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Advice on fishing opportunities for Northeast arctic haddock in 2024 in ICES subareas 1 and 2

Institute of Marine Research – IMR

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Advice on fishing opportunities for Northeast arctic haddock in 2024 in ICES subareas 1 and 2

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Stock Name: Northeast Arctic haddock (ICES areas 1 and 2)

Advice on fishing opportunities

The Joint Russian-Norwegian Arctic Fisheries Working Group (JRN-AFWG) advises that when the Joint Norwegian–Russian Fisheries Commission management plan is applied, catches in 2024 should be no more than 127 550 tonnes.

Stock development over time

Fishing pressure on the stock is below F_{pa} and F_{lim} and close to F_{msy}, and the spawning stock biomass is above B_{pa} and B_{lim}. The spawning stock biomass has been stable in last years, but the total stock biomass is declining.

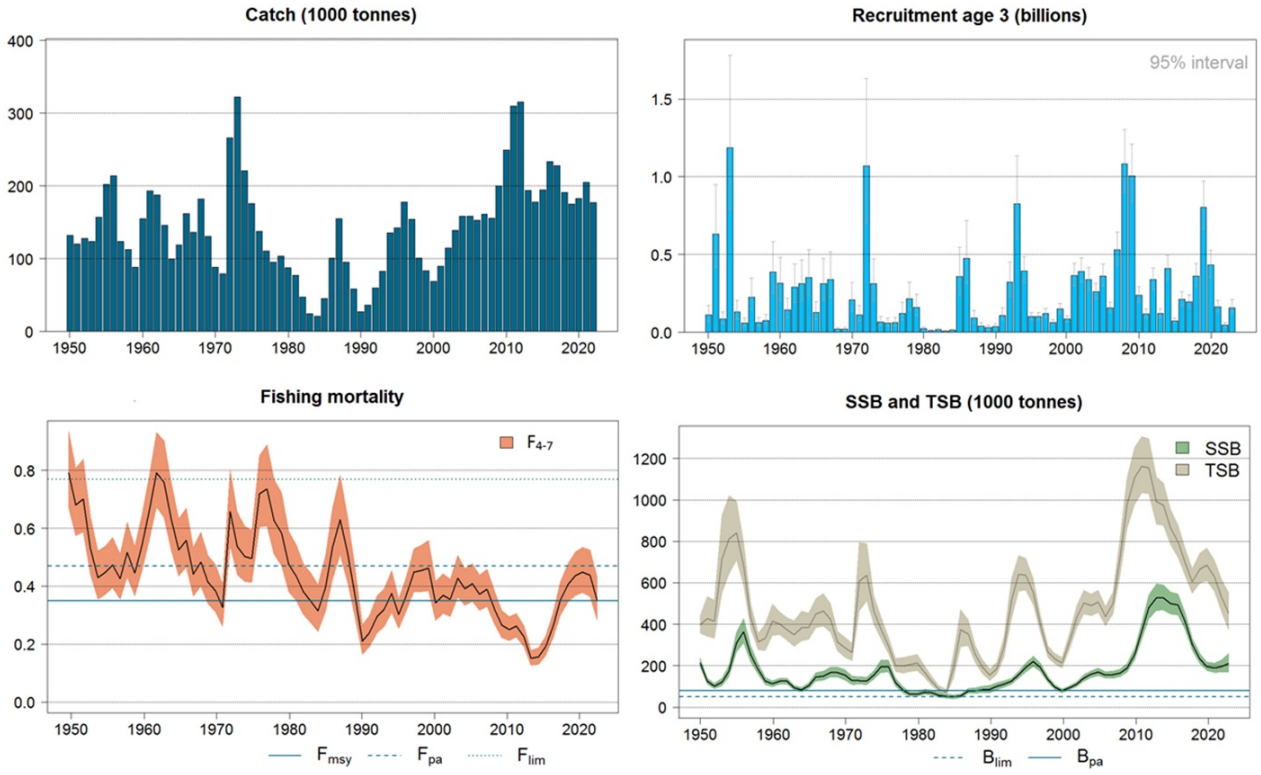

Figure 1 Haddock in ICES subareas 1 and 2 (Northeast Arctic). Catch, recruitment, F, SSB and TSB (total stock biomass, age 3+) with 95 % confidence levels. The biomass reference points relate to SSB.

Catch scenarios

Table 1 Haddock in ICES subareas 1 and 2 (Northeast Arctic). SSB, catch in tonnes and recruitment in thousands.

Variable	Value	Notes
$F_{4–7}$ (2023)	0.377	TAC constraint
SSB (2024)	189 420	
R age 3 (2023)	157 204	SAM estimates

Variable	Value	Notes
R age 3 (2024)	371 852	RCT3 estimates
R age 3 (2025)	230 976	RCT3 estimates
Total catch (2023)	170 067	TAC set by 52th session of JRNFC

Table 2 Haddock in ICES subareas 1 and 2 (Northeast Arctic). Annual catch options. All weights are in tonnes.

Basis	Total catch (2024)	F_{4-7} (2024)	SSB (2025)	% SSB change*	% TAC change**	% Advice change***
A dvice basis						
Management plan	127 550	0.368	159 292	-16	-25	-25
Other scenarios						
MSY approach: F_{MSY}	122 465	0.350	162 753	-14	-28	-28
F = 0	0	0.000	249 327	32	-100	-100
F = F_{2023}	130 057	0.377	157 591	-17	-24	-24
F_{pa}	154 413	0.470	141 245	-25	-9	-9
F_{lim}	218 207	0.770	100 344	-47	28	28

* SSB 2025 relative to SSB 2024.
** Catch in 2024 relative to TAC in 2023 (170 067 t).
*** Advice for 2024 relative to advice for 2023.

The advice for 2024 is 25% lower than the advice and TAC for 2023 due to a declining stock trend and the application of the 25% TAC change constraint according to the management plan.

Basis of the advice

Table 3 Haddock in ICES subareas 1 and 2 (Northeast Arctic). The basis of the advice.

Advice basis	**Joint Norwegian-Russian Fisheries Commission management plan.**
Management plan	The current harvest control rule (HCR) for haddock is as follows (see details in Protocol of the 46th Session of the Joint Norwegian–Russian Fisheries Commission [JNRFC, 2016]): • *TAC for the next year will be set at level corresponding to FMSY.* • *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 FMSY 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.* At the 46th Session of the Joint Norwegian–Russian Fisheries Commission in 2016 it was decided to keep the existing HCR for haddock for the next five years. Quota flexibility: In 2014, JNRFC decided that from 2015 onwards, Norway and Russia can transfer to, or borrow from, the following year up to 10% of the country's quota. ICES evaluated this HCR in 2016 (ICES, 2016) and rechecked it in 2020 (ICES, 2020). ICES concluded that the HCR is precautionary.

Quality of the assessment

After the 2020 benchmark, the assessment has been fairly consistent from year to year.

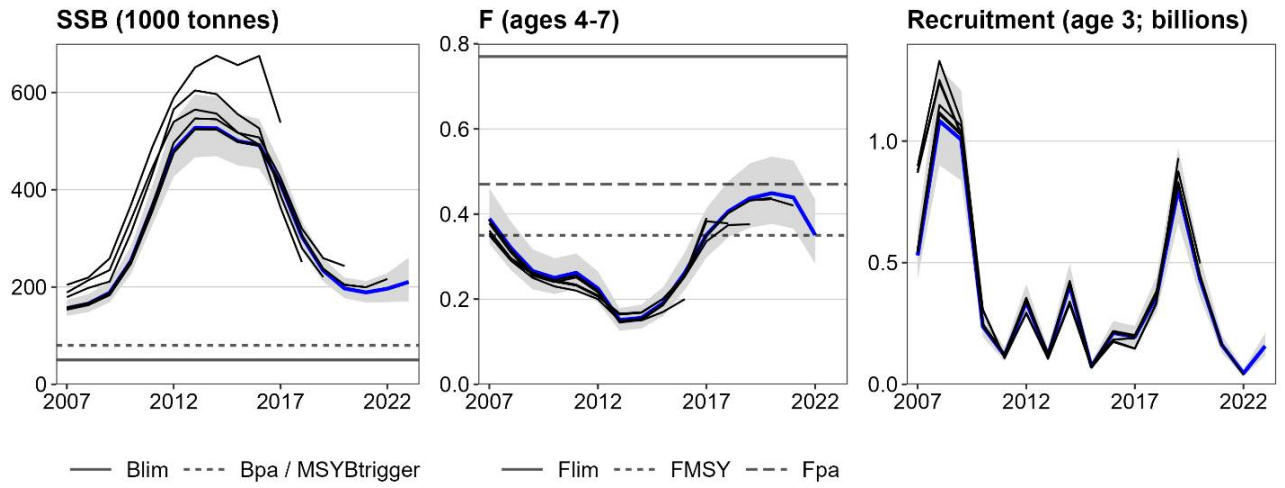

Figure 2 Haddock in ICES subareas 1 and 2 (Northeast Arctic). Historical assessment results. There was a benchmark revision in 2020. The shaded areas indicate the 95% confidence intervals for the 2023 assessment.

Issues relevant for the advice

Due to the temporary suspension of Russian scientists from ICES this assessment was conducted by a Joint Russian-Norwegian working group on Arctic Fisheries (JRN-AFWG) consisting of scientists from VNIRO (Russia), and IMR (Norway) (Howell et al., 2023).

This advice has been conducted outside ICES and should not be considered as ICES advice. However, this assessment and advice has been produced following the methodology agreed at the ICES benchmark in 2020 (ICES, 2020).

The decline in catches and spawning stock is expected to continue at least until the 2021 year-class is fully recruited to the fishery and spawning stock after age 5.

The 2022 data from the ecosystem survey were not included in the assessment due to incomplete spatial coverage and poor synopticity.

Reference points

Table 4 Haddock in ICES subareas 1 and 2 (Northeast Arctic). Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	80 000 tonnes	B_{pa}	ICES (2020)
	F_{MSY}	0.35	Stochastic long-term simulations	ICES (2020)
Precautionary approach	B_{lim}	50 000 tonnes	B_{loss} (lowest observed SSB)	ICES (2020)
	B_{pa}	80 000 tonnes	$B_{lim} \times \exp(1.645 \times \sigma)$, where $\sigma = 0.3$	ICES (2020)
	F_{lim}	0.77	Determined from replacement line leading from SSB = 0 to the geometric mean recruitment at SSB = B_{lim}	ICES (2020)
	F_{pa}	0.47	$F_{lim} \times \exp(-1.645 \times \sigma)$, where $\sigma = 0.3$	ICES (2020)

Framework	Reference point	Value	Technical basis	Source
Management plan	SSB_{MGT}	80 000 tonnes	B_{pa}	ICES (2020)
	F_{MGT}	0.35	F_{MSY}	ICES (2020)

Basis of the assessment

Table 5 Haddock in ICES subareas 1 and 2 (Northeast Arctic). Basis of the assessment and advice.

ICES stock data category	1
Assessment type	Age-based analytical assessment (SAM) that uses catches in the model (ICES, 2021).
Input data	Commercial landings (international landings, ages, and length frequencies from catch sampling); four survey indices (RU-BTr-Q4 (Btr), BS-NoRU-Q1(Aco), BS-NoRu-Q1 (BTr), and Eco-NoRu-Q3 (Btr)); annual maturity and stock weight-at-ag data from surveys; from 1984, the natural mortalities are derived from the consumption of haddock (ages 3–6) by cod.
Discards and bycatch	Discarding is considered negligible in recent years.
Indicators	None.
Other information	Last benchmarked in February 2020 (ICES, 2020).
Working group	Joint Russian-Norwegian Arctic Fisheries Working Group (JRN-AFWG)

History of the advice, catch, and management

Table 6 Haddock in ICES subareas 1 and 2 (Northeast Arctic). ICES advice, agreed TACs, the official and unreported landings, and ICES catches. All weights are in tonnes.

Year	ICES advice	Catch corresponding to advice	Agreed TAC	Official catches	Unreported landings (included in ICES catches)	ICES catches
1987	No increase in F; TAC	160000	250000	154916		154916
1988	No increase in F	< 240000	240000	95255		95255
1989	Large reduction in F	69000	83000	58518		58518
1990	No directed fishery	-	25000	27182		27182
1991	No directed fishery	-	28000	36216		36216
1992	Within safe biological limits	35000	63000	59922		59922
1993	No long-term gains in increasing F	56000	72000	82379		82379
1994	No long-term gains in $F > F_{med}$	97000**	120000	135186		135186
1995	No long-term gains in $F > F_{med}$	122000**	130000	142448		142448
1996	No long-term gains in $F > F_{med}$	169000**	170000	178128		178128
1997	Well below F_{med}	< 242000	210000	154359		154359
1998	Below F_{med}	< 120000	130000	100630		100630
1999	Reduce F below F_{pa}	< 74000	78000	83195		83195

Year	ICES advice	Catch corresponding to advice	Agreed TAC	Official catches	Unreported landings (included in ICES catches)	ICES catches
2000	Reduce F below F_{pa}	< 37000	62000	68944		68944
2001	Reduce F below F_{pa}	< 66000	85000	89640		89640
2002	Reduce F below F_{pa}	< 64000	85000	96062	18736	114798
2003	Reduce F below F_{pa}	< 101000	101000	105700	33226	138926
2004	Reduce F below F_{pa}	< 120000	130000	124502	33777	158279
2005	Reduce F below F_{pa}	< 106000	117000	118015	40283	158298
2006	Reduce F below F_{pa}	< 112000	120000	131706	21451	153157
2007	Limit catches	< 130000	150000	146972	14553	161525
2008	Limit catches to 2001–2004 average	< 130000	155000	149776	5828	155604
2009	Apply management plan	< 194000	194000	200061	0	200061
2010	Apply management plan	< 243000	243000	249200	0	249200
2011	Apply management plan	< 303000	303000	309785	0	309785
2012	Apply management plan	< 318000	318000	315627	0	315627
2013	Apply management plan	< 238000	200000	193744	0	193744
2014	Apply management plan	< 150000	178500	177522	0	177522
2015	Apply management plan	< 165000	223000	194756	0	194756
2016	Apply management plan	< 244000^	244000	233416	0	233416
2017	Apply management plan	≤ 233000	233000	227588	0	227588
2018	Apply management plan	≤ 202305	202305	191276	0	191276
2019	Apply management plan	≤ 152000	172000	175402	0	175402
2020	Apply management plan	≤ 215000	215000	182468	0	182468
2021	Apply management plan	≤ 232537	232537	204743	0	204743 ^^
2022	Apply management plan	≤ 178532	178532	176906	0	176906^^
2023	Apply management plan	≤ 1 70067 ^^	1 70067			
2024	Apply management plan	≤ 1 27550 ^^				

* Coastal haddock in Norwegian statistical areas 06 and 07 (south of Lofoten) are included.

** Predicted landings at F_{med} .

^ This advice was updated on 7 July 2015 in response to a special request (ICES, 2015) after a mid-year change in TAC in 2015 (from 178500 tonnes to 223000 tonnes) ⌞

^^ In 2022 and 2023 assessment and advice was carried out by the Joint Russian-Norwegian Arctic Fisheries Working Group (JRN-AFWG) which compiled catches for 2021-2022 and produced the advice for 2023 and 2024.

History of catch and landings

Table 7 Haddock in ICES subareas 1 and 2. History of official commercial catch and landings by country. All weights are in tonnes.

Year	Faroe Islands	France	Fed. Rep. Germany.	Greenland	Norway^	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total
1960	172	-	5597		46263	57025		45469	125	-	154651
1961	285	220	6304		60862	85345		39650	558	-	193224
1962	83	409	2895		54567	91910		37486	58	-	187408
1963	17	363	2554		59955	63526		19809	-	-	146224

Year	Faroe Islands	France	Fed. Rep. Germany.	Greenland	Norway^	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total
1964	-	208	1482		38695	43870		14653	250	-	99158
1965	-	226	1568		60447	41750		14345	242	-	118578
1966	-	1072	2098		82090	48710		27723	85	-	161778
1967	-	1208	1705		51954	57346		24158	26	-	136397
1968	-	-	1867		64076	75654		40129	0	-	181726
1969	2	-	1490		67549	24211		37234	334	-	130820
1970	541	-	2119		37716	26802		20423	656	-	88257
1971	81	-	896		45715	15778		16373	62	-	78905
1972	137	-	1433		46700	196224		17166	4493	-	266153
1973	1212	3214	9534		86767	186534		32408	2557	-	322226
1974	925	3601	23409		66164	78548		37663	10847	-	221157
1975	299	5191	15930		55966	65015		28677	4680	-	175758
1976	536	4459	16660		49492	42485		16940	6692	-	137264
1977	213	1510	4798		40118	52210		10878	431	-	110158
1978	466	1411	1521		39955	45895		5766	408	-	95422
1979	343	1198	1948		66849	26365		6454	466	-	103623
1980	497	226	1365		66501	20706		2948	261	-	92504
1981	381	414	2402		63435	13400		1682	22	-	81736
1982	496	53	1258		43702	2900	-	827	0	-	49236
1983	428	-	729		22364	680	139	259	1	-	24600
1984	297	15	400		18813	1103	37	276	4	-	20945
1985	424	21	395		21272	22690	77	153	20	-	45052
1986	893	12	1079		52313	45738	22	431	75	-	100563
1987	464	7	3105		72419	78211	59	563	88	-	154916
1988	1113	116	1323		60823	31293	72	435	80	-	95255
1989	1217	-	171		36451	20062	1	590	26	-	58518
1990	705	-	167		20621	5190	-	494	5	-	27182
1991	1117	-	213		22178	12177	-	514	17	-	36216
1992	1093	151	387	1719	36238	19699	38	596	1	-	59922
1993	546	1215	1165	880	40978	35071	76	1802	646	-	82379
1994	2761	678	2412	770	71171	51822	22	4673	877	-	135186
1995	2833	598	2675	1097	76886	54516	14	3111	718	-	142448
1996	3743	6	942	1510	94527	74239	669	2275	217	-	178128
1997	3327	540	972	1877	103407	41228	364	2340	304	-	154359
1998	1903	241	385	854	75108	20559	257	1229	94	-	100630
1999	1913	64	641	437	48182	30520	652	694	92	-	83195
2000	631	178	880	432	42009	22738	502	747	827	-	68944
2001	1210	324	554	553	49067	34307	1497	1068	1060	-	89640
2002	1564	297	627	858	52247	37157	1505	1125	682	18736	114798

Year	Faroe Islands	France	Fed. Rep. Germany.	Greenland	Norway^	Russia**	Spain	United Kingdom	Others	Unreported catches***	Total
2003	1959	382	918	1363	56485	41142	1330	1018	1103	33226	138926
2004	2484	103	823	1680	62192	54347	54	1250	1569	33777	158279
2005	2138	333	996	15	60850	50012	963	1899	1262	40283	158751
2006	2390	883	989	1830	69272	53313	703	1164	1162	21451	153157
2007	2307	277	1123	1464	71244	66569	125	1351	2511	14553	161525
2008	2687	311	535	1659	72779	68792	283	971	1759	5828	155604
2009	2820	529	1957	1410	104354	85514	317	1315	1845	0	200061
2010	3173	764	3539	1970	123384	111372	379	1758	2862	0	249200
2011	1759	268	1724	2110	158202	139912	502	1379	3929	0	309785
2012	2055	322	1111	3984	159602	143886	441	833	3393	0	315627
2013	1886	342	500	1795	99215	85668	439	639	3260	0	193744
2014	1470	198	340	1150	91306	78725	187	355	3791	0	177522
2015	2459	145	124	1047	95094	91864	246	450	3327	0	194756
2016	2460	340	170	1401	108718	115710	200	575	3838	0	233416
2017	2776	108	170	1810	113132	106714	228	372	2279	0	227588
2018	2333	183	385	1317	93839	90486	169	453	2173	0	191276
2019	1515	143	204	1208	93860	76125	280	456	1611	0	175402
2020	1392	96	282	910	88108	89030	45	320	2286	0	182468
2021^^	1722	105	365	1101	100673	98296	131	78	2272	0	204743
2022*^^	1831	164	268	1101	89044	82364	99	138	1897	0	176906

* Provisional figures.
** USSR prior to 1991.
*** Figures based on Norwegian/Russian illegal, unreported, and unregulated fisheries (IUU) estimates.
^ Landings of coastal haddock in Norwegian statistical areas 06 and 07 (south of Lofoten) are included from 1983.
^^ In 2022 and 2023 assessment and advice was carried out by the Joint Russian-Norwegian Arctic Fisheries Working Group (JRN-AFWG) which compiled catches for 2021-2022 and produced the advice for 2023 and 2024.

Summary of the assessment

Table 8 Haddock in ICES subareas 1 and 2 (Northeast Arctic). Assessment summary. High and low refer to 95% confidence bounds.

Year	Recruitment (thousands)			SSB (tonnes)			Total catch (tonnes)	F		
	Age 3	Low	High	SSB	Low	High		Ages 4–7	Low	High
1950	109623	69719	172368	213220	191156	237830	132125	0.792	0.672	0.934
1951	631600	419651	950595	124921	110924	140684	120077	0.681	0.574	0.808
1952	84773	54716	131341	100892	88188	115426	127660	0.702	0.587	0.839
1953	1185570	788600	1782370	120474	104198	139293	123920	0.531	0.44	0.642
1954	131072	84429	203482	173396	147339	204060	156788	0.43	0.354	0.521
1955	59015	37632	92549	310699	265693	363330	202286	0.448	0.372	0.539
1956	224093	143883	349018	365196	311618	427984	213924	0.473	0.394	0.569
1957	60604	38656	95014	253014	217173	294769	123583	0.427	0.356	0.512
1958	73937	47720	114558	181479	157787	208730	112672	0.517	0.431	0.622

Year	Recruitment (thousands)			SSB (tonnes)			Total catch (tonnes)	F		
	Age 3	Low	High	SSB	Low	High		Ages 4–7	Low	High
1959	385837	255412	582864	125376	108965	144258	88211	0.444	0.367	0.538
1960	316609	207861	482251	112820	99557	127849	154651	0.54	0.451	0.646
1961	142992	94247	216948	124521	110996	139694	193224	0.663	0.561	0.784
1962	290838	193209	437798	124755	110917	140319	187408	0.793	0.674	0.932
1963	312452	209219	466621	93953	82727	106701	146224	0.759	0.637	0.903
1964	352527	234648	529623	84272	74117	95818	99158	0.633	0.526	0.761
1965	126418	82446	193844	103006	90021	117864	118578	0.525	0.435	0.634
1966	311649	205173	473380	145159	126569	166479	161778	0.559	0.466	0.67
1967	339662	223233	516817	150924	130293	174822	136397	0.442	0.366	0.534
1968	18632	11581	29976	167460	145218	193109	181726	0.484	0.4	0.586
1969	20419	12678	32884	167225	143902	194328	130820	0.414	0.338	0.506
1970	207491	134384	320370	154939	131625	182383	88257	0.385	0.312	0.475
1971	111175	72211	171164	127393	107531	150922	78905	0.327	0.262	0.407
1972	1070502	702592	1631067	128356	111626	147594	266153	0.657	0.54	0.801
1973	313265	207865	472108	124981	107671	145074	322226	0.537	0.44	0.656
1974	65486	42670	100502	153799	134217	176238	221157	0.502	0.415	0.608
1975	59189	38540	90901	194901	167177	227223	175758	0.496	0.414	0.593
1976	60684	38901	94664	195998	168532	227941	137264	0.719	0.606	0.852
1977	121979	76877	193541	118883	100338	140857	110158	0.736	0.608	0.89
1978	214424	142356	322979	80977	67141	97665	95422	0.626	0.51	0.769
1979	160926	106383	243435	62345	52497	74039	103623	0.582	0.47	0.722
1980	23213	14499	37164	62642	53262	73674	87889	0.474	0.381	0.59
1981	10753	6412	18033	72614	61489	85753	77153	0.435	0.349	0.542
1982	16720	10242	27295	68575	56806	82784	46955	0.381	0.303	0.479
1983	8149	4776	13902	58539	48137	71188	24600	0.348	0.273	0.445
1984	12959	7947	21134	53258	43476	65242	20945	0.314	0.244	0.405
1985	359312	236221	546544	49122	40892	59009	45052	0.397	0.312	0.505
1986	475093	314149	718492	54736	46432	64525	100563	0.536	0.427	0.673
1987	91356	59208	140957	77455	66308	90476	154916	0.63	0.508	0.782
1988	39791	25056	63192	79718	67210	94553	95255	0.512	0.411	0.637
1989	28136	17461	45338	84374	69643	102221	58518	0.372	0.296	0.468
1990	36625	23539	56987	86094	70227	105547	27182	0.211	0.165	0.268
1991	109109	76849	154913	100514	84514	119543	36216	0.239	0.191	0.299
1992	322033	229560	451758	110630	95699	127889	59922	0.296	0.239	0.366
1993	826301	602336	1133542	124712	110048	141329	82379	0.319	0.26	0.391
1994	393766	319529	485252	156442	139995	174822	135186	0.375	0.31	0.453
1995	100598	78995	128108	190422	170029	213262	142448	0.302	0.254	0.359
1996	100245	79110	127026	220324	196959	246461	178128	0.369	0.314	0.433
1997	120223	95102	151980	191369	170872	214324	154359	0.448	0.38	0.529

Year	Recruitment (thousands)			SSB (tonnes)			Total catch (tonnes)	F		
	Age 3	Low	High	SSB	Low	High		Ages 4–7	Low	High
1998	63423	49360	81492	133091	118110	149971	100630	0.454	0.381	0.541
1999	149058	119876	185343	96283	85445	108497	83195	0.463	0.385	0.558
2000	83495	65831	105898	79739	70662	89982	68944	0.342	0.281	0.417
2001	364169	299709	442494	93068	83120	104206	89640	0.369	0.307	0.444
2002	391892	321807	477240	111070	99298	124238	114798	0.354	0.295	0.425
2003	338236	273815	417813	140482	126288	156272	138926	0.428	0.362	0.505
2004	259668	213462	315874	159092	143041	176944	158279	0.392	0.334	0.461
2005	362149	299324	438161	170323	153202	189358	158298	0.408	0.348	0.478
2006	156383	127361	192018	154878	139215	172302	153157	0.372	0.316	0.439
2007	529730	435759	643965	156349	140853	173550	161525	0.389	0.33	0.46
2008	1082898	900454	1302306	165612	148176	185101	155604	0.32	0.268	0.382
2009	1006157	838256	1207688	188052	168383	210019	200061	0.266	0.223	0.317
2010	238242	194758	291435	253718	226928	283670	249200	0.25	0.212	0.296
2011	118425	94405	148557	365658	326967	408928	309785	0.262	0.224	0.307
2012	338277	277459	412427	480739	426855	541425	315627	0.225	0.192	0.265
2013	119004	95182	148787	527223	466340	596054	193744	0.151	0.126	0.179
2014	408463	336651	495592	526488	469008	591013	177522	0.156	0.131	0.187
2015	72818	57371	92425	499967	449971	555517	194756	0.191	0.16	0.228
2016	211215	171518	260100	491826	443504	545413	233183	0.262	0.222	0.31
2017	195172	158817	239849	411777	373750	453673	227588	0.351	0.298	0.414
2018	361715	294755	443888	304028	275111	335985	191276	0.406	0.345	0.477
2019	803698	664905	971462	233785	211128	258874	175402	0.437	0.368	0.519
2020	432773	355823	526363	196925	176888	219231	182468	0.449	0.377	0.535
2021	162387	129606	203461	188827	167976	212267	204743	0.439	0.366	0.526
2022	44865	32747	61469	196492	168994	228465	176906	0.351	0.284	0.434
2023	157204	117650	210057	210340	169939	260346				

References

Howell et al. 2023. Report of the Joint Russian-Norwegian Working Group on Arctic Fisheries (JRN-AFWG). IMR-PINRO no.7-2023.

ICES. 2015. Norway and Russia request to ICES for revised advice for Haddock in Subareas I and II . *In* Report of the ICES Advisory Committee, 2015. ICES Advice 2015, Book 3, Section 3.2.3.1. 9 pp. http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2015/Special_Requests/Norway_Russia_had-arct_update.pdf .

ICES 2016. Report of the second Workshop on Management Plan Evaluation on Northeast Arctic cod and haddock and Barents Sea capelin (WKNEAMP-2) , 25-28 January 2016, Kirkenes, Norway. ICES CM 2016/ACOM:47, 76 pp.

JNRFC. 2016. Protocol of the 46th Session of the Joint Norwegian–Russian Fisheries Commission, 17–20 October 2016 (In Russian). 117 pp. Available at: http://www.jointfish.com/rus/content/download/502/6357/file/46-russisk.pdf .

ICES. 2020. Benchmark Workshop for Demersal Species (WKDEM). ICES Scientific Reports, 2:31. 136 pp. http://doi.org/10.17895/ices.pub.5548 .

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

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