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Fish parasitology

***EUBRACHIELLA ANTARCTICA* (QUIDOR, 1906) (COPEPODA)—
LEVELS OF INFECTION IN SELECTED FISH SPECIES
OF THE FAMILY NOTOTHENIIDAE**

***EUBRACHIELLA ANTARCTICA* (QUIDOR, 1906) (COPEPODA) –
STAN ZARAŻENIA NIEKTÓRYCH GATUNKÓW RYB
Z RODZINY NOTOTHENIIDAE**

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Infection levels of six fish species—representing the family Nothoteniidae—with external parasite *Eubrachiella antarctica* (Quidor, 1906) (Copepoda) were studied in the season of 1978/79. The prevalence and the intensity of infection of individual fish species on different fishing grounds of the Atlantic sector of Antarctic were determined. In addition the density analysis of the parasite occurrence on different parts of fish body was carried out as well as the relationship between the infection parameters and the body length of the studied fish species.

INTRODUCTION

In the second half of the 1970s the interest of the world fisheries was focused on the living resources of Antarctic. Along with the intensification of the catches the scientific research efforts increased on the size of resources, the biology of exploited species, and their parasites.

Parasitic copepod *Eubrachiella antarctica* (Quidor, 1906) of the family Lernaeopodidae Olsson, 1869 has been one of external parasites more frequently occurring on the Antarctic fishes.

Data on the fish infection with this parasites were published by Kock and Möller (1977), Kock (1979), Siegel (1980, 1980a), Sosiński and Janusz (1986), Rokicki and Skóra

(1986), Rokicki and Zdzitowiecki (1991), El Mehrawy et al. (1993). The host fishes were: *Champscephalus gunnari* Lönnberg, 1905, *Chaenocephalus aceratus* Lönnberg, 1906, *Pseudochaenichthys georgianus* Norman, 1937, *Chionodraco rastrispinosus* De Witt et Hureau, 1979, *Chaenodraco wilsoni* Regan, 1914 of the family Channichthyidae and *Dissostichus eleginoides* Smitt, 1898, *Dissostichus mawsoni* Norman, 1937, *Notothenia* (*Notothenia*) *rossi* Richardson, 1884, *Notothenia* (*Gobionotothen*) *gibberifrons* Lönnberg, 1905—of the family Nototheniidae.

In the season of 1978/79, during the IVth Polish Marine Antarctic Expedition on *R/V Profesor Siedlecki* (Sosiński 1979) in the frames of biological studies observations were conducted on the occurrence of *Eubrachiella antarctica* (Quidor, 1906) in selected fish species. The results acquired during the above-mentioned expedition were published on five fish species representing the family Channichthyidae (Sosiński and Janusz 1986) and *Notothenia* (*Gobionotothen*) *gibberifrons* Lönnberg, 1905 of the family Nototheniidae (Rokicki and Skóra 1986).

The present paper contains data on the hitherto unpublished results on the infection with the above-mentioned parasite of the remaining six fishes of the family Nototheniidae which were studied during that cruise, namely *Dissostichus eleginoides* Smitt, 1898, *Notothenia* (*Notothenia*) *rossi* Richardson, 1884, *Notothenia* (*Notothenia*) *neglecta* Nybelin, 1951; *Notothenia* (*Lepidonotothen*) *kempi* Norman, 1937; *Patagonotothen brevicauda guntheri* (Norman, 1937), and *Pagothenia hansonii* (Boulenger, 1902).

MATERIAL AND METHODS

The present survey was carried out within 1978–1979 (December 1978 to March 1979) in the Atlantic sector of Antarctic (Fig. 1). The samples were taken by *R/V Profesor Siedlecki* during the Fourth Polish Marine Antarctic Expedition. A total of 1 290 fishes were examined for presence of *Eubrachiella antarctica*. Detailed numbers of the fishes studied on individual fishing grounds is given in Tab. 1.

Table 1

Number of nototheniid fishes examined during the Antarctic Expedition of 1978/79

Species	Date	Fishing area				Total
		Shag Rocks	South Georgia	Elephant Islands	South Shetland	
<i>Dissostichus eleginoides</i>	Jan, Mar 79	68	101			169
<i>Notothenia</i> (<i>Notothenia</i>) <i>rossi</i>	Jan, Mar 79		202			202
<i>Notothenia</i> (<i>Notothenia</i>) <i>neglecta</i>	Mar 79				31	31
<i>Notothenia</i> (<i>Lepidonotothen</i>) <i>kempi</i>	Feb 79			100	300	400
<i>Patagonotothen brevicauda guntheri</i>	Jan, Mar 79	200				200
<i>Pagothenia hansonii</i>	Mar 79		288			288
Total		268	591	100	331	1290

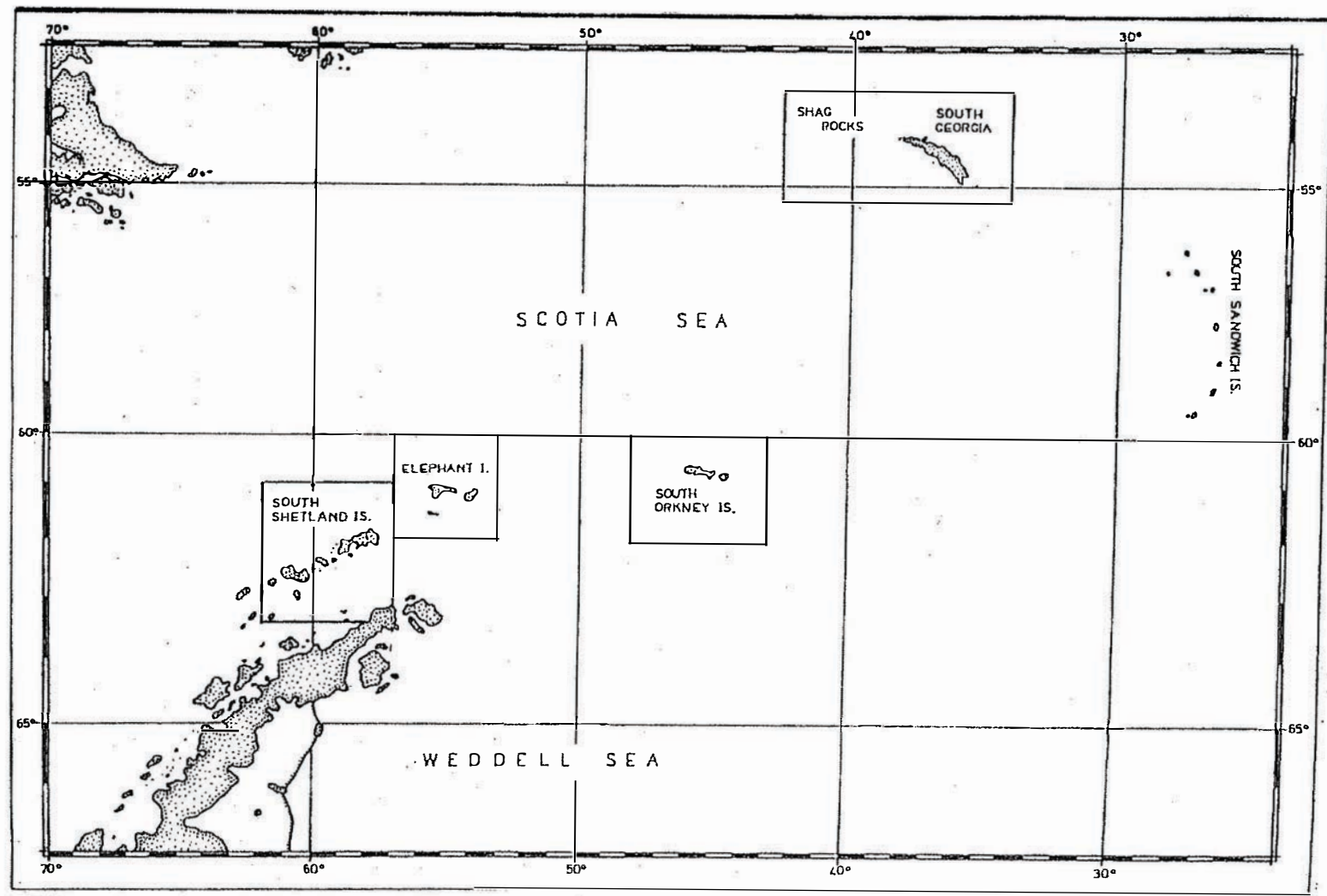


Fig. 1. The areas of study

Immediately after capture the fishes were subjected to routine ichthyological procedures followed by the search for the parasite. Distribution as well as numbers of the copepods on different body parts (buccal cavity, gills, skin, and individual fins) was recorded, and the basic infection parameters such as prevalence and intensity, were calculated. Two fish species exhibiting particularly highly parasitized were studied for possible relationship between the infection level and their total length. The fish were measured to the nearest 1 cm.

To make the biological description of the studied fish populations more complete, their gonad maturity was determined using 8 degree Maier scale.

The names of the fishes follow the key of FAO/CCAMLR (Fisher and Hureau 1958).

RESULTS

Dissostichus eleginoides Smitt, 1898

The observations were carried out in January 1979 on the Shag Rock fishing grounds and in March—off South Georgia.

Shag Rocks. The length of the studied fish ranged from 30 to 145 cm. The majority of them were 37 to 42 cm long. The fish were sexually immature with their gonads in 1st or 2nd stage. Only four specimens exceeding 100 cm had gonads in 3rd and 4th stage. The population studied was highly parasitized with the prevalence amounting to 79.4% and the mean intensity of 3.6 (Tab. 2). The parasites were found in the buccal cavity only (Tab 3).

South Georgia. The specimens caught in this area were relatively bigger. Their length ranged from 45 to 136 cm. Their mean modal length was 55 cm. Similarly as the fish from the Shag Rock they had their gonads representing 1st and 2nd stage. Only the gonads of four largest specimens were in 3rd and 4th stage. The infection level was higher than on the Shag Rock fishing ground. The prevalence was 84.2% while the mean intensity was 4.0 (Tab. 2). All parasites were located in the buccal cavity (Tab. 3).

The combined prevalence and mean intensity for both fishing grounds calculated separately for each length class is shown on Fig. 2. No clear relationship between the infection parameters and the fish length is visible. It may be a result of a small number of the fish longer than 65 cm.

Notothenia (Notothenia) rossi Richardson, 1884

The observations were carried out in January and March 1979 off South Georgia. In both periods the length structure of the fish was similar, ranging from 34 to 70 cm. The specimens caught in March were more sexually mature. More than 50% of them had gonads in stages 4th and 5th. The infection parameters of this species were relatively high with prevalence amounting to 59.4% and mean intensity of 18.9 (Tab. 2). The fish caught in

January were relatively more parasitized. Within the entire period of study the parasites occurred in the buccal cavity only (Tab. 3)

Fig. 3 shows a positive correlation between the fish length and the prevalence. The correlation coefficient, however, is low ($r = 0.3486$). More distinct is the increase of the intensity (abundance) associated with the fish length ($r = 0.6507$). This relationship is best described by a multinomial curve of the determination coefficient $r^2 = 0.4722$.

Notothenia (Notothenia) neglecta Nybelin, 1951

This species occurs on the fishing grounds located more south. Only 31 specimens of this fish caught in March 1979 were surveyed. They were collected off King George Island within South Shetland Islands. Their length ranged from 35 to 53 cm and their gonads were in stage 4, which indicated preparations for spawning. The prevalence was 29% while mean intensity was 2.6 (Tab. 2). All parasites were attached in the mouth cavity (Tab. 3).

Notothenia (Lepidonotothen) kemp Norman, 1937

The studies covered the specimens caught in February 1979 off Elephant and South Shetland Islands. The fish surveyed were sexually immature with gonads in 1st and 2nd stage. Out of 100 specimens collected off Elephant Island no one harbored *E. antarctica*. Out of 300 fish collected off South Shetland Island only one had two parasites on its caudal fin (Tabs. 2, 3).

Patagonototen brevicauda guntheri (Norman, 1937)

The survey was carried out off Shag Rocks in January and March 1979. Out of 100 fish examined in January and 100 in March, only a single fish in each month was infected with *E. antarctica* attached to the fins (Tab. 3). The length of the fish ranged from 10 to 22 cm. The fish caught in January showed maturation of the gonads in progress. About 37% of the specimens had gonads at 3rd stage of maturity. In March as many as 54% of the fish had their gonads at 3rd and 4th stage.

Pagothenia hanson (Boulenger, 1902)

The observations were conducted in March 1979 off South Georgia Island. The fish represented length classes from 16 to 40 cm. In this period, accelerated process of gonad maturation was observed. While in mid March 21% of the fish had gonads in 3rd and 4th maturity stage—by the end of March, the gonads of as many as 31% of specimens were at 3rd, 4th, 5th, and 6th stage. The population surveyed was characterized by a low prevalence (5.3%) and intensity (2.2). The parasites were located mainly on the caudal fin. (Tab. 3).

Table 2

Prevalence and mean intensity of infection of the nototheniid fishes with *Eubrachiella antarctica*

	Fishing area							
	Shag Rocks		South Georgia		Elephant Islands		South Shetland	
	P	I	P	I	P	I	P	I
<i>Dissostichus eloginoides</i>	79.4	3.6	84.2	4.0				
<i>Notothenia (Notothenia) rossi</i>			59.4	18.9				
<i>Notothenia (Notothenia) neglecta</i>							29.0	2.6
<i>Notothenia (Lepidonotothen) kempfi</i>					0.0	0.0	0.3	2.0
<i>Patagonotothen breviceauda guntheri</i>	1.0	1.5						
<i>Pagothenia hansonii</i>			5.3	2.2				

P—prevalence; I—mean intensity of infection

Table 3

Prevalence of *Eubrachiella antarctica* on the nototheniid fishes

Species	Area	Prevalence (%)						No. of parasites
		Buccal cavity	Skin	Dorsal fin	Caudal fin	Pectoral fin	Ventral fin	
<i>Dissostichus eloginoides</i>	Shag Rocks	100.0						196
<i>Dissostichus eloginoides</i>	South Georgia	100.0						338
<i>Notothenia (Notothenia) rossi</i>	South Georgia	100.0						2264
<i>Notothenia (Notothenia) neglecta</i>	South Shetland	100.0						23
<i>Notothenia (Lepidonotothen) kempfi</i>	South Shetland				100.0			2
<i>Patagonotothen breviceauda guntheri</i>	Shag Rocks			66.7	33.3			3
<i>Pagothenia hansonii</i>	South Georgia		15.2	3.0	57.6	15.2	9.1	33

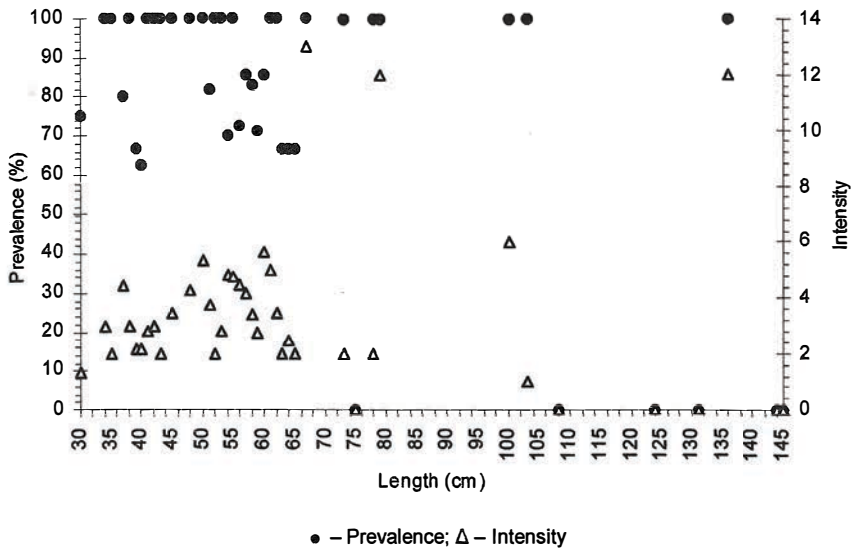


Fig. 2. Prevalence and mean intensity of infection of *Dissostichus eleginoides* with *Eubrachiella antarctica* in individual length classes

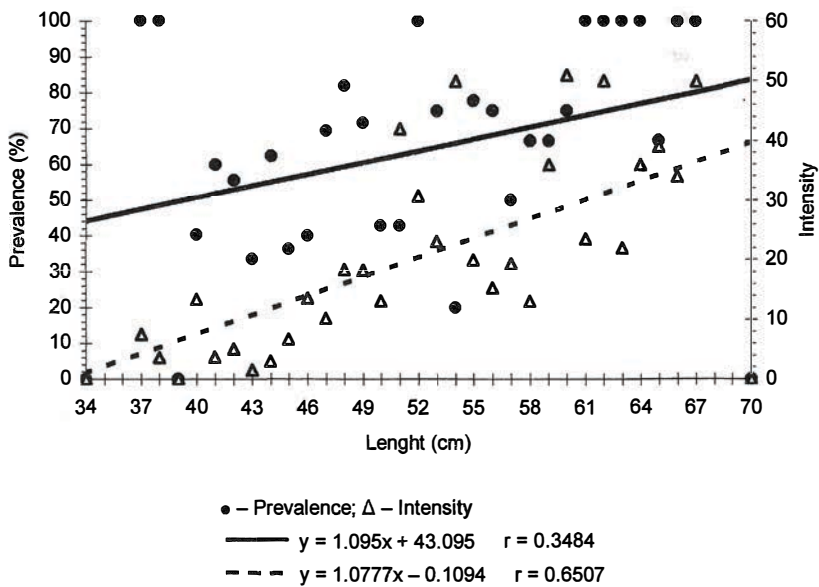


Fig. 3. Correlation between the prevalence and mean intensity of infection of *Notothenia rossi* with *Eubrachiella antarctica* in individual length classes

RECAPITULATION AND CONCLUSIONS

The present survey conducted in the Atlantic sector of Antarctic in the season of 1978/79 revealed that six species of the family Nototheniidae showed substantial differences in the infection levels with *Eubrachiella antarctica* (Quidor, 1906). The highest infection rate was demonstrated by *Dissostichus eleginoides* Smitt, 1898 and *Notothenia* (*Notothenia*) *rossi* Richardson, 1884. Slightly less parasitized was *Notothenia* (*Notothenia*) *neglecta* Nybelin, 1951. *Pagothenia hansonii* (Boulenger, 1902) showed low infection levels. The remaining species i.e. *Notothenia* (*Lepidonotothen*) *kempii* Norman, 1937 and *Patagonotothen breviceuda guntheri* (Norman, 1937), depending on the collection site, did not have the parasites at all or their prevalence was close to 1%.

The parasites were distributed on different body parts of the fishes. A characteristic feature was observed, that the fish species of low infection rates had the parasites attached only to their fins, while in heavily parasitized fish species, the infection was limited to the mouth cavity.

Two of the presently discussed fish species of the family Nototheniidae were also widely studied for their parasites in other seasons, which makes the results comparable.

The occurrence of *E. antarctica* on *Dissostichus eleginoides* in the Atlantic sector of Antarctic was studied in the seasons of 1975/76 (Kock and Möller 1977); 1977/78 (Siegel 1980; El Mehlaoui et al. 1993); 1978/79 (the present work); 1986/87 (El Mehlaoui et al. 1979). The surveys were carried out on the Burdwood Bank, off Shag Rocks, and off South Georgia. The results indicated that the infection rates in these areas was high and it exceeded 80%. Only off South Georgia in the season of 1986/87 the infection rate was lower (66.1%). In the same area, in the season of 1975/1976 the prevalence was from 56 to 67% (Kock and Möller 1977) which could have been a result of a small number of the fish studied (21).

The presently determined (1978/79) intensity of infection in individual length classes was similar to the values determined for the season of 1977/78 (Siegel 1980). At that time also the highest mean intensity (4.0–5.0) was observed in the fish 50–70 cm long.

While comparing the infection levels of *Notothenia* (*Notothenia*) *rossi* with *E. antarctica* on the shelf of South Georgia in different seasons (1977/78—Rokicki and Zdzitowiecki 1991; 1978/79—present work; and 1986/87—Rokicki and Zdzitowiecki 1991) it is evident that the prevalence decreased (93.4%, 59.4%, and 9.1% respectively). Low level of the infection in the last of the above-mentioned seasons might have been a result of examining previously frozen fish, which has also been indicated by the authors (Rokicki and Zdzitowiecki 1991). A similar decreasing tendency was observed in the values of the mean infection intensity which were 43.3; 18.9, and 2.4 respectively. In each season surveyed, the increase of the mean intensity of infection was positively correlated with the fish length.

ACKNOWLEDGEMENTS

The present work as well as the previous one (Sosiński and Janusz 1986) was made possible by our colleague, the late Zdzisław Formela, who collected the material during the cruise of *R/V Profesor Siedlecki* in the season of 1978/79.

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STAN ZARAŻENIA NIEKTÓRYCH GATUNKÓW RYB Z RODZINY NOTOTHENIIDAE
WIDŁONOGIEM *EUBRACHIELLA ANTARCTICA* (QUIDOR, 1906) (COPEPODA)

STRESZCZENIE

W sezonie 1978/79, w trakcie IV Polskiej Morskiej Ekspedycji Antarktycznej na R/V „Profesor Siedlecki”, prowadzono badania nad występowaniem pasożyta *Eubrachiella antarctica* (Quidor, 1906) na pięciu gatunkach ryb z rodziny Channichthyidae i sześciu gatunkach z rodziny Nototheniidae poławianych na łowiskach atlantyckiego sektora Antarktyki. Wyniki zapasozyczenia ryb z rodziny Channichthyidae zostały opublikowane w 1986 roku (Sosiński i Janusz 1986).

W niniejszej pracy przedstawiono wyniki badań nad ekstensywnością i intensywnością inwazji pasożytniczej na sześciu gatunkach z rodziny Nototheniidae. Ogółem przebadano 1290 ryb. Stwierdzono, że najbardziej zapasozyczone były ryby z gatunku *Dissostichus eleginoides* (84,2% i 79,4% w zależności od łowiska) i *Notothenia* (*Notothenia*) *rossi* (59,4%). Stosunkowo dużym zapasozyczeniem charakteryzowała się *Notothenia* (*Notothenia*) *neglecta* (29,0%). Najmniej zarażone były ryby z gatunku *Pagothenia hansonii* (5,3%), *Notothenia* (*Lepidonotothen*) *kempii* (0,3% i 0,0% – w zależności od łowiska) oraz *Patagonotothen breviceauda guntheri* (1,0%).

Najwyższą średnią intensywność zarażenia zanotowano u *Notothenia* (*Notothenia*) *rossi* (18,9 pasożyta na jedną zarażoną rybę), najmniejszą u *Patagonotothen breviceauda guntheri* (1,5). U *Notothenia* (*Notothenia*) *rossi* stwierdzono tendencję wzrostu intensywności zarażenia wraz z długością ryb.

Analiza rozmieszczenia *Eubrachiella antarctica* na różnych częściach ciała ryb wykazała, że u gatunków o dużym zapasozyczeniu 100% pasożytów umiejscowionych było w jamie gębowej, zaś u gatunków ryb o małym zapasozyczeniu na płetwach.

Received: 29 March 1999

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