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Length-age composition and sexual maturation rate of Greenland halibut *Reinhardtius hippoglossoides* (Walbaum) from the commercial catches in the area of the West Greenland (Divs.1AD) in 2003-2007

by

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Abstract

This paper presents the data on Greenland halibut collected by Russian observers aboard fishing vessels in the area of the Western Greenland, NAFO Divs.1AD, in 2003-2007.

Fishery was executed at 800-1,200 m, from July to December. The used fishing gears were bottom trawls with the mesh size of not less than 140 mm.

In the catches, halibut males were represented by specimens with 16-84 cm length, the average length was 49.6 cm. Female length varied from 16 to 110 cm, the average one was equal to 55.1 cm.

Among males the individuals aged 5-7 prevailed, among females 7-9 year individuals predominated.

During the period of study, sex ratio was about 1.6:1.0, on the average.

In the research period, in the West Greenland, in catches, males were mainly represented by mature specimens (over 70%). The portion of mature females varied from 75% in 2003 to 25-35% in 2005-2007.

The results of observations showed that, in July, in catches, the greatest amount of immature halibut with the gonads at Maturity Stage II was registered. In August and September, mature fish at early maturation stages (Stage III) already predominated. In December, most of mature males and females were prespawning (Gonad Development Stage IV).

Introduction

Greenland halibut *Reinhardtius hippoglossoides* is widely distributed in the West Greenland forming dense concentrations in some areas that makes its trawl fishery profitable. Despite very intensive exploitation of the stock, some biological aspects of Greenland halibut have not been studied completely yet.

Material and methods

This paper presents data on the biology of Greenland halibut from the commercial catches in the area of the West Greenland, NAFO Divs.1AD, in primarily autumn-winter 2003-2007. The biological data were collected by the

observers aboard Russian fishing vessels. Analysed were the length-age and sex composition of fished concentrations, as well as the dynamics of Greenland halibut sex maturation. The period of operation of commercial vessels in the West Greenland area is given in Table 1. In the period of study, there were 55,231 measurements of Greenland halibut body length and 1,737 age readings.

Table 1 Period of operation of Russian vessels in the area of the West Greenland.

2007	September-December
2006	July-October
2005	July-October
2004	August
2003	August-November

Ichthyological material was collected in accordance with methods applied in PINRO and NAFO. Used were the data from catches by bottom trawl with the mesh size of not less than 140 mm from 800-1,200 m layer. Length-age composition, sex ratio, the ratio of mature and immature individuals were analysed, as a whole, all over the surveyed area. The material to read age (by scale) was collected at a rate of 5-10 individuals per each length group. The length group for halibut of the Northwest Atlantic was taken to be equal to 2 cm. The age composition was calculated by the integrated keys for 2003-2007 based on the whole length distribution. To determine the stages of the development of gonads the maturity scales developed by K.Fedorov (Anon., 2004) were used. The mass maturation of fish was estimated as the maturity of 50% of fish.

Results

In 2003-2007, the process of fishing was mainly executed at 800-1,200 m depths (Fig.1). The portion of halibut in the trawl catches was 99.6%. Roughhead and roundnose grenadiers prevailed in bycatch.

Length age composition The analysis of length composition of catches by Russian fishing vessels showed that, in several recent years, in Div.1A, predominating were fish from 42-44 cm modal group. In Div.1D, in the catches by Russian, Norwegian and Greenland fishing vessels, fish as long as 52, 50 and 49 cm prevailed (Jorgensen, 2007). The data from mass measurement of halibut from the catches by Russian fishing vessels in Divs.1AD, in 2003-2007 (Fig.2) indicate that, in those years, the length composition was represented by 16-110 cm fish. Males were dominated by 48-54 cm length groups and 50-57 cm length groups were prevailing among females. The average length of males was 49.6 cm, of females – 55.1 cm. The results of researches showed that the relative abundance of halibut juveniles gradually decreased and the quantity of fish with large size and age grew. Fig.2 shows that, in 2003, the portion of females with length under 40 cm was about 1.5%. In the following years, the portion of small males somewhat reduced. During five years, the percent of large females (over 60 cm) rose.

The analysis of age composition showed that, in the catches, males aged to 13 occurred, prevailing were individuals at the age of 5-7. Females were represented by fish aged to 19, 7-9 year fish was dominating (Fig.3).

Sex ratio According to the data having been obtained before, in autumn 1999, in Div.1D, sex ratio was 3.7:1.0 (Gorchinsky, 1999). Data analysis for 2003-2007 indicated that, in the analogous period, sex ratio in catches significantly changed and only was 1.6:1.0, in favour of males. Only in 2004, the portion of males was somewhat higher – 1.9:1.0 (Fig.4). Thus, the portion of males reduced.

Ratio of mature and immature halibut In autumn, in the West Greenland, the most males (over 70%) were mature. The exclusion was 2007 when that index slightly decreased and amounted to about 60% (Fig.5).

Relative quantity of mature females abruptly dropped from 75% in 2003 to 25% in 2005. In the following two years, the portion of mature females became stable and equaled to 35% (Fig.6).

Sex maturation rate As it was shown before, sex maturation of some males started at 6, when their length was 46-47 cm, females matured when they were 7 and had 52-53 cm length (Chumakov, 1982). Most males mature at 12-13,

females – at 16-17. The analysis of Greenland halibut maturation rate in the West Greenland area in 2003-2007 showed that mature males which occurred for the first time had the length of 30 cm and were at 5 and the mature females first found were as long as 38 cm and aged 6. Most males matured when they had the length of 38 cm and were as old as 7, females entering maturity were 8-9, with 56 cm length (Fig.7-8).

Annual cycle of maturation The results of observations showed that, in July, in the catches, there was the greatest relative quantity of immature halibut with gonads at Maturity Stage II. In August and September, predominating were mature fish at early maturation stages (Stage III) and some males at Stage IV of gonad development (prespawning) occurred. In December, already the bulk of mature males and females were prespawning (Stage IV of gonad development) (Fig.9). Thus, the analysis of seasonal dynamics of maturity stage ratio have corroborated the results of previous researches, according to which, in the area of the West Greenland, the spawning of Greenland halibut takes place in winter (Chumakov, 1982).

References

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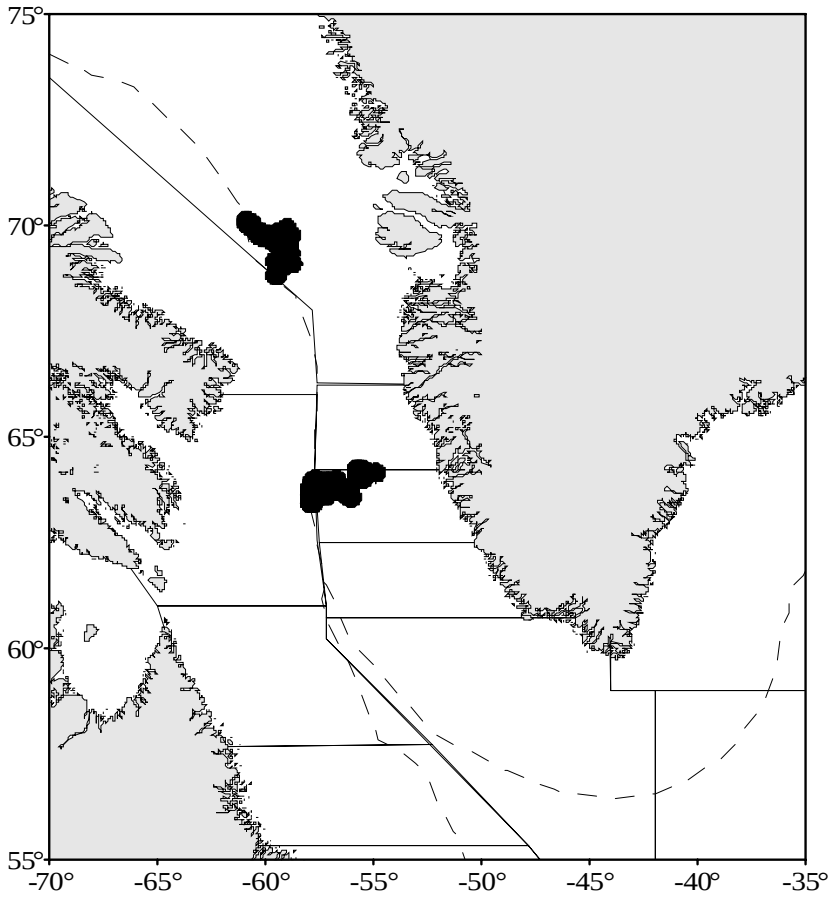

Fig. 1. Location of Russian trawlers during Greenland halibut target fishery in the West Greenland

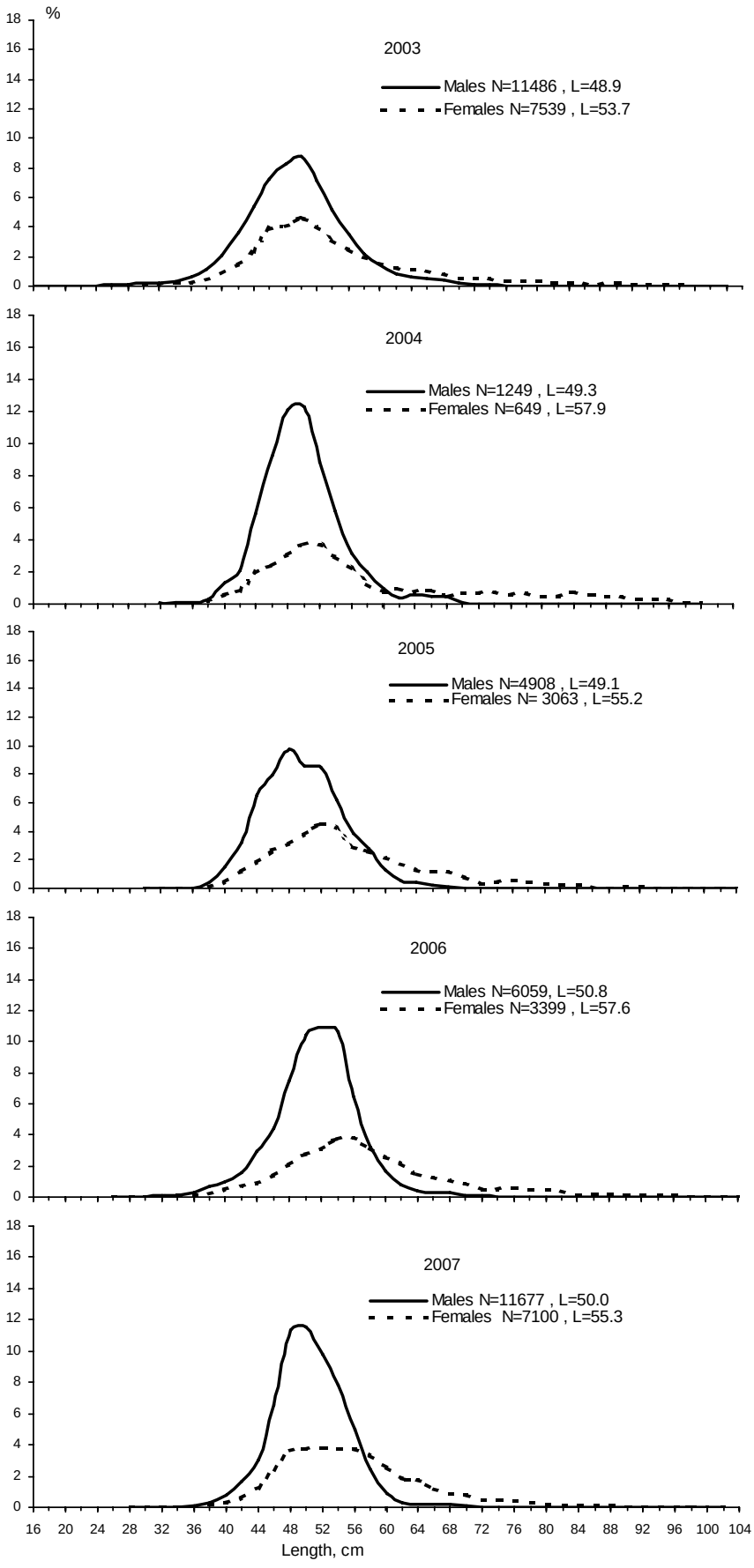
%
2003
Males N=11486 , L=48.9
Females N=7539 , L=53.7
2004
Males N=1249 , L=49.3
Females N=649 , L=57.9
2005
Males N=4908 , L=49.1
Females N= 3063 , L=55.2
2006
Males N=6059, L=50.8
Females N=3399 , L=57.6
2007
Males N=11677 , L=50.0
Females N=7100 , L=55.3
0 2 4 6 8 10 12 14 16 18
16 20 24 28 32 36 40 44 48 52 56 60 64 68 72 76 80 84 88 92 96 100 104
Length, cm

Fig.2. Length distribution of Greenland halibut in Divs.1AD, 2003-2007.

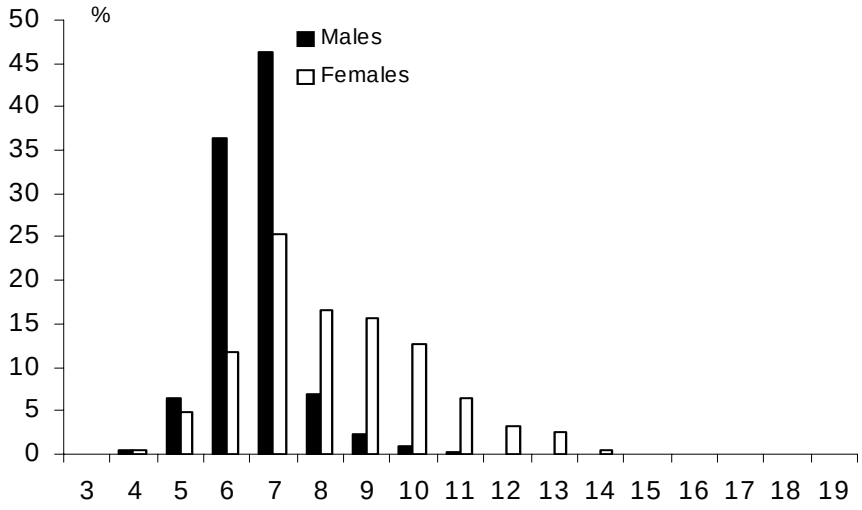

Fig.3. Age distribution of Greenland halibut in Divs. 1AD, 2003-2007.

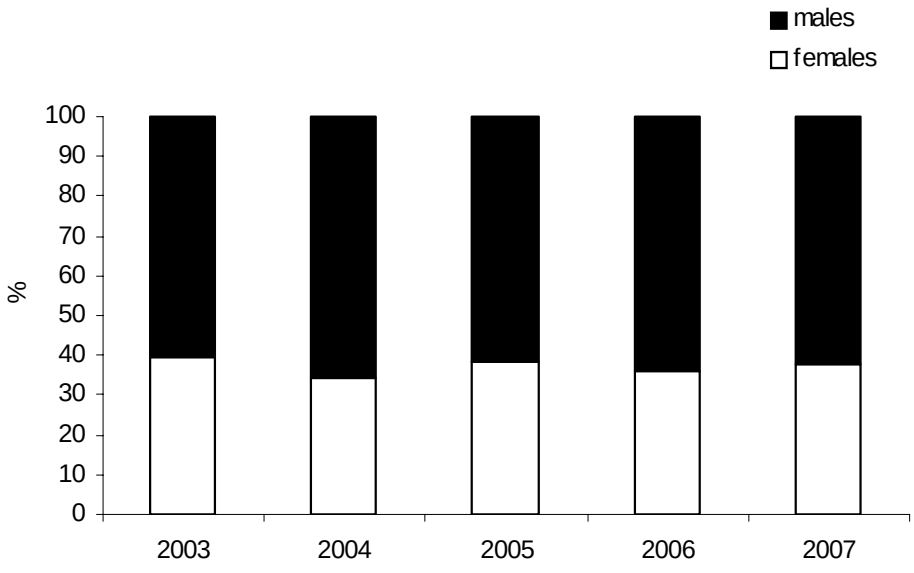

Fig.4. Sex ratio of Greenland halibut in catches in Divs. 1AD in 2003-2007.

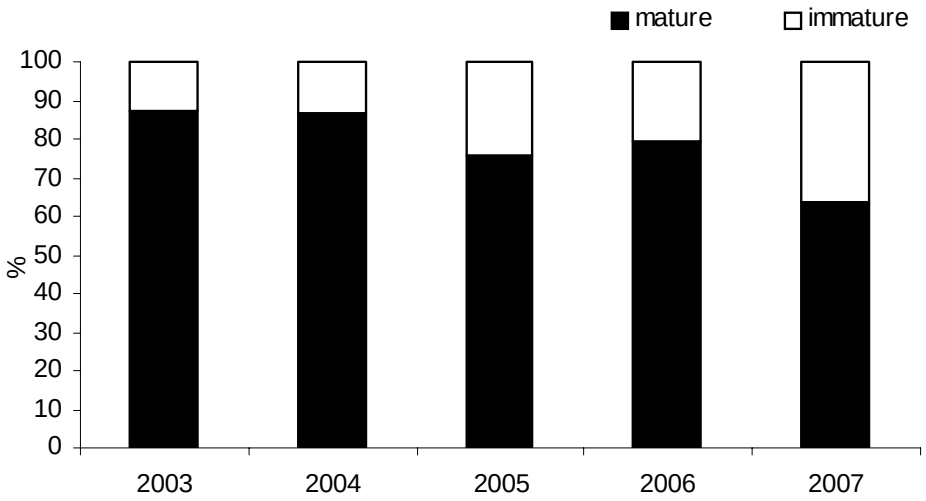

Fig.5. Percentage of Greenland halibut mature males in Divs.1AD in 2003-2007.

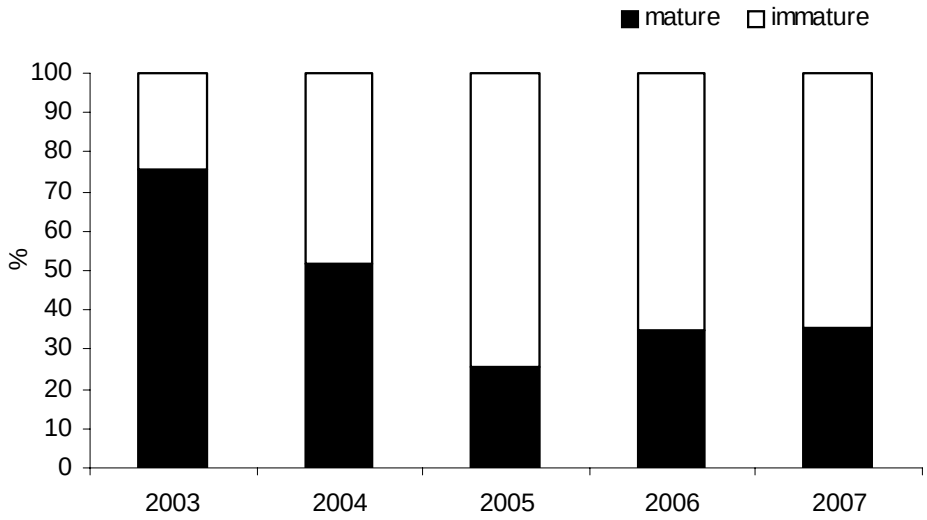

Fig.6. Percentage of Greenland halibut mature females in Divs.1AD in 2003-2007.

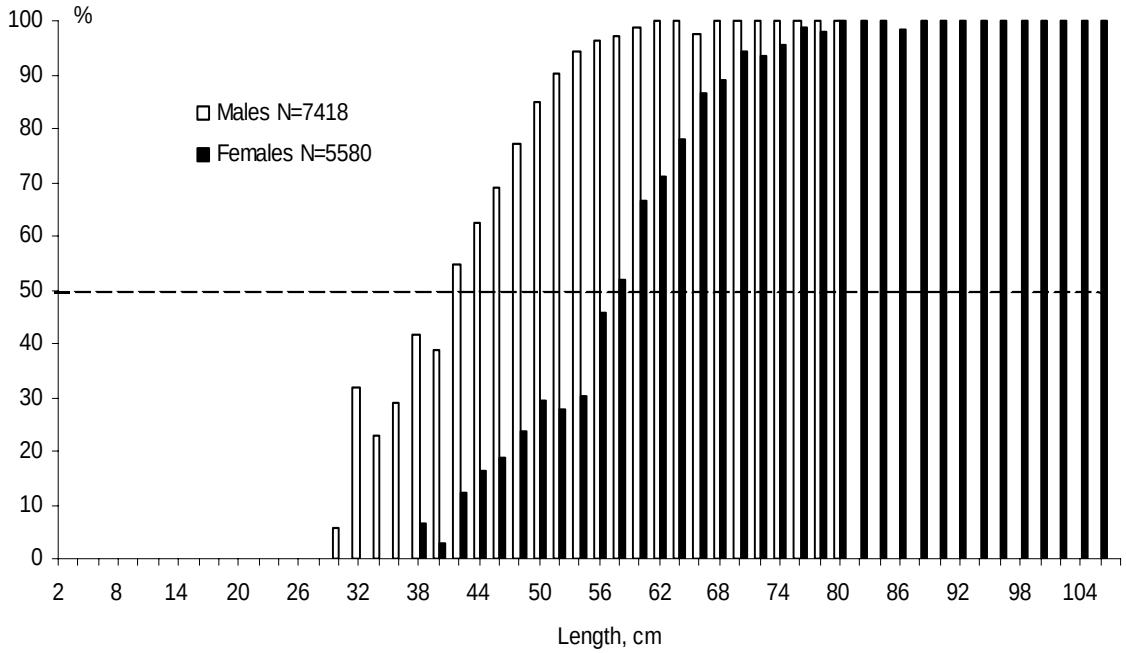

Fig.7. Halibut maturation in different length groups (2003-2007 data combined).

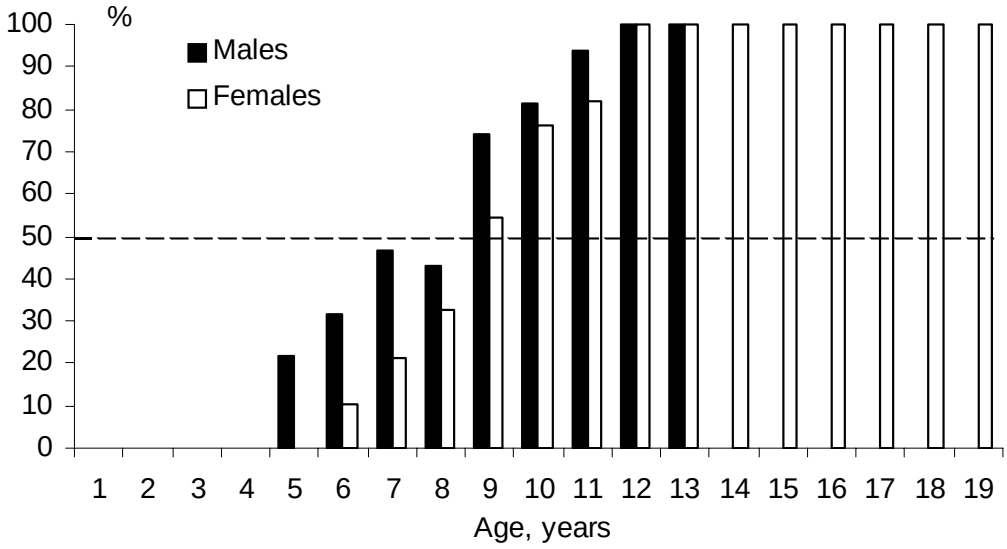

Fig.8. Maturation of halibut at different age (2003-2007 data combined)

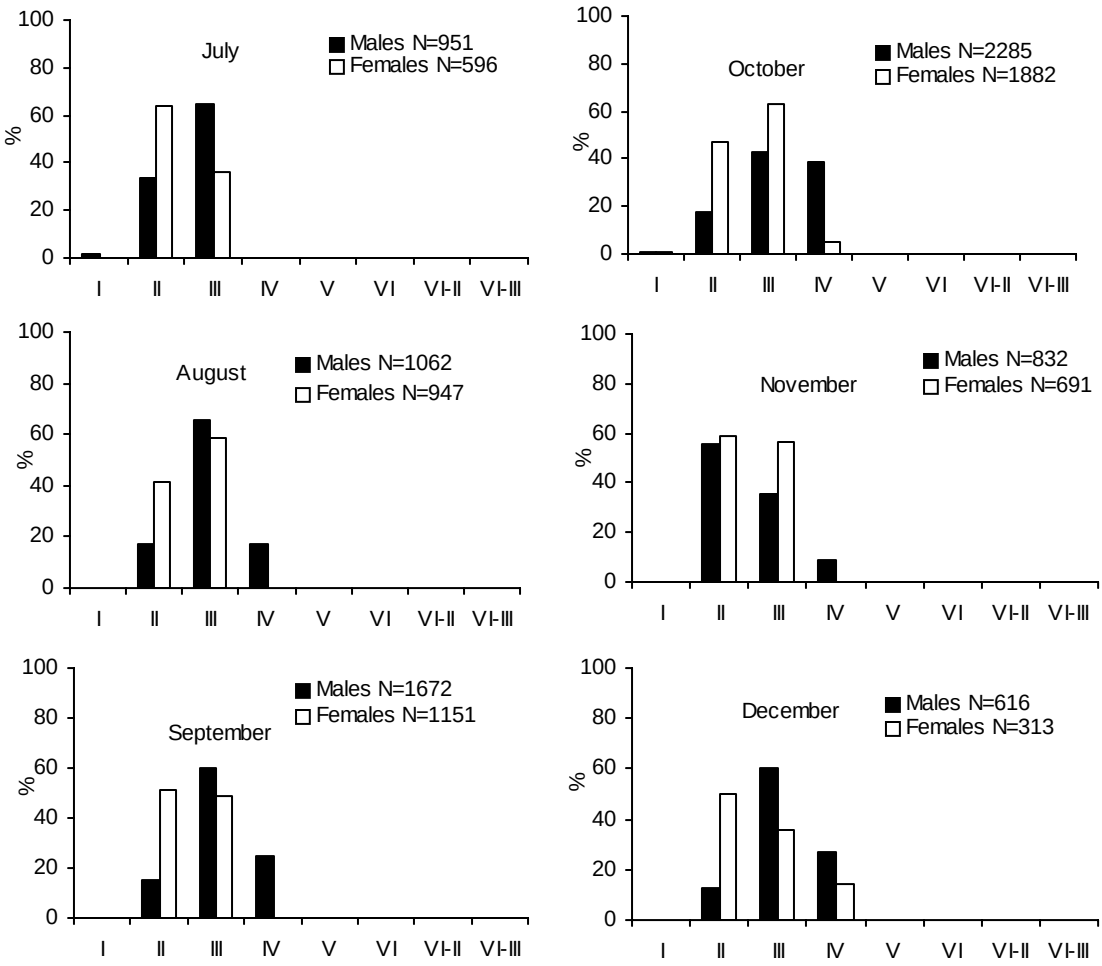

Fig. 9. Sexual maturity of Greenland halibut in Divs. 1AD, July-December (2003-2007 data combined).