Agenda Item 2	Review of New Information on Threats to Small Cetaceans (reporting cycle 2017 only) Bycatch
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Action Requested	• Take note
Submitted by	ICES WGBYC

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ICES REPORT WGBYC 2018

ICES ADVISORY COMMITTEE

ICES CM 2018/ACOM:25

Report from the Working Group on Bycatch of Protected Species (WGBYC)

1–4 May 2018

Reykjavik, Iceland

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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Acronyms

ADD	Acoustic Deterrent Device
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, Northeast Atlantic, Irish and North Seas
BRA	Bycatch Risk Assessment
BRD	Bycatch Reduction Device
DCF	Data Collection Framework
DC-MAP/EU-MAP	Data Collection Multi-Annual programme
EEZ	Exclusive Economic Zone
FPO	Pots and traps
GND	Drift gillnet
GNS	Set gillnet
GSA	Geographical subareas http://www.fao.org/gfcm/data/map-geographical-subareas/en/
GTR	Trammelnets
HELCOM	Baltic Marine Environment Protection Commission
LLD	Drifting longline
MS	Member State
NAFO	North Atlantic Fisheries Organisation
NAMMCO	North Atlantic Marine Mammal Commission
OTM	Midwater Otter trawl
PETS	Protected, Endangered and Threatened Species
PTB	Paired bottom trawl
PTM	Midwater pair trawl
RDB	ICES Regional Database
RDBES	ICES Regional Database and Estimation System
TAC	Total Allowable Catch
VMS	Vessel Monitoring System
WGBYC	Working Group on Bycatch of Protected Species (ICES)
WGCATCH	Working Group on Commercial Catches (ICES)
WKPETSAMP	Joint WGBYC/WGCATCH Workshop on sampling of bycatch and PET species (ICES)
WKREV812	Workshop to Evaluate the Implementation of Council Regulation (EC) 812/2004

Executive Summary

The Working Group on Bycatch of Protected Species (WGBYC) met at the Marine and Freshwater Research Institute in Reykjavik, Iceland 1–4 May 2018. The meeting was chaired by Sara Königson (Sweden) and Kelly Macleod (UK) and was attended by 21 participants from twelve nations.

Seven Terms of Reference (ToRs; Annex 2) were addressed during the meeting through plenary and subgroups. The 2018 report is structured in the same order as the ToRs. Contributions to ToRs were requested in advance of the meeting and all data submissions were requested via a formal WGBYC/ICES data call (ICES, 2018). These requests were met to varying degrees. Late data submissions and submissions not in the right format caused delay in the progress of some ToRs (A and C primarily) at the meeting. However, the response to the formal data call was encouraging with 19 out of 24 contacted countries responding, though the quality of data submissions was variable.

Highlights from the 2018 meeting include review of ongoing bycatch mitigation research projects (ToR-B), bycatch risk assessments (BRAs) for harbour porpoise and common dolphin in the Celtic Seas and Bay of Biscay and Iberian Coast Ecoregions (ToR C); review of the WKPETSAMP compiled inventory of the various sampling programmes that provide information on bycatch of protected species at the national level (ToR D); comparison of fishing effort from different sources (ICES Regional Database; WGBYC database; Logbooks) (ToR F); and a review and application of the fishPi method to inform relative risk of bycatch in different gears (ToR C; ToR G). The WG was also able to deliver responses to recommendations from the joint WGCATCH and WGBYC workshop PETSAMP (Tor G) held the week before WGBYC.

Reviewing data collated from 2016 Regulation 812/2004 annual reports (ToR-A) occupied a substantial amount of the meeting. The UK is the only Member State with a dedicated PETS observer programme; other MS use non-dedicated observers through the DCF ((EC) No 2017/1004) and DC-MAP (Commission Decision 2016/1251/EU). WGBYC remains concerned about the likely negative bias in PETS data recorded by non-dedicated observers and therefore discussions on training for on-board observers were recommended. WGBYC continues to incorporate monitoring, effort and bycatch data from non-EU states/countries that have fishing fleets in the North Atlantic and adjoining seas; this will facilitate more robust bycatch estimates for the many wide-ranging species that fall under WGBYCs remint. Bycatch of marine mammals and seabirds was evident in most ecoregions. Bycatch of marine turtles was only recorded in the Mediterranean. High bycatch rates for elasmobranchs were observed for some vulnerable and near threatened species in the Celtic Seas, the Greater North Sea and the Mediterranean.

The harbour porpoise BRA highlights the risk to this species in the Celtic Sea Ecoregion from net fishing; mortality may represent 1–2.4% of the best available abundance estimate for the Celtic Sea (CS). The BRA for common dolphin in midwater trawls and nets, suggest that the total mortality in the CS and the Bay of Biscay (BoB) is between 0.53 and 1.57% of the best regional abundance estimate; the mortality is highest in the BoB. However, there are incomplete observation and fishing effort data to inform this approach. The results from the BRA are biased and they should only be considered as indicators of areas and métiers in need of further investigation.

The results from bycatch assessments using cetacean strandings show comparable numbers of bycaught harbour porpoise and common dolphin. The stranding analysis

reported by Peltier *et al.*, 2016 is subject to several assumptions that are not fully understood and therefore contribute to uncertainty in the estimates derived from strandings data.

Ongoing challenges with the WGBYC data are the basis for a number of recommendations regarding improved on-board sampling protocols, training of bycatch observers and regional design of sampling programmes. The next WGBYC/ICES data call will be improved by providing greater clarity on the species of interest and will increase the number of mandatory data fields to improve data consistency.

1 Opening of the meeting

The Working Group on Bycatch of Protected Species (WGBYC) met at Marine and Freshwater Research Institute, Reykjavik, Iceland on 1–4 May 2018. The meeting was opened by a presentation on the work of the institute by the Head of Demersal Fisheries Division Gudmundur Thordarson. A complete list of participants is given in Annex 1. The Terms of Reference (ToRs) for the meeting are given in Annex 2.

2 Adoption of the agenda

The draft Agenda was agreed and is given in Annex 3. Participants were organised into subgroups associated with each of the ToRs to conduct the work.

3 Review and summarize annual national reports submitted to the European Commission under Regulation 812/2004 and other published documents and collated bycatch rates and estimates in EU waters (ToR A)

3.1 Summary of EU legislation concerning the collection of data on bycatch of protected species

The work of WGBYC is primarily driven by the requirements of Council Regulation (EC) No. 812/2004[1] of 26 April 2004 laying down measures concerning incidental catches of cetaceans in fisheries (hereafter referred to as Reg.812/2004). The Regulation has two components: Articles 1–3 concerning the use of Acoustic Deterrent Devices (ADDs or 'pingers') on vessels of 12 m or over on métiers identified in Annex I, and; Articles 4 and 5 concerning monitoring of 'incidental catches of cetaceans using observers on board the vessels flying their flag and with an overall length of 15 m or over, for the fisheries and under the conditions defined in Annex III'. Member States (MS) are obliged to establish Pilot or Scientific Studies on smaller vessels. MS are also required to report annually on their monitoring effort, fisheries effort, number of incidental catches of cetaceans and the use of pingers to the EC. The annual review of these reports are central to the work of WGBYC. The WGBYC repeatedly highlight the shortcomings of this Regulation (primarily it does not target métiers with the highest bycatch) and also the lack of compliance from MS with regards to pinger implementation and reporting.

Other appropriate data on cetacean bycatch may also be submitted through Reg.812/2004 reporting. These data are most commonly linked to at-sea observations carried out for the purposes of fisheries monitoring in accordance with the EU Data Collection Framework Regulation 2017/1004 (DCF)[2]. The aims of the DCF are to "*establish rules on the collection, management and use of biological, environmental, technical and socio-economic data concerning the fisheries sector*" and contribute "*towards reaching the objectives of the common fisheries policy, which include the protection of the marine environment, the sustainable management of all commercially exploited species, and in particular the achievement of good environmental status in the marine environment*" under the Marine Strategy Framework Directive (MSFD). In Article 4, it states that it "*shall establish a multiannual Union programme for the collection and management of data*". Article 4 is realised through Implementing Decisions (e.g. (EU) 2016/1251 of 12 July 2016). The implementing decision states that data collected should include '*incidental bycatch of all birds, mammals and reptiles and fish protected under Union legislation and international agreements, including the species listed in Table 1D, and if the species is absent in the catch during scientific observer trips on fishing vessels or by the fishers themselves through logbooks'*. Table 1D lists '*Species to be monitored under protection programmes in the Union or under international obligations'*. This Decision, and future decisions, may eventually replace the Regulation 812/2004. 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, the use of non-dedicated protected species bycatch observers may lead to downward bias in the number of recorded events (see WGBYC 2015). The requirements to implement pingers or other measures to reduce bycatch should be addressed in a Regulation of the European Parliament and of the Council on the conservation of fishery resources and the protection of marine ecosystems through technical measures; the

[1] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:150:0012:0031:EN:PDF

[2] https://datacollection.jrc.ec.europa.eu/legislation/current/obligations

proposal is still being discussed and the provisions within this to manage and reduce protected species bycatch are as yet unknown to WGBYC.

There are many obligations to monitor and introduce measures to reduce protected species bycatch outwith those within legislation specific to fisheries and the Common Fisheries Policy. As examples, MS have obligations under Council Directive 92/43/EEC[3] of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'). Article 12 states '*Member States shall establish a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a). In the light of the information gathered, Member States shall take further research or conservation measures as required to ensure that incidental capture and killing does not have a significant negative impact on the species concerned*.' The revised Commission Decision 2017/848[4] 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 —The mortality rate per species from incidental bycatch is below levels which threaten the species, such that its long- term viability is ensured*. 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 fisheries effort and bycatch monitoring data are required by MS to assess the impact of bycatch and work towards meetings the various legislative requirements and commitments.

3.2 Monitoring under (EC) Regulation 812/2004-Overview

The WG was provided with Member States (MS) annual report to the European Commission on at-sea observations carried out under Reg. 812/2004in 2016. Six of the 23 EU coastal MS were not affected by any part of Reg. 812/2004 in 2016 (Bulgaria, Croatia, Cyprus, Greece, Malta, Romania) because their vessels do not fish in areas covered by the regulation and therefore do not require any further discussion (Table 1). Three MS that are affected by Reg. 812/2004/2004, but which did not submit reports to the EC were Finland, Lithuania and Spain (Table 1). Reports were received from the remaining 14 of the 17 MS affected by Articles 4–5 of Reg. 812/2004. The reports from Belgium, Denmark, Estonia, France, Italy, Germany, Ireland, Latvia, Poland, Portugal, Slovenia, and the UK were obtained via the EC. The reports from Sweden, Portugal and the Netherlands were submitted directly to WGBYC. Section 3.2 below summarizes text extracted directly from individual MS reports.

The quality and scope of the information provided in the annual reports continues to be variable, with some MS simply repeating the information provided in previous years. Consistent with the annual content of WGBYC reports from previous years the Reg. 812/2004 reports have been reviewed for:

1) Implementation of mandatory monitoring of cetacean bycatch, and information on voluntary mitigation and observation schemes (see Section 4 for mitigation);
2) Information on cetacean bycatch (including records of individual bycatch events and bycatch estimates and magnitude of observer coverage provided by Member States);

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017D0848

3) Information on bycatch of non-cetacean taxa;

4) Other relevant issues emanating from the annual reports.

3.3 Monitoring under (EC) Regulation 812/2004 by Member States (including non-cetacean bycatch events when provided)

In **Belgium**, no observer scheme was in place in 2016 to monitor bycatch of marine mammals. However, observers conducting other studies (biological monitoring, etc.) were frequently on board vessels with towed fishing gear. No bycatch of marine mammals was observed or reported by fishermen. In addition, the small number of fishing vessels means that Belgian fishing practices have a limited impact on marine mammal populations.

Denmark reported no specific monitoring programs for incidental bycatch of marine mammals during 2016 in the Danish pelagic trawl fishery. The reason for not continuing the monitoring programmes carried out from 2006–2008 was that the observer schemes, with a coverage up to 7%, had no records of incidental bycatch of protected species. Neither was any specific monitoring according to the Reg. 812/2004/2004 carried out in the Danish gillnet fishery. Instead, observer data on incidental catches of marine mammals from gillnets was collected under the Data Collection Regulation scheme (DCR). Monitoring was carried out on vessels <15 m in area 27.3.a (five fishing days; 2.0% coverage; two bycaught harbour porpoises), vessels <15 m in area 27.4 (four days; 2.2% coverage; zero porpoise bycatch), and vessels >15 m in area 27.4 (30 days; 9.4% coverage; zero porpoise bycatch).[5].

Estonia reported that there was no fishery in area 24 using static gear and no observer coverage in areas 3.d.25 and 27 due to low total effort and unpredictable activity. In other areas 5% coverage was reached. Until 2014 at-sea observers collected herring, sprat, smelt and cod samples and recorded the proportion of herring and sprat in catches on board fishing vessels. That was also the case for some sampling in 2016. Estonia has no fishing effort using static gear with vessels larger than 15 m. Static gears are used in fisheries by boats up to 10 m. No studies have been conducted to assess the incidental catches of cetaceans for boats up to 10 m, but according to interviews with fishermen there have been no cetacean catches.

In **France** the programme OBSMER manages all the observations at sea required by various fishery regulations. During 2016, the effort dedicated to observation on board vessels represented 767 trips and 933 fishing days. A total of 192 trips representing 273 days were monitored for towed gears in ICES subareas 7 (including 7.k) and 8 and in the Mediterranean Sea. A total of 331 trips and 436 days were monitored for static gears in ICES Subarea 8. In addition, 244 trips and 224 days at-sea were dedicated to set-nets in areas concerned with pingers (subareas 4 and 7). Three species of cetaceans were recorded as bycatch during 2016 totalling 41 individuals: *Delphinus delphis* (35 animals), *Stenella coeruleoalba* (two animals) and *Phocoena phocoena* (four animals). Total bycatch estimates were not provided.

Germany monitored under the DCF observer programme, trying to follow the requirements of Reg. 812/2004 as much as possible. In one fleet segment, covering pelagic trawl vessels of over 15 m length in ICES subareas 6 and 7, the bycatch of 17 common

[5] During the ICES Advice Drafting Group on Bycatch (ADGBYC), it was found that the summary of Denmark's Reg. 812/2004 report was incomplete. Their report also documents Remote Electronic Monitoring (REM) trials in <15 m set gillnet fisheries in subareas 27.SD23 and 27.3a. In these areas, ten and 22 harbour porpoises were recorded bycaught, respectively.

dolphins (*Delphinus delphis*) in three different hauls was observed and reported according to Reg. 812/2004. During monitoring under the DCF observer programme bycatch of several seabirds was recorded and included 12 unidentified ducks and two velvet scoter (*Melanitta fusca*). These bycatches occurred in one fleet segment, vessels under 15 m that use gillnets with mesh sizes >=110 mm in the Baltic Sea. In addition, one bycatch of a harbour porpoise (*Phocoena phocoena*) in the same métier was reported by a fisherman to DCF observers. These bycatch events were not reported in the 2016 German Reg. 812/2004/2004 report, but were uploaded to the WGBYC database and are included together with information on observed effort in Table 2.

In **Ireland** a total of 28 trips comprising 170 days at sea and 178 hauls were observed in pelagic trawl fisheries in 2016. All of this work was carried out as part of DCF monitoring and surveys. Following a period of intensive monitoring of set-net fisheries from 2011 to 2013 no further monitoring of set-net fisheries occurred during 2016. No cetacean bycatch was observed in 2016. A total of seven common dolphins (*Delphinus delphis*) observed bycaught from a total of 1529 days at-sea observed in pelagic trawls since monitoring under Reg. 812/2004 commenced in 2005. Of these, a total of 219 days were carried out as part of dedicated independent observer programmes from 2010 to 2012 in a range of pelagic trawl fisheries with no cetacean bycatch observed. The report concludes that the risk of cetacean and other protected species bycatch in Irish pelagic trawl fisheries is low.

In **Italy** a total of 344 days were dedicated to monitor 22 pelagic pairtrawlers (>15 m) between GSA 16 (Southern Sicily) and GSA 17 (Northern Adriatic), which represent 2.34% coverage of the fleet. No bottlenose dolphin (*Tursiops truncatus*) were bycaught in either GSA. Observers from the monitoring programme are also trained to collect bycatch data of other PETS under Habitats Directive (i.e. loggerhead turtles, *Caretta caretta*) and species of conservation concern (e.g. sharks, pelagic rays and skates). Four loggerhead turtles and a large number of sharks and rays were taken as bycatch in GSA 17.

The **Latvian** national monitoring programme of incidental catches of cetaceans in 2016 covered observations of 496 trips in pelagic trawl fisheries and 33 trips in gillnet fisheries. The monitoring was carried out by seven observers on 13 different vessels. No incidental bycatch of cetaceans was observed in 2016, which is the same result as reported from 2006–2015. Reported observer coverage was 6.9% of the pelagic trawl fishery with vessels 12–18 m, and 11.4% with vessels 24–40 m (based on towing time). Reported coverage in the gillnet fishery vessels 24–40 meters was 11.8% (based on soak time). The report concludes that cetacean monitoring has no practical significance in Latvian waters and is therefore an unnecessary expenditure of financial and human resources. Latvia therefore suggests stopping future observations.

In the **Netherlands** bycatch monitoring is integrated with the collection of catch data under the EC Data Collection Regulation 199/2008 and Decision 93/2010. In 2016, during seven fishing trips, 32 days and 81 hauls were observed in the fleet segment of pelagic trawlers fishing from December to March in ICES subareas 6–8, and 85 days and 192 hauls were observed outside this area in the North Atlantic during other months. The total number of fleet days was 368 in the fleet segment of pelagic trawlers fishing from December to March in ICES subareas 6–8 (8.7% coverage) and 770 in the fleet segment outside this area in the North Atlantic during other months (11.0% coverage). However, five of twelve trips monitored by the Netherlands, were on board two German (three trips) and one French (two trips) flagged trawlers. The observer effort consisted of 46 days (127 hauls) on board the German trawlers and 23 days

(57 hauls) on the French trawler, covering approximately 59% of the total Dutch monitoring effort. The observed bycatch rate of zero dolphins per day in the pelagic fishery is in line with the findings in 2006–2015 when the bycatch rate was 0.00–0.01 dolphins per day. In addition to cetaceans, this report includes information on incidental bycatches of species listed in Table 1D of EU Decision 2016/2051. Three bluefin tuna (*Thunnus thynnus)* were caught during two incidents in both fleet segments in 2016.

In **Poland** for 2016, as in previous years, the Incidental Cetacean Catch Monitoring Programme was carried out by the National Marine Fisheries Research Institute in Gdynia. Since 2015, the Programme has been implemented under the National Fisheries Data Collection Programme. In 2016, observations were conducted on ten vessels of over 15 m in length, operating from six ports. As part of the Programme, observers were at sea for 102 days, including 47 days on single pelagic trawl vessels and 32 days on gillnets vessels, two days on a vessel using a bottom trawl, eleven days on a drifting longline vessel (LLD) and two days on a pelagic pairtrawler (PTM). It should be noted that, for larger vessels, the number of days at-sea was significantly different from the number of days when fishing was done. This was due to the transiting of the vessels to different areas during the trip.

During the trips on vessels of more than 15 meters in length, observations focused on the presence and bycatch of cetaceans and other marine mammals. In addition, the monitoring programme for incidental catches of cetaceans included observations of incidental catches of seabirds and endangered species such as the twaite shad (*Alosa fallax*) or fish from reintroduction programmes, such as the sturgeon (*Acipenser oxyrhynchus*). No cetacean bycatch was observed in any métier. However, a young grey seal (*Halichoerus grypus*), a female of 125 cm in length and weighing 35.2 kg, was bycaught in a set gillnet (GNS) fishery. During the monitored fishing activities in 2016, bycatch of birds was also reported and two common guillemots (*Uria aalge*) were observed bycaught in a set gillnet (GNS). No presence of other protected species such as the twaite shad (*Alosa fallax*) and the sturgeon (*Acipenser oxyrhynchus*) was observed.

In **Portugal,** monitoring of bycatch of cetacean and other protected species in the mainland were provided by IPMA at-sea observations carried out under the National Biological Sampling Program (PNAB/EU-DCF). The monitoring programme was maintained with the special collaboration of almost all Fishery Producers Organizations (PO's). A total of 13 trips and 48 hauls were observed in set-nets (GNS and GTR) included in the polyvalent/multi gear fishery (vessels ≥15 m) operating in the Portuguese waters of ICES Division 9.a. This observation effort translated into coverage of 0.033% of the fishing effort of boats operating off mainland Portuguese ports. In 2016, on-board observers (DCF) recorded no bycatch of any cetaceans or other protected species (e.g. marine birds or sea turtles).

Although not reported in the Reg. 812/2004 report, a study was recently published on cetacean bycatch assessment in a small-scale artisanal fishery in the Azores (Cruz *et al*., 2018). Cetacean bycatch has been documented in the pole-and-line tuna fishery in the Azores with common dolphins being the species more frequently taken, based on data collected by observers on ~50% of vessels operating from 1998 to 2012. The influence of various environmental and fisheries related factors in common dolphin bycatch and fleet-wide estimates of total bycatch using design-based and model-based methods were investigated. Over the 15-year study, dolphin bycatch occurred in less than 0.4% of the observed fishing events. Generalized Additive Modelling (GAM) results suggested a significant relationship between common dolphin bycatch and duration of fishing events, sea surface temperature and location. Total bycatch calculated from the

traditional stratified ratio estimation approach was 196 (95% CI: 186–205), while the negative binomial GAM estimated 262 (95% CI: 249–274) dolphins. This work suggested that rates of common dolphin bycatch in the pole-and-line tuna fishery in the Azores are low and exhibit considerable variation between years.

Slovenia have no vessels of over 15 m using pelagic trawls in its fishing fleet. For vessels fishing under Reg. 812/2004 no incidental catches were monitored by the Fisheries Research Institute of Slovenia during the course of its regular monitoring activities (monitoring of catches and discards) under the DCF. In addition, the Slovenian non-governmental organisation Morigenos has an independent long-term monitoring and conservation programme of observing bottlenose dolphins (*Tursiops truncatus*). No deaths of cetaceans due to fishing were reported in 2016.

In **Spain,** there is no dedicated observer programme for protected species bycatch. Monitoring is carried out under the DCF observer programme, and protected species are routinely recorded by the IEO and AZTI. Spain did not submit the Reg. 812/2004annual report to the EC this year.

Data for the Spanish fishing fleets operating in ICES major fishing area 27 (subareas 6.b.2, 7.b, 7.c.2, 7.h, 7.j.2, 7.k.2, 8c and 9a) in 2016 (collected under the DCF observer programme) were provided under the WGBYC data call (Annex 7). The data include one cetacean bycatch event of 10 common dolphins (*Delphinus delphis*) by a pairtrawler in Division 8.c during the second quarter of the year. Spain has not officially reported any data from the small fraction of the Spanish fishing fleet operating in subareas 1, 2, 6 and 12. However, a hooded seal (*Cystophora cristata*) bycaught by a bottom trawler in Division 12.b was communicated to the WG. No effort or bycatch data were reported for the Spanish fishing fleet operating in the Mediterranean Sea and the NAFO area (major fishing area 21). No seabirds, sea turtles or protected fish species were reported for any area.

Sweden has no dedicated marine mammal at-sea observer schemes focusing on the bycatch of marine mammals. The monitoring effort conducted and provided by Sweden is part of the EU DCF where on-board observer data are mainly from trawl fisheries but also pot fisheries for crayfish. The reason for this is due to Reg. 812/2004 article 4 and 5 not effectively serving its purpose to estimate bycatch in waters around Sweden. Harbour porpoises are bycaught in gillnets and bycatch in pelagic trawls are extremely rare. Therefore observing 5% of Swedish pelagic trawl effort in the Baltic cannot provide estimates of total cetacean bycatch with an acceptable level of uncertainty.

In the bottom-trawl fisheries, 40 trips were observed out of a total fleet effort of 6161 trips including all areas around Sweden. In the multi-rig otter trawl métier, also 40 trips were observed of a total effort of 5267 trips. In the pot and trap fisheries in Kattegat, 13 trips were observed of a total of 10 777 trips. No bycatch of cetaceans was observed.

United Kingdom has a dedicated protected species bycatch monitoring programme (PSBMP) for the purposes of meeting requirements of Reg. 812/2004 and the EU Habitats Directive. In 2016, the PSBMP conducted 315 dedicated bycatch monitoring days during 177 trips on board static net vessels, 36 dedicated bycatch monitoring days during four trips on longline vessels and 23 dedicated bycatch monitoring days during 17 trips on pelagic trawlers. Additional monitoring data were also summarised from DCF fish sampling programmes of England, Wales and Northern Ireland; including 79 days in in static net fisheries and 591 days mostly in a variety of demersal trawls.

Total observations of cetacean bycatch from dedicated bycatch sampling included ten harbour porpoises, two common dolphins and two long-finned pilot whales (*Globicephala melas),* all taken in static net gears (mainly large meshed tangle and trammelnet fisheries) in Subarea 7. A single common dolphin was also observed bycaught during DCF fish discard sampling in a static net fishery targeting anglerfish in Division 7.e.

Other protected species recorded during dedicated bycatch sampling included seven grey seals and 69 seabirds (30 guillemots, 26 fulmars (*Fulmarus glacialis),* six gannets, five cormorants (*Phalacrocorax* sp.) and two unidentified gulls). Rarer and/or protected fish species recorded included small-eyed ray (*Raja microocellata)* (97), six-gilled shark (*Hexanchus griseus)* (58), common skate (*Dipturus batis)* (56), blue shark (*Prionace glauca)* (48), undulate ray (*Raja undulata)* (39), tope (*Galeorhinus galeus)* (31) and porbeagle shark (*Lamna nasus)* (22). 25 shads (*Alosa* sp.) were also recorded mostly in gillnets.

The current best estimate of porpoise bycatch in all UK gillnet fisheries ranges from 771 to 2994 animals (best estimate 1482; CV=0.09) in the absence of pingers, and from 606 and 3114 animals (best estimate 1250 CV=0.11) if all over 12 m boats used pingers in relevant areas. These estimates are derived from extrapolation to fleet level of multiannual bycatch rates calculated over the period 2000–2016 (full details of the methodology used are provided in the UK report), though the estimates include several assumptions, the most important of which is the assumption that net fleet lengths are the same within a métier regardless of vessel size. This causes positive bias in bycatch rates for smaller inshore vessels and negative bias for larger offshore vessels. Bycatch estimates for common dolphins and seals (harbour and grey seals combined, (*Phoca vitulina, Halichoerus grypus*)) in 2016, with similar caveats, are 285 (range 137–922) and 610 (range 449–1262) respectively.

3.4 Observed PETS specimens, bycatch rates and mortality estimates, total and observed effort obtained from Regulation 812/2004 reports and ICES WGBYC Data call (includes non-cetacean species)

Prior to convening the WGBYC meeting, a WGBYC/ICES data call (Annex 7) requesting 2016 bycatch data from dedicated (i.e. Reg. 812/2004) and non-dedicated (i.e. DCF) monitoring programmes was issued. The data call is issued to EU Member States and ICES Member countries with coastal area in the European Atlantic (e.g. Iceland). This section summarises data extracted from the WGBYC database (Section 8) for 2016. The database houses the effort and bycatch-monitoring data collected, primarily, under Reg. 812/2004.

The total number of specimens or number of incidents of cetacean, seabird and elasmobranch bycatch, total fishing effort and observed effort aggregated by gear type (métier level 3), ecoregion (Figure 1) and ICES division extracted from the WGBYC database for 2016 are summarised in Table 2. A total of 69 cetaceans (from three species: twelve common dolphins; 55 harbour porpoise, two long-finned pilot whales) were observed bycaught in 2016 providing a total of nine associated métier specific bycatch rates. Bycatch rates were calculated by dividing the total number of observed bycaught specimens for a given species by the total number of observed days in each fishery stratum (Table 2). For some records, the number of bycaught specimens was missing in the database, but the number of incidents was provided. For this reason, both 'incidents' and 'specimens' bycatch rates were provided. This method was again extended to seabird and elasmobranch taxa given the increased reporting frequency for seabird and elasmobranch bycatch data in 2016. A total of 155 bird specimens and 22 associated bycatch rates are reported for 17 bird species. A total of 13 993 elasmobranch specimens and 57 associated bycatch rates are reported for 28 elasmobranch species (Table 2).

There are insufficient data to provide cetacean bycatch rates according to pinger functionality and/or presence/absence. As a result, all observed bycaught specimens were combined to provide uncorrected (i.e. functioning or presence/absence of pingers) bycatch rates for each stratum.

A compilation of all 2016 monitored strata with and without bycatch estimates reported through the WGBYC data call are summarized in Table 2. Data were aggregated by ecoregion and ICES division to provide consistency and improve the accessibility or transferability of the data to other Working Groups (WGs). No extrapolated bycatch estimates were provided. WGBYC has not computed bycatch estimates through extrapolation based on reported numbers of observed specimens, monitored days, and total effort due to uncertainty associated with incomplete spatial/temporal dedicated monitoring coverage and total fishing effort data as reported to WGBYC (WGBYC 2014). Bycatch risk assessments carried out by WGBYC are a special case where more data can be gathered by experts to support such assessments (WGBYC 2016).

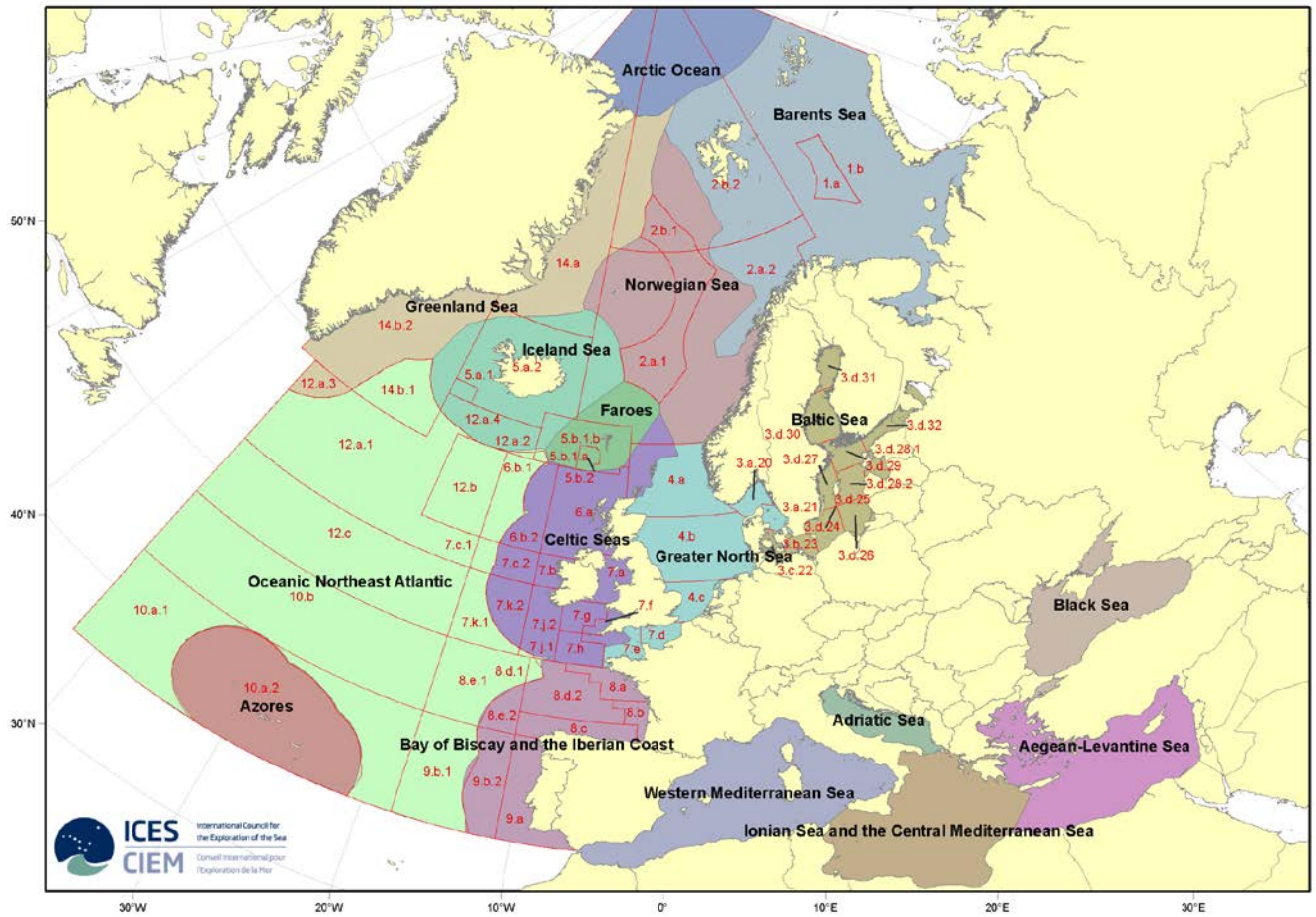

Figure 1. Map of ICES Ecoregions including ICES Statistical Areas, ices.dk. February 2017.

Table 3 shows a complete compilation of bycatch of marine mammals for the EU MS only, using data from both the WGBYC data call and Reg. 812/2004 reports. Certain MS have submitted more detailed information with regards to bycatch of cetaceans to the Regulation 812/2004 reports than was in the data submitted through the data call.

Bycatch estimates were only provided by certain countries for some seabird, elasmobranch and marine turtle species in some parts of Mediterranean waters for 2016. For other areas, a notable bycatch rate for non-marine mammal species consisted primarily of a range of elasmobranch species taken mostly in pelagic trawl fisheries in the Celtic Seas (velvet belly lantern shark, *Etmopterus spinax,* in area 27.6.a) and in bottom-trawlnet fisheries in the Greater North Sea (Table 2).

3.5 Monitoring and bycatch from non-EU Countries

WGBYC is working towards incorporating monitoring effort, fishing effort and bycatch data from non-EU states/countries that have fishing fleets in the North Atlantic. Iceland joined WGBYC in 2017 and has provided a summary of its PETS monitoring and bycatch below. In 2018, WGBYC anticipates incorporating new revised estimates of harbour porpoise and seal bycatch estimates from Norway. An overview of marine mammal, seabird and sea turtle bycatch estimates and coverage rates from the US Northwest Atlantic are also included below.

Monitoring of **Icelandic** waters was conducted by the Marine and Freshwater Research Institute (MFRI) in 2016. The primary purpose of the monitoring was to have bycatch estimates of seabirds and marine mammals available for various fishery certifications, such as the Marine Stewardship Council. The estimates have also been used for the coastal seal and harbour porpoise working groups at the North Atlantic Marine Mammal Commission (NAMMCO).

Icelandic monitoring included 57 trips/days on lumpsucker gillnet vessels, 60 trips/days on cod gillnet vessels, 61 trips/780 days on demersal trawl vessels, 72 trips/230 days on longline vessels, and three trips/days in monkfish gillnets, fishing within the Icelandic EEZ.

Observed marine mammal bycatch in the lumpsucker fishery was six harbour porpoises, ten harbour seals, 46 grey seals, three harp seals (*Pagophilus groenlandicus*), and two bearded seal (*Erignathus barbatus*). Observed seabird bycatch in the lumpsucker fishery was 32 eider ducks (*Somateria mollissima*), 16 black guillemots (*Cepphus grylle*), 12 common guillemots, one Brünnich's guillemot (*Uria lomvia*), one cormorant/shags (*Phalacrocorax* spp), one long tailed duck (*Clangula hyemalis*), and one Atlantic puffin (*Fratercula artica*). Observed marine mammal bycatch in the cod fishery was 35 harbour porpoises and one harp seal. Observed seabird bycatch in the cod fishery was 17 northern fulmars, three loons (*Gavia* spp.), two eider ducks and one common guillemot. Observed marine mammal bycatch in the monkfish gillnet fishery was three harbour porpoises and one harbour seal, while observed marine mammal bycatch in the demersal trawl fishery was a single grey seal. Observed seabird bycatch in the longline fishery was eleven northern fulmars.

Extrapolated estimates are available for the lumpsucker fishery based on observations from 2014–2017. These estimates are per year and are stratified by management area. Estimated raised marine mammal bycatch in the lumpsucker fishery was 3102 (2016–4188) animals (all mammal species), consisting of 1255 (728–1782) harbour seals, 1091 (502–1680) grey seals, 549 (264–834) harbour porpoises, 132 (15–249) harp seals, 33 (1–65) ringed seals and 42 (12–72) bearded seals. Estimated raised seabird bycatch in the

lumpsucker fishery was 7207 (4180–10 234) birds, consisting of 3232 (1616–4848) eider ducks, 1510 (695–2325) black guillemots, 1376 (372–2380) common guillemots, 813 (244–1382) cormorants/shags. 61 (1–122) long-tailed ducks, 59 (1–118) razorbills, and less than 50 Atlantic puffins, Black-legged Kittiwakes (*Rissa tridactyla*), Gannets and Common loons.

US Northwest Atlantic 2016 bycatch estimates (mortality and serious injuries for small cetaceans and pinnipeds) (Table 4) have undergone review by the US Atlantic Scientific Review Group and a public comment period. Final estimates are expected to be published in the 2018 US Atlantic and Gulf Of Mexico Marine Mammal Stock Assessment Report by the end of 2018. Earlier US Marine Mammal Stock Assessment Reports can also be found online https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region. Pelagic longline 2016 interactions with marine mammals and sea turtles were not readily available to include in this report. Reported sea turtle bycatch estimates from gillnet fisheries were extracted from the referenced literature.

In summary, during 2016 fisheries observers monitored gillnet and bottom-trawl fisheries in both the New England and mid-Atlantic regions of the US Northwest Atlantic. Observer coverage in gillnet fisheries was 10% and 8%, respectively for each area. Harbour porpoise, common dolphin, grey seal, harbour seal and harp seal were observed as bycatch in New England gillnet fisheries. These same species in addition to a hooded seal *(Cystophora cristata)* were also observed as bycatch in mid-Atlantic gillnet fisheries. Total 2016 bycatch estimates and relative standard error (CV) attributed to gillnet fisheries for these species ranged from three (CV=1.12) hooded seals to 498 (CV=0.33) grey seals (Table 3) (Orphanides, 2018).

Murray (2018) reported average sea turtle bycatch in gillnet fisheries, 2012–2016, for the Georges Bank to mid-Atlantic where overall coverage was 10%. During this period the total estimated bycatch and relative standard error (CV) for loggerhead sea turtles was 705 (CV=0.29), followed by Kemp's Ridley *(Lepidochelys kempii*) 145 (CV=0.43) and leatherback (*Dermochelys coriacea*) sea turtles 27 (CV=0.71) (Table 3).

Observer coverage in 2016 New England and mid-Atlantic bottom-trawl fisheries targeting fish species only was 12% and 10%, respectively. Several cetacean and one pinniped species were observed. Common dolphin, Risso's dolphin (*Grampus griseus*), long-finned pilot whale, white-sided dolphin (*Lagenorhynchus acutus*), and bottlenose dolphin were observed as bycatch in New England bottom-trawl fisheries. In the Mid-Atlantic region, common dolphin, Risso's dolphin, bottlenose dolphin and grey seal were observed as bycatch in bottom-trawl fisheries. Total 2016 bycatch estimates and relative standard error (CV) attributed to bottom-trawl fisheries for these species ranged from seven (CV=0.93) bottlenose dolphins to 177 (CV=0.33) common dolphins (Chavez-Rosales *et al.*, 2018) (Table 3).

3.6 Auxiliary data (strandings, entanglement and interviews) indicative of the impact of bycatch

In the absence of at-sea observer monitoring programmes or when monitoring effort is low, data from other sources such as cetacean strandings, can be assessed to highlight the occurrence of bycatch. Portugal, France, Belgium, Sweden and Poland have reported on assessments of strandings records in their Reg. 812/2004 reports or directly to WGBYC.

In 2016, 99 cetacean strandings were registered along the **Portuguese** mainland coast. As in previous years, for the same area, the indication was that about 30–50% mortality

was attributed to confirmed bycatch in fisheries, and most attributed to fixed net fisheries (either gill/trammelnets), thus showing the need to increase effort on monitoring the polyvalent fleet where this métier is included. The species with the highest percentage of mortality due to incidental capture was the common dolphin. Strandings data collected by a local stranding network run by the Life+ Marpro project from 2010–2016 along the southern Portuguese coast (Algarve) recorded a total of 445 cetaceans (Table 4). The common dolphin was the species of which most strandings have been recorded (n = 212; about 48% of total). Mortality due to bycatch (as identified by post-mortem analyses) was recorded for 87 common dolphins, corresponding to 41.2% of the analysed animals (n = 212). Most stranded animals with evidence of bycatch showed signs of interaction with fixed gears, either gill or trammelnets. This incidence of strandings of common dolphins confirmed bycaught in static gears supports the necessity of reinforcing the at-sea monitoring of incidental catch in static gear in order to assess the relative impact of the different gears used in the area.

The **French** stranding network (*Reseau National Echouage*, RNE) is coordinated by *Observatoire Pélagis*. Over 300 trained volunteers distributed along the whole French coast collect information on stranded marine mammals according to a standardized protocol (Kuiken and Hartmann, 1993). The observation effort is supposed to be stable since the late 1980s. Death in fishing gears was diagnosed following Kuiken, (1994). Main evidences were good nutritional conditions, evidence of recent feeding, jaw and rostrum fractures, froth in the airways, oedematous lungs and amputations. Bycatch was diagnosed only on fresh and lightly putrefied carcasses. In 2016, 1342 cetaceans and 271 pinnipeds were recorded stranded along the French coasts. For the two most abundant species, common dolphin and harbour porpoise, bycatch remains the main cause of death accounting for 76% and 59% of the examined carcasses in 2016, respectively.

From **Belgium**, data were available for the number of marine mammals stranded along the Belgian coast. The RBINS/OD Nature Federal Office maintains these statistics and also investigates the cause of death of stranded animals. Most of the animals stranded are harbour porpoises. 137 harbour porpoises were stranded in 2016: roughly the same number as in 2014, and many more than the 52 found stranded in 2015. The number of animals stranded increased in April–May in particular. 21 of the 54 animals examined were found to have been caught incidentally in fishing operations, although the type of fishery responsible for bycatch was not possible to establish. However, recreational use of tanglenets at-sea or on shore was not the cause, as the legal ban on those fishing methods is enforced.

In **Poland,** there has been a voluntary reporting scheme of marine mammal strandings under the joint project of WWF Poland and University of Gdańsk since 2010. The carcasses are collected and post-mortem analysis are carried out by Hel Marine Station UG. All data are delivered to the HELCOM/ASCOBANS cetacean strandings database. In 2016, there were five strandings of harbour porpoises and 67 strandings of seals voluntarily reported. One of the harbour porpoise specimens was bycaught as it was classified based on the netmarks. The remaining four carcasses were too decomposed and the cause of death was not possible to determine. The majority of reports of stranded seals referred to grey seals with single reports of harbour seal and ringed seal (*Phoca hispida)*. Four animals had pieces of fishing nets around the body. Most animals were in a good nutritional status.

In **Sweden,** a total of 59 dead harbour porpoises were reported along the Swedish west coast (ICES divisions 27.3.a and 27.3.b.23) in 2016. One of the animals was handed in

as bycatch by a fisherman, one was first encountered as a live stranding but died during rescue attempts, and the remaining 57 were encountered as dead strandings. Ten of the reported animals were collected for necropsy. Their cause of death was determined as bycatch (four), other trauma possibly related to bycatch (one), disease (three, whereof one in combination with starvation), and unknown (two).

3.7 Defining species of interest to the WGBYC

The Commission Implementing Decision (EU) 2016/1251 specifies that data collection is needed to assess the impact of Union fisheries on marine ecosystems inside and outside Union waters. These data should include 'incidental bycatch of all birds, mammals and reptiles and fish protected under Union legislation and international agreements, including the species listed in Table 1D, and if the species is absent in the catch during scientific observer trips on fishing vessels or by the fishers themselves through logbooks. Specifically, Table 1D lists 'Species to be monitored under protection programmes in the Union or under international obligations'.

The 2018 WGBYC data call did not include a 'species list' but data contributors were advised that the species of interest were those marine vertebrates and seabirds afforded protection through EU (e.g. Habitats Directive) and/or national legislation. However, EU 2016/1251 provides a species list that informs MS of the species that are to be recorded in their national sampling programmes under EU-MAP. The group noted that there was not any reference to a list of species in the WGBYC data call and that Table 1D from EU Dec. 1251/2016 could be a potential list for cross-reference, assuming this is comprehensive. The objective of the WGBYC data call is to provide data on the catch rates of protected species. The list should therefore contain a clear selection of the protected species within the North Atlantic area.

A number of issues were raised with regards the species on Table D1; notably that the list contains many species that, although covered by EU legislation or international treaties, are also targeted commercially and are under assessment by other ICES WGs. The list also contains benthos species (i.e. red coral) which WGBYC does not assess. Additionally, the list contains some very common species, which may be only locally rare in some Member States' waters because they are on the margins of their distribution area and therefore are not mentioned in treaties.

WGBYC needs a working list that can be issued with future data calls to ensure the group receives relevant species data. After discussion, the group decided that future data calls would request bycatch data for all marine mammals, seabirds and turtles, regardless of whether or not they are listed in Table D1. Bycatch data on elasmobranchs are also of interest but the criteria for the species listed in Table D1 is unclear. The species of interest are often not 'protected' species and a means of defining the species of interest is needed; the group decided that elasmobranchs that were classified as zero TAC or prohibited in any part of the ICES area would be a more useful qualifier.

The group attempted to further expand its request with a list of bony fish species, but a decision on which fish species to include was not reached. The selection of bony fish for a future data call is less straightforward. If species, which are commercially targeted or are strictly freshwater species, are removed from the Table D1, the remainder still contain many small and common species (e.g. *Gobies* sp., *Liparis liparis*), while a Natura 2000 species like twaite shad (*Alosa fallax*) is not included. Formerly the group has considered bycatch of fish species listed in Annex II of the Habitats Directive, such as *Alosa* sp. It was agreed to attempt to make a list of bony fish in next-year's meeting, taking

advice from other relevant ICES WGs. This could be done by assessing the species contained in the D1 table list and check whether they are covered/assessed by other ICES WGs.

However, to conclude, next year's data call should request records for all species of marine mammal, seabirds and turtles, zero TAC or prohibited elasmobranchs, and fish species from Table D1.

3.8 Conclusions

The quality and scope of the information provided by the reports for 2016 continues to be variable, with some MS simply repeating the information provided in previous years. Most countries rely on the DCF sampling programme to monitor marine mammal and other protected species bycatch, with the exception of the UK, the only EU country to have a dedicated protected species bycatch monitoring programme (PSBMP) for the purposes of meeting the requirements of Reg. 812/2004 and the EU Habitats Directive. As discussed in previous years´ reports, relying only on observations carried under the DCF may lead to underestimation of bycatch events as some bycatches may be missed by the observers who focus mostly on other tasks (e.g. fish sampling). This is a concern to WGBYC moving forward to data collection under the EU-MAP and the eventual likely repeal of the Reg. 812/2004.

The 2016 data submitted to the WGBYC database provided bycatch information for marine mammals, seabirds, turtles, elasmobranchs and teleost species, although for the scope of this discussion, teleost fish were not considered. WGBYC continues to have insufficient data to provide bycatch rates according to pinger functionality and/or presence/absence in relevant métiers. As a result, all observed bycaught specimens were combined to provide (i.e. functioning or presence/absence of pingers) bycatch rates for each métier and ecoregion with the exception of UK that reported extrapolated bycatch estimates for some species of cetaceans and seals..

Coverage rates per métier and vessel size are also highly variable within each ecoregion and ICES division, with some countries relying on monitoring vessel sizes and gear types only mandatory in the Reg. 812/2004 (>15 m for set-nets and pelagic trawls). Nonetheless, the data available can provide an indication of bycatch rates for various taxa per gear and ecoregion. Bycatch of marine mammals was observed in all ecoregions in both nets and trawl gears (pelagic or bottom trawl) with the exception of the Mediterranean. The Mediterranean is the only region from which bycatch of marine turtles has been recorded (based on submissions to the WGBYC database). Seabirds are also bycaught in most ecoregions, and are mainly taken in nets and longlines. High bycatch rates for elasmobranchs were observed for some vulnerable (e.g. *Squalus acanthias, Amblyraja radiate*), and near threatened (e.g. *Raja clavata*) species, especially in trawl gears in the Celtic Sea, the Greater North Sea and the Mediterranean. A notably high bycatch rate for *Etmopterus spinax* in the Celtic Sea ecoregion for pelagic trawls was observed, although this species is of least concern in the IUCN red list of threatened species.

WGBYC is working toward incorporating monitoring effort, fishing effort and bycatch data from non-EU states/countries that have fishing fleets operating in the North Atlantic and adjoining seas. Data were available in 2016 for countries such as Iceland and USA. In the USA for example, bycatch estimates were provided for several marine mammal and marine turtle species. In Iceland, bycatches were reported for birds and marine mammals. In both countries, the gear of most concern is set-nets.

Information on auxiliary data such as from cetacean strandings schemes, was presented by a few countries (France, Portugal, Poland, Sweden and Belgium). France had very large numbers of stranded marine mammals in the Bay of Biscay in 2016 (n = 1342 cetaceans and 271 pinnipeds), with the common dolphin and harbour porpoise as the two main species found and bycatch was a major cause of mortality for both species.

In conclusion, information provided through the Member States' Reg. 812/2004 reports and other additional and relevant sources of information is limited. For many areas and métiers, there is insufficient monitored effort to enable any assessment of the overall impact of fisheries on cetaceans or other protected species. However, with the new EU Multiannual Programme (EU-MAP), it is hoped that the consistency of bycatch data at a regional scale will be improved and thereby ICES WGBYC will be able to give better advice on the impact of fisheries on protected and potentially vulnerable species. A prerequisite for this is that Member States include bycatch monitoring of species from Table D1 in EU Implementing Decision 2016/1251 in their sampling scheme and carry out bycatch monitoring in the relevant métiers with sufficient observer coverage. The numbers of bycaught animals recorded on the shores of the Bay of Biscay indicate that a dedicated bycatch observer programme is required for relevant fisheries in this area.

The 2018 WGBYC data call did not include a 'species list' but data contributors were advised that the species of interest were those marine vertebrates and seabirds afforded protection through EU (e.g. Habitats Directive) and/or national legislation. However, EU 2016/1251 provides a species list, in Table D1 that informs MS of the species that are to be recorded in their national sampling programmes under EU-MAP. After discussion, WGBYC concluded that the next WGBYC/ICES data call should request records for all species of marine mammal, seabirds and turtles, 'zero TAC' or prohibited elasmobranchs and fish species from the Table D1 list.

Table 1. Summary table of coastal EU Member States (MS) by regional coordination meetings (RCM) regarding the status of Reg. 812/2004 report submissions to the European Commission (Green = Yes for report with data on observer effort (either days at sea or other measurement, e.g. effort per haul or set); Grey = Yes for report with no data on observer effort (either days at sea or other measurement); Orange = no report submitted;; * Two trawlers that were monitored in 2012 have since been scrapped. As a result, in 2013 no vessels are affected by the regulation; ** an independent scientific non-profit nongovernmental organization monitoring set-nets indicated the bycatch of one/two bottlenose dolphin."*No Reg.812/2004 report but reports on cetacean bycatch observations made under DCF sent to the Commission. Some of this information was made available at the meeting; **** Data made available at the meeting.**

RCM	Coastal Member State of the EU	Monitoring (Art. 4-5)	Annual Report Reg. 812 & effort data provided										
		Fishing in areas affected	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Baltic	Estonia EE	Yes											
Baltic	Finland FI	Yes											
Baltic	Latvia LV	Yes											
Baltic	Lithuania LT	Yes											
Baltic	Poland PL	Yes											
Mediterranean & Black Sea	Italy IT	Yes											
Mediterranean & Black Sea	Slovenia SI	Yes							*	**	**	**	
North Atlantic	Portugal PT	Yes											****
North Atlantic	Spain ES	Yes											
North Atlantic, Baltic	Germany DE	Yes		***							***		
North Atlantic, North Sea & Eastern Artic	France FR	Yes								****			
North Atlantic; North Sea & Eastern Arctic	Ireland IE	Yes											
North Atlantic; North Sea & Eastern Arctic	Netherlands NL	Yes											****
North Atlantic; North Sea & Eastern Arctic	United Kingdom UK	Yes											
North Sea & Eastern Arctic, Baltic	Belgium BE	Yes											
North Sea & Eastern Arctic, Baltic	Denmark DK	Yes											
North Sea & Eastern Arctic, Baltic	Sweden SE	Yes								****	****		****
Mediterranean & Black Sea	Bulgaria BG (MS since 2007)	No											
Mediterranean & Black Sea	Croatia HR (MS since 2013)	No											
Mediterranean & Black Sea	Cyprus CY	No											
Mediterranean & Black Sea	Greece GR	No											

Table 2. Total number of bycatch specimens or *number of incidents reported and bycatch rates (number of specimens/days at-sea or *number of incidents per days at-sea) derived from the ICES WGBYC 2016 data call. In most Member States, data submitted to ICES WGBYC data call reflect the same data as in the Reg. 812/2004 report. However, Germany, France, Denmark and Spain had additional information not included in this table. Bycatch numbers and rates are grouped by ecoregion, taxa, métier and species.

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Baltic Sea	Bird	27.3.c.22	Nets	Anatidae	25.8	55970	1	12	0.47	NA
Baltic Sea	Bird	27.3.d.24	Nets	*Melanitta fusca*	12.9	87658	1	2	0.16	NA
Baltic Sea	Bird	27.3.d.25	Nets	*Gavia arctica*	44	5198	NA	0	0.00	NA
Baltic Sea	Marine mammal	27.3.c.22	Nets	*Phocoena phocoena*	25.8	55970	1	1	0.04	NA
Baltic Sea	Marine mammal	27.3.d.25	Nets	*Halichoerus grypus*	44	5198	NA	0	0.00	NA
Bay of Biscay & Iberian Coast	Marine mammal	27.8.c	Bottom trawls	*Delphinus delphis*	105	11100	1	10	0.10	NA
Celtic Seas	Bird	27.7.f	Nets	*Phalacrocorax* spp.	44	4444	3	3	0.07	NA
Celtic Seas	Bird	27.7.f	Nets	*Uria aalge*	44	4444	15	15	0.34	NA
Celtic Seas	Bird	27.7.g	Nets	*Morus bassanus*	29	2772	1	1	0.03	NA
Celtic Seas	Bird	27.7.g	Nets	*Uria aalge*	29	2772	1	1	0.03	NA
Celtic Seas	Bird	27.7.j	Nets	*Morus bassanus*	53	1748	2	2	0.04	NA
Celtic Seas	Elasmobranch	27.7.h	Bottom trawls	*Dipturus batis*	4	1383	74	1*	18.5*	NA
Celtic Seas	Elasmobranch	27.7.h	Bottom trawls	Dipturus flossada	4	1383	89	1*	22.25*	NA
Celtic Seas	Elasmobranch	27.7.h	Bottom trawls	Dipturus oxyrinchus	4	1383	48	1*	12*	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Celtic Seas	Elasmobranch	27.7.h	Bottom trawls	*Squalus acanthias*	4	1383	31	1*	7.75*	NA
Celtic Seas	Elasmobranch	27.7.f	Nets	*Galeorhinus galeus*	44	4444	9	9	0.20	NA
Celtic Seas	Elasmobranch	27.7.f	Nets	*Raja microocellata*	44	4444	7	7	0.16	NA
Celtic Seas	Elasmobranch	27.7.f	Nets	*Squalus acanthias*	44	4444	14	14	0.32	NA
Celtic Seas	Elasmobranch	27.7.g	Nets	*Galeorhinus galeus*	29	2772	6	6	0.21	NA
Celtic Seas	Elasmobranch	27.7.g	Nets	*Lamna nasus*	29	2772	13	13	0.45	NA
Celtic Seas	Elasmobranch	27.7.g	Nets	*Prionace glauca*	29	2772	33	33	1.14	NA
Celtic Seas	Elasmobranch	27.7.g	Nets	*Raja batis*	29	2772	29	29	1.00	NA
Celtic Seas	Elasmobranch	27.7.h	Nets	*Galeorhinus galeus*	20	563	1	1	0.05	NA
Celtic Seas	Elasmobranch	27.7.h	Nets	*Lamna nasus*	20	563	4	4	0.20	NA
Celtic Seas	Elasmobranch	27.7.h	Nets	*Prionace glauca*	20	563	15	15	0.75	NA
Celtic Seas	Elasmobranch	27.7.h	Nets	*Raja batis*	20	563	1	1	0.05	NA
Celtic Seas	Elasmobranch	27.7.j	Nets	*Dipturus nidarosiensis*	53	1748	2	2	0.04	NA
Celtic Seas	Elasmobranch	27.7.j	Nets	*Galeorhinus galeus*	53	1748	11	11	0.21	NA
Celtic Seas	Elasmobranch	27.7.j	Nets	*Hexanchus griseus*	53	1748	57	57	1.08	NA
Celtic Seas	Elasmobranch	27.7.j	Nets	*Lamna nasus*	53	1748	4	4	0.08	NA
Celtic Seas	Elasmobranch	27.7.j	Nets	*Raja batis*	53	1748	25	25	0.47	NA
Celtic Seas	Elasmobranch	27.7.j	Nets	*Squalus acanthias*	53	1748	1	1*	0.019*	NA
Celtic Seas	Elasmobranch	27.6.a	Pelagic trawls	Etmopterus spinax	25	2727	8	9220	368.80	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Celtic Seas	Marine mammal	27.7.f	Nets	*Delphinus delphis*	44	4444	1	1	0.02	NA
Celtic Seas	Marine mammal	27.7.f	Nets	*Halichoerus grypus*	44	4444	4	4	0.09	NA
Celtic Seas	Marine mammal	27.7.f	Nets	*Phocoena phocoena*	44	4444	6	6	0.14	NA
Celtic Seas	Marine mammal	27.7.j	Nets	*Globicephala melas*	53	1748	2	2	0.04	NA
Celtic Seas	Marine mammal	27.7.j	Nets	*Halichoerus grypus*	53	1748	1	1	0.02	NA
Celtic Seas	Marine mammal	27.7.j	Nets	*Phocoena phocoena*	53	1748	2	2	0.04	NA
Celtic Seas	Marine mammal	27.6.a	Pelagic trawls	*Delphinus delphis*	25	2727	1	1*	0.04*	NA
Celtic Seas	Marine mammal	27.7.b	Pelagic trawls	*Delphinus delphis*	4	1002	1	1*	0.25*	NA
Celtic Seas	Marine mammal	27.7.c	Pelagic trawls	*Delphinus delphis*	2	650	1	1*	0.50*	NA
Greater North Sea	Bird	27.7.e	Nets	*Phalacrocorax* spp.	122	6796	2	2	0.02	NA
Greater North Sea	Bird	27.7.e	Nets	*Uria aalge*	122	6796	14	14	0.11	NA
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	*Amblyraja radiata*	71	10317	NA	481	6.77	NA
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	*Dipturus batis*	71	10317	NA	2	0.03	NA
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	*Dipturus linteus*	71	10317	NA	39	0.55	NA
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	*Etmopterus spinax*	71	10317	NA	537	7.56	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	Raja clavata	71	10317	NA	6	0.08	NA
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	Scyliorhinus canicula	71	10317	NA	6	0.08	NA
Greater North Sea	Elasmobranch	27.3.a.20	Bottom trawls	Squalus acanthias	71	10317	NA	166	2.34	NA
Greater North Sea	Elasmobranch	27.3.a.21	Bottom trawls	Amblyraja radiata	25	3076	NA	88	3.52	NA
Greater North Sea	Elasmobranch	27.3.a.21	Bottom trawls	Raja clavata	25	3076	NA	4	0.16	NA
Greater North Sea	Elasmobranch	27.3.a.21	Bottom trawls	Scyliorhinus canicula	25	3076	NA	2	0.08	NA
Greater North Sea	Elasmobranch	27.3.a.21	Bottom trawls	Squalus acanthias	25	3076	NA	22	0.88	NA
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	Amblyraja radiata	30	1051	NA	7	0.23	NA
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	Dipturus flossada	30	1051	1	1*	0.033*	NA
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	Dipturus intermedia	30	1051	9	1*	0.30*	NA
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	Dipturus oxyrinchus	30	1051	2	1*	0.07*	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	*Etmopterus spinax*	30	1051	NA	382	12.73	NA
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	*Leucoraja circularis*	30	1051	3	1*	0.1*	NA
Greater North Sea	Elasmobranch	27.4.a	Bottom trawls	*Squalus acanthias*	30	1051	11	1*	0. 37*	NA
Greater North Sea	Elasmobranch	27.4.b	Bottom trawls	*Amblyraja radiata*	36	47998	1	7	0.18	NA
Greater North Sea	Elasmobranch	27.4.b	Bottom trawls	*Raja clavata*	36	47998	17	598	16.61	NA
Greater North Sea	Elasmobranch	27.4.b	Bottom trawls	*Raja montagui*	36	47998	23	1439	39.97	NA
Greater North Sea	Elasmobranch	27.4.c	Bottom trawls	*Mustelus mustelus*	7	39218	2	88	12.54	NA
Greater North Sea	Elasmobranch	27.4.c	Bottom trawls	*Raja clavata*	7	39218	10	249	35.57	NA
Greater North Sea	Elasmobranch	27.4.c	Bottom trawls	*Raja montagui*	7	39218	5	160	22.91	NA
Greater North Sea	Elasmobranch	27.7.d	Nets	*Galeorhinus galeus*	22	12722	1	1	0.05	NA
Greater North Sea	Elasmobranch	27.7.d	Nets	*Raja batis*	22	12722	1	1	0.05	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Greater North Sea	Elasmobranch	27.7.d	Nets	*Raja microocellata*	22	12722	66	66	3.00	NA
Greater North Sea	Elasmobranch	27.7.d	Nets	*Raja undulata*	22	12722	37	37	1.68	NA
Greater North Sea	Elasmobranch	27.7.d	Nets	*Torpedo marmorata*	22	12722	1	1	0.05	NA
Greater North Sea	Elasmobranch	27.7.e	Nets	*Galeorhinus galeus*	122	6796	3	3	0.02	NA
Greater North Sea	Elasmobranch	27.7.e	Nets	*Lamna nasus*	122	6796	1	1	0.01	NA
Greater North Sea	Elasmobranch	27.7.e	Nets	*Raja microocellata*	122	6796	24	24	0.20	NA
Greater North Sea	Elasmobranch	27.7.e	Nets	*Raja undulata*	122	6796	17	2	0.02	NA
Greater North Sea	Elasmobranch	27.7.e	Nets	*Squalus acanthias*	122	6796	1	1*	0.008*	NA
Greater North Sea	Elasmobranch	27.3.a.20	Traps	*Scyliorhinus canicula*	12	11708	NA	1	0.08	NA
Greater North Sea	Marine mammal	27.7.e	Nets	*Delphinus delphis*	122	6796	1	1	0.01	NA
Greater North Sea	Marine mammal	27.7.e	Nets	*Halichoerus grypus*	122	6796	1	1	0.01	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Greater North Sea	Marine mammal	27.7.e	Nets	Phocoena phocoena	122	6796	2	2	0.02	NA
Greater North Sea	Marine mammal	27.4.b	Pelagic trawls	*Phoca vitulina*	14	867	3	1*	0.21*	NA
Iceland Sea	Bird	27.5.a	Longlines	*Fulmarus glacialis*	230	NA	11	11	0.05	NA
Iceland Sea	Bird	27.5.a	Nets	*Cepphus grylle*	120	NA	6	16	0.13	NA
Iceland Sea	Bird	27.5.a	Nets	*Clangula hyemalis*	120	NA	1	1	0.01	NA
Iceland Sea	Bird	27.5.a	Nets	*Fratercula arctica*	120	NA	1	1	0.01	NA
Iceland Sea	Bird	27.5.a	Nets	*Fulmarus glacialis*	120	NA	9	17	0.14	NA
Iceland Sea	Bird	27.5.a	Nets	*Gavia immer*	120	NA	2	3	0.03	NA
Iceland Sea	Bird	27.5.a	Nets	*Phalacrocorax* spp.	120	NA	1	1	0.01	NA
Iceland Sea	Bird	27.5.a	Nets	*Somateria mollissima*	120	NA	11	34	0.28	NA
Iceland Sea	Bird	27.5.a	Nets	*Uria aalge*	120	NA	4	13	0.11	NA
Iceland Sea	Bird	27.5.a	Nets	*Uria lomvia*	120	NA	1	1	0.01	NA
Iceland Sea	Marine mammal	27.5.a	Bottom trawls	*Halichoerus grypus*	780	33	1	1	0.001	NA
Iceland Sea	Marine mammal	27.5.a	Nets	*Erignathus barbatus*	120	NA	2	2	0.02	NA
Iceland Sea	Marine mammal	27.5.a	Nets	*Halichoerus grypus*	120	NA	4	46	0.38	NA
Iceland Sea	Marine mammal	27.5.a	Nets	*Pagophilus groenlandicus*	120	NA	4	4	0.03	NA
Iceland Sea	Marine mammal	27.5.a	Nets	*Phoca vitulina*	120	NA	7	11	0.09	NA
Iceland Sea	Marine mammal	27.5.a	Nets	*Phocoena phocoena*	120	NA	33	44	0.37	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Western Mediterranean Sea	Bird	17	Bottom trawls	*Phalacrocorax aristotelis*	25	812	1	1	0.04	1
Western Mediterranean Sea	Elasmobranch	22	Longlines	*Alopias*	22	105	1	1	0.05	NA
Western Mediterranean Sea	Elasmobranch	25~24~26	Longlines	*Alopias superciliosus*	10	1087	2	2	0.20	NA
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Alopias vulpinus*	342	15156	1	1	0.00	1
Western Mediterranean Sea	Elasmobranch	22	Longlines	*Prionace glauca*	22	105	1	1	0.05	NA
Western Mediterranean Sea	Elasmobranch	25~24~26	Longlines	*Isurus oxyrinchus*	10	1087	2	2	0.20	NA
Western Mediterranean Sea	Elasmobranch	25~24~26	Longlines	*Pteroplatytrygon violacea*	10	1087	1	2	0.20	NA

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Aetomylaeus bovinus*	342	15156	8	13	0.04	13
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Dasyatis pastinaca*	342	15156	1	1	0.00	1
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Mustelus mustelus*	342	15156	16	17	0.05	17
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Mustelus punctulatus*	342	15156	12	17	0.05	17
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Myliobatis aquila*	342	15156	8	9	0.03	9
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Prionace glauca*	342	15156	4	4	0.01	4
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Pteroplatytrygon violacea*	342	15156	7	9	0.03	9

Ecoregion	Taxa	ICES Subarea	Métier3	Species	Total Observed Effort (Days at-sea)	Fishing Effort (Days at-sea)	Total No. Incidents	Total No of Specimens *Incident reported but not No of specimen	Bycatch Rate No of specimen per day at-sea observed *No of incidents per days at-sea	Reported Bycatch Estimate by MS
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Raja clavata*	342	15156	3	3	0.01	3
Western Mediterranean Sea	Elasmobranch	17	Pelagic trawls	*Squalus acanthias*	342	15156	32	44	0.13	44
Western Mediterranean Sea	Marine Turtle	17	Bottom trawls	*Caretta caretta*	25	812	1	1	0.04	1
Western Mediterranean Sea	Marine Turtle	25~24~26	Longlines	*Caretta caretta*	10	1087	1	1	0.10	NA
Western Mediterranean Sea	Marine Turtle	25	Nets	*Caretta caretta*	2	27718	2	6	3.00	NA
Western Mediterranean Sea	Marine Turtle	25	Nets	*Chelonia mydas*	2	27718	1	1	0.50	NA
Western Mediterranean Sea	Marine Turtle	17	Pelagic trawls	*Caretta caretta*	342	15156	4	4	0.01	4

Table 3. Total number of marine mammal bycatch specimens and bycatch rates (number of specimens/days at sea) derived from Reg. 812/2004 reports and the ICES WGBYC 2016 data call.

Species	ICES Subarea	Level 3 Metier	Observed days at sea	Total number Incidents	Total number of Specimens	Bycatch rate (Number of specimens/day at sea observed OR * Number of incidents/days at sea observed)
Phocoena phocoena	27.3.c.22	Nets	25.8	1	1	0.04
	27.7.f	Nets	44	6	6	0.14
	27.7.j	Nets	72	2	2	0.03
	27.7.e	Nets	206.31	3	3	0.01
	27.8.a	Nets	192.83	1	1	0.01
	27.8.b	Nets	236.33	1	2	0.01
	27.III.a	Nets	71	-	22	0.31
	27.7D23	Nets	237	-	10	0.04
Subtotal				***14***	***47***	
Delphinus delphis	27.8.c	Bottom trawls	105	1	10	0.1
	27.8.b	Nets	236.33	1	1	0.00
	27.8.a	Nets	192.83	16	31	0.16
	27.7.h	Nets	14.9963	2	3	0.20
	27.7.f	Nets	44	1	1	0.02
	27.6a; 27.7.b-c	Pelagic trawls	31	3	17	0.55
	27.7.e	Nets	206.31	1	1	0.00
Subtotal				***25***	***64***	
Globicephala melas	27.7.j	Nets	53	2	2	0.04
Subtotal				***2***	***2***	
Stenela coeruleoalba	GSA07	Pelagic trawls	41.5	1	1	0.02
	27.7.g	Pelagic trawls	-	1	1	-
Subtotal				***2***	***2***	
Halichoerus grypus	27.7.f	Nets	44	5	5	0.11
	27.7.j	Nets	72	1	1	0.01
	27.7.e	Nets	206.31	1	1	0.00
	27.3.d.25	Nets	44	1	1	0.02
Subtotal				***8***	***8***	

Table 4. Summary of protected species bycatch in dedicated observer programmes off the northeast USA for 2016.

Area	Gear Type (Métier level 3)	Species	Unit of observer and fishing effort	Total Observer Effort	Total Fishing Effort	Total No. Specimens	Bycatch Estimate (CV)	Source
New England	Sink Gillnets	*Phocoena phocoena*	Metric tons	1454	14 568	11	125 (CV=0.34)	Orphanides, 2018 (*in review*)
New England	Sink Gillnets	*Delphinus delphis*		1454	14 568	8	80 (CV=0.38)	Orphanides, 2018 (*in review*)
New England	Sink Gillnets	*Halichoerus grypus*		1454	14 568	43	498 (CV=0.33)	Orphanides, 2018 (*in review*)
New England	Sink Gillnets	*Phoca vitulina*		1454	14 568	36	245 (CV=0.29)	Orphanides, 2018 (*in review*)
New England	Sink Gillnets	*Pagophilus groenlandicus*		1454	14 568	5	85 (CV=0.50)	Orphanides, 2018 (*in review*)
Mid-Atlantic	Sink Gillnets	*Phocoena phocoena*		967	12 251	2	23 (CV=.64)	Orphanides, 2018 (*in review*)
Mid-Atlantic	Sink Gillnets	*Halichoerus grypus*		967	12 251	1	7 (CV=0.93)	Orphanides, 2018 (*in review*)

Area	Gear Type (Métier level 3)	Species	Unit of observer and fishing effort	Total Observer Effort	Total Fishing Effort	Total No. Specimens	Bycatch Estimate (CV)	Source
Mid-Atlantic	Sink Gillnets	*Delphinus delphis*		967	12 251	1	7 (CV=0.97)	Orphanides, 2018 (*in review*)
Mid-Atlantic	Sink Gillnets	*Phoca vitulina*		967	12 251	2	18 (CV=0.95)	Orphanides, 2018 (*in review*)
Mid-Atlantic	Sink Gillnets	*Cystophora cristata*		967	12 251	1	3 (CV=1.12)	Orphanides, 2018 (*in review*)
New England	Bottom Trawls	*Delphinus delphis*	Trips	590	4868	2	16 (CV=0.46)	Chavez-Rosales, *et al*., 2018 (in press)
New England	Bottom Trawls	*Grampus griseus*		590	4868	2	17 (CV=0.88)	Chavez-Rosales, *et al*., 2018 (in press)
New England	Bottom Trawls	*Globicephala melas*	Trips	590	4868	4	29 (CV=0.58)	Chavez-Rosales, *et al*., 2018 (in press)

Area	Gear Type (Métier level 3)	Species	Unit of observer and fishing effort	Total Observer Effort	Total Fishing Effort	Total No. Specimens	Bycatch Estimate (CV)	Source
New England	Bottom Trawls	*Lagenorhynchus acutus*		590	4868	4	28 (CV=0.46)	Chavez-Rosales, *et al*., 2018 (in press)
New England	Bottom Trawls	*Tursiops truncatus*		590	4868	4	33 (CV=0.89)	Chavez-Rosales, *et al*., 2018 (in press)
Mid-Atlantic	Bottom Trawls	*Delphinus delphis*		1078	11 069	22	177 (CV=0.33)	Chavez-Rosales, *et al*., 2018 (in press)
Mid-Atlantic	Bottom Trawls	*Grampus griseus*		1078	11 069	4	39 (CV=0.56)	Chavez-Rosales, *et al*., 2018 (in press)
Mid-Atlantic	Bottom Trawls	*Halichoerus grypus*		1078	11 069	3	26 (CV=0.57)	Chavez-Rosales, *et al*., 2018 (in press)

Area	Gear Type (Métier level 3)	Species	Unit of observer and fishing effort	Total Observer Effort	Total Fishing Effort	Total No. Specimens	Bycatch Estimate (CV)	Source
Mid-Atlantic	Bottom Trawls	*Tursiops truncatus*		1078	11 069	1	7 (CV=0.93)	Chavez-Rosales, *et al.*, 2018 (in press)
Georges Bank to Mid-Atlantic	Sink Gillnets	*Caretta caretta*		4902	51 533	27	705 (CV=0.29)	Murray, 2018
Georges Bank to Mid-Atlantic	Sink Gillnets	*Lepidochelys kempii*		4902	51 533	7	145 (CV=0.43)	Murray, 2018
Georges Bank to Mid-Atlantic	Sink Gillnets	*Dermochelys coriacea*		4902	51 533	2	27 (CV=0.71)	Murray, 2018

Table 5. Summarized information of common dolphin stranded along the Portuguese South coast- Algarve for 2010–2016 including number of stranded common dolphins and apparent bycatch rate.

Year	Total Number common dolphins stranded	Total Number identified as bycaught	Proportion of stranded animals that had been bycaught (%)
2010	26	15	57.7
2011	31	11	35.5
2012	21	11	52.4
2013	64	25	39.1
2014	46	17	37.0
2015	9	3	33.3
2016	15	5	33.3
Total	212	87	41.2

4 Collate and review information from National Regulation 812/2004 reports and elsewhere relating to the implementation of bycatch mitigation measures and ongoing bycatch mitigation trials, compile recent results and coordinate further work on protected species bycatch mitigation (ToR B)

4.1 Mitigation compliance carried out under (EC) Reg. 812/2004 -Mandatory and voluntary mitigation measures

Relevant text extracted from Member States Reg. 812/2004 reports pertaining to mitigation compliance is summarized below by MS. Article 2 of Reg. 812/2004 requires certain métiers (identified in Annex I) to use pingers to mitigate against cetacean bycatch. However, other mitigation methods such as alternative fishing gear or modified gear (e.g. FLEXGRID) can also be reported by MS. Also included are results from presentations provided to WGBYC from Iceland and Denmark that described ongoing bycatch mitigation research trials and summaries from relevant literature.

4.1.1 Member states

In **Estonia, t**here was no static gear fishery in ICES Division 24 where pinger use is obligatory for boats >12 m under Reg. 812/2004. Therefore, no pingers were used by the Estonian fleet. No other pinger use was implemented.

In **France** in 2016, nine vessels using GNS-GTR gears deployed pingers STM DDD03L, fishing in Subarea 7. No studies were carried out by France to estimate the effect of pingers on cetacean bycatch.

In 2016, **Germany** had fisheries operating in some of the areas listed in Annex I to Reg. 812/2004 where the use of pingers is mandatory. Fishing vessels use analogue and digital pingers commercially available. In order to carry out compliance monitoring, the personnel of the competent federal and state authorities were equipped with Pinger Detector Amplifiers (Etec model PD1102) and trained accordingly. The detectors determine whether a pinger in the water actually emits its ultrasonic signals. The use of such detectors proves difficult in practice, since pinger signals can be masked by engine noise from control vessels. The relevant legal norm (Article 2, paragraph 2, Reg. 812/2004) requires that the pingers only have to function at the time of deployment. It is therefore irrelevant to check nets already set, as possible violations could not be punished. The legal framework for the detection and prosecution of violations should therefore be further optimised.

In 2016, federal fishing protection vessels carried out a total of five inspections on fishing vessels obliged to use pingers. No violations were found. In the state of Mecklenburg-Vorpommern (Baltic Sea), no inspections of acoustic deterrent devices were carried out in 2016. The four gillnetters ≥12 m registered in Mecklenburg-Vorpommern were not encountered in ICES Division 3.24 during the setting of gillnets in the course of sea inspections. The fishing gear listed in Annex I to Reg. 812/2004 was not used in the territories of the Länder of Lower Saxony and Bremen (North Sea) during the periods described in the Regulation and therefore no controls were carried out. Coastal waters of Schleswig-Holstein in the Baltic Sea do not fall within the scope of Annex I of Reg. 812/2004. During 2016, no activities of vessels requiring deterrent devices were seen in the coastal waters of Schleswig-Holstein in the North Sea.

The project to develop and test a new type of acoustic deterrent device (Porpoise Alert, PAL), carried out by the Thünen Institute of Baltic Sea Fisheries (Rostock) and F³:Forschung.Fakten.Fantasie (Kiel), was continued in 2016. To test their effectiveness, PAL

devices were deployed on a small number of German and Danish commercial gillnet vessels while carrying out their normal fishing activities in the Baltic Sea. For background information on the project and first results showing that PAL is able to reduce bycatch by 70% in the tested fisheries see the WGBYC report 2017 (WGBYC 2017).

Ireland acknowledges that numerous trials have shown that pingers of several types can reduce porpoise bycatch by around 90%. They state, however, that Acoustic Deterrent Devices (ADDs) are expensive and where many are required (e.g. for set-net fisheries), they need periodic maintenance to check and replace batteries and they can interfere with net setting and hauling. There is still ambivalence towards ADDs from NGOs due to perceived habitat exclusion and environmental noise effects. The seriousness of these effects is unknown. Habituation has also been cited as a reason that ADDs do not work, although again there is no evidence that this is an issue. ADD devices have good potential to work in pelagic trawl fisheries where incidental bycatch of common dolphins may occur. There is however no mentioning in the report if they are used in the fishery or not.

In **Italy,** Pingers (DiD 01) were voluntarily used by a few pelagic pairtrawlers in GSA 17 (northern Adriatic subarea). Sea trials with sorting grid (FLEXGRID) were carried out in May on board a pelagic trawler in Cesenatico to avoid bycatch of marine turtles. Results from the trials reveal poor fishing performance in terms of hydrodynamics and catch of target species. This device seems unsuitable for the midwater trawlers in this trial. Further development of mitigation measures and trials are needed for mitigating bycatch of protected species and species of conservation concern.

Latvia reports that Reg. 812/2004 mandates the use of acoustic deterrent devices in gillnet fisheries in area SD24 (fishing area 27.3.d.24). There are no Latvian fishing vessels in 2016 working in this area. Gillnet fishing effort targeting cod in Latvia has gradually decreased due to vessel scrapping and in 2016 only four vessels ≥12 m were operating with gillnets in the Eastern Baltic (divisions 3.d.25, 3.d.26 and 3.d.28). Although 50% of these vessels have commercially available pingers, they were not used. Thus, Latvia has no scientific studies aimed to assess the effects of pingers in this fishery.

The **Netherlands** reports that the use of pingers is obligatory in ICES Subarea 4 for vessels ≥12 m in the period 1 August until 31 October, using nets that do not exceed 400 m length (the regulation intends to cover set-nets worked on wrecks, where relatively short net lengths are being used). The vast majority of the Dutch set gillnet fleet fishes in this period for sole with much longer net fleets and meshes below 220 mm.

If some vessels are required to use pingers, this is not registered and thereby not known by government authorities, nor are the fishermen aware that they should use pingers. Most likely, no acoustic deterrents are in use by Dutch gillnet fishers. However, the number of vessels > 12 m fishing on wrecks (that is with nets that not exceed 400 m) is very low if not zero.

In 2008, fishing vessels flying the **Polish** flag, and fishing on the ICES Division 3.24 received 500 AQUATEC AQUAMARK 100 pingers. In 2015, a detailed inspection of the pingers bought in 2008 showed that 253 pingers needed replacing. Since the end of 2015, after checking the functioning of the pingers, the number of pingers on the fishing vessels has never been audited and pinger exchanges between vessels have not been monitored. However, the ship owners have been instructed to buy new equipment in replacement of any defective ones. The purchase of new pingers from the European Maritime and Fisheries Fund for the period 2013–2020, is planned after the entry into force of the Regulation on technical conservation measures. According to this there is no data on the use of pingers or replacement of the defective ones in 2016, except an

information that during routine inspections carried on Polish vessels fishing on ICES Division 3.24 by Polish and German authorities no cases of absence of pingers were reported.

In 2016, the National Marine Fisheries Research Institute together with Polish Society for the Protection of Birds conducted an international research project lead by Bird Life, on mitigation methods of seabird bycatch. Four boats tested gillnets equipped with lamps: two boats on the Pomeranian Bay and two boats on Puck Bay. The results will be presented after the end of the project.

In **Portugal,** for the Northwest coast, during 2011–2012, field tests of pingers were performed on seven boats using trammelnets. In 163 trips and 352 hauls observed, 156 hauls were controls (not using pingers) and 196 hauls used pingers, corresponding to the monitoring of 145 km of control nets and 121.25 km nets with pingers. In these trials, the cetacean species interacting the most (96.7%) was the common dolphin. Eleven common dolphins were captured in control nets and two common dolphins in nets using pingers. The bycatch rate associated with the trials was 0.07 and 0.01 dolphins per fishing haul (Pereira, 2016) respectively for controls and nets using pingers.

For the South of Portugal, the bottlenose dolphin was the species observed to interact the most with gillnets. The trials took place in 2014 and 2015 and indicated that the use of pingers was not an effective tool to decrease depredation, net damage and bycatch of bottlenose dolphins in gillnets. In fact, throughout the two-year study there was bycatch of two bottlenose dolphins that occurred in pingered nets only using 10 KHz FUMUNDA pingers. Final results of this study are not yet available.

So far and based on the pinger trials performed, FUMUNDA pingers used in set-nets seem to be an effective tool in reducing common dolphin bycatch, but ineffective for bycatch of bottlenose dolphins. It is clear that FUMUNDA pingers may not be the only effective tool and solution to reduce bycatch, and that any solutions are likely to be area and species dependent. Furthermore, it is clear that a number of technical challenges and economic issues may limit their wide-scale use in Portuguese waters.

In **Slovenia**, no pinger use is required under the Reg. 812/2004 and no pinger use reported.

The **Spanish** General Fishing Secretariat issues licences to the Spanish gillnet fishing fleet to operate in ICES subareas 6, 7 8 (divisions a, b and d). Only some divisions of Subarea 7 are affected by the obligation of using pingers under Reg. 812/2004 (divisions d, e, f, g, h and j). The Spanish Fishing Secretariat informs fishers about the obligation of using pingers in these divisions. The Spanish gillnet fishing fleet operates very sporadically in these divisions.

During 2016, the Spanish gillnet fishing fleet did not operate in any division affected by the obligation of using pingers under Reg. 812/2004.

Sweden reported that the implementation of pingers as laid down in Reg. 812/2004, most likely are not being implemented in regulated fisheries in Sweden. However, in 2015 a project started with the purpose of implementing pingers on a voluntary basis. After discussions with fishermen, Banana pingers were chosen for the project. The fishermen consider the Banana pinger to be practical to use and that the bycatch of harbour porpoises decreased. The fishermen report their catch, effort and bycatch. The voluntary pinger use has continued in 2016 and during that year seven fishermen used pingers voluntarily in the cod and gillnet fisheries in the Öresund Sound, ICES divisions 3.21 and 3.23.

In the area where pingers have been used in the commercial lumpfish fisheries in southern Sweden, a study looking at the distribution of harbour porpoises in relation to commercial fisheries with pingers is currently taking place. Preliminary results show that harbour porpoise detections in the area are low when fisheries with pingers are carried out. However, when fisheries have stopped the harbour porpoise detections do increase and are at the same levels as areas where no fishing with pingers has been carried out. The study continues in 2018.

In the Swedish small-scale coastal fisheries, alternative fishing gear has been, and is still being, developed. Pontoon traps for fishing salmon, white fish, trout and vendace are now used in commercial fisheries in the Northern Baltic. During recent years, there has been a development of a pontoon trap to be used for cod in the southern Baltic. The results show that during certain times catches of cod can be high; however, gear needs further development with regards to resistance to rough seas and open archipelagos as well as practical handling (Nilsson, 2018). The main reason behind the development of the fishing gear is the seal inflicted damages to fishing gear and catch, which threatens an economically viable gillnet fishery.

Since 2014 there has been funding opportunities for fishermen to put forward their ideas for selective fishing gear to the "Secretariat for selective fishing gear" funded by the Swedish agency for water management. The purpose of the secretariat was to enable the fishing industry to develop selective fishing gear to help the transition to the new landing obligation. Projects were carried out by the Swedish University of Agriculture Science in cooperation with the involved fishermen. In 2016 the secretariat funded projects regarding size and species selectivity in benthic trawl fisheries for cod, shrimp and crayfish, a project developing multifunctional pots for fishing for cod and lobster, a project developing pots for shrimp fisheries and a project regarding trapnet fisheries for mackerel, cod and herring (Nilsson, 2018). Developing selectivity grids in trawls prevent bycatch of certain fish species as well as birds and marine mammals. Pot and trapnet fisheries are fisheries with high selectivity with regard to marine mammals, birds and undersized fish. Developing these fisheries prevents an increase in for example gillnet fisheries, which can have high bycatch rates for both birds and marine mammals.

Several studies have been undertaken to evaluate the catch efficiency of different cod and lobster pots and what factors affect the pots' catch efficiency (Ljungberg *et al*., 2017; Hedgärde *et al*., 2016 and Nilsson, 2018). This is done partly by looking at the behaviour of cod in relation to cod pot models and other fisheries related factors such as soaktime. The entry rate of cod entering pots gives an indication on the pots' catch efficiency and by studying the entry rate in relation to factors such as cod pot model, number of fish inside the pot and current, you can get information on what factors affect the cod pots' catchability. Results showed that the number of entrances on the pot and the number of cod already inside the pot affected the entry rate of the cod entering the pot (Hedgärde *et al*., 2016). Another study showed that using a funnel on the entrance opening to the fish holding chamber also affects the entry behaviour of cod while entering the pots however it increases the pots catch efficiency (cpue) due to the decreasing number of cod exiting the pots (Ljungberg *et al*., 2016).

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 (ICES, 2006) and well-managed seine fisheries generally have minor ecosystem impacts (Morgan and Chuenpagdee, 2003). In 2016, the Swedish University of Agriculture Science has continued to develop a seine net modified for small open boats and

tried it for 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.

In 2016, the **UK** official fishing effort and landings statistics indicated that there were 23 UK registered vessels of 12 m or more that fished with specified gear types and in specific areas where acoustic deterrent devices are required under Reg. 812/2004. All relevant skippers are aware of the requirements of the regulation, and inspections at-sea by UK authorities indicate a high level of compliance. Static net vessels over 12 m account for only 2% of the UK static net fleet in terms of vessel numbers but are responsible for 45% of the total landings by the netting sector.

UK based vessels appear to be mainly using the DDD-03L acoustic deterrent device which is authorised for use by the UK government under derogation contained in Article 3(2) of Reg. 812/2004. A key requirement for the permitted use of these devices is that they should be positioned along each net fleet so that no part of the fleet is more than 2000 m from the nearest device. The Marine Management Organisation (MMO) has provided full guidance on the implementation of the Regulation and the use of acoustic deterrent devices (pingers), which is available at:

http://www.marinemanagement.org.uk/fisheries/monitoring/regulations_cetaceans.htm

In 2016, ten trips covering 117 sea days and 320 monitored net fleet hauls were observed on board over 12 m vessels for the purposes of monitoring pinger efficiency (this was out of a total of 315 dedicated monitoring days). Observed porpoise bycatch rates were consistent with previously observed rates in nets properly equipped with pingers, with no evidence of habituation thus far. Limited sample sizes restrict our ability to say with any confidence whether pingers influence seal or dolphin bycatch rates. The effects of pingers, in terms of the number of porpoise deaths avoided by their use to comply with Reg. 812/2004, was explored: the current best estimate of porpoise bycatch in all UK gillnet fisheries ranges between 771 and 2994 animals (best estimate 1482; CV=0.09) in the absence of pingers, and between 606 and 3114 animals (best estimate 1250 CV=0.11) if all over 12 m boats used pingers in relevant areas

In **Denmark,** A total of 24 Danish vessels were obliged to use pingers in 2016. In 3.d.24/3.c.22 only a few vessels are required to use pingers (4%), compared to 56% of the vessels operating in 3.a & 4. The pinger type "AQUAmark100" is generally used in gillnet fisheries, where the use of pingers is mandatory. No projects on monitoring of pinger use in Danish seas have been conducted in 2016. However, the Danish fisheries inspection vessels, which are equipped with hydrophones, check for active pingers as part of their at-sea inspections. In 2016, there were seven inspections on vessels of ≥12 meters and 59 inspections on vessels ≤12 m. No violations have been reported from these inspections. In 2016, four inspections were carried out for foreign vessels (two Polish, one German and one Swedish). Denmark recommends, that Member States indicate infringements in relation to national fishing vessels as well as other Member States fishing vessels. Thereby, all infringement cases will be reported to the Commission.

Furthermore, Denmark presented two mitigation trials. One tested if lower net height could reduce bycatch of harbour porpoises. A controlled experiment was conducted in the turbot fishery in the North Sea. The normal net height (14.5 meshes) was reduced to 9.5 meshes in 50% of the used nets. The results showed no differences in turbot catches but also no differences in porpoise bycatches. Unfortunately, the actual net

height when deployed was not measured; it is possible that the reduction in meshes simply reduced the bagging effect of the net and not the actual net height.

The second trial tested if light (ProGlow) could reduce the amount of seabird bycatch. A trial was conducted in the cod fishery. 50% of the nets were deployed with flashing ProGlow and 50% were standard cod nets. The lights were deployed with 20 m spacing both on the lead and bottom line; however in a zigzag setup creating lights every 10 m. The results showed no differences in bycatches of birds, however, cod catches increased by 50% in the ProGlow nets.

4.1.2 Mitigation trials outside the EU

In **Iceland,** banana pingers (from Fishtek Marine) were tested in April 2017 to try to reduce porpoise bycatch in the cod gillnet fishery. Three commercial vessels were used for the experiment, one in Breidafjordur in west Iceland, one in Hunafloi to the north of Iceland and one off the southeast coast. These areas were selected as they are sampled in the annual MFRI cod gillnet survey, and have historically had high cetacean bycatch, especially the north and southeast areas.

In each area, 3–4 paired sets of 12 nets were set, where half of the sets were set with banana pingers according to manufacturer's description (one pinger every 200 meters of net), and the other half without pingers. Two nautical miles were between the paired sets to avoid interaction from the pingers on the control sets. A total of 152 sets were hauled over a week.

Eleven cetaceans, nine harbour porpoises and two white beaked dolphins were caught in the experiment. Six of those animals, five harbour porpoises and one white beaked dolphin were caught in the sets equipped with banana pingers, while five animals, four harbour porpoises and one white beaked dolphin were caught in the control sets. No significant difference was therefore observed between the pinger and control sets. Interestingly, two harbour porpoises were caught in a net right beside a pinger. The size and gender composition of the bycaught animals was similar between the two treatments. No difference in catch or species composition of fish was observed between the pinger and control sets.

Porpoise alert devices (PALs) were tested in April 2018 in the cod gillnet fishery, and as with the trials using banana pingers, these were also unsuccessful. Two commercial vessels were used for the experiment, one in Hunafloi in northern Iceland, and one on the southeast coast, known hot spots for cetacean bycatch. In each area, three paired sets of 12 nets were set, where half of the sets were set with PALs according to the manufacturer's description (four PALs per set). One nautical mile was between the paired sets to avoid interaction from the devices on the control sets. A total of 98 sets were hauled over a week.

A total of 23 porpoises were caught in the trial. Twelve of those animals were caught in the sets with PALs, and eleven in the control sets. No significant difference was therefore observed between the PAL and control sets. Interestingly, almost all the bycaught porpoises in the PAL sets (eleven out of twelve) were large adult males, while the gender ratio was seven males and four females in the control sets. Interestingly, eight of the twelve porpoises caught in the PAL sets were found right by the PAL device, suggesting possible attraction of adult males towards the PAL devices.

Green lights (longline lights) were tested in April 2018 in the cod gillnet fishery, with the aim to reduce both bycatch of seabirds and marine mammals. One commercial vessel, Saxhamar SH, was used in the trial in Breidafjordur, West Iceland. In this area,

three paired sets of 12 nets were set, with a light on each net in half of the set, and the other half without lights. Half a nautical mile was between the paired sets to avoid interaction from the lights on the control set. A total of 42 sets were hauled over a week.

No marine mammals were caught in the trial, but five diving birds were caught. Two gannets, two common guillemots, and one Brünnich's guillemot were caught; all in the light sets. No birds were caught in the control, apart from two Northern fulmars that were caught when hauling in the gear and were subsequently released alive. The lights therefore seemed to attract the birds. The effect on marine mammals remains unknown.

A study in **Norway** revealed the annual bycatch to be about 3000 harbour porpoises, 550 harbour seals and 460 grey seals (Bjørge and Moan, 2016; Bjørge *et al*., 2016). Another small pilot study was conducted in 2017 in Norway by the IMR in Oslo using the Future Oceans' porpoise pinger and the Fishtek's Banana pinger in the cod and monkfish fisheries (WGMME 2017). The Future Oceans pinger emits signals (10 kHz) which are in the audible frequency range of pinnipeds. The Fishtek pinger emits signals with frequencies fluctuating between 50 and 120 kHz. The results from the cod fisheries study showed a 70% reduction of bycatch in nets with pingers. In the fishery for monkfish, there was no difference in bycatch. However, the bycatch of harbour seals was three times higher in nets equipped with Future Ocean (10 kHz) pingers. There was no difference in nets with and without the 50–120 kHz pingers.

In **USA** 2017, the Northeast Fisheries Science Centre (NEFSC) conducted three gear-related projects investigating methods to reduce sea turtle bycatch in fishing gear. The first was a comparative study of the ability of a large 12" (30.5 cm) mesh low profile gillnet to reduce sea turtle bycatch. We compared two different tie-down configurations: standard (12 meshes with 48 in (1.2 m) tie-downs) and low profile (eight meshes with 24 in (0.6 m) tie-downs) using the same experimental protocol. Previously this configuration proved successful at reducing the bycatch of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) with little effect on the targeted catch of monkfish (*Lophius americanus*) and winter skate (*Leucoraja ocellata*). Sixty paired sets (120 hauls) were completed in waters off Cape Hatteras, NC, an area chosen because of the high densities of sea turtles in winter. Results are being analysed but there was no significant difference in the capture of loggerhead sea turtles between treatments. Fourteen loggerheads were captured in the control nets and eight were captured in the experimental nets ($p = 0.125$). It is interesting to note that during the first seven trips of the study, ten loggerhead turtles were captured in the control nets while none were captured in the experimental nets. During the final five trips of the study, eight loggerheads were captured in the experimental nets and four were captured in the control nets. We are looking at environmental changes that may have caused these results.

The second study was a test of a cable-sorting grid to reduce turtle bycatch in the summer flounder fishery. Previous studies comparing catch rates of Turtle Excluder Device (TED)-equipped trawls and standard flatfish trawls found an average of 25–30% loss in targeted summer flounder (*Paralichthys dentatus*) catch in the TED equipped trawl. As such, additional bycatch reduction devices (e.g. topless trawls, cable grids) have been investigated. In 2016, the NESC was funded to run a comparative study of a NE-TIII (a type of cable grid)-equipped trawl to that of a standard flatfish trawl in the summer flounder trawl fishery. The study documented operational issues and compared the catch data aboard two commercial fishing vessels. Aboard the FV Darana R, significant reductions (29–45%) in summer flounder catch were observed during leg 1 and 2 of the project. Aboard the FV Jersey Cape, a modified configuration was used and no

significant reduction in summer flounder catch was observed. In total, four configurations were tested throughout the study in an attempt to improve target catch efficiency. From an operational and safety standpoint, the NETIII system was a substantial improvement from previous research using rigid grid TEDs. Because these studies proved to be a proof of concept for this gear, in 2017 we did a full study of the NETIII system in the most successful configuration form 2016 using a twin trawl out of Point Judith, RI. The vessel was able to complete 49-paired tows. The results, which were highly significant, showed that the NETIII Cable TED reduced that catch of the targeted summer flounder by almost 53% and reduced the targeted skate catch by almost 42%. These results suggest that this TED in this configuration was unsuccessful at maintaining the targeted catch.

The third study was another comparative cable TED study in the longfin inshore squid (*Loligo pealeii*) fishery. The cable TED [TI] tested is similar to a cable TED successfully tested in the croaker fishery. This work occurred in the southern New England waters in October of 2017. The vessel was able to complete 38-paired tows in six days. Results from this work, using a twin trawl configuration, showed that the cable equipped net caught similar quantities of longfin squid compared to an identical net without the cable TED attached. A modification was made to the floatation used to address an increase in benthic species encountered. The change reduced the catch of benthic species. Reports on PSB gear projects are located at: http://www.nefsc.noaa.gov/read/protspp/PR_gear_research/

4.1.3 Protected species bycatch mitigation studies from recent literature (2016–2018)

The articles highlighted below were selected based on knowledge of peer-reviewed papers published over the period as well as a similar review done by the working group on marine mammal ecology. This was supplemented by a Google Scholar and Web of Science searches using a filter for publication years (2016–2018), and the keywords "bycatch", "mitigation" and "reduction". If the papers in question reviewed or tested factors affecting bycatch, bycatch mitigation devices or alternative fishing gears aimed to reduce the bycatch of marine mammals, seabirds, reptiles and other PET species, they were included in this review.

4.1.3.1 Reviews of fishing gears and fisheries related factors affecting bycatch

Northridge *et al*. (2016) synthesized the results from several studies focusing on those factors contributing to the bycatch of protected species in gillnet fisheries in order to develop mitigation measures across taxa. Among the factors, water depth, net height, mesh size and floatline type warrant much more detailed work, including more comprehensive sea trials and experiments to test their effects on bycatch in situ. Lucchetti *et al*. (2017) suggested that the use of thin yarns and a mesh opening of less than 80 mm (or 70 mm according to a stricter approach) in small-scale driftnet fisheries in the Mediterranean Sea would preserve sensitive and protected species. More investigations are urgently required to evaluate how fishing practices, technologies and animal behaviour influence bycatch of protected species and species of conservation concern.

4.1.3.2 Fishing gear optimization and alternative gears

4.1.3.2.1 Marine mammals

For some years, efforts have been made to develop seal-safe fishing gear, to reduce depredation and ultimately bycatch. An example of such gear is cod pots, which may be seen as a viable alternative to gillnets in certain areas such as the Baltic Sea. However, since the catch efficiency is not as high as for gillnets, current designs need to be

optimised to increase rates of acceptance and use by fishers (Hedgärde *et al*., 2016; Ljungberg *et al*., 2016; Stavenow *et al*., 2016). Stavenow *et al*. (2016) found that the design of the cod pots affected seal attack rates; cod pots designed with loose netting around the upper chamber attracted more seals and received most attacks compared to pots designed with tightly stretched mesh. Neither mesh size nor material were correlated with seal presence or attack behaviour (Stavenow *et al*., 2016).

Knowlton *et a*l. (2016) investigated entanglement of North Atlantic right (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*) along the US East Coast and the Canadian Maritimes between the years 1994 and 2010. Knowlton *et al*. (2016) found that rope strength affected entanglement rates. Adult right whales were bycaught in stronger ropes (mean 34.09 kN) than juvenile right whales (mean 15.33 kN) and all humpback whale age classes (mean 17.37 kN). Right and humpback whales were found in ropes with stronger breaking strengths than minke whales (*Balaenoptera acuturostrata*) (19.30, 17.13, and 10.47 mean kN, respectively). Further, the severity of injuries had increased since the mid-1980s, which was suggested to be due to development in the rope industry resulting in production of stronger ropes. Hence, Knowlton *et al*. (2016) suggest that adoption of ropes with breaking strengths of ≤7.56 kN (≤1700 lbsf) could reduce the number of life-threatening entanglements for large whales by 72%, and while still providing sufficient strength to withstand forces involved in fishing operations.

4.1.3.2.2 Sea turtles

Over the past ten years, a number of technical devices directed at mitigating sea turtle bycatch have been tested in the Mediterranean Sea (Lucchetti *et al*., 2016a, b; Lucchetti *et al*., 2017). Among the proposed solutions, a Turtle Excluder Devices (TED) developed for bottom trawling has yielded promising results (i.e. FLEXGRID, Lucchetti *et al*., 2016b). This flexible device proved to be sturdier and easier to handle and ensured greater catch retention compared with previous devices (Lucchetti *et al*., 2016b). While, technical modifications in longlines (e.g. hook shape and size, bait type and setting position) have showed inconsistent results (Piovano and Swimmer, 2017) and should be optimized. In addition, UV-LED illumination seems to be an effective tool to deter sea turtles from approaching set-nets while preserving the commercial catch (Virgili *et al*., 2018). Apparently, no research is currently ongoing in other ICES areas. Furthermore, Chavez *et al*. (2017) tested a bycatch reduction device in the North Carolina blue crab fishery. The device narrows the funnel opening on crab pots and was designed to limit bycatch of the diamondback terrapin, which is a species of special concern. The devices did not have a statistically significant effect on blue crab catch. Thirteen of the 14 captured terrapins were in control pots, while only one male terrapin was captured in a pot equipped with the device, suggesting that the devices are successful in limiting the bycatch while maintaining similar target catch rates.

4.1.3.2.3 Elasmobranchs

There has been little research on effective mitigation measures to minimize elasmobranch bycatch within the ICES area. Bonanomi *et al*. (2017) summarized the current mitigation options adopted or proposed in different fishing gears. Ongoing studies are investigating potential mitigation measures to reduce shark bycatch in the shrimp trammelnet fishery off the Gulf of Gabès, Southern Tunisia, Mediterranean Sea (Saidi *et al*., 2016) and in the Portuguese pelagic longline swordfish fishery (Coelho *et al*., 2017). Ryan *et al*. (2018) have recently tested the effect of intense strobe light and loud

artificial sound on three species of sharks, wild-caught captive Port Jackson (*Heterodontus portusjacksoni*) and epaulette (*Hemiscyllium ocellatum*) sharks in aquaria and on wild great white sharks (*Carcharodon carcharias*) with the aim of exploring the potential of those methods for shark mitigation devices and bycatch mitigation devices. When presented alone and in combination with sound, the lights reduced the number of times that the bait was taken by both *H. portusjacksoni* and *H. ocellatum*, while it had little effect on *C. carcharias*. The authors mention that due to potential effectiveness of strobe lights in deterring other species of sharks, they may be used to reduce shark bycatch in fisheries.

4.1.3.2.4 Seabirds

Avery *et al*. (2017) reviewed the relevant literature on seabird bycatch reduction in longline fisheries, focusing specifically on the role of Bycatch Reduction Devices (BRDs) play in limiting or increasing target species catch and reducing fisheries-related seabird mortality in different ICES areas. This study strongly supports that BRDs are useful for achieving goals for fisheries and seabird conservation. Still, there is a limited number of studies of BRD effectiveness that provide comparable measures of effective size (i.e. those that provide birds caught per hook and that employ a standardised control) and that would allow direct comparison of BRD efficacy.

4.1.3.2.5 Other species

Fykenets used to target invasive green crabs were modified with special BRDs with the aim to reduce bycatch of American eel, American lobster, winter flounder, and other economically or ecologically important species (Poirier *et al*., 2018). In this study, the device reduced both catch of green crabs and bycatch of other species. However, bycatch diversity was significantly lower in the BRD equipped nets, and the authors speculate that using the device is less detrimental to three economically and ecologically important bycatch species. Furthermore, Bayse *et al*. (2017) tested a special species separation for squid trawl to reduce finfish bycatch in a trawl fishery for longfin inshore squid in southern New England. The bycaught species of interest were summer flounder (*Paralichthys dentatus*), black sea bass (*Centropristis striata*), smooth dogfish (*Mustelus canis*), and scup *Stenotomus chrysops*). The separation grid reduced bycatch of the main species of interest by 40–86%, but at the same time reduced targeted catch by 47.5%, and may therefore not be suitable for commercial use.

4.1.3.3 Acoustic Deterrent Devices (ADDs and other)

Culik *et al*. (2016) studied the use of specific acoustic porpoise communication signals (Porpoise ALarm, or "PAL") to mitigate bycatch in fisheries. PALs can be considered to be an alternative to the regular pingers and the experiments showed that PALs were effective in the fisheries trialled in the Baltic Sea. PAL is based on a synthetic porpoise click train, created from recordings of aggressive interactions between harbour porpoises in captivity, which is played back in the field.

The use of ADDs (emitting band-limited noise pulses with sharp onset times) was tested in a 19 months experiment at salmon farms in Scotland (Götz and Janik, 2016). Results showed that the use of ADDs reduced the loss of fish to seals by 91%; however, by visually monitoring the farms, it was observed that the numbers of seals within 100 m of the nets were only slightly lower during the experimental deployments. In contrast to some previous studies, harbour porpoises and otters were not affected by the ADDs, which was concluded to be due to the specific adaption of the deterrent signal to the hearing frequency bands of target and non-target species (Götz and Janik,

2016). Adapting the frequencies of ADD devices is seen as an important step in reducing adverse effects on non-target species. However, Trites and Spitz (2016) suggested that further investigation with larger samples sizes and in other areas are necessary to test for consistency of the results published by Götz and Janik (2016).

4.2 Conclusions

Table 5 provides a summary of the status of pinger implementation according the Reg. 812/2004 and status of other studies on mitigation by country. Of all the submitted Reg. 812/2004 reports, it appears that only in the UK is pinger use fully implemented and there is active enforcement. In some countries, monitoring of the implementation of pingers as per Annex I of Reg. 812/2004, which states which areas and fisheries in EU waters where pingers are obligatory, is limited and the degree of compliance is unknown. Sweden reported that Reg. 812/2004 most likely is not being implemented in part of the regulated fisheries, however, in 2015 a project started with the purpose of implementing pingers on a voluntary basis. In Italy and Portugal, pingers are implemented on a voluntary basis, together with monitoring about their effectiveness in reducing bycatch of dolphins. In France, pingers are used on a voluntary basis only, without further checking of their effectiveness. There are a number of EU countries, whose fleets are not covered by the regulation entirely (see Table 1) or the size of the vessels and/or the regions where the fishery takes place (e.g. Germany). In non-EU countries like Iceland and Norway pingers are tested to reduce the bycatch of small cetaceans, with mixed results. For example, in Iceland two different types of devices (banana pingers and PALs) had no effect in reducing the bycatch of harbour porpoises.

In Italy and the USA, devices, including grids, are tested to reduce the bycatch of turtles in trawl and gillnet fisheries with mixed results. In Italy, the grids tested were unsuitable for the trawl fishery trialled. In Poland (and Lithuania, although no information was provided), trials were carried out to test devices to reduce bycatch of seabirds in set-nets. Also, Denmark conducted a trial to reduce bycatch of birds by adding ProGlow light in gillnet fisheries. No effect on bird bycatch was found in the Danish trials.

Overall, little progress in mitigation of bycatch have been obtained and results have been inconsistent and ambiguous. An example is the reduction of bycatch of harbour porpoises in set-net fisheries in the Western Baltic with the PALs reported by Germany but these same devices were tested with no effect in Iceland. Effectiveness varies with area and fishing métier. Pingers have also been tested, with poor results, to reduce depredation and bycatch in nets of bottlenose dolphins in South-Portugal (Algarve). Trials with measures to reduce bycatch of turtles in the USA, resulted in significant reductions in catch too big to be economical viable or acceptable by the fisheries concerned.

In conclusion, further development of mitigation measures as well as trials to test their effectiveness are needed to reduce the bycatch of protected species in many fisheries.

Table 6. Summary of mitigation requirements in relation to Regulation 812/2004. The information is from the 2016 Reg. 812/2004 annual reports and additional information on mitigation submitted to WGBYC from Member States. Although Member States have reported that obligatory pinger use is being implemented, of all the submitted Reg. 812/2004 reports, only in the UK pinger use is fully implemented with active enforcement.

Country	Pinger use obligatory under Reg 812/2004	Obligatory pinger use implemented	Other pinger trials	Information about other mitigation trials
Denmark	YES	YES	YES	YES
Estonia	NO	-	NO	NO
France	YES	YES	NO	NO
Germany	YES	YES	YES	NO
Iceland	NO	-	YES	NO
Ireland	YES	No information	NO	NO
Italy	NO	-	YES	NO
Latvia	NO	-	NO	NO
Lithuania	NO REPORT			
The Netherlands	YES	Not known	NO	NO
Poland	YES	YES	NO	NO
Portugal	NO	-	YES	NO
Slovenia	NO	-	-	NO
Spain	NO	-	NO	NO
Sweden	YES	NO	YES	YES
UK	YES	YES	NO	NO
USA	NO	-	NO	YES
Norway (Info from WGMME report)	NO	-	YES	NO

5 Evaluate the range (min/max) impacts of bycatch on protected species where possible by assessment unit, furthering the bycatch risk approach to assess likely conservation level threats and prioritize areas where additional monitoring is needed (ToR C)

Bycatch Risk Assessments (BRA) were undertaken by a subgroup using data held in the WGBYC database. The subgroup focused on an assessment for harbour porpoise in static nets (GNS, GTR and GND) in parts of the Celtic Seas Ecoregion (ICES divisions 7 a–c, g–h, j–k; referred to as Celtic Sea [CS]) and common dolphin in static nets and midwater trawls (OTM and PTM) in the CS but also in part of the Bay of Biscay and Iberian Coast Ecoregion (ICES divisions 8a, b, c, d2 and e2; referred to as Bay of Biscay [BoB]).

WGBYC has been using the BRA approach since 2012, but its application is challenging for areas where monitoring has been insufficient. For this reason, France has been looking at other approaches to assess bycatch mortality from stranded cetaceans; the WG report on the use of this method for estimating bycatch mortality of harbour porpoise and common dolphin in the CS and BoB regions of their respective wider ecoregions.

A separate working group progressed a recommendation from PETSAMP that the WG apply the 'fishPi' method to an area that was yet to be assessed (fishPi 2014). Therefore, the WG used the same methodology to identify monitoring gaps in the Baltic Sea.

5.1 Bycatch risk assessments

During WGBYC 2018 meeting, the group repeated the BRA approach described in WKREV812 (ICES, 2011). The approach has been used previously to assess the risk bycatch poses to harbour porpoise in the North Sea (WGBYC 2015), the Kattegat and Belt Seas (WGBYC 2015; 2016) and Celtic and Irish Seas (WGBYC 2015). At the 2018 meeting, the WG focused on BRAs for the harbour porpoise and common dolphin in the CS and BoB (Figure 1).

The general approach relies on the use of the ICES WGBYC database, which holds data submitted by Member States (MS) that are subject to Reg. 812/2004 (Table 1). MS data are submitted to the WGBYC database in an aggregated form. Data are aggregated by MS, year, métier, and ICES Division (see ICES, 2018). As a result, bycatch event level data (i.e. haul or tow level data) are not available. Days at sea (DaS) is the only aggregated unit of effort that is consistently reported among MS. Consequently, monitored and total effort, and estimated bycatch rates are reported in units associated with DaS (ICES, 2017). The WGBYC database was used to estimate observed and total fishing effort, and bycatch of 1) harbour porpoise in CS in nets and 2) common dolphin in the CS and BoB in nets and midwater trawl gears. Data were used to evaluate minimum and maximum bycatch rates in respective métiers and areas. Bycatch rates were then scaled by available fishing effort to estimate the likely range of bycatch mortality; the results were set in the context of regional abundance estimates of the protected species of interest and, when available, assessed against existing environmental limits e.g. ASCOBANS 2016.

The most recent years that showed consistent reporting from MS with vessels using static nets and midwater trawl gears in the CS and BoB regions were evaluated. As a result, monitored and total fishing effort and incidents of bycatch from years 2015–2016 were selected for use in the harbour porpoise net and common dolphin midwater trawl and net BRAs. To increase sample size data from both years (2015 and 2016) were

pooled to calculate the métier specific harbour porpoise and common dolphin bycatch rates.

Total bycatch $\hat{Y}$ of species (i) by region (r) was estimated as the product of the ratio of the sum of observed specimens (y_i) to observed DaS (x), times total fishing DaS (X) (see 5.1.1) summed over ICES areas (a) that correspond to regions CS or BoB:

$$\hat{Y}_{ir} = \frac{\sum y_{iar}}{\sum x_{ar}} \cdot \sum X_{ar}$$

Due to the aggregated nature of data submissions to the WGBYC database, more traditional approaches to estimating uncertainty around a point estimate (e.g. bootstrapping) could not be applied. Alternatively, a binomial or Poisson probability density function (Source excel code: John Pezzullo–Kissimmee Florida USA, suggested reference: CJ Clopper and ES Pearson, 1934) was used to calculate the range (lower and upper) of bycatch estimates from an expected 95% confidence interval (CI). Bycatch events of harbour porpoise can be treated as binomial for the purposes of calculating 95% confidence intervals around a bycatch rate. Observed DaS are either porpoise positive or porpoise negative with a maximum of one animal observed in any one day (it is unusual to observe more than one animal bycaught in a single day). Common dolphin bycatch in nets was also treated as binomial, as bycatch incidents were of single animals. In contrast, common dolphin bycatch in midwater trawls during 2015–2016 ranged from single individuals to clusters of animals (e.g. 3–9) during a single observed incident. Consequently, the bycatch rate of common dolphin was treated as a Poisson process for the purposes of calculating 95% confidence intervals around the bycatch rate. The estimate of the 95% confidence intervals around harbour porpoise and common dolphin bycatch rates were then used to generate maximum and minimum bycatch totals based on the fishing effort data (see Section 1.1.1). The estimated total mortality and associated bycatch removal limits for harbour porpoise in nets in the CS and common dolphin in nets and midwater trawls in CS and BoB, are shown in Table 8 and Table 10, respectively.

5.1.1 Effort data used for scaling the Bycatch Risk Assessment

Accurate estimates of total fishing effort are a vital component in producing a realistic picture of the risk associated with bycatch mortality. To judge the quality of the available effort data a basic comparison was undertaken for the relevant ICES subareas (7 & 8) from data for 2015 and 2016 contained in both the WGBYC database and the ICES Regional Database (RDB).

Several discrepancies were found between and within the different effort datasets. For example, Figure 2 shows gillnetting effort by year and ICES division contained in the RDB indicating that netting effort in divisions 7.f and 7.g is very low (10–40 sea days per annum). This is inaccurate because there is known to be significant UK netting effort in both these divisions. In contrast, records from the WGBYC database (see Figure 3) for these same two divisions indicate much higher netting effort (range 1400–4500 sea days per division per annum).

There are also significant interannual differences in the RDB data for netting effort, particularly in Subarea 8, which are more likely due to data submission differences rather than actual reflections of significant changes in netting activity, but nonetheless further reduce confidence in using this dataset as the basis of effort data used in the

BRAs. Similar though less profound differences were also apparent for midwater trawls in the RDB data but are not shown here.

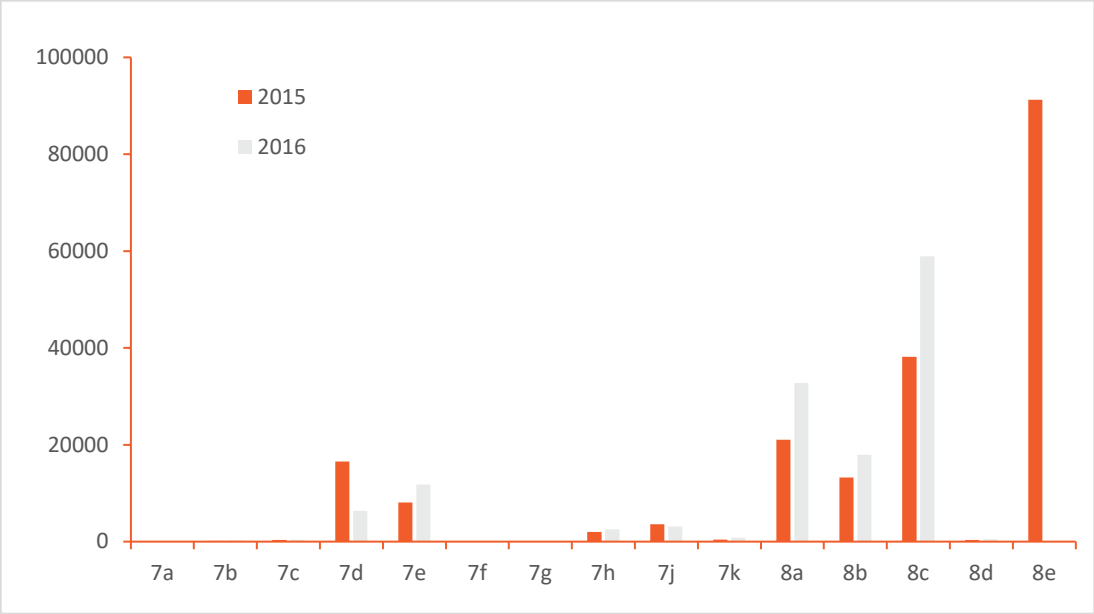

Figure 2. Netting effort (DaS) for relevant ICES divisions as contained in the ICES RDB.

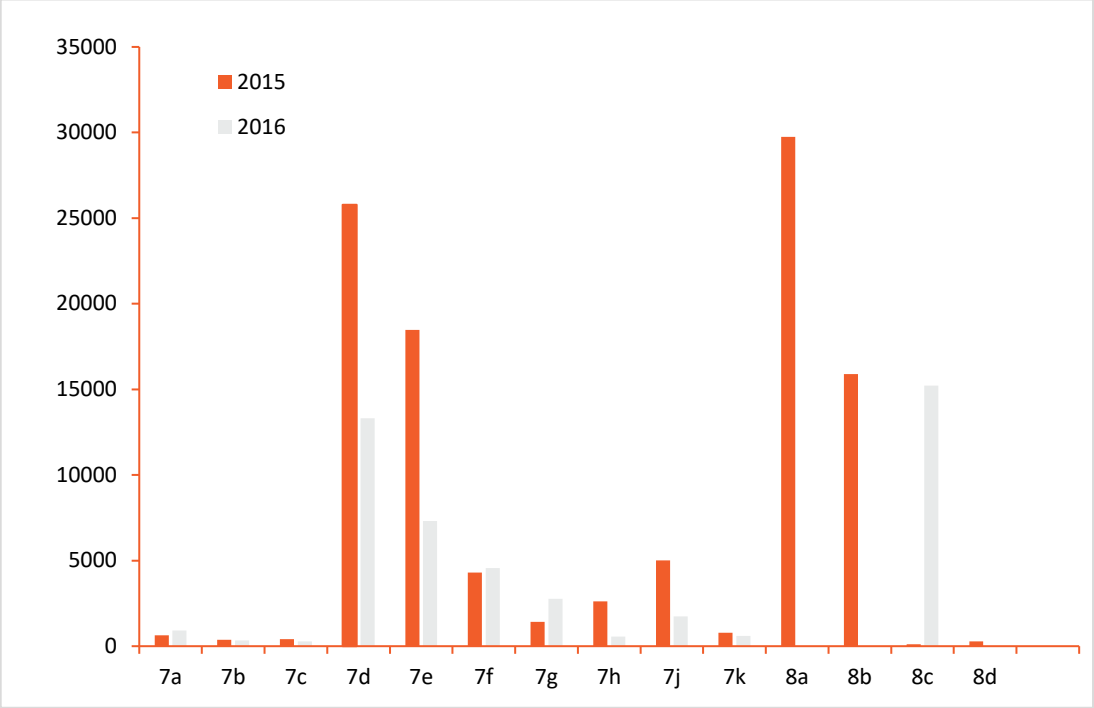

Figure 3. Netting effort (DaS) for relevant ICES divisions as contained in the WGBYC database.

Significant interannual discrepancies were also evident in the WGBYC data particularly in Subarea 8 (see Figure 3), but it was agreed that in general this dataset provided a more realistic picture of likely fishing effort across the region, and particularly in relation to netting in Subarea 7. However, given the much higher effort recorded in the

RDB for some divisions (e.g. 8.e) the data contained for those areas in the WGBYC database may be significantly underestimated.

Although it was decided to use the WGBYC data in the BRA, consistent data were not available for all areas for both years (again likely due to data submission inconsistencies) so choosing a single year's effort data would lead to gaps in the data available for scaling the BRA. Consequently, an approach was developed during the meeting, which used the maximum effort by division for either 2015 or 2016 from the WGBYC database, as this in part addresses potential biases that are introduced due to data submission inconsistencies. However, we acknowledge that this approach may further introduce error if there were unknown but genuine and significant shifts in fishing effort between divisions interannually.

At present, there is clearly no complete fishing effort dataset available to form the basis of risk assessments or the estimation of total bycatch numbers (see Section 8.2). However, using whatever data are available and exploring their quality prior to use, is an important way to at least improve confidence in analyses that utilise fishing effort data. We recommend that further exploration of available fishing effort datasets be conducted by WGBYC intersessionally to help improve assessments that support ICES in the provision of advice relating to protected species bycatch.

5.1.2 Harbour porpoise in the Celtic Sea ecoregion

The Celtic Sea Ecoregion comprises subareas 6 and 7 and parts of some divisions in subarea 4 and 2.a.2. Netting (GNS, GND, GTR) is the main cause of harbour porpoise bycatch in this region and is therefore the focus of the BRA. It was not possible to derive bycatch rate estimates throughout the whole Celtic Sea Ecoregion for several reasons. In the north of the ecoregion, there is a portion of Division 2.a for which, according to the WGBYC database for 2015 and 2016, there were 152 fishing days at-sea with GNS but no observed days at-sea. Division 2.a is a very large area covering parts of the Norwegian Sea and areas north of the Faroes, so it is not known whether the recorded fishing days were contained in the Celtic Sea Ecoregion or elsewhere within 2.a. Consequently, it was not possible to calculate a bycatch rate for the 2.a component of the Celtic Sea Ecoregion. Norway and Faroes did not contribute bycatch data to WGBYC.

Part of Division 4.a is also within the Celtic Seas Ecoregion and the WGBYC database documents 1789 fishing days for the whole of 4.a in 2015–2016. Of these, only 71 days at-sea were observed but no bycatch of harbour porpoise was reported. So the bycatch rate calculated from these data is zero, which may not reflect the actual bycatch rate in the area.

In Subarea 6, there is little netting, with ~400 days at-sea in each of 2015 and 2016 in the WGBYC database. There are no observed fishing days for netting within this area from those years, so bycatch levels are unknown but are likely to be very low given the amount of fishing effort.

Consequently, the BRA uses the data within the WGBYC database to calculate bycatch rates in Subarea 7 within the Celtic Sea Ecoregion only (7a–c, g–h, j–k) (Table 7). Most of the netting fishing effort in this area is undertaken by the UK, but also by France and Ireland, and limited effort by Germany and Denmark. When data from 2015 and 2016 were pooled, the highest bycatch rate was observed in 7.g in set gillnets. However, this was driven by bycatch events observed in 2015 but none in 2016 despite similar amounts of observed DaS (oDaS). In 2016, the highest bycatch rate was observed in setnets in 7.f. Pooling data over years and Divisions, the harbour porpoise bycatch rate ranged from 0.035–0.079 (95% CI). Using the reported fishing effort, the total bycatch

in nets in 2016 for Subarea 7 within the Celtic Sea Ecoregion ranged from 619–1391 harbour porpoises.

Historically, harbour porpoises have been recorded as bycatch in Division 7.h, but none were reported in 2015 or 2016 despite having the highest observer coverage (~3%) of all observed netting in divisions within Subarea 7. However, if we assume that the patterns of fishing have not changed in recent years, then one might expect bycatch still to be occurring in this division. Therefore, the bycatch rate for 7.h calculated from pooled data over 2008–2013 was applied to the current 2015–2016 assessment. This resulted in an upward bycatch estimate for 2016 to between 706–1514 (95% CI) porpoises.

In 2016, the SCANS-III project (Hammond *et al*., 2017) surveyed the northwestern European shelf and offshore waters to generate precise abundance estimates for the more common cetacean species. Unlike previous SCANS surveys, Irish waters were not surveyed as part of this project but through an independent programme ObSERVE (Rogan *et al*., 2017). The abundance estimates from these two projects were used to generate an abundance estimate for harbour porpoise in Subarea 7 within the Celtic Sea Ecoregion in 2016. Table 8 shows that bycatch of harbour porpoise in Subarea 7 is potentially above the 1% precautionary environmental limit recommended by ASCOBANS as an indication that bycatch levels may have an impact on the *population* (ASCOBANS 2016). However, it should be noted that the BRA presented here is an incomplete assessment at the *population* level; the population abundance within the wider Celtic Seas Ecoregion is larger and there is limited netting outside Subarea 7. An assessment of bycatch as a percentage of the best population estimate was also reported for the Celtic and Irish Seas (CIS) Assessment Unit (ICES, 2014) in the OSPAR Intermediate Assessment of 2017; it was concluded that there was 1.06–1.37% annual mortality due to bycatch in the CIS Assessment Unit (OSPAR IA 2017). The OSPAR assessment used best abundance estimates from SCANS-II in July 2005 (Hammond *et al*., 2013) and bycatch data pooled across years 2006–2013; for the BRA here, the WG has used new estimates from SCANS-III in July 2016 which report lower densities of harbour porpoise in the Celtic Seas area compared to previous surveys.

It should also be noted that the bycatch estimates are subject to unquantifiable biases. For example, fishing effort data are likely to be underestimated as effort from smaller vessels is not fully represented in both areas. In this respect, the bycatch range may be underestimated. Bycatch monitoring is also largely carried out through DCF fisheries observers; the UK is the only MS with a dedicated protected species bycatch monitoring programme. WGBYC have reported previously on the downward bias in bycatch rates from data collected in non-dedicated vs. dedicated observer schemes. Depending on the observer protocol and procedures, bycaught animals falling out of the net during hauling (e.g. Kindt-Larsen *et al*., 2012) may be overlooked which might also produce additional downward bias. Conversely, monitoring has focused on larger vessels, which are assumed to have higher bycatch due to larger numbers of nets set and this would cause a positive bias in the assessments. The magnitude of potential bias in fishing effort and bycatch numbers is unknown.

5.1.3 Common dolphin (*Delphis delphis*) Midwater Trawl and Static Net Bycatch Risk Assessment for the Celtic Sea (CS) and Bay of Biscay (BoB) regions

The MS represented in the WGBYC database extraction for the common dolphin midwater trawl and net BRA include France, Germany, UK, Ireland, and Netherlands. For midwater trawl métiers (OTM, PTM) fishing in subareas 7 (within the Celtic Seas Ecoregion) and 8 (Bay of Biscay), the WGBYC database provides a reasonable estimation of total fishing effort and observed effort reported by these MS subject to Reg.

812/2004. It was not possible to estimate bycatch rates for the Iberian Coast region due to limited monitoring and availability of fishing effort data in Subarea 9.

In the CS, the maximum midwater trawl effort from the analysis of total effort (Section 1.1.1) ranged from 142 DaS in Division 7.h to 4772 DaS in Division 7.d. Observer coverage ranged from 1.26% in Division 7.d to 12.68% in Division 7.h (Table 9). CS common dolphin bycatch in midwater trawls was observed in divisions 7.b, 7.c and 7.j (Table 9).

In the BoB, the maximum midwater trawl effort from the analysis of total effort ranged from 21 DaS in Division 8.e to 6320 DaS in Division 8.a. Observer coverage ranged from 1.03% in Division 8.b to 19.05% in Division 8.e (Table 9). BoB common dolphin bycatch in midwater trawls was observed in divisions 8.a and 8.b (Table 9).

With regards to BRA in net fisheries, the total effort ranged from 29 738 in Division 8.a to 281 DaS in Division 8.d. Total observer coverage in net fisheries in CS was 1.90% and in BoB 1.0%. Common dolphins were observed bycaught in divisions 7.a,f,g,h and 8.a and b.

After pooling (2015–2016) monitored effort and observed bycatch, the 95% CI around the common dolphin bycatch rate in the Subarea 7 of the CS Ecoregion ranged from 0.01–0.075 animals per DaS in midwater trawls. In nets, the bycatch rate ranged from 0.006 to 0.031 animals per DaS. Using the reported fishing effort, the total bycatch in 2016 for nets and midwater trawls for Subarea 7 of the CS Ecoregion ranged from 154 to 904 animals (Table 10). The 95% CI common dolphin bycatch rate in midwater trawls the BoB (Subarea 8) ranged from 0.084–0.199 animals per DaS and in nets from 0.011 to 0.035 animals per DAS (Table 10). Using the reported fishing effort, the total bycatch in 2016 for Subarea 8 of the BoB region ranged from 1607 to 4355 animals (Table 10).

The WG used new common dolphin abundance estimates (366 922 animals) from SCANS-III (Hammond *et al*., 2017) from July 2016 for the CS/BoB region as a whole to evaluate the impact of midwater trawl bycatch to common dolphins in this region. Table 10 shows that bycatch of common dolphin in Subarea 7 within the Celtic Seas Ecoregion may range from 0.02%–0.25% of the best common dolphin abundance estimate within this area. Additionally, bycatch mortality of common dolphin in the BoB (Subarea 8) may range from 0.61%–1.95% of the best common dolphin abundance estimate within this area. The total combined CS and BoB bycatch mortality of common dolphins attributed to midwater trawling effort ranged from 0.53%–1.57% of the best abundance estimates for these regions.

5.2 Using stranding's to assess bycatch; summary of current work in Celtic Seas and Bay of Biscay regions

The quality of data submitted on protected bycatch to WGBYC annually and, for cetaceans at least, reported to the EC under Reg. 812/2004 is variable and estimation of total bycatch can be challenging. In recent years, there has been growing interest in trying to develop alternative approaches to estimating bycatch from stranded cetaceans. WGBYC provides a summary of a published approach that has been led by researchers in France. For a full description of the methods, readers should refer to Peltier *et al*. (2016). A review of the approach was undertaken and reported through the IWC Scientific Committee meeting in 2018 (IWC_SC, 2018).

5.2.1 Bycatch of common dolphin and harbour porpoise in shelf waters of the Bay of Biscay, Celtic Sea and the Channel using French and UK strandings data

Following the method described in Peltier *et al*. (2016), strandings data collected by the French and UK stranding networks since 1990 were used to estimate the common dolphin and harbour porpoise mortality related to fisheries in shelf waters of the Bay of Biscay and the Channel (Table 12). As an indicator for the Good Environmental Status assessment for Marine Strategy Framework Directive (MSFD) in 2018 for France, these bycatch estimates, based on stranding data from 2012 to 2015, were assessed against the absolute abundance estimated in survey blocks B, C and D during SCANS-III (Hammond *et al*., 2017) (Figure 4). The total abundance of harbour porpoise in these blocks in July 2016 was approximately 26 500 animals while for common dolphin in the same area there were 200 000 animals. The 'best' annual mortality due to bycatch estimates ranged from 800–1800 for harbour porpoise and 1400–4800 for common dolphin over the period. In the national MSFD assessment undertaken by France, these estimates were compared against the ASCOBANS environmental limit for total anthropogenic mortality (including bycatch) of 1.7% of the best available abundance estimate for small cetacean populations. This was done under the assumption that most anthropogenic mortality could be assigned to bycatch. These results suggested that the mortality calculated for each year of the MSFD reporting cycle for harbour porpoise exceeded the threshold of 1.7% of best estimated abundance, with a probability close to 1. For common dolphins, this level is exceeded for two of four evaluated years.

However, the method is reliant on the parameterisation of a 'drift model' to predict the behaviour of strandings and the calculation of a buoyancy rate; therefore, uncertainty around some of these parameters is implicit. An IWC intersessional group for the Sub-Committee on Non-Deliberate Human Induced Mortality of Cetaceans reported at the Scientific Committee in 2018 (IWC_SC, 2018) and was specifically tasked to review the methods applied in Peltier *et al.* (2016). The group highlighted uncertainties in the estimation of immersion level, the probability of being buoyant, the probability of stranding, the time of death and potential sensitivity of this approach to application beyond the Bay of Biscay (IWC_SC, 2018).

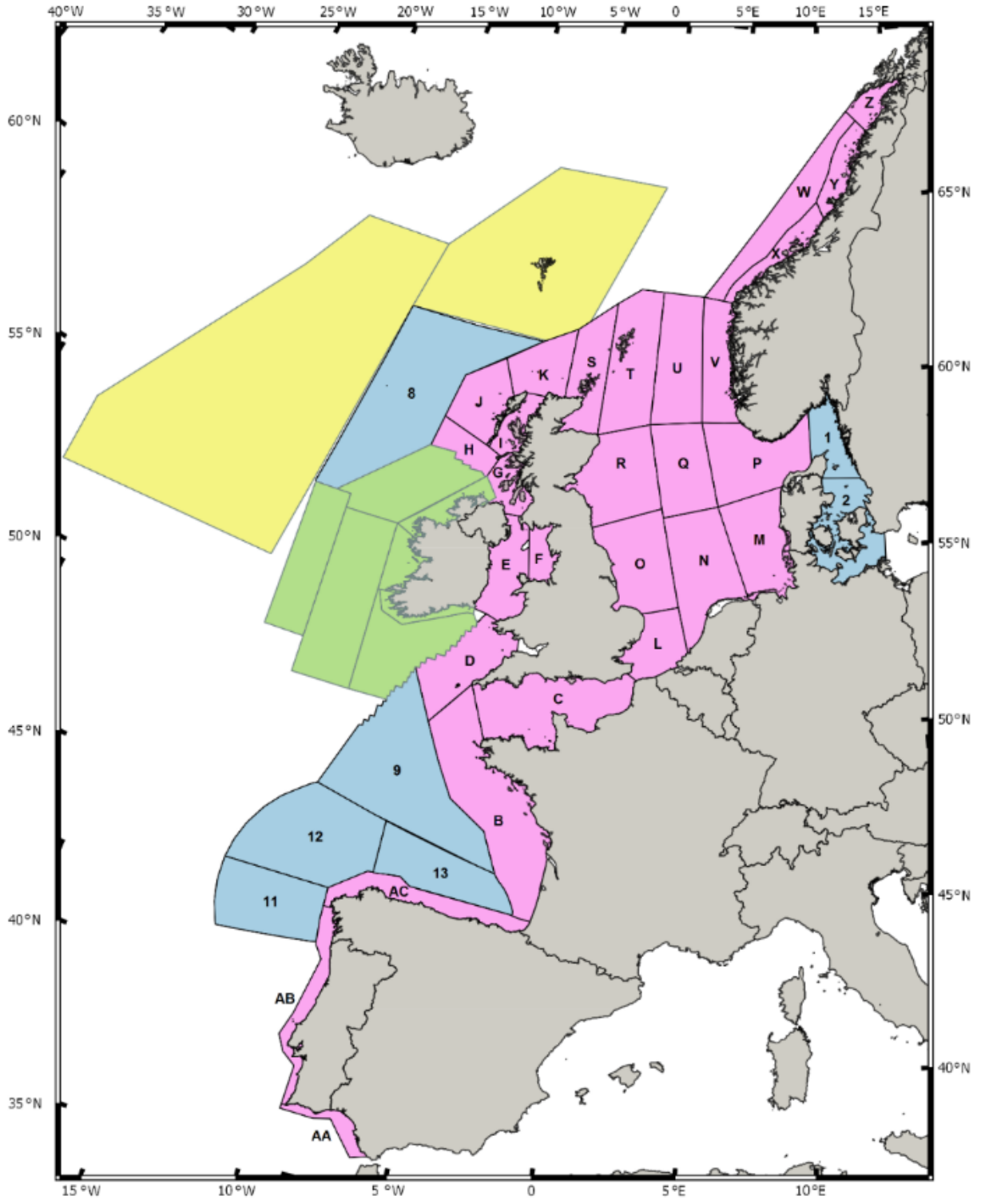

Figure 4. Area covered by SCANS-III and adjacent surveys. SCANS-III: pink-lettered blocks were surveyed by aircraft; blue numbered blocks were surveyed by ship. Blocks coloured green were surveyed by the Irish ObSERVE project. Blocks coloured yellow were surveyed by the Faroe Islands as part of the North Atlantic Sightings Survey in 2015. From Hammond *et al.* (2017). The area for the French assessment is blocks B, C and D.

5.2.2 Common dolphin (*Delphinus delphis*) assessment carried out for the Iberian Peninsula and other ongoing related studies

A short presentation was given to the WG concerning bycatch research on common dolphins in the Iberian Peninsula. Several studies have been carried out at the Spanish Institute of Oceanography (IEO) during the past years. Abundance has been estimated using a ten-year dataseries of annual oceanographic surveys (PELACUS) carried out in the north and northwest of the Iberian Peninsula (Saavedra *et al*., 2017). ASCOBANS (2016) considers a total anthropogenic mortality (including bycatch mortality) of 1.7% as an "unacceptable interaction" in harbour porpoise. In the absence of other thresholds, it has tentatively been applied to other species, including the common dolphin. The number of common dolphin bycatches reported in the literature for the study area during recent years seems to exceed 1.7% (Saavedra *et al*., 2017). Despite this, the abundance of common dolphins seems to be stable or even increasing in the study area, which might be due to regional influx from the wider Northeast Atlantic population, or to a real increase of the animals inhabiting the study area despite the high levels of bycatch (Saavedra *et al*., 2017a, b). The bycatch mortality-at-age of the common dolphins stranded in the Galician coasts (NW Spain) was also estimated using a Heligman-Pollard model (Saavedra, 2018). Population projections (performed using a Leslie matrix) showed that the current total mortality is unsustainable for this part of the population (Galician coast), with an annual population growth rate of about -10% (including natural and bycatch mortality). However, the observed proportion of bycaught dolphins in the strandings sample, could be overrepresented due to the proximity of the gillnet fishery to the coast, which can be responsible for a significant part of the apparent bycatch mortality and wide distribution range of the population. Bycatch limits were also estimated for common and bottlenose dolphins (*Tursiops truncatus*) using a Gadget population modelling software. The models developed show that bycatch mortality should not exceed 1.4% of the population's abundance for both species and 1% applying the calculated precautionary intervals. Dynamic population models developed in the IEO for common and bottlenose dolphins of the Iberian Peninsula can be used for assessing and managing cetacean populations as well as for applying a multispecies approach in fisheries (e.g. commercial species as European hake, *Merluccius merluccius*) (Saavedra, 2017).

5.3 Identifying métiers in need of monitoring (fishPi)

During WKPETSAMP, the methods used to establish criteria for evaluating if at-sea sampling programmes meet end-user needs (project fishPi funded by the European MARE framework, http://www.masts.ac.uk/research/fishpi-project/) was reviewed. The fishPi approach combines species (or species group) occurrence, bycatch risk, fishing effort and current monitoring levels by area. It is a useful tool to categorize the overall bycatch risk, highlight sampling needs and identify gaps or shortfalls in current monitoring levels. High bycatch risk métiers and fishing grounds were identified in the North Sea and North Atlantic regions, considering different protected species or taxa, in the 2014 fishPi project. WKPETSAMP recommended WGBYC to review this method, and to create tables for the areas which had not been completed in the fishPi project (i.e. the Baltic, the Mediterranean and Black sea). During the meeting, WGBYC had time to review and apply the assessment to the Baltic Sea. The Kattegat was excluded from this because the method has already been applied to this area combined with the Skagerrak (area SK in the frame of fishPi).

The method follows these steps:

1) A general assessment of the risk for a species group to being bycaught in a specific gear type (métier level 4, done by expert judgement);
2) Identification of presence or absence of a species group in the Baltic Sea;
3) Classification of fishing effort for each gear type;
4) Calculation of species and gear specific risk factors (multiplication of 1 to 3);
5) Summation of these index numbers across all species for each gear type[6] (summed risk factor for the Baltic Sea);
6) Calculation of relative sampling effort per gear type within the Baltic Sea; and
7) Comparison of relative risk factors and relative sampling effort (by calculating the difference of percentage of summed species group risk factors and percentage of the total sampling effort) for each gear type within the Baltic Sea.

The results of all steps of the fishPi method applied to the Baltic Sea are presented in Annex 4.

The final output from application of the fishPi method is a table with positive and negative values, where a positive value indicates undersampling and a negative value indicates oversampling (last column Table 13). This table provides an overview of sampling needs. However, the table should be carefully interpreted, as the index values are relative. The table is also dependent on the assumptions made and not all data are available at the scale needed to produce reliable results. The fishing effort was retrieved from the WGBYC database (2016 data) and may be incomplete. The basis for effort classification is the commercial effort and does not include effort in recreational fisheries, which could substantially add to the bycatch risk.

Gears, their use and gear classification differ between countries, which may affect the estimated bycatch risk factors. In this approach, we chose the highest risk classification when differences between countries were discovered, except for poundnets. Poundnets in some countries have codends acting similar as fykenets (e.g. in Sweden), causing a higher bycatch risk for seals and fish-feeding diving birds than completely uncovered poundnets. Despite this, the bycatch risk for poundnets was estimated as if all gears were completely uncovered. It might be required to reclassify these gears in future.

The gear classification is also debatable for semi-driftnets. These nets are anchored at one end, but otherwise drift at the surface like a driftnet. As semi-driftnets have officially been classified as set-nets[7] since 2007 and effort data does not allow separating bottom from surface nets, for all gillnets the bycatch risk for surface feeding birds was estimated as for semi-driftnets. Driftnets are not allowed in the Baltic Sea (including Belt Sea and the Sound) since 2008[8].

Further, for lampreys and roundfish we used the classification used by fishPi. However, the group noted that the roundfish species group is very diverse, and includes many commercial fish. Additionally, sturgeon, a species previously extinct in the Baltic

[6] Providing an index of which fishing gears are most in risk of having significant bycatch, and therefore are most in need of sampling.

[7] Definition in EC Council Regulation No. 809/2007.

[8] EC Council Regulation No. 812/2004.

Sea, was included in the assessment tables as there are currently reintroduction measures in rivers adjacent to the Baltic Sea.

Our expert judgement of general bycatch risk for each gear (see Table 1 in Annex 4) revealed a few differences to the fishPi judgement:

- **Harbour porpoise:** The bycatch risk for trawls was kept at one except for all pelagic trawls. It is known that some bycatch occurs in trawls (Lunneryd *et al*., 2004), but from this information the bycatch risk cannot be assigned to a specific métier at level 4. In Polish data, one bycatch could be assigned to a pelagic trawl (Skora and Kuklik, 2003).
- **Seals**: The bycatch risk for pots and traps could be assessed as high (3) if no excluding devices are used with push-up traps (Vanhatalo *et al*., 2015). However, here we suggest some risk (2) because this gear is most often used with seal excluding devices as a 'seal safe' gear. Lobster pots (Kattegat) are not known to produce seal bycatch. The risk for bottom pair trawls was assessed higher (2 instead of 1) due to their larger size compared to otter trawl (consistently assessed as 2) and higher risk of seals being entrapped when the gear collapses at start of hauling.
- **Surface feeding birds:** The bycatch risk in set-nets was assessed as high (3 instead of 1) because semi-driftnets in Poland (salmon/sea trout) and Sweden (sea trout) are set at the surface and thus pose a high risk for surface feeding birds.
- **Diving birds:** The fishPi project did not distinguish between bottom feeders and fish feeders, which we think is essential to the Baltic. In fykenets, the identified bycatch risk is classified as high for fish feeding birds (3 instead of 2 as in the fishPi project). A substantial bycatch, especially of cormorants, mergansers, diving ducks and grebes is known from fykenets in the backwaters of Usedom, Germany (Erdmann *et al*., 2005). Also, the bycatch risk in longlines differs between the bottom and surface feeding birds as well as between fish feeding and bottom feeding diving birds. The bycatch risk for bottom feeding diving ducks is low (1), although some bycatch is documented. Fish feeding diving birds are attracted to the bait resulting in some risk (2). Surface feeding birds are attracted to bait during the shooting of longlines. Thus the bycatch risk in longlines is considered to be high (3) in the latter group.

Another difference to the fishPi model that was used for the North Atlantic areas is that in this assessment all observed effort has been included (DCF and dedicated observer programmes) taken from the WGBYC database. The fishPi model only used observed DCF effort. To get a complete view of the monitoring needs also in the North Atlantic, the efforts that have been made with regards to monitoring under Reg. 812/2004 regulation should also be taken into account.

Table 13 shows that midwater otter trawls (OTM) are over-sampled whereas a number of other gear types are undersampled in the Baltic Sea. Gears subject to undersampling include fykenets (FYK), trammelnets (GTR), set gillnets (GNS), set longlines (LLS), pots and traps (FPO). Some of these gear types will have to be re-evaluated on a case-by-case basis, e.g. pots and traps are so diverse that the bycatch risk differs a lot between trap type and target species. Also, the use of excluding devices must be considered. In some countries, fykenets are classified as FPO, which would (from the perspective of bycatch risk) require reclassifying them.

The final table gives us a long list of métiers that are currently undersampled and a few gears that are over-sampled with regards to protected species bycatch. Therefore, there is a need for end-users to further prioritise the métiers identified in need of monitoring by the fishPi method.

5.4 Working towards improving knowledge of elasmobranch bycatch and mitigation

Interest in the assessment of elasmobranch bycatch was expressed to the chairs of WGBYC through the ICES Secretariat. An abstract entitled 'Tools for consistent reporting of protected and non-target bycatch data at a regional scale; an Elasmobranch test case' was submitted to the 2018 ICES Annual Science Conference (Fernandez *et al*., 2018). To date, submission of records of elasmobranch bycatch to WGBYC have been inconsistent. Many of the species of interest, perhaps those which are showing population declines, are not 'protected' but are zero TAC species. In order for assessments to be made of elasmobranch species, WGBYC identified two main tasks that would facilitate better data submissions: WGBYC needs a prioritised list of elasmobranch species from the relevant WGs and WGBYC needs to capture these in next year's data call. At this year's WGBYC, status of data within the WGBYC database were summarised in ToR A (see Section 3).

5.4.1 Deep-water shark bycatch

Al Kingston (UK) provided a short presentation detailing some preliminary work that was conducted in the UK in relation to deep-water shark bycatch. There have been no targeted fisheries for deep-water sharks in EU waters since 2006 and no landings at all permitted since 2011. All deep-water sharks are currently considered to be Zero TAC species and two species (*C. squamosus* and *C. coelolepis*) are also included on the EU prohibited species list for some ICES subareas. Several effort management measures are also in place in the North Atlantic that restrict netting effort to certain depths and in EU waters Regulation 41/2007 restricts any netting effort in depths >600 m in subareas 6, 7 and 12. The UK deep-water netting sector has been lobbying for an extension to this depth regulation to 800 m for large mesh fisheries targeting anglerfish (*Lophius* sp.) to try to reduce gear conflicts with towed gear fisheries, which currently operate in similar areas less than 600 m. The UK authorities were contacted to see if a dispensation would be provided to allow some exploratory fishing in the 600–800 m zone to assess deep-water shark bycatch rates in deeper water, but this was declined due to concerns over possible increased shark mortality. An alternative conceptual approach to try to predict likely bycatch rates in the 600–800 m zone was developed using data on shark bycatch rates at depths less than 600 m collected during monitoring under the UK protected species bycatch programme and combining these data with information on the relative depth abundance of the same species from survey data collected between 1998 and 2013 (Neat *et al*., 2015). Based on a general additive modelling approach (GAM) undertaken in Neat *et al*. (2015), the abundance of two species *C. squamosus* and *C. crepidater* is still decreasing (though several other species are showing increasing abundance) despite the management measures in place over the last 15 years and these species are now considered to be of most concern. The relative depth abundance of both these species peaks at about 800 m and increases by a factor of 2 to 4 from 600 m, meaning bycatch reduction rates in the region of 75% from current levels observed at less than 600 m would be required to ensure that no increase in mortality would occur if fishing effort was permitted in the 600–800 m zone. To determine if such reductions are achievable, testing of gear modifications (such as altering the mesh size, hanging ratio or net fishing height) to alter selectivity patterns would need to be undertaken in

the field. Anglerfish selectivity would almost certainly be affected by any gear modifications but losses resulting from the change in selectivity may be at least partially offset by observed increasing abundance of anglerfish at depths less than 600 m, which may continue in the 600–800 m zone. This basic concept, if robustly tested, has the potential to provide a win–win scenario whereby permitting an extension of effort into deeper waters would reduce gear conflicts between static and mobile gears (thus reducing gear loss / unaccounted mortality, industry operating costs, etc.), ensure no overall increase (and potentially decreases) in shark mortality and may lead to improvements to anglerfish stocks through altered selectivity (e.g. by increasing yield-per-recruit).

5.5 Conclusions

Based on the available data in the WGBYC database and the most recent abundance estimates from SCANS-III, the BRA for harbour porpoise highlights that the estimated mortality of this species in nets in Subarea 7 of the Celtic Seas Ecoregion in 2016 may be above environmental limits defined by ASCOBANS. The BRA estimates that ~600–1400 harbour porpoises may have been bycaught in 2016. For common dolphins, the BRA for midwater trawls and nets suggests that bycatch is greatest in the BoB (Subarea 8) with potentially 1760–5259 common dolphins bycaught in 2016 throughout the Celtic Seas and Bay of Biscay. The total mortality in both nets and midwater trawls in the BoB may exceed ASCOBANS limits within this region, although we are minded that the common dolphin in this region is part of one large panmictic population in the NE Atlantic (Murphy *et al*., 2013). Effort and bycatch from paired bottom-trawl gear (PTB) with very high vertical openings (VHVO) that also contribute to total common dolphin bycatch mortality were not included in the BRA. There are several unquantifiable biases in these estimates driven by the nature of the observation data (e.g. DCF vs.dedicated monitoring), relatively poor observer coverage of the fleets and, in particular, incomplete fishing effort data. For example, the problem of over and undersampling within some midwater trawl métiers has been reported frequently by the WG since the implementation of Reg. 812/2004 (WGBYC 2010; WGBYC 2013; WGBYC 2017). For the BRA, maximum effort by division for either 2015 or 2016 was used; this approach assumes that there are no significant shifts in fishing effort between divisions interannually.

The estimates of annual mortality from strandings data (2012-2015) vary from 800–1800 and 1400–4800 for harbour porpoise and common dolphin respectively in the shelf waters of the Bay of Biscay and Celtic Shelf. The approach used is published in Peltier *et al*. (2016). However, the method has been reviewed (IWC_SC, 2018) and several uncertainties pertaining to the parameterisation of the method were noted.

The fishPi approach combines species (or species group) occurrence, bycatch risk, fishing effort and current monitoring levels by area. It is a useful tool to categorize the overall bycatch risk, highlight sampling needs and identify gaps or shortfalls in current monitoring levels. Application of the approach gives rise to a table listing métiers that are under/oversampled given associated bycatch risk. For the Baltic, the approach showed that midwater otter trawls (OTM) are over-sampled whereas a number of other gear types are undersampled (e.g. fykenets (FYK), trammelnets (GTR), set gillnets (GNS), set longlines (LLS), pots and traps (FPO)). Some of these gear types are diverse and/or have mitigation as standard; therefore, further evaluation of bycatch risk is needed. End-users will need to further prioritise the métiers identified in need of monitoring by the fishPi method.

An abstract entitled 'Tools for consistent reporting of protected and non-target bycatch data at a regional scale; an Elasmobranch test case' was submitted to the 2018 ICES

Annual Science Conference (Fernandez *et al.*, 2018). The abstract highlights the value of the WGBYC database for an initial assessment of the elasmobranch species, areas and gear types where bycatch has been recorded (see Section 3). To date, submission of records of elasmobranch bycatch to WGBYC have been inconsistent. WGBYC identified two main tasks that would improve data submissions: WGBYC needs a prioritised list of elasmobranch species from the relevant ICES WGs and WGBYC needs to capture these in next year's data call.

Table 7. Total and observed netting (GNS, GTR, GND) effort in days at sea (DaS) and reported number of observed number of harbour porpoise (Pp) and common dolphins (Dd) bycatch events. Total maximum DaS estimated from WGBYC database after taking the maximum number of DaS reported by ICES Division for 2015 or 2016. DaS reported from the following Member States: Germany, Denmark, Great Britain, Ireland, and France.

Ecoregion	ICES Division	Total Maximum DaS	Observed DaS (2015–2016)	Observer coverage %	Observed No. Pp (2015–2016)	Observed No. Dd (2015–2016)
Celtic Sea	27.7.a	921.88	8.00	0.87	0	0
	27.7.b	370.00	0.00	0.00	0	0
	27.7.c	419.59	0.00	0.00	0	0
	27.7.f	4564.34	83.72	1.83	9	1
	27.7.g	2783.58	54.00	1.94	7	1
	27.7.h	2620.47	81.59	3.11	0	1
	27.7.j	5013.61	104.57	2.09	2	2
	27.7.k	791.12	0.00	0.00	0	0
	Total	17484.59	331.88	1.90	18	5

Table 8. Estimates of lower and upper 95% bycatch mortality for harbour porpoise in the context of harbour porpoise abundance estimated in Subarea 7 from SCANS-III survey data. Estimates were derived from data submitted to the WGBYC database and the French Reg. 812/2004 report for 2016 (since those data were not in the db).

Area	Year	Fishing Effort	Estimate of bycatch rate (number of bycatch events/observed DaS)		Estimate of porpoise bycatch		Best estimate of abundance	% mortality using lower bycatch estimate	% mortality using higher bycatch estimate
			Lower 95% CI	Upper 95% CI	Lower 95% CI	Upper 95% CI			
7 of the Celtic Sea Ecoregion	2015/2016	17,465.59	0.035	0.079	620	1391	57,491	1.08	2.42

Table 9. Total and observed midwater trawl (OTM+PTM) effort in days at-sea (DaS) and reported number of observed number of common dolphins (Dd) and bycatch events. Total maximum DaS estimated from WGBYC database after taking the maximum number of DaS reported by ICES Division reported in 2015 and 2016. DaS reported from the following Member States: Germany, Denmark, Great Britain, Ireland, and France.

Region	ICES Divisions	Total Maximum DaS	Observed DaS (2015–2016)	Observer Coverage%	Observed No. Dd (2015–2016)
Celtic Sea	7a	730	11	1.51	0
	7b	1012	25	2.47	1
	7c	662	20	3.02	1
	7d	4772	60	1.26	0
	7e	997	69	6.92	0
	7g	607	8	1.32	0
	7h	142	18	12.68	0
	7j	949	46	4.85	3
	7k	665	29	4.36	0
	Total	**10536**	**286**	**2.71**	**5**
Bay of Biscay	8a	6320	78	1.23	21
	8b	1654	17	1.03	2
	8c	1666	33	1.98	0
	8d	1301	41	3.15	0
	8e	21	4	19.05	0
	Total	**10962**	**173**	**1.59**	**23**

Table 10. Estimates of lower and upper 95% bycatch mortality for common dolphin in the context of its abundance estimated in subareas 7 and 8 from SCANS-III survey data.

Area	Métier	Year	Fishing Effort (DaS)	Estimate of bycatch rate (number of bycatch events/observed DAS)		Estimate of bycatch common dolphin		Best estimate of abundance	% mortality using lower bycatch estimate	% mortality using higher bycatch estimate
				Lower 95% CI	Upper 95% CI	Lower 95% CI	Upper 95% CI			
Celtic Sea Ecoregion 7 (a–c, g–h, j–k)	Midwater trawl (OTM, PTM)	2015/2016	4767	0.010	0.075	49	355	221 933	0.02	0.16
	Nets (GNS, GND, GTR)		17 485	0.006	0.031	104	549		0.05	0.25
Bay of Biscay 8 (a–e)	Midwater trawl (OTM,)	2015/2016	10 962	0.084	0.199	924	2187	111 990	0.83	1.95
Bay of Biscay and Iberian sea 8 (a–e)	Nets (GNS, GND, GTR)	2015/2016	61 124	0.011	0.035	683	2168		0.61	1.94
Total	**Midwater trawls and Nets**	**2015/2016**	**94 338**			**1760**	**5259**	**333 923**	**0.53**	**1.57**

Table 11. Common dolphin and harbour porpoise bycatch estimations inferred from strandings in the Bay of Biscay and the Channel (estimations were rounded to the closest dozen). Abundance in the area estimated from SCANS-III (Hammond *et al.*, 2017). The area of interest primarily falls within the Celtic Seas Ecoregion and the Bay of Biscay and Iberian Coasts Ecoregion.

Year	Common dolphin bycatch estimations inferred from strandings (95% CI)	Harbour porpoise bycatch estimations inferred from strandings (95% CI)	Abundance estimate SCANS-III blocks B,C,D	
			Common dolphin	Harbour porpoise
2012	1950 (1210–3760)	1120 (690–2150)	-	-
2013	4890 (3040–9410)	1830 (1140–3520)	-	-
2014	3750 (2330–7220)	1490 (930–2870)	-	-
2015	1470 (910–2830)	800 (500–1540)	-	-
2016	-	-	200 212 (0.16)	26 431 (0.24)

Table 12. Mortality rates related to bycatch of common dolphins and harbour porpoises in the shelf waters of the Bay of Biscay and the Channel based on assessments of stranded cetaceans. Values in red are those which exceed the ASCOBANS environmental limit on anthropogenic removals of 1.7% of the best available population estimate.

Year	Common dolphin mortality rates related to bycatch (%)	Probability >1.7% threshold	Harbour porpoise mortality rates related to bycatch	Probability >1.7% threshold
2012	1.074	0.063	4.809	0.998
2013	2.694	0.903	7.862	1
2014	2.068	0.659	6.42	1
2015	0.81	0.012	3.439	0.964

Table 13. Difference in relative summed bycatch risk factor and relative DCF sampling effort for each métier in the Baltic Sea. Positive numbers (in green), indicate relative under sampling; negative numbers (in red) indicate relative over sampling.

GEAR TYPE	CODE	SUMMED RISK FACTOR	% RISK	% SAMPLING	DIFFERENCE (OVER/UNDER SAMPLING)
Dredges	DRB	8	1.3	0	1.3
Stationary uncovered poundnets	FPN	33	5.2	0	5.2
Pots and traps	FPO	52	8.2	2.1	6.1
Fykenets	FYK	72	11.4	0	11.4
Driftnet	GND	0	0	0	0
Set gillnet (including semi-driftnet)	GNS	110	17.4	9.9	7.5
Trammelnet	GTR	80	12.6	2.5	10.2
Hand and Pole lines	LHM	16	2.5	0	2.5
Drifting longlines	LLD	0	0	1.3	-1.3
Set longlines	LLS	48	7.6	0.1	7.5
Trolling lines	LTL	0	0	0	0
Bottom otter trawl	OTB	48	7.6	4.2	3.4
Midwater otter trawl	OTM	48	7.6	79.8	-72.2
Multirig otter trawl	OTT	20	3.2	0	3.2
Purse-seine	PS	16	2.5	0	2.5
Bottom pair trawl	PTB	36	5.7	0.1	5.6
Midwater pair trawl	PTM	36	5.7	0	5.7
Beach and boat seine	SBV	10	1.6	0	1.6
Anchored seine	SDN	0	0	0	0
Fly shooting seine	SSC	0	0	0	0
Beam trawl	TBB	0	0	0	0

6 Continue to develop, improve and coordinate with other ICES WGs on methods for bycatch monitoring, research and assessment within the context of European legislation (e.g. MSFD) and regional conventions (e.g. OSPAR) (intersessional) (ToR D)

6.1 Coordination with WGCATCH through WKPETSAMP

6.1.1 Review of data fields for the ICES Regional Database and Estimation System (RDBES)

Reg. 812/2004 is due to be repealed, and the collection of bycatch data through this regulation will most likely discontinue in the form it has been carried out recent years. As a consequence, ICES is preparing for a period when data will be provided through the ICES Regional Database (RDB) as a result of Commission Implementing Decision (EU) 2016/1251. There is a need for the RDB structure to be adjusted so that protected species bycatch information can be included. This adjustment is to be carried out by the Steering Committee (SC) of the new RDB which will be called RDBES (Regional Database and Estimation System). The latest version of the RDBES data model and associated documentation were presented during WKPETSAMP, a joint WGCATCH and WGBYC workshop (ToR G). The presentation focused on the sampling hierarchies that most directly relate to "on-board sampling" and, in particular, on the fields most directly related to the recording of incidental bycatches. WKPETSAMP forwarded the following recommendation to WGBYC:

"WKPETSAMP recommends WGBYC to review the suggested data fields by WKPETSAMP for the RDBES and further recommend to the SCRDBE to implement these."

The data fields related to the fishing operation indicating what data have been collected by the on-board observers were reviewed by WKPETSAMP and then by WGBYC. The group reviewed the data fields suggested by WKPETSAMP for the RDBES. The data fields are as follows:

1) Approximate % hauling operation actually observed (with regards to incidental bycatch);
2) Approximate % sorting operation actually observed (with regards to incidental bycatch);
3) Checkbox for slipped incidental bycatch;
4) Checkbox to indicate whether mega fauna could have been observed.

WGBYC discussed these four fields and concluded for each:

1) WGBYC agrees that this data field should be in the RDBES.
3) WGBYC agrees that a record for megafauna falling out of the net should be in the RDBES. This field is necessary for gillnets, to check if megafauna fall out before the net enters the boat during hauling. Gillnets are extremely important with regard to the incidental bycatch of megafauna and experience in several studies (e. g. Kindt-Larsen *et al*., 2012) has shown that a considerable portion of bycaught porpoises (up to 50%) fall out of the net and do not come on board for (further) sampling. The group suggests that this data field should be able to hold percentages, because similarly to the situation for the % hauling and % sorting data fields, the observer may not be able to observe the complete hauling operation by looking over the side to where the net comes out of the water. The data field should be renamed "Approximate %

checking for megafauna falling out (including bycatch)". The word "slipped" may lead to confusion as it normally refers to catch that is deliberately let out of the net (e.g. in purse-seine fishery).

4) The group agrees that a box to indicate if an observer was in the position to observe the bycatch of megafauna. For example: in trawl fisheries, it is important that the observer can observe the opening of the codend. This checkbox can also refer to situation where the incidental bycatch of megafauna is hidden from the observer for whatever reason. In line with the labelling of the other data fields, we suggest to indicate that the data field is meant specifically for incidental bycatch.

Thus, the preferred data fields for the RDBES are:

1) Approximate % hauling operation actually observed (with regards to incidental bycatch);

2) Approximate % sorting operation actually observed (with regards to incidental bycatch);

3) Approximate % checking for megafauna falling out (with regards to incidental bycatch);

4) Indicator if megafauna could have been observed (with regards to incidental bycatch).

6.1.2 Inventory/Metadatabase for monitoring surveys of protected species bycatch

The ICES WKPETSAMP compiled an inventory of the various sampling programmes that provide information on bycatch of PETS at the national level. These programmes include regular DCF at-sea sampling programmes as well as other national sea sampling programmes and studies that target PET bycatch directly (various directed studies, small and large-scale). The inventory constitutes a possibility to compile an overview of all programmes and studies collecting information on bycatch. Such an overview gives end-users of data, such as ICES WGBYC, the potential to assess what data are expected to be present and also to identify areas in need of (additional) monitoring. WKPETSAMP recommended the WGBYC to review the list of programmes and that WGBYC should have the responsibility to gather and maintain an inventory of various sampling programs that provide data on protected species bycatch conducted by ICES countries.

WGBYC considered the list to be a useful metadatabase and reviewed the proposed columns. WGBYC suggested adding in a "source" column giving information on where the data could be found. The WGBYC participants also added sampling programmes / studies not mentioned in the current inventory list. WGBYC also discussed whether the inventory list could be part of the ICES Metadata catalogue. The WGBYC database subgroup will work on preparing for this intersessionally.

WGBYC accepted part of the responsibility to maintain the inventory list. However, updating and maintaining the inventory should be done in collaboration with WGCATCH due to that group's competency on DCF sampling programmes, which are included in the inventory. The task to maintain the inventory list will preferably be the responsibility of the person participating in both WGBYC and WGCATCH (Bram Couperus).

6.2 ICES Working Group on Marine Mammal Ecology

At their 2018 meeting, WGMME had the following ToR directed towards WGBYC: 'Review additional aspects of marine mammal fishery interactions not covered by WGBYC. Details of this ToR to be agreed with WGBYC.' E-mail correspondence regarding the ToR ensued between the chairs of both working groups suggested that topics not directly related to bycatch, such as depredation on catches or competition with fisheries, should fall within the WGMME remit. WGMME have a 2019 ToR reviewing current issues regarding the effects of seals on fisheries and these issues are not being handled by WGBYC neither is the competition between marine mammals and fisheries.

A suggestion that WGMME could explore information on strandings was raised within the group. WGBYC has, in recent years, reported on strandings in relation to bycatch (USA, Portugal and France). WGBYC concluded that the work on strandings estimating bycatch numbers was important and should stay within WGBYC. It is important to compare the bycatch estimates derived from strandings to estimates based on onboard observer data. However, the group will not report on Member States' stranding schemes, which do not include estimates of bycatch rates nor total mortality due to bycatch.

In future, WGBYC will aim to circulate their agenda for their 2019 meeting to WGMME chairs in advance of the WGMME meeting, should meeting timings allow. This will assist WGMME to scope the work of the group with regard to fisheries related ToRs.

6.3 Recommendation from JWGBIRD

The 2017 report of the Joint ICES/OSPAR/HELCOM Working Group on Seabirds (JWGBIRD) recommended the following for WGBYC: JWGBIRD recommends that WGBYC coordinate with JWGBIRD on matters related to seabird bycatch in fishing gear, risk assessment (as it relates to OSPAR indicator B.1). The WGBYC chairs tried to progress this recommendation intersessionally and ahead of the 2018 meeting. The chairs invited a discussion in relation to WGBYC ToR C (2017) that aims to assess population level impacts of bycatch; this seemed the most appropriate ToR in which to address this recommendation. However, JWGBIRD chairs felt that the available data on seabird bycatch were still not available to the WGBYC, and could not currently be used to calculate existing bycatch indicators (HELCOM). However, there will be a need to develop an OSPAR indicator on seabird bycatch and as work progresses on this, collaboration with WGBYC will be sought.

7 Continue to develop collaborative research proposals among WGBYC members to pursue research projects and funding opportunities in support of researching protected and target species behaviour in relation to fishing gear (ToR E)

The annual WGBYC meeting continues to be an important opportunity for participants to discuss and consider existing collaborative research and potential future work. At this year's meeting, WGBYC considered ways of working with NAMMCO with a view to obtaining more complete bycatch estimates for North Atlantic marine mammal species, such as the harbour porpoise. French and Portuguese participants also presented ongoing research projects and identified potential for future collaborations.

Finally, the WG, had a round table of forthcoming funding opportunities. Participants agreed that it would be useful to develop and maintain a 'database' of funding calls and make this available on the WGBYC website. The chairs agreed to progress this intersessionally.

7.1 Collaboration with the North Atlantic Marine Mammal Commission (NAMMCO)

Geneviève Desportes, General Secretary of NAMMCO, presented via Skype some of the major outcomes of a report by the NAMMCO Scientific Committee Working Group on Bycatch (BYCWG) (May 2–4 2017, Copenhagen, Denmark). The report had been made available as background information to ICES WGBYC. The aim of the NAMMCO BYCWG meeting was to provide advice on whether bycatch estimates were reliable and complete enough to be used in sustainability assessments. However, BYCWG do not carry out such assessments.

Potential collaboration between NAMMCO and ICES WGBYC was discussed. It was suggested that WGBYC and NAMMCO together could evaluate the sustainability of bycatches already reviewed by NAMMCO. As NAMMCO does not have a data call similar to WGBYC, such an evaluation would require that the NAMMCO members provide the necessary national data. After the end of the Skype meeting, the issue of data availability was discussed further. It was unclear to WGBYC which data, additional to the data already available in the WGBYC database, the NAMMCO members could provide for an evaluation. Members of NAMMCO are also participants of WGBYC and data, from for example Iceland, are collected through the ICES data call. However, it was recognized that such collaboration may encourage bycatch data submissions from Norway.

The General Secretary also informed the group about a workshop on harbour porpoises in the North Atlantic to be held in late 2018. The goal of the workshop is to identify the conservation status of North Atlantic harbour porpoise population(s) and outline the knowledge gaps. The workshop will review stock identity, biological parameters and direct and indirect stressors. Attendance at the workshop is through invitation; Chair Sara Königson will most likely attend the workshop on behalf of WGBYC. WGBYC are open to working with NAMMCO with regards to understanding bycatch of protected species and this workshop may facilitate identification of bycatch related questions that could be addressed jointly.

7.2 A collaborative approach to identify fisheries and common dolphin interactions; an example from France using strandings data

France gave a presentation on the work they are undertaking to assess bycatch using data from their strandings network. The work is a collaborative project between the newly created Working Group on Cetacean Bycatch initiated by the French Ministry in

charge of the environment which brings together industry, researchers and policy-makers. The research tentatively identified the fisheries involved with common dolphin interactions by inferring bycatch mortality from strandings by modelling carcass drift, with the distributions of fishing effort by gear types and vessel nationality. The presentation served to demonstrate a potential application of the 'strandings drift-model' for countries which do not have a protected species monitoring programme from which bycatch rates can be determined. However, currently the approach must be considered as a feasibility study.

The study focused on two unusual stranding events recorded in the first week of February 2017 and the first ten days of March 2017. During these events, 793 small cetaceans were recovered stranded along the French Atlantic coasts, and 573 in the counties of Loire Atlantique, Vendée and Charente Maritime, including 483 common dolphins. On the 297 fresh or slightly putrefied common dolphins examined, 95% of them presented evidence of death in fishing gears. Correcting for different factors occurring during stranding process (Peltier *et al*., 2016), this could represent ca. 3500 common dolphins bycaught between January and March in the Bay of Biscay.

The likely mortality areas at sea of stranded common dolphins diagnosed as bycaught were identified by using the reverse drift modelling methodology (Peltier *et al*., 2016). Fishing effort data were generated on the basis of vessel speeds derived from VMS positional data and provided by Ifremer (Leblond *et al*., 2008). Fishing effort during mortality events and carcass drift locations were aggregated in the same 0.4° x 0.4° grid. Generalised Additive Models (GAMs) were used to explore the spatial correlation between the distribution of fishing effort for ten different fisheries and the distribution of common dolphin bycatch mortality. The distributions of fishing effort by French midwater pairtrawlers, Spanish bottom otter trawlers and French-Danish seiners were significantly and positively correlated to the distribution of bycatch mortality corresponding to the two unusual stranding events. Overall, the analysis provided plausible results, highlighting three gear types that would deserve further investigation as to their interactions with common dolphins (possible high vertical opening trawls and fisheries targeting top predator fish in winter).

7.3 Alternative approaches to monitoring cetacean interactions along the Portuguese coast

Ana Marcelo (Portugal) gave a short presentation to provide an overview of work in Portugal to monitor interactions of marine protected species (with emphasis on cetaceans) and Portuguese fisheries. The challenges to monitor a very large fleet of multi-gear/polyvalent vessels with a dynamic nature leads to reduced observer effort and gaps in obtaining reliable information on fishing effort for specific métiers such as the set-nets. Furthermore, over 90% of the fleet is composed of very small vessels (<12 m) some of them <10 m long, that do not have space to take observers on board.

Projects dedicated to monitoring interactions emerged fairly recently (e.g. SafeSea-EEAGrants 2008–2010; Life+MarPro 2011–2016), identifying "hot spots" and levels of interactions between cetaceans and fisheries along the coast (Marçalo *et al*., 2015; 2018; Goetz *et al*., 2015; ICES, 2016; Wise *et al*., in press). Results from a two-year on-board observation study revealed that the common dolphin was the species interacting the most with the purse-seine fishery. Extrapolations to the fleet resulted in encirclement and mortality of 264 (95% CI 75–490) and 113 (95% CI 0–264) common dolphins respectively. On the other hand, higher levels of interaction are reported for the set-net fishery and bottlenose dolphins, especially in the Algarve and Portuguese south coast.

Mitigation approaches to reduce interactions (including potential depredation) and bycatch of cetaceans in both purse-seine and set-net fisheries on the Algarve and Portuguese south coast tested in 2014 and 2015 include the use of acoustic alarms (FUMUNDA pingers). Results showed that bycatch rates did not decrease significantly (Carvalho, 2018).

New work under the scope of iNOVPESCA is more localized and concentrated in the Algarve and Portuguese south coast region. Different types of acoustic deterrent devices are to be acquired and tested in purse-seines and set-net fisheries along the coast, while an expert company in acoustics (MarSensing, LDA) was contracted to collaborate in the project with the task to provide input on acoustic patterns of vessels, fishing activity and sound performance of acoustic deterrent devices.

7.4 Funding opportunities for collaborative research on bycatch of protected species

Funding opportunities were discussed only briefly at the meeting although funding is one of the key factors needed in collaborative research projects. Many members in the group have experience and knowledge of funding opportunities relating to bycatch and fisheries. The group concluded that an inventory list of possible funding opportunities for collaborative research would be set up in advance of the next WGBYC meeting. Having an inventory of available funding opportunities will facilitate discussions on collaborative research proposals and increase the possibility to seek funding for joint projects.

Two funding opportunities available in the USA are described: The USA solicits an annual request for proposals (RFP) through the National Oceanic Atmospheric Administration (NOAA) Bycatch Reduction Engineering Program (BREP). Within this annual RFP, there are four high priority areas for research, one of which is 'addressing international bycatch issues'. This grant programme provides competitive grants to non-federal researchers working on the development of improved fishing practices and innovative gear technologies. Eligible applicants include US citizens; institutions of higher education; non-profits; commercial organizations; foreign public entities; organizations under the jurisdiction of foreign governments; international organizations; and state, local and Indian tribal governments. The 2017–2018 budget for research proposals was $2.4 million USD. The RFP is generally announced during December every year with pre-proposals due by the end of January and subsequent award announcements in March. For more specific details on how to submit a proposal, please visit:

https://www.fisheries.noaa.gov/grant/bycatch-reduction-engineering-program-funding-opportunity

The USA NOAA International Science Program (ISP) also solicits a RFP that fits into a broader scope of International science projects with the aim of supporting collaborative science across international boundaries to meet the overall mission of responsible stewardship of marine resources. The budget for this RFP is $35k USD per project. Unlike the BREP RFP described above, this ISP RFP is submitted through NOAAs Science Centres, so it requires collaboration and coordination with a US delegate employed by a NOAA Science Centre. Each Science Centre is restricted to submitting two proposals to NOAA Headquarters for funding. For further details on the scope of this RFP, please visit:

https://drive.google.com/file/d/1Ral81sPrUzOXaFavJ5cK9Cwgx8uuIgMZ/view?pli=1

For further inquiries you may also contact US delegate to WGBYC Marjorie Lyssikatos (see 11 Annex 1).

8 Continue, in cooperation with the ICES Data Centre, to develop, improve, populate through formal Data Call, and maintain the database on bycatch monitoring and relevant fishing effort in European waters (ToR F)

8.1 WGBYC/ICES Data call

The ICES Secretariat along with chairs of WGBYC and members of the WGBYC Database Subgroup (DbSg) worked on producing a data call in early 2018 (ICES, 2018; Annex 5). The call, published on February 27th 2018, aims to collect data describing fishing effort, monitoring/sampling effort and protected and endangered species bycatch records from 2016 (and preceding years (2009–2015) when historical data were available and had not been previously submitted to ICES). The data support the ICES annual advice on the impact of fishing on protected species to answer a standing request from the European Commission for advice on the impacts of fisheries on the marine environment.

Data were requested through the data call to 18 out of the 20 ICES countries (all ICES countries except USA and Canada). In addition, six Mediterranean non-ICES countries were included in the call (i.e. Croatia, Cyprus, Greece, Italy, Malta and Slovenia).

The majority of the contacted countries submitted data through the call (18 out of 24 countries), but the quality and quantity of the data provided varied widely among nations. Furthermore, about half of the countries submitted data after the deadline outlined in the data call. Two countries did not submit data through the data call but brought information to the WGBYC meeting (Latvia and France).

The current data format template includes fixed/mandatory vocabularies for several data fields (e.g. for Métier Levels), which facilitates data harmonization but can create submission difficulties in first instances, particularly for nations that submitted data for the first time and for which tailored vocabularies may be needed. In order to achieve better data quality in following data calls, it would be necessary to mark some additional data fields as mandatory such as “fishing days at-sea”, “observed days at-sea”, “number of incidents” and “number of specimens (with and without pingers)”. For example the data provided by Spain recorded effort as “trips” instead of as “days at-sea” and, as a result, Spanish data were not, initially, automatically processed due to the fact that days at-sea, not number of trips, are used by WGBYC to describe effort so was not included in the summary tables until the problem was identified. On the other hand, some current mandatory fields should be changed to optional fields, as is the case for “Métier Level 5” and "Métier Level 6". Current mandatory fields within the template were tied to match the reporting requirements of Reg. 812/2004, which has been the main source of information for WGBYC to date, and this will be modified in future developments. However, until Reg. 812/2004 is repealed WGBYC will request data according to the WGBYC template.

To facilitate data submission and processing, we recommend that each nation nominates a single organization to coordinate and provide bycatch data in future ICES data calls; for example, in the UK, three different countries (England/Wales, Northern Ireland, Scotland) compile DCF data, and additional dedicated bycatch data are also compiled separately, and as a result of time constraints and data availability UK DCF data were not submitted (though dedicated bycatch data were) in response to the call or in time for WGBYC.

In the current data call, it has not been specified what was meant by “protected and endangered species”. WGBYC discussed this during the meeting (see Section 3.7) with

a view to developing a list of species/taxa of interest for the WG that will be included in future calls.

Reg. 812/2004 is due to be repealed, and consequently ICES is now preparing for a period when data will be provided through the ICES regional database (RDB) as a result of Commission Implementing Decision (EU) 2016/1251. However, non-EU countries are not covered under the legislation, so modifications may be needed in order to accommodate data from such countries within the RDB.

8.2 Comparison of effort from different sources (RDB;VMS;Logbooks; WGBYC)

WGBYC has historically mainly used fishing effort data for static nets and midwater trawls provided through MS annual Reg. 812/2004 reports for contextualising reported bycatch rates and to form the basis of bycatch risk assessments. As previously mentioned WGBYC was informed in 2017 that Reg. 812/2004 will be repealed at some point in future, meaning annual reports will no longer be submitted to the EC, so this source of effort data will no longer be available. However, at present it is not clear when Reg. 812/2004 will be repealed. Consequently, WGBYC is preparing for the transition away from using MS annual reports as the primary source of effort data. It was agreed at the 2017 WGBYC meeting that as an exploratory exercise, it would be useful for members of the WGBYC Database Subgroup (DbSg) to compare the suitability of other sources of fishing effort data to ensure that WGBYC can continue to undertake analyses to meet its annual Terms of Reference that rely on using total fishing effort data. These include presenting relevant information in Working Group report table that contain estimates of fishing effort by métier, so bycatch rates calculated from at-sea monitoring programmes can be viewed in light of the scale of effort in different fisheries.

At present, there are three other possible sources of effort data available to WGBYC through the ICES Data Centre: logbooks, vessel monitoring systems (VMS) and the Regional Database (RDB). Prior to the 2018 WGBYC meeting, a request was made to the ICES Data Centre to obtain data from these three sources for midwater trawl (OTM, PTM) and static net gears (GND, GNS, GTR) from 2015 and 2016 for Atlantic and Baltic ICES subareas to facilitate comparisons with effort data originating in Reg. 812/2004 reports for the same years, gears and areas. However, due to some late data submissions of 2016 data to the WGBYC database, we have only used data from 2015 for this comparison.

The data contained within each dataset are inherently different because:

1) Different effort metrics are used in each dataset; and
2) Different “populations” of vessels are covered by each data collection methodology.

Despite these acknowledged and well-known differences, other less obvious reasons that may lead to discrepancies between the data quality of each dataset may also be present, and this comparison has been carried out to try to identify, or at least highlight such issues and indicate which of the available datasets is likely to provide the most robust source of fishing effort data for WGBYC to utilise into the future. Table 13 highlights the broad differences in terms of the unit of effort recorded and vessel population between each dataset.

Table 14. Basic differences between different datasets containing fishing effort data.

DATA SOURCE	EFFORT RECORDED AS	VESSEL POPULATION
WGBYC	Days at-sea	>15 m mandatory, <15 m often provided
VMS	Hours fished	>12 m only
Logbook	Days fished	>10 m all areas, >8 m in Baltic
RDB	Days at-sea	All vessels

After some initial analysis and discussion at the 2018 meeting the DbSg decided to omit the VMS data from further comparison mainly because in order to compare datasets appropriately the same (or at least a similar) effort metric should be used from each dataset. The VMS data are recorded in hours fished, meaning that a conversion factor needs to be applied to convert hours fished to days fished or days at-sea. This is not a simple process because the factor will be métier-specific, for example hours fished in a midwater trawl fishery will not have the same relationship with days fished or days at-sea as in a static net fishery. Vessel size will also likely influence the calculation because smaller vessels tend to operate closer to shore and thus may have less steaming time to factor into the calculations. The VMS data only apply to >12 m vessels too, so excludes a large part of most Member States fishing fleets.

Days fished and days at-sea are not necessarily equivalent either but the group felt that in most cases (with the probable exception of large midwater trawlers, and possibly some confounding issues with how a "day fished" is defined by static gear vessels i.e. does shooting nets classify as a day fished?) they were likely to be sufficiently similar to permit comparison, though we acknowledge that some inherent difference will exist.

The RDB data use rules specify that mapping data must be aggregated sufficiently so that information potentially relating to individual vessels or trips cannot be identified. Although we are not mapping any data in this analysis, we have restricted the comparison to ICES subareas 3–8 (excluding 5) for midwater trawls and subareas 3–9 (excluding 5 and 6) for static nets, where significant amounts of data exist within each dataset. We have also excluded small amounts of data that were available for other subareas for both gear types (1, 2, etc.).

Figure 5 and Figure 6 show the reported fishing effort data for 2015 from each of the three datasets by subarea for midwater trawls and static nets respectively.

For the areas and gear types chosen there is on the whole reasonable consistency between datasets, but for the majority of areas the RDB is populated with the most effort data (in terms of the reported number of days at-sea). The RDB dataset in theory contains data for all vessel sizes in national fishing fleets, some of which originates from logbook submissions and/or VMS for relevant vessel sizes. For smaller vessels estimates of effort are derived by individual MS in a variety of ways, such as monthly journals, sales records or extrapolated sampling data (N. Prista, personal communication).

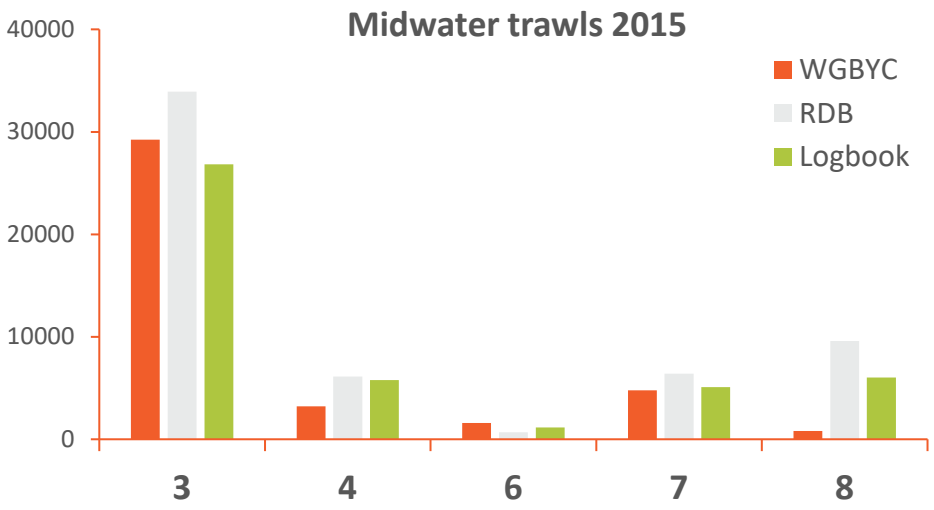

Figure 5. Midwater trawl fishing effort by subarea from the three datasets.

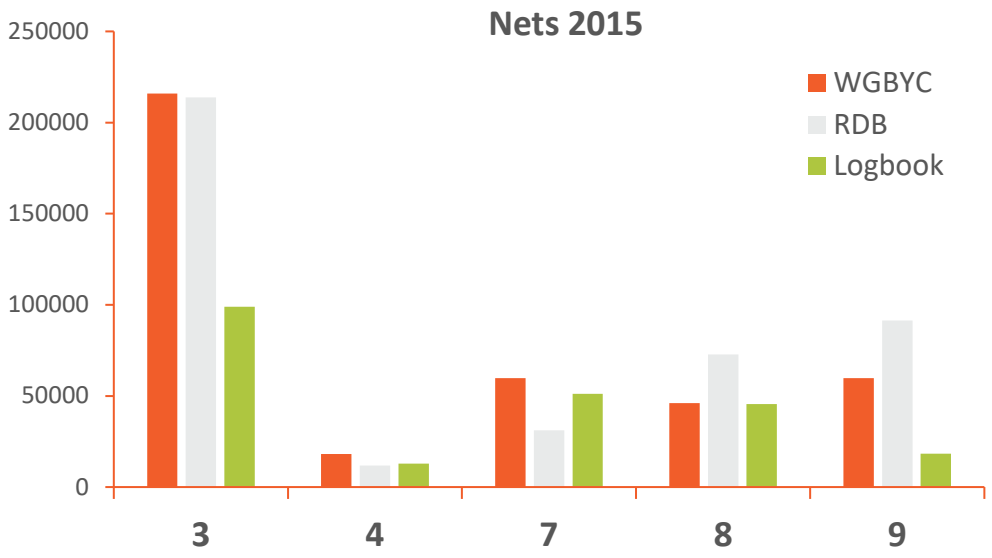

Figure 6. Static net fishing effort data by subarea from the three datasets.

Based on the broad comparison of reported fishing effort by métier and subarea, initial indications are that the RDB will provide the most robust dataset for WGBYC to use going forward, but there are cautionary aspects that require further exploration. For example, for static net fisheries in Subarea 7, the RDB contains the lowest reported 2015 effort levels of the three datasets. This area/gear combination is known to have relatively high effort and documented protected species bycatch of several species. Consequently, there is potential for significant underestimation of bycatch levels if the RDB dataset was used in future analyses. It is unlikely that the WGBYC and logbook data for this area/gear combination are overestimated, so it raises the questions of how the RDB data were calculated in this instance, and how best to utilise the data in these sort of situations. It would also be useful to understand how the small vessel effort is calculated by each MS, so that a judgement can be made about the relative quality of effort estimates emanating from each country.

Regardless of how effort data are measured, effort datasets should reflect the true amount of annual fishing effort by the relevant vessel population. However, the variability between the three datasets suggests that there is no single "always best" data source that accurately and consistently reflects total fishing effort. Further work is needed to better understand why such discrepancies exist and how they might influence analytical results, so that analyses that utilise fishing effort data, and form the basis of management advice, can be framed appropriately.

9 Convene a joint workshop with WGCATCH in 2018 (subject to joint approval of workshop ToRs). The aim of the workshop is to design the collection of data on incidental bycatch of protected and other species at risk (i.e. rare bycatch events) in the sampling protocols of national catch, bycatch and discards sampling schemes pursuant to EU 2016/1251 Chapter III, Sec 3. (ToR G)

The proceedings of the Joint WGBYC/WGCATCH Workshop on the Sampling of Protected species (WKPETSAMP) 24–26 April 2018 were presented by Bram Couperus.

This WK was initiated by the two groups, after the implementation of monitoring protected species in the new DCF. An inventory of existing sampling programmes that currently provide data on PETS bycatch at national level, including both DCF at-sea catch sampling programmes and studies that target primarily PET bycatch has been developed. Target population, the sampling units, sampling frames, stratification schemes and sample selection methods for the different levels of the sampling hierarchy was identified.

It was found that an advantage of directed/dedicated studies was that these are targeted towards fisheries and areas relevant to bycatches of birds and mammals.

A limitation was that in most countries directed studies are limited in time and space. Within Europe, the UK is the exception in running a long-term programme targeted towards the monitoring of protected species bycatch.

Advantages of at-sea catch sampling programmes under the DCF are that they are already running and have a large coverage in time and space and are financed through the European Maritime and Fisheries Fund (EMFF) in EU countries. DCF sampling is mainly aimed at fisheries with large volumes of catch and/or fisheries where discards are of relative importance. This often coincides with fisheries of relevance for bycatches of protected fish species and elasmobranchs.

However, a limitation of DCF at sea sampling programmes is that in most countries these are not targeted towards small-scale fisheries or fisheries with passive gears, which are known to be of importance for bycatches of birds and mammals. Observers might not be trained adequately for bycatch monitoring (e.g. they might not check for drop-outs and have difficulties with species identification). An additional limitation is that observers have to carry out multiple tasks on board and may not always be able to fully observe incidental bycatch, because they are not in the right position at the right time, and may not take account of to what extent the haul was adequately sampled with respect to protected species bycatch.

A limitation of both, directed/dedicated studies and fisheries catch sampling at-sea sampling programmes, was that both struggle to implement true random sampling that is considered optimal for thorough analyses because not all fishermen are cooperating or vessels are too small to take observers on board.

WKPETSAMP was also asked to attempt to identify the precision and accuracy needed by end-users. It appeared that WP3 from the FishPi project [http://www.masts.ac.uk/research/fishpi-project/] set up an overview of these. The group reviewed this work and concluded that the needs are not clearly defined by the end-users. Nevertheless, it was found that there is an overall need among end-users to access the level of bycatch mortality for protected species with a reasonable associated precision level.

Another part of WKPETSAMP's task was to develop criteria to evaluate if at-sea sampling programmes meet end-user needs. For this, it was proposed to carry out risk assessments following the method of WKBYC (ICES, 2013) which was further developed in the fishPi project. These risk assessments were carried out within the fishPi project for most areas in the NE Atlantic, but not for the Baltic, the Mediterranean and the Black Sea. WKPETSAMP has recommended that WGBYC fill this gap (see Section 5.3).

ToR C of WKPETSAMP was to define proper mechanism(s) for storage, maintenance and dissemination of monitoring data. The outcome can be summarized as follows: (1) build routine in sampling (parts of) the entire haul and treat any rare item in the catch as an incidental bycatch, (2) proper instructions, training, including protocols for identification of rare catch items, (3) clear indication of species selection in order to be able to distinct real zero's from not having been sampled, (4) adequate design of the database(s) where the information is stored (see 6.1.1). It appeared that, due to time constraints, this ToR has only been addressed briefly. The last task was to provide evidence of the preparation of guidelines for at-sea sampling programmes, listing best practices and relevant parameters for PETS sampling for specific fisheries. It appeared that, due to time constraints, this ToR has only been addressed briefly. However best practice for at-sea sampling schemes were discussed and that these should encompass survey design, documentation of objectives, design and sampling protocols, staff training, data collection and archiving, systems for monitoring sampling performance and data analysis. The different steps identified by ICES, WKPICS2 (2012) that need to be included when designing and implementing a regional data collection scheme to meet end-user needs were suggested to be relevant to any kind of catch or bycatch sampling programme.

As the meeting was held the week before WGBYC met, the report of WKPETSAMP was not yet ready. The following draft recommendations to WGBYC were presented at the meeting:

- WKPETSAMP recommends WGBYC to review the suggested data fields by WKPETSAMP for the RDBES and further recommend to the RDBES steering committee to implement these.
- WGPETSAMP recommends WGBYC to review the WKBYC-fishPi method and create tables for the areas which has not been done in the fishPi project (the Baltic, the Mediterranean and Black sea).
- WKPETSAMP recommends WGBYC to gather and maintain an inventory of various PET sampling programmes conducted by ICES nations. This includes regular DCF at-sea programmes, other national sea-sampling programmes, and studies that target PET bycatch directly (various directed studies, small and large-scale).

WGBYC reviewed the data field suggested by WKPETSAMP (see 6.1.1).

WGBYC utilized the fishPi method to carry out a risk assessment for the Baltic Sea (see Section 5.3).

The group adopted the proposal of WKPETSAMP to let WGBYC maintain the inventory of the sampling programmes. Initially the inventory will be kept in a spreadsheet. The responsible member will be the contact person of WGCATCH in WGBYC, Bram Couperus. WGBYC members will intersessionally add sampling programmes and dedicated bycatch studies to the inventory. WGCATCH will be asked to do the same. ICES will be addressed to assess other possibilities of maintaining it. The inventory

may for example be integrated into the existing database of Working Group on the History of Fish and Fisheries (WGHIST).

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Annex 1: List of participants

NAME	INSTITUTE	COUNTRY	E-MAIL
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Annex 2: Terms of Reference for 2018 meeting

2017/2/ACOM25 The Working Group on Bycatch of Protected Species (WGBYC), chaired by Sara Königson*, Sweden and Kelly Macleod*, UK will meet in Reykjavik Iceland, during 1–4 May in 2018 to:

a) Review and summarize annual national reports submitted to the European Commission under Regulation 812/2004 and other published documents to collate bycatch rates and estimates in EU waters;

b) Collate and review information from National Regulation 812/2004 reports and elsewhere relating to the implementation of bycatch mitigation measures and ongoing bycatch mitigation trials, compile recent results and coordinate further work on protected species bycatch mitigation;

c) Evaluate the range of (minimum/maximum) impacts of bycatch on protected species where possible by assessment unit, furthering the bycatch risk approach to assess likely conservation level threats and prioritize areas where additional monitoring is needed;

d) Continue to develop, improve and coordinate with other ICES WGs on methods for bycatch monitoring, research and assessment within the context of European legislation (e.g. MSFD) and regional conventions (e.g. OSPAR) (intersessional);

e) Continue to develop collaborative research proposals among WGBYC members to pursue research projects and funding opportunities in support of researching protected and target species behaviour in relation to fishing gear;

f) Continue, in cooperation with the ICES Data Centre, to develop, improve, populate through formal Data Call, and maintain the database on bycatch monitoring and relevant fishing effort in European waters. (Intersessional);

g) Convene a joint workshop with WGCATCH in 2018 (subject to joint approval of workshop ToRs). The aim of the workshop is to design the collection of data on incidental bycatch of protected and other species at risk (i.e. rare bycatch events) in the sampling protocols of national catch, bycatch and discards sampling schemes pursuant to EU 2016/1251 Chapter III, Section 3.

WGBYC will report no later than 1 June 2018 to the attention of the Advisory Committee.

Annex 3: Agenda

TUESDAY 1ST MAY		
Time	Type	Item
9:00	Plenary	Laptop/network setup
9:30		Welcome and routine business/house rules
10:00		Introductions Changes & agreement of agenda
10:15	Presentation	Overview of the Marine Institute (10–15 minutes)
10:30	Plenary	ToR A) Summary of reports (bycatch estimates): status review
		ToR A) Agree remaining tasks
		ToR B) Summary of reports (mitigation): status review
		ToR B) Agree remaining tasks
11:00	Presentation	ToR G) Report of the PETSAMP workshop
	Plenary	Review & response of drafted PETSAMP guidelines/recommended tasks for WGBYC
12:00	Plenary	ToR F) Report from the database subgroup
		Task: Comparison of effort from different sources (RBD;STECF;RBD;REG812)
12:30	Lunch	
13:30	Plenary	TOR C) Evaluation of population level impacts Porpoise Norway and Iceland
	Presentation	Report of the NAMMCO scientific committee working group on bycatch Discussion: Q&A; Future work and collaboration
14:00	Presentation	Bycatch research, Iceland Discussion: Q&A; Future work and collaboration
14.30	Plenary	Common dolphin Celtic & Biscay – UK work. (provided by Simon Northridge)
	Presentation (14:45)	Bycatch mortality and safe limits of common dolphin in the Bay of Biscay Discussion Q& A
		Potential cetacean tasks (to agree) Porpoise Celtic & Biscay
15:30	Presentation	Fish: Elasmobranchs: ASC September 2018 Ambition for 2019 Deep-water sharks (short presentation)
		ToR C) Hurdles to evaluating population impacts: Missing monitoring data
		ToR C) Impact of using historical data? (dependent on data call contribution, etc. Discuss to decide)
16:30	Plenary	ToR D) Continue to develop, improve and coordinate with other ICES WGs on methods for bycatch monitoring, research and assessment
17:30		*END*

Wednesday 2nd May		
9:00		Plan for the day
	Work session	ToRs A–D; F–G
10:45	Coffee	
	Work session	ToRs A–D; F–G
12:00	Presentation	ToR B) Bycatch mitigation tools Trials for reducing seabird and porpoise bycatch in Denmark Discussion Q& A session
12:30	Lunch	
13:30		ToR A and B) Status review
14:00	Work session	ToRs A–D; F–G
17:00	Plenary	ToR C) Review of progress
17:30	close	
Thursday 3rd May		
09:00	Plenary	Tasks
	Work session	All ToRs ToR A and B: draft conclusions
10:45		
11:00	Presentations	ToR E: Examples of research collaborations within WGBYC Common dolphin bycatch in the Bay of Biscay Bycatch assessment in Portugal Discussions Q&A
12:00	Plenary	ToR E Proposal pipeline/WGBYC input
12:30	Lunch	
13:30	Work session	Finishing up – all ToRs
15:00		Subgroups present key results and draft conclusions, 2 slides
16:00	Close – excursion	
Friday 4th May		
09:00	Work session	Finishing up – all ToRs
10:30		
11:00	Plenary	Writing and reviewing texts Draft recommendations
12:30		
13:30	Plenary	Writing and reviewing texts Finalise Recommendations
15:00		2019 ToRs
15:45		Wrap up Next meeting – timing; venues
16:00		CLOSE

Annex 4: The fishPi approach applied to the Baltic Sea to prioritise métiers for monitoring (ToR C)

In the fishPi project (fishPi 2014), a method was developed to identify areas/gear types where additional monitoring is needed (http://www.masts.ac.uk/research/fishpi-project/). As described in 5.3 the method was applied for the Baltic Sea. This Annex provides the additional tables needed to complete Table 13 in section 5.3.

Table 1. General assessment of the risk for a species group to get bycaught in a specific gear type (métier level 4, done by expert judgement).

Gear type	Code	Lampreys	Sturgeon	Round fish	Birds-Fish feeders diving	Birds-Bottom feeders	Birds-Surface feeders	Seals	Harbour porpoise
Dredges	DRB	1	1	1	1	1	1	1	1
Stationary uncovered poundnets	FPN	1	3	1	1	1	1	2	1
Pots and traps	FPO	2	3	1	2	1	1	2	1
Fykenets	FYK	3	3	2	3	2	1	3	1
Driftnet	GND	1	3	3	3	3	3	3	3
Set gillnet (including semi-driftnet)	GNS	1	3	3	3	3	3	3	3
Trammelnet	GTR	1	3	3	3	3	1	3	3
Hand and Pole lines	LHM	1	1	1	1	1	1	1	1
Drifting longlines	LLD	1	1	1	2	1	3	2	1
Set longlines	LLS	1	1	1	2	1	3	2	1
Trolling lines	LTL	1	1	1	2	2	3	1	1
Bottom otter trawl	OTB	2	2	2	1	1	1	2	1
Midwater otter trawl	OTM	1	1	3	1	1	1	2	2
Multirig otter trawl	OTT	2	1	2	1	1	1	1	1
Purse-seine	PS	1	1	1	1	1	1	1	1
Bottom pair trawl	PTB	2	2	2	1	1	1	2	1
Midwater pair trawl	PTM	1	1	3	1	1	1	2	2
Beach and boat seine	SBV	2	1	2	1	1	1	1	1
Anchored seine	SDN	2	1	2	1	1	1	1	1
Fly shooting seine	SSC	2	1	2	1	1	1	1	1
Beam trawl	TBB	2	1	1	1	1	1	1	1

Table 2. Identification of presence or absence of a species group in the Baltic Sea.

ICES Area	Area	Lampreys	Sturgeon	Round fish	Birds-Fish feeders diving	Birds-Bottom feeders	Birds-Surface feeders	Seals	Harbour porpoise
27.3b–d	Baltic Sea	1	1	1	1	1	1	1	1

Table 3. Risk factors for species groups and métiers (derived by multiplication of values from Table 1 and 2).

Gear type	Code	Lampreys	Sturgeon	Round fish	Birds-Fish feeders diving	Birds-Bottom feeders	Birds-Surface feeders	Seals	Harbour popoise
Dredges	DRB	1	1	1	1	1	1	1	1
Stationary uncovered poundnets	FPN	1	3	1	1	1	1	2	1
Pots and traps	FPO	2	3	1	2	1	1	2	1
Fykenets	FYK	3	3	2	3	2	1	3	1
Driftnet	GND	1	3	3	3	3	3	3	3
Set gillnet (including semi-driftnet)	GNS	1	3	3	3	3	3	3	3
Trammelnet	GTR	1	3	3	3	3	1	3	3
Hand and Pole lines	LHM	1	1	1	1	1	1	1	1
Drifting longlines	LLD	1	1	1	2	1	3	2	1
Set longlines	LLS	1	1	1	2	1	3	2	1
Trolling lines	LTL	1	1	1	2	2	3	1	1
Bottom otter trawl	OTB	2	2	2	1	1	1	2	1
Midwater otter trawl	OTM	1	1	3	1	1	1	2	2
Multirig otter trawl	OTT	2	1	2	1	1	1	1	1
Purse-seine	PS	1	1	1	1	1	1	1	1
Bottom pair trawl	PTB	2	2	2	1	1	1	2	1
Midwater pair trawl	PTM	1	1	3	1	1	1	2	2
Beach and boat seine	SBV	2	1	2	1	1	1	1	1
Anchored seine	SDN	2	1	2	1	1	1	1	1
Fly shooting seine	SSC	2	1	2	1	1	1	1	1
Beam trawl	TBB	2	1	1	1	1	1	1	1

Table 4. Classification of fishing effort for each gear type using index values from the fishPi project. The effort data do not include effort data from Denmark which were not available during the meeting. The additional effort by Denmark would not change the index values used for further analysis.

GEAR TYPE	CODE	DAYS AT-SEA	INDEX (FISHPI)
Dredges	DRB	80	1
Stationary uncovered poundnets	FPN	4904	3
Pots and traps	FPO	13927	4
Fykenets	FYK	4140	4
Driftnet	GND	0	0
Set gillnet (including semi-driftnet)	GNS	153516	5
Trammelnet	GTR	10664	4
Hand and Pole lines	LHM	136	2
Drifting longlines	LLD	1	0
Set longlines	LLS	20930	4
Trolling lines	LTL	1	0
Bottom otter trawl	OTB	17228	4
Midwater otter trawl	OTM	18272	4
Multirig otter trawl	OTT	378	2
Purse-seine	PS	126	2
Bottom pair trawl	PTB	1789	3
Midwater pair trawl	PTM	2201	3
Beach and boat seine	SBV	16	1
Anchored seine	SDN		0
Fly shooting seine	SSC		0
Beam trawl	TBB		0

Table 5. Calculation of species and gear specific risk factors taking account of species occurrence and multitude of effort (derived by multiplication of values from Table 2 and 3) and difference in relative summed risk factor and relative DCF sampling effort for each métier in the Baltic Sea (last column). Positive numbers (in green), indicate relative undersampling; negative numbers (in red) indicate relative oversampling. (Risk category: index values of summed risk factor given as follows: 0: 0, 1: 1–25, 2: 26–50, 3: 51–75, 4: 76–150).

GEAR TYPE	CODE	LAMPREYS	STURGEON	ROUND FISH	BIRDS-FISH FEEDERS DIVING	BIRDS-BOTTOM FEEDERS	BIRDS-SURFACE FEEDERS	SEALS	HARBOUR POPOISE	SUMMED RISK FACTOR	RISK CATEGORY	% RISK	%SAMPLING	DIFFERENCE
Dredges	DRB	1	1	1	1	1	1	1	1	8	1	1.3	0.0	1.3
Stationary uncovered poundnets	FPN	3	9	3	3	3	3	6	3	33	2	5.2	0.0	5.2
Pots and traps	FPO	8	12	4	8	4	4	8	4	52	3	8.2	2.1	6.1
Fykenets	FYK	12	12	8	12	8	4	12	4	72	3	11.4	0.0	11.4
Driftnet	GND	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Set gillnet (including semi-driftnet)	GNS	5	15	15	15	15	15	15	15	110	4	17.4	9.9	7.5
Trammelnet	GTR	4	12	12	12	12	4	12	12	80	4	12.6	2.5	10.2
Hand and Pole lines	LHM	2	2	2	2	2	2	2	2	16	1	2.5	0.0	2.5
Drifting longlines	LLD	0	0	0	0	0	0	0	0	0	0	0.0	1.3	-1.3
Set longlines	LLS	4	4	4	8	4	12	8	4	48	2	7.6	0.1	7.5

GEAR TYPE	CODE	LAMPREYS	STURGEON	ROUND FISH	BIRDS-FISH FEEDERS DIVING	BIRDS-BOTTOM FEEDERS	BIRDS-SURFACE FEEDERS	SEALS	HARBOUR POPOISE	SUMMED RISK FACTOR	RISK CATEGORY	% RISK	%SAMPLING	DIFFERENCE
Trolling lines	LTL	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Bottom otter trawl	OTB	8	8	8	4	4	4	8	4	48	2	7.6	4.2	3.4
Midwater otter trawl	OTM	4	4	12	4	4	4	8	8	48	2	7.6	79.8	72.2
Multirig otter trawl	OTT	4	2	4	2	2	2	2	2	20	1	3.2	0.0	3.2
Purse-seine	PS	2	2	2	2	2	2	2	2	16	1	2.5	0.0	2.5
Bottom pair trawl	PTB	6	6	6	3	3	3	6	3	36	2	5.7	0.1	5.6
Midwater pair trawl	PTM	3	3	9	3	3	3	6	6	36	2	5.7	0.0	5.7
Beach and boat seine	SBV	2	1	2	1	1	1	1	1	10	1	1.6	0.0	1.6
Anchored seine	SDN	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Fly-shooting seine	SSC	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Beam trawl	TBB	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0

Annex 5: WGBYC terms of reference for the 2019 meeting

The Working Group on Bycatch of Protected Species, chaired by Kelly Macleod, UK and Sara Königson, Sweden, will meet in Olhão/Faro, Portugal 5–8th March 2019. The Terms of Reference proposed:

a) Review and summarize annual national reports submitted to the European Commission under Regulation 812/2004 and other published documents to collate bycatch rates and estimates in EU waters and wider North Atlantic;

b) Collate and review information from national Regulation 812/2004 reports and elsewhere in the North Atlantic relating to the implementation of bycatch mitigation measures and ongoing bycatch mitigation trials and compile recent results on protected species bycatch mitigation;

c) Evaluate the range of (minimum/maximum) impacts of bycatch on protected species populations where possible, furthering the bycatch risk approach to assess likely conservation level threats and prioritize areas where additional monitoring is needed;

d) Continue to develop, improve and coordinate with other ICES WGs on methods for bycatch monitoring, research and assessment within the context of European legislation (e.g. MSFD) and regional conventions (e.g. OSPAR) (intersessional);

e) Continue to coordinate and support among WGBYC members research proposals/projects and funding opportunities in support of researching protected species bycatch mitigation;

f) Continue, in cooperation with the ICES Data Centre, to develop, improve, populate through formal Data Call, and maintain the database on bycatch monitoring and relevant fishing effort in European waters. (Intersessional).

WGBYC will report by 8th April 2019 to the attention of the Advisory Committee.

Supporting Information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem affects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority.
Scientific justification	a–b) This is essential to use in answering part of the European Commission MoU request to "provide any new information regarding the impact of fisheries on marine mammals, seabirds..."; c) ICES Member Countries are required to reduce levels of bycatch under several pieces of legislation; the response to this ToR will help meet that aim; d) Bycatch monitoring and assessment is fundamental to the work of the group; in light of significant changes in legislation that will impact monitoring programs for PETS any improvements in coordination and methods will help the group and other workers in this field; e) Improving scientific understanding how target and non-target catches interact with commercial fishing gear is fundamental to developing effective mitigation measures to reduce bycatch on vulnerable species; f) An operating database allows for more efficient response to future advice requests and an audit trail for information used in the Group's reports; remaining intersessional ToR's all aim to increase effeciency of WGBYC's tasks in providing advice to various groups; g) The European Commission has decided not to amend Res. 812/2004 and to integrate monitoring of protected and endangered species into the new DCF (DC-MAP). It is essential to cooperate with the scientists who design observer schemes and protocols for the monitoring of catch and discards;
Resource requirements	None beyond usual Secretariat facilities
Participants	15–25
Secretariat facilities	Secretariat support with meeting organization and final editing of report
Financial	No financial implications.
Linkages to advisory committees	ACOM
Linkages to other committees or groups	JWGBIRD, WGFTFB, WGMME, WGSE, WGEF, WGCATCH, WGMIXFISH, WGSFD, WGNSSK, SCICOM
Linkages to other organizations	NAMMCO, ASCOBANS, ACCOBAMS, GFCM, EC, IWC

Annex 6: Recommendations

RECOMMENDATION	ADRESSED TO
1. Best practice on-board sampling procedures need to be finalised and presented to the RCGs and/or national contacts leading sampling programmes under the EU-MAP. The procedures should take into account existing work, e.g. Report of the Joint NAMMCO/ICES Workshop on observation schemes for bycatch of mammals and birds (WKOSBOMB).	WKPETSAMP
2. Fleet level sampling programmes need to be designed to ensure adequate sampling for assessments of protected species bycatch. The design needs to consider which areas, métiers, number of vessels to be sampled, amount of sampling days/hauls etc. Priority areas for monitoring should be informed by the Bycatch Risk Assessment work of WGBYC and the FishPi method used in PETSAMP.	WKPETSAMP; RCGs
3. WGBYC recommends that WGEF and WGSHARK create a list of priority species with regard to conservation risk from bycatch.	WGEF, WGSHARK
4. WGBYC recommends the RDB Steering Group include additional fields to accommodate the new format of protected species data collection. New data fields were recommended by PETSAMP and reviewed by WGBYC (Section 6.1.1).	SCRDBES
5. WGBYC recommend that WGCATCH work with us to maintain the metadatabase on bycatch monitoring initiated at the joint PETSAMP workshp. ICES DataCenter should consider where the database should be placed.	WGCATCH, ICES Data Centre

Annex 7: ICES WGBYC Data Call

Data call: Data submission for ICES advisory work of the Working Group on Bycatch of Protected Species (WGBYC)

1.Scope of the Data call

This data call aims to collect data describing fishing effort, monitoring/sampling effort and protected species bycatch records from **2016** to support the provision of ICES management advice on the wider impacts of fishing activity.

2. Rationale

ICES has a standing request from the European Commission to advise and inform on the impacts of fisheries on the marine environment, and ICES currently provides advice on the impact of fishing on seabirds and marine mammals. The requested data will be used by ICES advisory groups involved in the provision of such advice.

Currently, ICES summarizes information about the bycatch of marine mammals and other protected species as reported by EU Member States (MS) under Council Regulation (EC) No. 812/2004 (Reg. 812/2004) and other mechanisms. Thus far, the available data have been insufficient to enable robust assessments of the overall impact of EU fisheries on a variety of protected species (ICES 2017[***]). Reg. 812/2004 is due to be repealed, and consequently ICES is now preparing for the transition away from using MS Reg. 812/2004 reports as the primary source of data on the bycatch of cetaceans (and other protected and endangered species). In future, data will be provided through the ICES regional database (RDB) as a result of Commission Implementing Decision (EU) 2016/1251[†††] (EU MAP). This data call aims to improve consistency in the reporting of bycatch data at a regional scale. ICES acquisition of fisheries sampling and protected species bycatch data will aid the transition from Reg. 812/2004 to EU MAP and improve the ability of ICES to advise on the impact of fisheries on non-target species.

The data will be used to provide summaries of bycatch rates by species / gear type and area, and will also inform the development of risk assessments designed to provide insights into the potential impacts of fisheries on protected and endangered species.

The data will also be used to undertake a comparative assessment of fishing effort data consistency when acquired from different sources, so that any inconsistencies are understood as WGBYC transition from using Reg. 812/2004 reports to the RDB as their main source of effort data that underpins advice.

3. Legal framework

All governments and intergovernmental commissions requesting and receiving advice from ICES and all contracting parties to OSPAR and HELCOM have signed international agreements under UNCLOS 1995 Fish Stocks agreement articles 5 and 6 to incorporate fisheries impacts on other components of marine ecosystems and WSSD 2002 article 30 to implement an ecosystem approach in relation to oceans policy including fisheries. These agreements include an obligation to support assessments of the impacts of fisheries on non-target species and the environment (UNCLOS FSA art 6).

For EU Member States, this data call is under Council Regulation 812/2004, the DCF regulation ((EC) No 2017/1004 and Commission Decision 2016/1251/EU) and in particular, Article 17(3) of regulation (EC) No 2017/1004 which states "*..requests made by end-users of scientific data in order to serve as a basis for advice to*

[***] ICES. 2017. Bycatch of small cetaceans and other marine animals – review of national reports under Council Regulation (EC) No. 812/2004 and other information. *In* Report of the ICES Advisory Committee, 2017. ICES Advice 2017, byc.eu. 4 pp.

[†††] EU. 2016. Commission Implementing Decision (EU) 2016/1251 of 12 July 2016 adopting a multiannual Union programme for the collection, management and use of data in the fisheries and aquaculture sectors for the period 2017–2019 (notified under document C(2016) 4329).

fisheries management, Member States shall ensure that relevant detailed and aggregated data are updated and made available to the relevant end-users of scientific data within the deadlines set in the request,..."

For non-EU states with fisheries operating in the North Atlantic, there is a requirement to make fisheries data available to support fisheries management under OSPAR, HELCOM and UNCLOS.

These data are made available to facilitate the scientific basis for advice in support of marine policies. In addition, ICES has a policy for the data use, which governs the process for whom is given access and what they can do with the data, see http://ices.dk/marine-data/Documents/Data_Policy_RDB.pdf.

This data call follows the principles of personal data protection as referred to in paragraph (9) of the preamble in Regulation (EU) 2017/1004 and repealing Council Regulation (EC) No 199/2008.

4. Deadlines

ICES requests the data to be delivered by the 1st of April 2018 to provide enough time for additional quality assurance and data handling procedures prior to the upcoming WGBYC meeting in May 2018.

5. Data to report

5.1 Geographic and temporal scope

The geographical scope of this data call includes all areas covered by the monitoring and mitigation requirements of Reg. 812/2004, and other North Atlantic (and adjacent) areas including:

- Northwest Atlantic Fisheries Organisation (NAFO) Fishing Areas http://www.fao.org/fishery/area/Area21/en
- ICES Fishing Areas (http://www.fao.org/fishery/area/Area27/en) on as detailed level as possible (including the adjustments to the North-East Atlantic Fisheries Commission (NEAFC) Regulatory Areas https://www.neafc.org/managing_fisheries/measures/ra_map)
- Geographical subareas GSA for GFCM (Mediterranean)

The temporal scope is for data collected specifically from **2016**. However, historical data (i.e. 2009–2015) that have not been submitted previously to ICES (by EU and non-EU countries) should also be submitted in the same format.

Please refer to Section 6 – Annex 1 & 2 for specific guidance on the data submission process, format, data fields and definitions.

5.2 Data types

Data covered by this data call include:

For EU countries:

1. *Data describing fishing effort, monitoring/sampling effort and incidental bycatch of **cetaceans** in pelagic trawl, high opening trawl, bottom-set-net and driftnet fisheries in accordance with the reporting requirements of **EC Council Regulation 812/2004;** and*
2. *Data describing monitoring/sampling effort and incidental bycatch of **any non-cetacean** protected species (i.e. species officially protected under national or international legislation), to include all other marine mammals (phocids etc.), all seabird species, all sea turtle species, and any protected elasmobranchs and fish, from the same gear types as listed in point 1.*
3. *Data describing monitoring/sampling effort and incidental bycatch of **all protected species** (including cetaceans) recorded from any **other** monitored gear types (demersal trawls, lines etc.) under national data collection programmes (e.g. DCF etc.).*

For non-EU countries:

1. *Data from any **non-EU countries** describing fishing effort, monitoring/sampling effort and incidental by-catch of any protected species by gear type and area.*

6 Data submission

Data submissions must conform to the present structure of the WGBYC database. As such, it is required that data be submitted using the Excel "data submission template". The template can be found here: http://bycatch.ices.dk/upload/bycatchReporting_template.zip

Once the Excel data submission template is completed, go to the "Export_data" sheet and press the "Export data to XML" button to create a data file in XML format, and save it onto your computer or network. Note: please do not use the Excel automatic XML conversion function; it will not produce the correct file.

Go to the bycatch portal http://bycatch.ices.dk

Press the 'Submit data' link and log in with your ICES SharePoint user credentials. If you do not have access to ICES SharePoint, please contact accessions@ices.dkfor assistance.

Full step-by-step instructions on how to submit data using the WGBYC data template is provided in Annex 1. The data format and look-up vocabularies are described in detail in Annex 2.

7. Contact information

For support concerning any issues about the data call, please contact the Advisory Department (Advice@ices.dk) and the WG chairs Sara Königson (sara.konigson@slu.se) and Kelly Macleod (Kelly.macleod@jncc.gov.uk). For support concerning technical data-submission issues, please contact: accessions@ices.dk.

8 Electronic outputs

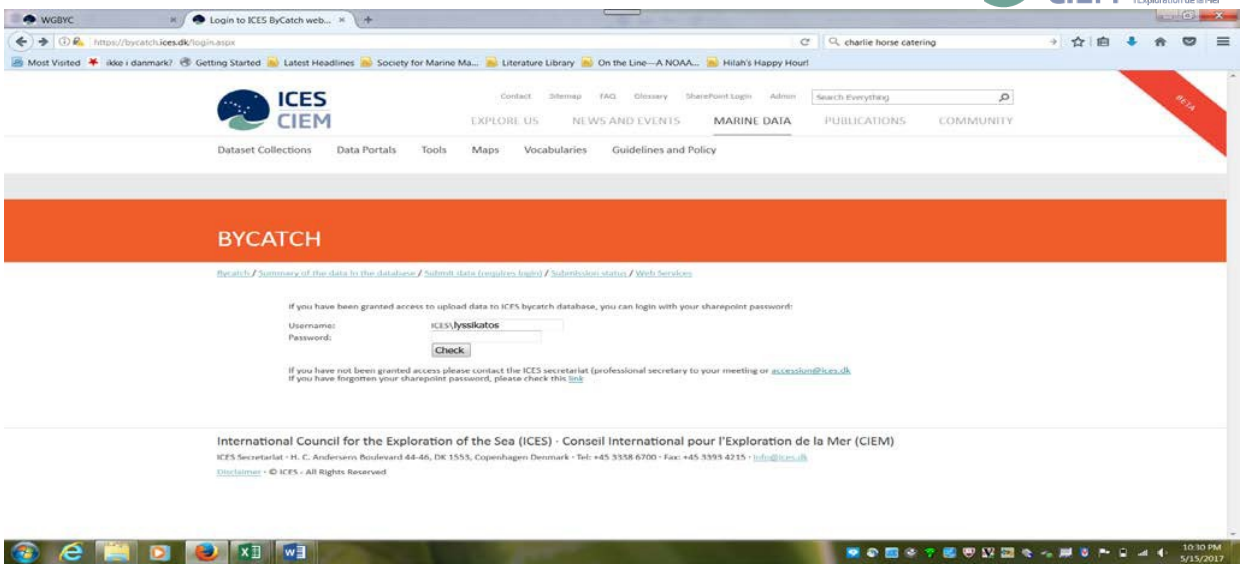
Data on fishing effort, monitored effort and bycatch of protected species will be aggregated by ICES Areas and RCG and in the Mediterranean by GSA areas and shown in maps and tables within ICES Bycatch reports and ICES Advice[###]. Aggregated data will also be visible and accessible on the ICES Bycatch data portal.

Annex 1. Data submission procedure

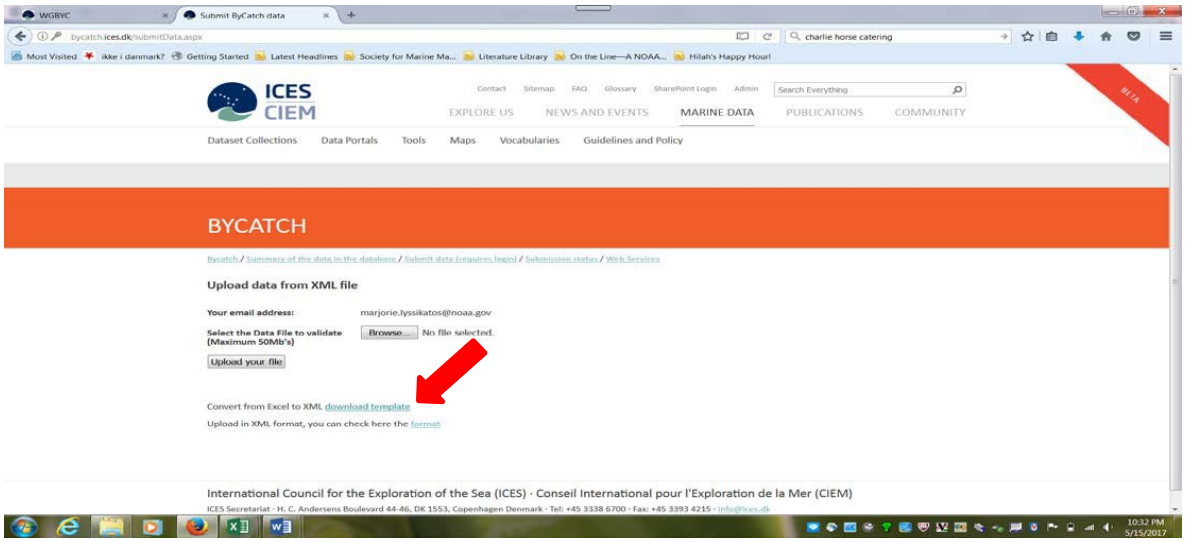
In the data submission template available from the ICES bycatch web-page, there are three primary worksheet tabs (file information - Annex 2 Table 1, bycatch main table - Annex 2 Table 2, and bycatch detail table - Annex 2 Table 3) that contain mandatory (red columns) data elements in order for data to be uploaded properly. Reporting of the non-mandatory data elements (green columns) is encouraged when possible. The worksheets and their respective data entry fields are described in more detail in Annex 2 below. ICES Data Centre has broadened the list of vocabularies to support data entry into several fields. Below are the brief step-by-step instructions for entering and uploading data.

The **first step** is to Click on the link provided here: http://bycatch.ices.dk/ to access the data entry and upload template from the data submission site. SharePoint login credentials are required to login, and can be requested at accessions@ices.dk.

[###] ICES. 2017. Bycatch of small cetaceans and other marine animals – review of national reports under Council Regulation (EC) No. 812/2004 and other information. *In* Report of the ICES Advisory Committee, 2017. ICES Advice 2017, byc.eu. 4 pp.

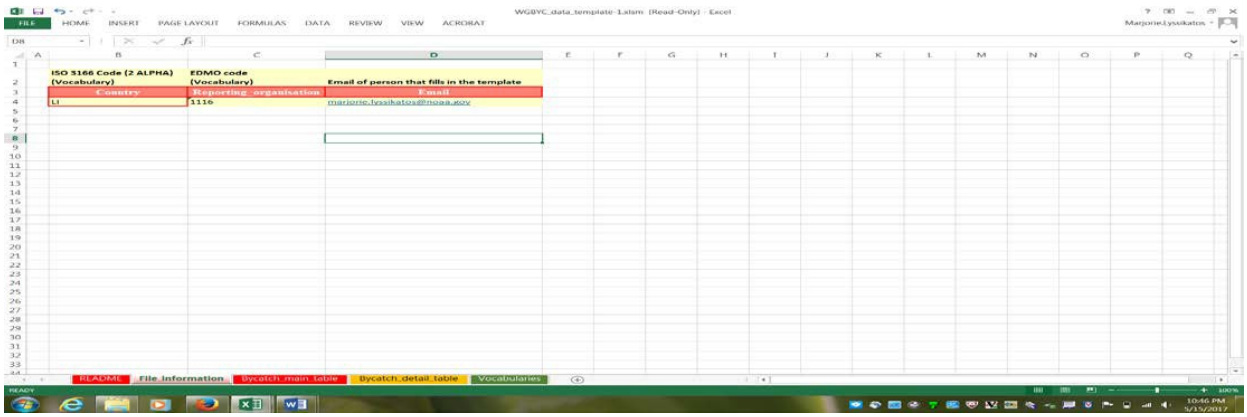


After entering your username and password, the **second step** is to download the template (see below).

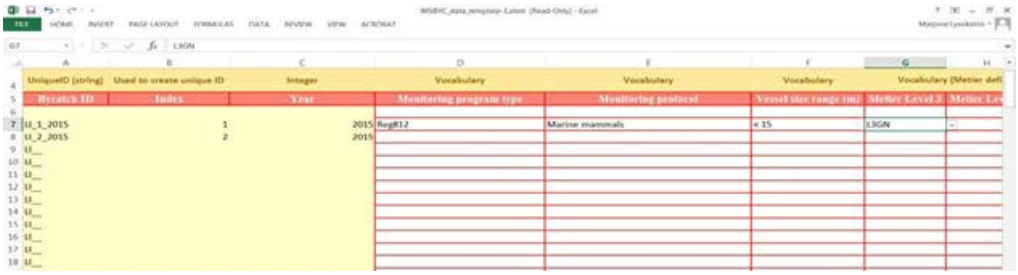


Step 3 is to review the 'README' tab in the template.

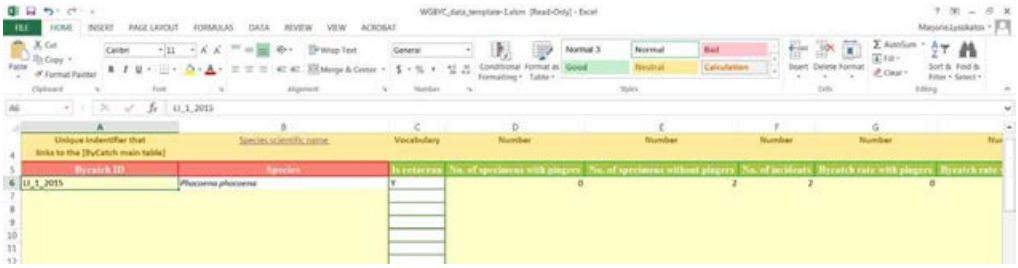
Step 4. Begin entering your data starting with the 'File_Information' tab (Annex 2 – Table 1).**NOTE: you may choose to manually enter the data or cut & paste data from an electronic file. However, if you cut & paste, the values must match the values provided in the vocabularies/drop down lists. Otherwise, you are likely to receive error messages upon data upload.**



Step 5. Move on to the 'Bycatch_Main_Table' tab (Annex 2 – Table 2). First, enter an index number for your first data entry record followed by the year. After entering an index number and year, the BycatchID field will automatically be generated. Then begin to populate the remaining columns and rows given the data you have available from your respective member state Regulation 812 report or other bycatch monitoring program(s).

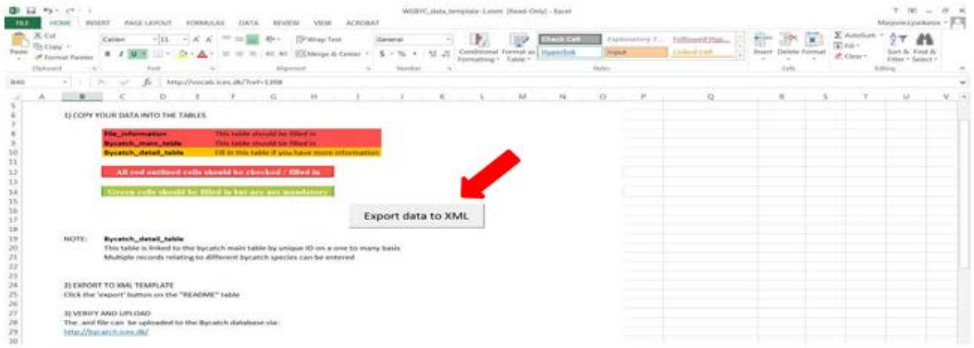


Step 6. After completing the Bycatch Main Table, move on to the next tab 'Bycatch_Detail_Table' (Annex 2 – Table 3). This tab is where observed bycatch events, bycatch rates and estimates for different species are entered and linked with the Bycatch Main Table records via the unique Bycatch_ID values. Copy and paste the unique BycatchID from the Main Bycatch Table into the Bycatch_ID in the Bycatch_Detail_Table. Then select the appropriate species from the WORMS link that were observed as bycatch associated with the unique Bycatch ID record.

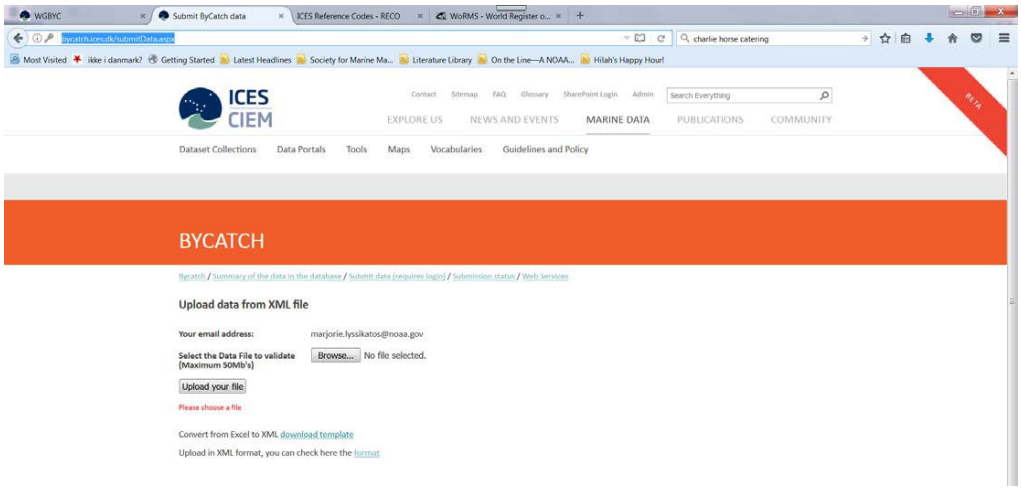


The Vocabularies tab includes additional links and drop down lists to populate both mandatory and option data fields in the template.

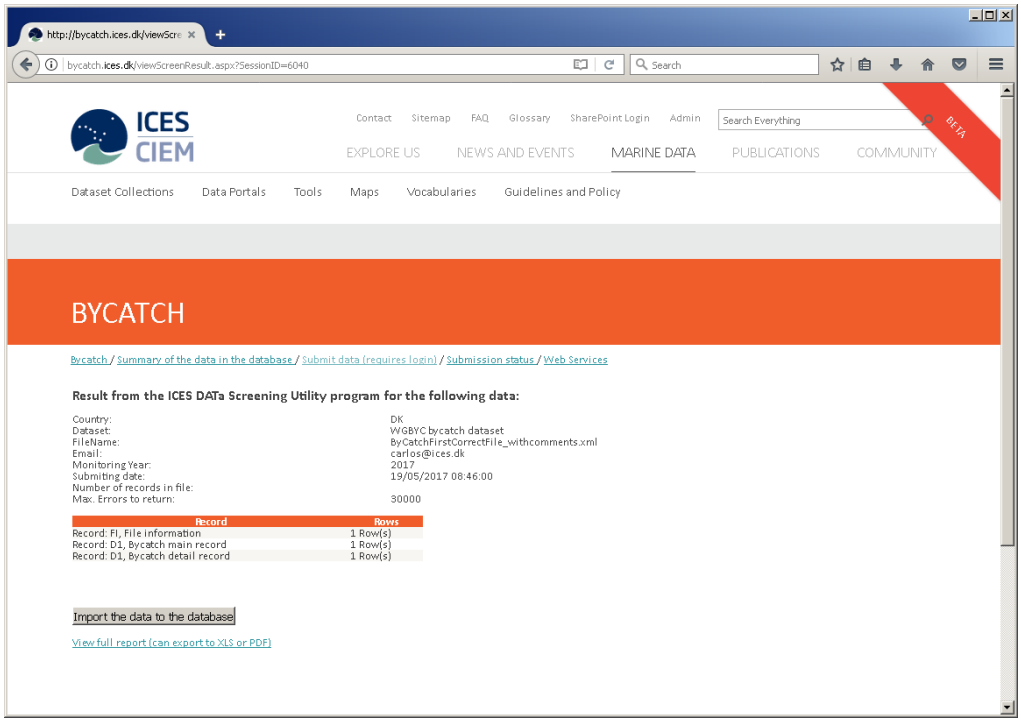
Step 7. Go back to the readme tab and export your data to XML file.



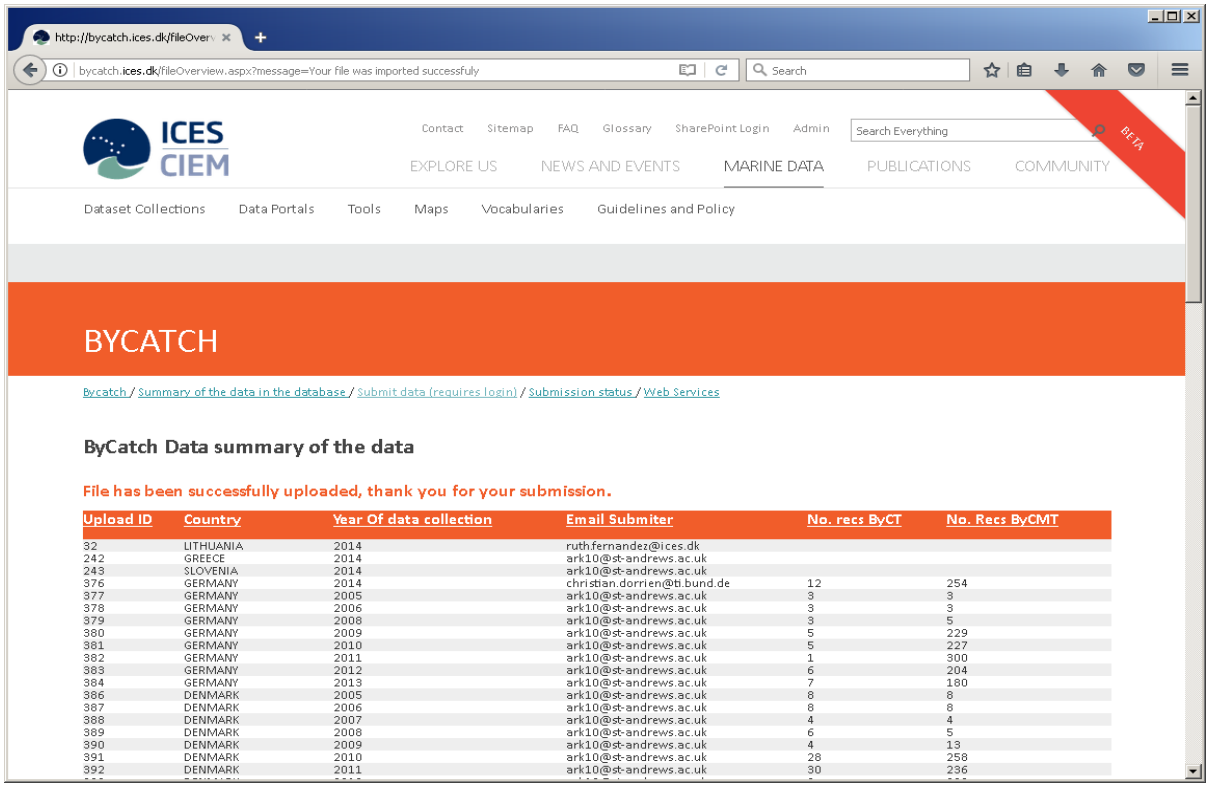
Step 8. Go back to the http://bycatch.ices.dk/submitData link, and **browse** to your directory where you saved your XML file and then click 'Upload your File' to upload your data to the database.



Step 9. After data upload is initiated, a message will appear, with the summary of your data, and possible error messages. If the file has no errors, then you should see (below) the "Import the data to the database button".



Step 10. Once you have clicked the import button, you will receive a message that the data has been successfully uploaded.



Upload ID	Country	Year Of data collection	Email Submiter	No. recs ByCT	No. Recs ByCMT
32	LITHUANIA	2014	ruth.fernandez@ices.dk		
242	GREECE	2014	ark10@st-andrews.ac.uk		
243	SLOVENIA	2014	ark10@st-andrews.ac.uk		
376	GERMANY	2014	christian.dorrien@ti.bund.de	12	254
377	GERMANY	2005	ark10@st-andrews.ac.uk	3	3
378	GERMANY	2006	ark10@st-andrews.ac.uk	3	3
379	GERMANY	2008	ark10@st-andrews.ac.uk	3	5
380	GERMANY	2009	ark10@st-andrews.ac.uk	5	229
381	GERMANY	2010	ark10@st-andrews.ac.uk	5	227
382	GERMANY	2011	ark10@st-andrews.ac.uk	1	300
383	GERMANY	2012	ark10@st-andrews.ac.uk	6	204
384	GERMANY	2013	ark10@st-andrews.ac.uk	7	180
386	DENMARK	2005	ark10@st-andrews.ac.uk	8	8
387	DENMARK	2006	ark10@st-andrews.ac.uk	8	8
388	DENMARK	2007	ark10@st-andrews.ac.uk	4	4
389	DENMARK	2008	ark10@st-andrews.ac.uk	6	5
390	DENMARK	2009	ark10@st-andrews.ac.uk	4	13
391	DENMARK	2010	ark10@st-andrews.ac.uk	28	258
392	DENMARK	2011	ark10@st-andrews.ac.uk	30	236

If errors are found in your file, you can re-upload and overwrite previously entered data. If you have no success with your data upload, please contact ICES Data Centre (accessions@ices.dk.). You can check the summary of records entered by clicking on the Summary of the data in database or Submission Status. **Please note that data uploaded after the designated deadline (April 1, 2018) might not be consider for providing advice on the bycatch of protected species in 2018.**

In case of questions about the template reporting format, vocabulary codes, etc., please contact accessions@ices.dk.

Annex 2. Data submission format in details

Table 1. File Information Worksheet

Note: in the 'Obligation' column, **M** stands for mandatory, **O** stands for optional and **C** stands for conditional (i.e. conditional on information being provided in the previous fields).

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
Country	Char	M	ISO 2-alpha country code	Use vocabulary link in template
Reporting_ organisation	Char	M	EDMO code of the organization responsible for the data.	Use vocabulary link in template
E-mail	Char	M	E-mail address for the point of contact about the data.	Valid e-mail address

Table 2. Bycatch Main Table (for fishing effort and observed/monitored effort)

Note: in the 'Obligation' column, **M** stands for mandatory, **O** stands for optional and **C** stands for conditional (i.e. conditional on information being provided in the previous fields).

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
Bycatch ID	Char	M	Unique identification for every record that will link with protected species records in the Bycatch Detail Table on a one to many basis.	This field is automatically generated by Excel after entering 'Index'. DO NOT EDIT!
Index	Char	M	Unique monitoring index	This unique index will be used to generate the BycatchID that is automatically generated by the template (see the first field). For example, enter "1" for the first record being entered for your member state.
Year	Char	M	Four-digit year (e.g. 2015)	Enter the year when the data were collected.
Monitoring program type	Char	M	Name of data collection program under which the data were collected.	Use vocabulary options provided in the template drop down list; if 'other' is selected please provide explanation in the comment field. You can check the vocabulary here: http://vocab.ices.dk/?ref=1500
Sampling protocol	Char	M	The type of monitoring protocol used by human observer. This should reflect the	Use vocabulary options provided in the template drop down list. For example, 'marine mammals' implies the observers main role was to monitor the gear for interactions with marine mammals; P=protected species; All=a multidisciplinary monitoring program

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
			objective(s) of the monitoring program. See guidance if electronic monitoring was used.	where bycatch of all species are reported, including fish. You can check the vocabulary here: http://vocab.ices.dk/?ref=1501
Vessel size range	Char	M	The size range of vessel that was observed in metres	Use vocabulary options provided in the template drop down list; if 'other' is selected please provide explanation in the comment field. You can check the vocabulary here: http://vocab.ices.dk/?ref=1502
Métier Level 3	Char	M	Generic gear group	Use vocabulary options provided in the template drop down list; if 'other' is selected, please provide explanation in the comment field.
Métier Level 4	Char	M	Gear type	Use vocabulary options provided in the template drop down list
Métier Level 5	Char	M	Target species group	Use vocabulary options provided in the template drop down list
Métier Level 6	Char	O	Mesh size and other selective devices	If applicable, briefly provide the mesh size ranges and other selective devices applicable for the métier, according to Appendix IV of the Commission Decision 2008/949/E
Target species	Char	O	Scientific name of the main target species. Minimum specification – group or common name; Maximum specification – scientific name of the species.	If more than one species separate scientific names by '~'
% Vessels using pingers	Char	O	The observed percentage of vessels that used acoustic deterrent devices (aka pingers) on their gear.	Enter the percentage (%) of vessels equipped with specific pingers relative to the overall number of vessels in the segment (e.g. 10%)
Pinger characteristics	Char	O	Pinger (i.e. acoustic deterrent devices) specifications according to	Indicate type of device being used. Use vocabulary options provided in the template drop down list; Type 1 or Type 2 (http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32004R0812, DDD=Dolphin Dissuasive Device; MIX =

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
			Annex II or Article 3.2 in Council Regulation (EC) 812/2004.	a mixture of acoustic deterrents used; other=devices other than Type 1, Type 2, DDD, or a mixture of these 3 types) You can check the vocabulary here: http://vocab.ices.dk/?ref=1504
Other mitigation measures	Char	O	Other observed active or passive mitigation techniques used on the gear.	Other observed mitigation techniques could include escape panels, reflective gear,
Area type	Char	M	Area reference type	Specify which area reference codes you are using: ICES areas, GFSM GSAs, NAFO areas
Area code	Char	M	Area code, where the majority of trips were observed	Use code options from the look-up lists for each area type; multiple areas must be separated by '~'
RCG	Char	O	Regional Coordination Group	Use vocabulary options provided in the template drop down list.
Monitoring period	Char	O	Winter, Summer, Year	Seasons are intended to capture approximate time of year the monitoring occurred to line up with monitoring requirements of EU Reg. 812/2004. Use vocabulary options provided in the template drop down list.
Start month	Numeric	O	The starting month in the season or year defined by Monitoring Period	If Winter then start month for example could be 12 (December). If Annual then default start month = 1 (January)
End month	Numeric	O	The last month in the season or year defined by Monitoring Period	If Winter then end month for example could be 3 (March). If annual then default end month = 12 (December).
VesselsF	Numeric	O	The total number of vessels	Indicate total number of vessels and trips operating at Métier Level V according to Appendix IV of the Commission Decision 2008/949/E
TripsF	Numeric	O	The Total number of trips	Indicate total number of vessels and trips operating at Métier Level V according to Appendix IV of the Commission Decision 2008/949/E

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
Days at seaF	Numeric	O	Total number of days at sea corresponding to fishing time* (e.g. 60)	Indicate total days at sea operating at Métier Level V according to Appendix IV of the Commission Decision 2008/949/E
Total length of nets (km)F	Numeric	O	Total length of nets in kilometers (km)	Indicate total length of nets (km) fished at Métier level V according to Appendix IV of the Commission Decision 2008/949/E
Total km hoursF	Numeric	O	Total soak time of nets in kilometer hours (kmh) – intended for fixed gears	Indicate total soak time (kmh) fished at Métier level V according to Appendix IV of the Commission Decision 2008/949/E
Number of haulsF	Numeric	O	Total number of hauls fished	Total number of hauls (aka tows or sets) fished at Métier level V
Total towing timeF	Numeric	O	Total tow time of gear in hours (h) – intended for mobile gears.	Total tow time (h) fished at Métier level V.
VesselsOb	Numeric	O	Total observed number of vessels	Indicate the total number of vessels that were observed at the Métier level reported.
Days at seaOb	Numeric	O	Total observed number of days at sea (e.g. 60)*	Indicate total days at sea observed at the Métier level reported.
Total length of nets (km)Ob	Numeric	O	Total observed length of nets in kilometers (km)	Indicated the total length of nets observed (km) at the Métier level reported.
Total km hoursOb	Numeric	O	Total observed soak time of nets in kilometer hours (kmh) – intended for fixed gears	Indicate total observed soak time (kmh) at the Métier level reported.
No of haulsOb	Numeric	O	Total observed number of hauls	Total number of hauls (aka tows or set) fished at the Métier level reported.
Total towing timeOb	Numeric	O	Total observed towing time in hours (h) –	Total tow time observed (h) at the Métier level reported.

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
			intended for mobile gears	
Type of 812 monitoring	Text	O	Type of monitoring program under Reg. 812	Indicate type of monitoring program conducted in agreement with Article 4 and Annex III of Council Regulation (EC) No 812/2004: MS – developed monitoring program; PMS – pilot monitoring progam: SS – scientific study/experiment; select 'EM' if electronic monitoring was used and specify in the comment field the intended taxonomic groups that reflect the objective of the EM program. You can check the vocabulary here: http://vocab.ices.dk/?ref=1505
% Coverage	Numeric	O	The percentage of fishing effort observed.	Not a calculated field. The percent coverage is provided by the respective MS. If coverage not measured in days at sea please provide metric used to calculate coverage in the comment field.
Comments	Char	C	Provide additional information where instructed	Follow guidance for mandatory fields; comments for optional fields are encouraged but not required.

Table 3. Bycatch Detail Table (bycatch events).

Note: in the 'Obligation' column, **M** stands for mandatory, **O** stands for optional and **C** stands for conditional (i.e. conditional on information being provided in the previous fields).

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
Bycatch ID	Char	M	Unique identification from the Bycatch Maine Table that will link the protected species records in the Bycatch Detail Table to the Bycatch Main Table on a one to many basis.	Manually enter the autogenerated Bycatch ID from the corresponding record in the Bycatch Main Table.
Species	Char	M	Scientific name of species caught incidentally. Minimum specification – group or common name; Maximum specification – scientific name of the species.	Use WoRMS to verify the valid species name http://www.marinespecies.org/
Is cetacean	Char	O	Yes; No	Indicate if the animal is a cetacean.
No. of specimens with pingers	Numeric	O	Total number of observed specimens by species incidentally caught in gear equipped with pingers.	Number of live and dead specimens caught in gear equipped with pingers.
No. of specimens without pingers	Numeric	O	Total number of observed specimens by species incidentally caught in gear NOT equipped with pingers.	Number of live and dead specimens caught in gear NOT equipped with pingers.
No. of incidents	Numeric	O	Number of fishing operations that caught	For example, this would be the total number of sets, hauls or tows observed with incidental bycatch.

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
			animals (dead and live animals)	
Bycatch rate with pingers	Numeric	O	The ratio of observed incidental bycatch per unit of fishing from gear equipped with pingers.	Indicate per unit of fishing effort the bycatch rate (e.g. specimens per day, /haul,/soak time x km, /hours x meters) for the observed species from gear that was equipped with pingers.
Bycatch rate without pingers	Numeric	O	The ratio of observed incidental bycatch per unit of fishing from gear NOT equipped with pingers.	Indicate per unit of fishing effort the bycatch rate (e.g. no. specimens per day, /haul,/soak time x km, /hours x meters) for the observed species from gear that was NOT equipped with pingers.
Total bycatch estimate	Numeric	O	Estimated total number of bycaught animals derived from observed incidental bycatch.	Provide the total bycatch estimate for species reported.
CV (%)	Numeric	O	Coefficient of Variation (%)	Provide the estimated CV (standard deviation/bycatch estimate x 100) associated with the total bycatch estimate.
Mesh size (mm)	Numeric	O	Average mesh size in millimetres (mm) of the observed gear	Indicate the average mesh size (mm) of the observed gear (e.g. gillnet gear 50 mm; trawl gear 100 mm).
Target species	Char	O	Indicate the main target species. Minimum specification – group or common name; Maximum specification – scientific name of the species.	Provide scientific name of species using link to WoRMS

Annex 8: Technical minutes from the Bycatch Review Group

- RGBYC
- By correspondence in July and beginning of August 2018
- Participants: Julio Valeiras (Chair), IEO, Spain; Ramunas Zydelis, Ornithology and Telemetry Applications, Lithuania, Chris Orphanides, NOAA, USA, Sara Königson and Kelly Macleod (WG chairs) and Ruth Fernandez (ICES Secretariat).
- Working Group: WGBYC

To the attention of ADGBYC 2018

General

The Review Group (RGBYC) acknowledges the intense effort expended by the Working Group to produce the WGBYC report 2018.

Comments per section

3 Review and summarize annual national reports submitted to the European Commission under Regulation 812/2004 and other published documents and collated bycatch rates and estimates in EU waters (ToR A)

3.1 Monitoring under (EC) Regulation 812/2004-Overview

RGBYC recognized the continuous missing reports from some Member States (Finland and Spain). The absence of data from the last eight years is a factor that prevents an overview of the situation throughout Europe. There should be a proposal for countries to complete the lack of Regulation 812 reports as soon as possible.

3.2 Monitoring under (EC) Regulation 812/2004 by Member States (including non-cetacean bycatch events when provided))

The RG appreciate the overview about the performed monitoring of fisheries bycatch by MS. The section provides a complete summary about the monitoring under Reg. 812 by MS and shows the differences on data within the countries. Reasons for non-reporting must be identified and described for data improvement in future.

3.4 Monitoring and bycatch from non-EU Countries

In the case of the USA, the monitoring includes live bycatch that was released unharmed. It is not clear if it is the same definition for EU member countries.

3.5 Auxiliary data (strandings, entanglement and interviews) indicative of the impact of bycatch

Stranding data of marine mammals only for five member States: Portugal France, Belgium, Poland and Sweden. Only France, Belgium and Poland seem to have a national official stranding recording scheme for all marine mammals.

3.6 Defining species of interest to the WGBYC

The Commission Implementing Decision (EU) 2016/1251 specifies that data collection of incidental bycatch of all birds, mammals and reptiles and fish protected, are needed both from MS scientific observer sampling and from fisheries logbooks. There is a lack of information from logbooks or has not been taken into account.

4 Collate and review information from National Regulation 812/2004 reports and elsewhere relating to the implementation of bycatch mitigation measures and ongoing bycatch mitigation trials, compile recent results and coordinate further work on protected species bycatch mitigation (ToR B)

This section does a good job summarizing the implementation of bycatch mitigation measures, but a table at the end of the section summarizing the degree to which each reduced bycatch would be helpful. However, the text does not address the phrase in the term of reference that asks for the coordination "further work on protected species mitigation"

5 Evaluate the range (minimum/maximum) impacts of bycatch on protected species where possible by assessment unit, furthering the bycatch risk approach to assess likely conservation level threats and prioritize areas where additional monitoring is needed (ToR C)

5.1.1 Effort data used for scaling the Bycatch Risk Assessment

Inconsistencies on RDB data are pointed out and those must be taken into account.

As mentioned by WG in previous years, the unit fishing effort should be standardized. Data of bycatches must be compared by métiers and at a regional scale. Identification of métiers (best available métier level) and scales is necessary to appropriate comparisons and assess of bycatch impact. New developments to WGBYC database should be coordinated to standardized fisheries formats currently used in EU/ICES.

5.3 Identifying métiers in need of monitoring (fishPi)

The WG states that high bycatch risk métiers and fishing grounds were identified in the North Sea and North Atlantic regions, considering different protected species or taxa. RG considers that this is something that could be summarized in this report in a table.

RG considers key for the analysis of bycatch to assets the type of gear, selectivity and excluding devices, which implies the precise definition of the fishing gear in the métiers/countries.

5.5 Conclusions

It was not mentioned, before the 'drift model' to predict the behaviour of strandings at the Bay of Biscay and Celtic Sea. So, it seems inappropriate to discuss it in the conclusion.

6 Continue to develop, improve and coordinate with other ICES WGs on methods for bycatch monitoring, research and assessment within the context of European legislation (e.g. MSFD) and regional conventions (e.g. OSPAR) (intersessional) (ToR D)

6.1 Coordination with WGCATCH through WKPETSAMP

The RG welcomes the joining work with WGCATCH and the joint workshops to improve the monitoring of bycatch and database schemes. Also, RG encourages the coordination with other Working Groups as WGMME and JWGBIRD.

6.1.1 Review of data fields for the ICES Regional Database and Estimation System (RDBES)

It would be appropriate to specify the meaning of 'Indicator if megafauna could have been observed (including bycatch)'

7 Continue to develop collaborative research proposals among WGBYC members to pursue research projects and funding opportunities in support of researching protected and target species behaviour in relation to fishing gear (ToR E)

This term of reference was partially met. Funding opportunities were minimally discussed and potential collaborations were mentioned, but it does not appear that they progressed to the point of any proposals being prepared. Sections 7.2 and 7.3 seem to be more about projects undertaken in France and Portugal rather than collaborative efforts among WGBYC members.

8 Continue, in cooperation with the ICES Data Centre, to develop, improve, populate through formal Data Call, and maintain the database on bycatch monitoring and relevant fishing effort in European waters (ToR F)

8.2 Comparison of effort from different sources (RDB; VMS; Logbooks; WGBYC)

Fishing effort data from VMS are recorded in hours fished. WGBYC indicates that a conversion factor needs to be applied to convert hours fished to days fished or days at sea. Nevertheless 'hours fished' would be most accurate and that conversion to days fished would introduce no worse biases than present with other methods.

General comments

The work of the WGBYC is essential to progress the developments of techniques for the assessment and mitigation of PETS bycatch, which will be required to address special requirements for each bycatch species group.

RGBYC welcomed the information from other countries which complement the overall perspective.

RGBYC thinks that the report should place greater emphasis on one of the most important problems: to receive the annual reports of the obligatory Member States according to Regulation 812/2004. Several countries do not provide information, and some provide very incomplete and repeated information from previous years, that hinders the work of the group. The RG continues giving its suggestion to solve the lack of the reports and the improvement of data to progress in the objectives of the ICES WGBYC.

The official data call to MS has partially repaired this problem and greatly improved the information available. The RG encourages continuing requesting new data calls to MS in future.

Technical comments

Readability of the report by those not specifically familiar with Northeast Atlantic bycatch and management could be greatly improved by a section defining acronyms (e.g. DCF, PETS, WKPETSAMP, etc.) - definitions of acronyms in the text are inconsistent, and there are a lot of them. A figure early in the document that provides a map of the management areas would add a lot of clarity. A short description at the beginning of this document of pertinent regulations and how they impact bycatch data collection would be extremely helpful to the reader. This could be done in its own short section, not more than a few paragraphs long. This should cover Reg. 812/2004, any relevant articles (perhaps 4–5), and additional relevant regulations. I would also recommend explaining a few of the key observer programmes in a few short sentences (i.e. DCF, OBSMER, etc.).

Some of the attached tables and figures could be improved for a better understanding e.g. sizes of letters.

Table 1: review legend, there are no cross-hatched cells.

Table 6: review legend, include abbreviations of harbour porpoise and common dolphins (as table: Pp, Dd).

Conclusions

The RGBYC congratulates to the submitted Working Group Report. The report of the WGBYC is very complete, well structured and covers the terms of reference. The work is at a sufficient scientific standard for ICES to base its advice on bycatch of protected species. The Working Group invested much working effort resulting in a positive progress concerning data management and information flow from last year's reports. The Data Call this year has meant a great improvement and progress in the objectives of the WG.

As in previous years, data reports from some Member States appear to be insufficient, and several States continue to not send the national reports to comply with regulation 812. The RGBYC suggests that coordinated work must be carried out between the EU and ICES for the improvement of the sending of the reports and precise data for the work of the WGBYC.

The report underpins the importance of the Working Group. The joint workshop with WGCATCH is really welcomed by the RGBYC and showed the important linkages to other working groups and the importance for improvement of WGBYC.