

**Re-estimation of swept area indices with CVs
for main demersal fish species
in the Barents Sea winter survey 1994 – 2016
applying the Sea2Data StoX software**

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1 Background

The new Sea2Data software StoX was applied to re-estimate swept area indices with CVs for cod, haddock, golden redfish, beaked redfish, Norway redfish, Greenland halibut and blue whiting. Length and weight at age was also re-estimated for cod and haddock. The main difference between the SAS based Survey Program presently used and StoX swept area estimation is in the use of the age-length data. StoX does not use age-length keys (ALK) in the traditional sense with ALKs estimated for large areas. Missing age information is imputed from known age-length data within station. If age information is still missing StoX searches within strata, or lastly within all strata. If no age is available for a length group, the abundance estimate is presented as unknown age. StoX does also allow for uncertainty estimation by bootstrapping primary sampling units (PSUs).

The Institute of Marine Research (IMR), Bergen, has performed acoustic measurements of demersal fish in the Barents Sea since 1976, and in 1981 a bottom trawl survey was combined with the acoustic survey. From 1981 to 1992 the survey area was fixed (strata 1-12, Main Areas ABCD in Fig. 2.1). Due to warmer climate and an increasing cod stock in the early 1990s, the distribution area increased. The survey area was extended towards north and east, beginning in 1993 and continuing in 1994 (strata 13-23, Main Areas D'ES in Fig. 2.1). This should allow for a more complete coverage of younger age groups of cod, and since 1994 the survey has aimed at covering the whole cod distribution area in open water. For the same reason the survey area was extended further northwards in the western part in 2014 (strata 24-26 in Fig. 2.1).

In many years since 1997 Norwegian research vessels have had limited access to the Russian EEZ, and in 1997, 1998, 2007 and 2016 the vessels were not allowed to work in the Russian EEZ. In 1999 the coverage was partly limited by a rather unusually wide ice-extension. Since 2000, except in 2006 and 2007, Russian research vessels have participated in the survey and the coverage has been better, but for various reasons not complete in most years. In 2008-2015 Norwegian vessels had access to major parts of the Russian EEZ. The coverage was more complete in these years, especially in 2008, 2011 and 2014. In 2009, 2010, 2012, 2013 and 2015 the coverage in eastern areas was more limited due to strict rules regarding handling of the catch, bad weather or vessel problems. Table 2.4 presents further comments to the annual coverages. The annual survey reports (Annex I) presents survey tracks and trawl stations.

2 Material and Methods

2.1 Survey operation and data sampled

Table 2.1 presents the vessels participating in the survey in 1994-2016 with some basic trawl information. Catch data and biological samples from the Russian vessels were first converted to the IMR SPD-format, and then exported as xml-files from the NMDbiotic data base. The column with number of trawl stations includes both valid swept area hauls, other bottom trawl hauls and pelagic trawl hauls.

Table 2.1. Sea2Data cruise number, start and end data, serial numbers, number of trawl stations and valid swept area hauls for Norwegian and Russian vessel participation in the Barents Sea winter survey in 1994-2016.

Year	Vessel	Cruise number	Start	End	Serial number		No. trawl stations	Valid swept area hauls
					From	To		
1994	Johan Hjort	1994202	21.01	06.03	80001	80161	161	284
	G.O. Sars	1994002	01.02	10.03	80301	80404	104	
	Anny Kræmer	1994001	01.02	01.03	80501	80663	163	
1995	G.O. Sars	1995901	28.01	27.02	80001	80146	146	298
	Johan Hjort	1995901	01.02	02.03	80201	80360	160	
	Jan Mayen	1995901	01.02	23.02	80401	80529	129	
1996	G.O. Sars	1996901	06.02	05.03	80001	80129	129	312
	Johan Hjort	1996901	06.02	02.03	80201	80337	137	
	Jan Mayen	1996901	05.02	29.02	80401	80527	127	
1997	G.O. Sars	1997901	06.02	04.03	80001	80075	75	167
	Johan Hjort	1997901	06.02	01.03	80201	80322	122	
	Jan Mayen	1997901	03.02	27.02	80401	80498	98	
1998	G.O. Sars	1998002	31.01	27.02	80001	80096	96	200
	Johan Hjort	1998202	31.01	01.03	80201	80286	86	
	Jan Mayen	1998825	31.01	24.02	80401	80477	77	
1999	G.O. Sars	1999002	27.01	27.02	80001	80144	144	223
	Johan Hjort	1999203	27.01	22.02	80201	80321	121	
2000	G.O. Sars	2000002	29.01	24.02	80001	80167	167	313
	Johan Hjort	2002202	01.02	29.02	80201	80333	133	
	Varegg	2000805	28.01	28.02	80401	80556	156	
	Persey-3	0119-2000	06.02	11.02	70701	70716	16	
2001	G.O. Sars	2001002	27.01	07.03	80001	80193	193	349
	Johan Hjort	2001202	20.01	28.02	80201	80375	175	
	Persey-4	0079-2001	01.02	21.02	70701	70739	39	
2002	G.O. Sars	2002002	30.01	02.03	80001	80165	165	392
	Johan Hjort	2002203	29.01	04.03	80201	80364	164	
	Persey-3	0083-2002	29.01	27.02	70701	70829	129	
2003	G.O. Sars	2003002	27.01	05.03	80001	80164	164	312
	Johan Hjort	2003202	27.01	05.03	80301	80450	150	
	Persey-3	0085-2003	30.01	26.02	70701	70833	133	
2004	Johan Hjort	2004203	31.01	14.03	70001	70256	256	355
	G.O. Sars	2004106	31.01	15.03	70301	70471	171	
	Smolensk	0090-2004	23.02	12.03	70701	70790	90	
2005	Johan Hjort	2005203	01.02	15.03	70001	70203	203	370
	G.O. Sars	2005104	01.02	07.03	70303	70475	173	
	Smolensk	0091-2005	08.02	04.03	70701	70815	115	
2006	Johan Hjort	2006203	01.02	15.03	70001	70182	182	271
	G.O. Sars	2006103	01.02	09.03	70251	70424	173	

2007	Johan Hjort G.O. Sars	2007203 2007103	01.02 07.02	15.03 14.03	70001 70301	70181 70464	181 164	258
Year	Vessel	Cruise number	Start	End	Serial number		No.trawl stations	Valid swept area hauls
					From	To		
2008	Johan Hjort Jan Mayen Fridtjof Nansen Smolensk	2008202 2008701 0101-2008 0102-2008	01.02 01.02 04.02 25.01	14.03 06.03 05.03 13.02	70001 70301 70501 70701	70174 70471 70591 70745	174 171 91 45	345
2009	Johan Hjort Jan Mayen Fridtjof Nansen Vilnyus	2009202 2009701 0104-2009 0121-2009	06.02 01.02 02.02 26.02	13.03 08.03 05.03 13.03	70001 70301 70501 70701	70152 70474 70537 70744	152 174 37 44	331
2010	Johan Hjort Jan Mayen Fridtjof Nansen	2010202 2010701 0122-2010	04.02 01.02 26.02	17.03 05.03 11.03	70001 70301 70501	70159 70480 70564	159 180 64	349
2011	Johan Hjort Jan Mayen Fridtjof Nansen	2011202 2011702 0108-2011	03.02 01.02 02.02	14.03 01.03 19.02	70001 70301 70501	70154 70486 70585	154 186 85	381
2012	Helmer Hansen Libas Fridtjof Nansen	2012839 2012841 0111-2012	22.01 19.02 03.02	21.02 15.03 18.02	70301 70001 70501	70473 70073 70573	173 73 73	284
2013	Johan Hjort Vilnyus	2013201 0113-2013	31.01 07.02	13.03 08.03	70001 70701	70187 70828	187 128	295
2014	Johan Hjort Helmer Hansen Fridtjof Nansen	2014202 2014805 0114-2014	31.01 22.01 29.01	16.03 02.03 17.02	70001 70301 1	70196 70490 113	196 190 113	404
2015	Johan Hjort Helmer Hansen Fridtjof Nansen	2015202 2015841 0120-2015	27.01 20.01 22.02	14.03 16.02 03.03	70001 70301 70501	70221 70431 70538	221 131 38	292
2016	Johan Hjort Helmer Hansen Fridtjof Nansen	2016202 2016846	24.01 25.01 05.02	16.03 08.02 26.02	70001 70301 1	70283 70377 101	283 177 101	341

Table 2.2 gives an account of the sampled length- and age material from all trawl hauls. Table 2.3 gives the area covered by the survey every year since 1994, while Table 2.4 summarizes the coverage and main reasons for incomplete coverage in the whole period.

Table 2.2. Number of fish measured for length (L) and age (A) in the Barents Sea winter survey 1994-2016.

Year	Cod		Haddock		Golden redfish	Beaked redfish	Greenland halibut	Blue whiting
	L	A	L	A	L	L	L	L
1994	57290	3400	40608	1808	3157	12389	525	
1995	66264	3547	37775	1692	3785	9622	583	
1996	61559	3304	34497	1416	2510	10206	587	
1997	35381	2381	30054	1003	5429	10997	675	
1998	39044	2843	12512	859	1739	9664	649	
1999	22971	2321	12752	926	1266	6677	397	
2000	31543	2871	25881	1426	1161	8739	546	
2001	36789	2998	30921	1657	1173	7323	499	
2002	45399	3730	58464	2057	1143	6660	688	
2003	59573	2857	54838	1883	1102	4654	657	
2004	40851	3175	51705	1874	1438	5507	459	
2005	33582	3216	67921	2060	835	5166	832	
2006	19319	2683	23611	1899	728	3356	962	
2007	16556	2954	26610	2023	798	4544	973	4657
2008	26844	3809	50195	2490	897	8568	1020	1350
2009	22528	3486	40872	2433	455	9205	807	891
2010	30209	4085	35881	2367	429	8564	984	626
2011	26913	3959	29180	2260	286	6885	607	105
2012	17139	3020	33524	1854	574	5721	354	2441
2013	14525	2451	19142	1671	479	6087	263	1091
2014	22624	4501	35940	2586	563	9310	444	1846
2015	25401	3795	18483	2038	395	8933	541	1991
2016	16636	3368	25423	2067	614	8668	425	2396

Table 2.3. Area (NM²) covered (StoX estimates) in the bottom trawl surveys in the Barents Sea winter 1994-2016

Year	Main Area								Total	Added area
	A	B	C	D	D'	E	S	N		
1994	27180	9854	5165	53394	36543	11417	17557		161110	
1995	26797	9854	5165	53394	58605	13304	24783		191904	
1996	26182	9854	5165	53394	54047	5738	11809		166190	
1997 ¹	27785	9854	5165	23964	2670	0	18932		88371	56200
1998 ¹	27785	9854	5165	23964	5911	3829	23931		100440	51100
1999	27785	9854	5165	43230	8031	5742	18737		118545	
2000	27173	9854	5165	52314	29438	14207	25053		163204	
2001	26609	9854	5165	53394	29694	15777	24157		164652	
2002	26594	9854	5165	53394	21914	15757	24689		157369	
2003	26621	9897	5165	52072	23947	6259	23400		147361	
2004	27785	9854	5165	53394	42731	4739	20760		164428	
2005	27785	9854	5165	53394	39104	19931	24648		179883	
2006 ²	27785	9854	5165	53394	35302	13872	24691		170064	18100
2007 ¹	27785	9854	5165	23911	8498	20822	27858		123894	56700
2008	27785	9854	5165	53394	23792	18873	26313		165176	
2009	27785	9854	5165	53394	31978	15739	27858		171774	
2010	27785	9854	5165	53394	17882	18562	27858		160501	
2011	27785	9854	5165	53394	33432	16835	27858		174324	
2012 ²	27785	9854	5165	53394	9917	17289	27858		151263	16700
2013	27785	9854	5165	53394	58183	21118	27858		203358	
2014 ³	27785	9854	5165	53394	54800	29897	27858	58048	208754	
2015 ³	27785	9854	5165	53394	45449	26541	27858	47263	196047	
2016 ³	27785	9854	5165	53526	29266	20342	27630	54387	173568	

¹REZ not covered, ²REZ (Murman coast and Area D' in 2006 and Area D' in 2012 not completely covered

³ Additional northern areas (N) covered, not included in total and survey index calculations.

Table 2.4. Barents Sea winter surveys 1981-2016. Main Areas covered, and comments on incomplete coverage.

Year	Main Areas covered	Comments
1981-1992	ABCD	
1993-1996	ABCDD'ES	
1997	Norwegian EEZ (NEZ), S	Not allowed access to Russian EEZ (REZ)
1998	NEZ, S, minor part of REZ	Not allowed access to most of REZ
1999	ABCDD'ES	Partly limited coverage due to westerly ice extension
2000	ABCDD'ES	
2001-2005	ABCDD'ES	Russian vessel covered where Norwegians had no access
2006	ABCDD'ES	Not access to Murman coast, no Russian vessel
2007	NEZ, S	Not allowed access to REZ, no Russian vessel
2008	ABCDD'ES	Russian vessel covered where Norwegians had no access
2009	ABCDD'ES	Reduced Norwegian coverage of REZ due to catch handling
2010	ABCDD'ES	Reduced Norwegian coverage of REZ due to bad weather
2011	ABCDD'ES	Russian vessel covered where Norwegians had no access
2012	ABCDD'ES	No Norwegian coverage of REZ due to vessel problems
2013	ABCDD'ES	No Norwegian coverage of REZ due to vessel shortage
2014	ABCDD'ESN	Strata 24-26 (N) covered for the first time
2015	ABCDD'ESN	Slightly reduced/more open coverage due to bad weather
2016	ABCDD'ESN	No access to REZ, Russian vessel covered most of REZ

2.2 Swept area measurements

All vessels were equipped with the standard research bottom trawl Campelen 1800 shrimp trawl with 80 mm (stretched) mesh size in the front. Prior to 1994 a cod-end with 35-40 mm (stretched) mesh size and a cover net with 70 mm mesh size were mostly used. Since this mesh size may lead to considerable escapement of 1-year-old cod, the cod-ends were in 1994 replaced by cod-ends with 22 mm mesh size. At present a cover net with 116 mm meshes is mostly used.

The trawl is now equipped with a rockhopper ground gear (Engås and Godø 1989). Until and including 1988 a bobbins gear was used, and the cod and haddock indices from the time period 1981-1988 have since been recalculated to 'rockhopper indices' and adjusted for length dependent fishing efficiency and/or sweep width (Godø and Sunnanå 1992, Aglen and Nakken 1997). The sweep wire length is 40 m, plus 12 m wire for connection to the doors.

In the Norwegian Barents Sea shrimp survey (Aschan and Sunnanå 1997) the Campelen trawl has been rigged with some extra floats (45 along the ground rope and 18 along the under belly and trunk, all with 20mm diameter) to reduce problems on very soft bottom. This rigging has been referred to as "Tromsø rigging". When the shrimp survey was terminated 2004 and later merged with the Barents Sea Ecosystem survey in 2005, improved shrimp data were also requested from the winter survey, and the "Tromsø rigging" was used in parts of the shrimp areas in 2004 (11 stations) and 2005 (9 stations). In 2006-2014 "Tromsø rigging" was used for nearly all bottom trawl stations taken by Norwegian vessels in the winter survey, while since 2015 "Tromsø rigging" has not been applied.

Vaco doors (6 m², 1500kg), were previously standard trawl doors on board the Norwegian research vessels. On the Russian vessels and hired vessels V-type doors (ca 7 m²) have been used. In 2004, R/V "Johan Hjort" and "G.O. Sars" changed to a V-type door (Steinshamn W-9, 7.1m², 2050 kg), the same type as used on the Russian research vessels. In 2010 the V-doors were replaced by 125" Thyborøn trawl doors. R/V "Helmer Hanssen" has used Thyborøn trawl doors since the 2008 survey. In order to achieve constant sampling width of a trawl haul independent of e.g. depth and wire length, a 10-14 m rope "locks" the distance between the trawl wires 80-150 m in front of the trawl doors on the Norwegian vessels. This is called "strapping". The distance between the trawl doors is then in most hauls restricted to the range 48-52 m regardless of depth (Engås and Ona 1993, Engås 1995). Strapping was first attempted in the 1993 survey on board one vessel, in 1994 it was used on every third haul and in 1995-1997 on every second haul on all vessels. Since 1998 it has been used on all hauls when weather conditions permitted. Strapping is not applied on the Russians vessels, but the normal distance between the doors is about 50 m (D. Prozorkevich, pers. comm.).

Standard tow duration is now 15 minutes (until 1985 the tow duration was 60 minutes and from 1986 to 2010 30 minutes). Trawl performance is constantly monitored by Scanmar trawl sensors, i.e., distance between the doors, vertical opening of the trawl and bottom contact control. In 2005-2008 sensors monitoring the roll and pitch angle of the doors were used due to

problems with the Steinshamn W-9 doors. The data is logged on files, but have so far not been used for further evaluation of the quality of the trawl hauls.

The positions of the trawl stations are pre-defined. When the swept area investigations started in 1981 the survey area was divided into four Main Areas (A, B, C and D, Fig 2.1) and 35 strata. During the first years the number of trawl stations in each stratum was set based on expected fish distribution in order to reduce the variance, i.e., more hauls in strata where high and variable fish densities were expected to occur. Since the 1990s trawl stations have been spread out more evenly, yet the distance between stations in the most important cod strata is shorter (16 or 20 NM) compared to the less important strata (24, 30 or 32 NM). During the 1990s considerable amounts of young cod were distributed outside the initial four Main Areas, and in 1993 the investigated area was therefore enlarged by areas D', E, and the ice-free part of Svalbard (S) (Fig. 2.1 and Table 3.5), 28 strata altogether. In the 1993-1994 survey reports, the Svalbard area was included in area A' and the western (west of 30°E) part of area E. Since 1996 a revised strata system with 23 strata has been used (Figure 2.1). The main reason for reducing the number of strata was the need for a sufficient number of trawl stations in each stratum to get reliable estimates of density and variance. In later years a few pre-defined trawl stations have been performed north of the strata system due to increased abundance of cod in these areas, and in 2014 the investigated area was enlarged by three new strata in northwest, 24-26 (Main Area N, Fig. 2.1). However, the data are so far not included in the estimation of standard abundance indices used in the assessments.

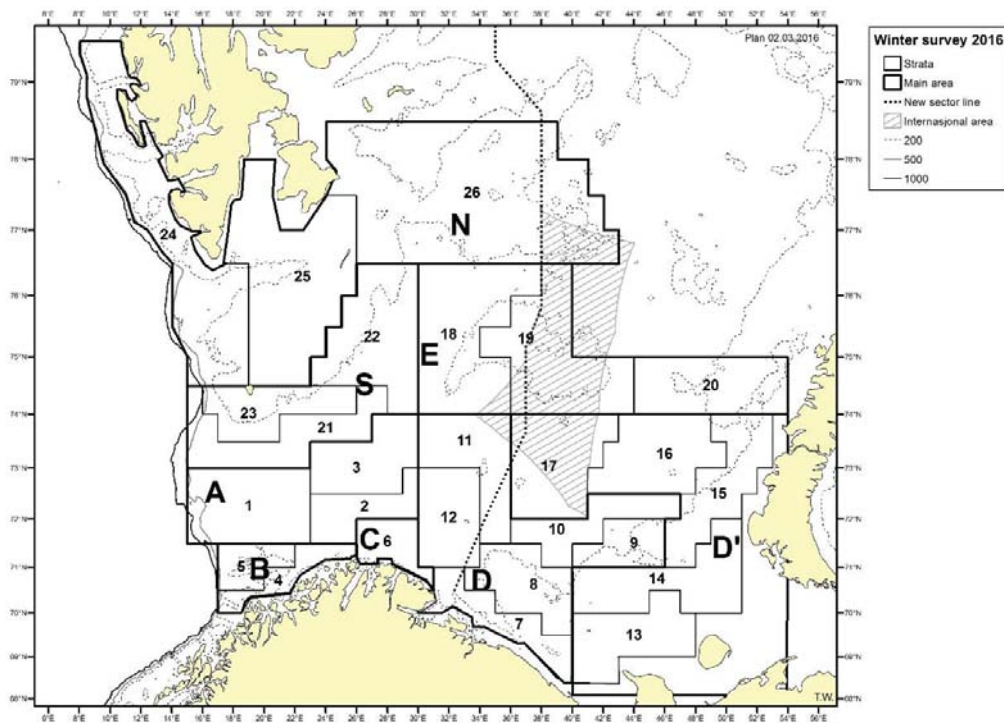


Figure 2.1. Strata (1-23) and Main Areas (A,B,C,D,D',E and S) used for swept area estimations and acoustic estimations with StoX. The Main Areas are also used for acoustic estimations with BEAM. Additional strata (24-26, Main Area N) are covered since 2014, but not included in the full time series.

Swept area fish density estimation

Swept area fish density estimates ($\rho_{s,l}$) by species (s) and length (l) were estimated for each bottom trawl haul by the equation:

$$\rho_{s,l} = \frac{f_{s,l}}{a_{s,l}}$$

$\rho_{s,l}$ number of fish of length l per n.m.² observed on trawl station s

$f_{s,l}$ estimated frequency of length l

$a_{s,l}$ swept area:

$$a_{s,l} = \frac{d_s \cdot EW_l}{1852}$$

d_s towed distance (nm)

EW_l length dependent effective fishing width:

$$EW_l = \alpha \cdot l^\beta \text{ for } l_{\min} < l < l_{\max}$$

$$EW_l = EW_{l_{\min}} = \alpha \cdot l_{\min}^\beta \text{ for } l \leq l_{\min}$$

$$EW_l = EW_{l_{\max}} = \alpha \cdot l_{\max}^\beta \text{ for } l \geq l_{\max}$$

The parameters are given in the text table below:

Species	α	β	l_{\min}	l_{\max}
Cod	5.91	0.43	15 cm	62 cm
Haddock	2.08	0.75	15 cm	48 cm

The fishing width was previously fixed to 25 m = 0.0135 nm. Based on Dickson (1993a, b), length dependent effective fishing width for cod and haddock was included in the calculations in 1995 (Korsbrette *et al.*, 1995). Aglen and Nakken (1997) have adjusted both the acoustic and swept area time series back to 1981 for this length dependency based on mean-length-at-age information.

For redfish, Greenland halibut and blue whiting, a fishing width of 25 m was applied, independent of fish length.

2.3 Sampling of catch and use of age-length data

Sorting, weighing, measuring and sampling of the catch are done according to instructions given in Mjanger *et al.* (2016). Since 1999 all data except age are recorded electronically by Scantrol Fishmeter measuring board, connected to stabilized scales. The whole catch or a representative sub sample of most species was length measured on each station.

At each trawl station age (otoliths) and stomachs were sampled from 1 cod per 5 cm length-group. In 2007-2009, all cod above 80 cm were sampled, and in 2010 all above 90 cm, limited to 10 per station. Haddock otoliths were sampled from 1 specimen per 5 cm length-group. Regarding the redfish species *Sebastes norvegicus* and *S. mentella*, otoliths for age determination were sampled from 2 fish in every 5 cm length-group on every station. Table 3.4 gives an account of the sampled material.

The Sea2Data software StoX does not use age-length keys (ALK) in the traditional sense with ALK estimated for large areas. Missing age information is imputed from known age-length data within station. If age information is still missing StoX searches within strata, or lastly within all strata. If no age is available for a length group, the abundance estimate is presented as unknown age.

2.4 Estimation of variance

The swept area survey indices of cod and haddock made with StoX are presented together with an estimate of uncertainty (coefficient of variation; CV). These estimates were made using StoX with a stratified bootstrap routine treating each trawl station as the primary sampling unit, and using 500 iterations. The estimated CV (Standard Deviation · 100/mean) is strongly dependent on the choice of estimator for the indices. A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength.

2.5 StoX input, settings and filters

StoX version 2.2 and Rstox 1.4 of 05.10.2016 was used for swept-area, length and weight at age and CV estimations (<http://www.imr.no/forskning/prosjekter/stox/en>). R for Windows version 3.3.1 was used in the R calls (<https://www.r-project.org/>).

Biotic XML-files were downloaded from:

<http://tomcat7.imr.no:8080/DatasetExplorer/v1/html/main.html>.

Under **FilterBiotic** and **FishStationExpr**, the following filters were applied:

gear =~['3270','3271'] and **gearcondition** < 3 and **trawlquality** =~['1','3'] and **fishstationtype** != 2, the latter leaving out trawl experiments, e.g. sea testing (see Mjanger et al. 2016 and Johnsen et al. 2016 for more info about codes and filters).

In **DefineStrata**, **vintertokt_barentshav.txt** was used as basis for strata definition in 1994-2013 and **vintertokt_barentshavny.txt for 2014-2016**. Nodes for strata towards north and east have been adjusted to give the same strata area as used in the SAS based Survey Program software, where these areas were reduced according to coverage and ice border in each year. In no years the difference between the strata areas used in the two programs are larger than 1 %.

In **StratumArea** and **AreaMethod**, **Accurate** was applied.

Under **StationLengthDist** and **LengthDistType**, **NormalLengthDist** was used, and under **RegroupLengthDist** and **LengthInterval**, **5.0** is applied.

In **SweptAreaDensity** and **FishingWithMethod**, **LengthDependent** was used for cod and haddock with parameters as given above, and **Constant** for the other species, with **FishingWidth** set to **25**.

Under **SuperIndAbundance** and **AbundWeightMethod**, **StationDensity** was used, with **LengthDist** set to **RegroupLengthDist**.

2.6 Raising of indices and adjusting of lengths and weights

In 1997, 1998 and 2007 only the Norwegian EEZ (REZ) and parts of the Svalbard area (S) was covered. The swept-area indices for cod, haddock, golden redfish, beaked redfish and Greenland halibut has therefore been raised to also represent the Russian EEZ (REZ).

A variable part of the Svalbard area (S) is covered each year due to variable ice extension and insufficient survey time, and the indices for this area have therefore not been included in the raising procedure. For 1997 and 1998 the proportion of fish by age or size group in REZ (\approx strata 7, 8, 9, 10, 13, 14, 15, 16, 17 and 20) relative to the total area covered minus S (\approx strata 21, 22, 23) was estimated by interpolating the proportion of fish in REZ relative to the total area covered minus S in 1996 and 1999, and for 2007 by interpolating the proportion of fish in REZ relative to the total area covered minus S in 2006 and 2008. The indices for REZ was then calculated by multiplying the indices for NEZ (\approx strata 1, 2, 3, 4, 5, 6, 11, 12, 18 and 19) by these proportions, and the total indices were found by adding the indices for NEZ and S.

Length and weight at age of cod and haddock in REZ is often lower than in areas further west, especially for younger age groups, and the observed data on lengths and weights for 1997, 1998 and 2007 have therefore been adjusted. For 1997 the observed mean lengths at age and mean weights at age in NEZ+S (area covered) has been scaled by the observed ratio between values in total area and values in NEZ+S in the 1996 survey. Similarly, for 1998 mean lengths and weights at age have been scaled by the corresponding ratios in the 1999 survey. For 2007 mean lengths and weights at age have been scaled by the corresponding ratios, averaged for the 2006 and 2008 survey.

In 2006 there was not a complete coverage in southeast due to restrictions. The observations in the partially covered strata 7 were extrapolated to the full strata, and the observations in the partially covered strata 13 were extrapolated to the same area as covered in 2005. Due to incomplete coverage in 2012, the cod and haddock swept area estimates within the covered area were raised by the “index ratio by age” observed for the same area in 2008-2011 (ICES 2012) (the scaling factor for estimating adjusted total from $\langle \text{Total} - D \rangle$ was the average ratio by age for $\text{Total}/(\text{Total} - D)$ in the years 2008-2011, Aglen et al. 2012).

3 Results

3.1 Cod

Table 3.1.1 presents swept area abundance indices for cod age groups 1 – 15+, where 15+ is the sum of indices for age groups 15 and older, for the standard area (strata 1-23) in 1994 to 2016, and Table 3.1.2 gives the ratio between new and old indices by age, total index and total biomass. The highest and lowest single index ratio was 3.12 and 0.38, while the highest and lowest average ratio over all age groups in one year was 1.18 and 0.96, and the highest and lowest average ratio for one age group over all years was 1.16 and 0.96. The highest and lowest ratios were mainly found for the years with raising of the indices, i.e. 1997, 1998, 2008 and 2012. The estimation of the proportion of fish in REZ relative to the total area minus Svalbard area in 1996, 1999, 2006 and 2008 was probably done more accurately using StoX, where it is more easy to include or exclude strata. The overall average index ratio was 1.04, the average total index ratio was 1.01 and the average total biomass ratio was 1.02.

Table 3.1.3 presents estimates of coefficients of variation (%) for age groups 1-14. Estimates are based on a stratified bootstrap approach with 500 replicates (with trawl stations being primary sampling unit). A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength. In all years CVs for age groups older than 10 years are above what could be considered as acceptable.

Tables 3.1.4 and 3.1.5 present the time series of mean length and mean weight at age for age groups 1-14 in the standard area. Age groups with few observations are marked with “ + “, while no observations are marked with “ - “. Observed data for 1997, 1998 and 2007 have been adjusted, see above. Since StoX does not use age-length keys (ALK) in the traditional sense with ALK estimated for large areas as done by the Survey Program, there are differences in length and weight at age for some age groups in some years. However, the overall average ratio for age 1-8 lengths was 0.98 and for age 1-9 weights 0.99.

Table 3.1.1. COD. Abundance indices (numbers in millions) from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software.

Year	Age group															Total	Biomass ('000 t)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+		
1994	1044.5	545.5	296.8	307.6	152.6	46.8	8.13	2.59	1.32	0.55	0.52	0.11	0.05	0	0	2407.0	760.2
1995	5343.8	540.2	280.4	242.1	252.3	77.1	17.9	2.33	1.13	0.55	0.59	0.19	0	0	0	6758.7	937.5
1996	5908.3	778.6	164.0	116.7	140.7	111.2	24.8	2.79	0.37	0.16	0.08	0.08	0.05	0.02	0	7247.9	725.4
1997 ¹	5122.8	1413.7	315.4	69.2	75.0	60.7	26.8	4.95	0.63	0.68	0.46	0.00	0.00	0.00	0.00	7090.2	502.4
1998 ¹	2512.1	492.5	355.2	167.4	31.7	26.4	17.5	8.26	0.79	0.52	0.65	0.00	0.35	0.00	0.04	3613.4	405.9
1999	479.7	353.6	189.6	181.9	61.3	12.8	6.83	5.19	0.98	0.27	0.02	0.03	0.02	0	0	1292.2	324.2
2000	128.2	242.8	247.5	130.0	112.0	27.0	4.73	1.82	1.23	0.36	0.10	0.03	0.02	0	0	895.8	364.7
2001	715.8	77.6	182.0	194.5	81.6	38.0	9.58	1.19	0.45	0.19	0.04	0	0	0	0.01	1300.9	433.8
2002	34.2	416.2	118.0	137.7	108.6	46.5	14.5	2.19	0.34	0.19	0.05	0	0	0	0.02	878.5	448.5
2003	3021.4	61.2	380.8	125.4	95.2	66.6	17.9	4.72	1.02	0.16	0.04	0	0.02	0.02	0	3774.3	546.9
2004	321.3	236.3	65.5	186.1	53.6	43.2	30.9	6.92	1.66	0.29	0.08	0.01	0.01	0	0	945.8	417.2
2005	846.8	216.4	244.8	54.8	102.7	22.4	16.4	3.80	0.88	0.30	0.04	0.02	0.03	0.04	0	1509.5	357.9
2006 ²	676.9	283.8	115.6	114.0	28.1	43.3	14.0	5.19	1.34	0.22	0.21	0.08	0	0	0	1282.6	332.2
2007 ¹	584.2	369.9	365.8	127.3	68.9	13.7	23.6	6.85	2.20	0.40	0.31	0.08	0.00	0.00	0.00	1563.2	459.2
2008	69.0	103.3	192.5	300.0	115.6	40.8	18.0	8.29	1.86	0.35	0.02	0.02	0.01	0	0	850.0	694.5
2009	389.4	35.5	124.3	196.1	218.0	58.2	17.5	8.44	5.27	0.50	0.18	0.03	0.03	0	0	1053.4	740.3
2010	1031.5	96.5	37.0	114.9	155.5	144.5	39.8	11.2	3.70	1.64	0.57	0.05	0.02	0.03	0.02	1637.0	831.1
2011	615.3	225.6	85.4	50.7	129.9	138.0	103.1	16.7	4.34	1.17	0.79	0.20	0.17	0.04	0.02	1371.4	890.1
2012 ³	1429.7	124.6	258.9	70.3	36.4	93.9	136.3	49.6	9.38	2.33	0.87	0.60	0.47	0.02	0.05	2213.5	931.7
2013	439.1	147.2	70.3	119.8	64.0	41.0	65.0	76.2	33.6	2.21	2.83	0.41	0.35	0.06	0.03	1062.0	958.1
2014	499.8	148.8	180.6	85.1	67.9	47.8	32.6	46.9	31.7	9.36	1.01	0.97	0.15	0.04	0.07	1153.0	789.0
2015	1295.0	196.8	125.4	170.2	135.7	99.8	71.2	27.4	52.8	17.0	2.86	0.72	0.10	0.07	0.04	2194.8	1220.0
2016	211.9	233.5	52.7	112.7	151.5	109.0	66.7	25.8	12.8	15.0	6.52	0.99	0.50	0.17	0.14	1000.0	979.3

¹Indices raised to also represent the Russian EEZ.

²Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

³Indices raised to also represent uncovered parts of the Russian EEZ.

Table 3.1.2. COD. Ratio new/old swept area abundance indices and total biomass in the Barents Sea winter 1994-2016.

Year	Age group										Total	Biomass
	1	2	3	4	5	6	7	8	9	10+		
1994	1.01	1.02	1.00	0.99	1.04	0.92	0.87	1.08	0.83	0.95	1.01	1.00
1995	1.02	1.00	1.02	1.00	0.99	1.01	0.97	0.97	1.41	1.21	1.01	0.99
1996	1.02	1.10	0.96	1.01	1.03	1.05	1.03	0.96	0.93	0.78	1.03	1.03
1997	1.06	1.35	1.33	1.08	1.07	1.15	0.95	0.87	0.70	2.28	1.12	1.01
1998	1.04	0.77	0.90	0.92	0.87	1.02	0.98	0.96	0.79	3.12	0.97	0.95
1999	0.99	1.04	0.90	1.05	1.06	0.96	1.05	1.02	0.82	0.85	1.00	1.02
2000	1.00	0.98	1.05	0.98	1.03	1.00	1.10	0.91	1.03	1.28	1.01	1.02
2001	1.09	1.01	0.95	1.06	0.98	0.99	1.08	1.08	1.13	1.20	1.05	1.01
2002	0.97	0.94	1.34	1.02	0.99	1.09	0.96	0.91	1.13	1.30	1.01	1.02
2003	1.01	0.77	1.01	0.97	1.05	0.99	0.98	0.96	1.02	1.20	1.00	1.00
2004	0.98	1.00	0.86	1.08	0.94	0.97	1.13	0.91	0.98	0.98	0.99	1.01
2005	1.03	0.96	0.99	0.88	1.05	0.91	1.06	0.84	0.80	1.08	1.00	1.01
2006	0.78	0.98	0.98	1.02	0.98	0.99	1.37	1.06	0.96	0.85	0.87	0.99
2007	1.20	0.94	0.99	1.50	1.10	0.93	1.32	1.43	1.22	0.60	1.09	1.16
2008	0.98	1.12	1.01	0.90	1.27	0.86	1.38	0.94	0.93	1.00	1.00	1.02
2009	1.02	0.91	1.05	0.89	1.12	0.99	0.89	1.24	1.08	0.82	1.01	1.00
2010	1.01	0.92	1.03	1.07	0.97	1.03	1.00	0.94	1.06	1.06	1.01	1.02
2011	0.99	1.01	0.97	0.94	1.06	0.99	1.08	0.99	1.11	1.00	1.00	1.02
2012	1.05	0.38	2.64	1.03	0.81	1.08	1.10	0.93	1.19	0.90	1.01	1.02
2013	1.10	0.90	0.95	1.09	0.98	1.16	1.06	0.96	1.24	1.28	1.04	1.04
2014	1.00	0.98	1.04	1.02	1.02	0.99	1.18	1.06	0.96	1.05	1.01	1.01
2015	0.96	1.10	1.01	0.93	1.15	0.81	1.15	0.85	1.36	0.77	0.98	0.99
2016	1.09	0.95	0.86	1.08	0.92	1.14	1.14	0.83	0.90	1.15	1.01	1.02

Table 3.1.3. COD. Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Age group														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1994	11	17	13	8	7	8	13	21	23	25	22	67	66	-	-
1995	8	14	11	12	10	10	12	23	33	27	43	39	-	-	-
1996	7	12	19	10	12	10	13	13	25	44	51	42	59	106	-
1997¹	27	28	16	14	13	10	9	14	21	55	70	-	-	-	-
1998¹	8	12	15	11	11	10	8	10	17	48	61	-	95	-	68
1999	18	28	17	14	8	10	14	29	22	62	105	94	91	-	-
2000	12	18	13	8	8	9	13	10	14	32	59	61	84	-	-
2001	11	14	17	14	9	10	13	23	25	35	59	-	-	-	-
2002	14	24	25	8	9	12	9	15	25	40	70	93	-	-	-
2003	25	33	26	18	7	7	9	11	15	39	56	65	65	-	-
2004	13	15	17	14	11	12	15	14	16	35	39	100	95	-	-
2005	9	15	26	16	16	14	12	11	17	23	60	66	43	50	-
2006²	12	13	14	26	17	12	20	12	17	27	54	76	-	-	-
2007¹	26	21	15	25	7	9	14	17	19	19	33	49	84	-	-
2008	9	16	17	23	33	10	35	14	26	23	74	83	97	-	-
2009	10	9	18	12	19	14	17	25	22	26	34	62	97	-	-
2010	33	9	11	18	13	11	22	13	24	21	27	64	57	57	97
2011	7	30	11	15	16	11	9	11	26	19	49	38	58	64	99
2012²	46	13	65	12	14	19	20	12	24	19	23	31	48	80	92
2013	10	18	16	19	12	10	11	10	18	22	55	35	59	102	99
2014	16	10	12	12	10	10	17	13	10	17	27	34	60	132	80
2015	7	24	9	9	14	13	30	21	42	20	20	34	95	82	87
2016	9	10	9	12	9	20	22	10	14	27	21	32	30	54	57

¹ REZ not covered

² REZ partly covered

Table 3.1.4. COD. Length (cm) at age from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software. + indicates few samples.

Age/ Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1994	11.3	17.9	30.2	44.6	55.1	65.5	73.8	78.5	87.5	97.9	97.7	100.8	122.1	-
1995	12.2	18.0	28.8	42.1	54.0	63.7	75.7	80.2	83.9	99.1	+	109.0	-	-
1996	12.1	18.9	28.7	40.6	49.3	60.9	71.7	84.8	92.2	92.2	99.5	104.6	108.7	121.0
1997¹	10.9	15.9	26.8	39.9	49.5	59.2	69.9	81.6	91.8	+	+	-	-	-
1998¹	9.8	18.0	29.3	40.0	50.9	58.9	67.7	76.7	87.4	+	+	-	+	-
1999	12.0	18.3	29.0	39.9	50.4	59.4	70.4	78.5	88.7	88.4	+	+	+	-
2000	12.9	20.7	28.4	39.7	51.5	61.4	70.5	76.2	84.8	81.8	99.7	+	+	-
2001	11.6	22.6	33.0	41.1	52.2	63.3	70.2	77.7	86.0	96.2	103.8	-	-	-
2002	12.0	19.5	28.6	43.6	52.1	62.0	71.3	79.5	91.0	89.3	102.3	-	-	-
2003	11.4	18.0	28.9	39.4	53.4	61.7	70.6	80.8	89.1	90.6	104.5	-	105.8	111.6
2004	10.6	18.4	31.7	40.6	51.7	61.6	68.6	79.7	90.9	88.5	91.7	+	+	-
2005	11.2	18.3	29.5	43.5	51.1	60.3	71.0	79.6	88.9	96.2	109.4	+	+	+
2006	12.0	19.5	30.9	42.1	53.6	60.2	66.4	76.5	84.5	98.8	93.2	96.3	-	-
2007¹	13.1	21.0	29.4	40.2	53.1	62.9	68.7	76.6	87.6	94.9	102.4	+	-	-
2008	12.1	22.4	33.1	43.2	51.7	64.1	69.0	81.3	88.4	94.6	108.9	+	+	-
2009	11.2	21.2	32.1	42.6	53.1	61.7	76.5	81.8	89.3	97.9	99.9	+	+	-
2010	11.2	18.2	31.5	42.7	52.4	60.7	70.6	80.4	88.5	96.2	102.7	+	+	+
2011	11.9	19.4	29.5	41.9	51.0	60.7	68.1	78.3	85.9	95.2	101.3	111.1	111.7	119.0
2012	11.0	18.4	22.6	41.0	52.4	58.0	66.5	75.7	86.0	91.4	106.2	113.4	119.7	+
2013	11.2	19.2	31.0	41.0	51.6	62.1	69.7	76.5	81.1	95.2	92.2	110.7	110.7	+
2014	9.8	17.3	29.1	40.1	51.8	59.5	70.3	77.0	81.9	87.1	96.7	98.1	110.5	+
2015	10.5	16.2	30.0	39.9	51.2	60.5	69.0	77.6	80.1	88.9	95.4	101.4	+	+
2016	12.2	18.5	29.9	40.6	50.0	60.6	68.4	76.9	85.4	86.0	90.0	91.9	111.8	122.2

¹⁾ Adjusted lengths, REZ not covered

Table 3.1.5. COD. Weight (g) at age from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software. + indicates few samples.

Age/ Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1994	12	55	260	796	1463	2372	3477	4624	6782	8420	8530	13516	20786	-
1995	15	53	239	656	1341	2194	3628	4577	5315	8907	+	12176	-	-
1996	15	62	232	632	1079	1979	3327	5479	7655	8192	9760	13013	13614	14650
1997 ¹	13	46	181	592	1097	1785	2917	4928	7290	+	+	-	-	-
1998 ¹	8	50	256	608	1184	1749	2601	4040	6383	+	+	-	+	-
1999	14	58	231	588	1178	1827	2994	4123	6343	7326	+	+	+	-
2000	16	74	210	558	1210	1961	3042	3842	5384	5727	9960	+	+	-
2001	14	106	336	642	1288	2233	3090	4332	5727	8571	11022	-	-	-
2002	14	67	233	747	1225	2065	3189	4577	7472	6431	11645	-	-	-
2003	13	59	229	586	1313	2013	2982	4725	6511	7552	12467	-	12885	16112
2004	10	59	276	607	1142	1946	2618	4139	6684	6988	7957	+	+	-
2005	13	61	245	724	1145	1857	2953	4224	6418	8607	12488	+	+	+
2006	13	69	280	663	1413	1965	2599	4244	5783	10131	8620	10735	-	-
2007 ¹	17	71	226	638	1370	2270	2918	4254	6556	8727	11130	+	-	-
2008	15	90	336	799	1410	2449	3144	5218	6793	9494	12918	+	+	-
2009	13	84	294	704	1293	2030	4061	5082	6884	9504	9614	+	+	-
2010	11	64	307	702	1297	2031	3165	4736	6501	9016	10417	+	+	+
2011	15	65	247	667	1129	1940	2725	4003	5914	8233	9888	13213	13814	+
2012	12	62	123	609	1278	1673	2480	3772	5923	7783	12298	14876	17868	+
2013	11	65	264	591	1201	2064	2804	3839	4814	8433	8759	15101	14729	+
2014	8	49	238	592	1234	1776	2849	3942	4946	6181	8368	9212	12578	+
2015	10	47	242	574	1250	1971	2760	4077	4621	6901	8096	11366	+	+
2016	13	54	240	600	1063	1953	2703	3873	5537	6024	6965	7924	15330	25046

¹⁾ Adjusted weights, REZ not covered

3.2 Haddock

Table 3.2.1 presents swept area abundance indices for haddock age groups 1 – 15+ for the standard area in 1994 to 2016, and Table 3.2.2 gives the ratio between new and old indices by age, total index and total biomass. The highest and lowest single index ratio was 4.24 and 0.20, both for two older neighbour age groups in 2008. Also for haddock high and low ratios were especially found in the years with raising of the indices, i.e. 1997, 1998 and 2008. The highest and lowest average ratio over all age groups in one year was 1.26 and 0.95, and the highest and lowest average ratio for one age group over all years was 1.09 and 0.86. The overall average index ratio was 0.99, the average total index ratio was 0.98 and the average total biomass ratio was 1.01.

Table 3.2.3 presents estimates of coefficients of variation (%) for age groups 1-14. Estimates are based on a stratified bootstrap approach with 500 replicates (with trawl stations being primary sampling unit). A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength. In most years CVs for age groups older than 7 years are above what could be considered as acceptable.

Tables 3.3.4 and 3.4.5 present the time series of mean length and mean weight at age for age groups 1-14 in the standard area. Age groups with few observations are marked with “ + “, while no observations are marked with “ - “. Observed data for 1997, 1998 and 2007 have been adjusted, see above. Since StoX does not use age-length keys (ALK) in the traditional sense with ALK estimated for large areas as done by the Survey Program, there are differences in length and weight at age for some age groups in some years. However, the overall average ratio for age 1-8 lengths was 0.99 and for age 1-9 weights 1.01.

Table 3.2.1. HADDOCK. Abundance indices (numbers in millions) from bottom trawl surveys in the Barents Sea standard area winter 1994–2016 estimated by Stox software.

Year	Age group															Biomass (*000 t)	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+	Total	
1994	593.5	220.9	315.2	427.9	48.3	3.39	0.14	0.17	0.16	0.14	0.45	0.04	0	0	0	1610.4	402.5
1995	1392.8	182.1	57.6	163.0	338.4	28.8	1.87	0.03	0.04	0.04	0	0.25	0.11	0	0	2165.1	435.7
1996	295.5	245.0	55.5	32.5	161.0	250.9	18.3	1.11	0	0.01	0	0.03	0.03	0	0	1059.9	453.3
1997 ¹	1068.7	93.5	80.9	39.6	18.2	61.4	87.3	3.22	0.08	0	0	0	0.03	0.02	0	1452.8	284.5
1998 ¹	239.2	196.0	21.2	36.1	12.8	3.24	8.15	5.94	0.56	0.03	0.02	0	0	0	0.05	523.3	85.2
1999	1186.4	79.8	57.1	15.6	9.36	2.87	0.86	1.30	0.74	0.01	0	0.02	0	0	0	1354.2	85.5
2000	817.0	429.8	24.1	35.8	6.91	4.05	0.65	0.01	0.81	0.24	0.03	0.03	0.01	0	0	1319.5	123.3
2001	1215.5	450.0	291.8	26.1	22.7	1.73	0.78	0.06	0.06	0.05	0.16	0.10	0.02	0	0.01	2009.1	226.6
2002	1652.1	464.5	313.8	186.8	11.9	8.43	0.86	0.19	0	0.10	0.15	0.04	0.04	0	0	2638.9	307.0
2003	3254.4	481.3	337.8	175.1	72.3	5.04	1.73	0.12	0.09	0.09	0.09	0.01	0.01	0	0	4328.1	408.3
2004	705.1	707.3	174.9	99.3	77.7	50.9	7.37	0.89	0.13	0.04	0.05	0.04	0.04	0.07	0	1824.2	307.5
2005	4400.9	369.6	315.7	140.1	50.9	61.7	10.2	0.25	0.08	0.01	0	0	0	0	0	5349.5	427.1
2006 ²	4879.2	1296.8	78.8	129.8	45.5	22.6	15.9	3.20	0.09	0.14	0	0.04	0	0	0.07	6470.4	449.1
2007 ¹	3654.3	1679.9	459.1	81.0	84.8	26.1	5.38	2.23	1.35	0.77	0.07	0	0	0	0.03	5995.0	677.3
2008	831.1	2072.2	1578.8	581.3	52.9	54.0	7.05	10.6	0.16	0.04	0.08	0.05	0	0	0	5189.1	1099.2
2009	550.0	329.1	1237.3	760.1	372.3	25.8	12.3	0.85	0.09	0.34	0	0.01	0	0	0	3288.1	986.5
2010	1586.4	81.4	96.1	492.8	454.6	149.4	7.80	0.99	0.35	0.42	0.03	0.02	0	0	0	2870.5	760.6
2011	670.9	354.4	52.6	125.7	472.5	293.6	66.3	1.45	1.11	0	0	0.14	0.03	0	0	2038.6	834.4
2012 ³	1844.8	137.3	321.6	29.1	76.1	270.9	156.4	24.5	2.64	0.31	0.04	0.07	0	0	0	2863.7	747.2
2013	335.7	480.2	55.5	146.0	20.9	34.2	193.8	68.6	6.00	0.08	0	0	0	0	0	1340.9	602.3
2014	1129.0	119.8	370.6	30.3	100.4	21.9	46.5	95.2	40.0	1.52	0.46	0	0	0.02	0	1955.7	631.3
2015	1071.7	315.2	30.2	176.7	44.1	35.6	13.6	18.3	27.7	7.76	0.28	0.13	0	0	0	1741.2	373.2
2016	2176.2	536.6	151.7	33.5	105.0	20.1	40.7	10.0	27.3	24.4	3.94	0.90	0	0.14	0.06	3130.8	518.9

¹Indices raised to also represent the Russian EEZ.

²Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

³Indices raised to also represent uncovered parts of the Russian EEZ.

Table 3.2.2. HADDOCK. Ratio new/old swept area abundance indices and total biomass in the Barents Sea standard area winter 1994-2016.

Year	Age group										Total	Biomass
	1	2	3	4	5	6	7	8	9	10+		
1994	0.98	0.97	0.93	0.98	0.97	1.00	0.70	1.70	0.80	1.05	0.97	0.97
1995	0.95	1.02	1.07	0.95	1.00	0.83	0.67	1.00	0.40	-	0.96	0.98
1996	0.95	0.93	1.06	0.68	1.08	0.99	1.58	1.23	-	0.70	0.97	0.98
1997	0.84	1.38	0.94	1.41	0.94	1.31	1.40	0.92	0.80	-	0.92	1.26
1998	1.12	1.42	0.93	1.09	0.97	0.95	1.02	0.73	0.80	1.00	1.19	1.09
1999	0.95	1.39	0.95	1.28	0.92	1.03	0.86	0.76	0.67	-	0.97	0.99
2000	0.96	0.95	0.89	1.01	0.82	1.01	0.81	-	1.16	1.55	0.96	0.98
2001	1.00	0.98	0.99	0.89	0.90	1.02	0.87	0.60	0.60	1.13	0.99	0.98
2002	0.98	0.87	1.00	1.01	0.68	1.03	1.08	0.63	-	1.10	0.96	0.97
2003	0.98	0.94	1.06	0.96	0.98	0.92	0.75	0.60	0.90	1.00	0.98	0.95
2004	0.98	0.99	0.93	0.97	0.97	1.10	1.25	0.81	0.65	2.40	0.98	0.99
2005	0.95	0.88	0.91	1.05	0.76	1.18	0.83	0.42	0.40	-	0.94	0.97
2006	0.95	0.99	1.02	0.92	0.94	1.15	1.05	1.03	0.90	0.83	0.96	0.97
2007	0.94	1.05	0.90	1.23	0.99	1.13	0.72	0.60	0.96	1.55	0.97	1.15
2008	0.97	0.97	1.04	0.97	0.61	1.10	1.12	4.24	0.20	1.70	0.99	0.99
2009	0.97	1.00	0.97	0.98	1.02	0.67	1.16	0.61	0.90	1.17	0.98	0.99
2010	0.98	0.73	0.93	0.97	0.95	1.14	1.11	0.99	0.58	0.78	0.97	0.99
2011	0.98	1.03	0.81	1.32	1.01	0.87	1.07	0.91	2.78	0.85	0.99	0.98
2012	0.96	1.27	1.02	0.63	0.91	0.94	1.07	1.12	1.10	1.05	0.98	0.98
2013	1.15	0.97	0.76	1.00	0.97	0.89	1.26	0.72	0.50	0.80	1.01	0.99
2014	0.94	1.02	0.99	0.68	1.00	0.89	1.09	1.04	0.78	0.38	0.95	1.02
2015	0.98	0.91	1.18	0.96	1.25	1.01	1.17	0.78	1.20	0.69	0.97	0.99
2016	0.97	0.99	0.89	1.30	0.99	0.99	1.24	0.70	0.98	0.98	0.97	0.98

Table 3.2.3. HADDOCK. Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Age group													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1994	12	13	13	13	15	25	47	45	34	61	39	100	-	-
1995	12	19	28	29	16	21	38	181	75	97	-	58	97	-
1996	14	12	11	26	29	25	60	64	-	98	-	95	96	-
1997¹	12	34	13	15	17	21	18	57	55	-	-	-	65	92
1998¹	15	13	13	14	16	25	18	16	35	107	106	-	-	-
1999	15	37	14	24	21	23	25	31	22	88	-	97	-	-
2000	9	11	21	10	18	14	32	51	32	35	65	91	105	-
2001	11	15	11	18	11	40	34	46	59	51	47	86	62	-
2002	9	12	11	12	19	17	27	44	-	57	52	54	80	-
2003	18	26	25	12	11	20	35	62	60	69	56	91	93	-
2004	10	12	16	14	11	12	28	26	43	56	56	94	59	51
2005	9	16	11	19	13	22	15	71	48	93	-	-	-	-
2006²	14	14	18	12	13	16	20	30	44	70	-	63	-	-
2007¹	11	7	10	20	12	12	24	25	46	51	58	-	-	-
2008	12	18	17	17	20	29	29	80	45	81	67	88	-	-
2009	13	21	16	17	19	19	33	25	91	68	-	94	-	-
2010	11	17	18	23	21	22	24	32	49	64	126	150	-	-
2011	10	10	16	25	17	13	18	33	73	-	-	83	84	-
2012²	20	29	16	17	14	12	15	34	73	47	83	62	-	-
2013	12	12	15	15	28	25	28	14	26	49	-	-	-	-
2014	9	24	14	19	17	22	21	17	24	41	62	-	-	99
2015	8	13	26	12	40	14	27	19	21	32	44	50	-	-
2016	22	25	15	47	11	17	20	16	17	21	29	45	-	62

¹ REZ not covered

² REZ partly covered

Table 3.2.4. HADDOCK. Length (cm) at age from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software. + indicates few samples.

Age/ Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1994	14.5	20.1	29.4	38.0	47.6	54.3	61.7	65.2	70.7	64.4	64.6	72.0	-	-
1995	15.1	18.4	28.7	34.0	42.8	51.0	59.6	60.0	67.2	68.0	-	64.7	78.6	-
1996	15.3	20.9	28.0	37.0	41.3	47.2	53.8	58.7	-	76.0	-	74.0	75.0	-
1997 ¹	15.8	19.4	27.0	33.5	40.5	46.9	47.6	53.3	62.0	-	-	-	75.6	78.0
1998 ¹	14.1	19.6	28.9	34.2	41.6	46.5	50.3	52.8	58.2	72.1	65.0	-	-	-
1999	14.3	18.0	32.3	38.6	46.5	51.9	56.1	55.1	58.8	62.0	-	72.0	-	-
2000	15.5	21.7	29.9	42.0	47.1	51.1	52.7	59.3	59.4	62.0	63.3	+	+	-
2001	14.6	22.1	32.1	37.6	48.0	50.1	59.2	55.0	64.9	66.3	67.7	+	+	-
2002	15.0	20.9	29.2	39.8	45.6	51.5	58.0	58.6	-	62.0	64.4	67.7	70.1	-
2003	15.8	24.0	26.4	36.5	45.8	49.8	54.5	61.2	62.6	60.3	66.0	70.0	+	-
2004	14.1	22.1	30.1	35.7	42.7	49.9	49.6	58.8	63.3	73.6	75.7	+	+	+
2005	14.8	20.6	29.9	36.1	40.4	48.4	51.5	56.2	60.8	67.0	-	-	-	-
2006	14.4	22.1	30.7	37.9	43.3	47.3	50.7	56.6	60.5	69.9	-	+	-	-
2007 ¹	15.2	23.5	28.2	31.2	43.5	43.9	50.0	58.0	58.1	+	62.0	-	-	-
2008	15.7	23.7	29.6	37.9	42.7	46.0	52.9	52.5	58.5	+	63.3	63.0	-	-
2009	14.2	22.6	29.7	35.5	41.8	48.1	48.9	56.4	65.0	62.3	-	62.0	-	-
2010	14.4	19.8	30.6	36.8	40.8	45.1	49.9	59.9	58.9	62.3	+	66.5	-	-
2011	13.6	23.3	28.5	39.5	42.9	46.1	48.2	62.7	+	-	-	63.3	+	-
2012	14.6	19.2	31.6	35.1	43.7	47.1	50.2	50.8	47.6	65.0	67.0	72.0	-	-
2013	14.5	22.8	30.0	40.9	42.8	48.6	52.3	52.8	55.6	67.3	-	-	-	-
2014	15.5	18.6	31.9	39.0	46.5	52.7	53.5	55.3	54.9	60.3	59.2	-	-	75.0
2015	14.5	20.4	26.1	39.8	45.3	52.6	53.4	57.6	56.9	60.2	59.6	67.4	-	-
2016	14.8	18.4	30.8	36.0	47.8	53.0	56.0	58.5	61.3	60.3	59.8	64.0	-	72.0

¹⁾ Adjusted lengths, REZ not covered

Table 3.2.5. HADDOCK. Weight (g) at age from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software. + indicates few samples.

Age/ Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1994	25	87	248	539	1056	1601	2201	2846	3439	2680	2712	3890	-	-
1995	30	71	221	380	775	1331	2005	2070	2685	2905	-	2502	3972	-
1996	32	93	218	472	668	1020	1537	1768	-	4630	-	4018	3626	-
1997 ¹	35	85	188	329	619	1034	1064	1532	2474	-	-	-	3731	4130
1998 ¹	24	89	232	416	815	1032	1298	1559	2006	3740	3040	-	-	-
1999	27	75	335	570	1022	1435	1791	1722	2011	2440	-	3525	-	-
2000	32	110	275	736	1061	1366	1521	2123	2239	2588	2741	+	+	-
2001	28	107	337	581	1145	1402	2147	1896	2903	3110	2965	+	+	-
2002	30	85	245	618	940	1375	1940	2048	-	2352	2670	3252	3497	-
2003	36	129	192	490	958	1209	1479	1933	2479	2533	3055	3470	+	-
2004	23	98	271	456	750	1162	1204	1958	2658	3926	4157	+	+	+
2005	29	98	261	474	666	1093	1372	1976	2120	2730	-	-	-	-
2006	25	109	302	561	810	1083	1358	1917	2102	3991	-	+	-	-
2007 ¹	30	114	246	356	894	956	1388	2135	2508	+	2959	-	-	-
2008	32	113	245	553	832	1080	1573	1417	2120	+	2280	2840	-	-
2009	26	96	225	442	747	1147	1275	1726	2377	2563	-	2594	-	-
2010	27	87	270	466	658	949	1260	1897	2143	2512	+	3184	-	-
2011	21	117	220	520	727	939	1163	2285	+	-	-	+	2805	-
2012	28	73	305	432	816	1015	1285	1282	1219	2683	2980	3264	-	-
2013	24	113	272	644	783	1130	1350	1495	1836	3098	-	-	-	-
2014	32	68	357	611	1014	1424	1551	1677	1671	2141	2184	-	-	4800
2015	23	88	201	588	848	1423	1465	1921	1834	2078	2256	3133	-	-
2016	27	74	283	465	1057	1456	1745	2071	2303	2263	2416	2803	-	3467

¹⁾ Adjusted weights, REZ not covered

3.3 Golden redfish (*Sebastes norvegicus*)

Table 3.3.1 presents swept area abundance indices by length groups in 1994 to 2016, and Table 3.3.2 gives the ratio between new and old indices by length groups, total index and total biomass. The highest and lowest single index ratio was 2.14 and 0.26, both for length groups with low indices in years with raising of the indices. The highest and lowest average ratio over all length groups in one year was 1.04 and 0.94, and the highest and lowest average ratio for one length group over all years was 1.03 and 0.99. The overall average index ratio was 1.00, the average total index ratio was 1.01 and the average total biomass ratio was 0.98.

Table 3.3.3 presents estimates of coefficients of variation (%) by length groups. A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength. In most years CVs for most length groups are above what could be considered as acceptable.

Table 3.3.1. Golden redfish (*Sebastes norvegicus*). Abundance indices (numbers in thousands) from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software.

Year	Length group (cm)												Total	Biomass (tons)
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	≥60		
1994	675	7493	10100	12840	10914	17834	10065	4799	1645	937	202	121	77623	31841
1995	387	4658	13515	13118	10398	15429	16223	10587	3112	852	455	148	88883	42151
1996	40	715	3291	5983	8863	14089	15709	7502	2692	893	168	165	60010	35775
1997 ¹	0	500	1197	2809	6522	22751	28797	8235	1747	1092	239	97	73985	44977
1998 ¹	51	4525	2043	10795	73085	30862	14707	6984	1712	456	142	0	145363	49253
1999	181	928	2070	4002	4351	6275	6143	5474	2618	738	75	0	32854	20330
2000	533	1122	1506	4196	4895	5146	3611	1908	620	466	89	0	24092	10946
2001	55	411	398	2452	5802	5463	4509	3239	1154	343	96	37	23960	13896
2002	133	1053	2043	1854	3955	4204	3335	3654	1656	619	192	28	22726	13242
2003	0	478	1303	1538	4192	4081	2765	3204	1996	548	123	327	20554	13399
2004	700	195	420	973	2842	4365	5404	3858	2281	562	140	45	21786	15758
2005	0	119	203	362	1110	2090	3849	4664	2730	1276	299	128	16831	16389
2006 ²	0	0	0	178	2495	5534	6307	4155	3179	950	124	12	22934	18790
2007 ¹	0	97	453	214	772	1526	2823	4275	2742	1194	197	58	14351	14553
2008	1736	2540	201	171	440	710	1969	2547	3049	1231	157	19	14768	12647
2009	0	0	86	0	39	436	1745	3779	4200	1959	267	101	12728	17237
2010	372	2017	1168	527	136	60	833	1062	2073	1596	205	128	10175	9787
2011	342	3187	2068	288	402	125	274	2329	3030	1912	131	243	14332	13302
2012 ³	805	4375	3995	1835	550	316	881	3645	4083	1775	320	85	22664	16011
2013	75	7418	4896	3952	1550	355	878	821	1284	1594	384	451	23658	11456
2014	128	1043	1440	3005	3363	1023	507	1427	2139	1176	633	193	16077	12087
2015	139	881	1467	3019	2603	2013	458	720	1237	1216	874	82	14710	10120
2016	748	1291	1484	2396	4290	3673	3391	1658	2147	2307	1114	250	24749	18189

¹ Indices raised to also represent the Russian EEZ

² Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

³ Indices not raised to also represent uncovered parts of the Russian EEZ.

Table 3.3.2. GOLDEN REDFISH. Ratio new/old swept area abundance indices and total biomass in the Barents Sea standard area winter 1994-2016.

Year	Length group (cm)									Total	Biomass
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	>45		
1994	0.96	1.15	1.09	1.10	0.95	0.92	1.11	1.09	1.04	1.03	0.97
1995	0.65	0.93	1.03	1.14	1.14	0.97	0.94	0.97	0.97	1.01	0.90
1996	1.00	1.02	0.94	0.93	0.94	1.20	0.95	0.95	1.00	1.00	0.94
1997	-	1.00	0.80	0.88	0.99	1.06	1.03	0.98	0.96	1.01	0.91
1998	0.26	0.75	0.82	1.03	1.48	1.22	1.12	1.01	1.00	1.25	0.96
1999	0.91	1.03	0.99	1.00	0.95	0.98	1.02	1.03	1.04	1.00	1.11
2000	1.07	1.02	1.00	1.00	1.04	1.03	1.03	1.06	0.98	1.02	1.05
2001	0.55	1.03	1.00	1.02	1.02	0.99	1.00	1.01	1.02	1.01	1.06
2002	1.33	1.05	1.02	1.03	1.04	1.03	1.01	1.02	1.00	1.02	0.98
2003	-	0.96	1.09	1.03	0.97	1.07	1.02	0.97	1.03	1.02	0.95
2004	1.00	0.98	1.05	0.97	0.98	0.99	0.98	0.96	0.95	0.98	0.95
2005	-	1.19	1.02	0.91	1.01	1.05	1.01	1.01	1.01	1.01	0.97
2006	-	-	-	0.89	1.00	1.02	1.03	1.01	1.02	1.02	1.02
2007	-	0.97	0.91	2.14	1.29	0.42	0.59	0.91	1.02	0.78	0.84
2008	0.96	0.98	1.01	0.86	1.10	1.01	1.04	1.02	1.01	1.00	1.02
2009	-	-	0.86	-	0.39	1.09	1.03	1.02	0.99	1.00	0.97
2010	0.93	1.01	0.97	0.88	1.36	0.60	1.04	0.97	1.03	0.99	1.01
2011	1.14	1.03	0.98	0.96	1.01	1.25	0.91	1.01	1.02	1.02	1.00
2012	1.01	0.99	1.00	0.97	0.92	1.05	0.98	1.01	1.01	1.00	0.99
2013	0.75	0.99	0.89	0.99	0.91	0.89	0.98	1.03	1.03	0.97	1.02
2014	1.28	0.95	0.96	1.00	0.99	1.02	1.01	1.02	1.01	1.00	1.03
2015	1.39	0.98	0.98	1.01	0.96	1.01	0.92	1.03	1.00	0.98	0.96
2016	0.94	0.99	0.99	1.00	1.02	1.02	1.00	0.98	0.99	1.00	0.89

Table 3.3.3. Golden redfish (*Sebastes norvegicus*). Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Length group (cm)										
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
1994	51	42	22	27	18	34	13	29	20	23	40
1995	47	39	38	31	16	33	31	33	21	22	34
1996	68	51	47	25	16	27	25	20	16	24	46
1997 ¹	-	40	30	28	20	64	71	37	14	19	34
1998 ¹	67	28	25	56	82	64	48	42	27	28	44
1999	62	38	37	35	33	25	33	59	57	29	70
2000	46	27	21	24	22	28	28	26	22	21	56
2001	53	28	31	24	31	27	38	50	29	26	45
2002	54	61	51	25	29	23	28	39	49	26	41
2003	-	29	34	34	27	23	16	20	27	36	70
2004	72	38	26	32	35	54	52	26	30	22	54
2005	-	73	46	32	20	25	31	22	23	34	65
2006 ²	-	-	-	46	46	45	37	30	22	18	43
2007 ¹	-	69	61	56	31	21	23	27	23	17	32
2008	33	30	41	60	42	27	22	23	17	24	64
2009	-	-	69	-	73	31	30	24	23	24	29
2010	54	31	45	51	41	70	31	34	17	19	31
2011	45	37	23	48	30	55	40	66	44	33	48
2012 ²	38	41	21	21	35	40	28	40	45	29	43
2013	55	40	27	17	22	45	38	39	38	27	44
2014	61	35	31	22	21	26	37	35	28	26	26
2015	64	44	33	29	26	24	30	36	27	18	37
2016	50	28	22	24	26	25	19	23	28	20	29

¹ REZ not covered

² REZ partly covered

3.4 Beaked redfish (*Sebastes mentella*)

Table 3.4.1 presents swept area abundance indices by length groups in 1994 to 2016, and Table 3.4.2 gives the ratio between new and old indices by length groups, total index and total biomass. The highest and lowest single index ratio was 1.86 and 0.67, both for length groups with low indices. For 1994 the new indices were considerable higher for most length groups. The highest and lowest average ratio over all length groups in one year was 1.33 and 0.89, and the highest and lowest average ratio for one length group over all years was 1.04 and 0.98. The overall average index ratio was 1.01, the average total index ratio was 1.02 and the average total biomass ratio was 1.03.

Table 3.4.3 presents estimates of coefficients of variation (%) by length groups. A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength. In most years CVs for length groups between 10 and 29 cm are at a level that could be considered as acceptable.

Table 3.4.1. Beaked redfish (*Sebastes mentella*)¹. Abundance indices (numbers in millions) from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software.

Year	Length group (cm)									Total	Biomass ('000 t)
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	>45		
1994	8.3	295.7	479.4	488.4	74.4	74.4	17.1	2.6	0.1	1440.4	161.2
1995	310.1	83.9	570.6	390.5	82.7	57.7	23.9	2.8	0.4	1522.5	153.0
1996	214.6	101.5	198.5	342.9	136.0	42.0	16.6	1.4	0.2	1053.8	127.9
1997 ²	64.6	118.45	22.0	242.4	258.2	70.2	39.1	4.4	0.1	819.4	165.3
1998 ²	1.0	88.0	62.4	101.4	203.2	40.0	12.9	1.7	0.2	510.7	96.1
1999	2.1	6.8	69.5	36.8	171.2	73.9	21.8	3.2	0.7	385.4	98.8
2000	9.2	12.9	40.2	78.0	142.2	94.8	24.5	7.0	1.5	410.3	111.5
2001	9.8	23.1	7.2	56.8	78.8	74.7	9.6	0.6	0.1	260.8	65.3
2002	16.5	7.5	19.3	36.5	96.2	116.7	23.9	1.4	0.03	318.1	90.2
2003	3.8	4.1	10.3	12.6	70.4	198.1	45.9	5.7	0.3	351.1	139.4
2004	2.2	3.0	6.9	18.5	32.8	86.3	31.6	1.9	0.8	183.4	68.4
2005	0	6.3	7.4	10.7	28.4	153.7	86.2	3.8	0.2	296.6	131.3
2006 ³	100.0	1.9	9.6	14.6	22.8	103.8	82.8	2.7	0.7	338.8	108.2
2007 ²	374.2	121.8	2.8	6.7	12.3	121.0	120.7	7.1	0	766.7	136.6
2008	858.2	359.1	26.8	4.6	11.5	103.6	165.4	4.7	0.1	1533.9	169.3
2009	95.3	324.7	135.5	5.4	8.8	67.1	162.6	5.8	0.4	805.7	155.1
2010	652.2	276.0	214.7	64.2	7.1	73.6	191.3	5.9	0.4	1485.4	198.1
2011	501.6	229.7	212.5	149.0	14.1	46.6	157.3	4.9	0.2	1315.8	177.8
2012 ⁴	129.4	280.1	86.4	125.3	47.3	14.4	153.9	17.7	0.2	854.7	170.7
2013	249.6	226.6	245.4	159.2	143.2	35.2	193.3	27.1	0.3	1279.8	242.2
2014	90.7	175.3	250.1	113.7	124.6	50.6	115.1	13.8	0.2	934.1	170.2
2015	175.2	110.7	216.2	302.2	289.8	214.8	170.9	18.1	0.2	1498.0	344.6
2016	615.1	105.3	148.6	331.5	213.1	162.7	123.6	14.1	0.6	1714.6	262.5

¹ Includes unidentified *Sebastes* specimens, mostly less than 10cm

² Indices raised to also represent the Russian EEZ

³ Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

⁴ Indices not raised to represent uncovered parts of the Russian EEZ

Table 3.4.2. BEAKED REDFISH. Ratio new/old swept area abundance indices and total biomass in the Barents Sea standard area winter 1994-2016.

Year	Length group (cm)									Total	Biomass
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	>45		
1994	1.20	1.14	1.66	1.72	1.45	1.07	0.86	1.86	1.00	1.47	1.38
1995	1.18	1.18	0.89	0.77	0.91	0.84	0.76	0.72	0.80	0.91	0.83
1996	1.01	1.01	1.04	1.02	1.01	1.00	1.00	1.00	0.67	1.02	1.04
1997	1.02	0.98	0.89	0.87	0.95	0.99	0.98	0.85	1.00	0.94	0.99
1998	0.77	1.00	1.00	1.00	1.00	0.99	1.00	1.55	1.00	1.00	1.01
1999	0.95	1.00	1.02	1.00	1.02	1.04	1.04	1.03	1.00	1.03	1.02
2000	1.02	1.02	1.02	1.02	1.00	0.98	0.92	1.01	1.00	1.00	0.98
2001	1.05	1.03	1.03	1.03	1.02	1.02	1.02	1.00	1.00	1.03	1.03
2002	1.02	1.04	1.01	0.88	0.93	1.03	1.04	1.00	1.00	0.98	0.99
2003	0.97	1.05	1.03	1.02	0.99	0.99	0.98	0.95	1.00	0.99	1.02
2004	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.95	1.00	1.00	0.98
2005	-	1.02	1.01	1.00	1.00	1.00	1.00	0.97	1.00	1.00	1.01
2006	1.01	1.00	0.98	1.00	1.00	1.01	1.01	1.00	1.00	1.01	1.05
2007	1.01	1.05	1.12	1.03	1.03	1.03	1.02	1.09	-	1.02	1.00
2008	1.01	1.01	1.02	0.87	0.97	0.91	0.92	0.96	1.00	0.99	1.05
2009	1.01	1.01	1.01	1.00	1.01	1.02	1.02	1.02	1.00	1.01	1.04
2010	1.01	1.01	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.01	1.03
2011	1.01	1.01	1.01	1.01	1.01	1.00	1.01	1.00	1.00	1.01	1.05
2012	1.02	1.02	1.02	1.02	1.03	1.02	1.02	1.02	1.00	1.02	1.07
2013	1.01	1.01	1.01	1.01	1.00	1.00	1.01	1.00	1.00	1.01	1.01
2014	1.02	1.01	1.00	1.01	1.01	0.99	0.98	1.00	1.00	1.01	1.03
2015	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.02
2016	1.00	1.01	1.02	1.02	1.02	1.02	1.03	1.02	1.00	1.01	1.01

Table 3.4.3. Beaked redfish (*Sebastes mentella*)¹. Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Length group (cm)								
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1994	40	14	25	28	20	23	26	49	53
1995	18	25	23	25	17	20	18	34	39
1996	18	23	27	22	19	36	23	37	58
1997 ²	18	15	13	11	14	17	26	53	53
1998 ²	28	16	21	14	17	16	21	31	77
1999	20	17	15	11	18	22	29	56	65
2000	16	12	17	12	16	21	31	64	76
2001	17	14	14	12	13	19	17	26	67
2002	57	13	15	18	16	21	19	31	65
2003	56	17	18	17	18	27	27	43	88
2004	19	15	15	19	16	14	18	21	59
2005	-	23	15	16	16	17	21	38	40
2006 ³	11	49	25	28	18	17	16	24	85
2007 ²	15	23	18	13	15	24	19	41	59
2008	14	15	29	23	20	23	22	24	45
2009	13	10	18	22	40	28	22	24	46
2010	14	12	12	18	22	31	31	22	80
2011	10	12	10	15	16	32	25	27	56
2012 ³	16	12	13	11	21	32	37	54	44
2013	15	15	35	23	32	29	39	41	49
2014	10	12	11	15	21	22	30	27	48
2015	14	11	14	18	26	22	19	29	52
2016	10	11	13	20	16	16	18	18	58

¹ Includes unidentified *Sebastes* specimens, mostly less than 10cm

² REZ not covered

³ REZ partly covered

3.5 Norway redfish (*Sebastes viviparus*)

Table 3.5.1 presents swept area abundance indices by length groups in 1994 to 2016, and Table 3.5.2 gives the ratio between new and old indices by length groups and total index. No biomass estimates are available from StoX since individual weights are not measured. The highest and lowest single index ratio was 1.68 and 0.74, both in the largest length group with low indices. For 1994 and 1995 the new indices were considerable higher for most length groups. The highest and lowest average ratio over all length groups in one year was 1.43 and 0.94, and the highest and lowest average ratio for one length group over all years was 1.05 and 1.02. The overall average index ratio was 1.03 and the average total index ratio was 1.04.

Table 3.5.3 presents estimates of coefficients of variation (%) by length groups. A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength. In most years CVs for most length groups are far above what could be considered as acceptable.

Table 3.5.1. Norway redfish (*Sebastes viviparus*). Abundance indices (numbers in thousands) from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software.

Year	Length group (cm)						Total
	5-9	10-14	15-19	20-24	25-29	>30	
1994	75355	94809	17218	12818	1377	279	201857
1995	10716	68713	22737	9349	3306	503	115325
1996	439	45798	43673	35921	5498	87	131417
1997 ¹	898	24202	28857	18768	4397	0	77122
1998 ¹	703	9835	42183	20801	2939	91	76102
1999	1577	10134	11675	2921	707	35	27049
2000	1011	5127	37429	22122	2118	140	67947
2001	249	2243	30082	34405	3802	120	70901
2002	332	3345	17674	15168	1276	88	37884
2003	234	4306	22603	31019	4277	181	62619
2004	102	1794	24462	32769	3294	291	62712
2005	172	1582	16444	37360	6153	356	62068
2006 ²	819	4480	3653	10381	2244	205	21782
2007 ¹	704	5238	15652	34395	2448	80	58517
2008	0	1882	5910	21022	4561	30	33344
2009	506	528	3096	11032	3405	419	18988
2010	1712	455	10134	53181	7572	22	73076
2011	533	1250	2169	7758	2197	106	14013
2012 ¹	586	3950	4080	29157	6212	74	44059
2013	1211	9522	3302	23464	8545	100	46144
2014	11388	17755	21079	64094	15135	1990	131441
2015	7384	27351	30768	65870	9048	88	140509
2016	2795	26824	18396	29229	11286	933	89464

¹ Indices not raised for uncovered parts of the Russian EEZ, *Sebastes viviparus* is mainly found in NEZ

² Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

Table 3.5.2. NORWAY REDFISH. Ratio new/old swept area abundance indices in the Barents Sea standard area winter 1994-2016.

Year	Length group						Total
	5-9	10-14	15-19	20-24	25-29	>30	
1994	1.57	1.48	1.15	1.04	1.15	1.40	1.43
1995	1.41	1.29	1.04	1.18	1.38	1.68	1.24
1996	0.88	1.02	1.03	1.01	1.00	0.87	1.02
1997	1.00	1.02	1.01	1.01	1.02	-	1.01
1998	1.00	1.06	1.01	1.01	1.01	0.91	1.01
1999	0.99	1.01	1.02	1.01	1.01	-	1.00
2000	1.12	1.07	1.03	1.02	1.01	1.40	1.03
2001	0.83	1.02	1.02	1.02	1.03	1.20	1.01
2002	1.11	1.08	1.04	1.05	1.06	0.88	1.05
2003	1.17	1.08	1.06	1.03	1.02	0.91	1.04
2004	1.02	1.00	1.00	1.00	1.00	0.97	1.00
2005	0.86	0.99	1.02	1.01	1.01	0.89	1.02
2006	1.02	1.02	1.01	1.02	1.02	1.03	1.04
2007	1.01	1.01	1.00	0.94	0.72	0.80	0.94
2008	-	1.05	1.02	1.01	1.01	-	1.01
2009	1.01	1.06	1.00	1.01	1.00	1.05	1.00
2010	1.01	0.91	1.01	1.01	1.01	-	1.01
2011	1.07	1.04	1.03	1.03	1.05	1.06	1.00
2012	0.98	1.01	1.02	1.01	1.00	0.74	1.00
2013	1.01	1.01	1.00	1.01	1.01	1.00	1.00
2014	1.16	1.06	1.04	1.05	1.04	1.00	1.05
2015	0.98	0.99	0.99	0.98	0.99	0.88	0.98
2016	1.00	0.98	1.01	0.99	1.00	0.93	0.99

Table 3.5.3. Norway redfish (*Sebastes viviparous*). Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Length group (cm)					
	5-9	10-14	15-19	20-24	25-29	30-34
1994	34	52	25	39	41	70
1995	42	31	43	34	70	89
1996	62	24	31	36	51	57
1997 ¹	84	31	27	48	56	-
1998 ¹	39	20	43	68	71	79
1999	78	58	32	25	37	65
2000	52	29	47	48	41	51
2001	39	26	31	30	34	85
2002	61	34	20	23	46	83
2003	73	34	35	30	31	76
2004	57	36	38	35	24	66
2005	69	35	40	31	34	69
2006 ²	75	75	25	30	21	58
2007 ¹	75	78	39	39	29	87
2008	-	58	32	28	42	73
2009	61	48	25	24	27	61
2010	47	42	47	52	57	97
2011	51	59	50	48	45	75
2012 ²	45	30	48	45	43	100
2013	58	32	25	41	51	98
2014	43	36	40	40	41	79
2015	38	32	34	43	53	100
2016	37	28	29	28	23	46

¹ REZ not covered

² REZ partly covered

3.6 Greenland halibut

Table 3.6.1 presents swept area abundance indices by length groups in 1994 to 2016, and Table 3.6.2 gives the ratio between new and old indices by length groups and total index. Indices for fish < 10 cm has been excluded in the comparisons. The highest and lowest single index ratio was 1.58 and 0.32, both for length groups with low indices. For 1994 the new indices were somewhat higher for most length groups, while they were lower for 1995. The highest and lowest average ratio over all length groups in one year was 1.10 and 0.93, and the highest and lowest average ratio for one length group over all years was 1.07 and 0.98. The overall average index ratio was 1.02, the average total index ratio was 1.03 and the average total biomass ratio was 1.01.

Table 3.6.3 presents estimates of coefficients of variation (%) for length groups. Estimates are based on a stratified bootstrap approach with 500 replicates (with trawl stations being primary sampling unit). A CV of 20 % or less could be viewed as acceptable in a traditional stock assessment approach if the indices are unbiased (conditional on a catchability model). Values above this indicate a highly uncertain index with little information regarding year class strength. In most years only CVs for length groups between 40 and 59 cm are at a level that could be considered as acceptable.

Table 3.6.1. GREENLAND HALIBUT. Abundance indices (numbers in thousands) from bottom trawl surveys in the Barents Sea standard area winter 1994–2016 estimated by StoX software.

Year	Length group (cm)																Biomass (tons)
	≤14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	≥ 80	Total	
1994	0	0	21	76	148	1117	3139	4740	3615	1941	889	541	21	0	0	16248	
1995	298	0	0	0	90	129	2877	7182	5739	2027	1622	839	489	86	0	21378	
1996	4121	0	0	0	62	124	1214	4086	4634	1871	1112	638	337	74	12	18285	
1997 ¹	0	68	0	0	55	163	949	4313	5629	2912	1609	643	300	65	21	16728	
1998 ¹	68	220	945	578	481	487	1088	4016	6591	3076	1798	707	326	93	44	20518	
1999	43	84	241	436	566	269	784	1701	3097	1669	1094	491	89	75	0	10640	
2000	140	184	344	836	1722	3857	2253	1560	2144	1714	1191	615	249	76	0	16883	
2001	68	49	147	179	737	1525	3716	3271	2302	2010	1088	529	160	50	39	15871	
2002	271	0	70	34	382	1015	1916	3803	3250	2279	1138	976	242	159	114	15648	
2003	51	0	74	19	304	715	1842	3008	4765	2235	714	561	245	146	0	14678	
2004	106	104	15	0	319	1253	1229	1717	2277	1227	798	298	148	94	26	9615	
2005	263	70	159	1139	2235	2621	4206	3782	3847	2037	917	585	336	118	0	22314	
2006 ²	0	72	94	414	1968	5149	4613	5743	4283	2132	891	449	258	34	18	26118	
2007 ¹	0	18	146	1869	1418	3114	5710	5947	4287	2205	963	658	391	80	89	26896	
2008	0	0	0	243	1708	5974	4654	6136	5198	3403	827	638	174	82	50	29088	
2009	55	0	0	26	1044	4327	8133	4551	4084	2266	996	627	442	253	154	26960	
2010	0	0	0	99	678	3648	5729	6560	4897	2467	1064	552	229	128	41	26092	
2011	51	0	0	0	216	4396	5864	5498	5237	3698	699	936	327	252	97	27271	
2012 ³	77	0	0	0	51	1145	4524	5366	4517	2774	1147	195	73	0	48	19917	
2013	0	0	0	0	0	511	5368	4868	5374	3687	1944	939	348	313	154	23504	
2014	0	0	46	92	156	368	2271	5587	5903	3555	2251	1369	154	260	79	22090	
2015	367	0	61	0	284	1612	3187	6452	7249	6752	3350	1936	587	334	0	32172	
2016	205	0	124	511	950	1953	3486	4539	5479	5613	1999	1973	646	98	80	27657	

¹ Indices raised to also represent the Russian EEZ

² Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

³ Indices not raised to also represent uncovered parts of the Russian EEZ.

Table 3.6.2. GREENLAND HALIBUT Ratio new/old swept area abundance indices and total biomass in the Barents Sea standard area winter 1994-2016.

Year	Length group (cm)																Total	Biomass
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	≥ 80			
1994	-	-	1.31	0.77	1.04	0.94	1.20	1.23	1.25	1.08	1.18	1.23	0.84	-	-	1.17	1.18	
1995	1.00	-	-	-	1.08	0.87	0.89	0.78	0.77	0.72	0.69	0.92	1.04	1.51	-	0.80	0.73	
1996	1.31	-	-	-	1.02	1.00	1.04	1.03	1.05	1.03	1.07	1.08	0.97	1.01	1.00	1.09	1.04	
1997	-	1.05	-	-	0.32	0.72	1.11	0.99	1.02	1.07	1.04	1.02	1.06	0.98	0.95	1.02	1.02	
1998	0.85	1.01	0.94	1.30	0.90	1.21	1.02	1.03	1.04	1.03	1.04	1.12	0.97	1.22	1.02	1.04	1.05	
1999	1.05	1.02	0.92	1.02	0.98	1.02	1.04	1.00	1.01	1.02	1.02	1.02	0.82	1.01	-	1.00	1.00	
2000	1.15	1.00	1.07	0.97	0.98	1.00	1.03	0.98	1.00	1.00	1.02	1.09	1.03	1.01	-	1.01	1.01	
2001	1.00	1.00	1.14	1.01	1.11	1.04	1.01	1.00	1.02	1.01	1.01	1.01	0.78	1.04	0.98	1.02	1.01	
2002	1.01	-	0.99	1.03	0.94	1.02	0.99	1.03	1.02	1.03	1.03	1.00	1.05	1.01	1.19	1.02	1.01	
2003	1.02	-	1.04	1.12	1.03	1.06	1.03	1.03	1.03	1.02	1.01	0.92	1.06	1.17	-	1.02	1.01	
2004	1.58	1.01	1.00	-	1.01	1.01	1.00	1.00	1.00	1.00	1.01	1.00	1.01	0.99	1.00	1.01	1.01	
2005	1.02	1.01	1.01	1.01	1.02	0.97	1.01	1.03	1.01	1.02	0.98	1.00	1.02	1.02	-	1.01	1.02	
2006	-	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.02	1.02	1.00	1.00	1.01	0.99	
2007	-	1.00	1.05	1.09	1.06	1.08	1.19	1.22	1.09	1.13	1.42	1.20	1.11	1.03	1.00	1.15	1.17	
2008	-	-	-	1.01	1.01	0.91	0.98	1.02	1.01	1.01	1.02	1.00	1.01	1.04	1.04	0.98	1.01	
2009	1.00	-	-	1.04	1.01	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.03	1.02	1.03	1.02	1.01	
2010	-	-	-	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.01	1.02	0.98	1.01	0.89	
2011	1.02	-	-	-	1.01	1.01	1.01	1.01	1.01	1.01	1.02	1.01	1.01	1.00	1.04	1.01	0.99	
2012	1.00	-	-	-	1.00	1.02	1.02	1.02	1.03	1.01	1.02	1.01	0.99	-	1.04	1.02	1.02	
2013	-	-	-	-	-	1.02	1.57	1.03	1.04	1.03	1.01	1.02	1.01	1.02	1.01	1.11	1.05	
2014	-	-	1.02	1.01	1.03	1.00	1.04	1.03	1.03	1.02	1.00	1.03	1.12	1.07	1.00	1.03	1.01	
2015	1.06	-	0.95	-	1.02	1.00	1.00	0.99	0.98	0.99	1.04	0.99	1.01	0.98	-	0.99	1.02	
2016	1.02	-	1.10	1.06	1.03	1.02	1.03	1.03	1.04	1.07	1.06	1.06	1.02	1.01	1.03	1.05	1.03	

Table 3.6.3. GREENLAND HALIBUT. Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Length group (cm)														
	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84
1994	0	0	105	57	46	28	17	20	17	15	20	26	97	-	-
1995	91	-	-	-	71	40	18	22	25	24	27	41	63	94	-
1996	33	-	-	-	69	45	22	25	18	19	36	29	40	58	-
1997 ¹	-	53	-	-	82	48	26	23	18	16	16	24	28	73	101
1998 ¹	66	53	26	44	42	18	22	23	28	26	28	31	33	50	101
1999	91	54	53	26	32	31	24	21	18	16	18	25	52	51	-
2000	71	66	72	83	56	58	41	20	22	23	21	36	45	54	-
2001	92	99	85	47	40	48	44	46	37	14	17	34	43	56	-
2002	71	-	70	104	29	27	17	13	16	16	14	27	24	37	55
2003	66	-	63	95	30	27	20	44	34	32	44	28	38	37	-
2004	78	59	97	-	26	17	16	16	17	17	15	29	39	46	92
2005	66	70	37	46	33	15	19	17	16	20	25	24	28	64	-
2006 ²	-	81	81	67	32	18	18	11	11	16	22	22	30	67	-
2007 ¹	-	99	52	23	20	13	12	12	14	14	24	37	26	44	99
2008	-	-	-	36	20	21	15	14	18	14	22	20	43	56	68
2009	98	-	-	103	23	14	16	16	19	18	17	21	26	46	53
2010	-	-	-	57	26	18	13	12	14	18	19	23	45	57	101
2011	66	-	-	-	43	18	15	14	17	14	25	26	33	46	70
2012 ²	93	-	-	-	100	23	13	14	14	11	24	70	72	-	-
2013	-	-	-	-	-	44	39	12	16	20	19	33	50	50	-
2014	-	-	99	68	68	37	20	14	20	18	18	24	53	51	72
2015	83	-	99	-	49	24	22	15	13	18	34	37	33	46	-
2016	-	-	101	50	43	31	21	34	26	31	16	20	36	70	98

¹ REZ not covered

² REZ partly covered

3.7 Blue whiting

Table 3.7.1 presents swept area abundance indices by length groups in 1994 to 2016, and Table 3.7.2 gives the ratio between new and old indices by length groups, total index and total biomass index for the years with Survey program estimates, i.e. 2001 to 2016. Swept area indices have not been estimated by the Survey Program prior to year 2001. In early years biomass estimates are not available from StoX since individual weights were not measured. Indices for fish < 10 cm has been excluded in the comparisons. The highest and lowest single index ratio was 2.00 and 0.30, both for length groups with low indices. The highest and lowest average ratio over all length groups in one year was 1.38 and 0.88, and the highest and lowest average ratio for one length group over all years was also 1.06 and 1.01. The overall average index ratio was 1.04, the average total index ratio was 1.03 and the average total biomass ratio was 1.03.

Table 3.7.3 presents estimates of coefficients of variation (%) by length groups. In most years CVs for most length groups are above what could be considered as acceptable.

Table 3.7.1. BLUE WHITING. Abundance indices (numbers in millions) from bottom trawl surveys in the Barents Sea standard area winter 1994-2016 estimated by StoX software.

Year	Length group (cm)								Total	Biomass (‘000 t)
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	≥40		
1994	0	0	1.2	13.6	25.7	10.9	1.1	0.1	52.6	NA
1995	0	0.5	0.8	2.4	10.3	10.8	3.9	0.2	29.0	NA
1996	0	80.0	1371.8	8.4	18.6	7.1	3.8	0.1	1489.9	38.2
1997 ¹	0	608.7	681.5	273.8	3.1	5.3	1.8	0.1	1574.3	NA
1998 ¹	0	1.2	34.5	42.2	3.6	1.5	1.4	0.1	84.5	NA
1999	0	0.02	11.0	40.0	16.1	5.0	1.7	0.1	74.0	NA
2000	0	12.3	557.5	44.1	25.7	4.4	0.7	0.1	644.9	NA
2001	0.04	311.6	1420.8	631.5	46.0	5.4	1.6	0.1	2417.0	NA
2002	0	0.9	428.9	636.3	77.6	17.5	3.2	0.1	1164.4	56.6
2003	0	3.9	220.5	493.4	73.4	28.0	4.0	0.3	823.4	48.1
2004	0	7.1	712.0	821.6	276.2	37.8	1.1	0.2	1856.0	95.8
2005	0	125.1	717.2	984.7	223.3	31.8	0.1	0.1	2082.4	105.0
2006 ²	0	0	164.4	1500.5	598.0	69.0	2.0	0.1	2333.9	172.9
2007 ¹	0	0	4.0	628.0	299.3	23.5	1.6	0.4	956.8	79.8
2008	0	0	0.3	12.1	126.1	19.8	1.3	0.1	159.7	20.6
2009	0	0	0.02	2.7	50.6	21.2	1.5	0.02	76.1	11.4
2010	0	0	0.5	1.6	9.4	16.9	1.0	0	29.4	5.2
2011	0	0	0.1	0.3	2.8	5.1	2.5	0	10.6	2.2
2012 ¹	0	85.6	674.6	1.1	1.8	5.3	2.0	0.3	770.7	18.2
2013	0	0	75.3	395.9	12.6	11.5	6.8	0.1	502.2	28.6
2014	0	0	182.1	34.2	9.7	1.6	1.5	0.04	229.2	8.5
2015	0	115.6	907.4	141.2	40.8	8.8	7.4	0	1221.3	34.2
2016	0	0.1	260.0	367.6	38.0	6.3	3.0	0.1	674.9	39.1

¹ Indices not raised for uncovered parts of the Russian EEZ, blue whiting is mainly found in areas A, B, C and S

² Not complete coverage in southeast due to restrictions, strata 7 area set to default and strata 13 as in 2005

Table 3.7.2. BLUE WHITING Ratio new/old swept area abundance indices and total biomass in the Barents Sea standard area winter 2001-2016.

Year	Length group (cm)						Total	Biomass	
	10-14	15-19	20-24	25-29	30-34	35-39			≥40
2001	1.02	1.02	1.03	1.03	1.02	1.07	1.00	1.02	-
2002	1.13	0.99	0.97	0.96	0.96	1.03	1.00	0.97	0.97
2003	1.22	1.15	1.01	0.90	0.94	0.63	0.30	1.03	0.90
2004	0.99	0.99	0.99	1.00	1.01	1.00	1.00	0.99	0.99
2005	1.00	1.00	1.00	1.00	1.01	1.00	0.50	1.00	0.99
2006	-	1.01	1.01	1.01	1.01	1.00	1.00	1.01	1.01
2007	-	1.00	1.06	1.08	1.09	1.07	1.33	1.07	1.09
2008	-	1.00	1.01	1.00	1.01	1.00	1.00	1.00	1.07
2009	-	1.00	1.00	1.01	1.01	1.07	1.00	1.01	1.12
2010	-	0.70	0.84	1.00	1.12	1.25	-	1.05	1.22
2011	-	2.00	1.50	1.12	1.09	1.19	-	1.18	1.23
2012	1.02	1.02	1.00	1.20	1.15	1.05	1.00	1.02	0.97
2013	-	1.01	1.01	1.01	1.01	1.00	2.00	1.01	1.01
2014	-	1.02	1.01	1.01	1.00	1.00	1.00	1.02	1.01
2015	0.99	1.02	1.01	0.99	1.00	1.00	-	1.01	0.82
2016	1.00	1.03	1.02	1.01	1.00	1.00	1.00	1.02	1.09

Table 3.7.3. BLUE WHITING. Estimates of coefficients of variation (%) for swept area abundance indices. Barents Sea standard area winter 1994-2016.

Year	Length group (cm)							
	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44
1994	-	-	94	68	51	28	31	49
1995	-	59	55	51	66	32	28	48
1996	-	49	79	56	49	30	33	59
1997 ¹	-	30	29	33	36	29	37	70
1998 ¹	-	91	60	33	35	33	28	70
1999	-	98	26	27	28	31	43	71
2000	-	37	21	20	25	29	31	95
2001	69	21	18	25	26	35	39	90
2002	-	56	25	17	20	33	52	69
2003	-	87	47	23	17	27	58	83
2004	-	86	23	19	15	14	30	61
2005	-	28	25	16	24	24	71	90
2006	-	-	17	12	13	26	46	61
2007 ¹	-	-	50	16	12	17	42	84
2008	-	-	51	59	27	22	47	82
2009	-	-	97	60	21	20	61	95
2010	-	-	91	80	29	25	33	-
2011	-	-	100	88	45	48	62	-
2012 ²	-	32	30	39	45	38	29	98
2013	-	-	70	31	57	44	44	99
2014	-	-	23	23	24	27	18	137
2015	-	50	21	21	31	31	37	-
2016	-	96	33	24	17	27	29	97

¹ REZ not covered

² REZ partly covered

4 Conclusions

For all species and in most years the StoX swept area estimates are quite similar to those obtained by the Survey Program. The largest deviations were found for age or length groups with low indices and/or in years with raising of the indices. Also estimates of length and weight at age for cod and haddock are comparable to those from the Survey Program.

For beaked redfish, Norway redfish and Greenland halibut the StoX indices for 1994 and 1995 were more different than the Survey Program indices compared to other years and other species in the same years. However, when the Survey Program was rerun for these years and species, the estimates were almost similar to the StoX indices. One explanation may be that when the original Survey Program estimates were made in 1994 and 1995, another strata system was applied. The one presently used was established in 1996. The input data may also have been changed/corrected since 1994 and 1995.

It is recommended that the present time series obtained by StoX become the “official” time series that are used for stock assessment and other purposes. The CV estimates show that some indices should be used with care for assessment purposes, i.e. for older age groups of cod and haddock, small and large beaked redfish and Greenland halibut, and all length groups of the other species. It is further recommended that StoX is used to estimate swept area indices with CVs and population parameters from future demersal fish winter surveys in the Barents Sea.

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