23 Greenlandic slope *Sebastes mentella* in 14.b

23.1 Stock description and management units

See Section 18 for description of the stock structure of *S. mentella* in the Irminger Sea and adjacent waters. ICES has advised separately for *S. mentella* found demersal in ICES 14.b since 2011 and will do so until all available information on stock origin in this area is analysed and a new procedure is agreed upon.

23.2 Scientific data

Indices were available from three surveys in 14.b. A German survey directed towards cod in Greenlandic waters (0–400 m) (Fock et al., 2013), the Greenland deep-water survey (400–1500 m) targeting Greenland halibut and the Greenland shrimp and fish survey in shallow water (0–600 m), which has been conducted since 2008 (Christensen and Hedeholm, 2018). The Greenland shrimp and fish survey is used in the assessment. No survey was conducted in 2017,2018 and 2019. The German survey on the slope in 14.b has since 1982 been covering the slopes in East Greenland waters. No survey was conducted in 2018. Cod is the target species in this survey, and it operates at depths of 400 m and shallower. The survey was re-stratified in 2009 (see Stock Annex). From 1993–1998 a large number of Sebastes spp. smaller than 17 cm was found in the German survey (Figure 23.2.1). This coincided with a large in-crease in the amount of 17–30 cm large S. mentella from 1995–1998. From 1998 to 2003 the total biomass increased as a result of many small fish (< 17 cm) in the survey, followed by a few years of high biomass estimates for S. mentella from 2003–2009. This increase occurred in one particular stratum only, i.e. stratum 8.2. From 2009 onward, a declining trend in both biomass and abundance was observed, with 2015 representing the lowest biomass for the last 20 years (Figure 23.2.1). In the same period, the amount of small fish (17–30 cm) has steadily declined causing an increase in the amount of larger fish (Figure 23.2.1) until the overall biomass declines in 2010 and 2011. The depletion of the small size group has led to a progressive decline in the juvenile biomass index to a current low level, and no new recruits have been seen in the survey since 2012. This pattern is also reflected in the abundance esti-mates (Figure 23.2.1). The modal size of the adult fish has increased from 25 cm in 2001 to around 37 cm in 2010 but declined slightly in 2011. The distribution has become flat with no clearly defined mode in 2013–2019 (Figure 23.2.2).

The Greenland deep-water survey has since 1998, except in 2001, surveyed the slopes of East Greenland from 400 to 1500 m with the majority of stations deeper than 600 meters targeting Greenland halibut. The biomass indices in the Greenland deep-water survey peaked in 2012 but has decreased since then (Figure 23.2.3). The overall length distribution from the entire area in 2013 and 2014 shows a mode around 31 cm. In 2015 and 2016, the mode increased slightly (Figure 23.2.4). The survey was aborted in 2017 due to vessel breakdown and in 2018 there was no available research vessel for the survey, why no new data is available since 2016.

The Greenland shrimp and fish survey in shallow water in East Greenland started in 2007, and surveys the East Greenland shelf and shelf edge at depths between 0–600 m. However, 2007 was mostly exploratory and is not reported. In general, survey estimates of schooling fish are associated with large uncertainties due to their patchy distribution. This, in conjunc-tion with the relatively short time-series, makes overall conclusions regarding stock trends based solely on this survey tentative although it is probably the survey with the best cover-age of redfish distribution. The 2016 biomass estimate for S. mentella increased from 61 kt to 164 kt from 2015 to 2016

(Figure 23.2.5). However, the estimate has large uncertainties since one haul accounted for 70% of the total biomass estimate. The haul was taken in area Q2 close to Icelandic waters. Due to the missing survey in 2017, 2018 and, no new data is availa-ble.

The German survey was in 2017 limited due to bad weather and only 46 out of an average of 75 stations were covered on the Greenland East coast. However, the most important Redfish strata were surveyed with a reasonable coverage, why the result is expected to be valid. In 2017 and 2019, the declining trend documented in the earlier years continues. The accuracy of the surveys as an indicator of recruitment is not known but recruitment is expected to be poor, and the abundance of juveniles is at the lowest level in the 30-year time-series. An ex-perimental fishery in 2019 partly focusing on juvenile redfish confirmed that the abundance of juvenile redfish continues to be at a very low level (Christensen, 2020b).

In 2016, there was a difference between the Greenland and the German survey; the Green-land survey had a length mode was 39 cm, while the mode in the German survey was 34 cm. The difference was attributed to the one large haul in the Greenland survey consisting of a high proportion of large S. mentella in the survey area close to Iceland (figures 23.2.2. and 23.2.6). Survey length distributions for the German survey had a mode of 39.5 cm in 2019, which is a notable increase compared to earlier years (figure 23.2.2).Information from the fishing industry.

23.2.1 Landings

From the Greenland and German surveys, we know that the demersal redfish found on the Greenland slope is a mixture of S. norvegicus and S. mentella. In 2019, the species split in the fishery was based on the information from logbooks and is therefore subject to uncertainties due to the fishermen's ability to distinguish between S. norvegicus and S. mentella in the catches. The species split in 2019 was estimated to be 60% S. mentella (3998) and 40% S. norvegicus (2665). Earlier S. mentella dominated the catches, but the proportion started to decline in 2014 (Figure 23.3.1.1). In 2016, the split changed and for the first time S. norvegicus now dominated the catches (Figure 23.3.1.1). In 2019, S. mentella was again dominating the catches. The large change between years is most likely due to the uncertainty of the split. Prior to 1974, all catches were reported as S. norvegicus and the split was determined by working groups on a yearly basis.

Catch depth has in the later years declined compared to earlier. In 2016, the catches were taken at a depth of 300–400 m. In 2017 and 2018 it declined even further and in 2019 an in-creasing part of the catch was taken at down to 300 m. In 2011–2012 were caught at 350–400 m (Figure 23.3.1.2).

Total annual landings of demersal S. mentella from Division 14.b since 1974 are presented in Table 23.3.1.3. From 1976–1994 annual landings were at a relatively high level with landings ranging between 2000 and 20 000 tonnes with a very high peak at nearly 60 000 t in 1976. This fishery was ended abruptly in 1995, due to large amounts of very small redfish in the catches. From 1998–2002 the landings ranged from 1000 to 2000 tonnes and from 2003 to 2008 landings remained at lower levels (< 500 tonnes). In 2009, an exploratory fishery landed 895 tonnes of S. mentella. This was a large increase compared to 2008 and for the first time in ten years the fishery was limited by a TAC.

In 2010, a quota on 5000 tonnes demersal redfish (mixed S. mentella and S. norvegicus) was initially given and of these, 400 tonnes were allocated to the Norwegian fleet. After this amount was fished, a research quota of 1000 tonnes were given to a Greenland vessel. Since 2010, the catches have been around 8300 tonnes (S. mentella and S. norvegicus combined) (Figure 23.3.1.3). In 2017, total catches decreased to 7568 tonnes and in 2018 the catch de-creased further to 5976 tonnes. However, in 2019 a notable increase in the catches occurred and the total catch was 6663 tonnes (Figure 23.3.1.3). Since 2011 the mixed TAC has been 8500 tonnes until 2017 where the TAC started to decrease. In 2019, the mixed TAC was 5274 tonnes.

In 2010, there was no jurisdiction that clearly delimited the pelagic stocks from the redfish found on the shelf. A few vessels benefitted from this by fishing their pelagic quota on the shelf (2179 tonnes) making catches on the shelf exceed the TAC. This led to the introduction of a "redfish line" that separates the demersal slope stock from the pelagic stocks (see stock annex).

23.2.2 CPUE and bycatch CPUE

A redfish bycatch CPUE was introduced at the redfish 2012 benchmark (WKRED). This is based on catches from the Greenland halibut directed fishery and include both S. mentella and S. norvegicus (Christensen 2020a), which covers redfish distribution better than data from the redfish directed fishery and covers a longer period (1999–2019). The Greenland halibut fishery is not as spatially restricted as the redfish fishery; thus it will not be as sensi-tive to local changes as the redfish directed CPUE. The CPUE has very low values in the ini-tial two years of the time-series, but following an increase in 2001, values have remained at the same level until 2006 after which a decline followed. Since 2011, the CPUE have been relatively stable with minor fluctuations (Figure 23.3.2.1). The increase in CPUE in 2016 and the decline in 2017 is reflected in the biomass index estimated based on the shallow water surveys in the same years (German).

The CPUE from the redfish directed fishery showed a decline from 2010 to 2015, while it increases in 2016 (1.7 t/h). in the later years the CPUE have been relatively stable (Figure 23.3.2.2). The fishery takes place in a geographically limited area between 63.5°N and 65°N, where approximately 90% of the catches are taken. Accordingly, the CPUE series can only be used as an index on local stock development. Both the Greenland shallow water survey (0–600 m) and the German survey (0–400 m) show that the main fishing area coincides with the area of highest overall abundance.

23.2.3 Fisheries and fleets

The fishery for S. mentella on the slopes in 14.b is mainly conducted with bottom trawl, only about 1% were caught with longlines. The area where S. mentella is caught, is closely related to the area where fishery for Greenland halibut and cod takes place (Figure 23.3.3.1). The majority of the catches are taken at depths from 300 m to 400 m.

The directed fishery was stopped in 1995, but in 1998 Germany restarted a directed fishery for redfish with annual landings of approximately 1000 tonnes in 1998–2001 increasing to 2100 tonnes in 2002 (Bernreuther et al., 2013). Samples taken from the German fleet indicated that substantial quantities of the redfish caught, especially in 2002, were juveniles, i.e. fish less than 30 cm. There was very little demersal redfish fishery in 14.b in 2003–2004 (less than 500 tonnes). This continued in 2005–2008 and most S. mentella were caught as bycatch in the Greenland halibut fishery.

After the German fleet stopped fishing in 2002 the majority of the catches have been taken by the British, Faroese, Norwegian and Greenland fleet. The British fishery took place from 2001–2005 and since 2006 only Greenland, Norway and Germany have had any significant catches (Table 23.3.3.2).

In 2009, three Greenland vessels started a fishery targeting demersal redfish. Each was given an explorative quota of 250 tonnes. This fishery was very successful and led to an increased fishery in 2010 (seven boats), 2011 (15 boats) and 2012 (21 boats). However, in 2012, 95% of the catch was taken by six vessels and 97% by five vessels in 2013.

On the steep slopes very little horizontal distance separates the distribution of cod, redfish and Greenland halibut (Figure 23.3.3.2). The part of the fleet with both quotas for redfish and Greenland halibut takes advantage of this by shifting between very short hauls targeting redfish and

long hauls directed to Greenland halibut. Thereby avoiding time where the ves-sel is not fishing due to processing of the catch.

23.2.4 Bycatch/discard in the shrimp fishery

To minimize bycatch of fish species in the fishery for shrimp the trawls have since 2002 been equipped with grid separators (G.H., 2001). However, the 22 mm spacing between the bars in the separator allows small fish to enter the codend. In a study on the amount of bycatch in the shrimp fishery the mean length of the redfish that entered the codend was 13–14 cm. The same study also documented that redfish by weight accounted for less than 1% of the amount of shrimp that were caught (Sünksen, 2007). Coincident with the introduction of these separator grids the amount of juvenile redfish caught by the shrimp fishery dropped from annual 100–200 tonnes to a lower level near 100 tonnes. Since 2006, limited shrimp fishery has taken place in ICES 14.b and the current level of bycatch must be considered neg-ligible and have for the last two years been zero (Table 23.3.4.1). From 1999–2009, the fishery started in April–May due to poor winter conditions such as ice and wind that prevents fish-ing. Only in 2000 and 2002, the fishery started already in February (Table 23.3.4.2). Since 2010, the fishery has started already in January and in 2018 February was the month with the highest landings. In 2019, the fishery was relatively high already in March, but most of the catch was fished in May and June. In earlier year, June and July were the most im-portant months today only catches in July are at the same level as earlier in the year (Table 23.3.4.2). The depth distribution of cod and redfish overlap (Figure 23.3.3.2) and therefore the fishery for redfish led to a bycatch of cod on 96 tonnes in 2013. The vessels are allowed a 10% bycatch of cod.

23.3 Methods

No analytical assessment was conducted.

23.4 Reference points

As described in Section 1.3, MSY proxy reference points needs to be defined for the Green-landic S. mentella slope stock. ICES suggested four methods for this purpose, and all methods were tested on the stock. The conclusion was that based on the caveats listed below and the declines seen in surveys, especially on recruitment over the past decade, the determination of the stock status in relation to reference points should not be based solely on any of the indi-cators pre-sented here, but rather a holistic view combining surveys and expert judgment with the results presented in Hedeholm and Christensen (2017).

The caveats to consider in relation to the Greenlandic *S. mentella* slope stock when concluding on the length-based indicators and the SPiCT model.

- If there are few year classes in the fishery, which is current for the present stock, the effect of overfishing the stock is more likely observed on biomass rather than length, especially on a slow growing species. There is no ageing done in this stock, why it is not possible to see if this is the case.
- *Sebastes mentella* is a slow growing species, thus the effect of the fishery on length may be very subtle. The relatively short time-series on length distributions available for this analysis and the limited number of samples per year entails that any effect is eas-ily missed.

- The schooling behavior of *S. mentella* in connection with the points made above means that the fishery can target a diminishing stock in a small area without seeing any effect on the length distribution. Indeed, the fishery is conducted with limited spatial extent.
- Several redfish stocks are present on the East Greenland slope, but in unknown quantities. Any changes in length could just as well be related to migration, timing of sampling, and latitude of sampling as to actual stock changes.
- Based on the three length-based methods the exploitation pattern appears reasonable. However, results from all three methods should be interpreted with some caution due to lack of knowledge of important input parameters (L_{inf}, M and k) for the specific stock (values from Fishbase are used).

23.5 State of the stock

The German survey and the Greenland shrimp and fish shallow water survey both show overall declines in the S. mentella biomass since 2010. In 2016, biomass indices increased but with high uncertainty of the estimate. In 2017-2019, no new biomass index was available from the Greenland survey due to vessel break down and no available research vessel. In both the Greenland and the German surveys there have been a complete absence of small fish since 2013. After a gradual decline from 2010 to 2015, the redfish directed fishery CPUE increased in 2016 to the same level as 2012–2014 but declined again in 2017 and 2018. In 2019, the CPUE increased again. Changes in length distributions also suggests that no new cohorts are present on the slope and that the change in adult biomass is caused by the grad-ual decline of a single/few cohorts. Especially the complete absence of juveniles is cause for concern.

The biomass estimates decline and the concentrated fishery could point to a fishery induced decline. However, the declines are of a magnitude that seems beyond what a limited number of years' catches can cause. Hence, surveys may either overestimate the biomass in especially Q3, not survey the entire area of distribution or S. mentella is disappearing due to migration. If large redfish aggregations change the catchability, the assumptions of linearity between catch and abundance are rendered invalid – high fish concentration may simply reduce the trawl escape potential. Such a situation would produce disproportionally high catches and subsequently biomass estimates in high density areas such as Q3. Hence, the decline may be a synergetic effect of a reduced biomass caused by the local fishery, and the reduced catcha-bility inferred from the less dense fish aggregations following some years of intense fishing. This is further complicated by the lack of knowledge of the stock's connection to the pelagic (deep and shallow) and Icelandic slope stocks and the degree of migration. Based on this, care must be taken when evaluating stock status, but nevertheless, the consistency in both the German and shallow Greenland surveys suggests that the biomass has a decreasing trend. The magnitude of the decline is probably not attributable to the fishery alone. Also, the apparent lack of juveniles in all the East Greenland area means that no new fish will grow into the fishable part of the stock for at least 6–8 years, and there is reason for concern.

The advice has until 2019 been based on the Data Limited Stock approach (DLS) including biomass indices from the Greenland shrimp and fish survey . The advice for 2020 was due to the lack of a survey estimate from the Greenland Shallow Water survey in 2017-2019 given based on a category 5 approach. CPUE has remained relatively stable. The advice should however be conservative due to the lack of survey data in 2017-2019, and the biology and dynamics of the species. Furthermore, from the German survey recruitment seems to contin-ue to be at a very low level. In 2018, a precautionary buffer was applied, and the advice is considered precautionary, why the buffer is not applied again this year. The advice for 2021 is 914 tonnes.

23.6 Management considerations

Sebastes mentella is a slow growing, late maturing deep-sea species and is therefore consid-ered vulnerable to overexploitation and advice must be conservative. The fact that the fish-ery is targeting a localized aggregation of fish is cause for concern as is the absence of juve-niles in the area. Given the biology of the species and the uncertainty in the biomass trend, any advice should consider this a hot spot fishery as it is potentially detrimental to this local and potentially important aggregation of larger fish. The fishery should still be at a low level involving few vessels. This should be maintained until the effect of the fishery can be clari-fied.

23.7 References

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23.8 Tables

Table 23.3.1.1 Nominal landings (tonnes) of demersal *S. mentella* 1974–2019 ICES division 14.b.

Demersal *S. mentella*	
1974	0
1975	4 400
1976	59 700
1977	0
1978	5 403
1979	5 131
1980	10 406
1981	19 391
1982	12 140
1983	15 207
1984	9 126
1985	9 376
1986	12 138
1987	6 407
1988	6 065
1989	2 284
1990	6 097
1991	7 057
1992	7 022
1993	14 828
1994	19 305
1995	819
1996	730
1997	199
1998	1 376
1999	853
2000	982
2001	901
2002	2109
2003	446
2004	482
2005	267
2006	202
2007	226
2008	92
2009	895
2010	6 613
2011	6 705
2012	6 572

Demersal *S. mentella*	
2013	6 597
2014	4 608
2015	5 977
2016	3 061
2017	3 027
2018	1 972
2019	3 998

Table 23.3.3.2 Landings (tonnes) of demersal redfish (*S. mentella* and *S. norvegicus*) caught in ICES 14.b by nation.

Year	DEU	ESP	EU	FRO	GBR	GRL	ISL	NOR	POL	RUS	UNK	Sum
1999											853	853
2000	884		11			19		65			3	982
2001	782				11	9		99				901
2002	1703			48	16	246	29	32		36		2109
2003	3	2	2	20	155	232		32				446
2004	5	1	79	12	221	93		68	3			482
2005	2		4	38	96	72		56				267
2006	1					152		48				202
2007	7		15	138		35		30				226
2008	1		8	50	5	5		23				92
2009				203		822		93				1118
2010	10		12	381		5672		2190		1		8266
2011	1262		26	2		6757		334		1		8381
2012	1810		5	32		5964	1	403		1		8216
2013	1957			32	30	5863		356		8		8246
2014	1973		0.2	13		4611	98	613		5		7314
2015	1987			74		4979	208	822		469		8539
2016		-	1759	25	2	5859	-	858	-	-	-	8503
2017	1060		537	31		4736		787		418		7568
2018	418		1295	48		3276		489		450		5976
2019	976		1021	5		3410		985		266		6663
Sum	14841	3	4774	1152	536	52812	336	8383	3	1655	856	85350

Table 23.3.4.1 Discarded bycatch (tonnes) of *Sebastes sp*. from the shrimp fishery in ICES 14.b.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
1999	6	16	17	5	1	13	2	48	22	30	40	33	234
2000	10	3	31	17	15	4	21	78	28	18	9	6	239
2001	7	9	10	16	9	11	4	5	3	3	28	6	111
2002	3	11	9	6	1	0	0	5	4	8	3	5	55

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
2003	5	6	8	5	5	8	8	15	2	10	12	4	88
2004	7	10	17	13	4	2	27	20	7	2	9	0	118
2005	7	14	16	8	7	5	6	21	14	4	5	20	126
2006	6	2	4	1	3	5	2	4	4	0	0	4	35
2007	7	3	2	1	0	0	0	0	0	0	0	0	14
2008	0	2	2	0	0	1	0	0	0	0	0	1	7
2009	1	2	11	1	0	0	0	0	0	0	0	0	16
2010	1	2	2	1	1	0	1	0	0	0	0	2	10
2011	0	0	0	0	1	0	0	0	0	0	0	0	3
2012	0	0	1	1	1	0	0	0	0	0	0	0	4
2013	0	1	1	0	0	0	0	0	0	0	0	0	2
2014	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum	60	81	131	75	48	49	71	196	84	75	106	81	1056

Table 23.3.4.2 Landings (tonnes) of demersal redfish (*S. mentella* and *S. norvegicus*) caught in ICES 14.b. by month.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Sum
1999		10		108		4	42	10	15	34	481	149	853
2000	18	238	286	260	10	4	79	72	13	0	3		982
2001			1				108	2		184	369	236	901
2002		183	445	354	390	50	472	35	44	59	77		2109
2003			9	4	26	27	135	195	20	16	12		446
2004				35	41	63	75	48	64	96	25	35	482
2005			1	15	66	24	80	29	13	18	19		267
2006		3	7	50	14	39	20	61	2	1	1	2	202
2007	6	13	8	8	14	42	4	106	16	7	1	1	226
2008	4	3	1	6	12	11	31	12	10	2			92
2009				1	84	346	148	105	128		288	17	1118
2010	799	786	708	1058	2149	2100	108	134	88	301	36		8266
2011	419	1396	1661	1017	268	250	236	598	255	583	1223	475	8381
2012	899	2197	628	852	577	699	966	143	44	23	474	712	8215
2013			709	1290	925	1423	1218	1086	723	227	119	527	8246
2014	10	421	206	1210	1187	1709	231	401	376	448	632	479	7314
2015	543	786	1016	451	507	1611	1160	1024	504	393	74	467	8539
2016	306	214	1130	1185	1426	1864	1298	559	466	38	14	1	8501
2017	373	1977	1368	751	308	513	1111	249	38	651	102	124	7568
2018	798	1273	819	779	367	189	1049	22	176	234	225	45	5976
2019	23	211	1102	653	1359	1316	601	520	365	379	36	98	6663
Sum	4198	9711	10105	10087	9730	12284	9172	5411	3360	3694	4211	3368	85347

23.9 Figures

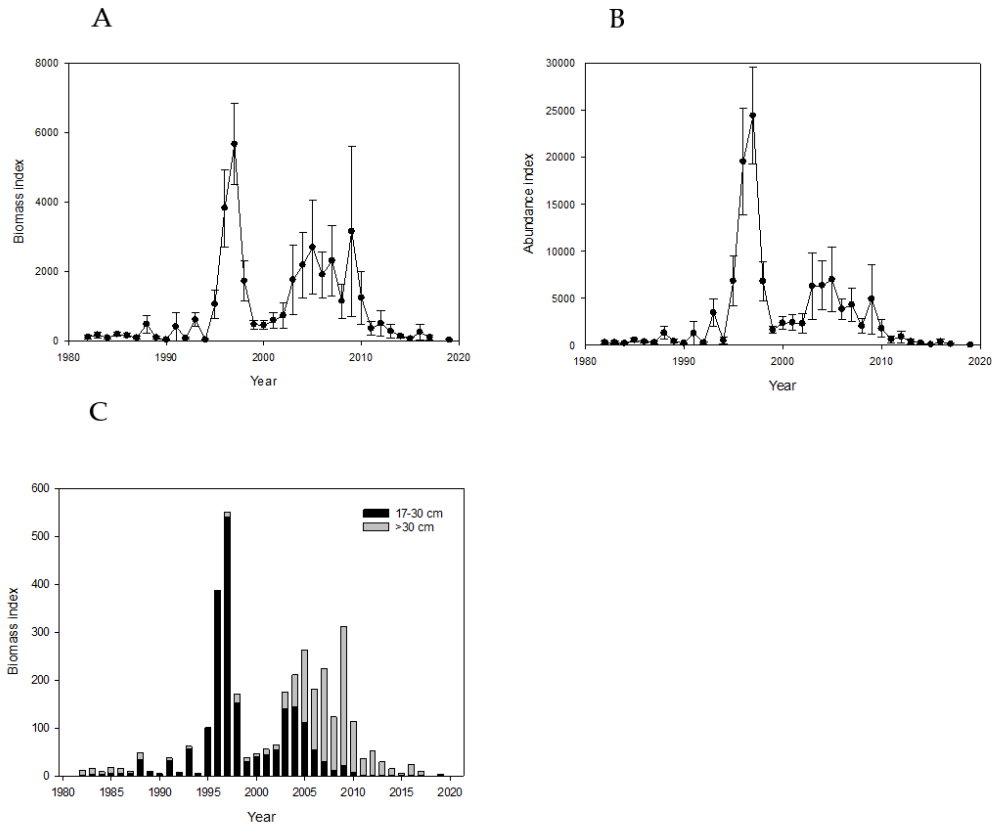

Figure 23.2.1. Indices from the German East Greenland survey of *S. mentella* larger than 17 cm. Biomass (A), abundance (B), and biomass split on length (C). On figure (C) the grey bars represent the biomass of *S. mentella* larger than 30 cm and the light bars biomass in fish from 17–30 cm. No survey was conducted in 2018.

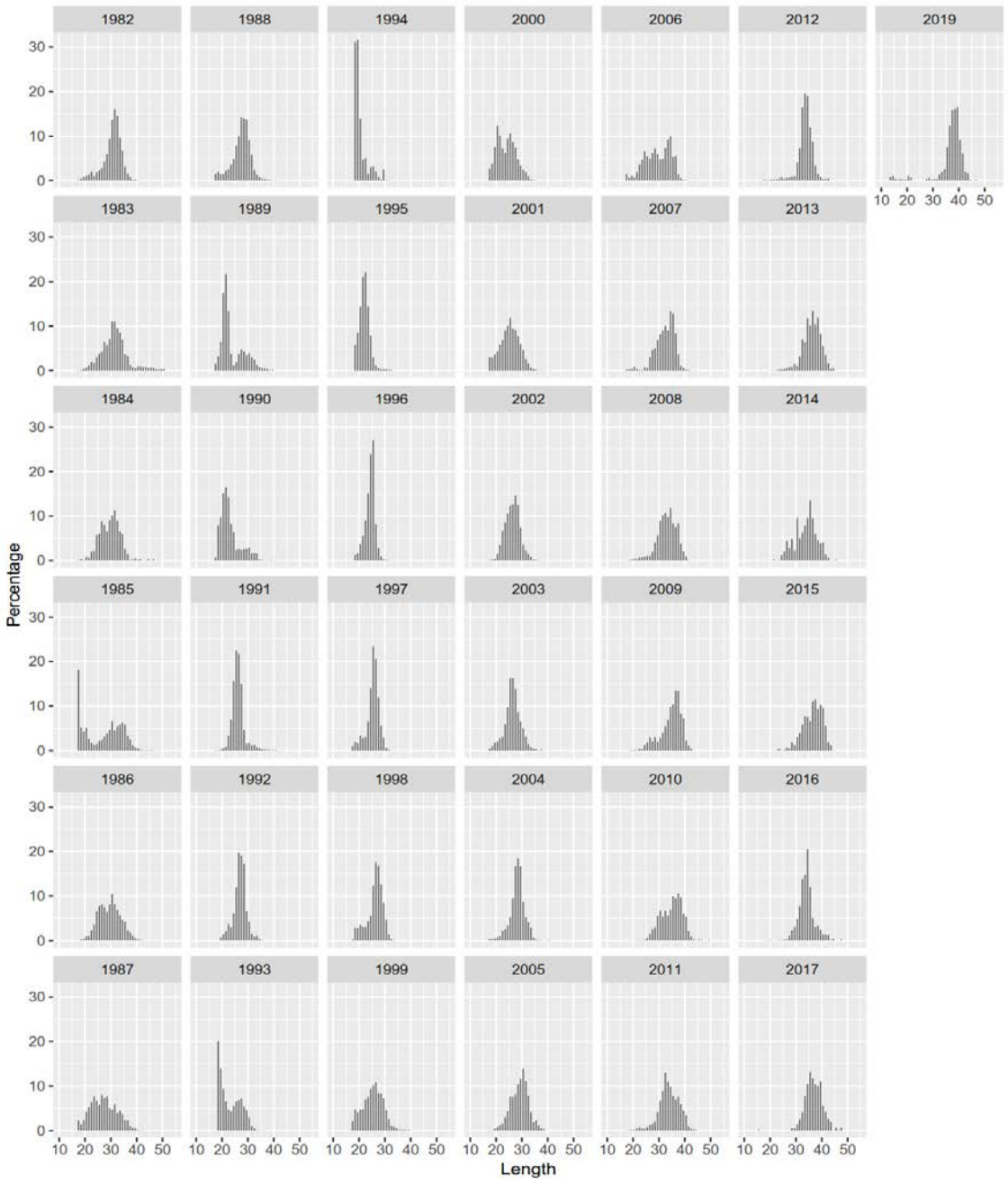

Figure 23.2.2. Length distributions from the German East Greenland survey 1985–2019. In 2018, the survey was not conducted due to break down of the German research vessel.

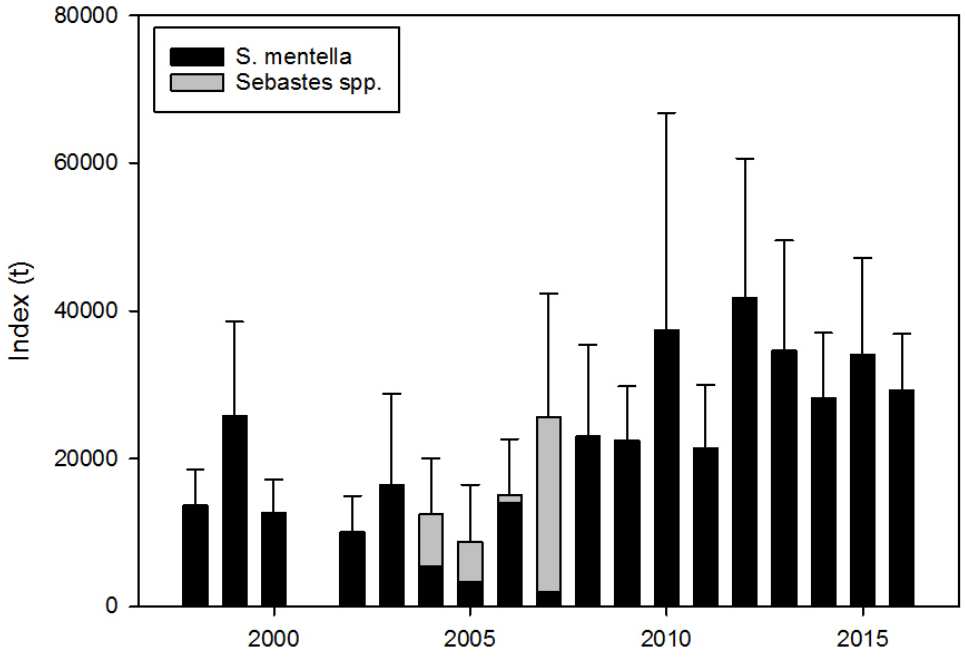

Figure 23.2.3. Biomass of *S. mentella* and *Sebastes* spp. derived from the deep Greenland survey. Bars indicate 2SE of the biomass of *S. mentella* including *Sebastes* spp. No survey in 2001. In 2004, 2005 and 2007 a large proportion of the redfish were not determined to species and only reported as "*Sebastes* spp". It is most likely that the majority of these fish were

S. mentella. **In 2017, the survey was aborted due to vessel break down. In 2018 and 2019, no research vessel was available.**

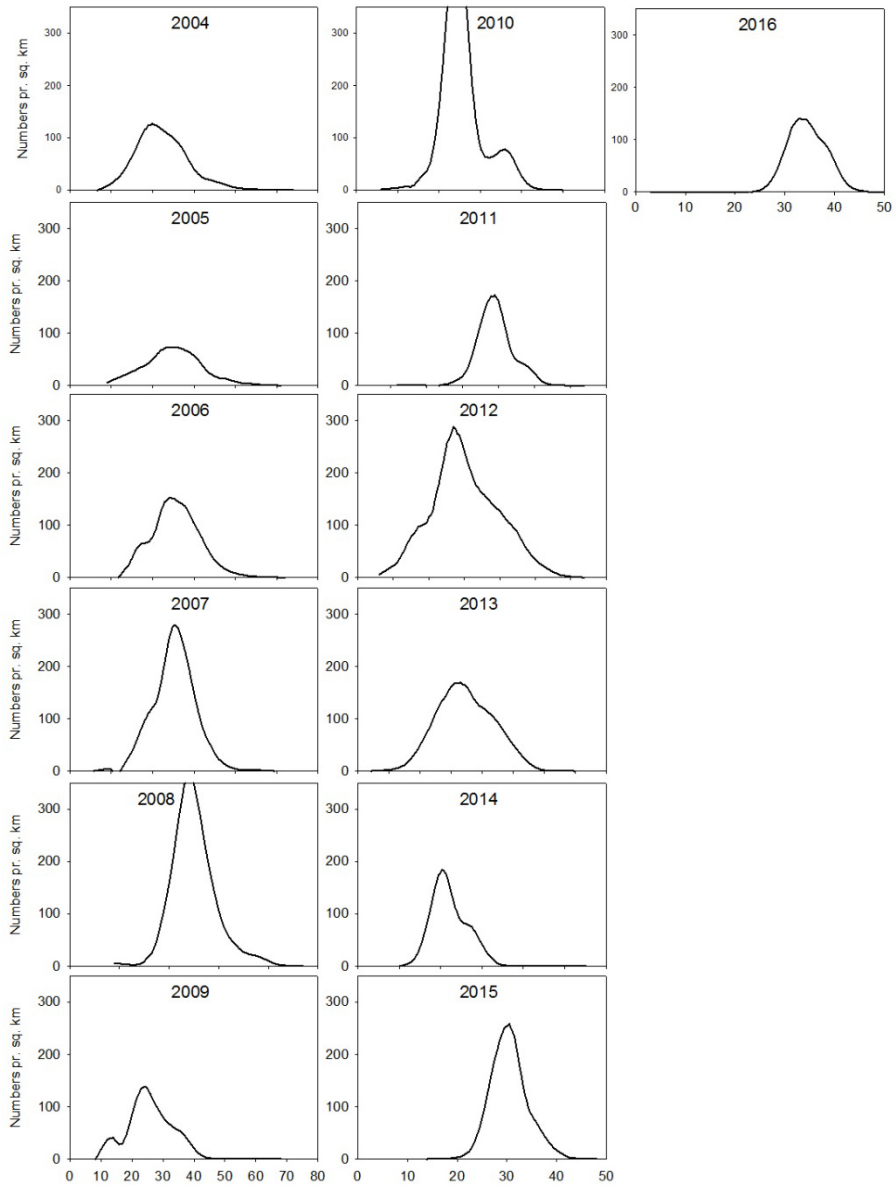

Figure 23.2.4. Overall length distribution of *Sebastes mentella* (number per km²) from the deep Greenland survey. In 2017, the survey was aborted due to vessel break down. In 2018 and 2019, no research vessel was available, therefore no new data is available.

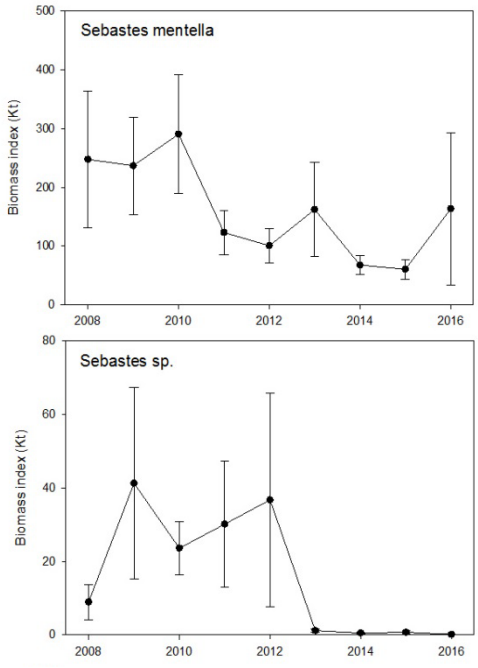

Figure 23.2.5: Biomass (kg*10^6, kt) (±CV%) indices for *S. mentella* (top) and *Sebastes* sp. (< 18 cm) (bottom) off East Greenland in 2008–2016 from the Greenlandic shallow water survey. All surveyed areas are combined (Q1–Q6). In 2017, the survey was aborted due to vessel break down. In 2018 and 2019, no research vessel was available, therefore no new data is available.

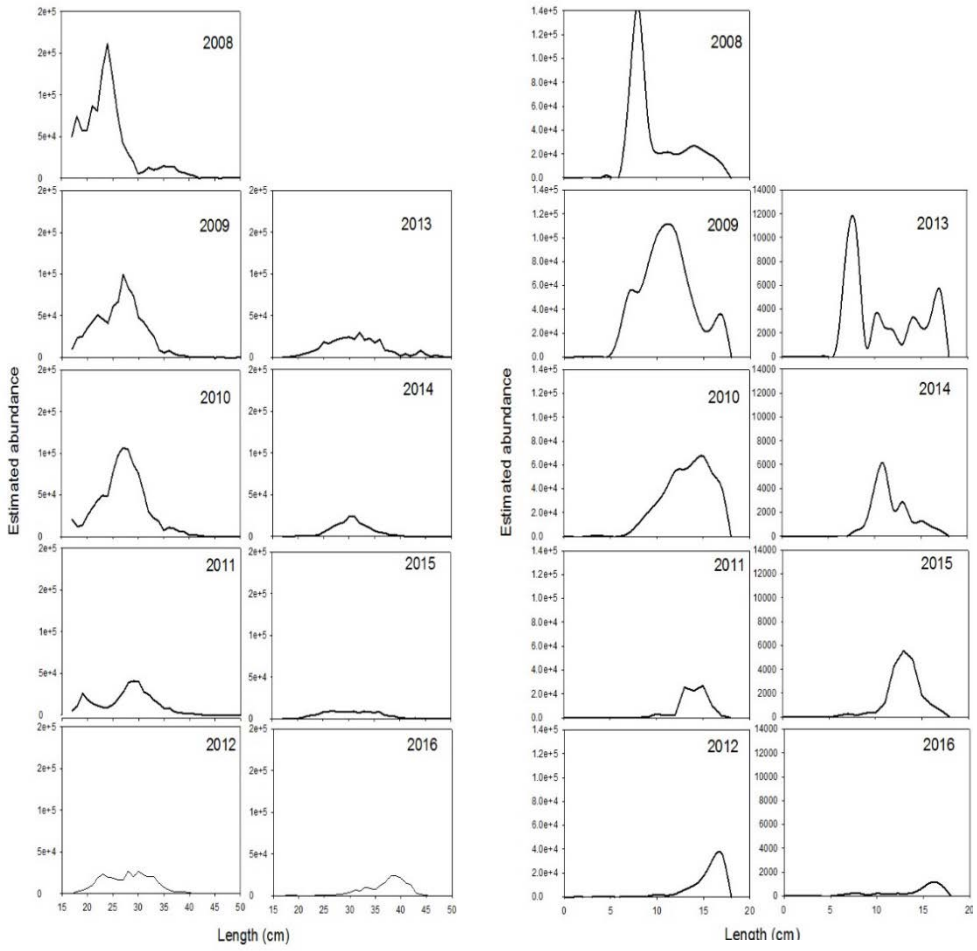

Figure 23.2.6. Overall length distributions for juvenile redfish *S. mentella* (left) and *Sebastes spp.* < 18 cm (right) (note the change in scale from 2013) from the Greenland shallow water survey. All surveyed areas combined (Q1–Q6). In 2017, the survey was aborted due to vessel break down. In 2018 and 2019, no research vessel was available, therefore no new data is available.

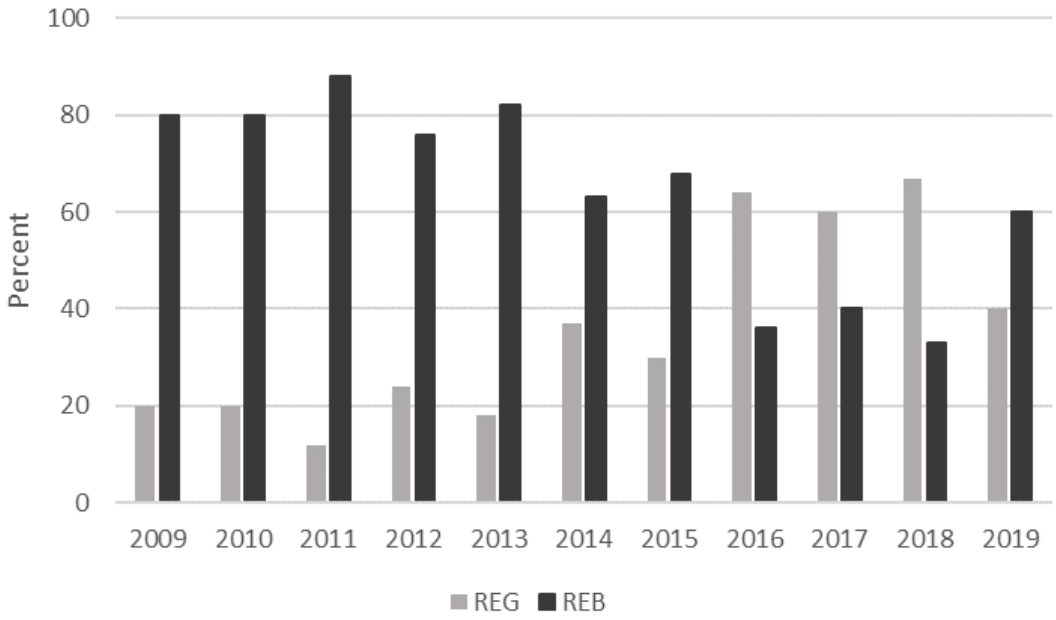

Figure 23.3.1.1. Development in split of *S. mentella* and *S. norvegicus* in the fisheries on the Greenland slope.

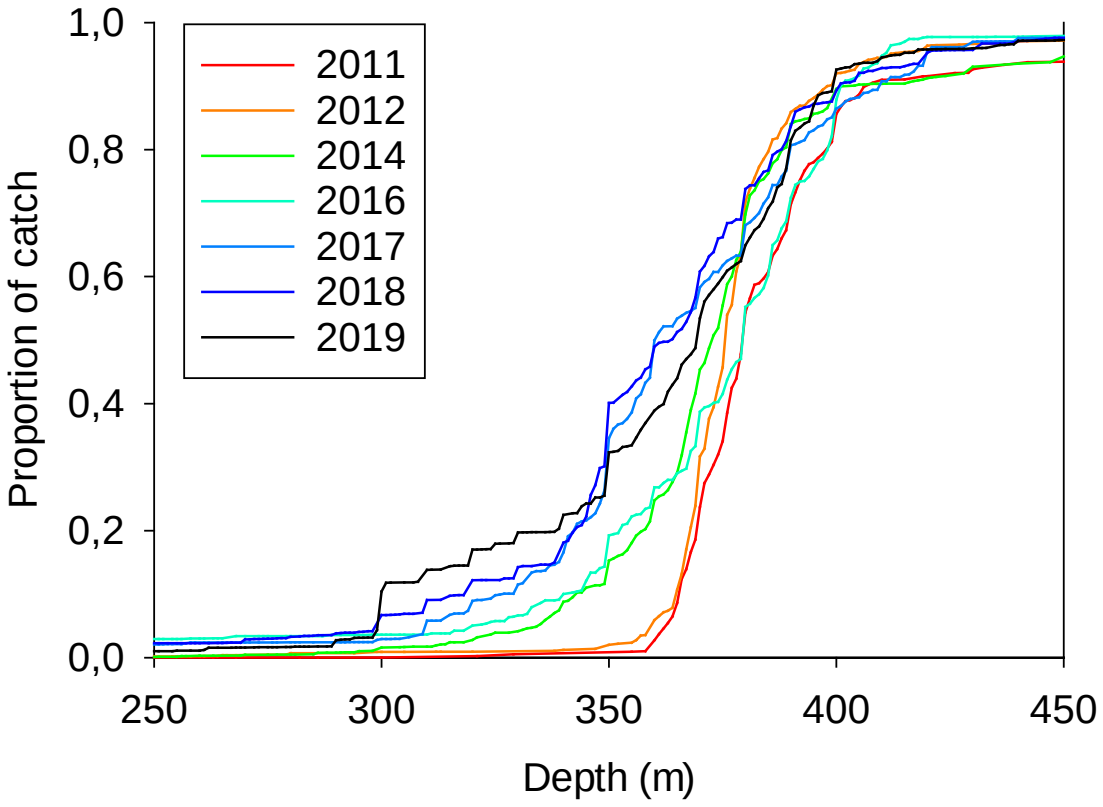

Figure 23.3.1.2 Development in catch depth of *Sebastes* (*S. mentella* and *S. norvegicus* combined).

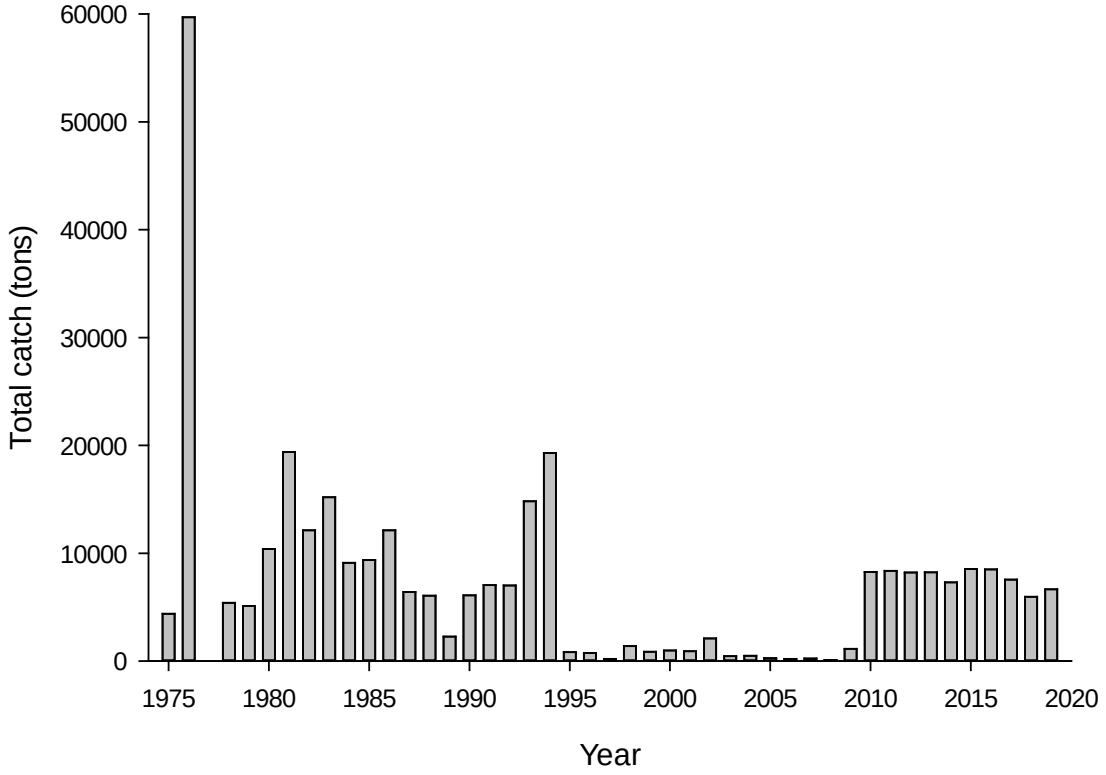

Figure 23.3.1.3 Landings of *S. mentella* in subarea 14.b. Landings of "redfish" have been split based on estimates from survey and commercial catches.

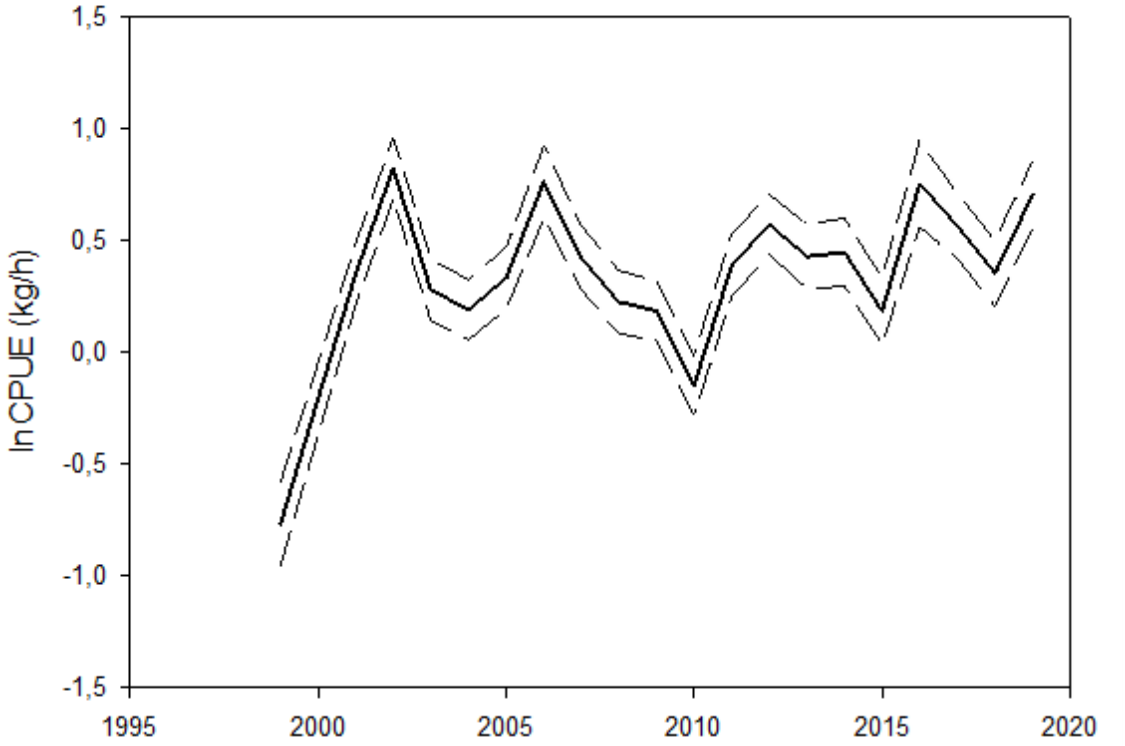

Figure 23.3.2.1 Standardized redfish bycatch CPUE in the directed fishery for Greenland halibut in ICES 14.b as a function of year. CPUE was estimated from the GLM model: lnCPUE = year + ICES Subdivision + depth. Bars represent standard error. Only hauls made below 1000m were used in the analyses.

Figure 23.3.2.2 Standardized redfish CPUE in the redfish directed fishery ICES 14.b as a function of year. CPUE was estimated from the GLM model: lnCPUE = year + ICES Subdivision + depth. Dashed lines represent standard error.

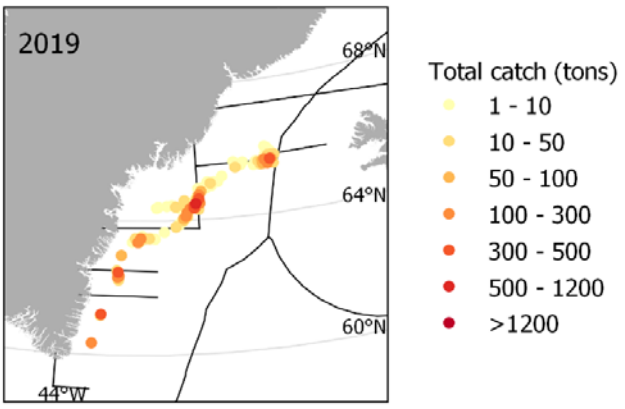

Figure 23.3.3.1 Distribution of catches of demersal redfish (*S. mentella* and *S. norvegicus*) in 2018 in ICES 14.b.

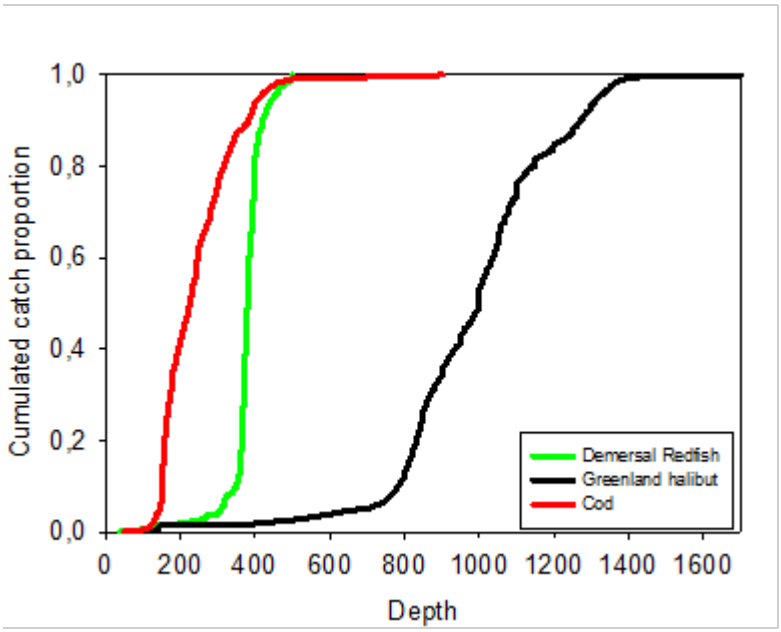

Figure 23.3.3.2. Lines represent the share of the total commercial catch caught at a given depth from 1999–2011 in *G. morhua*, demersal redfish (mixed *S. mentella* and *S. norvegicus)* and *R. hippoglossoides*.

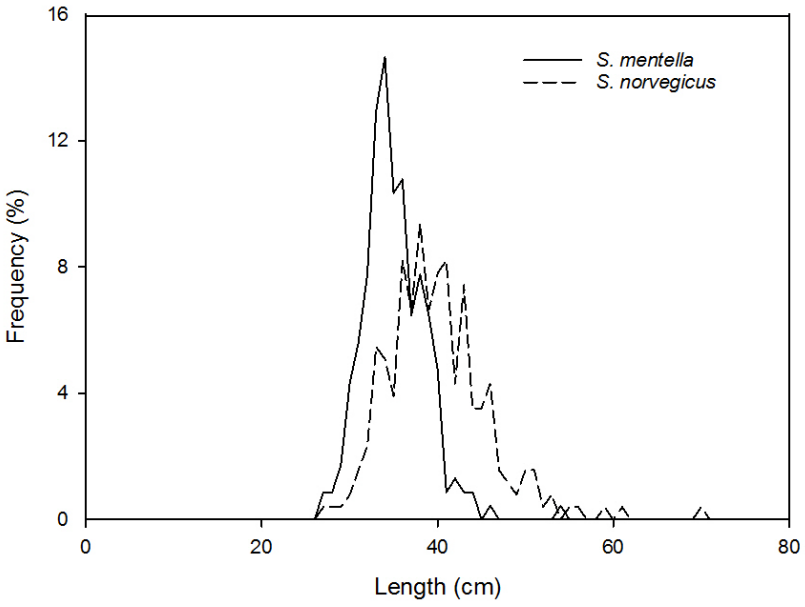

Figure 23.3.5.1: Length distribution of 488 redfish analysed by the Greenland Institute of Natural Resources in 2016 separated into *S. mentella* (N=232) and *S. norvegicus* (N=256). Due to missing samples from the commercial vessels an update of the length distribution was not possible. The missing samples was caused by a change in the license obligations.