4 Northeast Arctic Haddock (subareas 1 and 2)

4.1 Introductory note

The haddock assessment and advice include the effects of cod predation, and thus relies on the biomass in the NEA cod assessment. In AFWG 2019 there was a proposed revision of the NEA cod model (the "final" run described in Chapter 3). This revision was not accepted for advice, and the cod advice in 2019 was based on the SPALY NEA cod model. Consequently, the advice for NEA haddock is based on predation from the SPALY NEA cod model.

4.2 Status of the Fisheries

4.2.1 Historical development of the fisheries

Haddock is mainly fished by trawl as bycatch in the fishery for cod. Also, a directed trawl fishery for haddock is conducted. The proportion of the total catches taken by direct fishery varies between years. On average approximately 30% of the catch is with conventional gears, mostly longline, which in the past was used almost exclusively by Norway. Some of the longline catch are from a directed fishery, which is restricted by national quotas. In the Norwegian management, the quotas are set separately for trawl and other gears. The fishery is also regulated by a minimum landing size, a minimum mesh size in trawls and Danish seine, a maximum bycatch of undersized fish, closure of areas with high density/catches of juveniles and other seasonal and area restrictions.

The exploitation rate of haddock has been variable. The highest fishing mortalities for haddock have occurred at low to intermediate stock levels and historically show little relationship with the exploitation rate of cod, despite haddock being primarily caught as bycatch in the cod fishery. However, the more restrictive quota regulations introduced around 1990 have resulted in a more stable pattern in the exploitation rate.

The exceptionally strong year classes 2004—2006 have contributed to the strong in-crease to all-time high levels of stock size and SSB that we have seen in last decade. Their importance in the catches is now decreasing rapidly. The following year classes are at a much lower level. We are experiencing some years with a decreasing SSB, which again will result in lower catch advice. The 2016 year class is strong and if bycatch mortality and natural mortality is at a low level in the coming years, the catches are expected to increase when this year class enter the fishery.

4.2.2 Landings prior to 2019 (Tables 4.1–4.3, Figure 4.1)

The highest landing of haddock historically was 320 kt in 1973. Since 1973 the highest catches observed were about 316 kt in 2012. In 2013–2015 stock biomass started to decline and the level of landings decreased to below 200 kt (Figure 4.1). Provisional official landings for 2018 is about 191 kt which is 11% below the realized TAC (214 kt transfers included).

Estimates of unreported catches (IUU catches) of haddock have been added to reported landings for the years from 2002 to 2008. Two estimates of IUU catches were available, one Norwegian and one Russian. At the benchmark assessment in 2011 it was decided to base the final assessment on the Norwegian IUU estimates (ICES CM 2011/ACOM:38).

In 2006 it was decided to include reported Norwegian landings of haddock from the Norwegian statistical areas 06 and 07 (ICES CM 2006/ACFM:19; ICES CM 2006/ACFM:25) (i.e. between 62°N and Lofoten) not previously included in the total landings of NEA haddock used as input for this stock assessment (Tables 4.1—4.3). This practice is continued.

4.3 Catch advice and TAC for 2019

The catch advice for 2019 was 152 kt. However, the Joint Norwegian-Russian Fisheries Commission set aside the HCR and set the TAC to 172 kt so that the reduction in was 15% rather than 25%, and therefore total allowable catch was set 172 kt. Furthermore, Russia and Norway can transfer unused part of own quotas from 2018. Norway can transfer maximally 10% corresponding to 9.5 kt and Russian about 1.5 kt so the actual allowable catch in 2019 can reach about 183 kt.

4.4 Status of Research

4.4.1 Survey results (Tables B1-B5)

For this year's assessment only indices from the Joint Barents Sea winter survey could be used, since the Russian bottom-trawl survey was not conducted in 2018 and the joint ecosystem survey had a complete lack of coverage in southeast where most of the haddock is distributed. There was a slight difference in the Joint Barents Sea winter survey indices for the year 2018 compared to the estimates from 2018 presented and used in last year's report. This was due to data revisions after last year's AFWG meeting.

Joint Barents Sea winter survey (bottom trawl NoRu-BTr-Q1and acoustics NoRu-Aco-Q1)

The swept-area estimates and acoustic estimates from the Joint winter survey on demersal fish in the Barents Sea in winter 2019 are given in Mehl *et al.* (WD 04). The survey area has been extended the last years with additional northern areas (N) covered. The extended area is not included in total and standard survey index calculations. Almost all the haddock was found within the area used for the standard survey calculations. The survey indices are given in Tables B1 and B3.

Like in previous years, the distribution of haddock extends further to the north and to the east than what was common in the 1990s. Overall, this survey tracks both strong and poor year classes well. At the survey in 2019 young haddock was aggregated in the south-eastern Barents Sea (WD 04). These are from the year classes 2015–2017.

Russian bottom-trawl (RU-BTr-Q4) and acoustic survey

Russia provided indices for 1982–2015 and 2017 for the Barents Sea trawl and acoustic survey (TAS) which was carried out in October-December. In 2018 TAS was not conducted in the Barents Sea. Survey indices are given in Tables B2 and B4.

International 0-group survey and joint ecosystem survey (Eco-NoRu-Q3 (Btr))

The bottom-trawl estimates from the joint ecosystem survey in August-September started in 2004. This survey covers a larger proportion of the distribution area of haddock. At the benchmark assessment in 2011 it was decided to include this survey as tuning series (ages 3–8). Estimates of the abundance of age groups (indices) from the joint ecosystem survey are presented in Table B5. Estimates based on runs by StoX is presented in WD03. The abundance of age 6 and older in this survey in 2016 was unexpectedly high compared to the abundance of corresponding year classes in this survey in previous years. In 2017 the swept-area estimates of abundance of

haddock 6 years and older was only 16% of the abundance estimates from 2016. The spatial coverage at this survey in 2018 was too poor to calculate meaningful estimates and was not included in the assessment this year.

4.5 Weight-at-age (Tables B6 – B9)

Length- and weight-at-age from the NoRu-BTr and RU-BTr-Q4 bottom-trawl surveys are given in Tables B6- B9. There was no Russian bottom-trawl survey in 2018 and therefore no new data added in Tables B7 and B9.

4.6 Data Used in the Assessment

4.6.1 Estimates of unreported catches (Tables 4.1-4.3)

We continue to include the estimates of IUU catches as in previous years (see Section 4.1.2), but the IUU is negligible for 2009–2018 and therefore set to zero.

4.6.2 Catch-at-age (Table 4.4)

Age and length compositions of the landings in 2018 were available from Norway and Russia in Subarea 1 and Division 2.b, from Norway, Russia, and Germany in Division 2.a. The biological sampling of NEA haddock catches is considered good for the most important ages in the fisheries.

Relevant data of estimated catch-at-age obtained from InterCatch for the period 2008–2018 and historical values from 1950 is listed in Table 4.4.

4.6.3 Weight-at-age (Tables 4.5–4.6)

The mean weight-at-age in the catch (Table 4.5) was obtained from InterCatch as a weighted average of the weight-at-age in the catch for Norway, Russia, and Germany.

Since 1983 the stock weights at age (Table 4.6) are calculated taking the average of the weight-at-age estimate from the Joint Barents Sea winter survey and the Russian bottom-trawl survey. These averages are assumed to give representative values for the beginning of the year (see stock annex for details). However, the Russian bottom-trawl survey was not conducted in 2018 and therefor stock weights-at-age was calculated using a correction factor (WD 14). The same correction was also applied when the Russian bottom-trawl survey was lacking in 2016.

Stock weights seem to be stable with only small year-to-year differences for the last years.

4.6.4 Maturity-at-age (Table 4.7)

The estimates of maturity-at-age are shown in Table 4.7. Smoothed estimates were produced separately for the Russian autumn survey and the joint winter survey are later combined using an arithmetic average. These averages are assumed to give representative values for the beginning of the year. Since there was no Russian autumn survey in 2018, a correction was applied (WD 14). The same correction was also applied in 2016. Values for year classes 1993 and onwards changed somewhat compared the values used in the assessment last year.

4.6.5 Natural mortality (Tables 4.8)

Natural mortality used in the assessment was 0.2 + mortality from predation by cod (see Stock annex). For the period from 1984 to 2018 actual estimates of predation by cod have been used (see Table 4.8).

For the previous years (1950–1983) the average natural mortality for 1984–2017 was used (age groups 3-6). The historic estimates of natural mortality have changed slightly with the change of assessment model.

Estimated mortality from predation by cod in this year's assessment is based on the 'final run' cod assessment.

The proportion of F and M before spawning was set to zero.

4.6.6 Changes in data from last year (Tables 4.6-4.7)

As stock weights and maturity are modelled (See above) the values of these variables have changed for 2019 and for 2020–2021.

At the benchmark in 2011 it was decided that these (weight, M, and maturity) historic values (1950–1979) should be kept constant from the 2011 assessment and onwards (ICES CM 2011/ACOM:38). M estimates have been updated after the change of assessment model.

4.7 Assessment models and settings

At the benchmark it was concluded that for stock assessment at the AFWG, the SAM model can be applied as the main model and XSA, with revised settings, will be used as additional model (WKARCT 2015). This year the TISVPA model also is used as additional model for comparison.

4.7.1 Data for tuning (Table 4.9)

The following survey series are included in the data for tuning both for SAM:

Name	ICES Acronym	Place	Season	Age	Year	prior weight
FLT01: Russian bottom trawl	RU-BTr-Q4	Barents Sea	October-December	3–7	1991–2017	1
FLT02: Joint Barents Sea survey – acoustic	BS-NoRU-Q1(Aco)	Barents Sea	February-March	4–8	1993–2019	1
FLT04: Joint Barents Sea survey - bottom trawl	BS-NoRu-Q1 (BTr)	Barents Sea	February-March	4–9	1994–2019	1
FLT007: Joint Russian-Norwegian ecosystem autumn survey in the Barents Sea -bottom trawl	Eco-NoRu-Q3 (Btr)	Barents Sea	August - September	3-8	2004-2017	1

Detailed information about index estimates are described in the Stock annex and in Mehl *et al* (WD 04).

4.7.2 SAM model settings (Table 4.10)

The configuration and tuning of SAM was decided on during the benchmark process (ICES CM 2015/ACOM:31). These settings were used in this assessment. The configuration file is given in Table 4.10 and in (www.stockassessment.org)

4.8 Results of the Assessments (Tables 4.11–4.14 and Figures 4.1-4.3)

The stock summary table estimated by SAM (predation included) is given in Table 4.11, the fishing mortality in Table 4.12, stock numbers-at-age in Table 4.13 and natural mortality M in Table 4.14.

Standard stock graphs are given in Figure 4.1 the retrospective plot in Figure 4.2 and the log-catchability residuals plot is presented in Figure 4.3.

The estimate of fishing mortality of main ages (4–7) in 2018 was the same as for 2017 (0.38) and above F_{MSY} = 0.35.

The dominating feature of this assessment is that the stock reached an all-time high level around 2010 (about 1300 kt) due to the strong 2004–2006 year classes. The total biomass has decreased since the all-time high in 2010.

SSB was at a record high level from 2012 to 2016 but is now decreasing rapidly.

Figures 4.2 a-c show that there has been a strong retrospective pattern the last years, especially for SSB, which has been adjusted downwards considerably. The assessment for this year is well in agreement with the results from last year on SSB.

4.9 Predictions, reference points and harvest control rules (Tables 4.16- 4.21)

4.9.1 Recruitment (Tables 4.16, 4.17)

The RCT3 program translation in R was used to estimate the recruiting year classes 2017–2019 with survey data for ages 0–2 as input data (Russian autumn survey (not for 2016 and 2018), joint winter survey and ecosystem survey (not for 2018). Input data and results are shown in Tables 4.16 and 4.17, respectively.

4.9.2 Prediction data (Table 4.18)

The input data for making the prediction are presented in Table 4.18:

Stock numbers for 2019–2021 at age 3 taken from RCT3, abundance at ages 4–13+ in 2019 from the SAM assessment. The average fishing pattern observed in 2016–2018, scaled to F status quo was used for distribution of fishing mortality-at-age for 2019–2021. The proportion of M and F before spawning was set to 0. Smoothed observed average weight in stock-at-age and maturity-at-age for 2019 are used for 2019–2021.

Russian data for weight and maturity-at-age in autumn 2016 and 2018 were not available as the survey was not conducted. In WD14 to AFWG 2019, correction factors to allow for this when

calculating the weight and 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 2019.

The average weights-at-age in catch for the year classes with similar abundance at age 3 (2016—2018) are used for 2019—2021. For natural mortality for 2019-2021 the average for the 3 last years (2016—2018) was used.

4.9.3 Biomass reference points (Figure 4.1)

At AFWG in 2011 based on the analysis of the stock–recruitment plot it was proposed to keep B_{lim} = 50 000 t and B_{pa} = 80 000 t with the rationale that B_{lim} is equal to B_{loss}, and $B_{pa} = B_{lim}*\exp(1.645*\sigma)$, where $\sigma = 0.3$. This gives a 95% probability of maintaining SSB above B_{lim} taking into account the uncertainty in the assessments and stock dynamics. B_{MSY} trigger was proposed equal B_{pa}, $B_{trigger}$ was then selected as a biomass that is encountered with low probability if F_{MSY} is implemented, as recommended by WKFRAME2 (ICES CM 2011/ACOM:33). Values of reference points compared with current stock values are reflected in Figure 4.1.

4.9.4 Fishing mortality reference points (Figure 4.1)

Previous values were F_{lim} = 0.49 and F_{pa} = 0.35. There is no standard method of estimating F_{lim} nor F_{pa}, and ACOM accepted to use geometric mean recruitment (146 million) and B_{lim} as basis for the F_{lim} estimate. F_{lim} is then based on the slope of line from origin at SSB = 0 to the geometric mean recruitment (146 million) and SSB = B_{lim}. The SPR value of this slope give F_{lim} value on SPR curve; F_{lim} = 0.77 (found using Pasoft). Using the same approach as for B_{pa}; $F_{pa} = F_{lim}*\exp(-1.645*\sigma)$ = 0.47.

F_{MSY} = 0.35 has been estimated by long-term stochastic simulation (WD 16, AFWG 2011, ICES 2016a). Values of reference points compared with current stock values are reflected in Figure 4.1.

4.9.5 Harvest control rule

The harvest control rule (HCR) was evaluated by ICES in 2007 (ICES CM 2007/ACFM:16) and found to be in agreement with the precautionary approach. The agreed HCR for haddock with last modifications is as follows (Protocol of the 40th Session of The Joint Norwegian Russian Fishery Commission, 14 October 2011):

- *TAC for the next year will be set at level corresponding to F_{msy}.*
- *The TAC should not be changed by more than +/- 25% compared with the previous year TAC.*
- *If the spawning stock falls below B_{pa}, the procedure for establishing TAC should be based on a fishing mortality that is linearly reduced from F_{msy} at B_{pa} to F= 0 at SSB equal to zero. At SSB-levels below B_{pa} in any of the operational years (current year and a year ahead) there should be no limitations on the year-to-year variations in TAC.*

As mentioned above F_{lim} and F_{pa} were revised in 2011. The new values of F_{lim} = 0.77 and F_{pa} = 0.47 are higher than the previous values (0.49 and 0.35, respectively). In the 2012 meeting of the Joint Norwegian Russian Fishery Commission the proposals of ICES were accepted and the current HCR management is based on F_{MSY} instead of F_{pa}. This corresponds to the goal of the management strategy for this stock and should provide maximum sustainable yield.

In 2014, JNRFC decided that from 2015 onwards, Norway and Russia can transfer to next year or borrow from last year 10% of the country's quota. At its 45th session in October 2015, the Joint Norwegian-Russian Fisheries Commission (JNRFC) decided that a number of alternative harvest

control rules (HCRs) for North-east Arctic haddock should be evaluated by ICES. This was done by WKNEAMP (ICES 2015/ACOM:60, ICES C. M. 2016/ACOM:47) and six HCRs for NEA haddock including the existing one were tested. At its 46th session in October 2016, the Joint Norwegian-Russian Fisheries Commission (JNRFC) decided not to change the HCR.

4.9.6 Prediction results and catch options for 2020 (Tables 4.19 - 4.20)

The projection shows an increase in SSB in 2020 to 216 kt (Table 4.19). The TAC for 2020 is established using the current one-year HCR, in accordance of the management plan. F_{MSY} = 0.35 would give a quota for 2020 of 231 kt, this is a 35% increase from the quota advice for 2019. Therefore, the TAC constraint is used, giving a quota of 215 kt. F corresponding to the HCR in 2020 and 2021 is given in Table 4.20.

Catch options for 2020 are shown in the text table below (weights in tonnes).

Basis	Total catch (2020)	F ages 4-7 (2020)	SSB (2021)	% SSB change *	% TAC change **	% Advice change ***
ICES advice basis						
Management plan	215 000	0.32	268 486	24	25	41
Other scenarios						
MSY approach: F_{MSY}	231 352	0.35	261 810	21	35	52
F = 0	0	0	363 570	68	-100	-100
F = F_{2018}	247 231	0.38	255 407	18	44	63
F_{pa}	297 101	0.47	235 810	9	73	95
F_{lim}	438 518	0.77	184 630	-15	155	188

*** SSB 2021 relative to SSB 2020.**

**** Catch in 2020 relative to TAC in 2019 (172 000 t).**

***** Catch value for 2020 relative to advice value for 2019 (152 000 t).**

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.

4.10 Comparison with last year's assessment

The text table below compares this year's estimates with last year's estimates for 2018 of total biomass, spawning biomass (thousand tonnes), as well as reference F for the year 2017.

Compared to last year's assessment the current estimates by SAM model of the total stock (TSB), spawning stock (SSB) are higher for 2018. The F in 2018 estimated a bit lower.

Year of assessment, model	F (2017)	Numbers 2018 (ages)											TSB (2018)	SSB (2018)
		3	4	5	6	7	8	9	10	11	12	13+		
2018 SAM	0.39		113	106	18	39	13	14	7	9	8	4	505*	253*
2019 SAM	0.38	336	115	109	23	41	13	16	8	9	9	3	547	280
Changing,%	-3		2	3	27	5	0	16	15	0	11	-8	8	11

*** forecast in 2018 using RCT 3**

4.11 Additional assessment methods (Table 4.15, Figures 4.4-4.6)

4.11.1 XSA (Figure 4.4)

The Extended Survivors Analysis (XSA) was used to tune the VPA by available index series. As last years, FLR was used for the assessment of haddock (see stock annex), and thus all results concerning XSA are obtained using FLR. The settings used were as set in last benchmark (WKARCT 2015).

The estimated consumption of NEA haddock by NEA cod is incorporated into the XSA analysis by first constructing a catch number-at-age matrix, adding the numbers of haddock eaten by cod to the catches for the years where such data are available (1984–2018). The summary of XSA stock estimates are presented in Table 4.15. A retrospective plot for XSA is given in Figure 4.4.

4.11.2 TISVPA (Figure 4.5)

The TISVPA (Triple Instantaneous Separable VPA) model (Vasilyev, 2005; 2006) represents fishing mortality coefficients (more precisely – exploitation rates) as a product of three parameters: f(year)*s(age)*g(cohort). The generation-dependent parameters, which are estimated within the model, are intended to adapt traditional separable representation of fishing mortality to situations when several year classes may have peculiarities in their interaction with fishing fleets caused by different spatial distribution, higher attractiveness of more abundant schools to fishers, or by some other reasons. To NEA haddock stock the TISVPA model was at benchmark group for arctic stocks (WKARCT) in 2015 and this year it was decided to apply to NEA haddock using the same data as SAM except that natural mortality values from cannibalism were taken from the SAM runs. All the input data, including catch-at-age, weight-at-age in stock and in catches, maturity-at-age were taken the same as for stock assessment by means of SAM. During AFWG 2019 the results of exploratory runs using the TISVPA model were presented. The results are presented in WD10. In generally biomass estimates of this model much higher than SAM, which can be explained different assumptions about indices catchability. A retrospective plot for TISVPA is given in Figure 4.5

4.11.3 Model comparisons (Figure 4.6)

Results from SAM, XSA and TISVPA are compared in Figure 4.6. Comparison of results of SAM, TISVPA and XSA with previous year settings shows that the models demonstrate similar trends. The TSVPA model is more flexible for settings than the others and taking in account a possible decreasing in survey data consistency, it was attempted to do tuning of surveys not at abundance but to age proportions because the probable change in effective survey catchability.

4.12 Comments to the assessment

The retrospective runs show rather large discrepancies (Figure 4.3), in particular of SSB, but the result for the assessment of this year is well in agreement with the result from last year in showing a strong decline in SSB. The decline is due to the disappearance the 2004–2006 year classes from the stock. The influence of different SAM settings on the retrospective patterns, in particular with respect to the selectivity of older ages will be explored in the benchmark scheduled in 2020.

The advised catch for 2020 is considerably higher than that advised for 2019 because the strong year classes of 2016–2017 will be 4 and 3-year-old in 2020. These year classes are estimated to contribute almost 60% of the total-stock biomass in 2020, and over 40% of the catches. A large proportion of the strong 2016 and 2017 year classes are still under fishing size in 2019 and 2020, furthermore the 2018 year class appear to be above average. Therefore, there is a likelihood of higher catch of undersized fish in the next year(s). The minimum size for haddock is 40 cm, and 15% bycatch by number of cod, haddock, and saithe combined below the respective minimum sizes for the species is allowed. The minimum mesh size is 130 mm. The mean length of age 3 haddock in February is about 30 cm, and at that mean length the upper part of the length distribution for age 3 fish would be large enough to be caught in trawl fisheries, although only few fish would be above 40 cm at that age. It is therefore important that the fishery is regulated by a relatively low TAC and spatial and temporal closures in the next couple of years as this will reduce the likelihood of high catch and possible discarding of undersized fish of the abundant 2016–2017 year classes.

Table 4.1. North-East Arctic HADDOCK. Total nominal catch (t) by fishing areas.

Year	Subarea 1	Division 2.a	Division 2.b	un-reported (2	Total (3	Norw. stat.areas 06 and 07(4
1960	125026	27781	1844	-	154651	6000
1961	165156	25641	2427	-	193224	4000
1962	160561	25125	1723	-	187409	3000
1963	124332	20956	936	-	146224	4000
1964	79262	18784	1112	-	99158	6000
1965	98921	18719	943	-	118583	6000
1966	125009	35143	1626	-	161778	5000
1967	107996	27962	440	-	136398	3000
1968	140970	40031	725	-	181726	3000
1969	89948	40306	566	-	130820	2000
1970	60631	27120	507	-	88258	-
1971	56989	21453	463	-	78905	-
1972	221880	42111	2162	-	266153	-
1973	285644	23506	13077	-	322227	-
1974	159051	47037	15069	-	221157	10000
1975	121692	44337	9729	-	175758	6000
1976	94054	37562	5648	-	137264	2000
1977	72159	28452	9547	-	110158	2000
1978	63965	30478	979	-	95422	2000
1979	63841	39167	615	-	103623	6000
1980	54205	33616	68	-	87889	5098
1981	36834	39864	455	-	77153	4767
1982	17948	29005	2	-	46955	3335
1983	5837	16859	1904	-	24600	3112
1984	2934	16683	1328	-	20945	3803
1985	27982	14340	2730	-	45052	3583
1986	61729	29771	9063	-	100563	4021
1987	97091	41084	16741	-	154916	3194
1988	45060	49564	631	-	95255	3756

Year	Subarea 1	Division 2.a	Division 2.b	un-reported (2	Total (3	Norw. stat.areas 06 and 07(4
1989	29723	28478	317	-	58518	4701
1990	13306	13275	601	-	27182	2912
1991	17985	17801	430	-	36216	3045
1992	30884	28064	974	-	59922	5634
1993	46918	32433	3028	-	82379	5559
1994	76748	50388	8050	-	135186	6311
1995	75860	53460	13128	-	142448	5444
1996	112749	61722	3657	-	178128	5126
1997	78128	73475	2756	-	154359	5987
1998	45640	53936	1054	-	100630	6338
1999	38291	40819	4085	-	83195	5743
2000	25931	39169	3844	-	68944	4536
2001	35072	47245	7323	-	89640	4542
2002	40721	42774	12567	18736/5310	114798/101372	6898
2003	53653	43564	8483	33226/9417	138926/115117	4279
2004	64873	47483	12146	33777/8661	158279/133163	3743
2005	53518	48081	16416	40283/9949	158298/127964	5538
2006	51124	47291	33291	21451/8949	153157/140655	5410
2007	62904	58141	25927	14553/3102	161525/150074	7110
2008	58379	60178	31219	5828/-	155604/149776	6629
2009	57723	66045	76293	0	200061	4498
2010	62604	86279	100318	0	249200	3661
2011	86931	99307	123546	0	309785	4169
2012	90141	96807	128679	0	315627	3869
2013	68416	64810	60520	0	193744	4000
2014	61537	58320	57665	0	177522	3433
2015	75195	61567	57993	0	194756	3902
2016	78714	95140	59561	0	233416	3233
2017	94772	75455	57362	0	227589	2987

Year	Subarea 1	Division 2.a	Division 2.b	un-reported (2	Total (3	Norw. stat.areas 06 and 07(4
2018 1)	80902	58522	51853	0	191276	4437

1) Provisional figures, Norwegian catches on Russian quotas are included.

2) Figures based on Norwegian/Russian IUU estimates. From 2009, IUU estimates are made by a Joint Russian-Norwegian analysis group under the Russian-Norwegian Fisheries Commission.

3) In 2002–2008, the Norwegian IUU estimates were used in final assessment.

4) Included in total landings and in landings in region 2.a.

Table 4.2. North-East Arctic Haddock. Total nominal catch ('000 t) by trawl and other gear for each area

	Subarea 1		Division 2.a		Division 2.b		Unreported[2]
Year	Trawl	Others	Trawl	Others	Trawl	Others	
1967	73.7	34.3	20.5	7.5	0.4	-	-
1968	98.1	42.9	31.4	8.6	0.7	-	-
1969	41.4	47.8	33.2	7.1	1.3	-	-
1970	37.4	23.2	20.6	6.5	0.5	-	-
1971	27.5	29.2	15.1	6.7	0.4	-	-
1972	193.9	27.9	34.5	7.6	2.2	-	-
1973	242.9	42.8	14	9.5	13.1	-	-
1974	133.1	25.9	39.9	7.1	15.1	-	-
1975	103.5	18.2	34.6	9.7	9.7	-	-
1976	77.7	16.4	28.1	9.5	5.6	-	-
1977	57.6	14.6	19.9	8.6	9.5	-	-
1978	53.9	10.1	15.7	14.8	1	-	-
1979	47.8	16	20.3	18.9	0.6	-	-
1980	30.5	23.7	14.8	18.9	0.1	-	-
1981	18.8	17.7	21.6	18.5	0.5	-	-
1982	11.6	11.5	23.9	13.5	-	-	-
1983	3.6	2.2	8.7	8.2	0.2	1.7	-
1984	1.6	1.3	7.6	9.1	0.1	1.2	-
1985	24.4	3.5	6.2	8.1	0.1	2.6	-
1986	51.7	10.1	14	15.8	0.8	8.3	-
1987	79	18.1	23	18.1	3	13.8	-
1988	28.7	16.4	34.3	15.3	0.6	0	-
1989	20	9.7	13.5	15	0.3	0	-
1990	4.4	8.9	5.1	8.2	0.6	0	-
1991	9	8.9	8.9	8.9	0.2	0.2	-
1992	21.3	9.6	11.9	16.1	1	0	-
1993	35.3	11.6	14.5	17.9	3	0	-
1994	58.6	18.2	26.1	24.3	7.9	0.2	-

	Subarea 1		Division 2.a		Division 2.b		Unreported[2]
Year	Trawl	Others	Trawl	Others	Trawl	Others	
1995	63.9	12	29.6	23.8	12.1	1	-
1996	98.3	14.4	36.5	25.2	3.4	0.3	-
1997	57.4	20.7	44.9	28.6	2.5	0.3	-
1998	26	19.6	27.1	26.9	0.7	0.3	-
1999	29.4	8.9	19.1	21.8	4	0.1	-
2000	20.1	5.9	18.8	20.4	3.7	0.1	-
2001	28.4	6.7	23.4	23.8	7	0.3	-
2002	30.5	10.2	19.5	23.3	12.5	0.1	18.7/5.3
2003	42.7	10.9	21.9	21.7	8.1	0.4	33.2/9.4
2004	52.4	12.5	27	20.5	11.5	0.6	33.8/8.7
2005	38.5	15	24.9	20.9	13	1.6	40.3/9.9
2006	40.1	11	22	25.3	30.1	3.2	21.5/8.9
2007	51.8	11.1	30.5	27.7	20.4	5.5	14.6/3.1
2008	46.8	11.6	30.9	29.3	24.9	6.3	5.8/-
2009	49	8.8	40.1	25.3	67.1	7.8	0
2010	43.6	19	50	35.7	87	10.4	0
2011	55.8	31.1	61.1	38.9	107.7	14.3	0
2012	58.8	31.3	57.5	39.2	103.2	24.8	0
2013	40.1	28.3	37.7	26.9	52.1	8.1	0
2014	35.2	26.3	32.5	25.8	49	8.6	0
2015	49.1	26.1	34.6	27	48.5	9.4	0
2016	56.4	22.3	62.5	32.5	45.4	14.1	0
2017	65	29.8	50.7	24.7	47.1	10.3	0
2018 [1)]	51.7	29.2	36.9	21.6	43.2	8.6	0

1) Provisional.

2) Figures based on Norwegian/Russian IUU estimates.

Table 4.3 North-East Arctic Haddock. Nominal catch (t) by countries. Subarea 1 and Divisions 2.a and 2.b combined. (Data provided by Working Group members).

Year	Far Isl	France	GDR	FRG	Norway 4)	Poland	U K	Russia 2)	Others	Unrep 3)	Total 3)
1960	172	-	-	5597	46263	-	45469	57025	125	-	154651
1961	285	220	-	6304	60862	-	39650	85345	558	-	193224
1962	83	409	-	2895	54567	-	37486	91910	58	-	187408
1963	17	363	-	2554	59955	-	19809	63526	-	-	146224
1964	-	208	-	1482	38695	-	14653	43870	250	-	99158
1965	-	226	-	1568	60447	-	14345	41750	242	-	118578
1966	-	1072	11	2098	82090	-	27723	48710	74	-	161778
1967	-	1208	3	1705	51954	-	24158	57346	23	-	136397
1968	-	-	-	1867	64076	-	40129	75654	-	-	181726
1969	2	-	309	1490	67549	-	37234	24211	25	-	130820
1970	541	-	656	2119	37716	-	20423	26802	-	-	88257
1971	81	-	16	896	45715	43	16373	15778	3	-	78905
1972	137	-	829	1433	46700	1433	17166	196224	2231	-	266153
1973	1212	3214	22	9534	86767	34	32408	186534	2501	-	322226
1974	925	3601	454	23409	66164	3045	37663	78548	7348	-	221157
1975	299	5191	437	15930	55966	1080	28677	65015	3163	-	175758
1976	536	4459	348	16660	49492	986	16940	42485	5358	-	137264
1977	213	1510	144	4798	40118	-	10878	52210	287	-	110158
1978	466	1411	369	1521	39955	1	5766	45895	38	-	95422
1979	343	1198	10	1948	66849	2	6454	26365	454	-	103623
1980	497	226	15	1365	66501	-	2948	20706	246	-	92504
1981	381	414	22	2402	63435	Spain	1682	13400	-	-	81736
1982	496	53	-	1258	43702	-	827	2900	-	-	49236
1983	428	-	1	729	22364	139	259	680	-	-	24600
1984	297	15	4	400	18813	37	276	1103	-	-	20945
1985	424	21	20	395	21272	77	153	22690	-	-	45052
1986	893	12	75	1079	52313	22	431	45738	-	-	100563
1987	464	7	83	3105	72419	59	563	78211	5	-	154916
1988	1113	116	78	1323	60823	72	435	31293	2	-	95255
1989	1217	-	26	171	36451	1	590	20062	-	-	58518
1990	705	-	5	167	20621	-	494	5190	-	-	27182
1991	1117	-	Greenl	213	22178	-	514	12177	17	-	36216
1992	1093	151	1719	387	36238	38	596	19699	1	-	59922
1993	546	1215	880	1165	40978	76	1802	35071	646	-	82379
1994	2761	678	770	2412	71171	22	4673	51822	877	-	135186
1995	2833	598	1097	2675	76886	14	3111	54516	718	-	142448
1996	3743	6	1510	942	94527	669	2275	74239	217	-	178128
1997	3327	540	1877	972	103407	364	2340	41228	304	-	154359
1998	1903	241	854	385	75108	257	1229	20559	94	-	100630
1999	1913	64	437	641	48182	652	694	30520	92	-	83195
2000	631	178	432	880	42009	502	747	22738	827	-	68944
2001	1210	324	553	554	49067	1497	1068	34307	1060	-	89640
2002	1564	297	858	627	52247	1505	1125	37157	682	18736/5310	114798/101372
2003	1959	382	1363	918	56485	1330	1018	41142	1103	33226/9417	138926/115117
2004	2484	103	1680	823	62192	54	1250	54347	1569	33777/8661	158279/133163
2005	2138	333	15	996	60850	963	1899	50012	1262	40283/9949	158751/128417
2006	2390	883	1830	989	69272	703	1164	53313	1162	21451/8949	153157/140/655
2007	2307	277	1464	1123	71244	125	1351	66569	2511	14553/3102	161525/150074
2008	2687	311	1659	535	72779	283	971	68792	1759	5828/-	155604/149776
2009	2820	529	1410	1957	104354	317	1315	85514	1845	0	200061
2010	3173	764	1970	3539	123384	379	1758	111372	2862	0	249200
2011	1759	268	2110	1724	158202	502	1379	139912	4763	0	309785
2012	2055	322	3984	1111	159602	441	833	143886	3393	0	315627
2013	1886	342	1795	500	99215	439	639	85668	3260	0	193744
2014	1470	198	1150	340	91306	187	355	78725	3791	0	177522
2015	2459	145	1047	124	95094	246	450	91864	3327	0	194756
2016	2460	340	1401	170	108718	200	575	115710	3838	0	233416
2017	2776	108	1810	170	113132	228	372	106714	2279	0	227588
2018 1)	2333	183	1317	385	93839	107	453	90486	2173	0	191276

1) Provisional figures.

2) USSR prior to 1991.

3) Figures based on Norwegian/Russian IUU estimates

4) Included landings in Norwegian statistical areas 06 and 07 (from 1983)

Table 4.4. Northeast Arctic haddock. Catch numbers-at-age (numbers, ´000).

Age	1	2	3	4	5	6	7	8	9	10	11	12	13+
1950	0	4446	3189	37949	35344	18849	28868	9199	1979	1093	853	867	1257
1951	4069	222	65643	9178	18014	13551	6808	6850	3322	1182	734	178	436
1952	0	13674	6012	151996	13634	9850	4693	3237	2434	606	534	185	161
1953	392	8031	64528	13013	70781	5431	2867	1080	424	315	393	202	410
1954	1726	493	6563	154696	5885	27590	3233	1302	712	319	126	68	349
1955	0	989	1154	10689	176678	4993	28273	1445	271	100	50	30	20
1956	97	3012	16437	5922	14713	127879	3182	8003	450	200	80	60	45
1957	828	243	2074	24704	7942	12535	46619	1087	1971	356	17	40	119
1958	153	2312	1727	5914	31438	5820	12748	17565	822	1072	226	79	296
1959	169	2425	20318	7826	7243	14040	3154	2237	5918	285	316	71	113
1960	2319	3613	39910	70912	13647	7101	6236	1579	2340	2005	497	70	42
1961	362	5531	15429	56855	63351	8706	3578	4407	788	527	1287	67	80
1962	0	4524	39503	30868	48903	33836	3201	1341	1773	242	247	483	28
1963	3	2143	28466	72736	18969	13579	9257	1239	559	409	80	84	212
1964	149	834	22363	49290	30672	5815	3527	2716	833	104	206	235	190
1965	0	3498	5936	46356	40201	12631	1679	974	897	123	204	123	471
1966	0	2577	26345	22631	63176	29048	5752	582	438	189	186	25	30
1967	0	53	15907	41346	13496	25719	8872	1616	218	175	155	75	41
1968	0	33	657	67632	41267	7748	15599	5292	655	182	101	115	70
1969	0	1061	1524	1968	44634	19002	3620	4937	1628	316	43	43	23
1970	480	281	23444	2454	1906	22417	8100	2012	2016	740	166	26	96
1971	15	3535	1978	24358	1257	918	9279	3056	826	1043	369	130	35
1972	133	9399	230942	22315	42981	3206	1611	6758	2638	900	989	538	120
1973	0	5956	70679	260520	24180	6919	422	426	1692	529	147	339	95
1974	281	3713	9685	41706	88120	5829	4138	382	618	2043	935	276	659
1975	1321	4355	10037	14088	33871	49711	2135	1236	92	131	500	147	287
1976	3475	7499	13994	13454	6810	20796	40057	1247	1350	193	280	652	671
1977	184	18456	55967	22043	7368	2586	7781	11043	311	388	96	101	182
1978	46	2033	47311	18812	4076	1389	1626	2596	6215	162	258	3	139
1979	0	48	17540	35290	10645	1429	812	546	1466	2310	181	87	55
1980	0	0	627	22878	21794	2971	250	504	230	842	1299	111	50
1981	1	68	486	2561	22124	10685	1034	162	162	72	330	564	69
1982	2	29	883	900	3372	12203	2625	344	75	80	91	321	238
1983	3	351	1173	2636	1360	2394	2506	1799	267	37	60	100	132
1984	7	754	1271	1019	1899	657	950	2619	352	87	2	22	53
1985	4	2952	29624	1695	564	1009	943	886	1763	588	124	64	93
1986	506	650	23113	68429	1565	783	896	393	702	1144	443	130	414
1987	9	83	5031	87170	64556	960	597	376	212	230	419	245	73
1988	7	139	1439	12478	47890	20429	397	178	74	88	168	198	80
1989	611	221	2157	4986	16071	25313	3198	147	1	28	28	53	96
1990	2	446	1015	2580	2142	4046	6221	840	134	42	14	13	44
1991	23	533	4421	3564	2416	3299	4633	3953	461	83	9	18	27
1992	49	2793	11571	11567	4099	2642	2894	3327	3498	486	35	32	18
1993	498	272	13487	19457	13704	4103	1747	1886	2105	1965	201	96	25
1994	95	187	3374	47821	36333	13264	2057	903	1453	2769	1802	259	49
1995	2	85	2003	16109	72644	19145	6417	746	361	770	655	804	116
1996	35	478	1662	6818	36473	73579	13426	2944	573	365	533	598	767
1997	70	94	2280	5633	12603	32832	49478	5636	778	245	126	158	463
1998	547	1476	1701	11304	9258	8633	13801	19469	2113	330	59	54	377
1999	104	568	16839	8039	15365	6073	4466	6355	6204	647	117	109	220
2000	46	692	1520	29986	6496	5149	2406	1657	1570	1744	183	70	184
2001	374	1758	12971	5230	32049	5279	2941	1137	1161	1169	747	169	288
2002	59	603	7132	46335	11084	21985	2602	1602	482	448	581	349	98
2003	123	611	6803	31448	56480	11736	14541	1637	2178	858	411	413	395
2004	58	1295	7993	21116	41310	41226	4939	4914	598	1252	296	139	465
2005	102	865	11452	19369	22887	37067	24461	2393	2997	990	201	263	1059
2006	271	2496	4539	35040	27571	15033	16023	8567	1259	1298	222	175	321
2007	575	3914	30707	15213	45992	18516	10642	7889	2570	678	605	197	185
2008	440	2089	14536	44192	15926	31173	9145	4520	2846	1181	274	214	166
2009	483	1364	15379	55013	52498	13679	15382	3800	1669	887	285	353	321
2010	457	620	6545	52006	80622	50306	9273	5324	1954	1114	533	242	621
2011	909	806	1277	8501	90394	100522	39496	4397	2340	668	437	269	708
2012	268	611	7814	4206	18007	93055	82721	14445	1325	448	217	216	568
2013	402	904	1778	12780	3805	12297	58024	29930	4976	957	331	212	535
2014	528	649	6948	4503	14563	6833	16304	39620	16439	2431	619	440	545
2015	303	1334	1645	27317	8526	16624	7950	20538	25534	6677	1556	295	312
2016	294	655	5774	3482	33177	9563	18045	12030	21875	13492	4757	876	248
2017	724	1898	30744	46463	16895	48927	10518	14992	9 485	8447	6 640	1872	317
2018	679	1438	9424	16291	34060	8466	18882	5123	8902	4125	3564	4504	1354

Table 4.5. Northeast Arctic haddock. Catch weights-at-age (kg).

	1	2	3	4	5	6	7	8	9	10	11	12	13+
1950	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1951	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1952	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1953	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1954	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1955	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1956	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1957	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1958	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1959	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1960	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1961	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1962	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1963	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1964	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1965	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1966	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1967	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1968	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1969	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1970	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1971	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1972	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1973	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1974	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1975	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1976	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1977	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1978	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1979	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1980	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1981	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1982	0.299	0.519	0.75	1.038	1.321	1.617	1.873	2.147	2.418	2.698	2.931	3.094	3.461
1983	0.188	0.689	1.033	1.408	1.71	2.149	2.469	2.748	3.069	3.687	4.516	3.094	3.461
1984	0.408	0.805	1.218	1.632	2.038	2.852	2.845	3.218	3.605	4.065	4.407	4.734	5.099
1985	0.319	0.383	0.835	1.29	1.816	2.174	2.301	2.835	3.253	3.721	4.084	4.137	4.926
1986	0.218	0.325	0.612	1.064	1.539	1.944	2.362	2.794	3.25	3.643	4.14	4.559	5.927
1987	0.143	0.221	0.497	0.765	1.179	1.724	2.135	2.551	3.009	3.414	3.84	4.415	5.195
1988	0.279	0.551	0.55	0.908	1.097	1.357	1.537	1.704	2.403	2.403	2.486	2.531	2.834
1989	0.258	0.55	0.684	0.84	0.998	1.176	1.546	1.713	1.949	2.14	2.389	2.522	2.797
1990	0.319	0.601	0.793	1.172	1.397	1.624	1.885	2.112	2.653	3.102	3.18	3.438	3.319
1991	0.216	0.616	0.941	1.281	1.556	1.797	2.044	2.079	2.311	2.788	3.408	2.896	3.274
1992	0.055	0.458	0.906	1.263	1.535	1.747	2.043	2.2	2.298	2.494	2.49	2.673	2.923
1993	0.381	0.64	0.94	1.204	1.487	1.748	1.994	2.237	2.417	2.654	2.906	3.184	3.363
1994	0.278	0.521	0.614	0.906	1.287	1.602	1.968	2.059	2.39	2.545	2.881	2.918	3.222
1995	0.258	0.446	0.739	0.808	1.107	1.556	1.838	2.234	2.416	2.602	2.965	3.163	3.786
1996	0.287	0.427	0.683	0.868	1.045	1.363	1.71	1.886	2.214	2.37	2.438	2.707	2.896
1997	0.408	0.575	0.682	1.028	1.151	1.369	1.637	1.856	2.073	2.5	2.279	2.532	2.609
1998	0.409	0.593	0.748	0.974	1.262	1.433	1.641	1.863	2.069	2.335	2.511	2.8	2.849
1999	0.435	0.695	0.826	1.079	1.261	1.485	1.634	1.798	2.032	2.237	2.339	2.611	2.865
2000	0.378	0.577	0.853	1.186	1.395	1.588	1.808	1.989	2.264	2.415	2.587	2.647	3.098
2001	0.391	0.647	0.751	1.104	1.459	1.709	1.921	2.182	2.331	2.609	2.757	3.376	3.338
2002	0.159	0.407	0.687	1.001	1.363	1.643	1.975	2.086	2.294	2.487	2.612	2.847	3.501
2003	0.198	0.384	0.594	0.875	1.113	1.364	1.361	1.972	1.636	1.877	2.088	2.351	2.842
2004	0.328	0.429	0.636	0.886	1.183	1.508	1.821	2.075	2.339	2.58	2.527	3.153	3.197
2005	0.285	0.492	0.722	0.906	1.121	1.343	1.619	2.036	2.177	2.382	2.527	2.496	2.81
2006	0.311	0.567	0.745	1.041	1.287	1.504	1.72	2.082	2.377	2.738	3.082	3.02	3.43
2007	0.329	0.431	0.652	0.899	1.197	1.435	1.722	1.99	2.309	2.715	2.987	2.947	3.591
2008	0.383	0.484	0.658	0.901	1.242	1.515	1.781	2.18	2.33	2.664	3.019	3.326	3.829
2009	0.378	0.508	0.707	1.024	1.28	1.538	1.806	2.107	2.398	2.531	2.606	3.089	3.541
2010	0.317	0.499	0.642	0.887	1.137	1.396	1.702	1.907	2.095	2.404	2.534	3.064	3.249
2011	0.423	0.513	0.811	0.953	1.093	1.254	1.462	1.715	1.978	2.328	2.305	2.55	2.76
2012	0.271	0.506	0.756	1.004	1.174	1.371	1.514	1.715	2.051	2.444	2.414	2.615	2.932
2013	0.469	0.542	0.821	1.014	1.217	1.401	1.571	1.714	1.914	2.168	2.24	2.516	2.807
2014	0.469	0.645	0.792	1.033	1.253	1.417	1.625	1.793	1.941	2.081	2.479	2.703	3.011
2015	0.473	0.647	0.876	1.054	1.327	1.571	1.777	1.934	2.025	2.216	2.481	2.99	3.455
2016	0.497	0.743	0.882	1.115	1.369	1.662	1.917	2.089	2.301	2.567	3.076	3.286	3.331
2017	0.449	0.608	0.874	1.088	1.378	1.666	1.879	2.146	2.258	2.476	2.72	2.98	3.713
2018	0.443	0.663	0.820	1.051	1.339	1.629	1.927	2.156	2.372	2.588	2.728	2.773	3.175

Table 4.6. Northeast Arctic haddock. Stock weights-at-age (kg).

	1	2	3	4	5	6	7	8	9	10	11+
1950	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1951	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1952	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1953	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1954	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1955	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1956	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1957	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1958	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1959	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1960	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1961	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1962	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1963	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1964	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1965	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1966	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1967	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1968	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1969	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1970	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1971	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1972	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1973	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1974	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1975	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1976	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1977	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1978	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1979	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597
1980	0.063	0.262	0.454	0.878	1.159	1.675	2.292	3.134	3.31	3.553	3.792
1981	0.051	0.274	0.603	0.805	1.315	1.582	2.118	2.728	3.51	3.679	3.904
1982	0.036	0.224	0.631	1.049	1.217	1.782	2.017	2.553	3.14	3.853	4.016
1983	0.035	0.164	0.524	1.098	1.558	1.663	2.255	2.448	2.97	3.524	4.165
1984	0.028	0.158	0.391	0.926	1.632	2.093	2.121	2.718	2.865	3.363	3.878
1985	0.03	0.127	0.379	0.7	1.394	2.195	2.626	2.572	3.158	3.261	3.728
1986	0.035	0.136	0.311	0.682	1.069	1.898	2.761	3.138	3.005	3.568	3.632
1987	0.042	0.161	0.331	0.569	1.047	1.473	2.411	3.307	3.616	3.412	3.946
1988	0.039	0.189	0.383	0.603	0.887	1.452	1.895	2.915	3.822	4.054	3.787
1989	0.037	0.175	0.445	0.689	0.936	1.248	1.878	2.317	3.395	4.297	4.449
1990	0.031	0.169	0.413	0.789	1.054	1.312	1.635	2.308	2.728	3.844	4.73
1991	0.025	0.141	0.402	0.737	1.193	1.458	1.714	2.035	2.732	3.122	4.256
1992	0.023	0.114	0.34	0.721	1.119	1.63	1.881	2.127	2.437	3.142	3.491
1993	0.025	0.107	0.279	0.616	1.1	1.537	2.08	2.308	2.54	2.831	3.531
1994	0.03	0.115	0.262	0.512	0.952	1.518	1.969	2.527	2.729	2.945	3.213
1995	0.036	0.131	0.282	0.484	0.8	1.327	1.952	2.401	2.959	3.135	3.335
1996	0.037	0.154	0.313	0.52	0.76	1.128	1.724	2.388	2.82	3.369	3.52
1997	0.036	0.158	0.363	0.567	0.816	1.076	1.481	2.127	2.814	3.22	3.751
1998	0.029	0.153	0.371	0.65	0.879	1.155	1.418	1.847	2.526	3.221	3.595
1999	0.028	0.128	0.361	0.662	0.998	1.225	1.523	1.775	2.215	2.911	3.604
2000	0.026	0.122	0.305	0.647	1.014	1.375	1.592	1.905	2.137	2.578	3.278
2001	0.031	0.113	0.292	0.553	0.993	1.396	1.77	1.969	2.292	2.495	2.929
2002	0.03	0.133	0.272	0.531	0.859	1.369	1.795	2.17	2.349	2.676	2.845
2003	0.028	0.13	0.318	0.497	0.827	1.199	1.763	2.197	2.567	2.727	3.049
2004	0.025	0.12	0.31	0.575	0.778	1.157	1.561	2.162	2.597	2.956	3.095
2005	0.022	0.109	0.289	0.562	0.891	1.094	1.511	1.934	2.559	2.988	3.332
2006	0.023	0.096	0.263	0.526	0.873	1.239	1.434	1.877	2.31	2.948	3.363
2007	0.025	0.101	0.234	0.483	0.821	1.216	1.609	1.789	2.248	2.686	3.323
2008	0.031	0.109	0.246	0.432	0.758	1.15	1.582	1.988	2.151	2.619	3.052
2009	0.029	0.132	0.264	0.454	0.684	1.067	1.502	1.958	2.37	2.514	2.983
2010	0.039	0.125	0.315	0.484	0.715	0.97	1.402	1.866	2.336	2.749	2.873
2011	0.034	0.167	0.3	0.571	0.76	1.012	1.283	1.751	2.236	2.713	3.118
2012	0.039	0.151	0.391	0.55	0.884	1.082	1.37	1.619	2.084	2.625	3.094
2013	0.032	0.166	0.358	0.693	0.861	1.236	1.418	1.718	1.961	2.446	2.985
2014	0.036	0.136	0.391	0.64	1.059	1.2	1.602	1.773	2.073	2.309	2.802
2015	0.032	0.157	0.324	0.698	0.988	1.461	1.568	1.987	2.136	2.435	2.664
2016	0.029	0.139	0.371	0.585	1.065	1.357	1.869	1.937	2.367	2.505	2.79
2017	0.03	0.127	0.333	0.664	0.908	1.461	1.755	2.283	2.322	2.749	2.867
2018	0.028	0.129	0.303	0.598	1.013	1.266	1.878	2.153	2.686	2.699	3.121
2019	0.037	0.124	0.309	0.554	0.926	1.397	1.638	2.294	2.553	3.089	3.066

Table 4.7. Northeast Arctic haddock. Proportion mature-at-age.

	1	2	3	4	5	6	7	8	9	10	11	12	13+
1950	0	0	0.026	0.076	0.243	0.649	0.860	0.950	0.984	0.995	1	1	1
1951	0	0	0.056	0.104	0.303	0.549	0.857	0.948	0.984	0.995	1	1	1
1952	0	0	0.053	0.161	0.332	0.577	0.770	0.947	0.983	0.995	1	1	1
1953	0	0	0.057	0.183	0.472	0.665	0.800	0.906	0.983	0.995	1	1	1
1954	0	0	0.044	0.196	0.510	0.801	0.862	0.921	0.967	0.995	1	1	1
1955	0	0	0.027	0.149	0.522	0.796	0.928	0.953	0.973	0.989	1	1	1
1956	0	0	0.021	0.103	0.454	0.758	0.928	0.977	0.984	0.991	1	1	1
1957	0	0	0.021	0.076	0.294	0.713	0.918	0.976	0.993	0.994	1	1	1
1958	0	0	0.025	0.074	0.240	0.576	0.898	0.975	0.993	0.998	1	1	1
1959	0	0	0.032	0.090	0.250	0.534	0.822	0.966	0.993	0.998	1	1	1
1960	0	0	0.046	0.127	0.305	0.578	0.798	0.937	0.990	0.997	1	1	1
1961	0	0	0.041	0.164	0.358	0.623	0.820	0.925	0.980	0.997	1	1	1
1962	0	0	0.030	0.147	0.449	0.704	0.855	0.936	0.976	0.994	1	1	1
1963	0	0	0.018	0.113	0.396	0.741	0.878	0.950	0.979	0.992	1	1	1
1964	0	0	0.016	0.073	0.329	0.702	0.903	0.960	0.984	0.993	1	1	1
1965	0	0	0.016	0.059	0.227	0.633	0.885	0.969	0.987	0.995	1	1	1
1966	0	0	0.023	0.069	0.213	0.497	0.855	0.964	0.991	0.996	1	1	1
1967	0	0	0.034	0.083	0.204	0.495	0.760	0.948	0.989	0.997	1	1	1
1968	0	0	0.041	0.116	0.247	0.502	0.750	0.907	0.984	0.997	1	1	1
1969	0	0	0.050	0.133	0.316	0.521	0.760	0.898	0.969	0.995	1	1	1
1970	0	0	0.033	0.154	0.352	0.600	0.771	0.900	0.966	0.990	1	1	1
1971	0	0	0.032	0.106	0.385	0.642	0.819	0.911	0.967	0.989	1	1	1
1972	0	0	0.024	0.103	0.291	0.674	0.848	0.930	0.968	0.989	1	1	1
1973	0	0	0.027	0.080	0.283	0.575	0.867	0.943	0.975	0.989	1	1	1
1974	0	0	0.029	0.092	0.232	0.565	0.809	0.951	0.980	0.991	1	1	1
1975	0	0	0.030	0.096	0.263	0.498	0.803	0.927	0.983	0.993	1	1	1
1976	0	0	0.027	0.098	0.272	0.539	0.754	0.925	0.974	0.994	1	1	1
1977	0	0	0.022	0.089	0.273	0.551	0.781	0.902	0.973	0.990	1	1	1
1978	0	0	0.019	0.071	0.248	0.553	0.791	0.913	0.964	0.990	1	1	1
1979	0	0	0.019	0.064	0.206	0.520	0.795	0.919	0.968	0.987	1	1	1
1980	0	0	0.026	0.076	0.243	0.649	0.86	0.95	0.984	0.995	1	1	1
1981	0	0	0.056	0.104	0.303	0.549	0.857	0.948	0.984	0.995	1	1	1
1982	0	0	0.053	0.161	0.332	0.577	0.77	0.947	0.983	0.995	1	1	1
1983	0	0	0.057	0.183	0.472	0.665	0.8	0.906	0.983	0.995	1	1	1
1984	0	0	0.044	0.196	0.51	0.801	0.862	0.921	0.967	0.995	1	1	1
1985	0	0	0.027	0.149	0.522	0.796	0.928	0.953	0.973	0.989	1	1	1
1986	0	0	0.021	0.103	0.454	0.758	0.928	0.977	0.984	0.991	1	1	1
1987	0	0	0.021	0.076	0.294	0.713	0.918	0.976	0.993	0.994	1	1	1
1988	0	0	0.025	0.074	0.24	0.576	0.898	0.975	0.993	0.998	1	1	1
1989	0	0	0.032	0.09	0.25	0.534	0.822	0.966	0.993	0.998	1	1	1
1990	0	0	0.046	0.127	0.305	0.578	0.798	0.937	0.99	0.997	1	1	1
1991	0	0	0.041	0.164	0.358	0.623	0.82	0.925	0.98	0.997	1	1	1
1992	0	0	0.03	0.147	0.449	0.704	0.855	0.936	0.976	0.994	1	1	1
1993	0	0	0.018	0.113	0.396	0.741	0.878	0.95	0.979	0.992	1	1	1
1994	0	0	0.016	0.073	0.329	0.702	0.903	0.96	0.984	0.993	1	1	1
1995	0	0	0.016	0.059	0.227	0.633	0.885	0.969	0.987	0.995	1	1	1
1996	0	0	0.032	0.069	0.213	0.497	0.855	0.964	0.991	0.996	1	1	1
1997	0	0	0.04	0.098	0.204	0.495	0.76	0.948	0.989	0.997	1	1	1
1998	0	0	0.041	0.125	0.264	0.502	0.75	0.907	0.984	0.997	1	1	1
1999	0	0	0.039	0.129	0.32	0.535	0.76	0.898	0.969	0.995	1	1	1
2000	0	0	0.03	0.124	0.328	0.594	0.775	0.9	0.966	0.99	1	1	1
2001	0	0	0.028	0.094	0.318	0.601	0.808	0.909	0.967	0.989	1	1	1
2002	0	0	0.026	0.088	0.255	0.592	0.812	0.923	0.966	0.989	1	1	1
2003	0	0	0.032	0.078	0.24	0.524	0.807	0.925	0.972	0.988	1	1	1
2004	0	0	0.031	0.101	0.218	0.505	0.768	0.923	0.972	0.99	1	1	1
2005	0	0	0.028	0.097	0.269	0.476	0.756	0.906	0.971	0.99	1	1	1
2006	0	0	0.024	0.087	0.261	0.541	0.736	0.901	0.965	0.99	1	1	1
2007	0	0	0.021	0.075	0.237	0.531	0.778	0.892	0.963	0.987	1	1	1
2008	0	0	0.022	0.062	0.209	0.502	0.773	0.911	0.96	0.986	1	1	1
2009	0	0	0.025	0.067	0.177	0.463	0.754	0.908	0.967	0.985	1	1	1
2010	0	0	0.032	0.075	0.19	0.415	0.727	0.9	0.966	0.988	1	1	1
2011	0	0	0.029	0.099	0.21	0.436	0.69	0.888	0.963	0.987	1	1	1
2012	0	0	0.042	0.09	0.26	0.472	0.724	0.878	0.96	0.988	1	1	1
2013	0	0	0.037	0.132	0.25	0.537	0.737	0.889	0.955	0.986	1	1	1
2014	0	0	0.042	0.115	0.336	0.522	0.778	0.895	0.96	0.984	1	1	1
2015	0	0	0.032	0.133	0.305	0.616	0.771	0.913	0.962	0.986	1	1	1
2016	0	0	0.039	0.099	0.339	0.581	0.822	0.909	0.968	0.986	1	1	1
2017	0	0	0.033	0.122	0.27	0.616	0.805	0.93	0.967	0.989	1	1	1
2018	0	0	0.029	0.103	0.316	0.548	0.823	0.923	0.975	0.988	1	1	1
2019	0	0	0.029	0.091	0.278	0.595	0.785	0.93	0.972	0.991	1	1	1

Table 4.8. Northeast Arctic haddock. Consumption of Haddock by NEA Cod (mln. spec).

Age	0	1	2	3	4	5	6	Biomass consumed
1984	1985.443	986.818	14.650	0.076	0.000	0.000	0.000	51.256
1985	1709.736	1205.489	5.160	0.000	0.000	0.000	0.000	47.136
1986	90.808	548.712	240.740	165.543	0.000	0.000	0.000	108.658
1987	0.000	740.664	0.000	0.000	0.000	0.000	0.000	4.074
1988	0.000	17.109	0.508	9.140	0.000	0.225	0.000	2.620
1989	22.009	230.386	0.000	0.000	0.000	0.000	0.000	10.287
1990	50.957	143.914	37.877	3.665	0.000	0.000	0.000	15.476
1991	0.000	457.565	14.211	0.000	0.000	0.000	0.000	20.196
1992	165.872	2109.799	150.798	1.080	0.000	0.000	0.000	106.028
1993	755.633	1361.690	165.151	36.588	3.369	2.853	0.000	70.247
1994	1229.416	1393.089	79.775	24.548	7.439	0.900	0.011	47.587
1995	177.291	2870.300	160.907	11.669	27.911	27.353	0.308	111.356
1996	320.005	1504.648	160.623	40.125	5.454	2.639	3.445	66.687
1997	0.000	873.388	34.396	25.375	1.726	0.783	0.529	39.832
1998	0.000	1468.486	28.174	1.972	2.906	0.505	0.000	31.231
1999	0.000	888.567	23.251	0.325	0.000	0.000	0.000	25.549
2000	678.164	1191.522	64.620	2.085	1.145	0.187	0.079	50.186
2001	987.869	561.347	54.284	5.307	0.092	0.000	0.000	49.659
2002	457.281	2475.722	244.670	40.056	2.323	0.378	0.173	129.074
2003	1163.408	3689.149	227.213	42.043	13.581	1.289	0.000	173.573
2004	5403.863	2892.015	313.860	41.909	10.678	2.668	0.000	200.787
2005	7559.656	6545.499	276.384	56.809	9.766	2.371	0.949	319.686
2006	13687.148	8413.087	374.936	5.572	4.519	1.182	0.479	365.080
2007	1309.075	10846.114	661.442	71.874	3.867	2.217	0.218	391.677
2008	1547.783	1069.449	947.435	239.346	45.851	5.881	3.357	311.971
2009	6550.921	2148.662	314.601	293.839	78.551	25.256	1.732	289.203
2010	2336.074	6584.182	202.641	75.218	77.167	70.642	13.248	306.342
2011	2789.661	3078.071	512.932	63.657	85.831	99.208	22.411	322.924
2012	265.254	8425.262	158.043	126.641	17.801	8.097	5.125	259.431

Age	0	1	2	3	4	5	6	Biomass consumed
2013	2420.488	1816.924	452.778	37.895	26.895	6.696	5.126	236.321
2014	1355.720	2219.149	160.834	31.876	2.062	0.713	0.000	99.212
2015	4863.851	2622.732	148.128	15.756	52.709	1.740	0.272	186.701
2016	7520.836	2614.541	269.091	24.871	2.872	9.091	2.099	219.651
2017	2902.326	6929.716	223.909	23.707	14.660	7.761	15.428	261.285
2018	1927.166	5986.443	545.631	64.405	7.347	0.627	0.017	247.300
1984-2018	2063.8	2768.9	207.7	45.2	14.5	8.0	2.1	148.0

Table 4.9. Northeast Arctic haddock. Survey indices for tuning assessment models

North-East Arctic haddock
104
RU-BTr-Q4
1991 2018
1 1 0.9 1.00
3 7

1	62	9	3	6	18
1	346	50	4	6	9
1	1985	356	48	8	4
1	442	1014	116	15	1
1	31	123	370	40	5
1	28	49	362	334	29
1	32	32	10	27	10
1	38	46	8	5	15
1	196	39	37	8	3
1	60	109	26	11	2
1	334	40	65	11	4
1	399	450	47	24	4
1	221	299	231	34	16
1	113	94	107	87	5
1	240	86	48	57	24
1	113	119	57	26	24
1	838	73	137	38	14
1	2557	1051	124	111	17
1	1647	1704	631	57	32
1	299	1697	1589	466	34
1	47	268	1087	783	165
1	209	49	160	720	480
1	61	175	50	104	374
1	250	46	175	56	142
1	22	199	40	74	28
1	-1	-1	-1	-1	-1
1	71	99	9	38	6
1	-1	-1	-1	-1	-1

BS-NoRU-Q1(Aco)
1994 2019
1 1 0.083 0.21
4 8

1	626.6	121.4	8.6	0.7	0.3
1	121.5	395.4	47.6	2.8	0.1
1	22.1	68.7	143.7	5.7	0.9
1	22.2	15.5	56.1	62.8	4.7
1	58.8	24.2	7.7	14.1	20.7
1	21.6	22.1	6.2	1.6	3.9
1	75.5	14	12.6	1.6	0.5
1	40.2	41.4	2.2	1.6	0.2
1	201.8	18.5	11.7	1.6	0.3
1	184.6	136	12.3	6	0.3
1	101.8	107.8	57.7	7.6	1.2
1	115.7	57.4	56.7	12.7	0.4
1	123.8	47.4	19.3	13.6	3.2
1	46.1	80.6	28.9	10	5.1

1	303	90	74.1	7.4	12.8
1	630	266.6	38.9	14.6	1.3
1	631	604	167	12.1	2.9
1	84.2	313	292.2	54.9	1.7
1	48.8	88.1	310.6	172.5	30.1
1	146.8	35.4	53	223.8	102.7
1	38.2	107.9	22.4	33.8	84.5
1	171.5	25.5	39.4	8.3	21.1
1	11.8	56	11.8	16.6	6.9
1	62.8	4.4	32.2	5.8	7
1	60.3	60.7	5.7	12.8	2.3
1	142	29.7	21.2	4.5	3.4

Table 4.9. (Continuation)

BS-NoRu-Q1 (BTr)

1994 2019

1 1 0.083 0.167

4 9

1	4279	483	34	1.4	1.7	1.6
1	1630	3384	288	18.7	0.3	0.4
1	325	1610	2509	183	11.1	0
1	396	182	614	873	32.2	0.8
1	361	128	32	81.5	59.4	5.6
1	156	94	29	8.6	13	7.4
1	358	69	41	6.5	0.1	8.1
1	261	227	17	7.8	0.6	0.6
1	1868	119	84	8.6	1.9	0
1	1751	723	50	17.3	1.2	0.9
1	993	777	509	73.7	8.9	1.3
1	1401	509	617	102	2.5	0.8
1	1298	455	226	159	32	0.9
1	810	848	261	53.8	22.3	13.5
1	5813	529	540	70.5	106	1.6
1	7601	3723	258	123	8.5	0.9
1	4928	4546	1494	78	9.9	3.5
1	1257	4725	2936	663	14.5	11.1
1	291	761	2709	1564	245	26.4
1	1460	209	342	1938	686	60
1	303	1004	219	465	952	400
1	1767	441	356	136	183	277
1	329	1058	196	400	103	275
1	958	43.2	451	87.2	130	12
1	840	610	56	119	27.5	20.1
1	1797	459	158	37.8	27.9	6.9

FLT007: Eco-NoRu-Q3 (Btr)

2004 2018

1 1 0.65 0.75

3 8

1	123	70	69	31	3	2
1	325	90	30	32	15	-1
1	107	125	42	19	17	7
1	1283	88	90	19	6	7

1	1155	406	43	36	5	3
1	651	619	306	21	7	1
1	184	865	666	148	16	3
1	40	74	393	301	37	3
1	92	20	68	214	152	13
1	26	65	20	51	150	76
1	262	41	70	26	60	86
1	42	214	25	37	21	48
1	74	14	138	42	55	40
1	70	70	11	21	4	4
1	-1	-1	-1	-1	-1	-1

Table 4.10. Northeast Arctic haddock. SAM model configuration used

```
library(stockassessment)
setwd("run")
load("data.RData")
conf<-defcon(dat)
conf$keyLogFsta<-rbind(
c(0,1,2,3,4,5,5,6,6,6,6),
rep(-1,11),
rep(-1,11),
rep(-1,11),
rep(-1,11)
)
conf$corFlag<-2
conf$keyLogFpar<-rbind(
rep(-1,11),
c(0,0,1,1,1,-1,-1,-1,-1,-1,-1),
c(-1,2,2,3,3,3,-1,-1,-1,-1,-1),
c(-1,4,4,5,5,5,6,-1,-1,-1,-1),
c(7,7,8,8,8,9,-1,-1,-1,-1,-1)
)
conf$keyQpow<-rbind(
rep(-1,11),
c(0,0,1,1,1,-1,-1,-1,-1,-1,-1),
c(-1,2,2,3,3,3,-1,-1,-1,-1,-1),
c(-1,4,4,5,5,5,6,-1,-1,-1,-1),
c(7,7,8,8,8,9,-1,-1,-1,-1,-1)
)
conf$keyVarF[1,]<-
c(0,1,1,1,1,1,1,1,1,1,1)
conf$keyVarObs<-rbind(
c(0,1,1,1,1,1,1,2,2,2,2),
c(3,3,4,4,4,-1,-1,-1,-1,-1,-1),
c(-1,5,5,6,6,6,-1,-1,-1,-1,-1),
c(-1,7,7,8,8,8,9,-1,-1,-1,-1),
c(10,10,11,11,11,12,-1,-1,-1,-1,-1)
)
conf$fbarRange<-c(4,7)
par<-defpar(dat,conf)
fit<-sam.fit(dat,conf,par)

save(fit, file="model.RData")
```

Table 4.11. Northeast Arctic haddock. SAM model estimated recruitment, spawning-stock-biomass (SSB), and average fishing mortality.

Year	R(age 3)	Low	High	SSB	Low	High	Fbar(4-7)	Low	High	TSB	Low	High
1950	67909	39825	115798	210469	174737	253508	0.732	0.582	0.922	382994	323807	452999
1951	643146	381940	1082989	126945	108067	149121	0.686	0.555	0.847	429160	320910	573924
1952	95519	56772	160709	102125	86200	120993	0.705	0.572	0.869	425872	320733	565475
1953	1069379	631697	1810315	119871	95326	150735	0.544	0.436	0.679	677426	487858	940656
1954	133121	78815	224847	169170	133774	213933	0.485	0.386	0.609	753641	556624	1020393
1955	54736	32141	93214	272359	208456	355853	0.408	0.322	0.518	735371	547988	986829
1956	227460	133694	386988	332172	248574	443885	0.436	0.345	0.552	631234	486606	818849
1957	58058	34401	97985	257612	197382	336221	0.408	0.323	0.516	435988	349935	543201
1958	65914	38761	112090	186839	150030	232678	0.493	0.393	0.62	313929	259687	379500
1959	380492	227537	636265	129867	106580	158244	0.45	0.358	0.566	332138	260728	423108
1960	328005	195623	549973	116575	98052	138598	0.56	0.452	0.694	421747	333683	533053
1961	151834	91294	252518	125149	104701	149591	0.661	0.537	0.813	403800	328041	497057
1962	309574	186447	514012	123602	102017	149755	0.739	0.599	0.913	378215	306643	466492
1963	309158	186325	512967	97043	81565	115458	0.722	0.579	0.899	360111	287584	450930
1964	318887	191099	532126	86600	73054	102658	0.656	0.526	0.818	376119	297734	475140
1965	124551	74452	208364	100233	82674	121522	0.564	0.451	0.706	366066	293202	457038
1966	303549	181433	507857	134158	108853	165345	0.541	0.431	0.68	420647	337792	523826
1967	311969	185687	524135	145559	118029	179510	0.457	0.361	0.578	441850	354840	550195
1968	16240	9580	27530	160493	131932	195237	0.482	0.38	0.611	405614	326491	503913
1969	20621	12290	34598	161338	131563	197852	0.409	0.32	0.523	302334	242104	377547
1970	196935	116554	332747	150069	120579	186771	0.394	0.308	0.504	274162	219948	341739
1971	94394	55361	160949	122811	98558	153032	0.338	0.263	0.434	246428	200820	302396
1972	1102790	663243	1833635	122580	101908	147445	0.62	0.493	0.779	600216	427168	843365
1973	317217	190923	527053	125530	103501	152247	0.511	0.405	0.645	668369	504594	885299
1974	71085	43019	117460	165607	131322	208841	0.561	0.446	0.705	508550	396735	651879
1975	60663	36808	99979	189702	147075	244684	0.512	0.408	0.642	372602	296619	468050
1976	65598	39642	108548	183385	143112	234992	0.727	0.589	0.898	282789	229767	348047
1977	125133	74676	209684	116319	91453	147947	0.745	0.601	0.922	201557	165404	245613
1978	214073	129010	355223	78699	61857	100128	0.616	0.49	0.774	197763	155935	250812
1979	151398	91008	251860	62078	49323	78131	0.571	0.449	0.725	202152	160714	254273
1980	18899	10989	32502	62398	50495	77106	0.454	0.353	0.585	205306	162856	258822
1981	9225	5454	15605	71542	57391	89183	0.406	0.314	0.524	161137	127444	203736
1982	16484	9804	27715	68072	53725	86251	0.361	0.279	0.467	119985	95854	150190
1983	9852	5806	16716	58935	46841	74153	0.366	0.284	0.471	88970	72452	109254
1984	14518	8589	24538	53015	42159	66667	0.301	0.233	0.389	72312	59051	88551
1985	329518	196308	553121	49865	40553	61317	0.402	0.317	0.51	181492	126050	261320
1986	458287	274143	766123	54254	44475	66183	0.556	0.445	0.696	353438	262172	476475
1987	83081	49261	140123	72012	56565	91678	0.66	0.524	0.831	332644	258590	427905
1988	38441	22566	65484	77166	60462	98484	0.534	0.413	0.69	248509	195262	316277
1989	31772	18787	53729	83359	63879	108780	0.301	0.228	0.396	191394	150457	243469
1990	39106	24100	63456	87990	68071	113738	0.228	0.175	0.297	157919	126972	196410
1991	103256	71851	148385	100726	80956	125325	0.243	0.191	0.309	184269	154818	219323
1992	312998	218071	449247	116241	96275	140347	0.281	0.224	0.354	293504	246161	349953
1993	848378	584630	1231113	136413	115911	160541	0.292	0.233	0.367	549336	448167	673341
1994	295569	207171	421687	165211	143769	189851	0.348	0.278	0.437	642376	542825	760185
1995	79138	55424	112997	208941	181012	241180	0.328	0.262	0.411	628688	534295	739758
1996	94320	66015	134760	250661	214823	292479	0.391	0.316	0.484	546579	470657	634748
1997	96732	67573	138473	220527	188549	257929	0.465	0.37	0.584	391511	340767	449811
1998	64801	45571	92147	160426	137489	187189	0.46	0.37	0.572	283427	248953	322676
1999	197387	138542	281225	115023	98676	134079	0.466	0.376	0.578	261306	226164	301908
2000	81630	57442	116002	93447	80046	109092	0.368	0.295	0.46	231993	201606	266961
2001	347092	242808	496166	93381	80977	107685	0.365	0.294	0.453	292473	248294	344514
2002	355408	250073	505110	107449	94003	122817	0.341	0.275	0.423	411701	351593	482086
2003	246548	174767	347813	139684	122955	158691	0.407	0.332	0.5	487157	422386	561860
2004	220076	162331	298364	159778	141020	181032	0.417	0.337	0.515	467885	412552	530640
2005	353226	256327	486755	174816	154248	198126	0.436	0.355	0.536	489670	430295	557238
2006	163602	120716	221724	172205	152288	194728	0.389	0.316	0.479	430986	381786	486526
2007	879343	619641	1247890	179156	158611	202362	0.355	0.287	0.439	587670	499664	691178
2008	1251215	887076	1764830	198050	174048	225362	0.291	0.231	0.367	875010	732017	1045936
2009	1030019	729075	1455185	211140	185777	239966	0.259	0.205	0.328	1116645	930653	1339807
2010	307787	227558	416303	311541	269914	359588	0.241	0.192	0.304	1292280	1092193	1529023
2011	110337	81686	149038	432296	369456	505825	0.232	0.184	0.292	1179414	1002645	1387349
2012	293014	212566	403908	565427	479604	666606	0.206	0.164	0.26	1096489	939681	1279465
2013	106180	77825	144866	604134	511426	713648	0.164	0.13	0.207	963051	830830	1116314
2014	332329	242707	455043	596585	502251	708638	0.168	0.133	0.212	953001	824712	1101248
2015	68172	48383	96056	555089	462004	666931	0.201	0.16	0.252	877696	756100	1018847
2016	177353	124838	251960	526338	433025	639760	0.255	0.204	0.32	786746	670439	923230
2017	147786	109072	200240	388448	312924	482200	0.383	0.306	0.479	606029	514318	714093
2018	336138	200367	563908	279971	216450	362133	0.378	0.294	0.487	547117	451504	662979
2019	336138	26903	4199783	214924	161452	286106	0.369	0.223	0.612	524486	304865	902318

Table 4.12. Northeast Arctic haddock. SAM model estimated fishing mortality-at-age.

Year	3	4	5	6	7	8	9	10	11	12	13
1950	0.092	0.385	0.674	0.841	1.029	0.982	0.81	0.81	0.81	0.81	0.81
1951	0.086	0.354	0.622	0.789	0.978	0.957	0.805	0.805	0.805	0.805	0.805
1952	0.089	0.364	0.635	0.809	1.012	0.998	0.845	0.845	0.845	0.845	0.845
1953	0.067	0.279	0.486	0.62	0.789	0.78	0.679	0.679	0.679	0.679	0.679
1954	0.056	0.237	0.422	0.555	0.727	0.727	0.635	0.635	0.635	0.635	0.635
1955	0.045	0.197	0.358	0.473	0.605	0.573	0.481	0.481	0.481	0.481	0.481
1956	0.051	0.213	0.387	0.511	0.636	0.594	0.505	0.505	0.505	0.505	0.505
1957	0.048	0.203	0.369	0.478	0.585	0.542	0.484	0.484	0.484	0.484	0.484
1958	0.059	0.242	0.446	0.579	0.705	0.67	0.635	0.635	0.635	0.635	0.635
1959	0.061	0.24	0.425	0.529	0.607	0.574	0.565	0.565	0.565	0.565	0.565
1960	0.087	0.324	0.554	0.657	0.707	0.658	0.645	0.645	0.645	0.645	0.645
1961	0.111	0.4	0.677	0.776	0.791	0.711	0.675	0.675	0.675	0.675	0.675
1962	0.131	0.462	0.78	0.872	0.842	0.726	0.667	0.667	0.667	0.667	0.667
1963	0.125	0.448	0.759	0.857	0.823	0.696	0.631	0.631	0.631	0.631	0.631
1964	0.106	0.387	0.668	0.784	0.786	0.689	0.638	0.638	0.638	0.638	0.638
1965	0.088	0.329	0.565	0.672	0.692	0.622	0.587	0.587	0.587	0.587	0.587
1966	0.09	0.329	0.55	0.638	0.648	0.576	0.527	0.527	0.527	0.527	0.527
1967	0.078	0.285	0.466	0.533	0.545	0.495	0.455	0.455	0.455	0.455	0.455
1968	0.087	0.308	0.494	0.556	0.57	0.523	0.477	0.477	0.477	0.477	0.477
1969	0.08	0.275	0.427	0.466	0.468	0.427	0.388	0.388	0.388	0.388	0.388
1970	0.084	0.277	0.414	0.443	0.441	0.406	0.372	0.372	0.372	0.372	0.372
1971	0.076	0.248	0.361	0.374	0.369	0.343	0.32	0.32	0.32	0.32	0.32
1972	0.169	0.48	0.69	0.679	0.63	0.567	0.518	0.518	0.518	0.518	0.518
1973	0.159	0.436	0.588	0.54	0.482	0.426	0.39	0.39	0.39	0.39	0.39
1974	0.175	0.468	0.627	0.593	0.554	0.514	0.485	0.485	0.485	0.485	0.485
1975	0.171	0.451	0.581	0.53	0.486	0.445	0.417	0.417	0.417	0.417	0.417
1976	0.253	0.635	0.823	0.752	0.699	0.655	0.621	0.621	0.621	0.621	0.621
1977	0.271	0.675	0.866	0.759	0.678	0.623	0.576	0.576	0.576	0.576	0.576
1978	0.198	0.528	0.717	0.646	0.572	0.53	0.481	0.481	0.481	0.481	0.481
1979	0.156	0.447	0.656	0.629	0.551	0.522	0.467	0.467	0.467	0.467	0.467
1980	0.105	0.327	0.509	0.519	0.462	0.454	0.401	0.401	0.401	0.401	0.401
1981	0.087	0.28	0.447	0.473	0.423	0.414	0.357	0.357	0.357	0.357	0.357
1982	0.077	0.247	0.394	0.423	0.381	0.376	0.32	0.32	0.32	0.32	0.32
1983	0.081	0.258	0.398	0.422	0.385	0.381	0.31	0.31	0.31	0.31	0.31
1984	0.064	0.212	0.325	0.345	0.321	0.309	0.237	0.237	0.237	0.237	0.237
1985	0.076	0.257	0.411	0.468	0.472	0.465	0.359	0.359	0.359	0.359	0.359
1986	0.095	0.326	0.552	0.657	0.689	0.68	0.515	0.515	0.515	0.515	0.515
1987	0.105	0.368	0.652	0.787	0.832	0.805	0.572	0.572	0.572	0.572	0.572
1988	0.08	0.291	0.528	0.648	0.667	0.647	0.442	0.442	0.442	0.442	0.442
1989	0.046	0.178	0.312	0.362	0.351	0.315	0.214	0.214	0.214	0.214	0.214
1990	0.032	0.129	0.23	0.274	0.279	0.263	0.199	0.199	0.199	0.199	0.199
1991	0.032	0.131	0.244	0.296	0.303	0.284	0.221	0.221	0.221	0.221	0.221
1992	0.032	0.135	0.273	0.349	0.368	0.347	0.278	0.278	0.278	0.278	0.278
1993	0.027	0.12	0.268	0.371	0.41	0.389	0.317	0.317	0.317	0.317	0.317
1994	0.028	0.126	0.302	0.445	0.52	0.495	0.406	0.406	0.406	0.406	0.406
1995	0.025	0.115	0.279	0.417	0.502	0.479	0.392	0.392	0.392	0.392	0.392
1996	0.03	0.134	0.328	0.494	0.608	0.586	0.48	0.48	0.48	0.48	0.48
1997	0.036	0.161	0.396	0.587	0.714	0.66	0.522	0.522	0.522	0.522	0.522
1998	0.039	0.17	0.404	0.577	0.687	0.634	0.5	0.5	0.5	0.5	0.5
1999	0.044	0.183	0.421	0.578	0.681	0.625	0.499	0.499	0.499	0.499	0.499
2000	0.035	0.151	0.339	0.454	0.529	0.485	0.393	0.393	0.393	0.393	0.393
2001	0.034	0.147	0.335	0.452	0.525	0.484	0.404	0.404	0.404	0.404	0.404
2002	0.032	0.138	0.312	0.425	0.488	0.443	0.368	0.368	0.368	0.368	0.368
2003	0.038	0.159	0.363	0.505	0.603	0.556	0.468	0.468	0.468	0.468	0.468
2004	0.04	0.163	0.368	0.517	0.618	0.571	0.476	0.476	0.476	0.476	0.476
2005	0.041	0.166	0.376	0.539	0.664	0.63	0.535	0.535	0.535	0.535	0.535
2006	0.037	0.149	0.332	0.477	0.598	0.58	0.49	0.49	0.49	0.49	0.49
2007	0.032	0.13	0.292	0.436	0.563	0.555	0.469	0.469	0.469	0.469	0.469
2008	0.024	0.099	0.225	0.355	0.485	0.49	0.418	0.418	0.418	0.418	0.418
2009	0.021	0.086	0.193	0.311	0.447	0.466	0.404	0.404	0.404	0.404	0.404
2010	0.02	0.081	0.178	0.287	0.419	0.456	0.41	0.41	0.41	0.41	0.41
2011	0.021	0.08	0.172	0.274	0.402	0.444	0.407	0.407	0.407	0.407	0.407
2012	0.021	0.078	0.158	0.241	0.347	0.387	0.362	0.362	0.362	0.362	0.362
2013	0.018	0.068	0.129	0.188	0.271	0.32	0.321	0.321	0.321	0.321	0.321
2014	0.02	0.074	0.137	0.191	0.27	0.33	0.351	0.351	0.351	0.351	0.351
2015	0.026	0.094	0.171	0.228	0.31	0.374	0.406	0.406	0.406	0.406	0.406
2016	0.035	0.121	0.221	0.291	0.389	0.458	0.499	0.499	0.499	0.499	0.499
2017	0.054	0.182	0.335	0.44	0.576	0.647	0.682	0.682	0.682	0.682	0.682
2018	0.052	0.177	0.332	0.433	0.57	0.638	0.681	0.681	0.681	0.681	0.681
2019	0.051	0.173	0.325	0.423	0.556	0.623	0.666	0.666	0.666	0.666	0.666

Table 4.13. Northeast Arctic haddock. SAM model estimated stock numbers-at-age.

Year Age	3	4	5	6	7	8	9	10	11	12	13
1950	67909	107227	72214	37632	44464	16645	4833	3075	1279	1445	1974
1951	643146	44592	48826	27168	13050	12271	5241	2023	1191	445	1167
1952	95519	437279	28963	19384	9085	4348	3678	1711	831	449	580
1953	1069379	54828	210604	13581	6357	2728	1214	1064	574	317	424
1954	133121	795711	26845	93441	6658	2356	1194	549	390	212	323
1955	54736	83704	533568	14475	45820	2995	843	492	246	157	195
1956	227460	38487	57318	284653	7355	17249	1393	406	259	141	189
1957	58058	147937	26671	35665	113616	3283	6068	745	181	137	206
1958	65914	37856	88983	15421	19958	43305	1764	2501	386	103	220
1959	380492	47178	25259	40549	7470	7532	16128	822	887	164	151
1960	328005	263396	33531	15102	17791	3616	3910	6986	420	343	135
1961	151834	191838	144790	17118	6832	8095	1676	1546	2999	167	190
1962	309574	88372	89262	57661	6843	2726	3326	742	622	1259	132
1963	309158	186802	38226	27038	17709	2848	1133	1275	349	257	606
1964	318887	194545	79619	12310	7790	5865	1421	474	533	190	416
1965	124551	216527	111250	30262	3978	2658	2201	619	221	225	299
1966	303549	82231	141702	56993	11910	1538	1171	913	321	94	201
1967	311969	193075	43882	68767	24280	4669	692	568	445	164	140
1968	16240	233867	112617	22030	33937	12146	2175	364	300	231	158
1969	20621	10601	133867	52963	10717	15251	5625	1127	176	156	179
1970	196935	12184	6856	66679	24603	5939	7807	3006	644	96	200
1971	94394	124502	6742	4178	31865	12064	3271	4479	1671	380	162
1972	1102790	69667	72933	4450	3099	16630	6709	1949	2738	999	317
1973	317217	668499	39003	23649	1579	1631	7002	3011	918	1379	595
1974	71085	169222	296633	15188	10470	838	1189	3988	1677	545	1197
1975	60663	40102	87773	138331	6088	4691	376	638	1936	785	895
1976	65598	34018	17838	42303	72660	2821	2693	216	393	1038	929
1977	125133	34249	13652	6697	16925	29828	1102	1165	89	181	755
1978	214073	56760	10080	4365	3088	7469	14405	581	544	33	404
1979	151398	117247	23215	3163	2109	1492	4017	7010	350	265	207
1980	18899	97370	57120	8243	1040	1166	766	2203	3481	199	229
1981	9225	13938	59790	25715	3390	520	603	444	1239	1779	235
1982	16484	6058	10485	30590	10580	1622	271	348	295	731	1037
1983	9852	11472	4401	6767	13703	5448	983	146	211	196	898
1984	14518	5458	6710	2727	3911	8874	2578	593	78	126	602
1985	329518	9087	2853	3517	1973	2643	5470	1749	403	64	496
1986	458287	253882	5083	1663	1830	1020	1560	2902	1015	237	366
1987	83081	252430	134914	2454	727	730	474	771	1302	490	269
1988	38441	64725	140982	41541	1095	200	257	229	378	572	323
1989	31772	26653	46841	70146	11693	628	42	141	122	200	429
1990	39106	21939	17333	26767	33692	5167	529	48	95	78	341
1991	103256	26506	13412	13898	20041	20617	2937	380	42	66	232
1992	312998	86250	17156	10055	10829	12933	13892	1900	258	35	168
1993	848378	243098	60225	11731	6218	6628	8182	8668	1132	180	121
1994	295569	616291	145360	31069	4955	3150	4055	5207	5279	686	176
1995	79138	211435	422464	75076	15286	2056	1448	2244	2757	2884	459
1996	94320	62159	164824	226967	36884	7244	1252	800	1229	1537	1875
1997	96732	53743	38007	89386	97392	16527	2586	641	386	594	1687
1998	64801	77611	35300	21615	37549	40581	6012	1133	313	183	1149
1999	197387	49820	45086	19342	9800	15463	15235	2475	526	174	703
2000	81630	136241	28963	23861	7734	3667	6600	6743	1076	265	484
2001	347092	62846	82661	15888	10019	3145	2511	3795	3395	572	456
2002	355408	312871	45400	45788	8762	4798	1873	1482	2153	1786	528
2003	246548	263448	194193	33771	25178	4023	3567	1324	896	1275	1351
2004	220076	153886	156565	102791	17377	10935	2162	1903	759	466	1500
2005	353226	162996	90363	95789	47715	5985	5735	1330	903	423	1181
2006	163602	214317	96683	52932	46008	19500	3157	3023	688	443	791
2007	879343	128583	160919	58637	30213	19818	8314	1839	1612	378	624
2008	1251215	593613	105811	102296	25591	18922	7963	3862	1080	865	540
2009	1030019	848111	403505	64731	38895	10307	6655	3953	1894	691	869
2010	307787	790522	661967	233571	35646	15368	5386	3486	2096	1061	1029
2011	110337	202596	566178	390135	112441	13797	7453	2637	1802	1140	1317
2012	293014	71328	131023	345195	241502	54164	6785	3421	1336	971	1474
2013	106180	193760	53708	97185	238635	127259	23500	3667	1866	775	1490
2014	332329	73503	137563	51646	89110	142113	64786	11542	2050	1124	1356
2015	68172	290421	61717	88279	40914	65354	80299	31128	5740	1091	1283
2016	177353	39715	162841	49992	67352	33014	46098	41802	15027	2756	1139
2017	147786	152046	24757	87031	25083	34388	17925	21857	20183	6751	1664
2018	336138	115808	109135	23161	41136	13450	16480	7643	8864	8567	3406
2019	336138	231698	75011	57257	16735	18384	6254	6826	3166	3672	4960

Table 4.14. Northeast Arctic haddock. SAM model natural mortality estimated.

Year	3	4	5	6	7	8	9	10	11	12	13
1950	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1951	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1952	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1953	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1954	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1955	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1956	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1957	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1958	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1959	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1960	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1961	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1962	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1963	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1964	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1965	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1966	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1967	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1968	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1969	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1970	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1971	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1972	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1973	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1974	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1975	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1976	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1977	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1978	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1979	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1980	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1981	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1982	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1983	0.353	0.261	0.239	0.236	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1984	0.22	0.228	0.225	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1985	0.211	0.202	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1986	0.63	0.273	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1987	0.2	0.21	0.388	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1988	0.381	0.2	0.222	0.363	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1989	0.204	0.2	0.2	0.243	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1990	0.337	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1991	0.2	0.22	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1992	0.212	0.21	0.216	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.259	0.254	0.296	0.279	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.281	0.219	0.25	0.219	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1995	0.346	0.322	0.308	0.229	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1996	0.711	0.304	0.234	0.265	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1997	0.485	0.243	0.206	0.231	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1998	0.242	0.284	0.233	0.204	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1999	0.212	0.225	0.24	0.252	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2000	0.216	0.228	0.212	0.273	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2001	0.215	0.2	0.202	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2002	0.323	0.227	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2003	0.404	0.257	0.223	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2004	0.415	0.268	0.2	0.215	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2005	0.413	0.289	0.2	0.204	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2006	0.222	0.218	0.223	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2007	0.311	0.202	0.245	0.26	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2008	0.389	0.305	0.267	0.352	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2009	0.441	0.273	0.309	0.245	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2010	0.37	0.278	0.317	0.319	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2011	0.551	0.502	0.374	0.255	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2012	0.618	0.329	0.201	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2013	0.513	0.345	0.244	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2014	0.292	0.209	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2015	0.372	0.444	0.211	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2016	0.315	0.2	0.265	0.289	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2017	0.353	0.291	0.224	0.39	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2018	0.429	0.275	0.231	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2019	0.429	0.275	0.231	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table 4.15. Northeast Arctic haddock. Summary XSA (p-shrinkage not applied)
Wed May 22 14:47:48 2019

YEAR	RECR_a3	TOTBIO	TOTSPB	LANDINGS	YIELDSSB	SOPCOFAC	FBAR 4-7
1950	76656	234313	131580	132125	1.0041	1.5897	0.8652
1951	632805	338839	98204	120077	1.2227	1.2272	0.654
1952	71120	223913	55334	127660	2.3071	1.7404	0.7605
1953	1191820	477957	77602	123920	1.5969	1.4279	0.5462
1954	138033	500850	107937	156788	1.4526	1.474	0.4
1955	62457	456317	170331	202286	1.1876	1.536	0.5332
1956	195247	433516	222815	213924	0.9601	1.2623	0.4575
1957	60638	312422	181379	123583	0.6814	1.2455	0.4532
1958	80679	265315	153456	112672	0.7342	1.1252	0.5435
1959	379069	345838	127919	88211	0.6896	0.9405	0.3878
1960	279842	386132	111457	154651	1.3875	1.0411	0.51
1961	126095	376709	125565	193224	1.5388	0.9942	0.6642
1962	278911	330898	113156	187408	1.6562	1.0518	0.8368
1963	319522	296630	80006	146224	1.8277	1.1458	0.9038
1964	371407	284757	61393	99158	1.6151	1.3572	0.6855
1965	115788	334836	89622	118578	1.3231	1.1507	0.5188
1966	276029	361313	118841	161778	1.3613	1.1621	0.616
1967	339067	436932	144752	136397	0.9423	0.9984	0.4395
1968	21323	400431	163849	181726	1.1091	0.9976	0.5312
1969	19815	320703	174944	130820	0.7478	0.882	0.424
1970	193034	270439	148768	88257	0.5933	0.9762	0.3788
1971	116155	335710	166665	78905	0.4734	0.7638	0.2568
1972	1185095	591808	120823	266153	2.2028	1.0883	0.732
1973	322650	571776	109839	322226	2.9336	1.1656	0.5722
1974	65433	561646	188891	221157	1.1708	0.8946	0.4575
1975	57705	448529	232694	175758	0.7553	0.8957	0.4538
1976	65061	296885	201335	137264	0.6818	1.12	0.6013
1977	130645	225024	140560	110158	0.7837	1.09	0.7198
1978	203917	249630	129598	95422	0.7363	0.9219	0.5397
1979	164675	306596	128109	103623	0.8089	0.7684	0.5858
1980	31228	326123	130032	87889	0.6759	0.7568	0.4248
1981	13917	276226	142104	77153	0.5429	0.7174	0.4278
1982	16923	200375	121187	46955	0.3875	0.7224	0.3252
1983	9710	102857	70406	24600	0.3494	1.0373	0.2735
1984	12714	83954	64626	20945	0.3241	1.0547	0.2472
1985	281583	179889	61918	45052	0.7276	0.9761	0.3223
1986	525331	338672	61918	100563	1.6241	1.0484	0.447
1987	114301	321867	72702	154916	2.1308	0.992	0.627
1988	58068	247801	73117	95255	1.3028	0.9955	0.5325
1989	27154	205196	86342	58518	0.6777	0.9774	0.3923
1990	34682	175611	97951	27182	0.2775	1.0159	0.152
1991	98482	194419	111978	36216	0.3234	1.0374	0.2082
1992	193742	259714	124935	59922	0.4796	0.9797	0.294
1993	626895	419284	126490	82379	0.6513	1.0031	0.38
1994	325327	522832	143513	135186	0.942	1.0056	0.452
1995	108482	524967	163713	142448	0.8701	1.0247	0.3962
1996	102867	467558	202138	178128	0.8812	1.0175	0.4125
1997	114841	385083	206275	154359	0.7483	1.0519	0.4415
1998	71233	275741	152464	100630	0.66	1.0113	0.3872
1999	222065	270246	113796	83195	0.7311	1.021	0.3733
2000	118042	276387	106307	68944	0.6485	1.026	0.2362
2001	378944	388025	136432	89640	0.657	0.9903	0.2302
2002	362211	480755	158522	114798	0.7242	1.011	0.254
2003	270279	560283	199433	138926	0.6966	1.019	0.3485
2004	253945	565160	221817	158279	0.7136	1.0192	0.2878
2005	369805	632313	279242	158298	0.5669	1.0029	0.3385
2006	227707	608814	285805	153157	0.5359	0.9938	0.2735
2007	726300	716748	300838	161525	0.5369	0.9916	0.273
2008	1339523	1000952	314984	155604	0.494	0.9928	0.234
2009	1457159	1395840	379439	200061	0.5273	1.0019	0.1965
2010	601334	1626406	524641	249200	0.475	0.9994	0.1765
2011	256869	1679730	713064	309785	0.4344	0.9978	0.213
2012	429833	1636600	891007	315627	0.3542	0.9994	0.2152
2013	192610	1446766	930284	193744	0.2083	0.9967	0.1288
2014	390266	1336116	878576	177522	0.2021	0.9968	0.1045
2015	114789	1218838	830792	194756	0.2344	0.9953	0.138
2016	285074	1082192	738970	233183	0.3156	1.0006	0.18
2017	244619	873803	550062	227588	0.4137	0.994	0.2685
2018	485605	784760	406205	191276	0.4709	0.9943	0.2945

Table 4.16. Northeast Arctic haddock. Input data for recruitment prediction (RCT3)
NORTHEAST ARCTIC HADDOCK: recruits as 3 year-olds

yearclass	recruitment	NT1	NT2	NT3	NAK1	NAK2	NAK3	RT1	RT2	RT3	EC01	ECO2	ECO3
1990	866.3	NA	NA	NA	1890	868	563	NA	42.9	128.6	NA	NA	NA
1991	299.9	NA	NA	315.2	1135	626	348.7	16.7	28.2	35.7	NA	NA	NA
1992	80	NA	220.9	57.6	947	188	41.5	16.4	4.8	5.8	NA	NA	NA
1993	95.1	593.5	182.1	55.5	887.8	88.6	30	3.5	4.9	4.2	NA	NA	NA
1994	96.7	1393	245	80.9	1198	94.5	57.3	9.1	7.2	5.7	NA	NA	NA
1995	65.2	295.5	93.5	21.2	132.6	26.5	33.8	6.4	2.3	1.9	NA	NA	NA
1996	202	1069	196	57.1	508.9	151	83.7	6	4.6	11.5	NA	NA	NA
1997	82	239.2	79.8	24.1	211	30.1	36.4	1.8	2.9	6.1	NA	NA	NA
1998	352.1	1186	429.8	291.8	653.4	404.8	233.5	10.7	28.9	26.2	NA	NA	NA
1999	359.7	817	450	313.8	1063	266.1	255.2	11.7	20.7	26.1	NA	NA	NA
2000	250.9	1216	464.5	337.8	753	267.9	203.7	15.1	14.9	18.9	NA	NA	NA
2001	222.6	1652	481.3	174.9	1315	362.3	151	20.8	19.3	25.1	NA	NA	NA
2002	360.2	3254	707.3	315.7	2744	466.5	221.3	33.2	32.8	20.6	NA	NA	268
2003	165.6	705.1	369.6	78.8	529	144	56.3	19.8	11	13.6	NA	189	114
2004	900.9	4401	1297	459.1	2277	624.8	209.3	50	79.2	122.7	104	626	929
2005	1272.1	4879	1680	1579	2091	953.5	812.4	62	79.2	214.2	155	2270	1819
2006	1044.5	3654	2072	1237	2016	1754	883.7	53.4	83.9	232.7	283	988	1292
2007	311.5	831.1	329.1	96.1	778.4	209.1	128.1	6.5	12.7	15.8	114	322	144
2008	109.8	550	81.4	52.6	443.9	86	54.2	5.7	2.9	4.3	60	136	65
2009	291.3	1586	354.4	321.6	1559	288.3	191.6	10	19.7	21.7	169	274	114
2010	106.4	670.9	137.3	55.5	428.5	94.5	67.3	7.7	3.5	4.3	154	105	42
2011	334.3	1845	480.2	370.6	1583	407.2	324.5	14.7	30.6	28.3	213	591	223
2012	67.1	335.7	119.8	30.2	292.7	109	23.6	6.9	6	2.2	74	156	75
2013	178	1129	315.2	152.7	1704	224.4	68.5	33	10.2	10.2	163	265	145
2014	149.1	1072	509.2	127.5	1522	105.4	79.9	12	8.3	NA	183	320	84
2015	339.6	2203	734.6	312.6	1260	323.2	157.6	17.6	NA	24.2	343	538	189
2016	NA	4677	1598	1038	3264	760.5	490.6	NA	86.3	NA	496	936	NA
2017	NA	2690	1076	NA	2075	663.5	NA	33.8	NA	NA	931	NA	NA
2018	NA	1791	NA	NA	1473	NA	NA	NA	NA	NA	NA	NA	NA

Recr recruitment estimate from SAM 2019
RT1 Russian bottom trawl survey age 1
RT2 Russian bottom trawl survey age 2
RT3 Russian bottom trawl survey age 3
NT1 Norwegian bottom trawl survey age 1
NT2 Norwegian bottom trawl survey age 2
NT3 Norwegian bottom trawl survey age 3
NA1 Norwegian acoustic survey age 1
NA2 Norwegian acoustic survey age 2
NA3 Norwegian acoustic survey age 3
ECO1 Ecosystem survey age 1
ECO2 Ecosystem survey age 2
ECO3 Ecosystem survey age 3

Table 4.17. Northeast Arctic haddock Analysis by RCT3 ver3.1 - R translation

Data for 12 surveys over 29 year classes : 1990 - 2018
Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied
Final estimates shrunk towards mean
Estimates with S.E.'S greater than that of mean included
Minimum S.E. for any survey taken as 0.2
Minimum of 3 points used for regression
Forecast/Hindcast variance correction used.

yearclass:2012

index	slope	intercept	se	rsquare	n	indices	prediction	se.pred	WAP.weights
NT1	1.1272	-2.45962	0.4163	0.8301	19	5.819	4.100	0.5324	0.043585
NT2	0.8998	0.26847	0.2911	0.9124	20	4.794	4.582	0.3545	0.098272
NT3	0.7652	1.60650	0.3461	0.8795	20	3.440	4.239	0.4374	0.064567
NAK1	1.3772	-3.82337	0.5795	0.7136	20	5.683	4.003	0.7378	0.022694
NAK2	0.9083	0.58152	0.3197	0.8912	20	4.700	4.851	0.3789	0.086050
NAK3	0.9788	0.66985	0.3991	0.8400	20	3.203	3.805	0.5317	0.043697
RT1	1.1795	2.38734	0.5549	0.7395	20	2.067	4.825	0.6541	0.028871
RT2	0.8146	3.30106	0.2551	0.9278	20	1.946	4.886	0.3019	0.135483
RT3	0.6799	3.51079	0.2023	0.9534	20	1.163	4.302	0.2558	0.188800
EC01	4.3907	-15.91572	1.9966	0.2140	8	4.317	3.041	2.7584	0.001623
ECO2	0.9957	-0.09227	0.3249	0.9062	9	5.056	4.942	0.4110	0.073128
ECO3	0.7067	1.97740	0.2025	0.9571	10	4.331	5.038	0.2504	0.197002
VPA Mean	NA	NA	NA	NA	22	NA	5.737	0.8724	0.016229

yearclass:2013

index	slope	intercept	se	rsquare	n	indices	prediction	se.pred	WAP.weights
NT1	1.1108	-2.33608	0.3808	0.8702	20	7.030	5.473	0.4343	0.071862
NT2	0.9461	-0.03209	0.3086	0.9130	20	5.756	5.414	0.3523	0.109201
NT3	0.7700	1.57807	0.3323	0.8997	20	5.035	5.455	0.3791	0.094316
NAK1	1.3477	-3.61428	0.5258	0.7765	20	7.441	6.414	0.6130	0.036075
NAK2	1.0144	-0.07201	0.3774	0.8709	20	5.418	5.424	0.4307	0.073059
NAK3	0.9229	0.98310	0.3787	0.8701	20	4.241	4.897	0.4413	0.069612
RT1	1.3000	2.00089	0.6036	0.7311	20	3.526	6.585	0.7097	0.026911
RT2	0.9027	2.99200	0.3328	0.8966	20	2.416	5.173	0.3826	0.092580
RT3	0.6828	3.49866	0.1930	0.9627	20	2.416	5.148	0.2223	0.274327
EC01	3.6104	-11.97475	1.5452	0.3531	9	5.100	6.438	1.8853	0.003814
ECO2	1.1277	-0.94328	0.4213	0.8712	10	5.583	5.353	0.5025	0.053671
ECO3	0.8171	1.30861	0.3515	0.8993	11	4.984	5.380	0.4141	0.079064
VPA Mean	NA	NA	NA	NA	23	NA	5.630	0.9348	0.015510

yearclass:2014

index	slope	intercept	se	rsquare	n	indices	prediction	se.pred	WAP.weights
NT1	1.1296	-2.4990	0.3666	0.8724	20	6.978	5.384	0.4185	0.106121
NT2	0.9556	-0.1040	0.3056	0.9097	20	6.235	5.854	0.3493	0.152336
NT3	0.7820	1.4912	0.3307	0.8952	20	4.856	5.288	0.3783	0.129831
NAK1	1.4400	-4.3626	0.6471	0.6846	20	7.328	6.190	0.7465	0.033351
NAK2	1.0406	-0.2472	0.3665	0.8712	20	4.667	4.609	0.4354	0.098042
NAK3	0.9080	1.0808	0.3688	0.8698	20	4.393	5.070	0.4253	0.102765
RT1	1.4026	1.5897	0.7603	0.6176	20	2.565	5.187	0.8706	0.024519
RT2	0.9060	2.9824	0.3223	0.8974	20	2.230	5.003	0.3731	0.133521
RT3	NA	NA	NA	NA	NA	NA	NA	NA	NA
EC01	3.8008	-13.0625	1.5794	0.3173	10	5.215	6.759	1.9172	0.005056
ECO2	1.1386	-1.0265	0.4036	0.8689	11	5.771	5.545	0.4737	0.082813
ECO3	0.8288	1.2296	0.3471	0.8937	12	4.443	4.912	0.4126	0.109166
VPA Mean	NA	NA	NA	NA	24	NA	5.592	0.9093	0.022478

yearclass:2015

```
   index  slope intercept     se rsquare  n indices prediction se.pred WAP.weights
     NT1 1.1605   -2.7559 0.3634  0.8685 20   7.698      6.178  0.4220    0.082016
     NT2 1.0082   -0.4852 0.4057  0.8438 20   6.601      6.170  0.4706    0.065947
     NT3 0.7969    1.3875 0.3305  0.8899 20   5.748      5.968  0.3800    0.101150
    NAK1 1.5603   -5.3117 0.7609  0.5989 20   7.140      5.829  0.8693    0.019325
    NAK2 1.0259   -0.1407 0.3577  0.8711 20   5.781      5.791  0.4087    0.087420
    NAK3 0.9070    1.0816 0.3533  0.8739 20   5.066      5.677  0.4029    0.089989
     RT1 1.4368    1.4699 0.7473  0.6125 20   2.923      5.670  0.8519    0.020124
     RT2     NA        NA     NA      NA NA      NA         NA      NA          NA
     RT3 0.6742    3.5332 0.1747  0.9684 19   3.227      5.709  0.2017    0.359071
    EC01 4.1765  -15.1186 1.7405  0.2578 11   5.841      9.275  2.4094    0.002516
    ECO2 1.1791   -1.3155 0.4314  0.8416 12   6.290      6.101  0.5093    0.056303
    ECO3 0.8291    1.2382 0.3351  0.8938 13   5.247      5.588  0.3869    0.097571
 VPA Mean     NA        NA     NA      NA 25      NA      5.531  0.8869    0.018569
yearclass:2016
   index  slope intercept     se rsquare  n indices prediction se.pred WAP.weights
     NT1 1.1497   -2.7132 0.3458  0.8714 20   8.451      7.003  0.4346    0.132074
     NT2 0.9987   -0.4570 0.4030  0.8355 20   7.377      6.910  0.4991    0.100169
     NT3 0.7932    1.3919 0.3148  0.8921 20   6.946      6.901  0.3916    0.162657
    NAK1 1.5633   -5.3519 0.7300  0.6015 20   8.091      7.297  0.9167    0.029687
    NAK2 1.0328   -0.1782 0.3401  0.8743 20   6.635      6.675  0.4122    0.146868
    NAK3 0.9069    1.0946 0.3388  0.8752 20   6.198      6.715  0.4123    0.146798
     RT1     NA        NA     NA      NA NA      NA         NA      NA          NA
     RT2 0.9127    2.9645 0.3195  0.8960 19   4.469      7.044  0.4114    0.147428
     RT3     NA        NA     NA      NA NA      NA         NA      NA          NA
    EC01 3.6146  -12.6493 1.7049  0.2424 12   6.209      9.792  2.4328    0.004215
    ECO2 1.1711   -1.2996 0.4139  0.8378 13   6.843      6.714  0.5098    0.096009
    ECO3     NA        NA     NA      NA NA      NA         NA      NA          NA
 VPA Mean     NA        NA     NA      NA 26      NA      5.533  0.8554    0.034095
yearclass:2017
   index  slope intercept     se rsquare  n indices prediction se.pred WAP.weights
     NT1 1.1490   -2.7151 0.3352  0.8783 19   7.898      6.359  0.4020    0.309083
     NT2 0.9993   -0.4641 0.4122  0.8288 19   6.982      6.513  0.5000    0.199791
     NT3     NA        NA     NA      NA NA      NA         NA      NA          NA
    NAK1 1.5570   -5.3259 0.7347  0.5992 19   7.638      6.567  0.8828    0.064103
    NAK2 1.0358   -0.1955 0.3400  0.8747 19   6.499      6.536  0.4146    0.290698
    NAK3     NA        NA     NA      NA NA      NA         NA      NA          NA
     RT1 1.4875    1.3353 0.7485  0.5937 19   3.550      6.615  0.9021    0.061384
     RT2     NA        NA     NA      NA NA      NA         NA      NA          NA
     RT3     NA        NA     NA      NA NA      NA         NA      NA          NA
    EC01 3.4367  -11.8035 1.6201  0.2590 12   6.837     11.694  2.8388    0.006199
    ECO2     NA        NA     NA      NA NA      NA         NA      NA          NA
    ECO3     NA        NA     NA      NA NA      NA         NA      NA          NA
 VPA Mean     NA        NA     NA      NA 26      NA      5.505  0.8525    0.068742
yearclass:2018
   index slope intercept     se rsquare  n indices prediction se.pred WAP.weights
     NT1 1.146   -2.701 0.3261  0.8834 18   7.491      5.884  0.3860      0.7132
     NT2    NA        NA     NA      NA NA      NA         NA      NA          NA
     NT3    NA        NA     NA      NA NA      NA         NA      NA          NA
    NAK1 1.543   -5.249 0.7401  0.5946 18   7.296      6.011  0.8773      0.1381
    NAK2    NA        NA     NA      NA NA      NA         NA      NA          NA
    NAK3    NA        NA     NA      NA NA      NA         NA      NA          NA
     RT1    NA        NA     NA      NA NA      NA         NA      NA          NA
     RT2    NA        NA     NA      NA NA      NA         NA      NA          NA
     RT3    NA        NA     NA      NA NA      NA         NA      NA          NA
    EC01    NA        NA     NA      NA NA      NA         NA      NA          NA
    ECO2    NA        NA     NA      NA NA      NA         NA      NA          NA
    ECO3    NA        NA     NA      NA NA      NA         NA      NA          NA
 VPA Mean    NA        NA     NA      NA 26      NA      5.471  0.8454      0.1487


                  WAP logWAP int.se
yearclass:2012 103.8  4.643 0.1111
yearclass:2013 212.8  5.361 0.1164
yearclass:2014 196.3  5.279 0.1363
yearclass:2015 338.9  5.826 0.1209
```

```
yearclass:2016 930.1  6.835 0.1580
yearclass:2017 629.3  6.445 0.2235
yearclass:2018 343.9  5.840 0.3260
```

Table 4.18. Northeast Arctic haddock. Prediction with management option table: Input data (based on SAM estimates

MFDP version 1a
Run: 2019
Time and date: 07:55 23.05.2019
Fbar age range: 4-7

2019

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	930100	0.366	0.029	0	0	0.309	0.052	0.859
4	231698	0.255	0.091	0	0	0.554	0.178	1.085
5	75011	0.240	0.278	0	0	0.926	0.330	1.362
6	57257	0.293	0.595	0	0	1.397	0.433	1.652
7	16735	0.2	0.785	0	0	1.638	0.571	1.908
8	18384	0.200	0.930	0	0	2.294	0.648	2.130
9	6254	0.200	0.972	0	0	2.553	0.692	2.310
10	6826	0.200	0.991	0	0	3.089	0.692	2.544
11	3166	0.200	1.000	0	0	3.066	0.692	2.841
12	3672	0.200	1.000	0	0	3.066	0.692	3.013
13	4960	0.200	1.000	0	0	3.066	0.692	3.458

2020

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	629300	0.366	0.028	0	0	0.298	0.052	0.859
4	.	0.255	0.092	0	0	0.558	0.178	1.085
5	.	0.24	0.25	0	0	0.86	0.330	1.362
6	.	0.293	0.556	0	0	1.287	0.433	1.652
7	.	0.200	0.812	0	0	1.801	0.571	1.908
8	.	0.200	0.915	0	0	2.024	0.648	2.130
9	.	0.200	0.975	0	0	2.699	0.692	2.310
10	.	0.200	0.990	0	0	2.947	0.692	2.544
11	.	0.200	1.000	0	0	3.469	0.692	2.841
12	.	0.200	1.000	0	0	3.469	0.692	3.013
13	.	0.200	1.000	0	0	3.469	0.692	3.458

2021

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	343900	0.366	0.039	0	0	0.376	0.052	0.859
4	.	0.255	0.088	0	0	0.543	0.178	1.085
5	.	0.240	0.253	0	0	0.868	0.330	1.362
6	.	0.293	0.523	0	0	1.202	0.433	1.652
7	.	0.200	0.791	0	0	1.668	0.571	1.908
8	.	0.200	0.926	0	0	2.207	0.648	2.13
9	.	0.200	0.969	0	0	2.412	0.692	2.31
10	.	0.200	0.991	0	0	3.097	0.692	2.544
11	.	0.200	1	0	0	3.325	0.692	2.841
12	.	0.200	1	0	0	3.325	0.692	3.013
13	.	0.200	1	0	0	3.325	0.692	3.458

Table 4.19. Northeast Arctic haddock. Prediction with management option table for 2019-2021 (TAC constraint applied for intermediate year)

MFDP version 1a
Run: 2019
2019MFDP Index file 23.05.2019
Time and date: 07:55 23.05.2019
Fbar age range: 4-7

2019						
Biomass	SSB	FMult	FBar	Landings		
708019	220245	0.9084	0.3434	172000		
2020					2021	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
845706	216384	0	0	0	1097902	363570
.	216384	0.1	0.0378	28319	1075083	350302
.	216384	0.2	0.0756	55745	1053100	337660
.	216384	0.3	0.1134	82316	1031913	325611
.	216384	0.4	0.1512	108068	1011486	314122
.	216384	0.5	0.189	133038	991782	303165
.	216384	0.6	0.2268	157256	972768	292710
.	216384	0.7	0.2646	180756	954414	282731
.	216384	0.8	0.3024	203566	936688	273203
.	216384	0.9	0.3402	225716	919562	264102
.	216384	1	0.378	247231	903011	255407
.	216384	1.1	0.4158	268137	887007	247096
.	216384	1.2	0.4536	288459	871527	239149
.	216384	1.3	0.4914	308220	856549	231548
.	216384	1.4	0.5292	327442	842050	224275
.	216384	1.5	0.567	346145	828009	217314
.	216384	1.6	0.6048	364350	814408	210648
.	216384	1.7	0.6426	382076	801228	204262
.	216384	1.8	0.6804	399340	788451	198144
.	216384	1.9	0.7182	416160	776061	192278
.	216384	2	0.756	432552	764041	186654

Table 4.20. Northeast Arctic haddock. Prediction single option table for 2019-2021 based on HCR

MFDP version 1a
Run: HCR
Time and date: 08:33 23.05.2019
Fbar age range: 4-7

Year:	2019	F multiplier:	0.9084	Fbar:	0.3434				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan	SSB(Jan	SSNos(ST	SSB(ST
3	0.0472	35989	30914	930100	287401	26973	8335	26973	8335
4	0.1617	30639	33243	231698	128361	21085	11681	21085	11681
5	0.2998	17377	23667	75011	69460	20853	19310	20853	19310
6	0.3933	16295	26919	57257	79988	34068	47593	34068	47593
7	0.5187	6191	11813	16735	27412	13137	21518	13137	21518
8	0.5886	7486	15945	18384	42173	17097	39221	17097	39221
9	0.6286	2673	6174	6254	15966	6079	15519	6079	15519
10	0.6286	2917	7422	6826	21086	6765	20896	6765	20896
11	0.6286	1353	3844	3166	9707	3166	9707	3166	9707
12	0.6286	1569	4728	3672	11258	3672	11258	3672	11258
13	0.6286	2120	7330	4960	15207	4960	15207	4960	15207
Total		124609	172000	1354063	708019	157854	220245	157854	220245
Year:	2020	F multiplier:	0.8513	Fbar:	0.3218				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
3	0.0443	22849	19628	629300	187531	17620	5251	17620	5251
4	0.1515	76604	83116	615266	343319	56604	31585	56604	31585
5	0.2809	33443	45550	152740	131357	38185	32839	38185	32839
6	0.3686	11789	19476	43722	56271	24310	31287	24310	31287
7	0.4861	10138	19344	28824	51912	23405	42153	23405	42153
8	0.5516	3163	6737	8156	16509	7463	15105	7463	15105
9	0.5891	3404	7863	8355	22550	8146	21986	8146	21986
10	0.5891	1113	2830	2731	8048	2704	7967	2704	7967
11	0.5891	1214	3450	2981	10340	2981	10340	2981	10340
12	0.5891	563	1697	1382	4796	1382	4796	1382	4796
13	0.5891	1536	5310	3769	13075	3769	13075	3769	13075
Total		165817	215000	1497227	845706	186569	216384	186569	216384
Year:	2021	F multiplier:	0.9259	Fbar:	0.35				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
3	0.0481	13558	11646	343900	129306	13412	5043	13412	5043
4	0.1648	56195	60972	417524	226716	36742	19951	36742	19951
5	0.3056	96496	131427	409744	355657	103665	89981	103665	89981
6	0.4009	26229	43330	90724	109050	47449	57033	47449	57033
7	0.5287	8471	16162	22562	37633	17847	29768	17847	29768
8	0.6	5995	12768	14514	32033	13440	29663	13440	29663
9	0.6407	1667	3851	3847	9278	3727	8990	3727	8990
10	0.6407	1645	4184	3795	11754	3761	11648	3761	11648
11	0.6407	538	1527	1241	4125	1241	4125	1241	4125
12	0.6407	587	1768	1354	4502	1354	4502	1354	4502
13	0.6407	1014	3507	2340	7781	2340	7781	2340	7781
Total		212393	291143	1311545	927837	244978	268486	244978	268486

Table 4.21. Northeast Arctic haddock. Yield-per-recruit. Input data and results.

MFYPR version 2a
Run: 2019
Time and date: 09:24 23.05.2019
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	4.3935	6.3615	2.1395	4.9413	2.1395	4.9413
0.1	0.0516	0.1155	0.2404	3.8392	4.8276	1.6172	3.4511	1.6172	3.4511
0.2	0.1031	0.188	0.3638	3.498	3.9323	1.3061	2.5959	1.3061	2.5959
0.3	0.1547	0.2392	0.4359	3.2626	3.3479	1.0987	2.0483	1.0987	2.0483
0.4	0.2063	0.2781	0.4824	3.0875	2.9373	0.9502	1.6718	0.9502	1.6718
0.5	0.2578	0.3091	0.5145	2.9506	2.6334	0.8382	1.3994	0.8382	1.3994
0.6	0.3094	0.3348	0.5382	2.8393	2.3994	0.7506	1.1947	0.7506	1.1947
0.7	0.3609	0.3567	0.5563	2.7463	2.2136	0.6801	1.0362	0.6801	1.0362
0.8	0.4125	0.3757	0.5707	2.6669	2.0623	0.622	0.9105	0.622	0.9105
0.9	0.4641	0.3924	0.5825	2.5978	1.9366	0.5733	0.8087	0.5733	0.8087
1	0.5156	0.4074	0.5923	2.5369	1.8304	0.5317	0.725	0.5317	0.725
1.1	0.5672	0.421	0.6007	2.4826	1.7393	0.4959	0.655	0.4959	0.655
1.2	0.6188	0.4333	0.6079	2.4337	1.6601	0.4647	0.5959	0.4647	0.5959
1.3	0.6703	0.4446	0.6143	2.3892	1.5907	0.4373	0.5454	0.4373	0.5454
1.4	0.7219	0.4551	0.6198	2.3486	1.5291	0.4129	0.5017	0.4129	0.5017
1.5	0.7735	0.4648	0.6248	2.3112	1.4742	0.3911	0.4637	0.3911	0.4637
1.6	0.825	0.4738	0.6292	2.2766	1.4247	0.3716	0.4304	0.3716	0.4304
1.7	0.8766	0.4823	0.6332	2.2445	1.3799	0.3539	0.401	0.3539	0.401
1.8	0.9281	0.4903	0.6368	2.2145	1.3391	0.3379	0.3749	0.3379	0.3749
1.9	0.9797	0.4978	0.6402	2.1864	1.3018	0.3233	0.3515	0.3233	0.3515
2	1.0313	0.5049	0.6432	2.16	1.2674	0.3099	0.3305	0.3099	0.3305
Reference point	F multi	Absolute F							
Fbar(3-13)	1	0.5156							
FMax	>=1000000								
F0.1	0.4269	0.2201							
F35%SPR	0.3823	0.1971							

Table B1. HADDOCK. Abundance indices from bottom trawl surveys in the Barents Sea winter 1981-2018 (numbers in millions). 1981-1992 includes only main areas A, B, C and D.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+	10+	Total	Biomass
1981	7	14	5	21	60	18	1	+	+							+	126	166
1982	9	2	3	4	4	10	6	+	+							+	36	50
1983	0	5	2	3	1	1	4	2	+							+	18	25
1984	1685	173	6	2	1	+	+	+	+							+	1867	101
1985	1530	776	215	5	+	+	+	+	+							+	2526	259
1986	556	266	452	189	+	+	+	+	+							+	1463	333
1987	85	17	49	171	50	+	+	+	0							+	372	157
1988	18	4	8	23	46	7	+	0	0							+	106	56
1989	52	5	6	11	20	21	2	0	0							0	117	49
1990	270	35	3	3	4	7	11	2	+							+	335	51
1991	1890	252	45	8	3	3	3	6	+							0	2210	166
1992	1135	868	134	23	2	+	+	1	2							+	2165	239
1993	947	626	563	130	13	+	+	+	+							3	2282	385
1994	593.50	220.90	315.20	427.90	48.30	3.39	0.14	0.17	0.16	0.14	0.45	0.04	0.00	0.00	0.00	0.63	1610.4	402.5
1995	#######	182.10	57.60	163.00	338.40	28.80	1.87	0.03	0.04	0.04	0.00	0.25	0.11	0.00	0.00	0.40	2165.1	435.7
1996	295.50	245.00	55.50	32.50	161.00	250.90	18.30	1.11	0.00	0.01	0.00	0.03	0.03	0.00	0.00	0.07	1059.9	453.3
1997*	#######	93.50	80.90	39.60	18.20	61.40	87.30	3.22	0.08	0.00	0.00	0.00	0.03	0.02	0.00	0.05	1452.8	284.5
1998*	239.20	196.00	21.20	36.10	12.80	3.24	8.15	5.94	0.56	0.03	0.02	0.00	0.00	0.00	0.05	0.10	523.3	85.2
1999	#######	79.80	57.10	15.60	9.36	2.87	0.86	1.30	0.74	0.01	0.00	0.02	0.00	0.00	0.00	0.03	1354.2	85.5
2000	817.00	429.80	24.10	35.80	6.91	4.05	0.65	0.01	0.81	0.24	0.03	0.03	0.01	0.00	0.00	0.31	1319.5	123.3
2001	#######	450.00	291.80	26.10	22.70	1.73	0.78	0.06	0.06	0.05	0.16	0.10	0.02	0.00	0.01	0.34	2009.1	226.6
2002	#######	464.50	313.80	186.80	11.90	8.43	0.86	0.19	0.00	0.10	0.15	0.04	0.04	0.00	0.00	0.33	2638.9	307
2003	#######	481.30	337.80	175.10	72.30	5.04	1.73	0.12	0.09	0.09	0.09	0.01	0.01	0.00	0.00	0.20	4328.1	408.3
2004	705.10	707.30	174.90	99.30	77.70	50.90	7.37	0.89	0.13	0.04	0.05	0.04	0.04	0.07	0.00	0.24	1824.2	307.5
2005	#######	369.60	315.70	140.10	50.90	61.70	10.20	0.25	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.01	5349.5	427.1
2006**	#######	#######	78.80	129.80	45.50	22.60	15.90	3.20	0.09	0.14	0.00	0.04	0.00	0.00	0.07	0.25	6470.4	449.1
2007*	#######	#######	459.10	81.00	84.80	26.10	5.38	2.23	1.35	0.77	0.07	0.00	0.00	0.00	0.03	0.87	5995	677.3
2008	831.10	#######	#######	581.30	52.90	54.00	7.05	10.60	0.16	0.04	0.08	0.05	0.00	0.00	0.00	0.17	5189.1	1099.2
2009	550.00	329.10	#######	760.10	372.30	25.80	12.30	0.85	0.09	0.34	0.00	0.01	0.00	0.00	0.00	0.35	3288.1	986.5
2010	#######	81.40	96.10	492.80	454.60	149.40	7.80	0.99	0.35	0.42	0.03	0.02	0.00	0.00	0.00	0.47	2870.5	760.6
2011	670.90	354.40	52.60	125.70	472.50	293.60	66.30	1.45	1.11	0.00	0.00	0.14	0.03	0.00	0.00	0.17	2038.6	834.4
2012**	#######	137.30	321.60	29.10	76.10	270.90	156.40	24.50	2.64	0.31	0.04	0.07	0.00	0.00	0.00	0.42	2863.7	747.2
2013	335.70	480.20	55.50	146.00	20.90	34.20	193.80	68.60	6.00	0.08	0.00	0.00	0.00	0.00	0.00	0.08	1340.9	602.3
2014	#######	119.80	370.60	30.30	100.40	21.90	46.50	95.20	40.00	1.52	0.46	0.00	0.00	0.02	0.00	2.00	1955.7	631.3
2015	#######	315.20	30.20	176.70	44.10	35.60	13.60	18.30	27.70	7.76	0.28	0.13	0.00	0.00	0.00	8.17	1741.2	373.2
2016	#######	509.20	152.70	32.90	105.80	19.60	40.00	10.30	27.50	24.70	4.04	0.92	0.00	0.14	0.06	29.86	3130.8	518.8
2017**	#######	734.60	127.50	95.80	4.32	45.10	8.72	13.00	1.20	8.02	5.94	3.18	0.72	0.00	0.00	17.86	5742.8	485.2
2018	2690.3	1608.3	321.2	84	61	5.57	11.9	2.75	2.01	1.33	3.95	3.46	0.82	0.13	0	9.69	4796.8	497.6
2019	1791	1076.2	1038.3	179.7	45.9	15.8	3.78	2.79	0.69	0.97	0.14	0.29	0.17	0.01	0.03	1.61	4155.8	567.4

Table B2 Northeast Arctic haddock. Results from the Russian trawl survey (RU-BTr-Q4) in the Barents Sea and adjacent waters in late autumn (numbers per hour trawling).

Year \Age	0	1	2	3	4	5	6	7	8	9	10+	Total
					Sub-area I							
1983	39.9	97.3	16.5	0.8	0.7	+	-	-	-	-	1.1	156.3
1984	9.7	100.2	110.6	2.8	0.4	0.2	+	-	-	-	0.7	224.6
1985	3.9	19.1	213.4	168.8	0.8	0.2	0.1	-	-	-	0.3	406.6
1986	0.2	2.3	16.6	58.1	27.6	0.1	+	+	+	-	-	105
1987	0.4	1.4	2.5	12.5	34.2	8.6	+	+	-	+	-	59.8
1988	1.9	0.4	1.1	2.8	6.2	11.6	1.1	+	+	+	-	25.2
1989	3.3	3	3.6	0.7	2.5	7.1	13.9	1.8	0.1	+	-	36
1990	71.7	22.2	18.6	13.2	7.5	13.2	13.3	10.3	0.6	0.1	-	170.7
1991	15.9	61.5	27.5	10.8	1.6	0.6	1	3.3	2.6	0.3	-	125.1
1992	19.6	44.2	180.6	52.1	8.4	0.7	1	1.6	1.3	0.2	-	309.7
1993	5.5	8.1	69.2	371.5	78.4	10.2	1.4	0.7	0.8	1.8	-	547.7
1994	13.5	6.7	8	65.9	146	15.9	1.7	0.1	0.2	0.7	-	258.8
1995	9.9	12.7	6.5	4	26.8	77.6	7.3	1	0.1	0.5	-	146.3
1996 (1	5	3.1	5.6	3.4	7.7	62.3	56.5	4.8	0.4	0.6	-	149.3
1997 (1	2.7	6.9	3.2	5.3	5.5	1.5	4.5	1.7	1.5	-	-	32.7
1998	10.5	2.9	17.2	6.7	7.8	0.6	0.9	2.1	0.7	+	-	49.4
1999	6.9	34.9	8.8	34	5.3	5.6	1.2	0.3	0.9	0.3	-	98.2
2000	18	25.4	37.5	9.3	13	3.2	1.1	0.2	0.1	0.4	-	108.3
2001	30.5	18.6	42.3	58.9	5.8	6.8	0.8	0.5	0.1	0.1	-	164.5
2002 (2	39.7	29.2	29.4	69.2	74.7	6.7	3.2	0.6	0.1	0.2	-	252.7
2003	28.1	38.9	35.4	28.1	43	28	3.5	0.8	0.1	0.1	-	206
2004	47.9	12	27.9	18.6	12.8	16.1	12.4	0.8	0.3	0.1	-	148.9
2005	62.7	109.6	20.7	34.4	12.4	6.5	7.1	2.5	0.1	0.1	-	256.1
2006 (3	48	168.7	157.9	15.2	25.5	7.3	3.1	2.7	0.8	0.2	-	429.4
2007	4.3	90.2	153.6	98.7	9.1	9	2.3	0.7	0.4	0.1	-	368.5
2008	5.9	14.6	284.4	283.4	153	17.2	11.8	1.5	0.3	0.3	-	772.5
2009	14.7	3.2	25.2	243.8	264.8	102.5	8.8	4.3	0.6	0.4	-	668.4
2010	6.6	25.6	4.7	46.2	223.3	204.5	60	2.4	1.2	0.3	-	574.8
2011	16.7	4.8	32.1	6.6	37.9	127.1	96.9	20.9	1.2	0.4	-	344.6
2012	7.6	32.3	6.2	29.6	7.3	23	92.9	63.4	8	0.8	-	271.1
2013	14.1	4.7	38.2	9.8	26	8.1	13.3	35.2	25.2	4.1	-	178.6
2014	9	10.6	2.7	29.3	6.5	24	8.4	19.3	40.2	14.7	-	164.5
2015	16.2	7.3	13.1	2.8	27	5.5	10.9	3.8	8.2	12	-	106.7
2016 (4	-	-	-	-	-	-	-	-	-	-	-	-
2017	43.5	134.8	37.2	11.3	15	1.3	3.7	0.7	0.9	1.8		250.1
2018 (4	-	-	-	-	-	-	-	-	-	-	-	-
					Division IIa							
1983	5.4	5.5	0.1	0.2	0.3	0.1	-	-	-	-	1	12.6
1984	4.9	14.4	5.6	0.1	0.1	0.1	-	-	-	-	0.2	25.4
1985	3.8	7	11.7	4.1	0.1	-	+	-	-	-	0.1	26.8
1986	0.4	0.3	3.5	10.4	2.9	0.1	+	+	-	-	-	17.6
1987	-	-	-	-	0.3	0.3	-	-	-	-	-	0.6
1988	1	0.1	-	+	0.2	0.5	0.2	-	-	-	-	2.1
1989	0.1	0.7	2.7	+	0.1	0.1	0.1	-	-	-	-	3.8
1990	6.1	0.9	0.9	0.1	0.1	0.1	0.1	0.1	-	-	-	8.4
1991	5.7	3.8	0.6	0.1	+	-	-	-	-	-	-	10.2
1992	1.2	2.3	5.6	2.3	3	0.3	0.3	0.4	0.4	-	-	15.8
1993	1.8	1.1	1.5	4.5	2.5	0.8	0.2	0.1	0.2	0.2	-	12.8
1994	1	0.6	0.5	3.1	15.9	4.4	1.5	+	0.1	0.1	-	27.2
1995	5	8.5	6.3	5.3	6.2	23.9	4.1	0.6	+	0.2	-	60.1
1996 (1	29.2	4.1	25	8.1	4.9	9.1	13.4	1.3	0.4	0.1	-	95.7
1997 (1	1.2	2.8	0.8	1.3	0.7	0.6	0.9	0.5	0.1	-	-	8.9
1998	23.2	7.8	15.5	1.1	2.4	3.2	0.5	2.8	0.8	0.1	-	57.3
1999	34.8	34.1	4.3	16.9	3.9	6.3	1.7	0.9	1.2	0.5	-	104.6
2000	27.9	23.9	13.5	1.8	9.3	2	0.9	0.2	0.2	0.4	-	80.1
2001	39	13.5	7.6	8.4	2.2	7.9	1.4	0.3	0.1	0.4	-	80.8
2002 (2	61.9	16.6	5.3	10.2	29.9	6	3.3	0.3	0.1	0.2	-	133.7
2003	20.6	30.8	9.8	8.3	10.4	16.1	2.4	2.1	0.2	+	-	100.7
2004	100.2	32.8	18.1	4.5	5.5	7.2	8.1	0.7	1.1	0.3	-	178.4
2005	61.6	23.9	4.6	10.9	2.1	2.7	5.3	2.9	0.5	0.2	-	114.6
2006 (3	33.3	36.9	15.2	1.9	8.2	3.4	2.5	1.8	1.8	0.3	-	105.5
2007	28.2	96	33.9	14.1	2.1	5.1	2.2	0.6	0.9	0.4	-	183.4
2008	13.6	23.8	64.3	26.8	9.6	1.8	2.6	0.4	0.3	0.3	-	143.6
2009	8.6	5.7	7.6	34.5	23.2	9.2	1.2	1.7	0.2	0.1	-	91.9
2010	19.9	31.2	9.6	7.4	29.3	22.3	10.8	1	1.1	0.2	-	132.8
2011	13.6	2.2	8.2	1.8	1.7	20	16.4	4.3	0.2	0.4	-	68.8
2012	14.1	24.6	1.9	9.1	3	5	13.4	11.5	1.5	0.3	-	84.6
2013	24.8	8.1	9.1	2.4	7.9	2.4	4.7	31.6	17.7	5.8	-	114.4
2014	34.8	11	1.3	7.8	0.6	3.9	0.7	2.6	5.7	2.6	-	71.2
2015	16.2	9.4	3.7	0.3	6.5	1.4	2.1	1.5	1.6	4.1	-	46.8
2016 (4	-	-	-	-	-	-	-	-	-	-	-	-
2017	1.8	2.4	1.1	0.8	1.6	0.2	0.9	0.2	0.3	0.3		9.3
2018 (4	-	-	-	-	-	-	-	-	-	-	-	-

Table B2. (Continuation)

Division IIb												
1983	22.1	9.9	0.2	0.1	+	+	-	-	-	-	0.1	32.4
1984	2.2	14.3	1.8	-	-	-	-	-	-	-	+	18.3
1985	1.4	10.2	61.4	5.1	+	+	+	-	-	-	+	78.1
1986	+	0.2	3.1	7.2	1.4	-	+	-	-	-	-	12
1987	-	-	0.1	0.7	1.4	0.5	+	-	-	-	-	2.8
1988	0.2	-	-	+	0.3	1.1	0.2	-	+	-	-	1.8
1989	0.7	0.1	0.2	+	0.1	0.3	0.6	0.1	+	-	-	2.1
1990	12.9	5.4	0.8	+	+	0.2	0.1	0.1	+	-	-	19.5
1991	20	22.9	6.2	0.4	0.1	0.1	0.1	+	+	-	-	49.8
1992	13.3	9.1	69.8	13.9	0.5	+	+	-	+	+	-	106.6
1993	0.7	0.9	1.9	24.7	1.9	0.2	+	+	+	+	-	30.4
1994	0.4	1.7	1.7	2.3	15.7	2.7	0.8	0.2	+	+	-	25.5
1995	0.1	0.4	0.4	0.8	0.6	1.6	0.4	+	+	+	-	4.3
1996 (1	4.3	0.6	0.5	0.3	0.2	0.4	0.5	0.3	-	-	-	7.1
1997 (1	0.4	1.1	0.1	0.1	0.1	0.1	0.1	0.1	+	+	-	2.1
1998	5.8	1.1	0.2	+	0.1	0.1	+	0.1	+	-	-	7.5
1999	8.6	20.1	1.8	1.2	0.5	0.3	0.1	-	0.2	0.1	-	32.9
2000	7.9	10	13.4	1.3	5.5	2.2	1.2	0.4	0.2	0.3	-	42.4
2001	2.7	13.1	15.9	11.4	0.8	4.7	1.2	0.4	0.1	0.6	-	51
2002 (2	9	4.2	7.7	5.1	2.6	0.7	0.8	0.1	0.1	0.1	-	30.4
2003	3.6	21.5	10.4	15.5	11.3	15.9	3.6	3	0.4	0.3	-	85.7
2004	34.9	5.6	6.4	1.3	2.6	1.8	2.9	0.1	0.2	0.1	-	56
2005	60.9	43.5	4.1	10.3	4.1	2.7	3.6	2.2	0.1	0.3	-	131.7
2006 (3	75.4	110.6	71.6	4.6	6.1	2.4	1.4	2	1.8	0.3	-	276.2
2007	3.3	67.3	396.4	78.7	5.5	26	7.3	2.9	2.6	0.8	-	590.9
2008	1.5	3.8	204.1	304.3	50.7	7.4	13.6	2.9	2	0.7	-	591.9
2009	2.6	1.1	3.5	93.6	81	22	2.4	2.1	0.3	0.5	-	209
2010	4.3	4.5	1.3	11.1	136.5	138.4	38.6	6.3	1.7	0.6	-	343.2
2011	10.8	1.2	4.3	1.7	12	100.8	60.5	11.5	0.5	0.3	-	203.7
2012	3.1	29.2	1.4	8	0.7	6.3	51.5	30.8	4.9	0.3	-	136.2
2013	64.2	7.1	19.9	1.8	8.1	1.1	8.2	42.8	22	3.3	-	178.3
2014	5.6	8.4	1.2	24.3	2	7.5	1.6	6.9	15.3	9.8	-	82.7
2015	21.8	8.3	7.6	2	12.2	2.2	3.7	1.4	4.7	10.3	-	74.3
2016 (4	-	-	-	-	-	-	-	-	-	-	-	-
2017	22.3	21.6	7	1.4	3	0.4	4.4	0.6	0.6	2.1		63.4
Total-Sub-area I and Divisions IIa and IIb												
1983	29.8	59.2	9.5	0.5	0.4	+	-	-	-	-	0.8	100.2
1984	6.4	58.6	58.4	1.5	0.2	0.1	+	-	-	-	0.3	125.5
1985	3	14.4	134.3	90	0.4	0.1	0.1	-	-	-	0.2	242.7
1986	0.2	1.4	10.7	36.3	16.4	0.1	+	+	+	-	+	65.1
1987	0.3	0.9	1.7	8.3	22.5	5.7	+	+	-	+	-	39.4
1988	1.3	0.3	0.7	1.7	4	7.6	0.8	+	+	+	-	16.4
1989	2.2	1.8	2.4	0.4	1.4	4.1	8.1	1.1	0.1	+	-	21.6
1990	44.8	14.3	10.6	7.3	4.2	7.3	7.4	5.7	0.3	0.1	-	102
1991	16.7	42.9	17.6	6.2	0.9	0.3	0.6	1.8	1.5	0.2	-	88.7
1992	16.4	28.2	128.6	34.6	5	0.4	0.6	0.9	0.8	0.1	-	215.6
1993	3.5	4.8	35.7	198.5	35.6	4.8	0.8	0.4	0.4	-	-	284.5
1994	9.1	4.9	5.8	44.2	101.4	11.6	1.5	0.1	0.1	0.5	-	179.2
1995	6.4	7.2	4.2	3.1	12.3	37	4	0.5	0.1	0.3	-	75.1
1996 (1	6	2.3	5.7	2.8	4.9	36.2	33.4	2.9	0.3	0.3	-	94.8
1997 (1	1.8	4.6	1.9	3.2	3.2	1	2.7	1	0.8	-	-	20.2
1998	10.7	2.9	11.5	3.8	4.6	0.8	0.5	1.5	0.5	+	-	36.8
1999	11.7	28.9	6.1	19.6	3.9	3.7	0.8	0.3	0.7	0.7	-	76.4
2000	15.1	20.7	26.2	6	10.9	2.6	1.1	0.2	0.1	0.4	-	83.3
2001	20.8	14.9	26.1	33.4	4	6.5	1.1	0.4	0.1	0.3	-	107.5
2002 (2	33.2	19.3	18.9	39.9	45	4.7	2.4	0.4	0.1	0.2	-	164
2003	19.8	32.8	25.1	22.1	29.9	23.1	3.4	1.6	0.2	0.1	-	158.3
2004	50	11	20.6	11.3	9.4	10.7	8.7	0.5	0.4	0.2	-	122.8
2005	62	79.2	13.6	24	8.6	4.8	5.7	2.4	0.1	0.2	-	200.7
2006 (3	53.4	79.2	122.7	11.3	11.9	5.7	2.6	2.4	1.1	0.2	-	290.5
2007	6.5	83.9	214.2	83.8	7.3	13.7	3.8	1.4	1.1	0.4	-	416
2008	5.7	12.7	232.7	255.7	105.1	12.4	11.1	1.7	0.7	0.4	-	638.7
2009	10	2.9	15.8	164.7	170.4	63.1	5.7	3.2	0.5	0.4	-	436.7
2010	7.7	19.7	4.3	29.9	169.7	158.9	46.6	3.4	1.4	0.3	-	441.9
2011	14.7	3.5	21.7	4.7	26.8	108.7	78.3	16.5	0.9	0.4	-	276.3
2012	6.9	30.6	4.3	20.9	4.9	16	72	48	6.4	0.6	-	210.5
2013	33	6	28.3	6.1	17.5	5	10.4	37.4	23.2	4	-	170.7
2014	12	10.2	2.2	25	4.6	17.5	5.6	14.2	29.8	11.8	-	133.2
2015	17.6	8.3	10.2	2.2	19.9	4	7.4	2.8	6.3	10.8	-	89.5
2016 (4	-	-	-	-	-	-	-	-	-	-	-	-
2017	33.8	86.3	24.2	7.1	9.9	0.9	3.8	0.6	0.8	1.9		169.2
2018 (4	-	-	-	-	-	-	-	-	-	-	-	-

(1 Adjusted data based on average 1985–1995 distribution.

(2 Adjusted based on 2001 distribution.

(3 Adjusted based on 2004-2006 distribution. + means value <0.1; - means 0 value

(4 Not conducted survey

Table B3 Northeast Arctic HADDOCK. Results from the Joint Barents Sea acoustic survey (BS-NoRu-Q1 (Aco)) in the Barents Sea in January-March. Stock numbers in millions.

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+	10+	Total
1981	7	14	5	21	60	18	1	0	0	0							126
1982	9	2	3	4	4	10	6	0	0	0							38
1983	0	5	2	3	1	1	4	2	0	0							18
1984	1685	173	6	2	1	0	0	0	0	0							1867
1985	1530	776	215	5	0	0	0	0	0	0							2526
1986	556	266	452	189	0	0	0	0	0	0							1463
1987	85	17	49	171	50	0	0	0	0	0							372
1988	18	4	8	23	46	7	0	0	0	0							106
1989	52	5	6	11	20	21	2	0	0	0							117
1990	270	35	3	3	4	7	11	2	0	0							335
1991	1890	252	45	8	3	3	3	6	0	0							2210
1992	1135	868	134	23	2	0	0	1	2	0							2165
1993	947	626	563	130	13	0	0	0	0	3							2282
1994	887.8	188.0	348.7	626.6	121.4	8.6	0.7	0.3	0.6	0.5	1.5	0.2	0.0	0.0	0.0	2	2184.8
1995	1198.2	88.6	41.5	121.5	395.4	47.6	2.8	0.1	0.1	0.0	0.0	0.5	0.1	0.0	0.0	1	1896.4
1996	132.6	94.5	30.0	22.1	68.7	143.7	5.7	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	498.2
1997*	508.9	26.5	57.3	22.2	15.5	56.1	62.8	4.7	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0	754.1
1998*	211.0	151.0	33.8	58.8	24.2	7.7	14.1	20.7	1.4	0.0	0.0	0.0	0.0	0.0	0.1	0	522.8
1999	653.4	30.1	83.7	21.6	22.1	6.2	1.6	3.9	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0	825.3
2000	1063.0	404.8	36.4	75.5	14.0	12.6	1.6	0.5	2.0	0.7	0.2	0.1	0.0	0.0	0.0	1	1611.5
2001	753.0	266.1	233.5	40.2	41.4	2.2	1.6	0.2	0.1	0.1	0.3	0.1	0.1	0.0	0.0	1	1338.8
2002	1315.2	267.9	255.2	201.8	18.5	11.7	1.6	0.3	0.0	0.1	0.3	0.1	0.1	0.0	0.0	1	2072.7
2003	2743.7	362.3	203.7	184.6	136.0	12.3	6.0	0.3	0.1	0.3	0.3	0.1	0.1	0.0	0.0	1	3649.8
2004	529.0	466.5	151.0	101.8	107.8	57.7	7.6	1.2	0.3	0.0	0.1	0.1	0.0	0.1	0.0	0	1423.2
2005	2276.5	144.0	221.3	115.7	57.4	56.7	12.7	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0	2885.0
2006**	2091.1	624.8	56.3	123.8	47.4	19.3	13.6	3.2	0.1	0.2	0.0	0.0	0.0	0.0	0.1	0	2979.9
2007*	2015.7	953.5	209.3	46.1	80.6	28.9	10.0	5.1	2.3	0.3	0.2	0.0	0.0	0.0	0.1	1	3352.0
2008	778.4	1753.5	812.4	303.0	90.0	74.1	7.4	12.8	1.6	0.1	0.2	0.2	0.0	0.0	0.0	0	3833.8
2009	443.9	209.1	883.7	630.0	266.6	38.9	14.6	1.3	0.3	0.7	0.7	0.0	0.1	0.0	0.0	1	2489.0
2010	1559.4	86.0	128.1	631.0	604.0	167.0	12.1	2.9	1.0	1.0	0.1	0.1	0.0	0.0	0.0	1	3192.6
2011	428.5	288.3	54.2	84.2	313.0	292.2	54.9	1.7	1.0	0.2	0.0	0.2	0.1	0.0	0.0	1	1518.4
2012**	1583.4	94.5	191.6	48.8	88.1	310.6	172.5	30.1	0.5	0.3	0.0	0.1	0.0	0.0	0.0	0	2520.8
2013	292.7	407.2	67.3	146.8	35.4	53.0	223.8	102.7	14.1	0.3	0.0	0.0	0.0	0.0	0.0	0	1343.2
2014	1703.7	109.0	324.5	38.2	107.9	22.4	33.8	84.5	35.3	1.5	0.5	0.0	0.0	0.0	0.0	2	2461.4
2015	1521.9	224.4	23.6	171.5	25.5	39.4	8.3	21.1	17.3	6.8	0.4	0.2	0.0	0.0	0.0	7	2060.5
2016	1260.3	105.4	68.5	11.8	56.0	11.8	16.6	6.9	15.5	11.9	2.4	0.5	0.0	0.0	0.0	15	1567.5
2017**	3263.8	323.2	79.9	62.8	4.4	32.2	5.8	7.0	1.5	6.4	5.5	2.0	0.4	0.0	0.0	14	3795.1
2018	2074.8	759.2	158.7	60.3	60.7	5.7	12.8	2.3	2.2	1.3	5.0	2.6	1.4	0.2	0.0	10.4	3147.1
2019	1472.7	663.5	490.6	142.0	29.7	21.2	4.5	3.4	1.0	1.5	0.4	0.5	0.3	0.2	0.1	3.0	2832.2

*** Indices raised to also represent the Russian EEZ.**

**** Indices raised to also represent uncovered parts of the Russian EEZ.**

Table B4. Northeast Arctic HADDOCK. Results from the Russian trawl-acoustic survey (RU-Aco-Q4) in the Barents Sea and adjacent waters in late autumn (new method). Index of number of fish at age (+ means value <1; - means 0 value).

Year	0	1	2	3	4	5	6	7	8	9	10+	Total
1995 (5	163	170	79	71	230	404	41	5	1	1	2	1168
1996 (1,3	992	245	291	91	63	206	187	17	1	+	+	2092
1997 (1,3	185	104	21	121	94	48	47	31	20	+	+	671
1998 (2	257	44	83	20	20	6	2	7	2	+	+	442
1999 (1	632	499	60	123	14	16	4	1	4	1	+	1355
2000 (1	524	395	287	54	57	14	6	1	1	1	1	1340
2001 (1	491	160	227	221	19	35	5	2	1	1	1	1163
2002 (1,4,5,6	1045	209	139	268	239	27	17	2	1	+	1	1947
2003	1168	473	217	116	134	94	14	6	1	+	+	2223
2004	8529	1141	342	116	54	55	44	3	4	1	1	10289
2005	17782	2903	123	205	62	33	38	16	1	1	+	21165
2006 (7	9396	1286	308	30	31	10	-	5	5	4	1	11075
2007	812	1473	2226	745	53	75	22	8	7	2	1	5423
2008	245	203	2134	1947	728	88	83	13	6	4	2	5455
2009	1650	204	243	1455	1258	485	46	30	4	2	1	5380
2010	1033	643	133	267	1032	923	274	19	9	1	1	4335
2011	1603	137	242	40	166	631	459	96	5	1	1	3383
2012	320	501	52	166	35	101	429	286	37	2	+	1931
2013	1843	373	625	105	145	40	74	261	167	29	1	3665
2014	551	238	37	240	30	98	32	77	162	58	6	1529
2015	1032	334	176	28	161	30	58	21	49	62	19	1972
2016 (8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2017	1573	1601	409	109	133	12	39	6	8	4	13	3907
2018 (8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(1 October-December

(2 September-October

(3 November-January

(4 Adjusted based on average 1985-1995 distribution

(5 Adjusted based on 2001 distribution

(6 Adjusted data in 2004

(7 Not adjusted data to the whole area

(8 Not conducted

Table B5 Northeast Arctic HADDOCK. Results from the joint ecosystem survey (Eco-NoRu-Q3 (Btr)) in August-September in the Subareas 2 and 2. Indices of numbers (in millions) of fish at age (+ means value <0.5).

	Age													
Year	0	1	2	3	4	5	6	7	8	9	10	11	12+	Total
2004	104	189	268	123	70	69	31	3	2	0	+	0	+	861
2005	155	626	114	323	89	29	31	15	+	+	+	+	+	1383
2006	283	2270	929	107	125	42	19	17	7	1	+	+	+	3802
2007	114	988	1819	1283	88	94	19	6	7	2	1	+	+	4421
2008	60	322	1292	1155	406	43	36	5	3	2	+	0	0	3323
2009	169	136	144	651	618	306	21	7	1	1	+	0	0	2053
2010	154	274	65	184	865	666	148	16	3	0	+	+	+	2376
2011	213	105	114	40	74	393	301	37	3	+	+	0	+	1281
2012	74	591	42	93	20	68	214	152	13	+	+	0	2	1268
2013	163	156	223	26	65	20	51	150	76	7	+	0	+	938
2014	183	265	75	262	41	70	26	60	86	18	1	+	0	1087
2015	343	320	145	42	214	25	37	21	48	34	9	+	+	1238
2016	474	796	144	210	35	183	48	57	39	66	46	11	+	2111
2017	931	936	189	70	70	11	21	4	4	5	4	5	1	2252
2018(1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

(1 no coverage in main area of haddock, no index calculated

Table B6 Northeast Arctic HADDOCK. Length data (cm) from Joint Barents Sea surveys (BS-NoRu-Q1 (BTr)) in January-March (+ means value <1; - means 0 value)

Age/	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1983	16.8	25.2	34.9	44.7	52.5	58.0	62.4	65.1						
1984	16.6	27.5	32.7	-	56.6	62.4	61.8	66.2						
1985	15.7	23.9	35.6	41.9	58.5	61.9	63.9	67.6						
1986	15.1	22.4	31.5	43.0	54.6	-	-	-						
1987	15.4	22.4	29.2	37.3	46.5	-	-	-						
1988	13.5	24.0	28.7	34.7	41.5	47.9	54.6	-						
1989	16.0	23.2	31.1	36.5	41.7	46.4	52.9	57.6						
1990	15.7	24.7	32.7	43.4	46.1	50.1	52.4	55.7						
1991	16.8	24.0	35.7	44.4	52.4	54.8	55.6	55.9						
1992	15.1	23.9	33.9	45.5	53.1	59.2	60.6	60.5						
1993	14.5	21.4	31.8	42.4	50.6	56.1	59.4	64.2						
1994	14.5	20.1	29.4	38.0	47.6	54.3	61.7	65.2	70.7	64.4	64.6	72.0	-	-
1995	15.1	18.4	28.7	34.0	42.8	51.0	59.6	60.0	67.2	68.0	-	64.7	78.6	-
1996	15.3	20.9	28.0	37.0	41.3	47.2	53.8	58.7	-	76.0	-	74.0	75.0	-
1997*	15.8	19.4	27.0	33.5	40.5	46.9	47.6	53.3	62.0	-	-	-	75.6	78.0
1998*	14.1	19.6	28.9	34.2	41.6	46.5	50.3	52.8	58.2	72.1	65.0	-	-	-
1999	14.3	18.0	32.3	38.6	46.5	51.9	56.1	55.1	58.8	62.0	-	72.0	-	-
2000	15.5	21.7	29.9	42.0	47.1	51.1	52.7	59.3	59.4	62.0	63.3	+	+	-
2001	14.6	22.1	32.1	37.6	48.0	50.1	59.2	55.0	64.9	66.3	67.7	+	+	-
2002	15.0	20.9	29.2	39.8	45.6	51.5	58.0	58.6	-	62.0	64.4	67.7	70.1	-
2003	15.8	24.0	26.4	36.5	45.8	49.8	54.5	61.2	62.6	60.3	66.0	70.0	+	-
2004	14.1	22.1	30.1	35.7	42.7	49.9	49.6	58.8	63.3	73.6	75.7	+	+	+
2005	14.8	20.6	29.9	36.1	40.4	48.4	51.5	56.2	60.8	67.0	-	-	-	-
2006	14.4	22.1	30.7	37.9	43.3	47.3	50.7	56.6	60.5	69.9	-	+	-	-
2007*	15.2	23.5	28.2	31.2	43.5	43.9	50.0	58.0	58.1	+	62.0	-	-	-
2008	15.7	23.7	29.6	37.9	42.7	46.0	52.9	52.5	58.5	+	63.3	63.0	-	-
2009	14.2	22.6	29.7	35.5	41.8	48.1	48.9	56.4	65.0	62.3	-	62.0	-	-
2010	14.4	19.8	30.6	36.8	40.8	45.1	49.9	59.9	58.9	62.3	+	66.5	-	-
2011	13.6	23.3	28.5	39.5	42.9	46.1	48.2	62.7	+	-	-	63.3	+	-
2012	14.6	19.2	31.6	35.1	43.7	47.1	50.2	50.8	47.6	65.0	67.0	72.0	-	-
2013	14.5	22.8	30.0	40.9	42.8	48.6	52.3	52.8	55.6	67.3	-	-	-	-
2014	15.5	18.6	31.9	39.0	46.5	52.7	53.5	55.3	54.9	60.3	59.2	-	-	75.0
2015	14.5	20.4	26.1	39.8	45.3	52.6	53.4	57.6	56.9	60.2	59.6	67.4	-	-
2016	14.8	18.5	30.7	35.8	47.8	53.0	56.0	58.4	61.0	60.4	59.8	64.5	-	72.0
2017	15.8	20.6	30.4	39.7	49.4	52.7	55.8	60.4	59.8	63.0	62.1	63.9	69.0	-
2018	14.3	22.1	30.4	39.4	47.6	54.0	57.6	60.9	64.3	66.0	64.5	63.9	67.1	68.6
2019	14.8	21.5	29.7	37.0	46.0	52.5	52.9	60.4	64.5	65.8	67.4	68.1	69.5	75.0

***Limited area coverage, lengths are not adjusted to account for limited area coverage.**

+ indicates few samples, - means missing values

Table B7 Northeast Arctic HADDOCK. Length data (cm) from Russian surveys (RU-BTr-Q4) in November-December

Year	0	1	2	3	4	5	6	7	8	9	10
1982	14.5	21.3	33.4	37.0	-	-	-	-	-	-	
1983	18.1	26.2	30.9	44.9	53.3	62.0	65.5	67.6	68.0	73.1	
1984	-	24.0	35.8	42.7	53.7	63.1	68.1	68.1	71.0	75.2	
1985	-	21.1	31.7	43.4	53.6	62.2	64.2	-	73.1	74.1	
1986	18.1	21.0	28.7	37.0	46.6	58.8	63.1	68.1	-	73.1	
1987	-	21.7	27.6	33.3	40.9	49.4	-	-	-	-	
1988	-	19.9	29.9	35.1	40.4	46.6	52.0	-	-	-	
1989	-	20.5	25.1	40.2	45.0	48.5	52.2	58.8	63.5	-	
1990	-	20.5	29.8	37.3	48.7	50.8	54.7	58.8	63.3	68.1	
1991	-	23.2	31.7	40.3	52.7	56.7	58.8	60.3	63.2	69.1	
1992	-	22.0	32.2	41.6	52.6	59.7	61.9	65.7	68.3	70.3	
1993	18.1	20.8	28.0	38.6	48.8	55.0	61.2	64.1	63.2	65.0	
1994	15.5	20.8	28.9	36.2	44.6	53.6	60.0	66.2	67.7	67.0	
1995	14.9	21.8	28.6	36.6	42.0	48.3	56.6	62.5	66.1	66.8	
1996*	15.7	20.2	28.6	36.8	43.9	49.3	54.7	63.3	67.3	70.8	
1997*	13.7	23.3	29.5	36.6	44.6	50.0	54.7	58.7	69.1	68.1	
1998	14.4	19.3	33.1	39.2	45.9	47.9	53.5	56.1	62.0	74.1	
1999	13.5	22.6	28.0	41.9	46.6	49.2	53.1	56.3	59.8	63.5	
2000	14.2	22.3	31.7	37.0	48.6	52.5	54.8	60.8	62.0	60.5	
2001	14.8	21.9	30.7	40.3	45.1	53.0	57.3	60.7	62.2	62.5	
2002	14.7	23.5	29.4	38.2	46.4	50.8	56.2	56.0	64.6	66.9	
2003	13.8	22.7	29.4	37.5	43.9	50.5	55.2	61.1	63.3	63.5	
2004	14.3	22.5	30.0	37.9	43.6	48.4	53.7	58.4	63.5	69.1	
2005	14.9	23.5	30.0	36.9	44.8	49.9	54.7	59.2	65.9	66.6	
2006*	15.3	24.1	32.6	39.8	46.7	51.8	54.9	59.0	62.4	65.3	
2007	15.4	23.7	30.6	39.2	46.6	52.0	54.4	58.4	61.3	65.8	
2008	14.5	22.3	30.8	38.1	47.3	52.8	55.8	59.1	62.8	65.0	
2009	15.4	21.8	29.4	36.0	43.9	51.0	55.3	59.2	62.3	63.3	
2010	13.0	23.9	28.3	35.5	42.8	47.8	53.7	60.0	61.8	66.9	
2011	14.7	23.0	31.9	34.3	41.6	47.7	53.0	59.2	64.3	67.8	
2012	14.5	24.0	32.0	39.4	43.9	48.7	53.1	56.9	62.0	67.3	
2013	15.3	21.7	31.4	37.5	45.8	48.9	53.6	56.4	62.9	69.4	
2014	14.6	22.2	28.7	37.8	44.9	51.1	53.6	57.4	60.0	61.8	
2015	15.2	21.6	30.0	37.0	46.3	51.1	56.0	58.3	60.6	62.0	
2016	-	-	-	-	-	-	-	-	-	-	
2017	16.1	22.2	31.3	39.3	47.1	52.8	57.9	61.9	63.1	64.6	69.5
2018	-	-	-	-	-	-	-	-	-	-	

***Limited area coverage, lengths are not adjusted to account for limited area coverage.**

+ indicates few samples, - means missing values

Table B8 Northeast Arctic HADDOCK. Weight data (g) from Joint Barents Sea surveys (BS-NoRu-Q1 (BTr)) in January-March (revised data from 1994 onwards and historical data for 1983-1993) (+ means value <1; - means 0 value).

Age/ Yea	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1983	52	133	480	1043	1641	2081	2592	2847						
1984	36	196	289	964	1810	2506	2240	2905						
1985	35	138	432	731	1970	2517	-	3600						
1986	47	100	310	734	-	-	-	-						
1987	24	91	273	542	934	-	-	-						
1988	23	139	232	442	743	1193	1569	-						
1989	43	125	309	484	731	1012	1399	1833						
1990	34	148	346	854	986	1295	1526	1782						
1991	41	138	457	880	1539	1726	1808	1869						
1992	32	136	392	949	1467	2060	2274	2341						
1993	26	93	317	766	1318	1805	2166	2734						
1994	25	87	248	539	1056	1601	2201	2846	3439	2680	2712	3890	-	-
1995	30	71	221	380	775	1331	2005	2070	2685	2905	-	2502	3972	-
1996	32	93	218	472	668	1020	1537	1768	-	4630	-	4018	3626	-
1997*	35	85	188	329	619	1034	1064	1532	2474	-	-	-	3731	4130
1998*	24	89	232	416	815	1032	1298	1559	2006	3740	3040	-	-	-
1999	27	75	335	570	1022	1435	1791	1722	2011	2440	-	3525	-	-
2000	32	110	275	736	1061	1366	1521	2123	2239	2588	2741	+	+	-
2001	28	107	337	581	1145	1402	2147	1896	2903	3110	2965	+	+	-
2002	30	85	245	618	940	1375	1940	2048	-	2352	2670	3252	3497	-
2003	36	129	192	490	958	1209	1479	1933	2479	2533	3055	3470	+	-
2004	23	98	271	456	750	1162	1204	1958	2658	3926	4157	+	+	+
2005	29	98	261	474	666	1093	1372	1976	2120	2730	-	-	-	-
2006	25	109	302	561	810	1083	1358	1917	2102	3991	-	+	-	-
2007*	30	114	246	356	894	956	1388	2135	2508	+	2959	-	-	-
2008	32	113	245	553	832	1080	1573	1417	2120	+	2280	2840	-	-
2009	26	96	225	442	747	1147	1275	1726	2377	2563	-	2594	-	-
2010	27	87	270	466	658	949	1260	1897	2143	2512	+	3184	-	-
2011	21	117	220	520	727	939	1163	2285	+	-	-	+	2805	-
2012	28	73	305	432	816	1015	1285	1282	1219	2683	2980	3264	-	-
2013	24	113	272	644	783	1130	1350	1495	1836	3098	-	-	-	-
2014	32	68	357	611	1014	1424	1551	1677	1671	2141	2184	-	-	4800
2015	23	88	201	588	848	1423	1465	1921	1834	2078	2256	3133	-	-
2016	27	74	282	458	1057	1457	1752	2078	2280	2266	2404	2843	-	3555
2017	33	95	290	621	1220	1520	1785	2280	2309	2610	2594	2789	3369	-
2018	25	97	273	622	1039	1636	1935	2319	2699	2855	2652	2616	3005	3369
2019	25	90	242	507	965	1407	1558	2059	2712	2941	3001	3404	3412	3980

***Limited area coverage, weights are not adjusted to account for limited area coverage.**

+ indicates few samples, - means missing values

Table B9 Northeast Arctic HADDOCK. Weight (g) from Russian surveys (RU-BTr-Q4) in November-December (- means missing data).

Year /Age	0	1	2	3	4	5	6	7	8	9	10
1982	32	102	364	500	-	-	-	-	-	-	-
1983	57	170	271	916	1625	2346	2751	3153	3217	4290	5200
1984	-	124	434	722	1410	2296	3071	2942	3224	3747	5408
1985	-	94	302	788	1533	2275	2650	-	3400	4076	3943
1986	40	91	220	470	905	1759	2300	2500	-	3550	4100
1987	-	96	193	353	612	1101	-	-	-	-	-
1988	-	84	250	409	641	1036	1451	-	-	-	-
1989	-	94	160	718	926	1254	1548	2106	2781	-	7160
1990	-	97	264	530	1250	1474	1812	2188	2626	3080	5520
1991	-	122	342	702	1518	1915	2244	2324	2649	3249	3810
1992	-	103	310	726	1505	2101	2386	2977	3315	3773	4800
1993	55	84	197	543	1120	1568	2125	2474	2476	2803	3324
1994	34	91	217	435	850	1498	2167	2875	2880	2963	3742
1995	32	90	210	445	708	1123	1776	2398	2847	3032	3781
1996	37	80	210	468	854	1186	1643	2429	3038	2991	4413
1997	27	113	226	458	882	1191	1579	1963	3155	2815	3565
1998	38	72	340	593	972	1226	1593	1803	2389	3681	4494
1999	27	103	196	730	1003	1182	1522	1748	2148	2547	2807
2000	24	105	313	480	1197	1502	1713	2375	2445	2286	3065
2001	25	98	264	632	930	1534	1935	2383	2589	2631	3210
2002	26	127	302	586	1077	1470	2029	2127	1954	2933	3986
2003	21	103	229	498	797	1241	1649	2308	2617	3061	3390
2004	24	87	253	518	846	1130	1571	1959	2633	3366	3859
2005	27	115	259	511	933	1289	1670	2079	2833	2965	-
2006*	26	105	269	444	867	1307	1604	1922	2274	2520	-
2007	30	117	274	600	1012	1436	1647	2018	2314	2885	-
2008	25	94	267	545	1046	1445	1755	2126	2458	2735	3289
2009	28	91	241	448	841	1335	1666	2048	2438	2498	3132
2010	17	123	208	425	764	1071	1546	2116	2317	2827	-
2011	26	107	305	395	737	1102	1546	2177	2779	3055	4069
2012	25	120	300	599	852	1174	1519	1871	2467	3018	-
2013	29	86	280	488	924	1135	1504	1766	2065	2490	3216
2014	25	96	224	538	914	1340	1578	1913	2182	2407	2989
2015	28	89	256	524	1007	1369	1810	2031	2274	2446	2880
2016	-	-	-	-	-	-	-	-	-	-	
2017	33	97	291	603	1030	1477	1946	2384	2532	2671	2928
2018	-	-	-	-	-	-	-	-	-	-	-

***Limited area coverage, weights are not adjusted to account for limited area coverage**

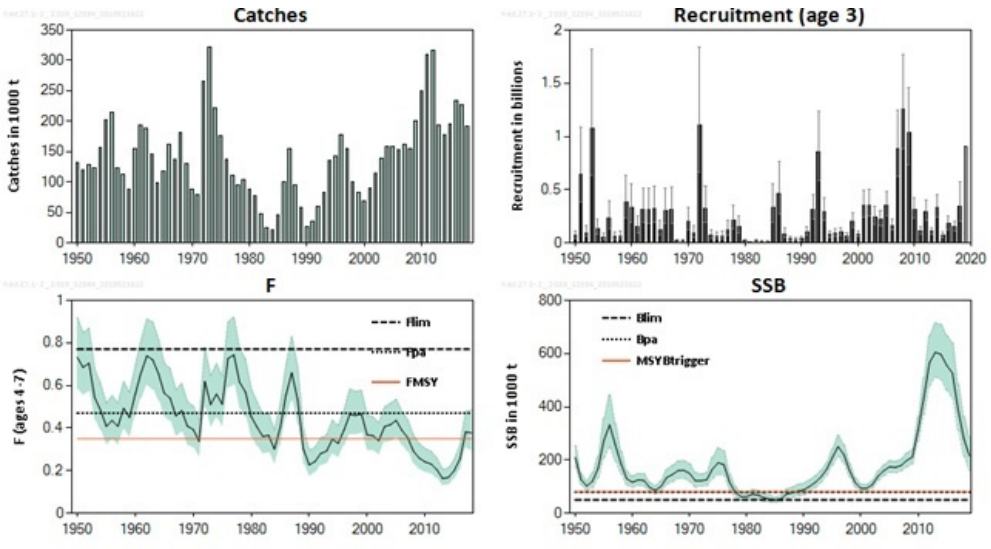
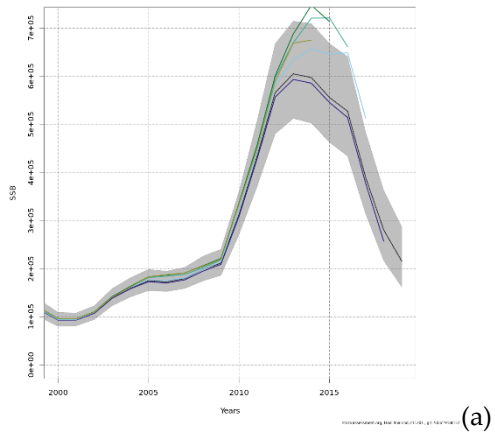
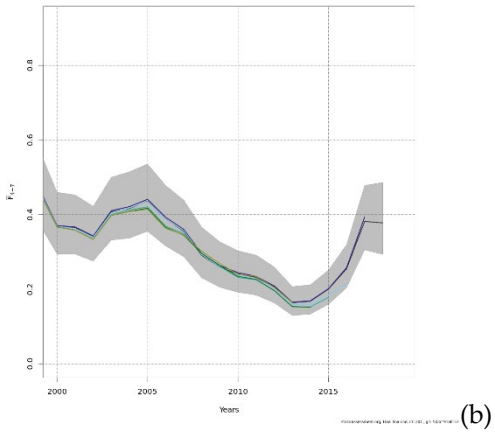


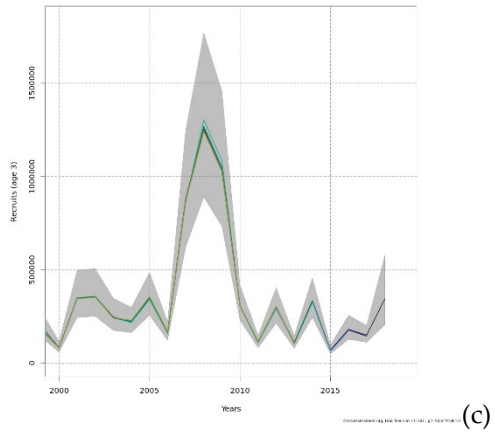
Figure 4.1 Landings, fishing mortality, recruitment (2018 prediction unshaded), and spawning-stock biomass of Northeast Arctic haddock 1950–2019. Fishing mortality and spawning-stock biomass are given with point wise 95% confidence intervals (shaded areas).



(a)



(b)



(c)

Figure 4.2. Northeast Arctic haddock. 5 year retrospective plots of SSB (a), fishing mortality (b), and recruitment (c) for years 2000–2018 (SAM with 95% confidence intervals).

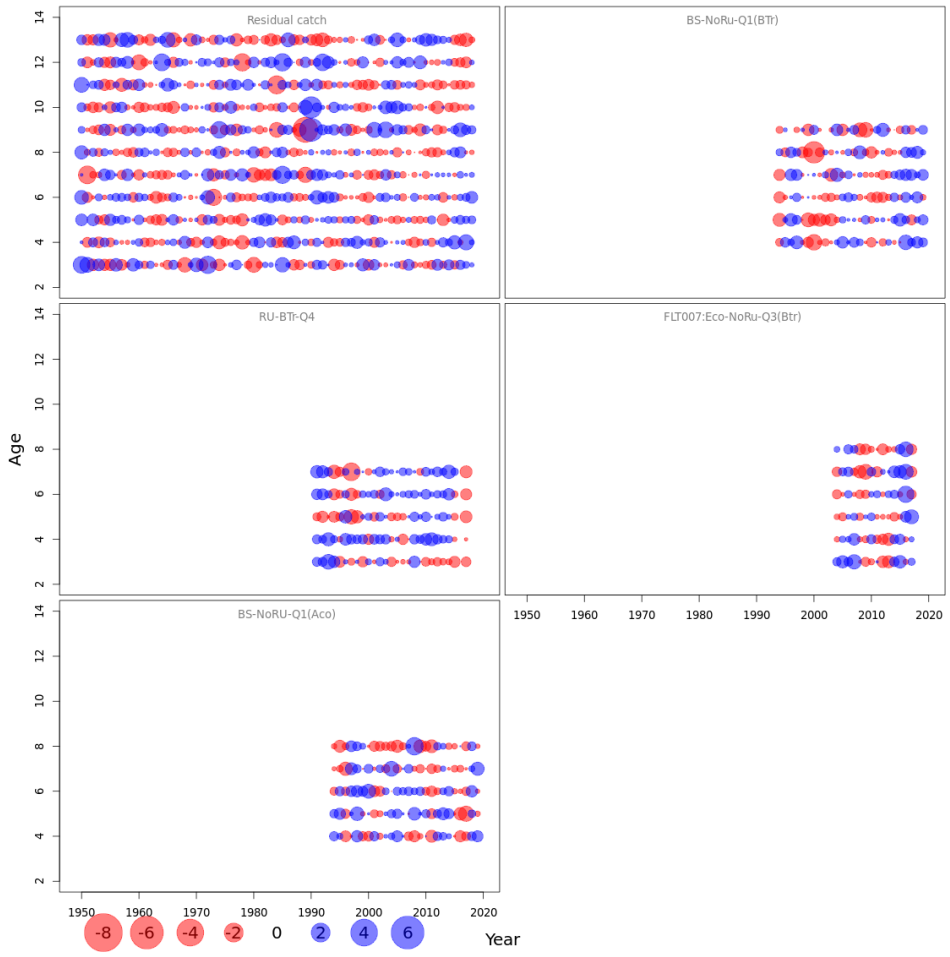


Figure 4.3. Northeast Arctic haddock; Normalized residuals for the final SAM run. Blue circles indicate positive residuals (observations larger than predicted) and white circles indicate negative residuals.

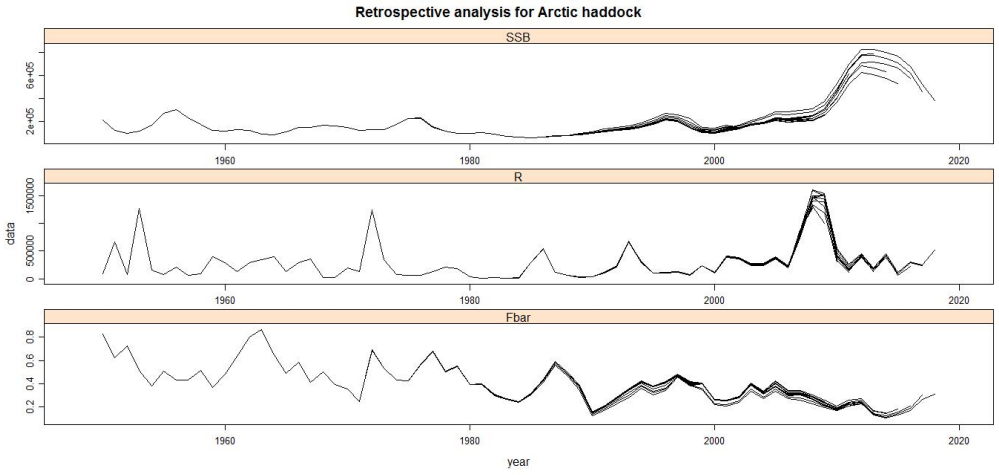


Figure 4.4. Northeast Arctic haddock. Retrospective plots of SSB, fishing mortality and recruitment for assessment years 1950–2017 (XSA without P shrinkage)

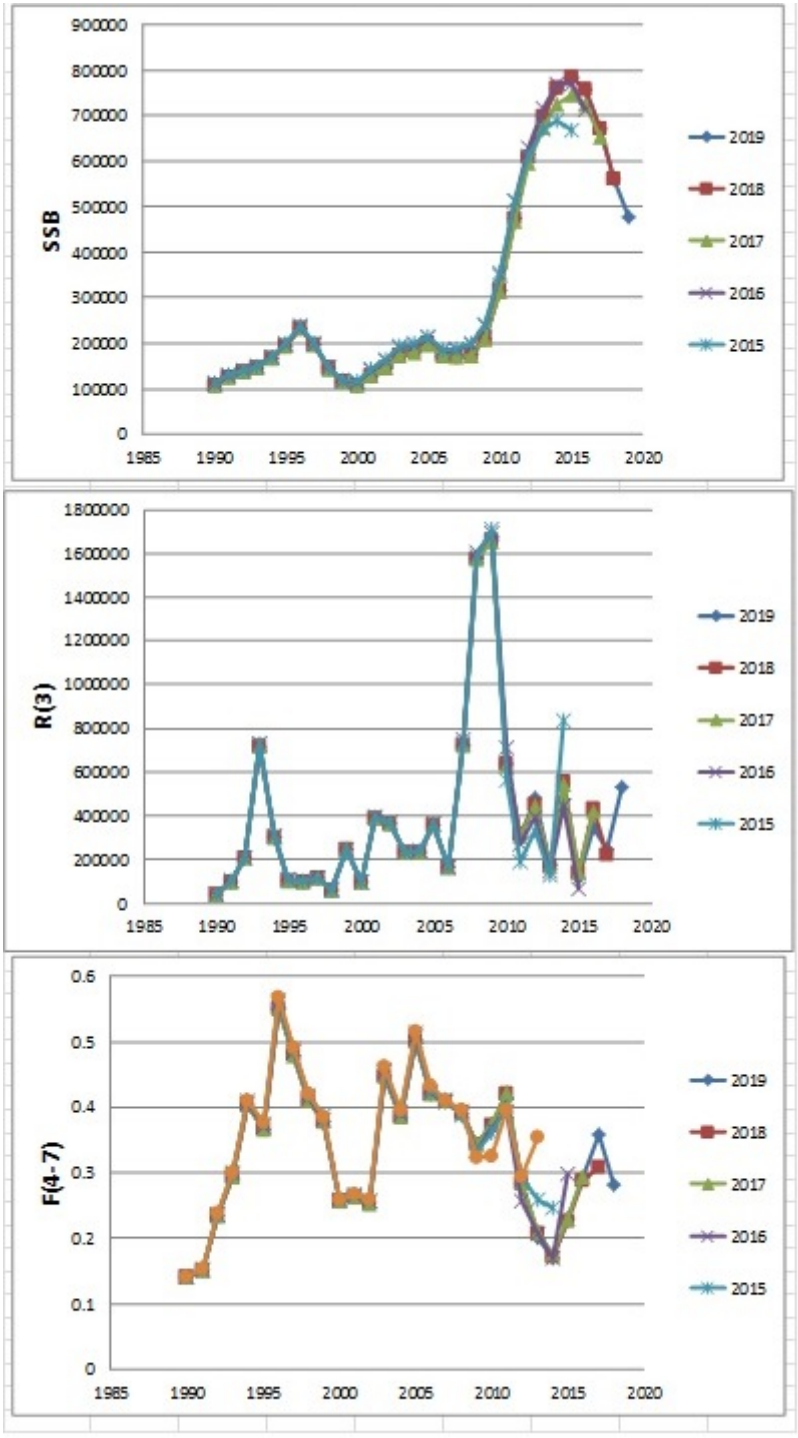


Figure 4.5. Northeast Arctic haddock. Retrospective plots of SSB, fishing mortality and recruitment for assessment years 1990–2018 from TSVPA model (see WD 10).

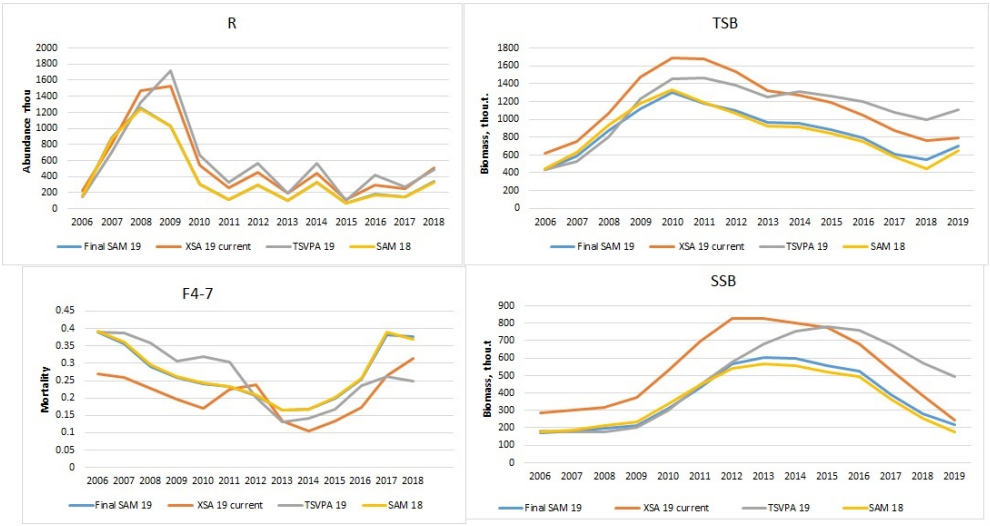


Figure 4.6. Results of assessment of NEA haddock - Recruits, biomass, spawning biomass and F by different models: medium SAM estimates from 2019 (final SAM 19), medium SAM estimates from 2018 (SAM 18) , XSA estimates from 2019 with current settings (XSA 19 current) and TISVPA estimates from 2019 with settings as mentioned at WD 10 (TISVPA 19).