Monitoring seabird bycatch in the North East Atlantic Fisheries Commission Regulatory Area

VOLUME 03 I ISSUE 02

ICES BUSINESS REPORTS

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

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

This document is approved by the ICES Advisory Committee and produced under the auspices of the International Council for the Exploration of the Sea.

ICES Business Reports

Volume 03 : Issue 02

Monitoring seabird bycatch in the North East Atlantic Fisheries Commission Regulatory Area

Recommended format for purpose of citation:

ICES. 2023. Monitoring seabird bycatch in the North East Atlantic Fisheries Commission Regulatory Area. ICES Business Reports, 03: 02. 11 pp. http://doi.org/10.17895/ices.pub.21908577

Authors

Mikel Basterretxea • Kim Magnus Bærum • Neil Campbell • Volker Dierschke • Christian von Dorrien • Ruth Fernandez • Gildas Glemarec • Allen Kingston • Henn Ojaveer • Nuno Oliveira Carlos Pinto • Gudjon Mar Sigurdsson

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

Contents

i Executive summary

In 2021, ICES received a special request for advice from the North East Atlantic Fisheries Commission (NEAFC) on bird bycatch in the NEAFC Regulatory Area (RA). Scoping exercises to address this request were carried out in 2021 and 2022 and the main results from that work are summarized in this report.

Data on monitoring effort and bycatch events were gathered through annual ICES data calls in 2021 and 2022. Only few EU countries reported limited bycatch monitoring data in the NEAFC RA in response to the data calls while major fishing nations failed to report information. No bird bycatch events were reported. For robust bycatch rate calculations and the ability to generate stratified bycatch estimates at appropriate temporal resolutions, data are needed for each bycatch event including the number of zero-bycatch events. This cannot be achieved currently with the available data.

Data on total fishing effort was submitted by NEAFC to ICES through a Memorandum of Understanding that provides annual VMS and catch data. The quality of the data provided to ICES by NEAFC has grown markedly in recent years enabling more precise linking of vessel catches to corresponding activities. However, important issues are still of concern. For example, the species composition of the catch targeted by midwater trawlers (e.g. blue whiting, mackerel, and herring) does not overlap with those recorded in catches taken with demersal gears (e.g. haddock, *Pandalus*). The catch composition by species provided in catch reports (as opposed to the gear information) is used to determine if a vessel is engaged in bottom or midwater fishing. This approach does not provide data (e.g. gear type, mesh size, selectivity devices) at a sufficiently granular level to align with the métier-based approach required for seabird bycatch analysis. In addition, fishing effort reported with longlines in very deep waters (i.e. too deep for commercial fishing) to the northwest of Josephine Seamount was not associated with catch reports. These vessels are assumed to be targeting tunas, which are not regulated by NEAFC, but from a bird-bycatch perspective, represent a data gap.

1 Introduction

This document summarises the work carried out by ICES so far to address the special advice request on bird bycatch in the NEAFC RA. The document is organised into the following four sections:

- Summary of data on bycatch monitoring and bycatch incidents in the NEAFC Regulatory Area (RA) in 2019 and 2020;
- Summary of data on bycatch of protected species in the NEAFC RA in 2021;
- Analysis of total fishing effort in the NEAFC RA for 2021;
- Preliminary conclusions.

1.1 Summary of data on bycatch monitoring and bycatch incidents in the NEAFC Regulatory Area in 2019 and 2020

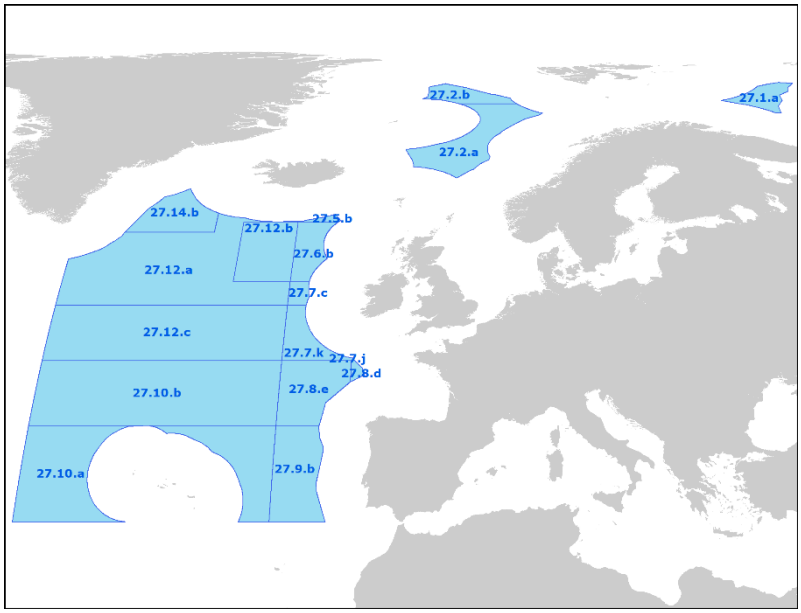

Figure 1.1. Maps of the ICES areas in the NEAFC Regulatory Areas (marked blue). source: EFCA.europa.eu

In 2021, ICES received a special request for advice from the North East Atlantic Fisheries Commission (NEAFC) on bird bycatch in the NEAFC Regulatory Area (RA) (Figure 1.1). NEAFC stated that according to anecdotal information bird bycatch is considered low in the fisheries conducted in the NEAFC RA. ICES was requested to compile and aggregate available data (spatially and temporally distributed, as well as per gear) and to advise upon what is necessary in order to provide annual advice on bird bycatch. As an initial step to determine whether data on bird bycatch in the NEAFC RA do exist, ICES carried out a scoping exercise in 2021 (ICES 2021a).

Based on a signed agreement, NEAFC provides ICES with data on VMS and catches in the NEAFC RA. These data are used, among other things, to feed into the ICES annual advisory process on Vulnerable Marine Ecosystems (VME). For VME work, the main gears of interest are those that have physical contact with the seafloor. For Protected, Endangered, and Threatened Species (PETS) bycatch work, all gears are relevant. Although the raw fishing effort data are available to ICES, workload and time constraints prevented the processing of the NEAFC total

fishing effort data in advance of the respective Expert Group (Working Group on Bycatch of Protected species, WGBYC) meeting in 2021.

The ICES 2021 data call (ICES 2021a) was sent to all NEAFC contracting parties. In relation to the special request from NEAFC, data from ICES Divisions containing both National EEZ and NEAFC RA waters was requested with the appropriate ICES/NEAFC Subdivision code (e.g. 7.k.1 (NEAFC RA) or 7.k.2 (National EEZ), and not just 7.k).

All NEAFC contracting parties except one submitted data in response to the ICES 2021 data call (Table 1.1). However, only a few EU countries reported any monitoring effort data within the NEAFC RA.

Table 1.1. NEAFC contracting parties and their contribution to the ICES 2021 data call.

NEAFC contracting parties	Submitted data to the ICES 2021 data call	Submitted monitoring effort data within the NEAFC RA to the ICES 2021 data call
Denmark (in respect of the Faroe Islands and Greenland)	Yes	No
EU	Yes	Partly (Estonia, Germany, Lithuania, Netherlands, Spain)
Iceland	Yes	No
Norway	Yes	No
Russian Federation	No	No
UK	Yes	No

Not all states reported their monitoring data. It is unclear whether no additional monitoring exist in the NEAFC RA or whether such monitoring data do exist but were not reported to ICES. Of the states that reported monitoring data, not all identified the ICES Subdivisions, making it impossible to determine if monitoring effort was specifically within the NEAFC RA (ICES, 2021b). Furthermore, due to time constraints no analyses were carried out for the total fishing effort data. Because of these significant data gaps, it does not make sense to present the extent of the reported but incomplete monitoring data here.

In the incomplete data reported via the data call, no bycatch of seabirds was reported in any fishery in the NEAFC RA. In addition, it was not possible to determine from some of the reported data whether monitoring had actually taken place in the NEAFC RA. Therefore, it cannot be concluded that no bycatch of seabirds occurs in the fisheries operating in the NEAFC RA.

According to the information available, there are currently no regulations in the NEAFC Statutes that require a monitoring programme for the recording of bycatch of protected species such as seabirds. NEAFC rules for Recording of Catch and Fishing Effort (Article 9) do not require vessels to record data about bycatch of seabirds in their logbook. Even if such reporting was required for fishing fleets flying the flags of EU Member States, for example under EU Data Collection Framework (DCF) or EU Marine Strategy Framework Directive (MSFD), the overall data would remain incomplete unless non-EU countries such as Russian Federation or Norway had similar rules for their fleets.

For robust bycatch rate calculations with error estimates, data should be provided on the magnitude and frequency of each bycatch event (i.e. per haul rather than aggregated) and include equivalent data for the number of zero-bycatch events. A time-series of data allows more robust

estimates and evaluation of trends for seabird bycatch (and other taxa) and the ability to generate stratified bycatch estimates at appropriate resolutions is important (ICES, 2020). This cannot be achieved currently with the available data.

1.2 Summary of data on bycatch of protected species in the NEAFC RA in 2021

ICES issued a data call in 2022 which was sent to all NEAFC contracting parties (ICES, 2022a). Only few EU countries reported monitoring data in the NEAFC RA in response to the 2022 data call (Table 1.2) and major fishing nations failed to report information. Monitoring data recorded based on sea observers or vessel observers corresponded to a total of 14 fishing trips and 189 days at sea observed. The monitored métiers were midwater otter trawl (OTM), bottom otter trawl (OTB), and drifting longlines (LLD). No other gears were reported as monitored for bycatch of protected species (ICES, 2022b).

Table 1.2. NEAFC contracting parties and their contribution to the ICES 2022 data call.

NEAFC contracting parties	Submitted data to the ICES 2022 data call	Submitted monitoring effort data within the NEAFC RA to the ICES 2022 data call
Denmark (in respect of the Faroe Islands and Greenland)	Yes	No
EU	Yes	Partly (Estonia, Netherlands, Spain, Ireland, Portugal) *
Iceland	Yes	No
Norway	Yes	No
Russian Federation**	NA	NA
UK	Yes	No

**Data on monitoring effort were also submitted by Lithuania, based on Logbook data (i.e. self-reporting by fishers). However, this monitoring method alone is not considered reliable to derive bycatch rates and mortality estimates (see ICES, 2022c).*

***Due to the suspension of participation of the Russian Federation in ICES activities no data were requested from Russia in 2022.*

Comparing the number of Days at Sea observed for OTM and OTB with the total number of days fished resulting from the analyses of the NEAFC VMS and catch data (see section 3 of this report), the percentage of the observer coverage (in Days at Sea) was 12% for OTB and 0.68% for OTM. No fishing effort was reported for LLD. Note that these estimates of coverage do not consider total effort allocated to the métier MIS (miscellaneous gears).

The NEAFC areas with some monitoring effort were: 27.1.a, 27.2.a.1, 27.6.b.1, 27.7.k.1, 27.9.b.1, 27.10.a.1.

Bycatch incidents of one marine turtle (*Dermochelys coriacea*) and ten species of fish (listed in Table 1.3) were reported in the NEAFC RA for 2021.

Table 1.3. List of fish species reported as bycaught in the NEAFC RA for 2021:

Common name	Scientific name
Northern wolffish	*Anarhichas denticulatus*
Portuguese dogfish	*Centroscymnus coelolepis*
Rabbitfish	*Chimaera monstrosa*
Lumpsucker	*Cyclopterus lumpus*
Birdbeak dogfish	*Deania calcea*
Great lanternshark	*Etmopterus princeps*
Atlantic cod	*Gadus morhua*
Blackbelly rosefish	*Helicolenus dactylopterus*
Longfin mako	*Isurus paucus*
Norway redfish	*Sebastes viviparus*

1.3 Analysis of total fishing effort in the NEAFC RA for 2021

An expert of the Working Group on Spatial Fisheries Data (WGSFD) analysed the data submitted by NEAFC to ICES through an specific agreement that provides annual VMS and catch data; https://www.ices.dk/about-ICES/Documents/Cooperation%20agreements/NEAFC/20190201-NEAFC-ICES-agreement-VMS-Logbook_2019.pdf

VMS data along with corresponding catch information from logbooks, authorisation details, and vessel information supplied to NEAFC by national administrations were analysed. Results were delivered in advance of the WGBYC 2022 meeting, in order to support the NEAFC request to ICES to provide information on bycatches of fishing activities in the NEAFC RA.

The vessel, catch and VMS tables were linked using a unique identifier (the "RID" field) which is changed on an annual basis to protect anonymity of vessels. Catch information is received as the catch report, transmitted over the VMS system, rather than from the logbook at the point of landing, allowing catch and fishing activity to be linked at a fine scale.

VMS data were filtered in R to exclude all duplicate reports, polls outside the year 2021, and messages denoting entry and exit to the NEAFC regulatory area ("ENT" and "EXT" reports). As the time interval between VMS pings can be variable, half the time interval between a ping and the one preceding it, plus half the time interval between that ping and the subsequent one, was assigned to each ping as a unit of effort. Any interval values greater than four hours were truncated to this duration, as this is the minimum reporting frequency specified in the event of equipment failure in Article 11 of the NEAFC Scheme of Control and Enforcement. Such a scenario could occur when a vessel leaves the NEAFC RA or has issues with its transmission system. As there is no logbook information available to provide information on trip durations, a decision was made that, after a period of reporting VMS positions, the first day on which a vessel records no VMS data corresponds to the end of a trip. While this may overestimate the total number of trips, for example if a vessel moves between NEAFC reporting areas, through the waters of a coastal state, it is the best heuristic available, given the limitations of the data. The number of trips, number of vessels, and hours on the ground are summarized in Table 1.4.

Table 1.4. Number of vessels, trips, VMS pings and effort (time at fishing speeds) registered against each fishing gear type in the amended NEAFC VMS data.

Gear	Description	Vessels	Trips	Number of pings	Hours on ground	Hours fished
FPO	Fish pots	1	3	134	138	-
GTR	Trammel nets	1	2	213	215	-
LL	Long lines	4	10	2014	1233	-
LLS	Long lines (set)	1	9	665	1116	-
OTB	Bottom otter trawl	48	153	67 847	49 756	31 383
OTM	Midwater otter trawl	149	639	167 004	113 742	81 130
PS	Purse seine	2	12	977	1311	815
TBS	Shrimp trawl	1	6	1801	86	68

Gear information is available in the vessel table received from NEAFC, but only for some boats – for others the gear field is blank. It is also only provided at the annual level, which means a vessel operating in two fisheries – pelagic redfish and demersal trawling, for example – will only have one gear recorded. Catch composition and spatial location of fishing can be used to make "expert judgements" about the fishing activity being undertaken. Two approaches were taken – one where the data is analysed as received, the other where judgement has been applied to estimate which fishery and gear a vessel is operating in, based on its speed profile, location, and catch composition. Both datasets were provided in advance of WGBYC 2022.

Effort was assigned to Métier Level 3 groupings based on which gear a vessel was recorded as using during the year (or assumed to be, using expert judgement). Mappings between gears and métier groups are provided in Table 1.5.

Table 1.5. Mapping between gear codes and level 3 metiers.

Gear	Level 3 Metier
Bottom otter trawl (OTB)	L3TB
Multi-rig otter trawl (OTT)	L3TB
Shrimp trawl (TBS)	L3TB
Midwater otter trawl (OTM)	L3PT
Purse seine (PS)	L3PS
Longlines (LL)	L3LL
Set longlines (LLS)	L3LL
Pots and traps (FPO)	L3FIX
Trammel nets (GTR)	L3GN
Blank	L3NK

Level 4 métier type was a direct copy of the gear code recorded (or assumed) for the vessel, on an annual basis. Vessels with a missing gear code were assigned the code "MIS". Level 5 target species groupings were also determined against gear code and validated against catch composition over the year (Table 1.66). The exception being for vessels fishing with OTB in ICES Subarea 27.1.a, where composition of catches (prawns, CRU, or demersal fish, DEF) was examined as a guide to determine whether a vessel was operating in the CRU or DEF target assemblage métiers. Where gear code had been assigned as miscellaneous (MIS, the target assemblage was determined on the basis of the main species in the catch, with blue whiting, mackerel, herring, and pelagic redfish being assigned to small pelagic fish (SPF), *Pandalus* to CRU, and all others to DEF.

Table 1.6. Mapping between registered (or likely) gear and target assemblage (PRA – prawns; MAC - mackerel, HER - herring, BWH - blue whiting, and REB - pelagic redfish.

Gear	Target Assemblage
OTM	SPF
PS	SPF
OTB	DEF
OTT	DEF
LL	DEF
LLS	DEF
GTR	DEF
FPO	CRU
TBS	CRU
OTB (in Subarea 27.1.a, recording PRA)	CRU
MIS (in Subarea 27.1.a, recording PRA)	CRU
MIS (recording MAC, HER, BWH, REB)	SPF
MIS (recording demersal fish species)	DEF

Examination of the speed field of the VMS data showed that the speed data, which have been problematic in previous years, were of usable quality. Fishing effort is inferred from VMS data based on speed, with pings at slower speeds deemed to represent fishing activity, and those at faster speeds to represent steaming and/or searching. In this instance, speeds of 1-6 knots or lower were used to demarcate fishing from non-fishing pings for bottom trawl gears (Figure 1.2). It should be noted that NEAFC use an upper threshold of 5 knots for inference of fishing activity by mobile gears, therefore some differences in perception should be anticipated. VMS data is known to be a poor estimator of effort for static gear fisheries, given the possible overlap between setting, hauling, and steaming speeds (e.g. Figure 1.2), the long interval between VMS polling relative to the time spent deploying and hauling gear, and the lack of correlation between the time a static gear is "fishing" and the time spent shooting or hauling it. Consequently, "hours fished" have not been calculated for static gears, and "hours on ground" is felt to be a more representative measure of activity by these fleets (Table 1.4).

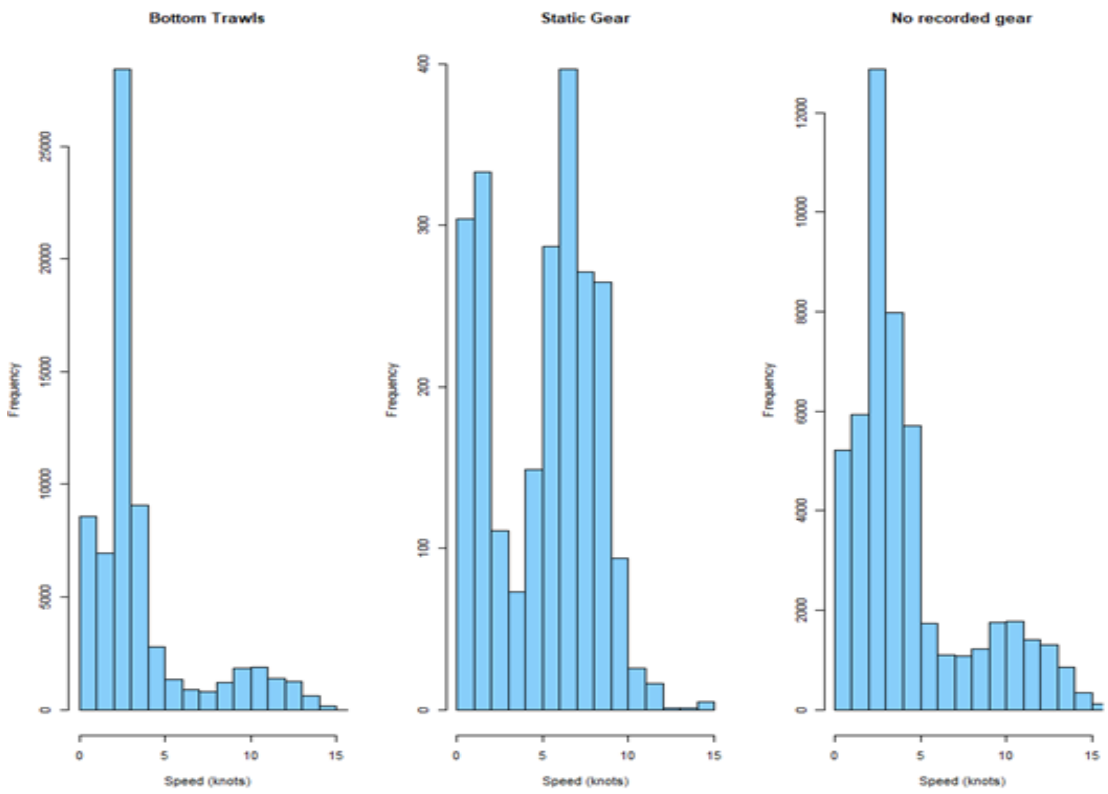

Figure 1.2. Histogram of derived speeds for vessels recorded as using bottom trawls, static gears, and without a specified gear type, based on position and time, conforms to expected distribution.

2 Preliminary conclusions

2.1 Monitoring of bycatch of seabirds in fisheries in the NEAFC RA

Systematic collection and reporting of data on seabird bycatch are essential. The EU's Action Plan for reducing incidental catches of seabirds in fishing gears states that a precautionary approach should be adopted where information is lacking or uncertain on seabird bycatch, and that a more extensive monitoring of fisheries falling into this category (a minimum 10% observer coverage in the short term should be aimed for) should be undertaken (European Commission, 2012).

In order to identify whether seabird bycatch is a problem at all in a fishery, sufficient monitoring should be established as soon as possible, recording both fishing effort and bycatch occurrences at the lowest taxon possible (ideally, at species level). It is recommended that observer data are routinely submitted to scientific bodies to facilitate analysis of observer programme data. Using a standard reporting format for recording seabird bycatch and to compile this as soon as possible in one place, e.g. in a database of seabird bycatch, would facilitate timely analysis by relevant experts. It is important to encourage the implementation of monitoring programmes and methods that produce unbiased data useful for further statistical analyses (notably including electronic monitoring and trained observers as suggested above, ICES, 2019, 2021c). As a start, monitoring of high-risk métiers for seabird bycatch such as gillnets and longlines could be prioritized. In addition, training on seabird species identification for observers at sea should be promoted.

Seabird species feed preferably in areas where prey densities are highest to maximise foraging efficiency and, in turn, many seabird species foraging at sea show a clumped distribution. As a result, monitoring studies generally show high spatial and temporal clustering of seabird incidental catches (Lewison *et al.*, 2014). Nevertheless, bycatch studies often concern areas relatively close to shore and not high seas like the NEAFC region (e.g. Bærum *et al.*, 2017; Glemarec *et al.*, 2020; Cleasby *et al.*, 2022; De la Cruz *et al.*, 2022). In high-sea areas, seabirds are generally observed at relatively low densities (Fauchald *et al.*, 2021), despite at least one major regional hotspot in the North Atlantic (Davies *et al.*, 2021). That said, and because fishing activities act as attractors for at least some species in their nonbreeding habitats (e.g. Bodey *et al.*, 2014; Clay *et al.*, 2019), there is a non-negligible probability that multiple seabird individuals would be involved in each single bycatch event. However, seabird bycatch events (i.e. occurrence of seabird bycatch during a fishing activity) might still be relatively rare. These aspects of seabird bycatch need to be considered when estimating mean bycatch with accompanying uncertainties. This presents challenges for obtaining good monitoring data and producing reliable mortality estimates as the data should be representative of the full statistical distribution of bycatch events. This is especially true in areas and fisheries with low observer coverage. In some species/areas, bird bycatch can be considered mainly seasonal and this has important implications when extrapolating monitoring data to fishing fleet effort data; ideally a monthly presentation would be preferable (ICES, 2022d).

To monitor bycatch of seabirds on all vessels fishing in the NEAFC RA, observers (and perhaps ship crews in the case of self-sampling) might make use of the list of seabirds of bycatch relevance for the Oceanic Northeast Atlantic agreed by ACOM and included in the Roadmap for ICES bycatch advice (ICES, 2022c).

2.2 Potential production of seabird risk maps

As ICES has access to the VMS data provided by NEAFC from the vessels operating in the NEAFC RA, these data could be used to estimate fishing effort. Associated with available bird distributions maps, ICES may be able to produce preliminary risk maps that would inform fisheries managers and highlight areas/métiers where future dedicated monitoring might be most effectively focussed. However, as there are limited bird abundance surveys for this area which could be used for risk-mapping, the use tracking data could be explored for this purpose (e.g. http://seapop.no/en/seatrack/, where a number of species vulnerable to bycatch are shown in seasonal distribution patterns; ICES, 2022d).

2.3 Fishing effort analysis

The quality of the data provided to ICES by NEAFC has grown markedly in recent years enabling more precise linking of vessel catches to corresponding activities, enabling provision of better-informed and more precise advice based on the VMS and logbook data supplied.

After consultation with the NEAFC Secretariat on the methods used in this analysis, it seems a key difference in approach is the use of the gear code field. The species composition of the catch targeted by midwater trawlers (e.g. blue whiting, mackerel and herring) does not overlap with those recorded in catches taken with demersal gears (e.g. haddock, *Pandalus*). The catch composition by species provided in catch reports (as opposed to the gear information) is used to determine if a vessel is engaged in bottom or midwater fishing. While this may be a valid approach when looking at the distribution of bottom trawling, it does not provide data (e.g. gear type, mesh size, selectivity devices) at a sufficiently granular level to align with the métier-based approach required for seabird bycatch analysis. The approach using expert knowledge to assign or correct a gear type was discussed. While it was noted that the results appeared to improve, the feeling was that there were risks associated with imputing data and false perceptions of precision, and that this would require further exploration before use in advisory products.

ICES plans to conduct a comparison of NEAFC and ICES data call VMS products, primarily in support of the analysis of bottom fishing in and around areas identified as VMEs, the reason being that the ICES data are available to métier level 6, providing a more precise reflection of fishing activity and associated impacts. Key differences between the data sets include polling frequency, availability of gear and catch information, and the countries contributing to each data set. This comparison is part of the 2022-2024 WGSFD work plan.

One feature which emerged during the analysis was the observation of effort by vessels fishing with longlines in very deep waters (i.e. too deep for commercial bottom fishing) to the northwest of Josephine Seamount. This fishing effort was not associated with NEAFC catch reports, and presumably was targeting species under the management of ICCAT and so working according to a different set of standards, with data communicated via an alternative route. This data gap creates a risk that, at an ecosystem level, potential bycatches and subsequent impacts on ecosystems could be missed or misinterpreted by only considering VMS and catch data from NEAFC. While formal collaboration between RFMOs on such an issue may be a difficult task, it may be the case that this problem could be explored using existing data received through the ICES VMS data call and could be included in a request relating to the point above.

References

Bærum, K.M. et al. (2017) 'Spatial and temporal variations in seabird bycatch: Incidental bycatch in the Norwegian coastal gillnet-fishery', PLoS ONE, 14(3). Available at: https://doi.org/10/ggkz9g.

European Commission. 2012. Action Plan for reducing incidental catches of seabirds in fishing gear, Brussels, 16pp.

ICES. 2019. Joint WGBYC-WGCATCH Workshop on sampling of bycatch and PET species (WKPETSAMP), 24–26 April 2018, SLU Aqua, Lysekil, Sweden, ICES CM 2018/EOSG:35. 76 pp. https://doi.org/10.17895/ices.pub.8183

ICES. 2020. Working Group on Bycatch of Protected Species (WGBYC). ICES Scientific Reports. 2:81. 216 pp. http://doi.org/10.17895/ices.pub.7471

Bodey, T.W. et al. (2014) 'Seabird movement reveals the ecological footprint of fishing vessels', Current Biology, 24(11), pp. R514–R515. Available at: https://doi.org/10.1016/j.cub.2014.04.041.

Clay, T.A. et al. (2019) 'A comprehensive large-scale assessment of fisheries bycatch risk to threatened seabird populations', Journal of Applied Ecology, 56(8), pp. 1882–1893. Available at: https://doi.org/10/ggmpg8.

Cleasby, I.R. et al. (2022) 'Assessing bycatch risk from gillnet fisheries for three species of diving seabird in the UK', Marine Ecology Progress Series, 684, pp. 157–179. Available at: https://doi.org/10.3354/meps13944.

Davies, T.E. et al. (2021) 'Multispecies tracking reveals a major seabird hotspot in the North Atlantic', Conservation Letters, 14(5), p. e12824. Available at: https://doi.org/10.1111/conl.12824.

De la Cruz, A. et al. (2022) 'Correlation between seabirds and fisheries varies by species at fine-scale pattern', ICES Journal of Marine Science, p. fsac170. Available at: https://doi.org/10.1093/icesjms/fsac170.

Fauchald, P. et al. (2021) 'Year-round distribution of Northeast Atlantic seabird populations: applications for population management and marine spatial planning', Marine Ecology Progress Series, 676, pp. 255–276. Available at: https://doi.org/10.3354/meps13854.

Glemarec, G. et al. (2020) 'Assessing seabird bycatch in gillnet fisheries using electronic monitoring', Biological Conservation, 243, p. 108461. Available at: https://doi.org/10.1016/j.biocon.2020.108461.

ICES. 2020. Working Group on Bycatch of Protected Species (WGBYC). ICES Scientific Reports, 2:81. http://doi.org/10.17895/ices.pub.7471.

ICES. 2021a. Data call for ICES advisory work related to bycatch of protected species (WGBYC-2021).. ICES Data Calls. https://doi.org/10.17895/ices.data.18600254

ICES. 2021b. Working Group on Bycatch of Protected Species (WGBYC). ICES Scientific Reports. 3:107. 168 pp. https://doi.org/10.17895/ices.pub.9256

ICES. 2022a. WGBYC Data call 2022: Bycatch of protected species for ICES advisory work. ICES Data Calls. https://doi.org/10.17895/ices.data.19745809

ICES. 2022b. Working Group on Bycatch of Protected Species (WGBYC). ICES Scientific Reports. Report. https://doi.org/10.17895/ices.pub.21602322

ICES. 2022c. Road map for ICES bycatch advice on protected, endangered, and threatened species. In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, section 1.6. https://doi.org/10.17895/ices.advice.19657167

ICES. 2022d. Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD; outputs from 2021 meeting). ICES Scientific Reports. 4:89. https://doi.org/10.17895/ices.pub.21602508 In preparation

ICES. 2022e. ICES Data call 2022 - Data submission of VMS/Log book data. Browse ICES content by Type. Report. https://doi.org/10.17895/ices.pub.19249019.v1

Lewison, R.L. et al. (2014) 'Global patterns of marine mammal, seabird, and sea turtle bycatch reveal taxa-specific and cumulative megafauna hotspots', Proceedings of the National Academy of Sciences, 111(14), pp. 5271–5276. Available at: https://doi.org/10.1073/pnas.1318960111.