
Celtic Seas	27.7.h	Pelagic trawls	276.43	SO	16.00	5.788	Teleostei	*Chelidonichthys lucerna*	4	1
Celtic Seas	27.7.h	Pelagic trawls	276.43	SO	16.00	5.788	Elasmobranchii	*Lamna nasus*	1	1
Celtic Seas	27.7.h	Pelagic trawls	276.43	SO	16.00	5.788	Teleostei	*Merluccius merluccius*	50	3
Celtic Seas	27.7.h	Pelagic trawls	276.43	SO	16.00	5.788	Teleostei	*Mola mola*	8	2
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Teleostei	*Conger conger*	530	79
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Elasmobranchii	*Dipturus batis*	1514	75
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Elasmobranchii	*Leucoraja fullonica*	141	21
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Elasmobranchii	*Leucoraja naevus*	235.5	37
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Elasmobranchii	*Raja clavata*	1	1
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Teleostei	*Scophthalmus maximus*	9	48
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Teleostei	*Scophthalmus rhombus*	7	29

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Elasmobranchii	*Torpedo marmorata*	7	6
Celtic Seas	27.7.h	Bottom Trawl	9691.28	SO	101.69	1.049	Teleostei	*Zeus faber*	662	96
Celtic Seas	27.7.h	Bottom Trawl	9691.28	VO	11.00	0.114	Teleostei	*Chelidonichthys lucerna*	5	3
Celtic Seas	27.7.h	Bottom Trawl	9691.28	VO	11.00	0.114	Teleostei	*Zeus faber*	3	2
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Elasmobranchii	*Dasyatis pastinaca*	2	2
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Elasmobranchii	*Dipturus intermedius*	1	1
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Mammals	*Halichoerus grypus*	12	10
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Elasmobranchii	*Hexanchus griseus*	6	3
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Elasmobranchii	*Leucoraja fullonica*	72	4
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Mammals	*Phocoena phocoena*	1	1
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Teleostei	*Polyprion americanus*	1	1
Celtic Seas	27.7.j.2	Nets	5660.08	SO	44.00	0.777	Teleostei	*Scophthalmus maximus*	11	6
Celtic Seas	27.7.j.2	Nets	5660.08	VO	212.00	3.746	Elasmobranchii	*Dasyatis pastinaca*	21	12
Celtic Seas	27.7.j.2	Nets	5660.08	VO	212.00	3.746	Elasmobranchii	*Dipturus intermedius*	61	33
Celtic Seas	27.7.j.2	Nets	5660.08	VO	212.00	3.746	Mammals	*Grampus griseus*	1	1
Celtic Seas	27.7.j.2	Nets	5660.08	VO	212.00	3.746	Mammals	*Halichoerus grypus*	125	92
Celtic Seas	27.7.j.2	Nets	5660.08	VO	212.00	3.746	Teleostei	*Scophthalmus maximus*	192	95

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.j.2	Nets	5660.08	VO	212.00	3.746	Elasmobranchii	*Squatina squatina*	14	7
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Teleostei	*Brama brama*	22	6
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Holocephali	*Chimaera monstrosa*	11	1
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Mammals	*Delphinus delphis*	2	1
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Elasmobranchii	*Lamna nasus*	2	1
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Teleostei	*Merluccius merluccius*	1082	26
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Teleostei	*Mola mola*	41	12
Celtic Seas	27.7.j.2	Pelagic trawls	1798.32	SO	66.67	3.707	Teleostei	*Zeus faber*	5	1
Celtic Seas	27.7.j.2	Seines	780.25	SO	0.80	0.103	Teleostei	*Chelidonichthys lucerna*	73	10
Celtic Seas	27.7.j.2	Seines	780.25	SO	0.80	0.103	Teleostei	*Scophthalmus rhombus*	1	1
Celtic Seas	27.7.j.2	Seines	780.25	SO	0.80	0.103	Teleostei	*Zeus faber*	41	6
Celtic Seas	27.7.j.2	Seines	780.25	VO	29.53	3.785	Teleostei	*Chelidonichthys lucerna*	7	6
Celtic Seas	27.7.j.2	Seines	780.25	VO	29.53	3.785	Teleostei	*Helicolenus dactylopterus*	2	1
Celtic Seas	27.7.j.2	Seines	780.25	VO	29.53	3.785	Elasmobranchii	*Tetronarce nobiliana*	2	2
Celtic Seas	27.7.j.2	Seines	780.25	VO	29.53	3.785	Teleostei	*Zeus faber*	1	1
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	SO	24.00	0.226	Elasmobranchii	*Centrophorus granulosus*	108	2
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	SO	24.00	0.226	Teleostei	*Conger conger*	474	34

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	SO	24.00	0.226	Elasmobranchii	*Dipturus batis*	412	10
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	SO	24.00	0.226	Elasmobranchii	*Leucoraja fullonica*	8	3
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	SO	24.00	0.226	Teleostei	*Scophthalmus maximus*	2	2
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	SO	24.00	0.226	Teleostei	*Zeus faber*	378	44
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	VO	3.00	0.028	Teleostei	*Chelidonichthys lucerna*	2	2
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	VO	3.00	0.028	Teleostei	*Helicolenus dactylopterus*	1	1
Celtic Seas	27.7.j.2	Bottom Trawl	10626.55	VO	3.00	0.028	Teleostei	*Zeus faber*	1	1
Celtic Seas	27.7.k.2	Bottom Trawl	4996.35	VO	60.27	1.206	Holocephali	*Chimaera monstrosa*	51	13
Celtic Seas	27.7.k.2	Bottom Trawl	4996.35	VO	60.27	1.206	Teleostei	*Conger conger*	3	3
Celtic Seas	27.7.k.2	Bottom Trawl	4996.35	VO	60.27	1.206	Elasmobranchii	*Etmopterus princeps*	1	1
Celtic Seas	27.7.k.2	Bottom Trawl	4996.35	VO	60.27	1.206	Elasmobranchii	*Etmopterus spinax*	7	6
Celtic Seas	27.7.k.2	Bottom Trawl	4996.35	VO	60.27	1.206	Teleostei	*Helicolenus dactylopterus*	958	42
Celtic Seas	27.7.k.2	Bottom Trawl	4996.35	VO	60.27	1.206	Elasmobranchii	*Hexanchus griseus*	1	1
Greater North Sea	27.3.a.20	Traps	11322.00	SO	7.50	0.066	Teleostei	*Anarhichas lupus*	10	6
Greater North Sea	27.3.a.20	Traps	11322.00	SO	7.50	0.066	Teleostei	*Labrus bergylta*	1	1
Greater North Sea	27.3.a.20	Traps	11322.00	SO	7.50	0.066	Teleostei	*Sebastes viviparus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Birds	*Aves*	2	2
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Elasmobranchii	*Elasmobranchii*	83	32
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Elasmobranchii	*Galeorhinus galeus*	1	1
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Elasmobranchii	*Mustelus*	1	1
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Mammals	*Phoca vitulina*	16	9
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Mammals	*Phocoena phocoena*	11	10
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Mammals	*Pinnipedia*	4	4
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Elasmobranchii	*Raja clavata*	7	6
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Elasmobranchii	*Scyliorhinus canicula*	2	1
Greater North Sea	27.3.a.20	Nets	6681.50	EM	177.00	2.649	Birds	*Uria aalge*	2	2
Greater North Sea	27.3.a.20	Nets	6681.50	VO	573.30	8.580	Mammals	*Phoca vitulina*	5	4
Greater North Sea	27.3.a.20	Nets	6681.50	VO	573.30	8.580	Mammals	*Phocoena phocoena*	6	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.3.a.20	Seines	2200.69	SO	11.00	0.500	Petromyzonti	*Petromyzon marinus*	1	1
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Alosa fallax*	1	1
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Anarhichas lupus*	4	3
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Chelidonichthys lucerna*	4	3
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Holocephali	*Chimaera monstrosa*	1247	47
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Cyclopterus lumpus*	269	29
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Elasmobranchii	*Etmopterus spinax*	404	31
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Elasmobranchii	*Galeus melastomus*	5	4
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Helicolenus dactylopterus*	30	12
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Hippoglossus hippoglossus*	11	6
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Lophius piscatorius*	4	1
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Merluccius merluccius*	32	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Pollachius virens*	78	1
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Elasmobranchii	*Rajella lintea*	1	2
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Sebastes viviparus*	14	7
Greater North Sea	27.3.a.20	Bottom Trawl	24361.08	SO	116.50	0.478	Teleostei	*Zeus faber*	5	4
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Alca torda*	4	3
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Aves*	1	1
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Elasmobranchii	*Elasmobranchii*	18	1
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Gavia arctica*	2	2
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Gaviidae*	2	2
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Melanitta fusca*	9	5
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Melanitta nigra*	3	2
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Phalacrocorax carbo*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Mammals	*Phoca vitulina*	3	3
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Mammals	*Phocidae*	1	1
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Mammals	*Phocoena phocoena*	1	1
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Somateria mollissima*	23	14
Greater North Sea	27.3.a.21	Nets	3806.00	EM	50.00	1.314	Birds	*Uria aalge*	13	13
Greater North Sea	27.3.a.21	Bottom Trawl	13732.06	SO	71.50	0.521	Teleostei	*Anarhichas lupus*	3	3
Greater North Sea	27.3.a.21	Bottom Trawl	13732.06	SO	71.50	0.521	Teleostei	*Chelidonichthys lucerna*	327	15
Greater North Sea	27.3.a.21	Bottom Trawl	13732.06	SO	71.50	0.521	Teleostei	*Cyclopterus lumpus*	5	4
Greater North Sea	27.4.a	Nets	5176.75	VO	284.20	5.490	Mammals	*Phocoena phocoena*	1	1
Greater North Sea	27.4.a	Longlines	6062.51	SO	22.00	0.363	Holocephali	*Chimaera monstrosa*	41	6
Greater North Sea	27.4.a	Longlines	6062.51	SO	22.00	0.363	Birds	*Fulmarus glacialis*	77	30
Greater North Sea	27.4.a	Longlines	6062.51	SO	22.00	0.363	Birds	*Morus bassanus*	4	4

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.a	Pelagic trawls	3013.52	SO	108.00	3.584	Teleostei	*Cyclopterus lumpus*	105	35
Greater North Sea	27.4.a	Pelagic trawls	3013.52	SO	108.00	3.584	Teleostei	*Helicolenus dactylopterus*	1	1
Greater North Sea	27.4.a	Pelagic trawls	3013.52	SO	108.00	3.584	Teleostei	*Hippoglossus hippoglossus*	1	1
Greater North Sea	27.4.a	Pelagic trawls	3013.52	SO	108.00	3.584	Teleostei	*Merlangius merlangus*	3575	28
Greater North Sea	27.4.a	Pelagic trawls	3013.52	SO	108.00	3.584	Teleostei	*Merluccius merluccius*	4	2
Greater North Sea	27.4.a	Pelagic trawls	3013.52	SO	108.00	3.584	Teleostei	*Pollachius virens*	190	18
Greater North Sea	27.4.a	Seines	3189.59	SO	22.00	0.690	Elasmobranchii	*Amblyraja radiata*	16	2
Greater North Sea	27.4.a	Seines	3189.59	SO	22.00	0.690	Elasmobranchii	*Galeus melastomus*	1	1
Greater North Sea	27.4.a	Seines	3189.59	SO	22.00	0.690	Elasmobranchii	*Lamna nasus*	1	1
Greater North Sea	27.4.a	Seines	3189.59	SO	22.00	0.690	Teleostei	*Sebastes norvegicus*	3	1
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Amblyraja radiata*	1599	41
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Anarhichas lupus*	83	23

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Brama brama*	2	1
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Holocephali	*Chimaera monstrosa*	1493	18
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Cyclopterus lumpus*	18	7
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Dipturus batis*	2	2
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Dipturus intermedius*	111	2
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Etmopterus spinax*	1987	23
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Galeorhinus galeus*	1	1
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Galeus melastomus*	224	13
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Helicolenus dactylopterus*	105	16
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Hippoglossus hippoglossus*	17	12
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Lepidorhombus whiffiagonis*	191	25
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Leucoraja naevus*	3	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Lophius piscatorius*	229	53
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Merlangius merlangus*	1965	44
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Merluccius merluccius*	1726	61
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Pollachius pollachius*	3839	43
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Pollachius virens*	152047	74
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Raja clavata*	3	2
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Rajella fyllae*	1	1
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Scophthalmus maximus*	5	2
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Scyliorhinus canicula*	4	4
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Elasmobranchii	*Scyliorhinus stellaris*	35	6
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Sebastes norvegicus*	9	4
Greater North Sea	27.4.a	Bottom Trawl	33778.17	SO	527.64	1.562	Teleostei	*Sebastes viviparus*	44	6

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Birds	*Alcidae*	2	1
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Birds	*Aves*	1	1
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Elasmobranchii	*Elasmobranchii*	317	36
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Mammals	*Halichoerus grypus*	5	4
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Birds	*Morus bassanus*	14	13
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Mammals	*Phoca vitulina*	2	2
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Mammals	*Phocoena phocoena*	328	90
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Mammals	*Pinnipedia*	11	10
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Birds	*Puffinus griseus*	1	1
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Elasmobranchii	*Squalus acanthias*	1	1
Greater North Sea	27.4.b	Nets	8071.76	EM	130.00	1.611	Birds	*Uria aalge*	2	1
Greater North Sea	27.4.b	Pelagic trawls	2139.47	SO	2.00	0.093	Teleostei	*Merlangius merlangus*	12085	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.b	Bottom Trawl	57875.05	OTH	117.00	0.202	Teleostei	*Anarhichas lupus*	30	1
Greater North Sea	27.4.b	Bottom Trawl	57875.05	OTH	117.00	0.202	Teleostei	*Chelidonichthys lucerna*	1962	38
Greater North Sea	27.4.b	Bottom Trawl	57875.05	OTH	117.00	0.202	Teleostei	*Cyclopterus lumpus*	1	1
Greater North Sea	27.4.b	Bottom Trawl	57875.05	OTH	117.00	0.202	Teleostei	*Pomatoschistus minutus*	41	3
Greater North Sea	27.4.b	Bottom Trawl	57875.05	OTH	117.00	0.202	Teleostei	*Zeus faber*	5	1
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Alosa fallax*	39	1
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Elasmobranchii	*Amblyraja radiata*	95	4
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Anarhichas lupus*	28	72
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Elasmobranchii	*Bathyraja brachyurops*	3	3
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Chelidonichthys lucerna*	823	13
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Cyclopterus lumpus*	2	2
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Helicolenus dactylopterus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Hippocampus hippocampus*	1	1
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Hippoglossus hippoglossus*	27	10
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Petromyzonti	*Lampetra fluviatilis*	1	1
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Elasmobranchii	*Leucoraja naevus*	42	20
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Lophius piscatorius*	9	6
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Merlangius merlangus*	18780	56
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Merluccius merluccius*	135	10
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Pollachius pollachius*	191	8
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Pollachius virens*	2597	11
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Elasmobranchii	*Raja clavata*	46	20
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Scophthalmus maximus*	140.7	57
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Scophthalmus rhombus*	50.5	29

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Elasmobranchii	*Scyliorhinus canicula*	340	10
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Sebastes norvegicus*	0	8
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Sebastes viviparus*	10	9
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Zeus faber*	3	4
Greater North Sea	27.4.b	Bottom Trawl	57875.05	SO	177.30	0.306	Teleostei	*Zoarces viviparus*	221	14
Greater North Sea	27.4.c	Traps	6323.00	SO	2.00	0.032	Teleostei	*Zoarces viviparus*	1	1
Greater North Sea	27.4.c	Nets	2609.24	SO	7.00	0.268	Teleostei	*Chelidonichthys lucerna*	2	2
Greater North Sea	27.4.c	Nets	2609.24	SO	7.00	0.268	Elasmobranchii	*Raja clavata*	30	1
Greater North Sea	27.4.c	Pelagic trawls	592.27	SO	11.89	2.007	Teleostei	*Chelidonichthys lucerna*	1	1
Greater North Sea	27.4.c	Pelagic trawls	592.27	SO	11.89	2.007	Teleostei	*Merlangius merlangus*	190	10
Greater North Sea	27.4.c	Bottom Trawl	27789.44	OTH	109.00	0.392	Teleostei	*Anarhichas lupus*	12	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	OTH	109.00	0.392	Teleostei	*Chelidonichthys lucerna*	8203	83

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.c	Bottom Trawl	27789.44	OTH	109.00	0.392	Teleostei	*Hippocampus hippocampus*	53	2
Greater North Sea	27.4.c	Bottom Trawl	27789.44	OTH	109.00	0.392	Teleostei	*Pomatoschistus minutus*	174	6
Greater North Sea	27.4.c	Bottom Trawl	27789.44	OTH	109.00	0.392	Teleostei	*Zeus faber*	13	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Chelidonichthys lucerna*	3453	40
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Conger conger*	1	2
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Cyclopterus lumpus*	2	2
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Mammals	*Halichoerus grypus*	1	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Hippocampus hippocampus*	25	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Merlangius merlangus*	1360	3
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Birds	*Morus bassanus*	3	2
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Mammals	*Phoca vitulina*	1	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Pomatoschistus minutus*	18	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Elasmobranchii	*Raja microocellata*	4	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Elasmobranchii	*Rajella fyllae*	10	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Scophthalmus maximus*	8	3
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Scophthalmus rhombus*	1	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Elasmobranchii	*Scyliorhinus canicula*	9	1
Greater North Sea	27.4.c	Bottom Trawl	27789.44	SO	47.71	0.172	Teleostei	*Zeus faber*	17	1
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Teleostei	*Alosa*	3	3
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Teleostei	*Alosa fallax*	2	2
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Elasmobranchii	*Bathyraja brachyurops*	1	1
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Teleostei	*Chelidonichthys lucerna*	4	3
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Elasmobranchii	*Dipturus*	3	2
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Elasmobranchii	*Dipturus batis*	3	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Teleostei	*Labrus bergylta*	133	21
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Mammals	*Phoca vitulina*	1	1
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Elasmobranchii	*Raja clavata*	218	51
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Elasmobranchii	*Raja microocellata*	16	5
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Elasmobranchii	*Raja undulata*	14	12
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Teleostei	*Scophthalmus maximus*	28	22
Greater North Sea	27.7.d	Nets	12372.14	SO	80.00	0.647	Teleostei	*Scophthalmus rhombus*	30	20
Greater North Sea	27.7.d	Pelagic trawls	3097.82	SO	29.89	0.965	Teleostei	*Chelidonichthys lucerna*	3	2
Greater North Sea	27.7.d	Pelagic trawls	3097.82	SO	29.89	0.965	Teleostei	*Zeus faber*	14	4
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Bathyraja brachyurops*	21	10
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Conger conger*	6	48
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Dasyatis pastinaca*	3	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Labrus bergylta*	1	1
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Raja clavata*	191	27
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Raja microocellata*	22	15
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Raja undulata*	30	80
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Scophthalmus maximus*	4	3
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Scophthalmus rhombus*	4	4
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Scyliorhinus stellaris*	3	11
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Sparus aurata*	147	5
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Spondyliosoma cantharus*	3	1
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Elasmobranchii	*Torpedo marmorata*	1	1
Greater North Sea	27.7.d	Bottom Trawl	21687.05	SO	148.45	0.685	Teleostei	*Zeus faber*	23	59
Greater North Sea	27.7.e	Dredges	27123.83	SO	2.74	0.010	Elasmobranchii	*Raja clavata*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.7.e	Dredges	27123.83	SO	2.74	0.010	Teleostei	*Zeus faber*	1	1
Greater North Sea	27.7.e	Nets	18551.11	EM			Mammals	*Delphinus delphis*	2	2
Greater North Sea	27.7.e	Nets	18551.11	EM			Mammals	*Halichoerus grypus*	7	6
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Birds	*Alcidae*	1	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Bathyraja brachyurops*	14	8
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Teleostei	*Conger conger*	1	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Dasyatis pastinaca*	2	2
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Mammals	*Delphinus delphis*	1	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Birds	*Gavia immer*	2	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Birds	*Gavia stellata*	1	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Mammals	*Halichoerus grypus*	5	5
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Leucoraja fullonica*	4	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Leucoraja naevus*	32	3
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Birds	*Phalacrocorax aristotelis*	1	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Birds	*Phalacrocorax carbo*	1	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Raja clavata*	83	21
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Raja microocellata*	11	4
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Raja undulata*	15	14
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Teleostei	*Scophthalmus maximus*	44	23
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Teleostei	*Scophthalmus rhombus*	15	11
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Elasmobranchii	*Scyliorhinus stellaris*	4	1
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Birds	*Uria aalge*	2	2
Greater North Sea	27.7.e	Nets	18551.11	SO	108.85	0.587	Teleostei	*Zeus faber*	6	2
Greater North Sea	27.7.e	Surrounding nets	3040.58	SO	18.50	0.608	Birds	*Larus argentatus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Alosa alosa*	6	4
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Bathyraja brachyurops*	835.39	188
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Holocephali	*Chimaera monstrosa*	1	1
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Conger conger*	403.5	180
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Dasyatis pastinaca*	7	5
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Mammals	*Delphinus delphis*	4	2
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Dipturus batis*	20	8
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Labrus bergylta*	8	7
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Leucoraja fullonica*	4	3
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Leucoraja naevus*	342.105	84
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Raja clavata*	610	115
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Raja microocellata*	441	94

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Raja undulata*	221	118
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Scophthalmus maximus*	455.27	239
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Scophthalmus rhombus*	947.76	310
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Scyliorhinus stellaris*	72	38
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Sparus aurata*	1	1
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Torpedo marmorata*	5	4
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Elasmobranchii	*Torpedo torpedo*	1	1
Greater North Sea	27.7.e	Bottom Trawl	29648.39	SO	262.61	0.886	Teleostei	*Zeus faber*	1107	271
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Alepocephalus bairdii*	34	21
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Elasmobranchii	*Amblyraja hyperborea*	8	2
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Elasmobranchii	*Amblyraja radiata*	51	19
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Anarhichas denticulatus*	576	83

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Anarhichas lupus*	107	16
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Anarhichas minor*	434	19
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Elasmobranchii	*Centroscyllium fabricii*	502	54
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Elasmobranchii	*Centroscymnus coelolepis*	4	4
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Holocephali	*Chimaera monstrosa*	1	1
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Cyclopterus lumpus*	1	1
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Hippoglossus hippoglossus*	18	16
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Lycodes esmarkii*	1	1
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Pollachius virens*	383	21
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Elasmobranchii	*Rajella fyllae*	38	21
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Holocephali	*Rhinochimaera atlantica*	21	14
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Sebastes mentella*	9339	66

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Sebastes norvegicus*	22522	41
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Sebastes viviparus*	11	8
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Elasmobranchii	*Somniosus microcephalus*	16	14
Greenland Sea	27.14.b.2	Bottom Trawl	627.00	SO	51.00	8.134	Teleostei	*Synaphobranchus kaupii*	19	12
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Alca torda*	3	3
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Elasmobranchii	*Centroscyllium fabricii*	1	1
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Cepphus grylle*	6	6
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Holocephali	*Chimaera monstrosa*	390	100
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Elasmobranchii	*Dipturus batis*	17	15
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Elasmobranchii	*Etmopterus spinax*	9	6
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Fulmarus glacialis*	2	2
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Teleostei	*Lycodes esmarkii*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Morus bassanus*	1	1
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Phalacrocorax carbo*	3	2
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Mammals	*Phoca vitulina*	9	8
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Mammals	*Phocoena phocoena*	31	26
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Teleostei	*Pollachius pollachius*	9	7
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Somateria mollissima*	43	10
Icelandic Waters	27.5.a	Nets	1974.00	SO	113.00	5.724	Birds	*Uria aalge*	17	12
Icelandic Waters	27.5.a	Longlines	4130.00	SO	34.00	0.823	Birds	*Fulmarus glacialis*	7	2
Icelandic Waters	27.5.a	Seines	1286.00	SO	22.00	1.711	Elasmobranchii	*Dipturus batis*	1	1
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Amblyraja hyperborea*	45	24
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Teleostei	*Anarhichas denticulatus*	144	81
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Apristurus aphyodes*	38	17

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Apristurus laurussonii*	20	8
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Centroscyllium fabricii*	730	67
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Centroselachus crepidater*	182	29
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Holocephali	*Chimaera monstrosa*	1424	89
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Deania calceus*	16	7
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Dipturus batis*	72	29
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Etmopterus princeps*	282	51
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Etmopterus spinax*	855	44
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Galeus murinus*	124	30
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Teleostei	*Helicolenus dactylopterus*	3126	53
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Holocephali	*Hydrolagus mirabilis*	5	3
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Teleostei	*Lycodes esmarkii*	633	114

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Rajella bathyphila*	1	1
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Rajella fyllae*	1631	113
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Rajella lintea*	15	12
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Holocephali	*Rhinochimaera atlantica*	53	18
Icelandic Waters	27.5.a	Bottom Trawl	6408.00	SO	327.00	5.103	Elasmobranchii	*Somniosus microcephalus*	1	1
Ionian Sea and the Central Mediterranean Sea	16	Nets	49947.00	PO	80.00	0.160	Elasmobranchii	*Oxynotus centrina*	2	1
Ionian Sea and the Central Mediterranean Sea	16	Nets	49947.00	PO	80.00	0.160	Elasmobranchii	*Raja polystigma*	1	1
Ionian Sea and the Central Mediterranean Sea	16	Nets	49947.00	PO	80.00	0.160	Elasmobranchii	*Raja radula*	1	1
Ionian Sea and the Central	16	Bottom Trawl	24018.00	PO	60.00	0.250	Elasmobranchii	*Bathyraja brachyurops*	3	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Mediterranean Sea										
Ionian Sea and the Central Mediterranean Sea	16	Bottom Trawl	24018.00	PO	60.00	0.250	Elasmobranchii	*Isurus oxyrinchus*	9	1
Ionian Sea and the Central Mediterranean Sea	16	Bottom Trawl	24018.00	PO	60.00	0.250	Elasmobranchii	*Raja montagui*	1	1
Ionian Sea and the Central Mediterranean Sea	16	Bottom Trawl	24018.00	PO	60.00	0.250	Elasmobranchii	*Rostroraja alba*	1	1
Ionian Sea and the Central Mediterranean Sea	19	Nets	79711.00	SO	8.00	0.010	Reptile	*Caretta caretta*	1	1
Ionian Sea and the Central Mediterranean Sea	19	Nets	79711.00	SO	8.00	0.010	Elasmobranchii	*Dasyatis pastinaca*	12	1
Ionian Sea and the Central	19	Nets	79711.00	SO	8.00	0.010	Elasmobranchii	*Raja radula*	5	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Mediterranean Sea										
Ionian Sea and the Central Mediterranean Sea	19	Nets	79711.00	VO	69.00	0.087	Elasmobranchii	*Raja radula*	10	3
Ionian Sea and the Central Mediterranean Sea	19	Bottom Trawl	31480.00	SO	9.00	0.029	Elasmobranchii	*Dasyatis pastinaca*	2	1
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Elasmobranchii	*Aetomylaeus bovinus*	1	1
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Teleostei	*Alosa fallax*	6	5
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Elasmobranchii	*Dasyatis pastinaca*	9	6
Ionian Sea and the Central	20	Nets	224210.00	SO	152.00	0.068	Teleostei	*Epinephelus marginatus*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Mediterranean Sea										
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Elasmobranchii	*Mustelus mustelus*	12	8
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Elasmobranchii	*Raja asterias*	1	1
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Elasmobranchii	*Raja clavata*	5	3
Ionian Sea and the Central Mediterranean Sea	20	Nets	224210.00	SO	152.00	0.068	Teleostei	*Sciaena umbra*	81	27
Ionian Sea and the Central Mediterranean Sea	20	Longlines	139586.00	SO	41.00	0.029	Teleostei	*Epinephelus marginatus*	18	5
Ionian Sea and the Central	20	Longlines	139586.00	SO	41.00	0.029	Elasmobranchii	*Raja asterias*	80	3

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Mediterranean Sea										
Ionian Sea and the Central Mediterranean Sea	20	Longlines	139586.00	SO	41.00	0.029	Teleostei	*Sciaena umbra*	3	2
Ionian Sea and the Central Mediterranean Sea	20	Longlines	139586.00	SO	41.00	0.029	Elasmobranchii	*Squalus blainville*	4	1
Ionian Sea and the Central Mediterranean Sea	20	Longlines	139586.00	SO	41.00	0.029	Teleostei	*Xiphias gladius*	2	2
Ionian Sea and the Central Mediterranean Sea	20	Bottom Trawl	7046.00	SO	20.00	0.284	Elasmobranchii	*Aetomylaeus bovinus*	2	2
Ionian Sea and the Central Mediterranean Sea	20	Bottom Trawl	7046.00	SO	20.00	0.284	Teleostei	*Alosa fallax*	48	4
Ionian Sea and the Central	20	Bottom Trawl	7046.00	SO	20.00	0.284	Elasmobranchii	*Mustelus mustelus*	10	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Mediterranean Sea										
Ionian Sea and the Central Mediterranean Sea	20	Bottom Trawl	7046.00	SO	20.00	0.284	Elasmobranchii	*Raja asterias*	73	8
Ionian Sea and the Central Mediterranean Sea	20	Bottom Trawl	7046.00	SO	20.00	0.284	Elasmobranchii	*Raja clavata*	58	9
Ionian Sea and the Central Mediterranean Sea	20	Bottom Trawl	7046.00	SO	20.00	0.284	Teleostei	*Sciaena umbra*	9	1
Ionian Sea and the Central Mediterranean Sea	20	Bottom Trawl	7046.00	SO	20.00	0.284	Elasmobranchii	*Squalus blainville*	8	1
North West Atlantic	21.3.N	Bottom Trawl	307.00	SO	66.00	21.498	Mammals	*Phoca vitulina*	2	3
North West Atlantic	21.3.N	Bottom Trawl	307.00	SO	66.00	21.498	Mammals	*Phocidae*	2	2
North West Atlantic	21.3.O	Bottom Trawl	273.00	SO	34.00	12.454	Mammals	*Phocidae*	2	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Norwegian Sea	27.2.a.2	Nets	49834.37	VO	1452.20	2.914	Mammals	*Phoca vitulina*	14	12
Norwegian Sea	27.2.a.2	Nets	49834.37	VO	1452.20	2.914	Mammals	*Phocoena phocoena*	119	46
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Elasmobranchii	*Amblyraja radiata*	354	49
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Anarhichas denticulatus*	33	19
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Anarhichas lupus*	150	37
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Anarhichas minor*	72	28
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Holocephali	*Chimaera monstrosa*	1	2
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Cyclopterus lumpus*	28	17
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Elasmobranchii	*Dipturus batis*	19	19
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Hippoglossus hippoglossus*	206	50
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Lepidorhombus whiffiagonis*	54	15
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Lophius piscatorius*	22	15

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Merlangius merlangus*	18	2
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Pollachius pollachius*	1	1
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Pollachius virens*	74351	63
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Elasmobranchii	*Rajella fyllae*	42	24
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Sebastes mentella*	541961	40
Norwegian Sea	27.2.a.2	Bottom Trawl	287.54	SO	65.80	22.885	Teleostei	*Sebastes norvegicus*	9053	70
Oceanic Northeast Atlantic	27.10.a.1	Longlines	2865.00	SO	2.00	0.070	Reptile	*Caretta caretta*	1	1
Oceanic Northeast Atlantic	27.10.a.1	Longlines	2865.00	SO	2.00	0.070	Elasmobranchii	*Isurus oxyrinchus*	1	1
Oceanic Northeast Atlantic	27.9.b.1	Longlines	363.00	SO	6.00	1.653	Reptile	*Caretta caretta*	1	1
Oceanic Northeast Atlantic	27.9.b.1	Longlines	363.00	SO	6.00	1.653	Elasmobranchii	*Isurus oxyrinchus*	4	4

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Western Mediterranean Sea	10	Nets	142632.00	PO	20.00	0.014	Elasmobranchii	*Raja radula*	2	2
Western Mediterranean Sea	11.2	Nets	46596.00	VO	401.00	0.861	Elasmobranchii	*Oxynotus centrina*	4	1
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	SO	14.00	0.113	Elasmobranchii	*Raja polystigma*	17	2
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Elasmobranchii	*Aetomylaeus bovinus*	1	1
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Reptile	*Caretta caretta*	4	4
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Elasmobranchii	*Dasyatis pastinaca*	25	10
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Birds	*Ichthyaetus melanocephalus*	1	1
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Elasmobranchii	*Oxynotus centrina*	6	5
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Birds	*Puffinus yelkouan*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Western Mediterranean Sea	11.2	Bottom Trawl	12344.00	VO	1042.00	8.441	Mammals	*Tursiops truncatus*	1	1
Western Mediterranean Sea	5	Nets	15040.00	SO	6.00	0.040	Elasmobranchii	*Gymnura altavela*	1	1
Western Mediterranean Sea	5	Longlines	3568.96	SO	141.00	3.951	Birds	*Calonectris diomedea*	66	12
Western Mediterranean Sea	5	Longlines	3568.96	SO	141.00	3.951	Reptile	*Caretta caretta*	30	12
Western Mediterranean Sea	5	Longlines	3568.96	SO	141.00	3.951	Mammals	*Globicephala melas*	1	1
Western Mediterranean Sea	5	Longlines	3568.96	SO	141.00	3.951	Mammals	*Grampus griseus*	1	1
Western Mediterranean Sea	5	Longlines	3568.96	SO	141.00	3.951	Birds	*Larus michahellis*	23	10
Western Mediterranean Sea	5	Longlines	3568.96	SO	141.00	3.951	Birds	*Puffinus mauretanicus*	10	4
Western Mediterranean Sea	5	Bottom Trawl	7257.38	SO	97.00	1.337	Elasmobranchii	*Gymnura altavela*	1	1

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Western Mediterranean Sea	6	Longlines	8748.43	SO	178.00	2.035	Reptile	*Caretta caretta*	1	1
Western Mediterranean Sea	6	Longlines	8748.43	SO	178.00	2.035	Birds	*Larus michahellis*	1	1
Western Mediterranean Sea	6	Longlines	8748.43	SO	178.00	2.035	Mammals	*Stenella coeruleoalba*	1	1
Western Mediterranean Sea	9	Nets	50126.00	SO	118.00	0.235	Elasmobranchii	*Dasyatis pastinaca*	1	1
Western Mediterranean Sea	9	Nets	50126.00	VO	387.00	0.772	Elasmobranchii	*Dasyatis pastinaca*	6	2
Western Mediterranean Sea	9	Nets	50126.00	VO	387.00	0.772	Elasmobranchii	*Heptranchias perlo*	2	2
Western Mediterranean Sea	9	Nets	50126.00	VO	387.00	0.772	Elasmobranchii	*Oxynotus centrina*	4	4
Western Mediterranean Sea	9	Nets	50126.00	VO	387.00	0.772	Elasmobranchii	*Raja montagui*	8	2
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Aetomylaeus bovinus*	16	2

Ecoregion	ICES Area /GFCM GSA	Metier L3	Fishing Effort (das)	Monitoring Method	Total Observed Effort (das)	Monitoring Coverage (%)	Taxa	Species	No. Specimens	Incidents
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Reptile	*Caretta caretta*	1	1
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Centrophorus granulosus*	2	2
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Dasyatis pastinaca*	4	4
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Dipturus batis*	1	1
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Leucoraja circularis*	3	2
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Oxynotus centrina*	3	2
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Raja polystigma*	8	1
Western Mediterranean Sea	9	Bottom Trawl	31025.00	VO	646.00	2.082	Elasmobranchii	*Tetronarce nobiliana*	9	1

Annex 4: Modelling outcome for each combination of Ecoregion, Species and Metier level 4

Table B: Modelling outcome for each combination of Ecoregion, Species and Metier level 4 which had non-zero bycatch events over the past five years. Presented is the model retained through AIC model selection. In addition, test of heterogeneity is presented (here TRUE means either the test is significant, or the best model includes variance component). The number of replicates (BPUE estimates) is presented. Note Metier Level 5 never appears as a variance component but was tested (see main text in Section 3).

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Azores	*Bodianus scrofa*	GNS	constant	4	FALSE
Azores	*Bodianus scrofa*	LHM	constant	15	FALSE
Azores	*Calonectris borealis*	LHM	constant	15	FALSE
Azores	*Calonectris borealis*	LHP	constant	4	FALSE
Azores	*Caretta caretta*	GNS	constant	4	FALSE
Azores	*Caretta caretta*	LLD	constant	9	FALSE
Azores	*Centrophorus granulosus*	LLS	constant	11	TRUE
Azores	*Centroscymnus crepidater*	LLS	constant	11	FALSE
Azores	*Conger conger*	FPO	constant	7	FALSE
Azores	*Conger conger*	LHM	constant	15	FALSE
Azores	*Conger conger*	LHP	constant	4	FALSE
Azores	*Conger conger*	LLS	(1 | Year)	11	TRUE
Azores	*Dasyatis pastinaca*	GNS	constant	4	FALSE
Azores	*Dasyatis pastinaca*	LHM	constant	15	FALSE
Azores	*Deania calcea*	LLS	constant	11	FALSE
Azores	*Delphinus delphis*	LHM	constant	15	FALSE
Azores	*Delphinus delphis*	LLD	constant	9	FALSE
Azores	*Dermochelys coriacea*	LLD	constant	9	FALSE
Azores	*Dipturus oxyrinchus*	LLS	(1 | Year)	11	FALSE
Azores	*Epigonus telescopus*	LLS	constant	11	TRUE

Ecoregion	Species	Metie rL4	variance components retained	repli-cates	heterogene-ity test
Azores	*Epinephelus marginatus*	GNS	constant	4	FALSE
Azores	*Etmopterus pusillus*	LLS	constant	11	TRUE
Azores	*Etmopterus spinax*	LLS	(1 | Year)	11	TRUE
Azores	*Helicolenus dactylopterus*	LHM	constant	15	FALSE
Azores	*Helicolenus dactylopterus*	LLS	(1 | Year)	11	TRUE
Azores	*Hexanchus griseus*	LHM	constant	15	FALSE
Azores	*Hexanchus griseus*	LLS	constant	11	FALSE
Azores	*Labrus bergylta*	GNS	constant	4	FALSE
Azores	*Labrus bergylta*	LHM	constant	15	FALSE
Azores	*Larus michahellis*	LHP	constant	4	FALSE
Azores	*Lepidopus caudatus*	LHM	(1 | Year) + (1 | SamplingProtocol)	15	TRUE
Azores	*Lepidopus caudatus*	LHP	constant	4	FALSE
Azores	*Lepidopus caudatus*	LLS	(1 | Year)	11	FALSE
Azores	*Lepidorhombus whiffiagonis*	LLS	constant	11	FALSE
Azores	*Leucoraja fullonica*	LLS	constant	11	FALSE
Azores	*Lophius piscatorius*	LLS	constant	11	FALSE
Azores	*Molva macrophthalma*	LLS	constant	11	FALSE
Azores	*Mora moro*	LLS	(1 | Year)	11	TRUE
Azores	*Mycteroperca fusca*	GNS	constant	4	FALSE
Azores	*Myliobatis aquila*	GNS	constant	4	FALSE
Azores	*Pagellus bogaraveo*	LHM	constant	15	FALSE
Azores	*Pagellus bogaraveo*	LLS	constant	11	FALSE
Azores	*Pagellus bogaraveo*	PS	constant	6	FALSE
Azores	*Pomatomus saltatrix*	GNS	constant	4	FALSE
Azores	*Pomatomus saltatrix*	LHM	constant	15	FALSE
Azores	*Puffinus gravis*	LHM	constant	15	FALSE
Azores	*Scorpaena scrofa*	LHM	constant	15	FALSE

Ecoregion	Species	Metier L4	variance components retained	replicates	heterogeneity test
Azores	*Sphyrna zygaena*	GNS	constant	4	FALSE
Azores	*Sphyrna zygaena*	LHM	constant	15	FALSE
Azores	*Sphyrna zygaena*	LLD	constant	9	FALSE
Azores	*Zeus faber*	LLS	constant	11	FALSE
Baltic Sea	*Acipenser oxyrinchus*	GNS	constant	56	FALSE
Baltic Sea	*Alca torda*	GNS	constant	56	FALSE
Baltic Sea	*Alca torda*	GTR	constant	14	FALSE
Baltic Sea	*Alosa fallax*	FPO	constant	13	FALSE
Baltic Sea	*Alosa fallax*	GNS	constant	56	FALSE
Baltic Sea	*Alosa fallax*	OTB	constant	29	FALSE
Baltic Sea	*Alosa fallax*	OTM	constant	17	FALSE
Baltic Sea	*Aythya fuligula*	GTR	constant	14	FALSE
Baltic Sea	*Aythya marila*	GTR	constant	14	FALSE
Baltic Sea	*Cepphus grylle*	GNS	constant	56	FALSE
Baltic Sea	*Clangula hyemalis*	GNS	constant	56	FALSE
Baltic Sea	*Cyclopterus lumpus*	FPO	constant	13	FALSE
Baltic Sea	*Cyclopterus lumpus*	GNS	constant	56	TRUE
Baltic Sea	*Cyclopterus lumpus*	GTR	constant	14	FALSE
Baltic Sea	*Cyclopterus lumpus*	OTB	constant	29	FALSE
Baltic Sea	*Cyclopterus lumpus*	OTM	constant	17	FALSE
Baltic Sea	*Cyclopterus lumpus*	SDN	constant	4	FALSE
Baltic Sea	*Gavia arctica*	GNS	constant	56	FALSE
Baltic Sea	*Halichoerus grypus*	FPO	(1 | Country)	13	TRUE
Baltic Sea	*Halichoerus grypus*	GNS	constant	56	FALSE
Baltic Sea	*Halichoerus grypus*	OTM	constant	17	TRUE
Baltic Sea	*Lampetra fluviatilis*	OTM	constant	17	TRUE
Baltic Sea	*Larus argentatus*	GNS	constant	56	FALSE
Baltic Sea	*Larus marinus*	FYK	constant	7	FALSE
Baltic Sea	*Melanitta fusca*	GNS	(1 | Year)	56	TRUE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Baltic Sea	*Melanitta nigra*	GNS	constant	56	FALSE
Baltic Sea	*Mergus serrator*	GTR	constant	14	FALSE
Baltic Sea	*Merlangius merlangus*	GNS	constant	56	FALSE
Baltic Sea	*Merlangius merlangus*	GTR	constant	14	FALSE
Baltic Sea	*Merlangius merlangus*	OTB	constant	29	TRUE
Baltic Sea	*Merlangius merlangus*	SDN	constant	4	FALSE
Baltic Sea	*Phalacrocorax carbo*	FPN	constant	2	FALSE
Baltic Sea	*Phalacrocorax carbo*	GNS	(1 | Country)	56	TRUE
Baltic Sea	*Phalacrocorax carbo*	GTR	(1 | VesselLength_group)	14	TRUE
Baltic Sea	*Phoca vitulina*	GNS	constant	56	FALSE
Baltic Sea	*Phoca vitulina*	GTR	constant	14	FALSE
Baltic Sea	*Phocoena phocoena*	GNS	(1 | Country)	56	TRUE
Baltic Sea	*Phocoena phocoena*	GTR	constant	14	FALSE
Baltic Sea	*Podiceps cristatus*	GNS	constant	56	FALSE
Baltic Sea	*Podiceps grisegena*	GNS	constant	56	FALSE
Baltic Sea	*Pusa hispida*	FPO	constant	13	FALSE
Baltic Sea	*Raja clavata*	GTR	constant	14	FALSE
Baltic Sea	*Somateria mollissima*	FPN	constant	2	FALSE
Baltic Sea	*Somateria mollissima*	GNS	(1 | Country)	56	TRUE
Baltic Sea	*Somateria mollissima*	GTR	constant	14	FALSE
Baltic Sea	*Uria aalge*	GNS	(1 | Country)	56	TRUE
Baltic Sea	*Uria aalge*	GTR	constant	14	FALSE
Baltic Sea	*Uria aalge*	LLD	constant	6	FALSE
Barents Sea	*Amblyraja hyperborea*	OTB	constant	15	FALSE
Barents Sea	*Anarhichas denticulatus*	OTB	constant	15	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Barents Sea	*Anarhichas lupus*	OTB	constant	15	FALSE
Barents Sea	*Anarhichas minor*	OTB	constant	15	FALSE
Barents Sea	*Halichoerus grypus*	GNS	constant	3	FALSE
Barents Sea	*Lycodes esmarkii*	OTB	constant	15	FALSE
Barents Sea	*Phoca vitulina*	GNS	constant	3	FALSE
Barents Sea	*Phocoena phocoena*	GNS	constant	3	FALSE
Bay of Biscay and the Iberian Coast	*Alca torda*	GND	constant	5	FALSE
Bay of Biscay and the Iberian Coast	*Alca torda*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Alca torda*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Alosa alosa*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Alosa alosa*	OTB	constant	57	TRUE
Bay of Biscay and the Iberian Coast	*Alosa fallax*	GNS	(1 | Country) + (1 | SamplingProtocol)	62	TRUE
Bay of Biscay and the Iberian Coast	*Alosa fallax*	OTB	(1 | Country) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Alosa fallax*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Alosa fallax*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Argyrosomus regius*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Argyrosomus regius*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Argyrosomus regius*	OTB	constant	57	TRUE
Bay of Biscay and the Iberian Coast	*Brama brama*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Brama brama*	OTM	constant	7	FALSE
Bay of Biscay and the Iberian Coast	*Brama brama*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Caretta caretta*	GNS	constant	62	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Centrophorus granulosus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Centrophorus granulosus*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Chelidonichthys lucerna*	GNS	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	62	TRUE
Bay of Biscay and the Iberian Coast	*Chelidonichthys lucerna*	GTR	(1 | Country) + (1 | Year)	35	TRUE
Bay of Biscay and the Iberian Coast	*Chelidonichthys lucerna*	OTB	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Chelidonichthys lucerna*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Chimaera monstrosa*	GNS	(1 | Country) + (1 | VesselLength_group)	62	TRUE
Bay of Biscay and the Iberian Coast	*Chimaera monstrosa*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Chimaera monstrosa*	OTB	(1 | Country) + (1 | Year)	57	TRUE
Bay of Biscay and the Iberian Coast	*Chimaera monstrosa*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Conger conger*	GNS	(1 | Country)	62	TRUE
Bay of Biscay and the Iberian Coast	*Conger conger*	GTR	(1 | Country)	35	TRUE
Bay of Biscay and the Iberian Coast	*Conger conger*	LLS	(1 | Country) + (1 | SamplingProtocol)	20	TRUE
Bay of Biscay and the Iberian Coast	*Conger conger*	OTB	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Conger conger*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Conger conger*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Dasyatis pastinaca*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Dasyatis pastinaca*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Dasyatis pastinaca*	LLS	(1 | Country) + (1 | VesselLength_group)	20	TRUE
Bay of Biscay and the Iberian Coast	*Dasyatis pastinaca*	PS	constant	36	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	FPO	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	GNS	(1 | Year)	62	TRUE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	OTM	constant	7	FALSE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Delphinus delphis*	PTM	constant	25	TRUE
Bay of Biscay and the Iberian Coast	*Dentex dentex*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Dentex dentex*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Dentex dentex*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Dermochelys coriacea*	LLD	constant	9	FALSE
Bay of Biscay and the Iberian Coast	*Etmopterus pusillus*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Etmopterus spinax*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Etmopterus spinax*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Etmopterus spinax*	OTB	(1 | Country) + (1 | Year)	57	TRUE
Bay of Biscay and the Iberian Coast	*Etmopterus spinax*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Gavia immer*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Gavia stellata*	GNS	constant	62	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Gavia stellata*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Globicephala melas*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Halichoerus grypus*	GNS	(1 | MonitoringMethod)	62	TRUE
Bay of Biscay and the Iberian Coast	*Halichoerus grypus*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Helicolenus dactylopterus*	GNS	(1 | Country) + (1 | VesselLength_group)	62	TRUE
Bay of Biscay and the Iberian Coast	*Helicolenus dactylopterus*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Helicolenus dactylopterus*	OTB	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Helicolenus dactylopterus*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Hexanchus griseus*	GNS	(1 | Country)	62	TRUE
Bay of Biscay and the Iberian Coast	*Hexanchus griseus*	OTB	(1 | Country) + (1 | Year)	57	TRUE
Bay of Biscay and the Iberian Coast	*Hexanchus griseus*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Hippocampus hippocampus*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Hydrolagus mirabilis*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Labrus bergylta*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Labrus bergylta*	GTR	(1 | Country)	35	TRUE
Bay of Biscay and the Iberian Coast	*Larus argentatus*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Larus argentatus*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Larus fuscus*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Larus fuscus*	OTM	constant	7	FALSE
Bay of Biscay and the Iberian Coast	*Larus marinus*	GNS	constant	62	FALSE

Ecoregion	Species	Metier L4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Larus marinus*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Larus michahellis*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Larus michahellis*	GTR	(1 | MonitoringMethod)	35	TRUE
Bay of Biscay and the Iberian Coast	*Larus michahellis*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Lepidopus caudatus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Lepidopus caudatus*	OTB	constant	57	TRUE
Bay of Biscay and the Iberian Coast	*Lepidopus caudatus*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Lepidopus caudatus*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Melanitta nigra*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Mola mola*	GNS	(1 | Country) + (1 | Year) + (1 | MonitoringMethod)	62	TRUE
Bay of Biscay and the Iberian Coast	*Mola mola*	GTR	(1 | Country) + (1 | SamplingProtocol)	35	TRUE
Bay of Biscay and the Iberian Coast	*Mola mola*	LLD	constant	9	FALSE
Bay of Biscay and the Iberian Coast	*Mola mola*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Mola mola*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Mola mola*	OTM	constant	7	FALSE
Bay of Biscay and the Iberian Coast	*Mola mola*	PS	(1 | Country) + (1 | Year)	36	TRUE
Bay of Biscay and the Iberian Coast	*Mola mola*	PTB	constant	20	TRUE
Bay of Biscay and the Iberian Coast	*Molva macrophthalma*	GNS	constant	62	TRUE
Bay of Biscay and the Iberian Coast	*Molva macrophthalma*	OTB	(1 | Country)	57	TRUE
Bay of Biscay and the Iberian Coast	*Molva macrophthalma*	PTB	constant	20	TRUE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Mora moro*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	GTR	(1 | VesselLength_group)	35	TRUE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	LLD	constant	9	FALSE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	LTL	constant	8	FALSE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	OTB	(1 | Country)	57	TRUE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	OTM	constant	7	FALSE
Bay of Biscay and the Iberian Coast	*Morus bassanus*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Myliobatis aquila*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Phalacrocorax aristotelis*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Phalacrocorax carbo*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Phalacrocorax carbo*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Phocoena phocoena*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Phocoena phocoena*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Polyprion americanus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Polyprion americanus*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Pomatomus saltatrix*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Pomatomus saltatrix*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Puffinus gravis*	GTR	constant	35	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Puffinus mauretanicus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Puffinus mauretanicus*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Puffinus mauretanicus*	LLS	(1 | MonitoringMethod)	20	TRUE
Bay of Biscay and the Iberian Coast	*Puffinus mauretanicus*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Rissa tridactyla*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Rissa tridactyla*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Sciaena umbra*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Scophthalmus maximus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Scophthalmus maximus*	GTR	(1 | Country)	35	TRUE
Bay of Biscay and the Iberian Coast	*Scophthalmus maximus*	OTB	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Scophthalmus rhombus*	GTR	(1 | Country)	35	TRUE
Bay of Biscay and the Iberian Coast	*Scophthalmus rhombus*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Scorpaena scrofa*	GNS	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	62	TRUE
Bay of Biscay and the Iberian Coast	*Scorpaena scrofa*	GTR	(1 | Country) + (1 | SamplingProtocol)	35	TRUE
Bay of Biscay and the Iberian Coast	*Scorpaena scrofa*	OTB	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Scorpaena scrofa*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Scyliorhinus stellaris*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Scyliorhinus stellaris*	GTR	(1 | Country)	35	TRUE
Bay of Biscay and the Iberian Coast	*Scyliorhinus stellaris*	LLS	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Scyliorhinus stellaris*	OTB	constant	57	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Scyliorhinus stellaris*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Scymnodon ringens*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Scymnodon ringens*	LLS	(1 | Country) + (1 | VesselLength_group)	20	TRUE
Bay of Biscay and the Iberian Coast	*Scymnodon ringens*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Scymnodon ringens*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Somniosus microcephalus*	PTB	constant	20	FALSE
Bay of Biscay and the Iberian Coast	*Sparus aurata*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Sparus aurata*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Sparus aurata*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Sparus aurata*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Stenella coeruleoalba*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Synaphobranchus kaupii*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Torpedo marmorata*	GNS	(1 | Country) + (1 | Year) + (1 | VesselLength_group)	62	TRUE
Bay of Biscay and the Iberian Coast	*Torpedo marmorata*	GTR	(1 | Country) + (1 | SamplingProtocol)	35	TRUE
Bay of Biscay and the Iberian Coast	*Torpedo marmorata*	OTB	constant	57	TRUE
Bay of Biscay and the Iberian Coast	*Torpedo marmorata*	PS	constant	36	FALSE
Bay of Biscay and the Iberian Coast	*Torpedo marmorata*	TBB	constant	5	FALSE
Bay of Biscay and the Iberian Coast	*Torpedo torpedo*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Tursiops truncatus*	GNS	constant	62	FALSE
Bay of Biscay and the Iberian Coast	*Tursiops truncatus*	PTB	constant	20	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Bay of Biscay and the Iberian Coast	*Umbrina cirrosa*	GTR	constant	35	FALSE
Bay of Biscay and the Iberian Coast	*Umbrina cirrosa*	OTB	constant	57	FALSE
Bay of Biscay and the Iberian Coast	*Uria aalge*	GND	constant	5	FALSE
Bay of Biscay and the Iberian Coast	*Uria aalge*	GNS	(1 | Country) + (1 | VesselLength_group)	62	TRUE
Bay of Biscay and the Iberian Coast	*Uria aalge*	GTN	constant	4	FALSE
Bay of Biscay and the Iberian Coast	*Uria aalge*	GTR	(1 | Year)	35	TRUE
Bay of Biscay and the Iberian Coast	*Zeus faber*	GNS	(1 | Country) + (1 | SamplingProtocol)	62	TRUE
Bay of Biscay and the Iberian Coast	*Zeus faber*	GTR	(1 | Country) + (1 | SamplingProtocol)	35	TRUE
Bay of Biscay and the Iberian Coast	*Zeus faber*	OTB	(1 | Country) + (1 | Year) + (1 | SamplingProtocol)	57	TRUE
Bay of Biscay and the Iberian Coast	*Zeus faber*	PTB	constant	20	TRUE
Celtic Seas	*Alosa fallax*	OTB	constant	49	FALSE
Celtic Seas	*Alosa fallax*	OTM	constant	17	FALSE
Celtic Seas	*Alosa fallax*	SSC	constant	9	FALSE
Celtic Seas	*Amblyraja radiata*	OTB	constant	49	FALSE
Celtic Seas	*Amblyraja radiata*	OTT	constant	21	FALSE
Celtic Seas	*Anarhichas lupus*	OTB	constant	49	FALSE
Celtic Seas	*Brama brama*	OTM	constant	17	FALSE
Celtic Seas	*Centroscyllium fabricii*	OTM	constant	17	FALSE
Celtic Seas	*Centroscymnus crepidater*	OTM	(1 | Year)	17	TRUE
Celtic Seas	*Chelidonichthys lucerna*	OTB	(1 | Country) + (1 | Year)	49	TRUE
Celtic Seas	*Chelidonichthys lucerna*	OTM	constant	17	FALSE
Celtic Seas	*Chelidonichthys lucerna*	SSC	constant	9	TRUE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Celtic Seas	*Chelidonichthys lucerna*	TBB	constant	13	FALSE
Celtic Seas	*Chimaera monstrosa*	OTB	(1 | Country) + (1 | Year) + (1 | MonitoringMethod)	49	TRUE
Celtic Seas	*Chimaera monstrosa*	OTM	constant	17	FALSE
Celtic Seas	*Chlamydoselachus anguineus*	OTM	constant	17	FALSE
Celtic Seas	*Conger conger*	FPO	constant	3	FALSE
Celtic Seas	*Conger conger*	GNS	constant	45	FALSE
Celtic Seas	*Conger conger*	LLS	constant	4	FALSE
Celtic Seas	*Conger conger*	OTB	(1 | Country) + (1 | Year)	49	TRUE
Celtic Seas	*Conger conger*	OTM	constant	17	FALSE
Celtic Seas	*Conger conger*	TBB	constant	13	TRUE
Celtic Seas	*Cyclopterus lumpus*	OTB	constant	49	FALSE
Celtic Seas	*Cyclopterus lumpus*	OTM	(1 | SamplingProtocol)	17	TRUE
Celtic Seas	*Dasyatis pastinaca*	GTR	constant	26	FALSE
Celtic Seas	*Deania calcea*	OTM	constant	17	FALSE
Celtic Seas	*Delphinus delphis*	GNS	(1 | SamplingProtocol)	45	TRUE
Celtic Seas	*Delphinus delphis*	OTB	constant	49	FALSE
Celtic Seas	*Delphinus delphis*	OTT	constant	21	FALSE
Celtic Seas	*Delphinus delphis*	PTM	constant	18	FALSE
Celtic Seas	*Dipturus intermedius*	GNS	constant	45	FALSE
Celtic Seas	*Dipturus intermedius*	GTR	(1 | MonitoringMethod)	26	TRUE
Celtic Seas	*Dipturus intermedius*	OTB	constant	49	FALSE
Celtic Seas	*Dipturus nidarosiensis*	OTB	constant	49	FALSE
Celtic Seas	*Epigonus telescopus*	OTM	(1 | Year)	17	TRUE
Celtic Seas	*Etmopterus princeps*	OTB	constant	49	FALSE
Celtic Seas	*Etmopterus princeps*	OTM	constant	17	FALSE
Celtic Seas	*Etmopterus spinax*	OTB	(1 | Country) + (1 | Year)	49	TRUE
Celtic Seas	*Etmopterus spinax*	OTM	constant	17	FALSE
Celtic Seas	*Fulmarus glacialis*	GNS	constant	45	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Celtic Seas	*Fulmarus glacialis*	LLS	constant	4	TRUE
Celtic Seas	*Globicephala melas*	OTM	constant	17	FALSE
Celtic Seas	*Grampus griseus*	GTR	constant	26	FALSE
Celtic Seas	*Halichoerus grypus*	GNS	(1 | Country) + (1 | VesselLength_group)	45	TRUE
Celtic Seas	*Halichoerus grypus*	GTR	constant	26	FALSE
Celtic Seas	*Halichoerus grypus*	OTM	constant	17	FALSE
Celtic Seas	*Helicolenus dactylopterus*	LLS	constant	4	TRUE
Celtic Seas	*Helicolenus dactylopterus*	OTB	(1 | Country) + (1 | Year)	49	TRUE
Celtic Seas	*Helicolenus dactylopterus*	OTM	(1 | Country)	17	TRUE
Celtic Seas	*Helicolenus dactylopterus*	SSC	constant	9	FALSE
Celtic Seas	*Helicolenus dactylopterus*	TBB	constant	13	FALSE
Celtic Seas	*Hexanchus griseus*	GND	constant	5	FALSE
Celtic Seas	*Hexanchus griseus*	OTB	(1 | Year)	49	TRUE
Celtic Seas	*Hexanchus griseus*	OTM	(1 | Year)	17	TRUE
Celtic Seas	*Hippoglossus hippoglossus*	OTB	constant	49	FALSE
Celtic Seas	*Labrus bergylta*	GNS	constant	45	FALSE
Celtic Seas	*Larus argentatus*	PS	constant	10	FALSE
Celtic Seas	*Larus marinus*	LLS	constant	4	FALSE
Celtic Seas	*Mola mola*	OTM	constant	17	FALSE
Celtic Seas	*Molva macrophthalma*	OTB	constant	49	FALSE
Celtic Seas	*Morus bassanus*	LLS	constant	4	FALSE
Celtic Seas	*Morus bassanus*	OTB	(1 | SamplingProtocol)	49	TRUE
Celtic Seas	*Morus bassanus*	PTB	constant	4	FALSE
Celtic Seas	*Morus bassanus*	PTM	constant	18	FALSE
Celtic Seas	*Petromyzon marinus*	OTM	constant	17	FALSE
Celtic Seas	*Phalacrocorax carbo*	GNS	constant	45	FALSE

Ecoregion	Species	Metie rL4	variance components retained	repli-cates	heterogene-ity test
Celtic Seas	*Phoca vitulina*	GNS	(1 | Year)	45	TRUE
Celtic Seas	*Phoca vitulina*	OTB	constant	49	FALSE
Celtic Seas	*Phocoena phocoena*	GNS	constant	45	FALSE
Celtic Seas	*Phocoena phocoena*	GTR	constant	26	FALSE
Celtic Seas	*Phocoena phocoena*	OTB	(1 | Country) + (1 | Year)	49	TRUE
Celtic Seas	*Phocoena phocoena*	OTT	constant	21	FALSE
Celtic Seas	*Polyprion americanus*	GNS	constant	45	FALSE
Celtic Seas	*Pomatoschistus microps*	OTB	constant	49	FALSE
Celtic Seas	*Pomatoschistus minutus*	OTB	constant	49	FALSE
Celtic Seas	*Puffinus gravis*	LLS	constant	4	FALSE
Celtic Seas	*Scophthalmus maximus*	GND	constant	5	TRUE
Celtic Seas	*Scophthalmus maximus*	GNS	(1 | Year)	45	TRUE
Celtic Seas	*Scophthalmus maximus*	GTR	(1 | Country) + (1 | Year)	26	TRUE
Celtic Seas	*Scophthalmus maximus*	LLS	constant	4	FALSE
Celtic Seas	*Scophthalmus maximus*	OTB	constant	49	TRUE
Celtic Seas	*Scophthalmus maximus*	SSC	constant	9	FALSE
Celtic Seas	*Scophthalmus maximus*	TBB	constant	13	FALSE
Celtic Seas	*Scophthalmus rhombus*	GNS	constant	45	FALSE
Celtic Seas	*Scophthalmus rhombus*	OTB	constant	49	TRUE
Celtic Seas	*Scophthalmus rhombus*	SSC	constant	9	FALSE
Celtic Seas	*Scophthalmus rhombus*	TBB	constant	13	TRUE
Celtic Seas	*Somniosus microcephalus*	OTM	constant	17	FALSE
Celtic Seas	*Tetronarce nobiliana*	SSC	constant	9	FALSE

Ecoregion	Species	Metier L4	variance components retained	replicates	heterogeneity test
Celtic Seas	*Tetronarce nobiliana*	TBB	constant	13	FALSE
Celtic Seas	*Torpedo marmorata*	OTB	constant	49	FALSE
Celtic Seas	*Uria aalge*	GNS	constant	45	FALSE
Celtic Seas	*Zeus faber*	GNS	constant	45	FALSE
Celtic Seas	*Zeus faber*	OTB	(1 | Country) + (1 | Year) + (1 | MonitoringMethod)	49	TRUE
Celtic Seas	*Zeus faber*	OTM	constant	17	FALSE
Celtic Seas	*Zeus faber*	SSC	constant	9	TRUE
Celtic Seas	*Zeus faber*	TBB	constant	13	TRUE
Greater North Sea	*Alca torda*	GNS	constant	72	FALSE
Greater North Sea	*Alosa alosa*	GNS	constant	72	FALSE
Greater North Sea	*Alosa alosa*	OTB	constant	97	FALSE
Greater North Sea	*Alosa fallax*	GND	constant	14	FALSE
Greater North Sea	*Alosa fallax*	OTB	constant	97	FALSE
Greater North Sea	*Alosa fallax*	OTM	constant	38	FALSE
Greater North Sea	*Alosa fallax*	OTT	constant	59	FALSE
Greater North Sea	*Alosa fallax*	TBB	(1 | Year)	44	TRUE
Greater North Sea	*Anarhichas lupus*	FPO	constant	19	FALSE
Greater North Sea	*Anarhichas lupus*	GNS	constant	72	FALSE
Greater North Sea	*Anarhichas lupus*	OTB	(1 | Country)	97	TRUE
Greater North Sea	*Anarhichas lupus*	OTT	constant	59	FALSE
Greater North Sea	*Brama brama*	OTB	constant	97	FALSE
Greater North Sea	*Chelidonichthys lucerna*	GNS	constant	72	TRUE
Greater North Sea	*Chelidonichthys lucerna*	GTR	constant	34	FALSE
Greater North Sea	*Chelidonichthys lucerna*	OTB	(1 | Country) + (1 | Year)	97	TRUE
Greater North Sea	*Chelidonichthys lucerna*	OTM	constant	38	FALSE
Greater North Sea	*Chelidonichthys lucerna*	OTT	(1 | Country) + (1 | SamplingProtocol)	59	TRUE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Greater North Sea	*Chelidonichthys lucerna*	SDN	constant	15	FALSE
Greater North Sea	*Chelidonichthys lucerna*	TBB	constant	44	TRUE
Greater North Sea	*Chimaera monstrosa*	LLS	constant	10	FALSE
Greater North Sea	*Chimaera monstrosa*	OTB	(1 | Country) + (1 | Year) + (1 | VesselLength_group)	97	TRUE
Greater North Sea	*Chimaera monstrosa*	OTT	(1 | Country) + (1 | Year)	59	TRUE
Greater North Sea	*Conger conger*	GNS	(1 | SamplingProtocol)	72	TRUE
Greater North Sea	*Conger conger*	OTB	(1 | Year) + (1 | SamplingProtocol)	97	TRUE
Greater North Sea	*Conger conger*	OTT	(1 | Year) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Conger conger*	TBB	constant	44	TRUE
Greater North Sea	*Cyclopterus lumpus*	GNS	constant	72	FALSE
Greater North Sea	*Cyclopterus lumpus*	GTR	constant	34	FALSE
Greater North Sea	*Cyclopterus lumpus*	OTB	(1 | Country) + (1 | Year)	97	TRUE
Greater North Sea	*Cyclopterus lumpus*	OTM	(1 | Country) + (1 | Year)	38	TRUE
Greater North Sea	*Cyclopterus lumpus*	OTT	(1 | Country) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Cyclopterus lumpus*	SDN	constant	15	FALSE
Greater North Sea	*Cyclopterus lumpus*	TBB	constant	44	FALSE
Greater North Sea	*Dasyatis pastinaca*	GNS	(1 | SamplingProtocol)	72	TRUE
Greater North Sea	*Dasyatis pastinaca*	GTR	constant	34	FALSE
Greater North Sea	*Dasyatis pastinaca*	OTB	(1 | SamplingProtocol)	97	TRUE
Greater North Sea	*Dasyatis pastinaca*	OTT	constant	59	FALSE
Greater North Sea	*Dasyatis pastinaca*	TBB	(1 | Year)	44	TRUE
Greater North Sea	*Delphinus delphis*	GNS	(1 | SamplingProtocol)	72	TRUE
Greater North Sea	*Delphinus delphis*	GTR	(1 | VesselLength_group)	34	TRUE
Greater North Sea	*Delphinus delphis*	OTB	constant	97	FALSE
Greater North Sea	*Delphinus delphis*	PS	constant	8	FALSE
Greater North Sea	*Dipturus intermedius*	OTB	constant	97	FALSE
Greater North Sea	*Dipturus oxyrinchus*	OTB	(1 | Country)	97	TRUE
Greater North Sea	*Etmopterus spinax*	OTB	(1 | Country) + (1 | Year) + (1 | VesselLength_group)	97	TRUE

Ecoregion	Species	Metie rL4	variance components retained	repli-cates	heterogene-ity test
Greater North Sea	*Etmopterus spinax*	OTT	(1 | Country) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Fulmarus glacialis*	LLS	(1 | SamplingProtocol)	10	TRUE
Greater North Sea	*Galeus melastomus*	OTB	(1 | Country)	97	TRUE
Greater North Sea	*Galeus melastomus*	OTT	constant	59	FALSE
Greater North Sea	*Galeus melastomus*	SSC	constant	9	FALSE
Greater North Sea	*Gavia arctica*	GNS	constant	72	FALSE
Greater North Sea	*Gavia immer*	GTR	constant	34	FALSE
Greater North Sea	*Gavia stellata*	GTR	constant	34	FALSE
Greater North Sea	*Halichoerus grypus*	GNS	constant	72	FALSE
Greater North Sea	*Halichoerus grypus*	GTR	constant	34	FALSE
Greater North Sea	*Halichoerus grypus*	OTB	constant	97	FALSE
Greater North Sea	*Halichoerus grypus*	OTM	constant	38	FALSE
Greater North Sea	*Halichoerus grypus*	TBB	constant	44	FALSE
Greater North Sea	*Helicolenus dacty-lopterus*	OTB	constant	97	TRUE
Greater North Sea	*Helicolenus dacty-lopterus*	OTM	constant	38	FALSE
Greater North Sea	*Helicolenus dacty-lopterus*	OTT	(1 | Country) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Helicolenus dacty-lopterus*	TBB	constant	44	FALSE
Greater North Sea	*Hippocampus gut-tulatus*	GTR	constant	34	FALSE
Greater North Sea	*Hippocampus hippo-campus*	TBB	constant	44	FALSE
Greater North Sea	*Hippoglossus hippo-glossus*	OTB	constant	97	FALSE
Greater North Sea	*Hippoglossus hippo-glossus*	OTM	constant	38	FALSE
Greater North Sea	*Hippoglossus hippo-glossus*	OTT	constant	59	FALSE
Greater North Sea	*Labrus bergylta*	FPO	constant	19	FALSE
Greater North Sea	*Labrus bergylta*	GND	constant	14	FALSE
Greater North Sea	*Labrus bergylta*	GNS	constant	72	FALSE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Greater North Sea	*Labrus bergylta*	GTR	constant	34	FALSE
Greater North Sea	*Labrus bergylta*	OTB	(1 | SamplingProtocol)	97	TRUE
Greater North Sea	*Labrus bergylta*	TBB	constant	44	FALSE
Greater North Sea	*Lagenorhynchus albirostris*	GNS	constant	72	FALSE
Greater North Sea	*Lampetra fluviatilis*	OTM	constant	38	FALSE
Greater North Sea	*Larus argentatus*	LLS	constant	10	FALSE
Greater North Sea	*Larus argentatus*	PS	constant	8	FALSE
Greater North Sea	*Leucoraja circularis*	TBB	(1 | VesselLength_group)	44	TRUE
Greater North Sea	*Leucoraja fullonica*	GTR	constant	34	FALSE
Greater North Sea	*Leucoraja fullonica*	OTB	constant	97	FALSE
Greater North Sea	*Leucoraja fullonica*	TBB	constant	44	FALSE
Greater North Sea	*Melanitta fusca*	GNS	(1 | VesselLength_group) + (1 | MonitoringMethod)	72	TRUE
Greater North Sea	*Melanitta nigra*	GNS	(1 | Country)	72	TRUE
Greater North Sea	*Morus bassanus*	GNS	constant	72	FALSE
Greater North Sea	*Morus bassanus*	LHM	constant	7	FALSE
Greater North Sea	*Morus bassanus*	LLS	constant	10	FALSE
Greater North Sea	*Morus bassanus*	OTB	constant	97	FALSE
Greater North Sea	*Morus bassanus*	PTB	constant	10	FALSE
Greater North Sea	*Morus bassanus*	TBB	(1 | Country)	44	TRUE
Greater North Sea	*Petromyzon marinus*	SDN	constant	15	FALSE
Greater North Sea	*Phalacrocorax aristotelis*	GNS	constant	72	FALSE
Greater North Sea	*Phalacrocorax aristotelis*	GTR	constant	34	FALSE
Greater North Sea	*Phalacrocorax aristotelis*	LLS	constant	10	FALSE
Greater North Sea	*Phalacrocorax carbo*	GNS	constant	72	FALSE
Greater North Sea	*Phalacrocorax carbo*	GTR	constant	34	FALSE
Greater North Sea	*Phoca vitulina*	FYK	constant	5	FALSE
Greater North Sea	*Phoca vitulina*	GNS	(1 | Country)	72	TRUE

Ecoregion	Species	MetierL4	variance components retained	replicates	heterogeneity test
Greater North Sea	*Phoca vitulina*	GTR	constant	34	FALSE
Greater North Sea	*Phoca vitulina*	OTB	constant	97	FALSE
Greater North Sea	*Phoca vitulina*	OTM	constant	38	FALSE
Greater North Sea	*Phocoena phocoena*	GNS	(1 | VesselLength_group) + (1 | MonitoringMethod)	72	TRUE
Greater North Sea	*Phocoena phocoena*	GTR	constant	34	FALSE
Greater North Sea	*Phocoena phocoena*	OTB	(1 | Year)	97	TRUE
Greater North Sea	*Phocoena phocoena*	SDN	constant	15	FALSE
Greater North Sea	*Pomatoschistus minutus*	OTB	constant	97	FALSE
Greater North Sea	*Puffinus griseus*	GNS	constant	72	FALSE
Greater North Sea	*Raja microocellata*	GND	constant	14	FALSE
Greater North Sea	*Raja microocellata*	GNS	(1 | Country) + (1 | VesselLength_group)	72	TRUE
Greater North Sea	*Raja microocellata*	GTR	(1 | Year) + (1 | SamplingProtocol)	34	TRUE
Greater North Sea	*Raja microocellata*	OTB	(1 | Year) + (1 | SamplingProtocol)	97	TRUE
Greater North Sea	*Raja microocellata*	OTT	(1 | Year) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Raja microocellata*	TBB	constant	44	FALSE
Greater North Sea	*Raja undulata*	GND	constant	14	FALSE
Greater North Sea	*Raja undulata*	GNS	(1 | Country)	72	TRUE
Greater North Sea	*Raja undulata*	GTR	(1 | SamplingProtocol)	34	TRUE
Greater North Sea	*Raja undulata*	OTB	(1 | Year) + (1 | SamplingProtocol)	97	TRUE
Greater North Sea	*Raja undulata*	OTT	(1 | Year) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Raja undulata*	TBB	constant	44	FALSE
Greater North Sea	*Rajella fyllae*	OTT	constant	59	FALSE
Greater North Sea	*Rajella lintea*	OTB	constant	97	FALSE
Greater North Sea	*Scyliorhinus stellaris*	GNS	constant	72	FALSE
Greater North Sea	*Scyliorhinus stellaris*	OTB	(1 | Year)	97	FALSE
Greater North Sea	*Scyliorhinus stellaris*	OTT	constant	59	FALSE
Greater North Sea	*Scyliorhinus stellaris*	TBB	constant	44	FALSE
Greater North Sea	*Sebastes norvegicus*	OTB	(1 | Country) + (1 | Year)	97	TRUE

Ecoregion	Species	Metie rL4	variance components retained	repli-cates	heterogene-ity test
Greater North Sea	*Sebastes norvegicus*	SSC	constant	9	FALSE
Greater North Sea	*Sebastes viviparus*	FPO	constant	19	FALSE
Greater North Sea	*Sebastes viviparus*	OTB	(1 | Country) + (1 | Year)	97	TRUE
Greater North Sea	*Sebastes viviparus*	OTT	constant	59	FALSE
Greater North Sea	*Sebastes viviparus*	SDN	constant	15	FALSE
Greater North Sea	*Somateria mollis-sima*	GNS	(1 | MonitoringMethod)	72	TRUE
Greater North Sea	*Sparus aurata*	GNS	constant	72	FALSE
Greater North Sea	*Sparus aurata*	OTB	constant	97	FALSE
Greater North Sea	*Sparus aurata*	OTT	constant	59	FALSE
Greater North Sea	*Stercorarius skua*	LLS	constant	10	FALSE
Greater North Sea	*Torpedo marmorata*	TBB	constant	44	FALSE
Greater North Sea	*Uria aalge*	GNS	(1 | MonitoringMethod)	72	TRUE
Greater North Sea	*Uria aalge*	GTR	(1 | Country)	34	TRUE
Greater North Sea	*Uria aalge*	LLS	constant	10	FALSE
Greater North Sea	*Zeus faber*	DRB	constant	10	FALSE
Greater North Sea	*Zeus faber*	GNS	(1 | Country) + (1 | Year)	72	TRUE
Greater North Sea	*Zeus faber*	GTR	constant	34	FALSE
Greater North Sea	*Zeus faber*	OTB	(1 | Year) + (1 | SamplingProtocol)	97	TRUE
Greater North Sea	*Zeus faber*	OTM	constant	38	FALSE
Greater North Sea	*Zeus faber*	OTT	(1 | Year) + (1 | SamplingProtocol)	59	TRUE
Greater North Sea	*Zeus faber*	TBB	(1 | Country) + (1 | Year)	44	TRUE
Greater North Sea	*Zoarces viviparus*	FYK	constant	5	FALSE
Greater North Sea	*Zoarces viviparus*	OTT	constant	59	FALSE
Greater North Sea	*Zoarces viviparus*	TBB	constant	44	FALSE
Icelandic Waters	*Alca torda*	GNS	constant	9	FALSE
Icelandic Waters	*Amblyraja hyperbo-rea*	OTB	constant	9	FALSE
Icelandic Waters	*Anarhichas denticu-latus*	OTB	constant	9	FALSE
Icelandic Waters	*Apristurus laurusso-nii*	OTB	constant	9	FALSE

Ecoregion	Species	Metie rL4	variance components retained	repli-cates	heterogene-ity test
Icelandic Waters	*Centroscyllium fab-ricii*	GNS	constant	9	FALSE
Icelandic Waters	*Centroscyllium fab-ricii*	OTB	constant	9	FALSE
Icelandic Waters	*Centroscymnus crepi-dater*	OTB	constant	9	FALSE
Icelandic Waters	*Cepphus grylle*	GNS	(1 | VesselLength_group)	9	TRUE
Icelandic Waters	*Chimaera monstrosa*	GNS	constant	9	FALSE
Icelandic Waters	*Chimaera monstrosa*	OTB	constant	9	TRUE
Icelandic Waters	*Clangula hyemalis*	GNS	constant	9	FALSE
Icelandic Waters	*Conger conger*	OTB	constant	9	FALSE
Icelandic Waters	*Deania calcea*	OTB	constant	9	FALSE
Icelandic Waters	*Dipturus batis*	GNS	constant	9	FALSE
Icelandic Waters	*Dipturus batis*	OTB	constant	9	TRUE
Icelandic Waters	*Dipturus batis*	SDN	constant	4	FALSE
Icelandic Waters	*Etmopterus princeps*	OTB	constant	9	FALSE
Icelandic Waters	*Etmopterus spinax*	GNS	constant	9	FALSE
Icelandic Waters	*Etmopterus spinax*	OTB	constant	9	TRUE
Icelandic Waters	*Fratercula arctica*	GNS	constant	9	FALSE
Icelandic Waters	*Fulmarus glacialis*	GNS	constant	9	FALSE
Icelandic Waters	*Fulmarus glacialis*	LLS	constant	6	FALSE
Icelandic Waters	*Galeus murinus*	OTB	constant	18	FALSE
Icelandic Waters	*Gavia immer*	GNS	constant	9	FALSE
Icelandic Waters	*Gavia stellata*	GNS	constant	9	FALSE
Icelandic Waters	*Halichoerus grypus*	GNS	(1 | VesselLength_group)	9	TRUE
Icelandic Waters	*Helicolenus dacty-lopterus*	GNS	constant	9	FALSE
Icelandic Waters	*Helicolenus dacty-lopterus*	OTB	constant	9	FALSE
Icelandic Waters	*Hydrolagus mirabilis*	OTB	constant	9	FALSE
Icelandic Waters	*Lagenorhynchus al-birostris*	GNS	constant	9	FALSE
Icelandic Waters	*Lycodes esmarkii*	GNS	constant	9	FALSE

Ecoregion	Species	Metier L4	variance components retained	replicates	heterogeneity test
Icelandic Waters	*Lycodes esmarkii*	OTB	constant	9	TRUE
Icelandic Waters	*Megaptera novaeangliae*	GNS	constant	9	FALSE
Icelandic Waters	*Morus bassanus*	GNS	constant	9	FALSE
Icelandic Waters	*Morus bassanus*	LLS	constant	6	FALSE
Icelandic Waters	*Pagophilus groenlandicus*	GNS	constant	9	FALSE
Icelandic Waters	*Petromyzon marinus*	OTB	constant	9	FALSE
Icelandic Waters	*Phalacrocorax aristotelis*	GNS	constant	9	FALSE
Icelandic Waters	*Phalacrocorax carbo*	GNS	constant	9	FALSE
Icelandic Waters	*Phoca vitulina*	GNS	constant	9	TRUE
Icelandic Waters	*Phocoena phocoena*	GNS	(1 | VesselLength_group)	9	TRUE
Icelandic Waters	*Pollachius pollachius*	GNS	constant	9	FALSE
Icelandic Waters	*Pusa hispida*	GNS	constant	9	FALSE
Icelandic Waters	*Rajella bathyphila*	OTB	constant	9	FALSE
Icelandic Waters	*Rajella fyllae*	OTB	constant	9	TRUE
Icelandic Waters	*Rajella lintea*	OTB	constant	9	FALSE
Icelandic Waters	*Rhinochimaera atlantica*	OTB	constant	9	TRUE
Icelandic Waters	*Somateria mollissima*	GNS	constant	9	TRUE
Icelandic Waters	*Somniosus microcephalus*	OTB	constant	9	FALSE
Icelandic Waters	*Uria aalge*	GNS	constant	9	TRUE
Icelandic Waters	*Uria aalge*	OTM	constant	4	FALSE
Icelandic Waters	*Uria lomvia*	GNS	constant	9	FALSE
Norwegian Sea	*Brama brama*	OTM	constant	15	FALSE
Norwegian Sea	*Cyclopterus lumpus*	OTM	(1 | Country)	15	TRUE
Norwegian Sea	*Halichoerus grypus*	GNS	constant	7	FALSE
Norwegian Sea	*Phoca vitulina*	GNS	constant	7	FALSE
Norwegian Sea	*Phocoena phocoena*	GNS	(1 | VesselLength_group)	7	TRUE

Ecoregion	Species	Metie rL4	variance components retained	repli-cates	heterogene-ity test
Oceanic Northeast Atlan-tic	*Caretta caretta*	LLD	constant	2	FALSE
Oceanic Northeast Atlan-tic	*Chimaera monstrosa*	OTB	constant	3	FALSE
Oceanic Northeast Atlan-tic	*Deania calcea*	OTB	constant	3	FALSE
Oceanic Northeast Atlan-tic	*Dermochelys coria-cea*	LLD	constant	2	FALSE
Oceanic Northeast Atlan-tic	*Helicolenus dacty-lopterus*	OTB	constant	3	FALSE
Oceanic Northeast Atlan-tic	*Isurus paucus*	LLD	constant	2	FALSE
Oceanic Northeast Atlan-tic	*Sebastes viviparus*	OTB	constant	3	FALSE

Annex 5: BPUE and total bycatch estimates (in log10) for 2022

Taxon	Ecoregion	Metier level 4	Common name	Monitoring effort (DaS, 2018-2022)	Fishing effort (Das, 2022)	BPUE [95% confidence interval]	representability of BPUE	2.5% confidence limit (log10)	97.5% confidence limit (log10)
Bird	Baltic Sea	FYK	Great Black-backed Gull	55	57077	0.14300 [0.0079499 ; 2.5722542]	a constant BPUE appears to be representative	2,66	5,17
Bird	Baltic Sea	LLD	Common Guillemot	51	45	0.12396 [0.021211 ; 0.7244471]	a constant BPUE appears to be representative	-0,02	1,51
Bird	Bay of Biscay and the Iberian Coast	GTN	Common Guillemot	9	2000	0.11349 [0.0159834 ; 0.8058769]	a constant BPUE appears to be representative	1,5	3,21
Bird	Bay of Biscay and the Iberian Coast	LLS	Herring Gull	340	146540	0.00294 [0.000414 ; 0.0208665]	a constant BPUE appears to be representative	1,78	3,49
Bird	Bay of Biscay and the Iberian Coast	LLS	Northern Gannet	340	146540	0.05451 [0.0174483 ; 0.1702738]	a constant BPUE appears to be representative	3,41	4,4
Bird	Bay of Biscay and the Iberian Coast	LLS	Black-legged Kittiwake	340	146540	0.00294 [0.000414 ; 0.0208665]	a constant BPUE appears to be representative	1,78	3,49
Bird	Bay of Biscay and the Iberian Coast	LTL	Northern Gannet	121	12404	0.03786 [0.0049184 ; 0.2914768]	a constant BPUE appears to be representative	1,79	3,56
Bird	Bay of Biscay and the Iberian Coast	OTM	Lesser Black-backed Gull	39	3793	0.11613 [0.0045946 ; 2.9353432]	a constant BPUE appears to be representative	1,24	4,05
Bird	Bay of Biscay and the Iberian Coast	OTM	Northern Gannet	39	3793	0.11613 [0.0045946 ; 2.9353432]	a constant BPUE appears to be representative	1,24	4,05
Bird	Celtic Seas	PTB	Northern Gannet	23	368	0.08335 [0.0144255 ; 0.4816108]	a constant BPUE appears to be representative	0,73	2,25
Bird	Icelandic Waters	LLS	Northern Fulmar	140	4130	0.21668 [0.0589543 ; 0.7963868]	a constant BPUE appears to be representative	2,39	3,52
Bird	Icelandic Waters	LLS	Northern Gannet	140	4130	0.00714 [0.0017858 ; 0.0285689]	a constant BPUE appears to be representative	0,87	2,07
Bird	Icelandic Waters	OTM	Common Guillemot	258	993	0.00754 [0.0009809 ; 0.0579476]	a constant BPUE appears to be representative	-0,01	1,76
Mammals	Aegean-Levantine Sea	LLS	Mediterranean monk seal	905	205325	0.00128 [1.54e-05 ; 0.1070825]	a constant BPUE appears to be representative	0,5	4,34
Mammals	Azores	LHM	Short-beaked Common Dolphin	2312	0	0.00086 [0.0003511 ; 0.0020956]	a constant BPUE appears to be representative	0	0
Mammals	Bay of Biscay and the Iberian Coast	FPO	Short-beaked Common Dolphin	96	205877	0.01039 [0.0014633 ; 0.073751]	a constant BPUE appears to be representative	2,48	4,18

Mammals	Bay of Biscay and the Iberian Coast	OTM	Short-beaked Common Dolphin	39	3793	0.28463 [0.0260849 ; 3.1056989]	a constant BPUE appears to be representative	2	4,07
Mammals	Bay of Biscay and the Iberian Coast	PS	Short-beaked Common Dolphin	940	71194	0.01215 [0.0052274 ; 0.0282631]	a constant BPUE appears to be representative	2,57	3,3
Mammals	Greater North Sea	FYK	Harbor Seal	9	636	0.26365 [0.0456262 ; 1.5235379]	a constant BPUE appears to be representative	1,46	2,99
Mammals	Norwegian Sea	GNS	Gray Seal	7426	49831	0.00027 [6.74e-05 ; 0.0010769]	a constant BPUE appears to be representative	0,53	1,73
Mammals	Norwegian Sea	GNS	Harbor Seal	7426	49831	0.00646 [0.0020404 ; 0.0204377]	a constant BPUE appears to be representative	2,01	3,01
Mammals	Norwegian Sea	GNS	Harbor Porpoise	7426	49831	0.03957 [0.0136069 ; 0.1150707]	there is between-vessel length category variability in BPUE	0,34	6,21
Reptiles	Adriatic Sea	OTB	Loggerhead	406	119497	0.04627 [0.0177156 ; 0.1208686]	a constant BPUE appears to be representative	3,33	4,16
Reptiles	Adriatic Sea	PS	Loggerhead	384	21697	0.02281 [0.0005731 ; 0.9076427]	a constant BPUE appears to be representative	1,09	4,29
Reptiles	Aegean-Levantine Sea	LLD	Green sea turtle	84	1924	0.08013 [0.0007784 ; 8.2499001]	a constant BPUE appears to be representative	0,18	4,2
Reptiles	Aegean-Levantine Sea	OTB	Green sea turtle	634	37118	0.01119 [0.0001877 ; 0.6674613]	a constant BPUE appears to be representative	0,84	4,39
Reptiles	Azores	GNS	Loggerhead	72	2428	0.02778 [0.0069472 ; 0.1110677]	a constant BPUE appears to be representative	1,23	2,43
Reptiles	Azores	LLD	Loggerhead	338	1243	0.06863 [0.0183568 ; 0.2565697]	a constant BPUE appears to be representative	1,36	2,5
Reptiles	Azores	LLD	leatherback turtle	338	1243	0.01775 [0.007975 ; 0.0395126]	a constant BPUE appears to be representative	1	1,69
Reptiles	Bay of Biscay and the Iberian Coast	LLD	leatherback turtle	105	5394	0.00951 [0.0013397 ; 0.0675799]	a constant BPUE appears to be representative	0,86	2,56
Reptiles	Ionian Sea and the Central Mediterranean Sea	GTR	Loggerhead	656	239886	0.00884 [0.0001946 ; 0.4018868]	a constant BPUE appears to be representative	1,67	4,98
Reptiles	Oceanic Northeast Atlantic	LLD	Loggerhead	25	3762	0.11060 [0.0105274 ; 1.1619122]	a constant BPUE appears to be representative	1,6	3,64
Reptiles	Oceanic Northeast Atlantic	LLD	leatherback turtle	25	3762	0.04000 [0.0056343 ; 0.2839736]	a constant BPUE appears to be representative	1,33	3,03
Reptiles	Western Mediterranean Sea	LLD	Loggerhead	1470	35466	0.01990 [0.002244 ; 0.1764095]	a constant BPUE appears to be representative	1,9	3,8
Reptiles	Western Mediterranean Sea	OTT	Loggerhead	382	26620	0.00523 [0.000551 ; 0.0496363]	a constant BPUE appears to be representative	1,17	3,12
Fish	Aegean-Levantine Sea	LLS	Spiny butterfly ray	905	205325	0.00442 [0.0009002 ; 0.0217005]	a constant BPUE appears to be representative	2,27	3,65
Fish	Aegean-Levantine Sea	OTB	Spiny butterfly ray	634	37118	0.00899 [0.002331 ; 0.0346999]	a constant BPUE appears to be representative	1,94	3,11
Fish	Azores	FPO	conger eel	36	621	0.69303 [0.1158845 ; 4.144556]	a constant BPUE appears to be representative	1,86	3,41

Fish	Azores	GNS	barred hogfish	72	2428	0.04167 [0.0134384 ; 0.1291904]	a constant BPUE appears to be representative	1,51	2,5
Fish	Azores	GNS	blue stingray	72	2428	0.02778 [0.0069472 ; 0.1110677]	a constant BPUE appears to be representative	1,23	2,43
Fish	Azores	GNS	dusky grouper	72	2428	0.04167 [0.0134384 ; 0.1291904]	a constant BPUE appears to be representative	1,51	2,5
Fish	Azores	GNS	ballan wrasse	72	2428	0.35204 [0.0637564 ; 1.9438973]	a constant BPUE appears to be representative	2,19	3,67
Fish	Azores	GNS	island grouper	72	2428	0.04167 [0.0134384 ; 0.1291904]	a constant BPUE appears to be representative	1,51	2,5
Fish	Azores	GNS	spotted eagle ray	72	2428	0.06046 [0.0105225 ; 0.3473371]	a constant BPUE appears to be representative	1,41	2,93
Fish	Azores	GNS	bluefish	72	2428	0.06691 [0.0106531 ; 0.4202988]	a constant BPUE appears to be representative	1,41	3,01
Fish	Azores	GNS	smooth hammerhead	72	2428	0.01389 [0.001956 ; 0.0986218]	a constant BPUE appears to be representative	0,68	2,38
Fish	Azores	LLS	longnose velvet dogfish	345	4897	0.00290 [0.0004083 ; 0.020577]	a constant BPUE appears to be representative	0,3	2
Fish	Azores	LLS	conger eel	345	4897	0.00002 [0 ; 0.1396025]	there is between-year variability in BPUE	-15,65	35,88
Fish	Azores	LLS	birdbeak dogfish	345	4897	0.12914 [0.0118285 ; 1.4099841]	a constant BPUE appears to be representative	1,76	3,84
Fish	Azores	LLS	longnosed skate	345	4897	0.00003 [0 ; 1.5528674]	there is between-year variability in BPUE	-8,45	6,9
Fish	Azores	LLS	velvet belly	345	4897	0.18731 [0.0015294 ; 22.941056]	there is between-year variability in BPUE	3,88	5,91
Fish	Azores	LLS	blackbelly rosefish	345	4897	0.00001 [0 ; 0.040071]	there is between-year variability in BPUE	-3,72	14,66
Fish	Azores	LLS	bluntnose sixgill shark	345	4897	0.01444 [0.0028698 ; 0.0727004]	a constant BPUE appears to be representative	1,15	2,55
Fish	Azores	LLS	scabbardfish	345	4897	0.00002 [0 ; 0.2424992]	there is between-year variability in BPUE	-15,65	99,15
Fish	Azores	LLS	megrim	345	4897	0.00685 [0.0005982 ; 0.0783733]	a constant BPUE appears to be representative	0,47	2,58
Fish	Azores	LLS	shagreen ray	345	4897	0.01629 [0.0031702 ; 0.0837044]	a constant BPUE appears to be representative	1,19	2,61
Fish	Azores	LLS	anglerfish	345	4897	0.00580 [0.0014498 ; 0.0231794]	a constant BPUE appears to be representative	0,85	2,06
Fish	Azores	LLS	Mediterranean ling	345	4897	0.17237 [0.0251096 ; 1.1832616]	a constant BPUE appears to be representative	2,09	3,76
Fish	Azores	LLS	googly-eyed cod	345	4897	0.00001 [0 ; 0.196524]	there is between-year variability in BPUE	-11,39	8,66
Fish	Azores	LLS	blackspot seabream	345	4897	4.85632 [0.1349597 ; 174.747151]	a constant BPUE appears to be representative	2,82	5,93
Fish	Azores	LLS	European john dory	345	4897	0.01280 [0.0008083 ; 0.2026643]	a constant BPUE appears to be representative	0,6	3
Fish	Azores	PS	blackspot seabream	59	3343	2.37357 [0.0233068 ; 241.7245189]	a constant BPUE appears to be representative	1,89	5,91

Fish	Baltic Sea	GNS	Atlantic sturgeon	1604	145119	0.00685 [0.0010301 ; 0.0455203]	a constant BPUE appears to be representative	2,17	3,82
Fish	Baltic Sea	GNS	Twaite shad	1604	145119	0.14523 [0.0138576 ; 1.5219372]	a constant BPUE appears to be representative	3,3	5,34
Fish	Baltic Sea	GNS	whiting	1604	145119	0.15136 [0.0145604 ; 1.5735105]	a constant BPUE appears to be representative	3,32	5,36
Fish	Baltic Sea	GTR	lumpfish	206	3729	0.14974 [0.0281167 ; 0.7974902]	a constant BPUE appears to be representative	2,02	3,47
Fish	Baltic Sea	GTR	whiting	206	3729	0.03555 [0.005601 ; 0.2256233]	a constant BPUE appears to be representative	1,32	2,92
Fish	Baltic Sea	GTR	thornback ray	206	3729	0.00862 [0.0005626 ; 0.1322046]	a constant BPUE appears to be representative	0,32	2,69
Fish	Baltic Sea	SDN	lumpfish	8	143	0.51517 [0.0618277 ; 4.2926068]	a constant BPUE appears to be representative	0,95	2,79
Fish	Baltic Sea	SDN	whiting	8	143	0.12500 [0.0176079 ; 0.8873839]	a constant BPUE appears to be representative	0,4	2,1
Fish	Barents Sea	OTB	Arctic skate	1328	3301	0.39491 [0.0020246 ; 77.0308578]	a constant BPUE appears to be representative	0,82	5,41
Fish	Barents Sea	OTB	northern wolffish	1328	3301	1.33524 [0.0043475 ; 410.0859005]	a constant BPUE appears to be representative	1,16	6,13
Fish	Barents Sea	OTB	Atlantic wolffish	1328	3301	0.09759 [0.0009041 ; 10.5339793]	a constant BPUE appears to be representative	0,47	4,54
Fish	Barents Sea	OTB	spotted wolffish	1328	3301	1.19752 [0.004053 ; 353.8216604]	a constant BPUE appears to be representative	1,13	6,07
Fish	Barents Sea	OTB	Esmark's eelpout	1328	3301	0.08707 [0.0008502 ; 8.9165136]	a constant BPUE appears to be representative	0,45	4,47
Fish	Bay of Biscay and the Iberian Coast	OTM	Atlantic pomfret	39	3793	0.02565 [0.0035983 ; 0.1827956]	a constant BPUE appears to be representative	1,14	2,84
Fish	Bay of Biscay and the Iberian Coast	OTM	ocean sunfish	39	3793	0.10259 [0.0385028 ; 0.2733339]	a constant BPUE appears to be representative	2,16	3,02
Fish	Black Sea	OTM	beluga sturgeon	110	18622	0.01818 [0.0019157 ; 0.1725611]	a constant BPUE appears to be representative	1,55	3,51
Fish	Celtic Seas	FPO	conger eel	3	87047	0.35294 [0.0497166 ; 2.5055545]	a constant BPUE appears to be representative	3,64	5,34
Fish	Celtic Seas	GND	bluntnose sixgill shark	56	35	0.11644 [0.0079114 ; 1.7138671]	a constant BPUE appears to be representative	-0,56	1,78
Fish	Celtic Seas	GNS	conger eel	1100	38381	0.00140 [8.07e-05 ; 0.0242132]	a constant BPUE appears to be representative	0,49	2,97
Fish	Celtic Seas	GNS	flapper skate	1100	38381	0.00212 [0.0001747 ; 0.0256605]	a constant BPUE appears to be representative	0,83	2,99
Fish	Celtic Seas	GNS	ballan wrasse	1100	38381	0.52994 [0.0156811 ; 17.9096154]	a constant BPUE appears to be representative	2,78	5,84
Fish	Celtic Seas	GNS	wreckfish	1100	38381	0.00091 [0.0001281 ; 0.0064545]	a constant BPUE appears to be representative	0,69	2,39

Fish	Celtic Seas	GNS	turbot	1100	38381	0.00002 [0 ; 0.1074547]	there is between-year variability in BPUE	3,66	4,99
Fish	Celtic Seas	GNS	brill	1100	38381	0.03241 [0.0020031 ; 0.5244795]	a constant BPUE appears to be representative	1,89	4,3
Fish	Celtic Seas	GNS	European john dory	1100	38381	0.06014 [0.0070875 ; 0.5102406]	a constant BPUE appears to be representative	2,43	4,29
Fish	Celtic Seas	OTB	Twaite shad	2665	121922	0.00078 [7.89e-05 ; 0.0077634]	a constant BPUE appears to be representative	0,98	2,98
Fish	Celtic Seas	OTB	thorny skate	2665	121922	0.08851 [0.000595 ; 13.1685643]	a constant BPUE appears to be representative	1,86	6,21
Fish	Celtic Seas	OTB	Atlantic wolffish	2665	121922	0.02256 [0.0002845 ; 1.7890859]	a constant BPUE appears to be representative	1,54	5,34
Fish	Celtic Seas	OTB	lumpfish	2665	121922	0.00038 [5.29e-05 ; 0.0026638]	a constant BPUE appears to be representative	0,81	2,51
Fish	Celtic Seas	OTB	flapper skate	2665	121922	0.00038 [5.29e-05 ; 0.0026638]	a constant BPUE appears to be representative	0,81	2,51
Fish	Celtic Seas	OTB	Norwegian skate	2665	121922	0.00645 [0.0001666 ; 0.2497287]	a constant BPUE appears to be representative	1,31	4,48
Fish	Celtic Seas	OTB	great lanternshark	2665	121922	0.00168 [0.0003173 ; 0.008842]	a constant BPUE appears to be representative	1,59	3,03
Fish	Celtic Seas	OTB	bluntnose sixgill shark	2665	121922	0.00067 [5.4e-06 ; 0.0826759]	there is between-year variability in BPUE	2,11	3,95
Fish	Celtic Seas	OTB	Atlantic halibut	2665	121922	0.00140 [9.47e-05 ; 0.0206122]	a constant BPUE appears to be representative	1,06	3,4
Fish	Celtic Seas	OTB	Mediterranean ling	2665	121922	0.00067 [6.78e-05 ; 0.0065443]	a constant BPUE appears to be representative	0,92	2,9
Fish	Celtic Seas	OTB	common goby	2665	121922	0.00233 [8.47e-05 ; 0.0639839]	a constant BPUE appears to be representative	1,01	3,89
Fish	Celtic Seas	OTB	freckled goby	2665	121922	0.00472 [0.0001287 ; 0.173019]	a constant BPUE appears to be representative	1,2	4,32
Fish	Celtic Seas	OTB	marbled electric ray	2665	121922	0.04192 [0.0003995 ; 4.3986987]	a constant BPUE appears to be representative	1,69	5,73
Fish	Celtic Seas	OTM	Twaite shad	725	3728	0.00138 [0.0001943 ; 0.0097918]	a constant BPUE appears to be representative	-0,14	1,56
Fish	Celtic Seas	OTM	Atlantic pomfret	725	3728	0.02008 [0.000578 ; 0.6979033]	a constant BPUE appears to be representative	0,33	3,42
Fish	Celtic Seas	OTM	black dogfish	725	3728	0.00316 [0.0003125 ; 0.0319608]	a constant BPUE appears to be representative	0,07	2,08
Fish	Celtic Seas	OTM	longnose velvet dogfish	725	3728	0.00138 [0.0001943 ; 0.0097919]	there is between-year variability in BPUE	-15,65	Inf
Fish	Celtic Seas	OTM	tub gurnard	725	3728	0.00393 [0.0003362 ; 0.0458951]	a constant BPUE appears to be representative	0,1	2,23
Fish	Celtic Seas	OTM	rabbitfish	725	3728	0.01058 [0.0004605 ; 0.2432066]	a constant BPUE appears to be representative	0,23	2,96

Fish	Celtic Seas	OTM	frill shark	725	3728	0.00316 [0.0003125 ; 0.0319608]	a constant BPUE appears to be representative	0,07	2,08
Fish	Celtic Seas	OTM	conger eel	725	3728	0.00494 [0.0011178 ; 0.0218122]	a constant BPUE appears to be representative	0,62	1,91
Fish	Celtic Seas	OTM	birdbeak dogfish	725	3728	0.00345 [0.0003363 ; 0.0352851]	a constant BPUE appears to be representative	0,1	2,12
Fish	Celtic Seas	OTM	telescope cardinal	725	3728	0.00138 [0.0001943 ; 0.0097919]	there is between-year variability in BPUE	-15,65	Inf
Fish	Celtic Seas	OTM	great lanternshark	725	3728	0.00412 [0.0009829 ; 0.0172626]	a constant BPUE appears to be representative	0,56	1,81
Fish	Celtic Seas	OTM	velvet belly	725	3728	0.02137 [0.004638 ; 0.0984736]	a constant BPUE appears to be representative	1,24	2,56
Fish	Celtic Seas	OTM	bluntnose sixgill shark	725	3728	0.00138 [0.0001943 ; 0.0097919]	there is between-year variability in BPUE	-15,65	Inf
Fish	Celtic Seas	OTM	ocean sunfish	725	3728	0.00000 [0 ; 0.0316513]	there is between-year variability in BPUE	0,99	3,4
Fish	Celtic Seas	OTM	sea lamprey	725	3728	0.00138 [0.0001943 ; 0.0097918]	a constant BPUE appears to be representative	-0,14	1,56
Fish	Celtic Seas	OTM	Greenland shark	725	3728	0.00390 [0.0010542 ; 0.0143909]	a constant BPUE appears to be representative	0,59	1,73
Fish	Celtic Seas	OTM	European john dory	725	3728	0.02857 [0.0029217 ; 0.2793756]	a constant BPUE appears to be representative	1,04	3,02
Fish	Celtic Seas	OTT	thorny skate	802	54939	0.06734 [0.0010633 ; 4.2651905]	a constant BPUE appears to be representa-tive	1,77	5,37
Fish	Celtic Seas	SSC	Twaite shad	195	2316	0.00790 [0.000444 ; 0.1404162]	a constant BPUE appears to be representa-tive	0,01	2,51
Fish	Celtic Seas	SSC	blackbelly rosefish	195	2316	0.00864 [0.0013954 ; 0.0534547]	a constant BPUE appears to be representa-tive	0,51	2,09
Fish	Celtic Seas	SSC	turbot	195	2316	0.02078 [0.001041 ; 0.4147266]	a constant BPUE appears to be representa-tive	0,38	2,98
Fish	Celtic Seas	SSC	brill	195	2316	0.02078 [0.001041 ; 0.4147266]	a constant BPUE appears to be representa-tive	0,38	2,98
Fish	Celtic Seas	SSC	Atlantic torpedo	195	2316	0.01532 [0.0047537 ; 0.0493559]	a constant BPUE appears to be representa-tive	1,04	2,06
Fish	Greater North Sea	FYK	viviporous blenny	9	636	0.13372 [0.0086683 ; 2.0627743]	a constant BPUE appears to be representa-tive	0,74	3,12
Fish	Greater North Sea	GTR	tub gurnard	477	82690	0.01505 [0.0008129 ; 0.2787954]	a constant BPUE appears to be representa-tive	1,83	4,36
Fish	Greater North Sea	GTR	lumpfish	477	82690	0.02967 [0.0008738 ; 1.0073498]	a constant BPUE appears to be representa-tive	1,86	4,92
Fish	Greater North Sea	GTR	blue stingray	477	82690	0.00282 [0.0002085 ; 0.0382638]	a constant BPUE appears to be representa-tive	1,24	3,5
Fish	Greater North Sea	GTR	long-snouted seahorse	477	82690	0.00850 [0.000634 ; 0.1139402]	a constant BPUE appears to be representa-tive	1,72	3,97

Fish	Greater North Sea	GTR	ballan wrasse	477	82690	0.19652 [0.0027016 ; 14.2949833]	a constant BPUE appears to be representa-tive	2,35	6,07
Fish	Greater North Sea	GTR	shagreen ray	477	82690	0.06518 [0.0014019 ; 3.0306956]	a constant BPUE appears to be representa-tive	2,06	5,4
Fish	Greater North Sea	GTR	European john dory	477	82690	0.01237 [0.0007603 ; 0.2012141]	a constant BPUE appears to be representa-tive	1,8	4,22
Fish	Greater North Sea	LLS	rabbitfish	180	26310	0.19105 [0.0040117 ; 9.0983401]	a constant BPUE appears to be representa-tive	2,02	5,38
Fish	Greater North Sea	OTB	Alice shad	3562	289177	0.00240 [0.0003567 ; 0.0161795]	a constant BPUE appears to be representa-tive	2,01	3,67
Fish	Greater North Sea	OTB	Atlantic pomfret	3562	289177	0.00054 [5.52e-05 ; 0.0052152]	a constant BPUE appears to be representa-tive	1,2	3,18
Fish	Greater North Sea	OTB	flapper skate	3562	289177	0.00664 [0.0001724 ; 0.2557409]	a constant BPUE appears to be representa-tive	1,7	4,87
Fish	Greater North Sea	OTB	shagreen ray	3562	289177	0.00152 [0.0002732 ; 0.0084239]	a constant BPUE appears to be representa-tive	1,9	3,39
Fish	Greater North Sea	OTB	freckled goby	3562	289177	0.00081 [6.3e-05 ; 0.0105245]	a constant BPUE appears to be representa-tive	1,26	3,48
Fish	Greater North Sea	OTB	sailray	3562	289177	0.00112 [0.0004215 ; 0.0029923]	a constant BPUE appears to be representa-tive	1,9	2,88
Fish	Greater North Sea	OTB	nursehound	3562	289177	0.00000 [0 ; 0.0090719]	there is between-year variability in BPUE	3,43	5,22
Fish	Greater North Sea	OTB	golden redfish	3562	289177	0.00479 [0.0009219 ; 0.0248588]	a constant BPUE appears to be representa-tive	1,74	3,2
Fish	Greater North Sea	OTB	gilthead seabream	3562	289177	0.00036 [2.69e-05 ; 0.0049626]	a constant BPUE appears to be representa-tive	0,89	3,16
Fish	Greater North Sea	OTM	Twaite shad	650	23501	0.00154 [0.0002167 ; 0.0109216]	a constant BPUE appears to be representa-tive	0,71	2,41
Fish	Greater North Sea	OTM	tub gurnard	650	23501	0.00892 [0.0028849 ; 0.0275577]	a constant BPUE appears to be representa-tive	1,5	2,77
Fish	Greater North Sea	OTM	blackbelly rosefish	650	23501	0.00154 [0.0002167 ; 0.0109218]	a constant BPUE appears to be representa-tive	0,71	2,41
Fish	Greater North Sea	OTM	Atlantic halibut	650	23501	0.00154 [0.0002167 ; 0.0109218]	a constant BPUE appears to be representa-tive	0,71	2,41
Fish	Greater North Sea	OTM	European river lamprey	650	23501	0.00154 [0.0002167 ; 0.0109216]	a constant BPUE appears to be representa-tive	0,71	2,41
Fish	Greater North Sea	OTM	European john dory	650	23501	0.02373 [0.0056515 ; 0.0996792]	a constant BPUE appears to be representa-tive	1,77	3,36
Fish	Greater North Sea	OTT	Twaite shad	924	19348	0.00661 [0.0002172 ; 0.2012498]	a constant BPUE appears to be representa-tive	0,62	3,59
Fish	Greater North Sea	OTT	Atlantic wolffish	924	19348	0.00415 [0.000859 ; 0.0200004]	a constant BPUE appears to be representa-tive	1,22	2,59
Fish	Greater North Sea	OTT	blue stingray	924	19348	0.01805 [0.0017598 ; 0.1850531]	a constant BPUE appears to be representa-tive	1,53	3,55

Fish	Greater North Sea	OTT	blackmouth catshark	924	19348	0.07812 [0.001106 ; 5.5177519]	a constant BPUE appears to be representative	1,33	5,03
Fish	Greater North Sea	OTT	Atlantic halibut	924	19348	0.09180 [0.0335045 ; 0.2515443]	a constant BPUE appears to be representative	2,35	3,34
Fish	Greater North Sea	OTT	round skate	924	19348	0.00115 [0.0001196 ; 0.0109946]	a constant BPUE appears to be representative	0,36	2,33
Fish	Greater North Sea	OTT	nursehound	924	19348	0.00561 [0.0007412 ; 0.0424581]	a constant BPUE appears to be representative	0,55	3,17
Fish	Greater North Sea	OTT	Norway haddock	924	19348	0.00225 [0.0002488 ; 0.0203318]	a constant BPUE appears to be representative	0,68	2,59
Fish	Greater North Sea	OTT	gilthead seabream	924	19348	0.83052 [0.0038192 ; 180.6054418]	a constant BPUE appears to be representative	1,87	6,54
Fish	Greater North Sea	OTT	viviporous blenny	924	19348	0.00119 [0.0001217 ; 0.0116963]	a constant BPUE appears to be representative	0,37	2,35
Fish	Ionian Sea and the Central Mediterranean Sea	LLS	Spiny butterfly ray	231	158304	0.00433 [0.0003747 ; 0.0500114]	a constant BPUE appears to be representative	1,77	3,9
Fish	Ionian Sea and the Central Mediterranean Sea	OTB	Spiny butterfly ray	272	67183	0.00544 [0.0007192 ; 0.0411204]	a constant BPUE appears to be representative	1,68	3,44
Fish	Oceanic Northeast Atlantic	LLD	longfin mako	25	3762	0.04000 [0.0056343 ; 0.2839736]	a constant BPUE appears to be representative	1,33	3,03
Fish	Oceanic Northeast Atlantic	OTB	rabbitfish	147	627	0.02386 [0.0006691 ; 0.851154]	a constant BPUE appears to be representative	-0,38	2,73
Fish	Oceanic Northeast Atlantic	OTB	birdbeak dogfish	147	627	0.00680 [0.0009584 ; 0.0482856]	a constant BPUE appears to be representative	-0,22	1,48
Fish	Oceanic Northeast Atlantic	OTB	blackbelly rosefish	147	627	12.13064 [0.0685318 ; 2147.2135125]	a constant BPUE appears to be representative	1,63	6,13
Fish	Oceanic Northeast Atlantic	OTB	Norway haddock	147	627	5.33036 [0.0383764 ; 740.3704161]	a constant BPUE appears to be representative	1,38	5,67
Fish	Western Mediterranean Sea	GTR	Spiny butterfly ray	364	344748	0.02121 [0.0001895 ; 2.3730005]	a constant BPUE appears to be representative	1,82	5,91

Annex 6: Bycatch context for which heterogeneity between BPUE estimates was detected but could not be explained by the random effects tested

Ecoregion	**Metier level 4**	**Species**	**bpue**
Azores	LLS	*Centrophorus granulosus*	
Azores	LLS	*Epigonus telescopus*	
Azores	LLS	*Etmopterus pusillus*	
Baltic Sea	GNS	*Cyclopterus lumpus*	
Baltic Sea	OTB	*Merlangius merlangus*	
Baltic Sea	OTM	*Lampetra fluviatilis*	
Bay of Biscay and the Iberian Coast	GNS	*Molva macrophthalma*	
Bay of Biscay and the Iberian Coast	OTB	*Alosa alosa*	
Bay of Biscay and the Iberian Coast	OTB	*Argyrosomus regius*	
Bay of Biscay and the Iberian Coast	OTB	*Lepidopus caudatus*	
Bay of Biscay and the Iberian Coast	OTB	*Torpedo marmorata*	
Bay of Biscay and the Iberian Coast	PTB	*Chelidonichthys lucerna*	
Bay of Biscay and the Iberian Coast	PTB	*Conger conger*	
Bay of Biscay and the Iberian Coast	PTB	*Delphinus delphis*	
Bay of Biscay and the Iberian Coast	PTB	*Etmopterus spinax*	
Bay of Biscay and the Iberian Coast	PTB	*Helicolenus dactylopterus*	
Bay of Biscay and the Iberian Coast	PTB	*Hexanchus griseus*	
Bay of Biscay and the Iberian Coast	PTB	*Mola mola*	
Bay of Biscay and the Iberian Coast	PTB	*Molva macrophthalma*	
Bay of Biscay and the Iberian Coast	PTB	*Zeus faber*	
Bay of Biscay and the Iberian Coast	PTM	*Delphinus delphis*	
Celtic Seas	GND	*Scophthalmus maximus*	
Celtic Seas	LLS	*Fulmarus glacialis*	
Celtic Seas	LLS	*Helicolenus dactylopterus*	
Celtic Seas	OTB	*Scophthalmus maximus*	
Celtic Seas	OTB	*Scophthalmus rhombus*	
Celtic Seas	SSC	*Chelidonichthys lucerna*	
Celtic Seas	SSC	*Zeus faber*	
Celtic Seas	TBB	*Conger conger*	
Celtic Seas	TBB	*Scophthalmus rhombus*	
Celtic Seas	TBB	*Zeus faber*	
Greater North Sea	OTB	*Helicolenus dactylopterus*	
Greater North Sea	TBB	*Chelidonichthys lucerna*	
Greater North Sea	TBB	*Conger conger*	
Icelandic Waters	GNS	*Phoca vitulina*	
Icelandic Waters	GNS	*Somateria mollissima*	

Icelandic Waters	GNS	*Uria aalge*	
Icelandic Waters	OTB	*Chimaera monstrosa*	
Icelandic Waters	OTB	*Dipturus batis*	
Icelandic Waters	OTB	*Etmopterus spinax*	
Icelandic Waters	OTB	*Lycodes esmarkii*	
Icelandic Waters	OTB	*Rajella fyllae*	
Icelandic Waters	OTB	*Rhinochimaera atlantica*	

Annex 7: Bycatch context for which there was only one BPUE observation

Ecoregion	Metier level 4	Species	bpue
Bay of Biscay and the Iberian Coast	DRB	*Mergus serrator*	
Celtic Seas	LHM	*Helicolenus dactylopterus*	
Celtic Seas	LLD	*Helicolenus dactylopterus*	
Celtic Seas	LTL	*Helicolenus dactylopterus*	
Faroes	OTB	*Helicolenus dactylopterus*	
Icelandic Waters	DRB	*Mergus serrator*	
Icelandic Waters	DRB	*Rajella bathyphila*	
Icelandic Waters	FPO	*Mergus serrator*	
Icelandic Waters	FPO	*Rajella bathyphila*	

Annex 8: Bycatch context for which there was no heterogeneity between BPUE estimates but for which less than five BPUE observations were available.

Ecoregion	Metier level 4	Species	BPUE estimate	2.5% confidence limit	97.5% confidence limit
Azores	GNS	*Bodianus scrofa*	0.042	0.0134	0.1292
Azores	LHP	*Calonectris borealis*	0.001	0.0002	0.0101
Azores	GNS	*Caretta caretta*	0.028	0.0069	0.1111
Oceanic Northeast Atlantic	LLD	*Caretta caretta*	0.111	0.0105	1.1619
Oceanic Northeast Atlantic	OTB	*Chimaera monstrosa*	0.024	0.0007	0.8512
Celtic Seas	FPO	*Conger conger*	0.353	0.0497	2.5056
Azores	LHP	*Conger conger*	0.216	0.0032	14.4885
Celtic Seas	LLS	*Conger conger*	0.026	0.0021	0.3342
Baltic Sea	SDN	*Cyclopterus lumpus*	0.515	0.0618	4.2926
Azores	GNS	*Dasyatis pastinaca*	0.028	0.0069	0.1111
Oceanic Northeast Atlantic	OTB	*Deania calcea*	0.007	0.001	0.0483
Oceanic Northeast Atlantic	LLD	*Dermochelys coriacea*	0.04	0.0056	0.284
Icelandic Waters	SDN	*Dipturus batis*	0.018	0.0025	0.1245
Azores	GNS	*Epinephelus marginatus*	0.042	0.0134	0.1292
Barents Sea	GNS	*Halichoerus grypus*	0.028	0.0007	1.1521
Oceanic Northeast Atlantic	OTB	*Helicolenus dactylopterus*	12.131	0.0685	2147.2135
Oceanic Northeast Atlantic	LLD	*Isurus paucus*	0.04	0.0056	0.284
Azores	GNS	*Labrus bergylta*	0.352	0.0638	1.9439
Celtic Seas	LLS	*Larus marinus*	0.012	0.0019	0.0733
Azores	LHP	*Larus michahellis*	0.003	7e-04	0.0113
Azores	LHP	*Lepidopus caudatus*	0.221	0.0079	6.2158

Baltic Sea	SDN	*Merlangius merlangus*	0.125	0.0176	0.8874
Celtic Seas	LLS	*Morus bassanus*	0.091	0.0361	0.2319
Celtic Seas	PTB	*Morus bassanus*	0.083	0.0144	0.4816
Azores	GNS	*Mycteroperca fusca*	0.042	0.0134	0.1292
Azores	GNS	*Myliobatis aquila*	0.06	0.0105	0.3473
Baltic Sea	FPN	*Phalacrocorax carbo*	0.063	0.0019	2.0987
Barents Sea	GNS	*Phoca vitulina*	0.105	0.0025	4.4084
Barents Sea	GNS	*Phocoena phocoena*	0.067	0.0017	2.5737
Azores	GNS	*Pomatomus saltatrix*	0.067	0.0107	0.4203
Celtic Seas	LLS	*Puffinus gravis*	0.012	0.0019	0.0733
Celtic Seas	LLS	*Scophthalmus maximus*	0.006	0.0009	0.0452
Oceanic Northeast Atlantic	OTB	*Sebastes viviparus*	5.33	0.0384	740.3704
Baltic Sea	FPN	*Somateria mollissima*	0.015	0.0021	0.1077
Azores	GNS	*Sphyrna zygaena*	0.014	0.002	0.0986
Bay of Biscay and the Iberian Coast	GTN	*Uria aalge*	0.113	0.016	0.8059
Icelandic Waters	OTM	*Uria aalge*	0.008	0.001	0.0579

Annex 9: The species listed where recorded as bycatch during a monitoring program where the sampling method did not focus on collecting data on the listed taxa i.e a record of a bird where the monitoring program was focusing on collecting data on only fish

Ecoregion	Metier level 4	Species
Azores	LHM	*Bodianus scrofa*
Azores	LHM	*Calonectris borealis*
Azores	LHM	*Conger conger*
Azores	LHM	*Dasyatis pastinaca*
Azores	LHM	*Helicolenus dactylopterus*
Azores	LHM	*Hexanchus griseus*
Azores	LHM	*Labrus bergylta*
Azores	LHM	*Lepidopus caudatus*
Azores	LHM	*Pagellus bogaraveo*
Azores	LHM	*Pomatomus saltatrix*
Azores	LHM	*Puffinus gravis*
Azores	LHM	*Scorpaena scrofa*
Azores	LHM	*Sphyrna zygaena*
Azores	LHP	*Calonectris borealis*
Azores	LHP	*Conger conger*
Azores	LHP	*Larus michahellis*
Azores	LHP	*Lepidopus caudatus*
Azores	LLD	*Delphinus delphis*
Azores	LLD	*Sphyrna zygaena*
Baltic Sea	FPO	*Halichoerus grypus*

Baltic Sea	FPO	*Pusa hispida*
Baltic Sea	GNS	*Alca torda*
Baltic Sea	GNS	*Cepphus grylle*
Baltic Sea	GNS	*Clangula hyemalis*
Baltic Sea	GNS	*Gavia arctica*
Baltic Sea	GNS	*Halichoerus grypus*
Baltic Sea	GNS	*Larus argentatus*
Baltic Sea	GNS	*Melanitta fusca*
Baltic Sea	GNS	*Melanitta nigra*
Baltic Sea	GNS	*Phalacrocorax carbo*
Baltic Sea	GNS	*Phoca vitulina*
Baltic Sea	GNS	*Phocoena phocoena*
Baltic Sea	GNS	*Podiceps cristatus*
Baltic Sea	GNS	*Podiceps grisegena*
Baltic Sea	GNS	*Somateria mollissima*
Baltic Sea	GNS	*Uria aalge*
Baltic Sea	GTR	*Alca torda*
Baltic Sea	GTR	*Aythya fuligula*
Baltic Sea	GTR	*Aythya marila*
Baltic Sea	GTR	*Mergus serrator*
Baltic Sea	GTR	*Phalacrocorax carbo*
Baltic Sea	GTR	*Phoca vitulina*
Baltic Sea	GTR	*Phocoena phocoena*
Baltic Sea	GTR	*Somateria mollissima*
Baltic Sea	GTR	*Uria aalge*
Baltic Sea	OTB	*Alosa fallax*
Baltic Sea	OTB	*Cyclopterus lumpus*
Baltic Sea	OTM	*Alosa fallax*
Baltic Sea	OTM	*Cyclopterus lumpus*
Bay of Biscay and the Iberian Coast	GNS	*Alca torda*

Bay of Biscay and the Iberian Coast	GNS	*Alosa alosa*
Bay of Biscay and the Iberian Coast	GNS	*Alosa fallax*
Bay of Biscay and the Iberian Coast	GNS	*Argyrosomus regius*
Bay of Biscay and the Iberian Coast	GNS	*Caretta caretta*
Bay of Biscay and the Iberian Coast	GNS	*Centrophorus granulosus*
Bay of Biscay and the Iberian Coast	GNS	*Chelidonichthys lucerna*
Bay of Biscay and the Iberian Coast	GNS	*Chimaera monstrosa*
Bay of Biscay and the Iberian Coast	GNS	*Conger conger*
Bay of Biscay and the Iberian Coast	GNS	*Dasyatis pastinaca*
Bay of Biscay and the Iberian Coast	GNS	*Delphinus delphis*
Bay of Biscay and the Iberian Coast	GNS	*Dentex dentex*
Bay of Biscay and the Iberian Coast	GNS	*Etmopterus spinax*
Bay of Biscay and the Iberian Coast	GNS	*Gavia immer*
Bay of Biscay and the Iberian Coast	GNS	*Gavia stellata*
Bay of Biscay and the Iberian Coast	GNS	*Halichoerus grypus*
Bay of Biscay and the Iberian Coast	GNS	*Helicolenus dactylopterus*
Bay of Biscay and the Iberian Coast	GNS	*Hexanchus griseus*
Bay of Biscay and the Iberian Coast	GNS	*Hydrolagus mirabilis*
Bay of Biscay and the Iberian Coast	GNS	*Labrus bergylta*
Bay of Biscay and the Iberian Coast	GNS	*Larus marinus*
Bay of Biscay and the Iberian Coast	GNS	*Larus michahellis*
Bay of Biscay and the Iberian Coast	GNS	*Lepidopus caudatus*
Bay of Biscay and the Iberian Coast	GNS	*Mola mola*
Bay of Biscay and the Iberian Coast	GNS	*Morus bassanus*
Bay of Biscay and the Iberian Coast	GNS	*Phalacrocorax aristotelis*
Bay of Biscay and the Iberian Coast	GNS	*Phalacrocorax carbo*
Bay of Biscay and the Iberian Coast	GNS	*Phocoena phocoena*
Bay of Biscay and the Iberian Coast	GNS	*Polyprion americanus*
Bay of Biscay and the Iberian Coast	GNS	*Puffinus mauretanicus*
Bay of Biscay and the Iberian Coast	GNS	*Scophthalmus maximus*

Bay of Biscay and the Iberian Coast	GNS	*Scorpaena scrofa*
Bay of Biscay and the Iberian Coast	GNS	*Scyliorhinus stellaris*
Bay of Biscay and the Iberian Coast	GNS	*Scymnodon ringens*
Bay of Biscay and the Iberian Coast	GNS	*Sparus aurata*
Bay of Biscay and the Iberian Coast	GNS	*Stenella coeruleoalba*
Bay of Biscay and the Iberian Coast	GNS	*Torpedo marmorata*
Bay of Biscay and the Iberian Coast	GNS	*Tursiops truncatus*
Bay of Biscay and the Iberian Coast	GNS	*Uria aalge*
Bay of Biscay and the Iberian Coast	GNS	*Zeus faber*
Bay of Biscay and the Iberian Coast	GTR	*Alca torda*
Bay of Biscay and the Iberian Coast	GTR	*Argyrosomus regius*
Bay of Biscay and the Iberian Coast	GTR	*Chelidonichthys lucerna*
Bay of Biscay and the Iberian Coast	GTR	*Conger conger*
Bay of Biscay and the Iberian Coast	GTR	*Dasyatis pastinaca*
Bay of Biscay and the Iberian Coast	GTR	*Dentex dentex*
Bay of Biscay and the Iberian Coast	GTR	*Gavia stellata*
Bay of Biscay and the Iberian Coast	GTR	*Labrus bergylta*
Bay of Biscay and the Iberian Coast	GTR	*Larus fuscus*
Bay of Biscay and the Iberian Coast	GTR	*Larus marinus*
Bay of Biscay and the Iberian Coast	GTR	*Larus michahellis*
Bay of Biscay and the Iberian Coast	GTR	*Melanitta nigra*
Bay of Biscay and the Iberian Coast	GTR	*Mola mola*
Bay of Biscay and the Iberian Coast	GTR	*Morus bassanus*
Bay of Biscay and the Iberian Coast	GTR	*Phalacrocorax carbo*
Bay of Biscay and the Iberian Coast	GTR	*Puffinus gravis*
Bay of Biscay and the Iberian Coast	GTR	*Puffinus mauretanicus*
Bay of Biscay and the Iberian Coast	GTR	*Rissa tridactyla*
Bay of Biscay and the Iberian Coast	GTR	*Scophthalmus maximus*
Bay of Biscay and the Iberian Coast	GTR	*Scophthalmus rhombus*
Bay of Biscay and the Iberian Coast	GTR	*Scorpaena scrofa*

Bay of Biscay and the Iberian Coast	GTR	*Scyliorhinus stellaris*
Bay of Biscay and the Iberian Coast	GTR	*Sparus aurata*
Bay of Biscay and the Iberian Coast	GTR	*Torpedo marmorata*
Bay of Biscay and the Iberian Coast	GTR	*Umbrina cirrosa*
Bay of Biscay and the Iberian Coast	GTR	*Uria aalge*
Bay of Biscay and the Iberian Coast	GTR	*Zeus faber*
Bay of Biscay and the Iberian Coast	LLD	*Mola mola*
Bay of Biscay and the Iberian Coast	LLD	*Morus bassanus*
Bay of Biscay and the Iberian Coast	LLS	*Chimaera monstrosa*
Bay of Biscay and the Iberian Coast	LLS	*Conger conger*
Bay of Biscay and the Iberian Coast	LLS	*Dasyatis pastinaca*
Bay of Biscay and the Iberian Coast	LLS	*Delphinus delphis*
Bay of Biscay and the Iberian Coast	LLS	*Etmopterus spinax*
Bay of Biscay and the Iberian Coast	LLS	*Helicolenus dactylopterus*
Bay of Biscay and the Iberian Coast	LLS	*Mola mola*
Bay of Biscay and the Iberian Coast	LLS	*Scyliorhinus stellaris*
Bay of Biscay and the Iberian Coast	LLS	*Scymnodon ringens*
Bay of Biscay and the Iberian Coast	PS	*Alosa fallax*
Bay of Biscay and the Iberian Coast	PS	*Conger conger*
Bay of Biscay and the Iberian Coast	PS	*Dasyatis pastinaca*
Bay of Biscay and the Iberian Coast	PS	*Helicolenus dactylopterus*
Bay of Biscay and the Iberian Coast	PS	*Larus michahellis*
Bay of Biscay and the Iberian Coast	PS	*Lepidopus caudatus*
Bay of Biscay and the Iberian Coast	PS	*Mola mola*
Bay of Biscay and the Iberian Coast	PS	*Pomatomus saltatrix*
Bay of Biscay and the Iberian Coast	PS	*Sparus aurata*
Bay of Biscay and the Iberian Coast	PS	*Torpedo marmorata*
Celtic Seas	GNS	*Delphinus delphis*
Celtic Seas	GNS	*Fulmarus glacialis*
Celtic Seas	GNS	*Halichoerus grypus*

Celtic Seas	GNS	*Phalacrocorax carbo*
Celtic Seas	GNS	*Phoca vitulina*
Celtic Seas	GNS	*Phocoena phocoena*
Celtic Seas	GNS	*Uria aalge*
Celtic Seas	GTR	*Grampus griseus*
Celtic Seas	GTR	*Halichoerus grypus*
Celtic Seas	GTR	*Phocoena phocoena*
Celtic Seas	LLD	*Helicolenus dactylopterus*
Celtic Seas	OTB	*Delphinus delphis*
Celtic Seas	OTB	*Morus bassanus*
Celtic Seas	OTB	*Phoca vitulina*
Celtic Seas	OTB	*Phocoena phocoena*
Celtic Seas	OTM	*Globicephala melas*
Celtic Seas	OTM	*Halichoerus grypus*
Celtic Seas	OTT	*Delphinus delphis*
Celtic Seas	OTT	*Phocoena phocoena*
Celtic Seas	PTM	*Delphinus delphis*
Celtic Seas	PTM	*Morus bassanus*
Greater North Sea	GNS	*Alca torda*
Greater North Sea	GNS	*Alosa alosa*
Greater North Sea	GNS	*Anarhichas lupus*
Greater North Sea	GNS	*Conger conger*
Greater North Sea	GNS	*Cyclopterus lumpus*
Greater North Sea	GNS	*Dasyatis pastinaca*
Greater North Sea	GNS	*Delphinus delphis*
Greater North Sea	GNS	*Gavia arctica*
Greater North Sea	GNS	*Halichoerus grypus*
Greater North Sea	GNS	*Labrus bergylta*
Greater North Sea	GNS	*Lagenorhynchus albirostris*
Greater North Sea	GNS	*Melanitta fusca*

Greater North Sea	GNS	*Melanitta nigra*
Greater North Sea	GNS	*Morus bassanus*
Greater North Sea	GNS	*Phalacrocorax aristotelis*
Greater North Sea	GNS	*Phalacrocorax carbo*
Greater North Sea	GNS	*Phoca vitulina*
Greater North Sea	GNS	*Phocoena phocoena*
Greater North Sea	GNS	*Puffinus griseus*
Greater North Sea	GNS	*Raja microocellata*
Greater North Sea	GNS	*Raja undulata*
Greater North Sea	GNS	*Scyliorhinus stellaris*
Greater North Sea	GNS	*Somateria mollissima*
Greater North Sea	GNS	*Sparus aurata*
Greater North Sea	GNS	*Uria aalge*
Greater North Sea	GNS	*Zeus faber*
Greater North Sea	GTR	*Delphinus delphis*
Greater North Sea	GTR	*Gavia immer*
Greater North Sea	GTR	*Gavia stellata*
Greater North Sea	GTR	*Halichoerus grypus*
Greater North Sea	GTR	*Phalacrocorax aristotelis*
Greater North Sea	GTR	*Phalacrocorax carbo*
Greater North Sea	GTR	*Phoca vitulina*
Greater North Sea	GTR	*Phocoena phocoena*
Greater North Sea	GTR	*Uria aalge*
Greater North Sea	LHM	*Morus bassanus*
Greater North Sea	LLS	*Fulmarus glacialis*
Greater North Sea	LLS	*Larus argentatus*
Greater North Sea	LLS	*Morus bassanus*
Greater North Sea	LLS	*Phalacrocorax aristotelis*
Greater North Sea	LLS	*Stercorarius skua*
Greater North Sea	LLS	*Uria aalge*

Greater North Sea	OTB	*Delphinus delphis*
Greater North Sea	OTB	*Halichoerus grypus*
Greater North Sea	OTB	*Morus bassanus*
Greater North Sea	OTB	*Phoca vitulina*
Greater North Sea	OTB	*Phocoena phocoena*
Greater North Sea	OTM	*Halichoerus grypus*
Greater North Sea	OTM	*Phoca vitulina*
Greater North Sea	TBB	*Halichoerus grypus*
Greater North Sea	TBB	*Morus bassanus*
Norwegian Sea	OTM	*Brama brama*
Norwegian Sea	OTM	*Cyclopterus lumpus*

Annex 10: List of acronyms

Acronym	Description
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
GFCM	General Fisheries Commission for the Mediterranean
HELCOM	Baltic Marine Environment Protection Commission
IWC	International Whaling Commission
JWGBIRD	Joint OSPAR/HELCOM/ICES Working Group on Seabirds
NAMMCO	North-Atlantic Marine Mammal Commission
NEAFC	North-East Atlantic Fisheries Commission
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
RCGs	Regional Coordination Groups
RDB	Regional Data Base
RDBES	Regional Data Base and Estimation System
STECF	Scientific, Technical and Economic Committee for Fisheries
VMS	Vessel Monitoring System
WGCATCH	Working Group on Commercial Catches
WGDEEP	Working Group on the Biology and Assessment of Deep-sea Fisheries Resources
WGEF	Working Group on Elasmobranch Fishes
WGFTFB	"ICES-FAO Working Group on Fishing Technology and Fish Behaviour"
WGHARP	ICES/NAFO/NAMMCO Working Group on Harp and Hooded Seals
WGMIXFISH	Working Group on Mixed Fisheries
WGMME	Working Group on Marine Mammal Ecology
WGRFS	Working Group of Recreational Fisheries Surveys
WGSFD	Working Group on Spatial Fisheries Data
WGTIFD	Working Group on Technology Integration for Fishery-Dependent Data
WPETSAMP	Joint WGBYC/WGCATCH Workshop on sampling of by-catch and PET species

Annex 11: Table of sea turtle species' presence in the ICES ecoregions

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This table will be used as basis for the creation of lists of turtle species of bycatch relevance by Ecoregion (for Atlantic waters). The lists, by ecoregion, will be incorporated into the ICES Roadmap for bycatch advice on protected species: https://doi.org/10.17895/ices.advice.19657167

Table A. Table of sea turtle species' presence in the ICES ecoregions

ICES ecoregion	**Loggerhead turtle (*Caretta caretta*)**	**Leatherback turtle (*Dermochelys coriacea*)**	**Green turtle (*Chelonia mydas*)**	**Kemp's ridley turtle (*Lepidochelys kempii*)**	**Olive ridley turtle (*Lepidochelys olivacea*)**	**Hawksbill turtle (*Eretmochelys imbricata*)**
ARCTIC AND SUB-ARCTIC						
Central Arctic Ocean	Absent	Absent	Absent	Absent	Absent	Absent
Barents Sea	Absent	Absent	Absent	Absent	Absent	Absent
Greenland Sea	Absent	Absent	Absent	Absent	Absent	Absent
Icelandic Waters	Absent	Occasional	Absent	Absent	Absent	Absent
Norwegian Sea	Absent	Occasional	Absent	Absent	Absent	Absent
NORTH-EAST ATLANTIC						
Faroes	Absent	Occasional	Absent	Absent	Absent	Absent
Greater North Sea	Occasional	Common	Absent	Occasional	Absent	Absent
Celtic Seas	Present	Common	Occasional	Occasional	Absent	Absent
Bay of Biscay and the Iberian Coast	Present	Common	Occasional	Occasional	Absent	Absent
Azores	Common	Present	Present	Occasional	Occasional	Occasional

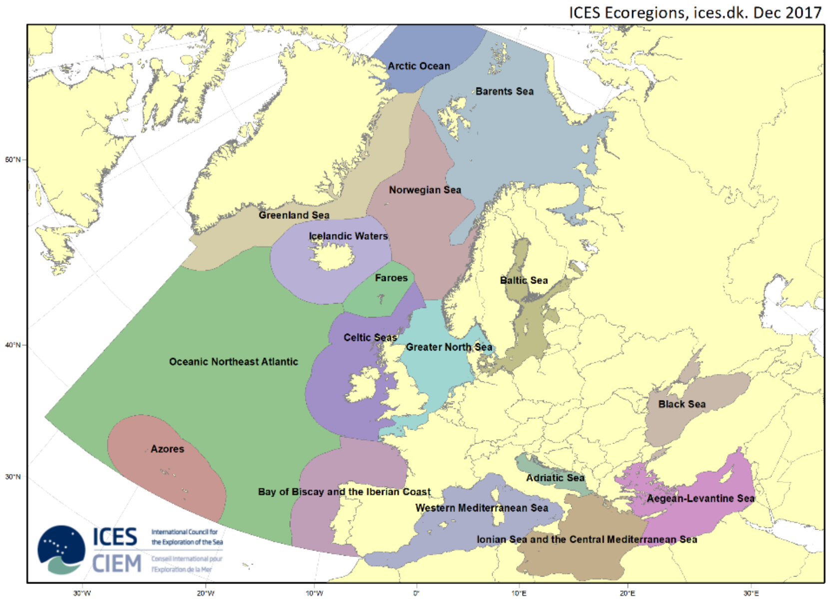
Oceanic Northeast Atlantic	Common	Common	Present	Occasional	Occasional	Occasional
BALTIC SEA						
Baltic Sea	Absent	Absent	Absent	Absent	Absent	Absent
MEDITERRANEAN SEA						
Western Mediterranean Sea	Common	Present	Occasional	Occasional	Occasional	Absent
Ionian Sea & Central Mediterranean Sea	Common	Occasional	Present	Occasional	Absent	Absent
Adriatic Sea	Common	Occasional	Occasional	Absent	Absent	Absent
Aegean-Levantine Sea	Common	Occasional	Common	Absent	Absent	Absent
BLACK SEA						
Black Sea	Absent	Absent	Absent	Absent	Absent	Absent

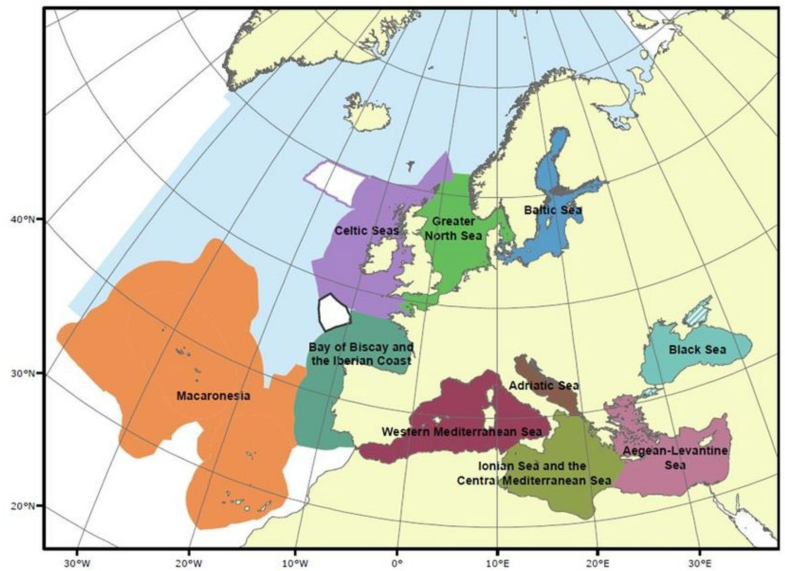
Key: Beside the absence of a given species, the gradient of importance of species' presence in each subregion (from negligible to important) is represented by the following qualitative categories: Occasional, Present (regular but in low densities), Common (regular in high densities).

In yellow, species by subregion for which specific bycatch monitoring should be planned to obtain bycatch rates.

In terms of bycatch data collection, it should be recommended that any event of any non-target species of any taxa should be always recorded/reported, but that when a signal of bycatch occurrence is detected (via multiple sources, e.g., observer programmes, logbooks, strandings and interviews) bycatch monitoring programmes be designed to obtain bycatch rates only for those species that are "common" or "present". The category "present" includes two scenarios: (a) low densities but known range with nesting and feeding sites; (b) low densities but regular presence over time. Clearly these two categories may have very different implications for conservation.

In addition, since distribution of some species could change over time due to increasing sea water temperature, lists of sea turtle (and other temperature-sensitive) species should be reconsidered regularly (e.g., every six years).





Sources

- IUCN. 2012. Marine Mammals and Sea Turtles of the Mediterranean and Black Seas. Gland, Switzerland and Malaga, Spain: IUCN. 32 pages.
- Pierpoint, C. 2000. Bycatch of marine turtles in UK and Irish waters. JNCC Report No 310.
- SWOT reports: see all reference material at https://www.seaturtlestatus.org/swot-report and https://www.seaturtlestatus.org/printed-maps

Annex 12: BPUE and total bycatch estimates (in number of individuals) for 2022

Taxon	Ecoregion	Metier level 4	Common name	Monitoring effort (DaS, 2018-2022)	Fishing effort (Das, 2022)	BPUE [95% confidence interval]	representability of BPUE	2.5% confidence limit	97.5% confidence limit
Bird	Baltic Sea	FYK	Great Black-backed Gull	55	57077	0.14300 [0.0079499 ; 2.5722542]	a constant BPUE appears to be representative	457	147911
Bird	Baltic Sea	LLD	Common Guillemot	51	45	0.12396 [0.021211 ; 0.7244471]	a constant BPUE appears to be representative	1	32
Bird	Bay of Biscay and the Iberian Coast	GTN	Common Guillemot	9	2000	0.11349 [0.0159834 ; 0.8058769]	a constant BPUE appears to be representative	32	1622
Bird	Bay of Biscay and the Iberian Coast	LLS	Herring Gull	340	146540	0.00294 [0.000414 ; 0.0208665]	a constant BPUE appears to be	60	3090

							representative		
Bird	Bay of Biscay and the Iberian Coast	LLS	Northern Gannet	340	146540	0.05451 [0.0174483 ; 0.1702738]	a constant BPUE appears to be representative	2570	25119
Bird	Bay of Biscay and the Iberian Coast	LLS	Black-legged Kittiwake	340	146540	0.00294 [0.000414 ; 0.0208665]	a constant BPUE appears to be representative	60	3090
Bird	Bay of Biscay and the Iberian Coast	LTL	Northern Gannet	121	12404	0.03786 [0.0049184 ; 0.2914768]	a constant BPUE appears to be representative	62	3631
Bird	Bay of Biscay and the Iberian Coast	OTM	Lesser Black-backed Gull	39	3793	0.11613 [0.0045946 ; 2.9353432]	a constant BPUE appears to be representative	17	11220
Bird	Bay of Biscay and the Iberian Coast	OTM	Northern Gannet	39	3793	0.11613 [0.0045946 ; 2.9353432]	a constant BPUE appears to be	17	11220

							representative		
Bird	Celtic Seas	PTB	Northern Gannet	23	368	0.08335 [0.0144255 ; 0.4816108]	a constant BPUE appears to be representative	5	178
Bird	Icelandic Waters	LLS	Northern Fulmar	140	4130	0.21668 [0.0589543 ; 0.7963868]	a constant BPUE appears to be representative	245	3311
Bird	Icelandic Waters	LLS	Northern Gannet	140	4130	0.00714 [0.0017858 ; 0.0285689]	a constant BPUE appears to be representative	7	117
Bird	Icelandic Waters	OTM	Common Guillemot	258	993	0.00754 [0.0009809 ; 0.0579476]	a constant BPUE appears to be representative	1	58
Mammals	Aegean-Levantine Sea	LLS	Mediterranean monk seal	905	205325	0.00128 [1.54e-05 ; 0.1070825]	a constant BPUE appears to be	3	21878

							repre-senta-tive		
Mammals	Azores	LHM	Short-beaked Common Dolphin	2312	0	0.00086 [0.0003511 ; 0.0020956]	a constant BPUE appears to be representative	1	1
Mammals	Bay of Biscay and the Iberian Coast	FPO	Short-beaked Common Dolphin	96	205877	0.01039 [0.0014633 ; 0.073751]	a constant BPUE appears to be representative	302	15136
Mammals	Bay of Biscay and the Iberian Coast	OTM	Short-beaked Common Dolphin	39	3793	0.28463 [0.0260849 ; 3.1056989]	a constant BPUE appears to be representative	100	11749
Mammals	Bay of Biscay and the Iberian Coast	PS	Short-beaked Common Dolphin	940	71194	0.01215 [0.0052274 ; 0.0282631]	a constant BPUE appears to be representative	372	1995
Mammals	Greater North Sea	FYK	Harbor Seal	9	636	0.26365 [0.0456262 ; 1.5235379]	a constant BPUE appears to be	29	977

							representative		
Mammals	Norwegian Sea	GNS	Gray Seal	7426	49831	0.00027 [6.74e-05 ; 0.0010769]	a constant BPUE appears to be representative	3	54
Mammals	Norwegian Sea	GNS	Harbor Seal	7426	49831	0.00646 [0.0020404 ; 0.0204377]	a constant BPUE appears to be representative	102	1023
Mammals	Norwegian Sea	GNS	Harbor Porpoise	7426	49831	0.03957 [0.0136069 ; 0.1150707]	there is between-vessel length category variability in BPUE	2	1621810
Reptiles	Adriatic Sea	OTB	Loggerhead	406	119497	0.04627 [0.0177156 ; 0.1208686]	a constant BPUE appears to be representative	2138	14454
Reptiles	Adriatic Sea	PS	Loggerhead	384	21697	0.02281 [0.0005731 ; 0.9076427]	a constant BPUE appears	12	19498

							to be representative		
Reptiles	Aegean-Levantine Sea	LLD	Green sea turtle	84	1924	0.08013 [0.0007784 ; 8.2499001]	a constant BPUE appears to be representative	2	15849
Reptiles	Aegean-Levantine Sea	OTB	Green sea turtle	634	37118	0.01119 [0.0001877 ; 0.6674613]	a constant BPUE appears to be representative	7	24547
Reptiles	Azores	GNS	Loggerhead	72	2428	0.02778 [0.0069472 ; 0.1110677]	a constant BPUE appears to be representative	17	269
Reptiles	Azores	LLD	Loggerhead	338	1243	0.06863 [0.0183568 ; 0.2565697]	a constant BPUE appears to be representative	23	316
Reptiles	Azores	LLD	leatherback turtle	338	1243	0.01775 [0.007975 ; 0.0395126]	a constant BPUE appears	10	49

							to be representative		
Reptiles	Bay of Biscay and the Iberian Coast	LLD	leatherback turtle	105	5394	0.00951 [0.0013397 ; 0.0675799]	a constant BPUE appears to be representative	7	363
Reptiles	Ionian Sea and the Central Mediterranean Sea	GTR	Loggerhead	656	239886	0.00884 [0.0001946 ; 0.4018868]	a constant BPUE appears to be representative	47	95499
Reptiles	Oceanic Northeast Atlantic	LLD	Loggerhead	25	3762	0.11060 [0.0105274 ; 1.1619122]	a constant BPUE appears to be representative	40	4365
Reptiles	Oceanic Northeast Atlantic	LLD	leatherback turtle	25	3762	0.04000 [0.0056343 ; 0.2839736]	a constant BPUE appears to be representative	21	1072
Reptiles	Western Mediterranean Sea	LLD	Loggerhead	1470	35466	0.01990 [0.002244 ; 0.1764095]	a constant BPUE appears	79	6310

							to be representative		
Reptiles	Western Mediterranean Sea	OTT	Loggerhead	382	26620	0.00523 [0.000551 ; 0.0496363]	a constant BPUE appears to be representative	15	1318
Fish	Aegean-Levantine Sea	LLS	Spiny butterfly ray	905	205325	0.00442 [0.0009002 ; 0.0217005]	a constant BPUE appears to be representative	186	4467
Fish	Aegean-Levantine Sea	OTB	Spiny butterfly ray	634	37118	0.00899 [0.002331 ; 0.0346999]	a constant BPUE appears to be representative	87	1288
Fish	Azores	FPO	conger eel	36	621	0.69303 [0.1158845 ; 4.144556]	a constant BPUE appears to be representative	72	2570
Fish	Azores	GNS	barred hogfish	72	2428	0.04167 [0.0134384 ; 0.1291904]	a constant BPUE appears	32	316

							to be representative		
Fish	Azores	GNS	blue stingray	72	2428	0.02778 [0.0069472 ; 0.1110677]	a constant BPUE appears to be representative	17	269
Fish	Azores	GNS	dusky grouper	72	2428	0.04167 [0.0134384 ; 0.1291904]	a constant BPUE appears to be representative	32	316
Fish	Azores	GNS	ballan wrasse	72	2428	0.35204 [0.0637564 ; 1.9438973]	a constant BPUE appears to be representative	155	4677
Fish	Azores	GNS	island grouper	72	2428	0.04167 [0.0134384 ; 0.1291904]	a constant BPUE appears to be representative	32	316
Fish	Azores	GNS	spotted eagle ray	72	2428	0.06046 [0.0105225 ; 0.3473371]	a constant BPUE appears	26	851

							to be representative		
Fish	Azores	GNS	bluefish	72	2428	0.06691 [0.0106531 ; 0.4202988]	a constant BPUE appears to be representative	26	1023
Fish	Azores	GNS	smooth hammerhead	72	2428	0.01389 [0.001956 ; 0.0986218]	a constant BPUE appears to be representative	5	240
Fish	Azores	LLS	longnose velvet dogfish	345	4897	0.00290 [0.0004083 ; 0.020577]	a constant BPUE appears to be representative	2	100
Fish	Azores	LLS	conger eel	345	4897	0.00002 [0 ; 0.1396025]	there is between-year variability in BPUE	0	8.E+35
Fish	Azores	LLS	birdbeak dogfish	345	4897	0.12914 [0.0118285 ; 1.4099841]	a constant BPUE appears to be	58	6918

							representative		
Fish	Azores	LLS	longnosed skate	345	4897	0.00003 [0 ; 1.5528674]	there is between-year variability in BPUE	0	7943282
Fish	Azores	LLS	velvet belly	345	4897	0.18731 [0.0015294 ; 22.941056]	there is between-year variability in BPUE	7586	812831
Fish	Azores	LLS	blackbelly rosefish	345	4897	0.00001 [0 ; 0.040071]	there is between-year variability in BPUE	0	5.E+14
Fish	Azores	LLS	bluntnose sixgill shark	345	4897	0.01444 [0.0028698 ; 0.0727004]	a constant BPUE appears to be representative	14	355
Fish	Azores	LLS	scabbardfish	345	4897	0.00002 [0 ; 0.2424992]	there is between-year variability in BPUE	0	1.E+99
Fish	Azores	LLS	megrim	345	4897	0.00685 [0.0005982 ; 0.0783733]	a constant BPUE appears	3	380

							to be representative		
Fish	Azores	LLS	shagreen ray	345	4897	0.01629 [0.0031702 ; 0.0837044]	a constant BPUE appears to be representative	15	407
Fish	Azores	LLS	anglerfish	345	4897	0.00580 [0.0014498 ; 0.0231794]	a constant BPUE appears to be representative	7	115
Fish	Azores	LLS	Mediterranean ling	345	4897	0.17237 [0.0251096 ; 1.1832616]	a constant BPUE appears to be representative	123	5754
Fish	Azores	LLS	googly-eyed cod	345	4897	0.00001 [0 ; 0.196524]	there is between-year variability in BPUE	0	5.E+08
Fish	Azores	LLS	blackspot seabream	345	4897	4.85632 [0.1349597 ; 174.747151]	a constant BPUE appears to be	661	851138

							representative		
Fish	Azores	LLS	European john dory	345	4897	0.01280 [0.0008083 ; 0.2026643]	a constant BPUE appears to be representative	4	1000
Fish	Azores	PS	blackspot seabream	59	3343	2.37357 [0.0233068 ; 241.7245189]	a constant BPUE appears to be representative	78	812831
Fish	Baltic Sea	GNS	Atlantic sturgeon	1604	145119	0.00685 [0.0010301 ; 0.0455203]	a constant BPUE appears to be representative	148	6607
Fish	Baltic Sea	GNS	Twaite shad	1604	145119	0.14523 [0.0138576 ; 1.5219372]	a constant BPUE appears to be representative	1995	218776
Fish	Baltic Sea	GNS	whiting	1604	145119	0.15136 [0.0145604 ; 1.5735105]	a constant BPUE appears to be	2089	229087

							representative		
Fish	Baltic Sea	GTR	lumpfish	206	3729	0.14974 [0.0281167 ; 0.7974902]	a constant BPUE appears to be representative	105	2951
Fish	Baltic Sea	GTR	whiting	206	3729	0.03555 [0.005601 ; 0.2256233]	a constant BPUE appears to be representative	21	832
Fish	Baltic Sea	GTR	thornback ray	206	3729	0.00862 [0.0005626 ; 0.1322046]	a constant BPUE appears to be representative	2	490
Fish	Baltic Sea	SDN	lumpfish	8	143	0.51517 [0.0618277 ; 4.2926068]	a constant BPUE appears to be representative	9	617
Fish	Baltic Sea	SDN	whiting	8	143	0.12500 [0.0176079 ; 0.8873839]	a constant BPUE appears to be	3	126

							representative		
Fish	Barents Sea	OTB	Arctic skate	1328	3301	0.39491 [0.0020246 ; 77.0308578]	a constant BPUE appears to be representative	7	257040
Fish	Barents Sea	OTB	northern wolffish	1328	3301	1.33524 [0.0043475 ; 410.0859005]	a constant BPUE appears to be representative	14	1348963
Fish	Barents Sea	OTB	Atlantic wolffish	1328	3301	0.09759 [0.0009041 ; 10.5339793]	a constant BPUE appears to be representative	3	34674
Fish	Barents Sea	OTB	spotted wolffish	1328	3301	1.19752 [0.004053 ; 353.8216604]	a constant BPUE appears to be representative	13	1174898
Fish	Barents Sea	OTB	Esmark's eelpout	1328	3301	0.08707 [0.0008502 ; 8.9165136]	a constant BPUE appears to be	3	29512

							representative		
Fish	Bay of Biscay and the Iberian Coast	OTM	Atlantic pomfret	39	3793	0.02565 [0.0035983 ; 0.1827956]	a constant BPUE appears to be representative	14	692
Fish	Bay of Biscay and the Iberian Coast	OTM	ocean sunfish	39	3793	0.10259 [0.0385028 ; 0.2733339]	a constant BPUE appears to be representative	145	1047
Fish	Black Sea	OTM	beluga sturgeon	110	18622	0.01818 [0.0019157 ; 0.1725611]	a constant BPUE appears to be representative	35	3236
Fish	Celtic Seas	FPO	conger eel	3	87047	0.35294 [0.0497166 ; 2.5055545]	a constant BPUE appears to be representative	4365	218776
Fish	Celtic Seas	GND	bluntnose sixgill shark	56	35	0.11644 [0.0079114 ; 1.7138671]	a constant BPUE appears to be	0	60

							representative		
Fish	Celtic Seas	GNS	conger eel	1100	38381	0.00140 [8.07e-05 ; 0.0242132]	a constant BPUE appears to be representative	3	933
Fish	Celtic Seas	GNS	flapper skate	1100	38381	0.00212 [0.0001747 ; 0.0256605]	a constant BPUE appears to be representative	7	977
Fish	Celtic Seas	GNS	ballan wrasse	1100	38381	0.52994 [0.0156811 ; 17.9096154]	a constant BPUE appears to be representative	603	691831
Fish	Celtic Seas	GNS	wreckfish	1100	38381	0.00091 [0.0001281 ; 0.0064545]	a constant BPUE appears to be representative	5	245
Fish	Celtic Seas	GNS	turbot	1100	38381	0.00002 [0 ; 0.1074547]	there is between-year	4571	97724

							variability in BPUE		
Fish	Celtic Seas	GNS	brill	1100	38381	0.03241 [0.0020031 ; 0.5244795]	a constant BPUE appears to be representative	78	19953
Fish	Celtic Seas	GNS	European john dory	1100	38381	0.06014 [0.0070875 ; 0.5102406]	a constant BPUE appears to be representative	269	19498
Fish	Celtic Seas	OTB	Twaite shad	2665	121922	0.00078 [7.89e-05 ; 0.0077634]	a constant BPUE appears to be representative	10	955
Fish	Celtic Seas	OTB	thorny skate	2665	121922	0.08851 [0.000595 ; 13.1685643]	a constant BPUE appears to be representative	72	1621810
Fish	Celtic Seas	OTB	Atlantic wolffish	2665	121922	0.02256 [0.0002845 ; 1.7890859]	a constant BPUE appears to be	35	218776

							representative		
Fish	Celtic Seas	OTB	lumpfish	2665	121922	0.00038 [5.29e-05 ; 0.0026638]	a constant BPUE appears to be representative	6	324
Fish	Celtic Seas	OTB	flapper skate	2665	121922	0.00038 [5.29e-05 ; 0.0026638]	a constant BPUE appears to be representative	6	324
Fish	Celtic Seas	OTB	Norwegian skate	2665	121922	0.00645 [0.0001666 ; 0.2497287]	a constant BPUE appears to be representative	20	30200
Fish	Celtic Seas	OTB	great lanternshark	2665	121922	0.00168 [0.0003173 ; 0.008842]	a constant BPUE appears to be representative	39	1072
Fish	Celtic Seas	OTB	bluntnose sixgill shark	2665	121922	0.00067 [5.4e-06 ; 0.0826759]	there is between-year	129	8913

							variability in BPUE		
Fish	Celtic Seas	OTB	Atlantic halibut	2665	121922	0.00140 [9.47e-05 ; 0.0206122]	a constant BPUE appears to be representative	11	2512
Fish	Celtic Seas	OTB	Mediterranean ling	2665	121922	0.00067 [6.78e-05 ; 0.0065443]	a constant BPUE appears to be representative	8	794
Fish	Celtic Seas	OTB	common goby	2665	121922	0.00233 [8.47e-05 ; 0.0639839]	a constant BPUE appears to be representative	10	7762
Fish	Celtic Seas	OTB	freckled goby	2665	121922	0.00472 [0.0001287 ; 0.173019]	a constant BPUE appears to be representative	16	20893
Fish	Celtic Seas	OTB	marbled electric ray	2665	121922	0.04192 [0.0003995 ; 4.3986987]	a constant BPUE appears to be	49	537032

							representative		
Fish	Celtic Seas	OTM	Twaite shad	725	3728	0.00138 [0.0001943 ; 0.0097918]	a constant BPUE appears to be representative	1	36
Fish	Celtic Seas	OTM	Atlantic pomfret	725	3728	0.02008 [0.000578 ; 0.6979033]	a constant BPUE appears to be representative	2	2630
Fish	Celtic Seas	OTM	black dogfish	725	3728	0.00316 [0.0003125 ; 0.0319608]	a constant BPUE appears to be representative	1	120
Fish	Celtic Seas	OTM	longnose velvet dogfish	725	3728	0.00138 [0.0001943 ; 0.0097919]	there is between-year variability in BPUE	0	NA
Fish	Celtic Seas	OTM	tub gurnard	725	3728	0.00393 [0.0003362 ; 0.0458951]	a constant BPUE appears to be	1	170

							representative		
Fish	Celtic Seas	OTM	rabbitfish	725	3728	0.01058 [0.0004605 ; 0.2432066]	a constant BPUE appears to be representative	2	912
Fish	Celtic Seas	OTM	frill shark	725	3728	0.00316 [0.0003125 ; 0.0319608]	a constant BPUE appears to be representative	1	120
Fish	Celtic Seas	OTM	conger eel	725	3728	0.00494 [0.0011178 ; 0.0218122]	a constant BPUE appears to be representative	4	81
Fish	Celtic Seas	OTM	birdbeak dogfish	725	3728	0.00345 [0.0003363 ; 0.0352851]	a constant BPUE appears to be representative	1	132
Fish	Celtic Seas	OTM	telescope cardinal	725	3728	0.00138 [0.0001943 ; 0.0097919]	there is between-year	0	NA

							variability in BPUE		
Fish	Celtic Seas	OTM	great lanternshark	725	3728	0.00412 [0.0009829 ; 0.0172626]	a constant BPUE appears to be representative	4	65
Fish	Celtic Seas	OTM	velvet belly	725	3728	0.02137 [0.004638 ; 0.0984736]	a constant BPUE appears to be representative	17	363
Fish	Celtic Seas	OTM	bluntnose sixgill shark	725	3728	0.00138 [0.0001943 ; 0.0097919]	there is between-year variability in BPUE	0	NA
Fish	Celtic Seas	OTM	ocean sunfish	725	3728	0.00000 [0 ; 0.0316513]	there is between-year variability in BPUE	10	2512
Fish	Celtic Seas	OTM	sea lamprey	725	3728	0.00138 [0.0001943 ; 0.0097918]	a constant BPUE appears to be representative	1	36

Fish	Celtic Seas	OTM	Greenland shark	725	3728	0.00390 [0.0010542 ; 0.0143909]	a constant BPUE appears to be representative	4	54
Fish	Celtic Seas	OTM	European john dory	725	3728	0.02857 [0.0029217 ; 0.2793756]	a constant BPUE appears to be representative	11	1047
Fish	Celtic Seas	OTT	thorny skate	802	54939	0.06734 [0.0010633 ; 4.2651905]	a constant BPUE appears to be representative	59	234423
Fish	Celtic Seas	SSC	Twaite shad	195	2316	0.00790 [0.000444 ; 0.1404162]	a constant BPUE appears to be representative	1	324
Fish	Celtic Seas	SSC	blackbelly rosefish	195	2316	0.00864 [0.0013954 ; 0.0534547]	a constant BPUE appears to be representative	3	123

Fish	Celtic Seas	SSC	turbot	195	2316	0.02078 [0.001041 ; 0.4147266]	a constant BPUE appears to be representative	2	955
Fish	Celtic Seas	SSC	brill	195	2316	0.02078 [0.001041 ; 0.4147266]	a constant BPUE appears to be representative	2	955
Fish	Celtic Seas	SSC	Atlantic torpedo	195	2316	0.01532 [0.0047537 ; 0.0493559]	a constant BPUE appears to be representative	11	115
Fish	Greater North Sea	FYK	viviporous blenny	9	636	0.13372 [0.0086683 ; 2.0627743]	a constant BPUE appears to be representative	5	1318
Fish	Greater North Sea	GTR	tub gurnard	477	82690	0.01505 [0.0008129 ; 0.2787954]	a constant BPUE appears to be representative	68	22909

Fish	Greater North Sea	GTR	lumpfish	477	82690	0.02967 [0.0008738 ; 1.0073498]	a constant BPUE appears to be representative	72	83176
Fish	Greater North Sea	GTR	blue stingray	477	82690	0.00282 [0.0002085 ; 0.0382638]	a constant BPUE appears to be representative	17	3162
Fish	Greater North Sea	GTR	long-snouted seahorse	477	82690	0.00850 [0.000634 ; 0.1139402]	a constant BPUE appears to be representative	52	9333
Fish	Greater North Sea	GTR	ballan wrasse	477	82690	0.19652 [0.0027016 ; 14.2949833]	a constant BPUE appears to be representative	224	1174898
Fish	Greater North Sea	GTR	shagreen ray	477	82690	0.06518 [0.0014019 ; 3.0306956]	a constant BPUE appears to be representative	115	251189

Fish	Greater North Sea	GTR	European john dory	477	82690	0.01237 [0.0007603 ; 0.2012141]	a constant BPUE appears to be representative	63	16596
Fish	Greater North Sea	LLS	rabbitfish	180	26310	0.19105 [0.0040117 ; 9.0983401]	a constant BPUE appears to be representative	105	239883
Fish	Greater North Sea	OTB	Alice shad	3562	289177	0.00240 [0.0003567 ; 0.0161795]	a constant BPUE appears to be representative	102	4677
Fish	Greater North Sea	OTB	Atlantic pomfret	3562	289177	0.00054 [5.52e-05 ; 0.0052152]	a constant BPUE appears to be representative	16	1514
Fish	Greater North Sea	OTB	flapper skate	3562	289177	0.00664 [0.0001724 ; 0.2557409]	a constant BPUE appears to be representative	50	74131

Fish	Greater North Sea	OTB	shagreen ray	3562	289177	0.00152 [0.0002732 ; 0.0084239]	a constant BPUE appears to be representative	79	2455
Fish	Greater North Sea	OTB	freckled goby	3562	289177	0.00081 [6.3e-05 ; 0.0105245]	a constant BPUE appears to be representative	18	3020
Fish	Greater North Sea	OTB	sailray	3562	289177	0.00112 [0.0004215 ; 0.0029923]	a constant BPUE appears to be representative	79	759
Fish	Greater North Sea	OTB	nursehound	3562	289177	0.00000 [0 ; 0.0090719]	there is between-year variability in BPUE	2692	165959
Fish	Greater North Sea	OTB	golden redfish	3562	289177	0.00479 [0.0009219 ; 0.0248588]	a constant BPUE appears to be representative	55	1585
Fish	Greater North Sea	OTB	gilthead seabream	3562	289177	0.00036 [2.69e-05 ; 0.0049626]	a constant	8	1445

							BPUE appears to be representative		
Fish	Greater North Sea	OTM	Twaite shad	650	23501	0.00154 [0.0002167 ; 0.0109216]	a constant BPUE appears to be representative	5	257
Fish	Greater North Sea	OTM	tub gurnard	650	23501	0.00892 [0.0028849 ; 0.0275577]	a constant BPUE appears to be representative	32	589
Fish	Greater North Sea	OTM	blackbelly rosefish	650	23501	0.00154 [0.0002167 ; 0.0109218]	a constant BPUE appears to be representative	5	257
Fish	Greater North Sea	OTM	Atlantic halibut	650	23501	0.00154 [0.0002167 ; 0.0109218]	a constant BPUE appears to be representative	5	257
Fish	Greater North Sea	OTM	European river lamprey	650	23501	0.00154 [0.0002167 ; 0.0109216]	a constant	5	257

							BPUE appears to be representative		
Fish	Greater North Sea	OTM	European john dory	650	23501	0.02373 [0.0056515 ; 0.0996792]	a constant BPUE appears to be representative	59	2291
Fish	Greater North Sea	OTT	Twaite shad	924	19348	0.00661 [0.0002172 ; 0.2012498]	a constant BPUE appears to be representative	4	3890
Fish	Greater North Sea	OTT	Atlantic wolffish	924	19348	0.00415 [0.000859 ; 0.0200004]	a constant BPUE appears to be representative	17	389
Fish	Greater North Sea	OTT	blue stingray	924	19348	0.01805 [0.0017598 ; 0.1850531]	a constant BPUE appears to be representative	34	3548
Fish	Greater North Sea	OTT	blackmouth catshark	924	19348	0.07812 [0.001106 ; 5.5177519]	a constant	21	107152

							BPUE appears to be representative		
Fish	Greater North Sea	OTT	Atlantic halibut	924	19348	0.09180 [0.0335045 ; 0.2515443]	a constant BPUE appears to be representative	224	2188
Fish	Greater North Sea	OTT	round skate	924	19348	0.00115 [0.0001196 ; 0.0109946]	a constant BPUE appears to be representative	2	214
Fish	Greater North Sea	OTT	nursehound	924	19348	0.00561 [0.0007412 ; 0.0424581]	a constant BPUE appears to be representative	4	1479
Fish	Greater North Sea	OTT	Norway haddock	924	19348	0.00225 [0.0002488 ; 0.0203318]	a constant BPUE appears to be representative	5	389
Fish	Greater North Sea	OTT	gilthead seabream	924	19348	0.83052 [0.0038192 ; 180.6054418]	a constant	74	3467369

								BPUE appears to be representative		
Fish	Greater North Sea	OTT	viviporous blenny	924	19348	0.00119 [0.0001217 ; 0.0116963]		a constant BPUE appears to be representative	2	224
Fish	Ionian Sea and the Central Mediterranean Sea	LLS	Spiny butterfly ray	231	158304	0.00433 [0.0003747 ; 0.0500114]		a constant BPUE appears to be representative	59	7943
Fish	Ionian Sea and the Central Mediterranean Sea	OTB	Spiny butterfly ray	272	67183	0.00544 [0.0007192 ; 0.0411204]		a constant BPUE appears to be representative	48	2754
Fish	Oceanic Northeast Atlantic	LLD	longfin mako	25	3762	0.04000 [0.0056343 ; 0.2839736]		a constant BPUE appears to be representative	21	1072
Fish	Oceanic Northeast Atlantic	OTB	rabbitfish	147	627	0.02386 [0.0006691 ; 0.851154]		a constant	0	537

							BPUE appears to be representative		
Fish	Oceanic Northeast Atlantic	OTB	birdbeak dogfish	147	627	0.00680 [0.0009584 ; 0.0482856]	a constant BPUE appears to be representative	1	30
Fish	Oceanic Northeast Atlantic	OTB	blackbelly rosefish	147	627	12.13064 [0.0685318 ; 2147.2135125]	a constant BPUE appears to be representative	43	1348963
Fish	Oceanic Northeast Atlantic	OTB	Norway haddock	147	627	5.33036 [0.0383764 ; 740.3704161]	a constant BPUE appears to be representative	24	467735
Fish	Western Mediterranean Sea	GTR	Spiny butterfly ray	364	344748	0.02121 [0.0001895 ; 2.3730005]	a constant BPUE appears to be representative	66	812831

Annex 13: Reviewers report

Review Report

Pierluigi Carbonara, Fondazione COISPA ETS

Alessandro Lucchetti, Italian National research Council

Stéphanie TACHOIRES, Office français de la biodiversité

Highlights

- An overall summary of the report (even by points) would be very useful to understand the general structure and the work done considering that the report is rather long and not everyone is able to read it all.
- A glossary would be practical: some technical terminology may be clear only to experts or after careful reading. Furthermore, clarifying certain parameters (e.g. bycatch mortality) from the outset would help the reading considerably. Similarly, for many working groups etc., only acronyms are given and these are not written in full when first referred to, which makes reading difficult for people who are not familiar with the issue.
- Some patches of the report are difficult for non-experts to read. Perhaps inserting subchapters could help the reader to better understand the text and the links between the various sections.
- Some methodological parts are very technical, so in order to facilitate reading it would be good to homogenise terminology, for example by trying to refer unambiguously when referring to certain parameters (for instance when reporting “Bycatch Removal Threshold", “Bycatch Reference point” and the PBR).
- The methodological section is also a basis for Advice for next year work, so it should be described in depth, without assuming that the reader knows the different approaches in detail (e.g. BEAM fishPI and their link) and considering that the working group may change over the years.
- Remote Electronic Monitoring seems to be a promising method for bycatch monitoring. The pros and cons should be discussed, as well as the need for future standardization of methodologies
- Strandings are a good means of implementing data. We should stress the need for standardisation of processes (and also of data submission; for example, some countries we know have good survey networks)
- The “Bycatch Mortality Estimate" is actually an estimate of the total bycatch. Indeed on base the formula of Bm each bycatch event is considered to be an event that leads to the death of the specimens. It is understandable that having data on survival to release and/or release rates is very difficult, which is why it would be appropriate to consider Bm as a maximum mortality rate

In order of priority, we have listed the comments as follows:

To be improved: Small actions to modify the text and make it more readable

To be checked: check for errors (sometimes perhaps resolved)

Advice for next year work: suggestion for Advice for next year work

Comment: just a comment, check whether or not action is needed

ToR A: Review and summarize information submitted through the annual bycatch data call and other means for assessment of protected/sensitive species bycatch (ToR A)

This ToR included a review of bycatch legislation and a summary of information received from 17 ICES member states and 8 EU non-ICES states) through the 2023 data call

- In the synthesis page 5, it would be useful to add a warning concerning the total days at sea mentioned and the bycatches recorded by ecoregion. For example, in France only marine mammals was mandatory on logbooks (not turtles or birds in 2022) and OBSCAMe project (REM program) focuses only on marine mammals also. So the days at sea mentioned doesn't concern all the PETS. It is probably the same in others countries. (To be checked)
- We think you need to explain what is meant by bycatch mortality throughout the report. As we understand it, it is an expansion of the BPUE figure to the entire applied fishing effort. Is this correct? Estimation of total bycatch mortality is a complicated subject because even survival rates on released animals (even apparently in good condition) are often estimated or unknown. So to avoid misunderstandings in our opinion it is good to explain what is meant by bycatch mortality. (to be improved)
- There is an inconsistency in the monitoring methods between Tor A and C. In the first, different methods are considered (e.g. logbook, monitoring landing site, monitoring at sea, electronic monitoring), while in Task C only at sea and electronic monitoring (To be checked)
- The effect of the Covid pandemic restrictions on on-board monitoring conducted in 2022 seems somewhat underestimated. We do not know the situation in whole, but we are aware that the use of on-board observers in some circumstances was forbidden or severely limited, and this certainly affected the quality of the bycatch data gathered. Alternative methods (i.e. logbook, interviews, Electronic Monitoring) have been also used to implement data collection (Comment)
- Figure 3 shows an important shift of the methods given days at sea data, it would be useful to have a description of the legislation conducted to this situation (If the change in legislation is one of the reason). (To be checked)
- Monitoring days at sea in Table 2: It would be useful to know how many of these area with observers and how many with electronic monitoring (EM), logbook etc. If EM is effective in guaranteeing wide coverage, it would be useful to know, especially considering the difficulty of using on-board personnel. It would also be useful to describe very briefly whether the EM technology still provided for a ground operator to review the videos in full or whether there was some kind of automatic detection system. It would also be useful for those countries that have not yet taken this route (Advice for next year work)
- The sentence "*In 2023 (2022 data), most submitted data (DaS monitoring effort) was reported as logbook data*". We see figure 4: are you sure about the sentence above? (To be checked)
- Figure 4 does not report information on the total number of monitored days, which would be useful. Moreover the size of the figure doesn't allow to sea information of methods used with a limited days at sea (figures too small). (to be improved)
- The sentence "*the majority of bycatch incidents for all species groups, except turtles, were recorded by at-sea-observers or electronic monitoring methods*" or "*As such caution is needed when*

interpreting observed effort of these ecoregions and métiers (id ecoregions and métiers with logbook data") : Those sentences emphasizes the need to consider logbook data with great caution (we see they are then deleted from the analysis, ok). (Comment)
Can the expert group precise clearly the limits of these data source – if under-reporting is suspected, it should be clearly precised and a comparison of the rate of bycatches in the ecoregions form the different methods logbook, ERM, observer at sea… could give a first idea of this under-reporting.
Figure 5 shows the evolution of the reported data of bycatches, it would be useful to have the same figure by eco-region to see if the situation is general or if it is linked to actions in a specific eco-region.
Table 3: Concerning other method such as "interviews with fishers", the WG members considered that is not suitable for the calculation of bycatch – but can it be considered as for log books "may have value for highlighting bycatch occurrence in fisheries with no other and/or for sensitive fish species that are permitted for sale? Or to try to better understand the factors involved in bycatches? (to be improved)

- About the section "Other monitoring programs or additional projects to monitor bycatch of PETS and associated bycatch estimates": It is not clear to us whether the monitoring programs listed are projects from which data were derived for the report or whether this is a list of 'other programs' and pilot projects that do monitoring. In this case, we are not sure if the list is exhaustive or if it is so fundamental. As a general comment to these types of ancillary monitorings, we think having so many monitoring programs (often without a coordination) is a dispersion of resources and knowledge; in fact, the data is often standardized differently, access to data is not always possible, etc. So please clarify better if the data coming from these additional programs are considered here. (to be improved)
- Concerning those programs, it would be also useful to have the % of coverage of the fishing effort concerned by the metiers targeted by these programs. The pilot spanish program dedicated to marine mammals and others PETS seemed to have increased his coverage by 50% but which part of the effort was covered? In Bulgaria, the on-board monitoring is an "observer" on-board monitoring program? It represents 2.4-4.3% "of licensed boats", does that mean 2.4-4.3% of fishing effort of licensed boat? (To be checked)
- We don't have information of the preliminary results for all programs (we have them for OBSCAMe, the on-board monitoring in Bulgaria and expriments in Portugal) preliminary results are not available concerning others programs (Batmap, EM in Finland…)?(Comment)
- About strandings, it is reported "They can be considered as another view of the bycatch process": Sometimes strandings can provide information on the type of bycatch taking place and also on the trend of fisheries interactions with certain groups (mammals, turtles), but they give a partial view of the situation; for example, only in the case of longlines and set nets are there clear and unmistakable signs of interaction with fishing activities. On bycatch from towed nets, little can usually be derived from strandings. Moreover, the analysis of data from strandings must take into account that only on a small proportion of animals is it possible to get a precise idea of the causes of death. So making bycatch estimates from strandings data is a bit of a guess. It could be done as in Peltier et al. (2016) but it needs: a very well organized strandings network, meteorological

model to simulate the drifting of the carcasses, to know the proportion of stranding carcasses vs sinking carcasses. But this seems to be well reported in the conclusions and we agree that data from strandings can improve knowledge. (Advice for next year work)

- Conclusions: From the data we have, is it possible to say that only in certain areas does the quality and quantity of data allow us to see a trend in PET catches? For many areas, the monitoring programs currently allow to identify the risk of bycatch (by area and gear) but not to identify a trend, which is only possible in our opinion with a much wider monitoring coverage. (Advice for next year work)
- In the conclusions, we really appreciated highlighting the future importance of electronic monitoring. UK and France have launched ERM program focused on marine mammals, mainly cetacean, it would be interested to explore the potentiality of such system for all PETS and to use the power of such tool in order to monitor all PETS not only cetacean. It could be a recommendation. (Advice for next year work)
- In general the recommendations seems to be limited and could be more precise: how sampling design and protocol have to be improvedd under DCF to better perform concerning calculation of PETS bycatch rate? (Comment)
- Several projects concern ERM and some mentioned the use of IA in order to facilitate analyze. A recommendation concerning a collaborative project to develop tools (based on IA) which could permit to reduce the video analyze could be an opportunity. (Advice for next year work)
- Annexe I – To be more comprehensive the table should indicated the abbreviation used in colum "monitoring method" (PO: Port observer or EM: electronic monitoring…). (to be improved)

TOR B: Collate and review information from WGFTB national reports, other ICES WGs and recent published documents relating to implementation of protected/sensitive species bycatch mitigation measures and summarize recent and ongoing bycatch mitigation trials.

This TOR implies a comprehensive review of studies carried out in the last few years (Report WGFTFB), recently published (google scholar and scopus search) and ongoing on the bycatch reduction through gear modifications and BRDs. We think this section is complete and informative. The TOR also involves a complete review of current legislation regarding mitigation measures.

Some comment could be made to improve such sections:

- The section separates projects from WGFTB and projects known by the experts group WGBYC, but it should be more clear to organize the section only by country and not from the sources WGFTB or members WGBYC, for example MITICET project conducted by Spain is mentioned twice (with different information). PECHDAUPHIR (a French project is also mentioned twice). (Comment)
- Med Bycatch project an important initiative in Mediterranean on bycatch is missing: monitoring bycatch and testing mitigation tools. Med Bycatch: https://www.iucn.org/news/mediterranean/201908/med-bycatch-project-a-collaborative-approach-understanding-multi-taxa-bycatch-vulnerable-species-mediterranean-fisheries-and-testing-mitigation; https://accobams.org/the-mava-2-project-ongoing/; https://medasset.org/portfolio-item/medbycatch-project/A summary table mentioned

the country, type of device tested gear or metier concerned and the species of PETS concerned could help to facilitate the use of this quite interesting synthesis (as it is done for the section concerning literature). (to be improved)

- Concerning the description of the device or the type pingers or ADD used, the model or a more precise description should be useful. (Advice for next year work - to be improved if available)
- The description of the analyses conducted to evaluate pinger in PIFIL project mentioned that "*The first data confirm that incidental catches are rare events and show that too few FOs and catches have been observed to allow a statistic conclusion to be drawn on the efficiency of pingers*". The use of the word "rare" is comprehensive from a statistical point of view, this requires specific statistical methods, but this statement should be linked to the statistic point of view regards the level of dolphin bycatches reported on the French by-caught observation in the bay of Biscaye (cf. WGBYC response to ToR A).
- The document referred to a French national Marine Mammals Action Plan, it would be the "French national small cetacean actions plan in the bay of Biscaye". (to be improved)
- The following document may be missing: doi: 10.1016/j.fishres.2022.106406 (To be checked)

Section: gaps between registered bycatch and mitigation trials and/or regulations

- The document analyse the situation of harbour porpoise, but nothing is saying about all other species. Why only harbour porpoise is analysed? Probably an important work but very important to be done (in a next WG?). Doesn't those analyse could be done linked to the results of the Bycatch evaluation and assessment matrix BEAM Tor C? (Comment)

The conclusion which show the main evolution of the mitigation projects and the promising devices is quite interesting.

This synthesis will be useful for scientists and policy makers and is quite impressive. For the future it would be useful to assess a) the commitment of National Governments in stimulating the adoption of mitigation measures and the b) the commitment of fishermen and stakeholders in adopting mitigation measures and practices. (Advice for next year work)

ToR C: Consider the quality of data available for use in the estimation of bycatch rates of protected species through a Bycatch Evaluation and Assessment Matrix, BEAM, to underpin assessments on the bycatch range (minimum/maximum) as appropriate, and where possible, to identify likely conservation level threats

We probably misunderstood some parts of the documents (time to read all the documents is really tight). The document is not totally clear and some results are confusing regarding our knowledge of certain level of bycatches in ecoregion. The document quite is difficult to read, we recommend homogenizing at least the terminology. Several points need clarifications:

- How Bycatch mortality is considered? The table on the criteria states Bm=BPUE * Effort. So, each bycatch event is considered to be an event that leads to the death of the specimens? Because in reality for some species (especially turtles or certain birds depends on the gear used), some specimens are released alive, although delayed mortality is almost always unknown. This is quite important to clarify because in the Criterion the Bycatch Mortality is related to the Bycatch Reference point. What we understand is that what is referred to as the "Bycatch Mortality Estimate" is actually an estimate of the total bycatch. (Advice for next year work)

- Is the "Bycatch Removal Threshold" the same value as the Bycatch Reference point and the PBR (we understand not in the results but the text is not clear enough)? In the table 1 BEAM traffic light indicators […] in section 2.2 of results it is mentioned that bycatch reference point are not available (no=red or not agreement = orange). Some members states adopted threshold but they are not indicated in the document, even they are not adopted at an ecoregion level, those threshold could be mentioned. (to be improved)

There is something in Table 1 that we do not understand and that does not correspond to the data in the tables of Annex I of ToR A. We know the Adriatic situation well. No turtle individuals are reported in the OTB (while they are reported in ToR A; this is strange both because bycatch is very common and because we know that individuals were reported. PS is reported where turtles are not caught instead (no turtle bycatch in ToR A). PTM is missing where bycatch turtles is very common and catches are reported in Annex I ToR A etc. Perhaps have we misinterpreted the table? In this table are confidence limits referring to Bm? If so, while the estimates for OTB seem to be reasonable (please see the GFCM 2021 review of bycatch), we think the estimates for Adriatic PS seem to be unrealistic, the same for GTR Ionian and Central Mediterranean. As well, as seems unrealistic that in LLD were not reported catch for the sea turtle in some areas (To be checked)

- In the same idea, the results for common dolphin in the bay of Biscay focused on FPO (pots, traps) which are not gear at risks even there is one bycatch observed by at-sea observer program… (To be checked)

In more details concerning the presentation of the results:

- The group should underlines the point that if there is no table concerning one species concerning a gear in an eco-region it doesn't mean that there is no bycatches, just not data recorded. (comment)
- The method emphasizes a problem regarding the size of the vessel (1.1) and the related data, should a recommendation of the experts concerning precision in data call be done to avoid the problem? (Advice for next year work)
- Concerning the presentation of the results, the use of the green colour is confusing when it is applied to the data effort or to the bycatch mortality estimation. (To be checked)
- Section 2. Results: the signification of the grey cell regarding "zero" cell are unclear – could it be precised? (To be checked)
- Figure 3: is it the bycatch mortality? The title indicates "total bycatch estimates"? (Formal mistake)
- Section 1.1 Data based on "vessel crew observers" were considered reliable, but logbook (based on fisherman observations /reports) no. Please specify better what mean "vessel crew observers" and which the criteria used to consider that data reliable (To be checked)
- Criteria 1: In the BPUE variance analysis there is an assumption too strong that the BPUE is significant linear correlated to the DaS. It is not clear to us at least whether this assumption has been tested in some way; (Advice for next year work)
- Criteria 2: criterion 2 thus defined, it would be enough to have documented the monitoring of at least 1 day at sea to receive the green light (to be improved)
- In the Appendix 2 there are some probable inaccuracy (e.g. OTB in Adriatic: Monitoring effort (DaS, 2018-2022) = 406; Fishing effort (Das, 2022) = 7) (To be checked)

On the conclusion, it would be appreciated to have focus on the limits of each sources of data. Some results are a bit strange so it is really necessary to emphasis the limit of the different data used…

ToR D: For high priority species, where bycatch rates and associated markers of sustainability are unavailable, highlight the types of fishing gears and fishing activities which pose the greatest risk to these species.

- After reading all the proposal for this ToR, the first figure could be improved. We recommend to present in a different manner because the metadata table is the basis but those metadata allows to construct the three tables 1. bycatch risk per gear / 2. Likelihood of spatial overlap and 3. Likelihood of impact on population and then those 3 tables give a "qualitative bycatch risk estimation". The box "qualitative bycatch risk estimation" is the result of the combination of the 3 tables. (to be improved)
- From the introduction it would seem that the TOR is based on a risk-assessment by species (e.g. PSA), instead the risk assessment is then developed by gear. This choice should be explained or in any case the methodological steps should be detailed (to be improved)
- Dealing with the following sentence "*Because of the nature of this task, in most, if not all cases, data or other evidence may be missing and thus in these cases the process necessarily relies to an extent on expert judgement*": which kind of data are missing? Species distribution? Other? As a precautionary approach, in case of missing data, we agree that expert judgement is a reasonable way to highlight possible risk of bycatch. (to be improved)
- *Emphasize quantitative (or semi-quantitative) rigour*. In reality, the proposed summary tables seem to be based on entirely qualitative data or at least the process of analyzing this data should be further clarified (To be checked)
- "*Develop a protocol for evaluating the expertise of experts*": it is not clear how the group of experts should be selected and based on which criteria. In other sections of the report it is reported that the confidence of the estimation will be based also on quality of the experts' knowledge for each case. This is not clear from the report (to be improved)
- "Metadata table": this part is a bit confusing, there are several topics, considerations and explanations mixed together that make the reading (and understanding) difficult. Probably it would be useful to itemize the different topics, to better clarify what has been done, which kind of data are available and what is the plan for the future. Furthermore, the structure of the table with the requested data should be indicated, while in the text only a list of biological parameters is indicated as an example. We suggest to itemize the data available as: life history traits, species distribution, bycatch data, population status etc. Than a section on incomplete or partially biased data. One section on species selection etc. It is not clear if this table is an excel/csv file or other type of DB. A short selection of this table would help the reader to understand better the matter. The type of metadata table would be available for the end-user (scientist, government…). But we understand that this metastable is not yet implemented or partially? (Advice for next year work)
- About the life-history traits, we do not fully understand why they should be provided by acknowledged experts instead of detailed, recent and scientifically based bibliography. (Advice for next year work)
- Concerning the parameters conducted to table 3 (Estimation of the likelihood of impact on the species (population) by gear type per ecoregion (only for gear types considered moderate or high evidence of risk for that species), the survival of the species (which could mainly concern sturgeon, some sharks/rays, turtles and birds in certain conditions and gear) doesn't seem to be consider… Nor the state of the population which could influence the capacity building to recover to a population is taken into consideration (not listed?). (Advice for next year work)

- The three proposed tables concern the synthesis of the final results, the methodological steps to arrive at the summary tables are missing or unclear for us (to be improved)
- 3. Qualitative bycatch risk estimations. Table 1: is this base on bycatch data (survey, REM etc.)? Table 2: is this base on data of species distribution and effort distribution? Is this information available for all the gears? Table 3: which kind of "impact" is this? Which kind of data are used to produce this matrix? We understood clearly what has been done only after multiple-reading and we realized that examples are reported below in the text. Probably it would clearer to move the tables above when you describe the three tables (To be checked)
- It is not fully clear why table 2 is produced only after table 1. We would first assess the overlap between species distribution and fishing effort. Once this is clear we would check the level of bycatch at gear level (depending on several factors, i.e. a kind of catch-ability). Not a big issue but It is just to have a clear logic flow. (to be improved)
- The scoring system in Table 2 seems totally qualitative. If this is the case, there is a judgment grid through which the score, although qualitative, is evaluated (to be improved)
- Table 3. Just to be sure we understand it correctly: the score assigned to each species, area and gear considers table 1 and 2 and the status (demographic parameters etc.) of each species. Is this correct?
- It is not clear how is estimated the level of confidence (to be improved)
- Conclusions are a bit weak and do not summarize clearly what has been found and what are the final considerations; (to be improved)
- A combined index for a gear per écoregion for all the species/taxa could be an interested way forward. (Advice for next year work)

ToR E – Review ongoing monitoring of different taxonomic groups in relation to spatial by-catch risk and fishing effort to inform coordinated sampling plans.

- A definition of the term risk-score used in the different ToR is absolutely needed to better understand the complementary of each approach. (To be checked)
- When referring to gillnets, trammel nets and similar static nets it is better to report "set nets" instead of "nets" or "fixed nets" and "drift nets". (comment)
- *"As in 2022, the main effect of removing the Vessel Logbook and Port Observer data from this analysis"*. Again it seems there is discrepancy among the monitoring effort data reported in ToR A and in ToR C and D. In ToR A the logbook and port observer data are included, while in ToR C and D those data are considered not reliable(To be checked)
- *"…the quantification of the perceived risk"* Please could you briefly report the method (to be improved)
- Some sections are not fully clear: *"Each functional group gets a score (1-3, where 3 is the highest) for each metier (level 4) based on data or knowledge from any ecoregion"*. Does the score range from low to high risk of by-catch from 1 to 3? (to be improved)
- deep water sharks, demersal sharks, pelagic sharks, skates and rays, and sturgeons how was integrate into the fishPi score with other "functional groups" already present into the fishPi-score (To be checked)
- *"The underlying hypothesis is that the risk of interaction with each fishing gear is independent of area provided the bycatch species/group are present in that area"* we agree with this (comment)
- *"This risk-score is therefore multiplied by an area dependant absent/present indicator (0 or 1). Risk scores for all functional groups are then summarised to get a "final risk score fishPi". An area/gear combination will get a high combined risk-score if species from many functional groups*

are present and if the gear is known to interact with those species in any region". Question: but isn't there a multiplication factor that considers the abundance of a species or functional group in an area? We think this is an important point to take in consideration and/or clarify. (To be checked)

- "Fish species groups or individual fish species can be added in the future if their inclusion is considered essential". The criterion to be used should always be a single one, e.g. the one relating to the threat level. Excluding some species because they are commercial and/or targets of some gear could lead to the exclusion, for example, of seriously endangered species such as some sharks (e.g. blue shark, mako, spurdog) or teleosts (e.g. eel) (Advice for next year work)
- Moreover the risk score of the fishPI (table 6.1 is in fact built on this method) is not described (only the bibliographic reference), but as many "risk score" is used in the different answer to the ToRs, a short definition should be done and a recall of that method in brief would be useful, otherwise the reader has to go back and review what was done in that project. An annex with the fishPI riskscore used could be useful. (to be improved)
- To produce table 6.1, the functional groups were therefore considered all together? How this merger was done is unclear. Is there a mirror table that considers the functional groups separately instead? It is important because different groups may be represented by a few or many species, a few or many individuals, so their 'weight' may also be different, perhaps it would be useful (To be checked)
- At the end of section 6.1, the difficulties of presented fishing effort by days at sea is underlined. But no recommendations is given to improve the situation and do better analysis in the future. Which metrics should be collected by gear (number of hook per line for long-line? Soaking time for static gear?...). Recommendations from the WGBYC on this matter to improve bycatch evaluation should be useful…(Advice for next year work)
- In Section 6.2, no link or differences are described between the 3. An estimated risk score and the work done in ToR c (BEAM approach) and ToR d. (to be improved)
- The group didn't propose any recommendations on how to improve monitoring. It is written that it is not intended to answer detailed questions about optimal sampling levels to produce bycatch estimates, but the ToR specifies the objective "*to inform coordinated sampling plans*". No information or recommendations are given to inform such coordinated sampling plans. (Advice for next year work)
- Table 6.1: Celtic Sea GTR the coverage is 201.65%? Is there a mistake? (To be checked)
- Table 6.1:
  - the calculation of the combined score which is the basis of the sort the results in descending order) should be recalled on the title of the table; (To be checked)
  - it would be useful to have the list or the ecoregions which were not included in the analysis. The members indicated five more ecoregions included. A list of the ecoregions not included would help the reading (no ecoregions in Mediterranean areas?). (To be checked)
- Even comments below could improve the document, in conclusion this approach seems to be very informative to identify the lack of monitoring on risk gear. We would appreciate some more recommendations on the design of sampling and protocols. The table 6.1 should be done available for end-user (xls to do research in it). (To be checked).