4 Northeast Arctic Haddock (Subareas I and II)

4.1 Status of the Fisheries

4.1.1 Historical development of the fisheries

Haddock is mainly fished by trawl as by-catch in the fishery for cod. Also a directed trawl fishery for haddock is conducted and the proportion of total catches taken by this fishery varies between years. On average approximately 33% 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 by-catch 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, in spite of haddock being primarily caught as by-catch 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 later years. These year-classes are fully recruited to SSB and still a significant part of catches in 2016 but their abundance is decreasing. The following year-classes are at a much lower level. The most numerous of them appeared in odd years and we will experience some years with a decreasing stock size and SSB, which again will result in lower catch advice. However, the WG states that the haddock stock will be at relatively high stock levels also in the coming years.

4.1.2 Landings prior to 2017 (Tables 4.1–4.3, Figure 4.1)

The highest landings of haddock (since 1973) observed were about 316 kt in 2012. In 2013-2015 stock biomass started to decline and level of landings decreased considerably to below 200 kt. However, based on investigation of assessment methods during benchmark and AFWG meetings and also transferring part of unused catches from 2015, the realized TAC in 2016 was increased to above 260 kt (244kt + transfer). Provisional official landings for 2016 is about 233 thousand tonnes which is 12% below the realized TAC (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.

4.2 Catch advice and TAC for 2017

The catch advice for 2017 was 233 kt, according to the HCR, and the Joint Norwegian-Russian Fisheries Commission set TAC to the same value. However, Russia and Norway can transfer unused part of own quotas (about 30 kt) of haddock in 2016 for 2017, so the actual TAC in 2017 can reach about 263 kt.

4.3 Status of Research

4.3.1 Survey results (Tables B1-B5)

The overall picture seen in the surveys is summarized as follows: many individuals of high abundant year-classes 2004—2006 are still present in the Barents Sea, but the surveys indicate that following less abundant year-classes dominated. Some of them as 2009, 2011and 2015 year-classes that seem to be a little stronger than average, while the 2016 year class was estimated as very strong.

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 2017 are given in Mehl *et al.* (WD 03). 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 standard area previously used. In 2017 was no Russian vessel, and not allowed access for Norwegian vessel to southwestern REZ. The survey indices and areas covered 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 usual in the 1990s. As with the acoustic indices, the strong 2004-2006 year-classes dominates bottom trawl indices. Overall, this survey tracks both strong and poor year-classes fairly well. In later years, the 2009, 2011, 2013, 2014, 2015 and especially the 2016 year-classes are stronger than the 2007, 2008, 2010 and 2012 year-classes.

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

Russia provided indices for 1982-2015 Barents Sea trawl and acoustic survey (TAS) (Tables B2 and B4), which was carried out in October-December. In 2016 TAS was not conducted in the Barents Sea due to financial reasons.

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, Fleet 007). Estimates of the abundance of age groups (indices) from the joint ecosystem survey are presented in Table B5 and in WD 02. 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.

4.4 Weight-at-age (Tables B6 - B9)

Length- and weight-at-age from the surveys are given in Tables B6- B9, respectively. Neither Norwegian nor Russian surveys show any strong trends in length- or weight-at-age; however, the weights at older ages are at a relatively low level, compared to the time series

4.5 Data Used in the Assessment

4.5.1 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 estimate is zero for 2009 - 2016.

4.5.2 Catch-at-age (Table 4.4)

Age and length compositions of the landings in 2016 were available from Norway and Russia in Subarea 1 and Division 2b, from Norway, Russia, and Germany in Division 2a. 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 2008-2016 and historical values from 1950 is listed in Table 4.4

4.5.3 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.

Stock weights (Table 4.6) used from 1985 to 2016 are averages of values derived from Russian surveys in autumn (mostly October-December) and Norwegian surveys in January-March the following year. These averages are assumed to give representative values for the beginning of the year (see stock annex and for details). Stock weights seem to be stable with only small year to year differences for the last years.

4.5.4 Maturity-at-age (Table 4.7)

The estimates of maturity-at-age are shown in Table 4.7. The proportions mature at age are presently increasing but lower than historic averages (see stock annex for estimation details)

4.5.5 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 2016 actual data from predation for cod have been used (see Table 4.8).

Unlike previous years, in 2017, the methodology for calculating natural mortality has been slightly modified, which includes natural loss (adopted as 0.2) and mortality from haddock consumption by cod (see stock annex for details)

For the previous years (1950-1983) the average natural mortality for 1984-2016 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.

4.5.6 Changes in data from last year (Tables 4.6–4.7, B3)

As stock weights and maturity are modeled (See above) the values of these variables have changed slightly for 2017 and for 2018-2019.

However, at the benchmark 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.

Natural mortality estimation procedure in the SAM model was revised (see above and stock annex).

Some settings (i.e. survey backshifting) in the SAM model were changed but model settings were mainly as last year.

One set of tuning indices (FLT04) was revised using StoX software and is now for period 1994-2016 (see WD03 and Table B3).

4.6 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 TSVPA model also is used as additional for comparison.

4.6.1 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	1991–2015	1
FLT02: Joint Barents Sea survey - acoustic	BS-NoRU-Q1(Aco)	Barents Sea	February-March	4–8	1993–2017	1
FLT04: Joint Barents Sea survey - bottom trawl	BS-NoRu-Q1 (BTr)	Barents Sea	February-March	4–9	1994–2017	1
FLT007: Joint Russian-Norwegian ecosystem autumn survey in the Barents Sea -bottom trawl	Eco-NoRu-Q3 (Btr)	Barents Sea	August - September	3-8	2004-2016	1

Some changes in using tuning indices were made: previously winter survey tuning indices were backshifted as it is done for XSA but SAM allows to use unshifted indices and it was done for Fleet 02 and 04 (Table 4.9)

Detailed information about index estimates described in tables B1-B6, Stock annex and working documents ##02-03 and 09.

4.6.2 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 input data used is the same as for XSA. The configuration file is given in Table 4.10 and in (www.stockassessment.org)

4.7 Results of the Assessments (Tables 4.11–4.15 and Figures 4.1, 4.2, 4.5 and 4.6)

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, stock-recruitment relationship in Figure 4.2, the retrospective plot in Figure 4.5 and the log catchability residuals plot is presented in Figure 4.6.

Fishing mortality of main ages (4-7) in 2016 increased somewhat compared to 2015 but still estimated close to the historic low level. XSA estimates shows the same trends (see Figure 4.1B, Table 4.11, 4.15).

The dominating feature of this assessment is that the stock reached an all-time high level around 2010 (about 1,400 kt) due to the strong 2004-2006 year classes, which still a significant part of catches. The total biomass has decreased since the all-time high in 2010 but is still high. SSB was stable at a record high level from 2013 to 2016 but is now decreasing somewhat.

4.8 Predictions, reference points and harvest control rules (Tables 4.16–4.21)

4.8.1 Recruitment (Tables 4.16, 4.17)

The RCT3 program has been used to estimate the recruiting year-classes 2014-2016 with survey data for ages 0-2 as input data (Russian autumn survey (not for 2016), joint winter survey and ecosystem survey) but historical data of recruitment abundance of year classes before 2015 was taken from SAM estimates. Input data and results are shown in Table 4.16 and 4.17, respectively

4.8.2 Prediction data (Table 4.18)

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

Stock numbers for 2017-2019 at age 3 taken from RCT3, abundance at ages 4-13+ in 2017. The average fishing pattern observed in 2014—2016, scaled to F status quo was used for distribution of fishing mortality at age for 2017—2018. The proportion of M and F before spawning was set to 0.

Smoothed observed average weight in stock at age and maturity-at-age are used for 2017, predicted maturity estimates, using the fitted parameters and last year lengths as input, are used for 2018-2019.

Russian data for weight and maturity at age in autumn 2016 were not available as the survey was not conducted. In WD09, correction factors to allow for this when calculating the weight and maturity at age in 2017 were calculated, based on historical differences between Norwegian and Russian data. These correction factors were then applied to the Norwegian data for 2017.

The average weights at age in catch for the year-classes with similar abundance at age 3 (2014—2016) are used for 2017—2019.

Natural mortality for 2017-2019 – average for the 3 last years (2014—2016).

4.8.3 Biomass reference points (Figure 4.1)

At AFWG in 2011 based on the analysis of 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 Bloss, and B_{pa}= B_{lim}*exp(1.645*σ), where σ=0.3. This gives a 95% probability of maintaining SSB above Blim taking into account the uncertainty in the assessments and stock dynamics. For BMSY 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 in comparison with current stock values are reflected in Figure 4.1.

4.8.4 Fishing mortality reference points (Table 4.21, 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*σ)= 0.47.

F_{msy}=0.35 has been estimated by long-term stochastic simulation (WD 16, AFWG 2011, ICES 2016a).

Values of reference points in comparison with current stock values are reflected in Figure 4.1. Yield per recruit (YPR) are presented in Table 4.21.

4.8.5 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 will 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 existing harvest control rule.

4.8.6 Prediction results and catch options for 2018 (Tables 4.19 – 4.20)

TAC constraint was used in the intermediate year because the catch in 2017 corresponding to Fsq is well below agreed TAC. Fishing according to the management rule in 2017 corresponds to total landings of about 233 000 t. The projection shows a decrease in SSB in 2018 to 402 000 tonnes (Table 4.19). The TAC for 2018 is established using the current one-year HCR, in accordance of the management plan.

The detailed outputs corresponding to $F_{TAC\ constraint}$ in 2017, the F corresponding to the HCR (i.e. F_{pa}) in 2018 and 2019 is given in Table 4.20. Catch options for 2018 are shown in the text table below.

RATIONALE	CATCHES (2018)	BASIS	F (2018)	SSB (2019)	%SSB CHANGE *)	%TAC CHANGE* *)
Management plan (HCR2)	202	FMP (HCR)	0.35	289	-27	-13
MSY approach	202	FMSY	0.35	289	-27	-13
Precautionary Limits	255	Fpa	0.47	250	-38	+9
Zero catch	0	0	0	451	12	-100
Status quo	185	Fsq	0.31	305	-24	-21

Weights in '000 t.

*)**SSB 2019 relative to SSB 2018.**

) **Catch 2018 relative to TAC 2017.

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.

4.9 Comparison with last year's assessment

The text table below compares this year's estimates with last year's estimates for 2016 and forecast for 2017 of total biomass, spawning biomass (thousand tonnes), as well as reference F for the year 2015.

Compared to last year's assessment the current estimates by SAM model of the total stock (TSB), spawning stock (SSB) and F are lower for 2015 - 2017.

Year of assessment, model	F (2015)	Numbers 2016 (ages)											TSB (2016)	SSB (2016)	F (2016)	TSB (2017)	SSB (2017)
		3	4	5	6	7	8	9	10	11	12	13+					
2016 SAM	0.207	235*	47	190	45	65	34	61	86	47	10	4	1001*	754*	0.28*	797*	574*
2017 SAM	0.17	184	39	183	61	81	37	61	65	29	6	2	911	675	0.2	743**	538**
Changing,%	-18	-22	-16	-3	34	24	9	0	-25	-38	-43	-48	-9	-10	-29	-7	-6
2016 XSA	0.181	261*	53	175	51	64	24	20	13	16	12	4	640*	398*	0.5*	491*	275*
2017 XSA	0.16	266	47	189	62	77	29	30	33	30	19	5	822	562	0.2	657**	428**
Changing,%	-12	2	-11	8	22	20	21	50	154	88	58	25	28	41	-60	34	56
Diff/ SAM/XSA 2017	-6	45	20	3	2	-4	-21	-51	-49	4	239	138	-10	-17	0	-12	-20

* forecast in 2016 using RCT 3 and TAC for 2016

** forecast in 2017 using RCT 3

In 2017 SAM assessment negative changes in 2016 abundance estimates versus last year estimates occurred for ages 3 and 10-13+, while for age groups which are reflected in fishing mortality estimates (Fbar 4-7) changes were mostly positive.

4.10 Additional assessment methods (Table 4.15,-Figure 4.3)

4.10.1 XSA

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 (1984–2016). The summary of XSA stock estimates are presented in Table 4.15. A retrospective plot for XSA is given in Fig 4.4.

4.10.2 TISVPA (Figure 4.3)

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 fishermen, 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 XSA except that natural mortality values from cannibalism were taken from the XSA 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 XSA. During AFWG 2016 the results of exploratory runs using the TISVPA model were presented and discussed (WD#12, 2016). The results generally support the results of SAM and XSA models demonstrating a dome-shaped structure of age-dependent components in the selection pattern and the estimate of SSB in 2015 about 600 thousand tonnes.

4.10.3 Results (Figure 4.3)

Results from SAM, XSA and TISVPA are compared in Fig 4.3. Comparison of results of SAM, TISVPA and XSA shows that the models demonstrate similar trends. For TSB and SSB, XSA and TISVPA results for the last couple of years are within the uncertainty range for SAM, while for F, XSA is inside the uncertainty range for SAM while TISVPA is outside (above). There are no evident differences in recent estimates of recruitment between all models except the very abundant year-classes 2004-2006.

4.11 Comments to the assessment

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

Other sources of uncertainties in assessment are described in Stock annex.

Table 4.1 North-East Arctic HADDOCK. Total nominal catch (t) by fishing areas.(Data provided by Working Group members).

Year	Sub-area I	Division IIa	Division IIb	un-reported2	Total3	Norw. stat. areas 06 and 074
1960	125 026	27 781	1844	-	154 651	6000
1961	165 156	25 641	2427	-	193 224	4000
1962	160 561	25 125	1723	-	187 409	3000
1963	124 332	20 956	936	-	146 224	4000
1964	79 262	18 784	1112	-	99 158	6000
1965	98 921	18 719	943	-	118 583	6000
1966	125 009	35 143	1626	-	161 778	5000
1967	107 996	27 962	440	-	136 398	3000
1968	140 970	40 031	725	-	181 726	3000
1969	89 948	40 306	566	-	130 820	2000
1970	60 631	27 120	507	-	88 258	-
1971	56 989	21 453	463	-	78 905	-
1972	221 880	42 111	2162	-	266 153	-
1973	285 644	23 506	13077	-	322 227	-
1974	159 051	47 037	15069	-	221 157	10000
1975	121 692	44 337	9729	-	175 758	6000
1976	94 054	37 562	5648	-	137 264	2000
1977	72 159	28 452	9547	-	110 158	2000
1978	63 965	30 478	979	-	95 422	2000
1979	63 841	39 167	615	-	103 623	6000
1980	54 205	33 616	68	-	87 889	5098
1981	36 834	39 864	455	-	77 153	4767
1982	17 948	29 005	2	-	46 955	3335
1983	5837	16 859	1904	-	24 600	3112
1984	2934	16 683	1328	-	20 945	3803
1985	27 982	14 340	2730	-	45 052	3583
1986	61 729	29 771	9063	-	100 563	4021
1987	97 091	41 084	16741	-	154 916	3194
1988	45 060	49 564	631	-	95 255	3756
1989	29 723	28 478	317	-	58 518	4701
1990	13 306	13 275	601	-	27 182	2912
1991	17 985	17 801	430	-	36 216	3045
1992	30 884	28 064	974	-	59 922	5634
1993	46 918	32 433	3028	-	82 379	5559
1994	76 748	50 388	8050	-	135 186	6311
1995	75 860	53 460	13128	-	142 448	5444
1996	112 749	61 722	3657	-	178 128	5126
1997	78 128	73 475	2756	-	154 359	5987

1998	45 640	53 936	1054	-	100 630	6338
1999	38 291	40 819	4085	-	83 195	5743
2000	25 931	39 169	3844	-	68 944	4536
2001	35 072	47 245	7323	-	89 640	4542
2002	40 721	42 774	12 567	18 736/5310	114 798/101 372	6898
2003	53 653	43 564	8483	33 226/9417	138 926/115 117	4279
2004	64 873	47 483	12 146	33 777/8661	158 279/133 163	3743
2005	53 518	48 081	16 416	40 283/9949	158 298/127 964	5538
2006	51 124	47 291	33 291	21 451/8949	153 157/140 655	5410
2007	62 904	58 141	25927	14 553/3102	161 525/150 074	7110
2008	58 379	60 178	31 219	5828/-	155 604/149 776	6629
2009	57 723	66 045	76 293	0	200 061	4498
2010	62 604	86 279	100 318	0	249 200	3661
2011	86 931	99 307	123 546	0	309 785	4169
2012	90 141	96 807	128 679	0	315 627	3869
2013	68 416	64 810	60 520	0	193 744	4000
2014	61 537	58 320	57 665	0	177 522	3433
2015	75 195	615 674	57 993	0	19 4756	3902
20161	78 714	95 140	59 561	0	23 3416	3233

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) Figures based on Norwegian/Russian IUU estimates. During the period 2002-2008, the Norwegian IUU-estimates (bold) were used in the final assessments.

4) Included in total landings and in landings in region IIa.

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

	Sub-area I		Division IIa		Division IIb		Unreported2
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	-
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
20161	56.4	22.3	62.5	32.5	45.4	14.1	0

1) Provisional

2) Figures based on Norwegian/Russian IUU estimates

Table 4.3 North-East Arctic HADDOCK. Nominal catch (t) by countries. Sub-area I and Divisions IIa and IIb combined. (Data provided by Working Group members).

Year	Faroe Islands	France	German Dem.Re Greenland.	Fed. Re. Germ.	Norway4	Poland	United Kingdom	Russia2	Others	Unreported catches3	Total3
1960	172	-	-	5597	46 263	-	45 469	57 025	125	-	154 651
1961	285	220	-	6304	60 862	-	39 650	85 345	558	-	193 224
1962	83	409	-	2895	54 567	-	37 486	91 910	58	-	187 408
1963	17	363	-	2554	59 955	-	19 809	63 526	-	-	146 224
1964	-	208	-	1482	38 695	-	14 653	43 870	250	-	99 158
1965	-	226	-	1568	60 447	-	14 345	41 750	242	-	118 578
1966	-	1072	11	2098	82 090	-	27 723	48 710	74	-	161 778
1967	-	1208	3	1705	51 954	-	24 158	57 346	23	-	136 397
1968	-	-	-	1867	64 076	-	40 129	75 654	-	-	181 726
1969	2	-	309	1490	67 549	-	37 234	24 211	25	-	130 820
1970	541	-	656	2119	37 716	-	20 423	26 802	-	-	88 257
1971	81	-	16	896	45 715	43	16 373	15 778	3	-	78 905
1972	137	-	829	1433	46 700	1433	17 166	196 224	2231	-	266 153
1973	1212	3214	22	9534	86 767	34	32 408	186 534	2501	-	322 226
1974	925	3601	454	23 409	66 164	3045	37 663	78 548	7348	-	221 157
1975	299	5191	437	15 930	55 966	1080	28 677	65 015	3163	-	175 758
1976	536	4459	348	16 660	49 492	986	16 940	42 485	5358	-	137 264
1977	213	1510	144	4798	40 118	-	10 878	52 210	287	-	110 158
1978	466	1411	369	1521	39 955	1	5766	45 895	38	-	95 422
1979	343	1198	10	1948	66 849	2	6454	26 365	454	-	103 623
1980	497	226	15	1365	66 501	-	2948	20706	246	-	92 504

1981	381	414	22	2402	63 435	Spain	1682	13 400	-	-	81 736
1982	496	53	-	1258	43 702	-	827	2900	-	-	49 236
1983	428	-	1	729	22 364	139	259	680	-	-	24 600
1984	297	15	4	400	18 813	37	276	1103	-	-	20 945
1985	424	21	20	395	21 272	77	153	22 690	-	-	45 052
1986	893	12	75	1079	52 313	22	431	45 738	-	-	100 563
1987	464	7	83	3105	72 419	59	563	78 211	5	-	154 916
1988	1113	116	78	1323	60 823	72	435	31 293	2	-	95 255
1989	1217	-	26	171	36 451	1	590	20 062	-	-	58 518
1990	705	-	5	167	20 621	-	494	5190	-	-	27 182
1991	1117	-	Greenland	213	22 178	-	514	12 177	17	-	36 216
1992	1093	151	1719	387	36 238	38	596	19 699	1	-	59 922
1993	546	1215	880	1165	40 978	76	1802	35 071	646	-	82 379
1994	2761	678	770	2412	71 171	22	4673	51 822	877	-	135 186
1995	2833	598	1097	2675	76 886	14	3111	54 516	718	-	142 448
1996	3743	6	1510	942	94 527	669	2275	74 239	217	-	178 128
1997	3327	540	1877	972	103 407	364	2340	41 228	304	-	154 359
1998	1903	241	854	385	75 108	257	1229	20 559	94	-	100 630
1999	1913	64	437	641	48 182	652	694	30 520	92	-	83 195
2000	631	178	432	880	42 009	502	747	22 738	827	-	68 944
2001	1210	324	553	554	49 067	1497	1068	34 307	1060	-	89 640
2002	1564	297	858	627	52 247	1505	1125	37 157	682	18 736/5310	
2003	1959	382	1363	918	56 485	1330	1018	41 142	1103	33 226/9417	
2004	2484	103	1680	823	62 192	54	1250	54 347	1569	33 777/8661	
2005	2138	333	15	996	60 850	963	1899	50 012	1262	40 283/9949	
2006	2390	883	1830	989	69 272	703	1164	53 313	1162	21 451/8949	

2007	2307	277	1464	1123	71 244	125	1351	66 569	2511	14 553/3102	
2008	2687	311	1659	535	72 779	283	971	68 792	1759	5828/-	
2009	2820	529	1410	1957	104 354	317	1315	85 514	1845	0	200 061
2010	3173	764	1970	3539	123 384	379	1758	111 372	2862	0	249 200
2011	1759	268	2110	1724	158 202	502	1379	139 912	4763	0	309 785
2012	2055	322	3984	1111	159 602	441	833	143 886	3393	0	315 627
2013	1886	342	1795	500	99 215	439	639	85 668	3260	0	193 744
2014	1470	198	1150	340	91 306	187	355	78 725	3791	0	177 522
2015	2459	145	1047	124	95 094	246	450	91 864	3327	0	194 756
20161	2460	340	1401	170	108 718	200	575	115 710	3838	0	233 416

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												
Year	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

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

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

	1	2	3	4	5	6	7	8	9	10	11	12	13+
1950	0.031	0.145	0.354	0.653	1.016	1.427	1.867	2.327	2.771	3.195	3.597	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.597	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	3.792	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	3.904	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	4.016	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	4.165	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	3.878	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	3.728	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	3.632	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	3.946	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	3.787	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	4.449	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	4.73	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	4.256	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	3.491	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	3.531	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	3.213	3.213
1995	0.034	0.128	0.282	0.484	0.8	1.327	1.952	2.401	2.959	3.135	3.335	3.335	3.335
1996	0.039	0.142	0.303	0.52	0.76	1.128	1.724	2.388	2.82	3.369	3.52	3.52	3.52
1997	0.039	0.161	0.333	0.551	0.816	1.076	1.481	2.127	2.814	3.22	3.751	3.751	3.751
1998	0.032	0.162	0.375	0.6	0.857	1.155	1.418	1.847	2.526	3.221	3.595	3.595	3.595

1999	0.031	0.135	0.376	0.665	0.926	1.206	1.523	1.775	2.215	2.911	3.604	3.604	3.604
2000	0.029	0.133	0.317	0.665	1.013	1.294	1.583	1.905	2.137	2.578	3.278	3.278	3.278
2001	0.031	0.124	0.314	0.569	1.01	1.395	1.688	1.977	2.292	2.495	2.929	2.929	2.929
2002	0.032	0.132	0.293	0.563	0.875	1.387	1.795	2.095	2.374	2.676	2.845	2.845	2.845
2003	0.032	0.137	0.314	0.528	0.865	1.216	1.78	2.196	2.503	2.768	3.049	3.049	3.049
2004	0.031	0.135	0.322	0.563	0.815	1.202	1.578	2.173	2.588	2.903	3.151	3.151	3.151
2005	0.027	0.132	0.319	0.578	0.865	1.137	1.559	1.946	2.554	2.962	3.29	3.29	3.29
2006	0.026	0.115	0.311	0.572	0.886	1.201	1.481	1.922	2.309	2.917	3.315	3.315	3.315
2007	0.027	0.111	0.274	0.559	0.879	1.23	1.557	1.833	2.281	2.661	3.257	3.257	3.257
2008	0.031	0.117	0.264	0.497	0.86	1.221	1.593	1.92	2.184	2.628	2.996	2.996	2.996
2009	0.029	0.13	0.278	0.479	0.77	1.197	1.584	1.961	2.278	2.526	2.958	2.958	2.958
2010	0.038	0.123	0.307	0.503	0.743	1.078	1.554	1.953	2.324	2.625	2.852	2.852	2.852
2011	0.032	0.157	0.292	0.551	0.778	1.043	1.407	1.917	2.317	2.675	2.955	2.955	2.955
2012	0.034	0.136	0.364	0.526	0.847	1.089	1.364	1.747	2.277	2.67	3.008	3.008	3.008
2013	0.025	0.143	0.319	0.645	0.813	1.179	1.421	1.696	2.086	2.626	3.005	3.005	3.005
2014	0.03	0.107	0.333	0.571	0.979	1.136	1.531	1.762	2.029	2.417	2.957	2.957	2.957
2015	0.026	0.126	0.256	0.592	0.875	1.345	1.481	1.889	2.104	2.356	2.736	2.736	2.736
2016	0.034	0.11	0.297	0.465	0.902	1.213	1.726	1.835	2.245	2.437	2.67	2.67	2.67

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	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1951	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1952	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1953	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1954	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1955	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1956	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1957	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1958	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1959	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1960	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1961	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1962	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1963	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1964	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1965	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1966	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1967	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1968	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1969	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1970	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1971	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1972	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1

1973	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1974	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1975	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1976	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1977	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1978	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	1	1	1
1979	0	0	0.027	0.101	0.311	0.622	0.845	0.944	0.982	0.994	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	0.019	0.069	0.213	0.497	0.855	0.964	0.991	0.996	1	1	1
1997	0	0	0.026	0.062	0.204	0.495	0.76	0.948	0.989	0.997	1	1	1
1998	0	0	0.035	0.104	0.25	0.502	0.75	0.907	0.984	0.997	1	1	1

1999	0	0	0.051	0.127	0.348	0.595	0.76	0.898	0.969	0.995	1	1	1
2000	0	0	0.033	0.19	0.406	0.617	0.754	0.9	0.966	0.99	1	1	1
2001	0	0	0.036	0.116	0.476	0.647	0.856	0.895	0.967	0.989	1	1	1
2002	0	0	0.024	0.141	0.375	0.725	0.872	0.937	0.965	0.989	1	1	1
2003	0	0	0.022	0.086	0.358	0.619	0.866	0.949	0.968	0.984	1	1	1
2004	0	0	0.028	0.079	0.247	0.605	0.749	0.949	0.98	0.993	1	1	1
2005	0	0	0.03	0.092	0.207	0.531	0.784	0.929	0.978	0.993	1	1	1
2006	0	0	0.03	0.108	0.264	0.511	0.734	0.928	0.971	0.995	1	1	1
2007	0	0	0.023	0.089	0.343	0.546	0.788	0.913	0.964	0.993	1	1	1
2008	0	0	0.02	0.091	0.281	0.494	0.793	0.871	0.962	0.982	1	1	1
2009	0	0	0.018	0.065	0.229	0.56	0.737	0.912	0.973	0.985	1	1	1
2010	0	0	0.021	0.071	0.189	0.461	0.738	0.932	0.967	0.986	1	1	1
2011	0	0	0.02	0.09	0.216	0.433	0.696	0.941	0.923	0.988	1	1	1
2012	0	0	0.032	0.066	0.239	0.448	0.698	0.839	0.895	0.991	1	1	1
2013	0	0	0.033	0.133	0.225	0.506	0.721	0.856	0.948	0.991	1	1	1
2014	0	0	0.034	0.118	0.347	0.558	0.751	0.872	0.944	0.964	1	1	1
2015	0	0	0.027	0.123	0.319	0.638	0.75	0.893	0.944	0.981	1	1	1
2016	0	0	0.033	0.091	0.383	0.65	0.829	0.898	0.961	0.979	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 EATEN, TONNES
1984	1923.8	980.7	14.7	0.1	0	0	0	50.3
1985	1697.3	1206.2	5.2	0	0	0	0	47
1986	92.2	566.3	244.2	168.1	0	0	0	110.4
1987	0	768.4	0	0	0	0	0	4.2
1988	0	17.1	0.5	9.1	0	0.2	0	2.6
1989	22	230.4	0	0	0	0	0	10.3
1990	51.1	144	37.9	3.7	0	0	0	15.5
1991	0	457.8	14.2	0	0	0	0	20.2
1992	166.4	2111.4	150.8	1.1	0	0	0	106.1
1993	776	1376.4	165.3	36.6	3.4	2.9	0	70.9
1994	1309.6	1412.3	80	24.6	7.4	0.9	0	48.3
1995	192.3	2899.5	163	11.7	27.9	27.4	0.3	112.8
1996	344.5	1594.1	161.4	40.2	5.5	2.6	3.4	68.7
1997	0	906.5	35.5	25.5	1.7	0.8	0.5	41.3
1998	0	1534.8	28.2	2	2.9	0.5	0	32.5
1999	0	898.2	23.4	0.3	0	0	0	25.8
2000	696.5	1216.4	65	2.1	1.1	0.2	0.1	51.1
2001	983	554.9	52.8	5	0.1	0	0	48.9
2002	445.8	2409.9	232.7	38.7	2.5	0.4	0.2	124.9
2003	1190.4	3668.9	225.9	40	12.6	1.2	0	171
2004	5693.2	3078.3	316.5	42.9	11.2	2.8	0	208.8
2005	7471.8	6660.1	281.5	58.2	10.2	2.5	1.2	320.3
2006	12854.8	7988.2	374.6	5.6	4.7	1.3	0.5	352.7
2007	1239.3	10291.5	665.8	71.7	4.2	2.5	0.3	381.9
2008	1451.3	1034.2	895.1	230.7	52.7	6.7	4.2	312
2009	6566	2127.1	304.9	271.8	75.5	25.5	1.8	281.6
2010	2347.1	6053.2	165.6	66.5	78.7	74.2	14.1	298.4
2011	3056.2	3061.7	406.2	48.8	73.8	88.5	23.8	301.2
2012	330.5	7875.9	138.6	108.7	15	6.6	4.3	238.3
2013	2726.3	2004.2	421	26.9	20	4.7	3.9	213.6
2014	1168	2344.8	140.9	22.6	1.4	0.5	0	91.5
2015	5920.3	2786.8	114.9	10.2	29.4	1	0.1	184.1
2016	14087.9	3648	351.2	17.2	1.9	5.2	1.2	277.8
1984-2016	2266.8	2542.7	190.2	42.1	13.4	7.9	1.8	140.2

Table 4.9. Northeast Arctic haddock. Survey indices used in tuning SAM assessment model

104
RU-BTR-Q4
19,912,016
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

BS-NoRU-Q1(Aco)

19,932,017

1 1 0.085 0.26

4 8

1	1300	130	-1	-1	-1
1	6310	1110	120	-1	-1
1	1110	3870	420	20	-1
1	310	760	1510	80	-1
1	170	120	430	430	20
1	280	120	50	130	160
1	130	140	40	10	20
1	650	190	110	20	10
1	230	220	10	10	-1
1	1490	140	120	10	-1
1	1980	1690	170	50	-1
1	760	760	660	70	20

1	1020	360	400	90	-1
1	860	300	120	90	20
1	540	880	220	60	50
1	2517	573	742	102	58
1	7730	4021	313	149	16
1	5930	5574	1914	103	29
1	681	3130	2626	524	16
1	300	584	2943	1349	316
1	1324	295	390	2437	1043
1	437	827	183	438	866
1	1464	365	308	115	185
1	96	613	141	244	79
1	766	45	392	72	90

BS-NoRu-Q1 (BTr)

19,942,017

1 1 0.085 0.189

4 9

1	4279	483	33.9	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	32.4	81.5	59.4	5.6
1	156	93.6	28.7	8.6	13	7.4
1	358	69.1	40.5	6.5	0.1	8.1

1	261	227	17.3	7.8	0.6	0.6
1	1868	119	84.3	8.6	1.9	0
1	1751	723	50.4	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	335	1050	201	407	100	273
1	946	47.6	452	88.4	129	11.5

FLT007: Eco-NoRu-Q3 (Btr)

20,042,016

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

Table 4.10. Northeast Arctic haddock. SAM model configuration used in 2017 assessment

```
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. Estimated recruitment, total stock biomass (TBS), spawning stock biomass (SSB), and average fishing mortality for ages 4 to 7 (F47)

Year	R(age 3)	Low	High	SSB	Low	High	Fbar(4–7)	Low	High	TSB	Low	High
1950	69139	41101	116303	209943	174431	252685	0.74	0.59	0.92	381758	323446	450582
1951	644460	388070	1070241	126789	108097	148712	0.69	0.56	0.85	429780	323911	570252
1952	94298	56845	156427	101855	86190	120368	0.7	0.57	0.87	423286	320401	559208
1953	1089462	653099	1817378	120005	95891	150182	0.54	0.44	0.68	684042	496455	942510
1954	134997	81052	224847	169415	134600	213237	0.48	0.39	0.61	756446	561895	1018359
1955	55903	33290	93877	269329	207124	350216	0.41	0.33	0.52	729034	546473	972582
1956	229037	136437	384485	327556	246539	435198	0.44	0.35	0.55	625300	485037	806125
1957	59373	35660	98855	256400	197450	332951	0.41	0.33	0.52	435557	351343	539957
1958	68083	40570	114254	186736	150435	231797	0.49	0.39	0.61	315346	261863	379753
1959	384308	232894	634161	130789	107673	158869	0.45	0.36	0.56	335598	265194	424692
1960	322474	194773	533901	117263	98881	139062	0.56	0.45	0.69	421165	335226	529135
1961	148830	90703	244208	125148	104957	149222	0.66	0.54	0.81	401546	327454	492402
1962	305263	186404	499910	122920	101722	148535	0.75	0.61	0.92	374504	305279	459426
1963	312159	190616	511202	96457	81299	114441	0.73	0.59	0.91	358537	287839	446600
1964	326481	198230	537707	86438	73159	102128	0.66	0.53	0.82	379304	301598	477030
1965	125969	76345	207849	100398	83128	121255	0.56	0.45	0.7	369101	296828	458971
1966	305967	185308	505190	133685	108946	164040	0.54	0.43	0.68	421124	339953	521675
1967	318932	192498	528409	145200	118355	178132	0.46	0.36	0.58	444664	359027	550728
1968	16620	9932	27810	159840	132042	193492	0.48	0.38	0.61	405585	327916	501651
1969	20637	12468	34158	160836	131848	196196	0.41	0.32	0.52	301766	242924	374862
1970	196985	118009	328815	149677	120915	185282	0.39	0.31	0.5	273805	220988	339244
1971	95942	57102	161201	122792	99052	152222	0.34	0.26	0.43	246994	202357	301477

1972	1104475	673680	1810749	122401	102068	146786	0.62	0.49	0.77	600405	431295	835821
1973	315862	192888	517237	125698	104072	151818	0.51	0.41	0.65	666424	506119	877502
1974	70631	43328	115138	166497	132481	209248	0.56	0.44	0.7	511871	400828	653677
1975	60251	37051	97977	190369	148261	244437	0.51	0.41	0.64	373585	298619	467372
1976	63906	39096	104461	183273	143536	234010	0.72	0.58	0.89	282140	229929	346206
1977	121998	73820	201618	117033	92333	148340	0.74	0.6	0.92	200703	165394	243550
1978	211641	129399	346156	78743	62123	99811	0.62	0.5	0.78	196284	155925	247090
1979	153353	93457	251638	61859	49373	77502	0.57	0.45	0.73	201604	161237	252078
1980	19647	11559	33393	62008	50435	76237	0.46	0.35	0.58	204946	163436	256999
1981	9475	5673	15824	71050	57313	88079	0.41	0.31	0.52	160513	127721	201724
1982	16570	9996	27467	67915	53936	85516	0.36	0.28	0.46	119919	96451	149097
1983	9553	5711	15980	59370	47433	74309	0.36	0.28	0.47	89330	73133	109113
1984	14128	8486	23522	53097	42456	66406	0.3	0.24	0.39	72136	59233	87849
1985	326349	196945	540778	49702	40571	60889	0.4	0.32	0.51	180151	126375	256810
1986	463304	280982	763929	53934	44359	65576	0.55	0.44	0.69	352316	263049	471877
1987	84067	50504	139934	71203	56150	90292	0.66	0.52	0.83	329657	257466	422088
1988	38432	22864	64600	76765	60447	97487	0.53	0.41	0.69	247829	195815	313659
1989	30395	18262	50588	82916	63988	107441	0.3	0.23	0.4	189489	150055	239287
1990	37246	23275	59603	88561	68862	113895	0.23	0.18	0.3	157452	127200	194900
1991	98851	69090	141432	100710	81142	124995	0.25	0.19	0.31	181465	152793	215518
1992	312410	219947	443743	114864	95282	138471	0.29	0.23	0.36	287812	242121	342126
1993	889656	615726	1285454	132379	112919	155193	0.3	0.24	0.37	550367	449732	673521
1994	303493	213759	430896	168189	146353	193282	0.35	0.27	0.43	668180	563641	792106
1995	82247	57703	117231	215789	186241	250025	0.33	0.26	0.41	658839	558330	777441
1996	92777	65205	132007	264686	225071	311274	0.4	0.32	0.49	577671	494297	675108
1997	91932	64675	130675	213340	181009	251445	0.49	0.39	0.61	377985	327016	436899

1998	61648	43517	87333	152132	129350	178927	0.48	0.39	0.6	263148	230174	300847
1999	192031	135345	272460	111677	95387	130749	0.47	0.38	0.58	248326	213939	288240
2000	77633	54831	109918	101294	87007	117929	0.37	0.29	0.46	231042	200547	266174
2001	349741	245939	497354	107078	92536	123904	0.36	0.29	0.45	294548	248568	349035
2002	367029	259338	519439	134151	116849	154015	0.33	0.27	0.41	434150	369896	509565
2003	246621	175533	346498	179813	156855	206132	0.4	0.32	0.49	528457	457031	611046
2004	222091	163266	302110	185071	161849	211625	0.41	0.33	0.51	487798	428834	554869
2005	350823	254099	484365	185096	162020	211460	0.43	0.35	0.53	506569	442698	579656
2006	164974	121382	224221	177148	155201	202198	0.38	0.31	0.47	446801	392955	508025
2007	898282	633503	1273730	204372	179846	232242	0.35	0.29	0.44	655753	552658	778081
2008	1329769	940149	1880857	219350	192268	250247	0.29	0.23	0.37	981142	814923	1181264
2009	1083394	765562	1533178	258731	225147	297324	0.25	0.2	0.32	1292442	1073014	1556741
2010	307270	226413	417003	368654	315885	430238	0.23	0.18	0.29	1442960	1213780	1715413
2011	106895	78804	144999	487852	412847	576485	0.22	0.18	0.28	1290389	1088707	1529433
2012	294197	212988	406370	588932	492660	704017	0.2	0.15	0.25	1159621	981641	1369871
2013	105011	76581	143995	651494	537000	790398	0.15	0.12	0.19	1029862	868471	1221245
2014	340143	247571	467328	675563	540987	843617	0.15	0.12	0.19	1026566	853865	1234198
2015	79170	55999	111928	656269	503483	855419	0.17	0.13	0.22	963719	780189	1190421
2016	183956	125741	269123	675068	501105	909423	0.2	0.15	0.26	911430	712613	1165716
2017	NA	14670	2306684	536454	372423	772732	0.2	0.12	0.34	741064	527854	1040393

Table 4.12. Northeast Arctic haddock. Estimated fishing mortality at age.

Year Age	3	4	5	6	7	8	9	10	11	12	13
1950	0.092	0.387	0.679	0.843	1.032	0.985	0.803	0.803	0.803	0.803	0.803

1951	0.085	0.354	0.624	0.789	0.98	0.964	0.803	0.803	0.803	0.803	0.803
1952	0.088	0.364	0.635	0.806	1.012	1.003	0.842	0.842	0.842	0.842	0.842
1953	0.066	0.279	0.485	0.618	0.789	0.784	0.679	0.679	0.679	0.679	0.679
1954	0.054	0.235	0.418	0.552	0.73	0.734	0.636	0.636	0.636	0.636	0.636
1955	0.044	0.196	0.358	0.476	0.615	0.581	0.48	0.48	0.48	0.48	0.48
1956	0.05	0.211	0.386	0.515	0.646	0.602	0.504	0.504	0.504	0.504	0.504
1957	0.047	0.201	0.368	0.48	0.592	0.548	0.487	0.487	0.487	0.487	0.487
1958	0.057	0.236	0.44	0.575	0.706	0.672	0.642	0.642	0.642	0.642	0.642
1959	0.059	0.237	0.42	0.524	0.603	0.573	0.572	0.572	0.572	0.572	0.572
1960	0.087	0.323	0.552	0.652	0.697	0.651	0.648	0.648	0.648	0.648	0.648
1961	0.113	0.403	0.682	0.776	0.782	0.703	0.672	0.672	0.672	0.672	0.672
1962	0.134	0.47	0.796	0.882	0.837	0.716	0.661	0.661	0.661	0.661	0.661
1963	0.127	0.454	0.776	0.874	0.826	0.69	0.627	0.627	0.627	0.627	0.627
1964	0.104	0.385	0.673	0.795	0.791	0.69	0.64	0.64	0.64	0.64	0.64
1965	0.086	0.324	0.563	0.677	0.696	0.624	0.591	0.591	0.591	0.591	0.591
1966	0.088	0.326	0.55	0.643	0.653	0.577	0.528	0.528	0.528	0.528	0.528
1967	0.076	0.282	0.465	0.535	0.549	0.499	0.457	0.457	0.457	0.457	0.457
1968	0.085	0.304	0.491	0.556	0.573	0.526	0.479	0.479	0.479	0.479	0.479
1969	0.079	0.273	0.425	0.468	0.47	0.43	0.389	0.389	0.389	0.389	0.389
1970	0.083	0.275	0.411	0.442	0.442	0.408	0.374	0.374	0.374	0.374	0.374
1971	0.075	0.246	0.358	0.373	0.369	0.345	0.324	0.324	0.324	0.324	0.324
1972	0.171	0.477	0.688	0.676	0.623	0.561	0.515	0.515	0.515	0.515	0.515
1973	0.166	0.442	0.594	0.541	0.478	0.422	0.388	0.388	0.388	0.388	0.388
1974	0.18	0.467	0.621	0.587	0.55	0.512	0.488	0.488	0.488	0.488	0.488
1975	0.179	0.456	0.579	0.525	0.483	0.442	0.42	0.42	0.42	0.42	0.42
1976	0.264	0.636	0.814	0.738	0.688	0.647	0.623	0.623	0.623	0.623	0.623

1977	0.289	0.689	0.871	0.75	0.666	0.613	0.573	0.573	0.573	0.573	0.573
1978	0.209	0.539	0.728	0.646	0.567	0.525	0.481	0.481	0.481	0.481	0.481
1979	0.159	0.45	0.664	0.633	0.548	0.52	0.468	0.468	0.468	0.468	0.468
1980	0.103	0.324	0.512	0.523	0.461	0.455	0.405	0.405	0.405	0.405	0.405
1981	0.086	0.276	0.447	0.477	0.421	0.415	0.36	0.36	0.36	0.36	0.36
1982	0.075	0.245	0.391	0.423	0.378	0.375	0.321	0.321	0.321	0.321	0.321
1983	0.082	0.259	0.397	0.421	0.379	0.379	0.308	0.308	0.308	0.308	0.308
1984	0.066	0.218	0.329	0.346	0.32	0.309	0.236	0.236	0.236	0.236	0.236
1985	0.077	0.258	0.409	0.467	0.472	0.466	0.36	0.36	0.36	0.36	0.36
1986	0.095	0.325	0.547	0.654	0.69	0.683	0.516	0.516	0.516	0.516	0.516
1987	0.105	0.367	0.648	0.785	0.836	0.811	0.568	0.568	0.568	0.568	0.568
1988	0.08	0.292	0.527	0.649	0.666	0.65	0.435	0.435	0.435	0.435	0.435
1989	0.048	0.184	0.318	0.367	0.35	0.311	0.207	0.207	0.207	0.207	0.207
1990	0.033	0.134	0.233	0.276	0.278	0.261	0.197	0.197	0.197	0.197	0.197
1991	0.033	0.137	0.25	0.3	0.302	0.281	0.219	0.219	0.219	0.219	0.219
1992	0.033	0.14	0.281	0.356	0.37	0.346	0.277	0.277	0.277	0.277	0.277
1993	0.026	0.122	0.273	0.379	0.414	0.388	0.318	0.318	0.318	0.318	0.318
1994	0.026	0.122	0.297	0.444	0.518	0.487	0.402	0.402	0.402	0.402	0.402
1995	0.024	0.112	0.273	0.414	0.501	0.47	0.386	0.386	0.386	0.386	0.386
1996	0.029	0.133	0.329	0.503	0.621	0.589	0.48	0.48	0.48	0.48	0.48
1997	0.038	0.168	0.416	0.619	0.747	0.676	0.528	0.528	0.528	0.528	0.528
1998	0.042	0.181	0.429	0.609	0.712	0.644	0.503	0.503	0.503	0.503	0.503
1999	0.045	0.19	0.431	0.585	0.67	0.606	0.484	0.484	0.484	0.484	0.484
2000	0.036	0.156	0.344	0.454	0.511	0.46	0.376	0.376	0.376	0.376	0.376
2001	0.034	0.15	0.337	0.45	0.501	0.454	0.382	0.382	0.382	0.382	0.382
2002	0.031	0.139	0.308	0.417	0.461	0.41	0.341	0.341	0.341	0.341	0.341

2003	0.037	0.158	0.355	0.495	0.574	0.52	0.437	0.437	0.437	0.437	0.437
2004	0.04	0.164	0.366	0.516	0.6	0.543	0.446	0.446	0.446	0.446	0.446
2005	0.041	0.167	0.373	0.537	0.649	0.603	0.5	0.5	0.5	0.5	0.5
2006	0.037	0.148	0.327	0.473	0.588	0.561	0.455	0.455	0.455	0.455	0.455
2007	0.032	0.129	0.287	0.436	0.565	0.55	0.437	0.437	0.437	0.437	0.437
2008	0.023	0.097	0.219	0.356	0.495	0.494	0.39	0.39	0.39	0.39	0.39
2009	0.02	0.083	0.183	0.305	0.448	0.463	0.366	0.366	0.366	0.366	0.366
2010	0.02	0.078	0.167	0.274	0.408	0.441	0.356	0.356	0.356	0.356	0.356
2011	0.021	0.078	0.164	0.262	0.388	0.425	0.341	0.341	0.341	0.341	0.341
2012	0.022	0.078	0.151	0.228	0.326	0.359	0.286	0.286	0.286	0.286	0.286
2013	0.019	0.067	0.121	0.171	0.245	0.286	0.239	0.239	0.239	0.239	0.239
2014	0.021	0.072	0.125	0.168	0.233	0.283	0.244	0.244	0.244	0.244	0.244
2015	0.027	0.089	0.15	0.191	0.253	0.307	0.263	0.263	0.263	0.263	0.263
2016	0.032	0.105	0.176	0.218	0.287	0.35	0.296	0.296	0.296	0.296	0.296
2017	0.033	0.108	0.181	0.224	0.295	0.359	0.304	0.304	0.304	0.304	0.304

Table 4.13. Northeast Arctic haddock. Estimated stock numbers at age. SAM

Year Age	3	4	5	6	7	8	9	10	11	12	13
1950	69139	105893	71803	37685	44152	16611	4894	3094	1275	1445	1971
1951	644460	45411	48680	27067	13087	12214	5192	2030	1197	449	1183
1952	94298	434011	29028	19315	9151	4323	3649	1716	825	450	589
1953	1089462	54716	210074	13564	6382	2751	1218	1079	578	313	421
1954	134997	798604	27184	93414	6637	2351	1183	547	400	216	319

1955	55903	85353	527140	14540	45105	2958	844	492	245	162	199
1956	229037	39121	57913	279795	7371	16999	1378	408	259	139	193
1957	59373	148794	26813	35541	112909	3276	6054	734	184	136	201
1958	68083	38866	89291	15470	19733	43337	1742	2524	379	103	211
1959	384308	48348	25677	40971	7507	7542	16218	806	904	160	145
1960	322474	263903	33847	15151	18101	3630	3871	7040	407	354	132
1961	148830	189983	144551	17170	6848	8134	1681	1545	3014	164	194
1962	305263	87191	88441	57126	6883	2733	3337	744	626	1268	134
1963	312159	184115	37815	26820	17569	2852	1137	1293	349	261	612
1964	326481	196470	79172	12170	7766	5840	1407	479	542	185	417
1965	125969	220341	111610	30069	3959	2662	2204	615	220	228	292
1966	305967	82805	141796	56508	11830	1535	1171	920	314	94	203
1967	318932	194402	44241	68381	24122	4659	691	568	446	159	141
1968	16620	234777	112636	22127	33630	12001	2180	362	299	231	156
1969	20637	10862	133715	52771	10719	15161	5587	1127	176	155	180
1970	196985	12310	6990	66421	24588	5890	7795	2997	641	96	197
1971	95942	124415	6836	4243	31869	12079	3242	4466	1667	375	161
1972	1104475	69931	72432	4402	3103	16682	6719	1930	2719	994	314
1973	315862	666221	38401	23841	1590	1635	7089	3044	918	1371	599
1974	70631	170737	299113	15069	10559	837	1167	4007	1689	541	1183
1975	60251	40002	88129	138794	6118	4752	378	626	1942	794	881
1976	63906	33962	17997	42272	72594	2853	2694	214	381	1037	921
1977	121998	33218	13667	6768	17063	30036	1127	1165	89	175	761
1978	211641	55736	9923	4395	3088	7547	14390	586	543	33	407
1979	153353	116033	22826	3129	2109	1496	4020	7004	346	266	210
1980	19647	97905	56341	8153	1050	1154	766	2187	3472	194	232

1981	9475	14314	59496	25326	3396	522	599	443	1224	1778	233
1982	16570	6225	10559	30355	10595	1644	272	345	289	719	1044
1983	9553	11420	4448	6745	13894	5474	987	147	209	190	911
1984	14128	5364	6654	2735	3913	8852	2627	596	81	125	613
1985	326349	9066	2865	3526	1950	2633	5427	1765	402	64	500
1986	463304	250007	5166	1650	1831	1018	1540	2893	1019	236	361
1987	84067	251241	132349	2514	714	733	470	764	1306	491	269
1988	38432	65220	140587	41069	1116	199	259	227	374	577	328
1989	30395	26326	46450	69439	11759	630	45	142	122	200	438
1990	37246	21230	17362	26896	33919	5276	520	49	96	79	352
1991	98851	25171	13157	13758	19944	20824	3003	374	41	66	242
1992	312410	80444	16533	9809	10668	12898	13910	1936	255	34	176
1993	889656	241092	52802	11309	6056	6587	8129	8685	1155	176	125
1994	303493	654783	148784	31822	4919	3089	4049	5147	5279	697	176
1995	82247	219126	451966	76649	14887	2290	1453	2245	2754	2897	468
1996	92777	66731	173778	244673	38699	7205	1319	804	1236	1543	1893
1997	91932	50838	37726	88941	95525	14930	2626	667	390	600	1705
1998	61648	68315	31468	20266	36774	39144	5750	1157	323	184	1154
1999	192031	46822	41290	17659	9321	14191	15281	2440	541	177	703
2000	77633	132021	31051	22435	7868	4085	6522	6930	1099	276	488
2001	349741	58637	76764	14972	9860	3578	2678	3819	3566	597	468
2002	367029	309168	44497	46856	8273	5576	2068	1582	2206	1913	562
2003	246621	274435	211016	34991	26045	4343	3890	1431	962	1327	1464
2004	222091	150741	155531	107983	17234	12160	2313	2072	822	511	1600
2005	350823	162994	86426	94615	48367	7024	6225	1410	1002	462	1261
2006	164974	210756	93574	51238	46425	19292	3512	3286	739	499	864

2007	898282	132345	169746	57753	27993	20402	8596	2037	1770	412	702
2008	1329769	610653	103010	104660	26221	16061	8434	4143	1198	963	608
2009	1083394	925642	456835	63893	38597	10907	6506	4324	2102	765	974
2010	307270	818030	714397	260679	36957	16064	5805	3626	2375	1214	1157
2011	106895	200014	594225	431953	118135	14791	8193	3029	2006	1356	1538
2012	294197	68201	129555	372460	261542	58424	7742	4105	1646	1159	1822
2013	105011	196837	54298	101714	262256	144407	28580	4569	2418	1023	1932
2014	340143	77394	139533	53840	100393	164995	83480	16138	2793	1569	1905
2015	79170	297180	69094	93377	45611	76078	105162	47985	9431	1670	2019
2016	183956	39246	183048	60630	80535	36625	61353	65090	28743	5603	2103
2017	183956	145846	18631	105411	34803	44155	19680	37363	39639	17504	4693

Table 4.14. Northeast Arctic haddock. Estimated natural mortalities M.

Year	3	4	5	6	7	8	9	10	11	12	13
1950	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1951	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1952	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1953	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1954	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1955	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1956	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1957	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1958	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1959	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2

1960	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1961	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1962	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1963	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1964	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1965	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1966	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1967	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1968	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1969	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1970	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1971	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1972	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1973	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1974	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1975	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1976	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1977	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1978	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1979	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1980	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1981	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1982	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1983	0.354	0.264	0.241	0.232	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1984	0.217	0.226	0.223	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1985	0.211	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

1986	0.631	0.272	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1987	0.2	0.209	0.382	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1988	0.382	0.2	0.221	0.356	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1989	0.202	0.2	0.2	0.239	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1990	0.338	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1991	0.2	0.215	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1992	0.211	0.206	0.209	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.258	0.247	0.27	0.27	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.28	0.222	0.246	0.234	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1995	0.348	0.321	0.315	0.22	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1996	0.726	0.316	0.247	0.295	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1997	0.497	0.242	0.21	0.226	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1998	0.241	0.272	0.201	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1999	0.211	0.216	0.222	0.211	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2000	0.215	0.224	0.247	0.257	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2001	0.214	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2002	0.324	0.219	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2003	0.416	0.264	0.241	0.203	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2004	0.418	0.278	0.2	0.227	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2005	0.415	0.291	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2006	0.222	0.214	0.214	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2007	0.307	0.205	0.259	0.247	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2008	0.381	0.3	0.26	0.362	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2009	0.432	0.273	0.321	0.233	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2010	0.363	0.274	0.315	0.333	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2011	0.539	0.483	0.364	0.259	0.2	0.2	0.2	0.2	0.2	0.2	0.2

2012	0.59	0.317	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2013	0.471	0.33	0.238	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2014	0.291	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2015	0.594	0.446	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2016	0.347	0.354	0.286	0.263	0.2	0.2	0.2	0.2	0.2	0.2	0.2
2017	0.347	0.354	0.286	0.263	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table 4.15. Northeast Arctic haddock. Summary. XSA ages 3-13+ (p-shrinkage not applied)

YEAR	RECR_A3 (THOUSANDS)	TOTBIO (TONNES)	TOTSPB (TONNES)	LANDINGS (TONNES)	YIELDSSB	SOPCOFAC	FBAR 4–7
1950	82768	242561	134510	132125	0.9823	1.5897	0.8318
1951	671718	356634	101063	120077	1.1881	1.2272	0.6245
1952	77193	235610	57477	127660	2.2211	1.7404	0.7252
1953	1280797	513066	82493	123920	1.5022	1.4279	0.5165
1954	153242	538239	117212	156788	1.3376	1.474	0.3808
1955	68959	485217	178635	202286	1.1324	1.536	0.5122
1956	209627	474285	243129	213924	0.8799	1.2623	0.4338
1957	66477	326299	186177	123583	0.6638	1.2455	0.433
1958	87476	276968	156903	112672	0.7181	1.1252	0.5195
1959	400386	365516	133201	88211	0.6622	0.9405	0.3678
1960	290969	401714	114630	154651	1.3491	1.0411	0.4845
1961	131367	391600	129927	193224	1.4872	0.9942	0.6372
1962	292118	346736	118775	187408	1.5778	1.0518	0.8012
1963	342507	311253	82633	146224	1.7696	1.1458	0.8658
1964	400057	302407	63844	99158	1.5531	1.3572	0.653
1965	124870	358065	95371	118578	1.2433	1.1507	0.494
1966	295150	387692	127375	161778	1.2701	1.1621	0.5842
1967	363900	468239	154361	136397	0.8836	0.9984	0.4155
1968	24031	421282	169418	181726	1.0726	0.9976	0.5038
1969	21528	342092	183920	130820	0.7113	0.882	0.398
1970	203355	286698	155928	88257	0.566	0.9762	0.3585
1971	123100	345988	168573	78905	0.4681	0.7638	0.247
1972	1256302	620825	123046	266153	2.163	1.0883	0.693
1973	343187	604205	114686	322226	2.8096	1.1656	0.5372
1974	69495	603210	200534	221157	1.1028	0.8946	0.4325
1975	60422	492134	255690	175758	0.6874	0.8957	0.4275
1976	67135	307263	206591	137264	0.6644	1.12	0.5715
1977	134783	229094	141797	110158	0.7769	1.09	0.6842
1978	214259	256346	130589	95422	0.7307	0.9219	0.5122
1979	176804	318719	129548	103623	0.7999	0.7684	0.5525
1980	34902	343258	133183	87889	0.6599	0.7568	0.3988
1981	13506	292664	148120	77153	0.5209	0.7174	0.4018
1982	17482	211749	127104	46955	0.3694	0.7224	0.3098
1983	9597	104370	71459	24600	0.3443	1.0373	0.2715
1984	13424	83509	64129	20945	0.3266	1.0547	0.2498
1985	288308	182821	62028	45052	0.7263	0.9761	0.32
1986	526772	342897	62304	100563	1.6141	1.0484	0.4388
1987	109804	333999	75071	154916	2.0636	0.992	0.5958
1988	55355	260336	78459	95255	1.2141	0.9955	0.499
1989	26605	212831	92036	58518	0.6358	0.9774	0.3888
1990	37335	171071	95383	27182	0.285	1.0159	0.156
1991	104717	195673	110622	36216	0.3274	1.0374	0.2082

1992	208374	269863	125916	59922	0.4759	0.9797	0.283
1993	667749	444619	130736	82379	0.6301	1.0031	0.3578
1994	293626	549427	151912	135186	0.8899	1.0056	0.424
1995	97892	544962	174845	142448	0.8147	1.0247	0.3815
1996	104990	479806	214214	178128	0.8315	1.0175	0.4215
1997	115698	353631	191927	154359	0.8043	1.0519	0.4822
1998	62738	255440	142508	100630	0.7061	1.0113	0.4162
1999	231851	261212	109384	83195	0.7606	1.021	0.4072
2000	98994	262450	105511	68944	0.6534	1.026	0.2665
2001	379252	375860	143088	89640	0.6265	0.9903	0.261
2002	359645	472054	168496	114798	0.6813	1.011	0.2902
2003	244219	523851	197072	138926	0.705	1.019	0.3972
2004	247586	519013	202898	158279	0.7801	1.0192	0.3322
2005	376957	557422	219642	158298	0.7207	1.0029	0.4262
2006	199683	515783	205191	153157	0.7464	0.9938	0.338
2007	783637	667887	231581	161525	0.6975	0.9916	0.3325
2008	1484051	1017797	240096	155604	0.6481	0.9928	0.2855
2009	1506965	1426912	299564	200061	0.6678	1.0019	0.2408
2010	490742	1586194	422828	249200	0.5894	0.9994	0.1922
2011	225705	1549006	598114	309785	0.5179	0.9978	0.232
2012	430219	1361285	678662	315627	0.4651	0.9994	0.2395
2013	181293	1141596	703989	193744	0.2752	0.9967	0.144
2014	435038	1085963	684878	177522	0.2592	0.9968	0.127
2015	78389	975710	643634	194756	0.3026	0.9953	0.1562
2016	266311	822148	561940	233183	0.415	1.0006	0.2

Table 4.16. Northeast Arctic haddock. Input data for recruitment prediction (RCT3)

ORTHEAST ARCTIC HADDOCK: RECRUITS AS 3 YEAR-OLDS

12 27 2

'YEAR-CLASS'	'SAM'	'NT1'	'NT2'	'NT3'	'NAK1'	'NAK2'	'NAK3'	'RT1'	'RT2'	'RT3'	'EC01'	'ECO2'	'ECO3'
1990	890	-11	-11	-11	1890	868	563	-11	42.9	128.6	-11	-11	-11
1991	303	-11	-11	315.2	1135	626	255	16.7	28.2	35.7	-11	-11	-11
1992	82	-11	220.9	57.6	947	193	36	16.4	4.8	5.8	-11	-11	-11
1993	93	593.5	182.1	55.5	562	285	44	3.5	4.9	4.2	-11	-11	-11
1994	92	1392.8	245	80.9	1379	229	51	9.1	7.2	5.7	-11	-11	-11
1995	62	295.5	93.5	21.2	249	24	20	6.4	2.3	1.9	-11	-11	-11
1996	192	1068.7	196	57.1	693	122	57	6	4.6	11.5	-11	-11	-11
1997	78	239.2	79.8	24.1	220	46	32	1.8	2.9	6.1	-11	-11	-11
1998	350	1186.4	429.8	291.8	856	509	210	10.7	28.9	26.2	-11	-11	-11
1999	367	817	450	313.8	1024	316	216	11.7	20.7	26.1	-11	-11	-11
2000	247	1215.5	464.5	337.8	976	282	145	15.1	14.9	18.9	-11	-11	-11
2001	222	1652.1	481.3	174.9	2062	279	127	20.8	19.3	25.1	-11	-11	-11
2002	351	3254.4	707.3	315.7	2394	474	219	33.2	32.8	20.6	-11	-11	268
2003	165	705.1	369.6	78.8	752	209	54	19.8	11	13.6	-11	189	114
2004	898	4400.9	1296.8	459.1	3364	804	379	50	79.2	122.7	104	626	929
2005	1083	4879.2	1679.9	1578.8	2767	868	723.4	62	79.2	214.2	155	2270	1819
2006	1108	3654.3	2072.2	1237.3	3197	1835.2	1021.7	53.4	83.9	232.7	283	988	1292
2007	307	831.1	329.1	96.1	1266.6	246.3	138	6.5	12.7	15.8	114	322	144
2008	107	550	81.4	52.6	849	81.8	47.6	5.7	2.9	4.3	60	136	65
2009	294	1586.4	354.4	321.6	2035.8	408	224.3	10	19.7	21.7	169	274	114

2010	105	670.9	137.3	55.5	786.5	176	52.9	7.7	3.5	4.3	154	105	42
2011	340	1844.8	480.2	370.6	2222.2	605	319	14.7	30.6	28.3	213	591	223
2012	79	335.7	119.8	30.2	525.5	114	17	6.9	6	2.2	74	156	75
2013	184	1129	315.2	152.7	1569.4	169.2	70	33	10.2	10.2	163	265	145
2014	-11	1071.7	509.2	129	1163.6	121.2	78.4	12	8.3	-11	183	320	84
2015	-11	2202.8	719.1	-11	1246.4	330	-11	17.6	-11	-11	343	538	-11
2016	-11	4693.3	-11	-11	3906.4	-11	-11	-11	-11	-11	496	-11	-11

1990 RT was removed from XSA tuning

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 ver.1

Analysis by RCT3 ver3.1 of data from file :

C:\r2017\2017.txt

NORTHEAST ARCTIC HADDOCK: recruits as 3 year-olds

Data for 12 surveys over 27 years : 1990 - 2016

Regression type = C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied

Final estimates shrunk towards mean
Minimum S.E. for any survey taken as .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 2011

	I----------Regression----------I		I----------Prediction---------I		
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
NT1	1.13	-2.45	.45	.805	18	7.52	6.02	.514	.041
NT2	.90	.23	.30	.904	19	6.18	5.80	.339	.094
NT3	.76	1.63	.35	.875	20	5.92	6.14	.398	.068
NAK1	1.46	-4.83	.58	.713	21	7.71	6.39	.673	.024
NAK2	.97	.08	.37	.859	21	6.41	6.30	.429	.058
NAK3	.84	1.41	.22	.945	21	5.77	6.28	.257	.163
RT1	1.18	2.36	.58	.709	20	2.75	5.60	.666	.024
RT2	.81	3.30	.24	.936	21	3.45	6.12	.274	.143
RT3	.68	3.47	.21	.948	21	3.38	5.78	.244	.181
EC01	4.06	-14.02	1.82	.278	7	5.37	7.76	2.462	.002
ECO2	1.00	-.07	.35	.907	8	6.38	6.31	.433	.057
ECO3	.70	1.98	.24	.948	9	5.41	5.78	.286	.131
			VPA Mean =			5.68	.871	.014	

Yearclass = 2012

Survey/ Series	Regression: Slope	Regression: Inter-cept	Regression: Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
NT1	1.12	-2.44	.42	.812	19	5.82	4.09	.537	.041
NT2	.89	.31	.28	.909	20	4.79	4.58	.337	.105
NT3	.76	1.62	.34	.867	21	3.44	4.23	.433	.063
NAK1	1.48	-5.09	.56	.709	22	6.27	4.20	.698	.024
NAK2	.97	.03	.36	.852	22	4.74	4.64	.440	.062
NAK3	.84	1.39	.25	.924	22	2.89	3.82	.337	.105
RT1	1.18	2.38	.56	.710	21	2.07	4.81	.658	.028
RT2	.81	3.31	.24	.932	22	1.95	4.88	.279	.153
RT3	.68	3.51	.20	.950	22	1.16	4.30	.253	.187
EC01	4.12	-14.58	1.84	.237	8	4.32	3.20	2.549	.002
ECO2	1.00	-.11	.36	.884	9	5.06	4.93	.458	.057
ECO3	.70	1.99	.22	.947	10	4.33	5.03	.276	.156
						VPA Mean =	5.72	.833	.017

Yearclass = 2013

Survey/ Series	Regression: Slope	Regression: Inter-cept	Regression: Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
NT1	1.08	-2.12	.38	.856	20	7.03	5.48	.435	.059
NT2	.91	.19	.27	.921	21	5.76	5.42	.312	.115
NT3	.75	1.70	.32	.892	22	5.04	5.46	.370	.082
NAK1	1.48	-5.05	.50	.772	23	7.36	5.81	.576	.034
NAK2	1.02	-.29	.36	.869	23	5.14	4.96	.419	.064
NAK3	.78	1.74	.27	.924	23	4.26	5.06	.308	.118
RT1	1.25	2.13	.58	.723	22	3.53	6.55	.678	.024
RT2	.86	3.11	.28	.917	23	2.42	5.19	.322	.108
RT3	.66	3.57	.18	.963	23	2.42	5.16	.211	.251
EC01	3.41	-10.98	1.44	.367	9	5.10	6.40	1.760	.004
ECO2	1.09	-.71	.41	.868	10	5.58	5.37	.490	.047
ECO3	.78	1.50	.32	.910	11	4.98	5.40	.374	.080
						VPA Mean =	5.63	.887	.014

Yearclass = 2014

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
NT1	1.10	-2.25	.37	.860	21	6.98	5.39	.417	.083
NT2	.91	.14	.27	.920	22	6.23	5.85	.306	.154
NT3	.76	1.63	.32	.888	23	4.87	5.31	.367	.107
NAK1	1.54	-5.60	.50	.766	24	7.06	5.28	.573	.044
NAK2	1.02	-.28	.35	.873	24	4.81	4.63	.412	.085
NAK3	.77	1.79	.26	.924	24	4.37	5.16	.300	.160
RT1	1.35	1.76	.72	.612	23	2.56	5.21	.826	.021
RT2	.86	3.11	.27	.919	24	2.23	5.04	.312	.148
RT3									
EC01	3.58	-11.98	1.47	.329	10	5.21	6.70	1.789	.005
ECO2	1.10	-.78	.39	.867	11	5.77	5.56	.459	.069
ECO3	.79	1.43	.31	.906	12	4.44	4.95	.371	.105
						VPA Mean =	5.60	.865	.019

Yearclass = 2015

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
NT1	1.10	-2.28	.36	.869	21	7.70	6.18	.419	.174
NT2	.91	.15	.27	.922	22	6.58	6.17	.314	.309
NT3									
NAK1	1.56	-5.76	.48	.789	24	7.13	5.36	.550	.101
NAK2	1.03	-.34	.35	.875	24	5.80	5.64	.402	.189
NAK3									
RT1	1.36	1.70	.74	.609	23	2.92	5.68	.851	.042
RT2									
RT3									
EC01	3.51	-11.66	1.45	.337	10	5.84	8.86	2.071	.007
ECO2	1.10	-.79	.39	.867	11	6.29	6.12	.469	.139
ECO3									
						VPA Mean =	5.58	.874	.040

Yearclass = 2016

Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
	I----------Regression----------I					I----------Prediction---------I			
NT1	1.10	-2.30	.35	.879	21	8.45	7.01	.452	.530
NT2									
NT3									
NAK1	1.56	-5.82	.45	.812	24	8.27	7.12	.591	.311
NAK2									
NAK3									
RT1									
RT2									
RT3									
EC01	3.43	-11.28	1.41	.345	10	6.21	10.01	2.342	.020
ECO2									
ECO3									
			VPA Mean =	5.56	.883	.139			

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
2011	411	6.02	.10	.07	.46	340	5.83
2012	95	4.56	.11	.12	1.23	80	4.38
2013	202	5.31	.11	.08	.59	185	5.22
2014	193	5.27	.12	.11	.79		
2015	386	5.96	.17	.15	.70		
2016	996	6.90	.33	.39	1.42		

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

2017	SAM							
Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	193000	0.411	0.031	0	0	0.281	0.032	0.85
4	145846	0.333	0.112	0	0	0.559	0.103	1.067
5	18631	0.229	0.281	0	0	0.804	0.172	1.316
6	105411	0.221	0.621	0	0	1.264	0.219	1.55
7	34803	0.2	0.823	0	0	1.598	0.293	1.773
8	44155	0.2	0.93	0	0	2.123	0.357	1.939
9	19680	0.2	0.961	0	0	2.199	0.305	2.089
10	37363	0.2	0.985	0	0	2.593	0.305	2.288
11	39639	0.2	1	0	0	2.751	0.305	2.679

12	17504	0.2	1	0	0	2.751	0.305	2.993
13	4693	0.2	1	0	0	2.751	0.305	3.265

2018								
Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	386000	0.411	0.032	0	0	0.298	0.032	0.85
4	.	0.333	0.077	0	0	0.498	0.103	1.067
5	.	0.229	0.281	0	0	0.921	0.172	1.316
6	.	0.221	0.493	0	0	1.145	0.219	1.55
7	.	0.2	0.826	0	0	1.832	0.293	1.773
8	.	0.2	0.918	0	0	2.069	0.357	1.939
9	.	0.2	0.979	0	0	2.67	0.305	2.089
10	.	0.2	0.987	0	0	2.631	0.305	2.288
11	.	0.2	1	0	0	3.155	0.305	2.679
12		0.2	1	0	0	3.155	0.305	2.993
13		0.2	1	0	0	3.155	0.305	3.265

2019								
Age	N	M	Mat	PF	PM	SWt	Sel	CWt
3	996000	0.411	0.062	0	0	0.434	0.032	0.85
4	.	0.333	0.089	0	0	0.537	0.103	1.067
5	.	0.229	0.211	0	0	0.778	0.172	1.316
6	.	0.221	0.557	0	0	1.281	0.219	1.55
7	.	0.2	0.725	0	0	1.499	0.293	1.773
8	.	0.2	0.93	0	0	2.238	0.357	1.939
9	.	0.2	0.974	0	0	2.462	0.305	2.089
10	.	0.2	0.991	0	0	3.065	0.305	2.288
11	.	0.2	1	0	0	3.004	0.305	2.679
12		0.2	1	0	0	3.004	0.305	2.993
13		0.2	1	0	0	3.004	0.305	3.265

"Input units are thousands and kg - output in tonnes"

Table 4.19. Northeast Arctic Haddock. Prediction with management option table for 2017–2019 (TAC constraint applied for intermediate year)

MFDP version 1a
Run: Man
MFDP Index file 27.04.2017
Time and date: 10:14 28.04.2017
Fbar age range: 4-7

2017				
Biomass	SSB	FMult	FBar	Landings
743605	537842	1.5664	0.3082	233000

2018					2019	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
658026	401586	0	0	0	1088285	451494
.	401586	0.1	0.0197	13839	1074847	440031
.	401586	0.2	0.0394	27343	1061767	428898
.	401586	0.3	0.059	40522	1049036	418086
.	401586	0.4	0.0787	53385	1036642	407584
.	401586	0.5	0.0984	65940	1024577	397384
.	401586	0.6	0.1181	78196	1012831	387477
.	401586	0.7	0.1377	90162	1001394	377854
.	401586	0.8	0.1574	101844	990258	368507
.	401586	0.9	0.1771	113252	979414	359427
.	401586	1	0.1968	124392	968855	350607
.	401586	1.1	0.2164	135272	958571	342039
.	401586	1.2	0.2361	145899	948555	333716
.	401586	1.3	0.2558	156279	938799	325630
.	401586	1.4	0.2755	166421	929296	317775
.	401586	1.5	0.2951	176329	920039	310143
.	401586	1.6	0.3148	186010	911021	302729
.	401586	1.7	0.3345	195471	902234	295525
.	401586	1.8	0.3542	204718	893673	288525
.	401586	1.9	0.3738	213755	885331	281724
.	401586	2	0.3935	222590	877202	275116

Input units are thousands and kg - output in tones

Table 4.20. Northeast Arctic Haddock. Prediction single option table for 2017-2019 based on HCR "MFDP version 1a"

MFDP	**version**	**1a**								
Run:	**final**									
Time	**and**	**date:**	**10:16**	**28/04/2017**						
Fbar	**age**	**range:**	**4-7**							
Year:		**2017**	**F multiplier:**	**1.5664**	**Fbar:**	**0.3082**				
Age	**F**		**CatchNos**	**Yield**	**StockNos**	**Biomass**	**SSNos(Jan**	**SSB(Jan)**	**SSNos(ST)**	**SSB(ST)**
3	0.0501		7751	6588	193000	54233	5983	1681	5983	1681
4	0.1613		18566	19810	145846	81528	16335	9131	16335	9131
5	0.2694		3953	5202	18631	14979	5235	4209	5235	4209
6	0.3431		27638	42839	105411	133240	65460	82742	65460	82742
7	0.459		11699	20742	34803	55615	28643	45771	28643	45771
8	0.5592		17301	33547	44155	93741	41064	87179	41064	87179
9	0.4778		6829	14265	19680	43276	18912	41589	18912	41589
10	0.4778		12965	29663	37363	96882	36803	95429	36803	95429
11	0.4778		13754	36848	39639	109047	39639	109047	39639	109047
12	0.4778		6074	18179	17504	48154	17504	48154	17504	48154
13	0.4778		1628	5317	4693	12910	4693	12910	4693	12910
Total			128157	233000	660725	743605	280271	537842	280271	537842
Year:		**2018**	**F multiplier:**	**1.7704**	**Fbar:**	**0.3483**				
Age	**F**		**CatchNos**	**Yield**	**StockNos**	**Biomass**	**SSNos(Jan**	**SSB(Jan)**	**SSNos(ST)**	**SSB(ST)**
3	0.0567		17466	14846	386000	115028	12352	3681	12352	3681
4	0.1823		17341	18503	121701	60607	9371	4667	9371	4667
5	0.3045		20994	27628	88962	81934	24998	23023	24998	23023
6	0.3877		3287	5095	11318	12959	5580	6389	5580	6389
7	0.5187		22187	39337	59968	109862	49534	90746	49534	90746
8	0.632		7726	14980	18007	37256	16530	34201	16530	34201
9	0.54		7885	16472	20666	55178	20232	54019	20232	54019
10	0.54		3813	8723	9993	26290	9863	25949	9863	25949
11	0.54		7238	19391	18971	59854	18971	59854	18971	59854
12	0.54		7679	22984	20127	63500	20127	63500	20127	63500
13	0.54		4300	14040	11271	35559	11271	35559	11271	35559
Total			119916	202000	766982	658026	198828	401586	198828	401586
Year:		**2019**	**F multiplier:**	**1.7681**	**Fbar:**	**0.3479**				
Age	**F**		**CatchNos**	**Yield**	**StockNos**	**Biomass**	**SSNos(Jan**	**SSB(Jan)**	**SSNos(ST)**	**SSB(ST)**
3	0.0566		45012	38260	996000	432264	61752	26800	61752	26800
4	0.1821		34416	36722	241818	129856	21522	11557	21522	11557
5	0.3041		17135	22549	72691	56554	15338	11933	15338	11933
6	0.3872		15138	23463	52180	66843	29064	37231	29064	37231
7	0.518		2276	4035	6158	9230	4649	6969	4649	6969
8	0.6312		12528	24292	29227	65410	27181	60832	27181	60832
9	0.5393		2987	6239	7836	19292	7632	18790	7632	18790
10	0.5393		3758	8599	9860	30222	9772	29950	9772	29950
11	0.5393		1817	4869	4768	14322	4768	14322	4768	14322
12	0.5393		3450	10327	9052	27191	9052	27191	9052	27191
13	0.5393		5710	18644	14981	45002	14981	45002	14981	45002
Total			144228	198000	1444570	896187	205710	290578	205710	290578

Input units are thousands and kg - output in tones

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

MFYPR	**version**	**2a**							
Run:	**2017**								
Time	**and**	**date:**	**10:21**	**28/04/2017**					
Yield	**per**	**results**							
FMult	**Fbar**	**CatchNos**	**Yield**	**StockNos**	**Biomass**	**SpwnNosJan**	**SSBJan**	**SpwnNosSpwn**	**SSBSpwn**
0	0	0	0	4.1877	5.4664	2.0637	4.2628	2.0637	4.2628
0.1	0.0246	0.0613	0.1222	3.8894	4.7261	1.7815	3.5428	1.7815	3.5428
0.2	0.0491	0.1091	0.2086	3.659	4.1678	1.5666	3.0038	1.5666	3.0038
0.3	0.0737	0.1475	0.2718	3.475	3.7333	1.3976	2.5877	1.3976	2.5877
0.4	0.0982	0.1793	0.3194	3.3243	3.3867	1.2613	2.2586	1.2613	2.2586
0.5	0.1228	0.206	0.3562	3.1982	3.1044	1.1493	1.9931	1.1493	1.9931
0.6	0.1473	0.229	0.3852	3.091	2.8706	1.0555	1.7752	1.0555	1.7752
0.7	0.1719	0.2491	0.4087	2.9983	2.6741	0.976	1.594	0.976	1.594
0.8	0.1964	0.2668	0.4279	2.9173	2.5068	0.9076	1.4413	0.9076	1.4413
0.9	0.221	0.2825	0.4439	2.8457	2.3628	0.8483	1.3114	0.8483	1.3114
1	0.2455	0.2968	0.4574	2.7818	2.2377	0.7964	1.1998	0.7964	1.1998
1.1	0.2701	0.3097	0.469	2.7243	2.1281	0.7505	1.103	0.7505	1.103
1.2	0.2947	0.3215	0.4791	2.6723	2.0312	0.7096	1.0186	0.7096	1.0186
1.3	0.3192	0.3323	0.4879	2.6247	1.9451	0.6731	0.9444	0.6731	0.9444
1.4	0.3438	0.3424	0.4957	2.5812	1.8679	0.6402	0.8789	0.6402	0.8789
1.5	0.3683	0.3517	0.5027	2.541	1.7985	0.6104	0.8205	0.6104	0.8205
1.6	0.3929	0.3605	0.509	2.5038	1.7356	0.5832	0.7684	0.5832	0.7684
1.7	0.4174	0.3687	0.5147	2.4691	1.6784	0.5585	0.7216	0.5585	0.7216
1.8	0.442	0.3764	0.5198	2.4368	1.6262	0.5357	0.6793	0.5357	0.6793
1.9	0.4665	0.3837	0.5246	2.4065	1.5782	0.5148	0.6411	0.5148	0.6411
2	0.4911	0.3907	0.529	2.3781	1.5341	0.4955	0.6063	0.4955	0.6063

Reference	**point**	**F multiplier**	**Absolute F**
Fbar(3-13)	**1**	**0.2455**	
FMax	**>=1000000**		
F0.1	**0.9014**	**0.2213**	
F35%SPR	**0.765**	**0.1878**	

***Weights in kilograms**

Table B1. Northeast Arctic HADDOCK. Abundance indices from bottom trawl surveys in the Barents Sea winter 1981-2017 (numbers in millions). 1981-1992 includes only main areas A, B, C and D.

	Age												Biomass
Year	1	2	3	4		5	6	7	8	9	10+	Total	('000 t)
1981	7	14	5	21		60	18	1	+	+	+	126	166
1982	9	2	3	4		4	10	6	+	+	+	38	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	562	193	255	631		111	12	+	+	+	+	1764	573
1995	1379	285	36	111		387	42	2	+	+	+	2242	466
1996	249	229	44	31		76	151	8	+	0	+	788	280
19971	693	24	51	17		12	43	43	2	+	+	885	155
19981	220	122	20	28		12	5	13	16	1	+	437	92
1999	855.8	45.5	57.3	13.1		13.9	3.6	1.4	1.9	1.6	0.03	994	81
2000	1024.4	508.9	32.2	64.9		18.5	10.5	1.6	0.5	1.8	0.4	1664	185
2001	976.5	315.6	209.6	23.1		21.6	1.3	0.9	0.1	0.04	0.5	1549	175

2002	2062.1	282	215.7	149.5		13.5	11.7	1	0.2	0.03	0.7	2736	264
2003	2394.5	278.6	145.2	197.6		168.8	17.2	5	0.2	0.1	1.1	3208	455
2004	751.8	474.3	126.7	75.9		76	65.9	6.6	2	0.1	0.3	1580	287
2005	3363.6	209.2	218.9	101.9		36.5	40.1	9	0.1	0.1	0	3979	302
20062	2767.1	803.6	54.2	86.2		30.2	11.6	9	2.2	0.09	0.21	3764	282
20071	3197	868	379	54		88	22	6	5	2	0	4621	462
2008	1266.6	1835.2	723.4	251.7		57.3	74.2	10.2	5.8	0.35	1.03	4226	841
2009	849	246.3	1021.7	773		402.1	31.3	14.9	1.6	0.13	0.53	3341	1006
2010	2035.8	81.8	138	593		557.4	191.4	10.3	2.9	0.68	0.72	3612	975
2011	786.5	408	47.6	68.1		313	262.6	52.4	1.6	0.45	0.63	1941	683
20122	2222.2	176	224.3	30		58.4	294.3	134.9	31.6	0.83	0.42	3173	739
2013	525.5	605	52.9	132.4		29.5	39	243.8	104.3	14.2	0.29	1747	772
2014	1569.4	114	319	43.7		82.7	18.3	43.8	86.6	37.64	3.49	2318	556
2015	1163.6	169.2	17	146.4		36.5	30.8	11.5	18.5	17.61	5.29	1617	312
2016	1246.4	121.2	70	9.6		61.3	14.1	24.4	7.9	13.26	18.55	1587	287
20172	3906.4	330	78.4	76.6		4.5	39.2	7.2	9	1.3	13.8	4474	362

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	5	3.1	5.6	3.4	7.7	62.3	56.5	4.8	0.4	0.6	-	149.3
19971	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	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
20063	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
					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	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	29.2		4.1		25	8.1		4.9		9.1		13.4		1.3		0.4	0.1	-	95.7
1997	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
20022	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	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

Year \Age	0	1	2	3	4	5	6	7	8	9	10+	Total
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
19961	4.3	0.6	0.5	0.3	0.2	0.4	0.5	0.3	-	-	-	7.1
19971	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
20022	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

20063	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
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
19961	6	2.3	5.7	2.8	4.9	36.2	33.4	2.9	0.3	0.3	-	94.8

19971	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
20022	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
20063	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
20164																			

1Adjusted data based on average 1985-1995 distribution.

2Adjusted based on 2001 distribution.

3Adjusted 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	Total	Biomass	Area covered	Added area
1981	7	14	5	21	60	18	1	0	0	0	126	166		
1982	9	2	3	4	4	10	6	0	0	0	38	50		
1983	0	5	2	3	1	1	4	2	0	0	18	25		
1984	1685	173	6	2	1	0	0	0	0	0	1867	101		
1985	1530	776	215	5	0	0	0	0	0	0	2526	259		
1986	556	266	452	189	0	0	0	0	0	0	1463	333		
1987	85	17	49	171	50	0	0	0	0	0	372	157		
1988	18	4	8	23	46	7	0	0	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	0	0	335	51		
1991	1890	252	45	8	3	3	3	6	0	0	2210	166		
1992	1135	868	134	23	2	0	0	1	2	0	2165	239	88 135	
1993	947	626	563	130	13	0	0	0	0	3	2282	385	137 642	
1994	562	193	255	631	111	12	0	0	0	0	1764	573	161 110	
1995	1379	285	36	111	387	42	2	0	0	0	2242	466	191 904	
1996	249	229	44	31	76	151	8	0	0	0	788	280	166 190	
19971	693	24	51	17	12	43	43	2	0	0	885	155	88 371	56 200
19981	220	122	20	28	12	5	13	16	1	0	437	92	100 440	51 100
1999	856	46	57	13	14	4	1	2	2	0	994	81	118 545	
2000	1024	509	32	65	19	11	2	1	2	0	1664	185	163 204	
2001	976	316	210	23	22	1	1	0	0	1	1549	175	164 652	
2002	2062	282	216	149	14	12	1	0	0	1	2737	264	157 369	

2003	2394	279	145	198	169	17	5	0	0	1	3208	455	147 361	
2004	752	474	127	76	76	66	7	2	0	0	1580	287	164 428	
2005	3364	209	219	102	36	40	9	0	0	0	3979	302	179 883	
2006	2767	804	54	86	30	12	9	2	0	0	3764	282	170 064	18 100
20071	3197	868	379	54	88	22	6	5	2	0	4621	462	123 894	56 700
2008	1266.6	1835	723	252	57	74	10	6	0	1	4226	841	165 176	
2009	849	246.3	1021.7	773	402.1	31.3	14.9	1.6	0.13	0.53	3341	1006	171 774	
2010	2035.8	81.8	138	593	557.4	191.4	10.3	2.9	0.68	0.72	3612	975	160 501	
2011	786.5	408	47.6	68.1	313	262.6	52.4	1.6	0.45	0.63	1941	683	174 324	
20121	2222.2	176	224.3	30	58.4	294.3	134.9	31.6	0.83	0.42	3173	739	151 263	16 700
2013	525.5	605	52.9	132.4	29.5	39	243.7	104.3	14.19	0.29	1747	760	203 358	
2014	1569.4	114	319	43.7	82.7	18.3	43.8	86.6	37.64	3.49	2318	554	208 754	
2015	1163.6	169.2	17	146.4	36.5	30.8	11.5	18.5	17.61	5.29	1617	312	196 047	
2016	1246.4	121.2	70	9.6	61.3	14.1	24.4	7.9	13.26	18.55	1587	287	173 568	
20172	3906.4	330	78.4	76.6	4.5	39.2	7.2	9	1.3	13.8	4474	362	146 903	37 460

1) **Indices adjusted to account for limited area coverage. Survey areas extended from 1993 onwards.**

2) 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).

	Age											
Year	0	1	2	3	4	5	6	7	8	9	10+	Total
19955	163	170	79	71	230	404	41	5	1	1	2	1168
19961,3	992	245	291	91	63	206	187	17	1	+	+	2092
19971,3	185	104	21	121	94	48	47	31	20	+	+	671
19982	257	44	83	20	20	6	2	7	2	+	+	442
19991	632	499	60	123	14	16	4	1	4	1	+	1355
20001	524	395	287	54	57	14	6	1	1	1	1	1340
20011	491	160	227	221	19	35	5	2	1	1	1	1163
20021,4,5,6	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
20067	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
20168	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 I and II . Indices of numbers (in millions) of fish at age (+ means value <1; - means 0 value).

	Age											
Year	0	1	2	3	4	5	6	7	8	9	10+	Total
2004	104	189	268	123	70	69	31	3	2	-	+	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	+	3323
2009	169	136	144	651	618	306	21	7	1	1	-	2053
2010	154	274	65	184	865	666	148	16	3	-	+	2376
2011	213	105	114	40	74	393	301	37	3	+	+	1281
2012	74	591	42	93	20	68	214	152	13	0.3	+	1268
2013	163	156	223	26	65	20	51	150	76	7	+	938
2014	183	265	75	262	41	70	26	60	86	18	1	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	47	2111

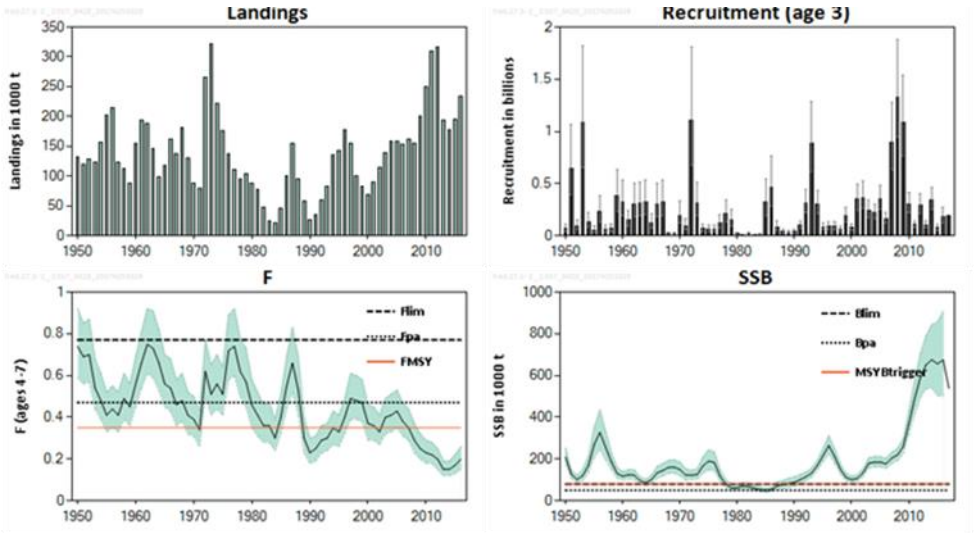

Figure 4.1 Landings, fishing mortality, recruitment (2016 prediction unshaded), and spawning stock biomass of Northeast Arctic haddock 1950-2017. Fishing mortality and spawning stock biomass are given with point wise 95% confidence intervals (shaded areas)

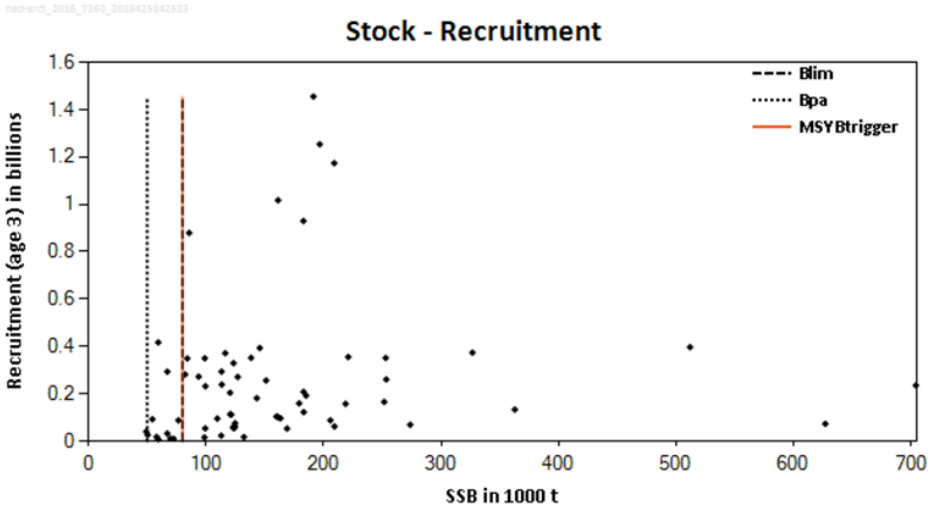

Figure 4.2 Stock-Recruitment relationship of Northeast Arctic haddock 1950–2016

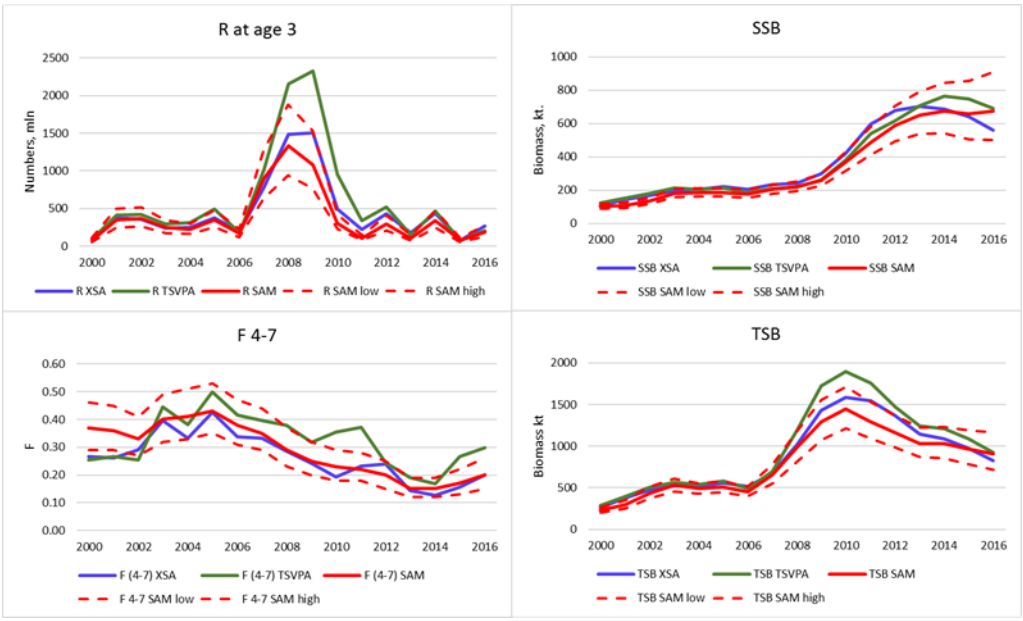

Figure 4.3. Results of assessment of NEA haddock - Recruits, biomass, spawning biomass and F by different models (SAM with point wise 95% confidence intervals, XSA with different settings and TISVPA).

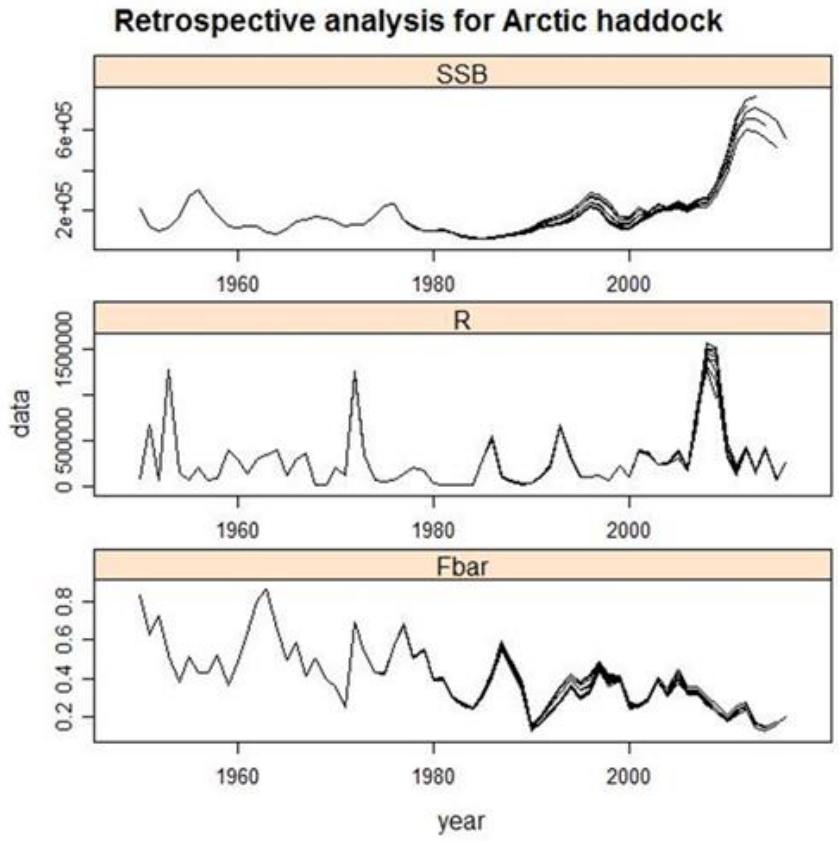

Figure 4.4. Northeast Arctic haddock. Retrospective plots of SSB, fishing mortality and recruitment for assessment years 1950-2016 (XSA without P shrinkage)

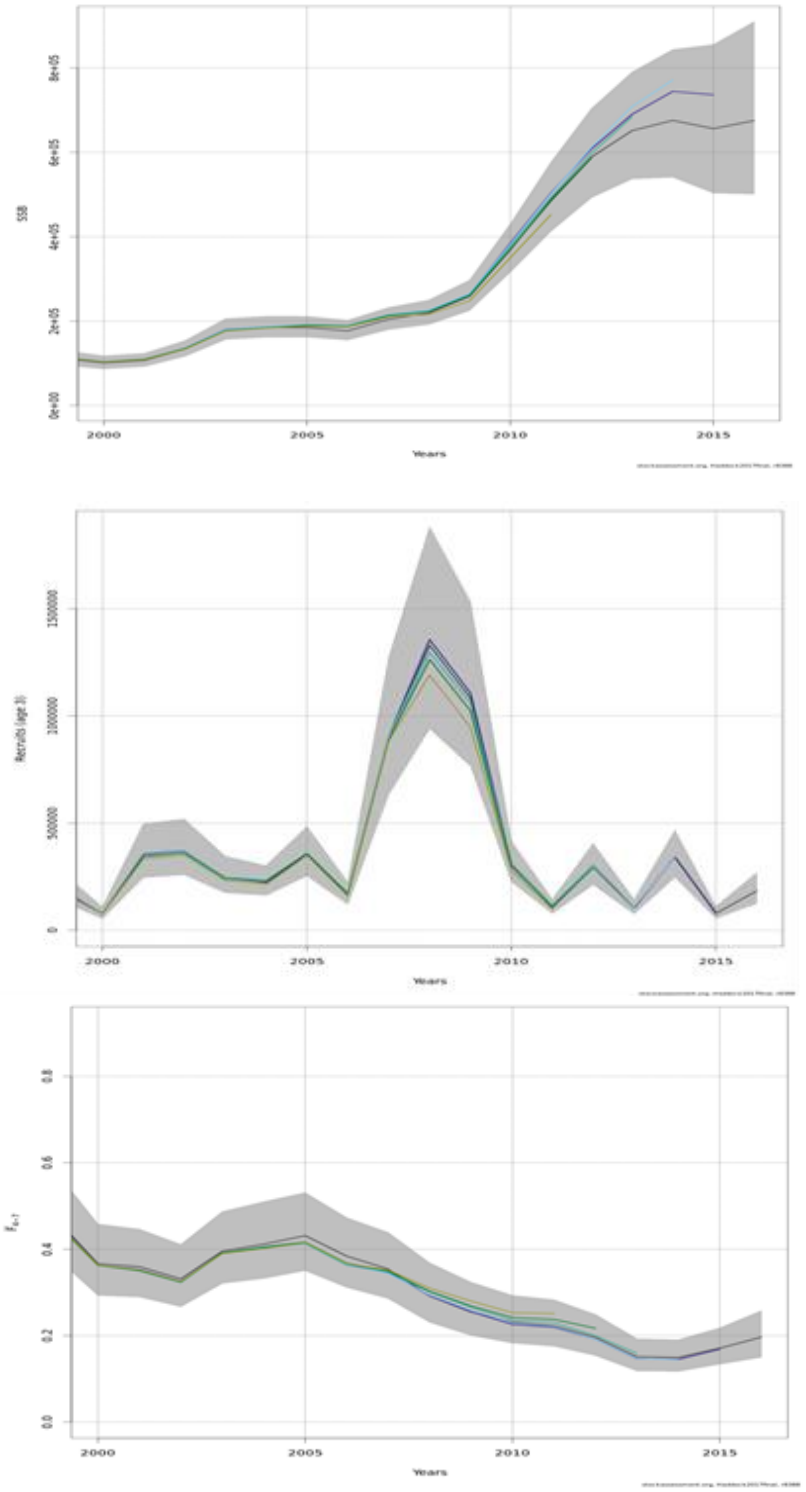

Figure 4.5. Northeast Arctic haddock. 5 year retrospective plots of SSB (a), fishing mortality (b) and recruitment (c) for assessment years 2000-2016 (SAM with 95 % confidence intervals)

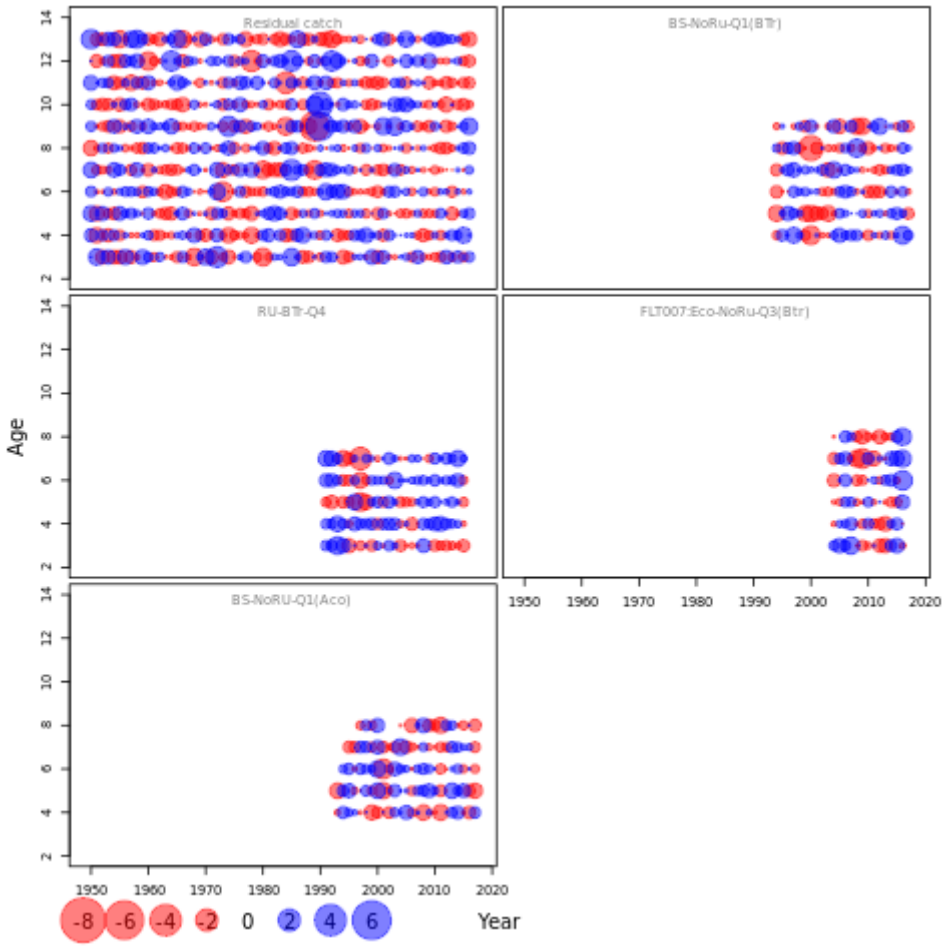

Figure 4.6. Northeast Arctic haddock; Normalized residuals for the final SAM run. Blue circles indicate positive residuals (obs larger than predicted) and white circles indicate negative residuals.