A C T A I C H T H Y O L O G I C A E T P I S C A T O R I A
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Ichthyology

STUDIES ON *PSILODRACO BREVICEPS* NORMAN, 1937 (*PISCES, NOTOTHENIOIDEI, BATHYDRACONIDAE*) FROM THE REGION OF SOUTH GEORGIA

BADANIA NAD *PSILODRACO BREVICEPS*, NORMAN, 1937 (*PISCES, NOTOTHENIOIDEI, BATHYDRACONIDAE*) Z REJONU POŁUDNIOWEJ GEORGII

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Studies were carried out on morphologic parameters, length-weight relationship, condition, fecundity and food of *Psilodraco breviceps* – little known bentho-pelagic fish from the region of South Georgia. Absolute fecundity was within the range 1206–3537. The fish fed mostly on *Mysidacea*.

INTRODUCTION

Most studies on the ichthyofauna in the region of South Georgia concentrate on the species of direct importance for the fishery. Representatives of two families: *Nototheniidae* and *Channichthyidae* have been most thoroughly studied. The subject of this study i.e. *Psilodraco breviceps* inhabits exclusively shelf waters of South Georgia (Norman 1938, Andriashev, 1965, Permitin 1973, 1977, Efremenko 1983, Sosiński and Skóra 1984, North 1988). The fish has no commercial value for the fishery and as such is very little known. As a matter of fact, the same is true of the whole family *Bathydraconidae*. Little knowledge on this fish can be illustrated by the fact that since it had been described by Norman in 1937, all sources stated that *Psilodraco breviceps* had three lateral lines: dorsal, medial and anal. Only recent studies by Voskobojnikova and Baluškin (1988) showed that there were also another two lines: supradorsal and infraanal. The other interesting characteristic of *Psilodraco breviceps* are internal nasals: choanae, very rare in fish. The same organ is present also in another representative of *Bathydraconidae: Gymnodraco acuticeps* Boulenger 1902. This, as well as some other specific characteristics of the two species, induced the taxonomists to create a separate family: *Gymnodraconinae* (Andriašev, Baluškin and Voskobojnikova 1989).

The aim of this study was to broaden our knowledge on this fish, and especially on its position in the trophic net.

MATERIALS AND METHODS

Fish samples were collected with a bottom trawl in the shelf of South Georgia (Tab. 1). Fish caught in 1987/88 were preserved in 4% formalin, and those caught in 1989 in ethyl alcohol. Detailed studies were performed on land, measuring total length, body length and head length up to 1 mm, and total weight up to 0.1 g. Rays were counted in dorsal, anal and right pectoral fin. Stomach content was determined and sorted to taxons under a binocular, dried on a blotting paper, and weighed up to 0.001 g. Frequency of particular food components was related to the number of fish having food in their food tracts. Index of filling with food was obtained multiplying the ratio between food weight and fish weight by 10^4. Fecundity was estimated with weight method. Gonads were dried on a blotting paper, weighed up to 0.001 g, and 3 samples were collected from each gonad. These were weighed and number of eggs in each sample was determined under a binocular. The results were recalculated for the whole gonad. Gonado-somatic index (GSI) was determined as gonad weight expressed in per cents of body weight.

Table 1

List of the materials

Data	Sampling place	Depth (m)	Total fish length (cm)	n
21.XII.1987	53°55'S; 37°18'W	142–260	8.5–19.4	15
3. I.1988	54°15'S; 37°33'W	221–235	11.0–20.3	17
7. II.1989	53°53'S; 37°16'W	261–287	7.7–16.1	5
10. II.1989	54°21'S; 37°39'W	154–215	12.0–13.2	3
			Total	40

RESULTS

1. Length, morphologic parameters, length-weight relationship.

Total length (l.t.) of the fish under study ranged from 71 to 203 mm, body length (l.c.) from 61 to 171 mm. The greatest length was therefore similar to that observed by Norman (1938): 195 mm. As regards fish caught in December 1987 and January 1988, males were slightly bigger that females (Tab. 2).

Table 2

Length of *Psilodraco breviceps* males and females caught in the region of South Georgia in December 1987 and January 1988

l. corp. (cm)	Numbers			
	♂	♀	unidentified	total
7.0		1		1
7.5				
8.0				
8.5			1	1
9.0				
9.5		1	1	2
10.0		1		1
10.5		2		2
11.0		1		1
11.5	1	1		2
12.0				
12.5		2		2
13.0		3		3
13.5	3	1		4
14.0	3			3
14.5	3	1	1	5
15.0		1		1
15.5		1		1
16.0	2			2
16.5				
17.0	1			1
Total	13	16	3	32
$\bar{x}$ length	14.35	12.03	–	12.9
± s	1.39	2.22	–	2.3

Morphologic characteristics are presented in Tab. 3. Maximal number of rays found in dorsal (32), anal (30), and pectoral (28) fins was greater than the numbers given by Norman (30, 29 and 27 respectively).

Relationship between body length (l.c.) and total weight (w) is presented in Fig. 1, and may be expressed as an equation: $W = 0.00238\ l.c.^{3.675}$.

Relationship between body length (l.c.) and condition coefficient is presented in Fig. 2. Increasing condition coefficient with increasing fish length reflects changes in body proportions with age. Most probably this explains the fact that average condition coefficient of *Psilodraco breviceps* males (1.404 ± 0.177) was slightly higher than

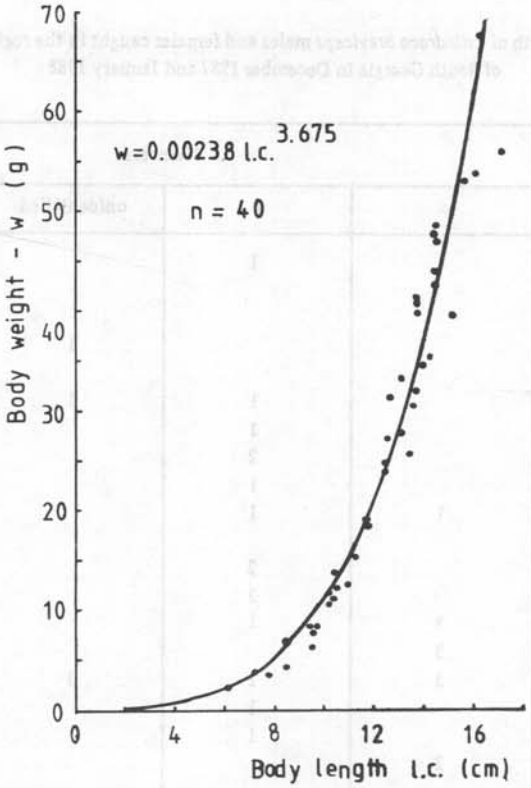

Fig. 1. Relationship between body length and total weight of *Psilodraco breviceps* from the region of South Georgia

Table 3

Morphologic characteristics of *Psilodraco breviceps* from the region of South Georgia

Feature	Range	$\bar{x} \pm s$	n
Total length (mm)	71–203	146.30± 31.60	40
Body length (mm)	61–171	122.85± 25.64	40
Head length in % of body length	29.76–36.84	33.12± 1.67	40
Number of rays in:			
dorsal fin	27–32	29.33± 0.79	40
anal fin	27–30	28.00± 0.55	40
pectoral fins	35–28	26.25± 0.85	40

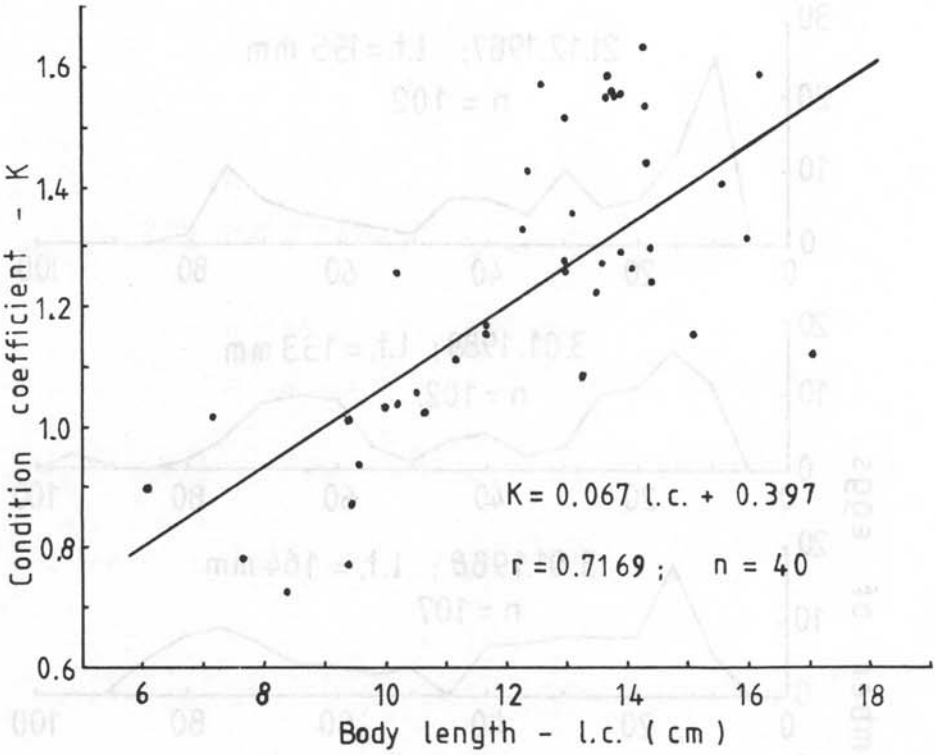

Fig. 2. Correlation between body length and condition coefficient of *Psilodraco breviceps* from the region of South Georgia

the average condition coefficient for females (1.234 ± 0.183). As stated before, females tended to be smaller than males.

2. Otoliths

Otoliths of *Psilodraco breviceps* were thoroughly descbribed by Hecht (1987). This author presented their view from the internal side. Our observations on otoliths from the fishes preserved in alcohol revealed that the internal side was unreadable as regards growth zones used to estimate fish age. On the other hand, dorsal part of the otoliths viewed from the outside was well readable. Fig. 3 made

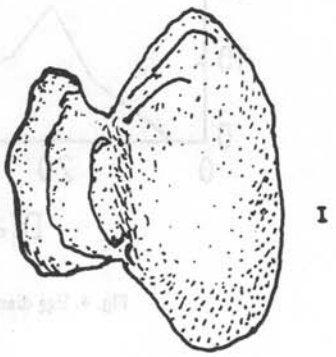

Fig. 3. External view of the right otolith of *Psilodraco breviceps* of total length 15.0 cm and body length 12.3 cm

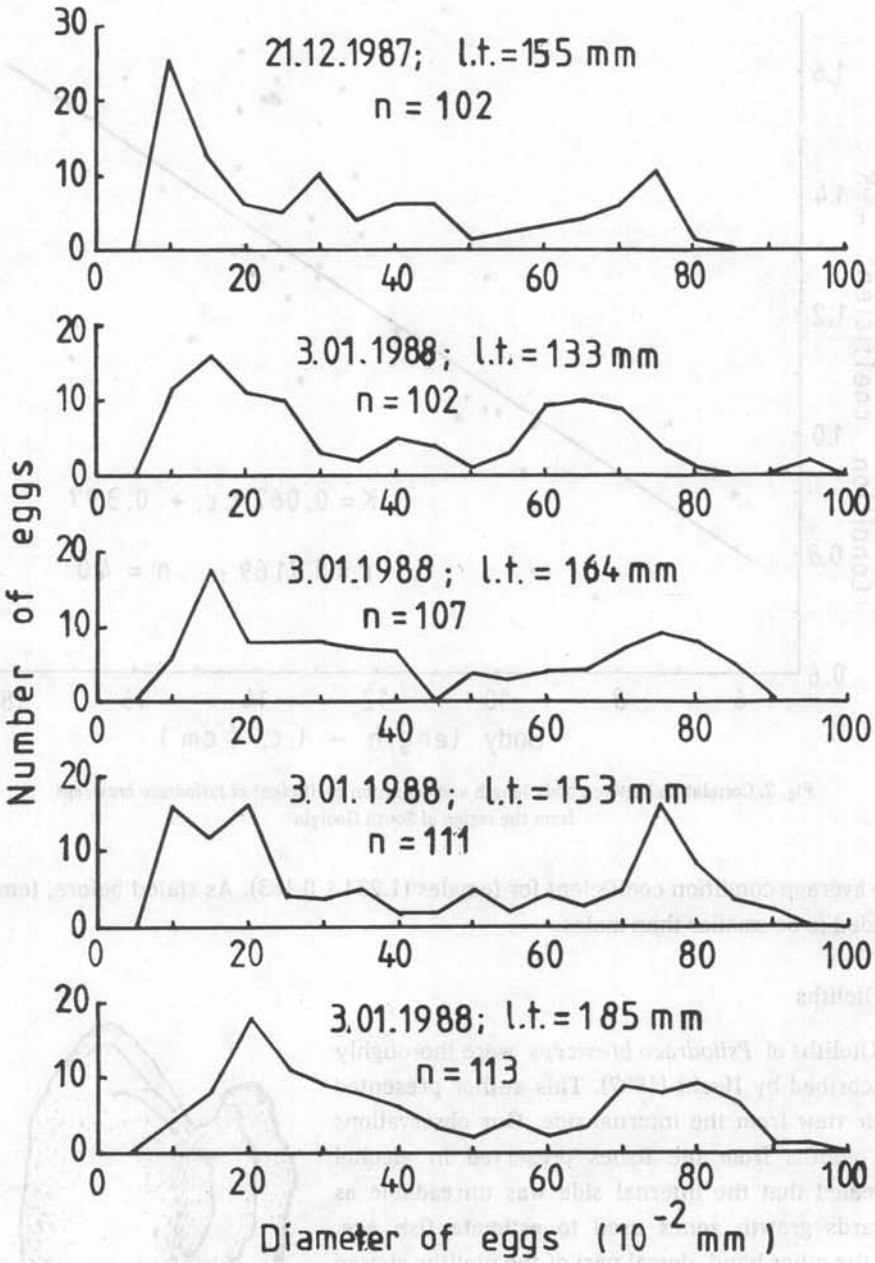

Fig. 4. Egg diameter of *Psilodraco breviceps* off South Georgia

from an original otolith viewed under a binocular presents a right-hand side otolith of a specimen of total length 15.0 cm, body length 12.3 cm. Three growth zones were readily seen on the dorsal part of this otolith.

3. Fecundity

Almost all fish longer than 9.5 cm were sexually mature. Sex could have been determined macroscopically. Testes of these fish were in stages II–IV according to Maier's scale; mostly stage IV. The same was true of the ovaries. Relative ovary weight was higher than relative testis weight. Gonado-somatic index (GSI) was 0.051–2.005 for females, 1.201 on the average (n = 16), and 0.088–1.382 for males, 0.455 on the average (n = 11).

Fecundity was estimated for 11 females of body length 9.6–15.6 cm, and gonads in stage IV of maturity. Egg counts were very difficult as the ovaries contained oocytes in different stages, with diameter ranging from 0.1 to 1.0 mm (Fig. 4). Only the biggest, yolked, opaque eggs (diameter 0.4–1.0 mm) were counted. No attention was paid to small, transparent oocytes with readily visible nucleus. It was assumed on the basis of the literature (Everson 1970, Kock 1979, Siljanova 1981, Boguckaja 1984, Kompowski 1985) that the latter oocytes would be spawned during the next reproductive season.

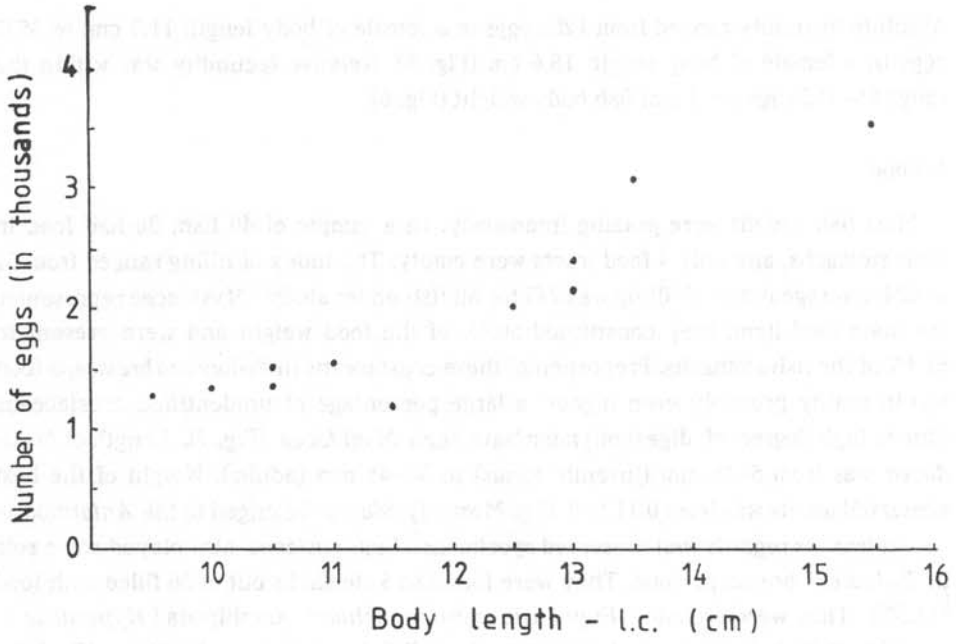

Fig. 5. Relationship between absolute fecundity and body length of *Psilodraco breviceps* from the region of South Georgia

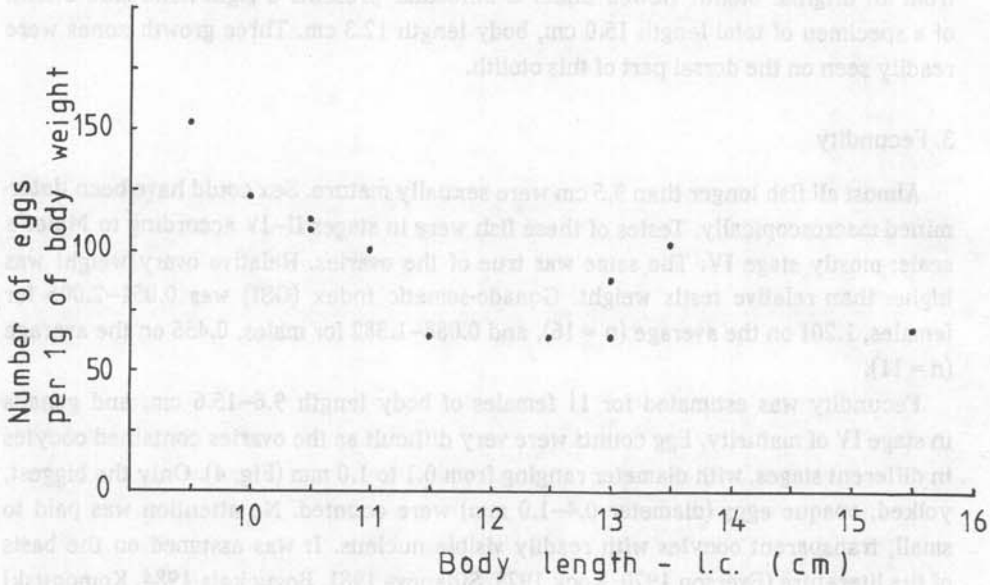

Fig. 6. Relationship between relative fecundity and body length of *Psilodraco breviceps* from the region of South Georgia

Absolute fecundity ranged from 1206 eggs in a female of body length 11.7 cm, to 3537 eggs in a female of body length 15.6 cm (Fig. 5). Relative fecundity was within the range 65–153 eggs per 1 g of fish body weight (Fig. 6).

4. Food

Most fish caught were grazing intensively. In a sample of 40 fish, 36 had food in their stomachs, and only 4 food tracts were empty. The index of filling ranged from 31 to 824. Average index of filling was 247 for all fish under study. *Mysidacea* represented the main food item; they constituted 60.6% of the food weight and were present in 61.1% of the fish stomachs. Proportion of these crustaceans in *Psilodraco breviceps* food was in reality probably even higher; a large percentage of unidentified crustaceans (due to high degree of digestion) must have been *Mysidacea* (Fig. 7). Length of *Mysidacea* was from 5–10 mm (juvenile forms) to 30–45 mm (adults). Weight of the best preserved adults was from 0.11 to 0.37 g. Most *Mysidacea* belonged to the *Antarctomysis*, at least as regards well preserved specimens. *Euphausiacea* also played some role in *Psilodraco breviceps* food. They were found in 5 stomachs out of 36 filled with food (13.5%). They were probably *Euphausia crystallorophias**. Amphipoda (*Hyperiidae*) were found in 3 stomachs, and remnants of small fish represented less than 1% of the

* determined by dr Wojciech Kittel

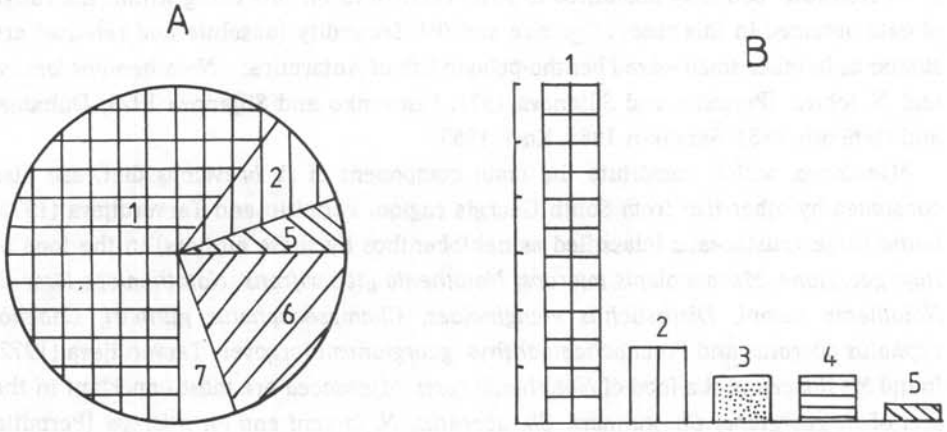

Fig. 7. Food composition of *Psilodraco breviceps* off South Georgia. A – % of food weight; B – frequency of occurrence, 1– *Mysidacea*, A – *Euphausiacea*, 3 – *Amphipoda*, 4 – *Pisces*, 5 – *Macrura natantia*, 6 – unidentified, 7 – other, n = 40

food weight. It is interesting to note that one shrimp, *Notocrangon antarcticus*, was found in a stomach of the fish of body length 16.2 cm. The shrimp was fairly big (length about 50 mm, weight 1.1 g), so it represented 4.8% of the food weight of all fish under study. The materials were not numerous; nevertheless it was possible to note that prey size increased with increasing fish length, the smallest fish (6–8 cm body length) fed mostly om juvenile *Mysidacea*, of about 10 mm in length, and *Amphipoda* and *Euphausiacea* of the same size. Bigger fish (body length over 14 cm) fed on big *Mysidacea* (35–45 mm in length). The shrimp and fish remnants were also found in this fish group.

DISCUSSION

Number of fin rays (D 27–32, $\bar{x}$ = 29.33; A 27–30, $\bar{x}$ = 28.00; P 25–28, $\bar{x}$ = 26.25) was similar to the data by Norman, 1938 (D 27–30, A 27–29, P 25–27) and North and White, 1982 (D 27–30, A 27–29, P 25–27). Larvae of *P. breviceps* 30.5 mm long, caught in the Scotia Sea near South Georgia and described by Efremenko (1983) had D 34, A 20, and P 18.

Efremenko (1983) classified *P. breviceps* as a fish spawning in the end of autumn or at the begining of Antarctic winter. Low values of gonado-somatic index (GSI) in the fish under study suggest that the period of sampling (December-January) preceeded the spawning by 3–4 months. This would confirm Efremenko's suggestion as to the time of *P. breviceps* reproduction. Permitin (1973) estimated fecundity of one *P. breviceps* female, of total length 14.7 cm, caught in the region of South Georgia on 9 March

1967. Absolute fecundity amounted to 1340, relative to 74, this being within the range of data obtained in this study. Egg size and fish fecundity (absolute and relative) are similar as in other small–sized bentho-pelagic fish of Antarctica: *Nototheniops larseni* and *N. tchizh* (Permitin and Siljanova 1971, Lisovenko and Siljanova 1979, Duhamel and Pleticosic 1983, Šandikov 1985, Kock 1989).

Mysidacea, which constitute the main component of *P. breviceps* diet, are also consumed by other fish from South Georgia region. Permitin and Tarverdijeva (1972) found these crustaceans (classified as nektobenthos by these authors) in the food of *Raja georgiana, Muraenolepis microps, Notothenia gibberifrons, Nototheniops larseni, Notothenia kempi, Dissostichus elenginoides, Champsocephalus gunnari, Chaenocephalus aceratus* and *Pseudochaenichthys georgianus.* Moreover, Tarverdijeva (1972) found *Mysidacea* in the food of *Notothenia rossi. Mysidacea* are most important in the diet of *R. georgiana, Ch. gunnari, Ch. aceratus, N. larseni* and *M. microps* (Permitin and Tarverdijeva 1972, Kock 1981) as well as of *Parachaenichthys georgianus* (Kompowski in press). As regards the latter group, *R. georgiana* is a typical benthic species. *Ch. aceratus* is also connected with the bottom, with the exception of the larval stage. On the other hand, *Ch. gunnari* and *N. larseni,* and the discussed *Ps. breviceps* were classified by Andriašev (1986) as "secondary pelagic" fish. They are benthic fish which have adapted to pelagic habitat relatively recently. Silvery colour, elongated body and upper mouth of *Ps. breviceps* support the hypothesis that this fish lives in the pelagic zone. However, the fact that it is caught with bottom trawl (Norman 1938, own observations) and that it feeds on *Mysidacea* i.e. on benthic crustaceans consumed by benthic fishes, suggests that it is a bentho-pelagic fish. Larvae and postlarvae of *Ps. breviceps* are pelagic (Efremenko 1983, North 1988). Increasing condition coefficient with fish length i.e. gradual change of body shape suggests that as the fish grow older they become more and more benthic dwellers.

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STRESZCZENIE

Cechy morfologiczne badanych ryb (tab. 3) zbliżone są do danych literaturowych. Zależność między długością ciała i masą ryb (rys. 1) wyraża się równaniem $w = 0.00238\ l.c.^{3.675}$. Wartość współczynnika kondycji rośnie wraz ze wzrostem długości ciała (rys. 2) – świadczy to o zmianie kształtu ciała z wiekiem – z wysmukłego na bardziej krępy. Otolity są czytelne po stronie zewnętrznej płatu grzbietowego (rys. 3). Wśród materiału złowionego w grudniu 1987/styczniu 1988 samce były przeciętnie nieco większe od samic (tab. 2). Płodność absolutna wahała się od 1206 do 3537 jaj, względna od 65 do 153 jaj/g masy ciała samicy (rys. 5 i 6). Podstawowym pokarmem *Psilodraco breviceps* były *Mysidacea* z rodzaju *Antarctomysis* (rys. 7). *Psilodraco breviceps* jest rybą bentopelagiczną.

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