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Assessment of Demersal Redfish in NAFO Subarea 1

by

Rasmus Nygaard
Greenland Institute of Natural Resources
rany@natur.gl

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Abstract

Two species of redfish are common in West Greenland, golden redfish (*Sebastes norvegicus*) and deep-sea redfish (*Sebastes mentella*). Golden redfish has a shallower depth distribution than deep-sea redfish. Redfish stock structure is complicated and connectivity to other nearby stocks is unknown.

The fishery targeting demersal redfish in subarea 1 increased during the 1950 from a level of more than 10.000 tons and peaked in 1962 at more than 60.000 tons. Catches then decreased to around 3000 tons in the beginning of the 1970's but increased again to around 10.000 tons by 1975. By 1986 catches had decreased to around 5000 tons and thereafter remained below 1000 tons per year with few exceptions.

The differentiation between stocks in official statistics is however not straight forward. Historic catch is also uncertain, particularly in the years 1977 to 1979 where in numerous cases cod was in many cases reported as redfish in logbooks. Prior to the implementation of sorting grids the shrimp fishery have been shown to have unregistered bycatches (particularly during the 1980's and 1990) far greater than official landings.

There are several surveys of relevance to the assessment of redfish at west Greenland but only the Greenland shrimp and fish survey covers the distribution other surveys of relevance is the EU-Germany survey, and the Greenland Deep survey. Few other surveys also contain relevant information, like the historic Greenland-Japan survey and the inshore surveys in divisions 1D, and 1A.

Survey results indicate decreasing biomass of Golden redfish from the 1980's to very low levels for two decades but slow recovery since then. However, the recovery been stagnant during the most recent two decades and remain far below the historic levels. Dep-sea redfish biomass was also at low levels from 1987 in the surveys but show signs of recovery after from 2008, but without no clear evidence of further recovery during the recent decade.

Recruitment indices indicate numerous of recruits from 1986 to 2000, but far lower numbers of rectuits during the the 2000's and an almost complete lack of recruits from 2010 to 2018. However, the Greenland Shrimp and Fish survey indicates several new year classes since 2020, at levels like the 1990's.

Biology

Two species of redfish are common inshore and offshore in West Greenland, golden redfish (*Sebastes norvegicus*) and deep-sea redfish (*Sebastes mentella*). Golden redfish has a shallower is connected to the shelf and fjord areas on shallower water, whereas the stock structure of deep-sea redfish is more complicated and can be divided into demersal stocks, and pelagic stocks. Deep-sea redfish can be found in the same areas as golden redfish including shallow waters and inside the fjords, and is the dominating species at greater depths offshore (>400m). Relationship to other redfish stocks off East Greenland, Irminger Sea and Iceland is unclear. Stock identities in terms of reproduction were investigated by a joint ICES/ICNAF Study Group (Anon., 1983). The study group concluded that The concept of self-sustaining units or stocks in NAFO Subarea 1 remained unproved for both species due to a general lack of records of maturing or spawning (bearing) specimens. The working group suggested strong relations to the two golden and deep-sea redfish stock complexes off East Greenland, Iceland and Faroes (ICES Subareas V and XIV). However, spawning individuals with live larvae are yearly observed in the inshore trawl survey in Nuuk in April-may.

Length distributions from commercial landings 1962 to 1991 reveals fish in the catches greater than deep-sea Lmax. Therefore historic catches are likely a mixture of both species. During the years, annual growth increments of 4 cm were indicated by repeatedly pronounced peaks in length compositions at 7-8 cm and 12 cm probably corresponding to age 1 and 2 (Nederaas, 1990).

Description of the Fisheries

The fishery targeting redfish in subarea 1 increased during the 1950 from a level of more than 10.000 tons and peaked in 1962 at more than 60.000 tons (Table 1 and figure 1). Catches then decreased to around 3000 tons in the beginning of the 1970's but increased again to around 10.000 tons by 1975. By 1986 catches had decreased to around 5000 tons and since then has been below 1000 tons per year with few exceptions. However, there is high uncertainty about the total landings of redfish in subarea 1. In the 1977, non-Greenland vessels were excluded access to the valuable cod fishery in subarea 1, which led to massive miss-reporting, where catches of cod were reported as other species such as American plaice, redfish, wolffish, finfish not specified and in these years total catches of redfish are overestimated (Horsted S.A. 1980).

With the decreasing cod stock and the increasing shrimp fishery during the 1980's and 1990, significant amounts of redfish may have been taken and discarded in the trawl fishery targeting shrimp. At least in the early part of the shrimp fishery some trawlers would to stop hauling close to the surface and leave the trawl hanging vertically in water so that the floating redfish would surface and be sorted from the shrimp catch, before finally retrieving the trawl. It seems unlikely that this practice would have been reported, since the redfish catch never reached the deck and the by-catch of redfish in the early part of the shrimp fishery may have been significantly underestimated. Riget et al, 1988, estimated a by-catch of redfish in 1988 to be 111 million and 15.584 tons out of a total shrimp catch of 49.089 tons. And based on the by-catch pr. kg shrimp from the Greenland shrimp and fish survey (SFW) and the total shrimp catch, Engelstoft J.J. (1996) estimated the total by-catch of redfish in the 1994 shrimp fishery to 4234 tons and 180 million individuals. A higher mean length of the redfish stock in the 1988 study accounted for the weight difference between the two studies (Engelstoft J.J. 1996). To minimize by-catch in the shrimp fishery, offshore operating shrimp trawlers have been equipped with grid separators since 2002 (G.H. 2001) and the grid separators have also been mandatory for inshore operating vessels since 2011(G.S. 2011). The implementation of sorting grids in the shrimp fishery has led to a high protection of redfish larger than 14 cm and in 2007 the by-catch of redfish in the shrimp fishery was estimated to 0.5% of the shrimp catch equivalent to about 700 tons in 2007 (Sünksen 2007).
In 2025, 2011 tonnes of redfish were reported. logbook reported bycatch of redfish was 133 tonnes (RED) mainly from the shrimp fishery. Inshore reported factory landings of commercially sized redfish amounted to 40 tonnes and another 40 tonnes were reported in logbooks mainly from offshore trawlers targeting Greenland. (Table 1 and figure 1). Besides the demersal redfish, Statlant 21A data further contain catches from a pelagic fishery beaked redfish (*Sebastes mentella*) that occurred for from 2000-2008 that was conducted close to the edge of the Greenland EEZ and far off the shelf of division 1F. Indeed, the differentiation between stocks in official statistics is however not straight forward and the two redfish

species, golden redfish are combined in the catch statistics (table 1). The Greenland authority operates the quota uptake by categorising the catches in three types of redfish. Redfish caught by bottom trawl and longlines on the bottom are called Sebastes norvegicus (REG). Redfish caught pelagic are called Sebastes mentella (and 3) fish caught as by-catch in the shrimp fishery are named Sebastes sp.

Commercial fishery data

Information on historical length composition was derived from sampling of EU-German commercial catches of golden redfish during 1962-90 covering fresh fish landings as well as catches taken by freezer trawlers (figure 2). Samples were quarterly aggregated and mean length was calculated. These, data revealed gradual mean size reductions from 45 to 35 cm, with the most significant reductions occurring during the 70s. The length frequency further indicates that Golden redfish constituted atleast part of the historic catches.

Survey data

The EU-Germany survey, the Greenland deep-water survey and the Greenland Shrimp and Fish survey are the most important.

The Greenland Shrimp and Fish survey has the largest geographical coverage and good overlap with both species (0-600m, NAFO 1A-F since 1988 and ICES XIV since 2008). The Greenland Shrimp and fish survey also uses a shrimp trawl and catch redfish from age 1 (SCR 26-01). The Greenland shrimp and fish survey timeseries was recalculated in 2026 for the entire timeseries using the same area file programming and coding.

The EU-Germany survey has the longest history but a shallower (0-400m, ICES XIV, NAFO 1C-F since 1982) and is based on a fast moving codtrawl and may be better at catching large redfish than the slow moving shrimp trawl used in the Greenland shrimp and fish survey. The EU-Germany survey is most important for Golden redfish as it does not fully cover the depth distribution of deep-sea redfish.

The Greenland deep-water survey covers a smaller geographical and is to deep to fully cover the distribution of Golden redfish (400-1500m, NAFO 1C-D since 1998).

Besides the recent surveys, a joint *Greenland-Japan* existed from 1987 to 1995 somewhat overlapping the areas and depths as the present Greenland deep-water survey. The surveys were however conducted with different vessels and gears and the results are not directly comparable. Results from division 1C and 1D indicated a decreasing biomass of deep-sea redfish from 1987 to 1995.

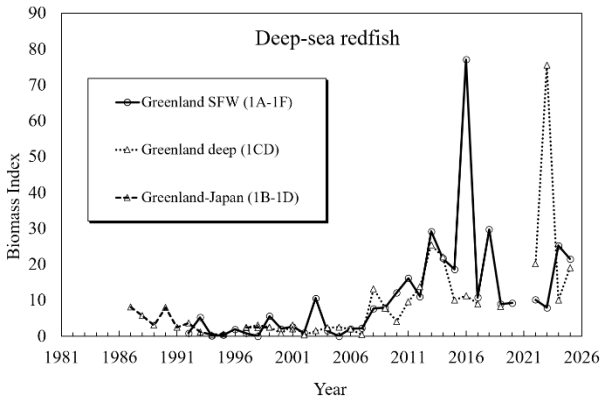
Golden redfish

The EU-Germany and Greenland Shrimp and fish survey have revealed a slightly increasing biomass of golden redfish from 2005 to 2015 (figure 3.). The indices in the survey has not been updated in west Greenland since 2016, and the 2020 indices were based on just a few stations. The Greenland shrimp and fish survey was also at a low level from 1992 to 2005 but slowly increased until 2012. A few large hauls in the survey causes the higher biomass estimates in 2016 and 2019. The indices for golden redfish have been stable in the most recent 4 years. The EU-Germany and the Greenland Shrimp and fish survey show good agreement in the biomass indices for Golden redfish. The biomass indices therefore remain far below the level in the early 1980's and the early indices were obtained after the large fishery in the 1960's.

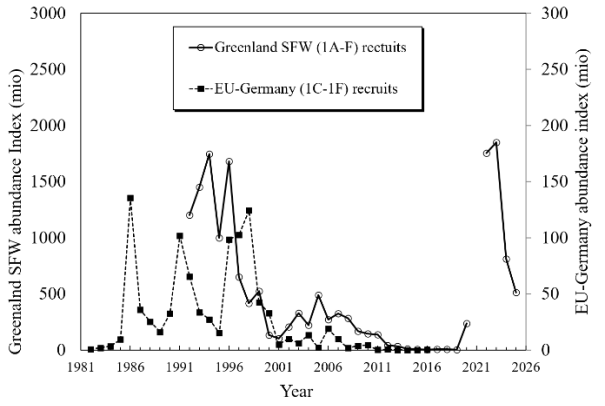
Deep-sea redfish

The EU-Germany survey results for deep-sea redfish remains at a low level throughout the timeseries from 1982, likely related to poor depth overlap with deep-sea redfish and is not included in the Biomass indices for deep-sea redfish. The Greenland-Japan survey indicate that the biomass decreased from 1987 to 1995 (figure 4).

The Greenland deep survey and the Greenland Shrimp and fish survey both indicated that the biomass remained low until 2007 (figure 4). Both the Greenland deep-sea survey and the Greenland shrimp and fish survey agree that the biomass of deep-sea redfish increased from after 2007 (figure 5). The Greenland Shrimp fish survey and the Greenland deep survey is in good agreement with the exception of a few larger hauls causing high indices in 2016 in the Greenland shrimp and fish survey and 2023 in the Greenland Deep survey.



The EU-Germany survey fluctuated without a trend between 1986 and 2000 but decreased to very low levels until the most recent survey updates in 2017. The Greenland Shrimp and Fish survey reveal gradually decreasing numbers of recruits from 1992 to 2000, low levels of recruits until 2011 and an almost complete lack of recruits until 2020. From 2020 the Greenland Shrimp and fish survey finds recruitment indices not seen since the 1990's (figure 5.) and the length distribution reveal that the recruitment is constituted by several incoming year classes (figure 6.). The overall trend in the EU-Germany and the Greenland Shrimp and fish survey is in good agreement although the Greenland Shrimp and fish survey is significantly higher, likely related to the differences in survey area.



Assessment

Initial attempts to use SPiCT model to estimate current stock levels for the species combined biomass converged, but had high uncertainty and did not produce a good production curve. The uncertainty is likely related to the underestimated catches and the uncertainty in the biomass indices from the surveys. The assessment is based on survey indices.

Golden redfish *(Sebastes norvegicus)*

Survey results indicate decreasing biomass of Golden redfish from the 1980's to very low levels for two decades but slow recovery since then. However, the recovery has been stagnant during the most recent two decades and remain far below the historic levels.

Deep-sea redfish (*Sebastes mentella*)

Deep-sea redfish biomass were also at low levels from 1987 in the surveys but show signs of recovery after from 2008, but without no clear evidence of further recovery during the recent decade.

Redfish recruitment (*S. norvegicus and S. mentella combined*)

Survey recruitment indices indicate numerous of recruits from 1986 to 2000, but far lower numbers of recruits during the 2000's and an almost complete lack of recruits from 2010 to 2018. However, the Greenland Shrimp and Fish survey indicates several new year classes since 2020, at levels like the 1990's. Length distributions from the surveys, visual species separation and few unpublished genetic assignment to species indicates that the recent recruitment events are almost exclusively deep-sea redfish.

Conclusion

To continue the rebuilding of the stock it is not advisable to initiate a commercial fishery at this moment. No directed fishery should occur until the stocks show signs of recovery.

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Table 1. Annual reported catches of redfish in NAFO Subarea 1: Golden and deep-sea redfish combined. Figures include reported discard by shrimp vessels.

YEAR	1A	1B	1C	1D	1E	1F	NK	TOTAL	Bycatch estimate	Pelagic (1F)	Note
1952							159	159			1
1953							13800	13800			1
1954							15520	15520			1
1955							32249	32249			1
1956							14008	14008			1
1957							28137	28137			1
1958							17945	17945			1
1959							32540	32540			1
1960		224	8275	16960	8810	9836	25	44130			2
1961	59	1404	11808	17129	9808	13685	525	54418			2
1962	82	2259	12248	15850	20490	9219	204	60352			2
1963		2770	8323	12561	15389	7403	5559	52005			3
1964	10	3370	5466	7083	6657	4500	2925	30011			4
1965		1364	3702	4065	4605	5216	100	19052			4
1966		281	3158	3819	3137	6316	47	16758			4
1967		346	1588	5384	2699	2923	270	13210			5
1968		3	1665	2240	2014	3712	65	9699			5
1969	5	2	724	1295	1056	1553	190	4825			5
1970			363	832	1826	2298	197	5516			5
1971			141	223	317	1687	388	2756			5
1972			99	223	1610	848	208	2988			5
1973		15	315	611	1385	977	16	3319			5
1974		78	511	790	1286	661		3326			5
1975		3609	639	787	1613	1981		8629			5
1976		2873	443	1706	3488	5188		13698			5
1977	3	1	1839	10925	4082	14061		30911			6
1978		5	417	1143	3313	3175		8053			6
1979		2	1357	3231	2172	2115		8877			6
1980	2	12	1895	776	1617	3205		7507			7
1981	9	12	462	205	1672	3401		5761			7
1982	1	24	734	2236	2708	2325		8028			7
1983	1	14	56	292	3812	2535	7	6717			7
1984			1	416	2303	2116	915	5751			7
1985	2	54	37	667	1524	1756		4040			7
1986	6	7		110	1595	952	2674	5344			7
1987		3		2	315	663	159	1142			7
1988	3	4	1	41	548	650	154	1401	15.584		8
1989		8		77	350	338	67	840			9
1990	15	25		84	163	67	60	414			9
1991	42	23		137	67	19	15	303			9
1992	6	44	4	163	104	122	2	445			9
1993	42	261	113	288	116	32		852			9
1994	18	373	224	284	123	87		1109			10
1995	8	262	256	259	104	1371	7	2267			11
1996	19	147	279	289	106	19		859	4234		11
1997	13	191	216	421	114	127	1	1083			11
1998		187	256	319	126	39		927			11
1999	8	195	192	263	67	215	1	941		0	11

YEAR	1A	1B	1C	1D	1E	1F	NK	TOTAL		Pelagic (1F)	Note
2000	6	106	173	217	57	141		700		11034	12
2001	7	87	78	103	21	4		300		5272	12
2002	4	151	171	113	31	30		500		15579	12
2003	9	136	102	113	48	92		500		24702	12
2004	112	21	0	26	11	230		400		24220	12
2005	88	55	0	50	17	(0)		200		22345	12
2006	45	63	162	93	16	(0)		300		19432	12
2007	59	29	58	75	19	(0)		235	700	2762	13
2008	60	3	30	54	10	232		389		1895	14
2009	0	1	6	6	3	358		374		0	14
2010							251	251		0	15
2011	40	4	35	32	4	1	64	180		0	15
2012	32	14	68	32	5	10	0	161		0	15
2013	43	9	44	56	4	14	0	170		0	15
2014	35	6	36	52	5	36	0	170		0	
2015	33	25	28	68	2	35	2	260		0	
2016	35	2	33	68	8	20	0	166		0	
2017	47	5	48	72	3	47	0	222		0	
2018	17	3	19	91	6	58	0	194		0	
2019	22	6	38	45	4	27	0	142		0	
2020	21	52	47	48	4	23	0	194		0	
2021	40	91	19	61	18	26	0	256		0	
2022	59	127	36	38	5	26	0	291		0	
2023								325		0	
2024	87	80	23	33	24	29	7	284		0	
2025	56	68	10	38	9	30	0	211		0	
2026										0	

NOTES

1- W.G.Mattox.
2- Statlant 21. Identical to W.G. Mattox. (years)
3- Statlant 21 (5 Kt more in statlant than in W.G. Mattox).
4- Statlant 21. Identical to W.G. Mattox.
5- Statlant 21.
6- Unreliable Catch data for 1977-1979 corrected as suggested by Horsted (Horsted S. A. 1980).
7- Statlant 21.
8- Redfish bycatch in shrimp trawl fishery estimated to 15.584 tons (Riget et al. 1988).
9- Statlant 21.
10- Redfish bycatch in shrimp trawl fishery estimated to 4234 tons (Engelstoft J.J. 1996).
11- Statlant 21.
12- Pelagic estimated as Statlant 1F redfish minus demersal redfish from previous assessments (STACFIS). (0) indicates minor negative result.
13- Redfish bycatch bycatch in shrimp fishery estimated to 0.5% of the shrimp catch ~700 tons (SCR 07/88). Pelagic estimated as Statlant 1F redfish minus Demersal redfish from previous assessments (STACFIS). (0) indicates minor negative result.
14- Pelagic estimated as Statlant 1F redfish minus Demersal redfish from previous assessments (STACFIS). (0) indicates minor negative result.
15- STACFIS

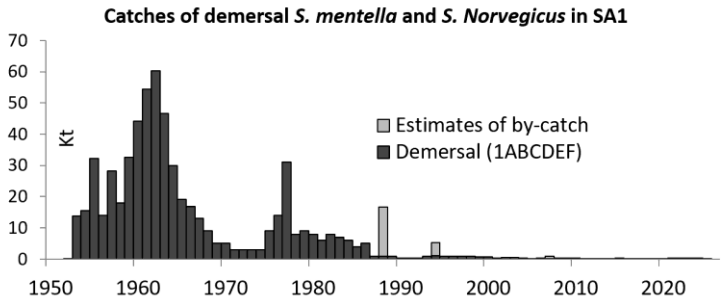

Figure 1. Catches of demersal golden redfish and deep-sea redfish combined in NAFO Subarea 1 (West Greenland).

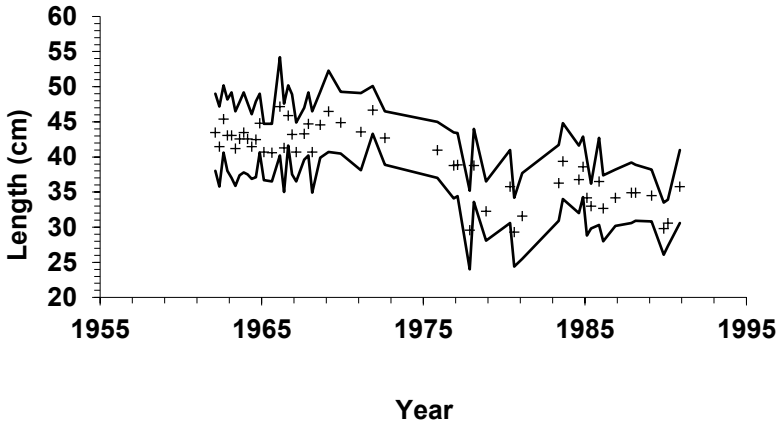

Figure 2. Mean length ± standard deviation derived from German catches of golden redfish in NAFO Subarea 1, 1962-90.

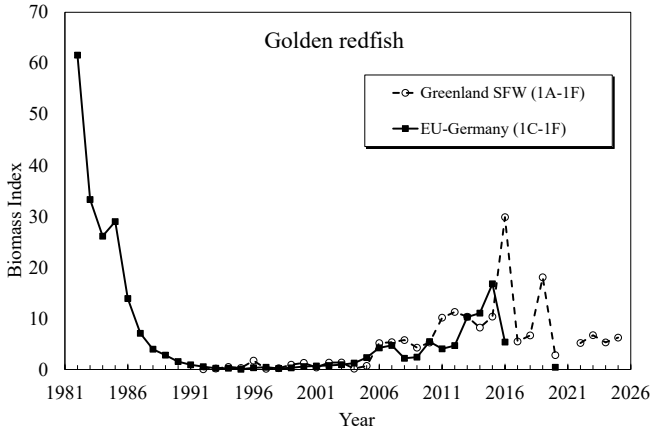

Figure 3. Golden redfish (≥17 cm) survey biomass indices derived from the EU-G survey and the Greenland SFW survey.

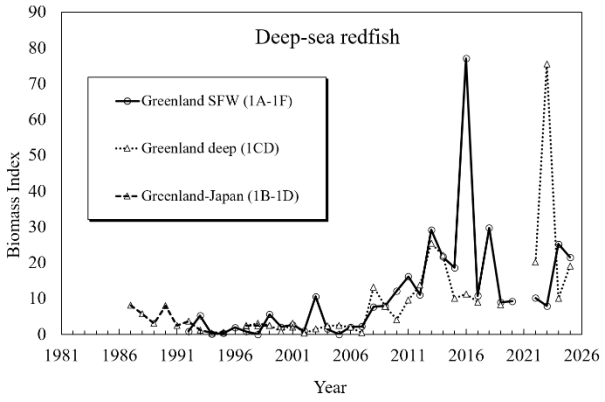

Figure 4. Deep-sea (adult ≥17 cm) survey biomass indices derived from the EU/Germany survey, the Greenland-Japan deep-sea survey, the Greenland deep sea survey and the Greenland SFW survey.

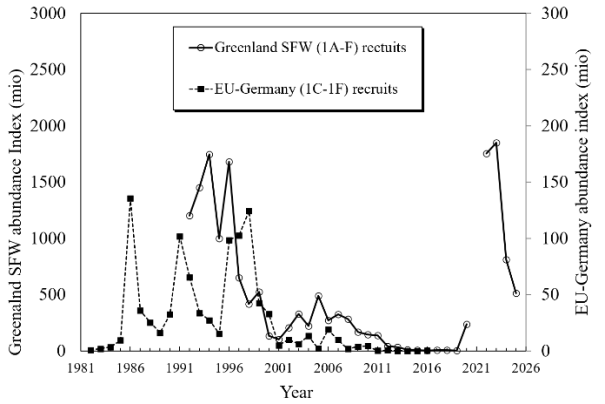

Figure 5. Survey abundance indices derived from the EU-German groundfish survey (recruits <17 cm) and from the Greenland shrimp and fish survey (recruits <18 cm).

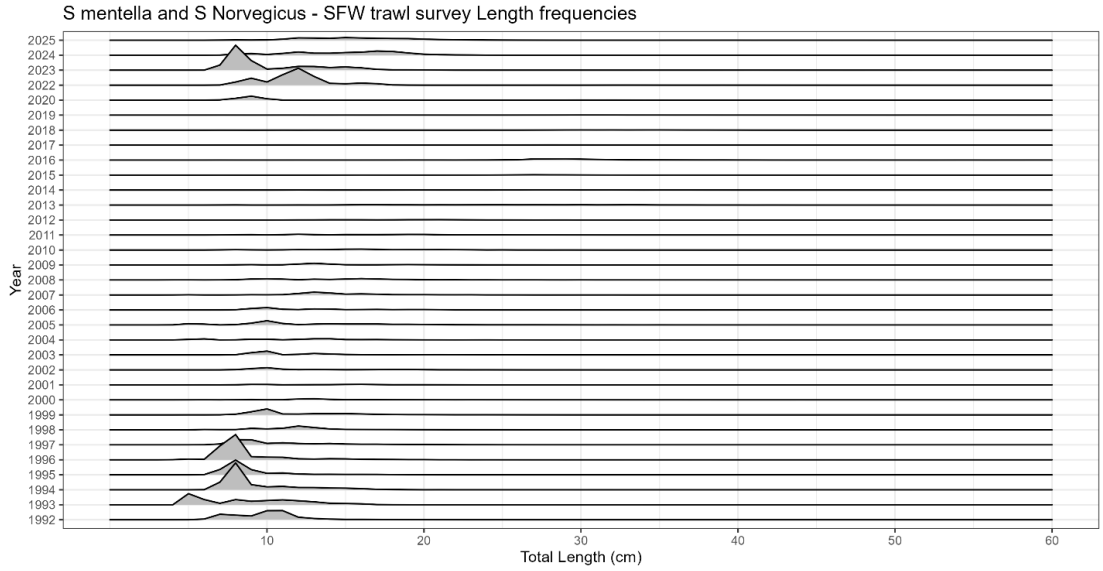

Figure 6. Length frequencies for golden redfish (*Sebastes Norvegicus*), deep-sea redfish (Sebastes mentella) combined (Sebastes sp.) from the Greenland SFW survey in West Greenland.