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Channichthys richardsoni sp. n., a new Antarctic icefish (Perciformes: Notothenioidei: Channichthyidae) from the Kerguelen Islands area, Indian sector of the Southern Ocean

G.A.Shandikov

V.N.Karazin Kharkiv National University (Kharkiv, Ukraine)
fishingnet@ukr.net

Robust icefish, *Channichthys richardsoni*, a new species (the ninth species of white-blooded fish in the genus *Channichthys*) is described from 18 specimens, 229–374 mm TL, taken in July and August 1990 by 2 bottom trawls at depths of 126–310 m near the Kerguelen Islands. The holotype (NMNH 5116, adult female, 355 mm TL and 316 mm SL) and 6 paratypes were deposited in the National Museum of Natural History of National Academy of Sciences of Ukraine. Judging the shape of the first dorsal fin (type II) and relatively narrow interorbital width, *C. richardsoni* belongs to the same group of species which includes *C. irinae*, *C. bospori* and *C. mithridatis*. It is closely related to *C. mithridatis*, but differs from it by very robust exterior, heavy ossification of head, strong bony tuberculation, presence of well developed thick bony plates in the proximal part of median lateral line, relatively smaller eyes, and by features of coloration.

Key words: *Antarctica, Kerguelen-Heard Submarine Ridge, white-blooded fish, endemic, systematics, taxonomy, biology, stages of gonad maturity.*

Channichthys richardsoni sp. n. – новый вид антарктической белокровковой рыбы (Perciformes: Notothenioidei: Channichthyidae) от островов Кергелен, индоокеанский сектор Южного океана

Г.А.Шандиков

Белокровка Ричардсона *Channichthys richardsoni* является новым, девятым видом эндемичных белокровковых рыб рода *Channichthys*, обитающих в субантарктических шельфовых водах островов и банок подводного хребта Кергелен-Хёрд. Вид описан по 18 экземплярам 229–374 мм TL, добытым автором у островов Кергелен в июле и августе 1990 г. из уловов 2 донных тралов на глубине 126–310 м (23-й рейс НИС «Профессор Месяцев»). Голотип (ННПМ: №5116, взрослая самка 355 мм TL и 316 мм SL) и 6 паратипов (взрослые и впервые созревающие самцы и самки) помещены на хранение в Национальный научно-природоведческий музей Национальной академии наук Украины (Киев). По форме первого спинного плавника (тип II) и относительно узкому межглазничному пространству *C. richardsoni* относится к той же группе видов, что *C. irinae*, *C. bospori* и *C. mithridatis*. Более близок к *C. mithridatis*, но отличается от него плотными мощными окостенениями головы, сильной костной туберкуляцией (грануляцией), наличием хорошо развитых толстых костных округлых бляшек в передней части срединной боковой линии, относительно меньшими глазами и особенностями окраски. *C. richardsoni*, судя по внешнеморфологическим особенностям, строению, расположению и небольшому числу жаберных тычинок, а также сравнительному анализу с другими видами рода, является преимущественным хищником-ихтиофагом, ведущим донный образ жизни. Размножается, по-видимому, осенью или ранней зимой.

Ключевые слова: *Антарктика, Южный океан, подводный хребет Кергелен-Хёрд, систематика, таксономия, белокровные рыбы, эндемик, биология, стадии зрелости гонад.*

Channichthys richardsoni sp. n. – новий вид антарктичної білокровкової риби (Perciformes: Notothenioidei: Channichthyidae) від островів Кергелен, індоокеанський сектор Південного океану

Г.О.Шандиков

Білокровка Ричардсона *Channichthys richardsoni* є новим, дев'ятим видом ендемічних білокровкових риб роду *Channichthys*, що поширені у субантарктичних шельфових водах островів та банок підводного хребту Кергелен-Херд. Вид описано по 18 екземплярах 229–374 мм TL, що були добуті автором біля островів Кергелен у липні та серпні 1990 р. з уловів 2 донних тралів на глибині 126–310 м (23-й рейс НДС «Професор Месяцев»). Голотип (ННПМ: №5116, доросла самка 355 мм TL та 316 мм SL) та 6 паратипів (дорослі та особини, що дозрівають вперше) розміщені на зберігання у Національному науково-природничому музеї Національної академії наук України (Київ). За формою першого спинного плавця (тип

II) та відносно вузького міжокового простору *C. richardsoni* належить до тієї ж самої групи, що *C. irinae*, *C. bospori* та *C. mithridatis*. Більш близький до *C. mithridatis*, але відрізняється від нього щільним та міцним закостенінням голови, сильною кістковою туберкуляцією (грануляцією), наявністю товстих округлих кісткових бляшок у передній частині медіальної бічної лінії, відносно меншими очима та особливостями забарвлення. *C. richardsoni*, судячи за зовнішньоморфологічними особливостями, побудовою, розміщенням та невеликою кількістю зябрових тичинок, а також за порівняльним аналізом з іншими видами роду, являється переважним хижаком-іхтіофагом, який веде донний спосіб життя. Розмножується, ймовірно, восени або на початку зими.

Ключові слова: *Антарктика, Південний океан, підводний хребет Кергелен-Херд, систематика, таксономія, білокровні риби, ендемік, біологія, стадії зрілості гонад*.

Introduction

The sub-Antarctic genus *Channichthys* includes 8 species of icefish, 5 of which were lately described by Shandikov (1995a, 1995b, 2008). The taxonomic status of the form *C.* aff*. rugosus* is regarded now as conspecific with *C. rugosus* Regan, 1913, and *C. normani* Balushkin, 1996 should be considered as a junior synonym of *C. panticapaei* Shandikov, 1995 (see Shandikov, 2008). Judging from the number of valid species, the genus *Channichthys* is the largest genus of the family Channichthyidae, encompassing a third of all "white-blooded" fishes, which include, according to my data, about 25–26 species. The type locality of all known *Channichthys* species is the Kerguelen Islands area (Fig. 1), though they also inhabit talassobathyal of the chain of south-eastern banks up to the nearshore waters of Heard and McDonalds Islands (Southern Scientific Research Institute of Marine Fisheries and Oceanography (YugNIRO, Kerch, Ukraine) unpublished data; Meissner, Kratkiy, 1978; Slosarczyk, Wysokinski, 1980; Duhamel et al., 1983; Williams, 1983; Shandikov, 1996; Duhamel et al., 2005).

The present paper continues the description of new *Channichthys* species based on materials of the collection obtained by the author in 1990 (Shandikov, 1995a) from nearshore waters of the Kerguelen Islands.

Material

Materials for description (18 specimens) were collected in 1990 in the Kerguelen Islands area during the YugNIRO fishery scientific research expedition on board of the *RV Professor Mesyatsev (PM)*. Basic material for comparison was sampled during the same and former YugNIRO expeditions and preserved at the National Museum of Natural History of National Academy of Sciences of Ukraine (NMNH, Kiev), YugNIRO and the Zoological Institute of Russian Academy of Sciences (ZISP, St.-Petersburg, Russia).

Main comparative materials include 142 specimens of 8 *Channichthys* species (see Shandikov, 1995b; 1996, 2008), and 5 additional specimens: 2 of *C. rhinoceratus* (NMNH 5114, male 410 mm TL, 368 mm SL, *FRV Reshetnyak*, bottom trawl, Kerguelen Islands, February–March 1995; YugNIRO uncatalogued, post-spawning female 435 mm TL, 387 mm SL, the same data) and 3 specimens of *C. rugosus* (ZISP uncatalogued, Kerguelen Islands: male 276 mm TL, 244 mm SL, bottom trawl, depth 105 m, 25 December 1969; male 238 mm TL, 212 mm SL and female 280 mm TL, 250 mm SL, *RV Skiff*, cruise 7, bottom trawl No. 188, 48°34' S, 70°37' E, depth 115–120 m, 28 June 1974) (see Fig. 1).

Methods

Morphometric measurements were made on specimens preserved in 10% formalin then the holotype and paratypes were transferred to alcohol and deposited at NMNH. The terminology, counts, and measurements follow our previous methodology (Shandikov, 1995a, 1996, 2008). Stages of gonad maturity (SGM) follow the six stage scale (see Shandikov, Faleeva, 1992).

C o u n t s . Fins: D_1 – 1st dorsal, D_2 – 2nd dorsal, A – anal, P – pectoral, V – pelvic; lld and llm – bony tubular plates (scales) of the dorsal lateral line and of the posterior part (canal) of the median lateral line, llm.pr – rounded separated bony plates in the anterior part of the median lateral line; sp.br.s and sp.br.i – number of gill-rakers on the outer side of the upper and lower part of the 1st arch.

M e a s u r e m e n t s . TL and SL – total and standard length; lc – head length; hco – head height at level of middle of eye; hc – occipital head height; wc – head width; ao – snout length (pre-orbital distance); po – postorbital distance; o – horizontal orbit diameter; io – interorbital distance; lmx – upper jaw length; lmd – lower jaw length; body depth: H – maximal depth, h_5 – middle body depth at level of 5th anal-fin ray and h – minimal depth (height of the caudal peduncle); distances: aD – predorsal, aP – pre-pectoral, aV – pre-pelvic, aA – pre-anal; lca – length of caudal peduncle; lD_1, lD_2 and lA – length of unpaired fins; hD_1, hD_2 and hA – height of unpaired fins (length of longest spine or ray); $h5D_1$ – length of 5th D_1 spine; iD – interdorsal distance; lP and lV – length of pectoral and pelvic fins.

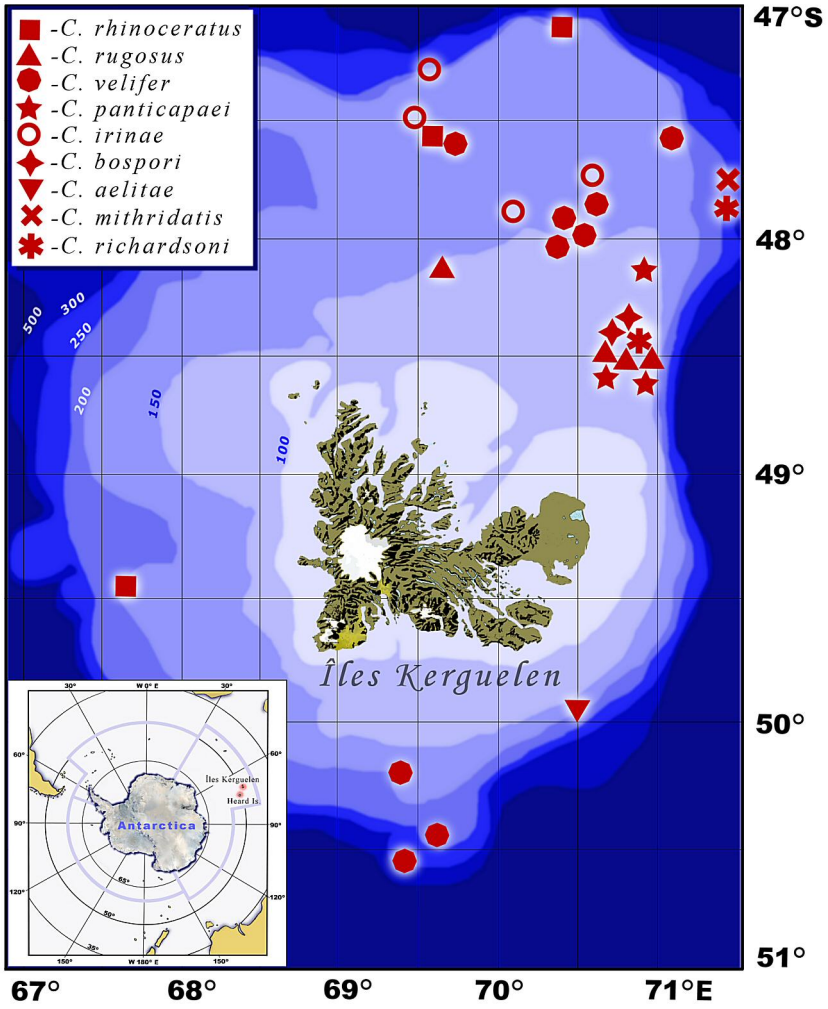

Fig. 1. Geographical distribution for endemic *Channichthys* species in the Southern Ocean comprises the inshore waters of Kerguelen and Heard Islands as like as talassobathyal of some banks in the Kerguelen-Heard Submarine Ridge. Captures (by bottom trawls), where nine species of the genus *Channichthys* were collected in the shelf waters of Kerguelen Islands, are showed

Results

***Channichthys richardsoni* sp. n., robust icefish**

Fig. 2, Tables 1, 2, 4

Channichthys richardsoni Shandikov, 1995: Manilo, 1997: 92 (*nomen nudum* in the list of NMNH collection of marine fishes. The name was mentioned by Dr. Leonid G.Manilo from my hand-written label deposited to NMNH with the type specimens in 1995).

Channichthys sp.: Shandikov, 2008: 124; Fig. 5, I (*"18 specimens of another yet undescribed species"* from comparative materials; drawing of first dorsal fin of female NMNH 5116 which is considered in the present paper as holotype).

Material. 18 specimens 229–374 mm TL, 204–333 mm SL. Counts and morphometric measurements are given for all studied specimens.

Holotype. NMNH 5116, adult female (SGM VI–III) 355 mm TL, 316 mm SL, *PM*, cruise 23, trawl (bottom) No. 6, Kerguelen Islands, 48°22'5 S, 70°44' E, depth 126 m, 19 July 1990, G.A.Shandikov (Fig. 2).

Paratypes. NMNH 5116a, b, 6 adult, post-spawning or firstly maturing specimens: 3 males 282–325 mm TL, 253–290 mm SL and 3 females 302–353 mm TL, 267–314 mm SL, the same data.

Non-type material. 11 specimens, YugNIRO, uncatalogued: 10 males and females 229–374 mm TL, 204–333 mm SL, caught with the type specimens; 1 female 294 mm TL, 258 mm SL, *PM*, cruise 23, trawl (bottom) No. 91, Kerguelen Islands, 47°44'4 S, 71°31'6 E, depth 270–310 m, 10 August 1990, G.A.Shandikov.

Data on holotype. D_1 7, D_2 33, A 31, P 19/20; lld 72/68, llm 12/14, llm.pr. 6/7; sp.br.s 2, sp.br.i 10.

Morphometrics. In % of SL: lc – 39.2, hco – 13.2, hc – 14.7, wc – 14.4, H – 15.7, h_5 – 11.4, h – 4.3, aD_1 – 37.0, aP – 41.3, aV – 33.0, aA – 56.0, lca – 7.6, lD_1 – 10.4, hD_1 – 25.9, $h5D_1$ – 10.2 (or 51.8% hD_1), lD_2 – 40.3, hD_2 – 9.7, iD – 7.6 (or 72.7% lD_1 and 74.8% $h5D_1$), lA – 36.7, hA – 7.7, lP – 18.4, lV – 20.9. In % of lc: hco – 32.7, hc – 37.6, wc – 36.8, ao – 48.2, o – 16.9 (or 35.1% ao), po – 36.3, io – 16.0 (or 94.3% o and 47.4% hco), lmx – 52.1, lmd – 64.5.

Diagnosis. D_1 7–8, D_2 31–34, A 29–32, P 19–20; lld 61–78, llm 9–23, llm.pr. 4–28, as a rule, more than 10; sp.br.i 6–15 (see Tables 1, 2, 4).

Interorbital width narrow, 1.0–1.4 times in horizontal orbit diameter, 5.8–7.5 in lc and 2.0–2.4 in hco. Eye moderate in size, its diameter is 5.2–6.3 times in lc and 2.6–3.0 in ao. Supraorbital outer bony edges of frontals noticeably elevated. Snout relatively long, approximately equal to or somewhat shorter than half the head length, 2.1–2.2 in lc. Tips of jaws aligned or lower jaw slightly protruding, teeth on symphysis not visible. Posterior edge of maxillary extending below 1/3–1/2 of the orbit diameter. One row of rakers on lower part of 1st gill arch on the outer side of ceratobranchial. Pectoral fin extending above to anus or origin of 1st anal fin ray. First dorsal fin high, 3.3–4.7 times in SL, 2nd and 3rd rays longest. Fin membrane of D_1 not reaching tips of longest rays, its height about 1.4–1.7 times in hD_1. Dorsal fins well separated, posterior edge of D_1 fin membrane not reaching 1st ray base of D_2. Interdorsal distance wide, 10.9–16.4 times in SL or 1.0–1.9 times in lD_1. As a rule, rounded thick bony plates present on the anterior part of the median lateral line. Bony tuberculation well developed on frontals and lacrimals, D_1 flexible spines, branchiostegals, pelvic fins and on bony structures of both lateral lines; absent on maxillary and on anterior part of lower jaw.

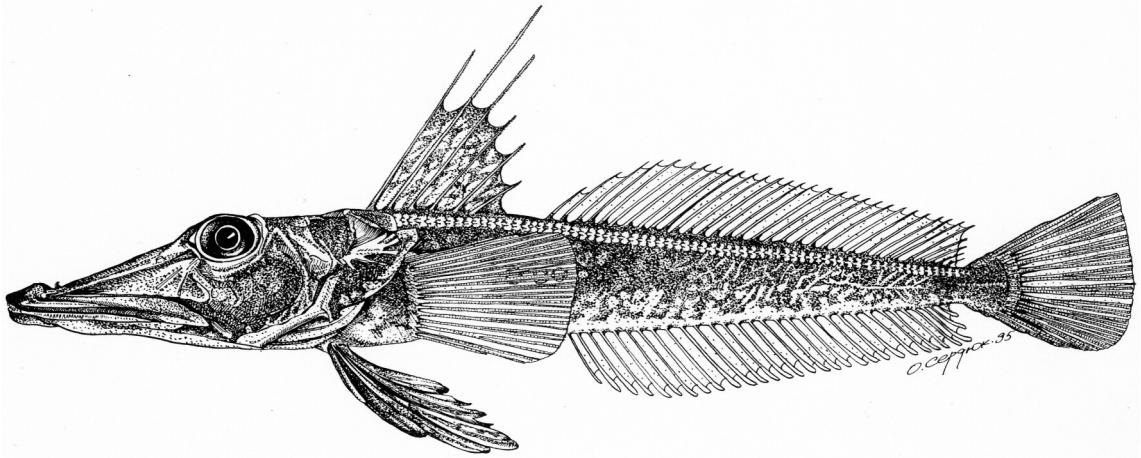

Fig. 2. *Channichthys richardsoni* sp. n., holotype, NMNH 5116, female, 355 mm TL, 316 mm SL

Description. Head length 36–40 % SL; occipital head height 32–38 approximately equal to head width 30–39 and somewhat larger than head height at middle of eye 30–37 % lc. Snout wide and spatulated, its length slightly shorter or approximately equal to half of the head length 45–50 % lc; dorsal profile of snout straightly rises to orbital region. Eye relatively moderate in size 16–19 % lc or 33–39 % ao, larger than interorbital width. The only specimen (paratype, female 267 mm SL) had size of eye equal to interorbital width – 17 and 17% lc. Postorbital distance shorter than snout length 33–39 % lc. Interorbital width narrow 13–17% lc, 41–51 % hco or 72–98(104) % o. Supraorbital outer bony edges of frontals noticeably elevated. Rostral spine vertical, usually with posteriorly bent tip. Opercular spine well developed, with 4–6 separated developed tips (spines). Upper jaw length longer than half the head length, 52–58 % lc, and extending to below middle or 1/3 of anterior part of eye. Lower jaw length 65–77 % lc, not projecting or only slightly projecting beyond upper, teeth on symphysis not visible.

Teeth on both jaws small and sharp, slightly bending inside the mouth: 4–6 irregular rows at front of upper jaw and 4–5 rows on symphysis of dentals.

Gill-rakers flattened, plate-like, dentigerous: 1–2 rakers on upper part of 1st arch and (6)10–13(15) rakers on lower part only on outer side of ceratobranchial.

Body depth at orbital region 12–15, at occipital region 12–15, maximal body depth 13–16, body depth at base of 5th anal fin ray 8–12, height of caudal peduncle 4–5 % SL. Predorsal distance to D_1 36–38, pre-pectoral distance 39–43, pre-ventral distance 30–35, pre-anal distance 55–60, length of caudal peduncle 6–8 % SL. First dorsal fin high, origins above opercular spine and includes 7–8 flexible spiny rays, 2nd and 3rd rays longest; height of D_1 21–30 % SL, length of 5th ray 9–17 % SL or 39–68 % hD_1; length of base of D_1 7.9–12 % SL. Fin membrane of D_1 not reaching tips of longest rays, its height about 58–74 % hD_1. Second

dorsal fin rays (31)32–33(34); height of fin 9–11 (based on 13 specim.), length of base 37–41 % SL. Both dorsal fins well separated, posterior edge of D_1 fin membrane not reaching the origin of D_2. Interdorsal space wide 6–9 % SL or 52–91(102) % lD_1, shorter than length of 5th ray of D_1 – 46–79 % $h5D_1$. Anal fin rays (29)30–32; fin origins below bases of 4th or 5th rays of D_2; height of anal fin 7–8 (based on 13 specim.), length of fin base 35–38 % SL. Pectoral fin rays 19–20, length of pectoral fin 16–18 % SL (based on 14 specim.); posterior edge of fin extending above to anus or origin of 1st anal fin ray. Pelvic fin length 18–24 % SL, as a rule no extending to anus. Caudal fin slightly rounded or truncate, posteroventral margin rounded.

D o r s a l l a t e r a l l i n e with 61–78 tubular bony members (scales), with flattened lateral margins. Posterior part of median lateral line (canal) with 9–23 tubular bony members. Anterior part of median line, represented by free neuromasts, with 4–28 well developed and thick, rounded bony plates. As a rule, at least on the one side of the body, a number of bony plates more than 10 (in 13 specimens). Only one (aberrant?) specimen was without any bony plate on the left side and with 1 plate on the other side of the body.

T u b e r c u l a t i o n (granulation) well developed in adult and subadult specimens with SL more than 220 mm. Rough and sharp bony tubercles present on occipital and orbital regions of frontals, on rostral ridges, lacrimals and postlacrimals, preopercles and opercles, on posterior part of lower jaw – in 4–8 irregular rows; on bony structures of both lateral lines, on the anterior 3–6 flexible spines of D_1, on branchiostegals and pelvic fin rays. Absent on maxillary and on anterior part of lower jaw.

In young specimens with shorter length granulation on rostral ridges, lower jaw, branchiostegals and pelvic fins often not yet fully developed.

C e p h a l i c s e n s o r y c a n a l s (based on 6 specimens). CSO with (7)8–10, oftener 8 pores, including the pore behind the coronal commissure, CC with one central pore. CIO with 8, rare with 7 or 9 pores, CT with 6 pores, including the pore on the supracleithrum. CST with 3 pores, and CPM with (12)13 pores.

C o l o r a t i o n . After fixation in formalin the general body and head coloration vary from dark grey to brown. Top of head, upper jaw, cheeks and opercle somewhat darker than trunk. Like in most other congeners 3 or 4 darker cross bars, 2 of them below D_2 can be distinctly present on the body of some specimens. Ventral part of head, breast, belly, and narrow body sectors over the anal fin are pale or whitish, with darker or brownish spots and blotches, which most clearly developed on the breast of adult specimens. Coloration of D_1 in the most specimens is uniformly blackish or brownish, in some fishes with indistinct lighter blotches. Second dorsal, pectoral, ventral, and caudal fins are greyish or light-brownish; anal fin is pale, with faint dusk pigmentation along the edge in some specimens. Narrow dark stripes (up to 6) can be present on pelvic and caudal fins. Mouth cavity and gill-rakers are not pigmented.

Mode of life. By its “heavy” robust appearance and also the darker ventral coloration *C. richardsoni* have a look of typical bottom dweller. Judging from the single row of gill-rakers and drawing a parallel with the feeding of other *Channichthys* species, it may be suggested, that *C. richardsoni* is a primary piscivorous predator. Females mature at a TL of about 29–31 cm (25–27 cm SL). The post-spawning SGM VI–III is clearly detected in females larger than 31 cm TL and the SGM III – in the smaller, firstly maturing ones. The SGM of the males examined varied from stage II to early stage III in the specimen of 325 mm TL. Spawning and pre-spawning SGM were absent. The spawning period apparently takes a place from autumn to the beginning of winter. The largest known specimen of this species is a post-spawning female 374 mm TL (333 mm SL).

Distribution. Shelf waters of Kerguelen Islands. Caught in 2 bottom trawls at depths of 126 and 270–310 m together with *C. rhinoceratus, C. rugosus, C. panticapaei, C. bospori, C. irinae* and *C. mithridatis* (see Fig. 1). Most of specimens were caught at depth of 126 m in an area with abundant benthic fauna and the alga *Macrocystis pyrifera*.

Etymology. The specific name is given in honour of the Scottish naturalist John Richardson, who described the first species of icefishes *C. rhinoceratus* and established the genus *Channichthys*.

Discussion

The frequency distribution of principal counts of *Channichthys* species are given for comparison in Tables 1–4. The shape and clearly separated D_1 (type II, see Shandikov, 2008, Fig. 3) of *C. richardsoni* readily distinguishes it from *C. velifer* and *C. rugosus* (type I of D_1, also see Table 1).

Table 1.

Frequency distribution of the rays of unpaired fins in nine *Channichthys* species from the Kerguelen Islands area. References: a – author's data (the holotype of *C. velifer* included), b – Blanc, 1958, c – Meissner, 1974 (5 paratypes), d – Balushkin, 1996 (the holotypes of *C. rhinoceratus* and *C. rugosus* included)

Species	First dorsal fin									Second dorsal fin									Anal fin								No.	Ref.
	5	6	7	8	9	10	11	Mean	SD	30	31	32	33	34	35	36	Mean	SD	28	29	30	31	32	33	Mean	SD		
C. rugosus				4	9	6	2	9.29	0.90		2	10	5	2			32.37	0.83		2	8	9			30.37	0.68	21	a
					2			9.00		2							30.00		2						28.00		2	b
				2				8.00		2							30.00				2				30.00		2	d
C. velifer						4	1	10.20	0.45		3	-	2				31.80	1.10		1	3	1			30.00	0.71	5	c
						6	4	10.40	0.52		1	3	5	1			32.60	0.84		6	4				29.40	0.52	10	a
C. irinae	3	11	8	1				6.30	0.76			2	12	8	1		33.35	0.71		2	13	7	1		30.30	0.70	23	a
C. bospori		1	4					6.80	0.45					5			34				3	2			30.40	0.55	5	a
C. mithridatis		1	6	20	2			7.79	0.62			2	15	12			33.34	0.61			2	15	12		31.34	0.61	29	a
C. richardsoni			12	6				7.33	0.49		1	8	8	1			32.50	0.71		1	4	11	2		30.78	0.73	18	a
C. rhinoceratus		10	11	3				6.71	0.69				6	9	7	2	34.21	0.93			2	5	15	2	31.71	0.75	24	a
			1	1				7.50	0.71				1	1			33.50	0.71			1	-	-	1	31.50	2.12	2	d
C. aelitae			1	2				7.67	0.58				2	1			33.33	0.58				3			31.00		3	a
C. panticapaei		6	14	10				7.13	0.73			13	11	6			32.77	0.77			14	15	1		30.57	0.57	30	a
				1				8.00				1					32.00					1			30.00		1	d

Table 2.

Frequency distribution of the pectoral fin rays (both sides) in nine *Channichthys* species from the Kerguelen Islands area. Species arranged in the order from minimal to maximal number of fin rays. References as in Table 1

Species	18	19	20	21	22	23	Mean	SD	No.	Ref.
C. rugosus	2	30	11				19.20	0.51	43	a
	2						18.00		2	b
	1	3					18.75	0.50	4	d
C. richardsoni		23	13				19.36	0.49	36	a
C. irinae		10	25	11			20.02	0.68	46	a
C. mithridatis		2	51	5			20.05	0.35	58	a
C. bospori			6	2			20.25	0.46	8	a
C. velifer		1	7	11			20.53	0.61	19	a
			2	3			20.6	0.55	5	c
C. panticapaei			33	23	4		20.52	0.62	60	a
			2				20.00		2	d
C. aelitae				5	1		21.17	0.41	6	a
C. rhinoceratus				35	17		21.33	0.47	52	a
				2	-	2	22.00	1.15	4	d

Table 3.

Frequency distribution of the total number of gill-rakers (toothed bony plates) on the lower part of the first arch in three *Channichthys* species (which have rakers arranged in two long rows) from the Kerguelen Islands area. References as in Table 1

Species	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Mean	SD	No.	Ref.
C. irinae			2	5	2	2	5	1	1	1	1	2	1		23.91	3.00	23	a
C. panticapaei	1	–	1	4	–	4	3	4	3	4	3	1	1	1	24.87	3.10	30	a
											1				28.00		1	d
C. bospori						1	–	–	–	1	1	1	–	1	27.60	2.97	5	a

This species differs significantly from the species with wide interorbital distance (*C. rhinoceratus, C. aelitae* and *C. panticapaei*) and belongs to the provisionally detired species group characterized by relatively narrow interorbital width – *C. irinae, C. bospori* and *C. mithridatis*. It clearly differs from *C. irinae* and *C. bospori* by a single row of gill-rakers (see Tables 3 and 4) and relatively small eye (33–39 versus 42–56 % ao) (Fig. 3).

Closely related to *C. mithridatis*, but as opposed to the fine elegant appearance with somewhat concaved dorsal profile of snout of the latter provided with very robust exterior. It differs from *C. mithridatis* also by heavy ossification of head, strong granulation, noticeably elevated and wide supraorbital outer bony edges of frontals, well developed and thick granulated bony plates in the proximal part of the median lateral line (occurrence 100 versus 21%, very small and soft semitranslucent ones), distinct frequency distribution of pectoral fin rays (see Table 2), relatively smaller eye (33–39 versus 37–47 % ao) and somewhat lesser height of first dorsal fin (21–30 as opposed to 25–34 % SL). *C. richardsoni* also differs by features of coloration, particularly by presence of dark spots and blotches on the ventral part of body and head, while the all specimens of *C. mithridatis* have a white lower surface of head, breast, belly, and narrow body sectors over anal fin, without any signs of pigmentation.

Table 4.

Frequency distribution of gill-rakers (toothed bony plates) on the lower part of the first arch in nine *Channichthys* species from the Kerguelen Islands area. Species arranged in the order from minimal to maximal total number of gill-rakers. Very rarely in single specimens of the species which have only outer row of gill-rakers can be present 1–2(3) rakers in the inner side of angle (is not considered as inner row), but the total number of rakers is not higher that it is showed in the Table. References as in Table 1

Species	Outer side														Inner side														No	Ref.
	6	7	8	9	10	11	12	13	14	15	16	17	M	SD	6	7	8	9	10	11	12	13	14	15	16	17	M	SD		
C. velifer					3	1	3	1					11.25	1.16															8	a
	1	–	–	2	1	1							9.00	1.87															5	c
C. rugosus		1	1	2	3	4	2	4	4				11.38	2.09															21	a
				1	1								9.50	0.71															2	b
C. rhino-ceratus	1	–	3	2	1	2	2	5	10				11.88	2.47															26	a
						1							11.00																1	d
C. richardsoni	1	–	–	–	2	1	5	7	–	1			11.94	1.95															17	a
C. aelitae						1	1	–	1				12.33	1.53															3	a
C. mithridatis						7	7	7	4	3	1		12.72	1.43															29	a
C. irinae					1	1	4	4	3	6	3	1	13.83	1.8	1	4	1	4	4	2	2	3	2				10.04	2.42	23	a
C. panticapaei						2	3	6	6	6	5	2	14.13	1.66	1	4	–	2	5	7	4	3	3	1			10.77	2.34	30	a
											1		16.00							1							11.00		1	d
C. bospori						1	1	1	–	1	–	1	13.60	2.41							1	–	2	1	1		14.20	1.48	5	a

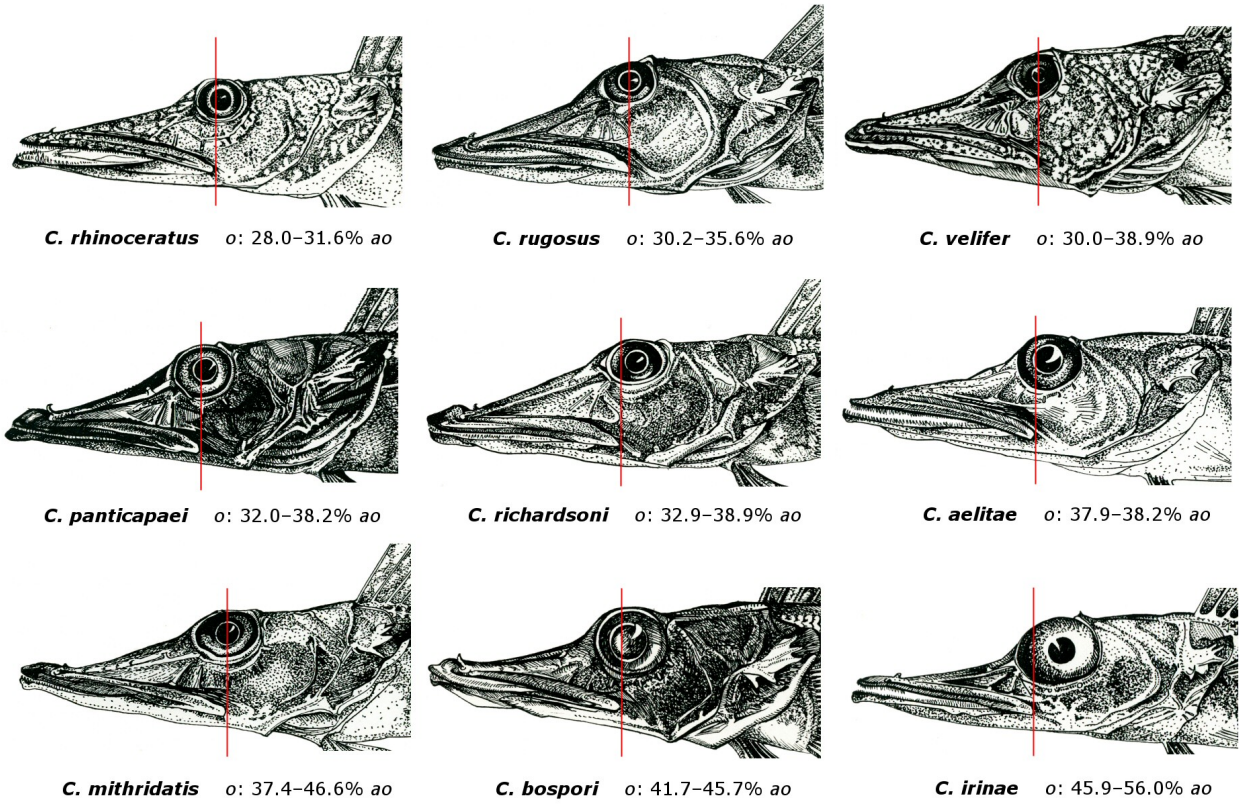

Fig. 3. Relative eye diameter to snout length in nine *Channichthys* species off the Kerguelen Islands based on the all studied material (165 specim.). Further data on specimens showed on drawing are given by Shandikov (2008, Fig. 3). Species arranged from left to right beginning from the smallest (*C. rhinoceratus*: 28.0–31.6 % ao) to the largest (*C. irinae*: 45.9–56.0 % ao) eye diameter. Vertical line marks position of the rear edge of the upper jaw relatively to the anterior edge of orbit. The upper jaw extending to below of eye from 1/5–1/3 in *C. irinae* and *C. aelitae* and 1/3–1/2 in *C. bospori* and *C. richardsoni* to middle or 2/3 of eye diameter in *C. mithridatis*. In the all other species the upper jaw extending to below middle of eye

By its appearance and coloration, *C. richardsoni* has a look of typical bottom dweller, while a more slender *C. mithridatis* appears as semipelagic species.

All nine species of the genus *Channichthys* can be considered in evolutionary trends as a good example of wide intraspecific adaptive radiation to the narrow trophic niches. The typical bottom benthopiscivorous food horizons apparently are occupied by *C. richardsoni*, *C. rugosus* and *C. velifer* (fish and cephalopods were detected in stomachs – Meissner, 1974; Shandikov, 1996), as like as the very large (attains 61 cm TL) nearbottom *C. rhinoceratus*, which feeds primarily on mackerel icefish *Champsocephalus gunnari* and *Channichthys* species (Shandikov, 1995b). At the same time, prey of another large bottom or nearbottom dweller *C. panticapaei* consists of macrozooplankton amphipod *Themisto gaudichaudi* and euphausiid *Thysanoessa macrura* (Shandikov, 1995a). The rest, more pelagic (by its morphology), species *C. aelitae* and *C. mithridatis* feed on fish over the bottom or perhaps rise to the middle layers of water, where the large big-eyed *C. bospori* and pygmy (under 259 mm TL) *C. irinae* consume pelagic zooplankton, in particularly *T. macrura* (Shandikov, 1995b).

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