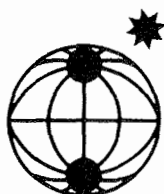


**Scientific Cruise Report of the 1991  
Arctic Expedition ARK VIII/2 of RV „Polarstern“  
(EPOS II: Study of the European Arctic Shelf,  
“SEAS”, of the European Science Foundation)  
Wissenschaftlicher Fahrtbericht über die  
Arktis-Expedition ARK VIII/2 von 1991  
mit FS „Polarstern“**

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**Edited by Eike Rachor  
with contributions of the participants**

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## C. Benthic fish investigations

(N. V. Chernova, Ch. von Dorrien, A. V. Neyelov, L. Saldanha)

Fish were collected from 20 Agassiz (AGT) and 5 Otter trawl (OT) catches. In most cases the total catch was sampled, but at St. 82 a subsample of 50% was taken, and at St.125 the catch was only qualitatively sorted. The catches were made at depths between 100 m (St. 55) and 2100 m (St. 108). For further information on stations see also Table 6.3 - 1. In addition, smaller numbers were caught in fish traps, Passalague nets and Bongo nets (Myctophidae, Gadidae, Zoarcidae).

All trawl samples were divided in three parts for the following investigations

- 1) for experiments with living fishes, as well as food composition analysis and age determinations (Ch. von Dorrien),
- 2) for stomach contents and calorimetric analyses (L. Saldanha),
- 3) for taxonomy, zoogeography and morphological investigations (N. Chernova, A. Neyelov).

Altogether, over 8000 fish weighing more than 180 kg from about 43 species were captured in the trawls (Table 6.3 - 3). These belonged to 29 genera of 14 families. The families are as follows: Cottidae, Zoarcidae, Gadidae (4 genera), Liparidae, Lampaenidae (3 genera), Pleuronectidae (2 genera) while all others (Scorpaenidae, Agonidae, Osmeridae, Anarhichadidae, Rajidae, Cottuncidae, Macrouridae, Cyclopteridae) were represented by a single genus.

The genus *Lycodes* (Zoarcidae) was the most diverse with 9 species. The most common species were *Hippoglossoides platessoides*, *Sebastes marinus* and *Leptagonus decagonus*, which were caught at two thirds of all stations. The species *Triglops nybelini*, *Lycodes pallidus*, *L. eudipleurostictus*, *Boreogadus saida* and *Artediellus atlanticus* appeared at almost half of the stations.

Next 3 pages: Table 6.3 -3: List of fish caught in Svalbard area during the cruise ARK VIII/2 of RV *Polarstern*

(individual fish numbers per species per haul)

Station:		40	42	45	50	55	70	76
Location:		Central	Barents	Sea		Storfjord		Istfjord
Depth:		Front	N Front	S Front	North	Middle	South	
Gear:		200	150	250	180	100	320	340
		OT	AGT	OT	AGT	AGT	AGT	AGT
1 <i>Raja radiata</i>	Starry ray							3
2 <i>Raja hyperborea</i>	Arctic ray							
3 <i>Mallotus villosus</i>	Capelin	2 203		1 312				
4 <i>Gadus morhua</i>	Cod	1		4			1	
5 <i>Melanogrammus aeglefinus</i>	Haddock			1				
6 <i>Boreogadus saida</i>	Polar cod	115	4	84	57	6		
7 <i>Onogadus argentatus</i>	Silvery rockling							
8 <i>Macrourus berglax</i>	Rough rat-tail							
9 <i>Sebastes marinus</i>	Red-fish	8		144			7	5
10 <i>Artedidellus atlanticus</i>	Hookear sculpin	121	11	42				
11 <i>Icelus bicornis</i>	Twohorn sculpin	3	14		11	5		
12 <i>Triglops nybelini</i>	Nybelin's sculpin	52	75	26	1	4		
13 <i>Triglops murrayi</i>	Moustache sculpin							
14 <i>Gymnacanthus tricuspis</i>	Arctic sculpin					9		
15 <i>Cottunculus microps</i>	Polar sculpin							
16 <i>Leptagonus decagonus</i>	Atlantic poacher	60	2	43				17
17 <i>Anarhichas minor</i>	Spotted catfish						1	
18 <i>Lumpenus lampretaeformis</i>	Snake blenny			2		6	2	2
19 <i>Anisarchus medius</i>	Stout eelblenny					23		
20 <i>Leptoclinus maculatus</i>	Spotted snake blenny	6		22				
21 <i>Lycenchelys kolthoffi</i>	Kolthoff's wolfeel							
22 <i>Lycodes eudipleurostictus</i>	Doubleline eelpout	1			1			
23 <i>Lycodes rossi</i>	Threespot eelpout	5	1	1				
24 <i>Lycodes reticulatus</i>	Arctic eelpout							
25 <i>Lycodes pallidus</i>	Pale eelpout	15			17			
26 <i>Lycodes frigidus</i>	Cold-water eelpout							
27 <i>Lycodes seminudus</i>	Longear eelpout							
28 <i>Lycodes squamiventer</i>	Scalebelly eelpout				7			
29 <i>Lycodes esmarki</i>	Esmark's eelpout							
30 <i>Lycodes vahli</i>	Vahl's eelpout						2	5
<i>Lycodes spec.</i>			1					
31 <i>Gymnelis retrodorsalis</i>	Aurora pout							
32 <i>Lycodonotus flagellicauda</i>								
33 <i>Lycodonotus spec.</i>								
34 <i>Liparis fabricii</i>	Gelatinous seasnail		1		52			
35 <i>Liparis gibbus</i>	Dusky seasnail	1	2	3	1	1		3
36 <i>Careproctus reinhardtii</i>	Sea tadpole	1		1			1	
37 <i>Careproctus ranula</i>	Tadpole							
38 <i>Careproctus spec. 1</i>								
<i>Careproctus spec. 2</i>								
39 <i>Paraliparis bathybius</i>	Deepsea seasnail							
40 <i>Eumicrotremus spinosus</i>	Spiny lumpsucker							
41 <i>Hippoglossoides platessoides</i>	Long rough dab	133	12	64	2	6	21	5
42 <i>Reinhardtius hippoglossoides</i>	Greenland halibut							
43 <i>Hippoglossus hippoglossus</i>	Halibut			1				
Rajidae								3
Osmeridae		2 203		1 312				
Gadidae		116	4	89	57	6	1	
Scorpaenidae		8		144			7	5
Cottidae		176	100	68	12	18		
Agonidae		60	2	43				17
Zoaridae		21	2	1	25		2	5
Liparidae		2	3	4	53	1	1	3
Pleuronectidae		133	12	65	2	6	21	5
Other families		6		24		29	3	2
Sum		2 725	123	1 750	149	60	35	40
Number of species		15	10	15	9	8	7	7

Station:	77	78	82	84	86	90	100	101	104	105
Location:	Kongsfjordrenna-Transect			Yermak-Transect			Sjuøyane-Trans.		NE-Transect	
Depth:	Middle	Deep	Djupet	NW	Middle	Shelf	Deep	Slope		
Gear:	960 OT	2 000 AGT	300 AGT	640 AGT	550 AGT	150 AGT	850 AGT	400 AGT	200 AGT	240 AGT
1 <i>Raja radiata</i>										
2 <i>Raja hyperborea</i>	4			1						
3 <i>Mallotus villosus</i>										
4 <i>Gadus morhua</i>										
5 <i>Melanogrammus aeglefinus</i>										
6 <i>Boreogadus saida</i>			4							
7 <i>Onogadus argentatus</i>	14			1						
8 <i>Macrourus berglax</i>					1					
9 <i>Sebastes marinus</i>	2		2			14		5	42	14
10 <i>Artediiellus atlanticus</i>								25	5	13
11 <i>Urophycis bicornis</i>						1				
12 <i>Triglops nybelini</i>									4	14
13 <i>Triglops murrayi</i>						1			3	2
14 <i>Gymnacanthus tricuspidis</i>										
15 <i>Cottunculus microps</i>	2			6			1			
16 <i>Leptagonus decagonus</i>			125	3	7			8		1
17 <i>Anarhichas minor</i>										
18 <i>Lumpenus lampretaeformis</i>			1							
19 <i>Anisarchus medius</i>										
20 <i>Leptoclinus maculatus</i>										
21 <i>Lycenchelys kolthoffi</i>										
22 <i>Lycodes eudipleurostictus</i>	2			33	25		24	4		
23 <i>Lycodes rossi</i>			6							
24 <i>Lycodes reticulatus</i>										
25 <i>Lycodes pallidus</i>	2			2	3		4			
26 <i>Lycodes frigidus</i>		15								
27 <i>Lycodes seminudus</i>				2	8			3		
28 <i>Lycodes squamiventer</i>							2			
29 <i>Lycodes esmarki</i>							2			
30 <i>Lycodes vahli</i>										
<i>Lycodes spec.</i>										
31 <i>Gymnelis retrodorsalis</i>										
32 <i>Lycodon flagellicauda</i>	1						11			
33 <i>Lycodon spec.</i>					1					
34 <i>Liparis fabricii</i>										
35 <i>Liparis gibbus</i>			4							
36 <i>Careproctus reinhardtii</i>				2	1					
37 <i>Careproctus ranula</i>							1			
38 <i>Careproctus spec. 1</i>	1									
<i>Careproctus spec. 2</i>										
39 <i>Paraliparis bathybius</i>	3	5								
40 <i>Eumicrotremus spinosus</i>						1				
41 <i>Hippoglossoides platessoides</i>			3					5		1
42 <i>Reinhardtius hippoglossoides</i>	23									
43 <i>Hippoglossus hippoglossus</i>										
Rajidae	4			1						
Osmeridae										
Gadidae	14		4	1						
Scorpaenidae	2		2			14		5	42	14
Cottidae						2		25	12	29
Agonidae			125	3	7			8		1
Zoarcidae	5	15	6	37	37		43	7		
Liparididae	4	5	4	2	1		1			
Pleuronectidae	23		3					5		1
Other families	2		1	6	1	1	1			
Sum	54	20	145	50	46	17	45	50	54	45
Number of species	10	2	7	8	7	4	7	6	4	6

Station:	107	108	112	119a	125	134	136	141
Location:	(Nansen Basin Slope)			Kvitøya-Renna	Barents-Sea-Transect			
Depth:	350	2 100	850	530	290	280	140	150
Gear:	OT	AGT	AGT	AGT	OT	AGT	AGT	AGT
1 <i>Raja radiata</i>	2							
2 <i>Raja hyperborea</i>								
3 <i>Mallotus villosus</i>	5				1			
4 <i>Gadus morhua</i>								
5 <i>Melanogrammus aeglefinus</i>								
6 <i>Boreogadus saida</i>	5				40	7	10	1
7 <i>Onogadus argentatus</i>	7							
8 <i>Macrourus berglax</i>								
9 <i>Sebastes marinus</i>	975			1	30	1	1	
10 <i>Artedius atlanticus</i>	437				50	16	7	44
11 <i>Icelus bicornis</i>							4	11
12 <i>Triglops nybelini</i>	136			3	50	125	81	33
13 <i>Triglops murrayi</i>								
14 <i>Gymnacanthus tricuspis</i>								
15 <i>Cottunculus microps</i>	17		1	5		1		
16 <i>Leptagonus decagonus</i>	28			20	15	1	2	6
17 <i>Anarhichas minor</i>	4							
18 <i>Lumpenus lampretaeformis</i>								
19 <i>Anisarchus medius</i>								
20 <i>Leptoclinus maculatus</i>								
21 <i>Lycenchelys kolthoffi</i>	9				1			
22 <i>Lycodes eudipleurostictus</i>	2		8	2	4			
23 <i>Lycodes rossi</i>	1							
24 <i>Lycodes reticulatus</i>	15				17		1	1
25 <i>Lycodes pallidus</i>			1	8		18	5	2
26 <i>Lycodes frigidus</i>		1						
27 <i>Lycodes seminudus</i>	6			8	17			
28 <i>Lycodes squamiventer</i>			1					
29 <i>Lycodes esmarki</i>								
30 <i>Lycodes vahli</i>								
<i>Lycodes spec.</i>								
31 <i>Gymnelis retrodorsalis</i>							2	
32 <i>Lycodon flagellicauda</i>								
33 <i>Lycodon spec.</i>								
34 <i>Liparis fabricii</i>							2	
35 <i>Liparis gibbus</i>	1				4			
36 <i>Careproctus reinhardtii</i>	1				1	2	1	
37 <i>Careproctus ranula</i>								
38 <i>Careproctus spec. 1</i>								
<i>Careproctus spec. 2</i>							1	
39 <i>Paraliparis bathybius</i>								
40 <i>Eumicrotremus spinosus</i>								
41 <i>Hippoglossoides platessoides</i>	215			5	30	15	3	10
42 <i>Reinhardtius hippoglossoides</i>	12		1		20			
43 <i>Hippoglossus hippoglossus</i>								
Rajidae	2							
Osmeridae	5				1			
Gadidae	12				40	7	10	1
Scorpaenidae	975			1	30	1	1	
Cottidae	573			3	100	141	92	88
Agonidae	28			20	15	1	2	6
Zoarcidae	33	1	10	18	39	18	8	3
Liparidae	2				5	2	4	
Pleuronectidae	227		1	5	50	15	3	10
Other families	21			5		1		
Sum	1 878	1	12	52	280	186	120	108
Number of species	19	1	5	8	14	9	13	8

## Taxonomy and zoogeography of fishes caught around Spitsbergen

(A. Neyelov, N. Chernova)

Currently 63 species of fishes are known from the area around Spitsbergen from the littoral zone to abyssal depths of about 3000 meters (Andriashev 1954, 1964 (in Russian); Nizovtsev et al. 1976 (in Russian); Pethon 1985; Weslawsky et al. 1990).

43 species of fishes have been caught during the ARK VIII/2 cruise. The list of these species is presented as Table 6.3 - 3.

In the case of the following 5 species records from the area around Spitsbergen extend their known distribution, as previously they were only recorded from Greenland coasts, Iceland and/or Norwegian coasts: *Lycodes esmarki*, *L. squamiventer*, *L. vahli gracilis*, *Lycenchelys kolthoffi*, *Careproctus ranula*.

19 species were only previously known from areas to the south-west or south-east of Spitsbergen, and hence records from this cruise expand their range to the north of Spitsbergen (Table 6.3 - 4).

Two species are probably new to science; these are a *Lycodonus* sp. and a *Careproctus* sp.

In summary, records from this cruise have expanded the known range of 26 species.

While working with specimens of 2 species of *Lycodes* (*L. reticulatus* which was described from Greenland by Reinhardt and *L. rossi* described from Spitsbergen by Malmgren), it became apparent that there was a very large overlap in many characters. We now consider that these may be the same species. Further analysis will be done after the cruise, which, we hope, will establish the validity of this assumption. This will be carried out by N. Chernova, Ch. von Dorrien, A. Neyelov and, if possible, A. Andriashev.



Table 6.3 - 4: Species which are new to the area of investigation (ARK VIII/2).

Rajidae:	1. <i>Raja radiata</i> Donovan
Osmeridae:	2. <i>Mallotus villosus</i> Müller
Myctophidae:	3. <i>Benthoosema glaciale</i> (Reinhardt)
Gadidae:	4. <i>Onogadus argentatus</i> (Reinhardt)
Macrouridae:	5. <i>Macrourus berglax</i> Lacepede
Anarhichadidae:	6. <i>Anarhichas minor</i> Olafsen
Lumpenidae:	7. <i>Anisarchus medius</i> (Reinhardt)
Zoarcidae:	8. <i>Lycodes esmarki</i> Collett 9. <i>L. rossi</i> Malmgren 10. <i>L. pallidus</i> Collett 11. <i>L. eudipleurostictus</i> Jensen 12. <i>L. frigidus</i> Collett 13. <i>L. squamiventer</i> Jensen 14. <i>L. vahli gracilis</i> M.Sars 15. <i>L. seminudus</i> Reinhardt 16. <i>Lycodonus flagellicauda</i> (Jensen) 17. <i>Lycodonus</i> s p. n o v. 18. <i>Lycenchelys kolthoffi</i> Jensen
Cottidae:	19. <i>Artediellus atlanticus</i> Jordan et Evermann 20. <i>Trigllops murrayi</i> Günther
Cottunculidae:	21. <i>Cottunculus microps</i> Collett
Liparididae:	22. <i>Liparis gibbus</i> Bean 23. <i>Careproctus reinhardti</i> Kröyer 24. <i>Careproctus ranula</i> ? (Goode et Bean) 25. <i>Careproctus</i> s p. n o v. 26. <i>Paraliparis bathybius</i> Collett

## Feeding relations and calorimetry

(L. Saldanha)

Samples were collected at the slope stations deeper than 300 m to assess fish feeding strategy and carry out calorimetry on the main species (predators and prey) (in collaboration with Ch. von Dorrien).

Comparisons with results in temperate seas will be made.

The contents of more than 300 guts belonging to 14 fish species were examined aboard and a further 400 fish specimens await examination. All these material will be studied in detail in the laboratory (Guia Marine Laboratory), and numerical methodology will be employed to assess feeding strategies and feeding guilds.

The species studied feed on a large spectrum of prey ranging from ophiurids and sea urchins to other fishes. The main prey for most fish are probably amphipods.

Comparisons of the abundance of prey in the stomach contents and the structure of the benthic communities will help to understand the feeding guilds, prey preference or opportunistic behaviour.

Fish traps were employed 4 times (using capelin as bait) at depths ranging from ca. 300 to 1000 m. One set of fish traps was lost in the Kongsfjorden Transect.

The experiments were ecologically interesting, particularly the last two, in a pack ice zone (St. 100 and 112), at depths of 859 and 980 m (respectively).

Some 22 fishes (1 + 2 + 19) were collected as well as many species of amphipods (that were feeding on the bait) and were still feeding on them when the traps were recovered.

In one or two cases fish were probably feeding on the bait but further examination of the respective stomach contents are still needed.

On the basis of the occurrence in the stomach contents of the fish 18 species (ca. 300 specimens) of benthic invertebrates were selected for calorimetry (ophiurids, echinoids, asteriods, crinoids, polychaetes, amphipods, decapod crustaceans and bivalves). These specimens were collected from the benthic samples taken simultaneously with the fishes.

All specimens were oven dried for later determination of calorific content (at the Guia Marine Laboratory, University of Lisbon).

## Experimental work, population and community studies

(Ch. F. von Dorrien)

Aim of the investigations was the study of the abundance, population dynamics and community structure of the Arctic bottom fish fauna north and east of Svalbard. On selected key species measurements of respiration rates were carried out for energy flux studies.

After identification of the species carried out in cooperation with colleagues from Murmansk (N. Chernova) and Leningrad (A. Neyelov) all specimens were counted and weighed. Based on calculation of the swept area using the ships satellite navigation data, abundance and biomass figures will be calculated. Species composition and distribution patterns of the shallow bottom fish assemblages around Svalbard and in the Barents Sea will be analysed for comparison with the shelf fauna off North East Greenland.

One main aim was the evaluation of growth and production of key-species in the bottom fish fauna. Investigations were carried out on two cottid (*Artediellus atlanticus*, *Triglops nybelini*) and nine zoarcid (genus *Lycodes*) species. For age-class determination the otoliths of 330 specimens were taken out and their sex noted. For these specimens stomach content analysis and calorimetry of the body and food organisms will be carried out in collaboration with L. Saldanha, Lisbon. Additionally 800 specimens of cottid and zoarcid species were frozen at -30 °C. These will be returned to the Institut für Polar Ecology Kiel University, where their age and the composition of their food will be determined. Further on 450 specimens of *Sebastes marinus* were frozen for investigations at the Bundesforschungsanstalt für Fischerei Hamburg.

All living species were sorted from the catches immediately and put into buckets with cold water. Afterwards they were transferred to aquaria in a cooled container (0°C). At the current moment there are living 160 specimens of 18 species; these will be transferred to Kiel and Bremerhaven.

For the determination of the energy expenditure of different species, the respiration of 114 individuals of 11 species were measured. Of these, 8 experiments were carried out in an Intermittent Flow System for a period of between 4 and 14 hours. After a breakdown of this system the other measurements had to be made in closed bottles for shorter periods (2-3h). Individuals were given at least two days to recover from stress of catching. Oxygen tensions were measured with polarographic oxygen sensors. All experiments were carried out in a refrigerator at 0°C. The data will be analysed in detail at the Institute for Polar Ecology in Kiel. Together with the

data on abundance and biomass, these will allow for an evaluation of the energy flux through the bottom fish fauna in Arctic ecosystems.

### Perspectives in benthos work (D. Piepenburg et al.)

The benthological research programme performed during EPOS II comprised a broad variety of studies, with different approaches aimed at different fractions of the bottom fauna. There were, for instance, analyses of distribution and structure of meiobenthic and macrobenthic communities, assessments of micro- and meso-scale dispersion patterns of benthic populations, and measurements of the metabolic performance both on the level of communities (micro- and meiobenthos) and individuals (macrobenthos). The various investigations were carried out by a joint working group of several scientists collaborating in the taking and initial processing of samples as well as in their evaluation and interpretation.

It is planned that the latter step, the evaluation of the data and the synoptic interpretation of the various results, will be performed during workshops in order to foster the interdisciplinary cooperation and promote joint publications integrating various aspects of the investigations carried out during SEAS.

We think that a "synoptic" symposium convening all working groups of EPOS II should be prepared by smaller "within-working-group" workshops. With regard to the investigations on benthic ecology we propose three consecutive "small" workshops, i.e. workshops of only four to eight members of the benthic working group:

- (1) A workshop dealing with the proper identification of the species caught:

The principal objective of this workshop is to produce a reliable species list of the trawl catches, corer samples, and bottom images. This list will serve as the basis of the zoogeographical examinations and of the subsequent analyses of community distribution and composition. The workshop should take place after the first sorting of the samples, approximately in the second half of 1992. For convenience, it should be held at a place with easy access to taxonomic experts specialized in the Arctic fauna. To our opinion, the natural choice would be the Zoological Institute in St. Petersburg, Russia.

- (2) A workshop to ensure the necessary standardization of the statistical data analyses:

One goal of the benthic investigations is to outline the distribution and structure of distinct bottom species assemblages in relation to the environmental conditions. These studies involve the application of several multivariate techniques which are relatively difficult to perform. We propose that this workshop attended by four members of the benthic working group should take place after summer 1992. Since at the Plymouth Marine Laboratory (UK) there is internationally acknowledged expertise concerning the use of multivariate statistics in marine ecology we propose Plymouth as location for this workshop.

- (3) A workshop on the comparison of the oxygen uptake of the sediment and of the macrofauna:

During EPOS II measurements of oxygen uptake were performed both on the level of sediment cores inhabited by meio- and microbenthos communities and of single macrofauna specimens. Estimates of the energy flow through the populations of certain macrofauna populations may be derived by extrapolation from the individual respiration rates and the absolute abundance figures obtained by underwater imaging (epifauna) or corer sampling (endofauna). These values can then be related to those from measurements of sediment cores taken at the same stations. Eventually, it will be possible to give good estimates of a total benthic energy budget comprising components from a broad size range of benthic organisms. This workshop should be held at the end of 1992, either in Poland or in Gothenburg (Sweden) or in Kiel (Germany).