The 10th Norwegian – Russian Symposium

Stock characteristics, fisheries and management of Greenland halibut (Reinhardtius hippoglossoides (Walbaum)) in the Northeast Arctic

by

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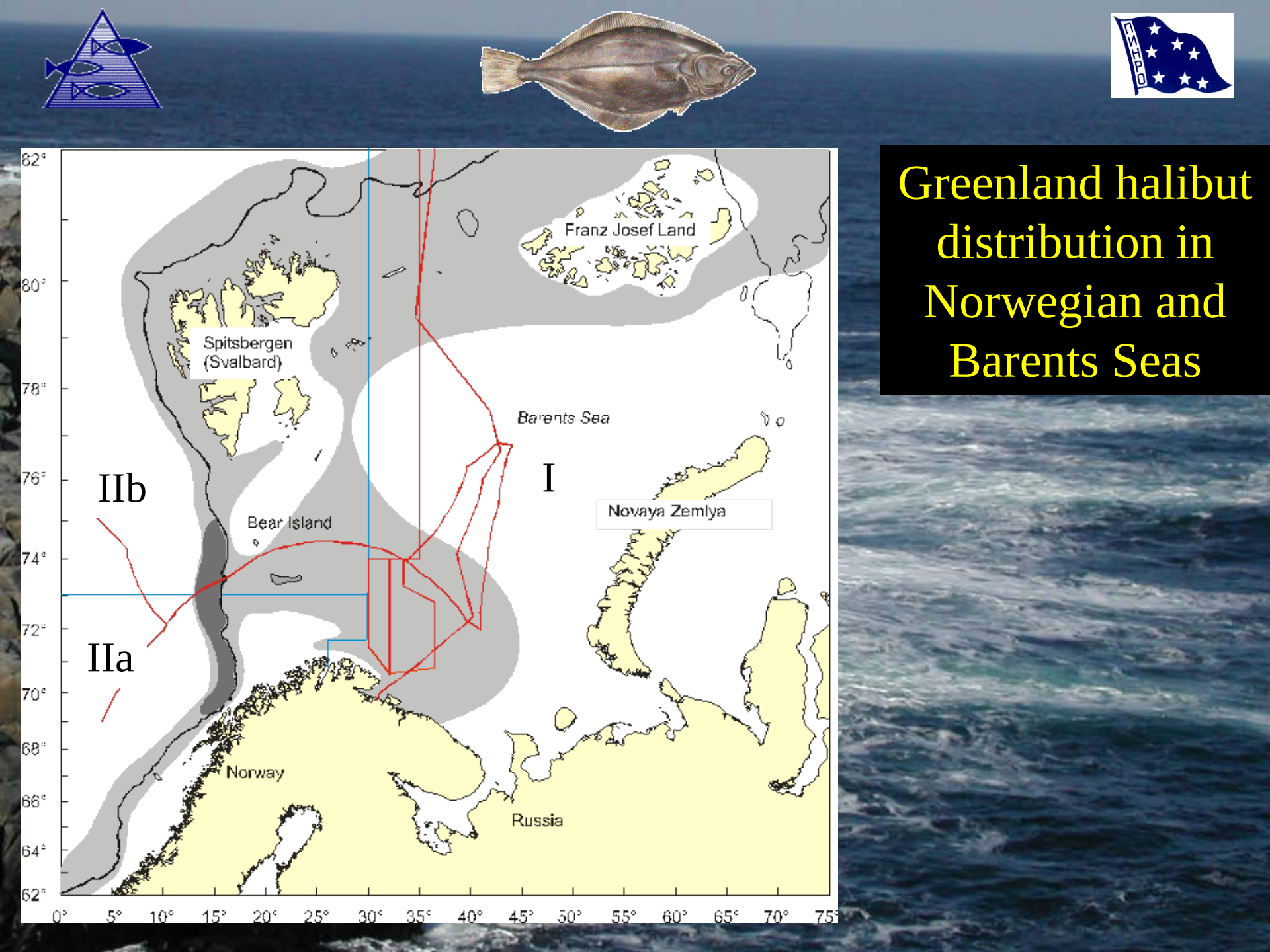
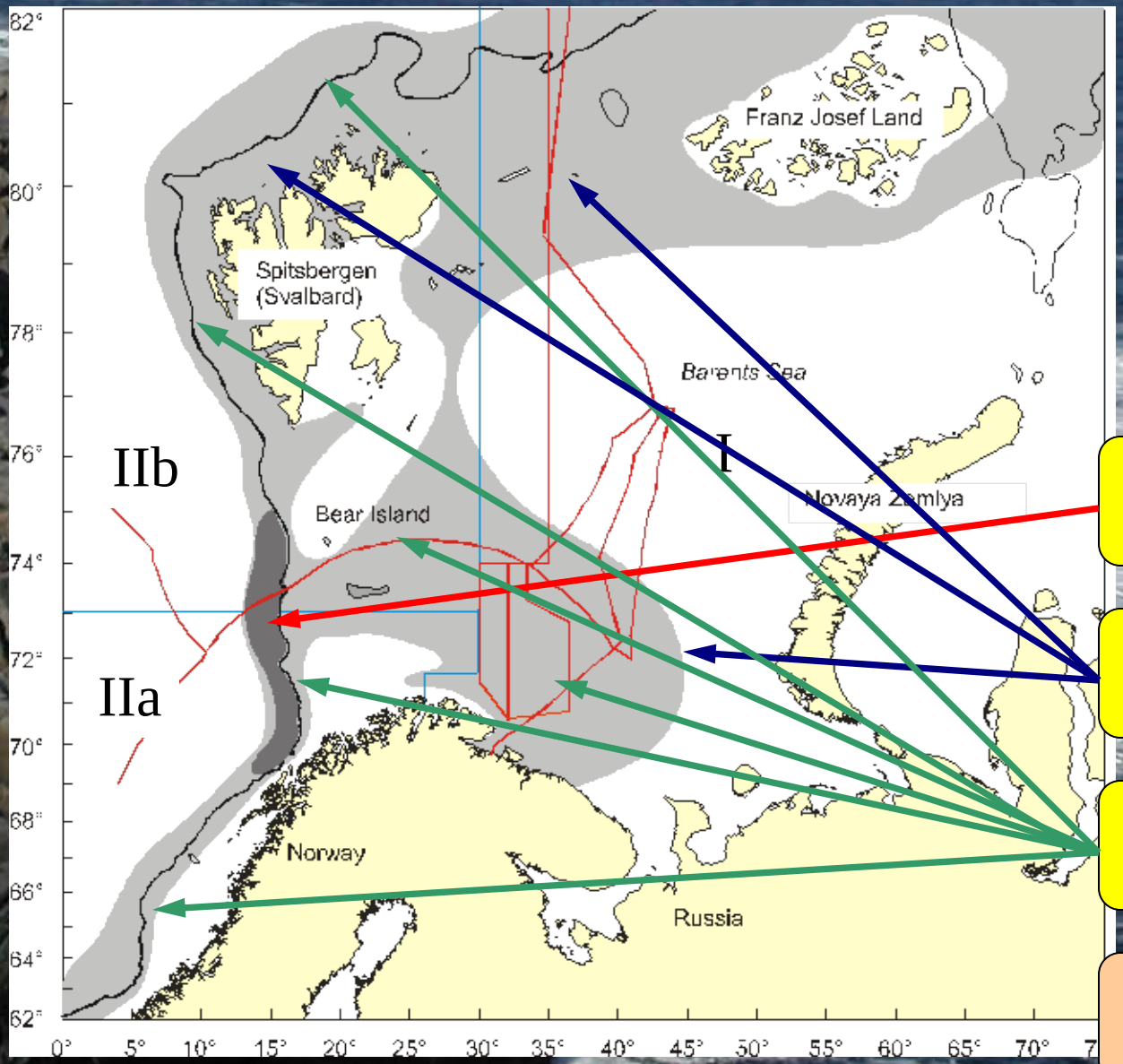


Greenland halibut distribution in Norwegian and Barents Seas

Brief history of investigations in 1960-1990s

Time period	Objects	References
1964-1967	Area of spawning grounds, the period of mass spawning, first representative data on age-length structure of stock	Lahn-Johannessen 1965 1972, Sorokin 1967, Nizovtsev 1968 1969 1970, Hognestad 1969,
1964-1970	Feeding	Nizovtsev 1972 1989
1965-1973	Seasonal migrations between spawning and feeding grounds	Lahn-Johannessen 1965 1972, Nizovtsev 1989
1968-1971	Gametogenesis and sexual cycle	Sorokin & Grigoryev 1968, Fedorov 1968 1969 1971
1978-1980	Nursery grounds to the northeast of Spitsbergen and in the area of Fr. Josef Land	Borkin 1983
1980s	Peculiarities of growth and maturation, dynamics of length-age structure of the stock	Kovtsova & Nizovtsev 1985, Nizovtsev 1987
1980s	Migration and recruitment patterns in the Spitzbergen area	Godø & Haug 1987
1980s	Distribution and feeding of larval Gr.halibut	Haug & al. 1989
1990s	Biological implications of a multi-gear fishery, gear selection	Nedreaas & al. 1996, Huse & al. 1997
1990s	Fecundity	Smirnov 1998, Gundersen & al. 1999
1990s	Spawning, recruitment	Hylen & Nedreaas 1995, Smirnov 1995, Albert & al. 1997, Albert & al. 1998, Stene & al. 1999
1990s	Feeding	Michalsen & Nedreaas 1998, Dolgov & Smirnov 2001

Greenland halibut distribution in Norwegian and Barents Seas

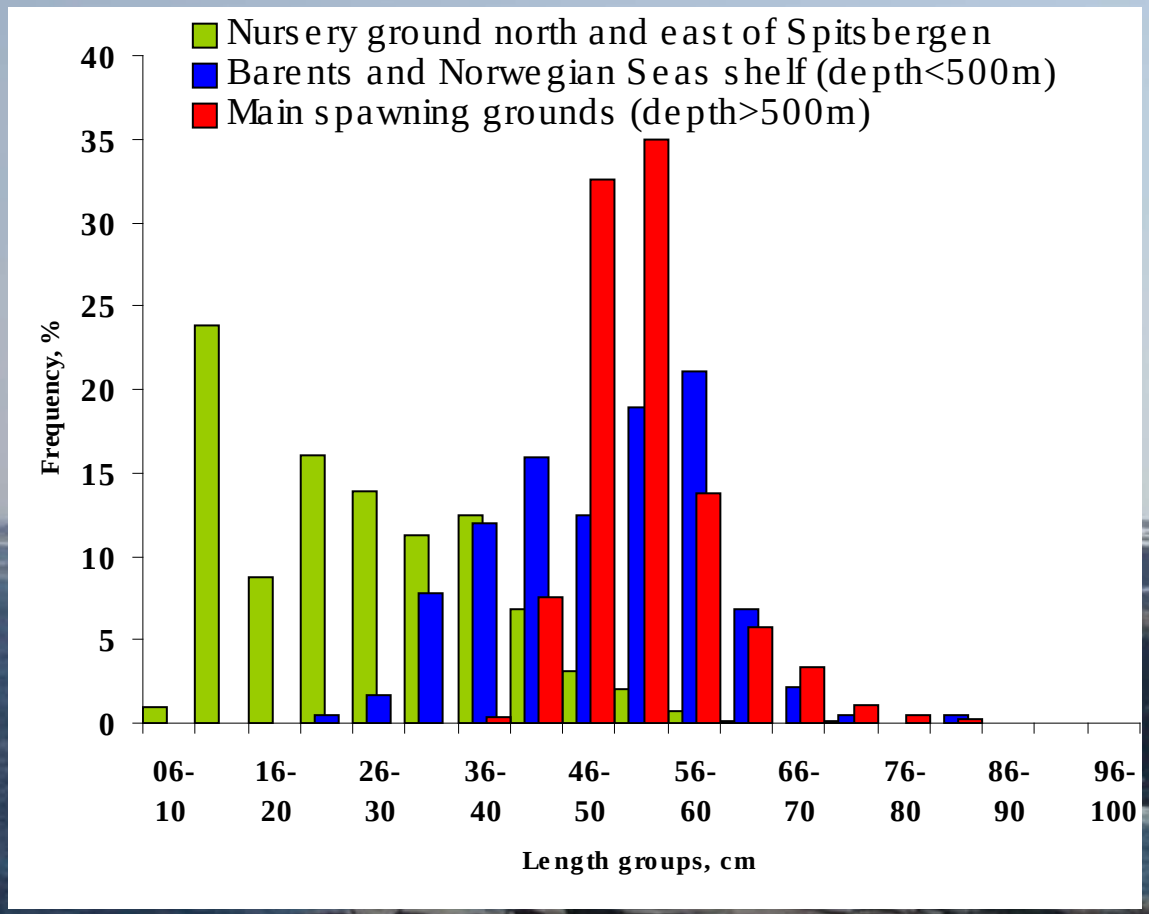


Main spawning grounds

Nursery grounds

Feeding grounds

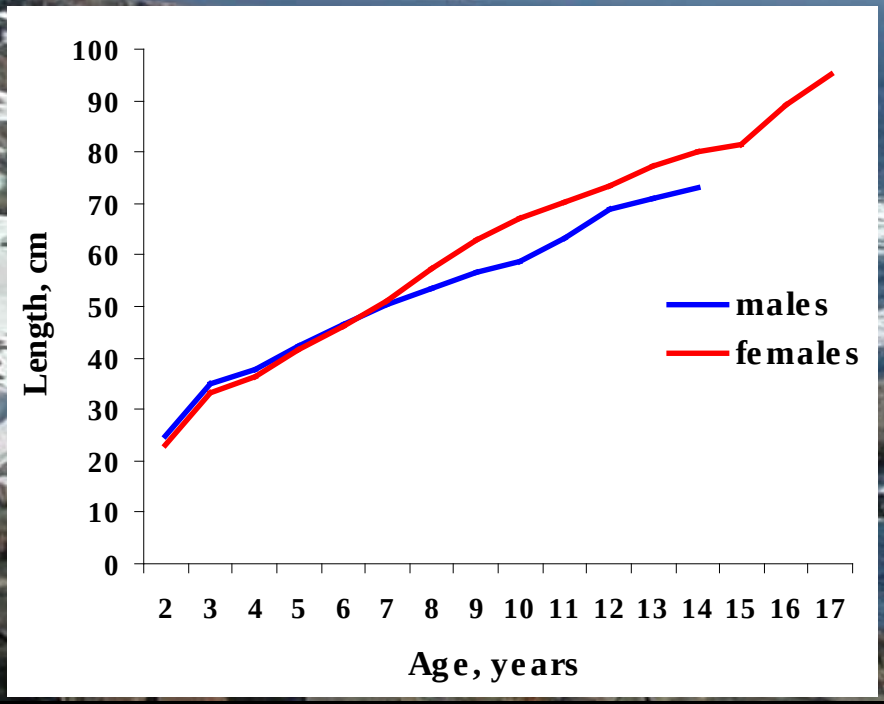
Transboundary stock



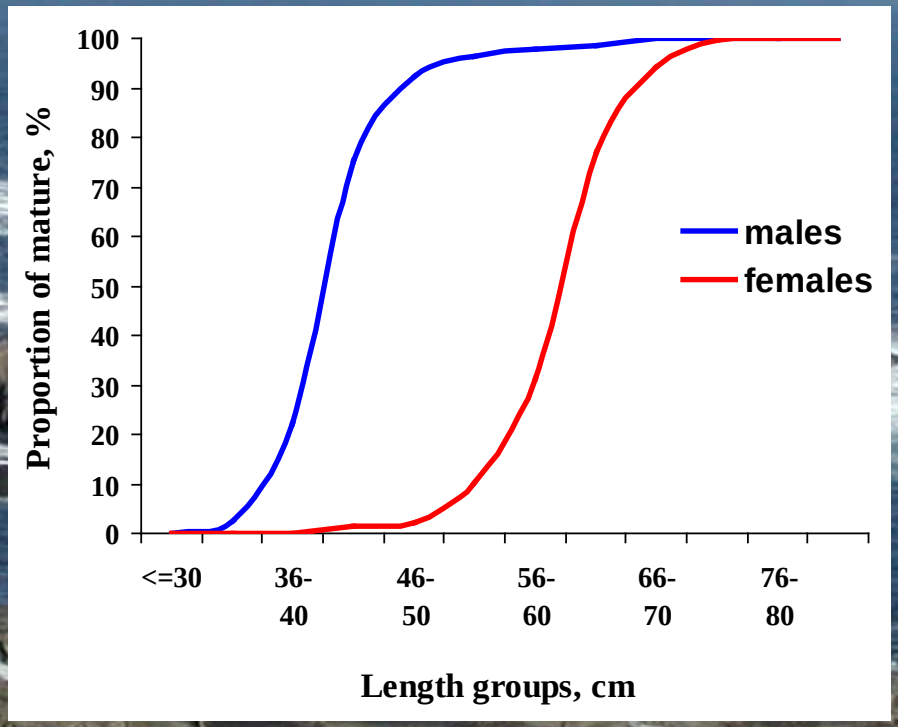
Length composition of Greenland halibut trawl catches in different areas by the data from Russian surveys (September-December 1999-2000).

Small mesh size trawls used everywhere.

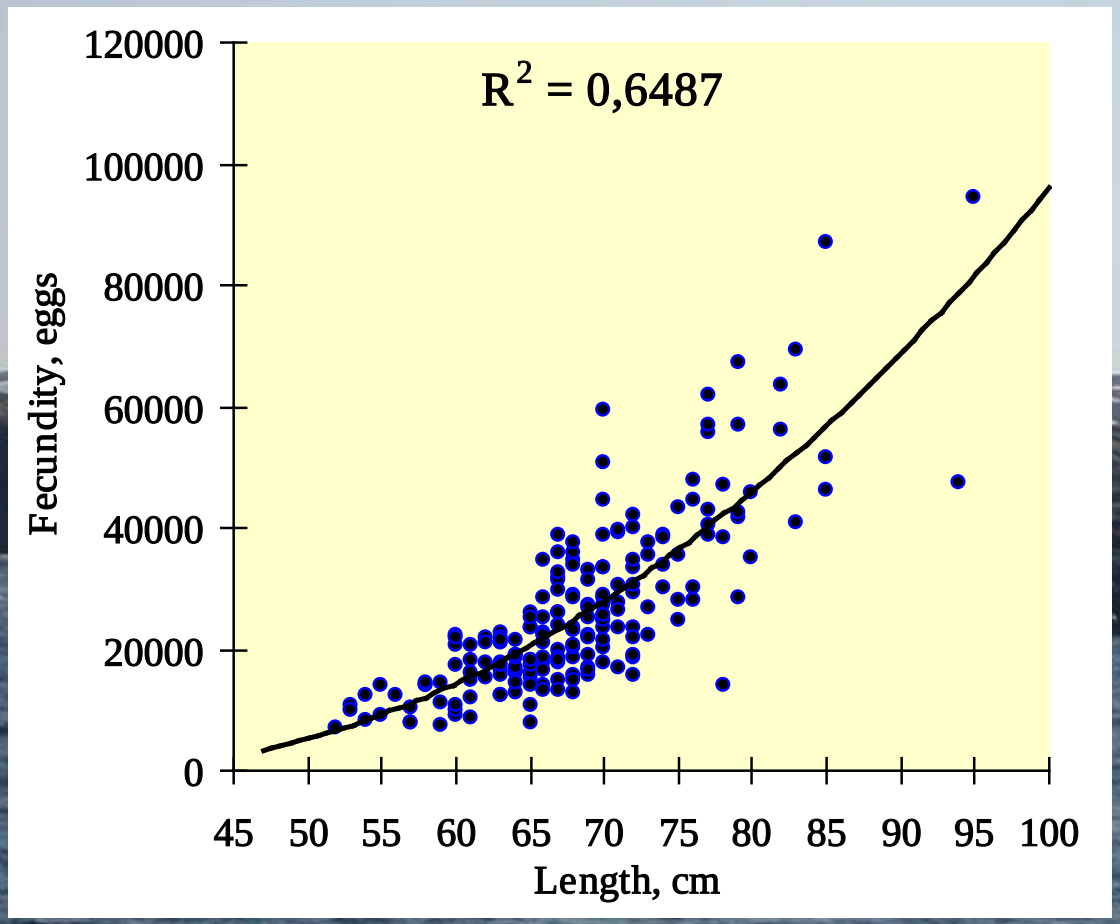
- Maximum reported age and length of Greenland halibut in the Norwegian and Barents Seas are 20 years and 120 cm.
- Some differences in growth and maturation between males and females were found. From age of 6-7 years females grow faster compared to males and have longer span of life. But males become mature at younger age and smaller size.



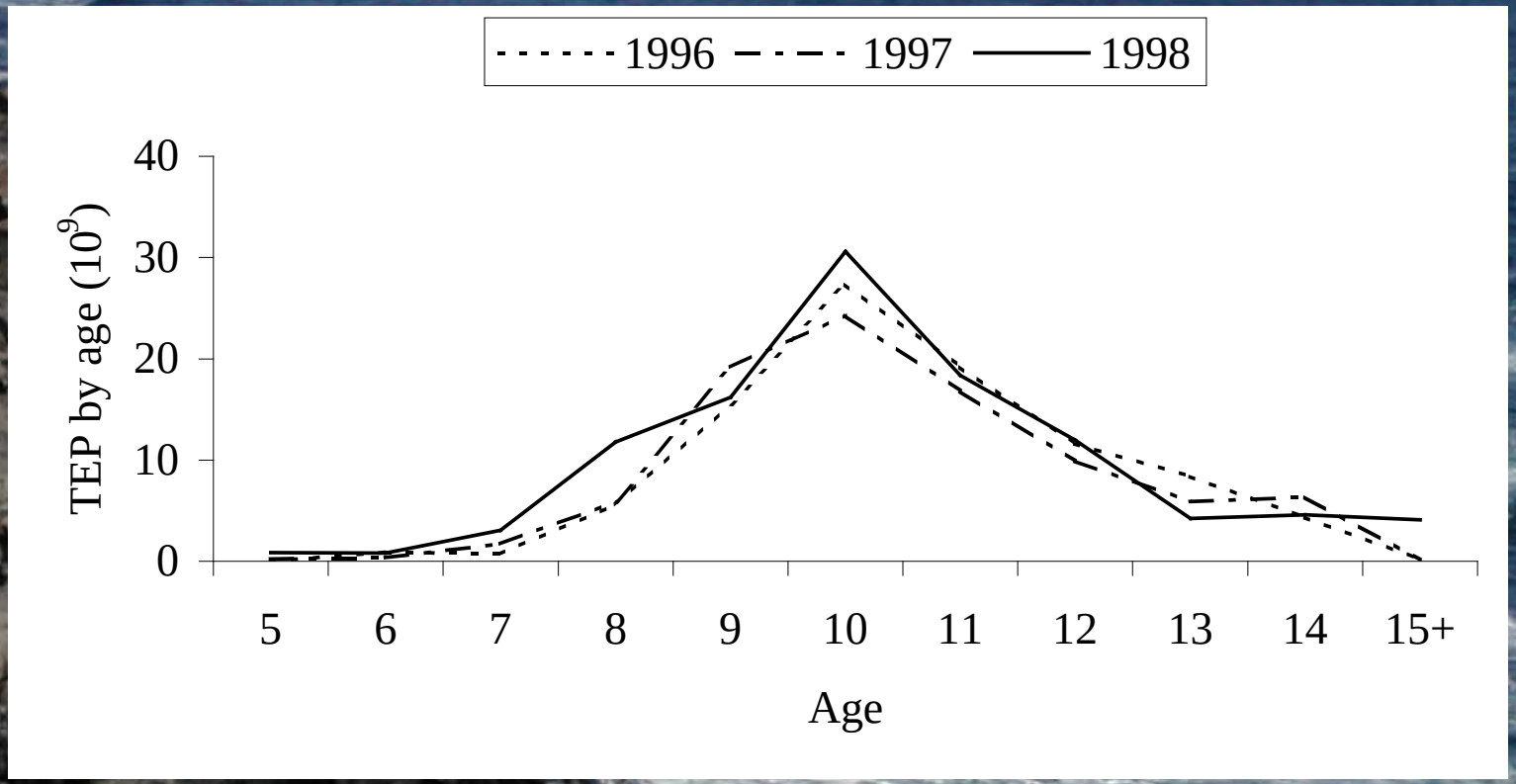
Greenland halibut length at age (mean for 1981-1997) (Russia, age determined by scale)



Proportion mature at length (mean for 1984-1998) (Russia)



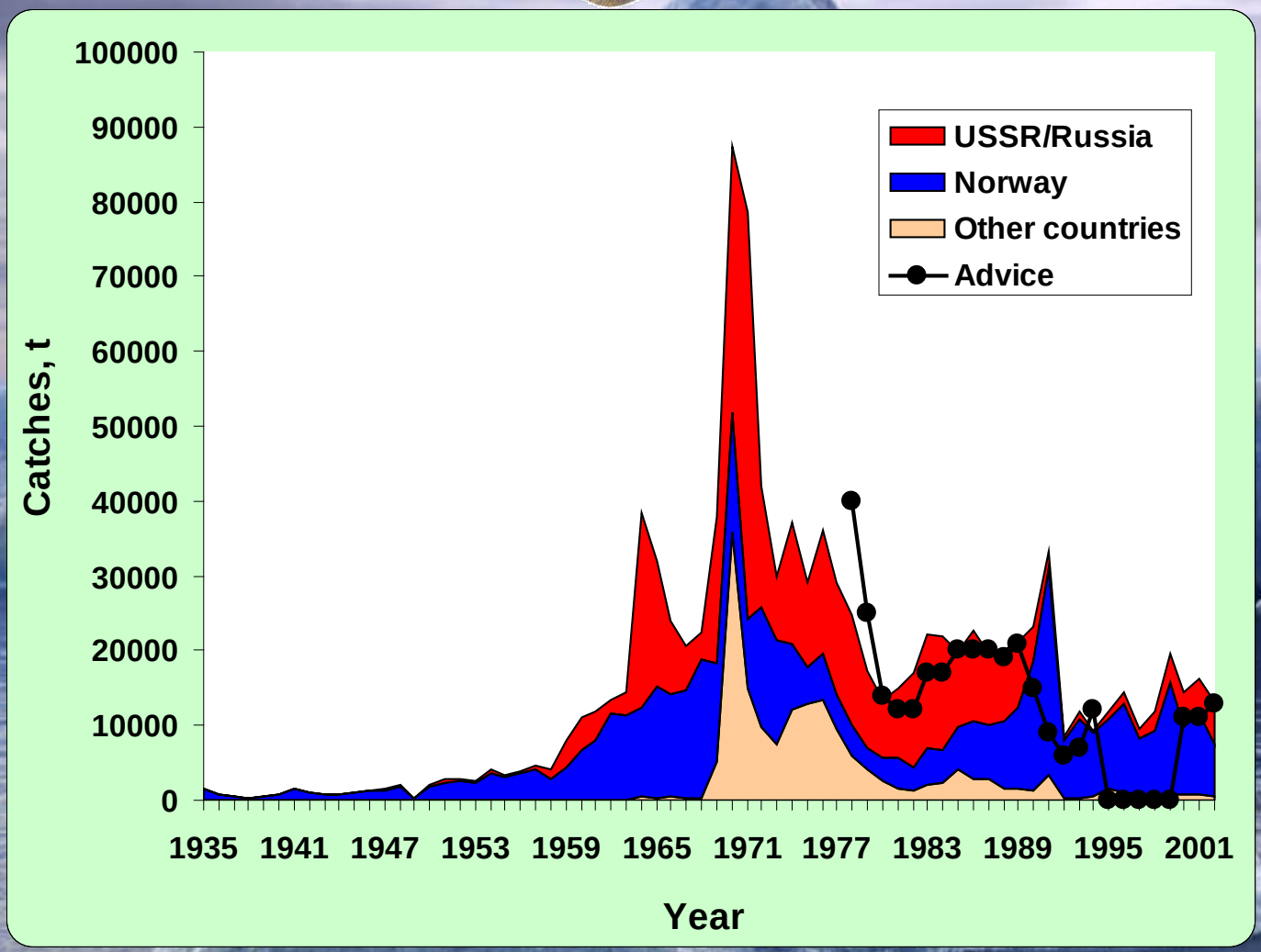
Fecundity of Greenland halibut is rather low compared to other flatfish. Estimates ranged from 6.4 to 94.4 thou. eggs per female depending on body size. Mean fecundity is evaluated by different authors at 18.1-28.1 thou. eggs.



Total egg production (TEP) by the northeast Arctic Greenland halibut stock by age in 1996-1998
(ref. Gundersen et al. 2000)

Position in food web

- Greenland halibut is a species, which has a negligible effect on the other commercial species of the Barents Sea and at the same time is not subject to their influence. The Greenland halibut were found in the diet of just three species - Greenland shark, cod and Greenland halibut itself. Besides, some sea mammals could be its potential predators.
- Food composition of the Greenland halibut in the Barents Sea includes more than 40 prey species. The main food consists of fish, mostly of herring, capelin and polar cod, as well as cephalopods and shrimp. In 1990’s an important place in the diet was occupied by wastes from the other species fishery (heads, guts etc.).
- It was calculated that with the Greenland halibut stock being nearly 100 thou. tonnes, the total food consumption constitutes about 280 thou. tonnes. The biomass of commercial species consumed (shrimp, capelin, herring, polar cod, cod, haddock, redfish, long rough dab) do not exceed from 5 to10 thou. tonnes of each species.



Catches of the Greenland halibut in the Barents and Norwegian Seas in 1935-2002.

Data for stock assessment provided by countries

Country	Kind of data				
	Catch in weight	Catch at age in numbers	Weight at age in the catch	Proportion mature by age	Length composition in catch
Norway	+	+	+		+
Russia	+	+	+	+	+
Germany	+				
United Kingdom	+				
France	+				
Spain	+				
Portugal	+				
Ireland	+				
Greenland	+				
Poland	+				

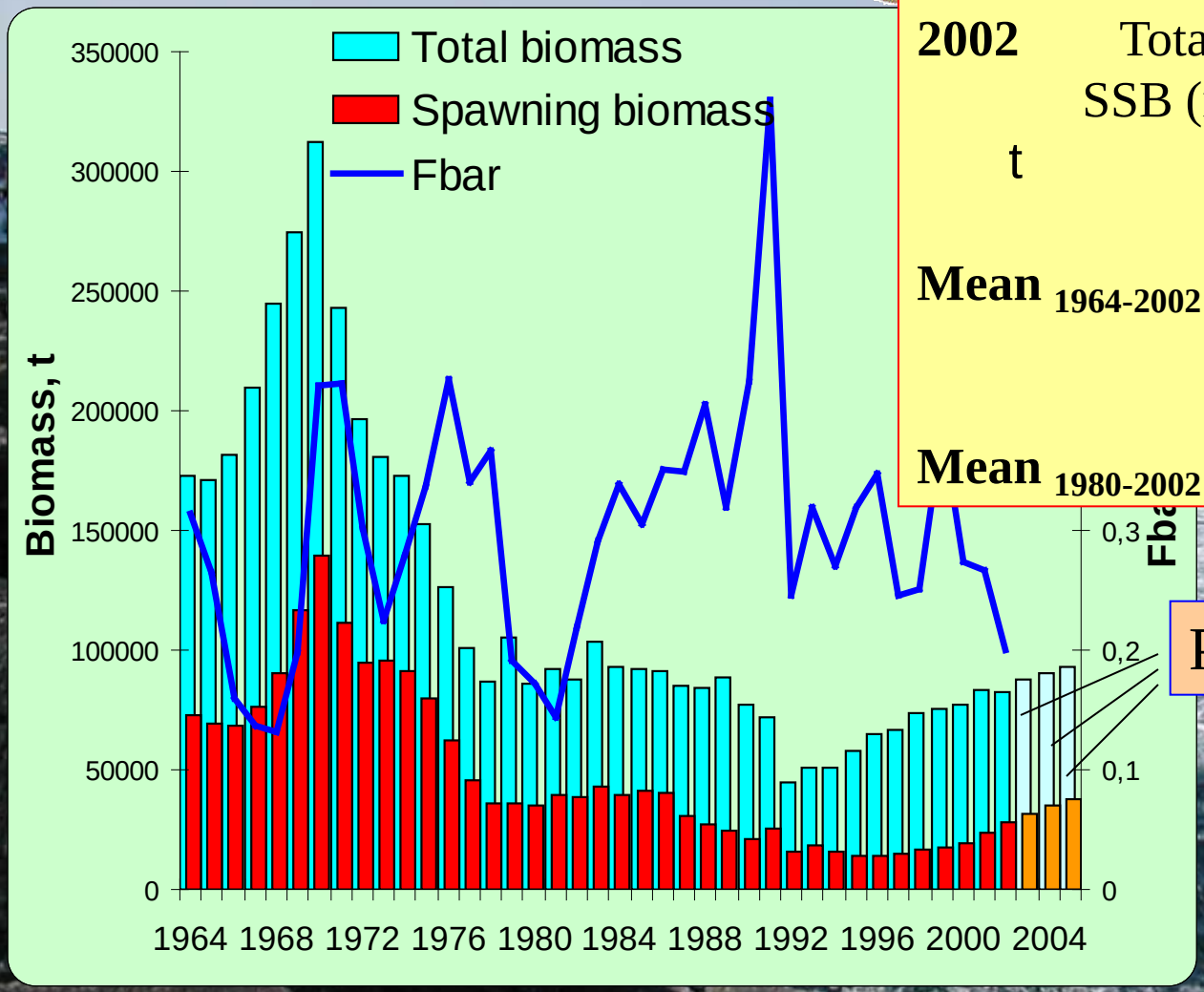
ICES Arctic Fisheries Working Group

Data available for AFWG

- Fishery statistics from 1964 onwards

- Survey data:

- Norwegian bottom trawl survey in August in the Barents Sea and Svalbard in fishing depths of less than 100 m and down to 500 m (from 1984).
- Norwegian Greenland halibut surveys in August. The surveys cover the continental slope from 68 to 80ºN, in depths of 400–1500 m north of 70º30'N, and 400–1000 m south of this latitude (from 1994).
- Norwegian bottom trawl surveys east and north of Svalbard in autumn (from 1996, from 2000 conducted as joint Norwegian-Russian survey).
- Russian autumn bottom trawl surveys in the Barents Sea in fishing depths of 100–900 m (from 1984).
- Spanish bottom trawl survey in the slope of Svalbard area in October (from 1997)
- Norwegian Barents Sea bottom trawl survey (winter) in fishing depths of less than 100 m and down to 500 m (from 1989).
- International pelagic 0-group surveys from 1970.
- Norwegian experimental commercial fishery (CPUE) from 1992.



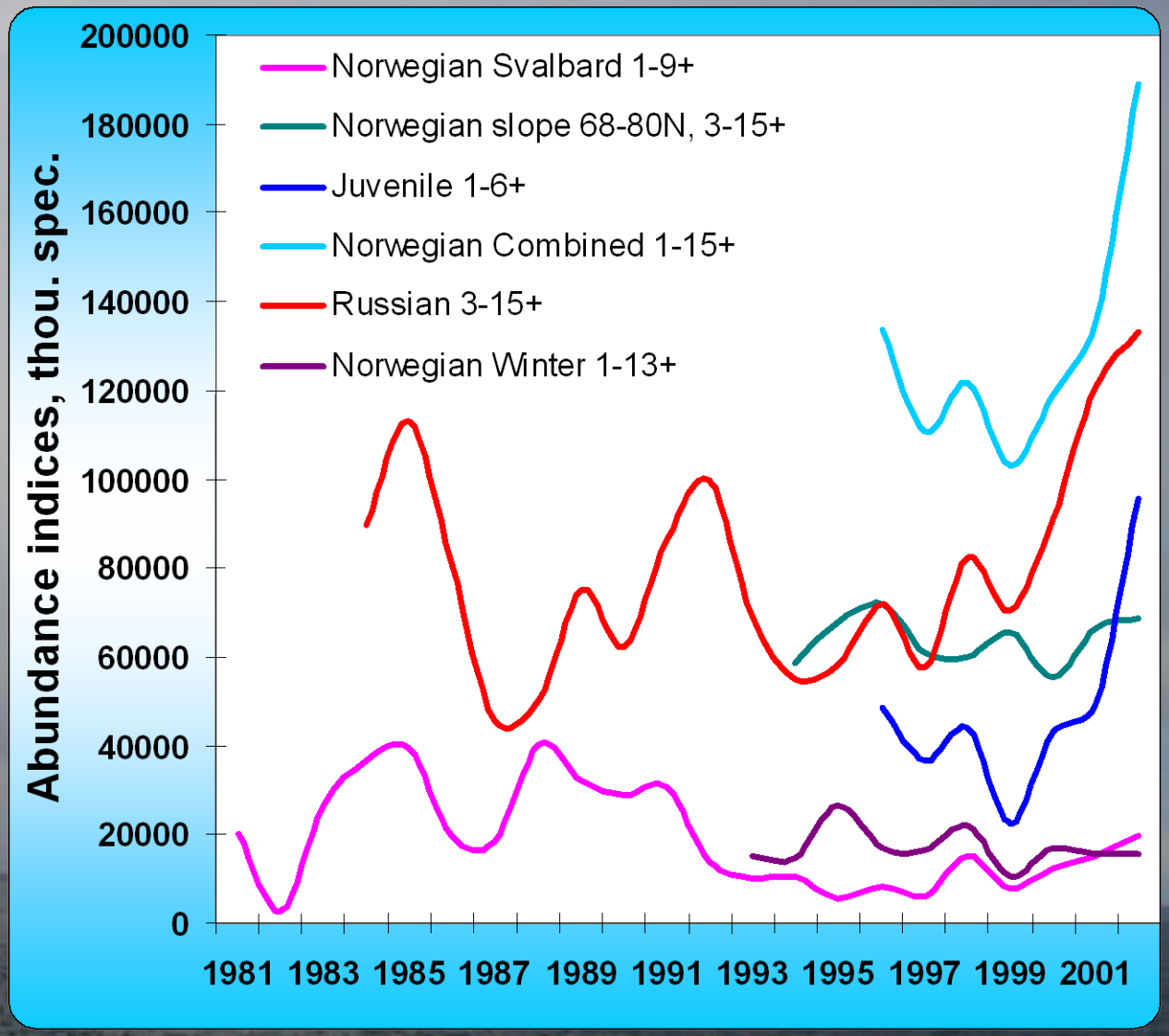
2002 Total biomass = 82.5 thou. t
SSB (mature females)= 28.5 thou. t

Mean $_{1964\text{-}2002}$ Total biomass = 121 thou. t
SSB = 48 thou. t

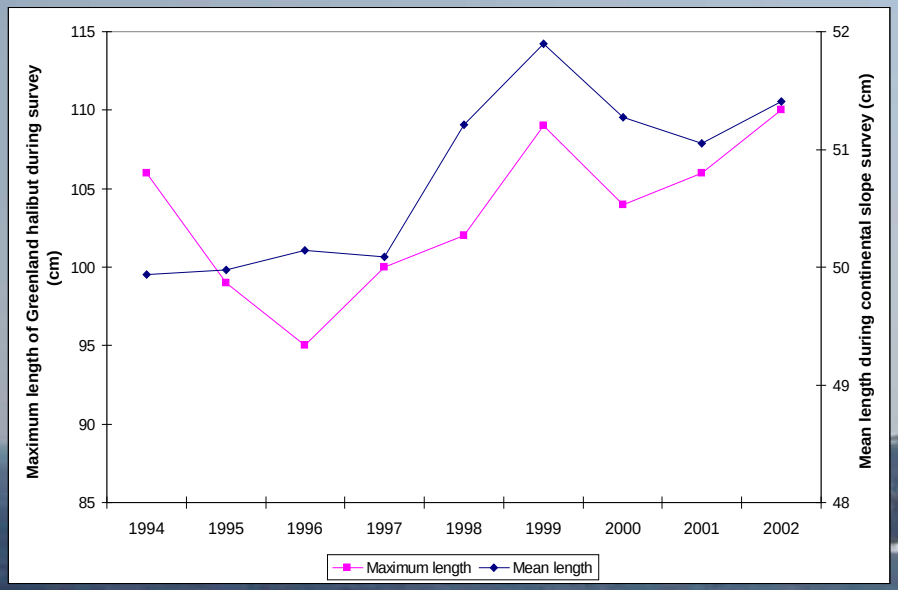
Mean $_{1980\text{-}2002}$ Total biomass = 77 thou. t
SSB = 26 thou. t

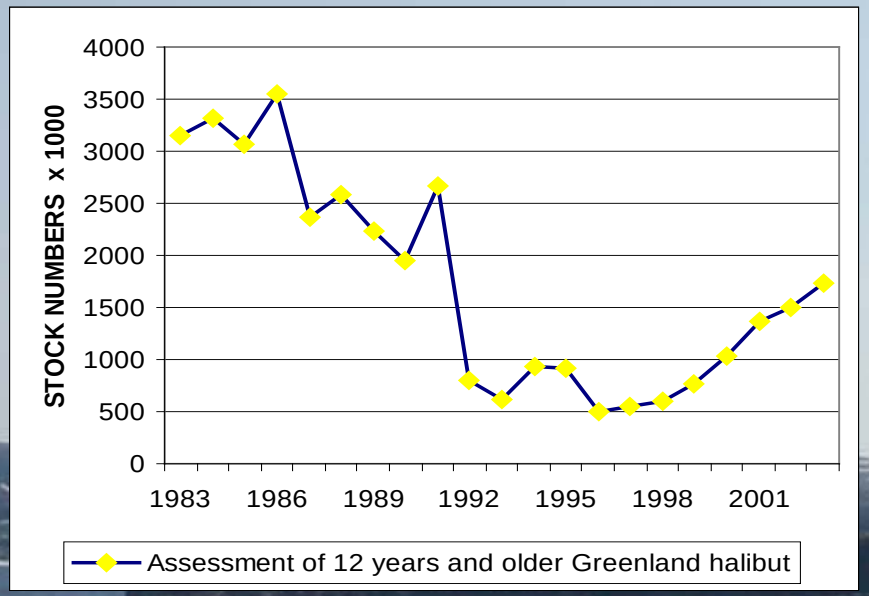
Prediction

Dynamics of the Greenland halibut stock and fishing mortality



Abundance indices of Greenland halibut from different surveys





Increased size of Greenland halibut in the surveys (left) and increased number of 12 year and older fish in the assessment (right), in addition to improved recruitment, both indicators of an improving stock structure.

Main points and purposes of the three-year (2002-2005) Russian-Norwegian research program on Greenland halibut for improvement of future managements and advice

- Distribution and migrations.
- Life history, reproductive biology, trophic relations.
- Accuracy in determination of age and its influence on the stock assessment.
- Improvement of time series by surveys and fishery.
- Catchability of research trawls and comparative selectivity of research and fishing trawls and longlines.
- Searching the ways of improvement of stock assessment on the basis of fulfillment of all projects.

- Development of biological reference points and advice on improvement of stock assessments.

ACFM recomendations

In 2003 ACFM mentioned that neither precautionary reference points nor explicit management objectives have been established for this stock.

“As the stock is at a low level and possibly slightly recovering there is a need for the stock size to increase. In order to achieve this, the landings should be kept at the 2002 level. Additional management measures to control catches, e.g. TACs, area closures and reduced by-catch limits, need to be introduced and enforced effectively”.

Advised, agreed and actual catches in 1988-2004

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC	Official catches
1987	Precautionary TAC	-	-	19
1988	No decrease in SSB	19	-	20
1989	F = F(87); TAC	21	-	20
1990	F = F (89); TAC	15	-	23
1991	F at $\mathbf{F}_{med}$; TAC; improved expl. pattern	9	-	33
1992	Rebuild SSB (1991)	6	6[1]	9
1993	TAC	7	7[1]	12
1994	F < 0.1	< 12	11[1]	9
1995	No fishing	0	2.5[2]	11
1996	No fishing	0	2.5[2]	14
1997	No fishing	0	2.5[2]	10
1998	No fishing	0	2.5[2]	13
1999	No fishing	0	2.5[2]	19
2000	No fishing	0	2.5[2]	14
2001	Reduce catch to rebuild stock	< 11	2.5[2]	16
2002	Reduce F substantially	< 11	2.5[2]	13
2003	Reduce catch to increase stock	< 13	2.5[2]	
2004	Do not exceed recent low catches	<13		

Decisions of the Joint Russian – Norwegian Fishery Commission for 1978 - 1991

Year of regulation, Session #	Main decisions			Details	
	TAC advised by ICES	Total catch in NEEZ	USSR/Russia quota in NEEZ	Other measures	By-catch during shrimp fishery
1978 (4th)	40 000	30 000	12 500	-	-
1979 (7th)	25 000	20 000	7 600	-	-
1980 (8th)	14 000	10 500	2 000	-	-
1981 (9th)	12 000	9 000	2 000	-	-
1982 (10th)	12 000	9 000	2 400	-	-
1983 (11th)	17 000	13 000	5 500	-	-
1984 (12th)	17 000	13 000	5 500	-	-
1985 (13th)	20 000	15 000	7 000	-	-
1986 (14th)	20 000	15 000	7 000	-	-
1987 (15th)	20 000	15 000	7 000	-	-
1988 (16th)	19 000	14 750	6 600	-	-
1989 (17th)	21 000	16 300	8 100+3 000	-	-
1990 (18th)	15 000	12 000	4100	-	-
1991 (19th)	9 000	7 000	2100	Norway introduced 45 cm as minimum legal catch size for foreign vessels fishing in NEEZ and at Jan Mayen and for Norwegian vessels in all areas	300 spec. per 1 ton of shrimp

Decisions of the Joint Russian – Norwegian Fishery Commission for 1992 - 2003

Year of regulation, Session #	Main decisions			Details		
	TAC advised by ICES	Total catch in NEEZ	USSR/Russia quota in NEEZ	Comments	By-catch during groundfish fishery	By-catch during shrimp fishery
1992 (20th)	6 000	**6 000**	-	The ban on the directed Greenland halibut trawl fishery is placed	10% in haul	300 spec. per 1 ton of shrimp
1993 (21st)	7 000	**7 000**	-	The same	10% in haul	The same
1994 (22nd)	<12 000	**11 000**	-	The same	10% in haul	The same
1995 (23rd)	0	**2 500**	-	The same	5% on board	The same
1996 (24rd)	0	**2 500**	-	The same	5% on board	The same
1997 (25th)	0	**2 500**	-	The same	5% in haul	The same
1998 (26th)	0	**2 500**	-	The same	5% in haul	The same
1999 (27th)	0	**2 500**	-	The same	10% in haul	The same
2000 (28rd)	<11 000	**2 500**	-	The same	10% in haul but 5% on board	The same
2001 (29rd)	<11 000	**2 500**	-	The same	12% in haul but 7% on board	The same
2002 (30th)	<13 000	**2 500**	-	The same	12% in haul but 7% on board	The same
2003 (31st)	<13 000	**2 500**	-	The same	12% in haul but 7% on board	The same

Set by Norwegian authorities, from 1995 onwards this TAC relates to the traditional non-trawl coastal fishery south of 71°30 N by vessels less than 28 m. Allowable bycatch for others is additional to this.