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PRELIMINARY ESTIMATION OF ABUNDANCE OF JUVENILE *NOTOTHENIIDAE*  
AND *CHANNICHTHYIDAE* WITHIN KRILL SWARMS EAST OF SOUTH GEORGIA

WSTĘPNA OCENA LICZEBNOŚCI MŁODOCIANYCH *NOTOTHENIIDAE*  
I *CHANNICHTHYIDAE* WYSTĘPUJĄCYCH W KONCENTRACJACH KRYLA  
NA WSCHÓD OD GEORGII POŁUDNIOWEJ

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The abundance of juvenile *Nototheniidae* and *Channichthyidae* within Antarctic krill concentrations occurring east of South Georgia was investigated. In krill catches, the occurrence of six species of fish was noted. *Patagonotothen larseni* was the most abundant among them.

INTRODUCTION

Investigation were conducted between April 11 and 17, 1981 on the research vessel Profesor Siedlecki. Materials were collected mainly of Clerke Rocks (Fig. 1), where krill exploitation by the fishing fleet centred at that time. The objective of the investigations was to emphasize the need to protect juvenile fish, especially those belonging to species of great commercial or ecological importance, occurring in intensively exploited krill concentrations.

The existing literature contains very few analyses dealing with the occurrence of juvenile fish in krill catches. The problem was investigated by Rembiszewski et al. (1978) during exploratory fishing for krill in the Drake Passage and the Scotia Sea. Such investigations, supplemented with abundance estimates of fish, were repeated in 1981 in the Bransfield Strait by Ślósarczyk and Rembiszewski (in press). Similar investigations were also conducted by Ślósarczyk (in press) off the Balleny Islands.

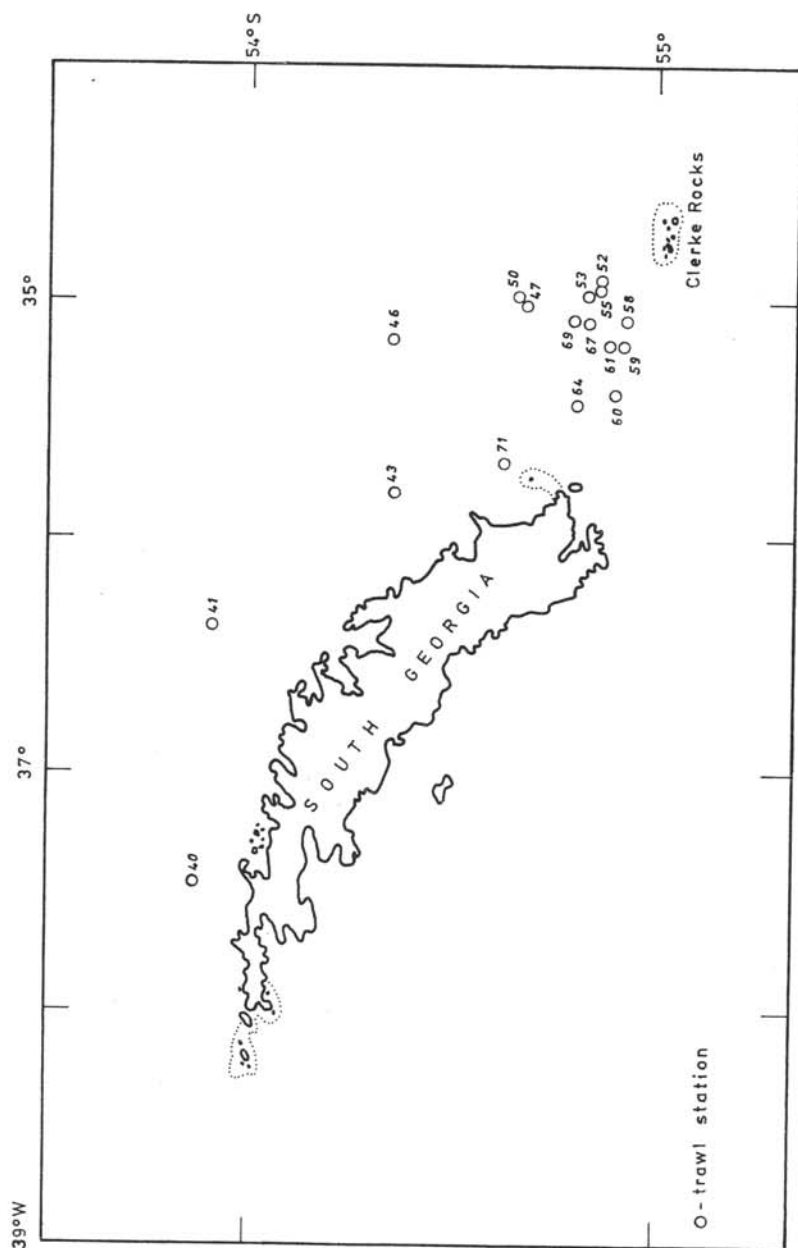


Fig. 1. The distribution of trawl stations of r/v "Professor Siedlecki" east of South Georgia in April 1981

## MATERIAL AND METHOD

The material for the investigations was collected during exploratory fishing for krill with pelagic trawl (type 40/75 x 4) with a 40-m head line, a finemeshed inset in the belly (mesh size 20 mm) and in the codend (mesh size 11 mm). The investigations covered 17 hauls, from which random samples of krill and fish weighing 15–90 kg (depending on the size of catch and the abundance of fish) were collected for estimations of the abundance of juvenile fish in krill concentrations. The samples were taken from several places from the catch on board the vessel since – in the light of observations made so far – the mixing of krill and fish is not uniform. Each sample was carefully sorted to separate the fish present. Two measures of fish abundance in krill concentrations were applied: number of fish in 1000 kg of krill catch and number of fish caught in one hour of trawling.

## RESULTS

In 15 krill hauls, the occurrence of juvenile stages of *Patagonotothen larseni*, *Notothenia gibberifrons*, *Trematomus vicarius* (?), *Champscephalus gunnari*, *Chaenoccephalus aceratus* and *Pseudochaenichthys georgianus* was noted. The most frequent and most abundant was *P. larseni*. The results of the investigations are presented in Table I and Figure 2.

*Patagonotothen larseni* occurred almost within the entire investigated region. Over the northern shelf of South Georgia (hauls no. 40 and 41), juvenile stages of these fish measuring 27–39 mm SL were observed. The number of fish in krill catches was relatively large, reaching 667 ind. (t and 2 500 ind.) hour fished. Off Clerke Rocks, juvenile and sometimes also mature fish measuring 24–42 and 54–102 (128) mm SL were observed. Apart from two hauls, in which no *P. larseni* were found, the abundance of these fish in krill catches fluctuated between 115 and 4,339 ind. (t and 179–26,003 ind.) hf. Juvenile individuals of *Notothenia gibberifrons* (33–41 mm SL) were noted in eight krill hauls, along the whole shelf of South Georgia. Their number estimated in four hauls fluctuated from 78 to 783 ind. (hf. and 15–63 ind.)t (with the exception of haul no. 71) (Table I). Individual juvenile specimens of *Trematomus vicarius* (Å) (30–33 mm SL) were found in four hauls, north of the island and off Clerke Rocks. Juvenile *Champscephalus gunnari* (52–106 and 150–200 mm SL) were observed in nine hauls; in two of them their number was estimated at a relatively high level – 10,653 to 12,759 ind/hf (1,295 ind./t in the former case) (Table I). Juvenile *Chaenoccephalus aceratus* (63–99 mm SL) were noted in nine hauls in two points north of island (hauls no. 40 and 41) and off Clerke Rocks. At this second fishing ground they were quite abundant in four hauls: 38–3, 720 ind./t and 499–4,240 ind./hf. Juvenile stages of *Pseudochaenichthys georgianus* (38–43 mm SL) were present in four hauls, both north of the island and off Clerke Rocks. In random samples specimens of *P. georgianus* were found only in haul no. 71, where their abundance was estimated at 26 ind./hf.

Table I

Abundance of juvenile *Nototheniidae* and *Channichthyidae* in the krill catches off South Georgia in April 1981 (r/v "Professor Siedlecki")

Haul	Yield of krill (kg per 1h)	Sample weight (kg)	<i>Patagonotothen larseni</i>		<i>Notothenia gibberifrons</i>		<i>Trematomus vicarius</i> (?)		<i>Champsocephalus gunnari</i>		<i>Chaenocephalus aceratus</i>		<i>Pseudo-channichthys georgianus</i>	
			a	b	a	b	a	b	a	b	a	b	a	b
40	4 200	31.8	63	264	+		+							
41	3 750	48.0	667	2 500	21	78	-		+					+
43	700	16.0	+				-		+					-
46	9 600	48.0	+				+		-					-
47	15 000	90.0					-		-					-
50	2 570	26.0	115	297			+		-					-
52	800	32.0	531	425			-		-					-
53	10 800	65.0	615	6 646	15	166	-		+		3 720			+
55	10 670	80.0					-		-		46			-
58	8 220	79.5	126	1 034			-		1 295		516			-
59	660	40.4	272	179			-		322					-
60	6 000	24.2	4 339	26 033	63	375	+		10 653		4 240			+
61	15 600	26.0	462	7 200			-		212					-
64	13 710	26.3	646	8 865			+		+					-
67	15 430	26.9	297	4 588			-		-					-
69	13 500	26.3	1 407	18 992			-		-					-
71 <sup>x</sup>	10	13.8		835		757	-		+		38			-
								26	12 759		513			26

a number per 1 t of krill

b number per 1 hour fished

+ juveniles found outside the sample (abundance not estimated)

- no juveniles in krill catch

x haul outside the concentration of krill (index: N/1 t not estimated)

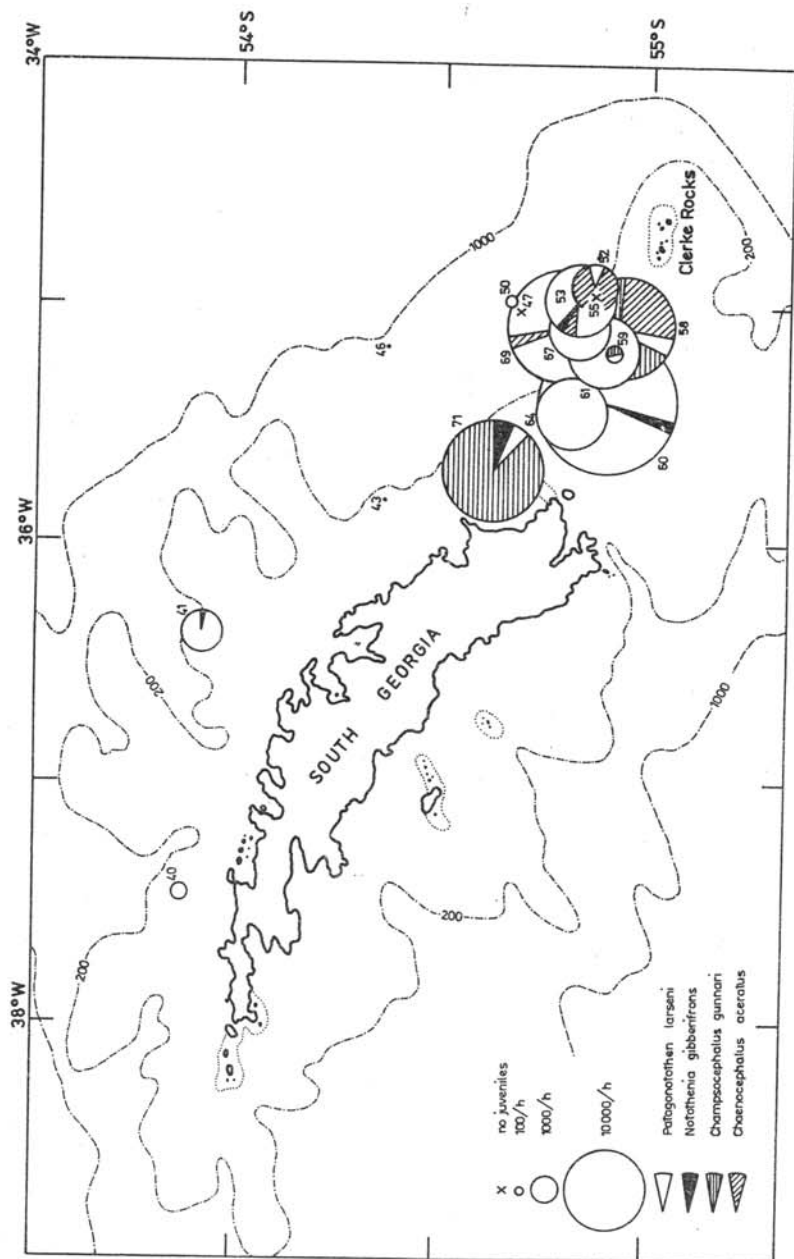


Fig. 2. The abundance of juvenile *Nototheniidae* and *Channichthyidae* within krill concentrations east of South Georgia in April 1981

Haul no. 71 is worth presenting separately. It was made with a pelagic trawl off Filchner Rocks, outside the krill concentrations. About 14,600/hf juvenile *Channichthyidae* and *Nototheniidae* were caught there (Table I). Fish were counted exactly because of scarcity of krill in the catch. Taking into account that was a single experiment, the result seem comparable with the estimated mean abundance of fish (about 5,880 ind./hf) in krill catches made off Clerke Rocks. Stormy weather did not permit to repeat such a haul as the vessel was forced to leave the grounds prematurely. Juvenile *Ch. gunnari* predominated in haul no. 71. However, the high share of juvenile *N. gibberifrons* and higher than usual occurrence of juvenile *P. georgianus* should be noted.

## DISCUSSION

Waters around South Georgia were investigated a number of times by Polish Antarctic expeditions. Ichthyological investigations carried there in 1977, 1979 and 1981 revealed that in krill concentrations east of the island there were abundant populations of juvenile fish belonging mainly to the species *Patagonotothen larseni*, *Champocephalus gunnari* and *Chaeocephalus aceratus* (Kompowski 1980 a, b; Wolnomiejski and Boberski, unpublished material).

On April 11, 1977, off Clerke Rocks, Kompowski (1980 a) noted massive occurrence of juvenile (18–23 cm TL) *Ch. gunnari* in krill concentrations. In several hauls these fish constituted about 20% of the catch weight (amounting to 2 tons in a haul). In the investigated period, the exploitation of krill to be processed into meal was carried out by a large fishing fleet and on this day considerable numbers of these juvenile fish were observed in krill catches on many vessels (Kompowski, 1980 a). In April 1981, *Ch. gunnari* of similar size (15–20 cm SL) comprised in one haul 5.8% of the catch (about 460 kg). It was estimated that in both cases 1 ton thus destroyed fish fry could contain about 22,350 individuals.

In 1979, also in April, over the shelf east of South Georgia, Wolnomiejski and Boberski (unpublished material) observed the frequency of occurrence and the abundance of juvenile fish during investigations of krill. In three hauls, in which these fish were very numerous, they determined the abundance of juvenile *Patagonotothen larseni* (41–48 mm SL) in krill catches to be 8,800, 14,000 and 45,000 ind./t. The area where these observations were made is a little farther north (54°00'–54°30'S) than the area investigated by Kompowski but in the 1979/1980 season there were also large exploited krill concentrations there (Wolnomiejski, personal communication).

Extensive investigations into the occurrence and abundance of juvenile fish in krill concentrations were carried out by Ślósarczyk and Rembiszewski (in press) during the FIBEX programme, in February and March, 1981. In krill catches in the Bransfield Strait and in the southern part of the Drake Passage they noted the presence of abundant ichthyofauna consisting of 37 species of fish, mainly in juvenile stages, belonging to 25 genera and 10 families (Rembiszewski and Ślósarczyk, unpublished material). These

fish were however not as numerous as off South Georgia: the most abundant *Chionodraco rastrospinosus* was found in numbers not exceeding 170 ind./t and 1,811 ind./hf.

Outside the Atlantic sector of the Southern Ocean, similar observations were made by Ślósarczyk (in press) off the Balleny Islands. In krill catches made there in late January and early February, 1978 he noted – besides several other species of fish – the presence of juvenile *Trematomus bernacchii*, the number of which reached 4,438 ind./0.1 t and 9,421 ind./hf (mean values in the region were 705.2 ind./0.1 t and 1,818 ind./hf). It should also be noted that the areas off these islands, just like the shelf waters off South Georgia, have become traditional krill fishing grounds.

Mass-scale commercial exploitation of concentrations of planktonic crustaceans, which are the habitat and the food of juvenile fish, is a new trend in the fisheries. It is still too early to evaluate the impact of krill catches on the populations of juvenile fish; the observations made so far are short-term and incomplete. That is why, in the future, the impact of the quickly-developing krill fishery should be investigated more often and more fully so that, besides the expected advantages, no damages would be caused to the already exploited ichthyofauna and the whole Antarctic ecosystem.

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WSTĘPNA OCENA LICZEBNOŚCI MŁODOCIANYCH  
 NOTOTHENIIDAE I CHANNICHTHYIDAE WYSTĘPUJĄCYCH W KONCENTRACJACH  
 KRYLA NA WSCHÓD OD GEORGII POŁUDNIOWEJ

## STRESZCZENIE

Observacje i badania zostały przeprowadzone w kwietniu 1981 r. na łowiskach Georgii Południowej. Celem badań była ocena liczebności ryb młodocianych w intensywnie eksploatowanych przez flotę rybacką koncentracjach kryla antarktycznego.

Krótki okres obserwacji pozwolił na zbadanie 17 zaciągów krylowych (Fig. 1). Pobrane z nich próby losowe kryla i ryb sortowano w poszukiwaniu larwalnych i młodocianych stadiów ryb antarktycznych.

W połowach kryla stwierdzono występowanie 3 gatunków ryb z rodziny *Nototheniidae*: *Patagonotothen larseni*, *Notothenia gibberifrons* i *Trematomus vicarius* (?) oraz 3 gatunków z rodziny *Channichthyidae*: *Champscephalus gunnari*, *Chaenocephalus aceratus* i *Pseudochaenichthys georgianus*. Spośród wymienionych gatunków najliczniej notowany był *P. larseni*. Wyniki badań przedstawia tabela I i rysunek 2.

Rezultaty obserwacji, zgodne z wynikami wcześniejszych badań, wskazują na potrzebę ochrony młodocianych ryb antarktycznych w warunkach rozwijającej się w szybkim tempie przemysłowej eksploatacji kryla.

## В. Слосарчик

ПРИБЛИЖЕННАЯ ОЦЕНКА ЧИСЛЕННОСТИ МОЛОДИ NOTOTHENIIDAE И  
 CHANNICHTHYIDAE ВСТРЕЧАЕМЫХ В КОНЦЕНТРАЦИЯХ АНТАРКТИЧЕСКОГО  
 КРЫЛЯ ВОСТОЧНЕЕ ЮЖНОЙ ГЕОРГИИ

## Резюме

Наблюдения и исследования проводились в апреле 1981 г. на банках Южной Георгии. Целью исследования была оценка численности молоди рыб в интенсивно эксплуатируемых промысловым флотом концентрациях антарктического криля.

Ограниченный срок наблюдений позволил на исследование 17 крилевых тралей (рис. 1). Взятые из этих тралей пробы криля и рыб, сортировались для выделения молоди и личиночных стадий антарктических рыб.

В массе уловов криля обнаружено присутствие трех видов рыб семейства *Nototheniidae*: *Patagonotothen larseni*, *Notothenia gibberifrons* и *Trematomus vicarius* (?), а также трех видов из семейства *Channichthyidae*: *Champscephalus gunnari*, *Chaenocephalus aceratus*, *Pseudochaenichthys georgianus*. Среди названных рыб наиболее численным оказался *P. larseni*. Результаты исследований показаны в табл. 1 и на рис. 2.



Исследования, также как и ранее проведенные наблюдения, указывают на необходимость охраны молодежи антарктических рыб в условиях быстро развивающегося промысла антарктического кряля.

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