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**ŽUVININKYSTĖS DEPARTAMENTAS
PRIE LIETUVOS RESPUBLIKOS ŽEMĖS ŪKIO MINISTERIJOS**

**FISHERIES DEPARTMENT
UNDER THE MINISTRY OF AGRICULTURE
OF THE REPUBLIC OF LITHUANIA**

Mr. Peter Gullestad
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Directorate of Fisheries of Norway
Strandgaten 229 Postboks 185
N5002 Bergen, Norway
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2007-07-23 Nr. R18-602(10.16)
Ref. _____ Nr. _____

**RE: REPORT OF FISHERY RESEARCH EXPEDITION OF LITHUANIAN F/V „POLARIS“
FOR THE EVALUATION OF GREENLAND HALIBUT RESOURCES IN THE
SVALBARD AREA IN AUTUMN 2006**

Dear Mr. Gullestad,

We are forwarding you scientific report „Evaluation of fishing efficiency and biological features of Greenland halibut (*Reinhardtius hippoglossoides*) and by-catch in Svalbard area (the Barents Sea) jointly prepared by Lithuanian and Polish specialists involved in research expedition with Lithuanian trawler „Polaris” in autumn 2006.

Also we want to inform you that June 20, 2007 we have received letter from your Directorate signed by Mr. Aksel R. Eikemo and Mr. Stein-Age Johnsen in which they informing us that our application regarding research cruise on Greenland halibut in Svalbard area in 2007 with trawler „Polaris” will be unsatisfied because Norwegian authorities have listed this vessel previously engaged in IUU activities. In this regard we need to explain you that Lithuanian owner JSC „Seivalas” has bought this vessel (former name „Bellsund) from Norwegian owner in 1998 and since this time using only for shrimp fishery in Svalbard area except last autumn when she was used

for Greenland halibut research trip. We have not received any information from Fishery inspection of Norway about infringements made by trawler „Polaris” since year 1998. Mr. Gullestad, we kindly ask you to check why your officials listing this trawler in the black list.

We still believe that Norwegian authorities will re-evaluate its decision on our application regarding research cruise on Greenland halibut in Svalbard area in 2007 with trawler „Polaris”.

We herewith enclose two copies of abovementioned report.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'A. Adomaitis', with a long horizontal stroke extending to the left.

Aidas Adomaitis
Director General

**Evaluation of Fishing Efficiency and Biological Features of
Greenland Halibut (*Reinhardtius hipoglossoides*) and By-catch in
Svalbard Area (The Barents Sea)**

**Report of Fishery Research Expedition done by the Lithuanian Trawler
„Polaris“**

07.10.2006 – 12.11.2006

Egidijus Bacevičius, Chief Specialist of the Fishery Research Laboratory
of the Lithuanian State Pisciculture and Fisheries Research Centre,
Chief of Fishery Research Expedition of trawler „POLARIS“



Klaipėda, 2006

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Introduction

Greenland Halibut is one of the most valuable deep water fish of Northern latitudes. According to the data of the North East Atlantic Fisheries Commission (NEAFC), the annual Greenland Halibut catch of Norway in the ICES areas I-IIb (Svalbard fishery area) has been fluctuated between 23 650 -19 700 MT in 1990 and 1991 (Merrett & Haedrich 1997; Pethon 2005; Fishing Tacs and Quotas, EU 2006). Exploratory fishery for Greenland halibut by especially issued fishing quotas in the Norwegian and the Barents Seas has been performed by the vessels Norwegian, Spanish, Polish, Estonian and Russian fishery companies. Ichthyologists-observers always participate in those fishing vessels. They performing monitoring on fish resources, collecting information on environmental conditions and other hydrobionts. The ichthyological information on biological features of Greenland Halibut resource status and tendencies of its change are collected and evaluated during the research expeditions (Lillemagi 2003; Canaleja 2002, 2003; Kaljuste 2005). The data is provided to the Norwegian Fisheries Department and other international statistical organisations. The results are available in the data base of the Norwegian Fisheries Department website: http://www.fiskeridir.no/fiskeridir/english/marine_scientific_research/cruises_2006).

Only deepwater prawns (*Pandalus borealis*) were caught by the Lithuanian vessels until the current year in the Svalbard Area. Directorate of Fisheries of Norway has allotted to Lithuania 200 MT of Greenland Halibut fishing quota for scientific purposes with the condition that this fishery need to be conducted between September 1 and November 15th 2006. The data on commercial trawling efficiency and biological analysis of cached fish were collected in this period. The collected ichthyological data will be used for the analysis of biological characteristics, migrations, sites of concentration, reproduction of Greenland Halibut as well as for the planning of sustainable fishery of this species in the Barents Sea.

I. Material and Methodology

The research expedition of the fishing vessel „Polaris“ has been performed during the September 25th – October 12th, 2006. The fishing was conducted in the ICES fisheries area IIB in the Norwegian territorial waters of the Barents Sea. The quantitative and biological parameters of fish were observed in the framework of the Lithuanian National Fishery Monitoring Programme. The data will be used for the determination of fish migration, genetic exclusion and mixture of different subpopulations in NEAFC fishery areas I and II in the Barents and the Norwegian Seas. Data also will be used to foresee the distribution of fish, factors of its determination, as well as calculation of fishery prognoses and strategy.

Objectives

The main objective of this research trip was to evaluate efficiency of Halibut fishery by a towing gear in the Barents Sea in the depth of 400-900 m in the ICES fishing area IIb. Perform biological analysis of Greenland Halibut according to standard methodologies of ichthyological research. Describe catch, composition of by-catch species in trawling samples, its biological features, and supplement information about biological features of Greenland Halibut in pre-spawning period, its migration routes, and quantitative relation of different age and sex, distribution and gathering places during autumn-winter period.

Methods

Trawling by standard demersal type of trawl with the mesh size of 37 cm. Its technical characteristics are provided in Table No. 1.

Table No. 1. The main characteristics of the fishing gear.

Fishing trawler „Polaris”, Lithuania
Barents Sea
Trawl characteristics
Torsktræl Rockhoppergear, Alfredo Nr. 5
Headline– 38 m; Fiskeline/ upper panel/ - 28 m
Trawl H -10 m, distance between wings– 15 m
Mesh size in wings -170 mm, in the codend - 145 mm
Speed during trawling – 2,5-3 knots
Duration of one trawling cast – 4.5-5 h

The trawling was performed four-three times per twenty four hours depending on meteorological conditions. The fishing grounds were selected with regard to fishing efficiency and meteorological conditions. The digital commercial fishery map prepared by the Russian Polar Fisheries Research Institute (PINRO) was used for the selection of fishing grounds.

100 trawling were performed in total during the expedition. Not all trawling casts were successful. Therefore the trawls of October 9-13, 2006 and November 1, 2006 were eliminated from the ichthyological analysis do the strong storm (9-10 points according to Boufort Scale) because nets were breaking, worked inefficiently and work was uncomfortable in general.

Detailed descriptions of trawling samples are provided in Table No.6 (see Appendix). Scientific specimens were taken during commercial fishing. The material about 96 trawls was used in the analysis of trawling samples. 13 analyses of control trawling samples were performed in total - five in the beginning and eight at the end of the expedition. The data on their catch is provided in Tables No.6 and 7, Appendix 3. Auditorial and eliminated from the analysis trawls are marked in the tables by the signs ** or ***.

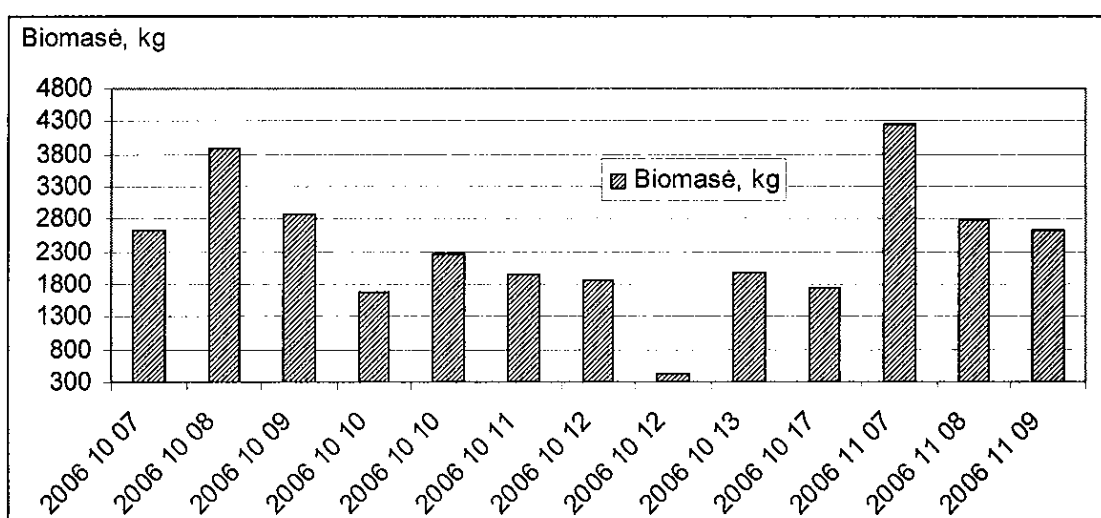
Regarding control samples the following trawling sample parameters are described as follows: 1) size of total trawl catch and the amount (in weight) of Greenland Halibut by kg and by boxes (frozen); 2) all by-catch from the trawling catch. The fish in each control sample was measured (cm) and weighed (kg) and sex of fish was determined. The sex products maturity stage was evaluated according the six-points scale. In parallel the specimen of internal organs of Greenland Halibut were taken to determine specific variety, intensity and extensiveness of infestation by parasitical helminths. Full biological analysis in control trawling was performed with only 100 fish, the remaining 200 individuals were randomly selected and only the spread of their body length was measured (cm) in the specimen. 200 ear bones (otoliths) of were collected. Due to the lack of skills, determination of their age was postponed for the future, after the consultations with the specialists of the Norwegian Institute for Fisheries and Aquaculture Research in Tromse. The fish was described according to the identification guidelines on ray and bone fish species in the Barents and Norwegian Seas (Andriyashev 1964; Moller 1989; Merrett & Haedrich 1997; Pethon 2005; Nelson 2006).

II. Results

II. I. Thirteen control trawling samples included 30533 kg of different bony fish. The main statistical parameters of trawling samples were as follows: min. – 434, kg; max. – 4262 kg; average – 2348,7 kg; statistical error ± 260 .

a) Abundance and domineering of fish species in control trawling

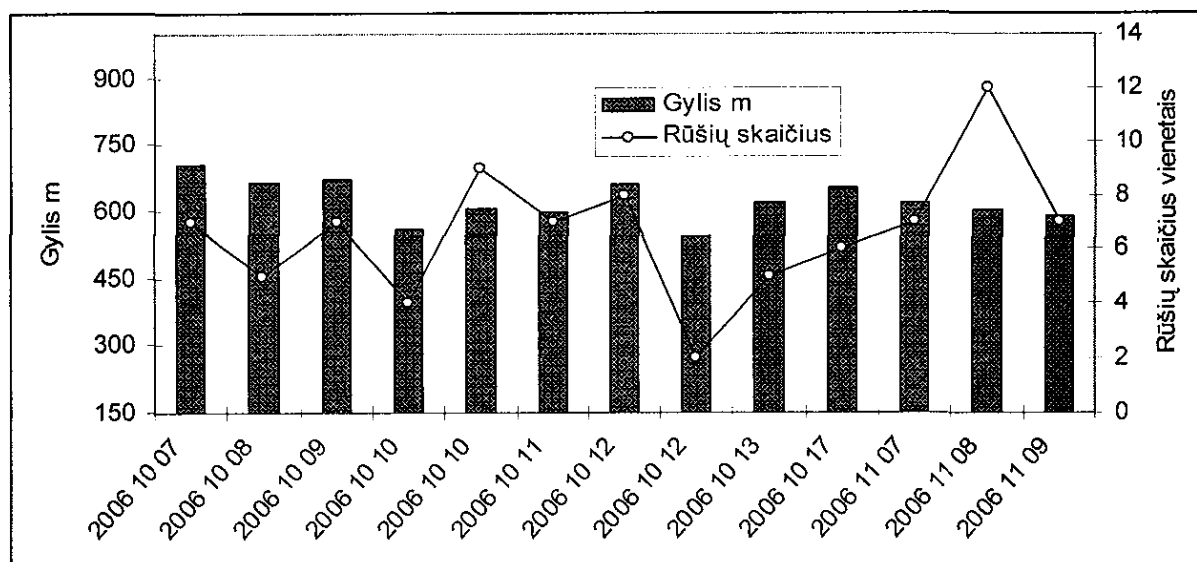
19 species of cartilaginous fish (Elasmobranchii) was caught and identified during the expedition and investigation of control samples.



Picture No.1. Biomass of control trawling catch (kg) , October-November, 2006.

Table No. 2. The list of caught fish species

	Lithuanian	Latin	English/ Species List
1	Grenlandijos paltusas	Reinhardtius hippoglossoides	Greenland halibut
2	Grenadierius	Macrourus berglax	Roughhead grenadier
3	Atlantinė menkė	Gadus morhua morhua	Atlantic cod
4	Putasu	Micromesistius poutassou	Blue whiting
5	Ledjūrio menkė	Pollachius virens	Pollock
6	Arktinė menkė	Pollachius pollachius	Pollack
7	Ledjūrio grundalas	Cottunculus microps	Polar sculpin
8	Glotnioji raja	Raja fyllae	Round ray
9	Šiurkščioji raja	Raja radiata	Starry skate
10	Dygliauodegė raja	Bathyrāja spinicauda	Spinetaile skate
11	Jūros ešerys	Sebastes mentella	Deepwater redfish
12	Giliavandenis jūrinis ešerys	Sebastes marinus	Red fish
13	Rainioji gyvavedė vėgėlė	Lycodes eudipleurostictus	Doubleline eelpout
14	Didžioji vilkžuvė	Anarhynchus lupus	Striped sea Wolf
15	Smulkiadantė vilkžuvė	Anarhynchus denticulatus	Sea wolf
16	Paltusinė plekšnė	Hippoglossoides platessoides	American plaice
17	Argentininė stinta	Argentina silus	Argentina
18	Brosmija	Brosme brosme	Brosme
19	Ciegorius	Cyclopterus lumpus	Lumpsucker



Picture No.2. The number of control trawlings in different depths, October-November, 2006.

Identification of some species (e.g., *Pollachus pollachus*, *Melanogamus eaglefinus*) is verified on the basis of the methods of comparative analysis of iso-enzymes. The caught species of ray and other fish are listed in tables 3-4, as well as in the detailed descriptions of control trawling samples in Table No.6.

Table No. 3. Summary of controlled-commercial trawling samples (07.10.2006 – 12.11.2006)

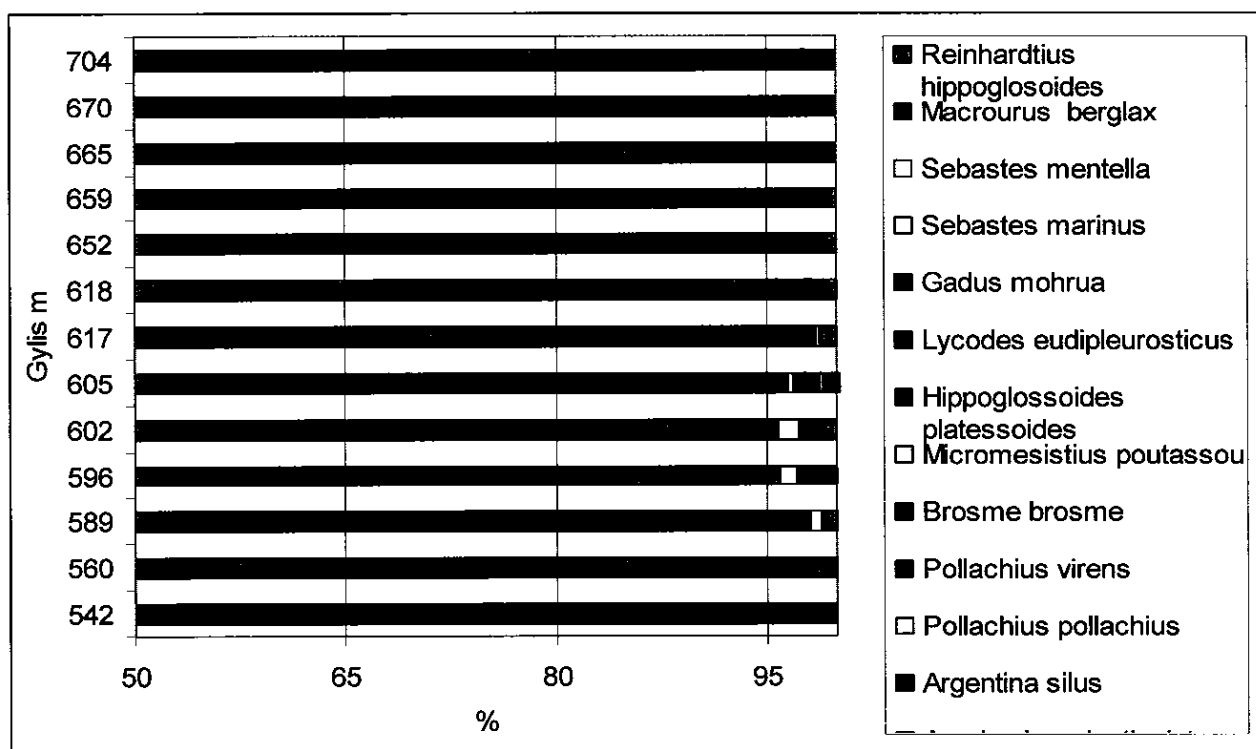
Date, Month	Fish Species	Composition of catch by weight and percentage		Fish weight average	Fish body length		Number of individuals
		kg	%		Min.-Max	Average	
				cm	cm		
07-11.10.2006 - 12.10.2006	Geenland halibut (<i>Reinhardtius hippoglossoides</i>)	29631	25,7	1,403	39-91	52	21074
	Roughhead grenadier (<i>Macrourus berglax</i>)	174,02	15,6	1,25	19-90	57	157
	Atlantic cod (<i>Gadus morhua morhua</i>)	154	13,5	3,50 (1,85-15,5)	56-109	72	44
	Blue whiting (<i>Micromesistius poutassou</i>)	0,88	0,08	0,29	30-37	33,3	3
	Pollock (<i>Pollachius virens</i>)	2,6	0,23	-	63	-	1
	Pollack (<i>Pollachius pollachius</i>)	1,4	0,12	-	52		1
	Polar sculpin (<i>Cottunculus microps</i>)	1,2	0,11	0,4	25-29	26,6	3
	Round ray (<i>Raja fyllae</i>)	214,3	18,86	3,15	55-89	68,12	68
	Starry skate (<i>Raja radiata</i>)	52,9	2,46	0,84	22-74	41,65	63
	Spinetaile skate (<i>Bathyraja spinicauda</i>)	27,95	4,6	1,47	43,62-88	65,5	19
	Deepwater redfish (<i>Sebastes mentella</i>)	119,39	10,50	0,603	22-49	37	174
	Red fish (<i>Sebastes marinus</i>)	0,55	0,05	-	35	-	1
	Doubleline eelpout (<i>Lycodes eudipleurostictus</i>)	1,7	0,15	-	-	67	1
	Striped sea Wolf (<i>Anarhynchus lupus</i>)	56,4	4,96	14,1	58-126	98,5	4
	Sea wolf (<i>Anarhynchus denticulatus</i>)	15,4	1,35	-	107	-	1
	American plaice (<i>Hippoglossoides platessoides</i>)	6,67	0,59	0,558	32-45	38	13
	Greater argentine (<i>Argentina silus</i>)	0,35	0,03	-	35	-	1
	Brosme (<i>Brosme brosme</i>)	1,5	0,132	-	70	-	1
Lumpsucker (<i>Cyclopterus lumpus</i>)	12	0,92	3,5	40	35	3	
Total weight in kg: 1136,31				Average - 3844; min.- 174,3; max. - 19553			

The trawling sample included 3 fish species in average; minimum - 2, maximum- 6 (n=13).

Less fish species were caught in shallow waters. There were only two species. A larger variety was observed in bigger depths. Although lumpsuckers were caught in commercial samples

however they were included into the summary of control samples. Domineering fish species were as follows: Greenland halibut, Atlantic Cod, Roughhead Grenadiers, and Oceanic Redfish. There were 15 non-domineering, rare and sparse fish species. All fish species belongs to the group of open-water, demersal, ground fish and deep water fish species. It is supposed that some fish species were not caught and were not included into the summaries because they has escaped through the mesh do the very high selectivity of the trawl. The quantitative and qualitative characteristics of fish are described in the material below.

Each separate control trawling sample included more than 94 % of Greenland Halibut from the total amount of fish in the trawling catch. This was the main domineering fish species.



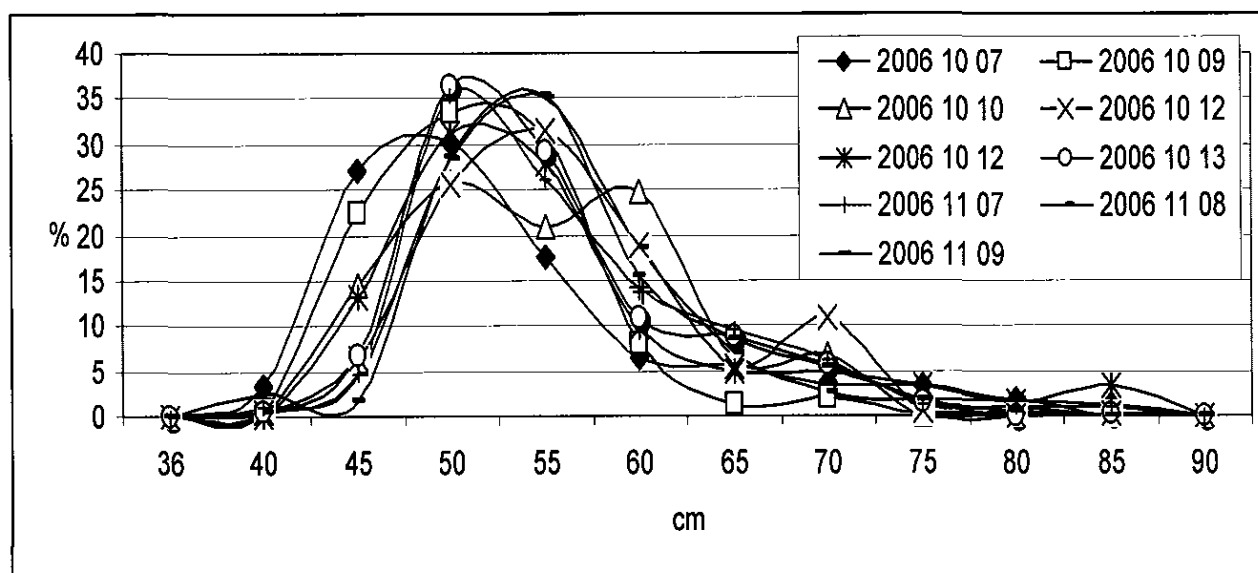
Picture No. 3 Domineering of different fish species in trawling samples in different depths, October-November, 2006.

Total summary of fish quantity and length in trawling samples is provided in table No. 3. The total catch was 46128,8 kg; average – 3844,1 kg; min.- 174,3; max. – 19553 kg. According to the available data of trawling samples the clear relation between on the depth and the location of trawling area was not distinguished. The dependence of trawling time during twenty four hours was not separately analysed. Otherwise, pelagic fish (of open waters) was caught (Argentina, Atlantic Cod and Pollock), as well as other species, which are typical of migration in water thickening at day time and depend on meteorological conditions.

b) Characteristics of Biological Features of Greenland Halibut (*Reinhardtius hippoglossoides*).

Total biomass of Greenland Halibut in control trawling samples was 29631 kg (min.– 432 kg; max. – 4176 kg; average – 2279 kg; statistical error \pm – 256). According to the abundance in the control samples (in 13 trawls) their average number was 1621 individuals in a trawl (min.– 284 individuals; max. – 3480 individuals; statistical error \pm – 209,4 units). Their total number in all samples was 21074. According to biomass in trawling samples they made 25,7 % of total fish amount. Whereas in separate commercial and control trawls they made 94 % of the total weight.

Average body length meanings of females and males of Greenland Halibut are provided in table No.4. Average length of Greenland Halibut in total control samples was 52,16 cm (min.- 31, max.-90, statistical error - 0,15; n=2155). Length analysis of the available data according to the sex has shown that females length average consist 56,71 cm (min.– 39, max.– 80, statistical error – 1,82; n=39) and males length average -



Picture No.4. Percentage of Greenland Halibut of different length (%) in trawling samples in different days. (Not less than 120 fish was calculated from each trawl).

52,3 cm (min.- 42 cm, max.- 91 cm, statistical error 0,706; n=112). Due to large mesh size of the trawl the young, non-commercial fish was not caught.

Table No. 4. Average length and weight of Greenland Halibut in different trawls during the period of 07 -17.10.2006.

Date of trawling	Sex	Length, cm average (min-max)	Weight, gr. average (min.- max)	Amount
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07.10.2006	Female	57 (40-79)	2,02 (5-5,35)	16
	Male	51,4 (42-91)	1,42 (0,5-9,12)	37
09.10.2006	Female	53 (41-77)	1,43 (0,7-3,3)	19
	Male	52,2 (44-83)	1,32 (0,7-6)	40
12.10.2006	Female	59,6 (40-80)	2,04 (0,6-3,6)	35
	Male	52,7 (42-71)	1,3 (0,65-3,95)	12
13.10.2006	Female	52,6 (37-69)	1,53 (0,5-3,9)	21
	Male	49,9 (41-62)	1,15 (0,7-1,85)	32
17.10.2006	Female	50,75 (42-58)	1,18 (0,75-2,5)	8
	Male	49,7 (40-58)	1,08 (0,55-1,65)	17
Average	Female	54,59 (40-72,6)	1,365 (1,21-3,298)	99
	Male	51,28 (41,8-73)	1,262 (0,62-4,514)	138
Total	Both sex	52,9 (40,9-72,8)	1,309 (0,915-3,91)	237

Sexual maturity

During the period of 9-17.10.2006 fish of both sexes was caught in trawling samples. The maturity of sexual products is provided in percentage in table No.5. As it may be seen from the table-summary, most individuals of Greenland Halibut of spawning age were in the maturity stage III – IV. 58 % males and only 8 % of females were in the maturity stage III. The ratio of fish of both sexes in the maturity stage IV was almost equal and was 40-30 % from the total amount of the analysed fish. Exceptionally large amount individuals were in the stage II, i.e. non-spawning females – 55 % whereas males of the same length were only 8 %. This could be explained by sexual dimorphism and selectivity of trawling equipment. In this regard only fish of more than 34 cm in length may be characterised because younger fish was not caught. During the expedition two males in medium maturity stage IV - V were caught, that is the spawning stage. They were single cases and therefore evaluated as extremes.

It is obvious from the provided data that a larger part of individuals of both sexes were in pre-spawning stage. The Greenland Halibut is spawning in waterholes during the period December-February.

Table No. 5. The amount of Greenland Halibut of both sexes in different sexual maturity in %, 9 -17.10.2006

Stage of Sexual Maturity	Female	Male
II	55*	8*
III	4	58
IV	40	33
V	0	2

* 2-3 years age, i.e. non-spawning fish.

c) Short biological characteristics of bycatch

Roghhead Grenadier (*Macrourus berglax*) – a pelagic fish, caught in seabed of 400-700 m depth. In trawling samples fish was 3-5 years old in the stage III of sexual maturity. Their quantity in the trawl differed and in average was 14,2 (min-1– max- 46) individuals. They formed 15,6 % in control trawling samples of all fish caught and were in the second place according to the biomass of caught fish (Table No. 3).

Atlantic Cod (*Gadus morhua*)– a demersal, open water fish species. There were 44 individuals of Atlantic Cod in control samples. In average 6,14 individuals (min-2, maksimum – 12 individuals in a trawl). Their total biomass in control samples was 154 kg (13,5 % of control samples fish). Atlantic Cod were in the stage II-III of sexual maturity, i.e.in pre-spawning stage. Their body length average was 72 cm (min.–19; max.–109 cm) and weight average was 3,50 (1,85-15,5) kg.

Blue Whiting (*Micromesistius poutassou*) – a demersal fish. They formed 0,88 % in control trawling samples according to biomass and 3 individuals in a trawl in average. They were very scarce.

Pollock (*Pollachius virens*) was caught only by one in two trawling samples. According to biomass they formed 0,23 %.

Argentina (*Argentina silus*) was caught only one at a time in separate trawls.

Polar Sculpin (*Cottunculus microps*) - a large depth seabed fish species. Only one-three individuals were caught in a trawl. The biomass was 1,2 kg - 0,11 % of all fish caught. 3 individuals were analysed in total. Average length was 26,6 cm (25-29 cm), weight - 0,400gr. There were females in the stage II of sexual maturity. Fish stomachs were empty.

Round Ray (*Raja fyllae*). In average 5 individuals per a trawl were caught (min.1, max.15 in a trawl, n=68). Reached 4,6 % in all control samples. Fish had two soft roes with juveniles. The stomachs were empty. The body weight average was 3,15 kg and length average was 68,12 cm (min – 55; max– 89 cm).

Starry Ray (*Raja radiata*). 63 individuals were caught in total. Average – 7 pieces (min- 1, max- 28) in trawl. Total biomass in control samples was 2,46 %. Fish stomachs were empty. Fish weight average was 0,84 kg; length average was 41,65 cm (min.– 22cm, max – 74 cm).

Spinetail skate (*Bathyraja spinicauda*) formed 27,95 kg in control samples. This was 4,6 % from the total fish biomass in control trawling samples. 19 individuals was caught in total. Fish weight average was 1,47 kg and length average - 65,5 cm (min– 43,6; max.- 88cm).

Oceanic Redfish (*Sebastes mentella*) was in the third place according to domineering in commercial and control trawling samples. 174 individuals were caught in total. Length average was 37 cm, (min-22 – max- 49 cm), weight average - 0,603 kg. 119,39 kg of fish was caught in control samples in total. The fish species was in the fourth place according to domineering in samples.

Sea Redfish (*Sebastes marinus*) also were caught accidentally. They were in negligible quantity.

Doubleline Eeelpout (*Lycodes eudipleurostictus*). They were caught only in commercial trawling samples one at a time.

Wolffish (*Anarhynchus lupus*). Four individuals of this fish were caught. It is supposed that they could be of three species. They are very polymorphic according to morphometrics and pigmentation, which changes according to age, ground type and season. Skills are required to identify it precisely. Therefore only two species of wolffish was distinguished in the research. Adult wolffish caught in control samples were females and males of the stage II of sexual maturity. Fish stomachs were empty.

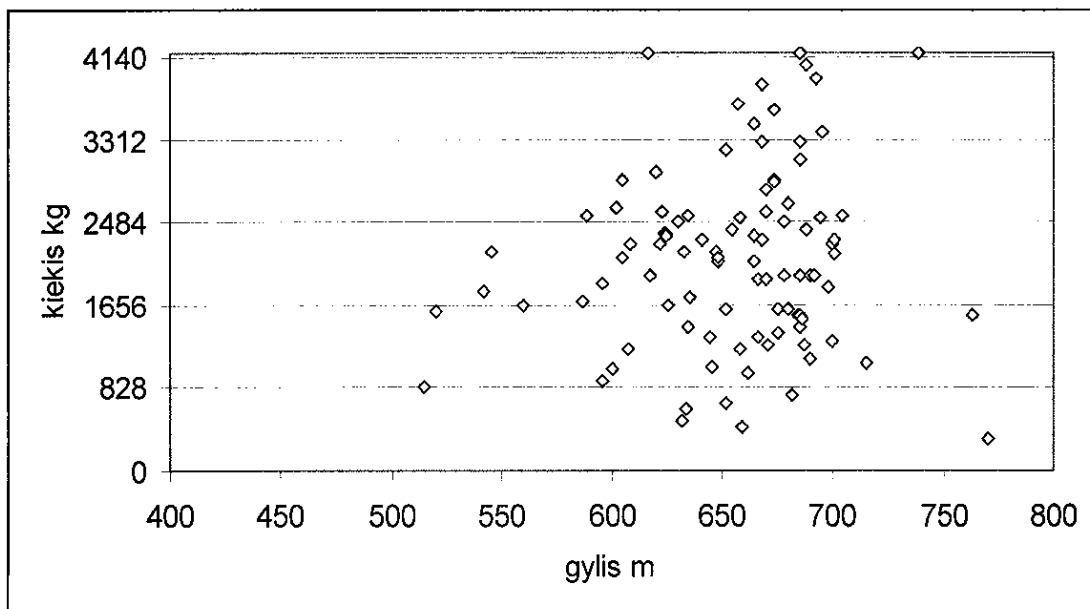
Pollack (*Pollachius pollachius*). Fish was caught only one at a time in commercial trawling samples. Fish was in the stage III of sexual maturity. Fish stomachs were empty.

Brosme (*Brosme brosme*). It was caught in trawling catch from large depths. Only one fish was caught in a commercial trawl.

Lumpsucker (*Cyclopterus lumpus*). Only single individuals were caught of 50 cm length. Lumpsucker females and males were in the stage of sexual maturity II i.e. in hibernation stage. They were caught only from large depths.

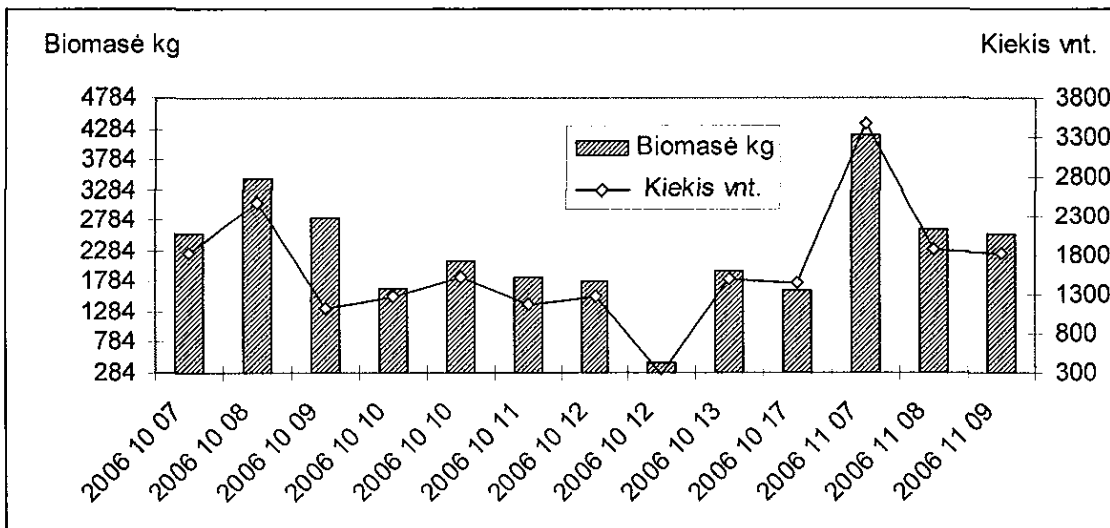
d) Effectiveness of deepwater fishing by bottom trawls

During the expedition the total catch of Greenland Halibut was 204228 MT (min. catch was – 324 kg, maximum – 4176 kg, average – 2127,37, \pm statistical error – 9, n= 96). Trawling depth average was 654,9 (min.– 515, max. – 770m). Biomass of Greenland Halibut in one sample ranged from 324-432 kg (659 - 770 m. depth) to 4176 kg (617-739 m depth). Catch larger than 1656 was in the depths of 500-750 m. The biggest catches were in the depths of 600-750 m (Pictures No. 5-6).



Picture No. 5. Biomass (kg) of Greenland Halibut commercial catches in different depths during the period of October-November, 2006.

Unfortunately it was impossible to provide representative data from trawling samples about distribution of different age and sex of Greenland Halibut as well as distribution by sex inside school or hemipopulation in the fishery area.



Picture No.6. Biomass shift of Greenland Halibut in control trawling samples during the period of 07.10.2006 – 09.11.2006.

III. Discussion on the results of the examination of trawling samples in October-November, 2006

19 cartilaginous and bony fish species were caught during commercial fishery operations by the demersal trawl in the period 07.10.2006 – 09.11.2006. The domineering fish species in commercial and control samples was Greenland Halibut. According to domineering (in decreasing sequence) were: Greenland Halibut, Oceanic Redfish, Atlantic Cods, Round and Deepwater Rays. Other fish species were random and according to scarcity evaluated as scarce and sparse species. According to ethologic complexes pelagic, demersal and ground fish were found in trawling samples. The dominants were benthic and demersal deep water cartilaginous and bony fish species. Analogical results were obtained by Estonian and Spanish scientists analysed biological characteristics of fishes in this area (Canaleja 2002; 2003; Lillemagi 2003; Kaljuste 2005). Sixteen caught fish species including Porbeagle Shark and other rare and scarcely caught accidental benthic and pelagic fish species are mentioned in the reports of above mentioned scientists.

During the expedition average trawling depth was 654,9 m. The biomass of Greenland Halibut ranged from 324 to 4176 kg in one sample. Catch larger than 1656 kg was in the depths of 500-750 m. Analogous CPUE coefficients in this area were received last year by the Estonian vessel „Lootus I“ (Kaljuste 2005). It is difficult to compare commercial effectiveness results from the same fishery area of different authors because fishing gear with different technical data was used. However according to the summary of the primary research results it could be stated that the size and the fluctuation of species caught their biological features and catch in different trawling

routes differed according to analogous consistent pattern and should meet common status in the fishery area.

According to the biological features the main commercial deepwater fish was in partial hibernation and pre-spawning migration stages. Maturity of their sexual products was in stages 3-4. The data of parasitological and age investigations are under summarising process. As was seed earlier the age reading of Greenland Halibut will be performed later after consultations with the specialists of the Norwegian Institute of Fishery Research. The available data could not provide clear dependence of trawling depth and catch size. After the comparative analysis of biological features of Greenland Halibut in six control samples credible differences according to the spread of fish length was not determined. The *Kuskal-Walis* test was used. The main indicators for this test were as follows: t. indicator – 7,98, P- value 0,919. Whereas value P was higher than 0,05, credible statistical differences among length medians 95,0 % of Greenland Halibut in different samples was not determined.

Having tasks for the future formulated by Eliassen & Jobling (1985) and Krzykowski & Wierzbicka (1992) to examine precisely migrations, seasonal distributions, taxonomic dependences and other biological aspects of Greenland Halibut caught in different parts of the Barents and the Norwegian Seas it is necessary to establish the programme of scientific research which will include new markers and research methods of fish schools (hemipopulations). Only complex data will help to specify peculiarities of Greenland Halibut migrations. In order to reach this objective the cooperation with leading ichtiologists of Norwegian scientific institutions is need to be established.

IV. Conclusions

- During research 19 cartilaginous and bony fish species were caught. The domineering fish species were demersal and ground fish. Due to selectivity of fishing gears (trawls) mostly Greenland Halibut, a much less Grenadiers, Oceanic Redfish, Atlantic Cod, Ocean and Round Rays were caught. Other species of fish and rays were caught accidentally and in small amounts.
- Biomass of Greenland Halibut during trawling samples ranged from 324 to 4176 kg in the depths of 654,9 m. Catch amount larger than 1656 was in the depths of 500-750 m.
- According to biological features the fish caught was in the status of pre-spawning or hibernation stages. In further researches distinguishing the hemipopulations, migrations routes, and fishing efficiency of Greenland Halibut it is necessary to apply standard complex, large scale research methods, applying constant research results of other scientific research institutions.

V. Summary in English: Evaluation of Biological Features and Fishing Efficiency of Greenland Halibut (*Reinhardtius hipoglossoides*) and by-catch in trawls from Svalbard Area (Barents Sea)

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Appendix

Table No. 6. Description of species, biomass and abundance of control trawling samples.

Date, Month	Fish Species	Weight of catch		Weight of fish body (average)	Length of fish body		Amount of fish individuals
					Min.-Max	Average	
		kg	%	g	cm	cm	
07.10. 2006	Reinhardtius hippoglossoides	2556	96,9	1000	36-91	50,7	1816
	Macrourus berglax	38	1,4	0,83	42-67	54	46
	Sebastes mentella	0,8	0,0	0,4	35-45	36,5	2
	Anarhynchus denticulatus	38	1,4	-	103	-	1
	Bathyraja spinicauda	2,1	0,1	-	60	-	1
	Raja radiata	2,81	0,1	0,7125	40-46	42,5	4
	Cottunculus microps	1,2	0,0	0,4	25-29	26,6	2
Total weight kg: 2638,9							
08.10. 2006	Reinhardtius hippoglossoides	3456	99	1		53	2468
	Macrourus berglax	14,6	0,418	1,22	40-73	58,9	12
	Anarhynchus denticulatus	15,5	0,444	-	107	-	1
	Sebastes mentella	0,45	0,013	-	33	-	2
	Raja fyllae	1,4	0,040	-	60	-	1
Total weight kg: 3490,8							
09.10. 2006	Reinhardtius hippoglossoides	2808	98,44	2	41-83	52,34	1123
	Macrourus berglax	8,54	0,30	1,22	42-67	59,3	7
	Sebastes mentella	0,50	0,02	-	-	37	1
	Gadus morhua	23,45	0,82	2,25	60-80	69	8
	Lycodes eudipleurostictus	1,7	0,06	-	-	67	1
	Raja radiata	4,200	0,15	0,70	40-43	38,2	6
	Hippoglossoides platessoides	0,25	0,01	-	-	36	1
Total weight kg: 2858,6							
10.10. 2006	Reinhardtius hippoglossoides	1656	98,95	1,3	42-51	46	1273
	Macrourus berglax	12,75	0,76	1,16	50-65	57,4	11

	Raja radiata	4,4	0,263	0,88	40-46	42,8	5
	Cottunculus microps	0,35	0,02	23	-	-	1
	Total weight kg: 1673,5						
10.10. 2006	Reinhardtius hippoglossoides	2124	94,45	1,2	21-77	42,7	1517
	Macrourus berglax	47,18	2,098	1,348	47-90	59,75	35
	Raja radiata	21,05	0,936	0,779	33-51	41,321	28
	Bathyraja spinicauda	4,5	0,200	0,562	34-58	43,62	8
	Sebastes mentella	8,8	0,391	0,55	32-37	35,18	16
	Anarhynchus denticulatus	2,1	0,09	-	62	-	1
	Gadus morhua	38,95	1,732	3,54	59-83	74,36	11
	Micromesistius poutassou	0,73	0,032	0,466	33-37	35	2
	Hippoglossoides platessoides	1,4	0,062	0,46	32-37	35,33	3
	Total weight kg: 2248,71						
11.10. 2006	Reinhardtius hippoglossoides	1875	95,86	1,6	39-81	53	1172
	Macrourus berglax	1,25	0,064	-	56	-	1
	Sebastes mentella	23,21	1,1885	1,747	34-109	43,846	13
	Micromesistius poutassou	0,15	0,008	-	30	-	1
	Gadus morhua	53,55	2,742	4,42	67-109	76,5	12
	Raja radiata	0,95	0,049	-	43	-	1
	Bathyraja spinicauda	1,65	0,084	-	65	-	1
	Total weight kg: 1952,76						
12.10. 2006	Reinhardtius hippoglossoides	432	99,42	1,52	40-80	54,5	284
	Macrourus berglax	2,5	0,57	1,25	-	56	2
	Total weight kg: 434,5						
12.10. 2006	Reinhardtius hippoglossoides	1800	97,23	1,4	42-85	53	1285
	Macrourus berglax	4,55	0,243	0,753	45-59	51	6

	Hippoglossoides platessoides	1,72	0,092	0,43	33-45	39	4
	Sebastes mentella	0,82	0,044	-	41	-	1
	Gadus morhua	21,2	1,145	3,53	69-84	71,5	6
	Raja radiata	3,15	0,170	1,05	35-49	43,3	3
	Bathyraja spinicauda	13,55	0,732	2,258	45-88	65,5	6
	Raja fyllae	6,25	0,337	-	85	-	1
	Total weight kg: 1851,19						
13.10. 2006	Reinhardtius hippoglossoides	1944	98,3457	1,299	37-55	50,9	1496
	Macrourus berglax	16,5	0,834	1,65	42-72	61,7	10
	Sebastes mentella	2,6	0,1315	0,866	39-44	41,66	3
	Raja radiata	2,05	0,1037	40,66	33-48	0,83	3
	Raja fyllae	11,55	0,584	5,775	69-89	79	2
	Total weight kg: 1976,7						
17.10. 2006	Reinhardtius hippoglossoides	1620	92,952	1,112	40-58	50,04	1457
	Macrourus berglax	4,5	0,258	0,9	42-65	56,6	5
	Sebastes mentella	4,4	0,252	0,88	35-48	40,6	5
	Brosme brosme	1,5	0,086	-	70	-	1
	Raja fyllae	106,28	6,098	3,1258	55-85	69,558	34
	Bathyraja spinicauda	6,15	0,35	2,05	40-75	63,3	3
	Total weight kg: 1742,83						
07.11. 2006	Reinhardtius hippoglossoides	4176	97,979	1,2	35-89	41,9	3480
	Macrourus berglax	22,25	0,522	1,39	39-74	60	16
	Sebastes mentella	11,75	0,27	0,53	33-42	36	22
	Gadus morhua	4,15	0,097	2,08	56-71	64	2
	Hippoglossoides platessoides	1,00	0,023	-	44	-	1
	Raja fyllae	44,55	1,046	2,97	59-78	67	15
	Raja radiata	2,40	0,05	0,80	33-79	42	3
	Total weight kg: 4262,10						
08.11. 2006	Reinhardtius hippoglossoides	2628	95,62	1,4	39-80	53,68	1877
	Macrourus berglax	4,05	0,147	0,675	44-64	51	6
	Sebastes mentella	43,91	1,597	0,577	33-49	36,81	76

	Sebastes marinus	1,86	0,065	-	49	-	1
	Gadus morhua	6,3	0,229	3,15	64-78	71	2
	Pollachius virens	2,6	0,094	-	63	-	1
	Polachius polachius	1,4	0,051	-	52	-	1
	Argentina silus	0,35	0,013	-	35	-	1
	Anarhynchus lupus	27,1	2,1/ 28	13,55	58/126	92	2
	Hippoglossoides platessoides	1,8	0,065	0,6	37-38	37,33	3
	Raja fyllae	21,55	0,784	2,69	55-76	65,87	8
	Raja radiata	9,3	0,3384	1,033	22-74	42-77	9
	Total weight kg: 2784,21						
09.11. 2006	Reinhardtius hippoglossoides	2556	97,66	1,4	36-77	53,67	1826
	Macrourus berglax	12,6	0,481	0,969	29-63	50,61	13
	Gadus morhua	3,5	0,1334	1,75	60-69	64,5	2
	Sebastes mentella	22,15	0,846	0,651	33-44	38,15	33
	Hippoglossoides platessoides	0,75	0,029	-	40	-	1
	Raja fyllae	16,7	0,638	2,783	63-71	66,3	6
	Raja radiata	5,35	0,204	0,8916	35-56	42,6	6
	Total weight kg: 2617,05						

Table No. 7. Description of commercial trawling samples and catch of Greenland Halibut in separate trawls
07.10.2006 – 12.11.2006

No. of day trawl.	Start positions				End positions				Catch (without by-catch)	
	Longitude/ Latitude/	Latitude/ Longitude/	Depth, m/	Time	Longitude	Latitude	Depth, m	Time	No. of boxes	Total catch, kg
1	73*57'N	15*41'E	770	22.15	73*59'N	15*47'E	745	0.55	9	324
1	73*58'N	15*47'E	680	03.55	74*07'N	16*02'E	698	3.00	45	1620
2**	74*07'N	16*05'E	704	08.50	74*19'N	16*13'E	705	4.40	71	2556
3	74*38'N	15*53'E	695	17.05	74*52'N	15*27'E	729	5.00	94	3384
1**	74*42'N	13*46'E	665	03.25	74*55'N	15*26'E	756	5.05	96	3456
2	74*40'N	15*48'E	668	18.50	74*54'N	15*29'E	684	5.05	91	3276
1**	74*52'N	15*30'E	670	02.50	75*05'N	15*16'E	723	4.40	78	2808
2***	74*56'N	15*31'E	655	09.35	74*47'N	15*43'E	657	4.45	-	0
3	74*41'N	15*44'E	680	16.20	74*56'N	15*32'E	654	5.00	74	2664
1	74*50'N	15*35'E	560	23.30	74*35'N	16*04'E	573	5.00	46	1656
2**	74*36'N	16*04'E	605	06.40	74*50'N	15*36'E	532	4.50	59	2124
3	74*50'N	15*36'E	545	13.50	74*39'N	15*56'N	590	5.00	61	2196
1	74*40'N	15*55'E	596	20.30	74*56'N	15*32'E	605	5.20	25	900
2**	74*51'N	15*35'E	596	04.00	74*38'N	15*59'E	575	5.00	52	1875
3	74*41'N	15*54'E	520	11.00	74*56'N	15*34'E	595	5.00	44	1584
4	74*50'N	15*37'E	515	19.45	75*04'N	15*23'E	672	5.10	23	828
1	75*09'N	14*57'E	763	03.00	75*12'N	14*43'E	746	1.30	43	1548
2	75*22'N	14*19'E	659	07.00	75*35'N	14*04'E	615	4.30	12	432
3**	75*34'N	14*08'E	542	13.45	75*48'N	14*01'E	595	4.50	50	1800
4	75*45'N	13*57'E	658	20.35	75*29'N	14*06'E	643	5.10	70	2520
1	75*31'N	14*05'E	648	03.50	75*45'N	13*58'E	643	5.05	58	2088
2***	75*42'N	13*57'E	654	11.55	75*27'N	14*08'E	643	4.55		0
3**	75*33'N	14*05'E	618	19.15	75*49'N	13*57'E	652	5.00	54	1944

1	75*48N	13*57E	668	02.50	75*33N	14*05E	620	5.00	64	2304
2	75*34N	14*05E	600	10.05	75*49N	13*39E	621	5.00	28	1008
3	75*46N	13*59E	624	17.05	75*30N	14*05E	632	5.20	66	2376
1	75*34N	14*03E	666	00.50	75*49N	13*58E	695	4.00	37	1332
2	75*51N	13*58E	655	07.10	75*41N	14*00E	610	4.00	67	2412
1	76*18N	14*24E	648	01.25	76*04N	14*07E	642	5.00	59	2124
2	76*04N	14*09E	620	08.45	75*49N	13*59E	627	4.55	83	2988
3	73*53N	14*00E	633	16.25	76*09N	14*13E	629	5.05	61	2196
1	76*07N	14*12E	626	23.40	75*50N	13*59E	642	5.20	46	1656
2**	75*58N	14*01E	652	07.15	76*18N	14*22E	656	5.30	45	1620
1	76*25N	14*29E	668	05.10	76*12N	14*15E	645	4.30	91	3276
2	76*08N	14*12E	635	11.40	75*54N	14*00E	638	4.45	40	1440
3	75*59N	14*03E	630	18.55	76*17N	14*20E	651	5.00	69	2484
1	76*16N	14*23E	634	03.20	76*02N	14*07E	632	4.50	17	612
2	76*07N	14*10E	635	10.35	76*22N	14*29E	659	4.25	71	2556
1	76*26N	14*35E	622	02.55	76*12N	14*17E	616	4.40	63	2268
2	76*11N	14*17E	608	09.55	76*25N	14*21E	660	4.10	34	1224
3	76*22N	14*31E	636	16.25	76*07N	14*11E	634	5.00	48	1728
1	76*06N	14*10E	647	23.55	75*51N	13*58E	659	5.00	61	2196
2	75*52N	13*57E	675	07.05	76*09N	14*12E	645	4.40	38	1368
3	76*06N	14*09E	665	14.00	75*51N	13*57E	670	5.00	65	2340
1	75*51N	13*59E	652	21.25	75*35N	13*59E	674	5.00	89	3204
2	75*36N	13*59E	674	04.40	75*52N	13*58E	655	4.50	81	2916
3	75*50N	13*57E	658	11.50	75*34N	14*00E	658	5.00	34	1224
4	75*36N	13*59E	675	17.25	75*54N	13*57E	678	5.00	45	1620
1	75*52N	13*50E	685	02.40	75*36N	13*50E	698	5.00	54	1944
2	75*39N	13*58E	670	10.00	75*47N	14*00E	670	5.00	53	1908
3	75*59N	14*00E	690	17.20	76*15N	14*15E	683	5.00	54	1944
1	76*16N	14*18E	684	00.40	76*01N	14*01E	697	5.00	43	1548
2	76*05N	14*03E	701	07.50	76*20N	14*24E	676	5.00	60	2160

3	76*21N	14*25E	688	15.10	76*05N	14*05E	687	5.00	113	4068
1	76*09N	14*07E	698	22.20	76*24N	14*29E	674	5.00	51	1836
2	76*21N	14*27E	687	05.40	75*05N	14*05E	690	5.00	35	1260
3	76*08N	14*09E	670	13.05	76*24N	14*27E	690	5.00	72	2592
1	76*24N	14*03E	678	20.50	76*09N	14*09E	682	5.00	54	1944
2	76*08N	14*09E	671	04.05	76*21N	14*25E	702	5.00	35	1260
3	76*24N	14*28E	685	10.55	76*08N	14*08E	696	5.00	43	1548
4	76*05N	14*08E	641	18.10	75*51N	13*55E	707	5.00	64	2304
1	75*50N	13*56E	694	01.20	75*34N	13*57E	709	5.00	70	2520
2	75*37N	13*57E	700	08.45	75*55N	13*57E	710	5.00	63	2268
3	75*53N	13*55E	715	16.55	75*37N	13*55E	715	5.00	30	1080
1	75*39N	13*56E	692	00.05	75*50N	13*56E	688	3.05	54	1944
2	75*52N	13*56E	685	05.25	76*07N	14*08E	693	5.00	86	3096
3	76*08N	14*07E	693	12.45	76*24N	14*27E	688	5.00	109	3924
1	76*24N	14*30E	674	20.10	76*08N	14*08E	681	5.00	80	2880
2	76*08N	14*08E	688	03.55	76*24N	14*28E	684	5.00	67	2412
3	76*23N	14*27E	685	11.05	76*08N	14*08E	690	5.00	91	3276
4	76*61N	14*10E	623	18.40	75*55N	13*56E	670	5.10	72	2592
1	75*52N	13*57E	668	02.30	76*81N	14*07E	670	5.30	107	3852
2	76*06N	14*06E	685	10.30	75*51N	13*57E	683	5.00	116	4176
3***	75*54N	13*58E	676	17.40	76*12N	14*12E	678	5.10		0
1	76*07N	14*07E	686	01.10	75*51N	13*56E	693	5.00	42	1512
2	75*49N	13*56E	678	08.10	75*34N	14*01E	651	4.50	69	2484
3	75*35N	14*02E	645	15.10	75*50N	13*57E	676	4.25	37	1332
1	75*52N	13*57E	690	21.50	76*12N	14*12E	688	6.30	31	1116
1	76*21N	14*29E	662	04.40	76*08N	14*09E	674	4.50	27	972
2	76*05N	14*05E	682	12.10	75*51N	13*57E	665	4.50	21	756
3	75*55N	13*57E	652	19.05	75*34N	14*00E	612	5.00	19	684
1	75*30N	14*04E	625	02.15	75*16N	14*22E	600	5.00	66	2376
2	75*00N	15*31E	700	10.40	74*45N	15*38E	617	5.00	36	1296

3	74*43N	15*41E	632	18.05	74*30N	16*09E	688	5.00	14	504
1	74*17N	16*14E	685	01.50	74*03N	16*00E	610	5.00	40	1440
2**	74*04N	15*21E	617	09.10	73*52N	15*35E	690	4.50	116	4176
3	73*57N	15*48E	625	16.10	74*12N	16*12E	597	5.00	65	2340
1**	74*13N	16*13E	602	23.25	73*58N	13*53E	589	5.00	73	2628
2	73*59N	15*52E	605	06.40	74*14N	16*15E	603	5.00	81	2916
3	74*13N	16*12E	609	13.50	73*58N	15*55E	596	5.00	63	2268
1	74*01N	16*01E	587	21.10	74*17N	16*15E	603	5.00	47	1692
2**	74*15N	16*13E	589	04.00	74*01N	15*53E	630	5.00	71	2556
3	73*35N	15*50E	666	11.10	74*15N	16*21E	606	5.00	53	1908
4	74*16N	16*13E	657	18.15	74*01N	16*00E	614	5.10	102	3672
1***	74*05N	16*06E	602	01.35	73*59N	15*55E		2.30		0
2	74*11N	16*10E	665	09.25	73*58N	15*52E	614	5.00	58	2088
3	74*00N	15*51E	701	16.55	74*16N	16*13E	716	5.00	64	2304
1	74*14N	16*12E	646	00.20	74*02N	15*56E	709	5.00	29	1044
2	74*02N	15*55E	739	07.45	74*71N	16*12E	712	4.45	116	4176
3	74*15N	16*11E	674	14.55	74*03N	15*57E	696	5.05	100	3600
									5673	204228

* Extract from the logbook of trawler „Polaris“.

** Control trawling samples with complete ichthyological analysis.

***- Trawling samples not included into the records.

Summary Report

Evaluation of Fishing Efficiency and Biological Features of Greenland Halibut (*Reinhardtius hippoglossoides*) and by-catch in the Svalbard Area (Barents Sea).

Fishery research expedition by Lithuanian trawler „Polaris” 10. 07. 2006 – 11. 12. 2006.

Mr. Egidijus Bacevičius, Chief Specialist of Fishery Research Laboratory, Lithuanian State Pisciculture and Fishery Research Centre, Klaipėda *

The fishery research expedition was organised during 07.10.2006 - 12.11.2006 by the fishing trawler „Polaris“ (Lithuania) in the ICES area IIb in the Barents Sea (Norwegian territorial waters). Technical data of the vessel is provided in *Table 1*. 100 trawling samples were performed during the expedition. Their detailed description is provided in *Table 7*. Scientific samples were taken during commercial fishing. Material on 96 trawls catch is used for the analysis of samples. In total 13 analysis of control trawling samples were performed, five in the beginning of the expedition and eight at the end. The data of caught fish from analysed samples is provided in *Tables 3 and 6*. Control and eliminated trawls from the analysis are marked by signs ** or ***. Complete biological analysis in control trawls was performed with only 100 fish individuals. The rest of 200 individuals are randomly selected, and only the spread of their body length (cm) is measured in the sample. 200 ear bones of Greenland Halibut, 70 parasitological and muscle samples were taken for biochemical researches. The data on control-commercial trawling samples (07.10.2006– 12.11.2006) is summarised in *Table 3*.

19 cartilaginous and bony fish species were caught during in this expedition: *Raja fyllae*, *Raja radiata*, *Bathyraja spinicauda*, *Reinhardtius hippoglossoides*, *Macrourus berglax*, *Gadus morhua morhua*, *Micromesistius poutassou*, *Pollachius virens*, *Pollachius pollachius*, *Cottunculus microps*, *Sebastes mentella*, *Sebastes marinus*, *Lycodes eudipleurostictus*, *Anarhynchus lupus*, *Anarhynchus denticulatus*, *Hippoglossoides platessoides*, *Argentina silus*, *Brosme brosme*, *Cyclopterus lumpus*. Domineering of different fish species in trawling samples taken in October-November, 2006 is provided in *Picture 3*.

According to ethologic grouping demersal and pelagic fish prevailed. Due to selectivity of trawling equipment mainly Greenland Halibut, less Oceanic Redfish, Atlantic Cod, Round and Deepwater Rays were caught. Other fish and ray species were caught accidentally and in small amounts. Changes of biomass of Greenland Halibut during control trawling samples in the period of 07.10.2006 – 09.11.2006 is provided in *Picture No.6*. Biomass of Greenland Halibut ranged from 324 to 4176 kg in trawling samples in the depth of

654,9 m. Catch larger than 1656 were in the depths of 500-750 m (*Picture No.5*). Average length and weight values of Greenland Halibut in separate trawls is presented in *Table 4*; The amount of Greenland Halibut (in %) of different length in trawling samples in different days (not less than 120 fish measured from each trawl) is provided in *Picture No.4*. The amount (in %) of Greenland Halibut of both sex in different sexual maturity stages in the period of 9-17.10.2006 is presented in *Table 5*. According to biological features fish caught was in pre-spawning or hibernation stages. Further researches on hemipopulation distinguishing, migration routes and fishery efficiency require the application of standard complex, wide-ranging research methods, as well as the adjustment of long-term research results of other scientific research institutions.

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Preliminary results of heavy metals and genetic analysis of Greenland halibut (*Reinhardtius hippoglossoides* Walbaum, 1792) from Barents Sea

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and

Report about condition and parasites of Greenland halibut (*Reinhardtius hippoglossoides* Walbaum, 1792) from Barents Sea

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July 2007

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1.0 HEAVY METALS

All samples had been collected during the cruise of trawler Polaris in October (07-14.10.2006) and November (03-11.11.2006) of 2006 at Barents Sea area – Table 1.

Individuals from three trawls, differentiated by depth and geographical locations have been used for determination of heavy metals (Zn, Cu, Cd and Pb) concentration.

Tissue samples – liver and muscles were mineralized by nitric acid (V) using acid – pressure system PDS-6. Copper and zinc were denoted using FAAS technique with reference method. Cadmium and lead were denoted using standard graphite cuvette with standard additions like $Mg(NO_3)_2$ for lead and $Pd(NO_3)_2$ for cadmium.

Table. 1. Geographic locations of trawls/samples used for heavy metals concentration analysis and for preliminary analysis of enzymatic systems.

No. of trawl	Data	Longitude	Latitude	Depth, [m]	Time	Longitude	Latitude	Depth, [m]	Time
2	09.10.2006	74°52'N	15°30'E	670	02.50	75°05'N	15°16'E	723	4.40
4	11.10.2006	74°51'N	15°35'E	596	04.00	74°38'N	15°59'E	575	5.00
9	06.11.2006	75°30'N	14°04'E	625	02.15	75°16'N	14°22'E	600	5.00

Analysis of samples no. 2, 4 and 9 (Table1), each including 25 individuals, revealed similar concentrations of zinc, copper, cadmium and lead (Fig. 1 and Fig. 2).

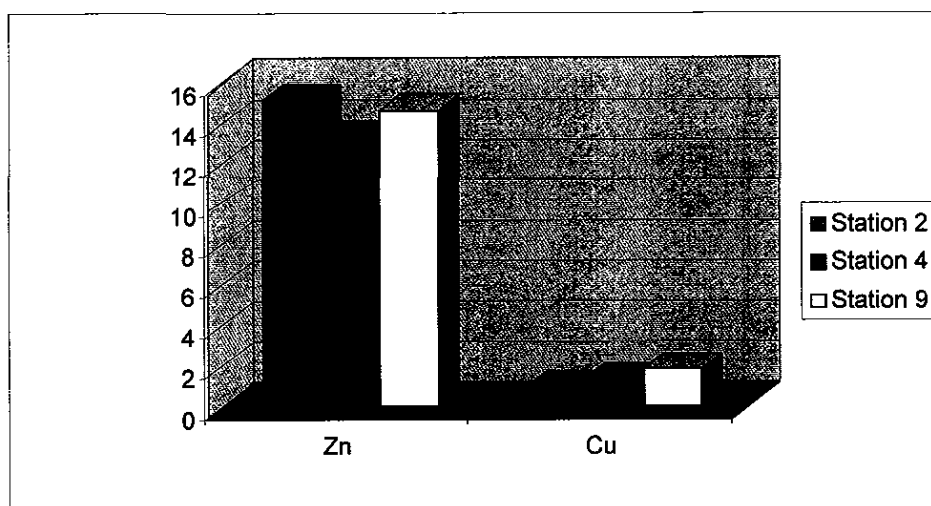


Fig. 1. Average concentration of zinc and copper in mussel tissue of Greenland halibut (milligram per kilogram of dry mass).

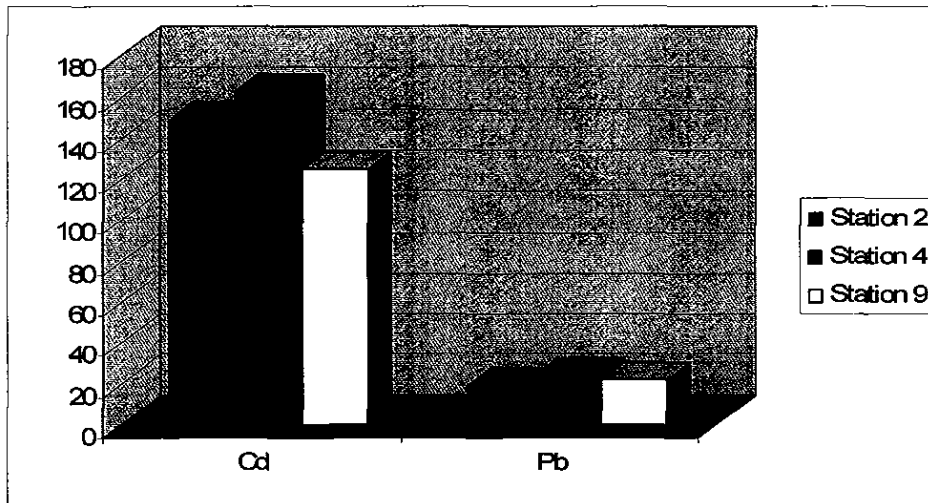


Fig. 2. Average concentration of cadmium and lead in mussel tissue of Greenland halibut (milligram per kilogram of dry mass).

There were no statistically significant differences between samples from different trawls. Small fluctuations between concentration values in case of each sample can be result of different diet, age or sex.

2.0 POPULATION GENETIC ANALYSIS

Samples of Greenland halibut from maximally different geographical locations and depth had been chosen to analysis (Table 1).

Table. 1. Geographic locations of trawls/samples collected for genetic analysis

No. of trawl	Date	Longitude	Latitude	Depth [m]	Time	Longitude	Latitude	Depth [m]	Time
3	07.10.2006	74°07'N	16°05'E	704	08.50	74°19'N	16°13'E	705	4.40
7	09.10.2006	74°52'N	15°30'E	670	02.50	75°05'N	15°16'E	723	4.40
10	10.10.2006	74°50'N	15°35'E	560	23.30	74°35'N	16°04'E	573	5.00
14	11.10.2006	74°51'N	15°35'E	596	04.00	74°38'N	15°59'E	575	5.00
18	12.10.2006	75°22'N	14°19'E	659	07.00	75°35'N	14°04'E	615	4.30
19	12.10.2006	75°34'N	14°08'E	542	13.45	75°48'N	14°01'E	595	4.50
22	13.10.2006	75°42'N	13°57'E	654	11.55	75°27'N	14°08'E	643	4.55
79	05.11.2006	76°21'N	14°29'E	662	04.40	76°08'N	14°09'E	674	4.50
82	06.11.2006	75°30'N	14°04'E	625	02.15	75°16'N	14°22'E	600	5.00
94	09.11.2006	74°16'N	16°13'E	657	18.15	74°01'N	16°00'E	614	5.10

Geographical location and depth of trawl were main condition for maximal representative cross-section of all samples taken during the cruise. From each location seventy – one hundred of individual tissue samples (liver and mussels) were taken. Tissues had been fixed and stored to liquid nitrogen and sent to laboratory.

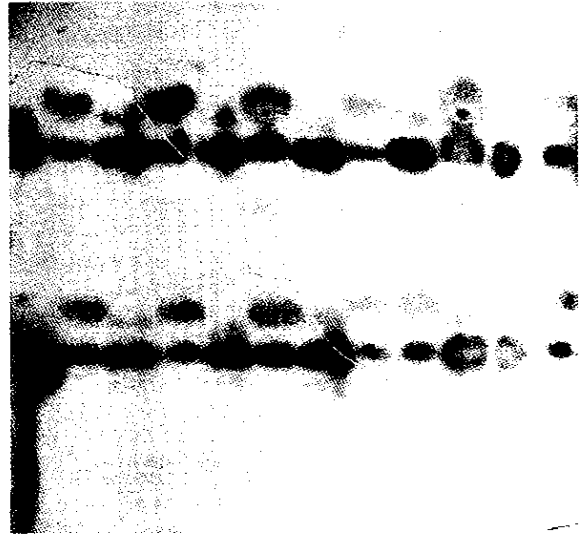
For preliminary studies modified procedures of Herbert and Beaton (1987) have been used. Few enzymatic systems have been evaluated: Alcohol dehydrogenase (ADH, E.C. 1.1.1.1), Adenylate Kinase (AK, E.C. 2.7.4.3), 6-Phosphogluconate Dehydrogenase (G6PDH, E.C. 1.1.1.49), Hexokinase (HEX, E.C. 2.7.1.1), Glutamate-Oxaloacetate Transaminase (GOT, E.C. 2.6.1.1), Isocitrate Dehydrogenase (IDH, E.C. 1.1.1.42), Malate Dehydrogenase (MDH, 1.1.1.37), Lactate Dehydrogenase (LDH, E.C.1.1.1.27), Superoxide Dismutase (SOD, 1.15.1.1), Malic Enzyme (ME, E.C. 1.1.1.40), Esterases (EST, E.C. 3.1.1.1), Phosphoglucomutase (PGM, E.C. 5.4.2.2), Phosphoglucose Isomerase (GPI, E.C. 5.3.1.9), 6-phosphogluconate Dehydrogenase (6PGDH, E.C. 1.1.1.44).

Because of late delivery of samples to laboratory (last days of March 2007) and the time of preparing method and statistical analysis, present results mainly concern the choice of enzyme systems used to further analysis. Six enzymatic systems are chosen: 6-PGDH, AK, GOT, LDH,

PGI, PGM. In case of GOT and PGM there is the difference of enzyme allelic patterns between muscle and liver tissues (Fig. 3).



GOT, muscle and liver



PGM, muscle and liver

In present results there is no genetic difference between samples/populations. Preliminary results revealed weak, non-significant differences only but conclusions concerning the level of isolation between samples and pattern of genetic structure are possible after full analysis that will be performed till the end of 2007.

Literature.

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3.0 PARASITES

This study was carried out on the trawler *Polaris* during cruise in October (07-14.10.2006) and November (03-11.11.2006) of 2006 at Barents Sea area

Table 1. Geographic locations of trawls/samples collected for parasitological analysis

No. of trawl	Data	Longitude	Latitude	Depth [m]	Time	Longitude	Latitude	Depth [m]	Time	No. of fish ^o
5	08.10.2006	74°42'N	13°46'E	665	03.25	74°55'N	15°26'E	756	5.05	10
7	09.10.2006	74°52'N	15°30'E	670	02.50	75°05'N	15°16'E	723	4.40	13
10	10.10.2006	74°50'N	15°35'E	560	23.30	74°35'N	16°04'E	573	5.00	6
11	10.10.2006	74°36'N	16°04'E	605	06.40	74°50'N	15°36'E	532	4.50	2
14	11.10.2006	74°51'N	15°35'E	596	04.00	74°38'N	15°59'E	575	5.00	10
18	12.10.2006	75°22'N	14°19'E	659	07.00	75°35'N	14°04'E	615	4.30	6
19	12.10.2006	75°34'N	14°08'E	542	13.45	75°48'N	14°01'E	595	4.50	3
21	13.10.2006	75°31'N	14°05'E	648	03.50	75°45'N	13°58'E	643	5.05	8
22	13.10.2006	75°42'N	13°57'E	654	11.55	75°27'N	14°08'E	643	4.55	4
86	07.11.2006	74°04'N	15°21'E	617	09.10	73°52'N	15°35'E	690	4.50	6
88	08.11.2006	74°13'N	16°13'E	602	23.25	73°58'N	13°53'E	589	5.00	3
90	08.11.2006	74°13'N	16°12'E	609	13.50	73°58'N	15°55'E	596	5.00	10
92	09.11.2006	74°15'N	16°13'E	589	04.00	74°01'N	15°53'E	630	5.00	8
97	10.11.2006	74°00'N	15°51'E	701	16.55	74°16'N	16°13'E	716	5.00	3

^o 92 fish, 4281 nematodes – *Reinhardtius hippoglossoides* only

Additionally analysed bycatch: *Gadus morhua*, *Sebastes mentella*, *Bathyraja spinicauda*,

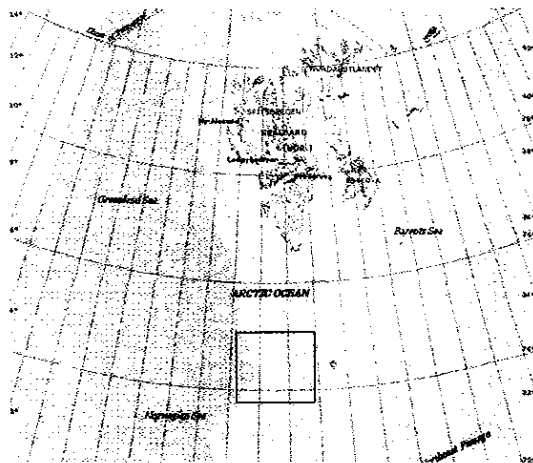


Figure 1. The sampling area.

From one trawl 3 to 13 fish were randomly selected to analysis. The fish, which were damaged, were excluded. After sorting the catch the total length of the fish was measured to the nearest cm and their weight was noted (± 50 g) and fish were gutted. The total of 98 fish was examined. The fish caught ranged in weight between 0,30 – 6 kg and in length from 35 - 83 cm.

Parasites infection

During analysis we focused on nematode infection of Greenland halibut (*Reinhardtius hippoglossoides*) were nematodes and they are the aim of this study. In the visceral cavity of the fish all Anisakidae nematodes visible to the naked eye were collected and counted. The parasite intensity ranged from 1 to 325 and it was divided in six categories: 0 (uninfected), 1 (1-5 individuals), 2 (6-15 individuals), 3 (16-30 individuals), 4 (31-90 individuals) and 5 (>90 individuals). For morphological identification in the laboratory nematodes were collected and preserved in 70% ethanol in 1,5ml eppendorf tubes.

Nematode species and prevalence

The overall prevalence of species belonging to family Anisakidae infected halibut was approximately 98%. Preliminary morphological analysis of nematodes show that Greenland halibut was infected with 3rd larval stages of: *Phocascaris / Contracaecum* spp., *Anisakis simplex* and *Pseudoterranova decipiens*. In the fish with low parasite intensity of infection dominated first two species, in the cases when there were over 30 individuals of parasites in fish – the dominant species was *Pseudoterranova decipiens*. Morphological identification of larval stages of nematodes is very difficult therefore collected during this cruise material will be further analyse using the molecular method (Kijewska *et. al.* 2002). The PCR-RFLP method will be use to determination of larvae of nematodes of Greenland halibut from the Barents Sea area.

Condition factor.

To estimate the condition of Greenland halibut the condition factor was estimated using the weight and the total length of the fish according to formula proposed by Fulton (1902) [Fafioye and Oluajo 1999]:

$$CF = \frac{100W}{L^3},$$

where W = weight in grams and L = total length (cm) of the fish.

There was no significant relationship between fish condition and the intensity of nematode infections (Figure 2).

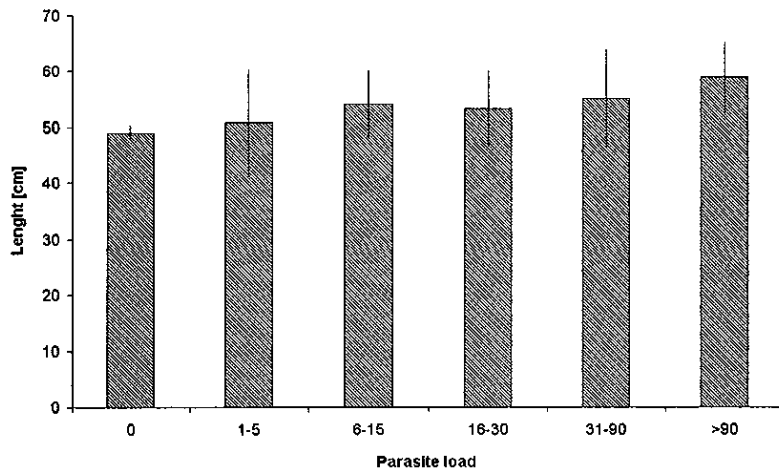


Figure 2. The mean length (\pm SD) of Greenland halibut as a function of parasite intensity of infection.

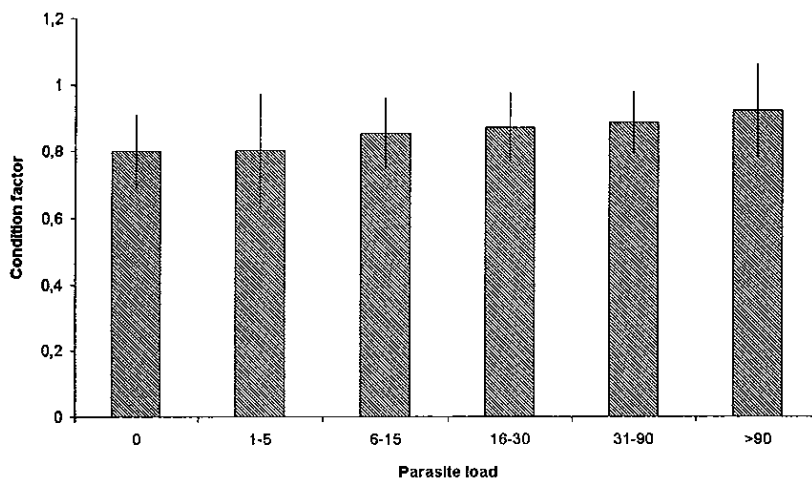


Figure 3. The mean condition factor (\pm SD) of Greenland halibut as a function of parasite intensity of infection.

There is no significant difference between each class of fish and intensity of infection despite slight variation in their food determined by geographical location and the depth. Nematodes belonging to family Anisakidae are characterised by life cycle involving crustacean like euphausiids and other invertebrate species. The Greenland halibut as intermediate host with food ingests the invasive stage what appears as the accumulation of nematodes and the increasing the intensity of infection.

The preferred site of infection was the body cavity and the liver; no specimen could be isolated from the fish muscles. This might be explained by the low water temperatures (Palm 1999). Despite disproportion between males and females, influence of gonad maturity on number of parasites was clear. Fish having mature gonads had been less infected than fish with lower gonads maturity level. There were only two individuals of females with low level of gonad maturity (1-3). Therefore results obtained for this group are not reliable.

Table 1. The relationship among gonad maturity stage and condition factor of fish.

Gender	Gonad maturity level	Condition Factor [CF]	Mean parasites number per fish
Female	1-3	0,950	5
	4-5	0,915	71
Male	1-3	0,906	103
	4-5	0,811	40

The material for present analysis was collected during approximately two weeks. Therefore there was no possibility to make reliable observations if and how above parameters change according to time. The next research in this area is necessary - any changes or migration should be visible only if samples will be collected again. General conclusion is that population on area of trawls done during cruise in 2006 year is almost homogenous.

Literature.

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