

Bregmaceros neonectabanus, a New Species of the Family Bregmacerotidae, Gadiformes

Shinya Masuda, Takakazu Ozawa and Osame Tabeta

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Abstract Close examinations of 3 forms of *Bregmaceros nectabanus* Whitley showed that the Southeast Atlantic and Indo-Malayan form and the Fiji Islands form are clearly distinct from the true *B. nectabanus* (Toyama Bay form) in principal caudal fin ray (14 vs. 13) and in appearance of the abdomen (pigmented vs. not pigmented). The SE Atlantic and Indo-Malayan form is described as a new species, *B. neonectabanus*. The Fiji Is. form, differing from the new species only in the arrangement of chromatophores, is left for further study. The new species was collected from Japanese waters.

According to D'Ancona and Cavinato (1965), *Bregmaceros nectabanus* Whitley of the family Bregmacerotidae, Gadiformes, is circumtropical in distribution and comprises the following 3 forms: Toyama Bay, Fiji Islands, and Southeast Atlantic and Indo-Malayan forms. From a study on the collections of *B. nectabanus* around Japanese waters, these 3 forms have been recognized. Upon close examination and comparison with the holotype of *B. nectabanus*, we found that the Toyama Bay form is the true *B. nectabanus* and the others are distinct from it. The SE Atlantic and Indo-Malayan form is described as a new species in this paper.

Materials and methods

Based on a revision by D'Ancona and Cavinato (1965), *B. nectabanus* and its 3 forms are distinguished from one another as follows: *B. nectabanus* is characterized by combination of meristics, especially the numbers of longitudinal scales (62–75) and of transverse scales (more than 14); the 3 forms by the distribution of body chromatophores; in the Toyama Bay form, dorsal chromatophores are distributed irregularly and abdominal ones are absent; in the SE Atlantic and Indo-Malayan form, dorsal chromatophores are the same as in the Toyama Bay form but abdominal ones are present; and in the Fiji Islands form, dorsal chromatophores are distributed longitudinally and abdominal ones present.

The specimens referable to the SE Atlantic and Indo-Malayan form were collected from Shingu

Beach at the south entrance of the Japan Sea (77 specimens, 29.5–54.0 mm in standard length) and the Pacific Ocean off central Japan (one specimen, 16.9 mm SL) (Fig. 1). Nine specimens (14.6–27.5 mm SL) of the Fiji Is. form were caught at the coast of Okinoerabu and Amami Islands, southern Japan (Fig. 1). Those of the Toyama Bay form (138 specimens, 30.4–65.5 mm SL) were collected from 12 localities around Japan inclusive of Toyama Bay and the East China Sea (Fig. 1). They were preserved in 70% ethanol after fixed with 10% formalin, and except the holotype and paratypes of the new species, are deposited in the Laboratory of Fisheries Resources, Faculty of Fisheries, Kagoshima University (not catalogued). In addition, we reexamined “Dana” specimens of the SE Atlantic and Indo-Malayan and Fiji Islands forms studied by D'Ancona and Cavinato (1965) which are deposited in Zoological Museum, University of Copenhagen.

Counts, measurements, terms and identification mainly follow those of D'Ancona and Cavinato (1965). Caudal skeleton terminology follows that of Gosline (1963). Longitudinal scales, LS, were counted in the series just above the upper insertion of the pectoral fin, and transverse scales, TS, in the series just before the origin of the dorsal fin base. Because the definition of scale counts differs among authors, this measurement was minimally assessed. Principal caudal fin rays, PC, are defined as the branched rays +2 unbranched rays, i.e. the rays supported by caudal plate +6 rays (Fig. 2). Counts of unpaired fin rays and vertebrae were made on radiographs,

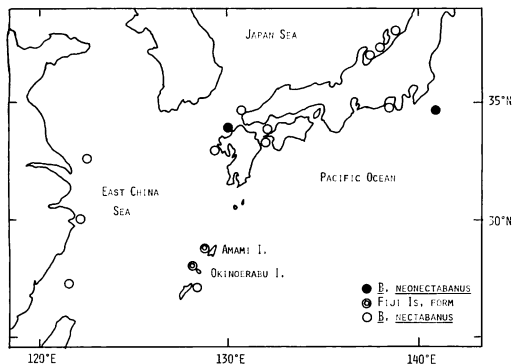


Fig. 1. Sampling localities of the study materials of the *Bregmaceros neonectabanus* sp. nov., Fiji Islands form and *B. nectabanus*. See the text for the systematic status of the Fiji Is. form.

and the internal chromatophores were observed on cleared specimens. Vertebral number includes the first preural.

Bregmaceros neonectabanus, sp. nov.

(New Japanese name: Kurohara-saiuo)

(Fig. 3)

Synonym. Southeast Atlantic and Indo-Malayan form of *Bregmaceros nectabanus* Whitley, D'Ancona and Cavinato, 1965: 47–51.

Holotype. ZUMT (Department of Zoology, University Museum, University of Tokyo) 54587, 42.6 mm SL; sex undetermined; stranded on Shingu Beach, Fukuoka Prefecture, northern Kyushu, Japan, collected on Dec. 27, 1965.

Paratypes. 5 specimens stranded on the same beach as the holotype (ZUMT 54588, 46.4 mm SL, Dec. 17, 1965; ZUMT 54590 and 54589, 39.0 and 41.0 mm SL, Dec. 27, 1965; NSMT-P (National Science Museum [Nat. Hist.], Tokyo) 23895, 44.3 mm SL, Dec. 2, 1966; NSMT-P 23896, 49.2 mm SL, Dec. 6, 1967).

Diagnosis. In a worldwide revision of Bregmacerotidae, D'Ancona and Cavinato (1965) recognized 7 species: *B. rarisquamosus* Munro, *B. bathymaster* Jordan et Boliman, *B. nectabanus* Whitley, *B. atlanticus* Goode et Bean, *B. arabicus* D'Ancona et Cavinato, *B. japonicus* Tanaka, and *B. macclellandii* Thompson. We are of the opinion that, except the present new species, there are 3 other valid species: *B. lanceolatus* Shen, the true *B. macclellandii* (*B. macclellandii* originally described by Thompson, 1840, is distinct from that described by D'Ancona and Cavinato, 1965, and

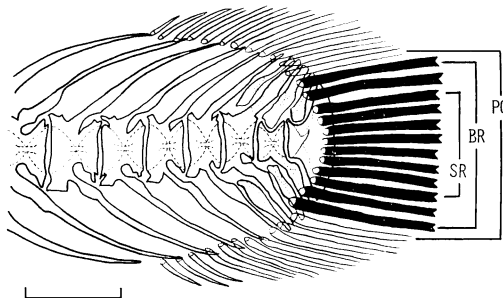


Fig. 2. Caudal fin rays of *Bregmaceros neonectabanus* sp. nov. Scale indicates 1 mm. SR, rays supported by caudal plate; BR (SR+4), branched rays; PC (BR+2), principal rays.

Belyanina, 1974), and *B. cantoni* Milliken et Houde.

Among the 11 valid species, *B. japonicus* and *B. macclellandii* of D'Ancona and Cavinato (1965) are nearly black in coloration and are easily distinguishable from other species. *B. atlanticus* shows a color variation from an intensely to a less intensely pigmented body (see D'Ancona and Cavinato, 1965). The number of its transverse scales, 11–13 (D'Ancona and Cavinato, 1965), differs from that of the present new species, 15–17. In the other 8 species, inclusive of the present new one, chromatophores are either scattered throughout the body or restricted to particular parts. The number of principal caudal fin rays, 14, easily distinguishes *B. neonectabanus* from its closest relative *B. nectabanus* with 13. *B. neonectabanus* differs from the other members in fin ray counts (43–48 in both dorsal and anal; 34–41 and 36–43, respectively, in *B. rarisquamosus*; and 50–60 and 50–63, respectively, in *B. arabicus*), and in transverse scales (15–17; less than 12 in *B. bathymaster* and *B. cantoni*). It also differs in the shape of the caudal fin (forked; pointed in *B. lanceolatus*—see “Remarks” below) and in the pigmentation of the pectoral and dorsal fins (the margin of both fins colorless; black in the true *B. macclellandii*—see Thompson, 1840, and D'Ancona and Cavinato, 1965, as the Bombay form of *B. macclellandii*).

Description. The following counts are based on the holotype and 77 specimens (16.9–54.0 mm SL) inclusive of 5 paratypes (counts for the holotype followed by the range in parentheses): D 45 (43–48); A 45 (43–48); P 17 (16–19); PC 14 (14); total caudal fin rays, TC 34 (33–36); V 7 (6 or 7);

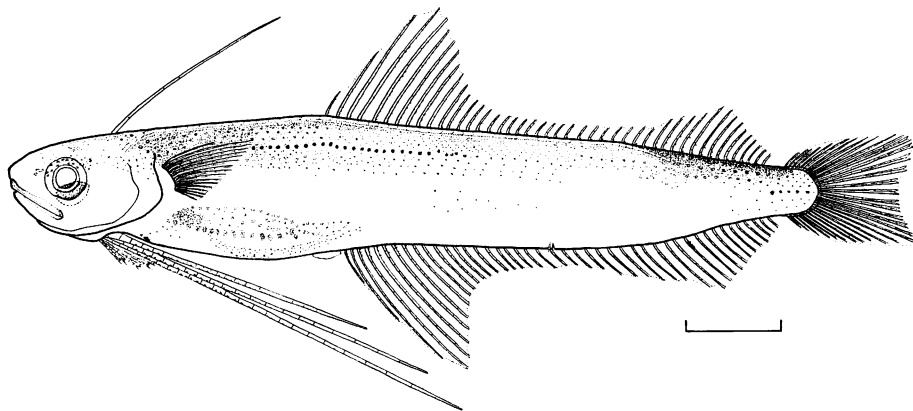


Fig. 3. Holotype of *Bregmaceros neonectabanus* sp. nov., ZUMT 54587, 42.6 mm SL. Scale indicates 5 mm.

vertebrae 15 (14–16)+34 (33–37)=49 (48–51); LS 68 (65–73); TS 15 (15–17).

Proportional data are based on the holotype and 76 specimens (29.5–54.0 mm SL) inclusive of 5 paratypes (values for the holotype followed by the range in parentheses). In % of SL: head 18.8 (18.1–21.5); maximum body depth 15.5 (13.1–17.7); caudal peduncle depth 5.6 (4.8–6.9); occipital ray 26.1 (20.5–27.5); longest pectoral ray 11.7 (11.4–14.2); longest pelvic ray 48.1 (43.0–50.9); pre-dorsal length 39.4 (37.4–42.6); pre-anal length 41.1 (39.0–44.2); pre-occipital length 12.4 (11.1–13.3); dorsal base 53.8 (50.7–57.3); anal base 52.8 (50.2–56.0). In % of head length: snout 21.3 (19.4–26.6); eye diameter 28.8 (23.3–30.1); upper jaw 43.8 (38.4–46.3); inter-orbital width 17.5 (14.3–18.8). In % of pre-dorsal length: occipital ray 66.1 (50.8–69.4). In % of pre-anal length: pre-dorsal length 96.0 (92.9–100.0).

Body elongated and slightly compressed. Snout smoothly pointed. Eye mostly covered with adipose eyelid; two nostrils just before each eye. Mouth oblique and inferior. Upper jaw slightly longer than the lower; its tip below a vertical through 1/2, rarely the posterior 2/3 of eye. Minute conical teeth arranged irregularly but nearly in two rows on both jaws; those on the upper jaw smaller than the lower. A few small conical teeth on tip of vomer, but none on palatine.

A slender occipital ray on the occiput, its tip not reaching to dorsal base. Both bases of dorsal and anal fins wide. Origin of dorsal fin slightly in advance of, or rarely on a vertical through that of anal fin. Shapes of dorsal and anal fins nearly

identical, both divided obscurely into three parts: the first high and triangular, the second low, and the third of moderate height. Caudal fin forked; among 12 branched rays, 8 are supported by a bony plate composed of fused post-terminal vertebrae (1+2) and hypurals (4+) (Fig. 2). Pectorals small, inserted slightly higher on body side. Pelvics jugular in position; outer 3 rays greatly elongated, their tips not branched; inner 3 or 4 rays short and branched complicatedly. Scales small, cycloid and deciduous. Head scaleless. Lateral line composed of pored and small scales beginning just after a vertical through the origin of occipital ray, running along the dorsal margin of the body from above the border of operculum to about 2/3 of the dorsal base, and, declining diagonally, ending below about posterior 1/4 of the base.

Body uniformly pale yellow; iris, operculum and abdomen with silvery hue; mouth cavity, inside of operculum colorless. Chromatophores relatively few and concentrated in particular parts. Irregularly longitudinal chromatophores distributed throughout the dorsal side, denser at the trunk and the posterior tail; a row of distinct chromatophores on the anterior half of body. On the midline of caudal peduncle, a short longitudinal row of several stellate chromatophores conspicuous, surrounded by small scattered pigments. Pigmentation on the flank characteristic of the species: two dissimilar chromatophore types visible; some composed of small pigments and distributed on the body surface from the abdomen to the ventral midline; others relatively large with internal pigmentation on the abdominal cavity wall,

Table 1. Meristics and body chromatophores of *Bregmaceros neonectabanus* sp. nov., the Fiji Islands form and *B. nectabanus*. Three forms are referable to those distinguished from one another within *B. nectabanus* by D'Ancona and Cavinato (1965). See the text for the systematic status of the Fiji Islands form.

Species	<i>B. nectabanus</i>			<i>B. neonectabanus</i> sp. nov.			
Form	Holotype	Toyama Bay		SE Atlantic and Indo-Malayan		Fiji Islands	
Location	North Australia	Toyama Bay	Off Japan	SE Atlantic and Indo-Malaya	Off Japan	Fiji Is.	Okinoerabu and Amami Is.
Authors	Masuda and Ozawa (1979)	D'Ancona and Cavinato (1965)	The present authors	D'Ancona and Cavinato (1965)	The present authors	The present authors	The present authors
No. specimens	1		138		78	9	9
SL (mm)	30.8		30.4–65.5		16.9–54.0	21.8–39.0	14.6–27.5
Total verts.	50	49–52	49–53		48–51	48–50	49–51
D	50	47–55	46–55	44–50	43–48	45–49	46, 47
A	53	50–55	47–57	46–50	43–48	45–49	47, 48
P	18	15–17	16–19	15–17	16–19	17–19	18
PC	13		13	14 ³⁾	14	14	14
TC	29		27–32		33–36	33–35	33–35
LS	73 ¹⁾	69–72	71–80	65–75	65–73	65–70 ²⁾	69
TS	17 ¹⁾	15, 16	15–17	15, 16	15–17	16, 17 ²⁾	16, 17
Dorsal chromatophores	Irregular	Irreg.	Irreg.	Irreg.	Irreg.	Regular	Reg.
Abdominal chromatophores	Absent	Absent	Absent	Present	Present	Present	Present

1) From the original description of Whitley (1941).

2) From D'Ancona and Cavinato (1965).

3) By the present authors (see the text).

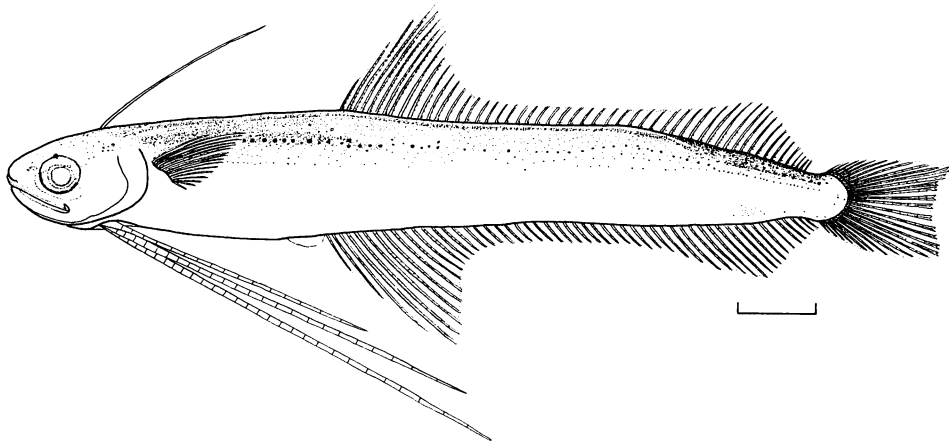


Fig. 4. *Bregmaceros nectabanus*, 54.0 mm SL. Scale indicates 5 mm.

seen through the body wall. Head nearly colorless, except on brain area; chromatophores are scattered above eye and operculum.

Chromatophores present along the dorsal base, on the first part of dorsal fin, at the base of some anteriormost anal rays and on the caudal fin only near its base. Pectorals colorless. Rays of pelvic except tips of outer 3 elongated rays and occipital ray with scattered melanophores.

Cleared specimens showing the following internal coloration: a row of chromatophores dorsal to the vertebral column; chromatophores on each vertebra and on the dorsal wall of the abdominal cavity penetrating slightly posterior to muscle.

Distribution. *B. neonectabanus* was recorded from 2 areas around Japan (Fig. 1). Two specimens (42.0 and 43.3 mm SL) caught at north of the Dampier Archipelago (19°50'S, 116°28'E), NW Australia, sent by Dr. I. S. R. Munro for identification were referred to the present new species. From the "Remarks" below, most specimens of the SE Atlantic and Indo-Malayan form of *B. nectabanus* designated by D'Ancona and Cavinato (1965) can be referred to *B. neonectabanus*. Therefore, *B. neonectabanus* occurs throughout tropical waters from Japan in the east to the Southeast Atlantic in the west.

Remarks. In a worldwide revision of the family Bregmacerotidae, D'Ancona and Cavinato (1965) reported the present new species as one of three forms of *B. nectabanus*, i.e. SE Atlantic and Indo-Malayan form, and recognized, though questionably, a few synonymous species. In this

section, *B. neonectabanus* is compared morphologically with those 3 forms and the synonymized species.

The meristic counts of the Toyama Bay form from Dana and the present samples agree quite well with those of the holotype of *B. nectabanus* (Table 1). The holotype and this form have the same pattern of body chromatophores, i.e. irregularly distributed dorsal chromatophores and absence of abdominal ones (Table 1 and Fig. 4). Moreover, no difference can be found in body proportions of these materials (Table 2). Thus, the Toyama Bay form is referable to *B. nectabanus* in all characters presented.

Fifty specimens (4.7 mm TL–21.0 mm SL) of the Dana Collection designated as the SE Atlantic and Indo-Malayan form by D'Ancona and Cavinato (1965) were reexamined by the present authors. They were collected from the South Pacific, coastal waters around Indonesia and Ceylon, the Indian Ocean off East Africa, and the Atlantic Ocean off western Africa (see D'Ancona and Cavinato, 1965: fig. 43). As they were all postlarvae and juveniles and were nearly bleached due to long preservation, precise examination of meristics and body chromatophores was impossible. The main results obtained are as follows: vertebrae were countable in 32 specimens; 29 had 48–51 vertebrae within the range of *B. neonectabanus* (Table 1), but the other 3 had 46, 54 and 61 vertebrae beyond that range; specimens with 48–51 vertebrae had 14 PC, which differs from the count of *B. nectabanus* (13); counts of dorsal and anal fin

rays were available on only one specimen (21.0 mm SL) caught from the Atlantic Ocean, off Guinea; its 45 dorsal and anal fin rays, 48 vertebrae and 14 PC coincided with those of the new species (Table 1); distribution of body chromatophores and internal ones could not be discernible.

From the above results, we can add only the number of PC (14) to the counts by D'Ancona and Cavinato (1965) shown in Table 1, suggesting that a few specimens of the Dana Collection do not fit with any species under consideration.

Meristics and body chromatophores of this form from Dana samples and the present new species are shown in Table 1. Although numbers of dorsal and anal fin rays of the Dana form are slightly higher than those of the present new species, all of the characters agree well with each other, indicating their identity.

Almost all of the characters of the new species and of *B. nectabanus* in Tables 1 and 2 are identical, but several clear differences are recognized: the numbers of PC and TC (14 and 33–36

vs. 13 and 27–32), and the presence of abdominal chromatophores in the new species vs. absence in *B. nectabanus*. In addition, the new species differs from *B. nectabanus* in the following characters: tip of upper jaw below 1/2, or rarely the posterior 2/3 of eye (below the posterior 2/3, or rarely posterior edge of eye in *B. nectabanus*); origin of dorsal fin slightly advance of, or rarely on a vertical through that of anal fin (slightly behind, or rarely on a vertical through that of anal fin); pelvics and occipital ray colored (vs. colorless); a short row of internal chromatophores absent ventral to posterior vertebral column (present).

Two samples of the Fiji Islands form were obtained for this study: the originally described Dana sample from Fiji Islands (9 specimens, 21.8–39.0 mm SL) and the present one from Amami and Okinoerabu Islands, southern Japan. As seen in Tables 1 and 2, there is no problem about their identity.

This form has 14 PC, 33–35 TC and abdominal

Table 2. Body proportions of *Bregmaceros neonectabanus* sp. nov., Fiji Islands form and *B. nectabanus*. Three forms are referable to those distinguished from one another within *B. nectabanus* by D'Ancona and Cavinato (1965). See the text for the systematic status of the Fiji Islands form.

Species	<i>B. nectabanus</i>		<i>B. neonectabanus</i> sp. nov.		
	Holotype ¹⁾	Toyama Bay	SE Atlantic and Indo-Malayan	Fiji Islands	
Location	North Australia	Off Japan	Off Japan	Fiji Is.	Okinoerabu and Amami Is.
No. specimens	1	138	77	9	5
SL (mm)	30.8	30.4–65.5	29.5–54.0	21.8–39.0	23.3–27.5
In % of SL					
Head	18.5	15.8–18.8	18.1–21.5	19.0–20.9	19.7–21.1
Max. body depth	15.3	10.8–16.8	13.1–17.7	12.1–16.3	11.9–14.2
Occipital ray	20.8	18.6–28.1	20.5–27.5	19.7–26.1	22.6–24.9
Longest pelvic ray	48.7	43.2–56.0	43.0–50.9	43.1–53.2	47.2–53.3
Pre-dorsal length	39.0	37.6–43.0	37.4–42.6	39.3–42.7	37.5–40.7
Pre-anal length	39.0	36.3–41.4	39.0–44.2	39.3–44.8	39.5–41.8
In % of head length					
Snout length	21.1	19.3–25.7	19.4–26.6	21.2–25.6	20.0–22.9
Eye diameter	26.3	24.4–33.3	23.3–30.1	21.8–26.1	23.9–27.5
Upper jaw length	45.6	40.2–50.7	38.4–46.3	38.3–46.5	41.8–50.0
Inter-orbital width	17.5	14.7–21.3	14.3–18.8	10.9–14.9	15.2–18.2
In % of pre-anal length					
Pre-dorsal length	100.0	100.0–108.6	92.9–100.0	92.8–100.0	95.0–98.1

1) From Masuda and Ozawa (1979).

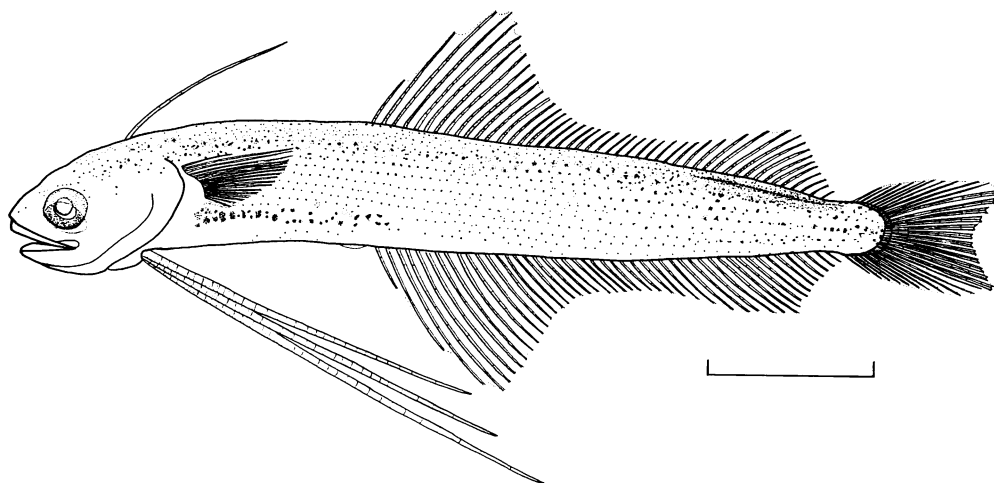


Fig. 5. Fiji Islands form of *Bregmaceros* sp., 26.1 mm SL. See the text for the systematic status of this form. Scale indicates 5 mm.

chromatophores (Table 1). These are the same as those of the new species, but are clearly different from those of *B. nectabanus*. On the other hand, only one difference is appreciated between this form and the new species: uniformly and regularly distributed body chromatophores used to define this form by D'Ancona and Cavinato (1965) (Fig. 5).

Although there is no doubt about a close relationship between this form and the new species, we cannot agree immediately the opinion of D'Ancona and Cavinato (1965) that they are forms of the same species, as the difference of the arrangement of chromatophores seems to be distinct between them, i.e. no intermediate specimens are found in past studies as well as the present one. Therefore, we cannot decide at present whether they are the same species or not, and have described the new species based on the SE Atlantic and Indo-Malayan form because the materials of that form are larger, more numerous and distributed more widely than those of the Fiji Islands form. Information about distribution, early development and genetic identity of these fishes will contribute to define their systematic status in the future.

There are three species described after the report of *B. nectabanus* by Whitley in 1941 and questionably synonymized by D'Ancona and Cavinato (1965) as follows: *B. cayorum* Nichols with *B. maclellandii*, *B. pescadorus* Shen with *B.*

japonicus, and *B. lanceolatus* Shen with *B. maclellandii*.

Milliken and Houde (1984) examined the holotype of *B. cayorum* and assigned it to *B. atlanticus* on the basis of meristic counts and morphometric measurements. *B. pescadorus* is not a synonym of *B. japonicus*, because it shows poor body pigmentation and has 26–29 TC (Shen, 1960: p. 30). According to Tanaka (1908), D'Ancona and Cavinato (1965) and Masuda and Ozawa (1979), *B. japonicus* is black in color and has 33–37 TC. *B. pescadorus* differs clearly from the present new species in TC (see Table 1). Although the examination of the holotype of *B. pescadorus* is needed, *B. pescadorus* seems to be a synonym of *B. nectabanus*. The last synonymized species, *B. lanceolatus*, with *B. maclellandii* by D'Ancona and Cavinato (1965), is a valid species showing poor body pigmentation and a uniquely pointed caudal fin. We have confirmed these features with a specimen (43.0 mm SL) collected from the East China Sea, north of Taiwan. Our new species does not show such a pointed caudal fin as *B. lanceolatus*.

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- (SM and TO: Faculty of Fisheries, Kagoshima University, Kagoshima 890, Japan; Present address of SM: Tottori Prefectural Fisheries Experimental Station, Ootani, Iwami, Tottori Prefecture 681, Japan; OT: Department of Aquaculture and Biology, Shimonoseki University of Fisheries, Yoshimi, Shimonoseki 759–65, Japan)
- タラ目サイウオ科の 1 新種 *Bregmaceros neonectabanus* クロハラサイウオ (新称)
増田紳哉・小沢貴和・多部田 修
- D'Ancona and Cavinato (1965) が規定した *Bregmaceros nectabanus* Whitley の 3 forms の精査により, Southeast Atlantic and Indo-Malayan form と Fiji Islands form は, *B. nectabanus* (Toyama Bay form) と尾鰭主鰭条数 (14 に対し後種は 13) および腹部の外観 (色素化しているに対し後種はしていない) において明らかに異なることが知られた. SE Atlantic and Indo-Malayan form を新種 *B. neonectabanus* として記載した. 新種と色素配列のみで異なる残りの form の分類学的問題は今後の研究課題として残された. 本研究で新種は日本周辺の 2 海域から採集された.
- (増田・小沢: 890 鹿児島市下荒田 鹿児島大学水産学部; 増田, 現住所: 681 鳥取県岩美町大谷 鳥取県水産試験場; 多部田: 759–65 下関市吉見 水産大学校)