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Fish biology

**STUDIES ON MORPHOLOGY AND OSTEOLOGY OF
PARACHAENICHTHYS GEORGIANUS (FISCHER, 1885)
(*NOTOTHENIOIDEI*, *BATHYDRACONIDAE*) FROM SHELF WATERS
OFF SOUTH GEORGIA (ANTARCTICA)**

**BADANIA NAD MORFOLOGIĄ I OSTEOLOGIĄ *PARACHAENICHTHYS*
GEORGIANUS (FISCHER, 1885) (*NOTOTHENIOIDEI*,
BATHYDRACONIDAE) Z WÓD SZELFOWYCH POŁUDNIOWEJ
GEORGII (ANTARKTYKA)**

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Body length-dependent variability of the 5 following characteristics, commonly regarded as diagnostic, was studied: head length, maximum body depth, interorbital distance, horizontal eye diameter, and snout length. Ray counts in the dorsal, anal, and pectoral fins were analysed. Skeletal bones were described in detail, based on material from 3 individuals. The data obtained served to extend the species description. Functional and evolutionary importance of variability in the characters studied was analysed.

INTRODUCTION

Of the six families distinguished in the suborder *Notothenioidei*, the *Bathydraconidae* are relatively poorly known. The following characters are diagnostic for the family: non-protractile snout with elongated jaws and shortened premaxilla ascendens; a total lack of articulated junction between the meso- and metapterygoid; the epiceratohyal very delicate and elongated; hypobranchial rays shortened; the upper end of the preopercle reduced; apparent lack of the first dorsal fin, although its reduced basal bones (*ossa basalia*) are retained inside the dorsal muscles (Voskobojnikova, 1986; Voskobojnikova and Baluškin, 1988).

The *Bathydraconidae* are rather diverse in their anatomy and morphology. After Jakubowski (1975) had discovered, in *Gymnodraco acuticeps* Boulenger, 1902 the internal nostrils (*choanae*), later on also observed in *Psilodraco breviceps* Norman, 1938, Andriašev (1983, 1986) suggested the genera *Gymnodraco* and *Psilodraco* be separated into a subfamily *Gymnodraconinae*. Detailed comparative studies of morphology and anatomy by Andriašev et al., (1989) proved the suggestion to be correct. At the same time, drawing from observations published by various authors, the authors mentioned state that the remaining bathydraconid genera, rather automatically incorporated into the subfamily *Bathydraconinae*, differ to a degree that warrants separation of further subfamilies. For this reason, all studies that would broaden the knowledge of morphology and anatomy of species belonging to the *Bathydraconinae* are necessary.

The studies on some morphometric, meristic, and osteologic characters described below will, perhaps, contributed to a better understanding of certain functional, evolutionary, and systematic problems related to the *Bathydraconidae*.

MATERIALS AND METHODS

The fish examined were caught with a demersal trawl operating at depths of 94 – 267 m during cruises of RV "Profesor Siedlecki" to the southern hemisphere in austral summers of 1987/88 and 1988/89. The fish were brought frozen to the laboratory. Table 1 shows the inventory of materials collected.

Table 1

Inventory of the materials examined

Date of capture	Position	Depth (m)	Length range of individuals examined (mm)	No. of individuals
31 Dec. 1987	54°52' S 36°16' W	131–143	154–580	68
7 Jan. 1988	53°50' S 36°47' W	244–267	140–348	75
1 Feb. 1989	54°32' S 35°44' W	179–192	154–176	13
2 Feb. 1989	54°54' S 35°41' W	94–119	156–450	7
3 Feb. 1989	54°57' S 35°08' W	101–107	446	1
Total		94–267	140–580	164

Based on a number of individuals (162) much higher than in the previous descriptions of the species, 9 characters, commonly regarded as diagnostic, were studied, including 5 morphometric characteristics (head length, maximum body depth, interorbital distance, horizontal eye diameter, and snout length). Results of the measurements were expressed as proportions of the total and/or head length and their body length-dependent variability was followed. Three meristic characters (ray counts in the dorsal, D, anal, A, and pectoral, P, fins) and a relationship between the total (longitudo totalis, l.t.) and the standard (longitudo corporis, l.c.) lengths were studied as well. The osteology was studied on 3 individuals selected from 1987/88 catches.

Table 2

Number of measurements and examinations

Type of analysis	No. of individuals examined in season	
	1987/1988	1988/1989
Morphology		
Length (l.t. + l.c.)	141	21
Head length	141	21
Maximum body depth	139	21
Interorbital distance	139	21
Snout length	141	21
Horizontal eye diameter	141	21
Ray count in D	141	21
Ray count in A	141	21
Ray count in P	140	21
Osteology	3	—

Table 2 summarises the analyses performed, while Fig. 1 outlines the system of measurements (taken to 1 mm).

The Latin nomenclature of bones follows that of Rojo (1988).

Morphometric and meristic characteristics

Table 3 summarises the results obtained.

Standard length varied from 84.27 to 91.00 (87.99 on the average) per cent of total length (Table 3). The relationship between the two characters is linear within the total length range at hand (140 – 580 mm) and expressed as $l.c. = 0.889 l.t. - 2.7$, where l.c. = standard length; l.t. = total length.

Head length ranged from 29.89 to 37.23 (33.34 on the average) per cent of total length. As shown in Fig. 2, the relevant relationship closely approaches linearity, although some

positive allometry can be detected, i.e. the head grows at a somewhat faster rate than the body.

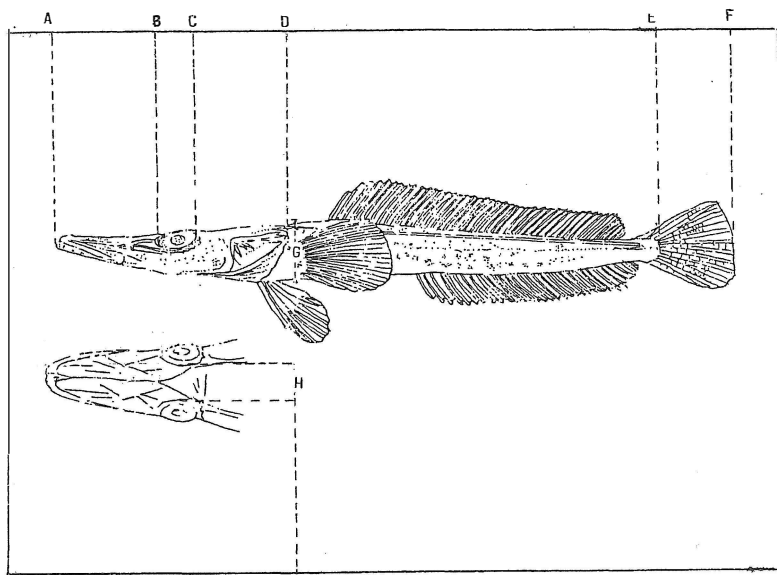


Fig. 1. Morphometric characters of *Parachaenichthys georgianus*: a schematic of measurements. AF, total length; AE, standard length; AD, head length; AB, snout length; SC, horizontal eye diameter; G, maximum body depth; H, interorbital distance.

Maximum body depth was 4.58 – 13.56 (8.76 on the average) per cent of total length. As shown in Fig. 3, the maximum body depth – total length relationship is curvilinear (positive allometry), which means that body depth increases disproportionately faster than the body length. The scatter of data points is large as the maximum body depth may vary widely in an individual, depending on gut fullness, gonad maturity, and even on depth of capture.

Interorbital distance made up 2.32 – 10.11 (5.85 on the average) per cent of head length. As seen in Fig. 4, the relevant relationship is curvilinear and shows positive allometry evidencing that the neurocranium width increase rate is disproportionately faster than the body growth rate. The data points are scattered rather widely, evidencing a high variability of the character.

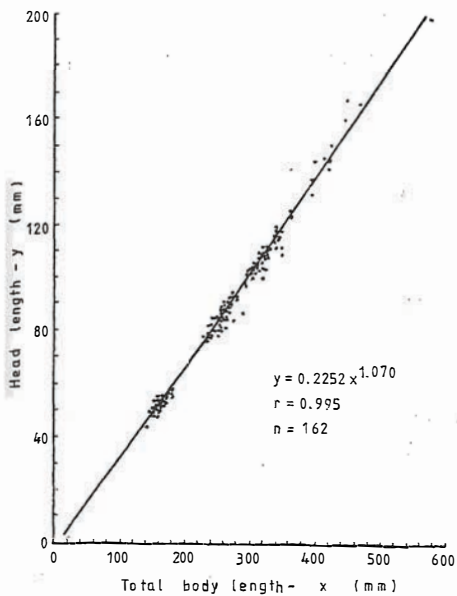


Fig. 2. Head length (y) vs. total body length (x) relationship in *P. georgianus*

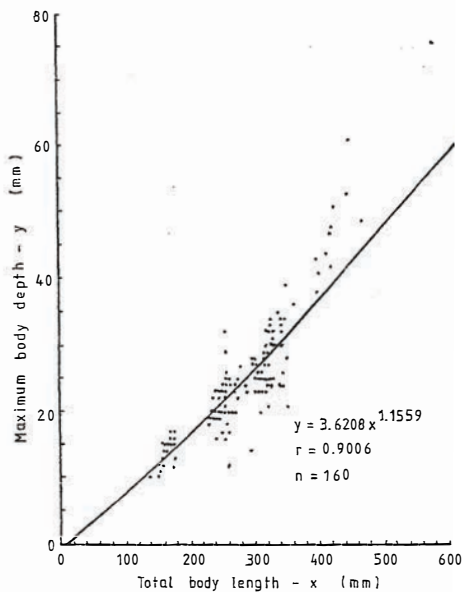


Fig. 3. Maximum body depth (y) vs. total length (x) relationship in *P. georgianus*

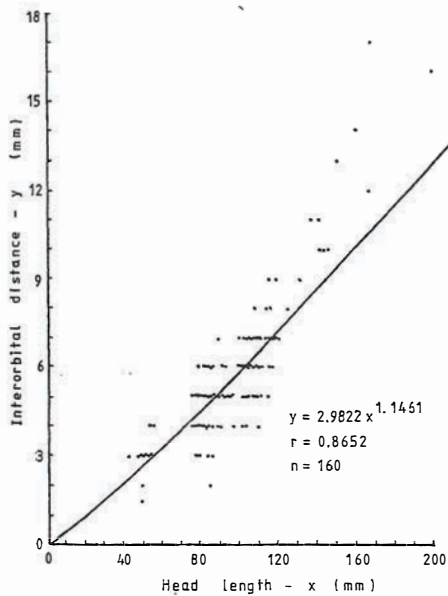


Fig. 4. Interorbital distance (y) vs. head length (x) relationship in *P. georgianus*

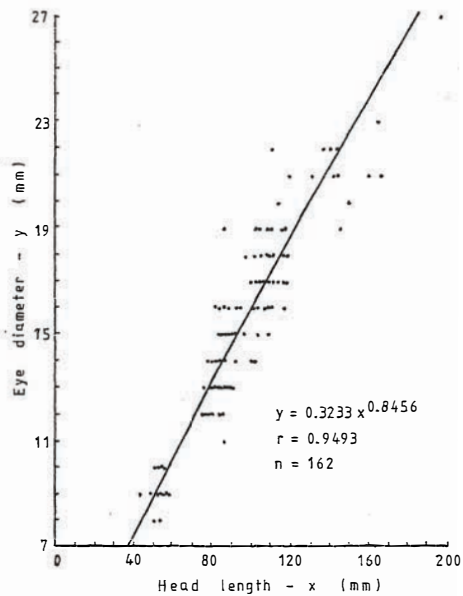


Fig. 5. Horizontal eye diameter (y) vs. head length (x) relationship in *P. georgianus*

Table 3

Summary of morphological data

Character	Range	\bar{x}	$\pm \sigma$	n
As % of total length:				
Standard length (l.c.)	84.27–91.00	87.99	1.31	161
Head length	28.89–37.23	33.34	1.17	162
Maximum body depth	4.58–13.56	8.76	1.36	160
Snout length	10.54–19.23	15.41	0.94	162
As % of head length:				
Interorbital distance	2.32–10.11	5.85	1.10	160
Snout length	31.39–55.55	46.24	2.38	162
Horizontal eye diameter	12.50–21.83	16.23	1.54	162
Meristic characters:				
Ray count in D	42–47	43.77	0.97	162
Ray count in A	30–34	31.70	0.75	162
Ray count in P	21–24	23.35	0.82	161

Horizontal eye diameter varied from 12.50 to 21.83 (16.23 on the average) per cent of head length. The relationship is curvilinear and evidences negative allometry: the eyes become relatively smaller with fish growth (Fig. 5).

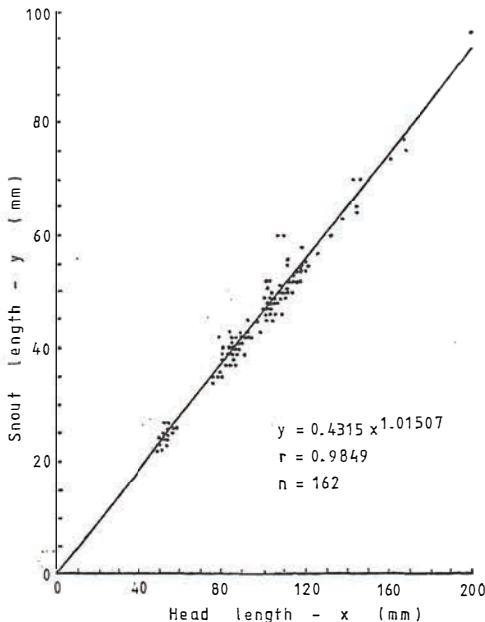


Fig. 6. Snout length (y) vs. head length (x) relationship in *P. georgianus*

Mouth length was 31.39 – 55.55 (46.24 on the average) per cent of head length. The relevant relationship is close to linearity, although a slight positive allometry is discernible (Fig. 6). The mouth length made up 10.54 – 19.23 (15.41 on the average) per cent of total length (Table 3).

Fin ray counts: the dorsal fin contained 42 – 47 (43.77 on the average); the anal fin contained 30 – 34 (31.77 on the average) rays; the pectoral fins had 21 – 24 (23.35 on the average) rays (Table 3).

Skeleton structure

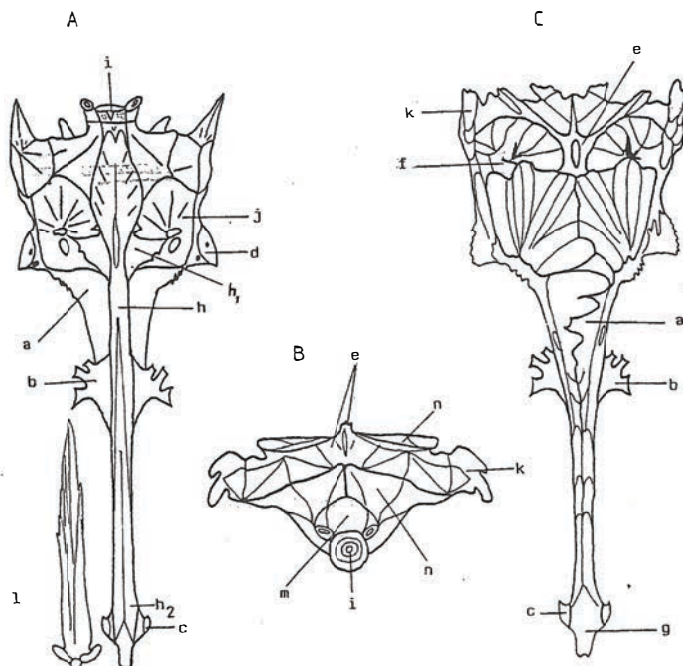
Neurocranial bones (Figs 7, 8, 9)

Fig. 7. Neurocranial bones in ventral (A), posterior (B), and dorsal (C) view. a – frontale; b – ethmoideum laterale posterioris; c – ethmoideum laterale anterioris; d – sphenoticum; e – supraoccipitale; f – parietale; g – mesethmoideum; h – parasphenoid; i – basioccipitale; j – prooticum; k – pteroticum; l – vomer; m – foramen magnum; n – exooccipitale

The frontals (frontalia; Fig. 7) are strongly elongated. Their external margins are irregularly serrated in the posterior part. The margins adjoin ventrally, in their mid-part, to the posterior lateral ethmoids (ethmoidalia laterale posterioris; Fig. 8) whose external margins are irregularly serrated. Anteriorly, the lateral margins of the frontals adjoin the small anterior lateral ethmoids (ethmoidalia laterale anterioris; Fig. 7 and 8). Posteriorly, the frontals touch the sphenotics (sphenotica; Fig. 7 and 8) which cover the anterior part of the canal in the prootics (prootica), the latter adjoining the supraoccipitals (supraoccipitalia; Fig. 7) and the parietals (parietalia; Fig. 7) which reach up to the upper branching on the parasphenoid (parasphenoid). The posterior parts of the frontals, along with the sphenotics, supraoccipitals, and parietals form the upper part of the neurocranium. A single, elongated mesethmoid (mesethmoideum; Fig. 7) is covered from above by the anterior

The mesethmoid extends to the mid-parts of the lateral posterior ethmoids. The mesethmoid is poorly ossified and connects with the ethmoid cartilage (cartilago ethmoidale).

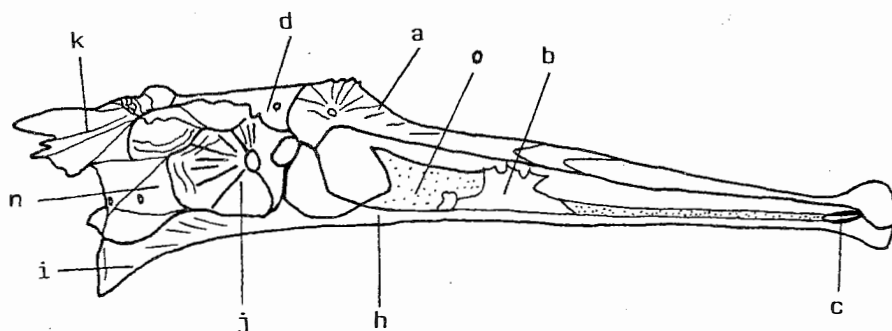


Fig. 8. Neurocranial bones in lateral view. o, – ethmoid cartilage (cartilago ethmoideum); remaining symbols as in Fig. 7

Ventrally, the axial part of the neurocranium contains the longest cranial bone, i.e., the single parasphenoid (parasphenoideum; Fig. 7 and 8). Its posterior part touches the basioccipital (basioccipitale; Fig. 7 and 8) and reaches up to the mesethmoid anteriorly. Branches of the parasphenoid (Fig. 7) extend to lower margins of openings in the prootics (prootica; Fig. 7 and 8). The parasphenoid splits in its anterior part (Fig. 7), while posteriorly, above the neurocranium, the bone broadens.



Fig. 9. The lacrimal (lacrimale) and infraorbitals (infraorbitalia) (a)

The elongated, lamellate lacrimals (lacrimalia; Fig. 9) are rounded in their posterior part and spine-like sharpened anteriorly. The lacrimals are adjoined by the four small infraorbitals (infraorbitalia; Fig. 9) touching the lateral line system canals.

The nasals (nasalia) are thin and elongated. They adjoin laterally to the frontals in the anterior elongated part of the latter.

The vomer (vomer; Fig. 7) shows a clear head, its posterior part taking the shape of a thin, elongated, posteriorly tapered lamella which extends to the posterior part of the lateral posterior ethmoids and attaches from below to the parasphenoid. The vomer is totally toothless.

Jaw bones (Fig. 10, 11, 12)

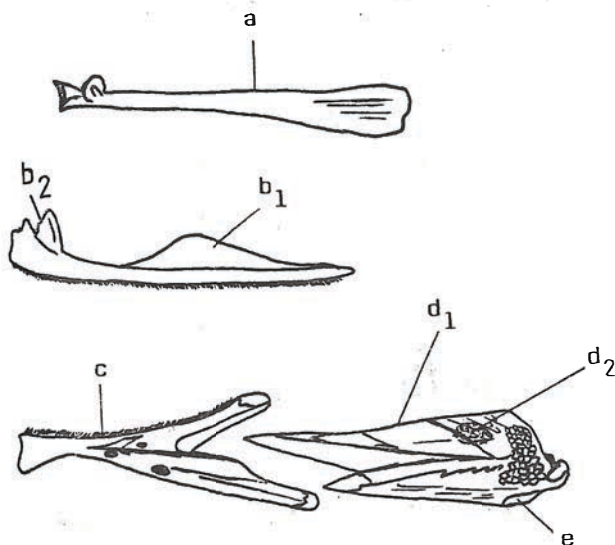


Fig. 10. Bones of the upper (maxilla) and lower (mandibula) jaws. a - maxillaria; b - prae-maxillaria; b1 - processus postmaxillaris; b2 - praemaxillare ascendens; c - dentalia; d - articularia; d1 - processa coronoidei; d2 - ossa coronomeckelium; e - angularia.

The upper jaw (maxilla; Fig. 10) consists of paired maxillaria (Fig. 10) and premaxillae (praemaxillaria; Fig. 10). The maxilla extends beyond the posterior end of the premaxilla; it is slightly rounded anteriorly, somewhat narrower in the mid-part, and broadens lamella-like to the posterior. The premaxillae are toothed almost along their entire length, the teeth slightly curving towards the posterior. The teeth are villiform, anteriorly arranged in 4 - 5 rows and posteriorly in a single row (Fig. 11A). The upper part of the bone houses lamellate processes (processus postmaxillaris; Fig. 10). The premaxillae ascendens (praemaxillare ascendens; Fig. 10b) are strongly reduced in *Parachae-nichthys georgianus*.

The mandible (mandibula; Fig. 10) consists of paired dentaries (dentalia; Fig. 10), articulars (articularia; Fig. 10), and angulars (angularia; Fig. 10). The dentaries are equipped with setiform teeth, bent posteriorly and arranged in 3 or 4 rows (Fig. 11B).

The angulars' upper parts, known as the processa coronoidei (Fig. 10) adjoin, along the larger part of their length, to the dentaries. The articular is spongy externally, at the level of the coronomeckelian bone (ossa coronomeckelium; Fig. 10). The angulars are fused with lower posterior parts of the articulars.

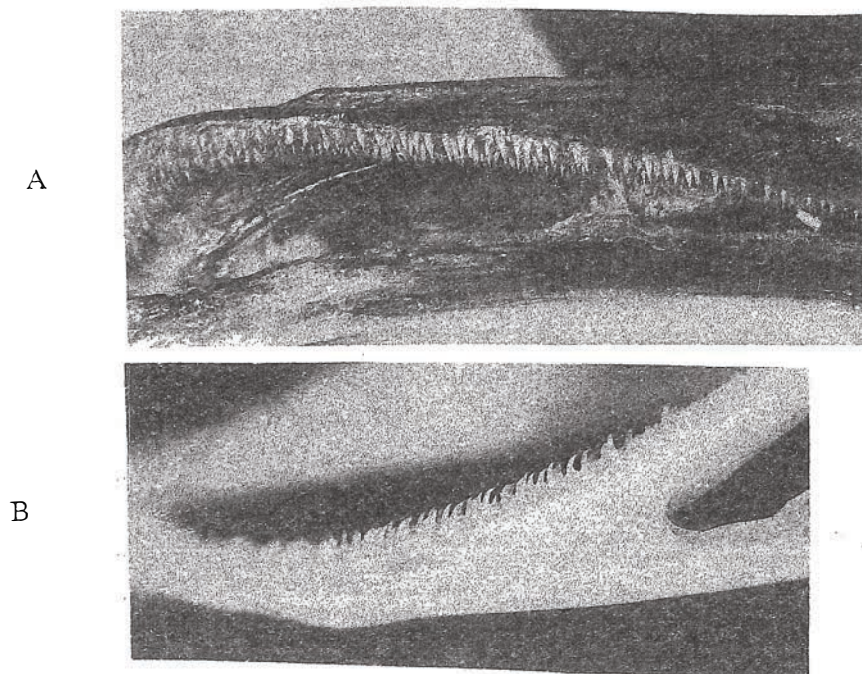


Fig. 11. A fragment of the upper (A) and lower (B) jaw; see villiform teeth curved backwards

The quadrate (quadratum; Fig. 12) connects in its upper part with the palatine (palatinum; Fig. 12), while its lower anterior part connects with the angular. The palatine is elongated, filliform. Its anterior part connects with the maxilla, its posterior end connecting – via the ecto- and mesopterygoid – with the quadrate. There is no clear separation between the ecto- and mesopterygoid.

Opercle bones

The opercular (operculare; Fig. 12) is very characteristic. Its upper posterior part has 4 or 5 processes ending with spines directed backwards and up. Anteriorly and from above, it forms an articulate junction with the hyomandibular (hyomandibulare; Fig. 12). From inside, the opercular is joined by the subopercle (suboperculare; Fig. 12) and the interopercle (interoperculare; Fig. 12). The opercular is spongy in its mid-part. The subopercle is poorly ossified, semi-translucent; its anterior end forms a sharp upturned process. The preopercle (praeoperculum; Fig. 12) is L-shaped, with numerous seismo-sensory canals almost on its entire surface. Its lower and upper parts adjoin to the interopercle and the hyomandibular, respectively. The interopercle is elongated, smooth on its internal surface and spongy externally. The bone narrows to the anterior and rounds off posteriorly. The

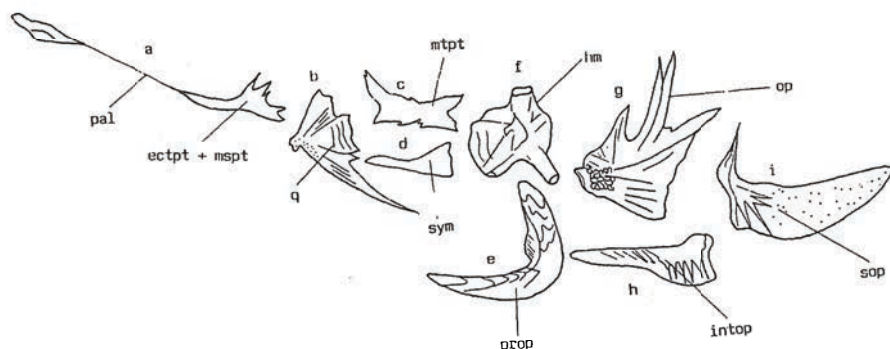


Fig. 12. Bones of the opercle, mandibular arch, and palatine. a – palatinum (ectpt + mspt = ectopterygoideum + mesopterygoideum); b – quadratum; c – metapterygoideum; d – symplecticum; e – praeoperculum; f – hyomandibulare; g – operculum; h – interoperculum; i – suboperculum

hyomandibular (hyomandibulare; Fig. 12) forms a joint with the neurocranium and with the opercular; via a cartilage, it connects with the metapterygoid (metapterygoideum; Fig. 12) and the symplectic (symplecticum; Fig. 12). The metapterygoid is poorly ossified along its lower margin which connects, via the interhyal (interhyale) with the hyoid arch (arcus hyoideus). Like Balužkin (1984) before, the authors observed a hook-like process in the mid-part of the hyomandibular.

Bones of the hyoid arch (arcus hyoideus; Fig. 13)

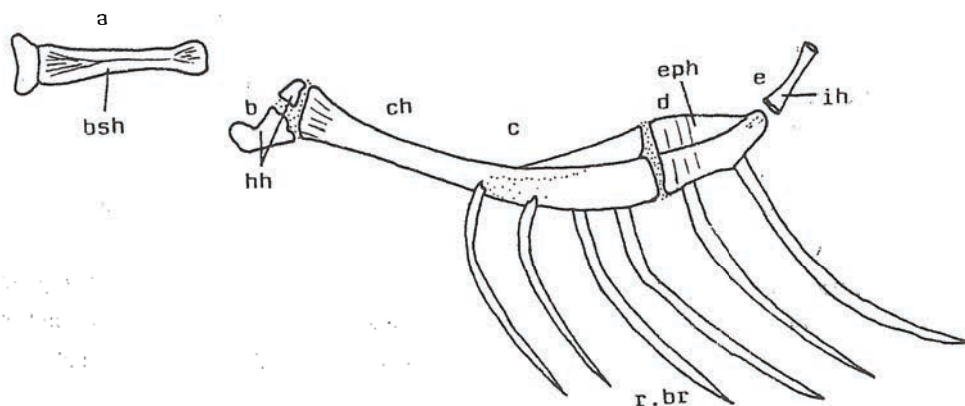


Fig. 13. Bones of the hyoid arch. a – basihyale; b – hypohyale; c – ceratohyale; d – epihyale; e – interhyale; f – radii branchiostegi.

The hyoid arch in *P. georgianus* is made up of a number of bones. The foremost is the basihyal (glossohyale = basihyale; Fig. 13) which connects the right and the left part of the arch. The anterior flattened part consists of cartilaginous tissue, the posterior, ossified part being narrower. The hypohyal (hypohyale; Fig. 13) consists of two parts, upper and lower, and connects with the basihyal at one end and with the ceratohyal (ceratohyale; Fig. 13) at the other. The ceratohyal is elongated and joins the epihyal (epihyale; Fig. 13), a triangular bone extending to the interhyal (interhyale; Fig. 13). The latter forms a connection between the hyoid arch and the opercle (more specifically, the hyomandibular). All the hyoid bones described are tubular in structure, posterior parts of the ceratohyal and the epihyal forming a crest. Elastic ligaments connect the hyoid arch with six branchiostegal rays (radii branchiostegii; Fig. 13), four of which are connected with the ceratohyal: two anterior rays join the bone externally, the next two joining the ceratohyal from the inside of the arch. The fifth and sixth branchiostegal rays are proximally fused with the ceratohyal.

Bones of the branchial apparatus (ossa branchiae; Fig. 14)

The branchial apparatus of *P. georgianus* consists of four branchial arches (arcus branchialis) and the fifth arch which is the pharyngeum inferioris. Small tufts of delicate villiform teeth are placed proximally on the branchial arches (Fig. 14). The pharyngeum inferioris has fine brush-like setiform teeth, curved backwards; these are the pharyngeal teeth (Fig. 14).

Pectoral girdle (cingulum extremitatis anterior; Fig. 15)

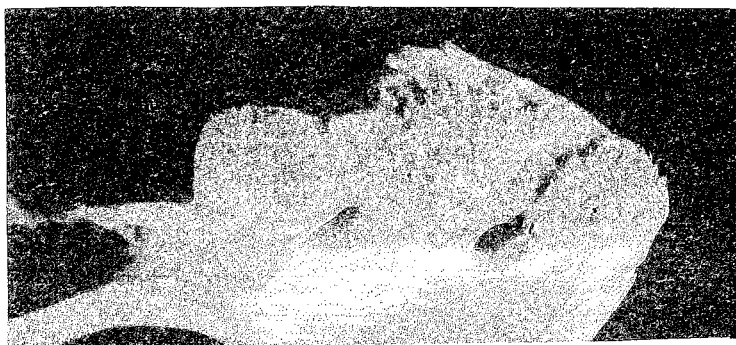
The anterior margin of the upper lobe of the cleithrum (cleithrum; Fig. 15) gives rise to a hook-like spine extending to about mid-height of the lobe. The radials look like three polygonal plates (Fig. 15). The coracoid (coracoideum; Fig. 15) is also plate-like. The upper lobe of the cleithrum and the coracoid and anterior radial are separated by the scapula (scapula); its upper (free) margin is provided with a small sharp process (Fig. 15). The pectoral girdle has two orifices the relative length of which increases with fish length. The upper orifice, i.e. the scapular one (foramen scapularum; Fig. 15) is bound by the cleithrum, scapula, and the coracoid. The lower orifice (foramen pericoracoideum; Fig. 15) is limited by the cleithrum and the coracoid.

The pectoral girdle contains additionally the supracleithrum (supracleithrum; Fig. 15) in the form of an elongated plate fused with the anterior lobe of the cleithrum, and the posttemporal (posttemporale; Fig. 15) housing some of the lateral line sensoric canals.

A



B



C



Fig. 14. Bones of the branchial apparatus (ossa branchialis) with visible brush-like tufts of fine teeth. a – arcus branchialis; b – ossa pharyngo-branchialia; c – pharyngeum inferioris.

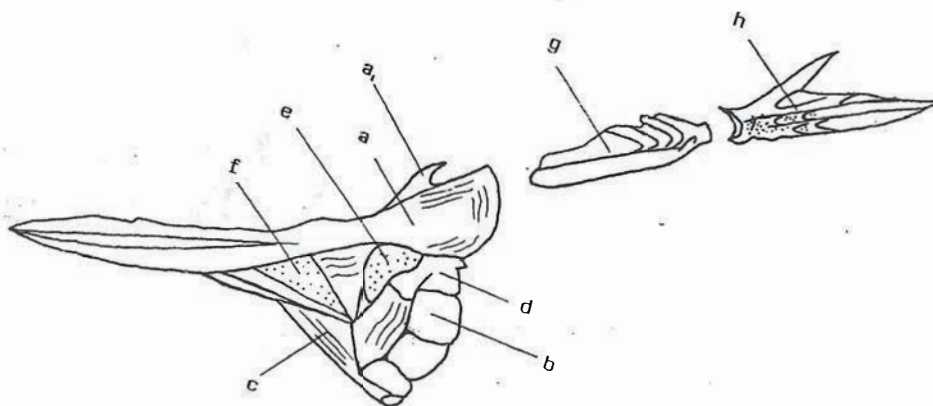


Fig. 15. Bones of the pectoral girdle a – cleithrum; b – radalia; c – coracoideum; d – scapula; e – foramen scapulium; f – foramen coracoideum; g – supracleithrum; h – posttemporale.

Pelvic girdle (cingulum extremitatis posterior)

The girdle consists of two pubic bones (ossa pubic); the left and right hand sides of the girdle are fused together with a medial cartilage. The girdle is fused with the lower part of the pectoral girdle (the cleithrum).

The pectoral fins are equipped with 6 soft furcated rays.

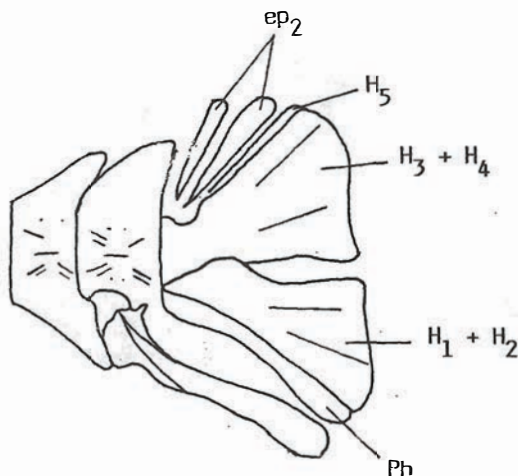


Fig. 16. Caudal bones ep₂ – epuralia; H₁ + H₂, H₃ + H₄, H₅ – hypuralia; Ph – parhypural.

Caudal skeleton (ossa caudalis; Fig. 16)

The base of the caudal peduncle is provided with 5 hypurals (hypuralia: h₁ + h₂; h₃ + h₄ and h₅) fused to the urostyl vertebra (vertebrum urostylae); 1 to 2 epurals were found in the upper part of the caudal skeleton.

The axial skeleton does not differ from that of other notothenioid species. It is, however, important to mention the frequently observed fusion of 2 – 5 vertebrae in the anterior part of the vertebral column.

Dorsal fin

Similarly to all other *Bathydraconidae*, *P. georgianus* has a single dorsal fin. However, some individuals did possess, invisible from the outside, rudiments of the first dorsal fin in the form of vestigial basal bones (ossa basalia) located above the frontal part of the pectoral fin.

DISCUSSION

The relative eye diameter in *P. georgianus* decreases with increasing head length. At the same time, the relative interorbital distance increases. Those changes may be important functionally and are perhaps related to a switch in feeding. As shown by studies on food and feeding of the species, small individuals (less than 15 cm in length) feed primarily on small crustaceans (*Mysidacea*) and gradually switch, as they grow, to a diet composed of small fish and prawns (Kompowski, 1992). The shape of the body, and particularly the snout shape of *P. georgianus*, resembles that of the pike. The convergence is suggestive of a similar feeding behaviour: stalking a prey and a rapid foray to capture it. The increased interorbital distance makes it possible to more accurately assess the distance from a potential nektonic prey.

Compared with data reported by Voskobojnikova (1985), more elongated jaws and a shorter premaxilla ascendens, observed in the osteological study, may be an evidence that the process of elongation and protractility limitation of the snout, found in some of the *Notothenioidei*, is advanced in *P. georgianus*. This is related to a gradual change from benthonic life, typical of primitive notothenioids, to pelagic life. This so-called pelagization of the bottom dwelling fish, demonstrated for the first time by Nybelin (1947, quoted after Andriašev, 1986) has been described by, among others, Naumov and Permitin (1973), Baluškin (1976), Iwami (1985), and Andriašev (1986). The small size, relative to the lower jaw length, of the dental bone and the postmaxillar process as well as a horizontal location of the articular, observed in *P. georgianus* are other characters associated with vanishing snout protractility. Poor ossification of the ethmoid part of the cranium and weak, setiform teeth on the jaws, observed in *P. georgianus* are typical of the *Bathydraconidae* and *Channichthyidae*, the families regarded by Baluškin (1984) as the most specialised ones within the *Notothenioidei*.

The poor ossification of some elements of the opercle (suboperculum and interoperculum) is most likely related to tightening of the opercle as a symptom of adaptation to feeding in the water column. The reduction in the upper part of the preopercular may be associated with shortening of the upper section of the seismo-sensoric canal. That would correlate with observations made on other *Bathydraconidae* (e.g. Voskobojnikova, 1986).

Generally, the skeleton of *P. georgianus* is poorly ossified, which results from the above mentioned "secondary pelagization" of the species and is an adaptation to reduce the body weight.

Drawings of certain skeletal components of *Parachaenichthys charcoti* (palatinal arch, bones of the opercle and branchial arch), published by Iwami (1985) evidence a great similarity between skeletal systems of the two species. However, no conclusions as to the differences between *P. georgianus* and *P. charcoti* can be drawn from the figures.

The dorsal fin ray count range found by the present authors (42 – 47) is wider than that reported by Norman (1938) and Gon (1990) (43 – 46). Also the anal fin showed the range of ray counts (30 – 34) to be wider than that reported by Norman (31 – 33) and Gon (30 – 33). The pectoral fin, too, had in the present study a wider range of ray counts (21 – 24) than 21 – 23 reported by Norman (1938) and Gon (1990).

Extended description of the species

Diagnosis: D 42 – 47; A 30 – 34; P 21 – 24. Maximum body depth is 4.58 – 13.56% of total length, the relative depth increasing with fish length. Head length is 29.89 – 37.23% of total length; head length increases somewhat with fish length. Interorbital distance is 2.32 – 10.11% of head length and increases with fish length. Horizontal eye diameter is 12.50 – 21.83% of head length and decreases with increasing fish length.

Body elongated, sagittal, cylindric-oval in cross section. Head flattened dorso-ventrally. Two lateral lines; the upper one long, extending from head to caudal peduncle narrowing where it converges with the short lower lateral line beginning on caudal peduncle. Opercle, in its posterior part, has 4 – 5 bony processes ended with spines directed backward and up. On the inside of branchial arches there are tufts of delicate setiform teeth (10 – 32 tufts depending on the arch). Pharyngeal arch has a brush-like tuft of fine teeth curved backward. Vomer and palatine toothless. Premaxillae equipped with villiform, backward curved teeth arranged in 4 – 5 rows. Similar teeth, arranged in 3 – 4 rows on dentaries.

Coloration grey-brown with a purplish hue. Dark spots on the dorsal part and on the sides of the body. Abdomen light in colour.

REFERENCES

- Andriašev A.P.**, 1983: Podotriad nototenivnykh (Notothenioidei). in: *Žizn' Životnykh*, t. 4, Izd. Prosveščeniye: 425–431. (In Russian).
- Andriašev A.P.**, 1986: Obščij obzor fauny donnykh ryb Antarktiki. Tr. Zool. Inst. AN SSSR, **153**: 9–45. (In Russian).
- Andriašev A.P., A.V. Baluškin, O.S. Voskoboynikova**, 1989: Morfologičeskoje obosnovanije podsemejstva plugariyevykh ryb (Gymnodraconinae, Bathydraconidae). Vopr. Ichtiol., **29**, 4: 515–523 (In Russian).
- Baluškin A.V.**, 1976: Obzor vidov gruppy "larseni" roda Nothotenia Rich. Vopr. Ichtiol., **16**, 1: 3–15. (In Russian).
- Baluškin A.V.**, 1984: Morfologičeskije osnovy sistematiki i filogenii nototeniyevykh ryb. Izd. Zool. Inst. AN SSSR, Leningrad: 1–140. (In Russian).
- Gon O.**, 1990: Bathydraconidae, in: *Fishes of the Southern Ocean* [Gon O., P.C. Heemstra eds.], J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa: 364–380.
- Iwami T.**, 1985: Osteology and relationships of the family Channichthyidae. Mem. Nat. Inst. Polar Res., ser. E, **36**: 1–69.
- Jakubowski M.**, 1975: Anatomical structure of olfactory organs provided with internal nares in the Antarctic fish *Gymnodraco acuticeps* Boul. (Bathydraconidae). Bull. Acad. Pol. Sci. (Ser. Biol.), **23**, 2: 115–120.
- Kompowski A.**, 1992: Food and feeding behaviour of *Parachaenichthys georgianus* (Fisher, 1885) and *Parachaenichthys charcoti* (Vaillant, 1906) (Pisces, Bathydraconidae). Acta Ichth. Piscat., **22**, 1: 15–29.
- Naumov A.G., J.E. Permitin**, 1973: O trofičeskikh vzaimootnošenijach *Euphasia superba* Dana i ryb Južnogo okieana (na primierie Morja Skotia). Tr. VNIRO, **93**: 216–229. (In Russian).
- Norman J.R.**, 1938: Coast fishes. Part 3, the Antarctic zone. Discov. Repts, **18**: 1–105.
- Rojo A.L.**, 1988: Diccionario enciclopédico de anatomia de los peces. Monografias del Instituto Espanol de Oceanografia, Madrid, **3**: 1–566.
- Voskoboynikova O.S.**, 1986: Evolucionnyje preobrazovanija visceralnogo skeleta i voprosy filogenezy nototeniyevykh ryb (Notothenioidae). Tr. Zool. Inst. AN SSSR, **153**: 46–66. (In Russian).
- Voskoboynikova O.S., A.V. Baluškin**, 1988: O nachoždenii piati tuloviščnykh bokovykh linii u antarktičeskoj ryby *Psilodraco breviceps*. Biol. Moria, Vladivostok, **6**: 47–52. (In Russian).

BADANIA NAD MORFOLOGIĄ I OSTEOLOGIĄ *PARACHAENICHTHYS GEORGIANUS*
(FISCHER, 1885) (*NOTOTHENIOIDEI*, *BATHYDRACONIDAE*) Z WÓD SZELFOWYCH
POŁUDNIOWEJ GEORGII (ANTARKTYKA)

STRESZCZENIE

W oparciu o znacznie obszerniejszy materiał niż w dotychczasowych opisach gatunku, przeprowadzono studia nad 9 cechami uznawanymi powszechnie za diagnostyczne (Tab. 2, Fig. 1).

Zbadano 5 cech morfometrycznych: długość głowy, maksymalną wysokość ciała, odległość międzyoczną, poziomą średnicę oka i długość pyska (Tab. 2, Fig. 1). Wyniki tych pomiarów wyrażono w % długości całkowitej lub długości głowy i zbadano zmienność tych proporcji wraz ze wzrostem długości ciała badanych ryb (Fig. 2–6). Dodatkowo zbadano zależność między długością całkowitą (l.t.) i długością ciała (l.c.). Ponadto zbadano 3 cechy merystyczne – liczebność promieni w płetwach: grzbietowej, odbytowej i piersiowej (Tab. 3). W oparciu o trzy osobniki wykonano dokładny opis kości szkieletu (Fig. 7–16).

Na podstawie tych badań morfologicznych i osteologicznych sporządzono rozszerzony opis gatunku.

Niektóre proporcje ciała *P. georgianus* ulegają zmianom wraz ze wzrostem długości osobnika. Wykryte względne zmniejszanie się średnicy oczu oraz zwiększanie się ich rozstawu wraz ze wzrostem długości ma prawdopodobnie znaczenie funkcjonalne i związane jest ze stopniowym przechodzeniem omawianych ryb z odżywiania się drobnymi skorupiakami przydennymi na odżywianie się nektonem.

Występujące u *P. georgianus* wydłużone, w porównaniu z niektórymi innymi przedstawicielami *Bathydraconidae* (*Gymnodraconinae*), szczęki oraz skrócony wyrostek praemaxillare (Fig. 10) – świadczą o zaawansowanym procesie "wtórnej pelagizacji". Innymi cechami świadczącymi o wtórnej pelagizacji jest słabe skostnienie, gąbczastość i przesylenie tłuszczem układu kostnego (zmniejszenie masy właściwej).

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