



Serial No. N5925

NAFO SCR Doc. 11/040

**SCIENTIFIC COUNCIL MEETING – JUNE 2011**

Assessment of Demersal Redfish in NAFO Subarea 1

by

Rasmus Nygaard  
Greenland Institute of Natural Resources  
[rany@natur.gl](mailto:rany@natur.gl)

and

Heino Fock and Christoph Stransky

Federal Research Centre for Fisheries, Institute for Sea Fisheries  
Palmaille 9, D-22767 Hamburg, Germany  
[heino.fock@vti.bund.de](mailto:heino.fock@vti.bund.de) [cristoph.stransky@vti.bund.de](mailto:cristoph.stransky@vti.bund.de)

**Abstract**

At the NAFO 2011 June meeting Scientific Council is requested to provide advice for 2012 and 2013 on management for redfish in Subarea 1. Two species of redfish of commercial interest occur off West Greenland inshore and offshore, golden redfish (*Sebastes marinus* L.) and deep-sea redfish (*Sebastes mentella* Travin). A pelagic fishery for pelagic redfish/beaked redfish (*Sebastes mentella*) occurred for the first time off West Greenland in 1999. The pelagic redfish in West Greenland is part of the Irminger stock complex and is assessed by ICES.

*Golden redfish:* The indices of golden redfish in the EU-Germany survey decreased in the 1980s and were at a very low level in the 1990s. However, the survey has revealed increasing biomass indices of golden redfish ( $\geq 17$ cm) since 2004, and the 2010 estimate is the highest observed since 1984.

*Deep-sea redfish:* The joint Greenland-Japan deep-sea survey (1987-1995) and the Greenland deep-sea survey (1997-2010) indices were at a low level from 1993 to 2007, but in 2008 a substantial increase in biomass was found in the Greenland deep-sea survey. The fluctuating trend in the survey indices could be caused by poor survey overlap with the depth distribution of the deep-sea redfish stock. The indices have decreased since then, but are still among the higher values seen since 1990.

*Juvenile redfish:* Juvenile redfish are difficult to distinguish and indices of juvenile redfish are combined. Abundance indices of juvenile redfish (both species combined) in the EU-German survey have fluctuated between 50 and 100 million individuals from 1985 to 2000. Since then abundance indices have been at a very low level (fig 4). Abundance indices of both redfish species combined in the Greenland Shrimp Fish survey have decreased from a level of around 1500 million individuals in the mid 1990s to around 100 million individuals in 2010.

## Introduction

Two species of redfish of commercial interest occur inshore and offshore at West Greenland, golden redfish (*Sebastes marinus* L.) and deep-sea redfish (*Sebastes mentella* Travin). Stock identities in terms of reproduction were investigated by 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). However, the common occurrence of golden redfish at length groups being mature in other areas were proved from historical length measurements before the 1970s.

## 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, German and Japanese trawlers prosecuted a directed fishery on redfish. With the collapse of the Greenland cod stock during the early-1990s, resulting in a termination of that fishery, redfish were only taken inshore by long-lining or jigging and offshore as by catch in the shrimp fisheries. To reduce the amount of juvenile redfish taken as by-catch in the shrimp fisheries, sorting grids have been mandatory since October 2000 and were fully implemented by 2002. Results of experimental fishing with 22mm sorting grids show a nearly complete protection to finfish larger than 20 cm (Engelstoft *et al.*, 2001, Sünksen 2007). Catch figures since 2007 include the amount of small redfish discarded by the trawl fisheries directed to shrimp (Table 1 and Fig 1).

The two redfish species, golden redfish (*Sebastes marinus* L.) and deep-sea redfish (*Sebastes mentella* Travin) are combined in the catch statistics. Other data suggest that until 1986, landings were almost exclusively composed 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. Recently, redfish catches has been reported as “Redfish” (unspecified - mainly taken as by-catch by the offshore shrimp trawlers), “Golden redfish” and “Beaked redfish” (pelagic redfish fishery). Since pelagic redfish is assessed by ICES (NWWG report 2011), the catch statistic reported as “Beaked redfish” is not included here.

In 1977, total reported catches peaked at 31 000 tons (Table 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 termination of the offshore cod fishery in 1990, catches decreased to less than 1 000t since 1987 and less than 500 t since 2001. These catches are mainly taken as a by-catch of commercially sized redfish in inshore longline and gillnet fishery targeting Greenland halibut and as by-catch of small redfish in the shrimp fishery. In 2010, 251 t were reported and of these 85t were reported as by-catch in the shrimp fishery.

## 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 (Fig 2). Samples were quarterly aggregated and mean length was calculated. These data revealed significant size reductions from 45 to 35 cm, with the most significant reductions occurring during the 70s. There are no data available to estimate the size composition of historical catches of deep-sea redfish.

Logbooks provided by Greenlandic and foreign vessels to the Greenland fisheries license office, was used to estimate the catches of the juvenile redfish discarded in the past decade in the shrimp fishery.

## Survey data

*EU-German survey:* Annual abundance and biomass indices were derived from stratified-random bottom trawl surveys commencing in 1982 (SCR 11/04). This survey covers the area from the 3-mile limit to the 400 m isobath of Div. 1B to 1F and was primarily designed for cod as target species.

Golden redfish ( $\geq 17$  cm) biomass and abundance indices decreased by more than 90% until 1990. However, since 2002 a steady increase has been observed (Fig. 3).

Deep-sea redfish ( $\geq 17$  cm) biomass indices have varied without a clear trend (Fig. 4). Since 1996, the survey abundance increased but the stock consists mainly of juvenile fish between 17 and 20 cm in length. The high variation deep-sea redfish could be caused as a result of the incomplete survey coverage in terms of depth range and of redfish.

Juvenile redfish ( $< 17$  cm *Sebastes spp.*) has varied over a wide range since 1982 (Fig. 5). Indices since 2001 have been among the lowest during the time series. The length composition of the stock revealed peaks at 6-7, 10-12 and 14-16 cm, an indication of sizes at ages 0, 1 and 2 years.

*The Greenland-Japan and the Greenland deep-sea surveys:* Deep-sea redfish were mainly caught in Div. 1C at depths less than 800 m (SCR 11/09). In 2000 and 2002, the survey did not cover the shallow areas ( $< 800$  m) sufficiently and no values were calculated in these years. The surveys are not directly comparable. From 1997 and until 2006 the biomass has been stable at about 2 000-2 500 tons (Fig. 4). In 2008 the highest index values was found, but the indices has decreased somewhat since then. Length measurements revealed that immature individuals  $< 30$  cm presently dominate the size composition of the stock. None of the redfish in surveys since 2002 have shown any sign on maturity.

*The Greenland Shrimp Fish Survey:* Since 1988, a shrimp survey was conducted by Greenland covering the Div. 1A to 1F down to 600 m depth (SCR 11/24). Redfish was found in all the survey areas, but was most common in Div. 1B and 1C. No species specific data is currently available from this survey)

The abundance and biomass fluctuated without a clear trend from 1992-1996 at a level of 900-2400 million individuals and 14 000-38 000 tons. From 1997 to 2007, the survey biomass decreased and has remained below 10 000 tons since then. The abundance indices throughout the time series and have been below 100 million since 2009 (Fig. 5). During the years, catches has comprised almost exclusively of individuals less than 20 cm. 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). The recent five survey estimates revealed only small peaks at 7-8 cm and 10-14 cm, leaving no sign of prominent future recruitment

### **Estimation of SSB and recruitment**

The golden redfish spawning stock biomass was estimated assuming knife edge maturity at 35 cm as observed in East Greenland applied to the length disaggregated abundance indices derived from the EU-German survey. Recruitment was estimated as the abundance of length groups 17-20 cm, taken as proxies for golden redfish recruitment at age 5. In 2010 both SSB and recruitment have increased (Fig. 6). SSB and recruitment indices decreased drastically from 1982 and have remained significantly below the average level since 1989. From 2002 to 2005 an increase in recruitment is observed which corresponds to the first yearclass protected by the sorting grids in the shrimp trawls is seen (Fig 7).

The deep-sea redfish spawning stock biomass SSB was estimated assuming knife edge maturity at 30 cm applied to the length disaggregated abundance indices derived from the EU-German survey. Recruitment was estimated as the abundance of length groups 17-20 cm, taken as proxies for deep-sea redfish recruitment at age 5. The SSB has been low since 1989, although slowly increasing since 2001 (Fig. 8). Recruitment variation is high, and the 1997, 2000 and 2001 estimates were above average, but since 2002 recruitment indices have remained low (Fig 8). The SSB plotted against recruitment at age 5 reveals decreasing values of both SSB and recruitment until 2005, with a few incidents of high recruitment (Fig 9).

### **Assessment**

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

### Assessment results

Golden redfish - The stock has revealed some recovery potential due to both increased recruitment and SSB and the survey indices are almost at the 1980s level. However, taking account of the low biomass estimates of the EU-German survey, the stock remains at a low level.

Deep-sea redfish - An increase in biomass has been observed in the Greenland deep-sea Survey and in SSB in the EU-German survey in recent years. However, the SSB indices derived from the EU-German survey are below the 1980s values. Recruitment has been low in recent years. The increase in SSB observed in the EU-German survey since 2002, is below the 1980s values. The stock remains at a low level.

### References

- Engelstoft, J. J, Isaksen, B., Larsen, R. B., Rosing, M. and K. Zachariassen, 2001. Studies of technical methods for secure shrimp fishery in the Redfish Box, East Greenland. Project Report for the Nordic Strategy for the Environment and Fisheries. *Tema Nord* (technical report at Greenland Institute of Natural Resources).
- Fock H. and Stransky C. 2011. Stock abundance Indices and Length Compositions of Demersal redfish and other finfish in NAFO Sub-area 1 and near bottom water temperatur derived from the German bottom trawl survey 1982-2010. NAFO SCR Doc. 11/04, Ser. No. N5882:1-26.
- Jørgensen, O. A. 2011. Survey for Greenland Halibut in NAFO Divisions 1C-1D, 2010. NAFO SCR Doc. 11/09, Ser. No. N5889:1-37.
- Nygaard R. and Jørgensen O.A. 2011. Biomass and abundance of demersal fish stocks off West Greenland estimated from the Greenland Shrimp-Fish Survey, 1988-2010. NAFO SCR Doc. 11/24, Ser. No. N5908.
- Siegstad, H. 2011. Denmark/Greenland Research Report for 2010. NAFO SCS Doc. 11/10, Ser. No. N5901 1-8.
- Sünksen, K. 2007: Discarded by-catch in shrimp fisheries in Greenlandic offshore waters 2006-2007. NAFO SCR Doc. 07/88

Table 1. TAC and annual catches of redfish in NAFO Subarea 1 (exclusive catches reported as pelagic redfish): golden and deep-sea redfish combined and the reported by-catch by shrimp vessels (SF by-catch).

Year	TAC (1 000 t)	SF by-catch	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	19		0.9
1999	19		0.8
2000	19		0.7
2001	19		0.3
2002	8		0.5
2003	1		0.5
2004	1	0.27	0.5
2005	1	0.45	0.2
2006	1	0.28	0.3
2007	1	0.15	0.3
2008	1	0.27	0.39
2009	1	0.13	0.37
2010	1	0.08	0.25

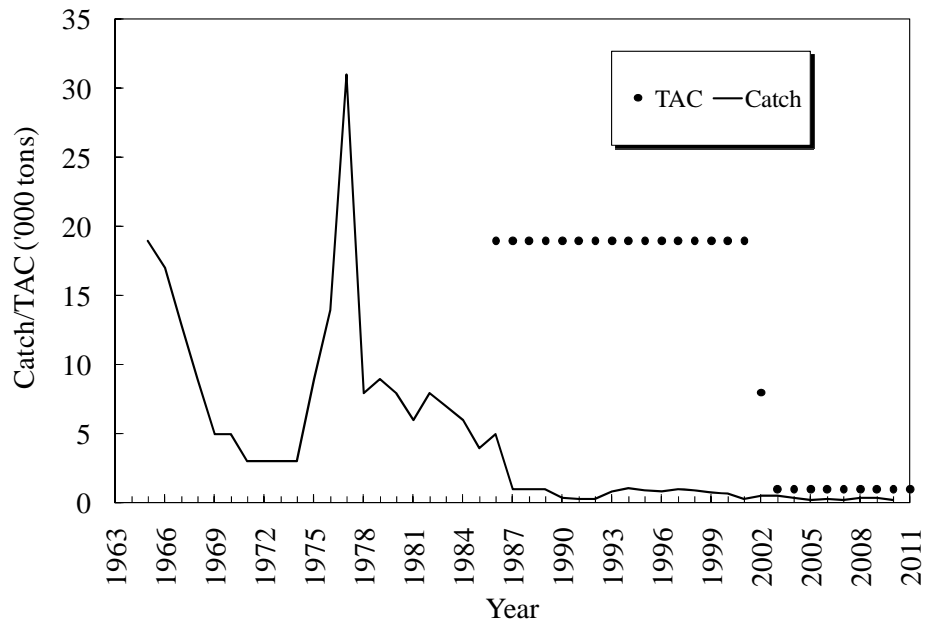


Fig. 1. TAC and catches including by-catch of Demersal redfish in NAFO Subarea 1, both golden and deep-sea redfish combined.

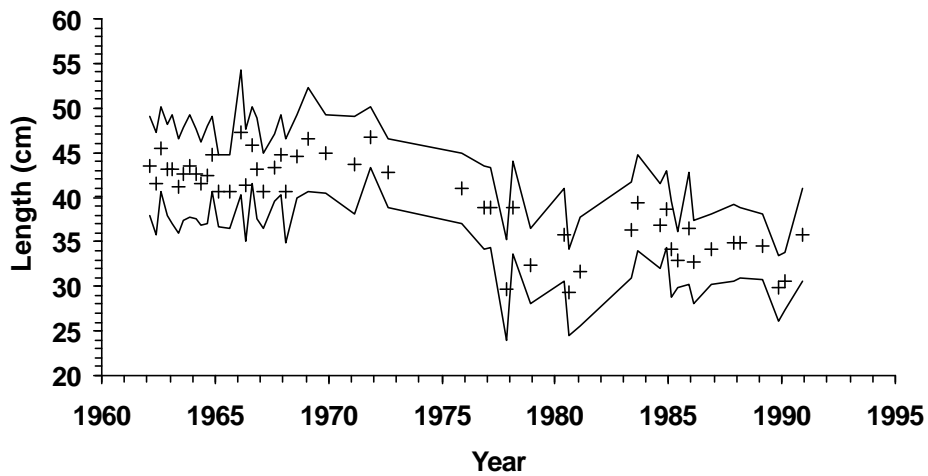


Fig. 2. Mean length  $\pm$  standard deviation derived from German catches of golden redfish in NAFO Subarea 1, 1962-90.

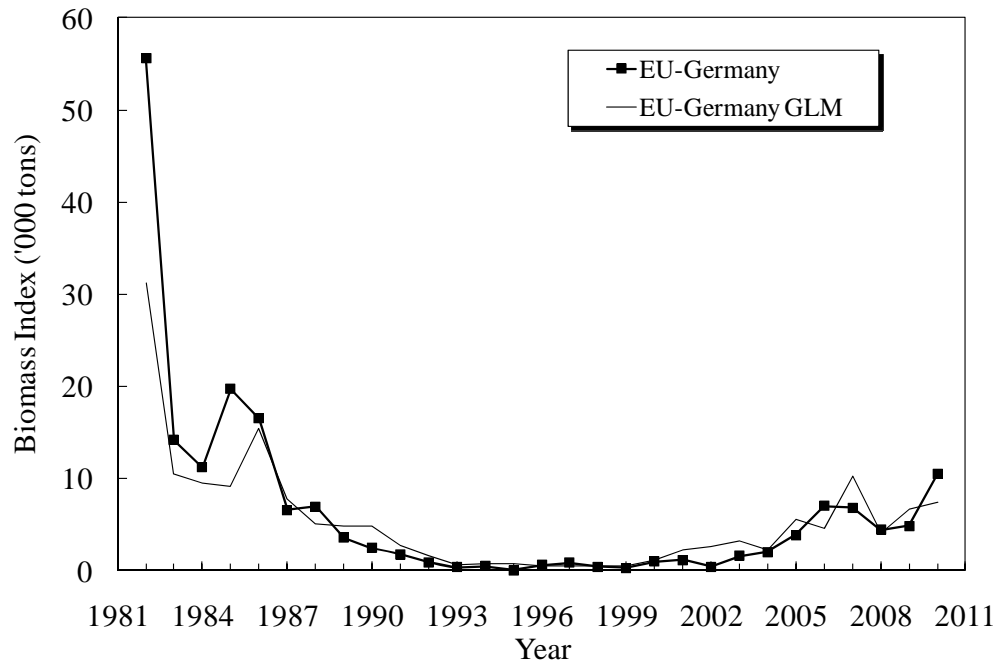


Fig. 3. Golden redfish ( $\geq 17$  cm) survey biomass indices derived from the EU-German groundfish survey.

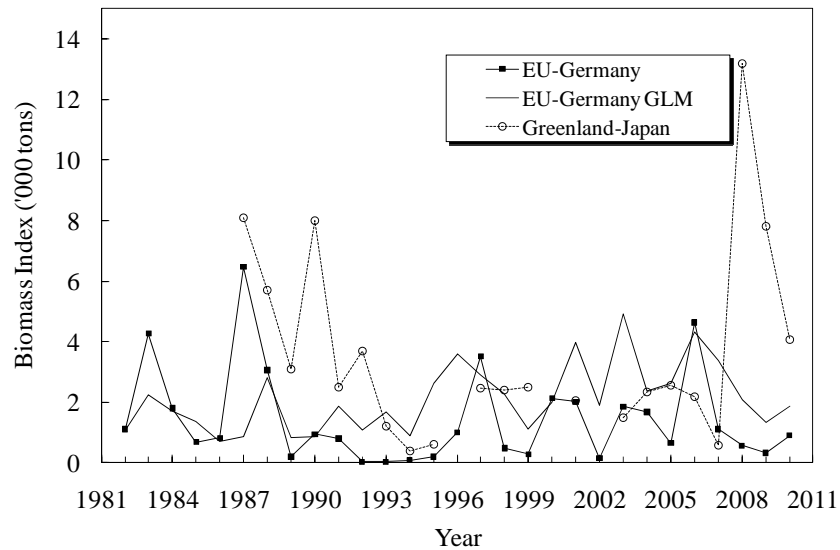


Fig. 4. Deep-sea ( $\geq 17$  cm) survey biomass indices derived from the EU-German groundfish survey and from the Greenland-Japan deep-sea survey including the entire length range.

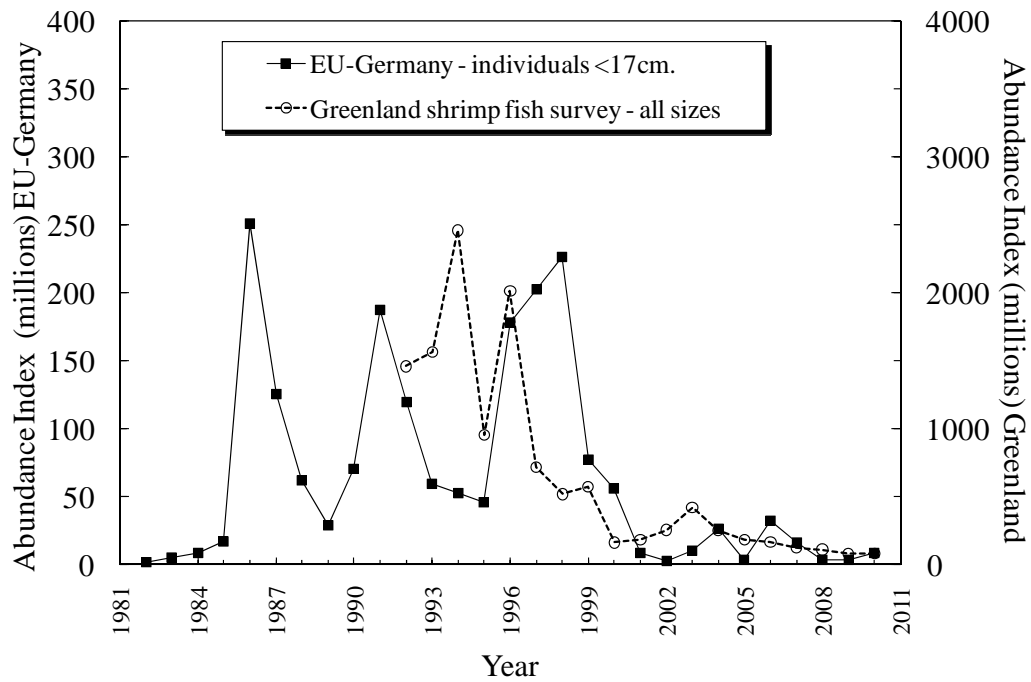


Fig. 5. Abundance indices for unspecified redfish (<17 cm) in Subarea 1: survey abundance indices derived from the EU-German groundfish survey and from the Greenland shrimp fish survey all sizes. Notice the different scales.

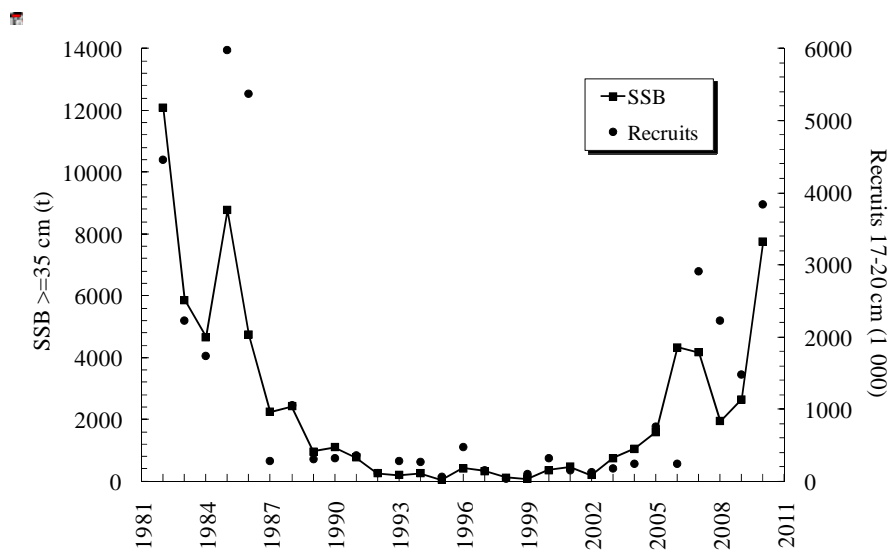


Fig. 6. Golden redfish Subarea 1. SSB and recruitment indices derived from the EU-German groundfish survey.



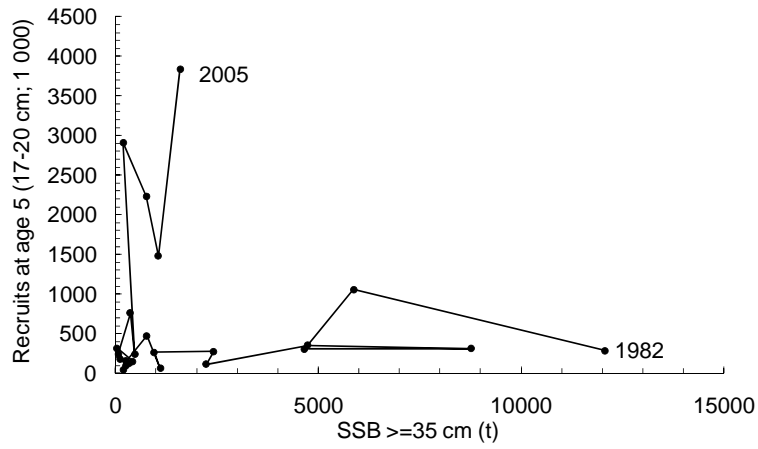


Fig. 7. Golden redfish Subarea 1. Recruitment at age 5 plotted against SSB 5 years before derived from the German groundfish survey.

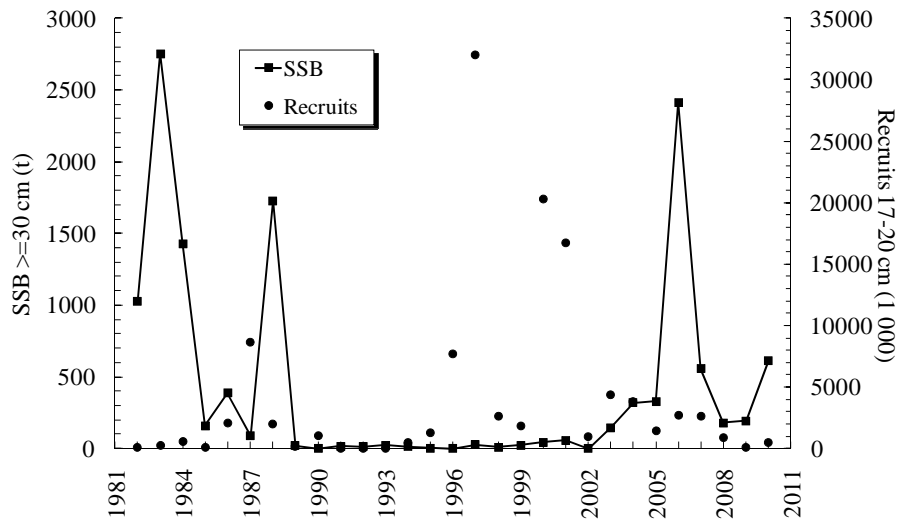


Fig. 8. Deep-sea redfish Sub-area 1. SSB and recruitment indices derived from the German groundfish survey.

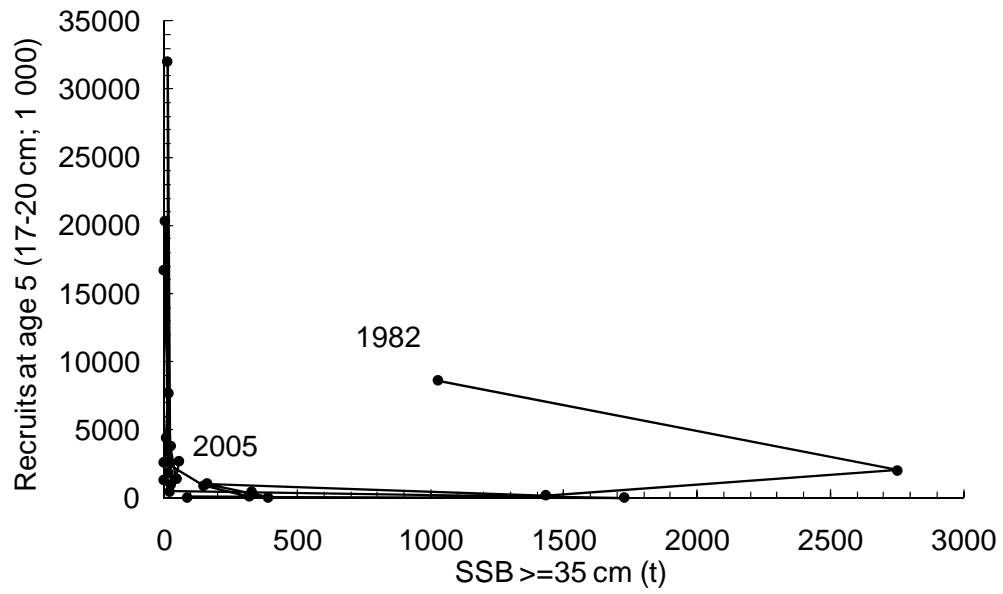


Fig. 9. Deep-sea redfish Sub-area 1. Recruitment at age 5 plotted against SSB 5 years before derived from the German groundfish survey.