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Blood of antarctic fishes: *Notothenia rossi marmorata* Fischer and *Notothenia* *neglecta* Nybelin *)

ABSTRACT: Blood of 71 specimens of *Notothenia rossii marmorata* and 61 specimens of *Notothenia neglecta* from the region of Admiralty Bay (King George Island) was examined. The number of erythrocytes and hemoglobin content were higher in the blood of *N. neglecta*. The number of erythrocytes and hemoglobin content were similar in males and females of both species. Considerable differences were noted between individual specimens.

Key words: Antarctic, fishes, blood

1. Introduction

The measurements of erythrocyte and hemoglobin content in blood of antarctic fishes are still scarce. Over 20 species were examined, yet not many specimens. Out of three families dominant in Antarctica *Chaennichthyidae* do not have hemoglobins in blood though they have a small number of erythrocytes (13–53 thousand/mm³) (Hureau et al. 1977). *Nototheniidae* have erythrocytes with hemoglobin, ranging from 500 to 1200 thousand/mm³. The third of the dominant families — *Bathyaconidae* is closely related to *Chaennichthyidae* and has least numerous erythrocytes with hemoglobin. It constitutes a link connecting the other two families on the way evolutionary changes leading to entirely colorless-blood species (Rakusa-Suszczewski 1975). Differentiation within the family *Nototheniidae* is particularly interesting. Results from the measurements of erythrocytes and hemoglobin content in two species of *Notothenia* verify the existing hitherto information on this matter.

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2. Methods

Studies were carried out from September 24 to October 8, 1977. Caught fishes were kept in aquaria at the temperature of -1.2°C to -0.1°C . Erythrocytes were counted in a Thoma chamber, hemoglobin content was determined with a Sahlie and hematocrit was measured in hematocrit tubes.

3. Results and discussion

Among Antarctic fish species found in the coastal zone of Admiralty Bay *Notothenia rossi marmorata* Fischer and *N. neglecta* Nybelin occur in greatest numbers. Thus, having and abundance of material for blood analyses it was possible to determine also the correlation between the body length and the body weight of the caught specimens. For *N. rossi marmorata* (50–500 g body weight) this dependence may be described by equation: $W = 0.0077 L^{3.123}$ ($R = 0.98$, $N = 71$). For the same species (1–7 kg body weight) occurring at South Georgia Shelf it may be expressed by: $W = 0.26 L^{2.84}$ (Linkowski and Rembiszewski 1978).

The comparison of the above equation shows that with the increase in body length the rate of the increase in weight is reduced. The correlation between the body length and body weight of *N. neglecta* (150–800 g) may be described by: $W = 0.0125 L^{3.03}$ ($R = 0.97$, $N = 67$). The obtained values of the a and b coefficients are almost identical with those given by Everson (1970) for the fishes occurring in the region of Signy Island.

The results from the measurements of erythrocytes, hematocrit and hemoglobin content are given in Table I and Figs. 1 and 2.

Hureau et al. (1977) basing on the analyses of 7 specimens of *N. rossi* and 6 specimens of *N. neglecta*, determined the number of erythrocytes in the blood of both species, as: 507 (321–720) and 906 (610–1150) thousand/ mm^3 , respectively. Our measurements show on the average slightly higher values than those given by Hureau et al. (1977). *N. neglecta* has a greater number of erythrocytes and hemoglobins than *N. rossi marmorata* (cf. Table I). There are considerable individual differences in the number of erythrocytes and hemoglobin content between the specimens of the same species. In *N. rossi marmorata* as well as in *N. neglecta* no significant differences in these values were found between males and females. An increase in the number of erythrocytes and hemoglobins was observed in *N. rossi marmorata* with the increase of its wet body weight (Figs. 1 and 2). The increase in erythrocyte and hemoglobin content in larger specimens may be associated with changes in the proportion between the surface to the weight of the body, due to the decrease of the surface with the growth of the fish. This was not observed in *N. neglecta* since the analysed specimens were of much larger size and greater weight than the specimens of *N. rossi marmorata*. The values of hematocrit are similar in both species.

Table I.
 Summary of the erythrocytes number and hemoglobin content of *Notothenia rossi marmorata* and *Notothenia neglecta* from Admiralty Bay

Species	Sex	Number of specimens studies	Mean length (cm \pm S. D.)	Mean weight (g \pm S. D.)	Erythrocytes number (thousands per (mm ³ \pm S. D.)	Hemoglobin	
						Mean Hematocryt	(g%) \pm S. D.
<i>Notothenia rossi marmorata</i>	male	40	25.31 \pm 4.15	200.0 \pm 105.2	940 \pm 287	36.04 \pm 9.8	39.7 6.3 \pm 1.45
	female	31	25.77 \pm 5.81	231.3 \pm 107.4	960 \pm 320	35.6 \pm 9.4	41.2 6.5 \pm 1.87
<i>Notothenia neglecta</i>	male	38	30.77 \pm 3.77	415.9 \pm 131.5	1110 \pm 275	34.6 \pm 9.9	42.7 6.9 \pm 1.53
	female	27	31.39 \pm 3.38	446.1 \pm 156.4	1230 \pm 311	36.9 \pm 8.5	45.0 7.2 \pm 1.68

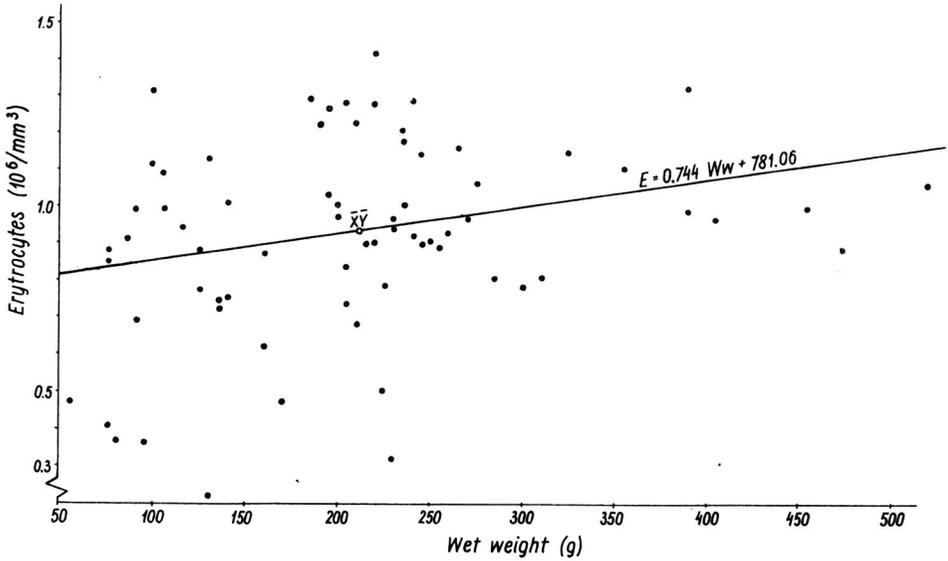


Fig. 1. Correlation between wet body weight and the number of erythrocytes in blood of *Notothenia rossi marmorata*

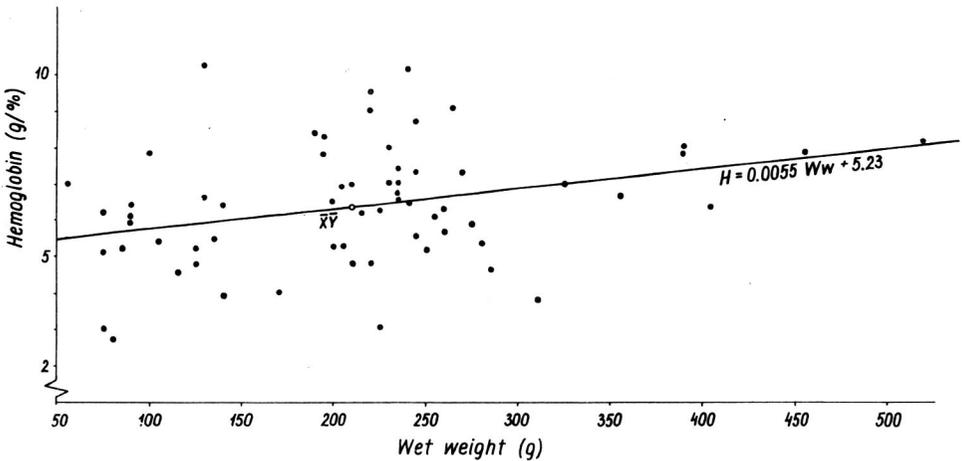


Fig. 2. Correlation between wet body weight and hemoglobin content in blood of *Notothenia rossi marmorata*

Among the fishes belonging to the family *Nototheniidae* two genera: *Trematomus* and *Notothenia* were observed. *Trematomus* fishes inhabit cooler waters in the immediate vicinity of the Continent of Antarctica whereas *Notothenia* is found in the areas farther north. The data on erythrocyte and hemoglobin content in genus *Trematomus* fishes are shown in Table II. Differences in blood composition between *Trematomus* and *Notothenia* fishes correspond to the difference in the distribution of the two genera. This

is also reflected in the differences in the mean level metabolism (cf. Hureau et al. 1977), which in fishes of the genus *Notothenia* is higher than in the genus *Trematomus* fishes.

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Table II.
Summary of antarctic fish blood analyses for the *Trematomus*

	No. of fish Erythrocytes		Hemoglobin	Hematocryt	Author
	21	750	2.5	24	Ruud (1954)
<i>T. bernacchii</i>	13	640	2.1	—	Rakusa-Suszczewski (1975)
	4	497(280-700)	—	—	Hureau et al. (1977)
	8	740	2.8	29	Ruud (1954)
<i>T. hansonii</i>	10	640	3.4	—	Rakusa-Suszczewski (1975)
	3	693(500-940)	—	—	Hureau et al. (1977)
<i>T. borchgrevinkii</i>	15	1190	5.3	38	Ruud (1954)
	9	710	5.0	—	Rakusa-Suszczewski (1975)
<i>T. newnesi</i>	9	990	4.5	—	Rakusa-Suszczewski (1975)
	2	700(690-710)	—	—	Hureau et al. (1977)
<i>T. loennbergii</i>	4	830	3.3	—	Ruud (1954)
<i>T. nicolai</i>	3	710	—	—	Rakusa-Suszczewski (1975)
<i>T. scotti</i>	3	600(550-680)	—	—	Hureau et al. (1977)

4. Summary

The blood (hemoglobin and number of erythrocytes) of two fish species (*Notothenia rossi marmorata* — 71 individuals, and *Notothenia neglecta* — 65 individuals), dominant in Admiralty Bay was studied. Higher values for hemoglobin and erythrocytes were found in blood of *N. neglecta* than of *N. rossi marmorata*. Studied blood indices were similar for males and females.

5. Резюме

Проведено исследование крови (гемоглобина и количество эритроцитов) двух преобладающих в Заливе Адмиральты пород рыб *Notothenia rossi marmorata* (71 особь) и *Notothenia neglecta* (65 особь). Больше гемоглобина и эритроцитов находится в крови *Notothenia neglecta* чем *N. rossi marmorata*. У самок и самцов количество эритроцитов и гемоглобина похожее.

6. Streszczenie

Badano krew (hemoglobina i liczba erytrocytów) u dwóch dominujących w Zatoce Admirałki gatunków ryb — *Notothenia rossi marmorata* (71 osobników) i *Notothenia neglecta* (65 osobników). Więcej hemoglobiny i erytrocytów stwierdzono we krwi *N. neglecta* niż we krwi *N. rossi marmorata*. Liczba erytrocytów i hemoglobiny we krwi samic i samców jest podobna.

7. References

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