

Careproctus rausuensis, a New Liparid Fish (Percomorphacea: Cottiformes), Collected from Hokkaido, Japan

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Abstract A new liparid fish, *Careproctus rausuensis*, is described on the basis of 35 specimens (54.0–164.3 mm in standard length: SL) collected by deep-sea water pumps set at 356 m depth off Hokkaido, Japan (Rausu Fishing Port, Shiretoko Peninsula). It is distinguished from known congeners by the following combination of characters: tips of the anterior dorsal- and anal-fin rays extending beyond distal margin of each fin membrane, head wide, its width 21.6–28.4% SL, gill slit long, reaching to 7–11th pectoral-fin rays, chin pore single, dorsal-fin rays 50–54, pectoral-fin rays 34–37, vertebrae 56–59, pectoral radials 4 (3 + 1), round, and lower pectoral lobe shorter than the upper one.

Key words: Liparidae, *Careproctus rausuensis*, new species, deep-sea water pump, Shiretoko Peninsula, Japan.

The genus *Careproctus* Krøyer, 1862 is one of the species-rich groups in the Liparidae, including over 100 species (Chernova *et al.*, 2004). According to Burke (1930) and Kido (1988), *Careproctus* is diagnosed by the following characters: disk present, nostril single, pseudobranchiae absent, and pectoral-fin with less rays than anal-fin. Nakabo (2002) recognized 19 species of *Careproctus* from Japan and adjacent waters. In addition, three species of *Careproctus* (*Careproctus parvidiscus* Imamura and Nobetsu, 2002, *C. rotundifrons* Sakurai and Shinohara, 2008 and *C. notosaikaiensis* Kai *et al.*, 2011) were described from Japan. Nobetsu *et al.* (1998) listed 7 species of *Careproctus* from the Shiretoko Peninsula and adjacent waters, Hokkaido, Japan (e. g., *C. colletti* Gilbert, 1895, *C. cyclocephalus* Kido, 1983, *C. mederi* Schmidt, 1915, *C. rastrinus* Gilbert and Burke, 1912, *C. roseofuscus* Gilbert and

Burke, 1912), and suggested that more species should be still present around the Shiretoko Peninsula.

Three deep-sea water pumps capturing deep-sea water for the local industries (e. g., for the material of drinking, for cooling fish) in Rausu, Shiretoko Peninsula were set up at 356 m depth about 2.8 km (44°00.09'N, 145°14.01'E) from Rausu Fishing Port, in the Nemuro Straits connecting the Sea of Okhotsk and the Pacific Ocean. While pumping up deep-sea water, many fishes were collected as impurities (e. g., *Malacocottus zonurus* Bean, 1890, *Careproctus macrodiscus* Schmidt, 1937, *C. mederi*, *C. rastrinus*, *C. roseofuscus*, *Liparis ochotensis* Schmidt, 1904). Recently, 35 specimens of a unique liparid fish were pumped up. These specimens were classified into the genus *Careproctus* Krøyer, 1862 owing to the following diagnostic

characters of this genus: snout without barbels, a single nostril, presence of disk and pleural ribs, pectoral-fin rays fewer than anal-fin rays (Burke 1930; Stein, 1978; Kido 1988; Orr and Maslenikov, 2007). Within the genus, this species resembles *C. cyclocephalus* Kido 1983, *C. comus* Orr and Maslenikov, 2007, *C. homopterus* Gilbert and Burke, 1912, and *C. sinensis* Gilbert and Burke, 1912 in having similar fin ray counts of the dorsal, anal and pectoral fins, but differs from them in having the unique morphology in the distal margin of the dorsal and anal fins. We herein describe it as a new species of the genus *Careproctus*.

Materials and Methods

Counts, measurements, and terminology follow Andriashev and Stein (1998), except for the lower lobe of pectoral fin following Kido (1988). Cephalic pores are shown as a series as described by Burke (1930): nasal-mandibular-maxillary-suprabranchial series. Counts of vertical fin rays, vertebrae, and pleural ribs are based on radiographs. Standard and head lengths are expressed as SL and HL, respectively. Although the family Liparidae was previously included in the order Scorpaeniformes, we follow Wiley and Johnson (2010) in placing it in the order Cottiformes. Specimens examined in this study are deposited in the Fisheries Science Center, Hokkaido University Museum, at Hakodate (HUMZ), Department of Zoology, National Museum of Nature and Science, Tsukuba (NSMT), and the National Museum of Natural History, Washington, D.C. (USNM).

Careproctus rausuensis sp. nov.

(New Japanese name: Tama-Konnyaku-uo)

(Figs. 1–3, Tables 1, 2)

Holotype. HUMZ 202085, 146.0 mm SL, female, 29 Sep., 2007, 44°00.09'N, 145°14.01'E, the Nemuro Straits, about 2.8 km distant from Rausu fishing port, Pacific coast of Shiretoko Peninsula, Hokkaido, Japan, 356 m depth, col-

lected by deep-sea water pump.

Paratypes. 34 specimens, 54.3–164.3 mm SL. HUMZ 202086, 106.1 mm SL, female, 2 Oct. 2007; HUMZ 203619, 59.5 mm SL, female, 25 Feb. 2008; HUMZ 203635, 137.8 mm SL, female, 5 Feb. 2008; HUMZ 203638, 92.6 mm SL, female, 22 June. 2008; HUMZ 203640, 164.3 mm SL, female, 21 July. 2008; HUMZ 203644, 88.0 mm SL, male, 14 Feb. 2008; HUMZ 203647, 136.2 mm SL, female, 1 Aug. 2008; HUMZ 203783, 56.0 mm SL, male, 5 Dec. 2008; HUMZ 203786, 106.8 mm SL, female, 26 Sep. 2008; HUMZ 203804, 74.8 mm SL, sex unknown, 12 Feb. 2008; HUMZ 203815, 161.2 mm SL, female, 20 Oct. 2008; HUMZ 203822, 108.0 mm SL, male, 13 Nov. 2008; HUMZ 203828, 135.0 mm SL, male, 27 Oct. 2008; HUMZ 203836, 54.3 mm SL, male, 22 Oct. 2008; HUMZ 203839, 84.0 mm SL, female, 19 Aug. 2008; HUMZ 203840, 79.5 mm SL, female, 10 Sep. 2008; HUMZ 203850, 54.0 mm SL, male, 4 Sep. 2008; HUMZ 203855, 97.2 mm SL, male, 19 Sep. 2008; HUMZ 204741, 107.0 mm SL, female, 19 Dec. 2008; HUMZ 204747, 111.8 mm SL, male, 16 Jan. 2009 (dissected); HUMZ 204756, 81.3 mm SL, female, 14 April. 2009; HUMZ 204768, 62.2 mm SL, female, 18 Jan. 2009; HUMZ 204776, 112.0 mm SL, male, 10 Jan. 2009; HUMZ 204791, 58.8 mm SL, female, 31 Dec. 2008; HUMZ 205645, 71.4 mm SL, male, 3 June. 2008; HUMZ 205764, 92.0 mm SL, female, 11 June. 2009. NSMT-P 106564, 120.8 mm SL, male, 20 Nov. 2007; NSMT-P 106565, 114.9 mm SL, female, 7 Jan. 2008; NSMT-P 106566, 91.0 mm SL, female, 19 Nov. 2007; HUMZ 202110, 73.1 mm SL, female, 7 Jan. 2008; NSMT-P 106567, 58.7 mm SL, male, 28 Sep. 2007; NSMT-P 106568, 151.4 mm SL, male, 20 Feb. 2008; USNM 404475, 114.9 mm SL, female, 4 Sep. 2008; USNM 404476, 125.0 mm SL, male, 15 Jan. 2008.

Diagnosis. A species of *Careproctus* diagnosed by the following characters: dorsal-fin rays 50–54 (mode 53); anal-fin rays 44–48 (mode 47); pectoral-fin rays 34–37, caudal-fin rays 10–11,

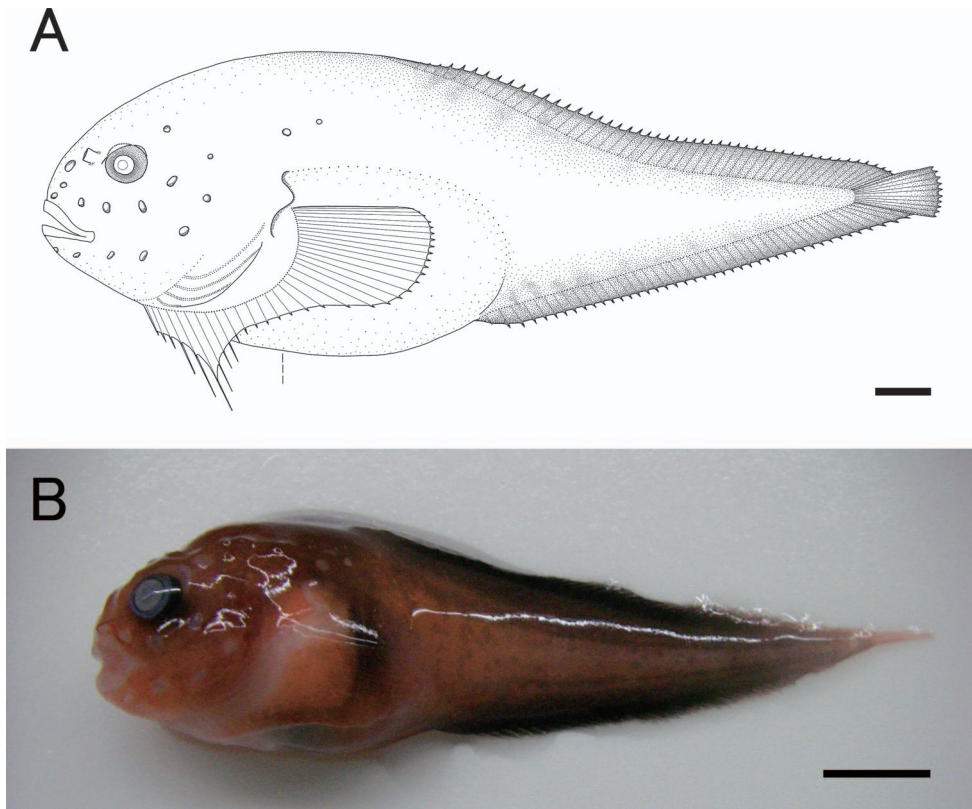


Fig. 1. Lateral view of *Careproctus rausuensis* sp. nov., collected from the western North Pacific. A: holotype, HUMZ 202085, 146.0 mm SL; B: paratype, HUMZ 203804, 74.8 mm SL. Bars 10 mm.

vertebrae 56–59. Pectoral radials 4 (3 + 1), round. Head width 22.6–28.4 % SL. Teeth trilobed. Gill slit long, reaching to 7–11th pectoral fin ray. Lower pectoral fin lobe shorter than the upper lobe. Tips of anterior dorsal- and anal-fin rays extending beyond distal margin of fin membranes.

Description. Data for the holotype are shown first, followed by data for paratypes in parentheses if different. Frequency distributions of counts are shown in Table 1.

Dorsal-fin rays 50 (50–54), anal-fin rays 45 (45–48), pectoral-fin rays 6 + 29 = 35 (5–6 + 29–31 = 34–37), caudal-fin rays 10 (10–11), vertebrae 11 + 45 = 56 (10–11 + 46–48 = 56–59), preural ribs 2, gill rakers 14 (observed in only HUMZ 204747), pyloric caeca 25 (24–28), epural 1.

Proportional measurements: head length 32.1

(26.7–38.8) %SL, head width 28.4 (22.6–27.4) %SL, body depth 31.7 (20.8–31.5) %SL, predorsal length 36.6 (27.4–37.8) %SL, preanal length 47.9 (37.9–49.4) %SL, distance between snout and disk 21.9 (14.9–24.0) %SL, distance between snout and anus 32.2 (23.5–31.4) %SL, distance between mandible and disk 20.9 (14.2–21.0) %SL, distance between mandible and anus 29.6 (23.1–29.2) %SL.

Snout length 30.5 (25.6–35.6) %HL, eye diameter 19.2 (16.5–28.9) %HL, orbit diameter 26.2 (22.4–34.5) %HL, interorbital width 43.1 (32.5–48.7) %HL, bony interorbital width 28.6 (20.6–33.0) %HL, postorbital distance 48.8 (37.2–56.4) %HL, gill opening length 30.7 (20.4–39.2) %HL, upper jaw length 43.5 (30.7–46.1) %HL, lower jaw length 44.6 (29.7–43.3) %HL, upper lobe of pectoral-fin length 59.3 (42.1–67.6) %HL, lower lobe of pectoral-fin

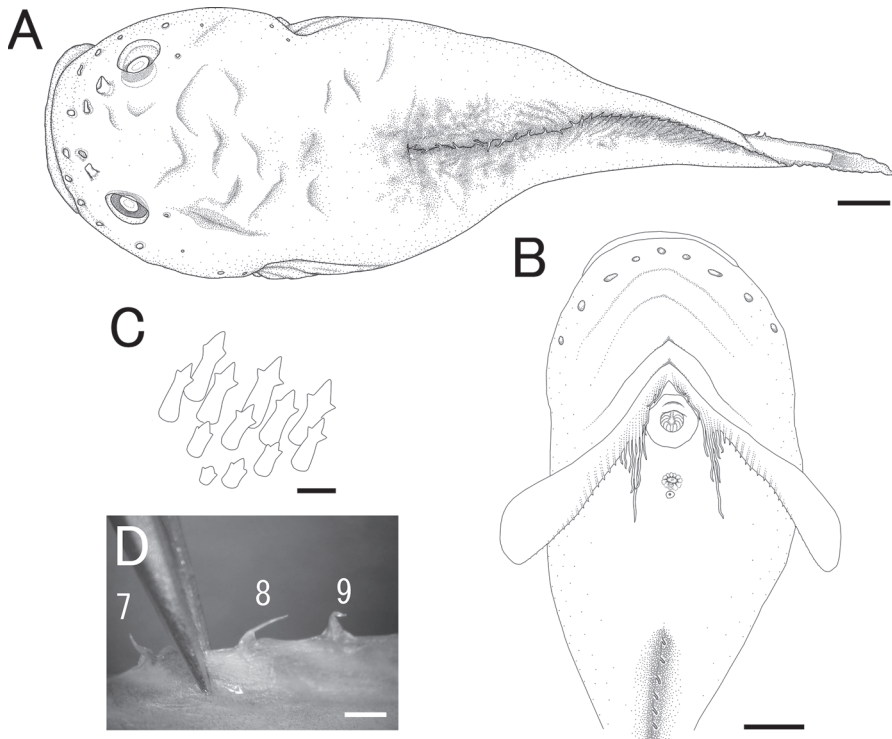


Fig. 2. *Careproctus rausuensis* sp. nov., holotype, HUMZ 202085, 146.0 mm SL: dorsal view (A), mandible and disk (B, ventral view), premaxillary teeth (C, ventral view), and anterior dorsal-fin membrane (D, picked up by a tweezers). Bars 10 mm in A and B, 0.1 mm in C, and 1 mm in D.

length 49.5 (33.9–54.1) %HL, caudal-fin length 29.0 (20.2–41.6) %HL, disk length 19.6 (16.5–25.1) %HL.

Body weakly compressed, deepest at nape, tapering to caudal fin. Head extremely wide and heavy; upper profile descending slowly to snout; width almost equal to its depth. Snout short, deep. Eye large; pupil round. Nostril opening on horizontal level between central and upper margins of eye. Nostril tube short. Mouth small, horizontal, maxilla extending just below anterior margin of eye. Teeth small, trilobed, arranged in 6–9 oblique rows in upper jaw, and in 5–8 oblique rows in lower jaw. Outer teeth weakly trilobed, smaller than inner teeth. Cephalic sensory pores large, its pore pattern 2-6-7-2. Antermost mandibular pore single, both canals opening into a single pore. Gill opening moderately large, upper margin at level of mid-orbit, extending to ventrally to 11th pectoral-fin ray (7–11th

in paratypes). Gill rakers short, triangular, covered with fine spines (in HUMZ 204747). Opercular flap supported by two spines extending horizontally, tip of upper spine on level with lower margin of eye.

Dorsal fin originating above gill opening. Anal fin originating below base of 9th dorsal-fin ray (7–9th). Caudal fin narrow, continuous with dorsal and anal fins for about half its length. Pectoral fin shallowly notched, uppermost fin ray on level between lower margin of eye and posterior corner of maxilla. Upper lobe of pectoral fin slightly not reaching a vertical through origin of anal fin (reaching 1–4 anal-fin ray in some paratypes). Lower lobe of pectoral fin short, reaching anus in the holotype (between the posterior portion of disk and anus in some paratypes), about the half length of rays free from fin membrane. Symphysis of lower lobe of pectoral fin below posterior portion of eye. No gelatinous layer in dorsal- and

Table 1. Frequency distributions of counts in *Careproctus rausuensis* sp. nov.

	Dorsal-fin rays						Anal-fin rays				Pectoral-fin rays				
	50	51	52	53	54	55	45	46	47	48	33	34	35	36	37
<i>n</i>	1*	1	5	10	5	1	3*	7	10	3	2	4	7*	8	12
	Caudal-fin rays		Pyloric caeca					Gill opening							
	10	11	24	25	26	27	28	6	7	8	9	10	11		
<i>n</i>	11*	4	4	6*	7	3	3	2	9	9	8	3	2*		
Vertebrae															
	Abdominal		Caudal				Total								
	10	11	45	46	47	48	56	57	58	59					
<i>n</i>	5	18*	1*	1	12	9	2*	3	10	8					

* holotype.

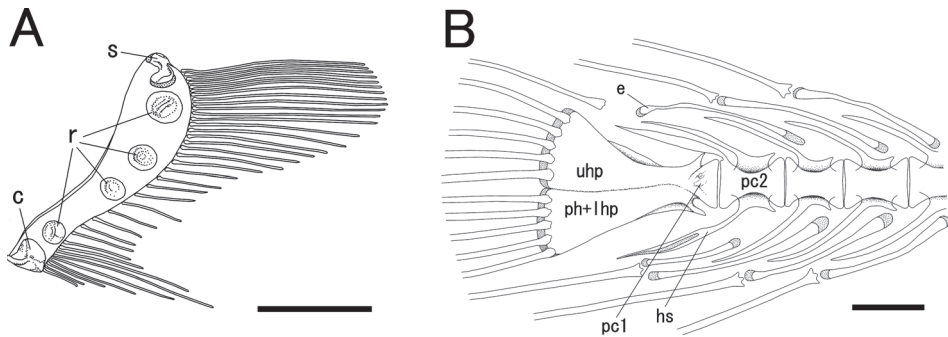


Fig. 3. Lateral views of pectoral girdle (A, left side) and caudal complex (B, right side) of *Careproctus rausuensis* sp. nov., paratype, HUMZ 204747, 111.8 mm SL. c, coracoid; r, radial; s, scapula; e, epural; hs, haemal spine; lhp, lower hypural plate; pc1, preural centrum 1; pc2, preural centrum 2; ph, parhypural; uhp, upper hypural plate. Bars 10 mm in A and 1 mm in B.

anal-fin membranes (weak layer in some paratypes). Tips of all dorsal- and anal-fin rays soft, free from fin membrane (Fig. 2D). Disk small, flat, round with wide and thin margin, its diameter about equal to eye diameter. Posterior margin of disk situated below posterior margin of preopercle. Anus situated almost below posterior margin of opercular flap, separated from disk by a space equal to orbit diameter. Stomach small, pyloric caeca long, slender. Skin smooth and thick, lacking prickles. Gelatinous tissue thin beneath skin. Male with short and conical genital papilla.

Abdominal vertebrae 11 (10–11). Caudal skeleton composed of two elements separated by a narrow slit: upper hypural plate and lower

hypural plate + parhypural (Fig. 3B).

Pectoral radials four (3 + 1), round, unnotched (Fig. 3A), with no fenestra. No distal radials. Scapula with strong helve. Coracoid triangular with broad lamina.

Color. Color in alcohol: body pale pinkish, caudal fin and posterior portions of dorsal and anal fins black. Nostril, iris, and lips pale. Anterior margin of both jaws with black pigments. Orobranchial cavities pale. Peritoneum and pyloric caeca pale. Stomach black. Color when fresh (HUMZ 203804, Fig. 1B): body dark reddish, caudal fin and posterior portions of dorsal and anal fins black.

Distribution. Known only from the type locality in the western North Pacific off Hokkaido, Japan

(Rausu, Shiretoko Peninsula), 356 m depth.

Etymology. The name *rausuensis* is in reference to the type locality, Rausu, a town on the Pacific coast of the Shiretoko Peninsula, Hokkaido, Japan.

Comparison. Within the genus *Careproctus*, *C. rausuensis* most resembles *C. cyclocephalus* Kido 1983, known from the southern Okhotsk Sea, in having a greater head length (26.7–38.8% SL in *C. rausuensis* vs. 25.7–29.9% SL in *C. cyclocephalus*), similar numbers of dorsal- and anal-fin rays (50–54 and 44–48 vs. 54–57 and 47–51), and dark reddish body color. However, *C. rausuensis* differs from the latter in having

more pectoral-fin rays (34–37 in *C. rausuensis* vs. 26–31 in *C. cyclocephalus*), fewer pyloric caeca (24–28 vs. 33–50), tooth form (trilobed vs. canine), shorter lower lobe of pectoral fin (33.9–54.1% HL vs. 84.5–126.6% HL), and larger head width (Fig. 4). Although *C. rausuensis* resembles *C. comus* Orr and Maslenikov, 2007, *C. homopterus* Gilbert and Burke, 1912, and *C. sinensis* Gilbert and Burke, 1912 in having similar fin ray counts of dorsal, anal, and pectoral fins, it differs from the latter three species in having a wider head width, and from *C. homopterus* and *C. sinensis* in having gill openings extending farther ventrally (Table 2) (Gilbert and Burke, 1912;

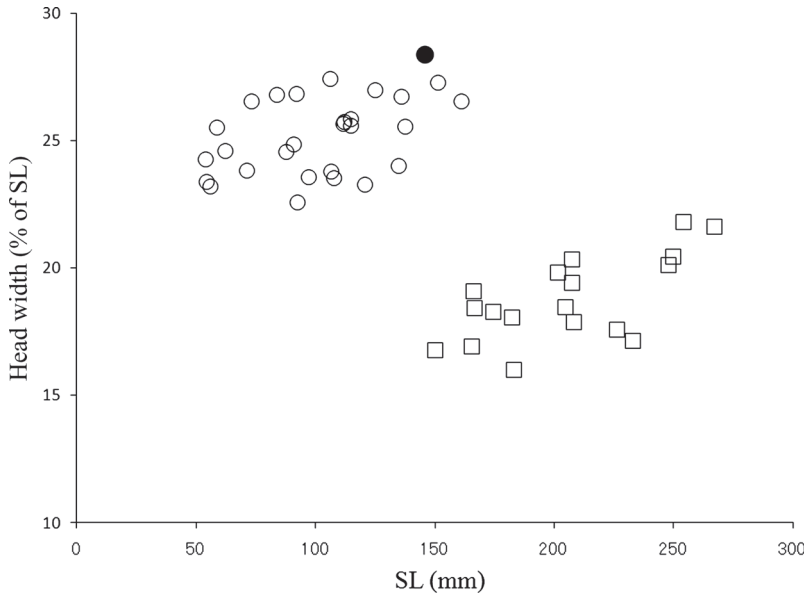


Fig. 4. Relationship between standard length (SL) and proportion of head width (% SL) for *Careproctus rausuensis* sp. nov. (holotype, solid circle; paratypes, open circles) and *C. cyclocephalus* (open squares).

Table 2. Comparisons of *Careproctus rausuensis* sp. nov. and three species of genus *Careproctus*.

Measurements	<i>C. rausuensis</i>	<i>C. comus</i>	<i>C. homopterus</i>	<i>C. sinensis</i>
% of SL				
Head width	22.6–28.4	7.4–15.6	14.0	13.2
Counts				
Dorsal-fin rays	50–54	50–56	55	53
Anal-fin rays	45–48	44–50	49	47
Pectoral-fin rays	34–37	33–39	32–34	33
Gill opening	7–11	0–5	0	1

Data of *C. comus* from Orr and Maslenikov (2007), *C. homopterus* and *C. sinensis* from Kido (1988).

Kido, 1988; Orr and Maslenikov, 2007). Furthermore, *C. rausuensis* is clearly distinguished from all known congeners by having the tips of rays on the anterior parts of the dorsal and anal fins extending beyond the distal margin of each fin membrane (Fig. 2D). Although this character has been regarded as a diagnosis of genus *Allocareproctus* Pitruk and Fedorov, 1993, *C. rausuensis* lacks other diagnostic characters of *Allocareproctus*: i.e. anterior dorsal-fin rays spiny, small papillae present on some pores of cephalic sensory system, an extremely large disk (30.0–45.0% HL), and a gill slit entirely above the pectoral fin (Pitruk and Fedorov, 1993; Orr and Busby, 2006).

It is similar to the following North Pacific species, *Careproctus simus* Gilbert, 1896, *C. bowerianus* Gilbert and Burke, 1912, *C. attenuates* Gilbert and Burke, 1912, *C. mollis* Gilbert and Burke, 1912, *C. opistrotremus* Gilbert and Burke, 1912, *C. faunus* Orr and Maslenikov, 2007, and *C. rotundifrons* Sakurai and Shinohara, 2008, by having similar counts and three-lobed teeth, but differs from all of them by having longer gill slit (reaching to 7–10th pectoral-fin base vs. 1–5th) and single chin pore (Gilbert and Burke, 1912; Mecklenburg *et al.*, 2002; Orr and Maslenikov, 2007; Sakurai and Shinohara, 2008).

Comparative materials. *Careproctus cyclocephalus*: Holotype: HUMZ 77754, 267.1 mm SL, female, 44°27'N, 144°26.5'E, 930–950 m depth. Paratype: HUMZ 70923, 226.3 mm SL, 44°12'N, 144°54'E, 750 m depth. Non types: 17 specimens (HUMZ 77613, 77947, 78743, 78865, 78867, 78868, 78898, 79699, 79701, 79702, 79706, 79719–79721, 124057, 126054 and 126082, 140.4–254.3 mm SL, southern Okhotsk Sea).

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