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Fish Biology

STUDIES ON JUVENILE *CHAENOCEPHALUS ACERATUS* (LÖNNBERG, 1906)
(*PISCES, CHAENICHTHYIDAE*) FROM OFF SOUTH GEORGIA

BADANIA NAD MŁODOCIANYM SZCZĘKACZEM – *CHAENOCEPHALUS ACERATUS*
(LÖNNBERG, 1906) (*PISCES, CHAENICHTHYIDAE*) Z REJONU POŁUDNIOWEJ
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Pelagic trawl catches of krill were found to contain 7.8–11.2 cm long (l.t.) juvenile *Chaenocephalus aceratus* (Lönnberg, 1906) whose morphological characters were studied. The following growth rate is hypothesised to take place during the first five years of life: 10, 20, 27, 34, and 40 cm. The fishes studied were found to feed exclusively on krill, dawn and sunset being the times of the most intensive fish feeding activities.

INTRODUCTION

Chaenocephalus aceratus is a species occurring commonly off South Georgia (Kompowski, 1977; Sosiński and Skóra, 1977) and playing a marked role in the fisheries of the area. The species is, however, rather poorly known here. Preliminary studies published by, i.a., the above mentioned authors concerned adults and juveniles found in demersal catches. Kompowski (1977) observed juveniles of the species to occur in the area as a by-catch in krill (*Euphausia superba*) hauls taken with a pelagic trawl.

The present work is aimed at studying length, certain morphological characters, and feeding of *Ch. aceratus* at this stage of their life.

MATERIAL AND METHODS

The juveniles studied were obtained as by-catch from krill caught with a pelagic trawl by a Polish trawler „Rekin” operating in 1977 east and north-east of South Georgia. The fishes were found exclusively in the daytime hauls. Those catches yielding the individuals studied were taken from small depths, 15–35 m (headline distance from the sea surface), the depth range of the area being 300–500 m.

The individuals separated on board from the krill were immediately fixed in 4% formalin. In the laboratory on land, the individuals collected were measured (l.t. and l.c.), their total and eviscerated weights were determined and the following morphological characters studied:

- 1) ray counts in D_1 , D_2 , P, and A fins;
- 2) head length*;
- 3) maximum body height*;
- 4) ventral fin length*;
- 5) eye horizontal diameter*.

Condition coefficients (Fulton coefficients) were calculated as well.

Stomach contents were scrutinised and weighed to 0.01g. The mean stomach content index (\bar{x}) was calculated as

$$\bar{x} = \frac{\sum \text{stomach content weight}}{\sum \text{weight of eviscerated fish}} \cdot 10^4$$

Table 1 summarises the scope of the research programme.

RESULTS AND DISCUSSION

a) Length and preliminary data on growth rate

Fig. 1 presents the length distribution in the individuals studied; the lengths ranged within 78–112 mm (l.t.) and 72–98 mm (l.c.). The length distribution curves approach the normal curves, which is particularly well-marked in the l.c. distribution. Thus it should be suspected that our studies encompassed a single age group. As shown by Kompowski (1977) and Sosiński and Skóra (1977), *Ch. aceratus* spawn off South Georgia in late April – early May. Although the egg incubation time is unknown, the individuals examined in this study were in all likelihood born in 1976 and so we were dealing with the age class 1 (assuming 1 May as the “date of birth”). Kompowski (1977) and Sosiński and Skóra (1977) showed several clearly marked length classes of *Ch. aceratus* to have occurred in the April and May bottom trawl catches from off South Georgia, namely: 17–23 cm (modal length of 20 cm), 26–28 cm (model length of 27 cm), 30–35 cm (modal length of 34 cm), and 38–41 cm) modal length of 40 cm). None of such

* Measurements were made following the guidelines published by Kochkin (1979)

Table 1

Scope of the research

Date	Hour (local time)		Ship's position		No. of individuals examined for			
	Trawling started	Trawling completed	Trawling started	Trawling completed	Length	Weight	Food	Morpho- logical characters
27 March 1977	19.42	21.06	54°49'S 34°32'W	54°48'S 34°32'W	7	7	7	—
7 April 1977	5.12	7.57	54°50'S 34°40'W	54°50'S 34°36'W	125	53	51	26
16 April 1977	16.12	18.17	54°49'S 34°39'W	54°47'S 34°39'W	10	10	10	—
Total	—	—	—	—	142	70	68	26

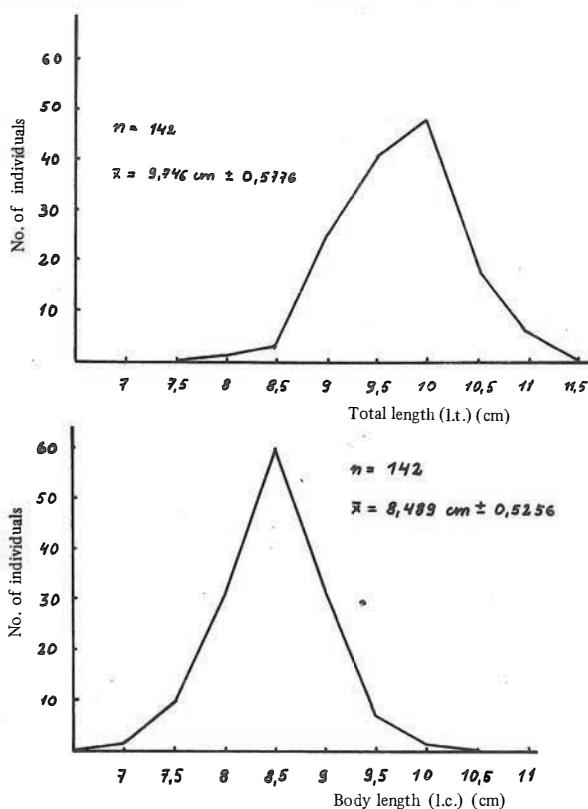


Fig. 1. Length of juvenile *Chaenocephalus aceratus* occurring in krill catches

well-marked peaks could be detected on the length frequency curve for *Ch. aceratus* larger than 4/cm found in demersal catches. (Fig. 2).

It can be supposed from the above that in the area of study *Ch. aceratus* grow relatively fast, reaching – on the average – 10, 20, 27, 34, and 40 cm (l.t.) in the first consecutive five years of their life. On the other hand, nothing, as yet, can be concluded on the older fishes growth rate. Sosiński and Skóra (1977) observed *Ch. aceratus* to mature when measuring as much as 50 cm on the average. Thus the hypothetical growth rate presented above holds for the immature individuals of the species.

b) Morphological characters

The results of studies on these characters are presented in Table 2. When our meristic data are compared to those reported by Norman (1938) and Sosiński and Skóra (1977), certain differences are easily seen: the D_1 ray count in our studies ranges within VI–VII, Norman and Sosiński and Skóra VII–VIII and VI–VIII, respectively; the D_2 ray count in the present studies, Norman's, and Sosiński's and Skóra's ranged within 37–42, 38–40, and 37–40, respectively; the respective ranges of ray counts in ventral fins were 23–26, 25–26, and 23–25; ray counts found for anal fins were 37–39 both in our studies and

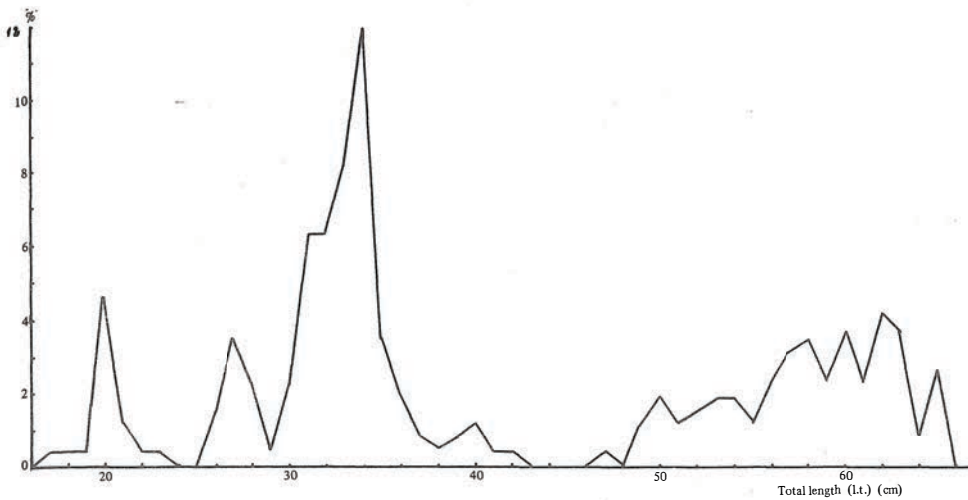


Fig. 2. Length of *Ch. aceratus* caught by demersal trawling off South Georgia within 14–24 May 1977. $n = 260$ (from Kompowski, 1977)

Norman's, while Sosiński and Skóra reported 36–39. The discrepancies observed in the variability ranges of the characters studied are difficult to account for. Norman worked on materials collected from a larger area, but his data did not receive any statistical treatment; on the other hand, although Sosiński and Skóra gave frequency distributions of the characters, they based their calculations on 10 individuals. Thus the discrepancies found may have resulted simply from the paucity of observations.

Table 2

Morphological character of juvenile *Ch. aceratus*

Character	Range	$\bar{x} \pm m$	$\pm \delta$	n
Total length (mm)	86–112	99.58 ± 1.2292	6.1460	26
Body length (mm)	75–96	86.73 ± 1.0500	5.2502	26
D ₁ ray count	VI–VII	6.56 ± 0.1034	0.5066	26
D ₂ ray count	37–42	39.08 ± 0.2035	0.9967	25
A ray count	37–39	37.72 ± 0.1106	0.5416	25
P ray count	23–26	24.85 ± 0.1761	0.8806	26
In per cent of body length:				
Head length	31.18–36.75	34.83 ± 0.2801	1.4006	26
Maximum body height	11.33–18.24	14.12 ± 0.2815	1.4073	26
Ventral fin length	35.80–45.98	41.34 ± 0.4646	0.3231	26
In per cent of head length:				
Eye diameter	19.30–24.14	21.12 ± 0.2248	1.1239	26

With regard to the metric characters, Norman (op. cit.) tentatively stated that the fish length was 5–7 times the maximum body height and $2\frac{1}{2} - 2\frac{4}{5}$ times the head length, no indication being given as to the type of length measurement (l.c. or l.t.) considered. The head length is, according to Norman, 5–6 times the eye diameter, while the factor of 4–5 was found in our studies. Body proportions in *Ch. aceratus* are very likely to alter markedly with age, which is the case in other species. Norman (op. cit.) found the relative length of ventral fins to be much greater in young than in older fishes, which is consistent with the present authors's tentative field observations.

Table 3

Juvenile *Ch. aceratus* coefficients of condition

Mean body length (l.c.) (cm)	Mean body weight (g)	Mean coefficient of condition	n
Whole fish			
8.567	3.233	0.51426	69
Eviscerated fish			
8.532	2.814	0.45308	68

Additionally, a mean condition (Fulton) coefficient was calculated separately for the total fish weight and eviscerated fish (Table 3), the fish body length (l.c.) being used in calculations.

c) Feeding

The overall number of 68 fish stomachs were examined; half of them turned out empty and the other half contained only the antarctic krill (*Euphausia superba* Dana). Table 4 provides data on the stomach filling at various times of the day, indicating the highest intensity of feeding to take place presumably at dawn and at sunset. This conclusion, however, calls for verification based on the full 24-hr sampling cycle. It is indicative, however, that juvenile *Ch. aceratus* were never found in the nighttime krill hauls; perhaps the fishes cease feeding at night.

Thus during the southern autumn the South Georgia juvenile *Ch. aceratus* fed exclusively on krill, taking advantage of huge concentrations of this crustacean occurring NE and E of the island. These concentrations described by, i.a., Jarogov (1969) and Bogdanov and Soliankin (1970) provide food for many fish species. Kanaeva et al. (1969) are of the opinion that role of fish as krill consumers in the Antarctic is much greater than previously suspected, and that in any case – the biomass of fish feeding mainly on krill exceeds the biomass of whales from the period before their extermination.

Krill concentrations were, in the period of our study, almost completely lacking any

Table 4

Stomach filling at various times of the day

Local time	No. of stomachs examined	Stomachs:				Mean filling index
		"full"		"empty"		
		n	%	n	%	
5.12– 7.57	51	34	66.67	17	33.33	182.942
16.12–18.17	10	5	50.0	5	50.0	106.030
19.42–21.06	7	5	71.43	2	28.57	420.732
Total	68	44	64.71	24	35.29	191.190

other organisms; only occasionally single specimens of the invertebrate *Parathemisto gaudichaudi* were observed, while the myctophid fishes *Protomyctophum andersoni* occurred sometimes at night. On occasions, however, the krill trawls were catching substantial amounts of small (18–24 cm l.t.) *Chamsocephalus gunnari* feeding – similarly to *Chaenocephalus aceratus* – on krill. It is therefore understandable, in view of this uniform composition of krill aggregations, that these crustaceans solely made up the juvenile *Ch. aceratus* food, being the only food item available. On the other hand, prey size selectivity could be observed. In those cases when the digestion process was not too advanced, length of krill encountered in the juvenile *Ch. aceratus* stomachs was measured and found to range within 10–40 mm (from the rostrum tip to the end of the telson), while the commercial catches yielded krill measuring 30–60 mm (mode of about 45 mm) (Kompowski, 1977). It is concluded that *Ch. aceratus* selected smaller krill individuals, some of them being so small as to pass through trawls meshes and therefore not recorded in the commercial catches. However, the consumed krill size is large relative to the size range of their predators, juvenile *Ch. aceratus*. Considering the fact that krill are capable of achieving a remarkable moving velocity, 1 and 3 knots when using pleopods and abdomen, respectively, to swim (Semenov, 1969), juvenile *Ch. aceratus* should be regarded as an active pelagic predator. Preliminary observations made by the present author showed large (more than 45 cm in length) *Ch. aceratus* to be fish-feeders, consuming, i.a., *Chamsocephalus gunnari*, *Notothenia gibberifrons*, *N. rossii*, *N. larseni*, and *Parachaenichthys georgianus*, which is consistent with findings reported by Kanaeva et al. (1969). Thus *Ch. aceratus*, similarly to the other white-blooded species occurring off South Georgia, *Pseudochaenichthys georgianus* are active hunters rather than necrophages as postulated by Everson (1970).

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Z REJONU POŁUDNIOWEJ GEORGII

Streszczenie

Zbadano długość, morfologię i odżywianie się młodocianych szczękaczy, będących domieszką do połowów kryla włokiem pelagicznym. (Tab. 1). Ryby te występowały w połowach wyłącznie w porze dziennej na głębokościach 15–35 m. Długość ich wahała się w granicach 78–112 mm (l.t.) i 72–98 mm (l.c.). W oparciu o te dane oraz o skład długościowy połowów szczękacza dokonywanych przy pomocy włoka dennego (Kompowski, 1977) można wstępnie przypuszczać, że szczękacz w omawianym rejonie osiąga w pierwszym roku długość całkowitą 10 cm, w drugim 20 cm, w trzecim 27 cm, w czwartym 34 cm i w piątym 40 cm (rys. 1 i 2).

Badane cechy morfologiczne były następujące: D_1 VI–VII; D_2 37–42; A 37–39; P 23–26. Długość głowy stanowiła 31,18–36,75%, maksymalna wysokość ciała 11,33–18,24%, zaś długość płetwy brzusznej 35,80–45,98% długości ciała. Pozioma średnica oka równała się 19,30–24,14% długości głowy. Współczynnik kondycji wynosił dla ryb pełnych 0,51426, dla ryb bez wnętrzości 0,45308 (tab. 2 i 3).

Młodociany szczękacz odżywiał się wyłącznie krylem (*Euphausia superba*), przy czym najintensywniej żerował o świcie i o zmierzchu (tab. 4). Zważywszy, że długość ofiar znajdujących się w żołądkach badanych ryb zawierała się w granicach 1–4 cm, przy czym ofiary te – tj. kryl – mogą poruszać się z szybkością do 1–3 węzłów – należy uznać, że młodociany szczękacz jest aktywnym drapieżnikiem.

Анжей Комповски

ИССЛЕДОВАНИЯ МОЛОДОГО *CHAENOSEPHALUS ACERATUS* (LÖNNBERG, 1906)
(PISCES, CHAENICHTHYIDAE) РАЙОНА ЮЖНОЙ ГЕОРГИИ

Резюме

Исследовали длину, морфологию и питание молодых *Chaenosephalus aceratus*, которые являлись приловом криля, отлавливаемого разноглубинным тралом (таб. 1). Эти рыбы попадались в прилове исключительно в дневное время суток на глубинах 15–35 м. Длина их колебалась в пределах 78–112 мм (l.t.) и 72–98 мм (l.c.). На основании этих данных, а также данных размеров *Chaenosephalus aceratus*, вылавливаемого донным тралом (Комповски, 1977), можно предположить, что *Chaenosephalus aceratus* в исследуемом районе достигает на первом году жизни длину 10 см, на втором – 20 см, на третьем 27 см, на четвертом – 34 см и на пятом – 40 см (рис. 1 и 2).

Исследованные морфологические признаки были следующие: D_1 VI–VII D_2 37–42; A 37–39; P 23–26. Длина головы составляла 31, 18–36, 75%, максимальная высота тела 11, 33–18, 24%, а длина брюшного плавника 35, 80–45, 98% от длины тела. Горизонтальный диаметр глаза равнялся 19, 30–24, 14% от длины головы. Коэффициент упитанности составил для всей рыбы 0,51426, а для рыб без внутренностей 0,45308 (таб. 2 и 3).

Молодой *Chaenosephalus aceratus* питался исключительно крилем (*Euphausia superba*), причём самое интенсивное питание проходило на рассвете и в сумерки (таб. 4). Имея в виду, что длина жертв, находящихся в желудках исследуемых рыб, составляет 1–4 см и что криль такой длины передвигается со скоростью 1–3 узлов, надо считать, что молодой *Chaenosephalus aceratus* является активным хищником.

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