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Results of the research cruises of FRV 'Walther Herwig' to South America. LXXII. *Patagonotothen krefftii* sp. n., a new Patagonian notothen from Burdwood Bank, Western South Atlantic (Pisces, Perciformes, Nototheniidae).*

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with 2 Figures and 3 Tables

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Kurzfassung

Ergebnisse der Forschungsreisen des FFS 'Walther Herwig' nach Südamerika. LXXII. *Patagonotothen krefftii* sp. n., eine neue patagonische Nototheniidenart von der Burdwood Bank im Südwestatlantik (Pisces, Perciformes, Nototheniidae).

Mit 13 Exemplaren aus Sammlungsbeständen des ZIN und ISH wird *Patagonotothen krefftii* sp. n. beschrieben, eine neue patagonische Nototheniidenart von der Burdwood Bank im Südwestatlantik. Die neue Art steht innerhalb der *longipes*-Artengruppe ihrer Gattung *P. ramsayi* verwandtschaftlich am nächsten, von der sie sich in Färbung, Zahl interorbitaler Schuppenreihen und einigen morphometrischen Proportionen unterscheidet. Beide Arten besitzen höhere Zahl von Kiemenreusenfortsätzen als die Schwesterarten *P. longipes* und *P. wiltoni*. Ein revidierter Bestimmungsschlüssel für alle vier Arten der *P. longipes*-Gruppe wird angeboten.

Abstract

Patagonotothen krefftii sp. n. is described, based on 13 specimens at ZIN and ISH collected on Burdwood Bank in the Western South Atlantic. Within the *longipes*-species group of its genus, the new species is most closely related to *P. ramsayi*, from which it is distinguished by colouration, number of interorbital scale rows, and several proportional morphometrics. Both species have higher gill raker counts than the other group members *P. longipes* and *P. wiltoni*. A revised key to the four species of the *P. longipes*-group is provided.

* Dedicated to Dr. Gerhard Krefft on the occasion of his 80th birthday in 1992.

1. Introduction

Fifteen nominal species are currently assigned to *Patagonotothen* (BALUSHKIN, 1993, in this issue of Arch. FischWiss.), the most speciose genus of the family Nototheniidae. The genus has been subdivided by BALUSHKIN (1976b) in the *P. brevicauda*-, *cornucola*-, *longipes*-, and *tesselata*-species groups. Among these four groups, species of the *P. longipes*-group are the most common ones in the Patagonian region, most advanced from an evolutionary point of view, and taxonomically the most problematical ones. Of the so far described three species, only *P. longipes* (Steindachner, 1876) has been recognized as a valid species by the majority of authors (e.g. THOMPSON, 1916; NORMAN, 1937). In contrast, *P. ramsayi* (Regan, 1913) has been understood in various ways either as a valid species (e.g. BALUSHKIN, 1976b, 1989; ANDERSEN, 1984), or as a subspecies only of *P. longipes* (DEWITT, 1967; HUREAU, 1985; LLORIS & RUCABADO, 1991). *P. wiltoni* (Regan, 1913) finally appears to be a nominal species rather. Some authors (e.g. DEWITT, 1967; HUREAU, 1985) considered this species as a synonym of *P. longipes*, following THOMPSON (1916). NORMAN (1937) also noted, that *P. wiltoni* and *P. longipes* may prove to be identical. In our opinion, the taxonomic rank of *P. wiltoni* will remain unresolved, until a detailed revision of this species group can be undertaken, including the re-examination of all type specimens.

The description of the new species is based on 13 preserved specimens sampled on Burdwood Bank during the first German Antarctic Expedition with FRV 'Walther Herwig' (1975/76) and the Russian Antarctic Expedition with RV 'Gizhiga' (1984/85). In both cruises, specimens of *P. krefftii* sp. n. were captured together with the closely related *P. ramsayi*. Beyond, the catch of 'W. Herwig' stat. 17/76 consisted of: *Bathyraja albomaculata* (Norman, 1937), *B. scaphiops* (Norman, 1937) (Fam. Rajidae), *Macrourus whitsoni* (Regan, 1913) which in fact probably were *M. carinatus* (Günther, 1878) (Fam. Macrouridae), *Cottoperca trigloides* (Forster, in Bloch & Schneider, 1801) (originally identified as *C. gobio*) (Fam. Bovichtidae), *Patagonotothen guntheri* (Norman, 1937), *Lepidonotothen squamifrons macrophthalma* (Norman, 1937) (originally identified as *N. macrophthalma*), *Dissostichus eleginoides* Smitt, 1898 (Fam. Nototheniidae); that of 'Gizhiga' stat. 68 also contained: *Bathyraja albomaculata*, *B. brachyurops* (Fowler, 1910), *B. griseocauda* (Norman, 1937), *B. macloviana* (Norman, 1937), *Micromesistius australis* Norman, 1937 (Fam. Gadidae), *Cottoperca trigloides* (Fam. Bovichtidae), *Dissostichus eleginoides*, and *Patagonotothen guntheri guntheri* (Norman, 1937) (Fam. Nototheniidae).

The type specimens of *P. krefftii* sp. n. are deposited in the collections of the Zoological Institute, Russian Academy of Sciences (ZIN), St. Petersburg, and the Institut für Seefischerei, Hamburg (ISH).

2. Methods and material

Definition of characters, the mode of their description, meristic counts and morphometric measurements follow BALUSHKIN (1976a, 1990). Measurements were taken by dial caliper to the nearest 0.1 millimeter. Counts of skeletal elements of unpaired fins, as well as further osteological observations were obtained from radio-graphs. Bilateral meristic counts given for left/right side. Observations on life colouration of specimens were noted by the senior author aboard RV 'Gizhiga'.

The following specimens were used for comparison:

Patagonotothen ramsayi: ISH 1230-1966 (3 spec.), ISH 261-1976 (3), ZIN 43326 (1), ZIN uncatalogued (20) from RV 'Andrus Yokhani' on Burdwood Bank (54°05'S, 58°00'W), 140-180 m, November 1984.

P. longipes: ISH 1704-1966 (2), ISH 268-1978 (5), ISH 275-1981 (4).

3. Systematics

3.1 Description of *Patagonotothen krefftii* sp. n. (Fig. 1)

Holotype: **ZIN 50258**, 299 mm SL (345 mm TL). RV 'Gizhiga' stat. 68; 54°07.8'S, 57°42.2'W; 155-160 m, 14.XII.1984. Coll. A.V. Balushkin.

12 paratypes: **ISH 263-1976**, 9 spec. 228-293 mm SL (276-348 mm TL). FRV 'Walther Herwig' stat. 17/76; 54°21'-22'S, 56°18'-15'W; 210 m, T_b: 4.68°C; 26.XI.1975; 140'-BT. Coll. G. Krefft & M. Stehmann. - **ZIN 50259**, 3 spec. 253-324 mm SL (293-377 mm TL); taken with the holotype.

Diagnosis

A species of the *P. longipes*-species group of *Patagonotothen*, which distinguished from the three other species groups of the genus mainly by having three pores in supratemporal commissure, four postlachrymalia, 51 or more vertebrae and high number also of branched caudal fin rays (14-16). *P. krefftii* is distinguished from congeners of the *P. longipes*-species group by gill raker counts higher than 35 in outer row of first arch and/or 4-6 scale rows in interorbital space, narrow interorbital width (16.6-20.7% of head length), long preorbital snout (28.0-31.6% of head length), and prenarial snout being longer than internarial distance.

Data of the paratypes follow in parentheses those of the holotype, respectively.

Principal meristics characters

D VII (VI-VII), 35 (34-35); A 33 (32-34); P 28/27 (26-28); C 40 (39-43), of which 14 (14-16) branched rays; 69 (65-70) vertical scale rows on trunk counted from base of P to C medially; 51/52 (51-58) tubular scales in dorsal, 12/14 (9-18) in median lateral line; gill rakers on first arch in outer row 14+24 = 38 (13-16+24-27 = 37-42), in inner row 4+1+19 = 24 (3-4+1+18-20 = 22-25); total vertebrae 52 (51-52), of which 17 (16-17) abdominal.

Lateral line system

Supraorbital canal with 3 (3) pores in front of the coronal commissure, and 2 (2) pores behind which situated posterior to eye. Infraorbital canal with 8 (8-9) pores, of which 4 (4) in lachrymal bone. Temporal canal with 5 (5) pores, excluding the sensory pore in supracleithrum. Preoperculo-mandibular canal with 10 (10-11) pores. A single pore in coronal, 3 (3) pores in supratemporal commissure.

Squamation

Scales on body ctenoid, except for those between occiput and spinous dorsal fin, on bases of pectoral fins with both ctenoid and cycloid scales mixed, on belly, and in front of and between pelvic fins where only cycloid scales. Small, usually non-ctenoid scales extend onto bases of pelvic and pectoral fins. Head scaled, except on lips, snout, jaws, and margins of preopercle and opercle; scales extending to premaxillary tip, to end of maxillary on cheeks, and to anterior margin of eyes in interorbital space. Scales absent along lining of preoperculo-mandibular and lachrymal canals; first postlachrymal partly scaled. On top of head and opercle, scales as large as those on flanks; scales somewhat smaller on cheeks, on belly, in front of and between pelvic fins. Scales on head ctenoid, or mixed cycloid and ctenoid on cheeks in young; mixed ctenoid and cycloid, or cycloid only in larger specimens. Larger specimens also have scales in interorbital space partly embedded in the skin.

Teeth

Teeth relatively small in both jaws: medially, 4-6 tooth rows in upper, 3-5 rows in lower jaw, with teeth of outermost row slightly enlarged and those of inner rows gradually reduced in size; laterally, teeth set in only 1-2 rows in upper, and 1 row in lower jaw.

Morphometrics

In per cent of SL (299, 276-377 mm): body depth at origin of anal fin (H) - 21.1 (16.6-24.2); antedorsal distance to D1 (aD1) - 29.4 (28.3-33.2); antedorsal distance to D2 (aD2) - 40.8 (39.6-45.5); height of D1 (hD1) - 11.0 (9.9-11.9); anteanal distance (aA) - 49.8 (47.8-52.8); length of pectoral fin (LP) - 21.7 (20.5-24.2); length of ventral fin (LV) - 19.1 (17.2-20.5); distance from base of ventral fin to anal fin (LVA) - 24.7 (21.4-26.8); length of caudal peduncle (lcp) - 7.7 (6.4-8.4); height of caudal peduncle (hcp) - 8.4 (7.1-8.8); head length to bony margin of operculum (Lc1) - 30.4 (29.0-32.4).

In per cent of head length (Lc1)(91.0, 73.6-98.0 mm): width of head (Wc) - 56.0 (52.7-59.3); depth of head at midlevel of eye (Ho) - 48.3 (44.7-51.8); antorbital distance (= snout length) (a0) - 28.6 (28.0-31.6); diameter of eye (0) - 24.2 (22.4-26.0); length of upper jaw (Lmx) - 39.6 (35.8-40.8); length of lower jaw (Lmd) - 45.0 (41.9-46.2); interorbital distance (i0) - 19.8 (16.6-20.7).

Skeleton, based on radiographs

Vertebrae to first interneurale of D1: 2 (2); to first interneurale of D2: 9 (8-9); to first interhaemale: 12 (11-12). Free caudal vertebrae in dorsal view: 10 (9-11); in ventral view: 7 (8-9). A pair of interneuralia situated jointly between the neural spines of third and fourth vertebrae. Eight (7-8) interneuralia in front of first interneurale of D2, of which 1 (0-1) free and not bearing a fin ray. Six (6-7) interhaemalia in front of first caudal vertebrae under abdominal section of vertebral column. Vertebrae of urostyle articulating with five hypural plates. Formula of distribution of principal C-fin rays with reference to hypural plates: 1-5-2-5-2. Caudal fin with 40 (39-43) rays, of which 14 (13-15) are upper procurrent, 15 (15) principal and 11 (11-13) lower procurrent ones.

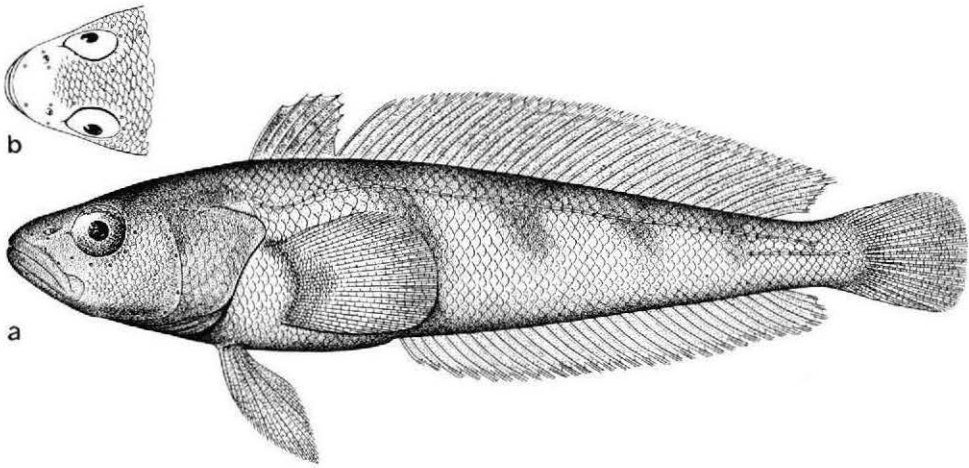


Figure 1: *Patagonotothen krefftii* sp. n., holotype ZIN 50258, 299 mm SL; Burdwood Bank.
a) Lateral view, b) dorsal view of head.

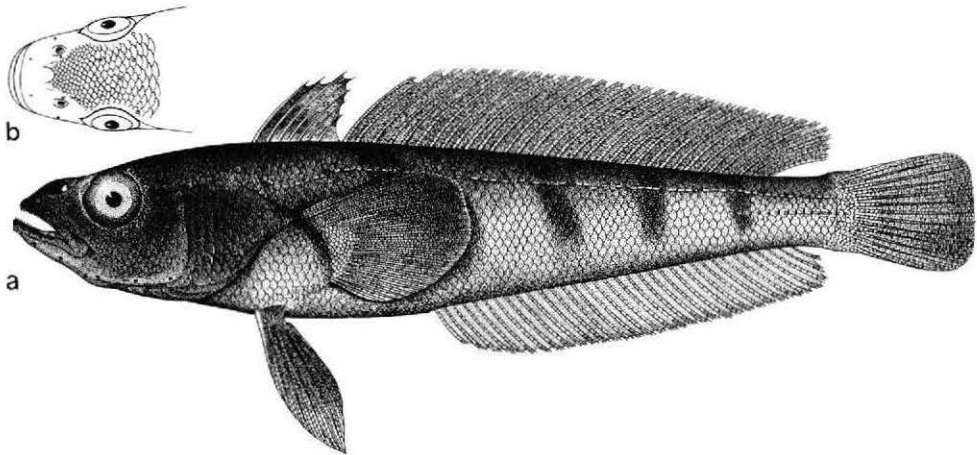


Figure 2: *Patagonotothen ramsayi* Regan, ZIN 43326, 238 mm SL; Burdwood Bank.
a) Lateral view, b) dorsal view of head.

Colouration

Holotype and paratypes show principally equal colouration.

(in life): on greyish ground colour, sides of body between pectoral and caudal fins with five dusky greenish cross-bars oriented somewhat obliquely rearward. D1 with two light brownish horizontal stripes, or with a diffuse brownish blotch with blue tinge distally. D2 vaguely dusky. Anal pale, or greyish-blue. Pectoral and caudal fins with green tinge; pectoral base with indistinct dusky vertical bar. Ventral surfaces dirty greyish. Dorsal, anal and caudal fins narrowly edged white. Upper side of head darker; top of head, cheeks and opercle with green lustre.

(in alcohol): ground colour ochre. Sides of body between pectoral and caudal fins with five more or less distinct broad, dusky bars; a sixth one vertically through origin, a seventh indistinct one through end of caudal fin, rear margin of which semitransparent ochre. Sides and top of head marked off rather dark greyish-brown, and pectoral base in most specimens with a vertical dusky to blackish stripe. Anterior half of opercle distinctly darker than posterior half in some specimens. D1 dusky, with base and upper margin pale. D2 more or less dusky, less intense than D1, with vague banding corresponding to dusky bars on body sides, and upper margin pale. Anal fin semitransparent ochre to vaguely dusky, and broadly edged pale. Belly ochre to creamy-white, but underside of head medium to dark greyish-brown, incl. branchiostegal membranes, as remainder of head in some specimens. Pectoral and pelvic fins totally ochre, or medium to darker greyish centrally, with rear edge lighter.

Etymology

Named in honour of Dr. Gerhard Krefft, founder and former head of the ISH ichthyology group and collection, for his fundamental contributions to marine ichthyology, in particular also on South Atlantic fishes.

3.2 Interspecific comparisons

P. krefftii corresponds well with all diagnostic features for the *P. longipes*-group as defined by BALUSHKIN (1976b), especially in high number of vertebrae (51 or more) and branched rays of the caudal fin (14-16), by having 4 postlachrymalia, and in composition of the seis-mosensory system (3 pores in supratemporal commissure), and furthermore in features of tooth morphology, squamation and colouration.

Both, *P. krefftii* and *P. ramsayi* are clearly distinguished from the two other congeners of their species group by the higher number of gill rakers on the first gill arch (Tables 1-3). Our new species differs from *P. ramsayi* in a meristic character and several morphometrics of the head specified in the key below. However, we must emphasize that literature information should be used with extreme care only in separating *P. krefftii* from *P. ramsayi*. In our opinion, NORMAN's (1937: 79) description of *P. ramsayi* was based on composite samples of several species resulting in a wide range of gill raker counts (16-26 on lower part of outer row) and thus causing difficulties for subsequent authors in the correct identification of species within the *P. longipes*-group. Among recent works, e.g., EKAU's (1982) biological study on *P. ramsayi* was apparently based on at least three species of the *P. longipes*-group, as well as NAKAMURA's (1986) description of *P. ramsayi*; also LLORIS & RUCABADO (1991) have misidentified *P. longipes* for *P. longipes ramsayi*.

Table 1: Range of outer row gill-raker counts on lower part of first arch in species of the *Patagonotothen longipes*-group, as comparison of literature data with authors' results. References: **a** - REGAN (1913), **b** - THOMPSON (1916), **c** - NORMAN (1937), **d** - NAKAMURA (1986), **e** - LLORIS & RUCABADO (1991, incl. subspecies *P. longipes ramsayi* and *P. longipes gilberti*), **f** - present authors' data, **g** - NYBELIN (1969), **h** - NYBELIN (1951).

Species	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Reference
<i>longipes</i>	*	*													a
			x	x	x	x	x	x							b
	*	*	*												c
	*	*	x	x											d
				x	x	x									e
				*	*	*	*	*							f
<i>wiltoni</i>			*	*	*	*									a
			*	*											g
				*											d
<i>krefftii</i>										*	*	*	*	f	
<i>ramsayi</i>								*	*	*	*	*			a
										-	*				h
									*	*	*	*	*		f

We therefore provide below an improved key to the four species of the *P. longipes*-group. Preliminarily, we follow REGAN (1913) and NORMAN (1937) in recognizing both, *P. longipes* and *P. wiltoni* as separate species.

Table 3: Frequency distribution of inner row gill-rakers on first arch in three species of the *Patagonotothen longipes*-group. (Material used, as in Table 2)

Species	upper part				lower part								
	2	3	4	5	14	15	16	17	18	19	20	21	22
<i>longipes</i>	4	4			1	4	-	1	1	-	1		
<i>krefftii</i>		9	4							4	5	4	
<i>ramsayi</i>		5	13	1					2	6	6	4	1

Species	total number											
	17	18	19	20	21	22	23	24	25	26	27	
<i>longipes</i>	3	1	1	-	1	-	1					
<i>krefftii</i>						2	6	4	1			
<i>ramsayi</i>						3	7	6	2	-	1	

- 2a. Interorbital width 7-8, eye 3-3.6 times in head length. At most 5 scale rows between eyes. Pelvics as long as, or longer than pectorals, extending to origin of anal fin or beyond *P. longipes*
- 2b. Interorbital width 5.8-7.3, eye 4-5 times in head length. 5-6 scale rows between eyes. Pelvics shorter than pectorals, not or just reaching to vent *P. wiltoni*
- 3a. Top of head, snout, opercle and cross-bars on body dark brown or blackish, with blue or purple lustre in life; pectoral and caudal fins distinctly green in life. 7-9 (rarely 6) scale rows between eyes. Interorbital space 19.7-26.6%, antorbital distance 24.6-28.2% of head length (Lc1); distance from snout tip to nostril as long as, or shorter than internarial distance (Fig. 2) *P. ramsayi*
- 3b. Top of head, snout, opercle and cross-bars on body greyish or light brown, with green lustre in life; pectoral and caudal fins light green in life. 4-6 scale rows between eyes. Interorbital space 16.6-20.7%, antorbital distance 28.0-31.6% of head length (Lc1); distance from snout tip to nostril longer than internarial distance (Fig. 1) *P. krefftii*

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