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Assessment of Redfish in NAFO Subarea 1

by

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1 Introduction

Two species of redfish occurr off West Greenland inshore and offshore, golden redfish (*Sebastes marinus* L.) and deep sea redfish (*Sebastes mentella* Travin). Stock identities in terms of reproduction were investigated by the a joint ICES/ICNAF Study Group (Anon., 1983). The concept of self-sustaining units or stocks in NAFO Subarea 1 remains unproved for both species due to a general lack of records of maturing or spawning (bearing) specimens. Therefore, 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) as well as the management unit of oceanic redfish (*Sebastes mentella* Travin) in the central Irminger Sea (ICES Subareas XII and XIV). However, the common occurrence of golden redfish at length groups being mature in other areas was proved from historical length measurements before the 70s.

2 Description of the Fisheries

Historically, redfish were taken mainly as by-catch in the trawl fisheries for cod and shrimp. However, occasionally during 1984-86, a directed fishery on redfish was observed for German and Japanese trawlers. With the collapse of the Greenland cod stock during the early 90s resulting in a termination of that fishery, catches of commercial sized redfish were taken inshore by long lining or jigging and offshore by shrimp fisheries only. There are also substantial numbers of juveniles discarded in the shrimp fishery.

3 Catches

Both redfish species golden redfish (*Sebastes marinus* L.) and deep sea redfish (*Sebastes mentella* Travin) are included in the catch statistics since no species specific data are available. Other data suggest that until 1986, landings were indicated to be composed almost exclusively of golden redfish. Subsequently, the proportion of deep sea redfish represented in the catches increased, and since 1991, the majority of catches are believed to be deep sea redfish.

In 1977, total reported catches peaked at 31 000 tons (Tab. 1, Fig. 1). During the period 1978-83, reported catches of redfish varied between 6 000 and 9 000 tons. From 1984 to 1986, catches declined to an average level of 5 000 tons due to a reduction of effort directed to cod by trawlers of the EU-Germany fleet. With the closure of this

offshore fishery in 1987, catches decreased further to 1 200 tons, and remained at that low level. The official catch figure for 1998 is 927 tons.

Recent and historical catch figures do not include the weight of substantial numbers of small redfish discarded by the trawl fisheries directed to shrimp.

4 Assessment

Due to a lack of adequate commercial data no analytical assessment could be formulated. Therefore, the assessment was based on survey indices.

4.1 Input Data

4.1.1 Commercial fishery data

No data on CPUE were available. Information on historical length compostion 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. 118 samples were quarterly aggregated and mean length was calculated. These data revealed significant size reductions of fish caught from 45 to 35 cm, with the biggest reductions occurring during the 70s. There are no data available to estimate the size composition of historical catches of deep sea redfish.

Converted length frequencies derived from the Greenland shrimp survey revealed that the commercial shrimp gear selected a significant proportion of fish <10 cm and all fish sizes >10 cm (Jørgensen and Carlsson, 1998). For July-August 1997 the by-catch and discard of redfish in the shrimp fishery was assessed to 30 million individuals and 870 tons. Given uncertainties related to the estimation method and likely seasonal changes, the assessment of annual discard rates is impossible. There was no information available for 1998.

4.1.2 Survey data

EU-German groundfish survey. Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commencing in 1982 (Rätz et al., 1999; Rätz and Stransky, 1998). These surveys covered the areas from the 3-mile limit to the 400 m isobath of Div. 1B to 1F and were primarily designed for cod as target species. Therefore, the high variation of the estimates for redfish could be caused as a result of the incomplete survey coverage in terms of depth range and pelagic occurrence of redfish. The survey results indicated that both abundance and biomass estimates of golden redfish (≥17 cm) decreased by more than 90 % until 1990 and remained at that low level since then (Fig. 3). Estimates for deep sea redfish (≥17 cm) varied without a clear trend but have frequently been extremely low since 1989 (Fig. 4). However, the 1997 estimate indicated a significant biomass increase due to recruitment which was not apparent in 1998. Juvenile redfish (<17 cm) were found to be very abundant, especially in 1986, 1991, and 1996-98 (Fig. 5). Reappearing peaks at 6, 10-12 and 15-16 cm might indicate annual growth increments and represent the age groups 0, 1 and 2 years. Comparisons between with the survey results off West and East Greenland revealed that all three redfish components were almost exclusively distributed off East Greenland. Significant recovery signals for deep sea redfish based on both fish abundance and size were limited to the area off East Greenland.

Greenland-Japan and Greenland groundfish surveys. During 1987-95, cooperative trawl surveys directed to Greenland halibut and roundnose grenadier have been conducted on the continental slope in Div. 1A-1D at depths between 400 and 1 500 m. This deep water survey was discontinued in 1996 but conducted again since 1997 by Greenland with another vessel and changed gear (Jørgensen, 1999). Deep sea redfish were mainly caught at depths less than 800 m. Despite the technical changes, the increase in stock abundance and biomass from lowest since 1995 is consistent with other survey information (Fig. 4). Length measurements revealed that the size composition of the stock is presently dominated by immature individuals <30 cm.

Greenland groundfish/shrimp survey. Since 1988, a shrimp survey was conducted by Greenland covering the Div. 1A to 1F down to 600 m depth (Engelstoft and Jørgensen, 1999). Due to changes in survey strategy and sampling of fish, determinations of abundance and biomass indices and length composition were considered comparable since 1992. Redfish was found to be most abundant in the northern Div. 1B. Abundance and biomass indices varied without a clear trend but indicated juvenile redfish to be very abundant, especially in 1994 and 1997 (Fig. 5). The estimate for 1998 was the lowest on record. During the entire survey series, catches were composed almost exclusively of juveniles being smaller than 15 cm.

4.2 State of the stocks

The golden redfish spawning stock biomass was assessed assuming knife edge maturity at 35 cm as observed in East Greenland applied to the length disaggregated abundance indices derived from the EU-German groundfish survey. The length groups 17-20 cm were chosen as recruitment indices and correspond approximately to age group 5. SSB and recruitment indices decreased drastically from 1982 and have remained significantly below the average level since 1989 (Fig. 6). Taking into account the recent very low SSB and the recruitment failure together with the absence of golden redfish in the Greenland surveys, the stock of golden redfish in Sub-area 1 is considered to be severely depleted with no signs of recovery. There are indications that the probability of future recruitment is reduced at the current low SSB (Fig. 7).

The German survey biomass of fish >=35 cm and the abundance of length groups 17-20 cm were taken as proxies for deep sea redfish SSB and recruitment at age 5. No clear trend can de derived from these estimates but SSB has been extremely low since 1989 (Fig. 8). The recently depleted status of the SSB is confirmed by the lack of adult fish in the Greenland deep water survey. Recruitment variation is high and the 1996-97 estimates of 5 years old fish were above average, the latter one representing the maximum of the time series.

Substantial numbers of redfish caught are caught and discarded by the shrimp fishery, and concern must be expressed about the continuing failure of the juveniles to rebuild the pre-mature and mature stock components. Considering the depleted SSBs, the recruitment potential of the very abundant early life stages at an age of 0-2 years to the Sub-area 1 stocks remains unclear. The probability of recovery of the redfish stocks in Sub-area 1 should increase if the by-catches taken by the shrimp fishery is reduced to the lowest level possible.

4.3 Limit and target reference points

Due to a lack of appropriate data there is no basis to propose any limit or target reference points for fishing mortality or spawning stock biomass for the stocks of golden and deep sea redfish stocks in Sub-area 1. Nevertheless, the recently depleted spawning stocks as derived from survey results are considered far below proper levels of Blim.

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Table 1 TAC and annual catches of NAFO Subarea 1 redfish, golden and deep sea redfish combined (Folmer, 1999).

Year	TAC (1 000 t)	Catch (1 000 t)
1965		19
1966		17
1967		13
1968		9
1969		5
1970		5
1971		3
1972		3
1973		3
1974		3
1975		9
1976		14
1977		31
1978		8
1979		9
1980		8
1981		6
1982		8
1983		7
1984		6
1985		4
1986	19	5
1987	19	1
1988	19	1
1989	19	1
1990	19	0.4
1991	19	0.3
1992	19	0.3
1993	19	0.8
1994	19	1.0
1995	19	0.9
1996	19	0.9
1997	19	1.0
1998[1]	19	0.9

[1]) Provisional

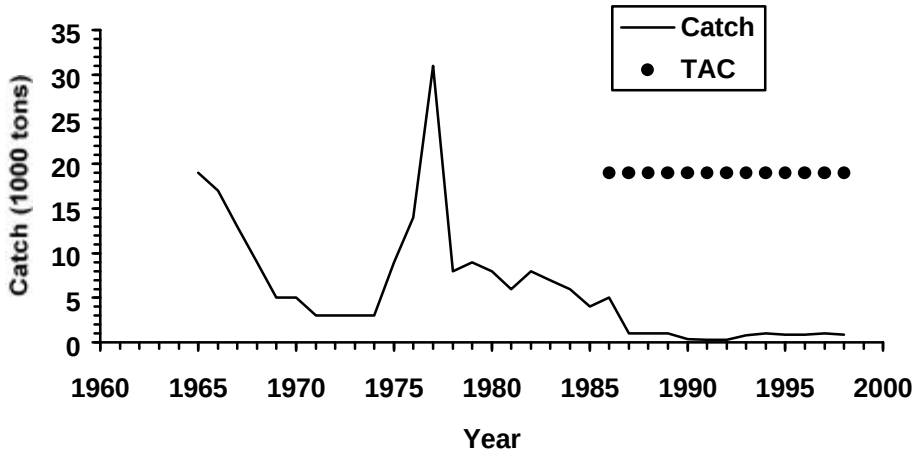

Fig. 1 TAC and catches of redfish in NAFO Subarea 1, both golden and deep sea redfish combined.

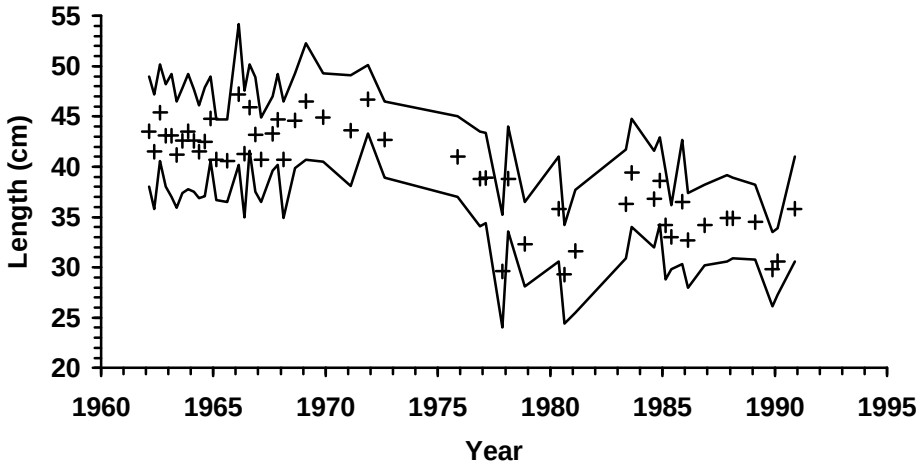

Fig. 2 Mean length ± standard deviation derived from German catches of golden redfish in NAFO Subarea 1, 1962-90.

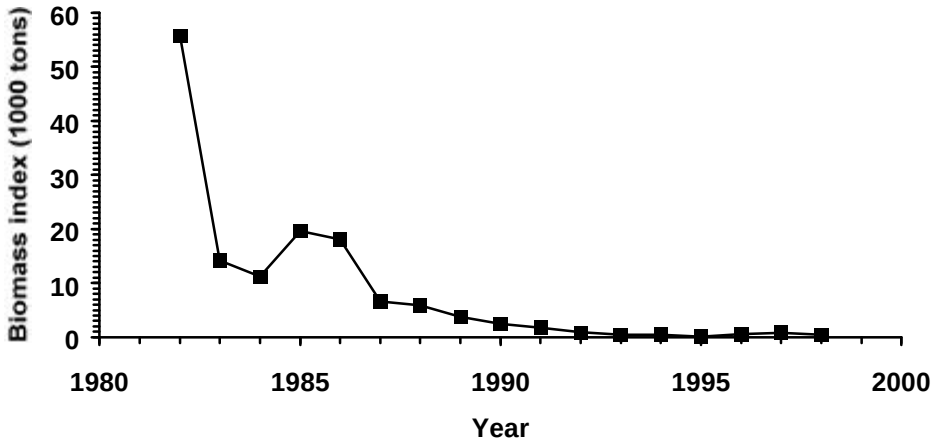

Fig. 3 Survey biomass indices for golden redfish (≥17 cm) in NAFO Subarea 1 derived from the EU-German groundfish survey.

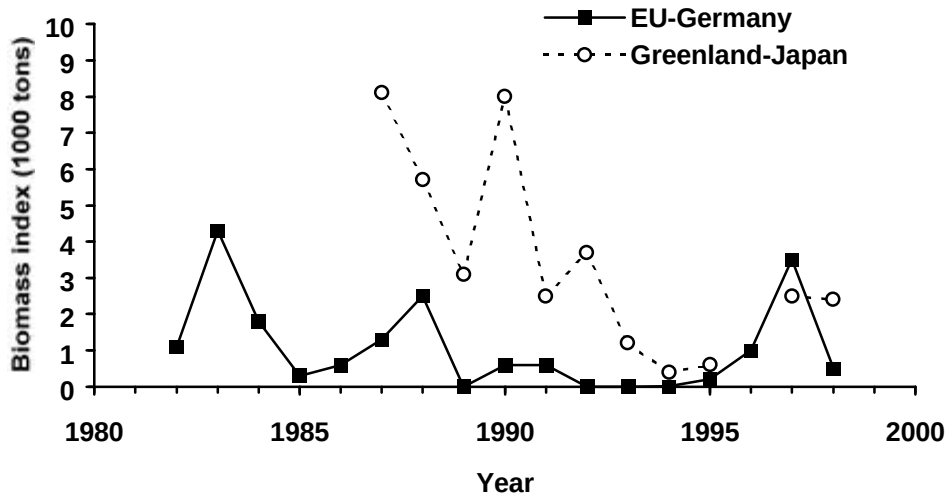

Fig. 4 Survey biomass indices for deep sea redfish (≥17 cm) in NAFO Subarea 1 derived from the EU-German groundfish survey and from the joint Greenland-Japan survey including the entire length range (since 1997 Greenland only).

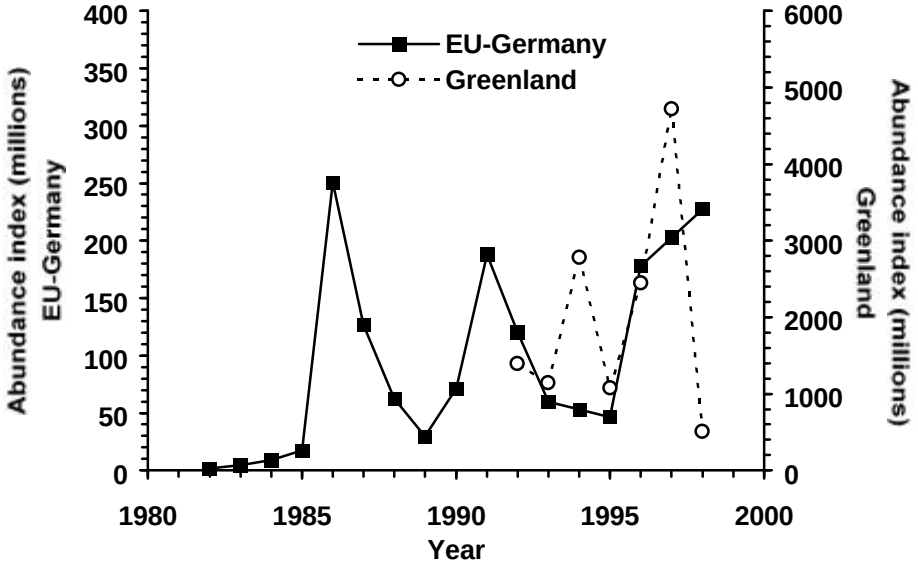

Fig. 5 Abundance indices for juvenile redfish (<17 cm) in Subarea 1: survey abundance indices derived from the EU-German groundfish survey and from the Greenland groundfish/shrimp survey including the entire length range.

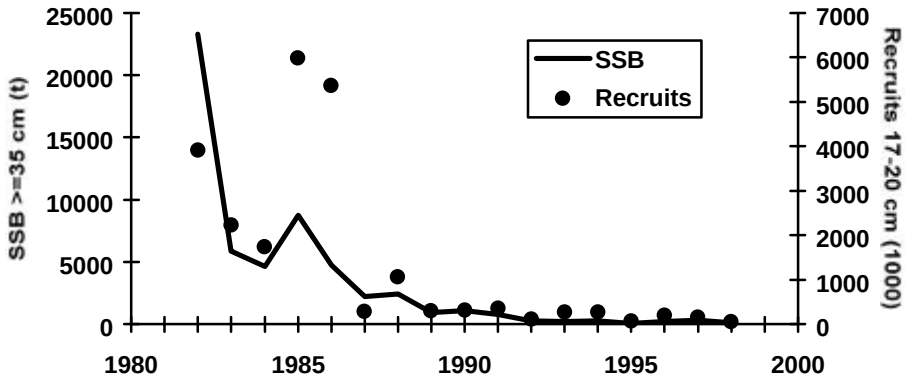

Fig. 6 Golden redfish Subarea 1. SSB and recruitment indices as derived from the German groundfish survey in the given years.

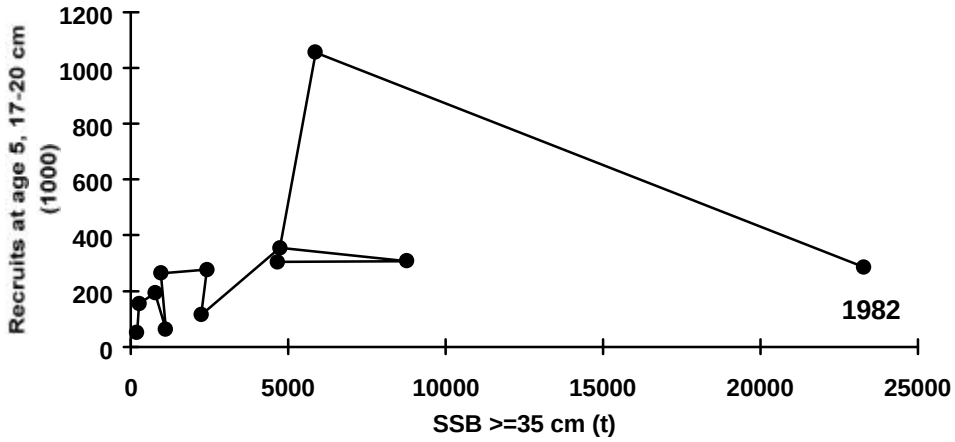

Fig. 7 Golden redfish Subarea 1. SSB-recruitment plot.

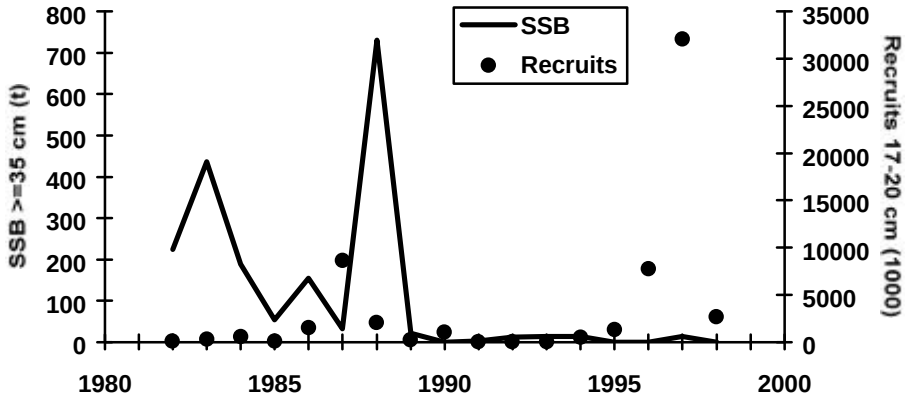

Fig. 8 Deep sea redfish Sub-area 1. SSB and recruitment indices as derived from the German groundfish survey.