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Results from Bottom Trawl Survey on Flemish Cap of June-July 2015

by

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Abstract

A stratified random bottom trawl survey on Flemish Cap was carried out from June 22th to July 23th 2015. 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*, 118 up to 730 meters depth and 56 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 2015. 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 28th 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	8/7 - 22/7	2002	Cornide de Saavedra	120	30/6 - 17/7
1989	Cryos	116	12/7 - 1/8	2003	Vizconde de Eza	177 (114)	2/6 - 2/7
					Cornide de Saavedra	50**	7/6 - 17/6
1990	Ignat Pavlyuchenkov	113	18/7 - 6/8	2004	Vizconde de Eza	177 (124)	25/6 - 2/8
1991	Cornide de Saavedra	117	24/6 - 11/7		Cornide de Saavedra	61**	23/7 - 2/8
1992	Cornide de Saavedra	117	29/6 - 18/7	2005	Vizconde de Eza	176 (117)	1/7 - 21/8
1993	Cornide de Saavedra	101	23/6 - 8/7	2006	Vizconde de Eza	179 (115)	1/7-26/7
1994	Cornide de Saavedra	116	6/7 - 23/7	2007	Vizconde de Eza	174 (117)	23/6-19/7
1995	Cornide de Saavedra	121	2/7 - 19/7	2008	Vizconde de Eza	179 (111)	23/6-19/7
1996	Cornide de Saavedra	117	28/6 - 14/7	2009	Vizconde de Eza	178 (119)	23/6-20/7
1997	Cornide de Saavedra	117	16/7 - 1/8	2010	Vizconde de Eza	153 (97)	22/6-21/7
1998	Cornide de Saavedra	119	17/7 - 2/8	2011	Vizconde de Eza	128 (79)	29/6-9/8
1999	Cornide de Saavedra	117	2/7 - 20/7	2012	Vizconde de Eza	174(118)	26/6-24/7
2000	Cornide de Saavedra	120	10/7 - 28/7	2013	Vizconde de Eza	181(120)	26/6-23/7
2001	Cornide de Saavedra	120	3/7 - 20/7	2014	Vizconde de Eza	181(120)	25/6-23/7
				2015	Vizconde de Eza	181(120)	23/6-22/7

() 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

Biomasses 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	
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	

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 2015 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) showed a significant increase in 2015 and is at its highest value. 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	114807		tons
1999	2,854	-	-				

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, 2013 and 2014 year-classes seem to have failed according to current results at age 1 (Figure 4).

The 2015 biomass decreased in relation to 2014 and is at the level of 2012 and 1989 but its abundance is much lower than those years, which 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	1994	8,227		2005	2,760	
1984		7,500	1995	6,785		2006	1,691	
1985		7,800	1996	4,098		2007	1,053	
1986		20,200	1997	3,026		2008	1,766	
1987		9,300	1998	3,437		2009	1,442	
1988	16,046	6,500	1999	2,585		2010	2,446	
1989	14,047	5,000	2000	1,606		2011	4,084	
1990	11,983	1,200	2001	2,404		2012	4,491	
1991	10,087	14,400	2002	2,049	548	2013	3,698	
1992	8,656	1,200	2003	2,286	1,398	2014	3,800	
1993	7,861	2,700 ton	2004	3,525	ton	2015	3,821	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 (no updated yet) and the abundances at age by stratum respectively. Figure 5 shows the distribution of the survey catches in 2014. 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. A change from an upper abundance level of recruitment to a lower one was observed from 1988 to 1991. The 1991 year-class was the first weak cohort of a period of 15 years. The 2006 year-class is the more abundant since 1991, but its abundance is only intermediate. Recruitment for recent years seems 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.

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

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. 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. (1988-2014 years) and in depths up to 1460 m. (2004-2015 years).

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

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

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. (2015) presented detailed results.

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Table 1. Technical data of the 2015 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 1988-2015 surveys in depths lesser than 730 m.

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

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Rajidae	1544	4608	6241	4238	3506	2179	6289	2244	3471	2188	1658	743	680	836
<i>Synaphobranchus sp.</i>	8	24	88	72	32	64	40	24	14	2	20	40	14	9
<i>Urophycis sp.</i>	129	547	667	740	611	249	547	217	685	682	380	332	258	145
<i>Antimora sp.</i>	346	306	1158	1110	474	587	893	499	670	342	727	655	649	630
Macrouridae	2043	3691	4914	3353	5026	2364	3957	1166	1926	561	1190	1253	980	843
<i>Notacanthus sp.</i>	64	24	145	64	145	64	88	32	21	12	69	68	40	17
<i>Illex sp.</i>	8	225	474	80	3546	410	5139	1737	43	89	0	0	0	0
Anarhichadidae	5227	5983	10591	9570	9272	8195	9867	4600	4256	3739	5073	3893	4775	5402
Witch flounder	209	844	1568	1777	893	595	2220	764	1836	1458	2283	940	1810	2163
Greenland halibut	12103	6216	12288	11701	11709	13044	11999	7777	6299	6481	4291	2884	5168	6577
Zoarcidae	812	2067	3683	3080	1801	354	458	56	75	20	1	6	0	1
Cod	2493	1592	4069	5243	12505	23884	43676	75232	69295	106151	113227	71903	159939	114807
American plaice	2051	2284	3522	2758	1689	1053	1769	1440	2446	4084	4491	3632	3800	3821
Redfish	121312	93817	250602	453041	766924	464621	566649	358476	212212	196493	305947	219729	179925	158001
Shrimp*	40177	21512	20129	30672	16237	17049	11066	2799	4889	1593	1055	844	900	1551
Total	189459	149394	322866	529181	845252	534714	664655	457062	317805	320886	448661	319157	365459	300443

*) 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 2015 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	668.13	425.58	17410	11089
2	838	10	99.09	29.68	6326	1896
3	628	7	185.19	116.45	8861	5572
4	348	4	191.84	77.18	5086	2046
5	703	8	107.87	38.29	5778	2051
6	496	6	323.23	196.16	12215	7413
7	822	9	174.98	94.43	10958	5914
8	646	7	262.83	116.45	12937	5732
9	314	3	37.08	10.69	887	256
10	951	11	295.40	135.98	21403	9852
11	806	9	42.93	24.26	2636	1490
12	670	8	48.23	14.63	2462	747
13	249	3	40.02	16.40	759	311
14	602	7	81.17	67.43	3722	3093
15	666	8	63.42	10.48	3218	532
16	634	7	2.71	1.93	131	93
17	216	2				
18	210	2				
19	414	5	0.54	0.54	17	17
Total < 730 m.	10555	120	142.77	24.83	114807	19966
Total < 1460 m.	16070	181	93.77	16.31	114807	19966

Table 4. Cod (*Gadus morhua*) length distribution ('000) in the 2015 survey.

length		length		length		length	
09-11		42-44	10685	75-77	523	108-110	48
12-14	115	45-47	8351	78-80	566	111-113	102
15-17	714	48-50	6599	81-83	395	114-116	32
18-20	116	51-53	5966	84-86	346	117-119	30
21-23	1891	54-56	6436	87-89	237	120-122	7
24-26	7330	57-59	6325	90-92	204	123-125	
27-29	3727	60-62	4579	93-95	135	126-128	7
30-32	669	63-65	3165	96-98	155	129-131	7
33-35	1919	66-68	1879	99- 101	236		
36-38	4399	69-71	1142	102-104	107		
39-41	9162	72-74	747	105- 107	111	total	89164

Table 5. Cod (*Gadus morhua*) Biomass (t.) by strata in 1988-2015 surveys.

stratum	year																												
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	1345	649	767	5585	76	516	2165	1563	1006	243	125	99	250	86	477	173	1996	1091	2433	4420	4224	2253	11815	4694	1567	1931	4688	11089	
2	10150	10320	2065	5486	5150	9044	8186	3040	3991	2049	1899	1502	740	491	736	102	1668	1888	4145	1775	5346	6627	23368	22980	13861	10230	27320	1896	
3	4471	10270	2391	2459	8473	8435	6092	1146	1054	1132	703	145	360	230	451	90	9	1791	1948	11466	4129	7630	4512	16920	17743	12291	22585	5572	
4	3130	4840	2446	2900	3443	14171	1885	746	1068	857	140	25	443	488	66	136	168	152	466	1132	771	5190	1716	10110	2903	7106	3081	2046	
5	2130	10700	8447	10651	4570	6824	924	1274	936	1149	976	256	425	260	146	303	19	30	644	548	1129	6947	3600	10940	11639	5528	5090	2051	
6	3230	6780	3286	1531	952	4220	1412	1310	620	1074	613	375	511	749	525	24	155	206	1224	3214	12487	10734	2303	9510	9991	3849	11494	7413	
7	2224	16020	4385	2538	945	6153	857	122	55	1067	78	52	5	12	24	107	18		473	140	4692	12659	4667	2580	6824	5872	37607	5914	
8	8931	16430	15973	5107	2349	7964	3615	349	93	1610	77	23	74	123	37	111	5		347	475	3471	2814	4204	10920	7739	4641	9335	5732	
9	184	5260	6340	188	143	998	239	9	103	174		20	41		14	376			64	151	81	503	2048	1990	5963	970	9040	256	
10	1338	4890	4193	1558	327	936	506	58	46	301	199	102	107	81	2	24		28	304	246	2625	5071	4275	5240	16988	5153	6655	9852	
11	2505	13210	3859	1787	224	1678	582	78	41	310	176	255	106	175	18	58	33	56	381	272	3699	4336	4458	4550	5701	4205	9585	1490	
12	335	2460	1587	126		24															42	339	588	1130	2538	1323	927	747	
13	9	2530	734	93																		15	135	124	410	875	940	529	311
14	107	1120	545	131	67															76		160	9795	1056	3180	3663	6094	8331	3093
15	748	8430	2344	108												18					47	805	195	475	920	5133	1961	3532	532
16		66																									82	142	93
17		5																											
18	2																									100			
19																							88				113		17
total	40839	114050	59362	40248	26719	60963	26463	9695	9013	9966	4986	2854	3062	2695	2496	1593	4071	5242	12505	23886	43675	75228	69295	106150	113227	72289	159939	114807	
s.e.	5784	12205	8225	6704	5837	17397	7367	2070	1459	1725	646	451	593	380	398	273	780	813	980	4526	5507	8109	16269	11800	12293	8904	25425	19966	

s.e.: standard error

Table 6. Cod (*Gadus morhua*) age-length key in 2015.

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
12-14	15																15
15-17	56																56
18-20	11	3															14
21-23	7	53															60
24-26		64															64
27-29		59	2														61
30-32		27	35														62
33-35		1	60	1													62
36-38			39	23													62
39-41			11	47	4												62
42-44			3	53	8												64
45-47				44	14	3											61
48-50				16	37	13											66
51-53				6	26	34	1										67
54-56					28	41											69
57-59					13	51											64
60-62					5	57	3										65
63-65						50	9	2									61
66-68						42	20	3	1								66
69-71						17	30	12									59
72-74						7	37	9	2								55
75-77						1	36	9	5								51
78-80						1	29	10	5	2	1						48
81-83							14	17	5	3							39
84-86							12	16	6	1							35
87-89							3	15	4	3							25
90-92							1	11	10	5		1					28
93-95							1	6	10	2	2						21
96-98								4	13	2	1		2				22
99-101								5	15	4	2						26
102-104									4	8	2			1			15
105-107									5	3	6		1	1			16
108-110									3	1	2	1					7
111-113								1		7	6						14
114-116										3	2						5
117-119										2	3						5
120-122														1			1
123-125												1					1
126-128																1	1
129-131										1							1
TOTAL	89	207	150	190	135	317	196	120	88	47	27	3	3	3	0	1	1576

Table 7. Cod (*Gadus morhua*) frequency ('0000) at age and stratum in the 2015 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	1	8	15	18	51	15	2	3		1							115	47	17	
2	8	25	200	413	316	136	13	157	5	9	12						1294	150	26	
3	148	8	88	39	47	47	43	152	6	114	21						714	455	37	
4	461	42	255	50	163	239	246	407	31	602	47	1	2	1			2547	728	43	
5	158	44	145	30	88	192	191	190	14	337	31	7	2	2	2		1434	1189	50	
6	290	111	196	53	116	300	287	248	13	438	48	42	9	13	35		2198	1820	58	
7	70	29	17	11	9	24	24	21	2	37	8	21	2	25	30	2	332	3402	71	
8	27	14	6	6	5	8	8	7	1	14	3	8	2	18	14	1	142	4840	79	
9	15	7	3	7	3	5	3	5		8	2	4	2	9	6		78	7194	90	
10	4	4	1	3	1	4	1	2		5	1	1	1	4	3		36	9526	99	
11	1	3	1	4		1		1		4	1			1	1		19	11530	106	
12																	1	9687	100	
13																	2	9395	100	
14								1		1							2	12837	110	
15																				
16+				1													1	19451	127	
Set	4	10	7	4	8	6	9	7	3	11	9	8	3	6	8	2	106	1245	46.9	
n	1183	295	928	637	799	970	819	1195	73	1569	175	84	21	75	91	3	8917			

Table 8. Cod (*Gadus morhua*) abundance ('000) at age in 1988-2015 surveys.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
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
3	49496	91303	5121	16903	5578	31096	27756	1338	6659	3478	95	116	327	13
4	13448	54613	16952	2125	2385	1099	5097	3892	892	4803	1256	117	198	122
5	1457	20424	15834	6757	385	1317	130	928	2407	391	1572	717	96	79
6	211	1336	4492	1731	1398	173	67	33	192	952	78	444	446	15
7	225	143	340	299	244	489	7	23	8	21	146	19	172	142
8	72	126	146	68	14	87	111		5			5	11	99
9		6	77	32				21			6		17	6
10		7	25	4			5	5						6
11				10	8									6
12										4			5	
13														
14													5	
Total	149683	198363	57637	183181	123468	176693	40319	19567	13320	9837	3259	1507	1470	2951

age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1		684		8069	19710	3912	6095	5130	66500	347800	103530	5500	7273	1153
2	1330	54	3379	16	3880	11625	16681	7480	27760	143100	127920	67560	2379	12941
3	641	628	49	1118	60	5021	12419	16170	8640	16900	10980	32230	48452	7137
4	29	134	618	78	1470	21	4545	14300	7660	6300	11720	4900	43163	25472
5	70	22	168	708	90	1138	73	4150	5000	7800	4960	4170	17986	14342
6	33	42	5	136	590	58	928	20	1800	3100	4870	2780	6894	21984
7	26	7	10		120	425	58	1090	10	1200	1630	1800	3369	3323
8	96	8	3	17	10	74	230		460		820	970	1977	1421
9	30	39	5	8		13	80	340	50	200	20	290	1530	777
10		24	16	8	10	20			260		90	40	601	361
11	5				10		15		30		30	30	77	192
12								10			80	30	51	13
13					10						0	10	8	22
14											10		0	21
15														0
16+														7
Total	2261	1642	4161	10157	25960	22307	41125	48690	118180	526500	266660	120310	133760	89166

Table 9. American plaice (*Hippoglossoides platessoides*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2015 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	15.72	8.07	410	210
2	838	10	19.55	5.93	1248	379
3	628	7	9.66	2.49	462	119
4	348	4	14.19	9.17	376	243
5	703	8	8.28	2.78	443	149
6	496	6	8.17	2.94	309	111
7	822	9	1.87	0.63	117	40
8	646	7	4.46	2.00	220	98
9	314	3	0.07	0.07	2	2
10	951	11	1.19	0.33	86	24
11	806	9	2.01	0.67	124	40
12	670	8				
13	249	3				
14	602	7	0.07	0.07	3	3
15	666	8	0.44	0.23	22	11
16	634	7				
17	216	2				
18	210	2				
19	414	5				
Total < 730 m.	10555	120	4.76	0.70	3821	556
Total < 1460 m.	16070	181	3.12	0.46	3821	556

Table 10. American plaice (*Hippoglossoides platessoides*) length frequency ('000) in the 2015 survey.

length	male	female	length	male	femal	length	male	female
10-11		7	28-29	187	174	46-47	82	203
12-13		7	30-31	178	209	48-49	20	377
14-15		7	32-33	82	62	50-51		413
16-17	14	41	34-35	21	40	52-53		189
18-19	83	103	36-37	68	55	54-55		95
20-21	109	158	38-39	278	21	56-57		48
22-23	27	41	40-41	353	27	58-59		48
24-25	42	21	42-43	449	26	60-61		35
26-27	145	141	44-45	220	47	total	2358	2593

Table 11. American plaice (*Hippoglossoides platessoides*) survey biomass (t) by strata in 1988-2015.

stratum	year																												
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1	1306	1000	505	1078	709	1079	661	2230	1462	381	156	372	345	1043	141	1292	1507	1038	714	284	144	548	716	693	462	329	181	410	
2	2845	3602	1375	2663	1714	1267	1199	1335	943	740	1587	1810	976	835	1262	713	768	796	354	209	513	370	1084	1141	1272	1202	1872	1248	
3	1367	1118	1668	1247	631	444	325	252	168	495	284	97	21	93	75	17	427	101	74	101	147	74	103	364	468	266	223	462	
4	2199	461	817	320	557	572	853	489	268	203	343	53	100	85		128	395	359	109	153	440	36	91	1201	749	671	258	376	
5	2599	3093	1830	1407	837	1291	1230	549	500	619	744	73	56	112	189	82	72	45	63	81	88	72	200	190	716	267	328	443	
6	479	1130	954	501	601	305	808	123	32	13	35	40	25	37	63	29	26	71	61	99	37	57	34	160	185	341	187	309	
7	1174	531	837	389	639	319	316	249	72	83	47	19	15	28	52	30	84	31	37	20	47	32	28	160	156	166	208	117	
8	417	164	263	251	727	487	171	132	56	123	165	3		45	43	14	55	175	163	58	128	47	49	65	187	156	249	220	
9	103	163	343		373	205	20	500	55	36					1	9	77	18				77			30	25	0	2	
10	2323	1491	2000	1308	1406	1459	2236	708	415	287	36	72	45	95	36	54	45	87	97	24	163	54	115	35	123	153	105	86	
11	1186	1168	1316	401	372	292	303	109	68	32	29	37	23	27	59	29	69	35	19	22	50	64	26	33	121	121	185	124	
12	9	19	45	17	11	15	33	12	32	7				4		11						11			11	0			
13	3		20					3																					
14	8	8	7	389	29		24	15	4		4	9												32				3	
15	23	99	3	97	37	109	40	68	23	7	7					6		4		3	7	1		10	13			22	
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	2286	3525	2760	1691	1053	1766	1442	2446	4084	4491	3698	3800	3821	
s.e.	1845	2048	1276	1180	954	1040	1373	1083	912	708	751	869	332	429	729	748	740	684	342	159	300	327	526	780	534	439	671	556	

Table 12. American plaice (*Hippoglossoides platessoides*) age-length key in 2015.**MALE**

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
16-17	1	1															2
18-19		12															12
20-21		13	3														16
22-23		1	3														4
24-25		2	4														6
26-27			15	6													21
28-29			11	15													26
30-31			7	19													26
32-33				10	1	1											12
34-35				2			1										3
36-37					3	1	3	1	1	1							10
38-39					1	3	8	10	18				1	1			42
40-41						3	9	11	22	2						4	51
42-43						1	2	15	33	3	1		1	1	1	3	61
44-45						1	3	5	9	1	1	2	1	1	2	7	33
46-47							1	1	3	1		1	1	1	1	2	12
48-49											1				1	1	3
total	1	29	43	52	5	10	27	43	86	8	3	3	4	4	5	17	340

FEMALE

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
10-11	1																1
12-13	1																1
14-15		1															1
16-17		6															6
18-19		15															15
20-21		23															23
22-23		6															6
24-25		1	2														3
26-27		3	16	1													20
28-29			20	5													25
30-31			15	15													30
32-33			2	8													10
34-35			1	1	4												6
36-37			1	4	3												8
38-39				1	2												3
40-41					1	3											4
42-43						1	1	1	1								4
44-45							3	3	1								7
46-47						2	5	8	15								30
48-49							6	18	24	1	2						51
50-51							4	11	33	2						1	51
52-53							1	1	16	5	1	2				3	29
54-55									6	2			1			5	14
56-57									1	1	1			2	1	1	7
58-59									1	1			1		2	2	7
60-61														1		5	6
Total	2	55	57	35	10	6	20	42	98	12	4	2	2	3	3	17	368

Table 13. American plaice (*Hippoglossoides platessoides*) frequency at age in the 2015 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		10								7	3					20	19	13
2		42	108	45	114	52	46	78	1	53	40					578	70	20
3		10	132	86	73	63	72	141	7	42	68					695	206	28
4		46	161	95	39	50	38	120		23	27					599	278	31
5	7	21	16	10	4	24	2	14		1				2		101	486	36
6	16	56	9	2	8	8	2	3		3	2			1	1	109	711	41
7	47	161	24	14	22	20	11	9		8	7			2	2	328	903	43
8	89	282	51	28	56	40	13	11		16	17			1	5	609	995	45
9	190	577	110	65	143	96	33	32		25	41			1	8	1320	1094	46
10	20	51	13	10	18	11	4	6		2	3			1		140	1315	49
11	9	16	4	4	7	3	1	2		1	1					49	1299	49
12	3	13	4	2	3	3	2	1		1	1					33	1232	48
13	7	19	4	4	2	1	1	2			1					41	1253	47
14	5	15	7	9	4	1	1	4			1					47	1416	49
15	13	19	6	7	2	1	1	4		1	2					55	1456	50
16+	32	83	25	30	15	9	5	15	0	2	7			0	1	228	1184	47
Sets	3	10	7	4	8	6	7	5	1	8	9			1	3	72	735	38.2
n	438	1420	674	412	511	383	230	441	8	186	221			7	20	4951		

Table 14. American plaice (*Hippoglossoides platessoides*) abundance ('000) at age in 1988-2015 surveys.

age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	0	40	8	40	0	0	0	0	8	8	0	8	16	0	0	8	0	0	7	207	51	26	10		7	27	8	20
2	402	563	426	354	852	8	40	32	32	16	24	0	24	40	0	8	113	32	28	7	1492	293	341	394	60	198	344	578
3	1882	8364	917	1206	796	1544	48	113	121	113	32	24	8	48	32	32	281	113	37	13	69	1107	608	601	447	76	219	695
4	1311	1874	8372	2171	1070	1086	2131	740	257	24	48	64	80	56	64	97	72	290	106	35		147	2000	1384	629	311	144	599
5	4230	4367	1126	5348	1938	780	1037	2131	587	121	72	80	105	105	16	80	80	105	133	106	32	29	301	2467	980	718	135	101
6	6385	4359	3370	2445	4769	418	877	1367	1665	418	265	80	153	56	88	56	105	105	139	119	127	22	187	454	2833	866	510	109
7	5010	4142	2340	2686	1279	4134	973	1375	893	1206	619	241	121	113	64	48	105	129	72	49	120	80	72	94	447	1596	816	328
8	5460	2429	2228	2067	1504	450	3426	909	547	273	901	474	153	265	129	137	129	105	57	49	108	57	139	49	84	138	1569	609
9	1753	804	1351	852	828	780	322	1536	402	410	523	507	394	434	161	290	249	225	123	35	104	94	122	90	111	64	190	1320
10	458	346	627	298	378	370	651	161	627	290	354	257	426	579	193	233	314	201	163	47	111	90	70	176	143	94	65	140
11	97	40	113	8	177	257	225	177	145	491	298	338	225	483	298	426	281	225	200	76	63	132	56	144	125	109	55	49
12	161	16	16	56	97	306	225	145	80	129	290	209	185	418	225	483	595	249	193	122	47	121	176	55	115	108	62	33
13	129	0	32	0	16	362	249	145	80	24	88	121	72	193	249	281	426	354	192	143	118	63	125	107	45	55	46	41
14	48	0	16	0	0	1070	523	290	105	97	113	121	56	161	145	265	402	394	213	82	110	104	114	148	133	61	64	47
15	56	0	0	0	0	32	491	217	72	48	56	56	48	113	129	145	330	257	201	75	150	121	134	82	130	54	50	55
16+	40	0	0	0	0	40	8	32	24	113	105	97	56	97	185	161	523	547	323	236	561	353	497	672	323	195	201	228
total	27415	27351	20949	17523	13711	11637	11226	9377	5645	3772	3804	2670	2131	3169	1970	2766	4013	3329	2188	1401	3262	2838	4952	6917	6614	4670	4477	4951
N6+	19598	12135	10093	8412	9047	8219	7970	6353	4640	3498	3611	2501	1890	2911	1866	2525	3458	2791	1877	1033	1619	1237	1692	2072	4489	3340	3628	2959
SOP	16041	14008	11982	10007	8623	7859	8229	6815	4073	3025	3437	2589	1596	2402	2047	2486	3524	2673	1743	1053	1817			4176	4428	3485	3725	3849
Biomass	16043	14044	11983	10088	8657	7861	8228	6785	4097	3024	3436	2587	1606	2404	2048	2286	3525	2760	1691	1053	1766	1442	2446	4084	4491	3698	3800	3821

Table 15. Redfish (*Sebastes marinus*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2015 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4	0.40	0.14	10	4
2	838	10	1.38	1.07	89	68
3	628	7	0.81	0.35	38	17
4	348	4	0.67	0.51	18	13
5	703	8	0.42	0.18	22	10
6	496	6	14.98	13.14	566	497
7	822	9	116.06	64.30	7269	4026
8	646	7	30.80	19.90	1516	980
9	314	3	45.61	22.44	1091	537
10	951	11	203.86	92.96	14771	6735
11	806	9	78.23	36.00	4804	2211
12	670	8	0.51	0.51	26	26
13	249	3	6.67	6.67	126	126
14	602	7	5.15	4.80	236	220
15	666	8	1.77	0.63	90	32
16	634	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	25.05	6.74	30672	8248
Total < 730 m.	10555	120	38.14	10.26	30672	8248

Table 16. Redfish (*Sebastes marinus*): age-length key in the 2015 survey.

Length	age																									total	
	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	1																									1	
13																											0
14	1																										1
15	5	1																									6
16	2	2																									4
17		4																									4
18		3	3																								6
19			4																								4
20			4	3																							7
21				5	1																						6
22				3	3																						6
23					7	1																					8
24					9	2																					11
25				5	7																						12
26					3	4																					7
27						2	4	1																			7
28						1	4	2	1																		8
29							1	5	5																		11
30								2	4	3																	9
31								1	6		1																8
32										2		1															3
33									1	2		2	1														6
34									1	1	1		2														5
35										2	1			2	1												6
36										1			1	1	1												4
37											1				3	1											5
38													1	2				1									4
39														1	1	2	1					1					6
40														1		2	1										4
41															1		1										2
42																1											1
total	9	10	11	11	25	16	13	11	18	9	5	4	7	9	9	2	2	0	0	0	0	1	0	0	0	0	172

Table 16 (cont.) Redfish (*Sebastes marinus*): age-length key in the 2015 survey.

Female

Length	age																									total
	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																									0	
13	3																								3	
14	8																								8	
15	9	7																							16	
16	6	8																							14	
17		9	4																						13	
18		3	6																						9	
19			3	2																					5	
20			3	7	2																				12	
21				7	3																				10	
22				8	7																				15	
23				3	5	2	1																		11	
24					7	4	1																		12	
25					5	7	4																		16	
26						15	5																		20	
27						12	4	2	1		1														20	
28						3	11	3	1	2															20	
29							10	4	4	2															20	
30							2	11	4	1	2														20	
31							1	5	8	4	1	2													21	
32								4	4	5	5	2													20	
33								3	9	6	1	4													23	
34								4	2	5	5	2	1		1										20	
35									5	3	5	3	2		1	1									20	
36								1	3	5	6	3	1	1		1									21	
37									3	3	5	1	4	3	2										21	
38									4	1	5	3	3	2	1										19	
39										1	3	6	1	7	1	1	1	1							21	
40											2	2	3	7	4	1									19	
41												1	6	8	2	3									20	
42												1	4	5	8	2									20	
43													4	1	9	2	1	1			1				19	
44													1	2	5	7	4							1	20	
45													1	2	7	2	4		1	1					18	
46													1		1	4	2				1	2			11	
47													1	1	2	2	1							1	8	
48															2	1						1		1	6	
49																1									1	
50																	1						2	2	5	
51																									0	
52																							1		1	
53																								1	1	
54																							1		1	
55																									0	
56																								1	1	2
total	26	27	16	27	29	43	39	37	44	40	35	33	39	47	52	24	2	3	2	2	3	1	4	7	582	

Table 17. Redfish (*Sebastes marinus*) length frequency ('000) in the 2015 survey.

length	male	female	length	male	female	length	male	female
11	23		27	584	473	43	7	386
12	20	8	28	741	381	44		468
13	101	21	29	728	899	45	13	220
14	119	104	30	1545	606	46		99
15	307	234	31	1709	1053	47		77
16	252	254	32	1816	1454	48		35
17	174	184	33	2256	1473	49		7
18	297	131	34	2674	1414	50		76
19	135	79	35	3004	1493	51		
20	191	153	36	2444	1869	52		7
21	232	151	37	1573	1399	53		7
22	286	213	38	737	1430	54		
23	334	113	39	466	1583	55		
24	303	206	40	185	1025	56		14
25	326	296	41	102	928			
26	621	320	42	63	857	Total	24368	22200

Table 18. *Sebastes marinus*: frequency at age ('000) by strata in the 2015 survey.

Age	Strata															total	mean			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		Weight(g)	Length(cm)		
1																				
2	13		41	17	3	112	382	115	35	138	46							903	55	15
3	21		26	3	10	199	325	55	28	166	66		40					938	76	17
4	15		11	11	24	98	183	23	47	79	83		40					615	107	19
5	13	9	19	16	17	78	233	23	145	168	77							798	153	21
6	15	15	12	12	9	65	301	27	314	262	229		25	7				1293	204	23
7	4	2	1	10	7	40	342	50	357	484	251		58	6				1613	282	26
8	1	1	5	8	19	57	394	35	334	877	332		106	1				2171	337	28
9		3	9	2	10	73	418	81	251	1444	551		28	3	9			2880	461	31
10		4	4	1	4	115	1019	151	307	3271	943		32	30	16			5896	523	32
11		4	3		1	115	1285	236	199	3302	1015		24	56	14			6254	593	33
12		2	5	2	1	66	960	209	118	2248	804		16	33	15			4479	667	35
13		5	1	1		58	822	158	88	2071	647			50	12			3913	673	35
14		10	2			73	1251	265	78	1986	667		32	29				4392	792	37
15		19	8	2		70	1441	304	62	2120	701			91	8			4825	853	38
16		14	4	1		52	1174	283	62	1631	557			31	19			3828	907	39
17		3				13	303	65	16	407	132	1			1			943	1036	40
18		7				5	77	12	3	135	78				13			331	923	39
19								28	9	1	52	17						108	1032	40
20								3	2		11		4					19	1851	49
21		1				1	38	9	6	36	16				1			107	1026	40
22		1					9	2	3	7					1			24	1540	46
23															7			7	2136	52
24								17		1	6	10	3					36	1870	50
25								36	2	2	27	11	6					83	1779	49
Set	3	3	4	2	6	5	7	4	3	11	9	1	1	2	5			66	611	
n	82	99	153	88	104	1291	11042	2114	2456	20928	7232	14	402	336	115			46456	28375	32.9

Table 19. Redfish (*Sebastes mentella*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2015 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	0.02	0.00	1	0
4	348	4				
5	703	8	0.02	0.02	1	1
6	496	6	0.09	0.09	3	3
7	822	9	26.95	14.44	1688	905
8	646	7	26.92	19.48	1325	958
9	314	3				
10	951	11	4.53	4.34	329	315
11	806	9	1.72	0.79	106	48
12	670	8	152.99	49.77	7809	2541
13	249	3	49.28	29.87	935	567
14	602	7	458.68	169.91	21038	7793
15	666	8	225.79	54.43	11457	2761
16	634	7	5.16	3.48	249	169
17	216	2	2.70	2.70	44	44
18	210	2	41.23	28.68	660	459
19	414	5	0.74	0.60	23	19
20	525	6	0.23	0.12	9	5
21	517	6	0.19	0.19	8	8
22	533	6				
23	284	3				
24	253	3	0.63	0.63	12	12
25	226	3				
28	530	6	0.25	0.16	10	7
29	488	6				
30	1134	11				
31	203	2				
32	238	2			7	7
33	98	2				
34	486	5				
Total < 1460 m.	16070	181	37.34	7.18	45714	8787
Total <730 m.	10555	120	56.79	10.92	45668	8787

Table 20 *Sebastes mentella*: age-length key in the 2015 survey.

Male Length 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		
13		2																								2	
14		3																								3	
15		3	2																							5	
16		2	6																							8	
17			9	4																						13	
18			6	6																						12	
19			1	5	2																					8	
20				7	2	1																				10	
21					10	3																				13	
22					7	8																				15	
23					2	13																				15	
24						10	2																			12	
25							10	1																		11	
26								11	4																	15	
27							2	10	1																	13	
28								3	5		2				1											11	
29								1	2	1		1			1											6	
30									1	2	1		1		2		1									8	
31										1	3							1								5	
32											1		1												2	4	
33													1					1				1			1	4	
34										1																1	
35																	1				1					2	
36														1	1											2	
37															1											1	
38																										0	
39																										0	
40																										0	
41																										0	
42																										0	
43																									1	1	
total	0	10	24	22	23	35	25	19	9	5	7	1	2	2	6	0	2	2	0	1	0	1	0	0	0	4	200

Table 20 (cont.) *Sebastes mentella*: age-length key in the 2015 survey.**Female**

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		
13		2																								2	
14		3																									3
15		2																									2
16		4	4																								8
17			13	1																							14
18			14	5																							19
19			2	5																							7
20				4	5																						9
21					14	5																					19
22					15	5																					20
23				3	14	1	1																				19
24					17	3																					20
25					6	6	7																				19
26						11	7		1	1																	20
27						9	3	5	1		1	1															20
28							7	10	2						1												20
29								7	3	8		2															20
30								1	7	6	4	1				1											20
31									3	3	3	4	3	3													19
32								2	4	3	5	2	1	3													20
33								1	3	2	2	1		2	1												12
34										3	1		2	1			1										8
35									1	1	2		1	2	2						1					1	11
36											1			1	1			1					1			1	6
37												1		1												3	5
38												1						1						2	2		6
39															2						1			1			4
40																									1		1
41																1											1
total	0	11	33	15	37	47	30	25	26	25	27	19	13	7	16	6	2	1	0	0	2	0	1	3	8	354	

Table 21. Redfish (*Sebastes mentella*) length frequency ('000) in the 2015 survey.

length	male	female	length	male	female	length	male	female
13	90	80	23	3810	2050	33	620	530
14	150	70	24	5280	1900	34	490	350
15	180	50	25	9530	3180	35	910	950
16	530	220	26	1680	0	36	330	250
17	630	320	27	2056	0	37	200	140
18	660	550	28	1361	0	38		620
19	660	530	29	0	12450	39		100
20	1060	590	30	4460	10720	40		150
21	1570	1070	31	2060	7010	41		10
22	3330	1520	32	850	2890	Total	89330	68280
				960	1430			

Table 22 *Sebastes mentella*: frequency at age ('0000) by strata in the 2015 survey.

Age	Strata																			total	mean		
	3	5	6	7	8	10	11	12	13	14	15	16	17	18	19	20	21	24	28		32	Weight h(g)	Length(cm)
1																							
2	1			9	47	4	6	3		2	9										81	45	15
3				34	67	18	49	1		35	22										228	73	17
4				63	85	13	12	2		38	35										248	98	19
5				147	140	37	7	26	6	81	178										622	141	22
6				247	198	44	8	172	19	332	451	1		2		1					1474	178	23
7				138	104	13	3	579	87	1696	897	3		26							3547	243	26
8				81	41	9	2	644	77	1684	964	6		34	1						3543	273	27
9				35	17	9	2	414	45	1058	675	6		31	1						2293	310	28
10				11	10	6	1	175	20	408	258	7	1	16							912	362	30
11				12	15	7	1	223	26	487	317	11	1	20	1						1121	353	29
12				3	4	3		83	11	151	119	2		11							389	382	30
13				4	3	2		65	7	156	93	4	1	7							343	378	30
14				2				16	2	53	23	1		3							103	492	33
15				8	2	1		87	12	216	112	5	3	10	1						459	393	30
16					1			12	1	27	17	1		2							62	471	32
17					1			6	1	72	3	2		1							86	544	34
18					1			2		28	3	2									37	474	32
19					1					44											46	591	35
20																							
21								2		22	1										27	558	34
22																							
23								1		2	1										4	643	36
24								1		37		1									39	655	36
25+								6		79	12	4	1	1	1						105	611	35
Sets	2	1	1	5	3	4	6	8	3	7	8	6	1	2	2	3	1	1	2	1	67	279	26.8
n	1	1	1	795	737	168	92	2519	315	6709	4190	56	8	165	5	2	1	1	2	1	15769		

Table 23. Redfish (*Sebastes fasciatus*) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2015 survey.

stratum	area sq. miles	tow number	catch (kg)		Biomass (t.)	
			mean	s. e.	value	s.e.
1	342	4				
2	838	10	0.04	0.04	2	2
3	628	7	0.28	0.16	14	7
4	348	4	0.79	0.61	21	16
5	703	8	0.11	0.05	6	3
6	496	6	0.95	0.95	36	36
7	822	9	55.13	23.08	3453	1445
8	646	7	162.59	80.15	8003	3945
9	314	3	16.59	12.41	397	297
10	951	11	33.65	14.68	2438	1064
11	806	9	60.22	23.28	3698	1430
12	670	8	247.15	125.20	12617	6391
13	249	3	304.71	166.36	5781	3156
14	602	7	675.99	187.97	31005	8621
15	666	8	243.93	55.74	12378	2828
16	634	7	1.79	0.70	86	34
17	216	2	0.68	0.19	11	3
18	210	2	34.20	25.04	547	401
19	414	5	0.05	0.05	2	2
20	525	6				
21	517	6				
22	533	6				
23	284	3				
24	253	3				
25	226	3				
28	530	6	0.21	0.14	8	6
29	488	6				
30	1134	11				
31	203	2				
32	238	2				
33	98	2				
34	486	5				
Total < 1460 m.	16070	181	65.75	10.15	80503	12418
Total < 730 m.	10555	120	100.09	15.44	80495	12418

Table 24 (cont.) *Sebastes fasciatus*: age-length key in the 2015 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	2																									2
12	2	3																								5
13		10																								10
14		19	1																							20
15		12	8																							20
16		9	9	1																						19
17			15	4																						19
18			6	13																						19
19				15	7																					22
20				6	12	2																				20
21					17	3																				20
22					10	12																				22
23					1	11	4																			16
24						15	5																			20
25						9	8	3																		20
26							13	7																		20
27							3	13	4	1																21
28								1	9	6	1	2					1									20
29								1	2	7	2	3	4				1									20
30									4	3	2	2	1	5	1						1					19
31									1	9	6		2					2								20
32										2	1	2	2	2	3	5	1				1					19
33										2	5		1	2	1	7			2						1	21
34										2		1	1	3	1	6	4	1							1	20
35											1	1	4	1	2			1		1	1		1			13
36											2					4			2			1	1			10
37													1	2	1	1			1							6
38													1	1							1				1	4
39															1	1										2
40																									1	1
41													1													1
42																										0
43																			1				1		1	3
44												1													1	2
45																										0
46																										1
total	4	53	39	39	47	52	33	25	20	32	17	14	15	19	9	28	7	8	0	3	4	1	2	0	6	477

Table 25. Redfish (*Sebastes fasciatus*) length frequencies ('000) in the 2015 survey.

length	male	female	length	male	female	length	male	female
10			23	11890	6100	36	150	1270
11	10	10	24	14910	5030	37	20	490
12	110	30	25	17760	6080	38	150	550
13	330	430	26	17810	8810	39		180
14	930	700	27	15150	13280	40		150
15	1550	1370	28	14740	19240	41		160
16	1780	2060	29	6630	18840	42		
17	2180	1640	30	3180	17500	43		
18	1400	2000	31	1010	9790	44		20
19	2390	1900	32	290	5040	45		
20	4370	2530	33	150	2650	46		10
21	5180	5030	34	370	1380			
22	9960	6470	35	300	1210	Total	134700	141950

Table 26. *Sebastes fasciatus*: frequency at age ('0000) by strata in the 2015 survey.

Age	strata																		total	average		
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		28	W(g)	L(cm)
1		2		1		1	4			1										11	26	12
2	3	8	5	5		78	144	44	103	238			8	5						642	53	15
3		3	3	1		67	108	32	111	290			50	31						697	75	17
4		1	3	1		67	186	20	132	257	3	3	93	88						855	104	19
5		2	2		3	192	682	42	287	444	69	159	279	307			3			2472	148	21
6		1	2		4	399	934	39	337	460	415	420	793	557	3		2			4366	197	23
7			1		3	415	701	24	149	276	644	518	1544	686	3		7	1		4972	248	25
8			1		1	99	252	9	42	71	459	261	1595	549	2	1	19			3361	300	27
9					1	44	137	2	25	32	462	214	1382	501	1	1	22			2822	343	28
10						47	144	3	21	38	540	188	1193	454	2	1	23			2655	378	29
11						22	70	1	12	20	257	78	470	192	2		10	1		1135	392	30
12						17	45	1	8	12	157	45	326	148	1		4			762	390	30
13						17	48	1	5	12	169	51	376	140	1		5			824	415	30
14						11	42	2	5	10	172	29	339	133	1		9			754	442	31
15						5	15	1	3	6	61	8	144	44	2		5			294	483	32
16						9	33	1	9	8	113	21	280	72	1		7			554	486	32
17						2	10			3	40	9	66	20			2			152	473	32
18							3		3	1	12	1	48	6			1			75	618	35
19						2	7		1	2	33	6	50	25			1			128	435	31
20									1		3		29	2						36	722	37
21									1		1		10	1						13	679	36
22											2		6	1						9	626	35
23																						
24							2				1		17	1						22	741	37
25+							1				4	1	35	1						42	700	36
Sets	1	4	2	4	1	9	6	3	11	9	8	3	7	8	5	2	2	1	2	88	279	
n	4	17	17	9	13	1494	3568	224	1255	2182	3615	2011	9135	3963	22	3	121	1	2	27655	7707	25.8

Table 27. Juvenile redfish (*Sebastes* sp.) mean catch per towed mile and the estimated biomass by stratum, and their standard error in the 2015 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	0.07	0.04	3	2
4	348	4	0.11	0.07	3	2
5	703	8	0.11	0.04	5	2
6	496	6	0.51	0.14	19	5
7	822	9	3.59	1.61	225	101
8	646	7	4.08	1.61	200	80
9	314	3	1.31	0.49	31	12
10	951	11	3.05	0.89	221	64
11	806	9	7.12	2.96	438	181
12	670	8				
13	249	3				
14	602	7	0.47	0.30	21	13
15	666	8				
16	634	7				
17	216	2				
18	210	2				
19	414	5				
Total <730 m	10555	181	1.45	0.30	1167	232
Total < 1460 m.	16070	120	0.95	0.19	1167	232

Table 28. Juvenile redfish (*Sebastes* sp.) length frequency ('000) in the 2015 survey.

length		length	
6	10	12	5640
7	130	13	9990
8	1570	14	11190
9	4470	15	1980
10	1680	16	20
11	1070	Total	37750

Table 29. Greenland halibut (*Reinhardtius hippoglossoides*) mean catch per towed mile by strata and the estimated biomass with their standard errors in the 2015 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				
4	348	4				
5	703	8	0.11	0.11	6	6
6	496	6	0.04	0.04	1	1
7	822	9	0.19	0.12	12	8
8	646	7				
9	314	3				
10	951	11	0.02	0.02	1	1
11	806	9				
12	670	8	10.22	4.24	522	216
13	249	3	4.22	4.22	80	80
14	602	7	0.49	0.25	22	11
15	666	8	4.76	3.06	241	155
16	634	7	63.11	20.23	3049	978
17	216	2	24.01	6.25	395	103
18	210	2	42.95	38.27	687	612
19	414	5	49.47	11.88	1560	375
20	525	6	63.40	8.37	2536	334
21	517	6	116.18	46.57	4577	1834
22	533	6	115.92	20.62	4707	838
23	284	3	75.01	1.28	1623	27
24	253	3	43.91	5.06	846	98
25	226	3	26.11	2.99	450	52
28	530	6	139.34	32.20	5627	1301
29	488	6	193.59	31.06	7198	1155
30	1134	11	173.30	16.96	14974	1466
31	203	2	105.46	5.13	1631	79
32	238	2	237.58	118.09	4308	2141
33	98	2	72.54	41.11	542	307
34	486	5	69.81	23.50	2585	870
Total < 1460 m.	16070	181	47.52	3.30	58180	4046
Total < 730 m.	10555	120	8.18	1.55	6576	1246

Table 30 (cont.) Greenland halibut (*Reinhardtius hippoglossoides*): Biomass (t.) by strata in 1988-2015 surveys.

Strata	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	0		2											
2	10	0	12	7	9									
3	140	55	852	416	325	22		4	6					
4	58	105	347	91	182	8								
5	66	92	254	280	231	92	15	7		6			0	6
6	104	21	466	332	61	75	8					0	2	1
7	429	414	1032	596	778	729	524	11	15	4		4	8	12
8	878	507	811	934	910	432	226	31	0		0			
9	138	140	464	91	550	487	401	31				9		
10	744	286	753	1058	850	560	777	25	19	5				1
11	338	277	631	1063	290	503	563	21	32	2	8	2	3	
12	1086	673	902	1020	978	1246	1393	1217	743	126	332	140	239	522
13	521	61	447	310	219	392	431	217	273	33	19			80
14	1081	885	1658	618	573	878	1023	742	62	35	256	28	22	22
15	1233	607	1084	1747	1783	3041	1621	771	1224	112	111	89	119	241
16	2182	633	1166	1357	1752	2263	1623	2186	2079	1892	1911	1038	2165	3049
17	204	148	223	429	639	407	411	558	446	236	401	170	298	395
18	694	1062	578	434	606	865	944	540	526	562	325	395	696	687
19	2194	248	608	915	971	1042	2035	1414	1231	3700	927	924	1615	1560
20			1647	1061	666	2041	4119	1855	1490	2471	2381	1858	3556	2536
21			729	345	359	742	2161	1569	1367	1258	1496	1952	1210	4577
22			454	510	845	551	883	1970	2410	1226	714	1220	1201	4707
23			407	42	130	495	1144	475	715	464	280	534	576	1623
24			208	328	555	588	1082	1185	461	1749	652	379	541	846
25			2377	993	322	436	441	732	473	593	459	392	968	450
28			1728	1162	1239	2857	3920	3153	1994	4188	2244	2150	1956	5627
29			2300	1330	674	1488	3335	2618	2091	2044	2237	2060	4603	7198
30			2024	602	2772	4719	5066	7692	5381	5060	4738	4685	3915	14974
31			546	186	354	347	385	944	319	414	82	461	754	1631
32			599	596	1357	1040	1755	2391	1539	1916	1097	1244	2610	4308
33			358	147	608	166	698	309	408	707	320	594	475	542
34			2675	1460	1886	2222	2627	3377	1790	3454	2514	3063	1756	2585
Total (1-19)	12100	6214	12292	11698	11708	13040	11997	7777	6656	6713	4291	2799	5168	6576
s.e. (1-19)	662	611	400	630	609	786	583	363	814	2728	338	345	542	1246
Total (1-34)			28343	21515	24357	31723	39614	36047	27096	32257	23505	23391	29288	58180
s.e. total (1-34)			1335	933	1263	1270	1312	1538	1791	3862	1416	1847	1880	4046

Table 31. Greenland halibut (*Reinhardtius hippoglossoides*) age-length key in the 2015 survey.**MALE**

Length cm	age																total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+	
14-15	3																3
16-17																	
18-19		1															1
20-21																	
22-23																	
24-25																	
26-27																	
28-29			1														1
30-31				1													1
32-33				2	2												4
34-35				2	6												8
36-37				2	17												19
38-39					17	4											21
40-41					9	11											20
42-43					6	15											21
44-45					1	19											20
46-47					1	19	1										21
48-49						13	7										20
50-51						3	14	3									20
52-53						2	17	3									22
54-55							17	6	1								24
56-57							9	7	3	1							20
58-59							4	2	2	2							10
60-61									1	5							6
62-63												4					4
64-65												1					1
total	3	1	1	7	59	86	69	21	7	8	5						267

Table 31 (cont.) Greenland halibut (*Reinhardtius hippoglossoides*) age-length key in the 2015 survey.**FEMALE**

length cm	age																total		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16+			
12-13	1																	1	
14-15	1																	1	
16-17	1																	1	
18-19																			
20-21		1																1	
22-23																			
24-25																			
26-27																			
28-29																			
30-31				4														4	
32-33				2	1													3	
34-35				1	7													8	
36-37				1	14	2												17	
38-39				1	16	3												20	
40-41					13	8												21	
42-43					7	16												23	
44-45					3	18	1											22	
46-47					1	19	2											22	
48-49						17	6											23	
50-51						7	13	1										21	
52-53						3	14	3										20	
54-55							12	8	1									21	
56-57							8	9	4									21	
58-59							6	5	6	4								21	
60-61								1	7	10	3							21	
62-63								1	1	14	6	2						24	
64-65										6	10	3	1					20	
66-67										1	11	5	2	1				20	
68-69											6	5	5	4	1			21	
70-71												5	5	6				16	
72-73												1	3	4	3	1		12	
74-75													1	5	7			13	
76-77														2	2	1		5	
78-79														1	4	3		8	
80-81																	4	4	
82-83																	2	2	
84-85															1	1		2	
86-87																	1	1	
88-89																			
90-91																		2	2
total	3	1		9	62	93	62	28	19	35	36	21	17	23	18	15		442	

Table 32. Greenland halibut (*Reinhardtius hippoglossoides*) length frequency ('000) in the 2015 survey.

depths < 730 m

length	male	female	length	male	female	length	male	female
12-13		7	32-33	15	14	52-53	169	624
14-15	20	7	34-35	21	16	54-55	70	459
16-17		7	36-37	28	44	56-57	15	172
18-19	7		38-39	64	108	58-59		86
20-21		7	40-41	87	215	60-61	8	95
22-23			42-43	210	335	62-63		64
24-25			44-45	342	606	64-65		30
26-27			46-47	253	703	66-67		10
28-29			48-49	376	785			
30-31	7	7	50-51	267	789	total	1959	5185

depths < 1460 m

length	male	female	length	male	female	length	male	female
12-13		7	42-43	981	1301	72-73		80
14-15	20	7	44-45	1357	2193	74-75		109
16-17		7	46-47	1898	3416	76-77		42
18-19	7		48-49	2236	4958	78-79		62
20-21		7	50-51	1871	5179	80-81		32
22-23			52-53	1192	5527	82-83		11
24-25			54-55	816	4790	84-85		16
26-27			56-57	256	3322	86-87		10
28-29	9		58-59	110	1983	88-89		
30-31	7	35	60-61	49	1449	90-91		17
32-33	42	23	62-63	26	734			
34-35	62	65	64-65	10	480			
36-37	162	156	66-67		375			
38-39	383	453	68-69		296			
40-41	543	799	70-71		171	total	12037	38112

Table 33. Greenland halibut (*Reinhardtius hippoglossoides*) frequency at age ('000) and strata in the 2015 survey.

age	strata																										total	mean		
	5	6	7	10	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				30			10																				40	22	15	
2				10							10																	10	55	20
3																						10						10	179	29
4		10							10		20								20	10	30		30		10	150	317	34		
5					60	10		80	300	30	40	200	60	130	130	10	30	10	490	280	720	50	290	30	130	3110	568	41		
6	10		10		280	30	10	140	1570	130	330	930	660	1060	1050	320	240	120	2520	2150	3910	350	1260	210	890	18180	872	47		
7					150	30	10	50	1030	130	250	460	770	1350	1300	370	250	120	1910	2180	4340	390	1150	160	790	17190	1224	52		
8					30	10		10	240	50	70	80	270	500	490	140	90	40	510	690	1590	150	380	40	270	5650	1418	55		
9					10			10	60	20	20	20	100	190	230	60	30	10	110	240	620	70	160	20	90	2040	1683	58		
10					10				60	10	20	20	80	130	200	80	20	10	50	230	510	90	140	20	50	1730	1975	61		
11					10				20		10	10	50	70	100	70	10		20	120	300	30	120		20	960	2312	64		
12													20	30	30	20					40	140	10	50		10	360	2614	67	
13														10	20	20	10				20	90	10	30			210	2906	69	
14														10	20	30	20				10	100	20	30			230	3264	71	
15															10	20	10				10	40	20	10		10	150	3866	75	
16+															10	10	10		10		10	30	10	10			120	5055	82	
Sets	1	1	2	1	8	1	3	3	7	2	2	5	6	6	6	3	3	3	6	6	11	2	2	2	5	97	1182			
n	10	10	10	30	540	70	30	290	3300	360	740	1740	2020	3540	3610	1130	680	330	5630	5990	12410	1220	3660	490	2290	50150	5927	50.9		

Table 34. Greenland halibut (*Reinhardtius hippoglossoides*) Abundance at age ('000) in the 1991- 2015 survey.

<730 m. strata (1-19)																									
age	Year																								
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	1302	1677	1423	1429	9978	4699	2674	2200	852	3014	6459	3282	1768	1762	437	550	301	157	61	38			6	20	40
2	207	1260	1245	996	2045	6408	3036	1716	563	235	1153	2364	804	2644	652	312	64	78	7	9		8			13
3	348	447	777	1365	1793	1942	4822	6180	2419	479	1456	2248	489	3517	2554	525	455	121	30	29		36	4	3	
4	1054	1023	692	1435	1535	2442	5225	8843	8419	1741	799	1342	1217	1585	2007	949	275	155	81	47	60	87	112	97	48
5	2307	1852	1021	1545	2136	3380	5714	9919	10787	5703	2242	3045	1991	5601	5537	4800	2765	1203	606	894	880	822	643	1089	719
6	1291	2249	1545	2385	4099	4680	6800	9085	10119	11336	6262	4498	2362	6271	6105	6002	5928	4586	2905	2469	2930	1827	1733	2315	3440
7	2212	1947	1627	2139	3029	2001	4014	6304	4467	4346	5328	4610	1552	2040	2345	2665	4632	4950	3255	2365	2850	1406	718	1566	2091
8	534	1054	1266	1180	1706	1299	1731	2108	1466	1865	2584	1025	375	518	491	623	1217	909	713	715	570	349	158	283	493
9	462	468	776	631	1052	341	528	600	280	361	147	104	105	233	89	180	247	283	153	259	160	112	39	63	120
10	352	273	213	219	209	70	177	157	82	92	36	48	79	107	97	143	165	210	215	137	110	83	44	66	115
11	141	138	104	90	53	21	23	27	6	44	5	16	15	63	44	103	62	100	62	50		54	12	22	50
12	12	67	38	47	18	31	17	6	3	0	0	6	4	38	15	45	38	43	47	22	10	15	10	9	12
13	0	25	21	18	0	0	17	16	3	0	0	0	0	5	3	10	5	18	35	10		10	6	12	2
14	0	12	9	0	5	4	0	0	5	0	0	0	0	3	3		2	10	12	2		10	2	6	
15	15	0	0	0	0	5	6	0	0	0	0	0	0	3	3			4	0			3	4	3	
16+	8	0	0	0	0	0	9	0	0	0	0	0	0	3	3			1	0			6	1	2	
Total	10245	12490	10757	13479	27659	27323	34792	47160	39470	29216	26471	22587	10762	24390	20374	16907	16156	12825	8182	7046	7420	4823	3492	5156	7143
Freq 10+	528	515	385	374	285	131	249	206	99	136	41	70	98	222	168	301	272	386	371	221	120	181	79	54	179

Table 34 (cont.) Greenland halibut (*Reinhardtius hippoglossoides*) Abundance at age ('000) in the 1991-2015 survey.

< 1460 m. strata (1-34)												
Age	Year											
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1	1710	438	550	310	160	60	38			6	20	40
2	2680	652	320	60	80	10	9		8			10
3	3580	2561	540	480	120	40	29	10	46	15	8	10
4	1880	2117	1110	360	200	100	137	110	200	393	200	150
5	8330	6470	7160	4700	2480	1380	2447	2280	2964	2583	3405	3110
6	11210	8314	10480	11130	11020	8330	7356	8260	7073	8608	9839	18180
7	6060	4182	5730	10490	15340	13990	9587	10460	6124	5538	8415	17190
8	1790	1206	1700	3530	3890	4340	3063	3160	2349	2005	1989	5650
9	890	318	510	880	1400	1140	1200	1370	920	643	548	2040
10	450	500	440	720	1060	1260	1019	1500	906	1026	780	1730
11	320	282	370	370	540	440	383	560	587	412	406	960
12	200	161	180	210	300	340	213	330	233	349	182	360
13	180	74	60	80	160	310	151	270	126	153	235	210
14	70	47	30	60	120	170	114	140	114	73	131	230
15	80	9	10	20	80	50	59	50	75	103	55	150
16+	60	9	10	10	70	70	55	40	140	94	81	120
total	39490	27340	29200	33410	37020	32030	25860	28539	21864	22002	26294	50140
Freq 10+	1360	1082	1100	1470	2330	2640	1994	2890	2181	1184	1090	3760

Table 35. Roughhead grenadier (*Macrourus berglax*) mean catch per towed mile by strata and the estimated biomass with their standard errors in the 2015 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	0.28	0.28	14	14
13	249	3	0.00	0.00	0	0
14	602	7	0.60	0.42	27	19
15	666	8	0.28	0.23	14	12
16	634	7	0.54	0.39	26	18
17	216	2	8.65	8.33	142	137
18	210	2	12.64	1.63	202	26
19	414	5	1.63	1.00	51	32
20	525	6	0.61	0.30	25	12
21	517	6	5.04	1.40	198	55
22	533	6	16.19	2.63	658	107
23	284	3	11.59	1.66	251	36
24	253	3	4.53	3.87	87	74
25	226	3	13.09	8.47	226	146
28	530	6	1.42	0.33	57	14
29	488	6	7.12	2.33	265	86
30	1134	11	10.26	1.38	887	119
31	203	2	17.45	2.80	270	43
32	238	2	6.44	1.86	117	34
33	98	2	5.22	1.14	39	8
34	486	5	3.94	0.89	146	33
Total < 1460 m.	16070	181	3.02	0.25	3702	300
Total <740 m.	10555	120	0.60	0.18	478	147

Table 36 (cont.) Roughhead grenadier (*Macrourus berglax*) biomass by strata in 1988-2015 surveys.

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

Table 37. Roughhead grenadier (*Macrourus berglax*) age-length key in the 2015 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	1																	1
4		2																2
5		4																4
6		9																9
7		4	1															5
8			10	4														14
9			3	3														6
10				3	2													5
11				5	1													6
12				1	5	1												7
13					2	3	1											6
14						4	2											6
15						3	5	1										9
16							4	2										6
17								3	3	1								7
18								3	2	1								6
19									2	3	1							6
20										1	3	2						6
21											3	2	1					6
22												1	2	1				4
23												1	1					2
24																1		1
total	1	19	14	16	10	11	12	9	7	6	7	6	4	1	1			124

Table 37 (cont.) Roughhead grenadier (*Macrourus berglax*) age-length key in the 2015 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		1																1
5		2																2
6		5	1															6
7		2	4															6
8			6	2														8
9			6	1														7
10			2	4														6
11				5	1													6
12					5	1												6
13					4	1	2											7
14						4	2	1										7
15						3	1	2										6
16							4	2	1									7
17								2	4									6
18								2	3	1								6
19										6								6
20										3	2	1						6
21										4	1	1						6
22											3	2	1					6
23											3	1		2				6
24													5		1			6
25												2	1	1	1	1		6
26													2	2	2			6
27													1		4	1		6
28													2	1	1	2		6
29													2	1	2			5
30															1	5		6
31																6		6
32															4	2		6
33																3		3
34																3		3
35																		
36																	1	1
37																	2	2
38																	1	1
total	10	19	12	10	9	9	9	9	8	14	9	7	14	7	16	27		180

Table 38. Roughhead grenadier (*Macrourus berglax*) length frequency ('000) in the 2015 survey.

depths < 730 m. strata (1-19)

length	indet.	male	female	length	indet.	male	female	length	indet.	male	female
3	16			13			8	23			20
4	7		7	14			10	24			24
5		8	28	15		22	32	25			18
6		24	33	16		13	15	26			16
7			34	17		13	7	27			
8			28	18		43	32	28			
9			24	19		44	24	29			17
10			8	20		29	44	30			10
11		20	8	21		29	18				
12		7	8	22		18	42	Total	23	271	516

depths < 1460 m. strata (1-34)

length	indet.	male	female	length	indet.	male	female	length	indet.	male	female
3	62	7		16		256	152	29			102
4	7	15	7	17		312	115	30			114
5	41	49	49	18		303	115	31			70
6		155	130	19		175	112	32			68
7		56	83	20		126	121	33			32
8		174	123	21		122	69	34			25
9		86	126	22		42	109	35			
10		36	79	23		15	70	36			9
11		232	108	24		8	130	37			15
12		228	93	25			116	38			9
13		341	136	26			120				
14		230	145	27			111				
15		352	129	28		7	67	Total	109	3325	3060

Table 39. Roughhead grenadier (*Macrourus berglax*) frequency ('000) at age and strata in the 2014 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	2	7					10			7		8				7	9			21			70	3	3		
2	33		13		27	27	11		36	35	36	18	45	14	21	33	96			48			8	501	21	6	
3	1		6		18	16	31		47	54	46	41	25	10	33	33	103			12	6			482	56	8	
4			2		1	15	23		36	93	44	9	10	30	15	30	142	9		40	5	28		531	107	10	
5			5			13	3		8	55	45	19		30	12	45	126	16		63	4	60		503	171	12	
6			7	2		10	11	3	22	38	70	34	17	37	9	29	216	22		81	4	46		657	245	14	
7			18	4		13	4	1	13	19	79	36	18	35	6	33	264	32		64	5	46		688	304	15	
8			16	6		15	19	8	11	17	72	41	4	25	4	22	212	33		54	3	32		593	419	17	
9			6	9		17	20	6	1	6	64	33	3	17	5	22	153	23		41	1	22		449	479	18	
10			9	4	5	42	36	2	5	23	65	37	3	15	28	15	105	14		25	3	6		442	603	19	
11	4			1	1	17	49	14	1	16	48	6	5	31	6	9	67	7		5	1	8		295	784	21	
12	2				3	11	35	6	1	16	30	4	2	32	4	7	44	7		2	2	11		219	896	22	
13	7				7	20	19	4		19	43	19	13	33		14	64	16		9	2	29		316	1320	25	
14					5	4	6	8		11	26	5	5	11		3	30	5			1	5		125	1416	26	
15	1				3	7	7	3		21	73	13	7	20		20	61	28		2	3	12		280	1780	28	
16+						1	10			15	94	36	10	20	8	39	63	28				8	5		338	2448	31
Sets	2	1	4	2	4	2	2	3	5	6	6	3	3	3	6	6	11	2		2	2	2	5	80	559	16.1	
n	50	7	80	26	70	229	294	54	179	444	834	358	167	360	151	360	1755	238		466	46	318		6487			

Table 40. Roughhead grenadier (*Macrourus berglax*). Abundance at age ('000) in the 1994 - 2015 survey.

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

Table 40 (cont.). Roughhead grenadier (*Macrourus berglax*). Abundance at age ('000) in the 1994 - 2015 survey.

< 1460 m. strata (1-34)

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

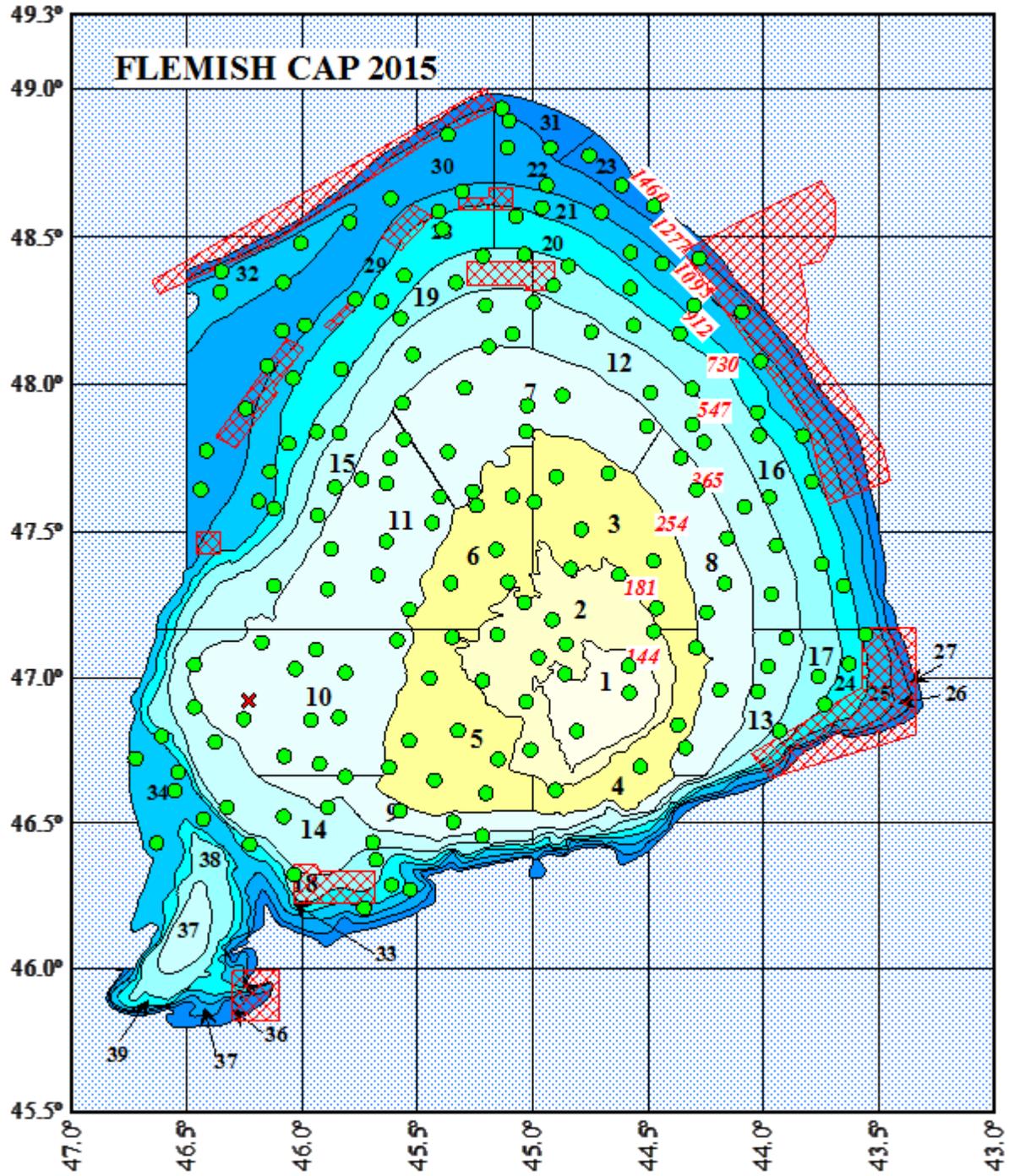


Fig. 1. Haul positions in the Flemish Cap survey 2015.

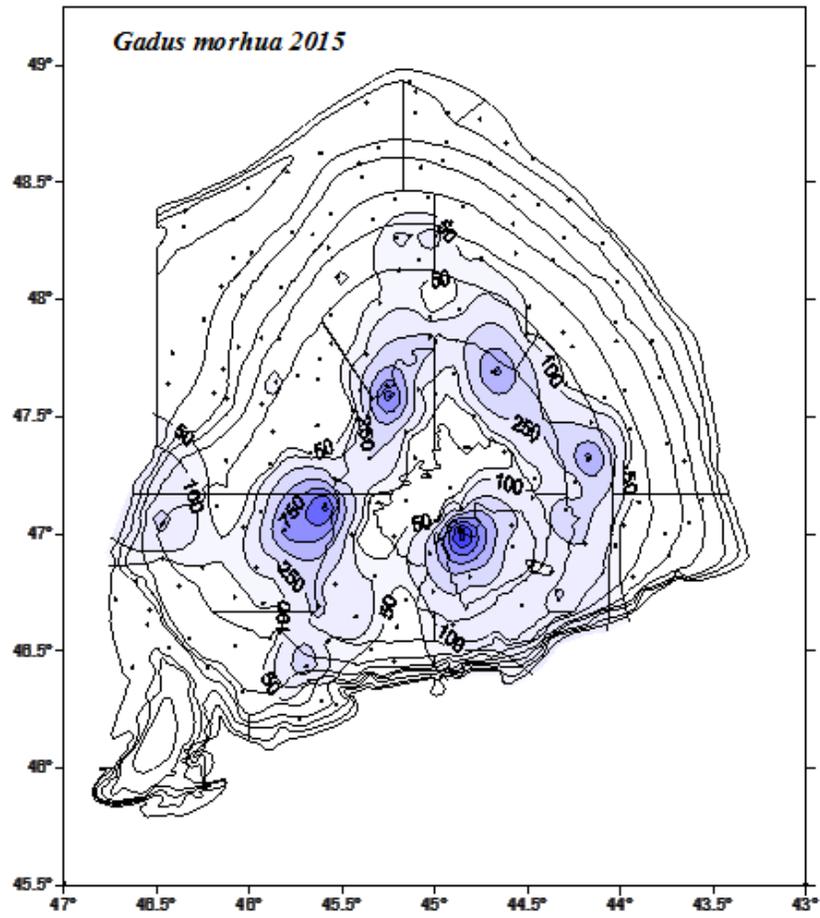


Fig. 2. Cod (*Gadus morhua*) catch (kg.) distribution in the 2015 survey.

Cod 3M

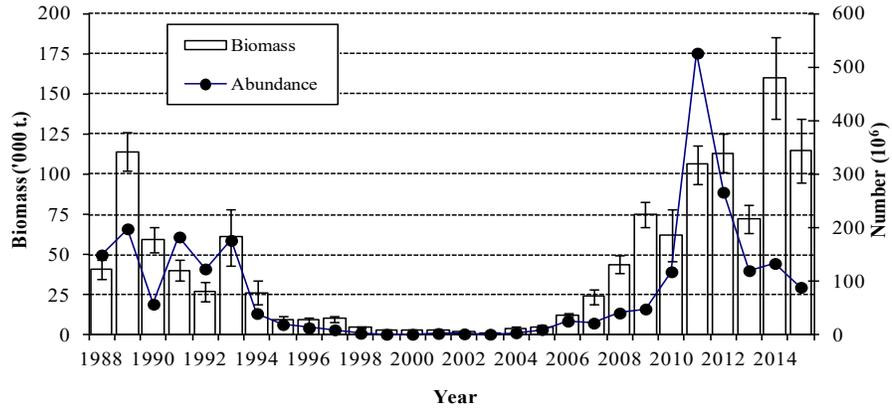


Fig. 3. Cod biomass (t) ± S.E. and abundance 1988-2015.

3M Cod age dsitribution

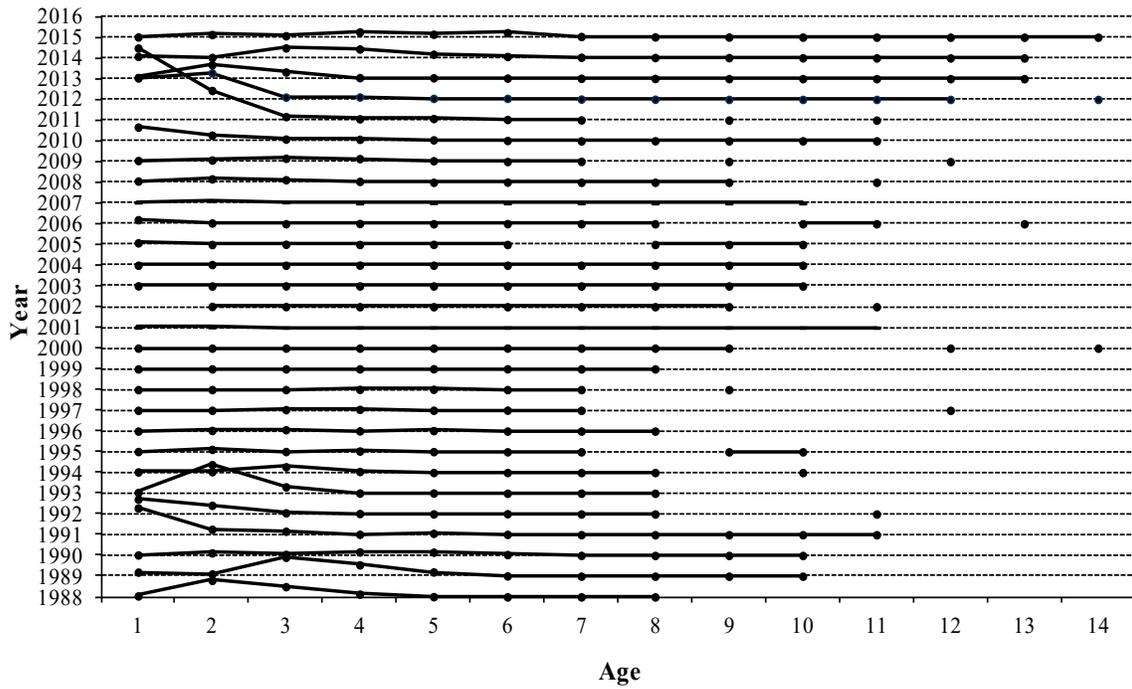


Fig. 4. Cod age distribution in Flemish Cap NAFO 3M 1988-2015.

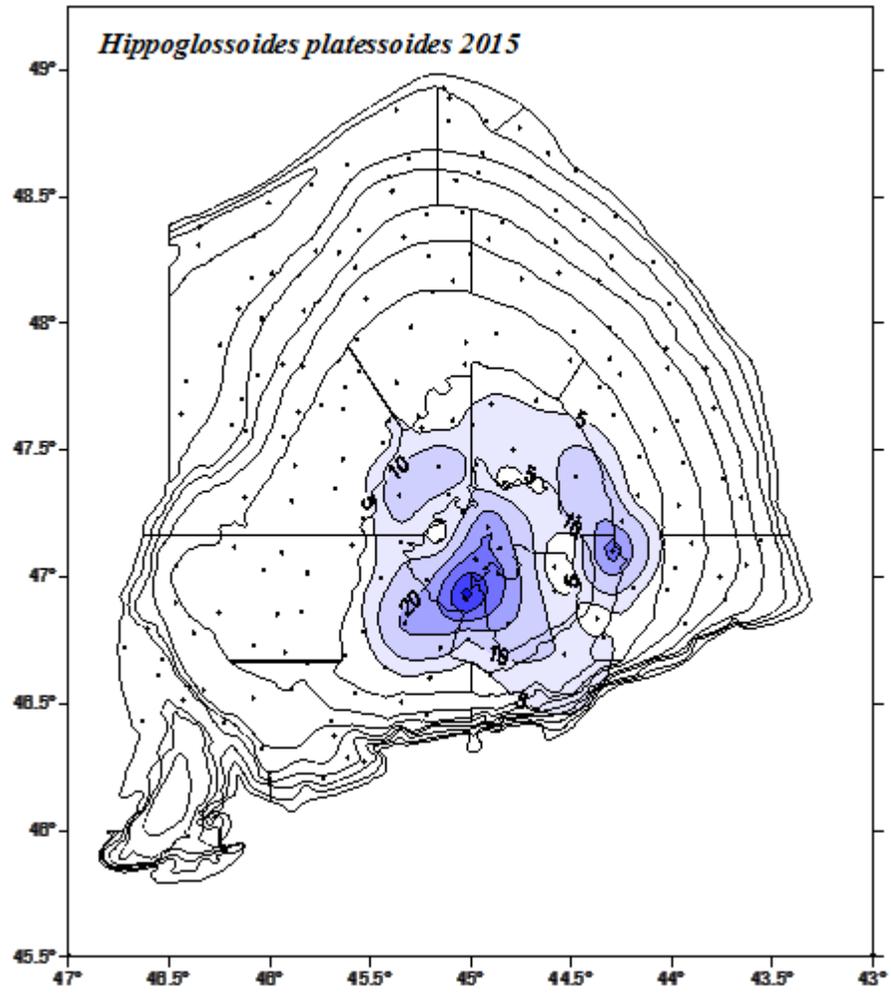


Fig. 5. American plaice (*Hippoglossoides platessoides*) catch (kg) distribution in 2015 survey.

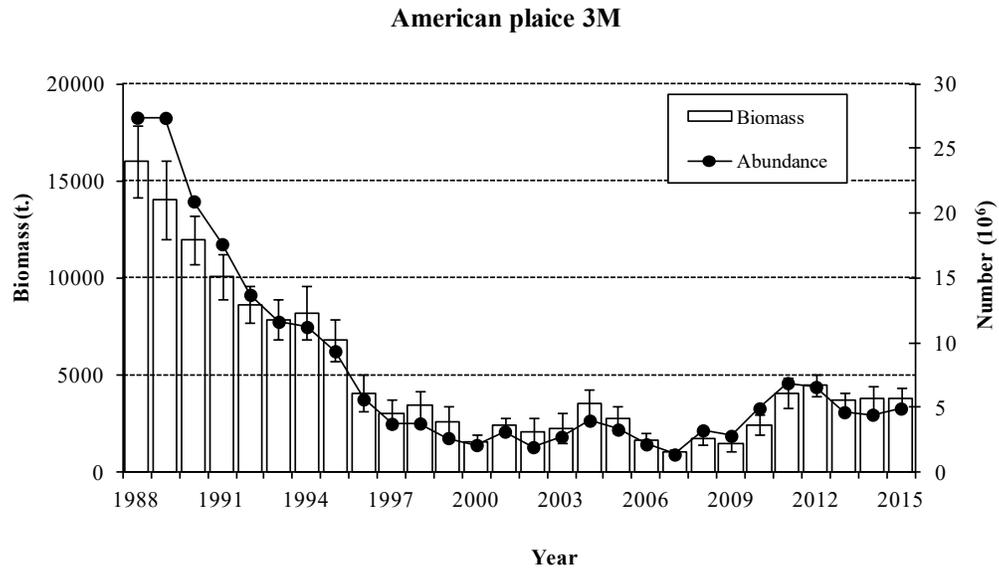


Fig. 6. American plaice (*Hippoglossoides platessoides*) biomass (t.) ± S.E. and abundance 1988-2015.

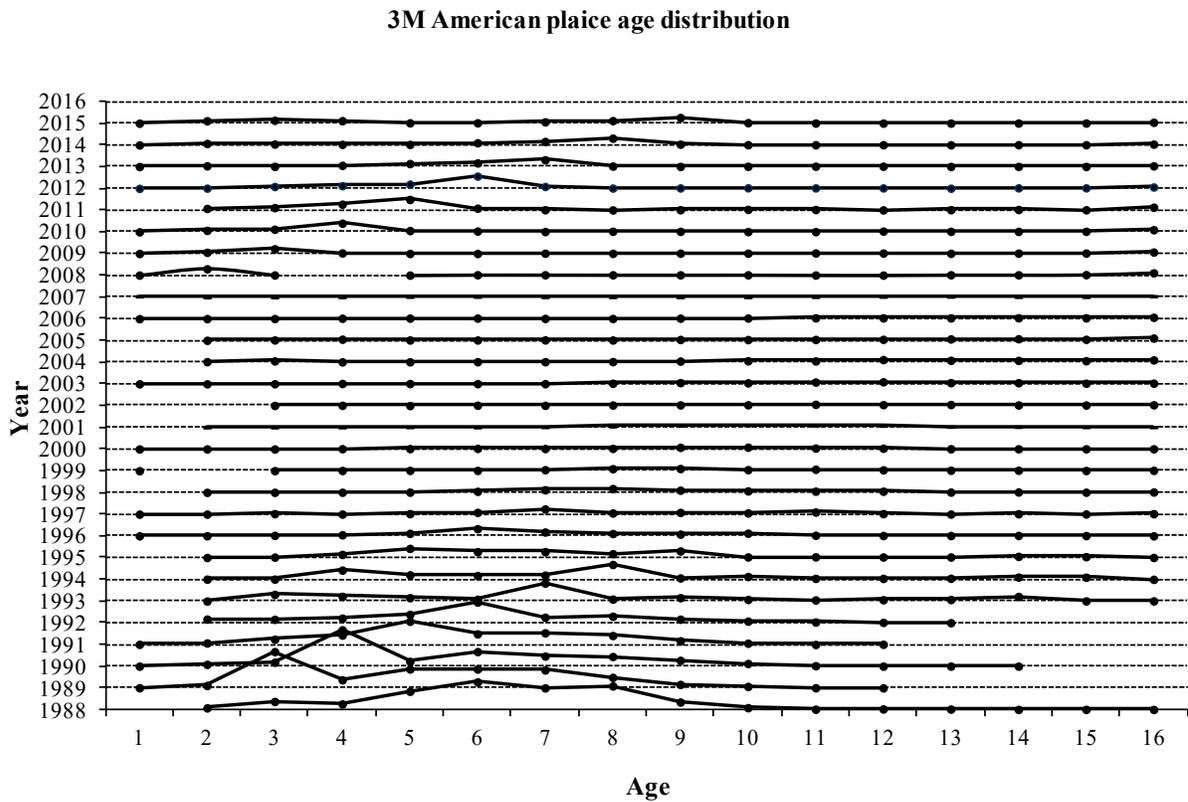


Fig. 7. American plaice age distribution on Flemish Cap, NAFO Div. 3M: 1988-2015.

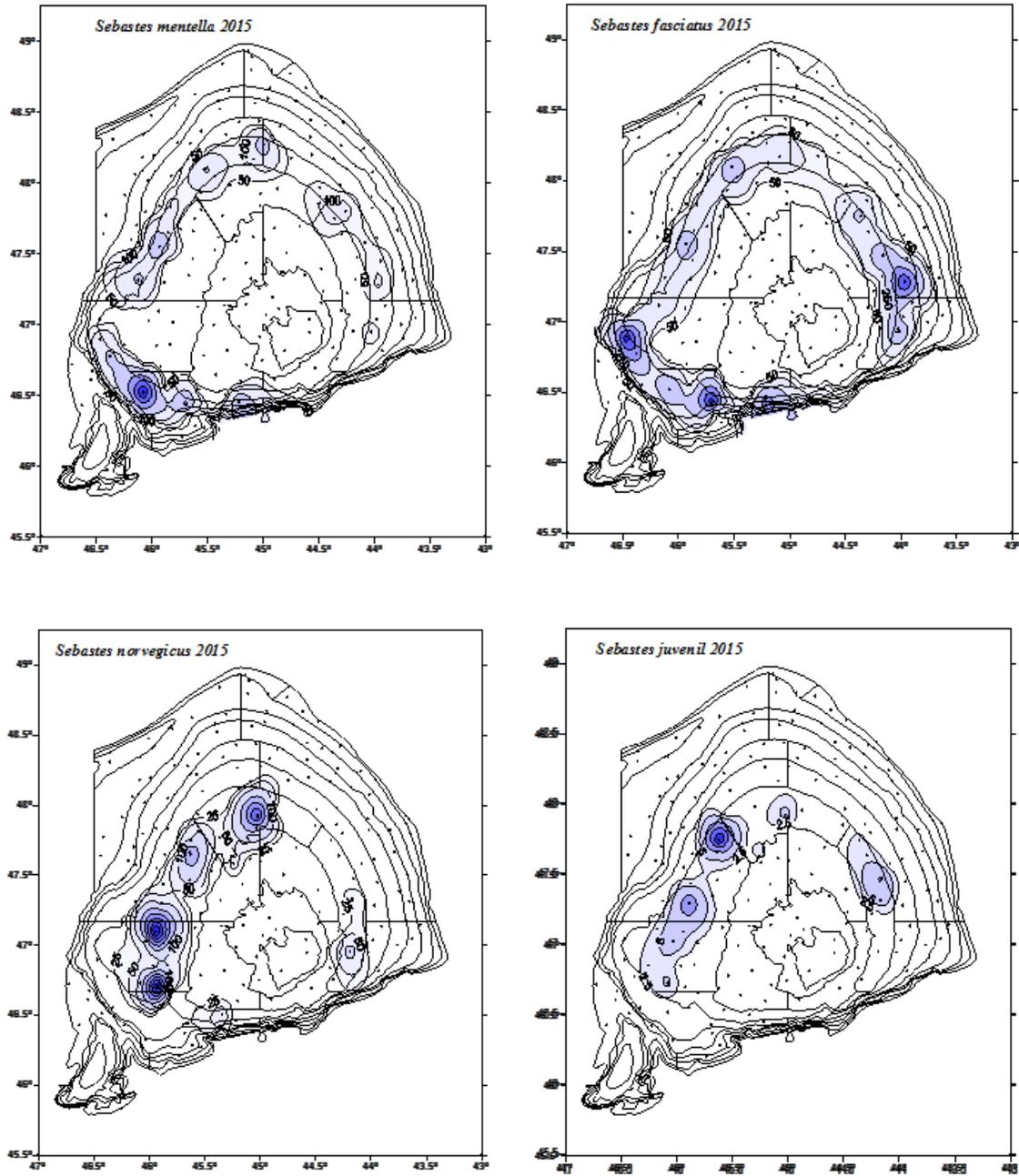


Fig. 8. Catch distribution (kg) of *S. marinus*, *S. mentella*, *S. fasciatus* and *S. juvenil* in 2015 survey.

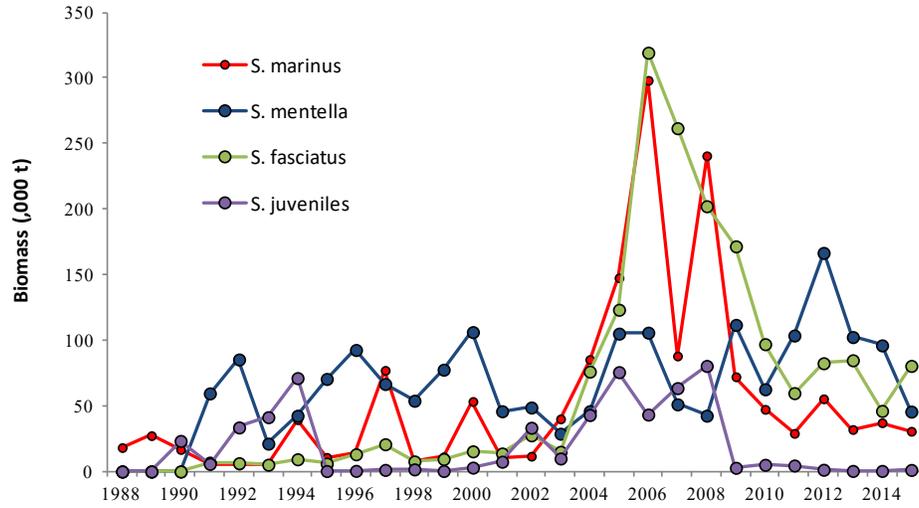


Fig. 9. Redfish species biomass (t) 1988-2015.

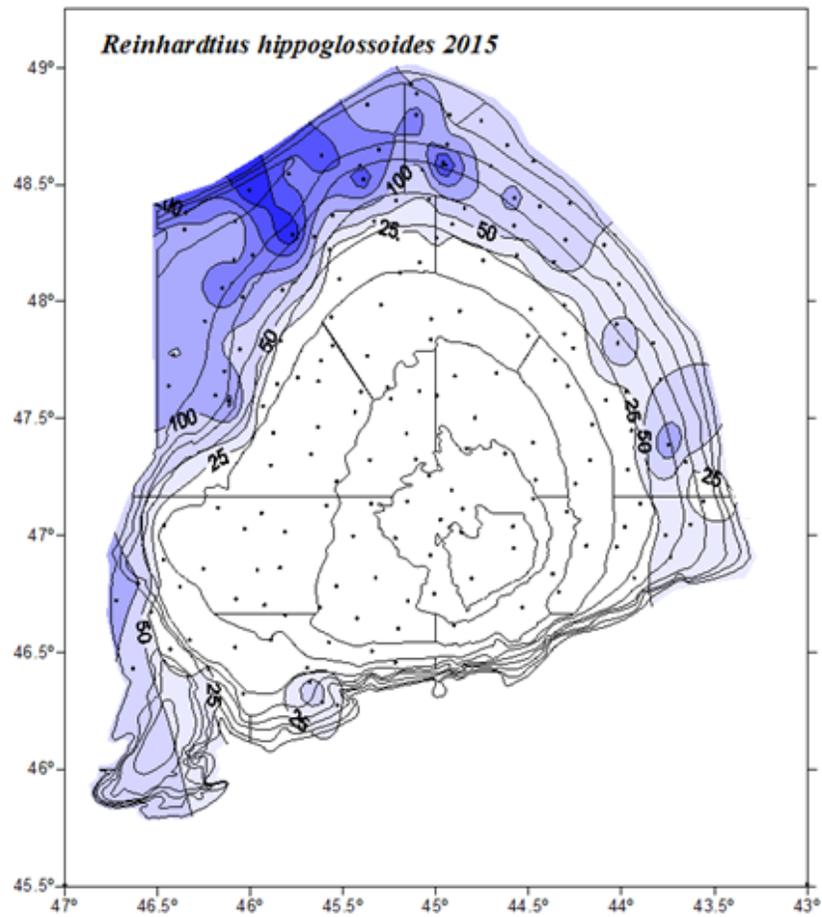


Fig. 10. Greenland halibut (*Reinhardtius hippoglossoides*) catch distribution (kg) in 2015 survey.

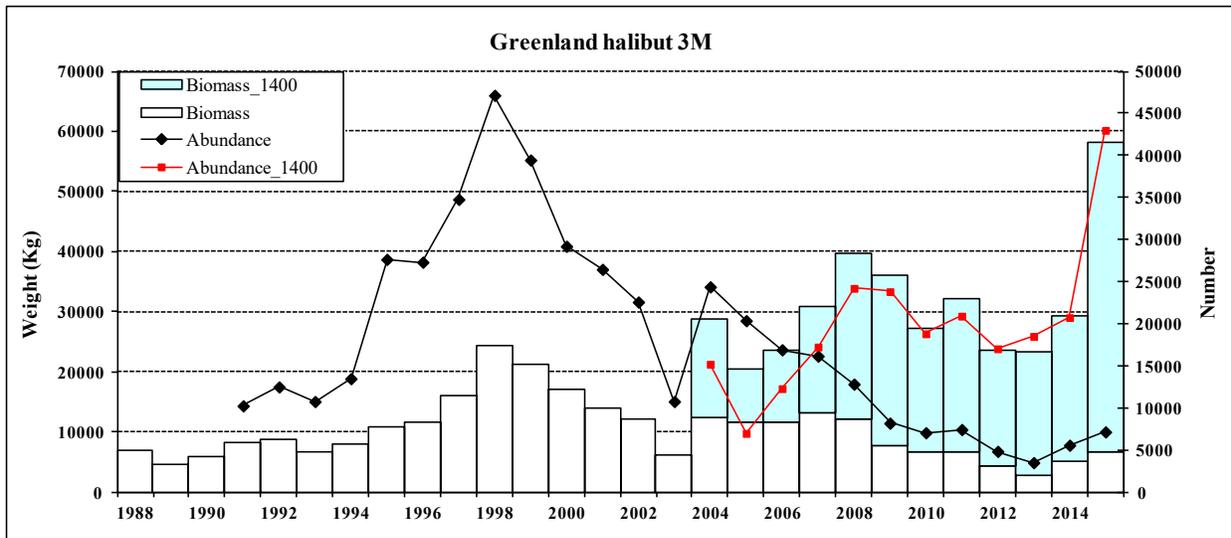


Fig. 11. Greenland halibut (*Reinhardtius hippoglossoides*) Biomass (t.) \pm S.E. and abundance 1988-2015.

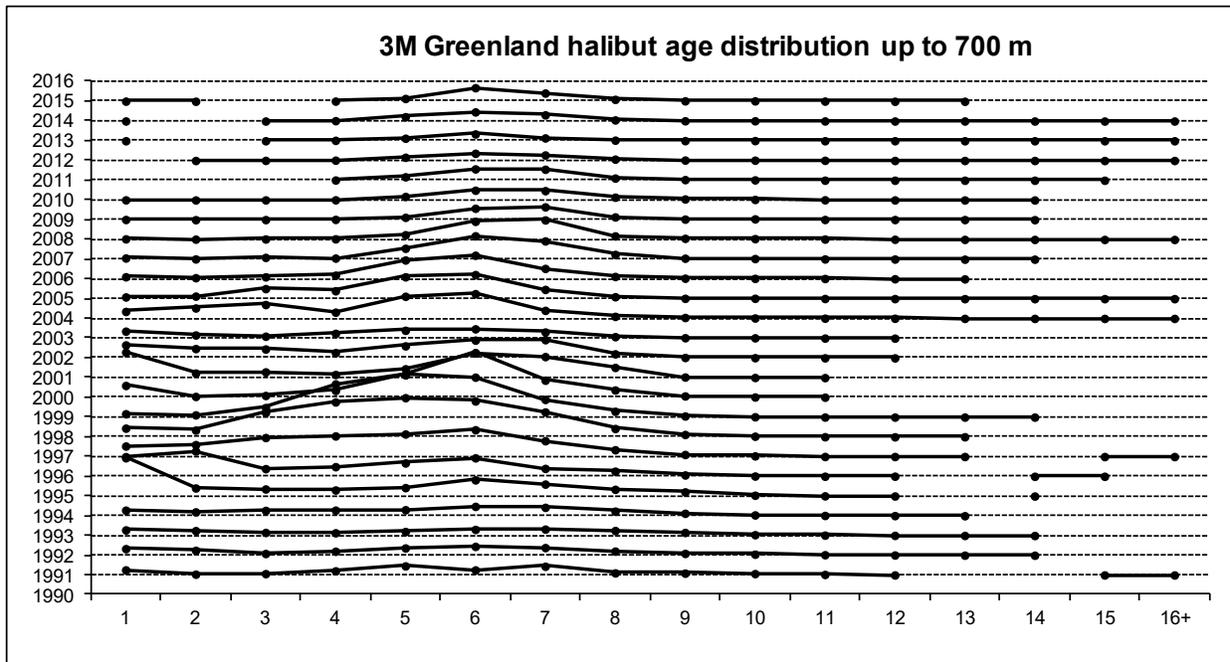


Fig. 12. Greenland halibut age distribution on Flemish Cap, NAFO Div. 3M: 1988-2015.

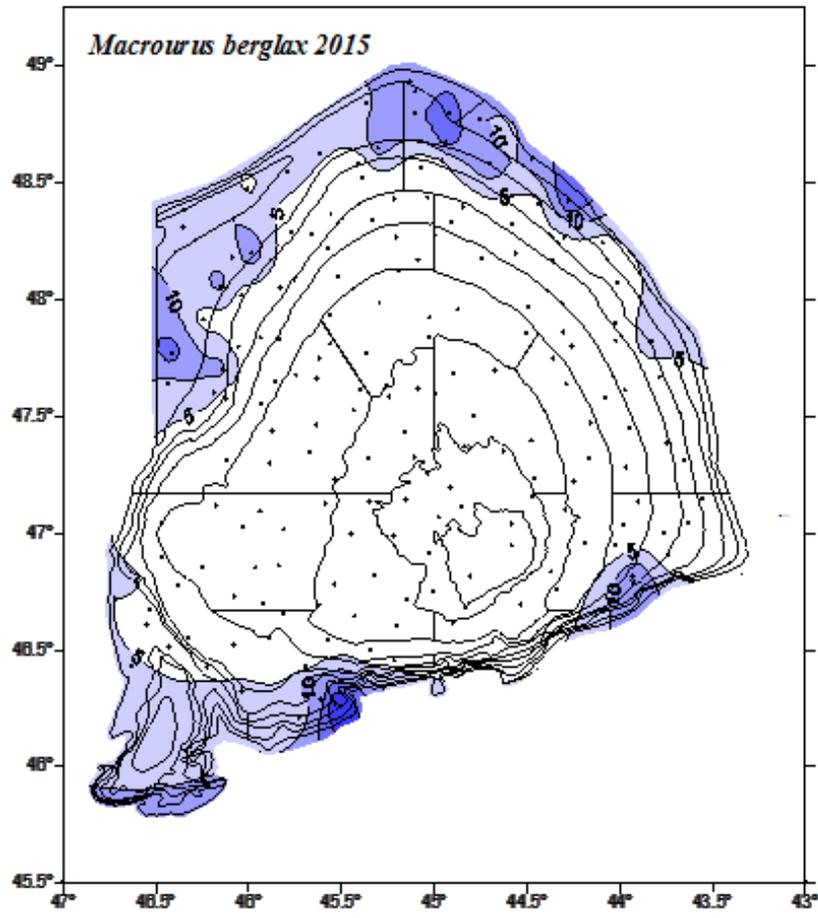


Fig. 13. Roughhead grenadier (*Macrourus berglax*) catch distribution (kg) in the 2015 survey.

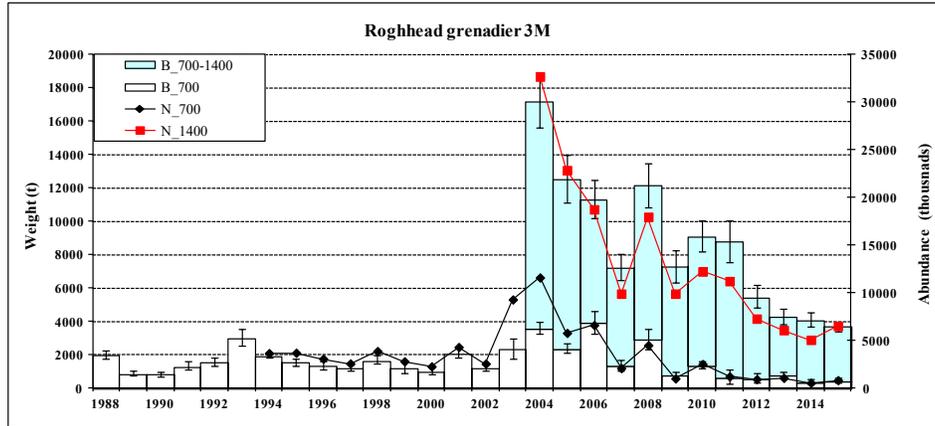


Fig. 14. Roughhead grenadier (*Macrourus berglax*) biomass (t) \pm S.E. and number ('000) 1988-2015.

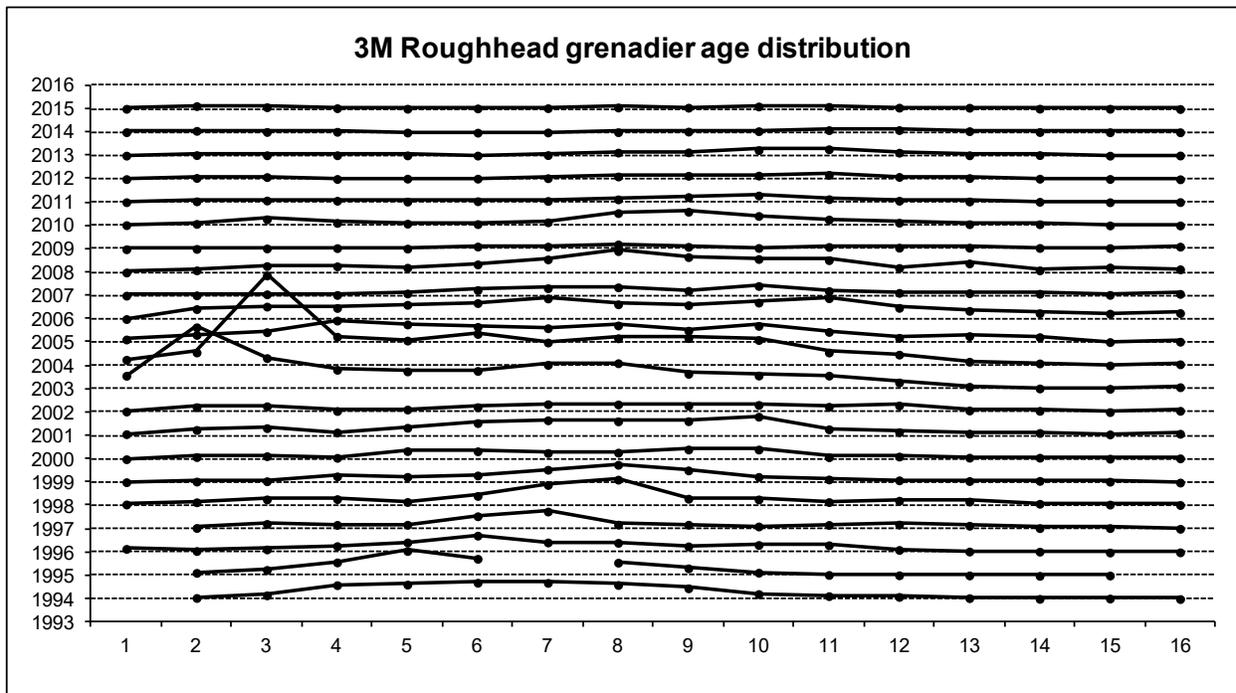


Fig. 15. Roughhead grenadier (*Macrourus berglax*) age distribution on Flemish Cap in depths < 730 m, NAFO Div. 3M: 1988-2015.