0 Introduction

0.1 Terms of reference

2018/2/FRSG02 The **Arctic Fisheries Working Group** (AFWG), chaired by Daniel Howell, Norway, will meet in Lisbon, Portugal, 24–30 April 2019 to:

a) Address generic ToRs for Regional and Species Working Groups, for relevant stocks except the Barents Sea capelin, which will be addressed at a meeting in the autumn;

b) For Barents Sea capelin oversee the process of providing intersessional assessment;

c) Address generic ToRs for Regional and Species Working Groups for the Barents Sea capelin stock.

d) Conduct reviews as required of any new time-series computed using the STOX and ECA open source software for use in assessments in the Barents Sea.

The assessments will be carried out on the basis of the Stock Annexes. The assessments must be available for audit on the first day of the meeting.

Material and data relevant to the meeting must be available to the group on the dates specified in the 2019 ICES data call.

AFWG will report by 14 May 2019 and in October 2019 for Barents Sea capelin for the attention of ACOM

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

Generic ToRs for Regional and Species Working Groups

2018/2/ACOM05 The following ToRs apply to: AFWG, HAWG, NWWG, NIPAG, WGWIDE, WGBAST, WGBFAS, WGNSSK, WGCSE, WGDEEP, WGBIE, WGEEL, WGEF, WGHANSA and WGNAS.

The working group should focus on:

a) Consider and comment on Ecosystem and Fisheries overviews where available;

b) For the aim of providing input for the Fisheries Overviews, consider and comment for the fisheries relevant to the working group on:

   i) descriptions of ecosystem impacts of fisheries

   ii) descriptions of developments and recent changes to the fisheries

   iii) mixed fisheries considerations, and

   iv) emerging issues of relevance for the management of the fisheries;

c) Conduct an assessment on the stock(s) to be addressed in 2019 using the method (analytical, forecast or trends indicators) as described in the stock annex and produce a **brief** report of the work carried out regarding the stock, summarizing where the item is relevant:

i) Input data and examination of data quality;

ii) Where misreporting of catches is significant, provide qualitative and where possible quantitative information and describe the methods used to obtain the information;

iii) For relevant stocks (i.e. all stocks with catches in the NEAFC Regulatory Area) estimate the percentage of the total catch that has been taken in the NEAFC Regulatory Area in 2018.

iv) Estimate MSY proxy reference points for the category 3 and 4 stocks

v) The developments in spawning-stock biomass, total-stock biomass, fishing mortality, catches (wanted and unwanted landings and discards) using the method described in the stock annex;

vi) The state of the stocks against relevant reference points;

vii) Catch scenarios for next year(s) for the stocks for which ICES has been requested to provide advice on fishing opportunities;

viii)Historical and analytical performance of the assessment and catch options and brief description of quality issues with these;

d) Produce a first draft of the advice on the stocks under considerations according to ACOM guidelines.

e) Review progress on benchmark processes of relevance to the Expert Group;

f) Prepare the data calls for the next year update assessment and for planned data evaluation workshops;

g) Identify research needs of relevance for the work of the Expert Group.

Information of the stocks to be considered by each Expert Group is available here.

0.2 Additional requests

At its 47^{th} meeting in October 2017, the Joint Norwegian-Russian Fisheries Commission (JNRFC) made the following request to ICES (Annex 17 to the protocol, request I was answered in 2018).

"JNRFC asks ICES to evaluate the impact of bycatch regulations for shrimp in the Barents Sea on the stocks of Sebastes mentella and Sebastes norvegicus in ICES subareas 1 and 2. This evaluation should be carried out for different levels of bycatch limitations and different levels of shrimp catch. It is suggested that this is added to the terms of reference for the ICES benchmark meeting for redfish (WKREDFISH) which will be held in February 2018. "

This request was considered both during AFWG 2018 and 2019. At AFWG 2019 it was concluded that for *S. mentella*, it is possible to evaluate the effect of such bycatch given the present criterion, for given redfish recruitment and shrimp catch levels. It is planned to provide such advice during 2019. However, evaluating the effect of changing the criterion would require further work, including simulation studies taking into account both biology and knowledge of behaviour of fishers and of the surveillance service. Also uncertainties in all quantities included in the calculations has to be accommodated. Spatial approaches and spatially varying criteria should be investigated in particular for *S.norvegicus*, for which also genetic studies may improve estimates of *norvegicus/mentella* ratio in different areas.

0.3 Responses to Terms of Reference

Under ToR a (address generic ToRs), the stock assessments and advice were conducted according to generic ToRs c and d, while the generic ToR e benchmark review can be found in further down in this introduction and in the haddock section. Work on generic ToRs a and b will be conducted intersessionally as it becomes appropriate.

Tor b and c are handled in detail by the capelin subgroup of AFWG, held in the autumn after the capelin survey. A brief report on the previous capelin assessment is given in this report.

0.4 Benchmarks

No benchmarks were conducted prior to AFWG 2019. A benchmark is planned for haddock prior to the 2020 AFWG. A tentative plan to propose future benchmarks for AFWG was disused at AFWG 2019. NEA cod (and possibly coastal cod) in 2021, and Greenland Halibut in 2022 (following the next assessment in 2021). Then work for a first HCR for GHL prior to the advice in 2023. For NEA cod and haddock work for a revised HCR in 2022 was suggested. These dates should be discussed with Icelandic researchers to see if there can be international cooperation there. Capelin will need a benchmark at some point, as work is underway to revise the assessment methodology, however no data were proposed at this meeting, and cooperation with Iceland was thought advisable.

0.5 Unreported landings, discards, bycatch, and uncertainties in the catch data

0.5.1 Total catches

In this report, the terms ‘landings’ and ‘catches’ are, somewhat incorrectly, used as synonyms, as discards are in no cases used in the assessments. This does not mean, however, that discards have not occurred, but the WG has no information on the possible extent. In contrast, available information indicates low discard rates at present (less than 5% of catch) and it is assumed that discards are negligible in the context of the precision of the advice.

As previous years, a report from the Norwegian-Russian Analysis group dealing with estimation of total catch of cod and haddock in the Barents Sea in 2018 was available to AFWG. The report presents estimated catches made by Norwegian, Russian and third countries separately. According to that report the total catches of both cod and haddock reported to AFWG are very close (within 1%) to the estimates made by the analysis group. Thus, it was decided to set the IUU catches for 2017 to zero.

For further information on under- and misreporting, we refer to the 2016 AFWG report.

Discards estimates (1994–2018) of redfish, cod, haddock and Greenland halibut juveniles in the commercial shrimp fishery in the Barents Sea are presented in Figure 0.1. These estimates are new compared to previous AFWG reports, and are obtained with a spatio-temporal model based procedure elaborated in Breivik *et al.* (2017). In Breivik *et al.* (2017) an extensive validation study indicates that the new procedure obtains bycatch estimates with approximately correct uncertainty. Previous estimates for the period 1982–2015 are given in earlier reports (e.g. AFWG 2018), and we have not been able to compare these two time-series in detail. Such a comparison should be performed on a relatively fine spatio-temporal resolution. The bycatch estimates illustrated in Figure 0.1 and are available for each quarter in each main statistical area (not shown in report). Note that it is still work in progress regarding improving the new estimates.

The new time-series in Figure 0.1 are obtained by scaling the estimated bycatch in the Norwegian fishery with the international fishery in each ICES area. The scaling procedure assumes that the Norwegian fishery is representative for the international fishery. This assumption is necessary because the international catch data are available only to a low spatio-temporal resolution. If the international vessels in a relatively high degree trawl at locations not trawled by Norwegian vessels, the bycatch estimates illustrated in figure 0.1 may be biased.
It was observed during AFWG2019 that scaling the fishery logbooks with the landing statistics in year 2016 and 2017 resulted in a large difference between the obtained shrimp catch and the reported shrimp catch from NIPAG (ICES CM 2018/ACOM:08). Because of this inconsistency, only logbooks and *not* the landing statistics are used in year 2016 and 2017 when estimating the bycatch. Before AFWG2020, this inconsistency should be further investigated.

0.5.2 Uncertainty in catch data

For the Norwegian estimates of catch numbers at-age and mean weight-at-age for cod and haddock methods for estimating the precision have been developed, and the work is still in progress (Aanes and Pennington, 2003; Hirst *et al.*, 2004; Hirst *et al.*, 2005; Hirst *et al.*, 2012). The methods are general and can in principle be used for the total catch, including all countries' catches, and provide estimates both at-age and at-length groups. Typical error coefficients of variation for the catch numbers at-age are in the range 5–40% depending on age and year. It is evident that the estimates of the oldest fish are the most imprecise due to the small numbers in the catches and resulting small number of samples on these age groups. From 2006 onwards, the Norwegian catch-at-age in the assessment has been calculated using the ECA method described by Hirst *et al.* (2005). The methodology for using ECA to split cod catches into NEA cod and coastal cod is still under development (WKARCT 2015). ECA has now been implemented for saithe, and with partial success for *S. mentella*.

Aging error is another source of uncertainty, which causes increased uncertainty in addition to bias in the estimates: An estimated age distribution appears smoother than it would have been in absence of aging error. Some data have been analysed to estimate the precision in aging (Aanes, 2002). If the aging error is known, this can currently be taken into account for the estimation of catch-at-age described above.

For capelin, the uncertainty in the catch data is not evaluated. The catch data are used, however, only when parameters in the predation model are updated at infrequent intervals, and the uncertainty in the catch data is considered small compared with other types of uncertainties in the estimation.

We note that the SToX survey methodology reviewed by the group is able to produce uncertainty estimates for the survey time-series. The XSAM model can utilize such estimates, and work is ongoing to explore to consequences of utilizing such estimates.

Additional sources of uncertainty arising from sources beyond sampling or age-reading errors have implications for a number of the stocks assessed here. Coastal cod catches, and to a lesser extent catches of the much larger NEA cod stock, have uncertainty issues due to the difficulty of splitting catches between the two stocks. A similar issue applies to small *S. norvegicus* stock and the larger *S. mentella* stock, where species misidentification can be a significant source of error. Finally, there is no agreement between Norway and Russia on an age-reading methodology for Greenland halibut, and such data are not used for tuning the model. The absence of age data creates an important (but unquantifiable) source of error on the GHL stock estimate.

0.5.3 Sampling effort– commercial fishery

Concerns about commercial sampling: The main Norwegian sampling program for demersal fish in ICES subareas 1 and 2 has been port sampling, carried out on board a vessel travelling from port to port for approximately 6 weeks each quarter. A detailed description of this sampling program is given in Hirst *et al.* (2004). However, this program was, for economic reasons, terminated 1 July 2009. Sampling by the 'reference fleet' and the Coast Guard has increased in recent years. However, the reduction in port sampling of many different vessels seems to have increased the uncertainty in the catch-at-age estimates from 2009 onwards (WD6, 2010). A Norwegian port sampling program was restarted in 2011, although with a lower effort, but this improved the basis for the 2011–2017 catch-at-age estimates. From 2014 this program is run by 4-year contracts of a vessel that sails between fish landing sites along the coast from about 66°N to Varanger (70°N, 30°E) three periods a year during the 1st, 2nd and 4th quarters, altogether up to 120 days. This is a reduction compared to about 180 days a year prior to 2009. The catch sampling is done of landed fish, mainly from the fleet fishing in coastal waters, and usually inside the plant, and the rented vessel acts as a transport, accommodation and working (age reading, data work) platform. AFWG recommends that such sampling is also carried out during the third quarter.

Tables 0.1-0.4 show the development of the Norwegian, Russian, Spanish and German sampling of commercial catches in the period 2008–2018. The tables show the total sampling effort, but do not show how well the sampling covers the fishery. Indices of coverage should be developed to indicate this. The main reason for the general strong decrease in numbers of Norwegian samples in the first part of this period is the termination of the port sampling program in northern Norway. This program is now up and running again. It should be considered whether catch sampling carried out by different countries fishing by trawl for the same time and area could be coordinated and data shared on a detailed level.

Cod, haddock and saithe: Previous concerns regarding poor biological sampling from the fishery were less of an issue in 2018, as available catch-at-age and length data covered the largest portion of catches by the respective fisheries. However, the aggregation level (time and space) used when splitting these catches into Northeast arctic cod and Norwegian Coastal Cod is also an important issue. Despite the improvement in sampling coverage in 2016–2018, the number of samples should be increased in coming years, with the aim of covering all quarters and areas contributing highest catches.

S. mentella

Data issues: There is still a concern about the biological sampling from the fishery and scientific surveys that may have become critically low, however, there is also a lag of several years between collection of age samples and the processing of them. This is elaborated in the section for this stock.

S. norvegicus

Data issues: Despite a recent increase in age-reading for this species, age data are rather poor, and effort in age sampling from the catches is required. The other main source of uncertainty is species misidentification from *S. mentella*, and consequently careful monitoring that species composition is being reported correctly is required.

NeA Greenland halibut

Data issues: There is still a concern about the biological sampling from the fishery that may have become critically low. Age information is not available, due to disagreements on age reading method, and may affect precision in the assessment which at the moment is length based. NOR landings are split on Greenland halibut by sex for area, gear groups and Quarters. Annual sample level has decreased in the last years and may affect the precision of the catch distribution.

The samples and data basis behind each stock assessment are discussed more in detail under each stock chapter (e.g. the coastal cod). The number of aged individuals per 1000 t is now well below the standard set by EU in their Data collection regulations. For several stocks sampling is clearly inadequate for area/quarter/gear combinations making up considerable proportions of the total catch.

Due to the adopted amendments of the Russian Federal Law "On fisheries and preservation of aquatic biological resources" coming into force, especially concerning the destruction of biological resources caught under scientific research, sampling activities (age sample numbers and length/weight measurements of fish) on board fishing vessels are also reduced, especially in ICES subareas 2.a and 2.b, which may result in greater uncertainty of the stock assessments due to possible biases in the age–length distributions of the commercial catch.

0.6 Uncertainties in survey data

While the area coverage of the winter surveys for demersal fish was incomplete in 1997 and 1998, the coverage was normal for these surveys in 1999–2002. In autumn 2002, 2006 and winter 2003, 2007, 2016 and 2017 however, surveys were again incomplete due to lack of access to both the Norwegian and Russian Economic Zones. This affects the reliability of some of the most important survey time-series for cod and haddock and consequently also the quality of the assessments.

It is very important that the Norwegian and Russian authorities give each other's research vessels full access to the respective economic zones when assessing the joint resources, as was the case for Joint winter surveys (BS-NoRu-Q1 (Btr) and BS-NoRu-Q1 (Aco)) in 2004–2005, 2008–2011 and 2013, for example.

The area coverage in the winter survey was extended from 2014 onwards (Mehl *et al.*, 2014; WD01), Figure 0.2. With the recent expansion of the cod distribution it is likely that in recent years the coverage in the February survey (BS-NoRu-Q1 (BTr) and BS-NoRu-Q1 (Aco)) has been incomplete, in particular for the younger ages. This could cause a bias in the assessment, but the magnitude is unknown. The 2014–2018 surveys covered considerably larger areas than earlier winter surveys, and showed that cod, haddock and Greenland halibut was distributed far outside the standard survey area. The 2017 and 2018 surveys were restricted by ice Northeast of Hopen Island, and the survey did not extend quite as far as in the years 2014–2016. In 2019 the coverage was almost as extensive as in 2014. The proportion of the total survey biomass (swept-area estimates) found in this new northern area by year and species in shown in Figure 0.3. For all stocks except Greenland halibut, mainly younger age groups are found in the northern area. It should however be noted that the survey index from this survey is currently not used in the assessment of Greenland halibut. The proportion by age of cod and haddock found in the northern area is shown in Figures 3.8 and 4.7.

The survey estimates within the standard area were used for the tuning data. If a wider coverage is continued in coming years, improved tuning data might be obtained.

There are also other issues with incomplete survey coverage of stocks, e.g. haddock off the Norwegian coast south of Finnmark is not covered in the winter survey and the *S. mentella* survey in the Norwegian Sea does not cover the entire distribution area.

From 2004 onwards, a joint Norwegian-Russian survey has been conducted in August-September. This is a multi-purpose survey termed an "ecosystem survey" because most part of the ecosystem is covered; including an acoustic survey for the pelagic species, which is used for capelin assessment, and a bottom-trawl survey which includes non-commercial species. The ecosystem survey is now included in both cod and haddock assessments. The survey is also utilized in the assessment of redfish and Greenland halibut. There is ongoing work on recalculation of the bottom-trawl series using the StoX framework, for inclusion in the assessment of cod and haddock (WD03).

In 2018, a large area in the eastern Barents Sea was not covered due to technical problems with one vessel (Figure 0.4). It is very important that this survey should be continued with complete spatial coverage. In addition to being the only survey used in capelin assessment and being used in assessment of demersal stocks, it has been shown to be valuable for sampling of synoptic ecosystem information, cover the entire area of fish distribution in the Barents Sea, and provide additional data on geographical distribution of demersal fish, which could prove valuable in future inclusion of more ecosystem information in the fish stock assessments.

0.7 Age reading

In 1992, PINRO, Murmansk and IMR, Bergen began a routine exchange program of cod otoliths in order to validate age readings and ensure consistency in age interpretations (Yaragina *et al.*, 2009b, AFWG 2008, WD 20). Later, a similar exchange program has been established for haddock, capelin and *S. mentella* otoliths. Once a year (now every second year, no exchanges of redfish age readers so far) the age readers have come together and evaluated discrepancies, which are seldom more than 1 year, and the results show an improvement over the period, despite still observing discrepancies for cod in the magnitude of 15–30%. An observation that is supported by the results of a NEA cod otolith exchange between Norway, Russia and Germany (Høie *et al.*, 2009; AFWG 2009, WD 6). 100 cod otoliths were read by three Norwegian, two Russian and one German readers, reaching nearly 83% agreement (coefficient of variation 8%). The age reading comparisons of these 100 cod otoliths show that there are no reading biases between readers <u>within</u> each country. However, there is a clear trend of bias between the readers from different countries, Russian age readers assign higher ages than the Norwegian and German age readers. This systematic difference is a source of concern and is also discussed in Yaragina *et al.* (2009b). This seems to be a persistent trend and will be revealed in the following annual otolith and age reader exchanges.

From 2009 onwards it was decided to have meetings between cod and haddock otolith readers only every second year. The overall percentage agreement for the 2015–2016 exchange was 88.7% for cod (WD 10), which was a little higher than at the previous meeting. The general trend is that the Russian readers assign slightly lower ages than the Norwegian readers compared to the modal age for all age groups. This is opposite of what we have seen in previous readings, where the Russian readers has tended to be slightly overestimating the age compared to the Norwegian readers.

It is not completely clear what are the main reasons for cod ageing discrepancies between Russian and Norwegian readers, as the interpretation of false zones, edge and centre seemed to be the same. Some increase in the percentage agreement in 2015–2016 is likely to be connected with less old fish present in catches and in the samples in later years. It is observed that the percent agreement between age readers decreases as fish age increases.

For haddock, the main reason of discrepancies between PINRO and IMR readers is different interpretation of the latest increments that were very thin in some years.

For both species the samples collected in autumn were the hardest to interpret. The main reason seems to be difficulties in determining if the marginal increment represents summer (opaque) or winter (translucent) growth.

A positive development is seen for haddock age readings showing that the frequency of a different reading (usually ±1 year) has decreased from above 25% in 1996–1997 to about 10% at present. The discrepancies are always discussed and a final agreement on the exchanged cod and haddock otoliths is at present achieved for all otoliths except ca. 2–5%. For haddock, the overall percentage agreement for recent data (2015–2016) was 93.0% and the precision CV was 2.0% and considered to be satisfactory.

The next workshop on cod and haddock otolith reading will be held in Murmansk in May-June 2019.

As the EU catches only make up few percent (<10%) of the total, the German and Spanish length and age data do not have a major impact in the assessment of the relevant stocks. But in order to use consistent datasets, regular age-reading comparisons should be made. EU age readers could be invited to the NOR-RUS exchanges and workshops.

To determine the effects of changes in age reading protocols between contemporary and historical practices, randomly chosen cod otolith material from each decade for the period 1940s–1980s has been re-read by experts (Zuykova *et al.,* 2009). Although some year-specific differences in age determination were seen between historical and contemporary readers, there was no significant effect on length at-age for the historical period. A small systematic bias in the number spawning zones detection was observed, demonstrating that the age at first maturation in the historic material as determined by the contemporary readers is younger than that determined by historical readers. The difference was largest in the first sampled years constituting approximately 0.6 years in 1947 and 1957. Then it decreased with time and was found to be within the range of 0.0–0.28 years in the 1970–1980s. The study also shows that cod otoliths could be used for age and growth studies even after long storage.

For capelin otoliths there is a very good correspondence between the Norwegian and Russian age readings, with a discrepancy in less than 5% of the otoliths. This was confirmed at the Norwegian-Russian age reading workshop on capelin in October 2011 (WD 13, 2012).

For some of the samples, a very high agreement was reached after the initial reading by the different experts. In other cases, some disagreement was evident after the first reading. After the initial reading, the results were analysed. The otoliths that caused disagreement were read again and discussed among the readers. After discussion about the reasons for disagreement, some readers wanted to change their view on some of the otoliths. When the samples were read once more, the agreement was 95%.

It was concluded that experts from all laboratories normally interpret capelin otoliths equally. Difficult otoliths are sometimes interpreted differently, but these samples are few, and should not cause large problems for common work on capelin biology and stock assessment. All participants noted the great value of conducting joint work on otolith reading, and it was decided to continue the programme of capelin otolith exchange and to involve the labs at Iceland and Newfoundland in the exchange program. Readers from Norway and Russia should continue to meet at Workshops every second year. A capelin age reading Workshop was held in Murmansk in April 2016, and the report from that meeting was presented to the capelin assessment meeting in October 2016. The next age reading Workshop for capelin will be held in Murmansk in October 2019.

In order to achieve the most accurate age estimates, ICES recommends methods and best practice for age reading of both redfish and Greenland halibut. Still there continue to be differences in opinion between PINRO and IMR regarding age reading methods for these species. It is recommended to start annual or biannual exchange of otoliths and age reading experts on these species in order to identify the differences in interpretation and to discuss possibilities for a common approach.

The report from Workshop on Age Reading of Greenland Halibut (WKARGH) (ICES CM 2011/ACOM:41) described and evaluated several age reading methods for Greenland Halibut. A second workshop (WKARGH 2) was conducted in August 2016 and worked on further validation on new age reading methods. The workshop recommended that two of new methods can be used to provide age estimations for stock assessments. Further, recognizing some bias and low precision in methods, the WKARGH2 recommends that an ageing error matrix or growth curve with error be provided for use in future stock assessments (WKARGH2 report 2016, ICES CM 2016/SSGIEOM:16). WKARGH2 recommends regular inter-lab calibration exercises to improve precision (i.e. exchange of digital images between readers for each method and between methods). The new age readings are not comparable with older data or the Russian age readings, and the new methods show that the species is more slow-growing and vulnerable than the previous age readings suggest. AFWG suggests that Russian and Norwegian scientists and age readers meet to work out issues of disagreements on Greenland halibut aging.

From 2009 onwards, an exchange of *Sebastes mentella* otoliths is conducted annually between the Norwegian and Russian laboratories (see Section 6.2.2). In 2011 ICES/PGCCDBS identified differences in the interpretation of age structure by different national laboratories and recommended that an international exchange of otoliths be conducted (ICES C.M. 2011/ACOM:40). The work was conducted during 2011 (Heggebakken, 2011) with participation from Canada, Iceland, Norway, Poland and Spain. Unfortunately, Russia did not respond to the invitation to participate. The agreement in age determination was 79.2% (with allowance for ±1 y) for all ages combined, but 38.6% when only fish older than 20 y were considered. It is recommended that 1) future exchanges be conducted every 3–5 y, 2) that these should primarily focus on 20+ year old fish and 3) that Russian scientists contribute to future exchanges. A meeting between *S. mentella* age readers from Norway and Russia was held in 2013. Otolith exchanges took place in 2014. It is recommended that such meetings and otolith exchanges be conducted regularly in future.

0.8 Assessment method issues

Following an IBP for NEA cod (ICES C. M. 2017/ACOM:29), the assessment method for NEA cod has been altered to the SAM model. In addition, the age range of the data (both catch and survey) has been extended as recommended by the benchmark. However, due to the increasing age structure of the cod, the settings for these older fish recommended by the benchmark were found to be problematic. In the SAM model, the variances for the oldest age categories in each tuning series (survey or commercial catch) were the same as for the youngest ages. This is unrealistic, but was a reasonable simplification when there were too few fish in these categories to allow for separate estimation of variances and too few to significantly affect the model tuning. These oldest age categories now represent a significant fraction of the stock (and catch), and AFWG 2019 therefore proposed allowing the SAM model to estimate these variances directly. This had the effect of increasing the assessed SSB by ca. 10%, and were proposed for review at IBPNEACOD 2019. The outcome of the review was that although the problem was real and re-evaluating the variance structure was a viable solution, the exact formulation chosen was considered to be too ad-hoc and lacking a solid justification. The result of the review was therefore to keep the previous model settings, and re-evaluate the issue in a full benchmark, likely in 2021. More details of the proposed solution are provided in the NEA cod chapter.

For coastal cod, the issues around the difficulties with the assessment model and management implementation of the management plan were noted. Work is ongoing to attempt to address these, and will lead to a benchmark in due course – although it is too early to set a timetable for this.

Greenland halibut largely followed the benchmark and stock annex. However, reduced sampling led to the sex splitting of the survey having to be done based on time-averaged values rather than annual samples. This affected the fraction of the stock in the 45 cm+ category used for reporting, and increased the assessed biomass by around 10% (although without changing the trends). This unavoidable described in the Greenland halibut section.

Work is in progress on revising the capelin assessment methodologies. However, it was considered that this would not be ready for a planned benchmark in 2020, and this has now been postponed to an unspecified future date.

0.9 Environmental information included in advice of NEA cod

For the twelfth time environmental information has been applied in the advice from AFWG. In this year's assessment ecosystem information was directly used in the projection of NEA cod. A combination of regression models, which is based on both climate and stock parameters, were used for prediction of recruitment-at-age 3, see section 1.4.

In addition, temperature is part of the NEA cod consumption calculations that goes into the historical back-calculations of the amount of cod, haddock, and capelin eaten by cod.

0.10 Proposals for status of assessments in 2018–2019

For anglerfish there is currently no assessment, however following the benchmark in 2018, work is being conducted with a view to a potential future assessment. AFWG proposes to set the following status for assessments for each stock. The redfish species, which were not assessed in 2019 will receive an update assessment in 2020.

Fish Stock	Stock Name	Advice in 2019	Previous benchmarks	Next bench-mark
cod.27.1-2	Cod in subareas 1 and 2 (Northeast Arctic)	Update	WKARCT 2015, IBP cod 2017	-
cod.27.1-2coast	Cod in subareas 1 and 2 (Norwegian coastal waters)	Update	WKARCT 2015	-
had.27.1-2	Haddock in subareas 1 and 2 (Northeast Arctic)	Update	WKARCT 2015 WKBENCH 2011	2020
pok.27.1-2	Saithe in subareas 1 and 2 (Northeast Arctic)	Update	IBP saithe 2014 WKROUND 2010	-
cap.27.1-2	Capelin in subareas 1 and 2 (Barents Sea), excluding Division 2.a west of 5°W	Update	WKARCT 2015 WKSHORT 2009	?
ghl.27.1-2	Greenland halibut in subareas 1 and 2	Update	WKBUT 2013 (finished in 2015)	-
reb.27.1-2	Redfish *Sebastes mentella* subareas 1 and 2	None (next in 2020)	WKREDFISH 2018 (WKREDMP 2014)	
reg.27.1-2	Redfish *Sebastes norvegicus* subareas 1 and 2	None (next in 2020)	WKREDFISH 2018	
anf.27.1-2	Anglerfish in subareas 1 and 2 (Northeast Arctic)	None	WKANGLERFISH 2018	

0.11 Stock annexes

There were no relevant benchmarks between AFWG 2018 and AFWG 2019, and no changes in the stock annexes. There has been a slight change in how sex splitting was conducted in one Greenland halibut series, but this change is within the description in the stock annex and therefore no changes have been made. For NEA cod a revision was proposed and reviewed at an interbenchmark following AFWG 2019. The revision was rejected, and no changes were made to the stock annex.

0.12 Audit reports

Audit reports were made for the 4 stocks for which updated advice is provided this year: north-east Arctic cod, haddock and saithe, and Greenland halibut. All audits reports except Norwegian Coastal cod were provided and available at the end of this report (Annex 5).

0.13 InterCatch

The assessment of NEA cod, haddock and saithe was partly based on output from InterCatch.

0.14 The percentage of the total catch that has been taken in the NEAFC regulatory areas by year in the last year

Generic ToR c-iii asks for the percentage of the total catch that has been taken in the NEAFC regulatory area by year in the last year. In the area where AFWG stocks are distributed, there are two areas outside national EEZs which are part of the NEAFC regulatory area: The International area in ICES Subarea 1 in the Barents Sea (“loophole”, denoted as 1.a or 27_1_A) and the International area in ICES divisions 2.a and 2.b in the Norwegian Sea (“banana hole”, denoted as 2.a.1 and 2.b.1 or 27_2_A_1 and 27_2_B_1). In the table below the WG presents the most likely landings from these areas based on the official reports and discussions within the WG. The text table below shows the percentages for *S. mentella*, Northeast arctic cod and haddock and Greenland halibut. For the other AFWG stocks no catches are taken in those areas. The highest precision in these numbers are probably the *S. mentella* figures since these figures have been tabulated each year since 2004, and have been given a regular and special attention, also by NEAFC.

	ICES 1.a	ICES 2.a.1	ICES 2.b.1	Total	%NEAFC
2018					
NEA cod	1724	2	0	778627	0.22%
Coastal cod	0	0	0	36375	0.0%
NEA haddock	24.1	0	0	191276	0.013%
NEA saithe	2.4	0	0	181280	0,001%
Sebastes mentella	3	7823	0	38765	20.2 %
Sebastes norvegicus	0	0	0	6647	0.0 %
Greenland halibut	798	0	0	28544	2.80 %
Capelin	0	0	0	0	0.0 %
Anglerfish	0	0	0	1903	0.0 %
2017					
NEA cod	1212	12	0	868276	0.14 %
Coastal cod	0	0	0	51053	0.0%
NEA haddock	90	0	0	227588	0. 0004%
NEA saithe	70	11	0	145403	0.06 %
Sebastes mentella	0	6463	0	31200	20.7 %
Sebastes norvegicus	5	0	0	5340	0.1 %
Greenland halibut	592	6	0	26380	2.3 %
Capelin	0	0	0	0	0.0 %
Anglerfish	0	0	0	1478	0.0 %

	ICES 1.a	ICES 2.a.1	ICES 2.b.1	Total	%NEAFC
2016					
NEA cod	3619	0	0	849422	0.4%
Coastal cod	0	0	0	54767	0.0%
NEA haddock	7	0	0	233416	0.003 %
NEA saithe	81	0	0	140392	0.06 %
Sebastes mentella	0	7170	0	35429	20.2 %
Sebastes norvegicus	10	0	0	4674	0.2 %
Greenland halibut	363	5	0	24972	1.5 %
Capelin	0	0	0	0	0.0 %
Anglerfish	0	0	0	1435	0.0 %
2015					
NEA cod	9	0	0	864384	0.001 %
Coastal cod	0	0	0	35843	0.0 %
NEA haddock	702	0	0	194756	0.4 %
NEA saithe	30	0	0	131765	0.0 %
Sebastes mentella	0	4752	0	25856	18.4 %
Sebastes norvegicus	13	0	0	3632	0.4 %
Greenland halibut	55	0	0	24748	0.2 %
Capelin	0	0	0	115044	0.0 %
Anglerfish	0	0	0	1043	0.0 %
2014					
NEA cod	534	0	0	986449	0.1 %
Coastal cod	0	0	0	33660	0.0 %
NEA haddock	0	0	0	177522	0.0 %
NEA saithe	0	0	0	132005	0.0 %
Sebastes mentella	0	4020	0	18780	21.4 %
Sebastes norvegicus	0	0	0	4438	0.0 %
Greenland halibut	211	0	0	23025	0.9 %
Capelin	0	0	0	66000	0.0 %

	ICES 1.a	ICES 2.a.1	ICES 2.b.1	Total	%NEAFC
Anglerfish	0	0	0	1657	0.0 %

0.15 Relationship with WGIBAR

The WGIBAR group (Working Group on Integrated Assessments of the Barents Sea) met for the sixth time in February 2019 (ICES C. M. 2019/SSGIEA:04). Most of the ecosystem information which was previously found in Chapter 1 in the AFWG report was from 2017 onwards moved to the WGIBAR report. Chapter 1 in AFWG now only contains ecosystem-related information and data directly relevant to the assessment of AFWG stocks.

0.16 Research needs of relevance for the Working Group

Agreeing on method for calculation of bottom-trawl indices from ecosystem survey.

Agreeing on an age-reading method for Greenland Halibut

Extending Greenland Halibut data back in time

Routine methods for species and stock identification for *Sebastes norvegicus* and *S. mentella*

0.17 Time and place of Next Meeting

The Working Group proposes to meet next time in the period 17–23 April 2020 at a location to be decided. A one-day review of changes to the redfish time-series will be conducted on the 16 April 2020 at the same location.

In the absence of any other candidates, Daniel Howell was proposed by the group to be chair for a second three-year term (2020-2022).

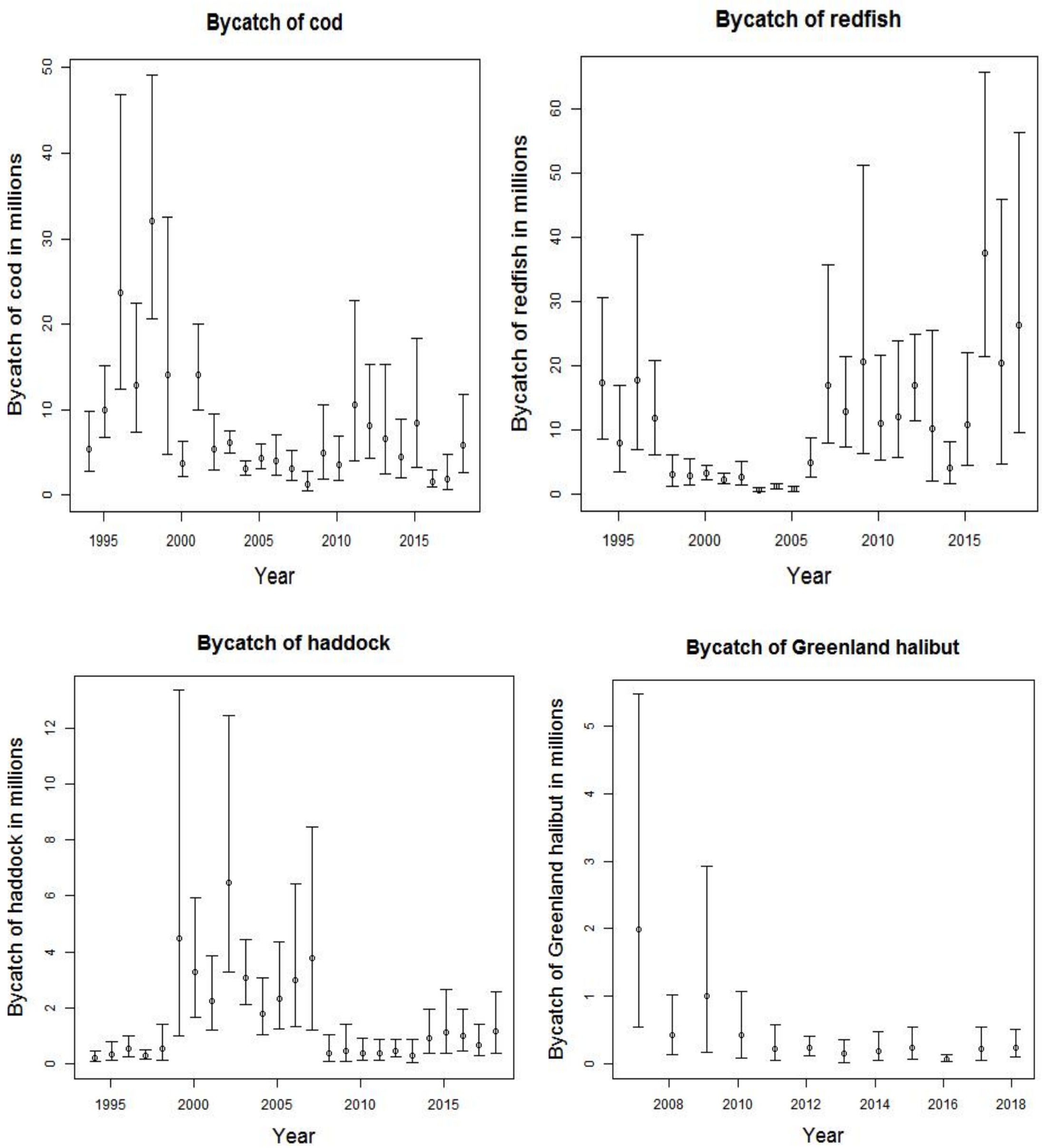

Figure 0.1. Estimated bycatch of cod, redfish, haddock, and Greenland Halibut in the Barents Sea shrimp fishery. Intervals are 90% confidence intervals.

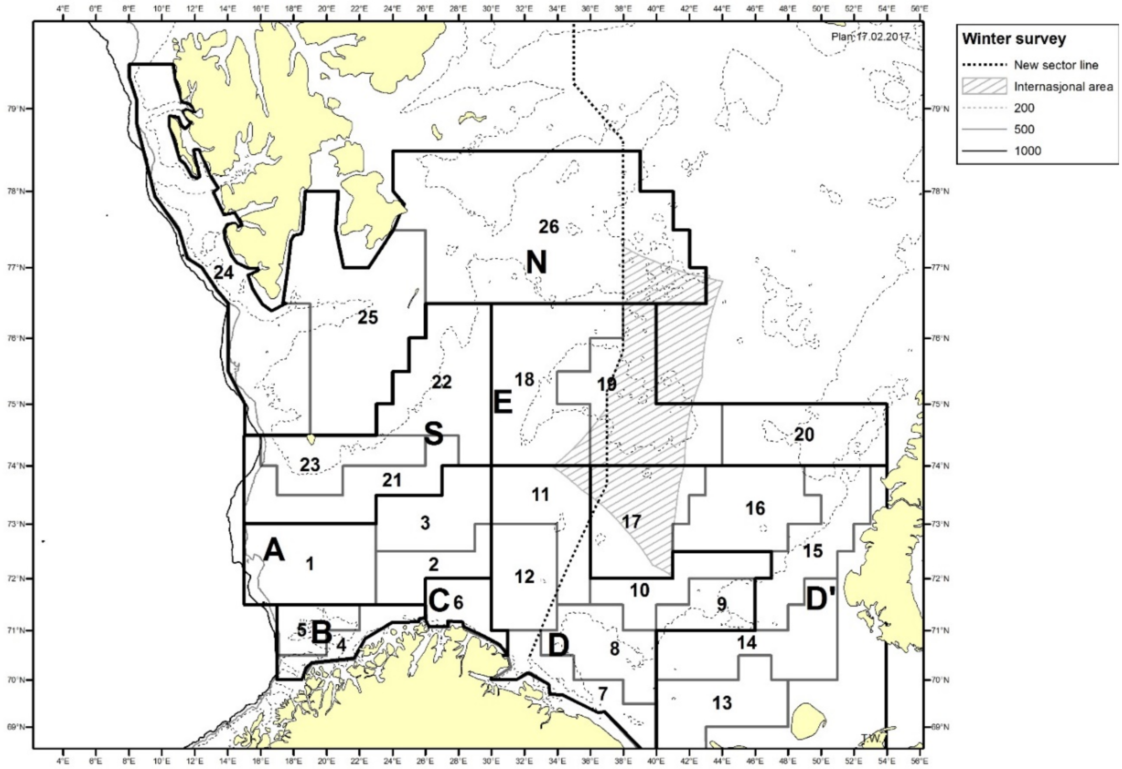

Figure 0.2. Strata (1–23) and main areas (A,B,C,D,D’,E and S) used for swept-area estimations and acoustic estimations with StoX. Additional strata (24–26, main area N) are covered since 2014, but not included in the standard time-series.

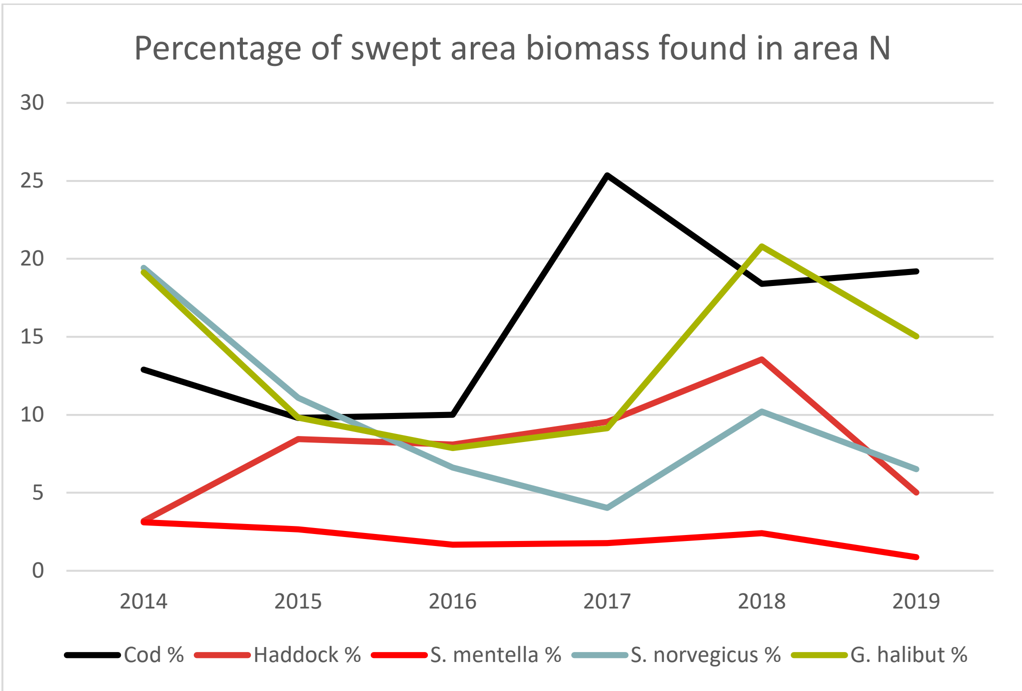

Figure 0.3. Proportion of swept-area biomass in the Joint winter survey found in the new northern area (N), by year and species.

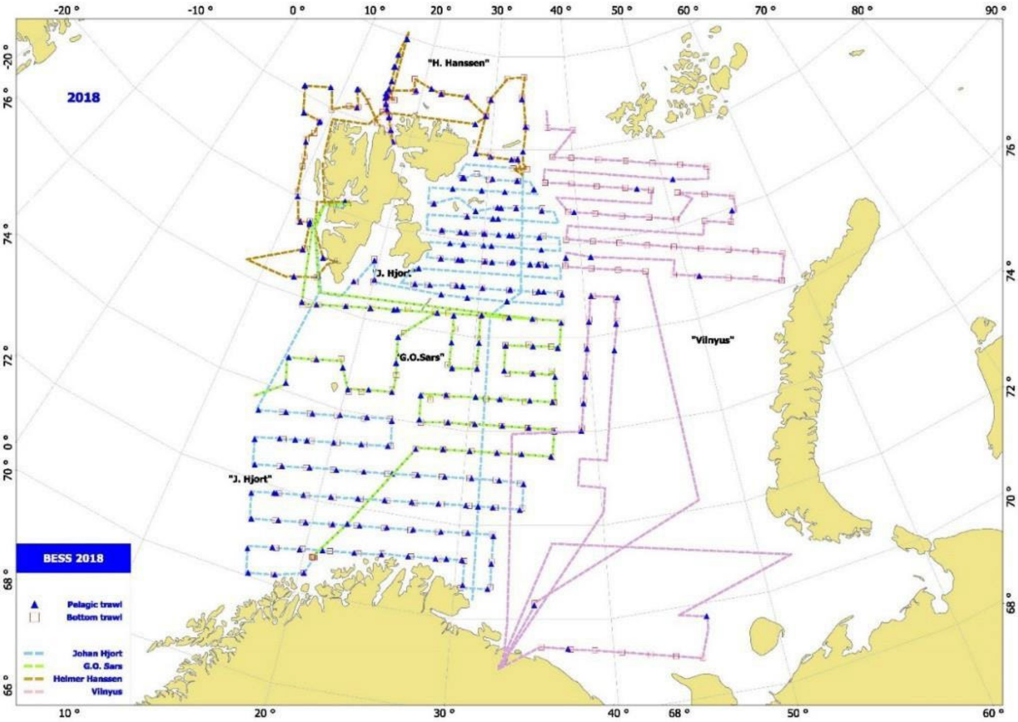

Figure 0.4 Barents Sea Ecosystem survey (BESS) 2018, realized vessel tracks with pelagic and bottom-trawl sampling stations.

Table 0.1. Age and length sampling by Norway of commercial catches in 2008-2018. Number of samples and average number of fish per sample. Also, number of age samples and aged individuals per 1000 t caught. For comparison, also the EU DCF requirements are shown.

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured individuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-samples per 1000 t	Aged individuals per 1000 t	EU DCF for comparison, per 1000 t
NEA-cod + coastal cod	2008	336	2526	51263		464	16026	196067	12.9	2.4	81.7	125
	2009	272	2669	53350		417	14170	224816	11.9	1.9	63.0	125
	2010	175	2542	39733		338	7671	263816	9.6	1.3	29.1	125
	2011	273	2305	46227		434	10043	331535	7.0	1.3	30.3	125
	2012	356	3132	57954		618	14710	363207	8.6	1.7	40.5	125
	2013	266	2917	81583	84	1275	13940	464258	6.3	2.7	30.0	125
	2014	556	2063	254627	306	1170	14815	465554	4.4	2.5	31.8	125
	2015	498	1654	130514	89	1392	16500	413741	4.0	3.4	39.9	125
	2016	482	2500	91590	401	1398	17027	403907	6.2	3.5	42.2	125
	2017	413	2615	91366	348	1458	15471	408423	6.4	3.6	37.9	125
	2018	873	3163	122788	346	1545	15535	369897	8.6	4.2	42.0	125

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured in-dividuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-sam-ples per 1000 t	Aged individ-uals per 1000 t	EU DCF for comparison, per 1000 t
NEA-haddock	2008	285	2177	45038		281	9474	72553	30.0	3.9	130.6	125
	2009	233	2255	41481		206	6010	104882	21.5	2.0	57.3	125
	2010	154	2155	38045		232	5458	123517	17.4	1.9	44.2	125
	2011	227	2028	39663		312	7225	158293	12.8	2.0	45.6	125
	2012	258	2609	47995		386	8191	159008	16.4	2.4	51.5	125
	2013	89	2142	62193	86	965	5718	99127	21.6	9.7	57.7	125
	2014	425	1479	114560	126	825	7297	91333	16.2	9.0	79.9	125
	2015	397	1380	76574	47	967	8394	95086	14.5	10.2	88.3	125
	2016	237	1986	47032	208	391	8202	108718	18.3	3.6	75.4	125
	2017	215	2108	57461	150	1084	8805	113206	18.6	9.6	77.8	125
	2018	536	2435	85303	130	1088	8397	93839	25.9	11.6	89.5	125
NEA-saithe	2008	252	1327	19419		160	5262	165998	8.0	1.0	31.7	125
	2009	182	1337	13354		113	2981	144570	9.2	0.8	20.6	125
	2010	138	1316	15998		151	3667	174544	7.5	0.9	21.0	125

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured individuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-samples per 1000 t	Aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2011	152	1210	17412		215	4843	143314	8.4	1.5	33.8	125
	2012	209	1474	19191		204	4113	143104	10.3	1.4	28.7	125
	2013	87	1570	69469	69	788	5507	111981	14.0	7.0	49.2	125
	2014	192	697	54365	94	575	5390	115880	6.0	5.0	46.5	125
	2015	206	839	69375	43	614	6484	114830	7.3	5.3	56.5	125
	2016	226	1448	52376	151	737	7278	121710	11.9	6.1	59.8	125
	2017	195	1416	42812	141	788	6348	128651	11.0	6.1	49.3	125
	2018	388	1665	43938	148	823	6937	162454	10.2	5.1	42.7	125
S. Norvegicus	2008	104	1093	18305		98	2281	6180	176.9	15.9	369.1	125
	2009	66	1131	17386		96	2302	6215	182.0	15.4	370.4	125
	2010	49	1050	19339		97	2164	6515	161.2	14.9	332.2	125
	2011	75	1064	16347		106	2310	4645	229.1	22.8	497.3	125
	2012	78	993	12994		76	1297	4250	39.1	3.1	56.7	125
	2013	35	654	627	17	74	1122	4244	154.1	17.4	264.4	125

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured individuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-samples per 1000 t	Aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2014	24	66	919	24	24	365	3053	21.6	7.9	119.6	125
	2015	28	121	3497	22	405	1281	2492	48.6	162.5	514.0	125
	2016	54	642	2376	36	517	1585	4606	139.4	112.2	344.1	125
	2017	69	695	6177	44	571	1633	3354	207.2	170.2	486.9	125
	2018	64	778	7354	32	629	1252	4275	182.0	147.1	292.8	125
*S. mentella **)*	2008	13	178	1038		0	0	2214	80.4	0.0	0.0	125
	2009	12	319	1841		2	40	2567	124.3	0.8	15.6	125
	2010	11	284	3664		11	320	2245	126.5	4.9	142.5	125
	2011	9	255	3210		11	298	2690	94.8	4.1	110.8	125
	2012	13	166	2187		13	241	2098	79.1	6.2	114.9	125
	2013	14	184	383	5	13	390	1361	135.2	9.6	286.6	125
	2014	11	36	4664	12	49	5	13402	2.7	3.7	0.4	125
	2015	21	166	23794	10	227		19700	8.4	11.5	0.0	125
	2016	26	271	3127	20	206	9	17631	15.4	11.7	0.5	125

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured individuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-samples per 1000 t	Aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2017	30	256	3196	24	211	24	17280	14.8	12.2	1.4	125
	2018	39	409	8782	20	364	25	19294	21.2	18.9	1.3	125
Greenland halibut	2008	53	580	9074		0	0	7394	78.4	0.0	0.0	125
	2009	36	922	12853		0	0	8446	109.2	0.0	0.0	125
	2010	26	519	8395		0	0	7685	67.5	0.0	0.0	125
	2011	29	463	8204		0	0	8273	56.0	0.0	0.0	125
	2012	34	610	7716		0	0	10074	60.6	0.0	0.0	125
	2013	26	597	4930		0	0	12613	47.3	0.0	0.0	125
	2014	33	236	2559	10	0	0	10876	21.7	0.0	0.0	125
	2015	31	273	8769	11	0	0	10704	25.5	0.0	0.0	125
	2016	83	384	2304	60	0	0	12573	30.5	0.0	0.0	125
	2017	67	556	10022	43	317	0	13194	42.1	24.0	0.0	125
	2018	96	582	11720	63	342	0	14876	39.1	23.0	0.0	125

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured individuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-samples per 1000 t	Aged individuals per 1000 t	EU DCF for comparison, per 1000 t
Anglerfish (Monk)	2013	14	126	636	12	109	0	2989	42.2	36.5	0.0	125
	2014	10	53	224	10	30	0	1655	32.0	18.1	24.8	125
	2015	10	105	518	10	33	0	934	112.4	35.3	0.0	125
	2016	22	161	489	10	38	0	2117	76.1	17.9	0.0	125
	2017	28	220	977	12	35	1	1468	149.9	23.8	0.7	125
	2018	24	229	907	12	46	2	1884	121.5	24.4	1.1	125
Capelin	2008	4	3	150		0	0	5000	0.6	0.0	0.0	125
	2009	18	97	7039		39	1039	233000	0.4	0.2	4.5	125
	2010	75	230	6191		47	1291	246000	0.9	0.2	5.2	125
	2011	115	315	8346		48	1313	273000	1.2	0.2	4.8	125
	2012	84	308	9337		29	843	181328	1.7	0.2	4.6	125
	2013	12	213	12215	47	47	773	156340	1.4	0.3	4.9	125
	2014	27	113	9054	1	8	1086	40021	2.8	0.2	27.1	125
	2015	65	722	83776	65	722	5393	71435	10.1	10.1	75.5	125

Stock	Year	No of unique vessels	No of length samples	No of lenght-measured individuals	No of unique vessels (***)	No of age samples	No of aged individuals	Landings, tonnes	Length-samples pr 1000 t	Age-samples per 1000 t	Aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2016	7	27	1863	7	27	649					125
	2017	21	43	2294	14	25	305					125
	2018	68	207	15022	33	76	823	123461	1.7	0.6	6.7	125

*) in addition to age the otoliths are also used for identification of coastal cod

**) age samples from surveys with commercial trawl come in addition

***) From 2013 No of unique vessels are splitted by length and age samples

Table 0.2. Age and length sampling by Russia of commercial catches and age sampling of surveys in 2008–2018. Also length-measured individuals and aged individuals per 1000 t caught. For comparison also the EU DCF requirements are shown.

Stock	Year	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
NEA-cod*	2008	380592	3097	7565	10662	190225	2001	16,3	56,0	125
	2009	178038	1075	7426	8501	229291	776	4,7	37,1	125
	2010	126502	1828	7670	9498	267547	473	6,8	35,5	125
	2011	122623	2376	5783	8159	310326	395	7,7	26,3	125
	2012***	140028	2040	7742	9782	329943	424	6,2	29,6	125
	2013	131455	1999	8103	10102	432314	304	4,6	23,4	125
	2014	114538	3110	7154	10264	433479	264	7,2	23,7	125
	2015***	105721	2486	6095	8581	381188	277	6,5	22,5	125
	2016	158006	5090	2704	7794	394107	401	12,9	19,8	125
	2017	161192	4918	6121	11039	396195	407	12,4	27,9	125
	2018	157048	3129	1982	5111	340364	461	9,2	15,0	125
NEA-haddock	2008	216959	2498	5677	8175	68792	3154	36,3	118,8	125

Stock	Year	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2009	43254	489	5421	5910	85514	506	5,7	69,1	125
	2010	85445	834	5060	5894	111372	767	7,5	52,9	125
	2011	61990	1570	3584	5154	139912	443	11,2	36,8	125
	2012***	87880	1545	5034	6579	143886	611	10,7	45,7	125
	2013	42927	1205	4021	5226	85668	501	14,1	61,0	125
	2014	45447	899	3796	4695	78725	577	11,4	59,6	125
	2015***	31009	914	2972	3886	91864	338	9,9	42,3	125
	2016	55598	2691	1884	4575	115710	480	23,3	39,5	125
	2017	74297	3554	2614	6168	106714	696	33,3	57,8	125
	2018	61360	2274	1136	3410	90486	678	25,1	37,7	125
NEA-saithe	2008	8865	479	175	654	11577	766	41,4	56,5	125
	2009	5279	7	68	75	11899	444	0,6	6,3	125
	2010	422	112	249	361	14664	29	7,6	24,6	125
	2011	88	9	27	36	10007	9	0,9	3,6	125

Stock	Year	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2012	4062	145	104	249	13607	299	10,7	18,3	125
	2013	17124	402	76	478	14796	1157	27,2	32,3	125
	2014	2302	278	26	304	12396	186	22,4	24,5	125
	2015	1505	104	131	235	13181	114	7,9	17,8	125
	2016	4233	272	16	288	15203	278	17,9	18,9	125
	2017	1762	228	110	338	14551	121	15,7	23,2	125
	2018	4758	454	9	463	14171	336	32,0	32,7	125
S. marinus	2008	1196	45	17	62	749	1597	60,1	82,8	125
(*norvegicus*)	2009	241	2	27	29	698	345	2,9	41,5	125
	2010	486	25	199	224	806	603	31,0	277,9	125
	2011	885	77	62	139	919	963	83,8	151,3	125
	2012	1564	58	54	112	681	2297	85,2	164,5	125
	2013	770	22	142	164	797	966	27,6	205,8	125
	2014	589	25	33	58	806	731	31,0	72,0	125

Stock	Year	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2015	120		20	20	664	181	0,0	30,1	125
	2016	1113	147	34	181	776	1434	189,4	233,2	125
	2017	1426	86	101	187	1131	1261	76,0	165,3	125
	2018	1877	30	21	51	1546	1214	19,4	33,0	125
S. mentella	2008	21446	471	3379	3850	7117	3013	66,2	541,0	125
	2009	29435	761	1447	2208	3843	7659	198,0	574,6	125
	2010	2776	100	2295	2395	6414	433	15,6	373,4	125
	2011	917	7	640	647	5037	182	1,4	128,4	125
	2012	7802	422	1146	1568	4101	1902	102,9	382,3	125
	2013	19092	1253	1625	2878	3677	5192	340,8	782,7	125
	2014	817	25	1297	1322	1704	479	14,7	775,8	125
	2015	771		1818	1818	1142	675	0,0	1591,9	125
	2016	27765	1076	85	1161	8419	3298	127,8	137,9	125
	2017	958	99	1000	1099	4952	193	20,0	221,9	125

Stock	Year	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2018	21004	845	39	884	10497	2001	80,5	84,2	125
G. halibut	2008	106411	1519	3366	4885	5294	20100	286,9	922,7	125
	2009	77554	819	2282	3101	3335	23255	245,6	929,8	125
	2010	32090	416	2784	3200	6888	4659	60,4	464,6	125
	2011	9892	115	1541	1656	7053	1403	16,3	234,8	125
	2012	82943	2140	2506	4646	10041	8260	213,1	462,7	125
	2013	12608	555	2756	3311	10310	1223	53,8	321,1	125
	2014	24346	633	2106	2739	10061	2420	62,9	272,2	125
	2015	22116	575	2489	3064	12953	1707	44,4	236,5	125
	2016	11818	574	221	795	10576	1117	54,3	75,2	125
	2017	24061	1205	1579	2784	10713	2246	112,5	259,9	125
	2018	21893	954	308	1262	12072	1814	79,0	104,5	125
Capelin	2008**	82625	1644	2341	3985	5000	16525	328,8	797,0	125
	2009	94541	900	2511	3411	73000	1295	12,3	46,7	125

Stock	Year	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2010	67265	1072	4043	5115	77000	874	13,9	66,4	125
	2011	63784	1273	2271	3544	86531	737	14,7	41,0	125
	2012	20023	1130	1783	2913	68182	294	16,6	42,7	125
	2013	54708	1565	1007	2572	60413	906	25,9	42,6	125
	2014	13206	850	1249	2099	25720	513	33,0	81,6	125
	2015	27200	1000	1004	2004	115				125
	2016	8669	3954	1047	5001	0				125
	2017			4115	4115	6				125
	2018	14491	250	1050	1300	65934	220	3,8	19,7	125

***) in addition also used long-term mean age-length keys**
****) age samples from surveys with commercial trawl come in addition**
*****) in addition used samples from Russian vessels, sampled by the Norwegian Coast Guard in 2012 and 2015**

Table 0.3. Age and length sampling by Spain of commercial catches and length sampling of surveys in 2008-2018. Also length-measured individuals and aged individuals per 1000 t caught. For comparison also the EU DCF requirements are shown.

Stock	Year	No of vessels	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
NEA-cod	2008	2	10108	610		610	9658	1047	63	63	125
	2009	2	8733	1834		1834	12013	727	153	153	125
	2010	2	28297	1735		1735	12657	2236	137	137	125
	2011	2	11633	964		964	13291	875	73	73	125
	2012	2	9849	998		998	12814	769	78	78	125
	2013	2	30295	2381		2381	15041	2014	158	158	125
	2014	2	27828	2306		2306	16479	1689	140	140	125
	2015	2	18568	1445		1445	18772	989	77	77	125
	2016	2	27937	1246		1246	14640	1908	85	85	125
	2017	2	33984	2018		2018	14414	2358	140	140	125
	2018	1	25933	911		911	14415	1799	63	63	125

Stock	Year	No of vessels	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
NEA-haddock*	2009	1	2561				240				
	2010	1	3243				379				
	2011	1	1796				408				
	2012	2	3198				647				
	2013	1	660				413				
	2014	1	2460				370				
	2015	1	702				418				
	2016	2	701				357				
	2017	1	710				156				
	2018	1	154				169				
NEA-saithe*	2009	1	123				2				
	2013	1					5				
	2014	1					13				

Stock	Year	No of vessels	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
	2015	1					33				
	2016						25				
	2017						85				
	2018						60				
S. mentella	2008**	1	2275	28			987	2304	28	0	125
	2011*	1	86				1237				
	2012**	2	11579	476			1612	7183	295	0	125
	2014**	1	6177				1146	5390			
	2015**	1	6117				2371	2580			
	2016**	1	11806				3133	3768			
	2017**	1	5015				2624	1911			
	2018**	1	11638				2399	4851			

Stock	Year	No of vessels	No of lenght-measured individuals (commercial catches)	No of aged individuals (commercial catches)	No of aged individuals (surveys)	Total No of aged individuals	Landings, tonnes	Lenght-measured individuals per 1000 t	Aged individuals per 1000 t (commercial catches)	Total aged individuals per 1000 t	EU DCF for comparison, per 1000 t
G. halibut***	2008	2	11662				112	103826			
	2009	1	3383				210	16143			
	2010	1	5783				182	31800			
	2011	1	8541				169	50600			
	2012	1	4809				186	25907			
	2013	1	11988				190	63019			
	2014	1	12002				206	58262			
	2015	1	17552				111	158126			
	2016	1	15031				218	68837			

***) sampling from bycatch in cod fishery**
****) sampling from pelagic redfish fishery**
*****) sampling from Spanish Greenland halibut survey**

Table 0.4. German Catch sampling.

Stock	Year	No of unique vessels	No of length samples	No of length-measured individuals	No of aged indi-viduals	Landings (t)	Length-measured indi-viuals per 1000 t	Age-sampled individu-als per 1000 t	EU DCF for com-parison
NEA cod	2008	5	3	65800	2033	4955	13280	410	125
	2009	5	2	43107	2419	8585	5021	282	125
	2010	5	2	51923	3075	8442	6151	364	125
	2011	4	1	7318	769	4621	1584	166	125
	2012	4	2	16315	1924	8500	1919	226	125
	2013	4	2	29281	2043	7939	3688	257	125
	2014	4	1	23137	1291	6225	3717	207	125
	2015	4	1	39335	886	6427	6120	138	125
	2016	3	1	22109	1060	6636	3332	160	125
	2017	4	1	19942	785	5969	3341	132	125
	2018	4	2	43371	2283	7774	5579	294	125
NEA haddock	2008	5	3	5548	442	535	10370	826	125
	2009	5	2	23348	958	1957	11931	490	125
	2010	5	2	54704	1039	3539	15457	294	125
	2011	4	1	1925	160	1724	1117	93	125
	2012	4	2	4088	502	1111	3680	452	125

Stock	Year	No of unique vessels	No of length samples	No of length-measured individuals	No of aged indi-viduals	Landings (t)	Length-measured indi-viuals per 1000 t	Age-sampled individu-als per 1000 t	EU DCF for com-parison
	2013	4	1	7040	478	501	14052	954	125
	2014	4	1	3113	261	340	9156	768	125
	2015	4	1	616	325	124	4968	2621	125
	2016	3	1	4807	544	170	28276	3200	125
	2017	4	1	3464	527	155	22348	3400	125
	2018	4	2	4345	497	391	11113	1271	125
NEA saithe	2008	5	3	10210	605	2263	4512	267	125
	2009	6	2	8667	1091	2021	4288	540	125
	2010	7	2	11424	1001	1592	7176	629	125
	2011	4	1	4863	530	1371	3547	387	125
	2012	7	2	14193	1202	1371	10356	877	125
	2013	4	1	1190	414	1212	982	342	125
	2014	3	1	25	0	259	97	0	125
	2015	4	0	0	0	424	0	0	125
	2016	3	1	13981	909	951	14701	956	125
	2017	4	1	15734	603	1154	13634	523	125

Stock	Year	No of unique vessels	No of length samples	No of length-measured individuals	No of aged indi-viduals	Landings (t)	Length-measured indi-viuals per 1000 t	Age-sampled individu-als per 1000 t	EU DCF for com-parison
	2018	4	1	19718	473	1651	11943	286	125
Redfish	2008	5	3	330	0	46	7174	0	125
	2009	8	2	0	0	100	0	0	125
	2010	6	2	0	0	52	0	0	125
	2011	6	1	7937	0	844	9404	0	125
	2012	9	2	4036	0	584	6911	0	125
	2013	4	1	1315	0	81	16235	0	125
	2014	4	1	571	0	451	1266	0	125
	2015	4	1	76	0	266	286	0	125
	2016	3	1	6095	0	497	12264	0	125
	2017	4	1	977	0	770	1269	0	125
	2018	4	2	3438	0	2508	1371	0	125
G. halibut	2008	5	2	0	0	5	0	0	125
	2009	3	2	0	0	19	0	0	125
	2010	2	2	0	0	14	0	0	125
	2011	3	1	0	0	81	0	0	125

Stock	Year	No of unique vessels	No of length samples	No of length-measured individuals	No of aged individuals	Landings (t)	Length-measured individuals per 1000 t	Age-sampled individuals per 1000 t	EU DCF for comparison
	2012	4	2	0	0	40	0	0	125
	2013	3	1	1298	0	49	26544	0	125
	2014	4	1	1076	0	34	31647	0	125
	2015	4	1	658	0	32	20563	0	125
	2016	3	1	365	0	9	40556	0	125
	2017	4	1	0	0	21	0	0	125
	2018	4	1	257	0	52	4942	0	125