ARCTIC FISHERIES WORKING GROUP (AFWG)

VOLUME 3 | ISSUE 58

ICES SCIENTIFIC REPORTS

RAPPORTS
SCIENTIFIQUES DU CIEM

ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
CIEM CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

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

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

ISSN number: 2618-1371

ICES Scientific Reports

Volume 3 | Issue 58

ARCTIC FISHERIES WORKING GROUP (AFWG)

Recommended format for purpose of citation:

ICES. 2021. Arctic Fisheries Working Group (AFWG).
ICES Scientific Reports. 3:58. 817 pp. https://doi.org/10.17895/ices.pub.8196

Editors

Daniel Howell

Authors

Jane Aanestad Godiksen • Erik Berg • Matthias Bernreuther • Bjarte Bogstad • José Miguel Casas Thomas de Lange Wenneck • Elena Eriksen • Johanna Fall • Anatoly Filin • Harald Gjøsæter • Elvar Hallfredsson • Hannes Höffle • Daniel Howell • Edda Johannesen • Yuri Kovalev • Kjell Nedreaas • Holly Ann Perryman • Dmitri Prozorkevich • Alexey Russkikh • Silje Elizabeth Seim • Arved Staby • Ross Tallman • Mikko Juhani Vihtakari • Tone Vollen • Kristin Windsland • Natalia Yaragina

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

Section contents

3 Cod in subareas 1 and 2 (Northeast Arctic) 120
3.1 Status of the fisheries 120
3.1.1 Historical development of the fisheries (Table 3.1) 120
3.1.2 Reported catches prior to 2021 (Table 3.1–Table 3.4, Figure 3.1) 120
3.1.3 Unreported catches of Northeast Arctic cod (Table 3.1) 121
3.1.4 TACs and advised catches for 2020 and 2021 121
3.2 Status of research 122
3.2.1 Fishing effort and CPUE (Table A1, Figure 3.6a–c.) 122
3.2.2 Survey results - abundance and size at age (Tables 3.5, A2-A14) 122
Joint Barents Sea winter survey (bottom trawl and acoustics) Acronyms: BS-NoRu-Q1 (BTr) and BS-NoRu-Q1 (Aco) 122
Lofoten acoustic survey on spawners Acronym: Lof-Aco-Q1 123
Russian autumn survey Acronym: RU-BTr-Q4 123
Joint Ecosystem survey Acronym: Eco-NoRu-Q3 (Btr) 123
Survey results: length and weight-at-age (Tables A5-A8, A11-A12, A15) 124
3.2.3 Age reading 124
3.3 Data used in the assessment 125
3.3.1 Catch-at-age (Table 3.6) 125
3.3.2 Survey indices used in assessment (Table 3.13, A13) 125
3.3.3 Weight-at-age (Table 3.7–Table 3.9, A2, A4, A6, A8, A12) 126
Catch weights 126
Stock weights 126
3.3.4 Natural mortality including cannibalism (Table 3.12, Table 3.17) 126
3.3.5 Maturity-at-age (Table 3.10–Table 3.11, Table 3.10– Table 3.11) 127
3.4 Changes of data and assessment model settings at the latest benchmark 127
3.5 Assessment using SAM 127
3.5.1 SAM settings (Table 3.14) 127
3.5.2 SAM diagnostics (Figure 3.1 and Figure 3.2 a–c) 128
3.5.3 Results of assessment (Table 3.15– Table 3.18, Table 3.20, Figure 3.1) 128
3.6 Reference points and harvest control rules 128
3.6.1 Biomass reference points 128
3.6.2 Fishing mortality reference points 129
3.6.3 Harvest control rule 129
3.7 Prediction 129
3.7.1 Prediction input (Table 3.16, Table 3.19, Figure 3.3–Figure 3.5) 129
3.7.2 Recruitment prediction (Table 1.9) 130
3.7.3 Prediction results (Table 3.20–Table 3.21) 131
3.8 Comparison with last year's assessment and prediction 131
3.8.1 Comparison to 2020 assessment and 2021 benchmark assessment (Figure 3.8b) 131
3.8.2 Comparison to prediction 132
3.9 Concerns with the assessment 132
3.10 Additional assessment methods 132
3.10.1 TISVPA (Table 3.22–Table 3.24, Figure 3.7a–c) 133
3.10.2 Model comparisons (Figure 3.2a, Figure 3.7a, Figure 3.8a) 133
3.11 New and revised data sources 133
3.11.1 Consistency between NEA cod and coastal cod catch data (Table 3.2) 133
3.11.2 Discard and bycatch data (Table 3.25–Table 3.26) 133

3 Cod in subareas 1 and 2 (Northeast Arctic)

Gadus morhua – cod.27.1-2

3.1 Status of the fisheries

3.1.1 Historical development of the fisheries (Table 3.1)

From a level of about 900 000 t in the mid-1970s, total catch declined steadily to around 300 000 t in 1983–1985 (Table 3.1). Catches increased to above 500 000 t in 1987 before dropping to 212 000 t in 1990, the lowest level recorded in the post-war period. The catches increased rapidly from 1991 onwards, stabilized around 750 000 t in 1994–1997 but decreased to about 414 000 t in 2000. From 2000–2009, the reported catches were between 400 000 and 520 000 t, in addition there were unreported catches (see below). Catches have been above the long-term average since 2011 and have decreased from a peak of 986 449 tonnes in 2014 to 692 000 tonnes in 2019–2020. The fishery is conducted both with an international trawler fleet and with coastal vessels using traditional fishing gears. Quotas were introduced in 1978 for the trawler fleets and in 1989 for the coastal fleets. In addition to quotas, the fishery is regulated by a minimum catch size, a minimum mesh size in trawls and Danish seines, a maximum bycatch of undersized fish, closure of areas having high densities of juveniles and by seasonal and area restrictions.

3.1.2 Reported catches prior to 2021 (Table 3.1–Table 3.4, Figure 3.1)

The provisional catch of cod in Subarea 1 and divisions 2.a and 2.b for 2020 reported to the working group is 738 204 t (including both NEA cod and NCC catches).

Reported catch figures used for the assessment of Northeast Arctic cod:

The historical practice (considering catches between 62°N and 67°N for the whole year and catches between 67°N and 69°N for the second half of the year to be Norwegian coastal cod) has been used for estimating the Norwegian landings of Northeast Arctic cod up to and including 2011 (Table 3.2). The catches of coastal cod subtracted from total cod catches in Subarea 1 and divisions 2.a and 2.b for the period 1960–2020 are given in Table 3.2. For 2012–2020 the Norwegian catches have been analysed by an ECA-version designed for simultaneously providing estimates of catch numbers-at-age for each of the two stocks. Coastal cod catches in 2020 for the southern and northern area combined were 45 301 tonnes using the current conversion factors between round and gutted weight, and this amount was as in previous years subtracted from the total cod catch north of 62°N to get the figure for NEA cod used in that assessment (Table 3.1 and 3.2). The figure for total coastal cod catch in 2020 using the revised conversion factors, as decided at WKBARFAR 2021 and used in the coastal cod assessment was 46 614 tonnes (Table 2.1a), which is 2.9% above the value using the current conversion factors.

These values for coastal cod are now inconsistent with the coastal cod catches presented in section 2, as the coastal cod catch time-series were revised at WKBARFAR, but not the NEA cod time-series. At WKBARFAR, the proposal for revision of NEA cod catch dataseries was rejected, as Norwegian data for many years and age groups (especially ages 12+ in years prior to 2013) were changed considerably and the reason for this was not sufficiently explained. WKBARFAR recommended that when the revision of the historical Norwegian catch data are ready it should be submitted to ICES for review, ideally by a review attached to the AFWG. The catch by area is shown in Table 3.1, and further split into trawl and other gears in Table 3.3. The distribution of

catches by areas and gears in 2020 was similar to 2019. The nominal landings by country are given in Table 3.4.

There is information on cod discards (see section 1) but it was not included in the assessment because these data are fragmented and different estimates are in contradiction with each other. Moreover the level of discards is relatively small in the recent period and inclusion of these estimates in the assessment should not change our perception on NEA cod stock size.

In summer/autumn 2018, a Norwegian vessel caught 441 t of cod in the Jan Mayen EEZ, which is a part of ICES area 2a, mostly by longline. Cod is known to occasionally occur in this area, but rarely in densities which are suitable for commercial fisheries. The cod caught in this area in 2018 was large (65–110 cm), and otolith readings and genetics both showed this cod to be a mix of Northeast Arctic and Icelandic cod. Norway did in 2019–2020 carry out an experimental longline fishery during four different periods in each year in order to investigate further the occurrence of cod in this area in space and time as well as stock identity. The size distribution and genetic composition of the cod caught in this area in 2019–2020 was similar to that in 2018, although there was somewhat more smaller cod (< 65 cm) in 2020 than in 2019. Most of the cod caught in April–May 2019 was spawning or spent, while most cod caught in March 2020 had not started spawning. Cod spawning in this area has not been observed prior to 2019. Total catches in 2019 amounted to 628 t and in 2020 to 522 t. The 2018 catches in this area were partly counted against the Norwegian TAC for cod north of 62°N , while the 2019 and 2020 TAC for this area comes in addition to the Norwegian TAC for cod as agreed by JNRFC. There has been varying practice considering including those catches in the assessment, they were included in 2020 but the plan is to exclude them for all years in future assessments. Regulations for the fishery in this area for 2021 have not yet been decided upon.

3.1.3 Unreported catches of Northeast Arctic cod (Table 3.1)

In the years 2002–2008 certain quantities of unreported catches (IUU catches) have been added to the reported landings. More details on this issue are given in the Working group reports for that period.

There are no reliable data on level of IUU catches outside the periods 1990–1994 and 2002–2008, but it is believed that their level was not substantial enough to influence on historical stock assessment.

According to reports from the Norwegian-Russian analysis group on estimation of total catches the total catches of cod since 2009 were very close to officially reported landings.

3.1.4 TACs and advised catches for 2020 and 2021

The Joint Norwegian-Russian Fisheries Commission (JNRFC) agreed on a cod TAC of 738 000 t for 2020, and in addition 21 000 t Norwegian coastal cod. The total reported catch of 738 204 t in 2020 was 20 796 t below the agreed TAC. Since 2015 JNRFC has decided that Norway and Russia can transfer to next year or borrow from last year 10% of the cod country's quota. That may lead to some deviation between agreed TAC and reported catch. Ignoring quota transfers, Norwegian catches in 2020 were about 10 000 t below the TAC, as were Russian catches, while third country catches were close to the TAC. The difference for Norway was mainly due to quota transfers between 2019 and 2020.

The advice for 2021 given by ACOM in 2020 was 885 600 t based on the agreed harvest control rule. The quota established by JNRFC for 2021 was set equal to the advice. In addition, the TAC for Norwegian Coastal Cod was set to the same value for 2021 as for 2020: 21 000 t.

3.2 Status of research

3.2.1 Fishing effort and CPUE (Table A1, Figure 3.6a–c.)

CPUE series of the Norwegian and Russian trawl fisheries are given in Table A1. The data reflect the total trawl effort (Figure 3.6a), both for Norway and Russia. The Norwegian series is given as a total for all areas. Norwegian data for 2011–2020 are not necessarily compatible with data for 2007 and previous years. Norwegian CPUE has been relatively stable since 2016 (Figure 3.6b), while in 2020 Russian CPUE decreased in areas 1 and 2b but increased in 2a compared to 2019. The trawl CPUE for Norway and Russia in the first part of 2020 were at the same level as in 2019 while in the second half of 2020 they were considerably lower than during the same period in 2019, particular for the Russian fleet, as seen from the monthly values in Figure 3.6c.

3.2.2 Survey results - abundance and size at age (Tables 3.5, A2-A14)

Joint Barents Sea winter survey (bottom trawl and acoustics) Acronyms: BS-NoRu-Q1 (BTr) and BS-NoRu-Q1 (Aco)

The preliminary swept-area estimates and acoustic estimates from the Joint winter survey on demersal fish in the Barents Sea in winter 2021 are given in Tables A2 and A3. More details on this survey are given in WD 02. The total area covered was larger than in 2020 but about the same as in 2019. The coverage was limited by ice particularly in the east and southeast. However, the fish density at the edge of the survey area was generally quite low, so overall the coverage was considered to be good. Note that since the AFWG was conducted, minor errors were discovered in the winter survey for 2021 (both acoustic and bottom trawl). These had minimal (<2%) impact on the assessment of SSB and no impact on the advised catch for NEA cod. This report is not updated to account for correcting these errors.

Before 2000 this survey was made without participation from Russian vessels, while in 2001–2005, 2008–2016 and 2018–2021 Russian vessels have covered important parts of the Russian zone. In 2006–2007 the survey was carried out only by Norwegian vessels. In 2007, 2016 and 2021 the Norwegian vessels were not allowed to cover the Russian EEZ. The method for adjustment for incomplete area coverage in 2007 is described in the 2007 report. The same method was used to adjust the 1997–1998 survey indices in the 2016 revision (Mehl *et al.*, 2016). Table 3.5 shows areas covered in the time-series and the additional areas implied in the method used to adjust for missing coverage in the Russian Economic Zone. In 5 of the 8 adjusted years (including 2021) the adjustments were not based on area ratios, but the "index ratio by age" was used. This means that the index by age for the covered area was scaled by the observed ratio between total index and the index for the same area observed in the years prior to the survey. The adjustments for 2017 were based on average index rations by age for 2014–2016. Adjustments were also made in 2020–2021 using the average index ratios by age for 2018–2019 and 2019–2020, respectively.

Regarding the older part of this time-series it should be noted that the survey prior to 1993 covered a smaller area (Jakobsen *et al.*, 1997), and the number of young cod (particularly 1 and 2 year-old fish) was probably underestimated. Other changes in the survey methodology through time are described by Jakobsen *et al.*(1997), while the surveys for the years 2007–2012 and 2013–2018 are reported in Mehl *et al.* (2013, 2014, 2015, 2016, 2017a). Note that the change from 35 to 22 mm mesh size in the codend in 1994 is not corrected for in the time-series. This mainly affects the age 1 indices.

Updated survey series for bottom trawl and acoustic indices are given in Fall *et al.* (2020 winter survey report).

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 2014–2021 surveys covered considerably larger areas than earlier winter surveys, and showed that most age groups of cod (particularly ages 1 and 2) were distributed far outside the standard survey area. The bottom trawl survey estimates including the extended area for 2014–2021 were used in the tuning data separately from the same index before 2014, as decided at WKBARFAR 2021.

Lofoten acoustic survey on spawners Acronym: Lof-Aco-Q1

The estimated abundance indices from the Norwegian acoustic survey off Lofoten and Vesterålen (the main spawning area for this stock) in March/April are given in Table A4. A description of the survey, sampling effort and details of the estimation procedure can be found in Korsbrekke (1997). The survey series for 2010–2020 was revised for the benchmark. The 2021 survey results in biomass terms was 237 thousand tonnes, this is 57% below the 2020 level and the lowest since 2008. The survey was carried out in the usual direction from north to south, while the 2020 survey was carried out in the opposite direction. It was noted that on the inner side of the Lofoten Islands the cod abundance was very low compared to previous years, this is in line with catch reports from fishers this winter.

Russian autumn survey Acronym: RU-BTr-Q4

Abundance estimates from the Russian autumn survey (November-December) are given in Table A9 (acoustic estimates) and Table A10 (bottom trawl estimates). The entire bottom trawl timeseries was in 2007 revised backwards to 1982 (Golovanov *et al.*, 2007, WD3), using the same method as in the revision presented in 2006, which went back to 1994. The new swept-area indices reflect Northeast Arctic cod stock dynamics more precisely compared to the previous one - catch per hour trawling. The Russian autumn survey in 2006 was carried out with reduced area coverage. Divisions 2a and 2b were adequately investigated in the survey in contrast to Subarea 1, where the survey covered approximately 40% of the long-term average area coverage. The Subarea 1 survey indices were calculated based on actual covered area (40 541 sq. miles). The 2007 AFWG decided to use the "final" year class indices without any correction because of satisfactory internal correspondence between year class abundances at age 2–9 years according to the 2006 survey and ones due to the previous surveys.

This survey was not conducted in 2016, but was carried out in 2017, when 79% of the standard survey area was covered (Sokolov *et al.*, 2018, WD 11). The index shows a reliable internal consistence and it was decided to use it in the assessment. This survey was not carried out in 2018–2020 and will likely be discontinued.

Joint Ecosystem survey Acronym: Eco-NoRu-Q3 (Btr)

Swept-area bottom trawl estimates from the joint Norwegian-Russian ecosystem survey in August-September for the period 2004–2020 are given in Table A14. This survey normally covers the entire distribution area of cod at that time of the year.

In 2014 this survey had an essential problem with area coverage in the northwest region because of difficult ice conditions. In the area covered by ice in 2014 a substantial part of population was distributed during 2013 survey. So, based on those observations AFWG decided in 2015 to exclude 2014 year from that tuning series in current assessment. In 2016 there was incomplete coverage in the international waters and close to the Murmansk coast. An adjustment for this incomplete coverage was made based on interpolation from adjacent areas (Kovalev *et al.*, 2017, WD 12). At this time of the year, usually a relatively small part of the cod stock is found in the area which was not covered in 2016. In 2017 and 2019 the coverage was close to complete,

although the far north-eastern part of the survey area (west of the north island of Novaya Zemlya) was not covered due to military restrictions. In 2018, a large area in the eastern part of the Barents Sea was not covered Thus it was decided not to include 2018 data from this survey in the assessment. The coverage in 2020 was less synoptic than usual, as explained in Section 0.6. As the survey indices from the BESS 2020 showed an unexplainable large decline compared to the 2019 indices, it was considered to exclude 2020 indices from this survey, but it was decided to keep them in and re-evaluate next year whether they should still be included in the assessment.

The survey indices are calculated both the BioFox and StoX calculation methods, and as in earlier years, the Biofox series was used in the tuning. A research recommendation from WKBARFAR was to unify these two methods for estimating indices from ecosystem survey. However, the benchmark decided to use weight at age from the StoX in calculations of weight at age used in the assessment.

Survey results: length and weight-at-age (Tables A5-A8, A11-A12, A15)

Length-at-age is shown in Table A5 for the Norwegian survey in the Barents Sea in winter, in Table A7 for the Lofoten survey and in Table A11 for the Russian survey in October-December. Weight-at-age is shown in Table A6 for the Norwegian survey in the Barents Sea in winter, in Table A8 for the Lofoten survey, Table A12 for the Russian survey in October-December and Table A15 for the BESS survey (calculated using StoX).

The joint winter survey in 2021 showed low values for most age groups, and for ages 4 and 5 the observed values were the lowest observed in the revised time-series going back to 1994. Length and weight at age in the Lofoten survey is stable. The size at age in the BESS survey shows similar trends, but the 2020 values are not as low compared to the time-series average as in the 2021 winter survey. One reason for this could be that the BESS survey in 2020 ended later in autumn than usual. The development of size at age and growth is discussed in an ecological context in section 1.2.

3.2.3 Age reading

The joint Norwegian-Russian work on cod otolith reading has continued, with regular exchanges of otoliths and age readers (see section 1.7). The results of fifteen years of annual comparative age readings are described in Yaragina *et al.* (2009). Zuykova *et al.* (2009) re-read old otoliths and found no significant difference in contemporary and historical age determination and subsequent length-at-age. However, age at first maturation in the historical material as determined by contemporary readers is younger than that determined by historical readers. Taking this difference into account would thus have effect on the spawning stock–recruitment relationship and thus on the biological reference points. The overall percentage agreement for the 2017–2018 exchange was 87.7% (WD 8, AFWG 2020). The main reason for cod ageing discrepancies between Russian and Norwegian specialists remains the same, representing the latest summer growth zone, and different interpretations of the false zones. 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. More details can be found in section 0.7.

The trend with bias in NEA cod age determination registered for some years of the period 1992–2018 between experts of both countries is a solid argument to continue comparative cod age reading between PINRO and IMR to monitor the situation. The German participant has expressed an intention to join the age reading cooperation in future.

3.3 Data used in the assessment

Data for the period 1946–1983 are taken from the AFWG 2001 report (ICES CM 2001/ACFM:19) and were not revised at the WKBARFAR benchmark in 2021.

3.3.1 Catch-at-age (Table 3.6)

For 2020, age compositions from all areas were available from Russia, Norway and Germany (divisions 1 and 2a). Unsampled catches were distributed on age by using data from Russian trawl in Subarea 1 and Division 2a, and by using data from Norwegian trawl in Division 2b. The catch-at-age data were calculated using InterCatch (Table 3.6).

There is still a concern about the biological sampling from parts of the Norwegian fishery that may be too low. Also the split between NEA cod and coastal cod may be affected by the sampling coverage.

Length distributions from the Russian fishery were made by observers on board fishing vessels in reasonably sufficient quantity in all areas. Also, length samples of cod taken by Norwegian Coast Guard on board Russian fishing vessels in Norwegian economic zone (NEZ) in the first and second quarter and in Division 2.b in the fourth quarter of 2020 were used in calculations of length/age distributions. These data were combined with Russian observers' data. An advantage of adding the Norwegian Coast Guard data are that they were taken regularly over the whole NEZ area and Division 2.b. However, biological sampling from the trawl fishery has been relatively low, especially in Division 2a.

Some minor error corrections in historical catch-at-age data (1984–2019) were made since WKBARFAR benchmark in 2021.

3.3.2 Survey indices used in assessment (Table 3.13, A13)

The following survey dataseries were used:

Fleet code	Name	Place	Season	Age	Years
Fleet 15*	Joint bottom trawl survey	Barents Sea	Feb-Mar	3–12+	1981–2013, 2014–2021
Fleet 16	Joint acoustic survey	Barents Sea+Lofoten	Feb-Mar	3–12+	1985–2021
Fleet 18	Russian bottom trawl surv.	Total area	Oct-Dec	3–12+	1982–2017
Fleet 007	Ecosystem surv.	Total area	Aug-Sep	3–12+	2004–2020

***Survey indices for Fleet 15 were divided by two series (before and after 2014) in model tuning as decided at WKBARFAR 2021.**

The tuning fleet file is shown in Table 3.13. Note that the joint acoustic survey (sum of Barents Sea and Lofoten acoustic survey indices) is given in Table A13.

Survey indices for Fleet 15 have been multiplied by a factor 100, while survey indices for Fleets 007, 16 and 18 have been multiplied by a factor 10. This is done to keep the dynamics of the surveys even for very low indices, because some models (e.g. XSA) adds 1.0 to the indices before the logarithm is taken.

3.3.3 Weight-at-age (Table 3.7–Table 3.9, A2, A4, A6, A8, A12)

Catch weights

For 2020, the mean weight-at-age in the catch (Table 3.8) was obtained from InterCatch as a weighted average of the weight-at-age in the catch for Norway, Russia, and Germany (Table 3.7). The weight-at-age in the catch for all countries is given in Table 3.7. For ages up to and including 11, observations are used. Following the WKBARFAR 2021 decision, weight at age in catch for the years 1983-present for ages 12–15+ are calculated by a cohort-based von Bertalanffy approach used to replace previous fixed values.

Stock weights

For ages 1–11 stock weights-at-age at the start of year y ($W_{a,y}$) for 1983–2021 are calculated combining, when available, weight at age from the wWinter, Lofoten, Russian autumn and ecosystem surveys. Ecosystem survey data were added following the WKBARFAR 2021. The details are given in the stock annex. For ages 12–-15+ a similar approach as for weight at age in the catch was used.

3.3.4 Natural mortality including cannibalism (Table 3.12, Table 3.17)

A natural mortality (M) of 0.2+ cannibalism was used. Cannibalism is assumed to only affect natural mortality of ages 3–6.

The method used for calculation of the prey consumption by cod described by Bogstad and Mehl (1997) is used to calculate the consumption of cod by cod (Table 3.12) for use in cod stock assessment. The consumption is calculated based on cod stomach content data taken from the joint PINRO-IMR stomach content database (methods described in Mehl and Yaragina 1992). On average about 9000 cod stomachs from the Barents Sea have been analysed annually in the period 1984–2020.

These data are used to calculate the per capita consumption of cod by cod for each half-year (by prey age groups 0–6 and predator age groups 1–11+). It was assumed that the mature part of the cod stock is found outside the Barents Sea for three months during the first half of the year. Thus, consumption by cod in the spawning period was omitted from the calculations.

An iterative procedure was applied to include the per capita consumption data in the SAM run. It is described in detail in Stock Annex.

For the cod assessment data from annual sampling of cod stomachs has been used for estimating cannibalism, since the 1995 assessment. The argument has been raised that the uncertainty in such calculations are so large that they introduce too much noise in the assessment. A rather comprehensive analysis of the usefulness of this was presented in Appendix 1 in the 2004 AFWG report. The conclusion was that it improves the assessment.

The data on cod cannibalism for the historical period (1946–1983) was included in assessment during the benchmark to make the time-series consistent (ICES 2015, WKARCT 2015). These estimates (Table 3.17) were based on hindcasted values of NEA cod natural mortality-at-ages 3–5 using PINRO database on food composition from cod stomach for the historical period (Yaragina *et al.*,. 2018).

At this year's meeting the consumption data for period 1994–2020 were slightly changed compare to last year's assessments because of changes in cod weights- and maturities-at-age in stock done during the WKBARFAR in 2021.

3.3.5 Maturity-at-age (Table 3.10–Table 3.11, Table 3.10– Table 3.11)

Historical (pre–1982) Norwegian and Russian time-series on maturity ogives were reconstructed by the 2001 AFWG meeting (ICES CM 2001/ACFM:19). The Norwegian maturity ogives were constructed using the Gulland method for individual cohorts, based on information on age at first spawning from otoliths. For the period 1946–1958 only the Norwegian data were available. The Russian proportions mature-at-age, based on visual examinations of gonads, were available from 1959.

Since 1982 Russian and Norwegian survey data have been used (Table 3.10). For the years 1985–2020, Norwegian maturity-at-age ogives have been obtained by combining the Barents Sea winter survey and the Lofoten survey. Russian maturity ogives from the autumn survey as well as from commercial fishery for November-February are available from 1984 until present. The Norwegian maturity ogives tend to give a higher percent mature-at-age compared to the Russian ogives, which is consistent with the generally higher growth rates observed in cod sampled by the Norwegian surveys. The percent mature-at-age for the Russian and Norwegian surveys have been arithmetically averaged for all years, except 1982–1983 when only Norwegian observations were used and 1984 when only Russian observations were used.

Russian data for the autumn survey for 2018 and later years were not available as the survey was not conducted. In WD 15, 2019, updated correction factors to allow for this when calculating the combined maturity-at-age in 2019 were calculated, based on historical differences between Norwegian and Russian data. These correction factors were then applied to the Norwegian data for 2020–2021.

The approach used for calculating maturity-at-age is the same as previously used and consistent with the approach used to estimate the weight-at-age in the stock, except that no data from the BESS survey are used. However, since survey data, both abundance indices and proportion mature, have been revised, the entire time-series of ogives back to 1994 was revised at the benchmark. The proportions of mature cod for age 13–15 are set to 1 for the period 1984–present.

Maturity-at-age for cod has been variable the last five years, particularly for ages 6–9. According to the combined data, maturity-at-age decreased in 2015–2016, then increased, but decreased again from 2019 to 2021 (Table 3.11).

3.4 Changes of data and assessment model settings at the latest benchmark

As mentioned in Sections 3.2 and 3.3, the survey-based dataseries (indices, weight at age in stock, maturity-at-age) were revised at the WKBARFAR benchmark. Further, age 12+ are now used in the tuning instead of age 12 for all series and age 3 indices are now also included in the assessment also for the bottom trawl and acoustic series form the winter survey (Fleet 15 and 16).

In addition weight at age in catch and in stock for ages 12–15+ were revised.

SAM settings were considerably revised at WKBARFAR.

3.5 Assessment using SAM

3.5.1 SAM settings (Table 3.14)

The SAM model settings optimized by WKBARFAR are shown in Table 3.14.

3.5.2 SAM diagnostics (Figure 3.1 and Figure 3.2 a–c)

Residuals for the SAM run are shown in Figure 3.2a, while retrospective plots of F, SSB and recruitment are shown in Figure 3.2b. Figure 3.2c shows the catchability by survey and age group.

Some high negative residuals in terminal year are observed for Ecosystem survey (Fleet007) for older ages and for some ages in Fleet15 (second part) in SAM.

The retrospective pattern is generally good (Figure 3.2b), but the largest discrepancies are observed for SSB (Mohn's rho 8%), while rho's for R and F are much smaller (2%). One of the possible sources of the observed retro pattern in SSB could be influence of ecosystem survey in 2020. The SAM run without that year included for the ecosystem survey shows a much better retro pattern.

The simulations done for testing model sensitivity to initial values of parameters (Jit analysis) showed the model result to be independent of them.

3.5.3 Results of assessment (Table 3.15– Table 3.18, Table 3.20, Figure 3.1)

Summaries of landings, fishing mortality, stock biomass, spawning-stock biomass and recruitment since 1946 are given in Table 3.18 and Figure 3.1.

The fishing mortalities and population numbers are given in Tables 3.15 and 3.16.

The estimated $F_{5–10}$ in 2020 is 0.43, which is above F_{pa} (Table 3.18), but equal to what the harvest control rule would have given based on this year's calculation of SSB in 2020. Fishing mortality has been increasing slowly in recent years. The spawning-stock biomass in 2021 is estimated to be 885 kt (Table 3.20), which is high but much lower than the peak in 2013 (2257 kt). One should bear in mind that in the early part of the time-series (before the 1980s) the fraction at age of mature fish was considerably lower.

Total stock biomass in 2021 is estimated to 2092 kt which is close to the long-term mean and well below the highest level observed after 1955 (3740 kt in 2013).

It is noted that the exploitation pattern is still dome-shaped with a marked decrease in selectivity above age 12, although the dome-shape is not as strong than in previous assessments.

M values (M = 0.2+cannibalism mortality) are given in Table 3.17. For ages 3–5 the M matrix in 1946–1983 also includes M2 since the benchmark meeting in 2015 (WKARCT 2015).

3.6 Reference points and harvest control rules

The current reference points for Northeast Arctic cod were estimated by SGBRP (ICES CM 2003/ACFM:11) and adopted by ACFM at the May 2003 meeting.

At the 46th session of JRNFC a new version of the management rule was adopted (see section 3.7.3). The TAC advice for 2022 is based on the agreed harvest control rule.

3.6.1 Biomass reference points

The values adopted by ACFM in 2003 are B_{lim} = 220 000 t, B_{pa} = 460 000 t. (ICES CM 2003/ACFM:11).

3.6.2 Fishing mortality reference points

The values adopted by ACFM in 2003 are F_{lim} = 0.74 and F_{pa} = 0.40. (ICES CM 2003/ACFM:11). The F_{MSY} for NEA cod was estimated by WKBARFAR 2021 to be in the range 0.40 - 0.60.

3.6.3 Harvest control rule

The history of how the harvest control rule has developed is given in the 2017 AFWG report. JNRFC in 2015 asked ICES to explore the consequences of 10 different harvest control rules. This was done by WKNEAMP (ICES 2015, 2016). JNRFC in 2016 adopted one of the rules explored by WKNEAMP (Rule 6 in that report).

The current rule reads as follows:

> **The TAC is calculated as the average catch predicted for the coming 3 years using the target level of exploitation (F_{tr}).**
>
> **The target level of exploitation is calculated according to the spawning-stock biomass (SSB) in the first year of the forecast as follows:**
>
> **if SSB < B_{pa}, then F_{tr} = SSB / B_{pa} × F_{MSY};**
>
> **if B_{pa} ≤ SSB ≤ 2×B_{pa}, then F_{tr} = F_{MSY};**
>
> **if 2×B_{pa} < SSB < 3×B_{pa}, then F_{tr} = F_{MSY} × (1 + 0.5 × (SSB - 2×B_{pa}) / B_{pa});**
>
> **if SSB ≥ 3×B_{pa}, then F_{tr} = 1.5 × F_{MSY};**
>
> **where F_{MSY}=0.40 and B_{pa}=460 000 tonnes.**
>
> **If the spawning-stock biomass in the present year, the previous year and each of the three years of prediction is above B_{pa}, the TAC should not be changed by more than +/- 20% compared with the previous year's TAC. In this case, F_{tr} should however not be below 0.30.**

3.7 Prediction

3.7.1 Prediction input (Table 3.16, Table 3.19, Figure 3.3–Figure 3.5)

The input data to the short-term prediction with management option table (2021–2024) are given in Table 3.19. For 2021 stock weights and maturity were calculated from surveys as described in Sections 3.3.2 and 3.3.4.

Catch weights in 2021 onwards and stock weights in 2022 and onwards for age 3–11 are predicted by the method described by Brander (2002), where the latest observation of weights by cohort are used together with average annual increments to predict the weight of the cohort the following year. The method is given by the equation:

W(a+1,y+1)=W(a,y) + Incr(a), where Incr(a) is a "medium term" average of Incr(a,y)= W(a+1,y+1)-W(a,y)

(eq 1)

This method was introduced in the cod prediction in the 2003 working group. Since 2005 working group an average of the 3 most recent values of annual increments have been used for predicting stock weights. For catch weights the last 5-year period for averaging the increments is used (changed from 10-year period at the benchmark). Figures 3.3 and 3.4 show how these predictions perform back in history.

The maturity ogive for the years 2022–2024 was predicted by using the 2019–2021 average. The exploitation pattern in 2021 and later years was set equal to the previous 5 years according to the benchmark decision and as described at Stock Annex.

The stock number-at-age in 2021 was taken from the final SAM run (Table 3.16) for ages 4 and older. The recruitment-at-age 3 in the years 2021–2024 was estimated as described in section 3.7.2. Figure 3.5 shows the development in natural mortality due to cannibalism for cod (prey) age groups 1–3 together with the abundance of capelin in the period 1984–2020. There was no clear trend in natural mortality, and the average M values for the last 3 years are used to predict natural mortality of age groups 3–6 for years 2021–2024 (based on benchmark decision, WKARCT 2015 and unchanged at WKBARFAR 2021).

The assessment shows a slightly increasing F from 2015 to 2020. In accordance with the benchmark decision (WKARCT 2015, not reviewed at WKBARFAR 2021) and with support from AFWG 2019 WD 11 (Kovalev and Chetyrkin, 2019), the last year's assessment F in terminal year 2020 (*status quo*) is used for F in the intermediate year (2021). Table 3.19 shows input data to the predictions. The results of prediction show that the catch in 2021 predicted using F_{sq} is about 230 kt less than the agreed TAC. As the coastal cod catch in recent years has been about 20 kt higher than the TAC of 21 kt, this means that if the total TAC for Northeast arctic cod and Coastal cod will be taken, the predicted catch using F_{sq} will be about 210 kt or 24% below the TAC. Reported catches so far in 2021 indicate that the TAC is not likely to be taken.

3.7.2 Recruitment prediction (Table 1.9)

At the 2008 AFWG meeting it was decided to use a hybrid model, which is a weighted arithmetic mean of different recruitment models (see section 1). It was agreed to use the same approach this year. The input data for those models are the following time-series; ice coverage, intensity of interaction between the arctic and boreal oceanic systems on the shelf of the Barents Sea, temperature and oxygen saturation at the Kola section. Prognosis from all the models, including the hybrid is presented in Table 1.9. Since 2014 the hybrid model is based on objective weighting of different submodels and includes the RCT3 model (see section 1 for details). The numbers-at-age 3 calculated by the hybrid method were: 561 million for the 2018 year class, 621 million for the 2019 year class, 548 million for the 2020 year class and 386 million for the 2021 year class (Table 1.9).

Although age 3 indices from the winter bottom trawl and acoustic surveys are now also included in the SAM tuning, it was decided at the benchmark to continue using in the predictions recruitment estimates at age 3 in the assessment year (intermediate year in prediction) from the hybrid model. The difference between the SAM estimate and the hybrid model estimate of age 3 in 2021 was small (483 vs. 561 million individuals).

The values used for the 2019 and 2020 year classes in the prediction are higher than the very low survey indices for those year classes at age 1 and 2 indicate. The reason for this should be investigated. It was noted that the age 1–3 survey series used in the hybrid model are not split in 2014 when the survey area was extended, as was done for the bottom trawl indices for age 3 and older used in the SAM assessment.

3.7.3 Prediction results (Table 3.20–Table 3.21)

The catch corresponding to F_{sq} in 2021 is 653.5 kt (Table 3.20). The resulting SSB in 2022 is 852 kt, which is slightly below SSB in 2021. Table 3.20 shows the short-term consequences over a range of F-values in 2022. The detailed outputs corresponding to F_{sq} in 2021 and the F corresponding to the HCR and F_{pa} in 2022 is given in Table 3.21. Summarized results are shown in the text table below.

Since SSB in 2022 is between B_{pa} = 460 000 t and 2 × B_{pa} = 920 000 t, F = 0.40 is used in the 3-year prediction, giving catches of 596 273, 596 141 and 606 946 tonnes in 2022, 2023, and 2024, respectively. The average of this is 599 787 tonnes. According to the HCR the maximum year-to-year decrease in TAC is limited by 20% which corresponds to a TAC of 708 480 tonnes for 2022.

Basis	Total catch (2022)	Ftotal (2022)	SSB(2023)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis						
Management plan^	708 480	0.50	758 177	−11	−20	−20
Other options						
MSY approach: F_{MSY}	596 273	0.40	839 903	−1	−33	−33
F = 0	0	0	1 306 235	53	−100	−100
F = F2020	637 009	0.4340	809 979	−5	−28	−28
F_{pa}	596 273	0.40	839 903	−1	−33	−33
F_{lim}	951 449	0.74	589 364	−31	7	7

Weights in tonnes.

^ 20% decrease from TAC 2021

*** SSB 2023 relative to SSB 2022.**

**** Catch 2022 relative to TAC 2021**

***** Advice for 2022 relative to advice for 2021**

This catch forecast covers all catches. It is then implied that all types of catches are to be counted against this TAC. It also means that if any overfishing is expected to take place, the above calculated TAC should be reduced by the expected amount of overfishing.

3.8 Comparison with last year's assessment and prediction

3.8.1 Comparison to 2020 assessment and 2021 benchmark assessment (Figure 3.8b)

The text tables below compare this year's estimates with the 2020 AFWG estimates and the WKBARFAR 2021 with the AFWG 2020 estimates, for numbers-at-age (millions), total biomass, spawning biomass (thousand tonnes) in 2020, as well as reference F for the year 2019.

							N 2020								TSB	SSB	F
	F(2019)	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10	age 11	age 12	age 13	age 14	age 15+	2020	2020	2020
Assessment																	
AFWG 2020	0.338	583*	460.18	290.83	284.66	111.15	64.75	66.94	29.4	11.276	4.364	2.529	3.595	9.803	2640	1368	0.338**
AFWG 2021	0.408	561	388.17	326.36	188.43	145.28	56.17	30.32	27.55	8.734	2.939	1.133	0.671	2.805	2248	1004	0.434
Ratio	1.21	0.96	0.84	1.12	0.66	1.31	0.87	0.45	0.94	0.77	0.67	0.45	0.19	0.29	0.85	0.73	1.28
AFWG2021/AFWG 2020																	

							N 2020								TSB	SSB	F
	F(2019)	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10	age 11	age 12	age 13	age 14	age 15+	2020	2020	2020
Assessment																	
AFWG 2020	0.338	583*	460.18	290.83	284.66	111.15	64.75	66.94	29.4	11.276	4.364	2.529	3.595	9.803	2640	1368	0.338**
WKBarFar 2021	0.386	692.1	525.88	329.7	286.56	106.5	57.75	57.32	24.38	9.19	4.087	1.867	2.207	5.271	2498	1091	0.385
Ratio	1.14	1.19	1.14	1.13	1.01	0.96	0.89	0.86	0.83	0.82	0.94	0.74	0.61	0.54	0.95	0.80	1.14
WKBARFAR 2021/AFWG 2020																	

***estimated by recruitment models **assuming F_{sq}**

At the WKBARFAR benchmark, the number in 2020 at age 3–5 was adjusted upwards compared to AFWG 2020 for ages 3–5 and downwards for ages 7 and older. Thus SSB was adjusted considerably downwards while immature fish abundance increased slightly. At AFWG 2021, number-at-ages 10 and older was adjusted further downwards. For younger ages, the changes went in both directions, but mostly there was a decrease from the benchmark, with age 7 being the main exception. On the other hand, age 9 in 2020 was adjusted considerably downwards.

3.8.2 Comparison to prediction

The changes in the advice are large compared to last year. The advice for 2022 is 708 480 t, while the advice for 2021 given by ICES was 885 600 tonnes. However, the advice for 2022 is not very different from the advice for 2019 and 2020.

There has been a downwards revision of the assessed stock in 2021 compared with the assessment in 2020. This revision is mainly due to revision in data and model settings made at WKBARFAR 2021, and partly due to an additional year of data. Overall, TSB in 2020 decreased by 392 kt from the AFWG 2020 to the AFWG 2021 assessment, with most of the reduction (364 kt) being in SSB. As this reduction in SSB occurs in the interval between $2*B_{pa}$ and $3*B_{pa}$ (920 and 1380 kt), where the second slope of the two-step HCR is, the reduction in SSB will lead to a larger reduction in TAC advice than the reduction in TSB alone would indicate. The downwards revision in SSB together with the decreasing trend in the stock results in a decrease in the target F to 0.40 compared with last year's 0.597. The average catch predicted for the coming 3 years, using the mentioned target level of exploitation (Ftr) in the HCR resulted in TAC advice equal to 708 480 t. This value corresponds to the −20% limit on year-to-year TAC change stated in the HCR, and is higher than the value without applying such a constraint (604 125 t).

3.9 Concerns with the assessment

The WG realizes that imprecise input data, in particular the catch-at-age matrix, and discontinuation of some surveys as well as incomplete spatial coverage and reduced synopticity in surveys could be a main obstacle to producing precise stock assessments, regardless of which model is used.

All surveys indicate a decreasing stock but this trend is stronger in the BESS than in the other surveys. This increases the uncertainty of assessment.

3.10 Additional assessment methods

All models use the same tuning data. The XSA model, which for many years was the main assessment model and since 2016 has been used as an auxiliary model, is no longer run for Northeast Arctic cod.

3.10.1 TISVPA (Table 3.22–Table 3.24, Figure 3.7a–c)

This year the TISVPA model was applied to NEA cod with the same settings as last year and using the same data as SAM except that natural mortality values from cannibalism were taken from the SAM runs. During AFWG 2021 the results of exploratory runs using the TISVPA model were discussed (WD 18). The residuals of the model approximation of catch-at-age and "fleets" data are presented in Figure 3.7a. Likelihood profiles for different data source are presented in Figure 3.7b. Retrospective run results are shown in Figure 3.7c. The results (Table 3.22–Table 3.24) generally support the results of the SAM model, with a similar SSB estimate but a lower TSB estimate in 2021.

3.10.2 Model comparisons (Figure 3.2a, Figure 3.7a, Figure 3.8a)

Figure 3.8a compares the results of SAM and TISVPA, showing F, SSB, TSB and recruitment. F, TSB and SSB in 2021 is very similar for all models, while recruitment in recent years is lower in TISVPA than in SAM. The residual pattern for the ecosystem survey in TISVPA model have some similarity to SAM model residuals for year 2020 (Figures 3.2a, 3.7a).

3.11 New and revised data sources

This section describes some data sources, which could be revised or included in the assessment in future.

3.11.1 Consistency between NEA cod and coastal cod catch data (Table 3.2)

Consistency between the catch data used for NEA cod and coastal cod should be ensured. The revised catch figures used in the coastal cod assessment do not correspond to the difference between the total cod catch and the catch used in the NEA cod assessment (Table 3.2). These discrepancies will be adjusted when the NEA cod catch series are revised (section 3.2.2).

3.11.2 Discard and bycatch data (Table 3.25–Table 3.26)

Work on updating discard and bycatch dataseries (Table 3.25 and Table 3.26) is ongoing, new data on age groups were not available in time for AFWG 2019. Revised bycatch estimates for the period 2005–2020 are described in section 1.6. At WKARCT in 2015 it was, however, decided not to include those data in the catch-at-age matrix.

Table 3.26 (taken from Ajiad *et al*., WD2, 2008) presents bycatch in the Norwegian shrimp fishery by cod age (previously this has been given by cod length). The bycatch mainly consists of age 1 and 2 fish, but the bycatch is generally small compared to other reported sources of mortality: catches, discards and the number of cod eaten by cod. From 1992 onwards, bycatches of age 3 and older fish are negligible, because use of sorting grids was made mandatory. However, in 1985, bycatches of age 5 and 6 cod were about one third of the reported catches for those age groups. The year class for which the bycatches were highest, was the 1983 year class (total bycatch of age 2 and older fish of about 60 million, compared to a stock estimate of about 1300 million at age 3.

Table 3.1. Northeast Arctic cod. Total catch (t) by fishing areas and unreported catch.

Year	Subarea 1	Division 2.a	Division 2.b	Unreported catches	Total catch
1961	409 694	153 019	220 508		783 221
1962	548 621	139 848	220 797		909 266
1963	547 469	117 100	111 768		776 337
1964	206 883	104 698	126 114		437 695
1965	241 489	100 011	103 430		444 983
1966	292 253	134 805	56 653		483 711
1967	322 798	128 747	121 060		572 605
1968	642 452	162 472	269 254		1 074 084
1969	679 373	255 599	262 254		1 197 226
1970	603 855	243 835	85 556		933 246
1971	312 505	319 623	56 920		689 048
1972	197 015	335 257	32 982		565 254
1973	492 716	211 762	88 207		792 685
1974	723 489	124 214	254 730		1 102 433
1975	561 701	120 276	147 400		829 377
1976	526 685	237 245	103 533		867 463
1977	538 231	257 073	109 997		905 301
1978	418 265	263 157	17 293		698 715
1979	195 166	235 449	9 923		440 538
1980	168 671	199 313	12 450		380 434
1981	137 033	245 167	16 837		399 037
1982	96 576	236 125	31 029		363 730
1983	64 803	200 279	24 910		289 992
1984	54 317	197 573	25 761		277 651
1985	112 605	173 559	21 756		307 920
1986	157 631	202 688	69 794		430 113
1987	146 106	245 387	131 578		523 071
1988	166 649	209 930	58 360		434 939
1989	164 512	149 360	18 609		332 481

Year	Subarea 1	Division 2.a	Division 2.b	Unreported catches	Total catch
1990	62 272	99 465	25 263	25 000	212 000
1991	70 970	156 966	41 222	50 000	319 158
1992	124 219	172 532	86 483	130 000	513 234
1993	195 771	269 383	66 457	50 000	581 611
1994	353 425	306 417	86 244	25 000	771 086
1995	251 448	317 585	170 966		739 999
1996	278 364	297 237	156 627		732 228
1997	273 376	326 689	162 338		762 403
1998	250 815	257 398	84 411		592 624
1999	159 021	216 898	108 991		484 910
2000	137 197	204 167	73 506		414 870
2001	142 628	185 890	97 953		426 471
2002	184 789	189 013	71 242	90 000	535 045
2003	163 109	222 052	51 829	115 000	551 990
2004	177 888	219 261	92 296	117 000	606 445
2005	159 573	194 644	121 059	166 000	641 276
2006	159 851	204 603	104 743	67 100	537 642
2007	152 522	195 383	97 891	41 087	486 883
2008	144 905	203 244	101 022	15 000	464 171
2009	161 602	207 205	154 623		523 431
2010	183 988	271 337	154 657		609 983
2011	198 333	328 598	192 898		719 829
2012	247 938	331087	148 638		727 663
2013	360 673	421678	183 858		966 209
2014	320 347	468 934	197 168		986 449
2015	272 405	375 328	216 651		864 384
2016	321 347	351 468	176 607		849 422
2017	309 902	360 477	197 898		868 276
2018	249 397	321 548	207 681		778 627

Year	Subarea 1	Division 2.a	Division 2.b	Unreported catches	Total catch
2019	234 985	318 539	139 084		692 609
2020[1]	234 029	298 707	160 166		692 903

Data provided by Working Group members.

1 - Provisional figure

Table 3.2. Catches of Norwegian Coastal Cod in subareas 1 and 2, 10^3 tonnes, which are removed from the NEA cod assessment.

Year	Norwegian catches of cod removed from the NEACcod-assessment
v1960–70	38.6
1971–79	no data
1980	40
1981	49
1982	42
1983	38
1984	33
1985	28
1986	26
1987	31
1988	22
1989	17
1990	24
1991	25
1992	35
1993	44
1994	48
1995	39
1996	32
1997	36
1998	29
1999	23
2000	19

Year	Norwegian catches of cod removed from the NEACcod-assessment
2001	14
2002	20
2003	19
2004	14
2005	13
2006	15
2007	13
2008	13
2009	15
2010	13.5
2011	18.8
2012	35.5
2013	30.1
2014	33.6
2015	35.8
2016	54.9
2017	51.0
2018	36.3
2019	40.1
2020	45.3

Table 3.3. Northeast Arctic COD. Total nominal catch ('000 t) by trawl and other gear for each.

	Subarea 1		Division 2.a		Division 2.b	
Year	Trawl	Others	Trawl	Others	Trawl	Others
1967	238	84.8	38.7	90	121.1	-
1968	588.1	54.4	44.2	118.3	269.2	-
1969	633.5	45.9	119.7	135.9	262.3	-
1970	524.5	79.4	90.5	153.3	85.6	-
1971	253.1	59.4	74.5	245.1	56.9	-
1972	158.1	38.9	49.9	285.4	33	-

	Subarea 1		Division 2.a		Division 2.b	
Year	Trawl	Others	Trawl	Others	Trawl	Others
1973	459	33.7	39.4	172.4	88.2	-
1974	677	46.5	41	83.2	254.7	-
1975	526.3	35.4	33.7	86.6	147.4	-
1976	466.5	60.2	112.3	124.9	103.5	-
1977	471.5	66.7	100.9	156.2	110	-
1978	360.4	57.9	117	146.2	17.3	-
1979	161.5	33.7	114.9	120.5	8.1	-
1980	133.3	35.4	83.7	115.6	12.5	-
1981	91.5	45.1	77.2	167.9	17.2	-
1982	44.8	51.8	65.1	171	21	-
1983	36.6	28.2	56.6	143.7	24.9	-
1984	24.5	29.8	46.9	150.7	25.6	-
1985	72.4	40.2	60.7	112.8	21.5	-
1986	109.5	48.1	116.3	86.4	69.8	-
1987	126.3	19.8	167.9	77.5	129.9	1.7
1988	149.1	17.6	122	88	58.2	0.2
1989	144.4	19.5	68.9	81.2	19.1	0.1
1990	51.4	10.9	47.4	52.1	24.5	0.8
1991	58.9	12.1	73	84	40	1.2
1992	103.7	20.5	79.7	92.8	85.6	0.9
1993	165.1	30.7	155.5	113.9	66.3	0.2
1994	312.1	41.3	165.8	140.6	84.3	1.9
1995	218.1	33.3	174.3	143.3	160.3	10.7
1996	248.9	32.7	137.1	159	147.7	6.8
1997	235.6	37.7	150.5	176.2	154.7	7.6
1998	219.8	31	127	130.4	82.7	1.7
1999	133.3	25.7	101.9	115	107.2	1.8
2000	111.7	25.5	105.4	98.8	72.2	1.3

	Subarea 1		Division 2.a		Division 2.b	
Year	Trawl	Others	Trawl	Others	Trawl	Others
2001	119.1	23.5	83.1	102.8	95.4	2.5
2002	147.4	37.4	83.4	105.6	69.9	1.3
2003	146	17.1	107.8	114.2	50.1	1.8
2004	154.4	23.5	100.3	118.9	88.8	3.5
2005	132.4	27.2	87	107.7	115.4	5.6
2006	141.8	18.1	91.2	113.4	100.1	4.6
2007	129.6	22.9	84.8	110.6	91.6	6.3
2008	123.8	21.1	94.8	108.4	95.3	5.7
2009	130.1	31.5	102	105.2	142.1	11.4
2010	151.1	32.9	130	141.4	149.2	5.4
2011	158.1	38.4	163.5	167	181	11.9
2012	212.1	35.9	172.7	158.4	133.8	14.9
2013	308.5	52.2	216.9	204.7	159.7	24.1
2014	268.8	51.5	246.8	222.1	177.9	19.3
2015	224.3	48.1	192.2	183.2	197.7	19.0
2016	285.5	35.8	181.7	169.8	156.3	20.3
2017	265.4	44.5	189.5	171.0	180.0	17.9
2018	204.7	44.7	156.7	164.9	192.0	15.6
2019	199.4	35.6	177.8	140.7	128.9	10.1
2020 [1]	199.4	34.6	157.2	141.5	153.5	6.7

Data provided by Working Group members

1 Provisional figures

Table 3.4. Northeast Arctic COD. Nominal catch(t) by countries. (Subarea 1 and divisions 2a and 2b combined, data provided by Working group members.

Year	Faroe Islands	France	German Dem.Rep.	Fed.Rep. Germany	Norway	Poland	United Kingdom	Russia[2]	Others	Total all countries
1961	3 934	13 755	3 921	8 129	268 377	-	158 113	325 780	1 212	783 221
1962	3 109	20 482	1 532	6 503	225 615	-	175 020	476 760	245	909 266
1963	-	18 318	129	4 223	205 056	108	129 779	417 964	-	775 577
1964	-	8 634	297	3 202	149 878	-	94 549	180 550	585	437 695
1965	-	526	91	3 670	197 085	-	89 962	152 780	816	444 930
1966	-	2 967	228	4 284	203 792	-	103 012	169 300	121	483 704
1967	-	664	45	3 632	218 910	-	87 008	262 340	6	572 605
1968	-	-	225	1 073	255 611	-	140 387	676 758	-	1 074 084
1969	29 374	-	5 907	5 543	305 241	7 856	231 066	612 215	133	1 197 226
1970	26 265	44 245	12 413	9 451	377 606	5 153	181 481	276 632	-	933 246
1971	5 877	34 772	4 998	9 726	407 044	1 512	80 102	144 802	215	689 048
1972	1 393	8 915	1 300	3 405	394 181	892	58 382	96 653	166	565 287
1973	1 916	17 028	4 684	16 751	285 184	843	78 808	387 196	276	792 686
1974	5 717	46 028	4 860	78 507	287 276	9 898	90 894	540 801	38 453	1 102 434
1975	11 309	28 734	9 981	30 037	277 099	7 435	101 843	343 580	19 368	829 377
1976	11 511	20 941	8 946	24 369	344 502	6 986	89 061	343 057	18 090	867 463
1977	9 167	15 414	3 463	12 763	388 982	1 084	86 781	369 876	17 771	905 301
1978	9 092	9 394	3 029	5 434	363 088	566	35 449	267 138	5 525	698 715
1979	6 320	3 046	547	2 513	294 821	15	17 991	105 846	9 439	440 538
1980	9 981	1 705	233	1 921	232 242	3	10 366	115 194	8 789	380 434
						Spain				
1981	12 825	3 106	298	2 228	277 818	14 500	5 262	83 000	-	399 037
1982	11 998	761	302	1 717	287 525	14 515	6 601	40 311	-	363 730
1983	11 106	126	473	1 243	234 000	14 229	5 840	22 975	-	289 992
1984	10 674	11	686	1 010	230 743	8 608	3 663	22 256	-	277 651
1985	13 418	23	1 019	4 395	211 065	7 846	3 335	62 489	4 330	307 920
1986	18 667	591	1 543	10 092	232 096	5 497	7 581	150 541	3 505	430 113
1987	15 036	1	986	7 035	268 004	16 223	10 957	202 314	2 515	523 071
1988	15 329	2 551	605	2 803	223 412	10 905	8 107	169 365	1 862	434 939
1989	15 625	3 231	326	3 291	158 684	7 802	7 056	134 593	1 273	332 481
1990	9 584	592	169	1 437	88 737	7 950	3 412	74 609	510	187 000
1991	8 981	975	**Greenland**	2 613	126 226	3 677	3 981	119 427 [3]	3 278	269 158
1992	11 663	2	3 337	3 911	168 460	6 217	6 120	182 315	**Iceland**	1 209	383 234
1993	17 435	3 572	5 389	5 887	221 051	8 800	11 336	244 860	9 374	3 907	531 611
1994	22 826	1 962	6 882	8 283	318 395	14 929	15 579	291 925	36 737	28 568	746 086
1995	22 262	4 912	7 462	7 428	319 987	15 505	16 329	296 158	34 214	15 742	739 999
1996	17 758	5 352	6 529	8 326	319 158	15 871	16 061	305 317	23 005	14 851	732 228
1997	20 076	5 353	6 426	6 680	357 825	17 130	18 066	313 344	4 200	13 303	762 403
1998	14 290	1 197	6 388	3 841	284 647	14 212	14 294	244 115	1 423	8 217	592 624
1999	13 700	2 137	4 093	3 019	223 390	8 994	11 315	210 379	1 985	5 898	484 910
2000	13 350	2 621	5 787	3 513	192 860	8 695	9 165	166 202	7 562	5 115	414 870
2001	12 500	2 681	5 727	4 524	188 431	9 196	8 698	183 572	5 917	5 225	426 471
2002	15 693	2 934	6 419	4 517	202 559	8 414	8 977	184 072	5 975	5 484	445 045
2003	19 427	2 921	7 026	4 732	191 977	7 924	8 711	182 160	5 963	6 149	436 990
2004	19 226	3 621	8 196	6 187	212 117	11 285	14 004	201 525	7 201	6 082	489 445
2005	16 273	3 491	8 135	5 848	207 825	9 349	10 744	200 077	5 874	7 660	475 276
2006	16 327	4 376	8 164	3 837	201 987	9 219	10 594	203 782	5 972	6 271	470 527
2007	14 788	3 190	5951	4619	199 809	9 496	9298	186 229	7316	5 101	445 796
2008	15 812	3 149	5 617	4 955	196 598	9 658	8 287	190 225	7 535	7 336	449 171
2009	16 905	3 908	4 977	8 585	224 298	12 013	8 632	229 291	7 380	7 442	523 431
2010	15 977	4 499	6 584	8 442	264 701	12 657	9 091	267 547	11 299	9 185	609 983
2011	13 429	1 173	7 155	4 621	331 535	13 291	8 210	310 326	12 734	17 354 [4]	719 829
2012 [5]	17523	2841	8520	8 500	315 739	12814	11166	329 943	9536	11 081	727 663
2013	13833	7858	7885	8 010	438 734	15042	12536	432 314	14734	15 263	966 209
2014	33298	8149	10864	6 225	431 846	16378	14762	433 479	18205	13 243	986 449
2015	26568	7480	7055	6 427	377 983	19905	11778	381 188	16120	9 880	864 384
2016	24084	7946	8607	6 336	348 949	14640	13583	394 107	16031	15 139	849 422
2017	28637	9554	13638	5 977	357 419	14414	16731	396 180	11925	13 802	868 276
2018	26152	6605	12743	9 768	333 539	13143	11533	340 364	10708	14 071	778 627
2019	22270	6371	7553	8 470	282 120	13939	11214	316 813	12294	11 565	692 609
2020 [1]	21679	5796	7391	9 725	289 472	11403	12113	312 683	9734	12 908	692 903

[1] Provisional figures.

[2] USSR prior to 1991.

[3] Includes Baltic countries.

[4] Includes unspecified EU catches.

[5] Revised figures.

Table 3.5. Barents Sea winter survey. Area covered ('000 square nautical miles) and areas implied in the method used to adjust for missing coverage in Russian Economic Zone. In 4 of the 5 adjusted years the adjustments were not based on area ratios, but the "index ratio by age" was used. This means that the index by age (for the area outside REZ) was scaled by the observed ratio between total index and the index outside REZ observed in the years prior to the survey.

Year	Area covered	Additional area implied in adjustment	Adjustment method
1981–1992	88.1		
1993	137.6		
1994	161.1		
1995	191.9		
1996	166.1		
1997	88.4	56.2	Index ratio by age
1998	100.4	51.1	Index ratio by age
1999	118.5		
2000	163.2		
2001	164.7		
2002	157.4		
2003	147.4		
2004	164.4		
2005	179.9		
2006	170.1	18.1	Partly covered strata raised to full strata area
2007	123.9	56.7	Index ratio by age
2008	165.2		
2009	171.8		
2010	160.5		
2011	174.3		
2012	151.3	16.7	Index ratio by age
2013	203.6		
2014	266.8		
2015	243.3		
2016	228.0		
2017	184.4	37.5	Index ratio by age
2018	236.3		

Year	Area covered	Additional area implied in adjustment	Adjustment method
2019	241.2		
2020	203.2	25.1	Index ratio by age
2021	242.9	10.9	Index ratio by age

Table 3.6. Northeast Arctic cod. Catch numbers-at-age (Thous)

SAM Sat Apr 17 21:10:24 2021

Year age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTALNUM
1946	4008	10387	18906	16596	13843	15370	59845	22618	10093	9573	5460	1927	750	189376
1947	710	13192	43890	52017	45501	13075	19718	47678	31392	9348	9330	4622	4103	294576
1948	140	3872	31054	55983	77375	21482	15237	9815	30041	7945	4491	3899	4205	265539
1949	991	6808	35214	100497	83283	29727	13207	5606	8617	13154	3657	1895	2167	304823
1950	1281	10954	29045	45233	62579	30037	19481	9172	6019	4133	6750	1662	1450	227796
1951	24687	77924	64013	46867	37535	33673	23510	10589	4221	1288	1002	3322	611	329242
1952	24099	120704	113203	73827	49389	20562	24367	15651	8327	3565	647	467	1044	455852
1953	47413	107659	112040	55500	22742	16863	10559	10553	5637	1752	468	173	156	391515
1954	11473	155171	146395	100751	40635	10713	11791	8557	6751	2370	896	268	123	495894
1955	3902	37652	201834	161336	84031	30451	13713	9481	4140	2406	867	355	128	550296
1956	10614	24172	129803	250472	86784	51091	14987	7465	3952	1655	1292	448	166	582901
1957	17321	33931	27182	70702	87033	39213	17747	6219	3232	1220	347	299	173	304619
1958	31219	133576	71051	40737	38380	35786	13338	10475	3289	1070	252	40	141	379354
1959	32308	77942	148285	53480	18498	17735	23118	9483	3748	997	254	161	98	386107
1960	37882	97865	64222	67425	23117	8429	7240	11675	4504	1843	354	102	226	324884
1961	45478	132655	123458	51167	38740	17376	5791	6778	5560	1682	910	280	108	429983
1962	42416	170566	167241	89460	28297	21996	7956	2728	2603	1647	392	280	103	535685

Year age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTALNUM
1963	13196	106984	205549	95498	35518	16221	11894	3884	1021	1025	498	129	157	491574
1964	5298	45912	97950	58575	19642	9162	6196	3553	783	172	387	264	131	248025
1965	15725	25999	78299	68511	25444	8438	3569	1467	1161	131	61	79	197	229081
1966	55937	55644	34676	42539	37169	18500	5077	1495	380	403	77	9	70	251976
1967	34467	160048	69235	22061	26295	25139	11323	2329	687	316	225	40	14	352179
1968	3709	174585	267961	107051	26701	16399	11597	3657	657	122	124	70	46	612679
1969	2307	24545	238511	181239	79363	26989	13463	5092	1913	414	121	23	46	574026
1970	7164	10792	25813	137829	96420	31920	8933	3249	1232	260	106	39	35	323792
1971	7754	13739	11831	9527	59290	52003	12093	2434	762	418	149	42	25	170067
1972	35536	45431	26832	12089	7918	34885	22315	4572	1215	353	315	121	40	191622
1973	294262	131493	61000	20569	7248	8328	19130	4499	677	195	81	59	55	547596
1974	91855	437377	203772	47006	12630	4370	2523	5607	2127	322	151	83	62	807885
1975	45282	59798	226646	118567	29522	9353	2617	1555	1928	575	231	15	37	496126
1976	85337	114341	79993	118236	47872	13962	4051	936	558	442	139	26	53	465946
1977	39594	168609	136335	52925	61821	23338	5659	1521	610	271	122	92	54	490951
1978	78822	45400	88495	56823	25407	31821	9408	1227	913	446	748	48	51	339609
1979	8600	77484	43677	31943	16815	8274	10974	1785	427	103	59	38	45	200224
1980	3911	17086	81986	40061	17664	7442	3508	3196	678	79	24	26	8	175669

Year age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTALNUM
1981	3407	9466	20803	63433	21788	9933	4267	1311	882	109	37	3	NA	135439
1982	8948	20933	19345	28084	42496	8395	2878	708	271	260	27	5	5	132355
1983	3108	19594	20473	17656	17004	18329	2545	646	229	74	58	20	5	99741
1984	6942	14240	18807	20086	15145	8287	5988	783	232	153	49	12	8	90732
1985	24634	45769	27806	19418	11369	3747	1557	768	137	36	31	32	8	135312
1986	28968	70993	78672	25215	11711	4063	976	726	557	136	28	34	14	222093
1987	13648	137106	98210	61407	13707	3866	910	455	187	227	21	59	20	329823
1988	9828	22774	135347	54379	21015	3304	1236	519	106	69	43	14	5	248639
1989	5085	17313	32165	81756	27854	5501	827	290	41	13	NA	11	16	170872
1990	1911	7551	12999	17827	30007	6810	828	179	59	15	6	5	2	78199
1991	4963	10933	16467	20342	19479	25193	3888	428	48	12	NA	NA	2	101755
1992	21835	36015	27494	23392	18351	13541	18321	2529	264	82	3	9	NA	161836
1993	10094	46182	63578	33623	14866	9449	6571	12593	1749	377	63	22	NA	199167
1994	6531	59444	102548	59766	32504	10019	6163	3671	7528	995	121	19	4	289313
1995	4879	42587	115329	98485	32036	7334	3014	1725	1174	1920	222	41	NA	308746
1996	7655	28782	80711	100509	54590	10545	2023	930	462	230	809	84	NA	287330
1997	12827	36491	69633	83017	65768	28392	4651	1151	373	213	144	238	NA	302898
1998	31887	88874	48972	40493	34513	26354	6583	965	197	69	42	22	53	279024

Year age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTALNUM
1999	7501	77714	92816	31139	15778	15851	8828	1837	195	40	34	8	30	251771
2000	4701	33094	93044	47210	12671	6677	4787	1647	321	71	11	NA	14	204248
2001	5044	35019	62139	62456	22794	5266	1773	1163	343	85	6	7	22	196117
2002	2348	31033	76175	67656	42122	11527	1801	529	223	120	21	9	6	233570
2003	7263	20885	64447	71109	36706	14002	2887	492	142	97	21	43	NA	218094
2004	2090	38226	50826	68350	50838	18118	6239	1746	295	127	39	16	8	236918
2005	5815	19768	113144	61665	44777	20553	6285	2348	562	100	21	24	7	275069
2006	8548	47207	33625	78150	31770	15667	7245	1788	737	210	26	45	155	225173
2007	25473	43817	62877	26303	34392	11240	4080	1381	505	285	44	13	35	210445
2008	8459	51704	40656	35072	14037	20676	5503	1794	715	229	42	26	13	178926
2009	4866	38711	83998	46639	20789	8417	8920	1957	872	987	76	21	20	216273
2010	1778	16193	53855	75853	36797	17062	4784	4325	3034	913	189	49	35	214867
2011	1418	8033	32472	70938	73875	21116	11708	5058	3237	600	434	12	0	228901
2012	2695	10462	16646	40372	70014	48315	12326	5214	1926	1124	317	70	24	209505
2013	2903	13659	22752	21020	54231	74451	47124	9143	2963	694	449	89	145	249623
2014	5234	19226	38407	36633	29901	56109	47540	22738	3717	1169	313	210	157	261354
2015	4315	31383	41181	51209	33745	22530	23609	24553	16071	2510	468	134	254	251962
2016	2076	11291	50231	43609	35265	23417	14592	20105	15862	4781	871	249	308	222657

Year age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTALNUM
2017	6535	13128	28365	66504	46136	28507	15307	10073	12169	6465	1927	399	285	235800
2018	6120	28569	27128	33816	54328	28323	16208	9722	7132	3740	2295	840	271	218492
2019	4389	21405	48422	29849	26548	39759	17395	8883	4606	2109	715	564	322	204966
2020	3992	22446	37649	52454	31009	20904	23618	11768	6130	1572	591	310	278	212721

Table 3.7. Northeast Arctic cod. Weights-at-age (kg) in landings from various countries.

Norway														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1983	0.41	0.82	1.32	2.05	2.82	3.94	5.53	7.70	9.17	11.46	16.59	16.42	16.96	24.46
1984	1.16	1.47	1.97	2.53	3.13	3.82	4.81	5.95	7.19	7.86	8.46	7.99	9.78	10.64
1985	0.34	0.99	1.43	2.14	3.27	4.68	6.05	7.73	9.86	11.87	14.16	14.17	13.52	15.33
1986	0.30	0.67	1.34	2.04	3.14	4.60	5.78	6.70	7.52	9.74	10.68	12.86	9.59	16.31
1987	0.24	0.48	0.88	1.66	2.72	4.35	6.21	8.78	9.78	12.50	13.75	15.12	10.43	19.95
1988	0.36	0.56	0.83	1.31	2.34	3.84	6.50	8.76	9.97	11.06	14.43	19.02	12.89	10.16
1989	0.53	0.75	0.90	1.17	1.95	3.20	4.88	7.82	9.40	11.52	11.47		19.47	14.68
1990	0.40	0.81	1.22	1.59	2.14	3.29	4.99	7.83	10.54	14.21	17.63	7.97	14.64	
1991	0.63	1.37	1.77	2.31	3.01	3.68	4.63	6.06	8.98	12.89	17.00		14.17	16.63
1992	0.41	1.10	1.79	2.45	3.22	4.33	5.27	6.21	8.10	10.51	11.59		15.81	6.52
1993	0.30	0.83	1.70	2.41	3.35	4.27	5.45	6.28	7.10	7.82	10.10	16.03	19.51	17.68
1994	0.30	0.82	1.37	2.23	3.35	4.27	5.56	6.86	7.45	7.98	9.53	12.16	11.45	19.79
1995	0.44	0.78	1.26	1.87	2.80	4.12	5.15	5.96	7.90	8.67	9.20	11.53	17.77	21.11
1996	0.29	0.90	1.15	1.67	2.58	4.08	6.04	6.62	7.96	9.36	10.55	11.41	9.51	24.24
1997	0.35	0.78	1.14	1.56	2.25	3.48	5.35	7.38	7.55	8.30	11.15	8.64	12.80	
1998	0.38	0.68	1.03	1.64	2.23	3.24	4.85	6.88	9.18	9.84	15.78	14.37	13.77	15.58
1999	0.46	0.88	1.16	1.65	2.40	3.12	4.26	6.00	6.52	10.64	14.05	12.67	9.20	17.22
2000	0.31	0.65	1.23	1.80	2.54	3.58	4.49	5.71	7.54	7.86	12.71	14.71	15.40	20.26
2001	0.30	0.77	1.18	1.83	2.75	3.64	4.88	5.93	7.43	8.90	10.22	11.11	13.03	18.85
2002	0.31	0.90	1.40	1.90	2.60	3.55	4.60	5.80	7.40	9.56	8.71	12.92	8.42	17.61
2003	0.55	0.88	1.39	2.01	2.63	3.59	4.83	5.57	7.26	9.36	9.52	9.52	10.68	21.66
2004	0.54	1.08	1.41	1.95	2.69	3.46	4.77	6.72	7.90	8.66	12.21	14.02	16.50	11.37
2005	0.58	0.92	1.38	1.86	2.61	3.54	4.57	6.41	8.24	9.89	11.04	14.08	11.81	20.08
2006	0.51	0.97	1.45	2.06	2.71	3.56	4.57	5.53	6.61	7.53	8.55	8.44	9.82	12.31
2007	0.53	1.07	1.70	2.37	3.26	4.36	5.45	6.71	8.08	8.56	9.75	11.72	12.72	15.58
2008	0.65	1.12	1.70	2.44	3.32	4.41	5.61	6.84	8.25	9.31	10.54	12.45	13.59	21.15

Norway														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
2009	0.56	0.98	1.47	2.10	2.83	3.90	5.06	5.76	7.31	7.79	7.81	10.68	11.83	14.76
2010	0.55	0.95	1.46	2.06	2.93	4.02	5.40	6.44	7.19	8.43	9.11	10.46	11.39	15.55
2011	0.53	1.09	1.50	2.06	2.85	3.70	5.01	6.26	7.33	8.34	9.87	13.23		
2012		0.83	1.32	1.92	2.65	3.52	4.71	6.34	8.11	9.92	11.31	13.45	15.75	
2013	0.43	0.95	1.40	2.00	2.64	3.44	4.51	5.67	7.29	8.80	10.33	11.38	12.56	
2014	0.59	1.07	1.55	2.15	2.80	3.70	4.57	5.78	6.97	8.35	9.46	10.99	12.28	15.49
2015	0.64	0.96	1.42	1.96	2.57	3.30	4.13	5.49	6.46	7.18	8.63	10.37	12.24	14.60
2016	0.59	0.96	1.46	1.99	2.71	3.57	4.56	5.78	6.82	8.08	9.33	10.01	11.68	14.79
2017	0.55	0.99	1.53	2.06	2.69	3.64	4.72	5.91	6.91	7.88	9.41	10.93	11.78	15.07
2018	0.62	1.05	1.51	2.11	2.80	3.48	4.54	5.80	6.97	7.64	9.11	10.29	11.35	14.05
2019	0.51	0.96	1.43	2.02	2.72	3.60	4.51	5.80	6.91	7.94	8.89	10.94	11.55	14.49
2020	0.58	0.94	1.42	2.01	2.66	3.50	4.59	5.77	7.03	8.46	9.78	10.97	12.74	16.08

Russia (trawl only)														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1983	0.65	1.05	1.58	2.31	3.39	4.87	6.86	8.72	10.40	12.07	14.43			
1984	0.53	0.88	1.45	2.22	3.21	4.73	6.05	8.43	10.34	12.61	14.95			
1985	0.33	0.77	1.31	1.84	2.96	4.17	5.94	6.38	8.58	10.28				
1986	0.29	0.61	1.14	1.75	2.45	4.17	6.18	8.04	9.48	11.33	12.35	14.13		
1987	0.24	0.52	0.88	1.42	2.07	2.96	5.07	7.56	8.93	10.80	13.05	18.16		
1988	0.27	0.49	0.88	1.32	2.06	3.02	4.40	6.91	9.15	11.65	12.53	14.68		
1989	0.50	0.73	1.00	1.39	1.88	2.67	4.06	6.09	7.76	9.88				
1990	0.45	0.83	1.21	1.70	2.27	3.16	4.35	6.25	8.73	10.85	13.52			
1991	0.36	0.64	1.05	2.03	2.85	3.77	4.92	6.13	8.36	10.44	15.84	19.33		
1992	0.55	1.20	1.44	2.07	3.04	4.24	5.14	5.97	7.25	9.28	11.36			
1993	0.48	0.78	1.39	2.06	2.62	4.07	5.72	6.79	7.59	11.26	14.79	17.71		
1994	0.41	0.81	1.24	1.80	2.55	2.88	4.96	6.91	8.12	10.28	12.42	16.93		

Russia (trawl only)														
Year	**Age**													
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15+**
1995	0.37	0.77	1.21	1.74	2.37	3.40	4.71	6.73	8.47	9.58	12.03	16.99		
1996	0.30	0.64	1.09	1.60	2.37	3.42	5.30	7.86	8.86	10.87	11.80			
1997	0.30	0.57	1.00	1.52	2.18	3.30	4.94	7.15	10.08	11.87	13.54			
1998	0.33	0.68	1.06	1.60	2.34	3.39	5.03	6.89	10.76	12.39	13.61	14.72		
1999	0.24	0.58	0.98	1.41	2.17	3.26	4.42	5.70	7.27	10.24	14.12			
2000	0.18	0.48	0.85	1.44	2.16	3.12	4.44	5.79	7.49	9.66	10.36			
2001	0.12	0.31	0.62	1.00	1.53	2.30	3.31	4.57	6.55	8.11	9.52	11.99		
2002	0.20	0.60	1.05	1.46	2.14	3.27	4.47	6.23	8.37	10.06	12.37			
2003	0.23	0.63	1.06	1.78	2.40	3.41	4.86	6.28	7.55	11.10	13.41	12.12	14.51	
2004	0.30	0.57	1.09	1.55	2.37	3.20	4.73	6.92	8.41	9.77	11.08			
2005	0.33	0.65	0.98	1.50	2.10	3.08	4.31	5.81	8.42	10.37	13.56	14.13		
2006	0.27	0.68	1.05	1.49	2.25	3.16	4.54	5.90	8.59	10.31	12.31			
2007	0.23	0.67	1.12	1.66	2.25	3.31	4.57	6.27	8.20	10.02	12.36	12.42		
2008	0.28	0.64	1.16	1.74	2.65	3.58	4.74	5.73	7.32	8.07	9.52	12.52		
2009	0.31	0.64	1.09	1.58	2.11	3.19	4.80	6.58	7.97	9.84	11.51			
2010	0.25	0.57	1.00	1.64	2.28	3.14	4.53	5.98	8.03	9.71	10.70	13.53		
2011	0.25	0.62	1.05	1.56	2.18	2.95	4.33	6.21	8.04	10.13	12.25	15.18		
2012	0.29	0.60	1.07	1.66	2.25	2.95	4.17	6.23	8.58	11.08	12.24	14.07	15.22	16.39
2013	0.33	0.63	1.05	1.54	2.26	3.09	4.08	5.47	7.37	9.59	12.57	15.54	17.05	
2014	0.32	0.61	1.05	1.61	2.26	3.15	4.00	5.24	7.13	9.46	11.18	14.47		
2015	0.30	0.60	0.97	1.49	2.11	3.13	4.64	5.78	7.13	9.53	12.12	16.71	17.37	
2016	0.26	0.55	0.97	1.53	2.20	3.19	4.50	6.12	7.97	9.55	10.95	14.35	14.74	17.25
2017	0.33	0.63	1.03	1.56	2.24	3.24	4.67	6.34	7.74	9.40	11.12	14.43	16.67	11.91
2018	0.33	0.68	1.06	1.62	2.40	3.22	4.66	6.23	7.79	8.91	10.26	11.26	13.41	10.14
2019	0.29	0.62	1.10	1.60	2.33	3.22	4.44	6.45	8.10	9.60	11.02	13.83	10.65	10.65
2020	0.27	0.47	0.93	1.44	2.05	2.95	4.28	5.73	7.59	8.45	10.66	12.3	12.2	12.23

Germany (Division IIa and IIb)														
Year	**Age**													
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15+**
1994		0.68	1.04	2.24	3.49	4.51	5.79	6.93	8.16	8.46	8.74	9.48	15.25	
1995		0.44	0.84	1.5	2.72	3.81	4.46	4.81	7.37	7.69	8.25	9.47		
1996		0.84	1.15	1.64	2.53	3.58	4.13	3.9	4.68	6.98	6.43	11.32		
1997		0.43	0.92	1.42	2.01	3.15	4.04	5.16	4.82	3.96	7.04	8.8		
1998	0.23	0.73	1.17	1.89	2.72	3.25	4.13	5.63	6.5	8.57	8.42	11.45	8.79	
1999[1]		0.853	1.448	1.998	2.65	3.473	4.156	5.447	6.82	5.902		8.01		
2000[2]	0.26	0.73	1.36	2.04	2.87	3.67	4.88	5.78	7.05	8.45	8.67	9.33	6.88	
2001	0.38	0.80	1.21	1.90	2.74	3.90	4.99	5.69	7.15	7.32	11.72	9.11	6.60	
2002	0.35	1.00	1.31	1.80	2.53	3.64	4.38	5.07	6.82	9.21	7.59	13.18	19.17	19.20
2003	0.22	0.44	1.04	1.71	2.31	3.27	4.93	6.17	7.77	9.61	9.99	12.29	13.59	
2004[2]	0.22	0.73	1.01	1.75	2.58	3.33	4.73	6.32	7.20	8.45	9.20	11.99	10.14	13.11
2005[3]	0.57	0.77	1.13	1.66	2.33	3.36	4.38	5.92	6.65	7.26	10.01	11.14		
2006[2]	0.71	0.91	1.39	1.88	2.56	3.77	5.33	6.68	9.14	10.89	11.51	16.83	18.77	
2007[3]	0.59	1.35	1.79	2.51	3.53	4.00	4.95	6.55	7.54	9.71	11.40	11.57	23.34	15.61
2008[3]	0.23	0.51	1.14	1.76	2.57	3.15	4.40	5.43	7.18	8.39	10.15	10.03	10.99	14.26
2009[3]	0.35	0.60	1.19	1.83	2.96	4.08	5.61	6.97	8.55	9.13	10.54	13.34	10.30	17.06
2010[3]	0.36	0.67	0.93	1.71	2.46	3.21	4.93	6.75	7.80	8.70	8.53	10.17	12.36	14.11
2011[1]			1.75	3.09	3.30	3.28	4.13	4.99	6.61	7.91	9.38	10.79	14.67	14.91
2013[3]			1.03	1.37	1.87	2.65	3.45	4.49	7.26	11.42	12.86	13.07		
2014[4]		0.68	0.96	1.39	1.69	3.06	4.07	5.65	8.15	10.36	13.07	13.52		
2015[4]	0.82	1.05	1.67	2.33	3.56	4.50	5.41	6.20	6.39					
2016[1]		1.38	2.60	3.55	4.81	6.33	7.61	8.90	9.26	10.83	13.41	16.84	17.03	17.76
2017[1]		1.58	2.79	3.93	3.93	4.77	6.35	8.16	9.09	10.39	11.24	12.48	14.39	13.04
2018[3]	0.58	1.16	1.76	2.45	3.34	4.13	5.81	7.16	8.99	9.96	10.85	11.73	14.01	17.79
2019[1]		0.82	1.37	1.80	2.26	3.49	4.45	5.44	7.08	9.25	9.39	13.30	12.24	15.25
2020[5]			1.6	1.63	2.48	3.13	5.01	5.93	8.36	9.31	12.16	12.96	12.77	14.08

1-Division IIa only

2-IIa and IIb combined

3-I,IIa and IIb combined

4-Division IIb only

5-I and IIa combined

Spain (Division IIb)														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1994	0.43	1.08	1.38	2.32	2.47	2.68	3.46	5.20	7.04	6.79	7.20	8.04	10.46	15.35
1995	0.42	0.51	0.98	1.99	3.41	4.95	5.52	8.62	9.21	11.42	9.78	8.08		
1996		0.66	1.12	1.57	2.43	3.17	3.59	4.44	5.48	6.79	8.10			
1997[1]	0.51	0.65	1.22	1.68	2.60	3.39	4.27	6.67	7.88	11.34	13.33	10.03	8.69	
1998	0.47	0.74	1.15	1.82	2.44	3.32	3.71	5.00	7.26					
1999[1]	0.21	0.69	1.06	1.69	2.50	3.32	4.72	5.76	6.77	7.24	7.63			
2000[1]	0.23	0.61	1.24	1.75	2.47	3.12	4.65	6.06	7.66	10.94	11.40	7.20		
2001	0.23	0.64	1.25	1.95	2.86	3.55	4.95	6.46	8.50	11.07	13.09			
2002	0.16	0.55	1.00	1.48	2.17	3.29	4.47	5.35	8.29	12.23	9.01	12.16	15.2	
2003		0.58	1.05	1.70	2.33	3.33	4.92	6.24	9.98	13.07	14.74	14.17		
2004[1]	0.31	0.56	0.80	1.28	1.96	2.59	3.72	5.36	5.28	7.41		11.43		
2005[1]		0.63	1.14	1.85	2.48	3.43	4.25	5.38	8.41	11.19	15.04	16.93		
2006	0.30	0.61	0.99	1.46	2.04	2.55	3.39	3.50	4.70	6.36				
2007	0.42	0.60	1.20	1.76	2.40	3.18	3.96	5.19	6.61	9.48	7.65	12.65	15.74	19.66
2009[1]	0.12	0.45	0.95	1.60	2.18	3.36	4.52	6.04	7.30	9.42	10.35	11.47	12.54	
2010[2]	0.18	0.56	1.11	1.73	2.36	3.36	5.14	6.88	8.64	9.65	6.83			
2011[1]		0.45	0.90	1.26	1.84	2.55	4.08	5.61	8.17	8.14	7.31	8.91		
2012[2]		0.40	0.84	1.29	1.96	2.78	3.71	4.99	7.42		7.19	9.32		
2013	0.17	0.72	1.06	1.63	2.36	3.14	3.90	4.36	6.55					
2014	0.24	0.43	0.74	1.27	1.85	2.60	3.56	4.51	5.52	7.18	9.42	9.26	13.16	15.05
2015[2]		0.40	0.80	1.19	1.79	2.45	3.38	4.41	5.85	6.64	7.48	6.77		
2016[3]	0.11	0.38	0.76	1.20	1.72	2.50	3.39	4.96	7.11	8.56				
2017[2]	0.12	0.42	0.75	1.17	1.69	2.50	3.39	4.47	5.69	5.93	6.00	10.91	13.57	10.52
2018[2]	0.19	0.45	0.83	1.30	1.86	2.57	3.55	4.92	5.51	7.84	7.08	7.28		
2019[2]	0.19	0.39	0.90	1.30	1.85	2.65	3.48	4.83	5.96	5.67	7.04	8.36		

1-IIa and IIb combined

2-I,IIa and IIb combined

3-I and IIb combined

Iceland (Sub-area I)														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1994	0.42	0.85	1.44	2.77	3.54	4.08	5.84	6.37	7.02	7.48	7.37			
1995		1.17	0.91	1.60	2.28	3.61	4.73	6.27			6.26			
1996		0.36	0.99	1.55	2.83	3.79	4.81	5.34	7.25	7.68	9.08	8.98	10.52	
1997	0.42	0.43	0.76	1.60	2.40	3.45	4.40	5.74	6.15		8.28	10.52	9.89	

UK (England and Wales)														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1995[1]			1.47	2.11	3.47	5.57	6.43	7.17	8.12	8.05	10.2	10.1		
1996[2]			1.55	1.81	2.42	3.61	6.3	6.47	7.83	7.91	8.93	9.38	10.9	
1997[2]			1.93	2.17	3.07	4.17	4.89	6.46		12.3	8.44			

1-Division IIa and IIb

2-Division IIa

Poland (Division IIb)														
Year	Age													
	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
2006	0.18	0.51	0.89	1.55	2.23	3.6	5.28	6.95	8.478	11	10.8	15.6	18.9	
2008		0.49	0.90	1.45	2.24	2.79	3.82	4.68	5.015	6.45	7.02	7.22	5.99	6.91
2009			1.02	1.72	2.65	3.81	5.23	6.91	8.862	11.1	13.6	16.5		
2010			1.39	1.66	2.29	2.98	3.92	5.18	6.313	6.66	8.72	9.05		
2011			0.99	1.50	2.17	3.15	4.43	7.45	7.28					
2016[1]		0.84	1.59	2.29	2.81	3.91	4.78	5.61	6.709	7.89	8.54	11.6	13.7	16.09
2017[2]		0.71	1.23	1.52	2.47	3.52	4.78	6.97	9.193	9.95	10.9	14.1		
2018[3]		0.74	1.15	1.66	2.45	3.55	4.48	6.06	6.31	7.59	7.91	8.28	8.52	9.40
2019[1]				1.57	2.00	2.69	4.04	5.61	7.23	9.13	11.62	12.41	13.46	11.47

1-Division IIa

2-Division IIa and IIb

3-I and IIb combined

Table 3.8. Northeast Arctic cod. Catch weights at age (kg)

SAM Sat Apr 17 21:10:24 2021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1946	0.35	0.59	1.11	1.69	2.37	3.17	3.98	5.05	5.92	7.2	8.15	8.13	9.25
1947	0.32	0.56	0.95	1.5	2.14	2.92	3.65	4.56	5.84	7.42	8.85	8.79	10
1948	0.34	0.53	1.26	1.93	2.46	3.36	4.22	5.31	5.92	7.09	8.43	8.18	9.43
1949	0.37	0.67	1.11	1.66	2.5	3.23	4.07	5.27	5.99	7.08	8.22	8.26	8.7
1950	0.39	0.64	1.29	1.7	2.36	3.48	4.52	5.62	6.4	7.96	8.89	9.07	10.27
1951	0.4	0.83	1.39	1.88	2.54	3.46	4.88	5.2	7.14	8.22	9.39	9.5	9.52
1952	0.44	0.8	1.33	1.92	2.64	3.71	5.06	6.05	7.42	8.43	10.19	10.13	10.56
1953	0.4	0.76	1.28	1.93	2.81	3.72	5.06	6.34	7.4	8.67	10.24	11.41	11.93
1954	0.44	0.77	1.26	1.97	3.03	4.33	5.4	6.75	7.79	10.67	9.68	9.56	11.11
1955	0.32	0.57	1.13	1.73	2.75	3.94	4.9	7.04	7.2	8.78	10.08	11.02	12.11
1956	0.33	0.58	1.07	1.83	2.89	4.25	5.55	7.28	8	8.35	9.94	10.25	11.56
1957	0.33	0.59	1.02	1.82	2.89	4.28	5.49	7.51	8.24	9.25	10.61	10.82	12.07
1958	0.34	0.52	0.95	1.92	2.94	4.21	5.61	7.35	8.67	9.58	11.63	11	13.83
1959	0.35	0.72	1.47	2.68	3.59	4.32	5.45	6.44	7.17	8.63	11.62	11.95	13
1960	0.34	0.51	1.09	2.13	3.38	4.87	6.12	8.49	7.79	8.3	11.42	11.72	13.42
1961	0.31	0.55	1.05	2.2	3.23	5.11	6.15	8.15	8.68	9.6	11.95	13.18	13.42
1962	0.32	0.55	0.93	1.7	3.03	5.03	6.55	7.7	9.27	10.56	12.72	13.48	14.44
1963	0.32	0.61	0.96	1.73	3.04	4.96	6.44	7.91	9.62	11.31	12.74	13.19	14.29
1964	0.33	0.55	0.95	1.86	3.25	4.97	6.41	8.07	9.34	10.16	12.89	13.25	14
1965	0.38	0.68	1.03	1.49	2.41	3.52	5.73	7.54	8.47	11.17	13.72	13.46	14.12
1966	0.44	0.74	1.18	1.78	2.46	3.82	5.36	7.27	8.63	10.66	14.15	14	15
1967	0.29	0.81	1.35	2.04	2.81	3.48	4.89	7.11	9.03	10.59	13.83	14.15	16.76
1968	0.33	0.7	1.48	2.12	3.14	4.21	5.27	6.65	9.01	9.66	14.85	16.3	17
1969	0.44	0.79	1.23	2.03	2.9	3.81	5.02	6.43	8.33	10.71	14.21	15	17
1970	0.37	0.91	1.34	2	3	4.15	5.59	7.6	8.97	10.99	14.07	14.61	16

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1971	0.45	0.88	1.38	2.16	3.07	4.22	5.81	7.13	8.62	10.83	12.95	14.25	15.97
1972	0.38	0.77	1.43	2.12	3.23	4.38	5.83	7.62	9.52	12.09	13.67	13.85	16
1973	0.38	0.91	1.54	2.26	3.29	4.61	6.57	8.37	10.54	11.62	13.9	14	15.84
1974	0.32	0.66	1.17	2.22	3.21	4.39	5.52	7.86	9.82	11.41	13.24	13.7	14.29
1975	0.41	0.64	1.11	1.9	2.95	4.37	5.74	8.77	9.92	11.81	13.11	14	14.29
1976	0.35	0.73	1.19	2.01	2.76	4.22	5.88	9.3	10.28	11.86	13.54	14.31	14.28
1977	0.49	0.9	1.43	2.05	3.3	4.56	6.46	8.63	9.93	10.9	13.67	14.26	14.91
1978	0.49	0.81	1.45	2.15	3.04	4.46	6.54	7.98	10.15	10.85	13.18	14	15
1979	0.35	0.7	1.24	2.14	3.15	4.29	6.58	8.61	9.22	10.89	14.34	14.5	15.31
1980	0.27	0.56	1.02	1.72	3.02	4.2	5.84	7.26	8.84	9.28	14.45	15	15.5
1981	0.49	0.98	1.44	2.09	2.98	4.85	6.57	9.16	10.82	10.77	13.93	15	16
1982	0.37	0.66	1.35	1.99	2.93	4.24	6.46	8.51	12.24	10.78	14.04	15	16
1983	0.84	1.37	2.09	2.86	3.99	5.58	7.77	9.29	11.55	11.42	12.8	14.18	15.55
1984	1.42	1.93	2.49	3.14	3.91	4.91	6.02	7.4	8.13	11.42	12.8	14.18	15.55
1985	0.94	1.37	2.02	3.22	4.63	6.04	7.66	9.81	11.8	11.42	12.8	14.18	15.55
1986	0.64	1.27	1.88	2.79	4.49	5.84	6.83	7.69	9.81	11.42	12.8	14.18	15.55
1987	0.49	0.88	1.55	2.33	3.44	5.92	8.6	9.6	12.17	11.42	12.8	14.18	15.55
1988	0.54	0.85	1.32	2.24	3.52	5.35	8.06	9.51	11.36	11.42	12.8	14.18	15.55
1989	0.74	0.96	1.31	1.92	2.93	4.64	7.52	9.12	11.08	11.42	12.8	14.18	15.55
1990	0.81	1.22	1.64	2.22	3.24	4.68	7.3	9.84	13.25	11.42	12.8	14.18	15.55
1991	1.05	1.45	2.15	2.89	3.75	4.71	6.08	8.82	11.8	11.42	12.8	14.18	15.55
1992	1.16	1.57	2.21	3.1	4.27	5.19	6.14	7.77	10.12	11.42	12.8	14.18	15.55
1993	0.81	1.52	2.16	2.79	4.07	5.53	6.47	7.19	7.98	11.46	12.8	14.18	15.55
1994	0.82	1.3	2.06	2.89	3.21	5.2	6.8	7.57	8.01	9.96	13.01	14.18	15.55
1995	0.77	1.2	1.78	2.59	3.81	4.99	6.23	8.05	8.74	9.77	11.39	14.55	15.55
1996	0.79	1.11	1.61	2.46	3.82	5.72	6.74	8.04	9.28	10.45	11.19	12.82	16.05
1997	0.67	1.04	1.53	2.22	3.42	5.2	7.19	7.73	8.61	11.14	11.93	12.61	14.23
1998	0.68	1.05	1.62	2.3	3.3	4.86	6.87	9.3	10.3	10.75	12.68	13.39	14.01
1999	0.63	1.01	1.54	2.34	3.21	4.29	6	6.73	10.08	11.15	12.26	14.19	14.84

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
2000	0.57	1.04	1.61	2.34	3.34	4.48	5.72	7.52	8.02	11.93	12.68	13.74	15.68
2001	0.66	1.05	1.62	2.51	3.51	4.78	6.04	7.54	9	10.23	13.52	14.2	15.21
2002	0.72	1.13	1.56	2.31	3.52	4.78	6.2	7.66	9.14	10.38	11.69	15.08	15.68
2003	0.67	1.12	1.83	2.5	3.58	5.04	6.36	8.2	10.71	10.17	11.85	13.14	16.6
2004	0.72	1.13	1.61	2.43	3.27	4.72	6.71	7.98	9.19	10.84	11.62	13.31	14.57
2005	0.69	1.08	1.57	2.21	3.26	4.44	6.23	8.19	9.72	10.63	12.35	13.07	14.75
2006	0.72	1.16	1.6	2.39	3.32	4.54	5.47	6.78	7.7	10.8	12.12	13.84	14.49
2007	0.74	1.21	1.83	2.51	3.82	5.04	6.58	8.08	8.94	10.35	12.3	13.6	15.31
2008	0.77	1.27	1.87	2.82	3.79	5.12	6.22	7.75	8.4	10.14	11.82	13.8	15.05
2009	0.75	1.17	1.74	2.42	3.86	5.35	6.43	8.01	8.67	10.05	11.59	13.28	15.26
2010	0.78	1.2	1.74	2.44	3.4	5.04	6.25	7.32	8.53	10.38	11.5	13.03	14.71
2011	0.78	1.31	1.72	2.37	3.2	4.62	6.18	7.47	8.57	10.39	11.85	12.94	14.46
2012	0.67	1.14	1.73	2.34	3.12	4.4	6.28	8.24	10.35	10.37	11.86	13.31	14.36
2013	0.71	1.17	1.67	2.36	3.19	4.22	5.58	7.31	9.08	11.03	11.84	13.32	14.75
2014	0.79	1.2	1.73	2.34	3.28	4.21	5.49	6.98	8.67	10.82	12.55	13.3	14.76
2015	0.78	1.09	1.55	2.18	3.14	4.46	5.61	6.62	7.34	10.21	12.33	14.06	14.74
2016	0.78	1.14	1.66	2.26	3.25	4.5	5.98	7.31	8.54	9.37	11.67	13.82	15.54
2017	0.71	1.15	1.66	2.32	3.32	4.67	6.13	7.15	8.14	9.6	10.75	13.12	15.29
2018	0.86	1.17	1.71	2.5	3.31	4.61	6.03	7.32	8.06	9.71	11	12.14	14.55
2019	0.68	1.15	1.66	2.39	3.33	4.45	6.11	7.29	8.41	9.81	11.12	12.4	13.51
2020	0.71	1.08	1.6	2.19	3.09	4.39	5.73	7.22	8.41	9.99	11.23	12.53	13.79

Table 3.9. Northeast Arctic cod. Stock weights at age (kg).

SAM Apr 17 21:10:24 2021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1946	0.35	0.59	1.11	1.69	2.37	3.17	3.98	5.05	5.92	7.2	8.146	8.133	9.253
1947	0.32	0.56	0.95	1.5	2.14	2.92	3.65	4.56	5.84	7.42	8.848	8.789	9.998
1948	0.34	0.53	1.26	1.93	2.46	3.36	4.22	5.31	5.92	7.09	8.43	8.181	9.433
1949	0.37	0.67	1.11	1.66	2.5	3.23	4.07	5.27	5.99	7.08	8.218	8.259	8.701
1950	0.39	0.64	1.29	1.7	2.36	3.48	4.52	5.62	6.4	7.96	8.891	9.07	10.271
1951	0.4	0.83	1.39	1.88	2.54	3.46	4.88	5.2	7.14	8.22	9.389	9.502	9.517
1952	0.44	0.8	1.33	1.92	2.64	3.71	5.06	6.05	7.42	8.43	10.185	10.134	10.563
1953	0.4	0.76	1.28	1.93	2.81	3.72	5.06	6.34	7.4	8.67	10.238	11.409	11.926
1954	0.44	0.77	1.26	1.97	3.03	4.33	5.4	6.75	7.79	10.67	9.68	9.557	11.106
1955	0.32	0.57	1.13	1.73	2.75	3.94	4.9	7.04	7.2	8.78	10.077	11.023	12.105
1956	0.33	0.58	1.07	1.83	2.89	4.25	5.55	7.28	8	8.35	9.944	10.248	11.564
1957	0.33	0.59	1.02	1.82	2.89	4.28	5.49	7.51	8.24	9.25	10.605	10.825	12.075
1958	0.34	0.52	0.95	1.92	2.94	4.21	5.61	7.35	8.67	9.58	11.631	11	13.832
1959	0.35	0.72	1.47	2.68	3.59	4.32	5.45	6.44	7.17	8.63	11.621	11.95	13
1960	0.34	0.51	1.09	2.13	3.38	4.87	6.12	8.49	7.79	8.3	11.422	11.719	13.424
1961	0.31	0.55	1.05	2.2	3.23	5.11	6.15	8.15	8.68	9.6	11.952	13.181	13.422
1962	0.32	0.55	0.93	1.7	3.03	5.03	6.55	7.7	9.27	10.56	12.717	13.482	14.44

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1963	0.32	0.61	0.96	1.73	3.04	4.96	6.44	7.91	9.62	11.31	12.737	13.193	14.287
1964	0.33	0.55	0.95	1.86	3.25	4.97	6.41	8.07	9.34	10.16	12.886	13.251	14
1965	0.38	0.68	1.03	1.49	2.41	3.52	5.73	7.54	8.47	11.17	13.722	13.465	14.118
1966	0.44	0.74	1.18	1.78	2.46	3.82	5.36	7.27	8.63	10.66	14.148	14	15
1967	0.29	0.81	1.35	2.04	2.81	3.48	4.89	7.11	9.03	10.59	13.829	14.146	16.756
1968	0.33	0.7	1.48	2.12	3.14	4.21	5.27	6.65	9.01	9.66	14.848	16.3	17
1969	0.44	0.79	1.23	2.03	2.9	3.81	5.02	6.43	8.33	10.71	14.211	15	17
1970	0.37	0.91	1.34	2	3	4.15	5.59	7.6	8.97	10.99	14.074	14.611	16
1971	0.45	0.88	1.38	2.16	3.07	4.22	5.81	7.13	8.62	10.83	12.945	14.25	15.973
1972	0.38	0.77	1.43	2.12	3.23	4.38	5.83	7.62	9.52	12.09	13.673	13.852	16
1973	0.38	0.91	1.54	2.26	3.29	4.61	6.57	8.37	10.54	11.62	13.904	14	15.841
1974	0.32	0.66	1.17	2.22	3.21	4.39	5.52	7.86	9.82	11.41	13.242	13.704	14.291
1975	0.41	0.64	1.11	1.9	2.95	4.37	5.74	8.77	9.92	11.81	13.107	14	14.293
1976	0.35	0.73	1.19	2.01	2.76	4.22	5.88	9.3	10.28	11.86	13.544	14.311	14.284
1977	0.49	0.9	1.43	2.05	3.3	4.56	6.46	8.63	9.93	10.9	13.668	14.255	14.906
1978	0.49	0.81	1.45	2.15	3.04	4.46	6.54	7.98	10.15	10.85	13.177	14	15
1979	0.35	0.7	1.24	2.14	3.15	4.29	6.58	8.61	9.22	10.89	14.344	14.5	15.315
1980	0.27	0.56	1.02	1.72	3.02	4.2	5.84	7.26	8.84	9.28	14.448	15	15.5

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1981	0.49	0.98	1.44	2.09	2.98	4.85	6.57	9.16	10.82	10.77	13.932	15	16
1982	0.37	0.66	1.35	1.99	2.93	4.24	6.46	8.51	12.24	10.78	14.041	15	16
1983	0.37	0.92	1.6	2.44	3.82	4.76	6.17	7.7	9.25	12.621	14.544	16.466	18.388
1984	0.42	1.16	1.81	2.79	3.78	4.57	6.17	7.7	9.25	12.621	14.544	16.466	18.388
1985	0.413	0.875	1.603	2.81	4.059	5.833	7.685	10.117	14.29	12.621	14.544	16.466	18.388
1986	0.311	0.88	1.47	2.467	3.915	5.81	6.58	6.833	11.004	12.621	14.544	16.466	18.388
1987	0.211	0.498	1.254	2.047	3.431	5.137	6.523	9.3	13.15	12.621	14.544	16.466	18.388
1988	0.212	0.404	0.79	1.903	2.977	4.392	7.812	12.112	13.107	12.621	14.544	16.466	18.388
1989	0.299	0.52	0.868	1.477	2.686	4.628	7.048	9.98	9.25	12.621	14.544	16.466	18.388
1990	0.398	0.705	1.182	1.719	2.458	3.565	4.71	7.801	8.956	12.621	14.544	16.466	18.388
1991	0.518	1.136	1.743	2.428	3.214	4.538	6.88	10.719	9.445	12.621	14.544	16.466	18.388
1992	0.44	0.931	1.812	2.716	3.895	5.176	6.774	9.598	12.427	12.621	14.544	16.466	18.388
1993	0.344	1.172	1.82	2.823	4.031	5.497	6.765	8.571	10.847	12.621	14.544	16.466	18.388
1994	0.237	0.757	1.419	2.458	3.845	5.374	6.648	7.653	8.136	12.916	16.114	16.466	18.388
1995	0.197	0.487	1.141	2.118	3.504	4.915	6.949	9.051	9.775	11.409	15.248	18.62	18.388
1996	0.206	0.482	0.98	2.041	3.52	5.507	7.74	9.922	10.63	12.093	13.533	17.659	21.171
1997	0.211	0.537	1.11	1.876	3.381	5.258	8.546	10.653	10.776	13.232	14.313	15.745	20.122
1998	0.242	0.561	1.179	1.936	2.944	4.583	7.092	10.7	12.042	13.771	15.607	16.617	18.021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1999	0.209	0.514	1.183	2.007	3.037	4.479	6.512	10.028	11.117	14.698	16.215	18.057	18.981
2000	0.194	0.465	1.218	1.963	3.064	4.12	5.746	7.157	9.961	14.589	17.26	18.733	20.557
2001	0.284	0.513	1.21	2.25	3.299	5.066	6.373	9.29	11.456	13.317	17.138	19.887	21.294
2002	0.23	0.603	1.184	2.138	3.336	4.81	6.912	8.809	10.475	12.534	15.703	19.752	22.549
2003	0.233	0.551	1.317	2.022	3.239	4.984	6.727	8.422	14.226	12.524	14.815	18.164	22.403
2004	0.24	0.55	1.074	2.038	2.911	4.402	6.263	8.535	10.197	12.371	14.803	17.176	20.674
2005	0.225	0.61	1.083	1.87	3.002	3.971	5.789	8.127	12.759	12.611	14.63	17.163	19.594
2006	0.252	0.591	1.219	2.014	3.028	4.434	5.999	7.774	9.954	13.679	14.902	16.97	19.58
2007	0.249	0.663	1.329	2.127	3.183	4.59	6.477	8.88	12.124	12.261	16.111	17.274	19.368
2008	0.286	0.726	1.418	2.41	3.331	4.914	6.747	8.851	10.393	12.776	14.504	18.617	19.701
2009	0.274	0.652	1.353	2.312	3.803	5.103	6.75	9.252	10.119	12.323	15.09	16.83	21.168
2010	0.258	0.608	1.208	2.01	3.088	4.903	6.498	7.992	9.689	12.467	14.574	17.483	19.214
2011	0.225	0.6	1.097	1.926	2.861	4.403	6.531	8.648	9.885	12.508	14.738	16.909	19.929
2012	0.227	0.555	1.182	1.834	2.831	4.124	6.056	8.584	11.498	12.249	14.785	17.092	19.3
2013	0.247	0.577	1.134	1.998	2.841	4.015	5.523	8.077	10.304	13.207	14.491	17.144	19.501
2014	0.216	0.577	1.137	1.791	2.781	3.85	5.245	6.992	9.378	12.746	15.578	16.816	19.558
2015	0.229	0.54	1.134	1.934	2.753	4.081	5.315	7.135	8.947	11.778	15.056	18.025	19.198
2016	0.21	0.536	1.001	1.812	2.72	3.958	5.64	7.064	8.569	10.885	13.954	17.445	20.522

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
2017	0.255	0.675	1.107	1.896	2.826	4.158	5.7	7.628	9.071	10.634	12.934	16.216	19.888
2018	0.286	0.62	1.188	1.949	2.768	4.059	5.749	7.38	9.097	10.8	12.646	15.073	18.54
2019	0.24	0.603	1.085	1.82	3.025	4.296	5.891	7.293	9.667	11.186	12.837	14.749	17.28
2020	0.148	0.503	1.055	1.692	2.59	4.064	5.617	7.673	9.313	11.306	13.278	14.964	16.922
2021	0.175	0.44	0.972	1.755	2.71	3.865	5.703	7.448	9.084	11.187	13.415	15.459	17.159

Table 3.10. Northeast Arctic cod. Basis for maturity ogives (percent) used in the assessment. Norwegian and Russian data.

Norway								
	Percentage mature							
	Age							
Year	3	4	5	6	7	8	9	10
1982	0	5	10	34	65	82	92	100
1983	5	8	10	30	73	88	97	100

Russia								
	Percentage mature							
	Age							
Year	3	4	5	6	7	8	9	10
1984	0	5	18	31	56	90	99	100
1985	0	1	10	33	59	85	92	100
1986	0	2	9	19	56	76	89	100
1987	0	1	9	23	27	61	81	80
1988	0	1	3	25	53	79	100	100
1989	0	0	2	15	39	59	83	100
1990	0	2	6	20	47	62	81	95
1991	0	3	1	23	66	82	96	100
1992	0	1	8	31	73	92	95	100
1993	0	3	7	21	56	89	95	99
1994	0	1	8	30	55	84	95	98
1995	0	0	4	23	61	75	94	97
1996	0	0	1	22	56	82	95	100
1997	0	0	1	10	48	73	90	100
1998	0	0	2	15	47	87	97	96
1999	0	0.2	1.3	9.9	38.4	74.9	94	100
2000	0	0	6	19.2	51.4	84	95.5	100
2001	0.1	0.1	3.9	27.9	62.3	89.4	96.3	100

Russia								
	Percentage mature							
	Age							
Year	3	4	5	6	7	8	9	10
2002	0.1	1.9	10.9	34.4	68.1	82.8	97.6	100
2003	0.2	0	11	29.2	65.9	89.6	95.1	100
2004	0	0.7	8	33.8	63.3	83.4	96.4	96.4
2005	0	0.6	4.6	24.2	61.5	84.9	95.3	98.1
2006	0	0	6.1	29.6	59.6	89.5	96.4	100
2007	0	0.4	5.7	20.8	60.4	83.5	96	100
2008	0	0.5	4	24.6	48.3	84.4	94.7	98.7
2009	0	0	6	28	66	85	97	100
2010	0	0.2	1.5	22.8	47	77.4	90.2	95.5
2011	0	0	2.2	20.7	50.4	73.7	90.6	95.6
2012	0.2	0	1.5	10.8	43.9	76.1	90.8	96.4
2013	0	0	0.6	10.6	41.8	70.6	89.8	96.9
2014	0	0	1.9	14.1	45.9	76	92	97.5
2015	0	0.2	0.2	7.9	27	60.8	83.4	93.7
2016	0	0	0.2	5.2	22.4	44.1	74.8	92.5
2017*	0	0	0.8	6.3	20.8	51.6	80.4	98.6
2018	0	0.5	2.5	23.6	53.9	79.4	92.5	96.0
2019**	0	0	4.5	11.9	56.4	91.8	95.1	100
2020**	0	0.4	1.7	15.8	43.8	71.2	74.9	84.9
2021**	0	0	2.7	16.1	44.1	72.2	87.1	88.1

Norway								
	Percentage mature							
	Age							
Year	3	4	5	6	7	8	9	10
1985	0.31	1.36	8.94	38.33	51.27	85.13	100	79.2
1986	2.92	7	7.85	18.85	49.72	66.52	35.59	80.09

Norway								
	Percentage mature							
	Age							
Year	3	4	5	6	7	8	9	10
1987	0	0.07	4.49	12.42	16.28	31.23	19.32	
1988	0	2.35	6.16	40.54	53.63	45.36	100	100
1989	1.52	0.67	3.88	30.65	70.36	82.02	100	100
1990	1.52	0.67	4.18	22	57.45	80.95	100	100
1991	0.1	3.4	13.93	38.03	75.52	90.12	95.39	100
1992	0.22	1.85	21.04	52.83	86.95	96.52	99.83	100
1993	0	2.6	10.37	52.6	84.8	97.25	99.3	99.73
1994	0.51	0.33	15.78	36.92	62.84	88.44	97.56	100
1995	0	0.62	8.19	51.48	63.75	81.11	98.01	99.34
1996	0.03	0	2.82	29.56	70.22	82.06	100	100
1997	0	0	1.48	17.91	73.31	93.01	99.12	100
1998	0.12	0.68	3.17	15.42	47.31	75.73	94.3	100
1999	0.42	0.16	1.6	27.46	70.48	94.57	98.99	100
2000	0	0.11	8.15	30.23	77.3	81.95	100	100
2001	0.49	0.51	9.03	43.81	62.52	74.36	94.13	100
2002	0.27	0.73	5.94	43.22	68.4	85.31	92.52	100
2003	0.02	0.18	6.5	35.97	68.56	87.97	96.3	100
2004	0.24	1.36	10.23	54.56	81.84	90.94	98.76	98.91
2005	0	0.27	9	55.16	81.77	93.51	98.03	100
2006	0	0.22	5.92	44.25	69.85	89.89	96.65	100
2007	0.12	0.33	8.7	47.88	84.29	91.68	99.11	100
2008	0	0.27	9.27	34.13	61.39	88.04	91.17	100
2009	0	0	9	46	85	86	98	99
2010	0	0.36	7.5	41.75	67.7	90.1	95.29	98.55
2011	0	0.2	5.2	48	77.7	89.7	97.3	97.2
2012	0	0	7.7	32.2	67.5	81	90.9	96.3

Norway								
	Percentage mature							
	Age							
Year	3	4	5	6	7	8	9	10
2013	0	0.3	1	20.2	55.3	80	91.8	99.3
2014	0	0.4	2	13.3	56.7	85	93.8	98.7
2015	0	0	1.9	10.9	29.2	79.1	93.1	99.6
2016	0.07	0.2	1.0	6.4	28.5	71.3	86.1	98.6
2017	0	0.2	0.5	18	54.8	81.4	95.9	100
2018	0	0.1	3.0	16.2	38.3	61.0	93.7	98.9
2019	0	0.4	4.0	24.0	68.6	93.2	96.7	99.8
2020	0	0.44	3.18	13.68	42.51	80.06	91.18	94.03
2021	0.28	0.25	0.79	17.11	43.21	68.80	90.75	98.63

Not used in inputs (instead ratios presented in WD 10, 2017 used for further calculations)

****Not used in inputs (instead ratios presented in WD 15, 2019 used for further calculations)**

Table 3.11. Northeast Arctic cod. Proportion mature-at-age.

SAM Apr 17 21:10:24 2021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1946	0	0	0.01	0.03	0.06	0.11	0.18	0.44	0.65	0.86	0.96	0.96	1
1947	0	0	0.01	0.03	0.06	0.13	0.16	0.42	0.75	0.91	0.95	1	1
1948	0	0	0.01	0.03	0.07	0.13	0.25	0.47	0.73	0.91	0.97	1	1
1949	0	0	0.01	0.03	0.09	0.17	0.29	0.54	0.79	0.88	0.97	1	1
1950	0	0	0.01	0.03	0.09	0.23	0.35	0.52	0.79	0.95	0.97	1	1
1951	0	0	0.01	0.03	0.1	0.24	0.4	0.58	0.72	0.85	0.96	1	1
1952	0	0	0.01	0.03	0.08	0.22	0.41	0.63	0.82	0.92	0.97	1	1
1953	0	0	0.01	0.03	0.07	0.19	0.4	0.64	0.84	0.94	0.97	1	1
1954	0	0	0.01	0.03	0.08	0.16	0.37	0.68	0.87	0.93	0.96	1	1
1955	0	0	0.01	0.03	0.07	0.13	0.26	0.53	0.83	0.92	0.97	1	1
1956	0	0	0.01	0.03	0.06	0.12	0.14	0.41	0.67	0.91	0.96	1	1
1957	0	0	0.01	0.03	0.06	0.09	0.12	0.22	0.6	0.82	0.97	1	1
1958	0	0	0.01	0.03	0.06	0.1	0.1	0.3	0.5	0.82	0.97	1	1

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1959	0	0	0.01	0.04	0.12	0.34	0.49	0.67	0.84	0.87	1	1	1
1960	0	0.01	0.03	0.06	0.1	0.19	0.45	0.69	0.77	0.85	0.99	1	1
1961	0	0	0.01	0.06	0.12	0.31	0.65	0.91	0.98	0.98	1	0.96	1
1962	0	0	0.01	0.05	0.15	0.34	0.61	0.81	0.92	0.97	1	0.932	1
1963	0	0.01	0.01	0.03	0.07	0.28	0.42	0.81	0.98	0.98	1	0.966	1
1964	0	0	0	0.03	0.13	0.37	0.66	0.89	0.95	0.99	1	1	1
1965	0	0	0	0.01	0.06	0.2	0.55	0.73	0.99	0.98	1	1	1
1966	0	0	0.01	0.02	0.06	0.22	0.35	0.74	0.94	0.94	1	1	1
1967	0	0	0	0.03	0.07	0.14	0.38	0.64	0.89	0.9	1	1	1
1968	0	0	0.03	0.05	0.09	0.19	0.39	0.58	0.82	1	1	1	1
1969	0	0	0	0.02	0.04	0.12	0.34	0.55	0.74	0.95	1	1	1
1970	0	0.01	0	0.01	0.07	0.23	0.58	0.81	0.89	0.91	1	1	1
1971	0	0	0.01	0.05	0.11	0.3	0.59	0.79	0.86	0.88	1	1	1
1972	0.01	0.02	0.02	0.01	0.1	0.34	0.64	0.81	0.94	1	1	1	1
1973	0	0	0	0.02	0.16	0.53	0.81	0.92	0.95	0.98	1	1	1
1974	0	0	0	0.01	0.03	0.21	0.5	0.96	1	0.96	1	1	1
1975	0	0	0.01	0.02	0.09	0.21	0.56	0.78	0.79	0.95	1	1	1
1976	0	0	0	0.05	0.12	0.29	0.45	0.84	0.83	1	0.9	1	1
1977	0	0	0.02	0.08	0.26	0.54	0.76	0.87	0.93	0.94	0.9	1	1
1978	0	0	0	0.02	0.13	0.44	0.71	0.77	0.81	0.89	0.8	1	1
1979	0	0	0	0.03	0.13	0.39	0.77	0.89	0.83	0.78	0.9	1	1
1980	0	0	0	0.02	0.13	0.35	0.65	0.82	1	0.9	0.9	1	1
1981	0	0	0.02	0.07	0.2	0.54	0.8	0.97	1	1	1	1	1
1982	0	0.05	0.1	0.34	0.65	0.82	0.92	1	1	1	1	1	1
1983	0.01	0.08	0.1	0.3	0.73	0.88	0.97	1	1	1	1	1	1
1984	0	0.05	0.18	0.31	0.56	0.9	0.99	1	1	1	1	1	1
1985	0	0.01	0.09	0.36	0.55	0.85	0.96	0.9	1	1	1	1	1
1986	0	0.05	0.08	0.19	0.53	0.71	0.62	0.9	1	1	1	1	1
1987	0	0.01	0.07	0.18	0.22	0.46	0.5	0.75	1	1	1	1	1

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1988	0	0.02	0.05	0.33	0.53	0.62	1	1	1	1	1	1	1
1989	0.008	0.003	0.029	0.228	0.547	0.705	0.915	1	1	1	1	1	1
1990	0.008	0.013	0.051	0.21	0.522	0.715	0.905	0.975	1	1	1	1	1
1991	0.001	0.032	0.075	0.305	0.708	0.861	0.957	1	1	1	1	1	1
1992	0.001	0.014	0.145	0.419	0.8	0.943	0.974	1	1	1	1	1	1
1993	0	0.028	0.087	0.368	0.704	0.931	0.972	0.994	1	1	1	1	1
1994	0	0.005	0.119	0.336	0.583	0.876	0.965	0.99	1	1	1	1	1
1995	0	0.005	0.06	0.373	0.614	0.748	0.955	0.98	1	1	1	1	1
1996	0	0	0.016	0.252	0.619	0.817	0.975	1	1	1	1	1	1
1997	0	0	0.014	0.14	0.597	0.842	0.95	0.967	1	1	1	1	1
1998	0	0.005	0.031	0.168	0.468	0.828	0.956	0.98	1	1	1	1	1
1999	0	0.001	0.014	0.17	0.506	0.841	0.961	1	1	1	1	1	1
2000	0	0	0.066	0.261	0.699	0.872	0.978	1	1	1	1	1	1
2001	0.001	0.006	0.069	0.378	0.646	0.851	0.955	1	1	1	1	1	1
2002	0.001	0.015	0.085	0.412	0.695	0.846	0.97	1	1	1	1	1	1
2003	0.001	0	0.089	0.331	0.662	0.882	0.96	1	1	1	1	1	1
2004	0	0.009	0.092	0.438	0.728	0.883	0.973	0.974	1	1	1	1	1
2005	0	0.003	0.066	0.366	0.72	0.897	0.971	0.991	1	1	1	1	1
2006	0	0.015	0.061	0.367	0.633	0.907	0.961	1	1	1	1	1	1
2007	0	0.007	0.076	0.37	0.719	0.884	0.977	1	1	1	1	1	1
2008	0.005	0.008	0.082	0.309	0.539	0.869	0.928	0.994	1	1	1	1	1
2009	0	0	0.081	0.362	0.745	0.859	0.978	0.997	0.994	1	1	1	1
2010	0.005	0.006	0.06	0.335	0.552	0.838	0.931	0.971	0.983	1	1	1	1
2011	0	0	0.04	0.339	0.644	0.798	0.932	0.963	0.991	1	1	1	1
2012	0.001	0	0.058	0.209	0.544	0.799	0.93	0.967	0.99	1	1	1	1
2013	0	0	0.01	0.156	0.482	0.763	0.913	0.982	0.985	1	1	1	1
2014	0	0	0.025	0.137	0.516	0.806	0.935	0.984	0.996	1	1	1	1
2015	0	0.001	0.004	0.074	0.282	0.681	0.891	0.963	0.984	1	1	1	1
2016	0	0	0.002	0.057	0.256	0.569	0.832	0.955	0.984	1	1	1	1

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
2017	0	0.018	0.003	0.148	0.463	0.749	0.931	0.99	1	1	1	1	1
2018	0	0.003	0.028	0.207	0.478	0.731	0.916	0.971	1	1	1	1	1
2019	0	0	0.01	0.126	0.466	0.842	0.942	0.968	0.996	1	1	1	1
2020	0	0	0.014	0.116	0.361	0.775	0.904	0.955	1	1	1	1	1
2021	0.002	0.002	0.006	0.142	0.393	0.66	0.889	0.976	0.957	1	1	1	1

Table 3.12. The Northeast Arctic cod stock's consumption of cod in million individuals

Year/age	0	1	2	3	4	5	6
1984	0.000	444.793	22.421	0.216	0.000	0.000	0.000
1985	1646.300	356.452	71.610	0.197	0.000	0.000	0.000
1986	69.788	1140.065	344.772	87.575	0.000	0.000	0.000
1987	655.229	195.917	328.064	14.440	0.000	0.000	0.000
1988	32.232	486.338	26.522	1.792	0.000	0.000	0.000
1989	947.615	142.107	0.000	0.000	0.000	0.000	0.000
1990	0.000	108.740	23.196	0.000	0.000	0.000	0.000
1991	118.655	137.811	180.868	1.609	0.000	0.000	0.000
1992	3136.027	893.837	143.253	4.174	0.000	0.000	0.000
1993	3882.321	18273.196	479.941	46.584	1.309	0.421	0.000
1994	7994.069	7030.331	650.414	130.088	49.798	7.935	0.413
1995	8215.712	14883.942	759.195	211.397	67.146	3.744	0.224
1996	10359.897	22194.437	1478.602	136.428	52.697	18.476	1.071
1997	3087.255	18165.901	1907.141	165.772	15.725	1.222	0.221
1998	93.616	5782.534	583.122	205.385	23.515	1.463	0.468
1999	638.847	2124.668	305.355	50.820	4.202	0.004	0.000
2000	1921.393	2561.048	188.889	38.444	14.001	3.845	0.042
2001	94.522	2397.127	114.550	23.796	11.630	1.792	0.916
2002	7579.447	456.386	404.318	41.309	5.324	0.808	0.017
2003	5392.632	4114.100	107.429	24.114	0.000	0.000	0.000
2004	6492.720	2413.993	566.424	20.453	10.459	1.325	0.226
2005	2471.254	3030.736	133.376	80.275	4.557	5.527	0.514

Year/age	0	1	2	3	4	5	6
2006	3295.083	2131.960	150.936	6.290	2.030	0.075	0.000
2007	2286.367	1149.305	189.571	74.677	3.445	0.128	0.000
2008	14254.749	695.971	85.770	96.946	32.044	4.240	0.000
2009	9501.679	7295.908	142.051	66.490	20.599	5.123	0.219
2010	4125.979	7084.630	299.399	53.694	27.910	16.915	2.242
2011	12413.114	4396.901	450.706	172.425	40.771	10.781	5.150
2012	21166.208	11742.803	1014.087	101.931	30.845	4.365	0.000
2013	26858.477	4925.670	1572.174	174.858	16.890	7.507	1.132
2014	36285.134	6154.893	732.616	195.070	53.208	5.174	0.064
2015	1541.100	10561.520	307.344	68.247	39.793	16.841	1.659
2016	11871.321	2539.152	501.568	11.974	18.726	27.386	6.464
2017	22048.064	1596.572	388.184	116.690	8.031	4.421	3.029
2018	7446.421	14075.658	279.208	35.827	2.239	0.269	0.000
2019	858.743	8725.376	853.377	55.002	5.824	0.019	0.000
2020	4375.080	3074.313	356.638	150.881	45.899	11.701	0.605

Table 3.13. Northeast Arctic cod. Tuning data.

North-East Arctic cod (Sub-areas I and II) (run name: XSAASA01)										
104										
FLT15_I: NorBarTrSur_I										
1981	2021									
1	1	0.085	0.189							
3	12									
1	1640	2330	4000	3840	480	100	30	NA	NA	NA
1	2830	2770	2360	1550	1600	140	20	NA	NA	NA
1	2495	5234	4333	1696	582	321	97	NA	NA	NA
1	9749	2828	2144	1174	407	40	8	NA	NA	NA
1	16679	12598	1992	767	334	21	7	NA	NA	NA
1	80500	14393	6414	830	191	34	4	NA	NA	NA
1	24038	39115	5435	1570	200	45	3	NA	NA	NA
1	14803	8049	17331	2048	358	53	3	NA	NA	NA
1	4636	7586	3779	9019	982	94	10	NA	NA	NA
1	2835	3487	3459	2056	2723	161	38	NA	NA	NA
1	4585	3367	2565	2149	1215	1267	61	NA	NA	NA
1	15826	5771	1782	1283	767	429	272	NA	NA	NA
1	27389	14013	7248	1583	624	389	223	NA	NA	NA
1	29392	30704	15333	4572	795	261	148	55	55	13
1	28284	24236	25101	7642	1798	242	107	50	61	19
1	16308	11743	13859	10888	2443	264	37	17	12	16
1	31799	6844	7426	5999	2667	485	64	91	8	NA
1	35510	16694	3167	2615	1752	816	79	52	4	4
1	18848	18075	6139	1271	681	514	101	26	2	6
1	24581	13003	11173	2675	456	184	121	33	10	5
1	18279	19511	8290	3796	945	117	44	19	4	1
1	11836	13756	10895	4579	1440	220	32	18	5	2
1	37670	12631	9393	6688	1750	467	102	17	4	4
1	6388	18462	5346	4324	3059	685	165	28	7	2
1	24888	5506	10297	2238	1636	381	92	30	4	10
1	11649	11538	2832	4342	1372	524	136	24	18	18
1	36113	12773	6851	1365	2360	682	230	41	11	10
1	19437	30059	11190	4024	1734	811	179	36	3	3
1	12628	19670	22023	6069	1790	902	524	51	17	7
1	3681	11425	15480	14450	3956	1124	367	160	58	12
1	8540	5037	12970	13866	10351	1637	436	120	82	39
1	7572	6459	3371	9069	13258	4861	902	226	88	111
1	6884	11409	6318	4043	6454	7638	3352	222	287	84
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FLT15_II: NorBarTrSur_II										
2014	2021									
1	1	0.085	0.189							
3	12									
1	22685	9379	8859	5639	3274	5305	3619	981	101	120
1	14407	22825	14729	11353	7443	2922	5351	1808	338	98
1	9937	13548	18831	11347	7233	2856	1317	1606	677	180
1	17925	6215	8454	9016	3782	2633	818	326	261	451
1	13941	18478	6181	6417	7388	2588	928	587	129	419
1	28157	17915	22190	7965	3296	3831	815	262	54	70
1	23773	16024	13156	11488	4983	2426	2044	453	166	243
1	11474	12073	11355	5471	4034	1424	816	406	143	45

FLT16: NorBarLofAcSur										
1985		2021								
1	1	0.085	0.26							
3	12									
1	1530	1416	204	151	157	33	13	10	5	NA
1	4996	1343	684	116	77	31	3	NA	4	NA
1	628	2049	502	174	14	30	7	NA	NA	NA
1	504	355	578	109	40	3	0	1	NA	NA
1	170	344	214	670	166	32	5	2	NA	NA
1	148	206	262	269	668	73	6	3	NA	NA
1	502	346	293	339	367	500	37	2	2	NA
1	1765	658	215	184	284	254	824	43	17	NA
1	3572	1911	1131	354	255	252	277	442	49	NA
1	3239	3745	2293	961	234	118	103	42	187	29
1	1377	1395	2036	1016	281	47	45	29	26	81
1	994	896	1128	974	462	59	11	4	9	15
1	1586	442	503	459	510	215	23	7	1	8
1	3912	1898	449	415	349	271	51	10	2	1
1	1476	1303	523	139	118	187	99	10	2	1
1	2948	1673	1492	546	146	69	50	13	6	2
1	1774	1606	851	621	191	27	8	6	3	1
1	614	1062	1011	713	366	94	12	8	6	0
1	3067	1168	1271	1461	677	235	38	4	1	2
1	334	852	349	456	480	217	88	24	2	7
1	1250	333	693	341	438	180	75	18	1	3
1	648	538	186	420	176	159	87	23	3	10
1	585	304	308	129	466	151	80	33	9	4
1	1999	2887	1166	789	248	352	55	28	17	7
1	1078	1825	1415	560	415	128	266	36	17	4
1	228	880	1614	1750	618	314	108	125	40	29
1	404	283	674	1595	2727	645	233	68	75	9
1	828	494	344	895	2266	1335	257	104	38	28
1	606	845	724	541	1336	2338	1617	215	111	88
1	2869	1242	1115	777	553	1490	1739	980	146	105
1	1387	2356	1300	1442	964	498	969	686	325	127
1	563	769	1199	664	594	409	356	565	344	286
1	1115	424	444	742	486	484	268	167	146	230
1	1090	1499	540	584	775	456	193	141	61	137
1	2036	1254	1446	639	493	739	273	218	65	111
1	1173	1173	819	943	506	509	495	195	84	80
1	700	648	528	389	370	155	119	146	82	34

FLT18: RusSweptArea										
1982	2020									
1	1	0.9	1							
3	12									
1	1413	1525	721	198	551	174	37	19	15.1	1.5
1	520	642	506	358	179	252	94	NA	NA	NA
1	1189	700	489	357	154	69	61	17	14.6	7.4
1	1188	1592	1068	365	165	37	8	16	1.5	20.9
1	1622	1532	1493	481	189	42	2	6	NA	NA
1	557	3076	900	701	184	60	25	4	0.7	3.3
1	993	938	2879	583	260	47	24	NA	NA	NA
1	490	978	1062	1454	1167	299	112	47	18.5	11.7
1	167	487	627	972	1538	673	153	49	9.1	1.7
1	1077	484	532	583	685	747	98	14	2.6	NA
1	675	308	239	273	218	175	25	25	4	0.1
1	1604	1135	681	416	354	87	3	7	0.6	0.7
1	1363	1309	1019	354	128	49	21	11	5.7	2.2
1	589	1065	1395	849	251	83	19	18	9.5	5.8
1	733	784	1035	773	348	132	19	5	12	1.6
1	1342	835	613	602	348	116	32	30	NA	NA
1	2028	1363	788	470	259	130	48	5	NA	0.9
1	1587	2072	980	301	123	94	42	4	NA	NA
1	1839	1286	1786	773	114	52	23	9	3.9	0.4
1	1224	1557	1290	1061	304	50	14	5	25.4	13.1
1	980	1473	1473	896	600	182	29	8	0.8	0.5
1	1246	1057	1166	1203	535	241	40	9	3.1	1.1
1	329	1576	880	1111	776	279	93	23	3.6	2.5
1	1408	631	1832	744	605	244	88	28	6.4	1.1
1	927	1613	777	1801	662	342	161	43	17.5	7.4
1	2579	1617	1903	846	1525	553	226	86	49	18.5
1	2203	3088	1635	1472	830	863	291	115	33	19
1	974	2317	3687	2016	1175	620	413	205	65	41
1	334	1070	2505	3715	1817	789	395	299	155.9	75.2
1	882	508	1432	3065	3300	917	439	176	175.5	105.4
1	815	1114	839	2122	3358	1878	432	195	45.7	76.3
1	747	1174	1177	884	2349	3132	1367	306	92.4	98.5
1	1399	1368	1725	1483	1111	1929	1297	383	93.4	55.1
1	657	1583	1742	1932	1610	925	1158	761	241.6	113.6
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	1456	884	1063	1952	1231	567	266	120	119.8	103.8
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
FLT007: Ecosystem_2018corr										
2004	2020									
1	1	0.65	0.75							
3	12									
1	1477	4215	1502	798	402	101	22	5	1.3	2
1	2166	558	1009	280	156	57	12	5	1.2	0.5
1	1861	2056	599	698	176	81	26	6	2.5	0.4
1	5862	1592	791	246	269	60	22	9	1.5	2.4
1	6526	4834	1323	511	128	175	33	9	2.3	3.9
1	2023	2806	2896	1017	319	127	73	26	8.1	5.1
1	568	1770	3972	4249	1427	385	105	68	15.9	6.2
1	1236	1015	2402	3004	1784	323	77	18	13.4	8.7
1	2291	1464	700	1508	1652	845	127	44	15.5	20.8
1	2491	1836	1257	632	1182	1302	538	91	33.2	24.6
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	1744	2252	1413	726	486	262	353	266	78.7	27
1	772	937	1216	701	444	272	138	132	54.2	30.2
1	3750	1415	1049	1209	626	280	112	64	44.5	71.7
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1	4166	2323	2151	766	422	444	161	49	21.9	29.5
1	1337	1343	986	796	316	157	114	29	11.1	11.2

Table 3.14. Parameters settings used in SAM run.

```
$minAge
# The minimium age class in the assessment
 3
$maxAge
# The maximum age class in the assessment
 15
$maxAgePlusGroup
# Is last age group considered a plus group (1 yes, or 0 no).
 1 1 1 1 1 1
$keyLogFsta
# Coupling of the fishing mortality states (nomally only first row is used).
  0  1  2  3  4  5  6  7  8  9 10 11 11
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
$corFlag
# Correlation of fishing mortality across ages (0 independent, 1 compound symmetry, or 2 AR(1)
 0
$keyLogFpar
# Coupling of the survey catchability parameters (nomally first row is not used, as that is covered by fishing mortality).
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
  0  1  2  3  4  5  6  7  8  8 -1 -1 -1
  9 10 11 12 13 14 15 16  17 17 -1 -1 -1
 18 19 20 21 22 23 24 25 26 26 -1 -1 -1
 27 28 29 30 31 32 33 34 35 35 -1 -1 -1
 36 37 38 39 40 41 42 43 44 44 -1 -1 -1

$keyQpow
# Density-dependent catchability power parameters (if any).
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
$keyVarF
# Coupling of process variance parameters for log(F)-process (nomally only first row is used)
  0  1  1  1  1  1  1  1  1  1  1  1  1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1
$keyVarLogN
# Coupling of process variance parameters for log(N)-process
 0 1 1 1 1 1 1 1 1 1 1 1 1
$keyVarObs
# Coupling of the variance parameters for the observations.
  0  1  2  2  2  2  2  2  3  3  4  4  4
  5  6  6  6  6  7  7  7  7  7 -1 -1 -1
```

```
  5  6  6  6  6  7  7  7  7  7 -1 -1 -1
  8  8  8  8  8  8  9  9  9  9 -1 -1 -1
 10 10 10 10 10 10 11 11 11 11 -1 -1 -1
 12 12 12 12 12 12 12 12 12 12 -1 -1 -1
$obsCorStruct
# Covariance structure for each fleet ("ID" independent, "AR" AR(1), or "US" for unstructured). | Possible values are: "ID"
"AR" "US"
 "ID" "AR" "AR" "AR" "AR" "AR"
$keyCorObs
# Coupling of correlation parameters can only be specified if the AR(1) structure is chosen above.
# NA's indicate where correlation parameters can be specified (-1 where they cannot).
#3-4 4-5 5-6 6-7 7-8 8-9 9-10 10-11 11-12 12-13 13-14 14-15
NA NA NA NA NA NA NA NA NA NA NA
0 0 0 0 1 1 2 2 3 -1 -1 -1
0 0 0 0 1 1 2 2 3 -1 -1 -1
4 4 4 5 6 6 6 7 8 -1 -1 -1
9 9 9 9 9 10 10 10 11 -1 -1 -1
12 12 12 13 13 13 14 14 15 -1 -1 -1
$stockRecruitmentModelCode
# Stock recruitment code (0 for plain random walk, 1 for Ricker, and 2 for Beverton–Holt).
 0
$noScaledYears
# Number of years where catch scaling is applied.
 0
$keyScaledYears
# A vector of the years where catch scaling is applied.
$keyParScaledYA
# A matrix specifying the couplings of scale parameters (nrow = no scaled years, ncols = no ages).
$fbarRange
# lowest and higest age included in Fbar
 5 10
$keyBiomassTreat
# To be defined only if a biomass survey is used (0 SSB index, 1 catch index, and 2 FSB index).
 -1 -1 -1 -1 -1 -1
$obsLikelihoodFlag
# Option for observational likelihood | Possible values are: "LN" "ALN"
 "LN" "LN" "LN" "LN" "LN" "LN"
$fixVarToWeight
# If weight attribute is supplied for observations this option sets the treatment (0 relative weight, 1 fix variance to weight).
 0
```

Table 3.15. Northeast Arctic cod. Fishing mortality

SAM, Apr 17 21:10:25 2021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	FBAR5–10
1946	0.003	0.020	0.070	0.138	0.273	0.250	0.381	0.397	0.575	0.563	0.627	0.647	0.647	0.251
1947	0.002	0.021	0.091	0.188	0.388	0.295	0.451	0.447	0.692	0.635	0.689	0.782	0.782	0.310
1948	0.001	0.022	0.096	0.220	0.463	0.346	0.511	0.451	0.713	0.694	0.742	0.923	0.923	0.348
1949	0.002	0.030	0.139	0.301	0.472	0.366	0.460	0.477	0.771	0.751	0.788	1.029	1.029	0.369
1950	0.002	0.043	0.165	0.315	0.437	0.363	0.480	0.538	0.837	0.854	0.816	1.150	1.150	0.383
1951	0.009	0.078	0.231	0.344	0.446	0.392	0.496	0.567	0.781	0.866	0.841	1.198	1.198	0.413
1952	0.014	0.103	0.276	0.429	0.476	0.408	0.522	0.638	0.842	0.919	0.844	1.199	1.199	0.458
1953	0.020	0.112	0.251	0.360	0.404	0.374	0.474	0.613	0.813	0.824	0.799	1.020	1.020	0.413
1954	0.017	0.116	0.267	0.384	0.424	0.359	0.490	0.707	0.832	0.823	0.790	0.929	0.929	0.438
1955	0.015	0.108	0.294	0.492	0.496	0.508	0.565	0.750	0.895	0.866	0.791	0.862	0.862	0.518
1956	0.018	0.122	0.348	0.578	0.557	0.596	0.588	0.739	0.892	0.985	0.825	0.804	0.804	0.568
1957	0.021	0.137	0.293	0.529	0.547	0.586	0.536	0.675	0.880	0.914	0.822	0.719	0.719	0.528
1958	0.035	0.181	0.360	0.544	0.540	0.512	0.509	0.693	0.829	0.880	0.721	0.631	0.631	0.526
1959	0.035	0.202	0.425	0.525	0.527	0.529	0.552	0.722	0.788	0.802	0.708	0.644	0.644	0.547
1960	0.036	0.211	0.407	0.511	0.496	0.548	0.526	0.756	0.854	0.803	0.698	0.712	0.712	0.541
1961	0.038	0.225	0.489	0.577	0.547	0.644	0.696	0.850	0.897	0.863	0.742	0.749	0.749	0.634
1962	0.036	0.224	0.580	0.745	0.631	0.683	0.795	1.007	0.935	0.845	0.775	0.738	0.738	0.740

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	FBAR5–10
1963	0.024	0.194	0.580	0.793	0.752	0.770	0.891	1.078	1.077	0.850	0.802	0.735	0.735	0.811
1964	0.019	0.160	0.413	0.554	0.584	0.697	0.932	0.883	0.976	0.802	0.881	0.756	0.756	0.677
1965	0.023	0.144	0.366	0.461	0.474	0.590	0.786	0.799	0.806	0.671	0.891	0.759	0.759	0.579
1966	0.031	0.141	0.290	0.390	0.470	0.601	0.754	0.791	0.715	0.655	0.799	0.675	0.675	0.549
1967	0.029	0.155	0.267	0.332	0.466	0.640	0.829	0.812	0.771	0.665	0.793	0.610	0.610	0.558
1968	0.025	0.176	0.355	0.433	0.497	0.635	0.848	0.833	0.749	0.601	0.800	0.631	0.631	0.600
1969	0.026	0.182	0.402	0.480	0.627	0.811	1.005	0.922	0.834	0.631	0.757	0.621	0.621	0.708
1970	0.034	0.165	0.376	0.466	0.587	0.822	0.996	0.933	0.796	0.578	0.713	0.631	0.631	0.697
1971	0.031	0.156	0.308	0.357	0.504	0.807	0.981	0.920	0.802	0.605	0.691	0.617	0.617	0.646
1972	0.051	0.184	0.335	0.404	0.430	0.719	1.054	1.010	0.894	0.652	0.746	0.636	0.636	0.659
1973	0.132	0.226	0.387	0.441	0.462	0.701	0.919	0.861	0.846	0.674	0.757	0.621	0.621	0.628
1974	0.158	0.296	0.480	0.520	0.511	0.627	0.672	0.868	0.910	0.715	0.893	0.629	0.629	0.613
1975	0.115	0.276	0.506	0.620	0.640	0.731	0.726	0.731	0.936	0.778	0.953	0.598	0.598	0.659
1976	0.142	0.306	0.529	0.615	0.685	0.851	0.876	0.677	0.799	0.821	0.942	0.675	0.675	0.705
1977	0.128	0.333	0.629	0.677	0.707	0.899	1.125	0.858	0.897	0.810	1.052	0.810	0.810	0.816
1978	0.110	0.253	0.567	0.733	0.765	0.892	1.215	0.945	1.297	1.005	1.201	0.916	0.916	0.853
1979	0.056	0.202	0.410	0.622	0.711	0.805	1.093	0.991	1.290	1.093	1.126	1.008	1.008	0.772
1980	0.038	0.158	0.346	0.628	0.724	0.811	1.000	1.055	1.226	0.996	1.162	0.906	0.906	0.761

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	FBAR5–10
1981	0.032	0.142	0.284	0.583	0.785	0.969	1.159	0.974	1.069	0.937	1.045	0.835	0.835	0.792
1982	0.040	0.158	0.287	0.644	0.841	0.917	1.131	0.829	0.823	0.924	0.866	0.823	0.823	0.775
1983	0.027	0.163	0.300	0.551	0.905	1.077	1.068	0.847	0.715	0.727	0.802	0.867	0.867	0.791
1984	0.024	0.155	0.330	0.583	1.057	1.167	1.166	0.898	0.747	0.703	0.671	0.893	0.893	0.867
1985	0.037	0.160	0.388	0.667	0.944	1.146	0.936	0.783	0.760	0.656	0.594	0.951	0.951	0.810
1986	0.031	0.169	0.452	0.762	0.910	1.137	0.931	1.041	0.887	0.850	0.587	1.074	1.074	0.872
1987	0.038	0.153	0.466	0.820	1.010	1.110	0.896	1.244	0.975	0.997	0.636	1.257	1.257	0.924
1988	0.034	0.126	0.334	0.637	0.928	1.015	1.023	1.344	0.955	0.912	0.729	1.213	1.213	0.880
1989	0.030	0.106	0.253	0.460	0.642	0.827	0.818	0.996	0.752	0.709	0.696	1.428	1.428	0.666
1990	0.020	0.093	0.180	0.312	0.420	0.500	0.552	0.593	0.652	0.612	0.625	1.308	1.308	0.426
1991	0.020	0.102	0.214	0.346	0.437	0.473	0.506	0.485	0.497	0.594	0.571	1.261	1.261	0.410
1992	0.024	0.114	0.281	0.430	0.529	0.556	0.566	0.560	0.518	0.700	0.540	1.251	1.251	0.487
1993	0.014	0.110	0.316	0.523	0.617	0.659	0.692	0.709	0.688	0.824	0.678	1.224	1.224	0.586
1994	0.012	0.109	0.322	0.597	0.920	0.915	0.869	0.849	0.907	0.931	0.778	1.210	1.210	0.745
1995	0.014	0.116	0.323	0.607	0.929	0.896	0.946	0.921	1.004	0.961	0.858	1.122	1.122	0.770
1996	0.021	0.133	0.352	0.619	0.887	0.938	0.857	1.096	0.959	0.961	0.928	1.029	1.029	0.791
1997	0.022	0.167	0.444	0.682	0.899	1.200	1.125	1.262	1.027	1.017	0.924	0.936	0.936	0.935
1998	0.026	0.179	0.470	0.708	0.857	1.162	1.133	1.306	1.049	0.895	0.829	0.785	0.785	0.939

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	FBAR5–10
1999	0.015	0.148	0.459	0.679	0.870	1.102	1.217	1.291	0.951	0.879	0.688	0.692	0.692	0.937
2000	0.009	0.114	0.362	0.585	0.832	1.019	1.105	1.180	0.841	0.894	0.547	0.672	0.672	0.847
2001	0.009	0.096	0.294	0.531	0.754	0.924	0.887	1.045	0.727	0.762	0.436	0.702	0.702	0.739
2002	0.008	0.091	0.277	0.520	0.772	0.882	0.833	0.784	0.619	0.721	0.382	0.660	0.660	0.678
2003	0.010	0.089	0.285	0.474	0.726	0.808	0.770	0.728	0.559	0.621	0.353	0.624	0.624	0.632
2004	0.010	0.090	0.294	0.500	0.761	0.851	0.886	0.920	0.617	0.657	0.332	0.519	0.519	0.702
2005	0.011	0.102	0.319	0.516	0.731	0.859	0.939	0.860	0.649	0.719	0.330	0.463	0.463	0.704
2006	0.016	0.102	0.282	0.441	0.613	0.731	0.788	0.763	0.654	0.740	0.352	0.538	0.538	0.603
2007	0.017	0.091	0.241	0.348	0.446	0.538	0.553	0.515	0.626	0.718	0.359	0.456	0.456	0.440
2008	0.011	0.070	0.163	0.276	0.367	0.444	0.477	0.429	0.573	0.669	0.369	0.369	0.369	0.359
2009	0.010	0.058	0.133	0.222	0.316	0.353	0.453	0.361	0.519	0.716	0.404	0.312	0.312	0.306
2010	0.009	0.050	0.108	0.179	0.279	0.375	0.389	0.411	0.582	0.586	0.456	0.284	0.284	0.290
2011	0.006	0.049	0.107	0.162	0.254	0.350	0.439	0.521	0.544	0.491	0.442	0.230	0.230	0.305
2012	0.007	0.047	0.120	0.162	0.241	0.324	0.413	0.472	0.526	0.453	0.414	0.220	0.220	0.289
2013	0.007	0.048	0.123	0.191	0.269	0.360	0.439	0.502	0.539	0.457	0.392	0.239	0.239	0.314
2014	0.008	0.054	0.143	0.230	0.313	0.391	0.413	0.499	0.580	0.496	0.398	0.251	0.251	0.331
2015	0.010	0.056	0.151	0.270	0.324	0.394	0.360	0.487	0.722	0.563	0.415	0.264	0.264	0.331
2016	0.009	0.052	0.149	0.259	0.340	0.417	0.403	0.534	0.815	0.622	0.449	0.283	0.283	0.350

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	FBAR5–10
2017	0.010	0.057	0.152	0.272	0.355	0.475	0.471	0.577	0.890	0.701	0.485	0.290	0.290	0.384
2018	0.011	0.059	0.158	0.265	0.362	0.457	0.514	0.637	0.891	0.779	0.514	0.282	0.282	0.399
2019	0.009	0.061	0.155	0.251	0.361	0.482	0.510	0.691	0.856	0.819	0.508	0.259	0.259	0.409
2020	0.009	0.060	0.157	0.266	0.377	0.480	0.539	0.785	0.877	0.845	0.526	0.241	0.241	0.434
FBAR	0.010	0.060	0.157	0.261	0.367	0.473	0.521	0.705	0.874	0.814	0.516	0.260		

Table 3.16. Northeast Arctic COD Stock number-at-age (Thous)

SAM Apr 17 21:10:25 2021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTAL
1946	1135788	673447	368922	170374	77540	84044	226764	80614	36008	30581	18809	8088	1995	2912974
1947	581941	678173	497718	297877	133287	53334	56210	132717	45802	17371	14681	8420	4520	2522053
1948	438495	333453	461332	345543	207140	75302	34966	29882	69604	18393	7666	6094	4977	2032846
1949	625699	286421	262850	354740	228994	104145	42883	16916	15958	28246	7428	3005	3612	1980897
1950	1026289	394679	228003	186847	208567	114717	57072	22790	8661	6120	11093	2733	1943	2269514
1951	2445052	784058	311246	176855	114626	111071	65970	28196	10895	2982	2093	4041	1193	4058279
1952	2343271	1142862	464111	190263	115912	61757	61091	33261	13115	4216	1025	729	1281	4432893
1953	2420871	1121669	640545	245343	90633	60007	33121	28491	13939	4520	1346	356	477	4661318
1954	831333	1392086	712164	387865	137794	48657	34604	17296	12911	5053	1646	496	245	3582150
1955	383557	550030	925137	436299	224114	75104	30519	18117	6934	4698	1836	617	240	2657200

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTAL
1956	746609	245807	396250	552943	212676	113018	35671	14606	7032	2276	1660	691	298	2329537
1957	1428442	404735	150540	208923	238721	95088	49172	15386	5685	2358	663	596	362	2600672
1958	937440	718081	249267	95707	100297	109295	40956	23285	6418	1910	780	227	381	2284045
1959	1314694	488736	429677	141032	47114	47559	54793	20164	9515	2297	638	320	267	2556806
1960	1483389	627007	253277	207775	69312	23040	22893	25307	8034	3645	862	256	262	2725059
1961	1554485	709902	348968	134231	102448	36312	11334	12013	9795	2782	1376	361	209	2924217
1962	1252375	815845	393065	169388	64401	49190	15644	4561	4402	3275	939	542	221	2773848
1963	900621	703227	457805	166536	63099	28906	20764	5767	1329	1471	1160	350	301	2351334
1964	468028	409336	369099	179312	54937	21672	10588	6928	1522	350	516	433	257	1522980
1965	870506	247989	258463	199920	82930	23755	8202	3221	2390	451	122	172	266	1698388
1966	1842715	561254	165004	144335	106213	44039	10938	3045	1178	896	192	39	163	2880008
1967	1311586	1272325	393425	105077	80211	55301	20428	4374	1136	491	389	73	81	3244897
1968	183717	1018021	892662	279468	72002	42107	23711	7293	1616	422	206	146	70	2521442
1969	110450	138283	707101	496680	154885	41113	19617	8553	2640	651	194	74	95	1680337
1970	205641	85642	88050	370860	238713	64528	15127	5826	2766	914	280	75	75	1078498
1971	402577	144737	57585	45157	174681	103435	22571	4586	1860	1030	428	113	65	958827
1972	1045979	311616	104639	37160	27113	81739	36156	6982	1532	695	466	181	80	1654337
1973	1723668	750447	211782	63601	21142	15821	32389	9738	1983	500	296	179	114	2831661

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTAL
1974	568211	1214867	516750	122967	35281	11274	6597	10173	3410	702	207	118	131	2490686
1975	608710	366545	672580	258926	61634	18442	5346	3066	3305	1119	284	68	109	2000136
1976	607084	445875	227168	312094	108601	26058	7495	2258	1301	999	417	88	82	1739520
1977	372778	419035	274357	112989	137148	43331	8842	2624	1045	526	345	136	73	1373231
1978	622679	247732	219663	112822	47653	55821	14045	2251	894	385	210	98	77	1324331
1979	202675	447989	155327	90932	40844	17647	18418	3270	697	186	116	51	57	978210
1980	130292	155113	301715	87258	39247	16093	6536	5042	981	155	48	32	31	742541
1981	143781	102417	112595	174252	38040	15670	6029	2074	1396	231	47	12	21	596563
1982	183737	126101	83645	63342	81754	15284	4648	1517	643	379	74	13	11	561149
1983	141514	137439	92475	51860	28732	28260	4910	1238	567	230	118	26	9	487379
1984	442251	115561	83599	54108	24608	10641	7719	1353	440	242	95	41	12	740671
1985	534310	388889	82590	44867	24228	6361	2799	1912	437	166	101	41	18	1086720
1986	1374917	406832	245743	46587	19122	7407	1598	1009	750	176	73	47	19	2104281
1987	360087	1009632	257001	109705	16499	6823	1787	574	287	255	62	35	19	1762766
1988	335536	239626	593614	118643	32964	5027	1739	625	135	90	73	27	12	1328112
1989	157635	228475	147532	302747	55094	9930	1484	487	126	41	29	27	10	903617
1990	130130	128201	128716	94933	140107	22887	2904	533	138	48	16	11	7	648632
1991	295846	126093	97490	85560	61507	81244	11439	1372	247	54	22	7	4	760886

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTAL
1992	715916	270862	100817	69005	48560	33859	46245	6076	805	133	25	10	3	1292314
1993	988150	502301	241460	72845	36842	23486	15481	23997	3045	435	58	13	3	1908114
1994	752473	732759	400196	146966	39199	15936	10658	6384	9849	1329	161	24	4	2115938
1995	539384	492484	525039	231641	63093	12523	5319	3437	2212	3253	425	61	7	1878879
1996	407389	304466	337308	282239	103864	19865	4296	1585	1117	619	1025	147	18	1463938
1997	785420	210434	206036	183000	119806	37428	6317	1650	440	337	193	333	48	1551443
1998	1063528	478552	127601	98021	70895	41547	9524	1628	357	132	95	61	120	1892061
1999	632034	604809	264985	62522	32893	26006	11636	2528	347	98	46	33	68	1638006
2000	749727	409959	377210	122447	24444	11220	7403	2651	586	109	33	19	41	1705849
2001	593152	533789	291155	184584	51933	8998	3404	1928	666	201	35	15	26	1669888
2002	374202	430656	367941	186135	82158	20377	3116	1183	564	251	79	19	17	1466696
2003	756675	287667	287454	235160	84302	30316	6773	1146	445	265	97	46	15	1690360
2004	242069	575263	214309	182400	116317	33942	10973	2652	493	228	128	55	26	1378854
2005	693264	185631	405774	136165	94377	39206	11221	4008	856	215	100	81	40	1570938
2006	536630	467590	141119	231818	68923	34127	13728	3396	1376	381	85	62	70	1499304
2007	1243906	436976	304344	89000	120464	30519	12712	4646	1209	583	152	48	65	2244624
2008	1002761	966398	334693	167959	53182	63401	15804	5785	2011	553	226	88	58	2612919
2009	581758	786082	737615	248496	89681	33914	29121	8114	3156	975	239	126	83	2519359

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp	TOTAL
2010	201832	453844	646771	548012	169178	54809	19264	15054	4798	1687	374	134	126	2115883
2011	358117	181500	377832	534262	390226	86933	32026	10888	8445	2131	810	181	159	1983510
2012	503017	275696	146709	315471	407162	221596	45594	16568	5538	4053	1073	437	218	1943135
2013	464921	369325	226090	129011	243287	267395	138031	24018	8977	2638	2122	582	449	1876846
2014	852202	357736	297268	182017	102626	172079	150135	67574	11880	4149	1345	1174	673	2200859
2015	452019	573369	300103	213797	133367	68981	99660	77937	32181	5620	2027	734	1180	1960976
2016	286334	316470	418548	215227	136866	77503	45139	55725	36725	12607	2621	1086	1200	1606049
2017	781901	241199	228531	287358	147649	79492	41832	25192	24806	13661	5536	1368	1381	1879906
2018	508296	547174	190157	161562	188440	87140	40741	22286	11459	8106	5456	2743	1620	1775181
2019	659091	378054	394365	152320	94700	110096	46911	20048	9548	3862	2946	2581	2523	1877045
2020	572413	443253	285668	249747	104606	58411	58219	22301	8816	3250	1394	1444	3015	1812537
2021		388172	326358	188432	145279	56170	30322	27549	8734	2939	1133	671	2805	1661419

Table 3.17. Northeast Arctic cod. Natural mortality used in final run

SAM. Apr 17 21:10:25 2021

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1946	0.490	0.304	0.226	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1947	0.544	0.325	0.231	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1948	0.493	0.305	0.226	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1949	0.434	0.282	0.221	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1950	0.316	0.236	0.210	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1951	0.724	0.394	0.247	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1952	0.715	0.391	0.246	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1953	0.537	0.322	0.230	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1954	0.388	0.264	0.217	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1955	0.406	0.271	0.218	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1956	0.590	0.342	0.235	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1957	0.725	0.395	0.247	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1958	0.562	0.332	0.232	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1959	0.713	0.390	0.246	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1960	0.704	0.387	0.245	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1961	0.609	0.350	0.237	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1962	0.520	0.315	0.229	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1963	0.788	0.419	0.253	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1964	0.603	0.348	0.236	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1965	0.416	0.275	0.219	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1966	0.353	0.250	0.214	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1967	0.271	0.219	0.206	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1968	0.224	0.201	0.202	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1969	0.206	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1970	0.293	0.227	0.208	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1971	0.256	0.213	0.205	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1972	0.323	0.239	0.211	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1973	0.217	0.200	0.201	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
1974	0.217	0.200	0.201	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1975	0.232	0.204	0.203	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1976	0.224	0.200	0.202	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1977	0.249	0.210	0.204	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1978	0.234	0.204	0.203	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1979	0.208	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1980	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1981	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1982	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1983	0.203	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1984	0.201	0.200	0.219	0.210	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1985	0.205	0.225	0.201	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1986	0.270	0.217	0.255	0.233	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1987	0.256	0.238	0.220	0.274	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1988	0.223	0.212	0.244	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1989	0.200	0.230	0.200	0.233	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1990	0.200	0.200	0.206	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1991	0.200	0.200	0.200	0.206	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1992	0.207	0.200	0.200	0.202	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1993	0.240	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1994	0.348	0.261	0.215	0.220	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1995	0.530	0.314	0.228	0.203	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1996	0.524	0.327	0.244	0.217	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1997	0.421	0.269	0.243	0.227	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1998	0.429	0.274	0.221	0.270	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
1999	0.264	0.234	0.239	0.225	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2000	0.248	0.212	0.244	0.227	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2001	0.236	0.220	0.200	0.231	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2002	0.278	0.212	0.200	0.224	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200

Year_age	3	4	5	6	7	8	9	10	11	12	13	14	+gp
2003	0.239	0.200	0.200	0.211	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2004	0.250	0.215	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2005	0.298	0.212	0.214	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2006	0.203	0.228	0.200	0.206	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2007	0.247	0.200	0.247	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2008	0.258	0.213	0.200	0.232	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2009	0.274	0.208	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2010	0.296	0.234	0.206	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2011	0.422	0.312	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2012	0.380	0.300	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2013	0.394	0.235	0.204	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2014	0.370	0.294	0.212	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2015	0.356	0.262	0.235	0.204	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2016	0.216	0.256	0.265	0.215	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2017	0.399	0.218	0.213	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2018	0.276	0.215	0.200	0.215	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2019	0.303	0.222	0.220	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200
2020	0.415	0.231	0.213	0.216	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.200

Table 3.18. Northeast Arctic cod. Summary table.

SAM, Apr 17 21:10:26 2021

Year	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 5–10
1946	1135788	3922916	951257	706000	0.7422	0.2514
1947	581941	3382444	903002	882017	0.9768	0.3097
1948	438495	3346692	784808	774295	0.9866	0.348
1949	625699	2889457	595004	800122	1.3447	0.3691
1950	1026289	2789609	535963	731982	1.3657	0.3828
1951	2445052	3709628	494928	827180	1.6713	0.4128
1952	2343271	4137579	489062	876795	1.7928	0.458
1953	2420871	4106232	411896	695546	1.6886	0.4126

Year	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 5–10
1954	831333	4208804	407928	826021	2.0249	0.4384
1955	383557	3545134	328216	1147841	3.4972	0.5175
1956	746609	3326386	281791	1343068	4.7662	0.5677
1957	1428442	2812873	212420	792557	3.7311	0.5276
1958	937440	2359384	205292	769313	3.7474	0.5262
1959	1314694	2727446	434170	744607	1.715	0.5466
1960	1483389	2353397	384244	622042	1.6189	0.5405
1961	1554485	2353878	386337	783221	2.0273	0.6338
1962	1252375	2180958	315428	909266	2.8826	0.7402
1963	900621	2012402	216372	776337	3.588	0.8105
1964	468028	1507547	200639	437695	2.1815	0.6771
1965	870506	1451326	108010	444930	4.1194	0.5792
1966	1842715	2213432	120906	483711	4.0007	0.5494
1967	1311586	2728486	128596	572605	4.4527	0.5576
1968	183717	3288929	222794	1074084	4.821	0.6001
1969	110450	2829574	149048	1197226	8.0325	0.7077
1970	205641	2167602	242300	933246	3.8516	0.6965
1971	402577	1657516	330605	689048	2.0842	0.6463
1972	1045979	1608552	353303	565254	1.5999	0.6589
1973	1723668	2279737	334009	792685	2.3732	0.6283
1974	568211	2188062	158889	1102433	6.9384	0.613
1975	608710	2094916	133446	829377	6.2151	0.6587
1976	607084	1943691	167169	867463	5.1891	0.7053
1977	372778	1937560	336183	905301	2.6929	0.8156
1978	622679	1589042	228078	698715	3.0635	0.8529
1979	202675	1137172	180492	440538	2.4408	0.7719
1980	130292	852518	108433	380434	3.5085	0.7605
1981	143781	963860	161314	399038	2.4737	0.7923
1982	183737	750840	321065	363730	1.1329	0.7748

Year	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 5–10
1983	141514	747868	311275	289992	0.9316	0.7913
1984	442251	831178	243575	277651	1.1399	0.8671
1985	534310	1006525	195200	307920	1.5775	0.8104
1986	1374917	1409753	164255	430113	2.6186	0.872
1987	360087	1243086	115231	523071	4.5393	0.9244
1988	335536	1008678	191380	434939	2.2726	0.8801
1989	157635	953135	236896	332481	1.4035	0.6659
1990	130130	903703	300543	212000	0.7054	0.4261
1991	295846	1337457	631789	319158	0.5052	0.4101
1992	715916	1685490	801116	513234	0.6406	0.4867
1993	988150	2201357	700998	581611	0.8297	0.5859
1994	752473	2118586	571721	771086	1.3487	0.7453
1995	539384	1852971	534198	739999	1.3853	0.7702
1996	407389	1697469	550491	732228	1.3301	0.7914
1997	785420	1542345	545261	762403	1.3982	0.9353
1998	1063528	1360918	385646	592624	1.5367	0.9393
1999	632034	1207368	280650	484910	1.7278	0.9365
2000	749727	1227729	255508	414868	1.6237	0.8472
2001	593152	1478197	382986	426471	1.1135	0.7393
2002	374202	1594432	520717	535045	1.0275	0.678
2003	756675	1680492	570925	551990	0.9668	0.6318
2004	242069	1566989	665416	606445	0.9114	0.7019
2005	693264	1517099	578794	641276	1.108	0.7041
2006	536630	1541849	583476	537642	0.9214	0.6028
2007	1243906	1866680	650377	486883	0.7486	0.44
2008	1002761	2548331	721138	464171	0.6437	0.3593
2009	581758	3081618	1009877	523430	0.5183	0.3062
2010	201832	3325191	1241679	609983	0.4913	0.2901
2011	358117	3563773	1803005	719830	0.3992	0.3054

Year	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 5–10
2012	503017	3644935	2022883	727663	0.3597	0.2886
2013	464921	3740027	2257041	966209	0.4281	0.3139
2014	852202	3480488	2153272	986449	0.4581	0.3312
2015	452019	3321906	1750900	864384	0.4937	0.3308
2016	286334	2898026	1407673	849422	0.6034	0.3504
2017	781901	2829945	1428859	868276	0.6077	0.3838
2018	508296	2631587	1286834	778627	0.6051	0.3989
2019	659091	2528242	1227414	692609	0.5643	0.4085
2020	572413	2248053	1004037	692903	0.6901	0.4342
Arith. Mean	740346	2223721	568086	672476	2.0335	0.5937

Table 3.19. Northeast Arctic cod. Input for the short-term prediction.

2021								
Age	N	M	Mat	PF	PM	SWT	Sel	CWT
3	561000	0.3313	0.002	0	0	0.175	0.011	0.755
4	388172	0.2227	0.002	0	0	0.440	0.064	1.086
5	326358	0.2110	0.006	0	0	0.972	0.170	1.603
6	188432	0.2103	0.142	0	0	1.755	0.290	2.289
7	145279	0.2	0.393	0	0	2.710	0.396	3.125
8	56170	0.2	0.660	0	0	3.865	0.509	4.346
9	30322	0.2	0.889	0	0	5.703	0.535	5.848
10	27549	0.2	0.976	0	0	7.448	0.705	7.017
11	8734	0.2	0.957	0	0	9.084	0.955	8.391
12	2939	0.2	1	0	0	11.187	0.825	10.002
13	1133	0.2	1	0	0	13.415	0.546	11.402
14	671	0.2	1	0	0	15.459	0.300	12.654
15	2805	0.2	1	0	0	17.159	0.300	13.958

2022								
Age	**N**	**M**	**Mat**	**PF**	**PM**	**SWT**	**Sel**	**CWT**
3	621000	0.3313	0.001	0	0	0.178	0.011	0.726
4		0.2227	0.001	0	0	0.466	0.064	1.132
5		0.2110	0.010	0	0	0.902	0.170	1.604
6		0.2103	0.128	0	0	1.618	0.290	2.288
7		0.2	0.407	0	0	2.709	0.396	3.219
8		0.2	0.759	0	0	3.991	0.509	4.379
9		0.2	0.912	0	0	5.463	0.535	5.804
10		0.2	0.966	0	0	7.422	0.705	7.134
11		0.2	0.984	0	0	9.354	0.955	8.190
12		0.2	1	0	0	10.951	0.825	9.988
13		0.2	1	0	0	13.266	0.546	11.415
14		0.2	1	0	0	15.552	0.300	12.831
15		0.2	1	0	0	17.651	0.300	14.083

2023								
Age	**N**	**M**	**Mat**	**PF**	**PM**	**SWT**	**Sel**	**CWT**
3	548000	0.3313	0.001	0	0	0.177	0.011	0.726
4		0.2227	0.001	0	0	0.469	0.064	1.132
5		0.2110	0.010	0	0	0.928	0.170	1.604
6		0.2103	0.128	0	0	1.548	0.290	2.288
7		0.2	0.407	0	0	2.573	0.396	3.219
8		0.2	0.759	0	0	3.990	0.509	4.379
9		0.2	0.912	0	0	5.589	0.535	5.804
10		0.2	0.966	0	0	7.182	0.705	7.134
11		0.2	0.984	0	0	9.328	0.955	8.190
12		0.2	1	0	0	11.221	0.825	9.988
13		0.2	1	0	0	13.030	0.546	11.415
14		0.2	1	0	0	15.403	0.300	12.831
15		0.2	1	0	0	17.744	0.300	14.083

Table 3.20. Northeast Arctic cod. Management option table.

2021					
Biomass (t)	SSB (t)	FMult	FBar	Landings (t)	
2091633	884509	1	0.434	653500	
2022				2023	
Biomass	SSB	FBar	Landings	Biomass	SSB
2002020	851783	0.00	0	2629316	1306235
		0.05	88431	2533231	1234101
		0.10	172371	2442432	1166506
		0.15	252105	2356569	1103128
		0.20	327897	2275319	1043672
		0.25	399991	2198384	987863
		0.30	468613	2125487	935451
		0.35	533976	2056371	886203
		0.40	596273	1990799	839903
		0.45	655688	1928550	796353
		0.50	712389	1869420	755370
		0.55	766535	1813219	716783
		0.60	818271	1759770	680434
		0.65	867736	1708908	646178
		0.70	915056	1660481	613879
		0.75	960352	1614345	583411
		0.80	1003734	1570369	554658
		0.85	1045308	1528427	527512
FLR					

Table 3.21. Northeast Arctic cod. Detailed prediction output assuming Fsq in 2021 and HCR in 2022.

Fbar range:	age 5-10						
Year:	2021						
F multiplier:	1						
Fbar:	0.4340						
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)
3	0.011	5037	4	561000	98	1386	0
4	0.064	21467	23	388172	171	924	0
5	0.170	46152	74	326358	317	2113	2
6	0.290	42993	98	188432	331	26758	47
7	0.396	43298	135	145279	394	57122	155
8	0.509	20473	89	56170	217	37099	143
9	0.535	11481	67	30322	173	26967	154
10	0.705	12782	90	27549	205	26901	200
11	0.955	4945	41	8734	79	8363	76
12	0.825	1517	15	2939	33	2939	33
13	0.546	436	5	1133	15	1133	15
14	0.300	159	2	671	10	671	10
15+	0.300	663	9	2805	48	2805	48
Total	NA	211404	654	1739564	2092	195179	885
		Thous	Thou. tonnes	Thous	Thou. tonnes	Thous	Thou. tonnes
Fbar range:	age 5-10						
Year:	2022						
F multiplier:	1.14						
Fbar:	0.4965						
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)
3	0.012	6373	5	621000	110	414	0
4	0.073	25102	28	398532	186	266	0
5	0.195	46625	75	291542	263	2915	3
6	0.332	57089	131	222945	361	28537	46
7	0.452	37970	122	114254	310	46463	126
8	0.582	32335	142	80087	320	60786	243
9	0.611	11580	67	27649	151	25207	138
10	0.807	7397	53	14546	108	14056	104
11	1.092	6830	56	11142	104	10968	103
12	0.944	1548	15	2753	30	2753	30
13	0.625	448	5	1054	14	1054	14
14	0.344	142	2	537	8	537	8
15+	0.344	559	8	2107	37	2107	37
Total	NA	234000	708	1788149	2002	196064	852
		Thous	Thou. tonnes	Thous	Thou. tonnes	Thous	Thou. tonnes

Table 3.22. Northeast Arctic cod. Assessments results by means of TISVPA.

Year	B(3+)	SSB	R(3)	F(5-10)
1984	807954	250746	410523	0.797
1985	980750	198920	572528	0.636
1986	1373006	181043	1093298	0.777
1987	1235908	134626	287903	1.008
1988	1014506	224385	216977	0.981
1989	916885	239238	176343	0.468
1990	990201	334926	208876	0.311
1991	1552666	722740	394071	0.227
1992	1941853	963126	677277	0.407
1993	2420887	851159	985577	0.613
1994	2220662	642878	733691	0.809
1995	1899651	565667	451863	0.739
1996	1831162	635149	398175	0.702
1997	1707205	701702	615599	1.022
1998	1310400	440043	786884	1.039
1999	1086240	278844	446021	0.956
2000	1057202	237512	551676	0.671
2001	1282493	363769	454131	0.533
2002	1402591	484448	403270	0.517
2003	1513047	529317	651690	0.510
2004	1466859	619630	270922	0.613
2005	1440571	562183	521538	0.619
2006	1497323	593686	532430	0.650
2007	1801766	625622	1305559	0.513
2008	2545295	664342	1258479	0.367
2009	3212962	962458	853957	0.353
2010	3480838	1156171	499582	0.389
2011	3610421	1621078	609473	0.335
2012	3692618	1843690	718214	0.302
2013	3787101	2014197	838254	0.313
2014	3553222	1927922	1035664	0.343
2015	3399199	1536347	476073	0.366
2016	3035769	1255420	349877	0.331
2017	3058797	1484139	630535	0.382
2018	2753200	1424145	405472	0.410
2019	2481220	1367254	447065	0.355
2020	2116031	1128535	390173	0.447
2021	1739852	911290		

Table 3.23. NEA cod TISVPA estimates of abundance-at-age (thousands)

	3	4	5	6	7	8	9	10	11	12	13	14	15
1984	410523	135361	73038	41968	24276	12026	8938	1468	676	461	204	35	24
1985	572528	328885	97230	42154	18143	7015	3360	2497	476	386	175	111	28
1986	1093298	450718	227239	56521	19969	6784	2322	1323	1071	220	267	105	43
1987	287903	813483	306460	114066	23174	7127	2188	724	435	368	76	161	55
1988	216977	214133	536192	153748	36097	6227	2073	709	148	142	110	39	14
1989	176343	167180	149847	286245	59642	9164	1507	604	182	33	50	53	77
1990	208876	141119	119573	95102	155696	26282	3530	627	280	102	16	35	14
1991	394071	169454	108844	84293	60687	96088	14766	2047	357	174	67	9	19
1992	677277	319370	131230	77094	53911	35799	58652	8865	1282	238	123	51	6
1993	985577	538231	237036	87118	44197	28095	17282	30658	4521	714	126	89	4
1994	733691	765179	402113	144673	44957	20161	11587	6812	12530	1801	278	63	13
1995	451863	510878	531121	239795	65665	14500	6205	3351	1856	3852	551	138	3
1996	398175	261986	335690	315000	116737	25336	5210	1983	990	512	1385	282	3
1997	615599	230456	167601	193804	154458	48851	9337	2044	630	320	175	617	3
1998	786884	393527	146146	81861	76453	47171	12992	2173	483	115	60	57	138
1999	446021	492048	237442	71578	30352	24034	10507	3707	515	140	25	22	82
2000	551676	335073	321484	111407	25292	10341	5853	2062	1137	156	52	4	51
2001	454131	424077	240836	170235	48105	9087	3647	1697	590	542	64	31	98
2002	403270	353825	307475	147349	79869	20291	3317	1636	627	240	316	43	29
2003	651690	302383	260499	188743	70234	31599	7770	1309	843	315	109	216	5
2004	270922	506524	228784	164312	95987	30781	12864	3571	600	497	170	70	35
2005	521538	208554	372200	144592	81918	37204	11225	4558	1373	239	270	104	30
2006	532430	381711	152345	216484	72092	33374	12883	4166	1540	571	103	180	621
2007	1305559	427361	267972	94678	106475	31217	12822	4136	1598	516	242	61	165
2008	1258479	1002021	316032	160193	53322	52304	14713	6114	1796	763	198	154	77
2009	853957	964086	761058	219428	94827	30261	25732	7558	3264	866	415	128	122
2010	499582	644435	743877	537212	136711	55224	16599	13253	4217	1813	205	275	196
2011	609473	369409	488219	534378	345967	76109	28437	8804	6674	1631	846	73	0
2012	718214	397644	261153	358720	357297	206007	41841	14106	3890	3147	871	447	153
2013	838254	488540	283846	195322	246505	222263	119010	23097	7289	1878	1679	516	840
2014	1035664	562226	372114	207725	136189	150095	120387	60051	11501	3605	982	1048	784
2015	476073	710234	400851	265783	135767	83673	77213	59825	28889	5780	1825	580	1100
2016	349877	330004	516712	277166	170497	78757	46893	39623	27636	11604	2587	1095	1354
2017	630535	279667	242691	345652	180680	104598	43119	25723	17644	11568	5392	1476	1054
2018	405472	417114	211326	165467	214530	103813	57111	21430	12571	6367	4647	2921	942
2019	447065	301865	306286	144999	97871	118343	55958	30358	9624	5342	2504	2244	1281
2020	390173	325871	218726	196445	90708	54824	62333	30750	16717	4549	2761	1448	1299
2021	0	254403	238659	142919	111198	46207	25971	29664	14528	8140	2302	1726	905

Table 3.24. NEA cod TISVPA estimates of fishing mortality coefficients.

F	3	4	5	6	7	8	9	10	11	12	13	14	15
1984	0.023	0.137	0.325	0.561	0.998	0.967	0.990	0.941	0.279	0.926	0.469	0.469	0.469
1985	0.020	0.123	0.314	0.455	0.622	0.911	0.740	0.774	0.685	0.217	0.382	0.382	0.382
1986	0.021	0.148	0.392	0.640	0.743	0.874	1.109	0.905	0.873	0.749	0.443	0.443	0.443
1987	0.025	0.152	0.487	0.842	1.132	1.079	1.061	1.446	1.034	0.967	0.518	0.518	0.518
1988	0.024	0.162	0.417	0.874	1.216	1.330	1.017	1.030	1.248	0.894	0.500	0.500	0.500
1989	0.013	0.089	0.242	0.368	0.564	0.611	0.554	0.471	0.444	0.496	0.260	0.260	0.260
1990	0.008	0.059	0.157	0.263	0.315	0.404	0.377	0.352	0.286	0.266	0.172	0.172	0.172
1991	0.006	0.038	0.112	0.186	0.250	0.258	0.286	0.273	0.241	0.194	0.127	0.127	0.127
1992	0.009	0.066	0.166	0.316	0.439	0.521	0.465	0.533	0.473	0.404	0.219	0.219	0.219
1993	0.015	0.084	0.251	0.403	0.654	0.803	0.825	0.741	0.803	0.682	0.320	0.320	0.320
1994	0.017	0.114	0.278	0.543	0.717	1.051	1.098	1.169	0.939	0.999	0.404	0.404	0.404
1995	0.016	0.109	0.306	0.465	0.742	0.826	1.011	1.087	1.051	0.832	0.397	0.397	0.397
1996	0.020	0.103	0.297	0.530	0.643	0.884	0.824	1.037	1.016	0.956	0.399	0.399	0.399
1997	0.027	0.175	0.377	0.728	1.131	1.157	1.411	1.327	1.618	1.511	0.556	0.556	0.556
1998	0.030	0.177	0.508	0.669	1.068	1.407	1.142	1.440	1.215	1.406	0.555	0.555	0.555
1999	0.025	0.188	0.481	0.884	0.886	1.186	1.244	1.056	1.183	0.991	0.518	0.518	0.518
2000	0.020	0.120	0.389	0.596	0.831	0.686	0.740	0.786	0.641	0.683	0.365	0.365	0.365
2001	0.015	0.106	0.258	0.523	0.624	0.718	0.513	0.561	0.552	0.451	0.286	0.286	0.286
2002	0.013	0.087	0.264	0.401	0.659	0.659	0.644	0.475	0.484	0.467	0.264	0.264	0.264
2003	0.013	0.078	0.216	0.417	0.505	0.712	0.605	0.605	0.420	0.419	0.248	0.248	0.248
2004	0.014	0.098	0.241	0.425	0.687	0.708	0.868	0.746	0.690	0.463	0.290	0.290	0.290
2005	0.015	0.094	0.267	0.412	0.591	0.826	0.716	0.903	0.716	0.647	0.295	0.295	0.295
2006	0.016	0.105	0.273	0.499	0.621	0.768	0.922	0.814	0.952	0.732	0.323	0.323	0.323
2007	0.013	0.085	0.236	0.379	0.553	0.578	0.604	0.730	0.605	0.679	0.267	0.267	0.267
2008	0.009	0.065	0.175	0.300	0.382	0.471	0.424	0.451	0.500	0.414	0.206	0.206	0.206
2009	0.008	0.057	0.164	0.277	0.386	0.423	0.451	0.415	0.413	0.447	0.200	0.200	0.200
2010	0.008	0.058	0.161	0.296	0.408	0.493	0.467	0.510	0.438	0.427	0.220	0.220	0.220
2011	0.007	0.044	0.137	0.239	0.355	0.420	0.438	0.425	0.433	0.367	0.200	0.200	0.000
2012	0.006	0.043	0.106	0.211	0.298	0.383	0.394	0.420	0.381	0.381	0.190	0.190	0.190
2013	0.007	0.042	0.122	0.190	0.309	0.381	0.429	0.450	0.449	0.399	0.212	0.212	0.212
2014	0.008	0.048	0.127	0.232	0.294	0.422	0.455	0.526	0.517	0.504	0.250	0.250	0.250
2015	0.010	0.060	0.144	0.240	0.361	0.397	0.502	0.554	0.601	0.577	0.295	0.295	0.295
2016	0.009	0.062	0.154	0.229	0.310	0.405	0.387	0.499	0.514	0.543	0.290	0.290	0.290
2017	0.016	0.070	0.196	0.306	0.370	0.437	0.500	0.486	0.592	0.597	0.355	0.355	0.355
2018	0.021	0.107	0.197	0.348	0.440	0.457	0.468	0.549	0.498	0.594	0.382	0.382	0.382
2019	0.015	0.116	0.248	0.277	0.395	0.426	0.384	0.401	0.437	0.390	0.325	0.325	0.325
2020	0.013	0.080	0.213	0.353	0.475	0.547	0.543	0.550	0.520	0.481	0.270	0.270	0.270

Table 3.25. North East arctic cod. Stock numbers-at-age (in thousands) estimated by VPA including discard estimates, and % increase in stock numbers relative to a VPA without discards. From Dingsør (2001). The discard numbers applied correspond to method II (1946–1982) and IIIb (1983–1998) mentioned in Dingsør (2001).

	Estimated stock numbers (thousands)			Percent increase		
Year	Age 3	Age 4	Age 5	Age 3	Age 4	Age 5
1946	875 346	602 579	407 163	20 %	4 %	1 %
1947	531 993	676 806	465 099	27 %	14 %	0 %
1948	570 356	392 309	497 476	29 %	14 %	5 %
1949	589 367	416 668	285 459	26 %	16 %	3 %
1950	799 732	414 016	291 200	13 %	9 %	1 %
1951	1 235 322	586 054	302 346	14 %	2 %	0 %
1952	1 388 731	889 509	401 768	17 %	3 %	0 %
1953	1 801 114	975 004	600 908	13 %	2 %	0 %
1954	830 653	1 321 053	684 303	29 %	5 %	0 %
1955	381 489	615 696	907 875	40 %	19 %	2 %
1956	567 555	274 235	399 344	29 %	25 %	3 %
1957	914 850	387 496	161 710	14 %	10 %	2 %
1958	552 600	672 221	262 135	11 %	4 %	2 %
1959	757 567	391 906	406 694	11 %	3 %	0 %
1960	855 470	534 350	240 047	8 %	1 %	0 %
1961	1 041 570	620 707	347 043	13 %	1 %	0 %
1962	894 728	739 196	382 556	23 %	4 %	0 %
1963	551 938	614 025	429 068	17 %	10 %	0 %
1964	389 151	396 165	361 790	15 %	5 %	0 %
1965	845 469	293 844	266 134	9 %	8 %	0 %
1966	1 618 188	647 435	203 168	2 %	4 %	2 %
1967	1 404 569	1 249 506	465 035	9 %	0 %	1 %
1968	210 875	1 088 071	876 095	24 %	6 %	0 %
1969	143 791	155 947	699 033	28 %	15 %	2 %
1970	222 635	104 415	92 541	13 %	17 %	4 %
1971	462 474	164 397	65 112	14 %	6 %	2 %
1972	1 221 559	358 357	115 892	20 %	10 %	1 %
1973	1 858 123	947 409	249 400	2 %	19 %	11 %
1974	598 555	1 246 499	583 612	14 %	2 %	9 %
1975	654 442	382 692	627 793	5 %	10 %	3 %
1976	622 230	477 390	233 608	1 %	2 %	1 %
1977	397 826	426 386	280 645	14 %	0 %	0 %
1978	653 256	277 410	198 204	2 %	11 %	0 %
1979	225 935	460 104	164 243	14 %	2 %	1 %
1980	152 937	171 954	300 312	11 %	11 %	0 %
1981	161 752	116 964	116 337	7 %	7 %	4 %
1982	151 642	125 307	81 780	0 %	4 %	1 %
1983	166 310	115 423	82 423	0 %	-1 %	3 %
1984	408 525	133 333	77 728	3 %	0 %	0 %
1985	543 828	324 072	96 327	4 %	2 %	0 %
1986	1 114 252	412 683	219 993	7 %	2 %	0 %
1987	307 425	767 656	268 642	7 %	4 %	0 %
1988	222 819	215 720	490 161	9 %	3 %	2 %
1989	180 066	166 955	151 576	4 %	6 %	0 %
1990	249 968	139 922	114 006	3 %	2 %	1 %
1991	418 955	200 700	105 559	2 %	2 %	0 %
1992	748 962	333 517	151 973	4 %	1 %	0 %
1993	1 002 933	576 112	238 980	10 %	2 %	0 %
1994	896 184	744 062	420 039	9 %	8 %	0 %
1995	733 664	584 808	476 048	10 %	6 %	3 %
1996	467 093	341 918	344 124	3 %	7 %	3 %
1997	765 234	238 202	193 102	3 %	0 %	4 %
1998	836 301	429 147	144 629	2 %	1 %	-1 %

Table 3.26. Northeast Arctic cod. Number (thousands) of cod by age groups taken as bycatch in the Norwegian shrimp fishery (1984–2006) .

Age\Year	1984	1985	1986	1987	1988	1989	1990	1991
0	322	4537	28	1408	259	717	2971	11651
1	4913	19437	2339	3259	1719	668	13731	34450
2	1624	49334	6952	1961	1534	418	1518	2759
3	1073	2720	5245	499	1380	694	1019	87
4	2200	1891	716	2210	1882	2096	403	64
5	161	9306	737	1715	1124	2281	909	33
6	89	6374	520	411	269	1135	2913	293
7	144	266	92	79	186	184	1434	1138
8	38	1	93	28	178	13	185	316
9	1	2	165	6	1	0	3	29
10	0	3	88	1	0	0	9	0
11	0	0	0	0	0	0	0	0
Total('000)	10564	93872	16976	11576	8532	8206	25095	50819

Age\Year	1992	1993	1994	1995	1996	1997	1998	1999
0	6486	604	1042	1138	519	896	506	651
1	5236	6702	1628	1896	9084	17157	40314	7155
2	2922	4032	410	99	359	1805	5248	245
3	242	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
Total('000)	14886	11339	3080	3133	9962	19858	46068	8052

Age\Year	2000	2001	2002	2003	2004	2005	2006
0	66	1188	478	4253	713	945	1355
1	1572	7187	293	8805	1014	3411	2597
2	3152	1348	893	96	323	1628	218
3	218	0	190	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
Total('000)	5007	9723	1854	13154	2051	5984	4170

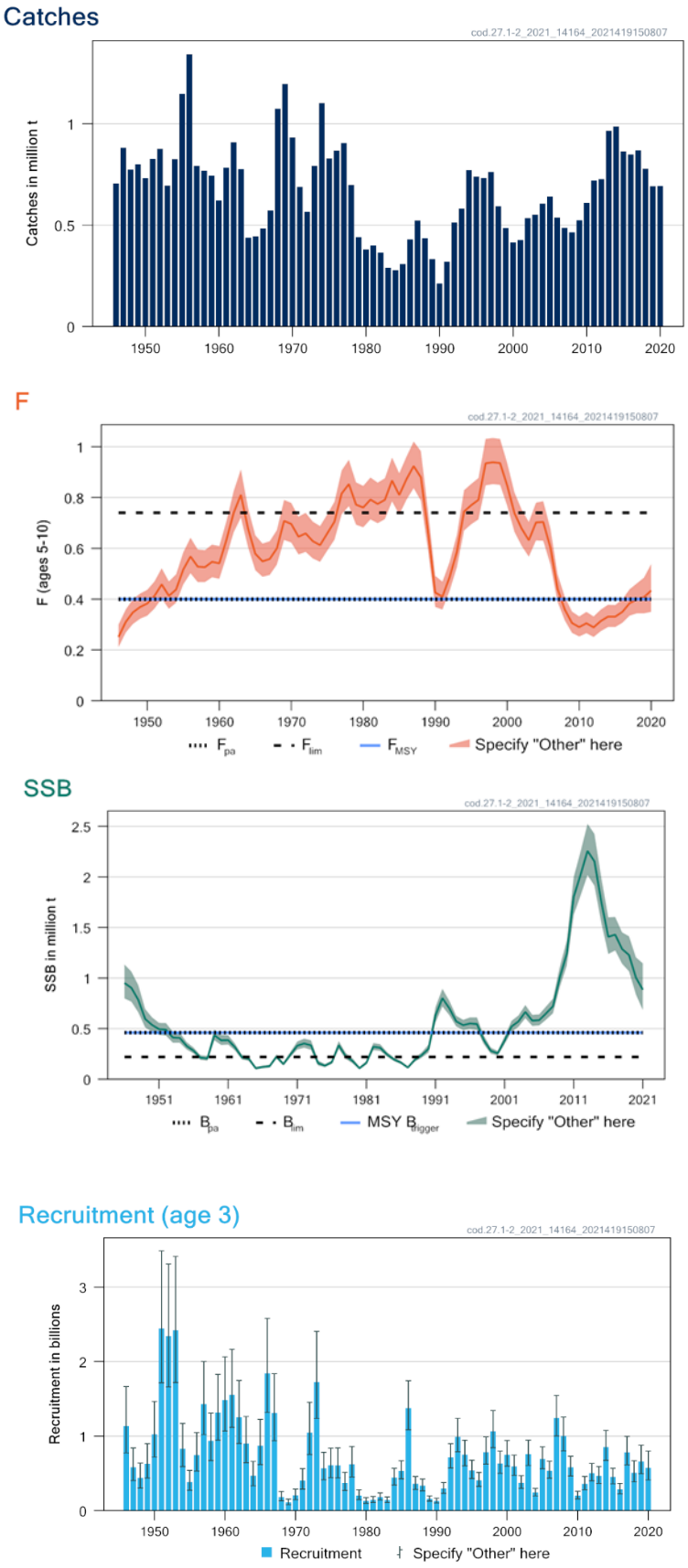


Figure 3.1. ICES Standard plots for Northeast Arctic cod (subareas 1 and 2).

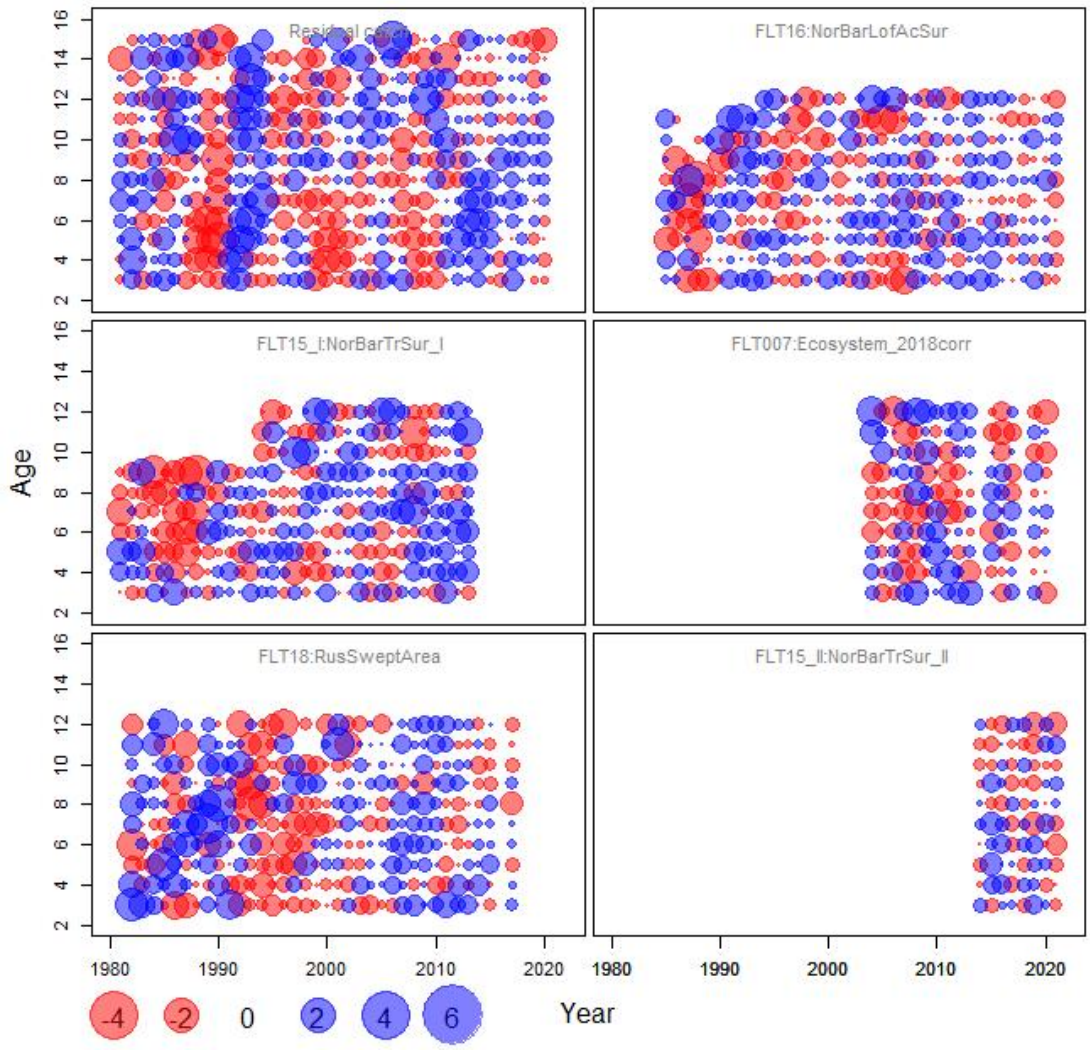


Figure 3.2a. Standardized one-observation-ahead residuals for log-catches and log-indices (Thygesen *et al.,*. 2017) in the final SAM run.

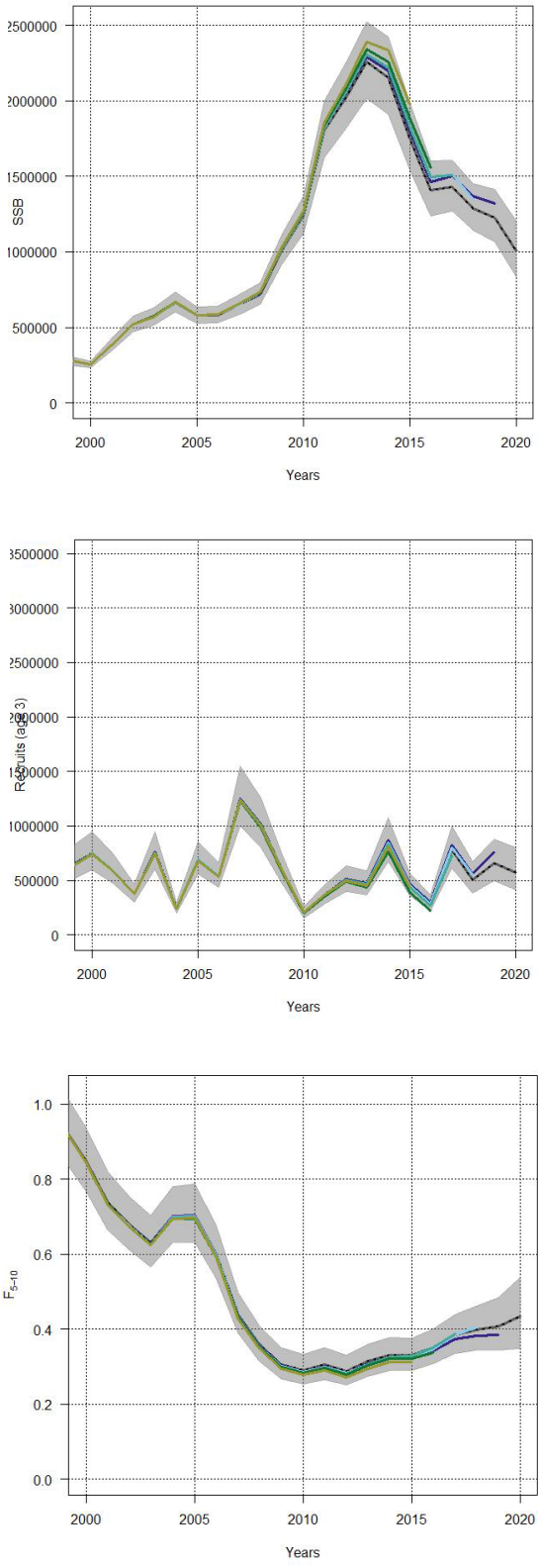


Figure 3.2b. NEA cod SSB, R and F_{bar} retrospective pattern for final SAM run.

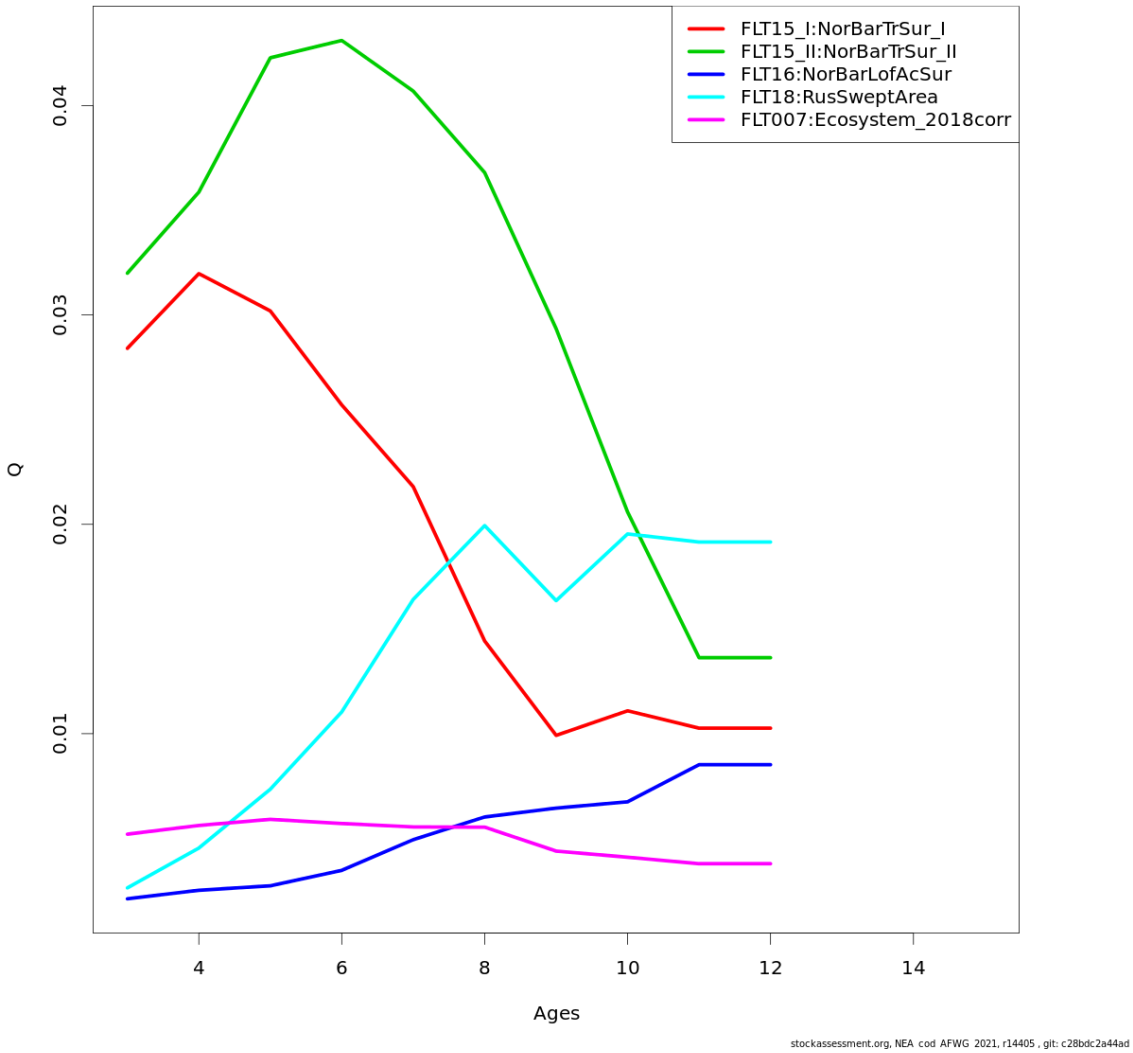


Figure 3.2c. NEA cod. Catchability of different fleets used for final SAM run fit.

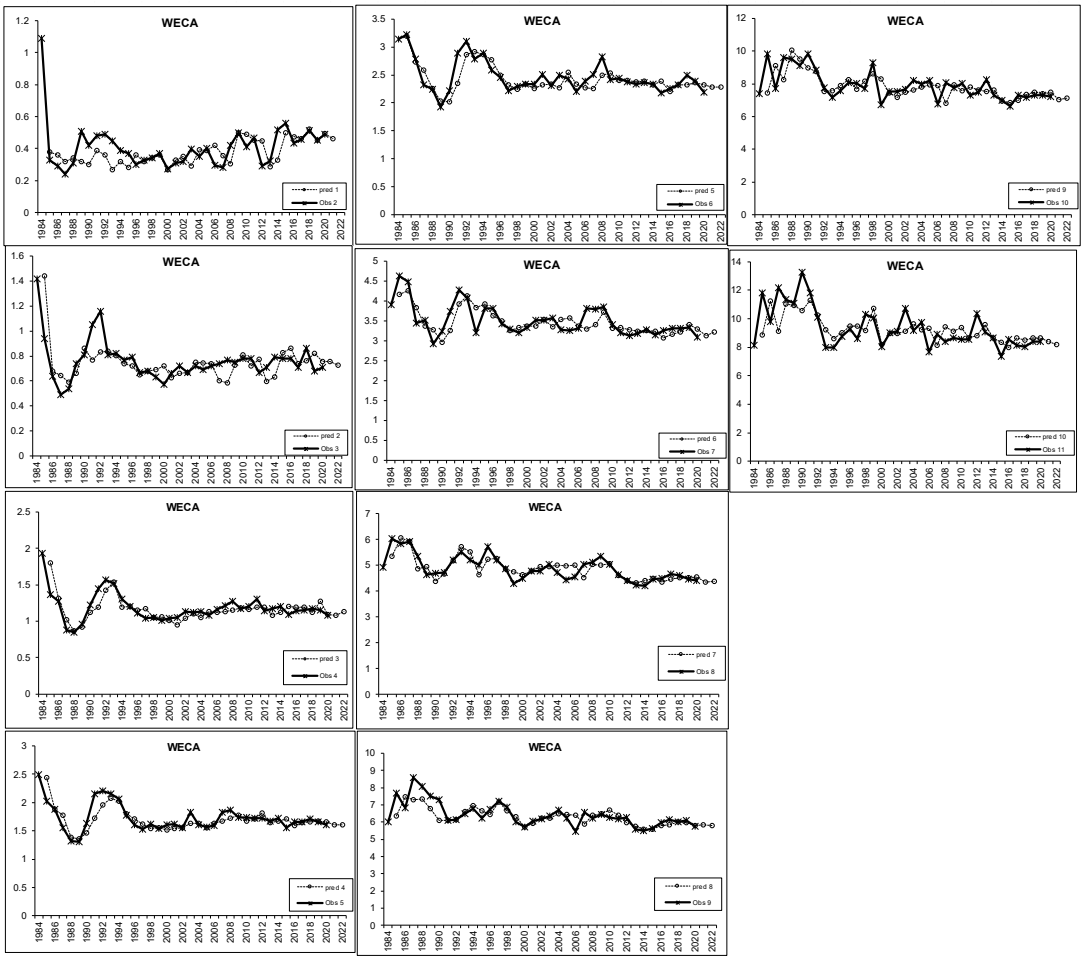


Figure 3.3. Northeast Arctic cod. Weight in catch predictions.

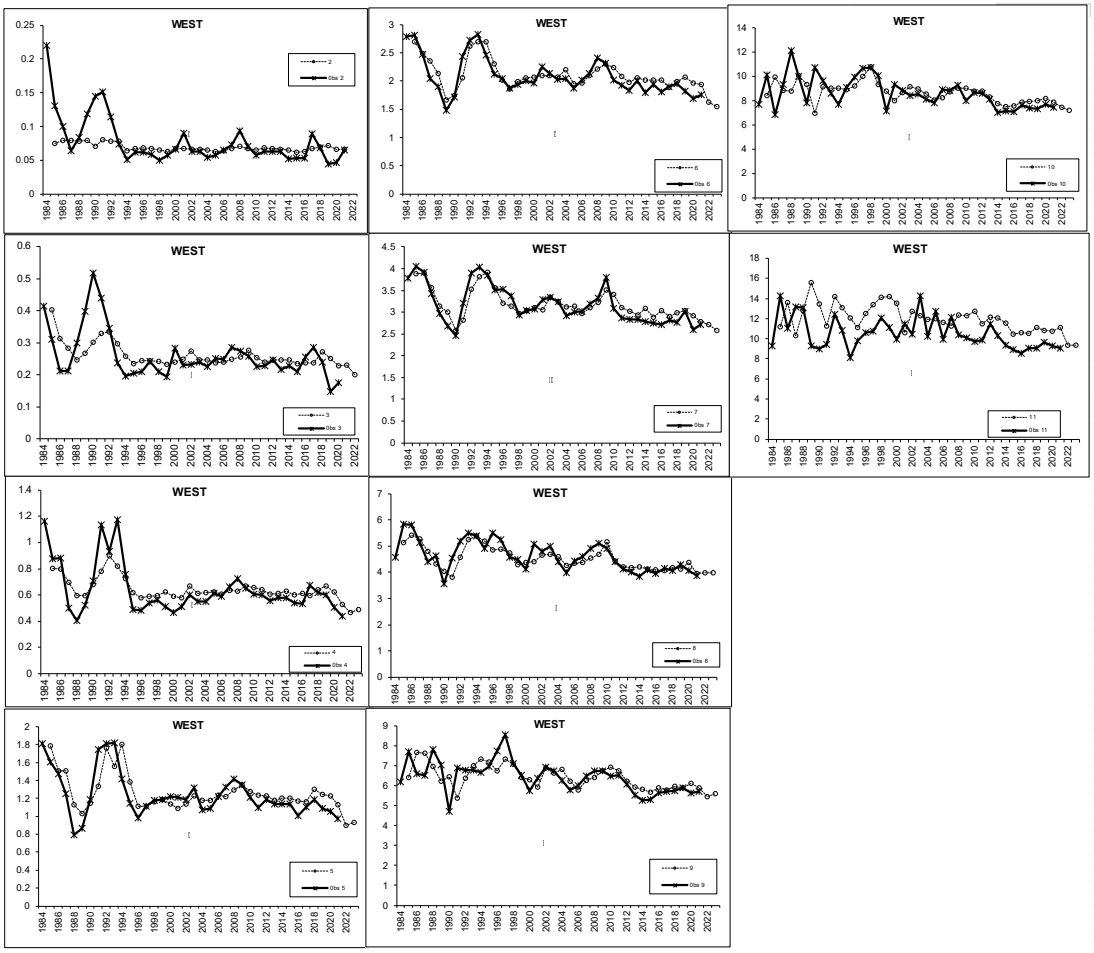


Figure 3.4. Northeast Arctic cod. Weight in stock projections.

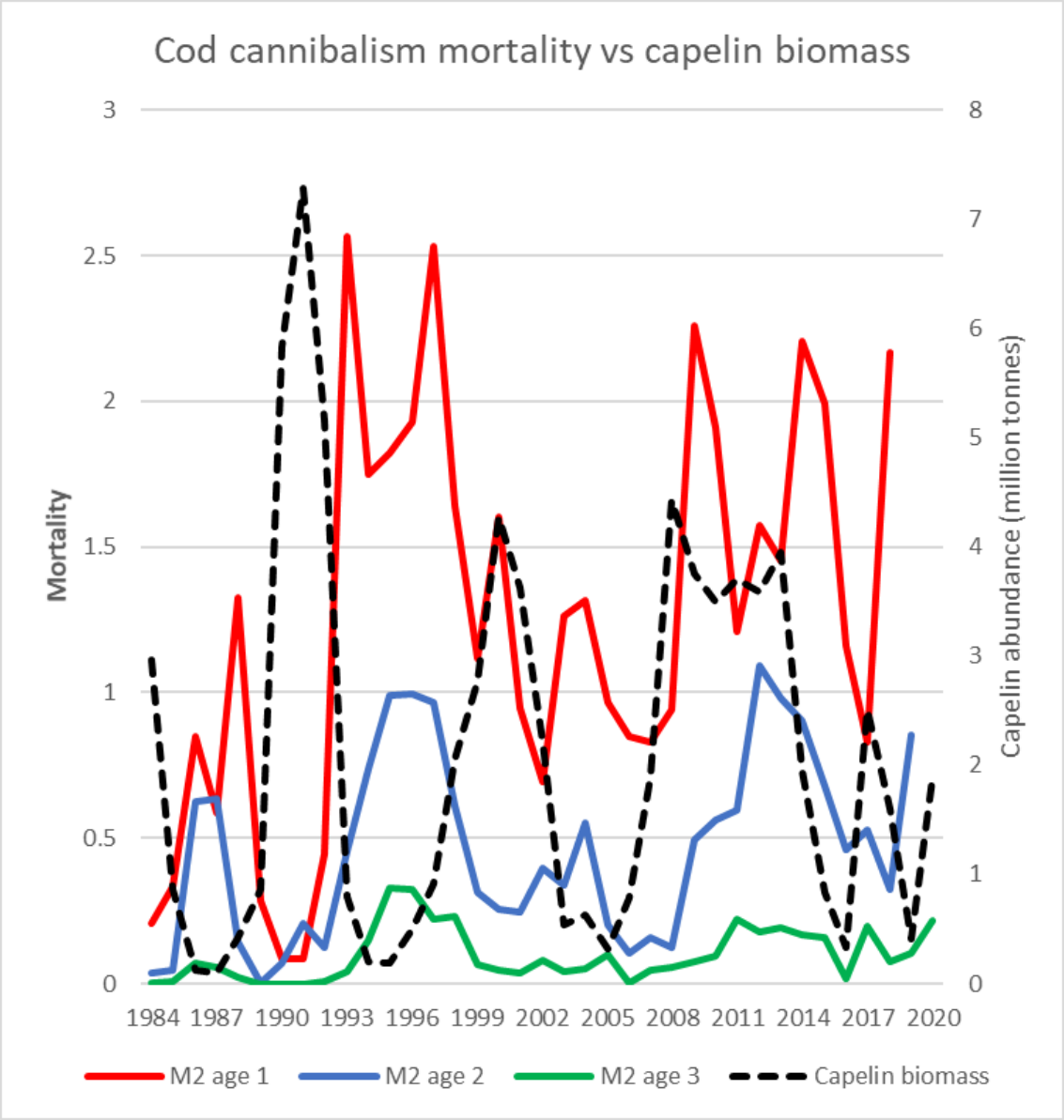
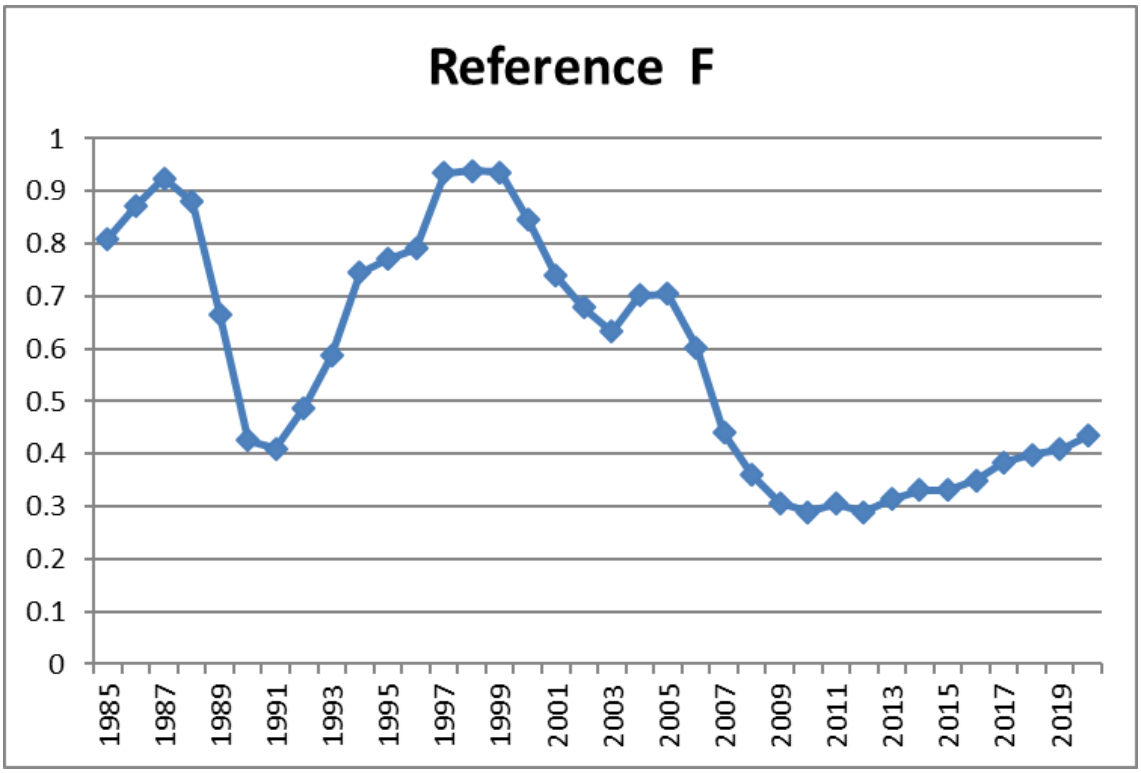


Figure 3.5. NEA cod cannibalism mortality vs. capelin abundance.



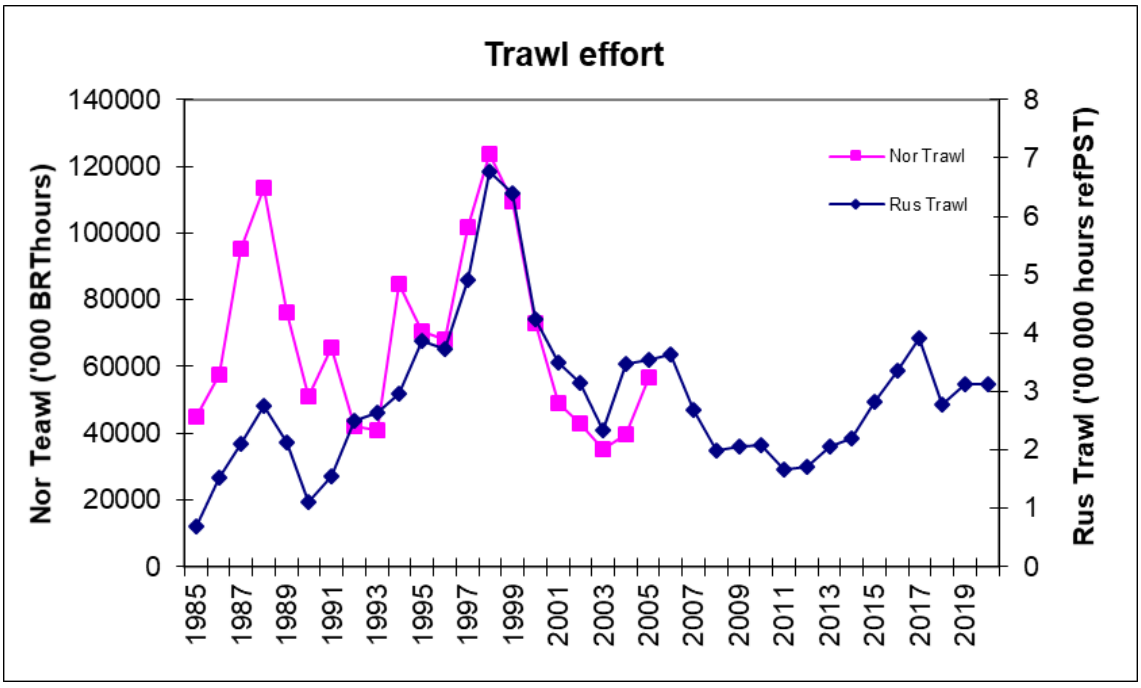


Figure 3.6a. Northeast Arctic cod. Fishing mortality (F5–10; top panel) and trawl efforts in 1985–2020 (bottom panel).

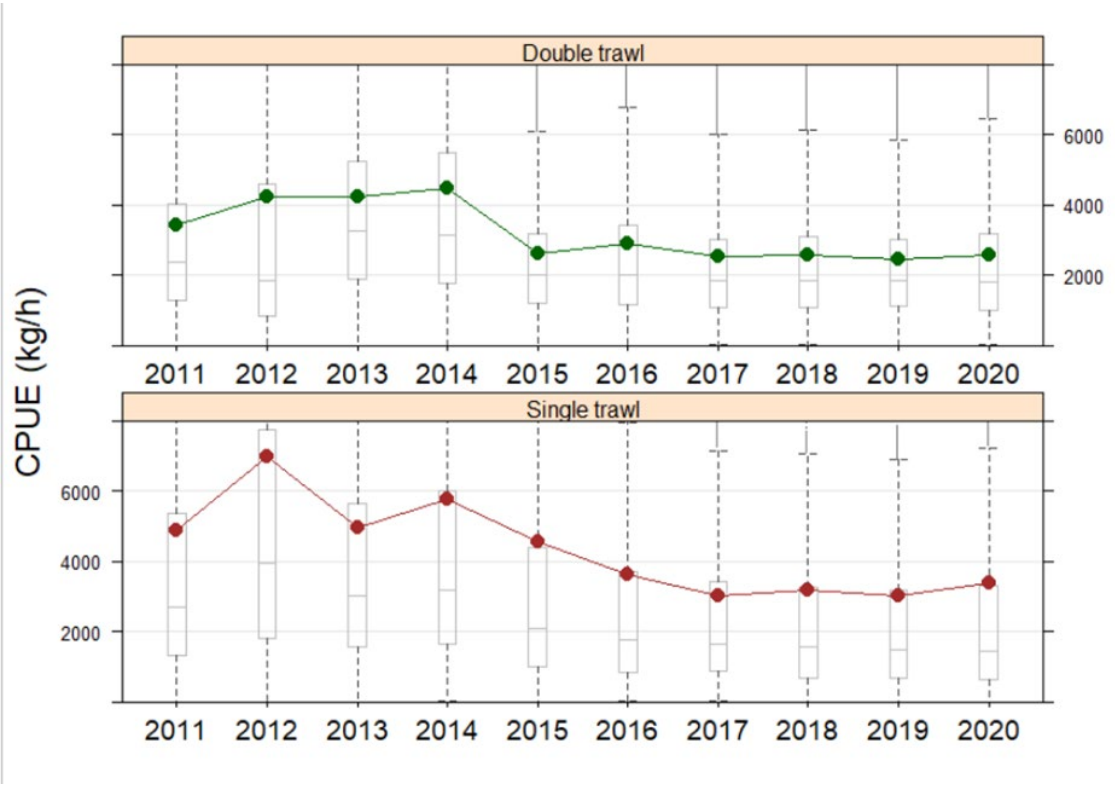


Figure 3. 6b. Cod CPUE in Norwegian trawl catches where cod is the main species (double and single trawl). Connected line shows mean, line inside the box shows the median, and the box shows 25 and 75 percentiles.

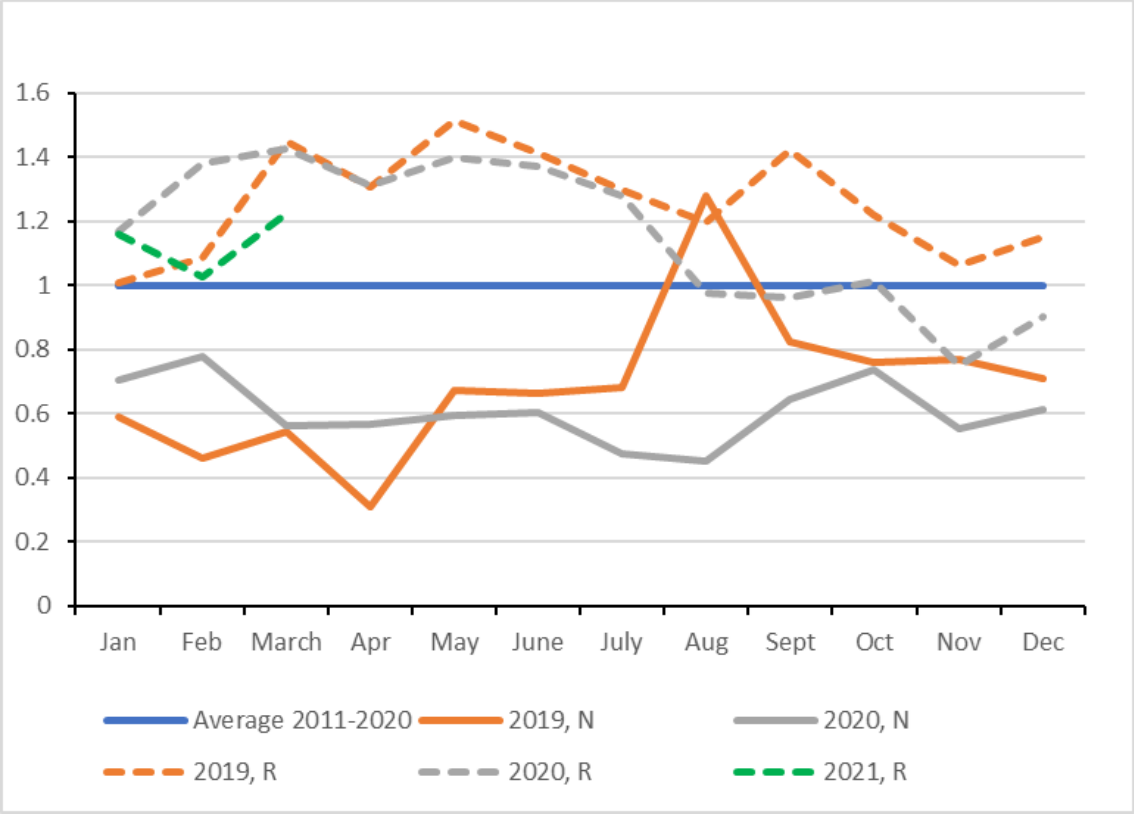


Figure 3.6c. Northeast Arctic cod. Monthly trawl CPUE of Russian (R) and Norwegian (N) vessels in 2019, 2020 and 2021 vs. the long-term average values (2011–2020).

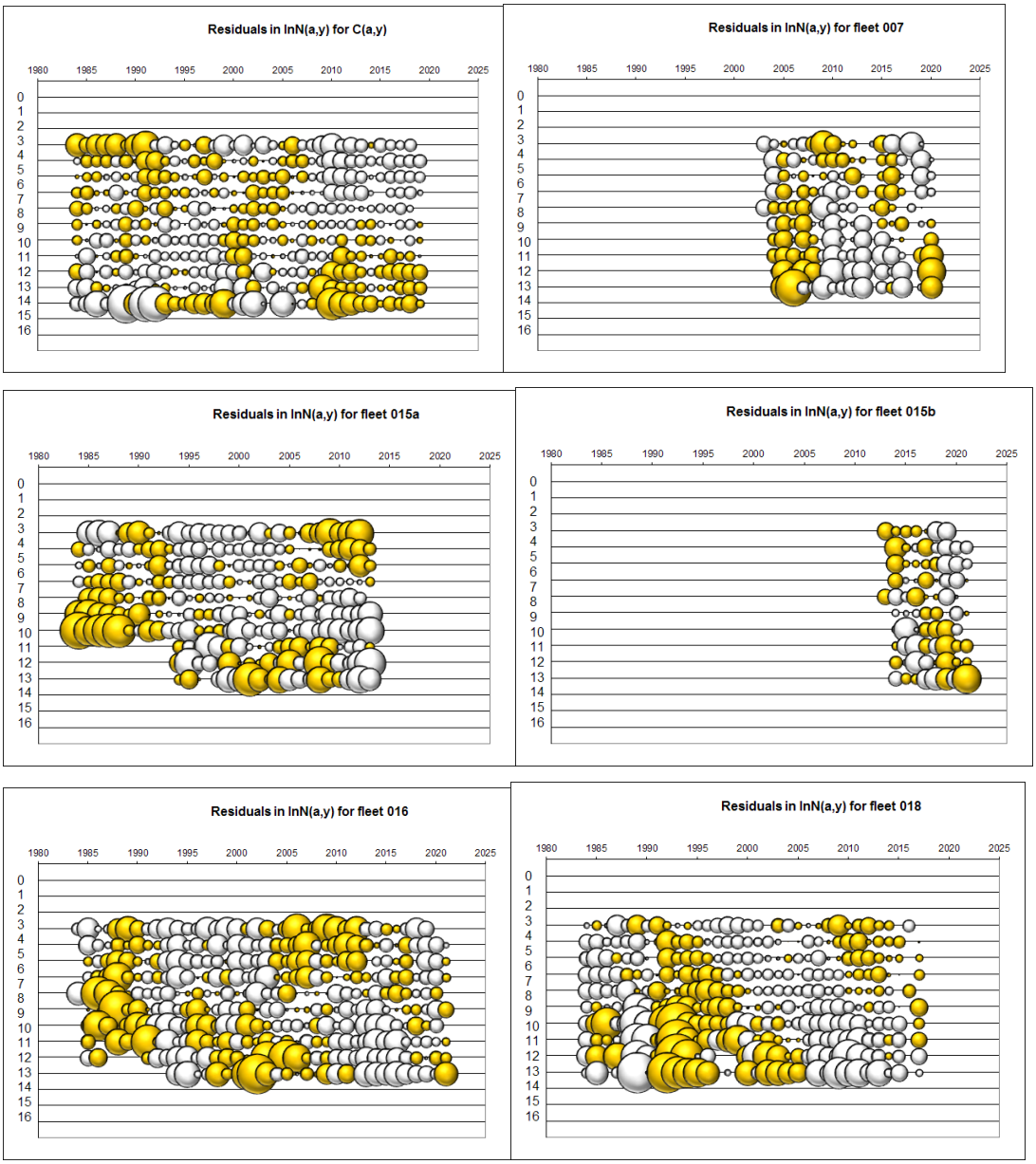


Figure 3.7a. Residuals of the TISVPA data approximation (yellow circles are positive residuals, white – negative, maximum bubble size corresponds to residual = 2.4).

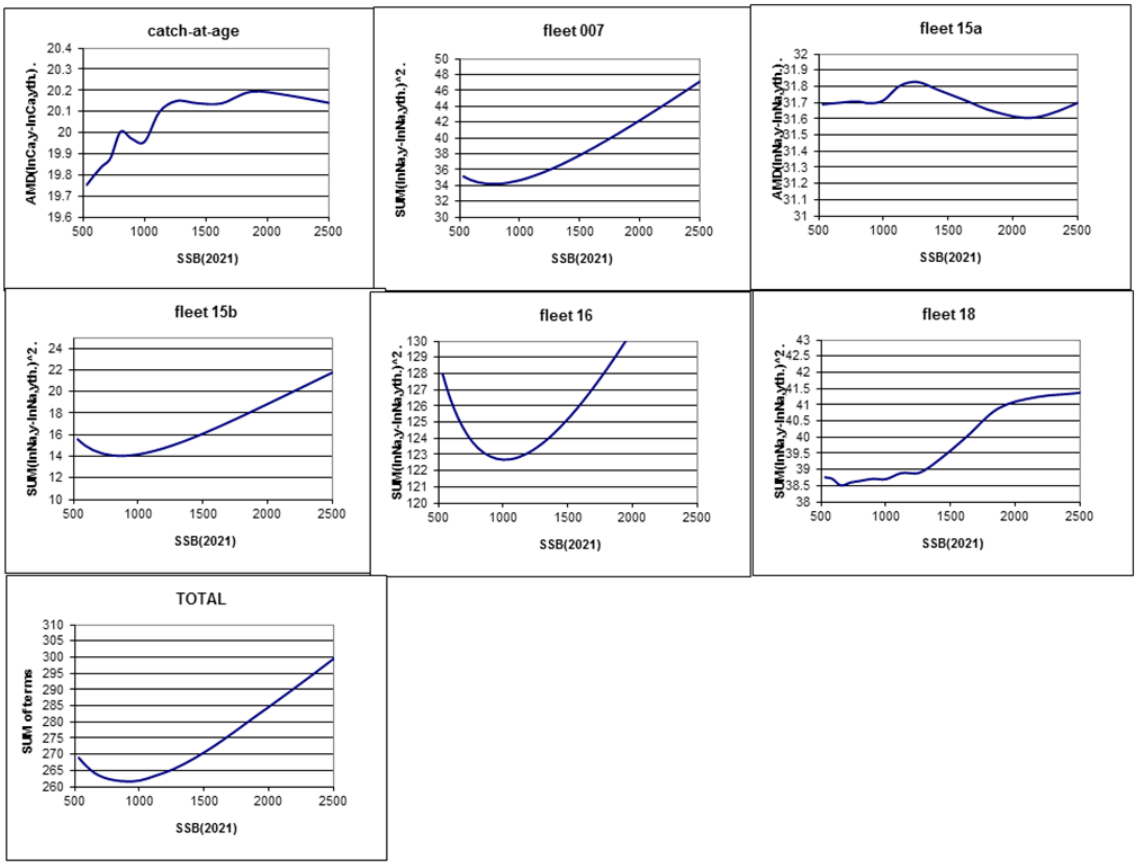


Figure 3.7b. Profiles of the components of the TISVPA objective function.

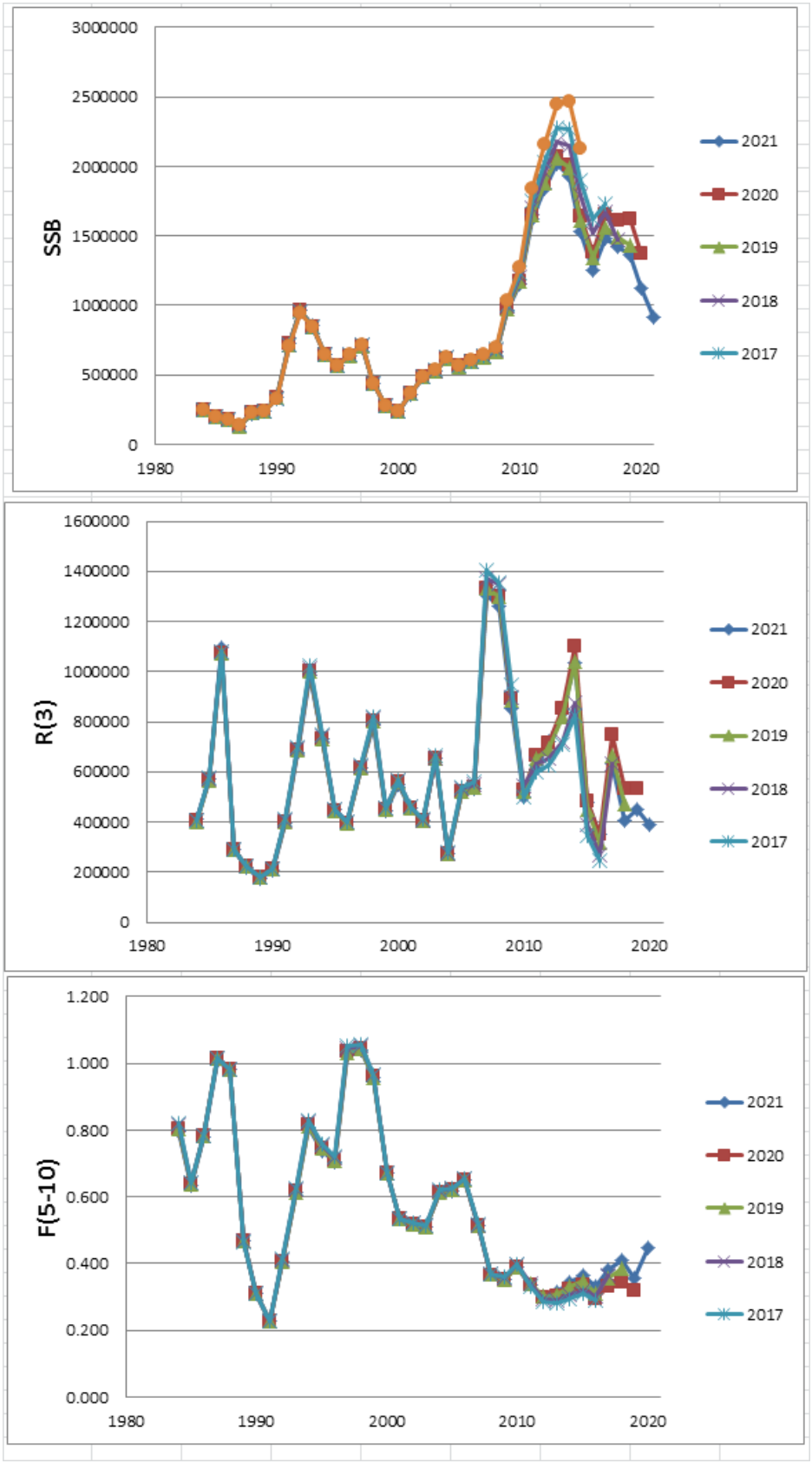


Figure 3.7c. TISVPA retrospective runs.