DEMERSAL BEAKED REDFISH – DJÚPKARFI
Sebastes mentella

GENERAL INFORMATION

Icelandic slope beaked redfish (*Sebastes* mentella) is a redfish species which is similar in appearance to golden redfish (*Sebastes norvegicus*). However, there are some characteristic features that distinguish those two species apart, and the depth is one of them, with demersal beaked *S. mentella* inhabiting deeper waters (>400 m). Around Iceland the species is mainly found in the warmer waters in the western, southern and south-eastern parts of continental slope. Demersal beaked redfish is a slow growing, long-lived and late-maturing species. For further species information see ICES Stock Annex for demersal beaked redfish.

The *S. mentella* on the continental shelf and slope of Iceland (the Iceland Sea ecoregion, which is defined to be within the Icelandic 200 NM EEZ and includes ICES Division 5.a and part of ICES Subarea 14) is treated as separate biological stock and management unit. Only the fishable stock of Icelandic slope *S. mentella* is found in Icelandic waters, i.e. mainly fish larger than 30 cm. The East Greenland shelf is most likely a common nursery area for the three biological stocks, including the Icelandic slope one.

SCIENTIFIC DATA

The Icelandic autumn survey (IS-SMH) on the continental shelf and slope in Icelandic waters covers depths down to 1500 m. Data for Icelandic slope S. mentella is available from 2000–2018. No survey was conducted in 2011.

The total biomass index has fluctuated during the 2000-2018 period (Table 1 and Figure 2). The index was highest in 2000 and 2001, declined sharply in 2002 and 2003 and increased again from 2004 to 2006. After gradual decrease to 2013 to the lowest level in the time series, the total biomass index has increased to similar level as in 2006. The total abundance index has on the other hand been relatively stable at low levels since 2007 (Figure 2). The biomass index of fish 45 cm and larger shows different trend than the total biomass index where it has increased from the lowest value in 2007 to the highest one in the time series in 2017 and 2018 (Figure 2). The abundance index of fish 30 cm and smaller (recruits) has since 2007 been at very low level (Figure 2).

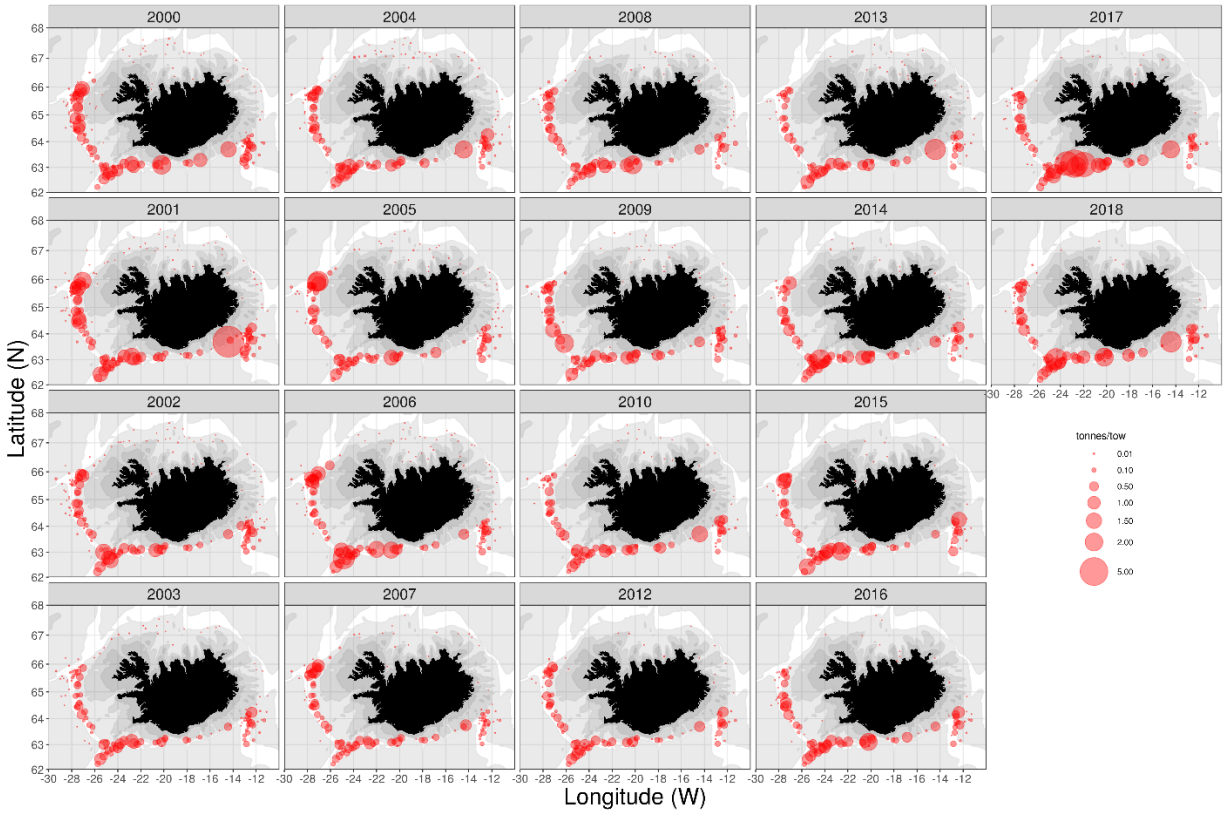

Figure 1. Demersal beaked redfish. Spatial distribution of Icelandic slope *Sebastes mentella* in Icelandic autumn survey in 2000-2018. No survey was conducted in 2011.

Mynd 1. Djúpkarfi. Útbreiðsla í stofnmælingu botnfiska að hausti árin 2000-2018. Engin stofnmæling var árið 2011.

Table 1. Demersal beaked redfish. Total biomass index of Icelandic slope *S. mentella* in the Icelandic Autumn Groundfish survey 2000-2018. No survey was conducted in 2011.

Tafla 1. Djúpkarfi. Stofnvísitala úr stofnmælingu botnfiska að hausti frá 2000 ásamt staðalfráviki. Engin stofnmæling var árið 2011.

Year	Iceland	cv
2000	134 407	0.145
2001	161 733	0.182
2002	95 059	0.140
2003	63 179	0.127
2004	96 465	0.171
2005	109 196	0.250
2006	123 059	0.166
2007	82 062	0.183
2008	80 011	0.141
2009	93 653	0.174
2010	77 852	0.154
2011		
2012	74 604	0.145
2013	70 055	0.156
2014	103 051	0.191
2015	107 423	0.174
2016	80 855	0.123
2017	125 611	0.172
2018	122 719	0.208

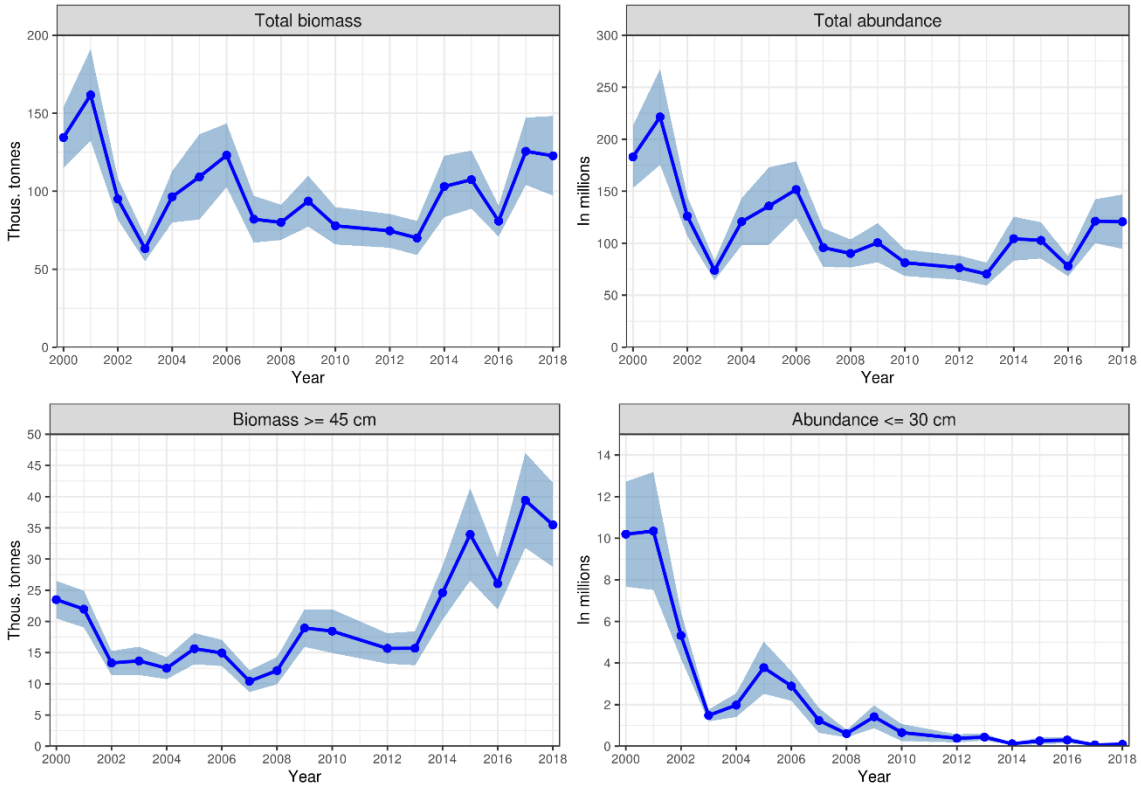

Figure 2. Demersal beaked redfish. Survey indices of the Icelandic slope *S. mentella* in the autumn survey in ICES Division 5.a in 2000-2018. No survey was conducted in 2011. The figure shows the total biomass index, total abundance index in millions of fish, biomass index of fish 45 cm and larger and abundance index of fish 30 cm and smaller.

Mynd 2. Djúpkarfi. Stofnvísitala djúpkarfa (efri til vinstri), fjöldi í milljónum (efri til hægri), vísitala stærri einstaklinga (>45 cm, neðri til vinstri) og nýliðunarvísitölu (<=30 cm, neðri til hægri) úr stofnmælingu botnfiska að hausti frá 2000, ásamt staðalfráviki.

Spatial distribution of biomass indices of Icelandic slope *S. mentella* from Icelandic Autumn survey indicates increase in relative abundance in south-western part of the shelf and decrease in western part in recent years (Figure 3). In the 2017 survey, the highest catch was in the south-western part which is simultaneously the highest catch in this area since the beginning of the survey.

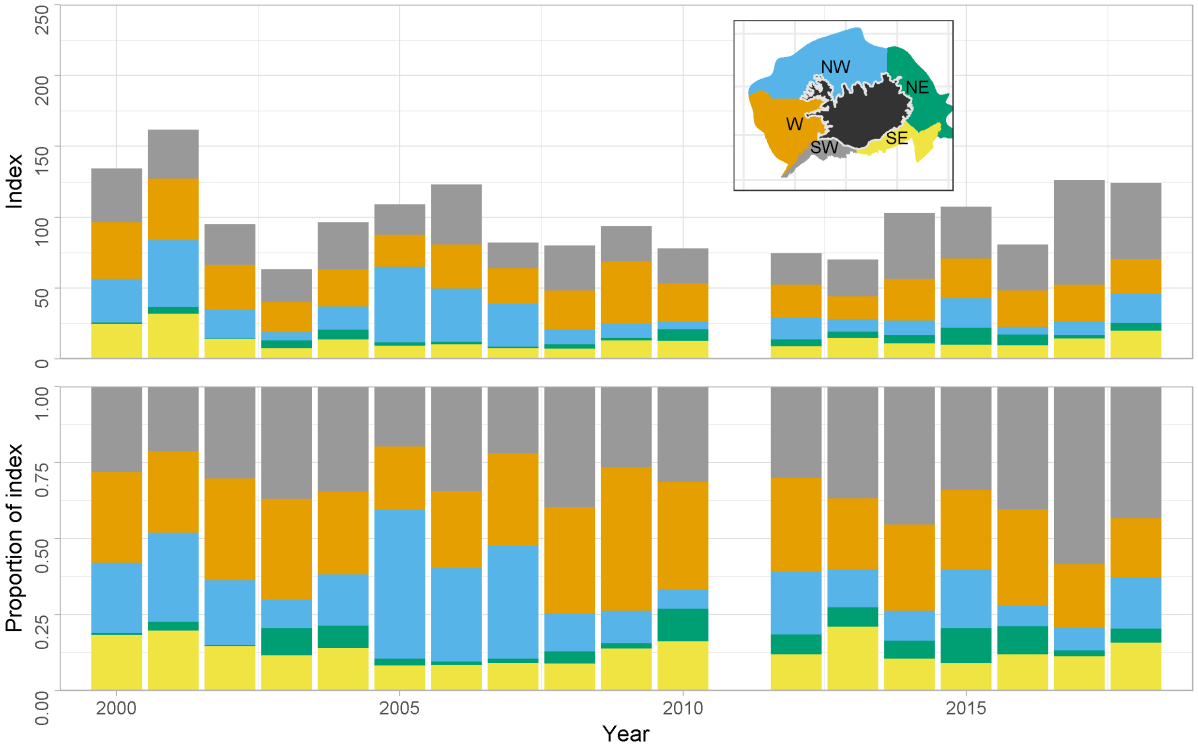

Figure 3. Demersal beaked redfish. Spatial distribution of biomass index from the Icelandic autumn survey since 2000. No survey was conducted in 2011.

Mynd 3. Djúpkarfi. Dreifing lífmassavísitölu í stofnmælingu botnfiska að hausti frá árinu 2000. Engin stofnmæling var árið 2011.

The length of the Icelandic slope *S. mentella* in the autumn survey is between 25 and more than 50 cm. Since 2000, the mode has shifted to the right, that is, from 36-39 cm in 2000 to about 42-43 cm in 2012-2018 (Figure 4). Very little Icelandic slope *S. mentella* smaller than 35 cm was observed in the surveys in recent years.

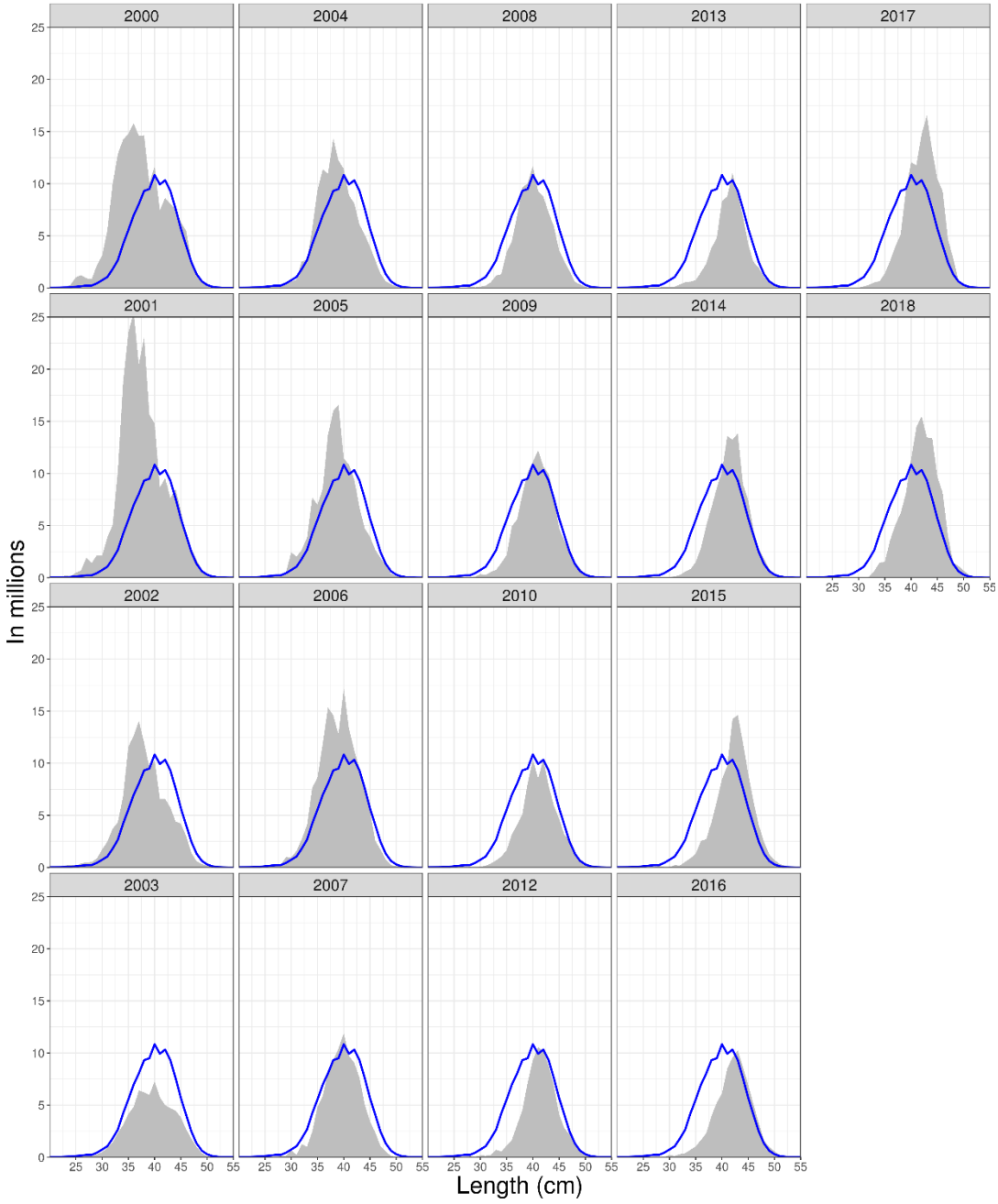

Figure 4. Demersal beaked redfish. Length disaggregated abundance indices of Icelandic slope *S. mentella* in the Autumn Survey since 2000 in ICES Division 5.a. No survey was conducted in 2011. The blue line is the mean of 2000-2018.

Mynd 4. Djúpkarfi. Lengdarskiptar vísitölur úr stofnmælingu botnfiska að hausti frá árinu 2000 ásamt meðaltali allra ára (blá lína). Engin stofnmæling var árið 2011.

Otoliths from the autumn survey have been sampled since 2000 and otoliths from the 2000, 2009, 2010 and 2017 surveys have been age read (Figure 20.2.3). The age reading shows that the stock consists of many yearclasses and the age ranges from 5 to over 50 years. The 1985 and 1990 yearclasses were large and were in the 2017 survey still relatively strong. There is an indication in the 2017 survey that the 2002-2005 yearclasses are relatively strong (seen as 12-15 years old fish). These yearclasses can also be seen in the 2010 survey as 5-8 years old fish.

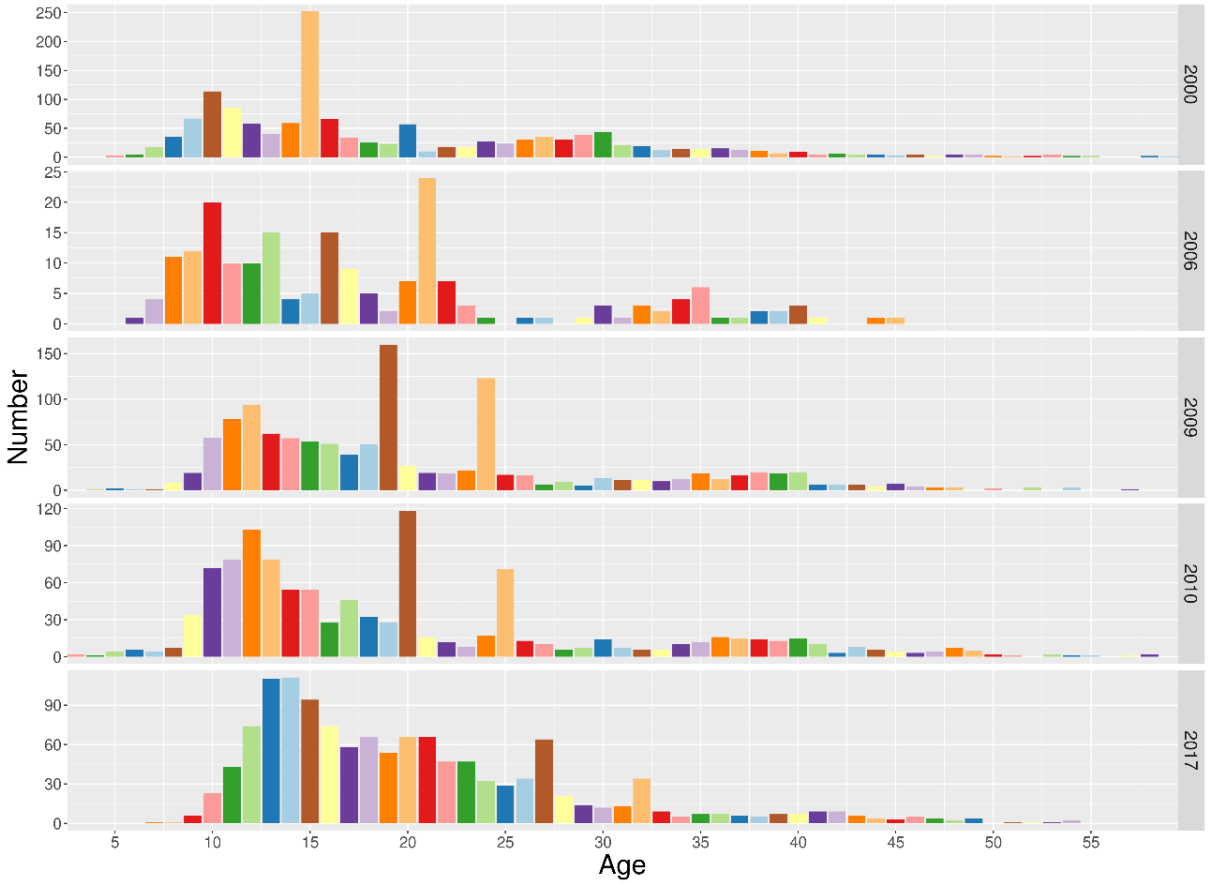

Figure 5. Demersal beaked redfish. Age distribution of Icelandic slope *S. mentella* from the Autumn Survey in 2000 (n = 1405), 2006 (n = 199), 2009 (n = 1206), 2010 (n = 1101), and 2017 (n = 1299). The age class 60 are the combined age-classes of 60 years and older.

Mynd 5. Djúpkarfi. Aldursgreindir einstaklingar úr stofnmælingu botnfiska að hausti árin 2000 (n = 1405), 2006 (n = 199), 2009 (n = 1206), 2010 (n = 1101) og 2017 (n = 1299). 60 ára er samansettur úr fiski 60 ára og eldri.

INFORMATION FROM THE FISHING INDUSTRY

LANDINGS

Total annual landings of Icelandic slope *S. mentella* from the Icelandic Sea ecoregion 1950–2018 are presented in Table 2 and Figure 6.

During the 1950-1977 period, before the extension of the Icelandic EEZ to 200 NM, Icelandic slope *S. mentella* was mainly fished by West-Germany. The catches peaked in 1953 to about 87 000 t but gradually decreased to about 23 000 t in 1977. After the extension of the Icelandic EEZ in 1978 the fishery has almost exclusively been conducted by Icelandic vessels. Annual landings gradually decreased from 57 000 t in 1994 to 17 000 t in 2001. Landings in 2001-2010 fluctuated between 17 000 and 20 500 t except in 2003 and 2008 when annual landings were 28 500 and 24 000 t respectively. Annual landings in 2011-2018 were between 8300 and 12 000 t. The total catch in 2018 were 9995 t.

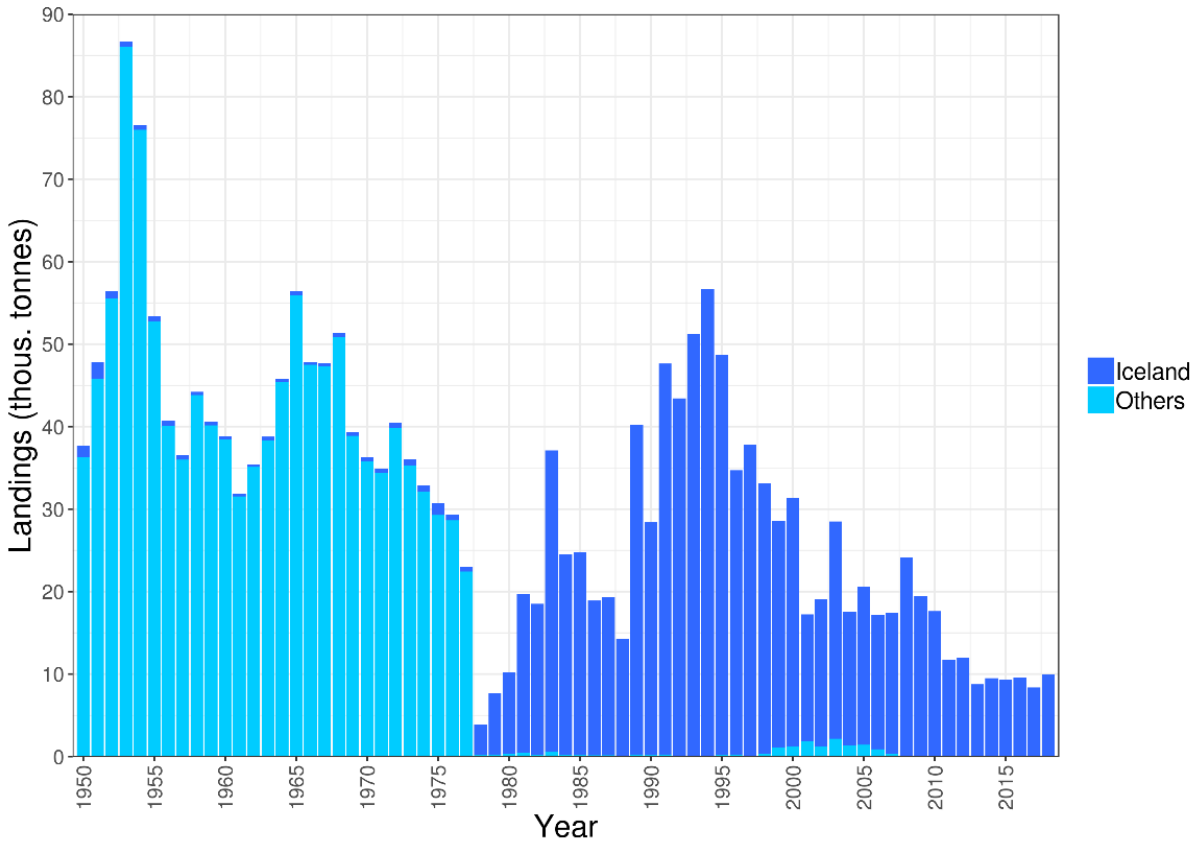

Figure 6. Demersal beaked redfish. Nominal landings (in tonnes) of Icelandic slope *S. mentella* from Icelandic waters (ICES Division 5.a and Subarea 14) 1950-2018.

Mynd 6. Djúpkarfi. Landaður afli (í tonnum) á Íslandsmiðum 1950-2018.

Table 2. Demersal beaked redfish. Nominal landings (in tonnes) of Icelandic slope *S. mentella* 1978-2018 ICES Division 5.a.

Tafla 2. Djúpkarfi. Landaður afli (í tonnum) á Íslandsmiðum 1978-2018.

Year	Iceland	Others	Total
1950	1 458	36 269	37 727
1951	1 944	45 825	47 769
1952	885	55 554	56 439
1953	658	86 011	86 669
1954	577	75 972	76 459
1955	654	52 784	53 438
1956	674	40 047	40 721
1957	558	35 993	36 551
1958	409	43 820	44 229
1959	398	40 175	40 573
1960	407	38 428	38 836
1961	307	31 534	31 841
1962	264	35 122	35 386
1963	456	38 338	38 794
1964	362	45 414	45 776
1965	473	55 930	56 403
1966	332	47 491	47 823
1967	357	47 313	47 670
1968	494	50 892	51 386
1969	486	38 358	39 345
1970	500	35 800	36 300
1971	495	34 376	34 871
1972	593	39 874	40 468
1973	794	35 251	36 045
1974	806	32 103	32 909
1975	1 404	29 301	30 705
1976	715	28 632	29 346
1977	590	22 427	23 018
1978	3 693	209	3 902
1979	7 448	246	7 694
1980	9 849	348	10 197
1981	19 242	447	19 689
1982	18 279	213	18 492
1983	36 585	530	37 115
1984	24 271	222	24 493
1985	24 580	188	24 768
1986	18 750	148	18 898
1987	19 132	161	19 293
1988	14 177	113	14 290

Year	Iceland	Others	Total
1989	40 013	256	40 269
1990	28 214	215	28 429
1991	47 378	273	47 651
1992	43 414	0	43 414
1993	51 221	0	51 221
1994	56 674	46	56 720
1995	48 479	229	48 708
1996	34 508	233	34 741
1997	37 876	0	37 876
1998	32 841	284	33 125
1999	27 475	1 115	28 590
2000	30 185	1 208	31 393
2001	15 415	1 815	17 230
2002	17 870	1 175	19 045
2003	26 295	2 183	28 478
2004	16 226	1 338	17 564
2005	19 109	1 454	20 563
2006	16 339	869	17 208
2007	17 091	282	17 373
2008	24 123	0	24 123
2009	19 430	0	19 430
2010	17 642	0	17 642
2011	11 738	0	11 738
2012	11 965	0	11 965
2013	8 761	0	8 761
2014	9 500	0	9 500
2015	9 311	0	9 311
2016	9 536	0	9 536
2017	8 371	0	8 371
2018[1)]	9 995	0	9 995

1) Provisional

FISHERIES AND FLEETS

The fishery for Icelandic slope *S. mentella* in Icelandic waters is a directed bottom trawl fishery along the shelf and slope west, southwest, and southeast of Iceland at depths between 500 and 800 m (Figure 7). The proportion of Icelandic slope S. mentella catches taken by pelagic trawls 1991-2000 varied between 10 and 44% of the total landings (Table 3). In 2001-2018, no pelagic fishery occurred, or it was negligible except in 2003 and 2007. The pelagic fishery was mainly in the same areas as the bottom trawl fishery (Figure 8).

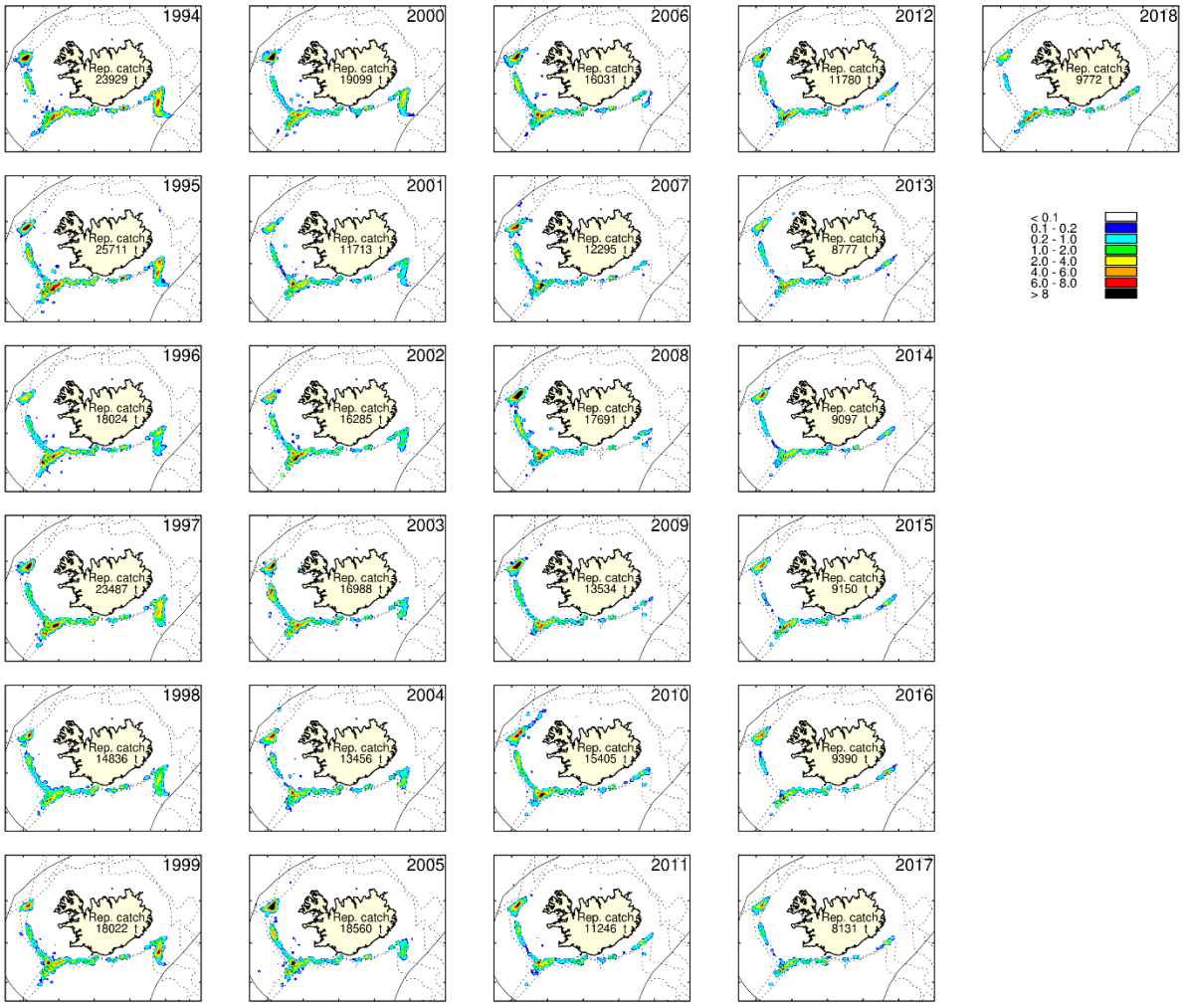

Figure 7. Demersal beaked redfish. Geographical location of the Icelandic slope *S. mentella* catches in Icelandic waters (ICES Division 5.a and Subarea 14) 1991-2018 as reported in logbooks of the Icelandic fleet using bottom trawl. The black line indicates part of the management unit for the deep-pelagic redfish stock. The dotted line represents the 500 and 1000 m isobaths.

Mynd 7. Djúpkarfi. Útbreiðsla botnvörpuveiða á Íslandsmiðum 1991-2018 samkvæmt afladagbókum. Svartar línur sýna stjórnunareiningu neðri stofns úthafskarfa, en punktalínur eru 500 og 1000 m dýptarlínur.

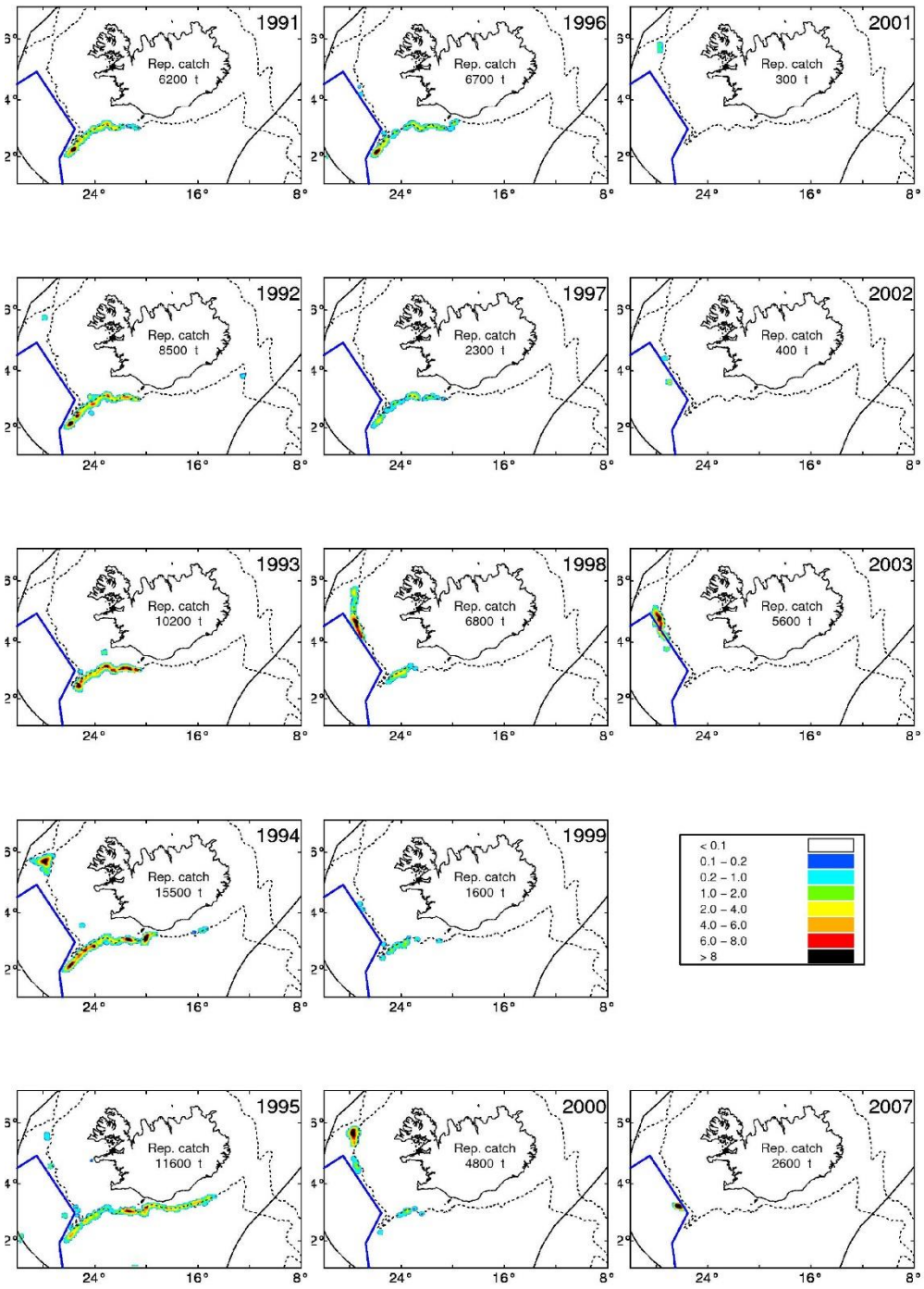

Figure 8. Demersal beaked redfish. Geographical location of the Icelandic slope *S. mentella* catches in Icelandic waters (ICES Division 5.a and Subarea 14) 1991-2003 and 2007 as reported in logbooks of the Icelandic fleet using pelagic trawl. The blue line indicates part of the proposed management unit for the deep-pelagic redfish stock. The dotted line represents the 500 m isobaths.

Mynd 8. Djúpkarfi. Útbreiðsla íslenskra flotvörpuveiða 1991-2003 og 2007 samkvæmt afladagbókum. Blá lína sýnir tillögu að stjórnunareiningu fyrir neðri stofn úthafskarfa. Sýnd einnig 500 m dýptarlína (punktalína).

Table 3. Demersal beaked redfish. Proportion of the landings of Icelandic slope *S. mentella* taken in ICES Division 5.a by pelagic and bottom trawls since 1991.

Tafla 3. Djúpkarfi. Skipting landaðs afla við Ísland eftir veiðarfærum (flotvörpu og botnvörpu frá 1991).

Year	Pelagic trawl	Bottom trawl
1991	22%	78%
1992	27%	73%
1993	32%	68%
1994	44%	56%
1995	36%	64%
1996	31%	69%
1997	11%	89%
1998	37%	63%
1999	10%	90%
2000	24%	76%
2001	3%	97%
2002	3%	97%
2003	28%	72%
2004	0%	100%
2005	0%	100%
2006	0%	100%
2007	17%	83%
2008-2018	0%	100%

SAMPLING FROM THE COMMERCIAL FISHERY

The table below shows the 2018 biological sampling from the catch and landings of Icelandic slope *S. mentella* in ICES Division 5.a. Number of samples and hence, number of fish length measured, were fewer in 2018 than in 2017 (number of samples were 57 and over 10 000 fish were length measured). The reason is reduced sampling effort of onboard observers from the Directorate of Fisheries.

Otoliths from the commercial catch have been collected, but no systematic age reading is done.

Year	Nation	Gear	Landings (t)	No. samples	No. length measured
5.a	Iceland	Bottom trawl	9 995	35	4 283

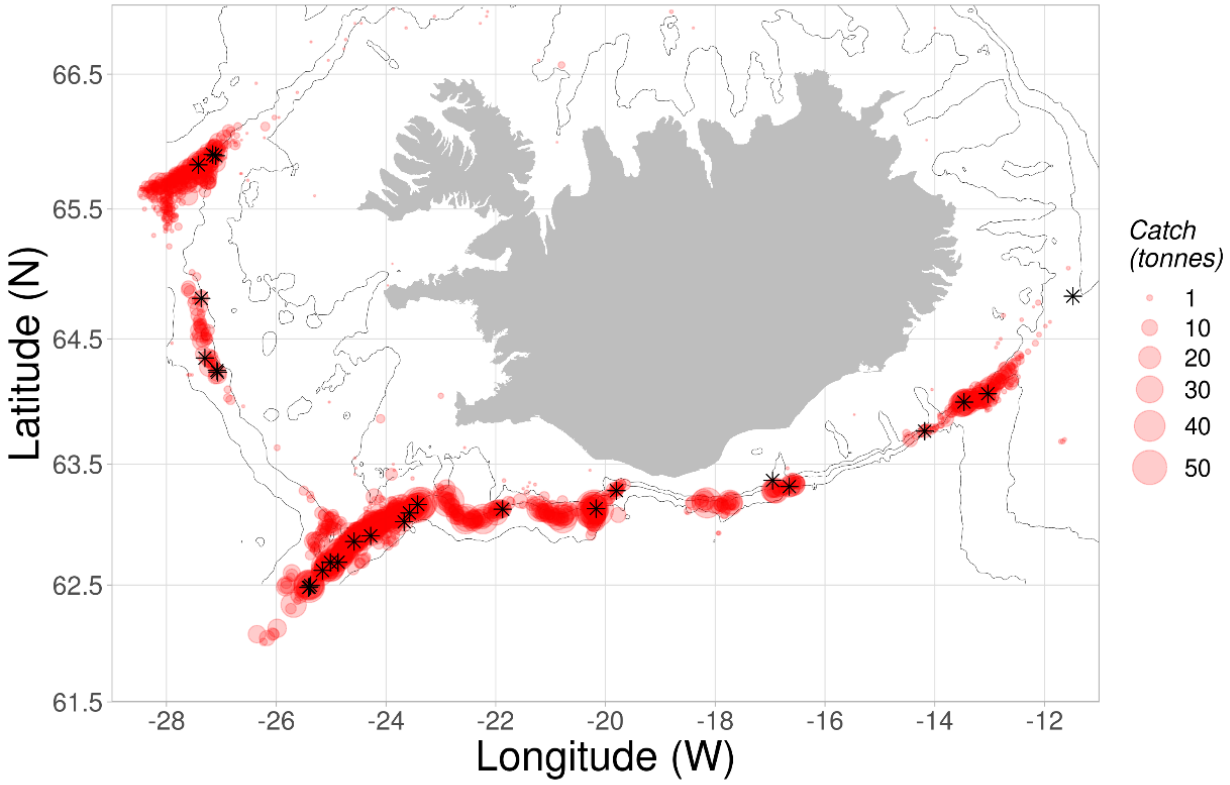

Figure 9. Demersal beaked redfish. Demersal trawl fishing grounds in 2018 as reported in logbooks (red) and positions of samples taken from landings (asterisks). The 200, 500 and 1000 m isobaths are shown.

Mynd 9. Djúpkarfi. Veiðisvæði við Ísland árið 2018 samkvæmt afladagbókum (rautt) og staðsetningar sýna úr lönduðum afla (stjörnur). Sýndar eru 200, 500 og 1000 m dýptarlínur.

LENGTH DISTRIBUTION FROM THE COMMERCIAL CATCH

Length distributions of Icelandic slope *S. mentella* from the bottom trawl fishery show an increase in the number of small fish in the catch in 1994 compared to previous years (Figure 10). The peak of about 32 cm in 1994 can be followed by approximately 1 cm annual growth in 1996—2002. The fish caught in 2004—2018 peaked around 39—42 cm. The length distribution of Icelandic slope *S. mentella* from the pelagic fishery, where available, showed that in most years the fish was on average bigger than taken in the bottom trawl fishery (Figure 10).

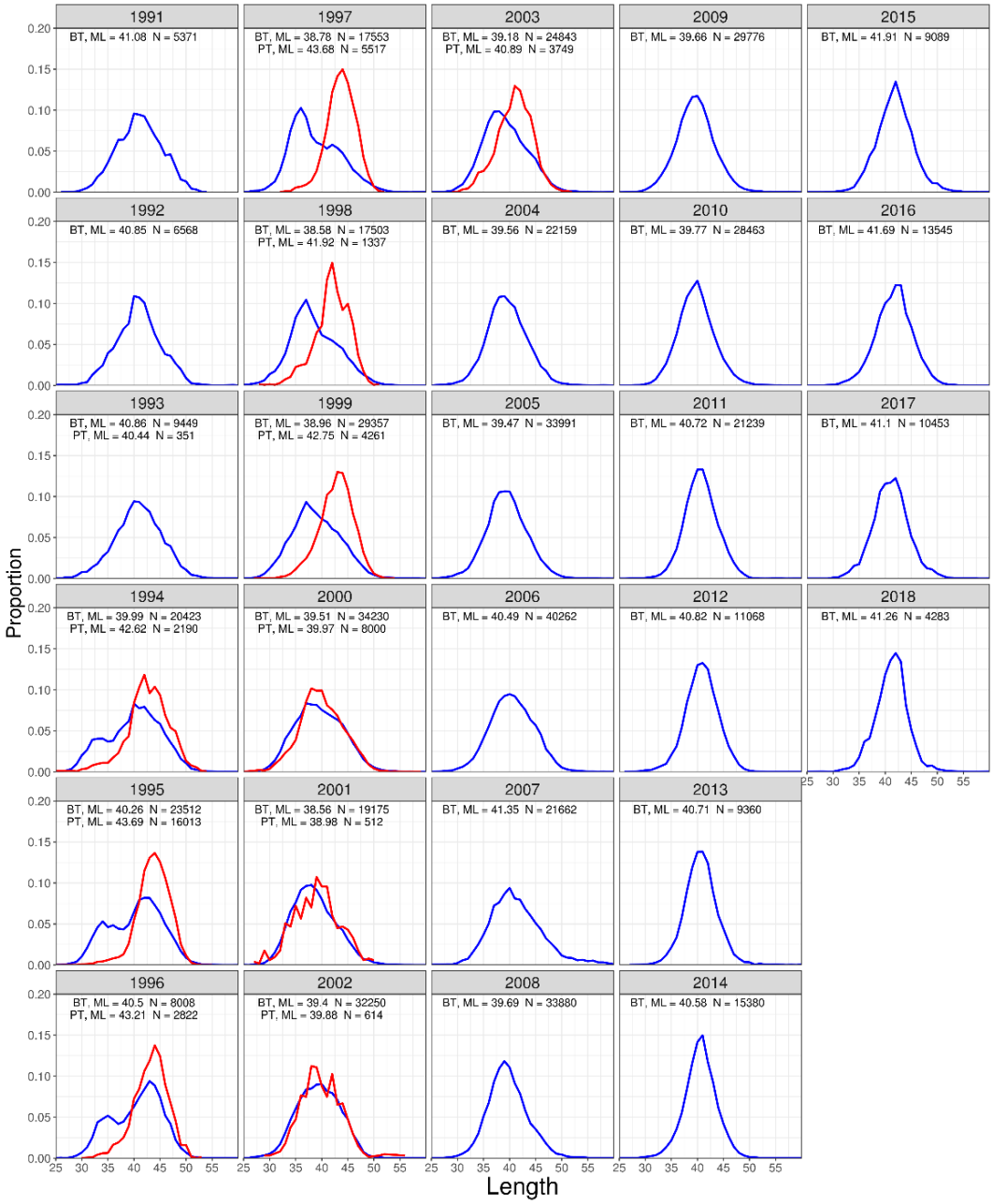

Figure 10. Demersal beaked redfish. Length distributions of Icelandic slope *S. mentella* from the Icelandic landings taken with bottom trawl (blue line) and pelagic trawl (red line) in Icelandic waters (ICES Division 5.a and Subarea 14) 1991-2018.

Mynd 10. Djúpkarfi. Lengdardreifing úr afla botnvörpu (bláar línur) og flotvörpu (rauðar línur) 1991-2018.

CATCH PER UNIT EFFORT

Trends in non-standardized CPUE (kg/hour) and effort (thousand hours fished) are shown in Figure 11. The figure shows CPUE and effort in all bottom trawl tows where of Icelandic slope *S. mentella* was caught and were more than 50% and 80% of individuals tows. CPUE of tows where more than 50% and 80% gradually decreased from 1978 to a record low in 1994. Since then CPUE has been steadily increasing. The CPUE estimates in 2018 was at similar level as in 1980. From 1991 to 1994, when CPUE decreased, the fishing effort increased drastically. Since then, effort has decreased and is now at similar level as in 1980.

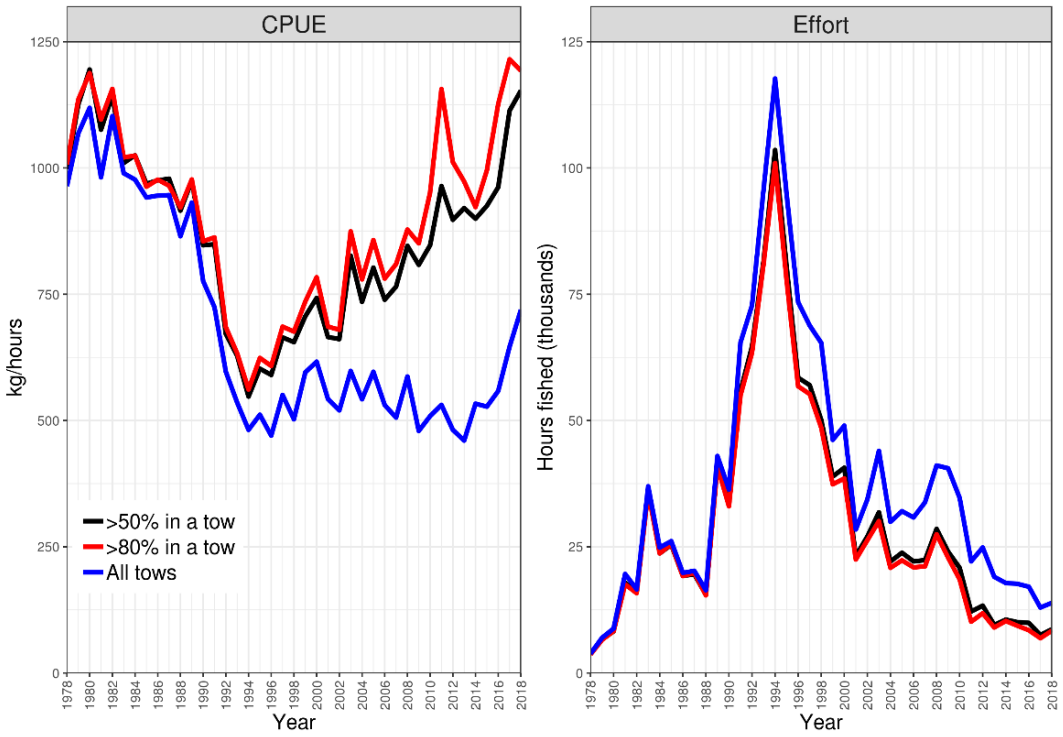

Figure 11. Demersal beaked redfish. CPUE and effort of Icelandic slope *S. mentella* from the Icelandic bottom trawl fishery in Icelandic waters (ICES Division 5.a and Subarea 14) 1978-2018.

Mynd 11. Djúpkarfi. Afli á sóknareiningu í botnvörpu frá íslenskum skipum á Íslandsmiðum 1978-2018.

DISCARD

Although no direct measurements are available on discards, it is believed that there are no significant discards of Icelandic slope *S. mentella* in the Icelandic redfish fishery.

STOCK ASSESSMENT METHODS

No analytical assessment was conducted on this stock.

REFERENCE POINTS

There are no biological reference points for the species. Previous reference points established were based upon commercial CPUE indices, but they are now considered to be unreliable indicators of stock size.

STATE OF THE STOCK

The North-Western Working Group concludes that the state of the stock is on a low level. With the information at hand, current exploitation rates cannot be evaluated for the Icelandic slope *S. mentella* in Division 5.a.

The fishable biomass index of Icelandic slope *S. mentella* from the Icelandic autumn survey shows that the biomass index for 2004-2013 decreased to similar level as in 2003 when it was at lowest level but has increased again to a similar level as in 2006.

CPUE indices show a reduction from highs in the late 1980s, but there is an indication that the stock has started a slow recovery since the middle of 1990s, when CPUE was close to 50% of the maximum. The CPUE index gradually increased from 1995–2018 to a similar level as in the early 1980s and has since then been at that level. It is, however, not known to what extent CPUE series reflect change in stock status of Icelandic slope *S. mentella*. The nature of the redfish fishery is targeting schools of fish using advancing technology. The effect of technological advances is to increase CPUE but is unlikely to reflect biomass increase.

In 2000-2008, good recruitment was observed in the German survey on the East Greenland shelf (growth of about 2cm/yr) which is assumed to contribute to both the Icelandic slope and pelagic stock at unknown shares. The German survey and the Greenland shrimp and fish shallow water survey both show no new recruits (>18 cm) and no juveniles are present (<18 cm). This suggests that the fishery in coming years will be based on the same cohorts.

MANAGEMENT CONSIDERATIONS

S. mentella is a slow growing, late maturing deep-sea species and is therefore considered vulnerable to overexploitation and advice has to be conservative.

BASIS FOR ADVICE

Icelandic slope *S. mentella* is considered a data limited stock (DLS) and follows the ICES framework for such (Category 3.2; ICES 2012). Below is the description of the formulation of the advice.

Based on the North Western Working Group recommendation, the stock is treated as a stock with survey data, but no proxies for MSY $B_{trigger}$ or F values are known. The IS-SMH survey index was used as an indicator of stock development. The advice is based on a comparison of the two latest index values with the three preceding values, combined with the latest catch advice This means that the catch advice is based on the survey adjusted status quo catch equation:

$$C_{y+1} = C_{y-1}\left(\frac{\sum_{i=y-x}^{y-1} I_i/x}{\sum_{i=y-z}^{y-x-1} I_i/(z-x)}\right)$$

where I is the survey index, x is the number of years in the survey average, z > x, and C_{y-1} is the advice last year. In this case, x = 2, which is the average of the two latest index values, and z = 5 the total number of survey values.

REGULATIONS AND THEIR EFFECTS

The species is managed under the Icelandic ITQ system, without direct management. Until the 2010/11 fishing year, Icelandic authorities gave a joint quota for golden redfish (*S. norvegicus*) and Icelandic slope *S. mentella*. The separation of quotas was implemented in the fishing year that started September 1, 2010.

Figure 12 shows the net transfers of Icelandic slope *S. mentella* in the Icelandic ITQ-system. Quota transfers from other species to demersal beaked redfish have been minimal or within 5%. However, net transfers from demersal beaked redfish to other species have been rather high, especially in last year's fishing year (Figure 12, upper). Those net transfers were most likely due to fleet not finishing the given quota and possibly moving the quota to golden redfish. Net transfers of unused Icelandic slope *S. mentella* quota from one fishing year to the next have usually been within 5% (Figure 12, lower).

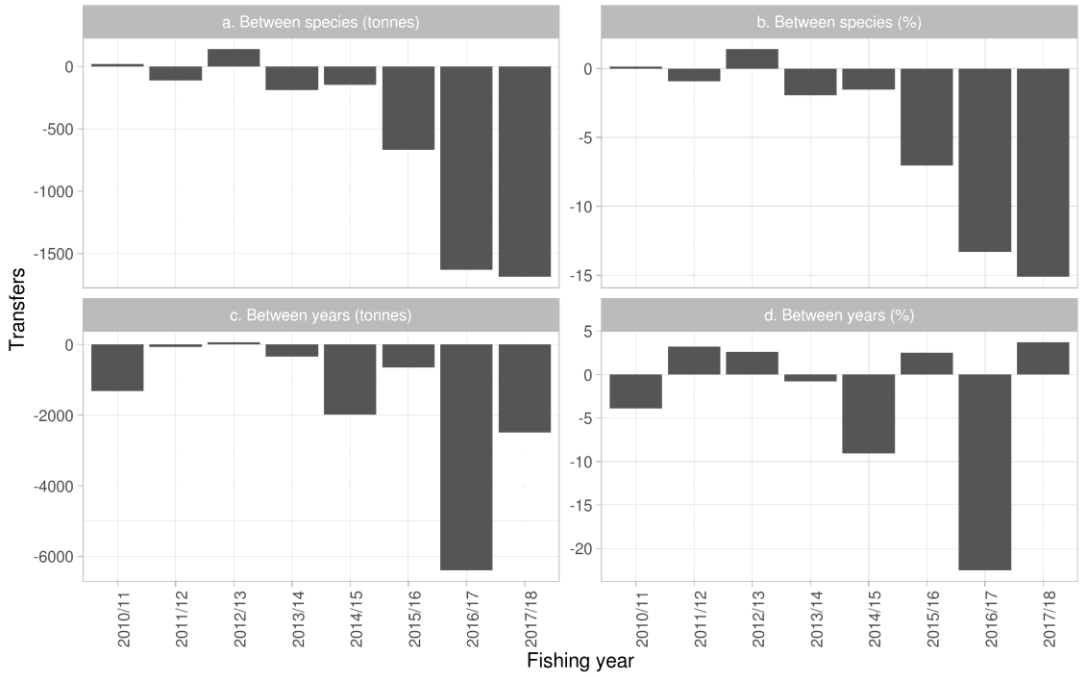

Figure 12. Demersal beaked redfish. Net transfers of quota to and from Icelandic slope *S. mentella* in the Icelandic ITQ system by quota year. Between species (upper): Positive values indicate a transfer of other species to demersal beaked redfish, but negative values indicate a transfer of demersal beaked redfish quota to other species. Between years (lower): Transfer of quota from given quota year to the next quota year (may include unused quota).

Mynd 21. Djúpkarfi. Nettó tilfærsla á kvóta eftir fiskveiðiárum. Tilfærsla milli tegunda (efri myndir): Jákvæð gildi tákna tilfærslu á kvóta annarra tegunda yfir á djúpkarfa en neikvæð gildi tilfærslu djúpkarfakvóta á aðrar tegundir. Tilfærsla milli ára (neðri myndir): Tilfærsla kvóta frá viðkomandi fiskveiðiári yfir á næsta fiskveiðiár (gæti innihaldið ónotaðar aflaheimildir).