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**Results from Bottom Trawl Survey on Flemish Cap of June-July 2016**

by

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**Abstract**

A stratified random bottom trawl survey on Flemish Cap was carried out from June 22<sup>th</sup> to July 23<sup>th</sup> 2016. The area surveyed was extended up to depths of 800 fathoms (1460 meters) following the same procedures as in previous years and 181 fishing stations planned. The survey was carried out by the R/V *Vizconde de Eza* with the usual survey gear (*Lofoten*). A total of 181 valid hauls were made by the vessel R/V *Vizconde de Eza*, 120 up to 730 meters depth and 61 up to 1460 meters. Survey results including abundance indices of the main commercial species and age distributions for cod, redfish, American plaice, Greenland halibut, roughhead grenadier and shrimp are presented. The general indexes for this year are estimated taken into account the traditional swept area (strata 1-19, up to depths of 730 m.) and the total area surveyed (strata 1-34, up to depths of 1460 m.).

**Introduction**

The survey on Flemish Cap was carried out on board R/V *Vizconde de Eza* in 2016. A total of 181 valid bottom trawls were made up to a depth of 1460 m (800 fathoms) (Fig. 1). The survey covered all strata of the bank adequately with the exception of the strata corresponding with the Beothuk knoll (35-39 strata) in the Southwest of the bank and the strata 26 and 27 in the Southeast. In this Figure we can observe the closed areas for Vulnerable Marine Ecosystems. A synoptic sheet of the survey with vessel and gear characteristics is shown in Table 1. This was the 29<sup>th</sup> survey of the series initiated by the EU in 1988. All surveys had a stratified random design following NAFO specifications (Doubleday, 1981). Dates, vessel, number of valid tows (including the number of valid tows until 700 m in brackets since 2002) and dates of all the surveys were:



Year	Vessel	Valid tows	Dates	Year	Vessel	Valid tows	Dates
1988	Cornide de Saavedra	115	08/07 – 22/07	2003	Vizconde de Eza	177 (114)	02/06 – 02/07
1989	Cryos	116	12/07 – 01/08		Cornide de Saavedra	50**	07/06 – 17/06
1990	Ignat Pavlyuchenkov	113	18/07 – 06/08	2004	Vizconde de Eza	177 (124)	25/06 – 02/08
1991	Cornide de Saavedra	117	24/06 – 11/07		Cornide de Saavedra	61**	23/07 – 02/08
1992	Cornide de Saavedra	117	29/06 – 18/07	2005	Vizconde de Eza	176 (117)	01/07 – 21/08
1993	Cornide de Saavedra	101	23/06 – 08/07	2006	Vizconde de Eza	179 (115)	01/07 – 26/07
1994	Cornide de Saavedra	116	06/07 – 23/07	2007	Vizconde de Eza	174 (117)	23/06 – 19/07
1995	Cornide de Saavedra	121	02/07 – 19/07	2008	Vizconde de Eza	179 (111)	23/06 – 19/07
1996	Cornide de Saavedra	117	28/06 – 14/07	2009	Vizconde de Eza	178 (119)	23/06 – 20/07
1997	Cornide de Saavedra	117	16/07 – 01/08	2010	Vizconde de Eza	153 (97)	22/06 – 21/07
1998	Cornide de Saavedra	119	17/07 – 02/08	2011	Vizconde de Eza	128 (79)	29/06 – 9/08
1999	Cornide de Saavedra	117	02/07 – 20/07	2012	Vizconde de Eza	174(118)	26/06 – 24/07
2000	Cornide de Saavedra	120	10/07 – 28/07	2013	Vizconde de Eza	181(120)	26/06 – 23/07
2001	Cornide de Saavedra	120	03/07 – 20/07	2014	Vizconde de Eza	181(120)	25/06 – 23/07
2002	Cornide de Saavedra	120	30/06 – 17/07	2015	Vizconde de Eza	181(120)	23/06 – 22/07
				2016	Vizconde de Eza	181(120)	23/06 – 22/07

( ) valid tows carried out in depths lesser than 400 fathoms

\*\* calibration tows

### Material and Methods

As the last year, the R/V *Vizconde de Eza* carried out the survey following the same procedures as in previous years, the same bottom trawl net *Lofoten*, with a cod-end mesh size of 35 mm, as well as all other details of its use (Vazquez et al, 2014).

## Results

Biomass of main species in past surveys estimated by swept area method (tons) are:

	Survey	Cod	American plaice	Redfish	Greenland halibut	Roughhead grenadier	Shrimp
120-730 m	1988	40839	16046	188331	6926	2009	5615
	1989	114050	14047	162535	4472	871	2252
	1990	59362	11983	126757	5799	852	3405
	1991	40248	10087	76955	8169	1335	11352
	1992	26719	8656	130209	8728	1577	24508
	1993	60963	7861	72608	6529	3021	11673
	1994	26463	8227	162525	8037	1975	3879
	1995	9695	6785	87644	10875	1558	7276
	1996	9013	4098	119662	11594	1362	10461
	1997	9966	3026	165816	16098	1197	7449
	1998	4986	3437	70832	24229	1691	39367
	1999	2854	2585	98651	21207	1250	24692
	2000	3062	1606	177990	16959	1047	19003
	2001	2695	2404	77345	13872	2079	27204
	2002	2496	2049	121312	12100	1211	36510
	2003	1593	2286	93816	6214	2348	21087
	2004	4071	3525	250605	12292	3597	20182
	2005	5242	2760	451215	11698	2387	30675
	2006	12505	1691	766922	11708	3933	16235
2007	23886	1053	464628	13040	1367	17046	
2008	43675	1766	566126	11997	2961	11092	
2009	75228	1442	358479	7777	782	2797	
2010	69295	2446	212211	6657	1402	4894	
2011	106151	4084	197031	6765	888	1621	
2012	113227	4491	305946	4291	612	1041	
2013	72289	3698	219737	2799	807	844	
2014	159939	3800	179925	5168	399	900	
2015	114807	3821	158001	6577	478	1551	
2016	80583	4325	171199	6139	373	2478	
120-1460 m	2004	4071	3525	250638	28676	17184	20195
	2005	5242	2760	453086	20460	14253	31186
	2006	12505	1691	766952	23475	12109	15250
	2007	23886	1053	464660	30731	7807	17120
	2008	43675	1766	566647	39614	12139	11141
	2009	75228	1442	358521	36047	7304	2792
	2010	69295	2446	212282	27096	9091	4896
	2011	106151	4084	196574	32309	8997	1733
	2012	113227	4491	305974	23505	5476	1063
	2013	72289	3698	219767	23391	4298	855
	2014	159939	3800	179956	29288	4111	901
	2015	114807	3821	158055	58180	3702	1551
2016	80583	4325	171219	34642	3836	2479	

Values for surveys before 2003, when R/V *Cornide de Saavedra* was used, are transformed to their equivalences for R/V *Vizconde de Eza* following the accepted calibration among the two vessels (González Troncoso and Casas, 2005). From 2004 onwards, abundances are calculated for 19

shallowest strata covering the bank up to 730 m deep, as it was done in previous years, and for 32 strata up to 1460 m deep.

These survey indices are also presented in Table 2, and even they belong to different species and pelagic vs. demersal character and the transformation to the new scale (since 2003 the R/V *Cornide de Saavedra* was substituted by the R/V *Vizconde de Eza*) only was carried out for the main species, a global index is presented for each year, which minimum occurred in 2001. The composition of the species in 2016 is similar to that found in the beginning of the series: cod at high levels, shrimp residual, redfish fluctuating around 150-300 kt. and grenadiers and Greenland halibut (<730m) at low levels. Greenland halibut biomass index (<1400m) decreased in 2016 but remains at high level. Everything seems to point to a return to the situation found at the beginning of the EU survey series, and prior to the changes induced by the collapse of cod in the late 90. Only American plaice with low values of biomass does not show clear signs of recovery.

## Cod

Mean catch per towed mile and biomass by strata with standard errors are presented in Table 3. These indices are compared with results of previous surveys in Table 5. Total biomass calculated by the swept area method and compared with Russian survey results are:

Year	EU (1)	Russia: (2)	(3)	Year	EU (1)	Russia: (2)	(3)
1983		23,070		2000	3,062		-
1984		31,210		2001	2,695	784	-
1985		28,070		2002	2,496	694	-
1986		26,060		2003	1,593		-
1987		10,150	21,600	2004	4,071		
1988	40,839	7,720	34,200	2005	5,242		
1989	114,050	36,520	78,300	2006	12,505		
1990	59,362	3,920	15,200	2007	23,866		
1991	40,248	6,740	8,200	2008	43,675		
1992	26,719	2,490	2,400	2009	75,228		
1993	60,963	8,990	9,700	2010	69,295		
1994	26,463	-	-	2011	106,151		
1995	9,695	8,260	-	2012	113,227		
1996	9,013	730	-	2013	72,289		
1997	9,966	-	-	2014	159,939		
1998	4,986	-	-	2015	114,807		
1999	2,854	-	-	2016	80,583		tons

1) Biomass estimated from bottom trawl survey. 2) Biomass estimated from bottom trawl survey (Kiseleva and Vaskov 1994; Kiseleva 1996, 1997; Vaskov and Igashov, 2003). 3) Biomass estimated of bottom trawlable plus pelagic biomass (Borovkov *et al.* 1993; Kiseleva and Vaskov 1994).

Tables 4, 6 and 7 show the length distribution, the age-length key and the abundance at age by stratum respectively. Distribution of survey catches is presented in Figure 2. Evolution of biomass and abundance are illustrated in Figure 3. The abundance at age along the series is also shown in Table 8.

The 1992 to 2003 year-classes failed almost completely. The abundances of 2004-2008 year classes are higher than in previous 12 years. The abundance of the 2010 year-class was the highest of those in previous recent years, and the 2009 and 2011 ones were also high. The 2012-2016 year-classes seem to have failed according to current results at age 1 (Figure 4).

The 2016 biomass decreased in relation to 2015 (30%) and is 50% below the historic maximum in 2014. Although the biomass remains above the mean values in the series its low abundance indicates an increase in older ages and a fail in recruitment.

### American plaice

Mean catch per towed mile and biomass by strata with standard errors are presented in Table 9. Survey biomass, as calculated by the swept area method, is compared with results of previous surveys in Table 11. This biomass is compared with Russian survey results in the following table:

Year	EU	Russia (1)	Year	EU	Russia (1)	Year	EU	Russia (1)
1983		8,900	1995	6,785		2007	1,053	
1984		7,500	1996	4,098		2008	1,766	
1985		7,800	1997	3,026		2009	1,442	
1986		20,200	1998	3,437		2010	2,446	
1987		9,300	1999	2,585		2011	4,084	
1988	16,046	6,500	2000	1,606		2012	4,491	
1989	14,047	5,000	2001	2,404		2013	3,698	
1990	11,983	1,200	2002	2,049	548	2014	3,800	
1991	10,087	14,400	2003	2,286	1,398	2015	3,821	
1992	8,656	1,200	2004	3,525		2016	4,325	ton
1993	7,861	2,700	2005	2,760				
1994	8,227	ton	2006	1,691	ton			

1) Rikhter *et al.* 1991; Borovkov *et al.* 1992, 1993, 1994; Vaskov and Igashov, 2003.

Tables 10, 12 and 13 show the length distribution, the age-length key and the abundances at age by stratum respectively. Figure 5 shows the distribution of the survey catches in 2016. The abundance at age along the series is shown in Table 14. Also, the evolution of survey biomass and abundance along the series is presented in Figure 6.

Fish aged 6 or more roughly correspond with fishable biomass. Results indicate two periods for recruitment, and a change from an upper abundance level to a lower one. The 1991 year-class was the first weak cohort. The 2006 year-class is the more abundant since 1991, but its abundance is only intermediate. Recruitment for later year-classes seems to be weaker; too weak for a quick recovery of the stock. Figure 7 shows the age distribution over the years. It illustrates the lack of recruitment that occurred for many years, and how most recent year-classes are weaker than those at the beginning of the series. In 2015, good presence of individuals of age 2 can be seen, followed in 2016 (age 3).

### Redfish

All redfish catches were classified by species. The group name *juvenile* contains those individuals of small size for which routine classification was not possible. The 15 cm maximum length is a good reference for this group, but it was never used as a criterion. The skill required to identify the species increased over time, so the group *juvenile* is not a uniform defined group, but it is maintained for practical reasons.

Mean catch per standard towed mile and biomass by strata with the standard errors are presented in Tables 15, 19, 23 and 27 for *Sebastes marinus*, *S. mentella*, *S. fasciatus* and the *juvenile* group respectively. The following table shows the total biomass (tons) by year in the traditional strata (<730 m.).

Year	<i>Sebastes</i>	<i>Sebastes spp.</i>			Total
	<i>marinus</i>	<i>mentella</i>	<i>fasciatus</i>	<i>juvenile</i>	
1988	18,229		170,102		188,331
1989	27,312		135,223		162,535
1990	16,751	86,695		23,311	126,757
1991	4,864	59,552	6,755	5,784	76,955
1992	4,909	85,408	6,314	33,578	130,209
1993	4,789	21,235	5,175	41,409	72,608
1994	39,516	42,495	9,303	71,211	162,525
1995	10,754	70,567	5,986	337	87,644
1996	13,431	92,647	13,112	472	119,662
1997	77,125	66,710	20,780	1,201	165,816
1998	7,640	53,946	7,656	1,590	70,832
1999	11,215	77,610	9,460	366	98,651
2000	53,388	106,283	15,364	2,955	177,990
2001	10,244	45,931	13,715	7,455	77,345
2002	11,651	48,760	27,556	33,345	121,312
2003	40,110	28,785	15,031	9,890	93,816
2004	85,383	45,999	76,164	43,059	250,605
2005	147,688	105,110	123,326	75,762	451,215
2006	298,290	105,849	319,387	43,396	766,922
2007	88,071	51,191	261,790	63,576	464,628
2008	240,777	42,570	202,288	80,491	566,126
2009	72,211	111,787	171,676	2,804	358,479
2010	47,377	62,684	97,067	5,083	212,211
2011	29,056	103,678	59,753	4,543	197,030
2012	55,410	166,693	82,539	1,304	305,946
2013	32,016	102,500	84,801	420	219,737
2014	37,171	96,158	46,174	422	179,925
2015	30,672	45,668	80,494	1,167	158,001
2016	35,069	79,143	55,394	1,593	171,199

Tables 16-18, 20-22, 24-26 show the age length key, length frequency and the abundance at age by stratum for the three species of redfish respectively. For *Sebastes marinus* the ALK is not yet available. Catches per haul distributions and biomass of the three species and juveniles are presented in the Figure 8 and 9 respectively. Tables 27 and 28 show the mean catch per towed mile y biomass by stratum of the juveniles (redfish with length up to 16 cm).

### Greenland halibut

Mean catch per towed mile and the estimated biomass by strata with their standard errors are presented in Table 29. These indices are compared with results of previous surveys in Table 30. The following table summarises the total biomass in tons by year in depths <730 m. (1988-2016 years) and in depths up to 1460 m. (2004-2016 years).

Year	EU < 730 m.	Year	EU < 730 m.	EU < 1460 m.
1988	6,926	2003	6,214	
1989	4,472	2004	12,292	28,343
1990	5,799	2005	11,698	21,515
1991	8,169	2006	11,706	24,357
1992	8,728	2007	13,040	31,723
1993	6,529	2008	11,995	39,614
1994	8,037	2009	7,775	36,047
1995	10,875	2010	6,299	26,739
1996	11,594	2011	6,713	32,257
1997	16,098	2012	4,291	23,505
1998	24,229	2013	2,799	23,391
1999	21,207	2014	5,168	29,288
2000	16,959	2015	6,577	58,180
2001	13,872	2016	6,139	34,642
2002	12,100			

Age-length keys, length frequency and frequency at age by stratum are presented in Tables 31, 32 and 33 respectively. Catch per haul distribution is presented in Figure 10. Figure 11 shows the estimated biomass with their standard error and numbers by year. The abundance at age along the series is shown in Table 34. The figure 12 shows the age distribution by year in the EU Flemish Cap surveys.

#### **Roughhead grenadier (*Macrourus berglax*)**

Mean catch per standard towed mile and estimated biomass by strata with their standard errors are presented in Table 35. These indices are compared with results of previous surveys in Table 36. The following table summarises the total biomass in tons by year:

Biomass (tons) along this survey series were:

Year	EU < 730 m.	Year	EU < 730 m.	EU < 1460 m.
1988	2,009	2003	2,348	
1989	871	2004	3,597	17,185
1990	852	2005	2,387	12,560
1991	1,335	2006	3,933	11,336
1992	1,577	2007	1,367	7,271
1993	3,021	2008	2,961	12,138
1994	1,975	2009	781	7,303
1995	1,558	2010	1,403	9,092
1996	1,362	2011	729	8,800
1997	1,197	2012	612	5,477
1998	1,691	2013	807	4,298
1999	1,250	2014	399	4,111
2000	1,047	2015	478	3,702
2001	2,079	2016	373	3,836
2002	1,211			

Age-length keys, length frequency and frequency at age by strata are presented in Tables 37, 38 and 39, respectively. Catch per haul distribution is presented in Figure 13. Figure 14 shows the

estimated biomass with their standard error and numbers by year. The abundance at age along the series is shown in Table 40. Figure 15 shows the age distribution by year in the EU Flemish Cap surveys.

## Shrimp

Casas J.M. (2016) presented detailed results.

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Table 1. Technical data of the 2016 survey.

Procedure	Specification
Vessel	R/V <i>Vizconde de Eza</i>
GT	1 400 t
Power	1 800 HP
Mean trawling speed	3.0 -3.5 knots
Trawling time	30 minutes effective time
Fishing gear	type <i>Lofoten</i>
footrope / handrope	31.20 / 17.70 m
footgear	27 steel bobbins of 35 cm
vertical opening	3.0 m (MARPORT)
warps	100 meters, 45 mm, 200 Kg/100m
trawl doors	polyvalent, 850 Kg
wire length	2 × depth echo sounder (m.) + 250.
mesh size in cod-end	35 mm
Type of survey	Stratified sampling
Station selection procedure	Random
Criterion to change position of a selected tow	- Unsuitable bottom for trawling according to ecosounder register. - Information on gear damage from previous surveys.
Criterion to reject data from tow	- tears in cod-end - severe tears in the gear - less than 20 minutes tow - bad behaviour of the gear
Daily period for fishing	6.30 to 18:30 hours
Species for sampling	All fish, cephalopods, shrimp and invertebrates
Species for age determination	Cod, American plaice, redfish ( <i>Sebastes sp.</i> ), Greenland halibut and Roughhead grenadier ( <i>Macrourus berglax</i> ).

Table 2. Biomass (t.) for the most important species or groups of species in 1988-2016 surveys in depths lesser than 730 m.

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Rajidae	4495	1938	2823	4061	3780	6241	3506	2268	2051	1842	1978	1608	1150	2236	1544
<i>Synaphobranchus sp.</i>	217	88	40	80	72	105	8	16	0	8	40	0	0	24	8
<i>Urophycis sp.</i>	643	169	169	257	72	169	217	80	80	32	225	249	169	394	129
<i>Antimora sp.</i>	394	306	281	563	724	820	796	193	185	233	491	290	265	667	346
Macrouridae	3088	1456	1222	2252	2589	6498	3233	2606	2340	2292	2831	2332	1809	3080	2043
<i>Notacanthus sp.</i>	499	410	64	474	450	740	458	346	177	290	169	64	97	105	64
<i>Illex sp.</i>	8	8	1649	1158	64	0	209	0	88	64	72	16	0	8	8
Anarhichadidae	7994	7487	8122	10101	9095	14355	15642	19220	20563	14033	10985	5581	4471	5863	5227
Witch flounder	909	338	418	772	820	1045	788	708	507	322	241	378	410	458	209
Greenland halibut	6924	4471	5798	8171	8725	6530	8034	10873	11596	16100	24230	21207	16960	13872	12103
Zoarcidae	563	1142	1206	1978	1359	3474	1874	2179	1705	1729	2059	893	780	1246	812
Cod	40837	114050	59365	40250	26715	60966	26466	9699	9015	9964	4986	2855	3064	2694	2493
American plaice	16044	14049	11982	10085	8653	7865	8227	6787	4101	3024	3434	2581	1608	2405	2051
Redfish	188333	162535	126757	76953	130206	72610	162527	87641	119664	165816	70833	98650	177991	77347	121312
Shrimp*	5742	2300	3490	11661	25155	12087	3981	7503	10905	7704	41971	25734	19719	28316	40177
Total	277325	310956	224530	169483	218909	193504	236440	150512	183669	224039	165655	163058	230087	140162	189459

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Rajidae	4608	6241	4238	3506	2179	6289	2244	3471	2188	1658	743	680	836	1073
<i>Synaphobranchus sp.</i>	24	88	72	32	64	40	24	14	2	20	40	14	9	23
<i>Urophycis sp.</i>	547	667	740	611	249	547	217	685	682	380	332	258	145	113
<i>Antimora sp.</i>	306	1158	1110	474	587	893	499	670	342	727	655	649	630	748
Macrouridae	3691	4914	3353	5026	2364	3957	1166	1926	561	1190	1253	980	843	655
<i>Notacanthus sp.</i>	24	145	64	145	64	88	32	21	12	69	68	40	17	69
<i>Illex sp.</i>	225	474	80	3546	410	5139	1737	43	89	0	0	0	0	3
Anarhichadidae	5983	10591	9570	9272	8195	9867	4600	4256	3739	5073	3893	4775	5402	5371
Witch flounder	844	1568	1777	893	595	2220	764	1836	1458	2283	940	1810	2163	2126
Greenland halibut	6216	12288	11701	11709	13044	11999	7777	6299	6481	4291	2884	5168	6577	6139
Zoarcidae	2067	3683	3080	1801	354	458	56	75	20	1	6	0	1	5
Cod	1592	4069	5243	12505	23884	43676	75232	69295	106151	113227	71903	159939	114807	80583
American plaice	2284	3522	2758	1689	1053	1769	1440	2446	4084	4491	3632	3800	3821	4325
Redfish	93817	250602	453041	766924	464621	566649	358476	212212	196493	305947	219729	179925	158001	171198
Shrimp*	21512	20129	30672	16237	17049	11066	2799	4889	1593	1055	844	900	1551	2478
Total	149394	322866	529181	845252	534714	664655	457062	317805	320886	448661	319157	365459	300443	283269

\*) Values affected by mesh size cod-end: 40 mm in 1994, 25 mm in 1998 and 30 mm in 1999.

Table 3. Cod (*Gadus morhua*) mean catch per standard towed mile and the estimated biomass by strata and its standard error in the 2016 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	122.61	55.20	3195	1438
2	838	10	130.74	44.29	8348	2828
3	628	7	453.55	129.75	21702	6208
4	348	5	424.97	332.90	11268	8827
5	703	7	65.31	16.26	3499	871
6	496	6	60.81	12.15	2298	459
7	822	9	113.37	40.85	7099	2558
8	646	7	107.36	28.18	5284	1387
9	314	3	378.63	372.07	9058	8901
10	951	11	23.12	5.34	1676	386
11	806	9	40.01	5.78	2457	355
12	670	8	19.09	7.14	974	365
13	249	3	44.61	16.89	846	321
14	602	7	23.80	13.35	1092	612
15	666	8	35.23	13.44	1787	682
16	634	7				
17	216	2				
18	210	2				
19	414	5				
Total < 730 m.	10555	120	100.20	18.30	80583	14715
Total < 1460 m.	16070	181	65.82	12.02	80583	14715

Table 4. Cod (*Gadus morhua*) length distribution ('000) in the 2016 survey.

length	length	length	length	length	length	length	
09-11		42-44	1078	75-77	485	108-110	55
12-14		45-47	1828	78-80	353	111-113	42
15-17	41	48-50	3527	81-83	251	114-116	32
18-20	20	51-53	5303	84-86	215	117-119	26
21-23	98	54-56	5474	87-89	184	120-122	7
24-26	2227	57-59	4873	90-92	202	123-125	19
27-29	2113	60-62	3836	93-95	167	126-128	
30-32	1642	63-65	3171	96-98	104	129-131	
33-35	5286	66-68	2122	99-101	115	132-134	7
36-38	6069	69-71	1310	102-104	82		
39-41	1820	72-74	740	105-107	108	total	55032

Table 5. Cod (*Gadus morhua*) Biomass (t.) by strata in 1988-2016 surveys.

stratum	year														
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	1345	649	767	5585	76	516	2165	1563	1006	243	125	99	250	86	477
2	10150	10323	2065	5486	5150	9044	8186	3040	3991	2049	1899	1502	740	491	736
3	4471	10276	2391	2459	8473	8435	6092	1146	1054	1132	703	145	360	230	451
4	3130	4843	2446	2900	3443	14171	1885	746	1068	857	140	25	443	488	66
5	2130	10702	8447	10651	4570	6824	924	1274	936	1149	976	256	425	260	146
6	3230	6789	3286	1531	952	4220	1412	1310	620	1074	613	375	511	749	525
7	2224	16025	4385	2538	945	6153	857	122	55	1067	78	52	5	12	24
8	8931	16434	15973	5107	2349	7964	3615	349	93	1610	77	23	74	123	37
9	184	5261	6340	188	143	998	239	9	103	174		20	41		14
10	1338	4898	4193	1558	327	936	506	58	46	301	199	102	107	81	2
11	2505	13219	3859	1787	224	1678	582	78	41	310	176	255	106	175	18
12	335	2469	1587	126		24									
13	9	2534	734	93											
14	107	1121	545	131	67										
15	748	8436	2344	108											
16		66													
17		5													
18	2														
19															
total	40839	114050	59362	40248	26719	60963	26463	9695	9013	9966	4986	2854	3062	2695	2496
s.e.	5784	12205	8225	6704	5837	17397	7367	2070	1459	1725	646	451	593	380	398

s.e.: standard error

stratum	year														
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
1	173	1996	1091	2433	4420	4224	2253	11815	4694	1567	1931	4688	11089	3195	
2	102	1668	1888	4145	1775	5346	6627	23368	22985	13861	10230	27320	1896	8348	
3	90	9	1791	1948	11466	4129	7630	4512	16922	17743	12291	22585	5572	21702	
4	136	168	152	466	1132	771	5190	1716	10114	2903	7106	3081	2046	11268	
5	303	19	30	644	548	1129	6947	3600	10947	11639	5528	5090	2051	3499	
6	24	155	206	1224	3214	12487	10734	2303	9510	9991	3849	11494	7413	2298	
7	107	18		473	140	4692	12659	4667	2586	6824	5872	37607	5914	7099	
8	111	5		347	475	3471	2814	4204	10921	7739	4641	9335	5732	5284	
9	376			64	151	81	503	2048	1997	5963	970	9040	256	9058	
10	24		28	304	246	2625	5071	4275	5247	16988	5153	6655	9852	1676	
11	58	33	56	381	272	3699	4336	4458	4557	5701	4205	9585	1490	2457	
12	71						42	339	588	1135	2538	1323	927	747	974
13							15	135	124	415	875	940	529	311	846
14				76			160	9795	1056	3186	3663	6094	8331	3093	1092
15	18				47	805	195	475	926	5133	1961	3532	532	1787	
16											82	142	93		
17															
18										100					
19							88				113			17	
total	1593	4071	5242	12505	23886	43675	75228	69295	106151	113227	72289	159939	114807	80583	
s.e.	273	780	813	980	4526	5507	8109	16269	11805	12293	8904	25425	19966	14715	

s.e.: standard error

Table 6. Cod (*Gadus morhua*) age-length key in 2016.

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
15-17	7																7
18-20	3	1															4
21-23		18															18
24-26		63															63
27-29		60	1														61
30-32		3	61														64
33-35			68														68
36-38			61	1													62
39-41			46	13	1												60
42-44			6	44	12												62
45-47				20	39												59
48-50				6	52	2											60
51-53					71	10											81
54-56					51	17	2										70
57-59					17	43	2										62
60-62					1	50	10										61
63-65						45	16										61
66-68						33	27										60
69-71						10	45	5									60
72-74						2	46	12									60
75-77							26	15	2								43
78-80							16	20	1	3							40
81-83							10	17	2	2	1						32
84-86							2	20	4	1							27
87-89							1	17	9	2							29
90-92								9	15	3	1	1					29
93-95								6	12	3	1		1				23
96-98								4	10	2							16
99-101									5	5	6						16
102-104								1	6	3	1						11
105-107								2	3	8	2						15
108-110									2	5	1						8
111-113										3	3						6
114-116											3	1					4
117-119									1	2		1					4
120-122									1								1
123-125											1		2				3
126-128																	
129-131																	
132-134												1					1
TOTAL	10	145	243	84	244	212	203	128	73	42	20	4	3				1411

Table 7. Cod (*Gadus morhua*) frequency ('0000) at age and stratum in the 2016 survey.

age	strata																	total	mean	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	18	Weight (g)		Length (cm)	
1	2	2			1	1											6	42	17	
2	2	39	84	112	153	30	2	14	2	6	5						449	164	26	
3	40	420	268	102	158	154	31	116	41	55	50						1436	406	36	
4	9	22	65	31	8	11	12	18	31	10	6						223	777	44	
5	41	66	482	245	26	26	99	106	300	25	12	3	1	2	4		1439	1304	52	
6	32	90	416	204	20	21	117	84	197	11	17	10	8	5	21		1255	2018	60	
7	16	55	141	68	15	9	43	23	40	5	19	12	9	4	23		481	2911	68	
8	6	19	17	12	9	4	10	4	1	3	10	4	3	2	10		114	5100	81	
9	3	8	6	2	5	3	9	2	1	3	4	2	1	3	2		52	7927	94	
10	2	4	2	2	3	1	5	2		2	2		1	2	1		31	9415	99	
11	1	2		1	2	1	2	3			1		1	1			15	11066	105	
12	1						1	1									3	15002	115	
13																	2	14243	113	
14																				
15																				
16+																				
Set	4	10	7	5	7	6	9	7	2	11	9	7	3	6	8		101	1481	50	
n	155	729	1482	780	399	260	330	372	613	121	126	31	23	20	61		5503			

Table 8. Cod (*Gadus morhua*) abundance ('000) at age in 1988-2016 surveys.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	4868	19604	2303	129032	71533	4075	3017	1425	36	37	23	5	178	473	
2	79905	10800	12348	26220	41923	138357	4130	11901	3121	150	83	84	16	1990	1330
3	49496	91303	5121	16903	5578	31096	27756	1338	6659	3478	95	116	327	13	641
4	13448	54613	16952	2125	2385	1099	5097	3892	892	4803	1256	117	198	122	29
5	1457	20424	15834	6757	385	1317	130	928	2407	391	1572	717	96	79	70
6	211	1336	4492	1731	1398	173	67	33	192	952	78	444	446	15	33
7	225	143	340	299	244	489	7	23	8	21	146	19	172	142	26
8	72	126	146	68	14	87	111		5			5	11	99	96
9		6	77	32				21			6		17	6	30
10		7	25	4			5	5						6	
11				10	8									6	5
12										4			5		
13															
14													5		
15															
16+															
<b>Total</b>	149683	198363	57637	183181	123468	176693	40319	19567	13320	9837	3259	1507	1470	2951	2261

age	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	684		8069	19710	3912	6095	5130	66500	347800	103530	5500	7273	1153	57
2	54	3379	16	3880	11625	16681	7480	27760	143100	127920	67560	2379	12941	4486
3	628	49	1118	60	5021	12419	16170	8640	16900	10980	32230	48452	7137	14357
4	134	618	78	1470	21	4545	14300	7660	6300	11720	4900	43163	25472	2225
5	22	168	708	90	1138	73	4150	5000	7800	4960	4170	17986	14342	14385
6	42	5	136	590	58	928	20	1800	3100	4870	2780	6894	21984	12545
7	7	10		120	425	58	1090	10	1200	1630	1800	3369	3323	4814
8	8	3	17	10	74	230		460		820	970	1977	1421	1138
9	39	5	8		13	80	340	50	200	20	290	1530	777	525
10	24	16	8	10	20			260		90	40	601	361	305
11				10		15		30		30	30	77	192	146
12							10			80	30	51	13	27
13				10						0	10	8	22	20
14										10		0	21	57
15													0	
16+													7	
<b>Total</b>	1642	4161	10157	25960	22307	41125	48690	118180	526500	266660	120310	133760	89166	55030

Table 9. American plaice (*Hippoglossoides platessoides*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2016 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	8.40	5.71	219	149
2	838	10	20.48	4.90	1307	313
3	628	7	10.20	3.29	488	157
4	348	4	6.70	1.45	178	38
5	703	8	11.04	3.34	592	179
6	496	6	7.46	1.91	282	72
7	822	9	4.04	0.82	253	52
8	646	7	7.04	3.97	346	196
9	314	3	0.51	0.30	12	7
10	951	11	4.48	0.60	325	43
11	806	9	5.02	1.09	308	67
12	670	8	0.00	0.00		
13	249	3	0.09	0.09	2	2
14	602	7	0.07	0.07	3	3
15	666	8	0.21	0.14	10	7
16	634	7				
17	216	2				
18	210	2				
19	414	5				
Total < 730 m.	10555	120	5.38	0.60	4325	481
Total < 1460 m.	16070	181	3.54	0.39	4325	481

Table 10. American plaice (*Hippoglossoides platessoides*) length frequency ('000) in the 2016 survey.

length	male	female	length	male	female	length	male	female
10-11	14	20	30-31	186	190	50-51	13	300
12-13	21		32-33	123	124	52-53	7	340
14-15		8	34-35	212	198	54-55		180
16-17	7	7	36-37	324	242	56-57		67
18-19	14	34	38-39	285	182	58-59		15
20-21	28	75	40-41	265	73	60-61		14
22-23	49	14	42-43	370	35	62-63		
24-25	191	69	44-45	265	43	64-65		14
26-27	314	280	46-47	109	72			
28-29	452	381	48-49	55	245	total	3301	3224



Table 11. American plaice (*Hippoglossoides platessoides*) survey biomass (t) by strata in 1988-2016.

stratum	year														
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	1306	1000	505	1078	709	1079	661	2230	1462	381	156	372	345	1043	141
2	2845	3602	1375	2663	1714	1267	1199	1335	943	740	1587	1810	976	835	1262
3	1367	1118	1668	1247	631	444	325	252	168	495	284	97	21	93	75
4	2199	461	817	320	557	572	853	489	268	203	343	53	100	85	
5	2599	3093	1830	1407	837	1291	1230	549	500	619	744	73	56	112	189
6	479	1130	954	501	601	305	808	123	32	13	35	40	25	37	63
7	1174	531	837	389	639	319	316	249	72	83	47	19	15	28	52
8	417	164	263	251	727	487	171	132	56	123	165	3		45	43
9	103	163	343		373	205	20	500	55	36					1
10	2323	1491	2000	1308	1406	1459	2236	708	415	287	36	72	45	95	36
11	1186	1168	1316	401	372	292	303	109	68	32	29	37	23	27	59
12	9	19	45	17	11	15	33	12	32	7				4	
13	3		20					3							
14	8	8	7	389	29		24	15	4		4	9			
15	23	99	3	97	37	109	40	68	23	7	7				
16	5			4	9	12	5								
17															
18															
19				15	4	5	3	11							
total	16046	14047	11983	10087	8656	7861	8227	6785	4098	3026	3437	2585	1606	2404	2049
s.e.	1845	2048	1276	1180	954	1040	1373	1083	912	708	751	869	332	429	729

stratum	year													
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	1292	1507	1038	714	284	144	548	716	693	462	329	181	410	219
2	713	768	796	354	209	513	370	1084	1141	1272	1202	1872	1248	1307
3	17	427	101	74	101	147	74	103	364	468	266	223	462	488
4	128	395	359	109	153	440	36	91	1201	749	671	258	376	178
5	82	72	45	63	81	88	72	200	190	716	267	328	443	592
6	29	26	71	61	99	37	57	34	160	185	341	187	309	282
7	30	84	31	37	20	47	32	28	160	156	166	208	117	253
8	14	55	175	163	58	128	47	49	65	187	156	249	220	346
9	9	77	18				77			30	25	0	2	12
10	54	45	87	97	24	163	54	115	35	123	153	105	86	325
11	29	69	35	19	22	50	64	26	33	121	121	185	124	308
12	11						11			11	0			
13														2
14									32				3	3
15	6		4		3	7	1		10	13			22	10
16														
17														
18														
19														
total	2286	3525	2760	1691	1053	1766	1442	2446	4084	4491	3698	3800	3821	4325
s.e.	748	740	684	342	159	300	327	526	780	534	439	671	556	481

Table 12. American plaice (*Hippoglossoides platessoides*) age-length key in 2016.**MALE**

Length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
10-11	2																	2
12-13	3																	3
14-15																		
16-17	1																	1
18-19		2																2
20-21		4																4
22-23		3	4															7
24-25			25	2														27
26-27			42	4														46
28-29			18	38	5													61
30-31			4	18	6													28
32-33				8	5	2	2											17
34-35				7	19	5	1											32
36-37				4	26	8	4	1	3	1						1		48
38-39					7	9	5	5	6	6								38
40-41							2	9	13	12							2	38
42-43						1	3	6	14	22	1						4	51
44-45							2	3	6	21				1	1	5		39
46-47							2	1	1	8	1		1	1	1			16
48-49									1	3		1	1		1	1		8
50-51										1				1				2
52-53											1							1
total	6	9	93	81	68	25	21	25	44	74	3	1	2	3	4	12		471

Table 12 (cont.). American plaice (*Hippoglossoides platessoides*) age-length key in 2016.**FEMALE**

Length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
10-11	3																	3
12-13																		
14-15	1																	1
16-17		1																1
18-19		5																5
20-21		11	1															12
22-23		1	1															2
24-25			10															10
26-27			31	9														40
28-29			20	32	1													53
30-31			7	20	1													28
32-33			4	12	2													18
34-35				17	12													29
36-37			1	9	23	3												36
38-39				2	19	5	2											28
40-41					8	3												11
42-43					4	1												5
44-45							2	2	2									6
46-47						1		4	2	2							1	10
48-49							2	9	5	17	1							34
50-51							4	8	4	22	1	2		1				42
52-53							3	7	9	23	2	2	1				2	49
54-55								1	5	13	3	1			1	2	2	26
56-57								1	2	3	1						3	10
58-59												1					1	2
60-61																	2	2
62-63																		
64-65																	2	2
total	4	18	75	101	70	13	13	32	29	80	8	6	1	1	1	1	13	465

Table 13. American plaice (*Hippoglossoides platessoides*) frequency at age in the 2016 survey.

age	stratum															total	Mean Weight g	Mean Length cm
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
1	0.00	0.01	0.03	0.00	0.01	0.01	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.09	14	12
2	0.00	0.02	0.07	0.03	0.00	0.01	0.02	0.00	0.00	0.04	0.02	0.00	0.01	0.00	0.00	0.22	69	20
3	0.00	0.10	0.18	0.09	0.14	0.12	0.14	0.16	0.00	0.26	0.27	0.00	0.01	0.00	0.00	1.46	181	27
4	0.00	0.12	0.24	0.14	0.15	0.14	0.17	0.18	0.01	0.24	0.19	0.00	0.00	0.00	0.00	1.59	280	31
5	0.01	0.16	0.19	0.13	0.08	0.11	0.11	0.14	0.00	0.11	0.10	0.00	0.00	0.00	0.00	1.16	474	36
6	0.01	0.08	0.05	0.03	0.03	0.03	0.03	0.02	0.00	0.02	0.03	0.00	0.00	0.00	0.00	0.33	551	38
7	0.02	0.11	0.03	0.01	0.04	0.02	0.02	0.01	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.30	875	43
8	0.04	0.22	0.04	0.01	0.08	0.03	0.02	0.02	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.50	1088	46
9	0.07	0.31	0.04	0.02	0.07	0.03	0.02	0.02	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.64	1046	45
10	0.13	0.60	0.10	0.03	0.19	0.06	0.05	0.05	0.00	0.08	0.06	0.00	0.00	0.00	0.00	1.35	1197	47
11	0.00	0.03	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.10	1534	51
12	0.00	0.02	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	1641	53
13	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	1314	49
14	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	1215	48
15	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1117	46
16+	0.02	0.09	0.03	0.01	0.02	0.01	0.00	0.02	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.22	1537	51

Table 14. American plaice (*Hippoglossoides platessoides*) abundance ('000) at age in 1988-2016 surveys.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0	40	8	40	0	0	0	0	8	8	0	8	16	0	0
2	402	563	426	354	852	8	40	32	32	16	24	0	24	40	0
3	1882	8364	917	1206	796	1544	48	113	121	113	32	24	8	48	32
4	1311	1874	8372	2171	1070	1086	2131	740	257	24	48	64	80	56	64
5	4230	4367	1126	5348	1938	780	1037	2131	587	121	72	80	105	105	16
6	6385	4359	3370	2445	4769	418	877	1367	1665	418	265	80	153	56	88
7	5010	4142	2340	2686	1279	4134	973	1375	893	1206	619	241	121	113	64
8	5460	2429	2228	2067	1504	450	3426	909	547	273	901	474	153	265	129
9	1753	804	1351	852	828	780	322	1536	402	410	523	507	394	434	161
10	458	346	627	298	378	370	651	161	627	290	354	257	426	579	193
11	97	40	113	8	177	257	225	177	145	491	298	338	225	483	298
12	161	16	16	56	97	306	225	145	80	129	290	209	185	418	225
13	129	0	32	0	16	362	249	145	80	24	88	121	72	193	249
14	48	0	16	0	0	1070	523	290	105	97	113	121	56	161	145
15	56	0	0	0	0	32	491	217	72	48	56	56	48	113	129
16+	40	0	0	0	0	40	8	32	24	113	105	97	56	97	185
<b>total</b>	27415	27351	20949	17523	13711	11637	11226	9377	5645	3772	3804	2670	2131	3169	1970
<b>N6+</b>	19598	12135	10093	8412	9047	8219	7970	6353	4640	3498	3611	2501	1890	2911	1866
<b>SOP</b>	16041	14008	11982	10007	8623	7859	8229	6815	4073	3025	3437	2589	1596	2402	2047
<b>Biomass</b>	16043	14044	11983	10088	8657	7861	8228	6785	4097	3024	3436	2587	1606	2404	2048

age	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	8	0	0	7	207	51	26	10		7	27	8	20	70
2	8	113	32	28	7	1492	293	341	394	60	198	344	578	178
3	32	281	113	37	13	69	1107	608	601	447	76	219	695	1176
4	97	72	290	106	35		147	2000	1384	629	311	144	599	1275
5	80	80	105	133	106	32	29	301	2467	980	718	135	101	936
6	56	105	105	139	119	127	22	187	454	2833	866	510	109	263
7	48	105	129	72	49	120	80	72	94	447	1596	816	328	239
8	137	129	105	57	49	108	57	139	49	84	138	1569	609	405
9	290	249	225	123	35	104	94	122	90	111	64	190	1320	515
10	233	314	201	163	47	111	90	70	176	143	94	65	140	1083
11	426	281	225	200	76	63	132	56	144	125	109	55	49	77
12	483	595	249	193	122	47	121	176	55	115	108	62	33	49
13	281	426	354	192	143	118	63	125	107	45	55	46	41	21
14	265	402	394	213	82	110	104	114	148	133	61	64	47	27
15	145	330	257	201	75	150	121	134	82	130	54	50	55	34
16+	161	523	547	323	236	561	353	497	672	323	195	201	228	175
<b>total</b>	2766	4013	3329	2188	1401	3262	2838	4952	6917	6614	4670	4477	4950	6523
<b>N6+</b>	2525	3458	2791	1877	1033	1619	1237	1692	2072	4489	3340	3628	2959	2888
<b>SOP</b>	2486	3524	2673	1743	1053	1817			4176	4428	3485			
<b>Biomass</b>	2286	3525	2760	1691	1053	1766	1442	2446	4084	4491	3698	3800	3821	4325

Table 15. Redfish (*Sebastes marinus*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2016 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	0.21	0.12	6	3
2	838	10	10.83	10.69	691	683
3	628	7	20.23	12.65	968	606
4	348	4	11.87	11.69	315	310
5	703	8	6.04	3.50	324	188
6	496	6	18.34	11.22	693	424
7	822	9	101.73	37.70	6371	2360
8	646	7	17.31	7.02	852	346
9	314	3	401.42	277.15	9604	6631
10	951	11	74.83	15.58	5422	1128
11	806	9	148.58	67.36	9124	4136
12	670	8	4.99	4.99	254	254
13	249	3				
14	602	7	4.73	4.73	217	217
15	666	8	4.38	2.29	222	116
16	634	7	0.16	0.16	7	7
17	216	2				
18	210	2				
19	414	5				
20	525	6				
21	517	6				
22	533	6				
23	284	3				
24	253	3				
25	226	3				
28	530	6				
29	488	6				
30	1134	11				
31	203	2				
32	238	2				
33	98	2				
34	486	5				
Total < 1460 m.	16070	181	28.65	6.81	35069	8325
Total < 730 m.	10555	120	43.61	10.36	35069	8325

Table 16. Redfish (*Sebastes marinus*): age-length key in the 2016 survey. NOT YET AVAILABLE

**Male**

Table 16 (cont.) Redfish (*Sebastes marinus*): age-length key in the 2016 survey. NOT YET AVAILABLE

**Female**





Table 17. Redfish (*Sebastes marinus*) length frequency ('000) in the 2016 survey.

length	male	female	length	male	female	length	male	female
11			27	795	374	43	13	514
12	25		28	28	728	44	207	420
13			29	29	979	45	13	427
14			30	30	1219	46	7	315
15	72	38	31	31	1283	47	7	412
16	2365	1479	32	32	2617	48		230
17	3406	2493	33	33	2373	49		189
18	3819	2581	34	34	2308	50		59
19	1128	1023	35	35	2290	51	11	44
20	367	532	36	36	2957	52		32
21	336	438	37	37	1958	53		34
22	397	498	38	38	1172	54		7
23	628	377	39	39	669	55		
24	544	381	40	40	353	56		
25	638	451	41	41	233			
26	392	393	42	42	82	Total	36391	31278

Table 18. *Sebastes marinus*: frequency at age ('000) by strata in the 2016 survey. NOT YET AVAILABLE

Table 19. Redfish (*Sebastes mentella*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2016 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	0.04	0.04	1	1
2	838	10				
3	628	7	0.02	0.02	1	1
4	348	4				
5	703	8	0.09	0.09	5	4
6	496	6				
7	822	9	26.32	17.27	1649	1082
8	646	7	23.47	11.50	1155	566
9	314	3	22.38	10.43	536	250
10	951	11	52.45	28.28	3800	2049
11	806	9	22.30	9.92	1369	610
12	670	8	304.45	75.25	15541	3841
13	249	3	216.28	68.51	4103	1300
14	602	7	615.23	201.51	28218	9243
15	666	8	311.92	85.00	15827	4313
16	634	7	2.03	1.07	98	52
17	216	2	3.22	1.59	53	26
18	210	2	421.89	418.81	6750	6701
19	414	5	1.17	0.44	37	14
20	525	6	0.14	0.14	6	6
21	517	6				
22	533	6	0.09	0.09	4	4
23	284	3				
24	253	3				
25	226	3	0.32	0.32	5	5
28	530	6	0.02	0.02	1	1
29	488	6	0.04	0.04	1	1
30	1134	11				
31	203	2				
32	238	2				
33	98	2	0.42	0.07	3	1
34	486	5				
Total < 1460 m.	16070	181	64.66	10.69	79163	13096
Total <730 m.	10555	120	98.42	16.29	79143	13096

Table 20 *Sebastes mentella*: age-length key in the 2016 survey.

Length	age																									total			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				
13																													
14																													
15																													
16			5																									5	
17			7	2																								9	
18			3																									3	
19				1	1																							2	
20				3	3																							6	
21					4	2																						6	
22					3	3																						6	
23					1	5	2																					8	
24							3																					3	
25							5	1																				6	
26							5	5	1																			11	
27							1		7	1						1												10	
28									2	2	1																	5	
29								1	1	2				1	1				1									7	
30										1	1	1		1														4	
31												1							1							2		4	
32												1			1													2	
33											1																	1	
34																													
35																1												1	
36																													
37																													
38																													
39																													
40																													
41																													
42																													
43																													
total			15	6	12	10	16	7	11	6	3	3	1	2	1	2	1	1									2	99	

Table 20 (cont.) *Sebastes mentella*: age-length key in the 2016 survey.**Female**

Length	age																									total			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				
13																													
14																													
15																													
16				6																								6	
17				4																								4	
18				4	2																							6	
19					3	1																						4	
20					2	2																						4	
21						1	1																					2	
22						4	3																					7	
23						3	5																					8	
24							2	2																				4	
25								5																				5	
26						1	5	5																				11	
27							1	4	1	3	1	1																11	
28								2	3	1																		6	
29									2	4	4	5																15	
30										1	1	3	1	1														7	
31										1	2	3	4		1													11	
32											2	1	2	1	1													7	
33												2		3	1	2												8	
34												1			1	1	3	2	4									12	
35														1	2	1	3	1	2								1	11	
36																		2	2							1		5	
37													1				1		1	1							1	5	
38													1				1	1									1	4	
39															1			1	1									3	
40																													
41																													
total			14	7	11	12	13	11	8	15	13	16	7	7	5	7	9	6	1		2					2	166		

Table 21. Redfish (*Sebastes mentella*) length frequency ('000) in the 2016 survey.

length	male	female	length	male	female	length	male	female
13	90	80	23	1650	970	33	310	3000
14	150	70	24	3230	2170	34		340
15	70	60	25	6970	2180	35	20	560
16	3000	1840	26	16690	6500	36	20	420
17	5900	4180	27	32580	12710	37		190
18	3320	2380	28	31130	23270	38	10	40
19	700	800	29	17080	26730	39		70
20	1060	790	30	5790	22910	40		
21	1720	820	31	1540	10990	41		
22	1330	1020	32	580	6460	Total	134700	131400

Table 22 *Sebastes mentella*: frequency at age ('0000) by strata in the 2016 survey.

Age	Strata																		mean		
	3	5	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	total	Weight(g)	Length(cm)
1																					
2																					
3	1	1	23	20	15	768	48			5									1852	70	17
4			53	37	18	170	99			13	6								398	89	18
5			64	36	31	160	92	13	9	48	32								485	133	21
6			61	34	27	135	73	41	22	87	56			4					541	172	23
7		2	11	93	25	244	59	491	143	974	447	1		177	1	1	1		2769	233	26
8			38	34	10	105	26	536	106	114	351	1		303					2652	275	27
9			83	48	3	152	21	127	302	228	117	3	1	633					5984	300	28
10			60	36	3	130	24	899	235	167	933	4	2	434					4439	331	29
11			42	25	12	69	21	658	138	111	618	3	2	293	1				3003	355	29
12			42	20	6	53	18	470	102	797	496	3	2	234					2244	376	30
13			9	4	1	21	8	141	46	255	169	1		57					714	383	30
14			10	3		28	6	108	57	218	189	2	1	45					669	396	30
15			1		3		1	5	7	12	8	1		7					45	505	33
16			6	3		9	3	76	22	117	80	1	1	34	1				353	299	28
17			2	1		12	4	49	26	87	78	1	1	19					280	375	30
18			1		1	3	1	16	8	16	18	1		5					72	520	33
19									1	1	2								4	697	37
20																					
21								2	1	3	4			3					13	623	36
22																					
23																					
24																					
25+			2		3	6	1	22	8	20	20	1							82	430	31
Sets	1	2	6	5	3	8	7	8	3	7	8	4	2	2	4	1	1		78	291	
n	1	3	81	58	29	206	94	479	123	888	468	2	1	224	7	1	1		2660	7729	27.1

Table 23. Redfish (*Sebastes fasciatus*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2016 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4				
2	838	10				
3	628	7	2.38	0.82	114	39
4	348	4	0.44	0.37	12	10
5	703	8	0.79	0.42	43	23
6	496	6	4.06	1.84	153	69
7	822	9	179.27	98.58	11227	6174
8	646	7	39.53	21.37	1946	1052
9	314	3	129.66	82.53	3102	1974
10	951	11	30.31	6.23	2196	452
11	806	9	91.32	33.27	5608	2043
12	670	8	379.49	199.89	19372	10203
13	249	3	128.98	78.72	2447	1493
14	602	7	78.54	38.61	3602	1771
15	666	8	109.69	59.15	5566	3001
16	634	7	0.14	0.11	7	5
17	216	2				
18	210	2				
19	414	5				
20	525	6				
21	517	6				
22	533	6				
23	284	3				
24	253	3				
25	226	3				
28	530	6				
29	488	6				
30	1134	11				
31	203	2				
32	238	2				
33	98	2				
34	486	5				
Total < 1460 m.	16070	181	45.24	10.52	55394	12883
Total <730 m.	10555	120	68.88	16.02	55394	12883

Table 24. *Sebastes fasciatus*: age-length key in the 2016 survey.**Males**

Length	age																									total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
12																											
13																											
14																											
15		4																									4
16		8	5																								13
17			4	2																							6
18			3	7																							10
19				7	1																						8
20				1	6																						7
21				1	5	1	1																				8
22					3	2																					5
23						2	3																				5
24					1	2	4																				7
25							5	1																			6
26								3	2	3																	8
27								1	5	1																	7
28									2	5	1		1														9
29										2	3	1			1												7
30																					1						1
31																											
32																											
33																											
34																											
35																											
36																											
37																											
38																											
39																											
40																											
total	1	12	12	18	16	7	17	10	11	4	1	1		1							1						111

Table 24 (cont.) *Sebastes fasciatus*: age-length key in the 2016 survey.**Females**

Lengt h	age																									total			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				
11																													
12																													
13																													
14																													
15		1																										1	
16		7	11																									18	
17			5	9																								14	
18			2	8																								10	
19				7	4																							11	
20				3																								3	
21					1	2																						3	
22					2	1																						3	
23					2		2																					4	
24								2																				2	
25						3	2	2																				7	
26							2	2	1																			5	
27							2	1	1																			4	
28								2	1	2	1			1														7	
29										3	2																	5	
30										2	1		1	1														5	
31										2			1	1		1	1											6	
32												1	2		3													6	
33												1	3	3	3	1	1		1	1								14	
34									1		1		4	3	2	1	2	1										15	
35												1		1	1	1	1								1			6	
36												1			1													2	
37																				1								1	
38																													
39																													
40																													
41																													
42																													
43																													
44																													
45																													
46																													
total		8	18	27	9	6	10	7	4	9	5	4	11	10	10	4	5	1	2	1					1			152	



Table 25. Redfish (*Sebastes fasciatus*) length frequencies ('000) in the 2016 survey.

length	male	female	length	male	female	length	male	female
10			23	6390	3630	36		660
11			24	8460	4300	37		510
12			25	14300	4940	38		20
13			26	12900	3430	39		
14	20	40	27	11090	4220	40		
15	80	50	28	6380	7360			
16	2990	2330	29	3870	9220			
17	4110	2950	30	1200	12910			
18	3530	3770	31	640	9360			
19	3760	4120	32	150	7930			
20	2310	2040	33	90	3950			
21	2960	2320	34		2810			
22	4340	3320	35		1440	Total	89570	97630

Table 26. *Sebastes fasciatus*: frequency at age ('0000) by strata in the 2016 survey.

Age	strata															total	average	
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	W(g)		L(cm)	
1																		
2	6	1	7	6	58	11	51	63	78			1	5		287	65	16	
3	18	3	11	15	165	26	146	176	250			4	4		818	77	17	
4	39	4	10	31	282	51	274	355	686			8			1741	100	18	
5	16	1	4	14	369	61	195	213	463	17	34	38	16		1442	154	21	
6	4		1	7	355	55	141	136	291	56	62	41	38		1186	188	23	
7	4		3	10	1179	184	285	231	600	610	263	203	266	1	3838	233	25	
8	1		1	4	502	81	106	66	176	651	116	149	237		2089	284	27	
9				2	304	56	58	28	97	468	94	107	191		1405	304	27	
10	1			1	179	50	41	18	67	831	107	212	323		1829	382	29	
11				1	84	22	17	10	29	345	49	94	156		806	376	29	
12					58	9	8	2	6	150	9	15	32		288	484	32	
13					104	19	11	4	23	507	20	59	90		838	463	31	
14				1	77	20	15	5	26	399	30	69	97		739	432	31	
15					106	14	8	2	11	357	3	22	52		575	513	33	
16					23	5	4		6	147	3	18	20		227	483	32	
17					26	5	5		6	161	3	18	21		246	490	32	
18					3					14			1		19	576	34	
19					44	4	12	3	3	79	12	13	30		200	504	32	
20					4	1			1	18		1	3		28	528	33	
21																		
22																		
23					3	1	1			18		1			24	626	35	
24																		
25+																		
Sets	7	2	4	6	9	7	3	11	9	8	3	7	8	2	86			
n	89	10	36	92	3925	675	1377	1312	2819	4828	806	1073	1581	2	18626	276	25.6	

Table 27. Juvenile redfish (*Sebastes sp.*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2016 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	0.04	0.04	1	1
2	838	10	0.02	0.02	1	1
3	628	7	1.59	0.65	77	31
4	348	4	0.23	0.21	6	5
5	703	8	0.56	0.33	30	18
6	496	6	1.14	0.23	43	8
7	822	9	4.34	1.63	272	102
8	646	7	0.96	0.33	47	16
9	314	3	4.34	3.31	104	79
10	951	11	7.07	2.03	512	147
11	806	9	8.03	2.22	494	136
12	670	8				
13	249	3				
14	602	7	0.11	0.07	5	3
15	666	8				
16	634	7				
17	216	2				
18	210	2				
19	414	5				
Total <730 m	10555	181	1.98	0.30	1593	242
Total < 1460 m.	16070	120	1.30	0.19	1593	242

Table 28. Juvenile redfish (*Sebastes sp.*) length frequency ('000) in the 2016 survey.

length		length	
6	10	12	5790
7	120	13	15720
8	450	14	11510
9	760	15	5780
10	1230	16	110
11	2010	Total	43490

Table 29. Greenland halibut (*Reinhardtius hippoglossoides*) mean catch per towed mile by strata and the estimated biomass with their standard errors in the 2016 survey.

stratum	Area sq. miles	tow number	catch (Kg)		Biomass (t.)	
			mean	st. error	value	s.e.
1	342	4				
2	838	10				
3	628	7	0.00	0.00	0	0
4	348	4	0.00	0.00	0	0
5	703	8				
6	496	6	0.21	0.19	8	7
7	822	9	0.35	0.23	21	14
8	646	7	0.32	0.21	15	10
9	314	3				
10	951	11	0.02	0.00	1	0
11	806	9	0.28	0.18	17	11
12	670	8	2.59	0.93	133	48
13	249	3	1.37	0.49	26	9
14	602	7	1.94	0.96	89	44
15	666	8	0.96	0.67	49	34
16	634	7	45.31	11.01	2188	531
17	216	2	41.42	10.12	682	166
18	210	2	17.29	1.65	277	26
19	414	5	83.46	18.13	2633	572
20	525	6	47.60	13.48	1904	539
21	517	6	26.85	5.78	1058	227
22	533	6	46.81	14.35	1901	582
23	284	3	31.31	8.65	677	187
24	253	3	56.14	20.95	1082	404
25	226	3	29.40	9.52	506	164
28	530	6	72.31	5.44	2920	220
29	488	6	81.71	13.44	3038	500
30	1134	11	65.54	10.31	5662	891
31	203	2	42.61	2.29	659	36
32	238	2	142.71	10.24	2588	186
33	98	2	90.74	66.31	678	495
34	486	5	157.48	81.06	5831	3002
Total < 1460 m.	16070	181	28.30	2.82	34642	3454
Total < 730 m.	10555	120	7.63	1.0	6139	802

Table 30. Greenland halibut (*Reinhardtius hippoglossoides*): Biomass (t.) by strata in 1988-2016 surveys.

Strata	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	3	6	0	0	0	0	121	0	2	6	3	0	15	10
3	26	31	8	8	18	3	0	21	108	90	367	347	244	384	140
4	144	20	0	15	27	10	0	5	0	23	41	197	207	157	58
5	74	98	0	28	42	1	2	21	36	98	173	409	307	268	66
6	31	18	15	12	8	15	0	31	106	228	361	301	178	265	104
7	85	63	58	189	246	94	214	904	1148	1423	2607	2356	1570	982	429
8	151	222	62	180	379	140	46	333	359	1065	989	1993	1317	1124	878
9	180	165	53	76	323	30	43	178	160	254	471	354	245	355	138
10	108	82	58	172	362	31	235	526	716	862	1369	1528	1602	1743	744
11	45	61	22	106	229	234	236	492	671	627	1227	1320	1088	1021	338
12	405	647	288	761	619	933	1219	1147	2124	2248	3077	3661	2174	1582	1086
13	64	124	218	44	24	143	152	127	298	484	554	978	382	291	521
14	368	302	284	787	847	0	620	410	902	1589	1461	1080	491	877	1081
15	435	169	525	973	643	1378	1492	1768	1448	2689	4055	2987	2687	1616	1233
16	1374	1363	2543	2527	1827	2175	1524	1861	2098	1770	3356	1143	2016	1328	2182
17	266	120	127	415	40	0	742	742	258	525	737	603	498	170	204
18	106	50	506	354	58	0	386	958	191	557	775	932	179	574	694
19	3064	934	1026	1522	3036	1342	1126	1230	971	1564	2603	1015	1774	1120	2194
20															
21															
22															
23															
24															
25															
28															
29															
30															
31															
32															
33															
34															
Total (1-19)	6926	4472	5799	8169	8728	6529	8037	10875	11594	16098	24229	21207	16959	13872	12100
s.e. (1-19)	768	392	809	817	1389	956	678	1226	882	1136	1348	1520	923	776	662
Total (1-34)															
s.e. total (1-34)															

Table 30 (cont.) Greenland halibut (*Reinhardtius hippoglossoides*): Biomass (t.) by strata in 1988-2016 surveys.

Strata	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1		2												
2	0	12	7	9										
3	55	852	416	325	22		4	6						0
4	105	347	91	182	8									0
5	92	254	280	231	92	15	7		6			0	6	
6	21	466	332	61	75	8					0	2	1	8
7	414	1032	596	778	729	524	11	15	4		4	8	12	21
8	507	811	934	910	432	226	31	0		0				15
9	140	464	91	550	487	401	31				9			
10	286	753	1058	850	560	777	25	19	5				1	1
11	277	631	1063	290	503	563	21	32	2	8	2	3		17
12	673	902	1020	978	1246	1393	1217	743	126	332	140	239	522	133
13	61	447	310	219	392	431	217	273	33	19			80	26
14	885	1658	618	573	878	1023	742	62	35	256	28	22	22	89
15	607	1084	1747	1783	3041	1621	771	1224	112	111	89	119	241	49
16	633	1166	1357	1752	2263	1623	2186	2079	1892	1911	1038	2165	3049	2188
17	148	223	429	639	407	411	558	446	236	401	170	298	395	682
18	1062	578	434	606	865	944	540	526	562	325	395	696	687	277
19	248	608	915	971	1042	2035	1414	1231	3700	927	924	1615	1560	2633
20		1647	1061	666	2041	4119	1855	1490	2471	2381	1858	3556	2536	1904
21		729	345	359	742	2161	1569	1367	1258	1496	1952	1210	4577	1058
22		454	510	845	551	883	1970	2410	1226	714	1220	1201	4707	1901
23		407	42	130	495	1144	475	715	464	280	534	576	1623	677
24		208	328	555	588	1082	1185	461	1749	652	379	541	846	1082
25		2377	993	322	436	441	732	473	593	459	392	968	450	506
28		1728	1162	1239	2857	3920	3153	1994	4188	2244	2150	1956	5627	2920
29		2300	1330	674	1488	3335	2618	2091	2044	2237	2060	4603	7198	3038
30		2024	602	2772	4719	5066	7692	5381	5060	4738	4685	3915	14974	5662
31		546	186	354	347	385	944	319	414	82	461	754	1631	659
32		599	596	1357	1040	1755	2391	1539	1916	1097	1244	2610	4308	2588
33		358	147	608	166	698	309	408	707	320	594	475	542	678
34		2675	1460	1886	2222	2627	3377	1790	3454	2514	3063	1756	2585	5831
														6139
Total (1-19)	6214	12292	11698	11708	13040	11997	7777	6656	6713	4291	2799	5168	6576	802
s.e. (1-19)	611	400	630	609	786	583	363	814	2728	338	345	542	1246	34642
Total (1-34)		28343	21515	24357	31723	39614	36047	27096	32257	23505	23391	29288	58180	3454
s.e. (1-34)		1335	933	1263	1270	1312	1538	1791	3862	1416	1847	1880	4046	28503

Table 31. Greenland halibut (*Reinhardtius hippoglossoides*) age-length key in the 2016 survey.**MALE**

Length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
12-13	10																	10
14-15	7																	7
16-17																		
18-19		1																1
20-21		1																1
22-23																		
24-25			1															1
26-27																		
28-29																		
30-31																		
32-33																		
34-35					5													5
36-37					5	2												7
38-39					10	6												16
40-41					7	13												20
42-43						19	1											20
44-45					4	15	2											21
46-47						16	4											20
48-49						10	12											22
50-51						5	17											22
52-53						1	19	2										22
54-55							14	4	1	1								20
56-57							11	7	2									20
58-59							3	4	3	1								11
60-61							1		2	4								7
62-63									1	2								3
64-65										1								1
total	17	2	1		31	87	84	17	9	9								257

Table 31 (cont.) Greenland halibut (*Reinhardtius hippoglossoides*) age-length key in the 2016 survey.**FEMALE**

length cm	age																total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+		
12-13	4																4	
14-15	7																7	
16-17																		
18-19																		
20-21																		
22-23		1															1	
24-25																		
26-27																		
28-29																		
30-31																		
32-33					1												1	
34-35					1												1	
36-37				1	9												10	
38-39					7	8											15	
40-41					7	14											21	
42-43					3	17											20	
44-45					1	20	2										23	
46-47						18	3										21	
48-49						10	12										22	
50-51						2	18	2									22	
52-53							17	4									21	
54-55							9	13	2								24	
56-57							8	14	3								25	
58-59							3	6	8	2	1						20	
60-61								1	7	9	4						21	
62-63								1	2	13	3	2					21	
64-65									1	6	8	5					20	
66-67									1	6	5	5	2	1			20	
68-69										3	7	3	1		1		15	
70-71											1	3	6	1		1	12	
72-73											1	2	7	4	2		16	
74-75													2	1	1		4	
76-77																1	1	
78-79													2	2	2	1	7	
80-81															1	2	3	
82-83														2	2	2	6	
84-85																2	2	
86-87																1	1	
88-89																		
90-91																	1	1
total	11	1		1	29	89	72	41	24	39	30	20	20	11	9	11	408	

Table 32. Greenland halibut (*Reinhardtius hippoglossoides*) length frequency ('000) in the 2016 survey.

depths < 730 m

length	male	female	length	male	female	length	male	female
12-13	61	28	34-35	7	9	56-57	27	328
14-15	48	54	36-37	28	30	58-59	20	210
16-17			38-39	53	56	60-61	7	100
18-19			40-41	140	80	62-63		48
20-21	9		42-43	150	155	64-65		36
22-23		6	44-45	177	228	66-67		20
24-25	7		46-47	231	459	68-69		13
26-27			48-49	293	422	70-71		21
28-29			50-51	275	590	72-73		
30-31	7		52-53	155	595	74-75		7
32-33			54-55	83	490	total	1775	3985

depths < 1460 m

length	Indet.	male	female	length	male	female	length	male	female
12-13	21	61	28	42-43	377	534	72-73		135
14-15		48	54	44-45	531	841	74-75		49
16-17				46-47	843	1253	76-77		7
18-19		7		48-49	1001	1783	78-79		57
20-21		9		50-51	1104	2910	80-81		25
22-23			6	52-53	859	3195	82-83		54
24-25		7		54-55	493	3024	84-85		14
26-27				56-57	294	2492	86-87		7
28-29				58-59	155	1662	88-89		
30-31		7		60-61	60	1131	90-91		9
32-33			8	62-63	25	534			
34-35		40	9	64-65	8	353			
36-37		35	95	66-67		289			
38-39		133	149	68-69		127			
40-41		281	230	70-71		97	total	6399	21161



Table 33. Greenland halibut (*Reinhardtius hippoglossoides*) frequency at age ('000) and strata in the 2016 survey.

age	strata																												total	mean		
	3	4	6	7	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	28	29	30	31	32	33	34		weigh (g)	length(cm)	
1	10	10	10	60	30	40	20	10			10	10			10															210	16	13
2			10										10										10							20	61	20
3							10																							10	106	25
4																														10	374	37
5								20				70	70		100	30	10	10		20		70	50	50		50	10	140	710	508	40	
6				10				60	10	10	660	310	50	720	310	120	140	60	230	50	660	380	520	40	380	100	1160	5970	781	46		
7		10	10	10			10	30	10	30	20	790	290	80	970	610	360	460	160	450	150	1140	920	1480	170	690	230	2230	11310	1147	52	
8								20	10	10	240	60	50	340	310	170	240	90	170	80	430	440	720	90	350	110	890	4820	1390	55		
9								10				60	10	20	110	110	70	120	50	40	30	120	150	360	40	160	40	300	1800	1645	58	
10												30		10	70	60	40	110	30	20	10	70	130	340	50	120	20	160	1300	1963	62	
11												20		10	30	30	20	60	10	10	10	40	70	180	20	60	10	70	660	2118	63	
12												10			10	10	30					20	30	80	20	20		20	280	2452	66	
13													10						10	10			10	30	60	10	20		20	190	3177	72
14																							10	40		20		10	100	3615	74	
15																			10	10			10	30		20			80	3957	77	
16+																10		10	10				10	20	30		10		90	4820	82	
Sets	1	1	3	5	3	5	5	6	3	3	4	7	2	2	5	6	6	6	3	3	3	6	6	11	2	2	2	5	116	1234		
n	10	10	30	70	40	40	40	140	30	50	50	1900	750	230	2380	1470	800	1220	430	940	340	2570	2250	3900	430	1890	530	5010	27550	3400	52.2	

Table 34. Greenland halibut (*Reinhardtius hippoglossoides*) Abundance at age ('000) in the 1991-2016 survey.

<730 m. strata (1-19)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	1302	1677	1423	1429	9978	4699	2674	2200	852	3014	6459	3282
2	207	1260	1245	996	2045	6408	3036	1716	563	235	1153	2364
3	348	447	777	1365	1793	1942	4822	6180	2419	479	1456	2248
4	1054	1023	692	1435	1535	2442	5225	8843	8419	1741	799	1342
5	2307	1852	1021	1545	2136	3380	5714	9919	10787	5703	2242	3045
6	1291	2249	1545	2385	4099	4680	6800	9085	10119	11336	6262	4498
7	2212	1947	1627	2139	3029	2001	4014	6304	4467	4346	5328	4610
8	534	1054	1266	1180	1706	1299	1731	2108	1466	1865	2584	1025
9	462	468	776	631	1052	341	528	600	280	361	147	104
10	352	273	213	219	209	70	177	157	82	92	36	48
11	141	138	104	90	53	21	23	27	6	44	5	16
12	12	67	38	47	18	31	17	6	3	0	0	6
13	0	25	21	18	0	0	17	16	3	0	0	0
14	0	12	9	0	5	4	0	0	5	0	0	0
15	15	0	0	0	0	5	6	0	0	0	0	0
16+	8	0	0	0	0	0	9	0	0	0	0	0
Total	10245	12490	10757	13479	27659	27323	34792	47160	39470	29216	26471	22587
Freq 10+	528	515	385	374	285	131	249	206	99	136	41	70

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	1768	1762	437	550	301	157	61	38			6	20	40	211
2	804	2644	652	312	64	78	7	9		8			13	15
3	489	3517	2554	525	455	121	30	29		36	4	3		7
4	1217	1585	2007	949	275	155	81	47	60	87	112	97	48	3
5	1991	5601	5537	4800	2765	1203	606	894	880	822	643	1089	719	264
6	2362	6271	6105	6002	5928	4586	2905	2469	2930	1827	1733	2315	3440	1826
7	1552	2040	2345	2665	4632	4950	3255	2365	2850	1406	718	1566	2091	2256
8	375	518	491	623	1217	909	713	715	570	349	158	283	493	733
9	105	233	89	180	247	283	153	259	160	112	39	63	120	219
10	79	107	97	143	165	210	215	137	110	83	44	66	115	123
11	15	63	44	103	62	100	62	50		54	12	22	50	64
12	4	38	15	45	38	43	47	22	10	15	10	9	12	27
13	0	5	3	10	5	18	35	10		10	6	12	2	17
14	0	3	3		2	10	12	2		10	2	6		5
15	0	3	3			4	0			3	4	3		3
16+	0	3	3			1	0			6	1	2		2
Total	10762	24390	20374	16907	16156	12825	8182	7046	7420	4823	3492	5156	7143	5775
Freq 10+	98	222	168	301	272	386	371	221	120	181	79	54	179	241

Table 34 (cont.) Greenland halibut (*Reinhardtius hippoglossoides*) Abundance at age ('000) in the 1991- 2016 survey.

< 1460 m. strata (1-34)

Age	Year												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	1710	438	550	310	160	60	38			6	20	40	210
2	2680	652	320	60	80	10	9		8			10	20
3	3580	2561	540	480	120	40	29	10	46	15	8	10	10
4	1880	2117	1110	360	200	100	137	110	200	393	200	150	10
5	8330	6470	7160	4700	2480	1380	2447	2280	2964	2583	3405	3110	710
6	11210	8314	10480	11130	11020	8330	7356	8260	7073	8608	9839	18180	5970
7	6060	4182	5730	10490	15340	13990	9587	10460	6124	5538	8415	17190	11310
8	1790	1206	1700	3530	3890	4340	3063	3160	2349	2005	1989	5650	4820
9	890	318	510	880	1400	1140	1200	1370	920	643	548	2040	1800
10	450	500	440	720	1060	1260	1019	1500	906	1026	780	1730	1300
11	320	282	370	370	540	440	383	560	587	412	406	960	660
12	200	161	180	210	300	340	213	330	233	349	182	360	280
13	180	74	60	80	160	310	151	270	126	153	235	210	190
14	70	47	30	60	120	170	114	140	114	73	131	230	100
15	80	9	10	20	80	50	59	50	75	103	55	150	80
16+	60	9	10	10	70	70	55	40	140	94	81	120	90
total	39490	27340	29200	33410	37020	32030	25860	28539	21864	22002	26294	50140	27560
Freq 10+	1360	1082	1100	1470	2330	2640	1994	2890	2181	1184	1090	3760	2700

Table 35. Roughhead grenadier (*Macrourus berglax*) mean catch per towed mile by strata and the estimated biomass with their standard errors in the 2016 survey.

stratum	Area sq. miles	tow number	catch per tow (Kg)		Biomass (t.)	
			mean	st. error	value	s.e.
1	342	4				
2	838	10				
3	628	7				
4	348	4				
5	703	8				
6	496	6				
7	822	9				
8	646	7				
9	314	3				
10	951	11				
11	806	9				
12	670	8	0.56	0.23	29	12
13	249	3	0.12	0.12	2	2
14	602	7	0.93	0.84	42	39
15	666	8	0.40	0.21	20	11
16	634	7	1.65	0.63	80	30
17	216	2	3.78	2.35	62	38
18	210	2	6.27	3.43	100	55
19	414	5	1.17	0.44	37	14
20	525	6	3.01	0.54	120	22
21	517	6	10.01	1.89	394	74
22	533	6	16.47	5.86	669	238
23	284	3	11.99	6.18	259	134
24	253	3	2.73	1.40	53	27
25	226	3	5.83	2.84	100	49
28	530	6	2.22	0.77	89	31
29	488	6	4.13	0.60	154	22
30	1134	11	13.16	2.82	1137	243
31	203	2	9.87	4.60	153	71
32	238	2	5.06	0.75	92	14
33	98	2	11.85	8.82	89	66
34	486	5	4.17	0.89	154	33
Total < 1460 m.	16070	181	3.13	0.33	3836	403
Total <740 m.	10555	120	0.46	0.11	373	86

Table 36. Roughhead grenadier (*Macrourus berglax*) biomass by strata in 1988-2016 surveys.

Stratum	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
1																
2								8								
3																
4																9
5																
6									22							
7					0								3	0		0
8		10		1					11	3		7		16	2	13
9	47	4		5	28	21	3	21	153	18	40	45	29	29		30
10	1								6	1		18	68	18		0
11												3	8	6		
12	112	103	40	108	100	413	55	126	46	137	55	191	81	236	154	165
13	21	64	18	18	60	18	32	75	5	18	78	92	50	116	121	123
14	200	145	107	85	139		73	67	270	77	194	135	103	292	124	346
15	92	5	29	64	52	321	82	180	84	69	101	72	103	60	16	87
16	349	140	212	229	432	1333	523	256	397	211	405	150	225	338	272	352
17	134	45	31	180	123		98	129	27	116	204	96	67	370	380	101
18	311	128	143	356	215		756	414	154	224	189	313	219	383	27	877
19	743	227	273	289	429	915	352	282	187	322	424	129	92	216	116	245
20																
21																
22																
23																
24																
25																
28																
29																
30																
31																
32																
33																
34																
total (1-19)	2009	871	852	1335	1577	3021	1975	1558	1362	1197	1691	1250	1047	2079	1211	2348
s.e. (1-19)	264	142	149	250	270	487	169	223	277	169	243	338	196	284	176	611
total																
s.e. total (1-34)																

Table 36 (cont.) Roughhead grenadier (*Macrourus berglax*) biomass by strata in 1988-2016 surveys.

Stratum	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1													
2													
3	10												
4													
5													
6													
7	10												
8	28	65	13										
9	282	82	181	17	39								
10	48	38	21										
11	3	2											
12	292	207	97	22	92	73	60	0	27	39	17	14	29
13	299	94	154	80	108	25	97	43	6			0	2
14	877	379	362	223	539	1	3	10	67	28	14	27	42
15	259	16	85	55	12		132	8		34	4	14	20
16	594	426	1391	242	493	213	79	112	134	122	102	26	80
17	244	124	603	70	385	40	278	38	111	134	52	142	62
18	423	588	435	491	610	194	685	445	235	422	173	202	100
19	228	366	592	167	683	235	69	73	32	29	36	51	37
20	419	182	353	144	269	130	355	78	88	47	101	25	120
21	1432	996	763	755	1114	528	1135	1606	768	299	375	198	394
22	1095	1115	1545	608	1735	1216	967	1610	945	537	747	658	669
23	897	463	342	332	399	305	388	506	325	382	168	251	259
24	137	1030	419	165	152	146	207	222	218	97	160	87	53
25	344	870	817	197	391	362	149	98	146	260	326	226	100
28	425	695	610	299	360	273	338	137	68	70	29	57	89
29	3113	1012	445	527	555	424	509	163	309	200	437	265	154
30	3553	2869	1108	2139	3356	2560	2816	2965	1582	1224	836	887	1137
31	650	327	235	242	176	225	107	295	137	60	199	270	153
32	274	267	132	86	222	197	242	172	63	100	80	117	92
33	118	17	122	105	38	12	57	112	54	22	42	39	89
34	1131	330	511	305	410	144	419	145	162	191	212	146	154
total (1-19)	3597	2387	3933	1367	2961	782	1403	729	612	807	399	478	373
s.e. (1-19)	362	281	700	314	611	209	201	409	258	141	113	147	86
total	17184	12560	11336	7270	12139	7304	9091	8838	5476	4298	4111	3702	3836
s.e. total (1-34)	1616	1420	1167	808	659	478	930	1212	678	475	407	300	403

Table 37. Roughhead grenadier (*Macrourus berglax*) age-length key in the 2016 survey.**MALE**

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
1																	
2																	
3																	
4		4															4
5		7															7
6		17															17
7		3	5														8
8			17														17
9			13	3													16
10				15	5												20
11				20	1												21
12				7	11	2											20
13					9	7											16
14					6	14	1										21
15					1	8	11										20
16						1	10	7	1								19
17							6	12	4								22
18							1	6	9	3							19
19								1	3	9	2		1				16
20									1	9	7	2	1				20
21										3	3	6					12
22											1	2					3
23															1		1
24													1				1
total		31	35	45	33	32	29	26	18	24	13	10	3	1			300

Table 37 (cont.) Roughhead grenadier (*Macrourus berglax*) age-length key in the 2016 survey.**FEMALE**

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
1																	
2																	
3																	
4																	
5		13															13
6		18															18
7		3	1														4
8		1	17														18
9			13	3													16
10			1	18													19
11				5	6												11
12				2	8	4											14
13					12	5											17
14					7	6											13
15						12	6	1									19
16							13	5									18
17							4	9	2								15
18								2	6	1							9
19								1	6	4	2	1					14
20									1	3	5						9
21										2	8						10
22										2	5	4	1				12
23											3	6					9
24												4	7	2			13
25												1	6	4	2		13
26													5	7	7		19
27													2	4	6		12
28													1	4	7	3	15
29														4	1	4	9
30															4	14	18
31															1	8	9
32																5	5
33																3	3
34																	
35																1	1
36																1	1
37																2	2
38																	
39																	
40																1	1
total		35	32	28	33	27	23	18	15	12	23	16	22	25	28	42	379



Table 38. Roughhead grenadier (*Macrourus berglax*) length frequency ('000) in the 2016 survey.

## depths &lt; 730 m. strata (1-19)

length	indet.	male	female	length	indet.	male	female	length	indet.	male	female
2	14			13		7	8	24			7
3				14		13	14	25			22
4	6	30		15		7	13	26			15
5	9	26	30	16		26	13	27			16
6		69	75	17		35	22	28			9
7		9	8	18		30	7	29			15
8		9	40	19		16	8	30			
9		8	23	20		15	23	31			9
10		30	40	21		9	7				
11				22			15				
12			8	23			36	Total	29	339	483

## depths &lt; 1460 m. strata (1-34)

length	indet.	male	female	length	indet.	male	female	length	indet.	male	female
2	14			17		343	143	32			48
3	20			18		343	70	33			21
4	6	30		19		161	112	34			
5	32	56	94	20		183	75	35			9
6		176	192	21		97	72	36			8
7		43	53	22		20	102	37			19
8		161	156	23		8	66	38			
9		127	142	24		4	96	39			
10		282	170	25			110	40			8
11		273	130	26			159				
12		177	99	27			92				
13		189	131	28			123				
14		368	125	29			80				
15		344	167	30			144				
16		368	153	31			75	Total	72	3752	3242

Table 39. Roughhead grenadier (*Macrourus berglax*) frequency ('000) at age and strata in the 2016 survey.

age	strata																				total	mean			
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	28	29	30	31	32	33		34	Weight (g)	Length (cm)	
1		1	7		7												20					36	2	3	
2	26	5	7	7	52	46	66	46	50	36	58	17	29	17	7	42	97	19		20		648	21	6	
3					15	14	47	5	77	64	75	16	23	31	18	44	132			7	8	575	58	8	
4					14	15	28	11	66	115	109	16	5	33	33	74	263			7	10	20	818	113	11
5	2	0	2	7	4	2	13	3	40	111	58	9	10	25	25	52	253	4	5	11	61	697	188	13	
6	9	0	5	7	6	0	5	4	31	128	54	15	9	25	14	45	253	15	7	6	95	733	258	14	
7	2	3	21	9	4	2	3	4	18	86	61	35	8	28	13	51	267	21	21	4	52	713	358	16	
8	2	2	21	13	1	5	11	4	9	57	63	42	3	17	9	34	220	17	34	4	35	602	433	17	
9	4	0	6	8	1	3	15	1	4	36	43	35	4	14	2	22	141	13	27	8	18	405	512	18	
10	2		5	2	4	8	14	1	1	26	32	36	5	12	1	25	124	11	10	7	21	347	646	19	
11	10		6		6	7	16	3		25	17	36	3	7	6	17	90	5	8	15	19	294	766	21	
12	9		3		10	7	8	3	2	20	26	17	2	10	3	7	62	1		11	4	204	924	22	
13			4		5	2	8	5	7	27	32	7	6	13	7	12	46	4	3	8	4	200	1254	25	
14			1		11	2	8	5	11	32	32	5	6	14	3	5	61	4	4	3	9	214	1551	27	
15					6	5	9	4	12	33	32	5	7	13	4	2	74	4	6	5	9	228	1713	27	
16+					7	9			10	17	117	43	1	1	11		97	19	8	8	4	352	2493	31	
Sets	2	1	4	2	4	2	2	3	5	6	6	3	3	3	6	6	11	2	2	2	5	85			
n	65	13	87	53	154	128	251	99	339	813	808	333	120	259	155	433	2198	135	139	127	356	7066	520	16	

Table 40. Roughhead grenadier (*Macrourus berglax*). Abundance at age ('000) in the 1994 - 2016 survey.

&lt;730 m. strata (1-19)

age	Year																						
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1			129		51	15	3	63	39	467	216	109	10	12	5	3	30	18	9	14	16	18	15
2	46	107	56	46	128	36	77	208	189	2139	466	267	353	23	79	15	73	48	49	31	63	112	255
3	136	209	110	186	227	49	108	271	220	1077	3119	362	438	59	228	31	232	76	79	26	25	73	81
4	487	467	224	153	236	216	50	120	57	672	1009	762	392	35	219	42	107	69	14	27	30	41	68
5	507	861	351	157	138	199	283	283	108	618	877	628	501	87	170	25	81	39	25	22	5	21	34
6	570	592	586	450	346	247	277	445	189	635	1105	544	561	202	285	96	66	54	24	15	0	32	36
7	566		351	613	725	445	218	540	290	843	810	499	719	268	458	94	128	63	40	32	8	40	49
8	493	458	338	162	907	616	231	505	283	901	955	593	519	298	743	168	446	119	98	118	16	63	59
9	379	263	216	158	250	422	339	510	241	535	962	413	487	178	536	87	492	199	124	126	37	58	39
10	181	113	264	98	226	197	338	666	266	474	896	579	577	345	471	48	347	251	129	203	52	99	37
11	109	35	254	151	135	109	72	231	203	472	465	371	727	172	431	82	224	122	154	233	88	86	47
12	82	23	93	164	182	80	95	131	244	236	392	167	396	108	162	56	113	70	84	115	90	58	39
13	40	19	38	124	152	55	57	80	75	88	147	227	293	95	318	56	62	43	44	25	52	56	24
14	15	5	34	42	76	61	55	104	63	31	89	191	211	77	79	49	61	33	23	32	22	23	28
15	27	15	4	42	48	33	23	55	19	18	18	21	195	39	179	43	21	18	14	12	15	21	23
16+	9		10	18	34	3	33	76	64	73	60	33	215	72	116	94	19	25	3	18	14	11	16
Total	3647	3685	3060	2564	3862	2783	2259	4288	2550	9278	11584	5765	6593	2069	4479	988	2501	1247	911	1049	533	811	851

Table 40 (cont.). Roughhead grenadier (*Macrourus berglax*). Abundance at age ('000) in the 1994 - 2016 survey.

&lt; 1460 m. strata (1-34)

Age	Year												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	461	391	34	51	52	19	37	39	52	71	103	70	36
2	856	719	602	81	549	143	125	172	177	178	244	501	648
3	6380	1420	855	222	1086	306	622	395	405	279	221	482	575
4	2989	2303	1532	321	1268	419	616	509	349	320	298	531	818
5	2576	2425	1399	543	1269	253	755	587	409	316	232	503	697
6	3062	2695	2316	1063	1578	954	1084	775	348	435	346	657	733
7	2552	2069	2351	1209	1954	936	1054	1009	572	533	344	688	713
8	3215	2418	1184	1285	2010	1680	2392	1466	1052	836	507	593	602
9	2670	1442	1737	770	1649	866	1451	1241	919	610	436	449	405
10	2282	1666	1643	1109	1454	476	911	1160	517	638	300	442	347
11	1863	1123	1409	697	1333	824	685	652	650	583	350	295	294
12	1374	676	739	473	626	564	565	660	491	317	441	219	204
13	670	1090	823	412	1170	563	461	516	429	116	350	316	200
14	416	1007	566	432	348	490	510	570	307	247	259	125	214
15	178	298	478	272	718	434	255	460	215	138	237	280	228
16+	1130	1113	1069	944	887	959	692	1044	373	443	372	338	352
total	32674	22855	18737	9884	17951	9886	12215	11255	7265	6059	5039	6487	7066

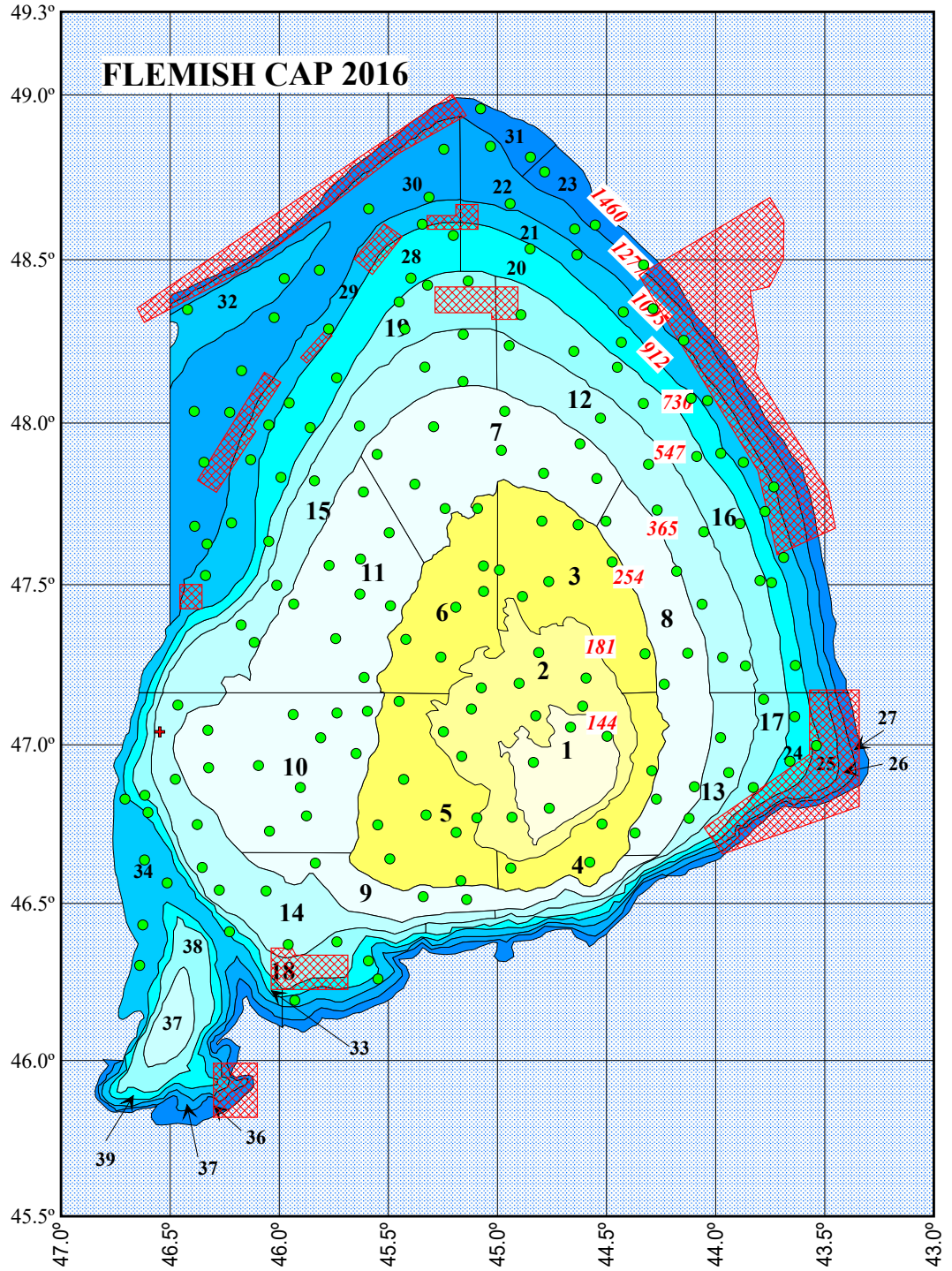


Fig. 1. Haul positions in the Flemish Cap survey 2016.

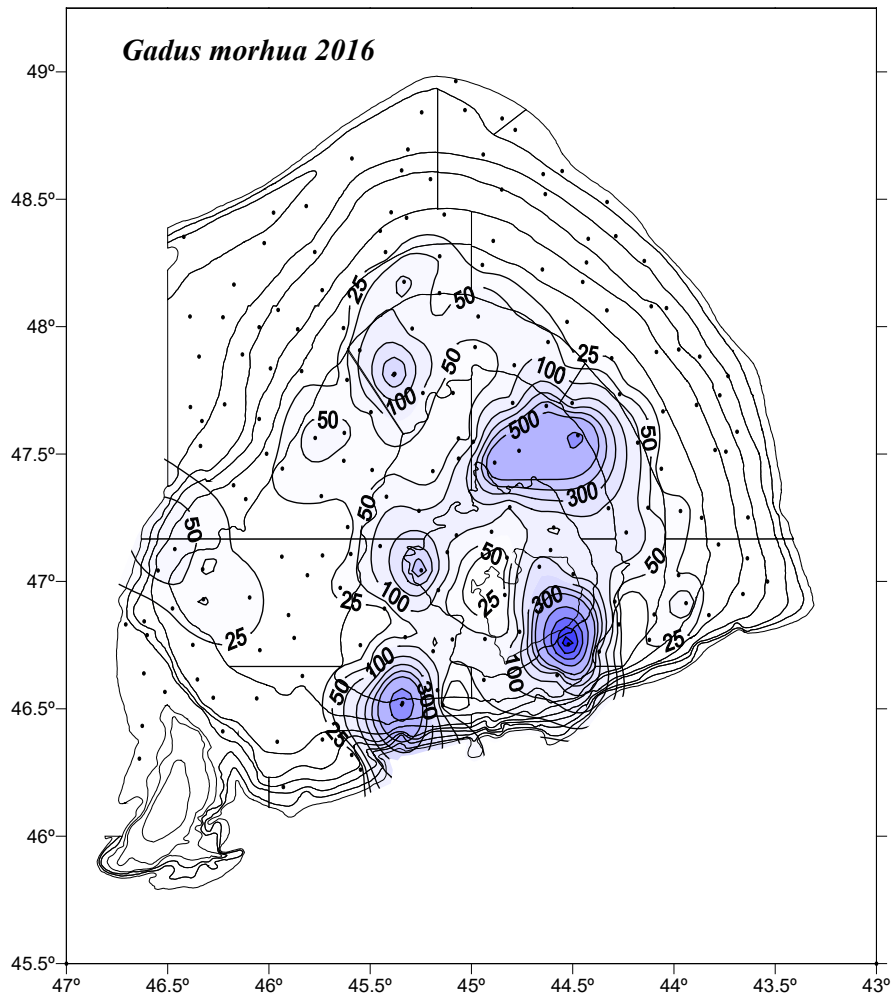


Fig. 2. Cod (*Gadus morhua*) catch (kg.) distribution in the 2016 survey.

### Cod 3M

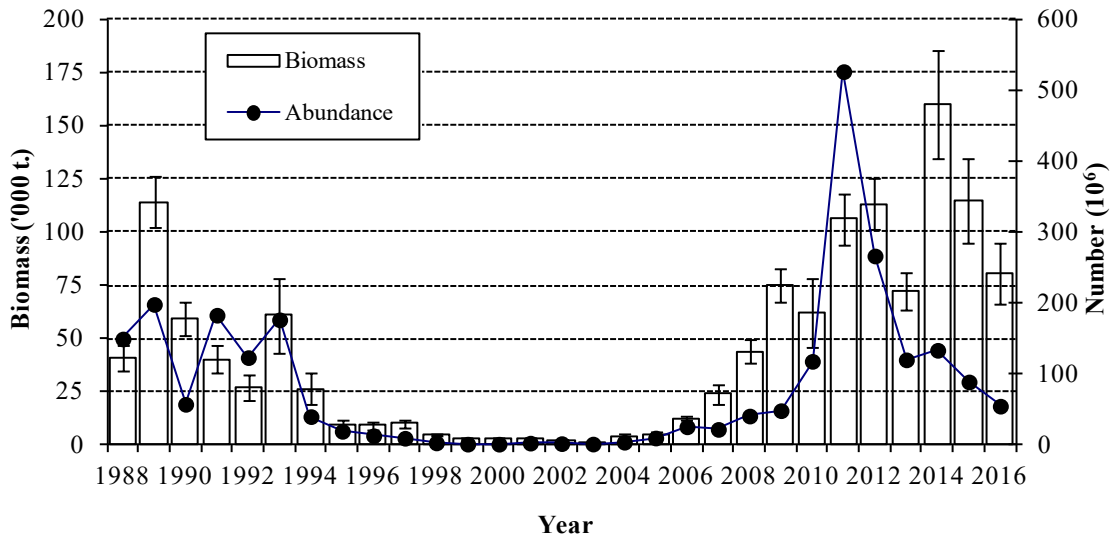


Fig. 3. Cod biomass (t.) ± S.E. and abundance 1988-2016.

### 3M Cod age dsitribution

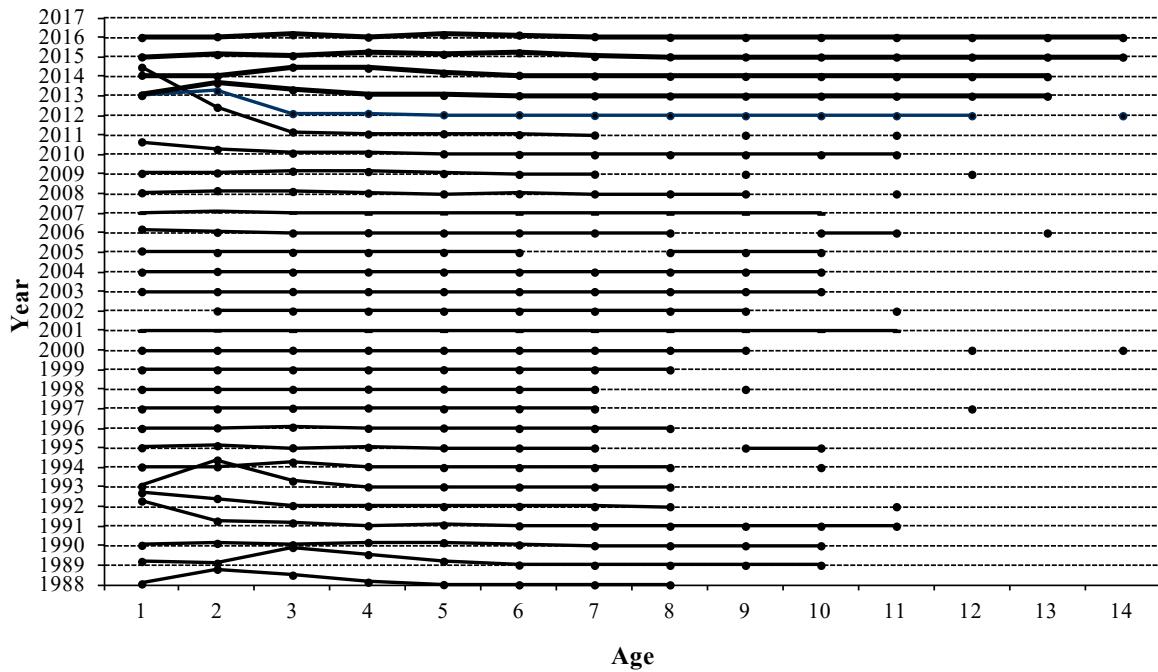


Fig. 4. Cod age distribution in Flemish Cap NAFO 3M 1988-2016.

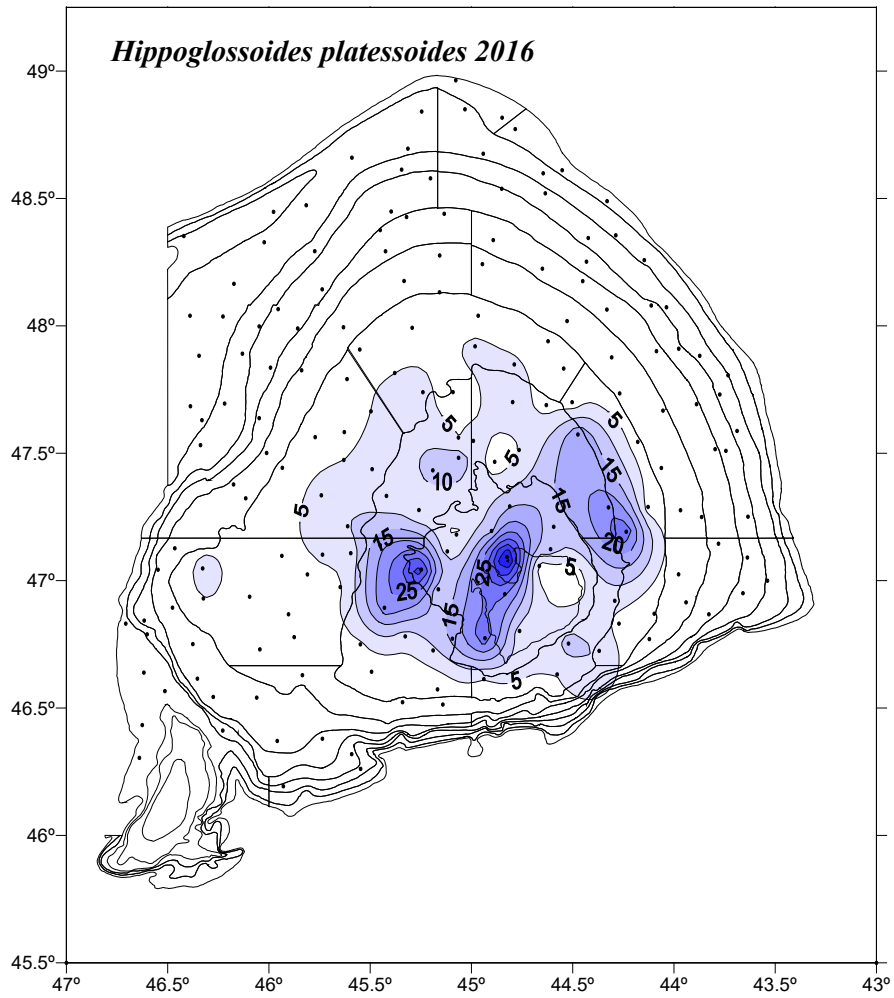


Fig. 5. American plaice (*Hippoglossoides platessoides*) catch (kg) distribution in 2016 survey.



American plaice 3M

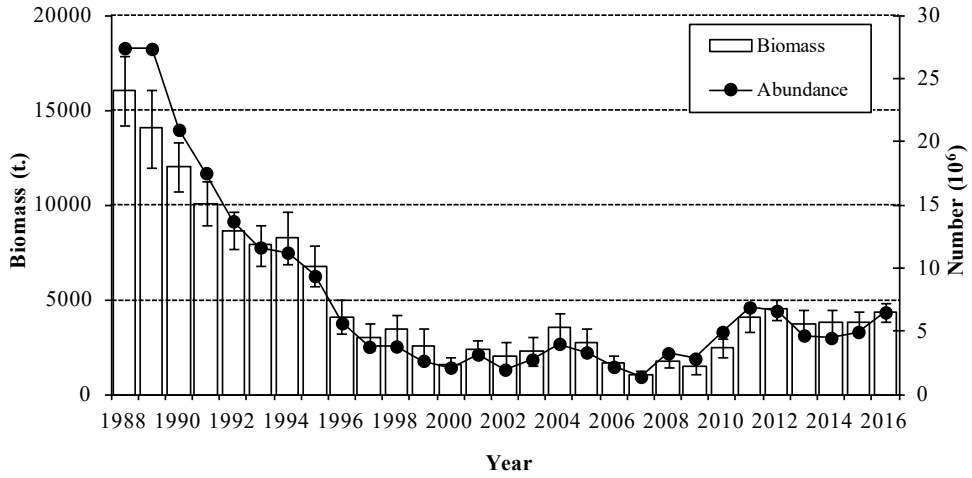


Fig. 6. American plaice (*Hippoglossoides platessoides*) biomass (t.) ± S.E. and abundance 1988-2016.

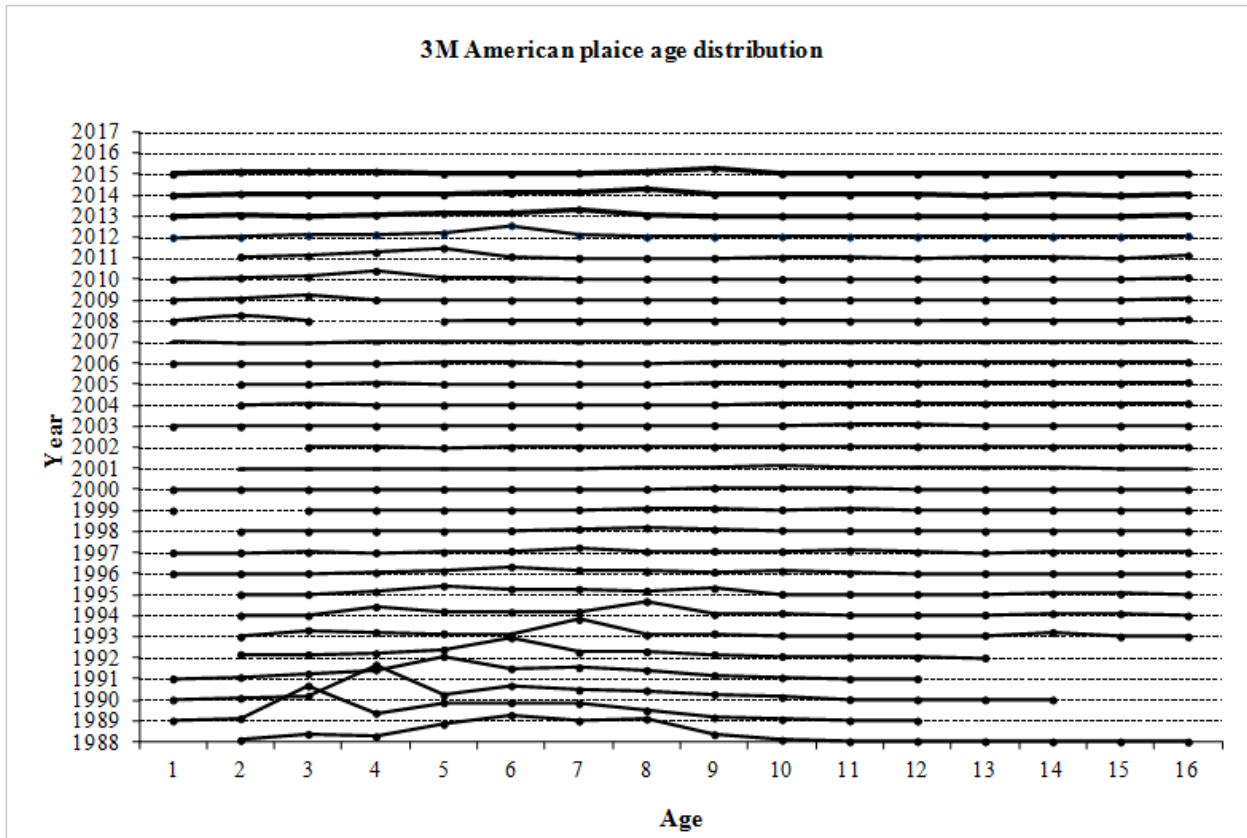


Fig. 7. American plaice age distribution on Flemish Cap, NAFO Div. 3M: 1988-2016.

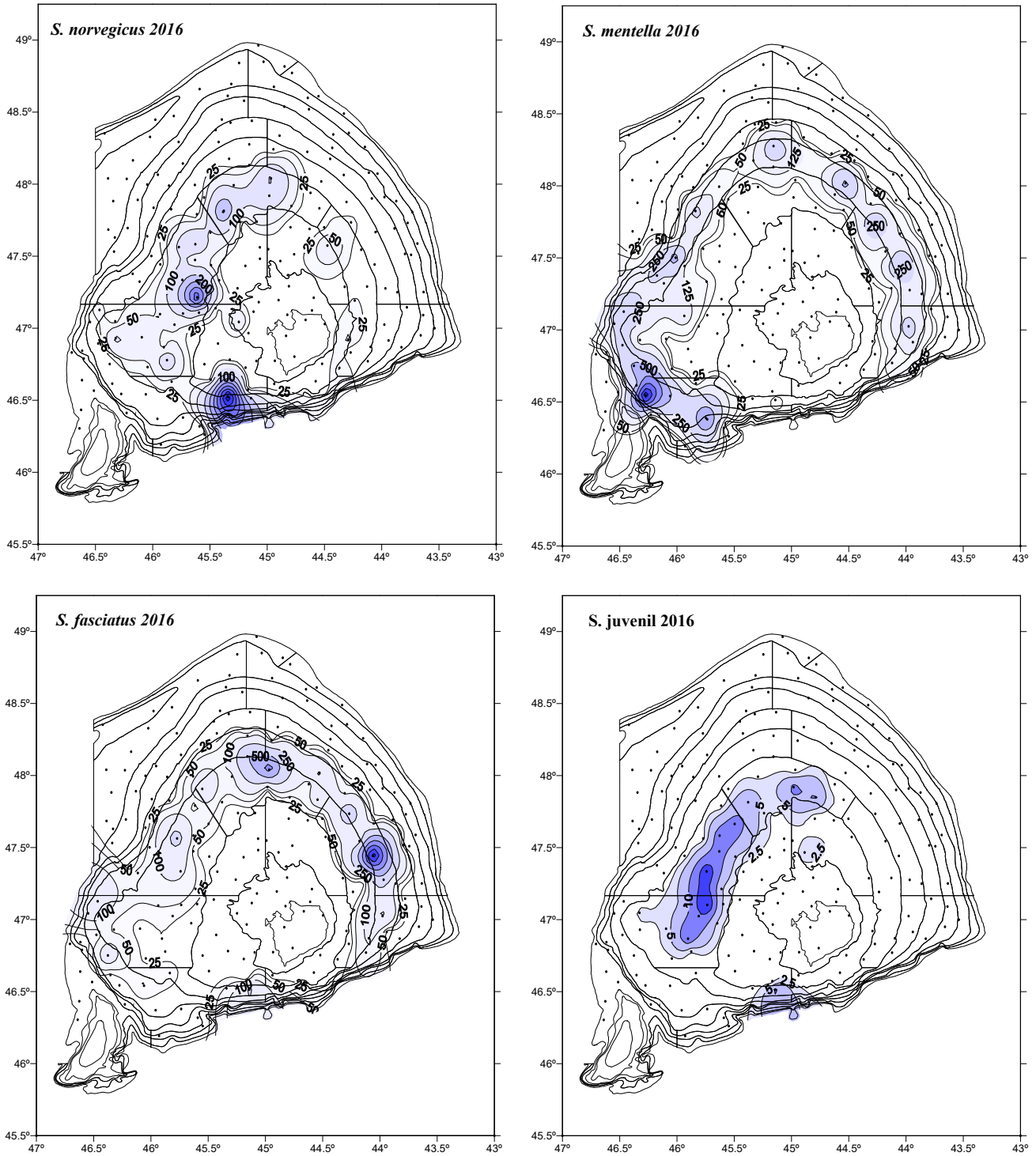


Fig. 8. Catch distribution (kg) of *S. marinus*, *S. mentella*, *S. fasciatus* and *S. juvenil* in 2016 survey.

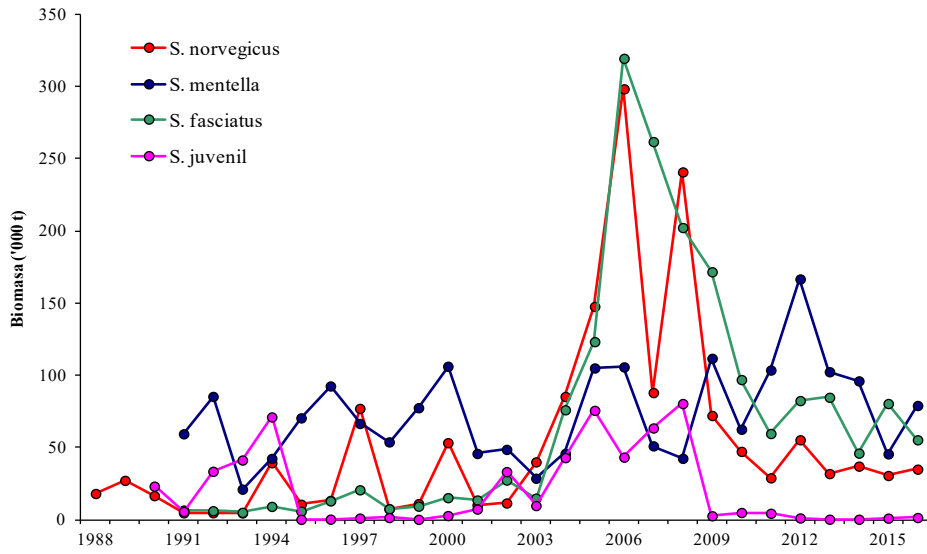


Fig. 9. Redfish species biomass (t.) 1988-2016.

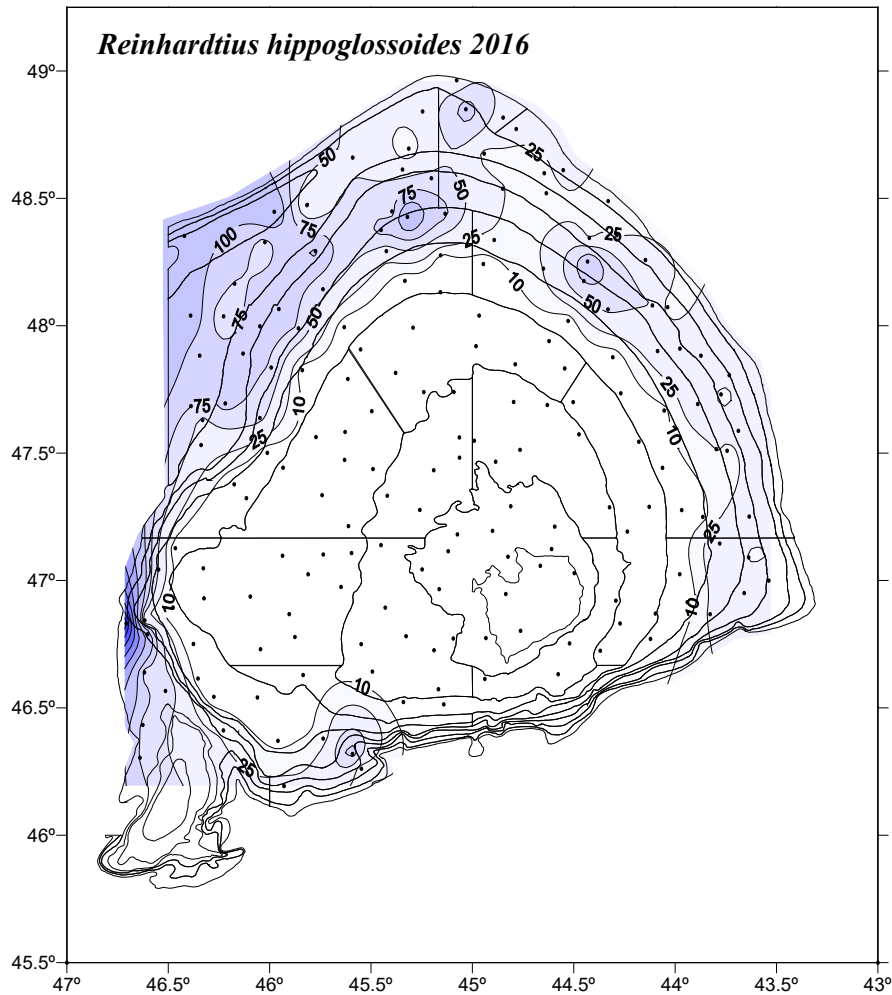


Fig. 10. Greenland halibut (*Reinhardtius hippoglossoides*) catch distribution (kg) in 2016 survey.

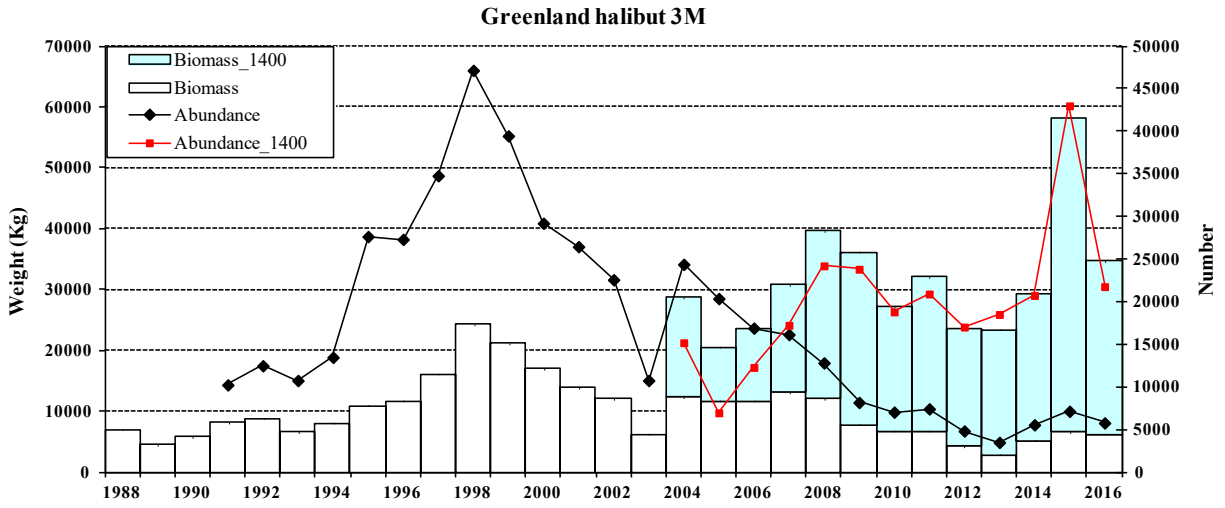


Fig. 11. Greenland halibut (*Reinhardtius hippoglossoides*) Biomass (t.) ± S.E. and abundance 1988-2016.

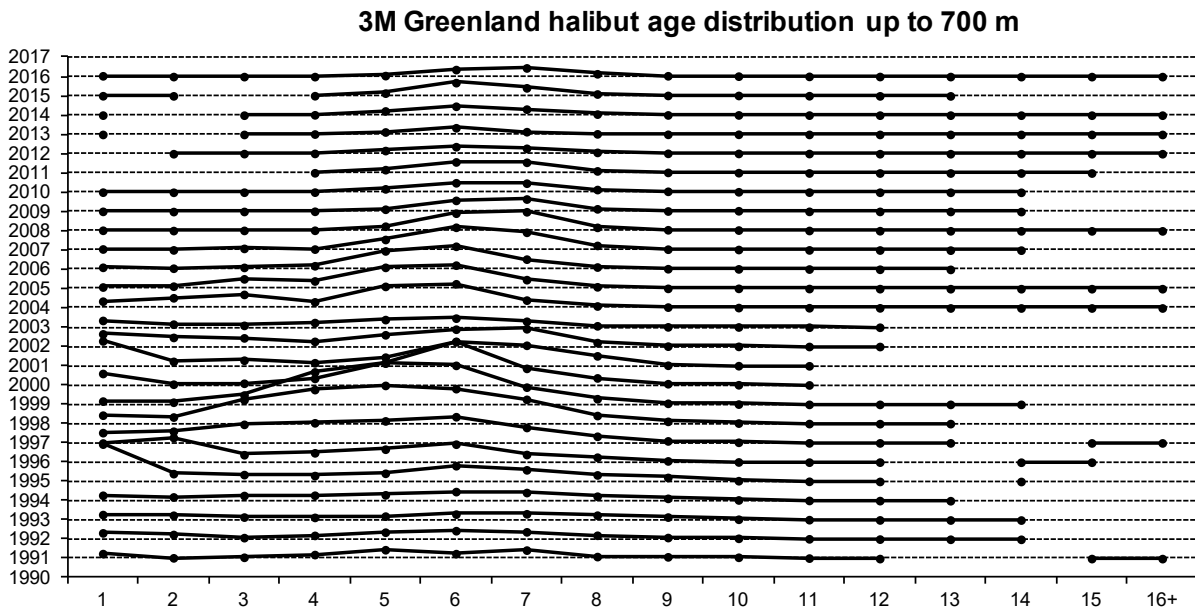


Fig. 12. Greenland halibut age distribution on Flemish Cap, NAFO Div. 3M: 1988-2016.

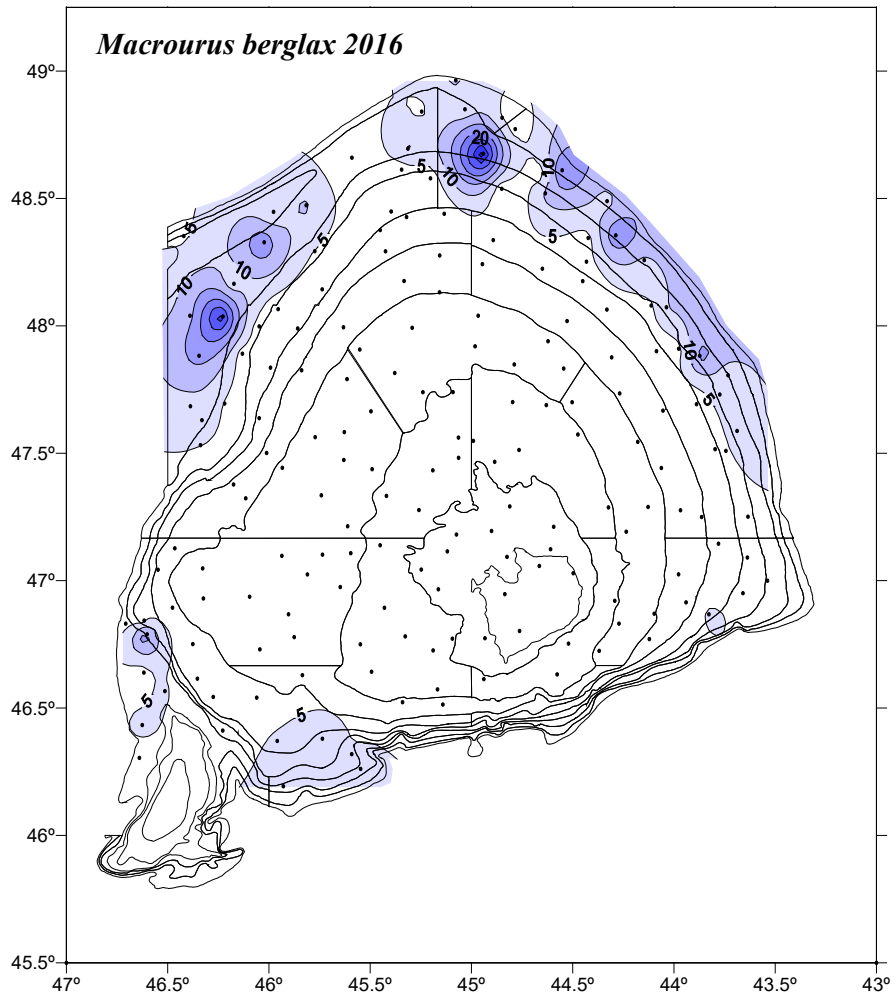


Fig. 13. Roughhead grenadier (*Macrourus berglax*) catch distribution (kg) in the 2016 survey.

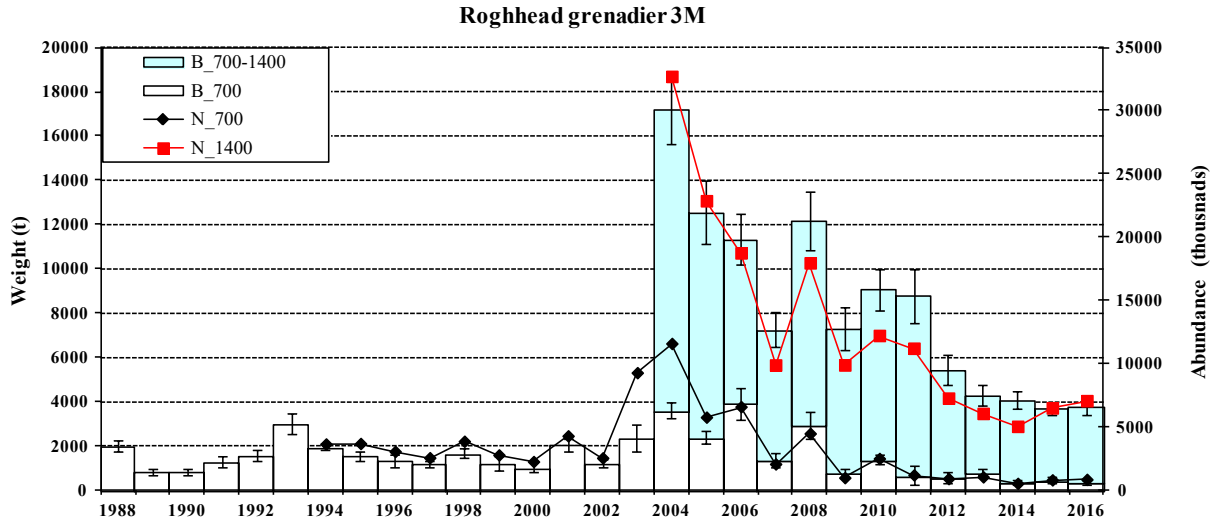


Fig. 14. Roughhead grenadier (*Macrourus berglax*) biomass (t.) ± S.E. and number ('000) 1988-2016.

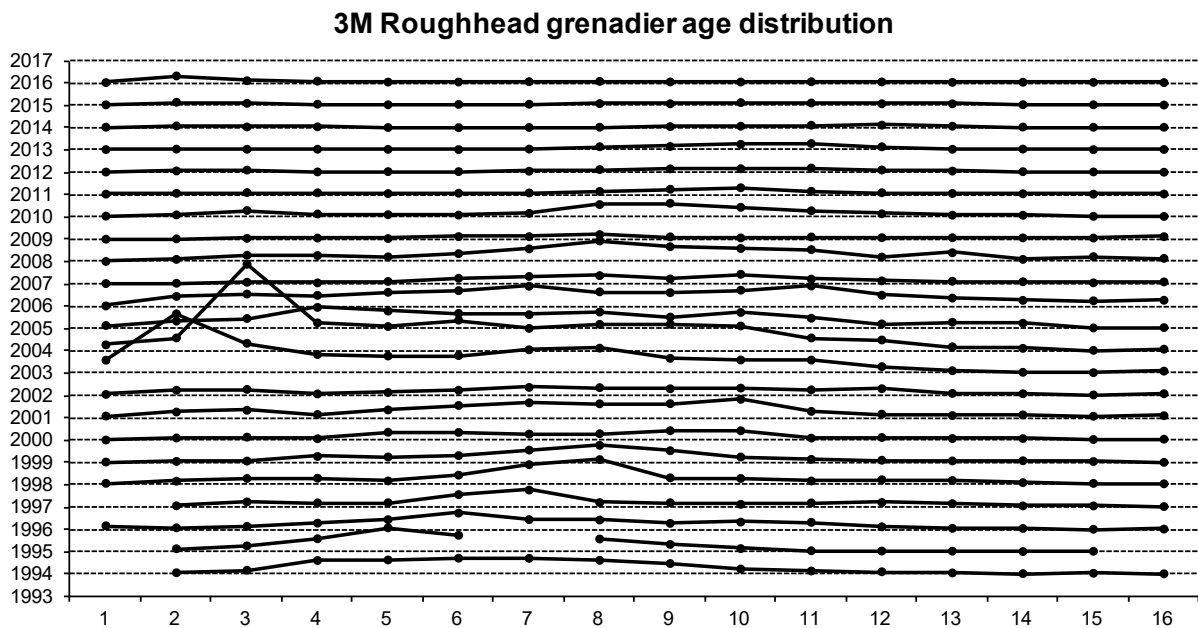


Fig. 15. Roughhead grenadier (*Macrourus berglax*) age distribution on Flemish Cap in depths < 730 m, NAFO Div. 3M: 1988-2016.