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Characteristics of South  
Georgia icefish  
(*Pseudochaenichthys  
georgianus*, Norman) from the  
region of South Georgia Island  
(Antarctic) in the years  
1977—1979

**ABSTRACT:** The material obtained between 1977 and 1979 has allowed to compare body length, age and sex of South Georgia fish caught in the region of South Georgia Island. The growth rate of body length and weight of individuals have been determined. According to results the South Georgia icefish at the time of investigations did not form a homogenous, stable stock in the region of South Georgia Island.

**Key words:** Antarctic, South Georgia icefish

## 1. Introduction

The South Georgia icefish (*Pseudochaenichthys georgianus*, Norman) is one of the more important species of bottom fishes in the region of South Georgia Island. This is a white-blooded fish and although it is being caught by fishing boats from many countries the biology of South Georgia icefish is not well known. This is an attempt to characterize chosen biological features and to calculate the growth parameters of the South Georgia icefish.

## 2. Material and methods

The material was obtained from January to September in the years 1977—1979. In 1977 and 1978 analyses and measurements were made on the trawler m/t “Gemini” used for industrial catches in the region of South Georgia, whereas in 1979 — on a research vessel “Profesor Siedlecki” participating

in the IVth Polish Marine Antarctic Expedition. The total length of fishes (*longitudo totalis*), body weight, sex, maturity of gonads (acc. to 8-degree Maier's scale) and age (on the basis of otoliths) were investigated. When reading the age (determined by the year of fish life) there were difficulties in distinguishing particular annual rings in otoliths, similarly as for other white-blooded fish. Therefore data on age may have an error. Age composition was determined by taking into consideration mass measurements, i.e. using the key: length — age (Gulland 1969). The investigations were conducted in the north-eastern region of the shelf of South Georgia Island (Fig. 1).

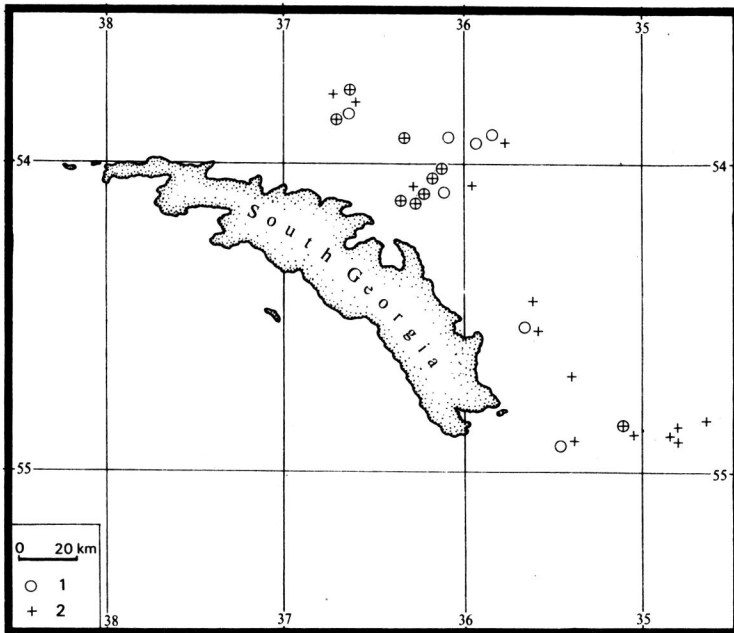


Fig. 1. Places of catches

1 — detailed analyses, 2 — mass measurements of body length

### 3. Results

Measurements of body length of fish indicate considerable changes in the frequency of length of South Georgia icefish specimens. In 1977 there were mainly individuals from 41 to 57 cm in length. Most numerous were fish of 45—50 cm in length (Fig. 2). Also small individuals (21—41 cm) were caught but their contribution to the total number did not exceed 2% (Table I). In 1978 fish of a body length 49—52 cm dominated and individuals of a body length 38—42 cm were quite numerous. Among small fish, i.e. up to 37 cm in length and contributing less than 1%, the frequency increased in classes of 20 and 35 cm. The fish caught in 1979 can be divided into three basic groups: 1) 15—25 cm in length, 2) 30—40 cm, 3) 47—57 cm. Fish from the

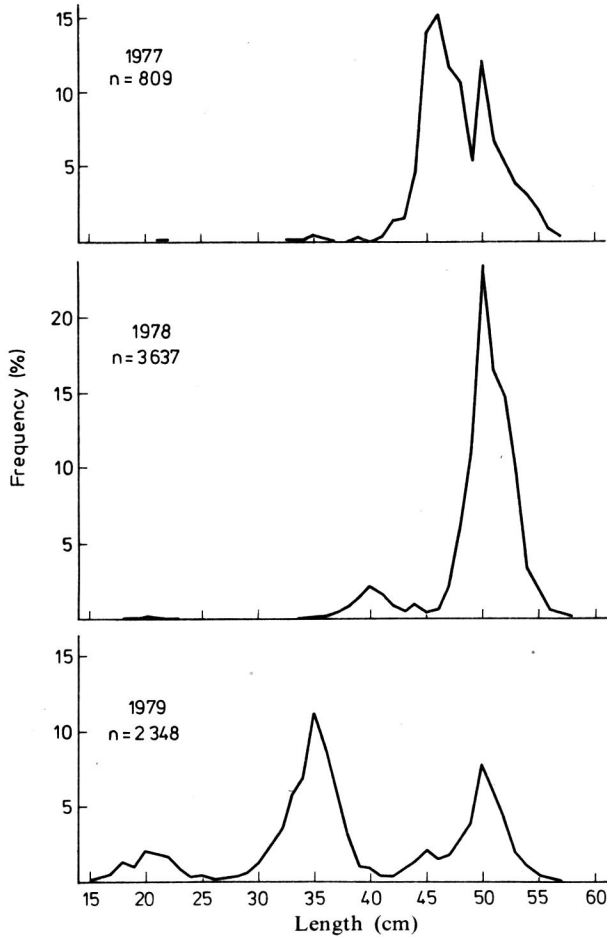


Fig. 2. Body length of South Georgia icefish caught in the years 1977—1979

two first groups occurred mainly in January and in the second decade of March, whereas in the third decade of March the majority of caught individuals were 48 to 53 cm long. It is characteristic that in the distributions of fish body length the number peak occurred in each period mentioned in the 50 cm class.

Investigations of age pointed to the dominance of 5—9 years old fish in 1977 and of 8—10 years old next year (Fig. 3). In 1979 the fish were much younger. Fishes in their third year of life dominated. In the investigations it was only possible to determine the age of fish to the age of twelve. The age of older fish was not given as small annual increments makes the otoliths illegible. Fish 13 years old and older were treated jointly as a separate cohort under the symbol 13<sup>+</sup>.

Among fish subjected to detailed analyses the females dominated, mostly in 1977 and 1978 (Table II).

The growth rate of South Georgia icefish was calculated on the basis of mean body lengths of fish in consecutive years of their life (Table III).

Table I

## Body length of South Georgia icefish

Class of length (cm)	1977		1978		1979	
	Number of individuals	%	Number of individuals	%	Number of individuals	%
15					2	0.1
16					8	0.3
17					12	0.5
18			1	0.1	31	1.3
19					24	1.0
20			5	0.1	47	2.0
21	3	0.4	3	0.1	44	1.9
22	2	0.3	1	0.1	39	1.7
23			1	0.1	23	1.0
24					8	0.3
25					9	0.4
26			2	0.1	4	0.2
27					6	0.3
28					7	0.3
29					14	0.6
30					28	1.2
31			2	0.1	56	2.4
32					83	3.5
33	1	0.1	2	0.1	134	5.7
34	1	0.1	4	0.1	162	6.9
35	3	0.4	6	0.2	263	11.2
36	2	0.2	5	0.1	207	8.8
37			10	0.3	189	8.0
38			27	0.7	69	2.9
39	2	0.2	53	1.4	26	1.1
40			80	2.2	22	0.9
41	2	0.2	65	1.8	10	0.4
42	11	1.4	32	0.9	10	0.4
43	12	1.5	16	0.4	16	0.7
44	38	4.7	34	0.9	31	1.3
45	115	14.2	17	0.5	47	2.0
46	123	15.2	22	0.6	34	1.5
47	95	11.7	81	2.2	42	1.8
48	85	10.5	221	6.1	64	2.7
49	42	5.2	406	11.2	91	3.9
50	99	12.2	856	23.5	178	7.6
51	54	6.7	592	16.3	136	5.8
52	41	5.1	527	14.5	94	4.0
53	30	3.7	338	9.3	43	1.9
54	25	3.1	123	3.4	22	1.0
55	16	2.0	70	1.9	7	0.3
56	5	0.6	20	0.5	4	0.2
57	2	0.3	13	0.4	1 less than	0.1
58			2	0.1	1 less than	0.1
Total	809	100.0	3637	100.0	2348	100.0

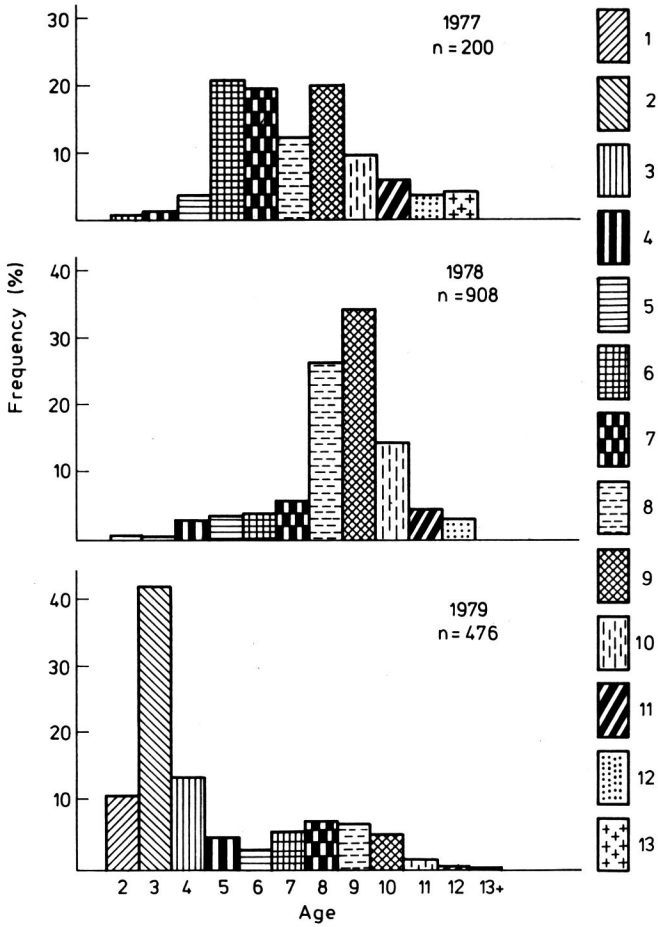


Fig. 3. Age composition of South Georgia icefish in the years 1977—1979  
 Year class: 1 — 1977, 2 — 1976, 3 — 1975, 4 — 1974, 5 — 1973, 6 — 1972, 7 — 1971, 8 — 1970,  
 9 — 1969, 10 — 1968, 11 — 1967, 12 — 1966, 13 — 1965

Table II  
 Contribution of males and females in catches of South Georgia icefish

Year	Males (%)	Females (%)	Number of individuals examined
1977	39	61	200
1978	39	61	908
1979	47	53	476

Table III  
Empirical mean values and theoretical values of body length (cm)  
of South Georgia icefish in consecutive years of life

Age	Empirical mean values	Theoretical mean values
1	lack of data	8.30
2	20.60	22.25
3	34.79	32.01
4	39.00	38.82
5	44.14	43.59
6	46.13	46.91
7	48.00	49.24
8	49.79	50.87
9	51.01	52.00
10	52.14	52.80
11	53.59	53.35
12	54.74	53.74
13	55.67	54.01

These data allowed to calculate parameters of von Bertalanffy equation by the method of Beverton and Holt (1957) using the right programme of computer ODRA 1305. The parameters of equation were as follows:

$$L_{\infty} = 54.64 \text{ cm}, t_0 = 0.5403 \text{ year}, K = 0.35828$$

The comparison of subsequent mean body lengths of fishes shows that in the first four years of life the growth rate is fast (Fig. 4). Its mean value

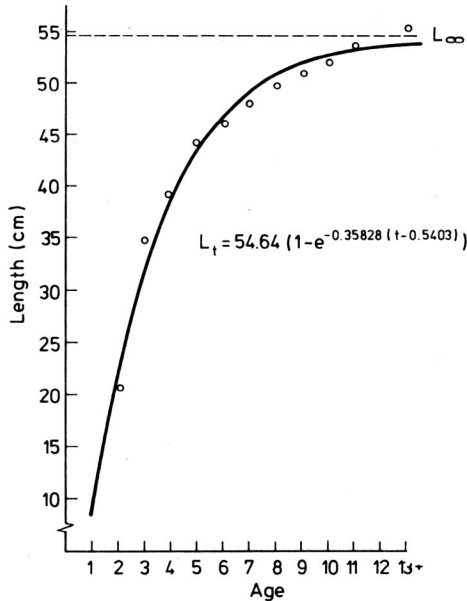


Fig. 4. Growth in length curve of South Georgia icefish

Table IV

Mean weights of South Georgia icefish in particular years of life

Age	1977	1978	1979	Mean
2	50.000 (1)*	59.091 (11)	94.625 (40)	86.250 (52)
3	310.000 (4)	289.500 (10)	382.133 (211)	376.751 (225)
4	782.500 (8)	478.571 (7)	546.190 (42)	571.052 (57)
5	901.176 (34)	980.000 (7)	840.000 (27)	884.999 (68)
6	1018.077 (26)	1085.867 (15)	1003.077 (13)	1033.241 (54)
7	1170.526 (19)	1197.235 (51)	1164.643 (14)	1102.153 (84)
8	1377.143 (42)	1350.022 (226)	1288.750 (36)	1346.513 (304)
9	1539.167 (24)	1479.003 (321)	1371.026 (39)	1471.797 (384)
10	1646.471 (17)	1592.205 (161)	1440.541 (37)	1570.395 (215)
11	1829.091 (11)	1655.625 (56)	1572.000 (10)	1669.545 (77)
12	1865.000 (10)	1810.735 (34)	1718.000 (5)	1812.347 (49)
13	2075.000 (2)	1823.500 (6)	—	1893.125 (8)

\*) in brackets — number of individuals

being about 10 cm per year. Olsen (1955) has pointed out this fact but could not determine fully the growth rate of South Georgia icefish because of scarce material available.

The individuals investigated weighed from 40 g to 2295 g. Mean weights (Table IV) were affected by changes in feeding intensity and the growth of gonads. The weight of South Georgia icefish as a function of body length was calculated separately for two groups of fishes depending on the extent of gonad development (Fig. 5). Group of fish with maturing or mature gonads i.e., stages III—VI counted 1179 specimens, whereas of individuals with gonads, stages I, II, VII and VIII, counted 399 individuals. The second group displayed higher correlation of characters. Correlation coefficients for these groups were respectively  $r = 0.79$  and  $r = 0.92$ .

#### 4. Conclusions

Measurements of body length of South Georgia icefish in the years 1977—1979 showed considerable differences in the frequency of individuals in particular classes of length. The local frequency peak was repeated only in the 50 cm class. Changes in other classes of length indicated either a higher

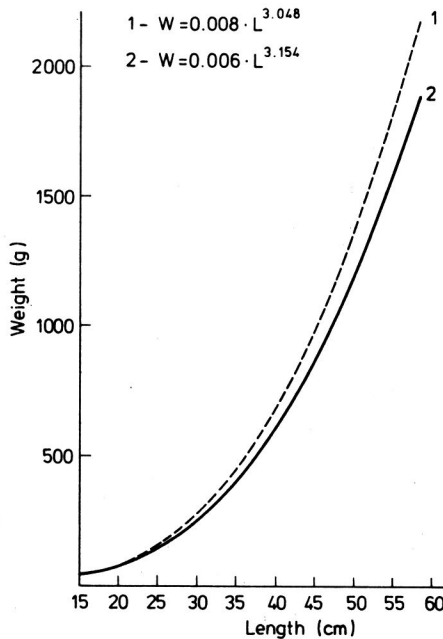


Fig. 5. Relation between weight and body length of South Georgia icefish for fishes with gonads in stages: 1 — I, II, VII, VIII, 2 — III, IV, V, VI

or lower number of fish belonging to different classes. These changes were confirmed by the analysis of the age of fish. In 1977 among the South Georgia icefish caught in the region of South Georgia Island fish 5—9 years old dominated and in the next year 6—7 years old fish, i.e., fish which were dominant the year before. This could be connected with migrations of fish from different year-classes.

In 1979 fish 3 years old dominated. Analysis of changes in frequency of body length and of age composition in the years 1977—1979 allows to assume that the South Georgia icefish in the region of South Georgia Island did not form a homogenous, stable stock. This made it impossible to estimate the mortality rate.

## 5. Summary

Results of investigations conducted between January and September in three consecutive years 1977—1979 were compared. South Georgia icefish (*Pseudochaenichthus georgianus*) in the region of South Georgia Island varied as to length. In 1977 fish of a body length 41—57 cm dominated, in 1978 fish 49—52 cm in length, and in both years individuals over 40 cm in length were the main component of catches (Table I, Fig. 2). In 1979 the contribution of fish of a body length below 40 cm was greater. Differences were also observed in the age composition. In 1977 fish 5—9 years old dominated and in 1978 — fish 8—10 years old at a simultaneous small contribution of fish 6 and 7 years old, i.e., fish from year-classes belonging to the dominant group the year before. In 1979 the mean age of fish decreased and the most abundant group were the 3 years old. Females dominated in all periods of



investigations (Table II). Analysis of the growth rate of South Georgia icefish showed intense body length increment in the first four years of life of this fish. Parameters of von Bertalanffy equation calculated on the basis of mean body lengths in consecutive years of life were as follows:

$$L_{\infty} = 54.64 \text{ cm}, t_0 = 0.5403 \text{ year}, K = 0.35828$$

Changes in age composition probably due to migrations of fish from different year-classes and increasing number of younger fishes in 1979 did not allow to use the material for estimations of mortality rate of South Georgia icefish.

## 6. Резюме

Проведено сравнение результатов исследований проведенных в первых кварталах очередных трёх лет 1977—1979. South Georgia icefish (*Pseudochaenichthys georgianus*) в районе Острова Южная Джорджия характеризовалась отменным распределением длины. В 1977 году было преимущество рыб с длиной тела от 41 до 57 см а в 1978 году от 49 до 52 см, при чём в обоих периодах главной частью ловли были особи выше 40 см длины (таблица I, рис. 2). В 1979 году выступало преимущество рыб длиной меньше 40 см. Разницы наблюдались также в возрастном составе. В 1977 году преобладали 5—9-летние рыбы, а в 1978 году 8—10-летние. Одновременно замечено небольшое участие 6 и 7-летних рыб, т.е. из поколений которые в прошлом году принадлежали к преобладающей группе (рис. 3). В 1979 году замечено значительное понижение возраста, самые многочисленные были трёхлетние рыбы. Во всех периодах исследований преобладали самки (таблица II). Анализ темпа роста South Georgia icefish указывал на интенсивное увеличение длины тела в первых четырёх годах жизни этой рыбы. Параметры равнения von Bertalanffy вычисленные на основании средней длины тела в очередных годах жизни следующие:

$$L_{\infty} = 54,64 \text{ см}, t_0 = 0,5403 \text{ года}, K = 0,35828.$$

Изменения в возрастном составе, которых причиной являются вероятно миграции рыб разных поколений, а также замеченное в 1979 году понижение возраста не дали возможности использовать материал для оценки смертности South Georgia icefish.

## 7. Streszczenie

Porównano wyniki badań prowadzonych w pierwszych kwartałach kolejnych trzech lat okresu 1977—1979. Georgianka (*Pseudochaenichthys georgianus*) w rejonie Wyspy Południowa Georgia charakteryzowała się odmiennym rozkładem długości. W 1977 roku dominowały ryby o długości ciała od 41 do 57 cm, a w 1978 roku od 49 do 52 cm, przy czym w obu okresach główny składnik połowów stanowiły osobniki o długościach powyżej 40 cm (tabela I, rys. 2). W 1979 roku większy był udział ryb o długościach ciała poniżej 40 cm. Różnice obserwowano także w składzie wiekowym. W 1977 roku dominowały ryby 5—9 letnie, a w roku 1978 — 8—10 letnie, przy jednoczesnym niewielkim udziale ryb w wieku 6 i 7 lat, tj. ryb z pokoleń, które w roku poprzednim należały do grupy ryb dominujących (rys. 3). W 1979 roku zaobserwowano znaczne odmłodzenie, najliczniejsze były ryby trzylenie. We wszystkich okresach badań dominowały samice (tabela II). Analiza tempa wzrostu georgianki wykazała intensywny przyrost długości ciała w pierwszych czterech latach życia tej ryby. Parametry równania von Bertalanffy'ego obliczone na podstawie średnich długości ciała w kolejnych latach życia wynoszą:

$$L_{\infty} = 54,64 \text{ cm}, t_0 = 0,5403 \text{ roku}, K = 0,35828$$

Zmiany w składzie wiekowym, spowodowane prawdopodobnie migracjami ryb różnych pokoleń oraz zaobserwowane w 1979 roku znaczne odmłodzenie, nie pozwoliły wykorzystać materiału w celu oszacowania śmiertelności georgianki.

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