Report of the NAMMCO Scientific Committee Working Group on By-Catch

Video conference
31 October 2018

Please cite this report as:
NAMMCO-North Atlantic Marine Mammal Commission (2018) Report of the NAMMCO Scientific Working Group on By-catch, October 2018. Available at https://nammco.no/topics/sc-working-group-reports/

NAMMCO
Postbox 6453, Sykehusveien 21-23, N-9294 Tromsø, Norway, +47 77687371, nammco-sec@nammco.no, www.nammco.no, www.facebook.com/nammco.no/, https://twitter.com/NAMMCO_sec

The **NAMMCO Scientific Committee Working Group on By-Catch** held a video conference on 31 October 2018. The Working Group was convened by Geneviève Desportes (NAMMCO Secretariat) and chaired by Kimberly Murray (NOAA, US, Invited Expert). A list of participants is contained in Appendix 1. Simon Northridge (UK, Invited Expert) could not participate to the meeting, but had provided comments on the documents to be reviewed ahead of the meeting.

1 OPENING REMARKS

General Secretary Geneviève Desportes welcomed the delegates to the meeting on behalf of NAMMCO.

This meeting was a follow up of the April meeting. The specific task for this was to review the updated analysis of the Icelandic and Norwegian by-catch data in response to the recommendation of the WG formulated at its 2017 meeting (Iceland and Norway) and at its 2018 April meeting (Iceland) as well the implementation of the recommendations addressed to the Faroe Islands at the 2017 meeting and reiterated at the April 2018 meeting, with the order of priority defined under point 4.

Chair Kimberly Murray (NOAA, Invited Expert) welcomed the participants to the third meeting of the NAMMCO By -Catch Working Group (BYCWG), which follow up on the discussions from the two first meetings.

2 ADOPTION OF AGENDA

The draft agenda (Appendix 2) was adopted without changes.

3 APPOINTMENT OF RAPPORTEURS

Solveig Enoksen and Geneviève Desportes from the Secretariat were appointed as rapporteurs, with the help of participants where needed.

4 TERMS OF REFERENCE

ToRs for the meeting were the following, given in order of priority and depending on time:

Review of the

- Icelandic by-catch estimate for cod gillnet (porpoises and seals)
- Norwegian by-catch estimate (porpoises and seals) for the ten-year period 2006-2015
- Faroese update on progress in implementation of the WG recommendations from May 2017
- Parties updates on the collation of effort and by-catch reporting from foreign vessels fishing in national waters (WG recommendation from April 2018).

The WG dealt with point 1, point 2 for harbour porpoise by-catch, got a short update on point 3 and did not have time to deal with point 4.

The upcoming NAMMCO meetings that are relevant for the Working Group on By-Catch are the Joint IMR/NAMMCO International Workshop on the Status of Harbour Porpoises in the North Atlantic (WSHPNA) on 3-7 December 2018, and the next meeting of the Coastal Seals Working Group in spring 2020. As the Workshop is coming up shortly, the WG should aim at providing estimates, at least preliminary, of harbour porpoise by-catch for Iceland and Norway.

5 REVIEW OF AVAILABLE DOCUMENTS AND DATA

Documents available for the meeting are listed in Appendix 3.

6 ICELAND

Sigurðsson (Iceland) reviewed document **SC/25/BYCWG/03** presenting three revised and updated estimates of by-catch, which included the estimate presented before (stratification by statistical square and month based on survey data from 2013-2016), as well as two new non-stratified estimates based on data from inspectors and the Survey data, respectively, from 2013-2017.

Author's summary

The main changes made were due to requests from the working group and those include a map showing fishing effort in gillnets (Figure 1c), map showing the area sampled during the cod gillnet survey (Figure 2), fishing effort by month (Table 2), inclusion of fishery inspector data, inclusion of data from 2017, and two new methods of analysis. Previously presented analysis based on spatially stratified cod gillnet survey data adjusted for seasonality in abundance was then included for comparison.

The first analysis was a raw non-stratified method, using cod survey data raised by effort, while the second analysis was done the same way except fishery inspector data was used instead of the survey data. These two analyses were then compared with the previously presented analysis and logbook records.

The most common bycaught marine mammal was harbour porpoise, in the survey, records by inspectors and logbook records, followed by several seal species that were much rarer than porpoises in the three sources of data (with notable exception of the logbook records that reported similar numbers of harbour seals and harbour porpoise). The results of the two analyses/raising methods based on the survey data were largely similar, both for porpoises and seals, while the analysis based on inspector data and logbook records resulted in much lower values.

Raised porpoise numbers in the analyses based on the gillnet survey data were around 1800 porpoises annually, which is similar to the study by Pálsson et al (2015), which reported 1600 porpoises caught annually from 2009-2013. Meanwhile, the raised porpoise estimate based on the 2014-2017 inspector data was 223 porpoises annually and around 35 porpoises were reported annually by the fleet in logbooks.

Harbour seals and grey seals were reported in log books, but very uncommon in both survey and inspector data, this could be a misidentification issue.

Overview of estimates compared to BYCWG April 2018

Recommendations from BYCWG 2018 are listed in Section 9.1.2.1. Some of these recommendations were incorporated into the updated report (SC/25/BYCWG/03) provided to the WG. The WG recommended that 2017 data be included from the April cod gillnet Survey. The 2017 data were included in 2 of the 3 estimation approaches reported; however, 2017 data were not included in the approach which stratified by statistical square and month. The WG recommended that observer data be explored to check the assumption that porpoises are only "available" in March-June. These data were provided and demonstrated that porpoises also caught in Feb-April. The WG recommended that cod gillnet fishing effort be provided by month to see if it was low in months outside of April - June; these data were provided and showed that fishing effort is as high or higher compared to April – June. Lastly, the WG recommended that a map of cod gillnet bycatch and effort be provided. A map of effort was provided but did not include reported bycatch.

6.1 Comments and discussion of by-catch of harbour porpoises in cod gillnets

Written comments on the Icelandic estimates were provided by WG members. While discussion around some of these comments are captured in this report, the WG **recommended** that responses to each set of comments be circulated by Iceland to WG members prior to the next meeting.

The WG expressed concern that the April cod gillnet Survey (called Survey onwards) data, which are being used to infer bycatch rates over the entire coastline throughout the year, may not be representative of fishing effort in other times and areas.

There were questions regarding how representative the cod Survey is to the rest of the fishery. For instance, the WG noted that a high by-catch of fulmars is reported in the Survey data, while such by-catch is not present in the inspectors[1]' data. This suggests that the Survey effort could be fishing different mesh, or perhaps different areas, compared to the rest of the fleet. Sigurðsson explained that the fishing fleet do not gut the fish on deck while setting the nets, while this is done during the Survey. Gutting the fish attracts more birds, resulting in a higher by-catch rates of birds. The Survey uses the same gear as the rest of the fleet, a mix of mesh 8/9" to catch cod (to be salted) and mesh 6/7" for smaller fish.

The Survey (which uses regular gillnetting vessels) fishes in an area used by the fleet, but in the second half of April the fleet does not fish there because of seasonal closures around Iceland to protect the spawning cods (closure periods: West 1-21/04; North 15-30/04, South West 12-21/04). This means that the Survey has access to porpoises that would not be available to the fleet, although 5 out of 10 porpoises recorded by inspectors were recorded in April and 10 out of 134 logbook entries. Only in the North and in the Southwest do the fleet and the survey overlap in the first half of April. Therefore, the WG was concerned that the survey data (with an effort corresponding to 1% of that of the fleet) may not represent normal fishing activity, because part of the fleet cannot fish in the same area.

For the non-stratified estimates and the stratified estimates where bycatch rates have been adjusted by the abundance index, the April bycatch rate calculated from the Survey is assumed to be the same in all other months. This relies on the assumption that the Survey is representative of commercial effort in other months. However, although April is by far the highest month if inspector data is used, there are higher reported bycatch of harbour porpoise in March from logbooks (as shared on the call) and higher fishing effort in the month of March, compared to April. Therefore, bycatch rates may vary by month.

The WG noted that the results of both the stratified and non-stratified estimates using the Survey data were very similar for harbour porpoises (1841 and 1836 porpoises a year respectively, Table 5 and Table 3). Given that the abundance of porpoise varies by month, it is surprising that the stratified estimate adjusted for porpoise abundance is nearly the same as the unstratified estimate. One would expect the stratified estimate to be lower as porpoises are not present in some months, but it was difficult to evaluate the stratified results from the summarized results presented.

The WG **recommended** that the bycatch rates be reported by month and statistical areas, adjusted for availability, to follow the derivation of the estimate reported in Table 3. If 2017 data could be added in at the same time, that would allow the WG to compare to the other 2 estimates which used the 2013-2017 time series.

The WG **did not endorse** any of by-catch estimates presented for harbour porpoises in Iceland and the recommended analyses should be presented to the BYCWG at its next meeting before an estimate can be endorsed. The WG strongly **recommended** that detailed information on the calculations be provided in the next report, rather than the summary format provided, so that the bycatch estimates can be more easily appraised and recommendations made if necessary.

However, regarding the need for information on harbour porpoise by-catch rates off Iceland for the upcoming WSHPNA, the WG agreed that as an interim measure the stratified estimate presented here, i.e. 1841 porpoises a year, could be considered as an upper bound for the by-catch in cod gillnets for the period 2013-2017. This estimate presumes that April bycatch rates are indicative of activity in other months and is based on the porpoise availability index which might need some more tweaking. The WG is therefore concerned, that the harbour porpoise bycatch estimate for cod gillnet might be lower than the presented stratified estimate.

6.2 Comments and discussion on by-catch of seals in cod gillnets

The WG found it difficult to evaluate the quality of the seal bycatch estimates due to the uncertainties in the species recorded in the data. There are discrepancies between the species reported and their relative proportions in the April Survey, by the inspectors and in the logbooks. For instance, the Survey

[1] Icelandic fisheries inspectors correspond to what is called observers in other countries, but they have in Iceland the authority to fine or charge the vessels with criminal offenses.

reported only 1 harbour seal and 0 grey seal during 2014-2017; inspectors reported 1 harbour seal and 1 grey seal; logbooks reported an average of 33 harbour and 11 grey seals per year. Grey seals were reported in logbooks in April, so it is not because logbook data were collected in different months. Out of the 16 grey seals reported by the logbook, 11 were caught in April. This suggests estimates from the Survey or inspectors are under-estimates, or species ID in the logbooks are poorly recorded.

Harp and ringed seals are vagrant and thus exhibit an interannual variability in presence. This was also noted for Norway, where they have had only one harp seal by-caught in 2 years, while there were 60.000 by-caught in 1986/87 in gillnet fishing for migrating cod (Haug et al 1991).

There might also be a seasonal effect for some species. It could be interesting to look at market data if that is available to see when the different species were brought to the market. The difference between the inspectors' data and the Survey data may also come from the fact that any bycatch on the Survey is brought onboard, while the inspectors might not always see the by-catch event on the boat and the animals are not brought onboard for good identification.

Sigurðsson indicated he had more confidence in the species recorded in the Survey dataset, because the observers on those surveys are trained well in species ID. The fact that there are almost twice as many harbour seals in Iceland as there are grey seals, could also contribute to the zero by-catch estimate of grey seals, the zero not being a true zero but indicative of the seasonal sampling and limited effort.

If the Survey data are considered the best available with respect to the species of bycatch reported, the same issues as those mentioned for porpoise apply here. If April rates are not representative of bycatch in other months, either the stratified or non-stratified bycatch could be biased. There are likely not any other reliable data to use for seal estimates, so this caveat about April rates should be noted.

The WG **recommended** that the manuscript clarifies the stratification scheme and calculation used for seals (which is different than porpoise because a seal abundance index is not available). The WG recommended that the stratified estimates use data from 2014-2017, and that the estimates be reported for each stratum (as was recommended for the porpoise estimates) so the WG can understand the bycatch calculations.

It was pointed out that in Norway it is mostly young seals, less than a year, which are by-caught, which makes species identification even more difficult. The WG **recommended** that the species identification on the logbooks be improved, perhaps with a picture of the species at different life stages appearing when the species identification is to be entered in the logbook.

The WG **did not endorse** any of the by-catch estimates presented for seals in Iceland and the recommended analyses should be presented to the BYCWG at its next meeting before an estimate can be endorsed.

7 NORWAY

Arne Bjørge introduced André Moan as his PhD student working on by-catch monitoring and mitigation. For this meeting, the focus would be on harbour porpoises. An estimate for the coastal seals will be prepared in time to be reviewed by the WG before the Coastal Seal WG in 2020.

7.1 Norwegian by-catch estimate for the ten-year period 2006-2015

Moan reviewed documents **SC/25/BYCWG/04-06,** presenting the harbour porpoise by-catch estimate for 2006-2015 and addressed recommendations from the 2017 WG meeting.

Authors' summary of their presentation

GLM/GAM vs. stratified ratio approach

We used a stratified ratio and a modelling approach to estimate bycatch rates. In the modelling approach, we tried modelling bycatch with Poisson, zero-inflated poisson (ZIP) and negative binomial (NB) distributions using GLMs. The model AIC comparisons and QQ plots suggested an NB model was the

best fit, but a Poisson model gave the most sensible predictions. We also think that vessels must be included in the models as a random effect to account for inter-vessel variation, and this has not been done yet. For these reasons, we believe that it is best to defer to the stratified ratio bycatch estimates until such a time that the modelling problems can be solved.

Estimating effort in the coastal fleet.

We used cod and monkfish landings from a subset of vessels from the coastal fleet of small vessels (< 15 m length overall) (henceforth "reference vessels", collectively comprising the "coastal reference fleet", the CRF) as a proxy for effort. Reference vessels provide detailed fish logs, including catch composition, number of nets, net mesh size, net soak time and fishing coordinates. Therefore, for these reference vessels, we could calculate CPUE directly. However, the data that we have been provided from the Norwegian Directorate of Fisheries only includes cod and monkfish landings summed over years, months and areas.

Ordinary (non-reference) vessels less than 15 m length do not provide detailed fish logs. It is our understanding that information about the number and mesh size of the nets used is not available for these vessels. As pointed out by the NAMMCO Working Group, gillnets catch a variety of species, and not just the ones intended. Using cod and monkfish landings as opposed to total landings would overestimate the bycatch rate. Therefore, total landings taken with "cod and monkfish nets" matched the type and quantity of landings sampled by the CRF used in the calculation of bycatch rates.

The reason that we opted to use only cod and monkfish catch is because we wanted to be able to apply the estimated bycatch rates from the CRF to the entire coastal fleet. To do this, we had to use information that was available in both sets of fish logs (i.e. fish logs from the CRF and from ordinary vessels). Therefore, it must be emphasized that our bycatch estimate is *only* for the Norwegian coastal cod and monkfish gillnet fisheries, and *not* for the entire coastal fisheries.

Stratification of data

In our models and in our ratio approach we stratified data according to one or more of three temporal variables (year and/or month or year and/or season) and one of two spatial variables (area or region). The cod and monkfish fisheries are distinctly seasonal, with the former occurring in the first half of the year and the latter in the last half of the year. We therefore divided the year into two seasons. Adjacent areas were combined into regions to model bycatch on a coarser scale. The nine areas used were of comparable sizes, and taken together, they covered the entire Norwegian coastline.

The distribution of vessels in the coastal reference fleet is such that each of these nine areas have at least two vessels. Fish landings from Directorate of Fisheries are also summed by these same areas. We therefore consider these nine statistical areas the finest possible (i.e. highest resolution) spatial scale by which we can model bycatch. We agree that it may have been possible to use other definitions of areas, based on biological assumptions, to estimate bycatch rates. But we think that the usability of such an estimate would be limited, because it would not be possible to use it to extrapolate to the entire coastal fishery fleet. As far as we know, non-reference vessels in the coastal fleet do not report fine positional data for their fishing activities.

Future work

We have been limited in our bycatch estimation to work with aggregated cod and monkfish landing data that we obtained from the Directorate of Fisheries. We intend to contact the Directorate of Fisheries to get a better overview of what data are available for non-reference vessels. In particular, whether it is possible to get individual fish logs associated with each vessel (anonymized), or in some aggregated form, so that the number of fishing trips or the number of hauls and associated fishing logs for individual vessels can be obtained. We would also like to determine to what extent information about the mesh sizes and number of nets used is available for non-reference vessels. We already know that the

Directorate of Fisheries have decided that, over the next four years, ALL vessels fishing in the coastal zone will be required to provide coordinates of fishing locations in their fish logs[2].

Additionally, we will look into estimating bycatch rates for the entire coastal gillnet fishery, not just the cod and the monkfish fisheries. We believe that most harbour porpoises are bycaught in the cod and monkfish fisheries, but we know that bycatches do occur in other fisheries as well.

WG comments and discussion

Written comments on the Norwegian estimates were provided by WG members. While discussion around some of these comments are captured in this report, the WG recommends that responses to each set of comments be circulated by Norway to WG members prior to the next meeting.

Norway explained that they are still looking at cod and monkfish fisheries, using gill nets with mesh sizes 75-105 mm (cod) and 180 mm (monkfish). For each stratum, the rates and total bycatch is calculated separately for each fishery, then sum the estimates together when reporting total. For the rest of the fleet (non CRF vessels) they are using data from the logbooks as provided by the Directorate of Fisheries, using only monkfish and cod landings. However, while monkfish gillnets catch only monkfish, cod gillnets catch cod and some other species, but in smaller quantity. At least another fishery takes harbour porpoises, the lumpsucker fishery for which there are no data yet, but it is a seasonal fishery limited in time, area and effort.

Moan pointed out that the analysis only encompasses vessels <15 m. Norway can explore the possibility of including other vessel sizes with the Directorate of Fisheries, but there are restrictions on larger vessels fishing with gillnet in the coastal zone. The WG **recommended** that the possibility of including larger vessels be explored.

Landings were used to produce the estimates in Table 2 in doc **SC/25/BYCWG/04**, because until now this has been the only information available from the Directorate of Fisheries. The authors are presently investigating whether further information exists.

There are no good data on number of trips, as vessels <15 m are not required to report this. For the cod fishery, trip numbers could be assumed based on number of hauls, but this cannot be done for the monkfish fishery. Some fisheries only include one haul. The WG pointed out that this should be made clearer in the text.

The present approaches used to calculate the bycatch estimates in the CRF do not take into account variation between fishing vessels. Every haul is considered an independent observation. To explore a 'vessel effect', hauls should be grouped by fishing vessels, e.g. by adding the vessel as a random effect term in a GLMM. The WG **recommended** that the inter-vessel variation was explored and captured in the stratification and the model if further modelling was performed.

The WG **remained concerned** that the bycatch rates reflect only cod and monkfish landings, and not all landings caught in bottom-set gillnets with meshes ranging from 75-105mm (i.e. "cod"), or with 180mm (i.e. "monkfish"). The porpoise will get caught in the net regardless of what the net is catching, so rates could actually be lower if other fish species are caught in these mesh sizes (which it looks like they do from Appendix 3 in document #6). It is appropriate that only cod and monkfish landings were used to expand the rates to derive total bycatch, but it is difficult to evaluate whether total bycatch might actually be higher or lower without knowing the amount of total landings of all species. The WG **recommended** that this potential bias in the by-catch rate be acknowledged in the manuscript.

There is harbour porpoise bycatch occurring in other fisheries which are not included in the cod and monkfish bycatch estimate provided. The authors mention that 16% of harbour porpoises caught in the CRF data are "in other fisheries" (line 211 of document #4) but do not elaborate further. The authors should detail which other fisheries in the manuscript. The WG **recommended** to address this missing portion of bycatch (the 16% in other fisheries) in future analyses, as well as the by-catch in the lumpsucker fishery.

[22] See article in Norwegian: https://www.fiskeridir.no/Yrkesfiske/Nyheter/2018/0918/OEnsker-mer-data-fra-fiskeflaaten

It is not clear which unit of effort was used to produce the estimates in Table 2, either landings or trips. In line 114 of document #4, it mentions both. Comments were provided by the WG for improving the manuscript, including: a) specify that landings are used to provide the estimates in Table 2 (as only data are available from the Directorate of Fisheries); b) the stratification schemes listed should also explicitly mention whether year is used (as mentioned on line 161), as this is not explicit from lines 120-121.

Including year in the stratification scheme would account for annual changes in the bycatch rate due to variation in landings (apparent in Appendix 1, doc #6), and allow estimates to be reported out by year which provides some information about a trend (as asked to be provided by the WSHPNA). The WG **recommended** that year be including in the stratification if it had not been already.

The finest stratification level was area x month (which had a maximum estimated bycatch of 2926 porpoises). This may be over stratified, in which case further grouping by region and/or season seemed reasonable.

Acknowledging the caveats in document #1, the WG **agreed** that ratio estimates in Table 2 stratified by both time and area seemed reasonable to use for the WSHPNA but remains a **preliminary estimate, pending further review** as recommended by the WG. The WG **recommended** that a revised ratio estimate be presented to the WG at its next meeting. As there are some smaller fisheries that also by-catch harbour porpoises, although likely on a smaller scale, this will be an underestimate, which also needs to be underlined.

8 FAROE ISLANDS

Mikkelsen gave an update on the Faroe Islands. There was not much to update, as the recommendations from May 2017 were not implemented yet.

One positive thing though was the placement of observers on the pelagic fleet for mackerel and blue whiting. These observers had in their protocol the mandatory reporting of marine mammal by-catch. The data gathered in summer 2018 had not been analysed yet.

The BYCWG noted this and reiterated the recommendations formulated at its 2017 and April 2018 meetings.

9 RECOMMENDATIONS

9.1 Review of implementation of recommendations 2017 and 2018-April

Due to time limitation and technical problem with the connection, the WG did not review in detail the implementation of previous recommendations but see under point 6. for Iceland

9.1.1 Recommendations from BYCWG 2017 for Faroe Islands, Iceland and Norway

9.1.1.1 Norway

Harbour Porpoise

The ratio estimates as presented in SC/24/BYC/Info07 be preferred over the model-based approaches for reasons mentioned above.

Revisions per the Technical Comments listed in Appendix 1, and that these be addressed and endorsed prior to the Harbour Porpoise WG Assessment in late 2018.

Grey and Harbour Seals

The ratio estimates as presented in SC/24/BYC/Info07 be preferred over the model-based approaches for reasons mentioned above.

Revisions per the Technical Comments listed in Appendix 1, and that these be addressed and endorsed prior to the Coastal Seals WG Assessment in 2019.

In in the mark-recapture estimation approach, analysts consider the implications of different age structures between the tagged, harvested sample and the by-catch sample.

9.1.1.2 Iceland

Cod Fishery

The uncertainty around the estimates be re-evaluated, such as with a bootstrap approach. These revisions should be completed and endorsed by the group prior to the Harbour Porpoise WG Assessment meeting in 2018, and the Coastal Seals WG Assessment meeting in 2019.

Iceland conduct monitoring of the monkfish and Greenland halibut gillnet fishery, as by-catch has been observed in this type of gear in other areas.

9.1.1.3 Faroe Islands

Regarding by-catch reporting

1.1. Add selection of local marine mammal species to e-logbook design, so species identification can be easily reported.

1.2 Implement a reporting system for vessels below 15 GMT, as also recommended by the previous BYCWG.

Regarding by-catch observation

2.1 Improve reporting of by-catch on pelagic pair trawl fisheries by monitoring vessels in the fleet with an electronic monitoring video system (EM) or onboard observers. Electronic Monitoring might be more cost-effective than an observer scheme, particularly because only 5 vessels operate in the pelagic pair trawl fishery, and likely only a few hours per fishing trip need to be observed and videoed. The use of the EM could also be rotational. These fisheries are difficult to observe due to the high volume of catch and the multi-vessel nature of the fishery, so attention must be given to where the observer or cameras are placed and to the stage of the haul.

2.2 Implement observer coverage in other fleets with potential for by-catch, such as the high vertical opening trawl fleet (6 vessels).

2.3 Review the data already collected by fishery observers on the monkfish fishery during an experimental monitoring of the fishery prior to 2015.

9.1.2 Recommendations from BYCWG 2018 (Faroe Islands and Iceland)

9.1.2.1 Iceland

Harbour porpoise – cod gillnet

1.1 - Include the 2017 data from the April cod gillnet Survey

1.2 - Explore the observer data from 2015 and 2017 – especially, check if observers recorded harbour porpoise bycatch in other months to check the assumption that porpoises are only "available" in May/June. It would also be helpful to determine the level of observer effort each month.

1.3 - Provide cod gillnet fishing effort by month. If the effort is very low in the months outside of April-June, then it is likely that the by-catch rate is low as well.

1.4 - Create a map for cod gillnet by-catch and effort like the one generated for lumpsucker net

Seals – cod gillnet

2.1 - To provide a map of the fishing effort around Iceland by month to show whether there is high effort in the months outside of April. This would indicate if it is likely that there is bycatch in other months.

2.2 - Seals are by-caught in the lumpsucker fishery in other months, suggesting that they are present and available to be by-caught by the cod gillnet fishery outside of April. Iceland examine these data (i.e. look in which months the fishing fleet reports the by-catch; look whether/where seal presence and the cod gillnet fishery overlap in space and time).

2.3 - Explore for all species using a broader spatial and temporal scheme for stratifying (e.g., include area/region).

Other fisheries

3.1 - Iceland provide more detail on the amount of observer effort in pelagic trawl fleets which would give more confidence in stating that there is no by-catch in the pelagic trawl fleet.

3.2 - There is also very high observer coverage in the mid-water trawl fleet (10 vessels), however the WG noted that in other areas it is very easy for observers to miss by-catch events in this type of fishery. Iceland should note this caveat when stating that there is little to no by-catch in this fishery.

Lumpsucker fishery – recommendation for future work

4.1 - The analysis did not show a significant difference between randomly and non-randomly selected inspected vessels, however the data should be further explored. Specifically, whether the difference changes if the analysis uses number of by-catch events rather than number of individuals caught should be investigated (i.e., using a binomial analysis with "catch vs no-catch").

4.2 - It is helpful to continue selecting vessels randomly and keeping track of which vessels are selected randomly/non-randomly.

4.3 - The depth stratification would be improved with more consistent reporting, and an agreed consistent definition of how to report the depth.

4.4 - The stratification of management areas could be improved by examining the management areas with high by-catch versus low by-catch. This could be done by reducing the management areas to these 2 strata, and then by month or quarter. This is mostly a spring fishery (from March/April to July/August) and the by-catch is mainly March–May. Collating the data on fewer strata will both improve the estimate and its precision.

Foreign fisheries

1.1 - Any information that is available on by-catch from foreign vessels be presented to the WG.

1.2 - Iceland provide a description of the coverage and by-catch reports, even if there is none, as it provides more evidence that there is little by-catch risk.

9.1.2.2 Faroe Islands

Faroese fisheries

Repetitions of BYCWG 2017 recommendations.

Foreign fisheries

The WG recommended that any information on observers and reports of by-catch by foreign fleet be presented to the next BYCWG meeting.

9.2 New Recommendations for Research

9.2.1 Iceland

Harbour porpoise – cod gillnet

1.1 – Responses to each set of comments be circulated by Iceland to WG members prior to the next meeting.

1.2 – The bycatch rates be reported by month and statistical areas, be adjusted for availability.

1.3 – Detailed information on the calculations be provided in the next report, rather than the summary format provided, so that the bycatch estimates can be more easily appraised, and recommendations made if necessary.

1.4 – Revised analyses be presented to the next WG meeting

Seals – cod gillnet

2.1 – The report clarifies the stratification scheme and calculation used for seals.

2.2 – The stratified estimates use data from 2014-2017, and the estimates be reported for each stratum.

2.3 – Analyses be presented to the BYCWG at its next meeting.

9.2.2 Norway

Harbour porpoises

1.1 – Comments submitted to the authors should be addressed in their revisions and responses circulated by Norway to WG members prior to the next meeting.
1.2 – The possibility of including larger vessels in the by-catch estimation be explored.
1.3 – The inter-vessel variation was explored and captured in the stratification and the model if further modelling was performed.
1.4 – The potential bias in the by-catch rate [of excluding of other landings in the net than cod and monkfish] be acknowledged in the manuscript.
1.5 – The missing portion of bycatch (the 16% in other fisheries) be adressed in future analyses, as well as the by-catch in the lumpsucker fishery.
1.6 – Year be including in the stratification if it had not been already.
1.7 – A revised ratio estimate be presented to the WG at its next meeting.

9.2.3 Faroe Islands

Faroese fisheries

1.1 – Reiteration of recommendations formulated by BYCWG 2017.

9.3 New Other Recommendations

9.3.1 Faroe Islands

Foreign fisheries

The WG reiterated its recommendation from April 2018
1.1 – Any information on observers and reports of by-catch by foreign fleet be presented by Faroe Islands to the next BYCWG meeting.

Logbook

The WG reiterated its recommendation from May 2017 and April 2018
2.1 – Add selection of local marine mammal species to e-logbook design, so species identification can be easily reported.
2.2 – Implement a reporting system for vessels below 15 GMT, as also recommended by the previous BYCWG.

9.3.2 Iceland

Foreign fisheries

The WG reiterated its recommendation from April 2018
1.1 – Any information that is available on by-catch from foreign vessels be presented by Iceland to the BYCWG.
1.2 – Iceland provide a description of the coverage and by-catch reports, even if there is none, as it provides more evidence that there is little by-catch risk.

Logbook

2.1 – The species identification on the logbooks be improved, perhaps with a picture of the species at different life stages appearing when the species identification is to be entered in the electronic logbook.

10 OTHER BUSINESS

There was no other business

11 CLOSING REMARKS, FUTURE STEPS AND ADOPTION OF REPORT

The Chair thanked everyone for their time and input – and their patience towards the technical challenges, which made communication a bit difficult. She appreciated people efforts and the work made in the documents circulated to the working group, both by the authors and the reviewers. She particularly thanked Northridge, who could not attend the video conference, but provided in advance his thorough comments on the analysis presented in the working documents.

She underlined the nest steps

1. Members of the working group should send any written comments about the working documents to the group, today or tomorrow, to compensate for the difficult communication.

2. Desportes, Enoksen and herself will prepare a draft document about this meeting by the end of this week and circulate to the group for feedback. A quick turnaround for review of the draft report was needed (within a few days) as it is needed for the upcoming meeting of the NAMMCO Scientific Committee.

3. A face to face meeting will be held sometime next year, pending availability of information. A review of a revised Icelandic estimate was however also a possibility.

A preliminary report was accepted by correspondence on November 11 and the final report was adopted on November 30th.

References

Tore Haug, Ari B. Krøyer, Kjell T. Nilssen, Karl I. Ugland, Paul E. Aspholm (1991) Harp seal (*Phoca groenlandica*) invasions in Norwegian coastal waters: age composition and feeding habits, ICES Journal of Marine Science, Volume 48, Issue 3. Pages 363–371. https://doi.org/10.1093/icesjms/48.3.363.

Appendices

Appendix 1: List of Participants and List of Documents

Appendix 2: Agenda

Appendix 1

LIST of PARTICIPANTS

Thorvaldur Gunnlaugsson (SC, Iceland), Icelandic Marine and Freshwater Research Institute +354 5752080, thorvaldur.gunnlaugsson@hafogvatn.is

Marjorie Lyssikatos (External Expert), NOAA/Northeast Fisheries Science Centre, USA marjorie.lyssikatos@noaa.gov

Bjarni Mikkelsen (SC, Faroe Islands), Faroese Museum of Natural History + 298 790576, bjarnim@savn.fo

Kimberly Murray (Chair, External Expert), NOAA/Northeast Fisheries Science Centre, USA +1 508-495-2197, kimberly.murray@noaa.gov

Guðjón Sigurdsson (Iceland), Icelandic Marine and Freshwater Research Institute gudjon.mar.sigurdsson@hafogvatn.is

Arne Bjørge (Norway), Norwegian Institute for Marine Research, Oslo arne.bjoerge@hi.no

André Moan (Norway), Norwegian Institute for Marine Research, Oslo Andre.Moan@hi.no

Geneviève Desportes (Convenor) & Solveig Enoksen, NAMMCO +47 95021228, genevieve@nammco.no; +47 92245790, solveig.enoksen@nammco.no

LIST of DOCUMENTS

SC/25/BYCWG/01 Draft agenda

SC/25/BYCWG/02 List of documents and participants

SC/25/BYCWG/03 Bycatch of seabirds and marine mammals in cod gillnets 2013-2017. Short summary for NAMMCO Bycatch working group

SC/25/BYCWG/04 Moan et al. Revised and new estimates of bycatch of harbour porpoise (*Phocoena phocoena*) in two Norwegian gillnet fisheries, 2006–2015

SC/25/BYCWG/05 Anonym. Clarifications in response to NAMMCOs [BYCWG 2017] technical comments

SC/25/BYCWG/06 Anonym. Best estimate for annual harbour porpoise bycatch per area and region 2006-2015 in Norway

SC/25/BYCWG/FI01 NAMMCO**.** 2017. Report of the NAMMCO Scientific Working Group on By-catch, May 2017. Copenhagen, Denmark.

SC/25/BYCWG/FI02 NAMMCO**.** 2018. Report of the NAMMCO Scientific Working Group on By-catch, April 2018. Videoconference.

Appendix 2

AGENDA

1. OPENING REMARKS

2. ADOPTION OF AGENDA

3. APPOINTMENT OF RAPPORTEURS

4. TERMS OF REFERENCE

5. REVIEW OF AVAILABLE DOCUMENTS AND DATA

6. ICELAND

7. NORWAY

8. FAROE ISLANDS

9. RECOMMENDATIONS

9.1 Review of implementation of recommendations 2017 and 2018-April
9.2 New Recommendations for research
9.3 New Other recommendations

10. OTHER BUSINESS

11. CLOSING REMARKS, FUTURE STEPS AND ADOPTION OF REPORT