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Morphological characters of *Bregmaceros japonicus* Tanaka, 1908 (Gadiformes: Bregmacerotidae)

Akihisa Torii*[1,2], Takakazu Ozawa*[3,4], and Antony S. Harold*[5]

Keywords : Bregmacerotidae; *Bregmaceros japonicus*; Validity; Morphology

Abstract

This paper considers the validity and morphological characters of *Bregmaceros japonicus* Tanaka, Bregmacerotidae, based upon examination of the holotype and 37 specimens collected from eight areas along the Pacific coast of Japan. Reining confusion as to the identity and status of this species makes this redescription necessary. Morphology, including external features and osteology is described, based on the holotype and 12 non-type specimens. The holotype and the other specimens are completely identical in all of the characters examined. Comparisons with all other recognized species in the genus indicate that *B. japonicus* is valid. One particular feature, the position of the dorsal fin origin, which has been discussed in the literature as being diagnostic is not recognized as a diagnostic character of *B. japonicus*. This species appears to be most similar to, but distinct from, *B. atlanticus* in the number of transverse scales (14-15, compared with 11-13 in *B. atlanticus*).

Bregmaceros japonicus Tanaka, 1908 of the gadiform family Bregmacerotidae was described originally based on four specimens from Sagami Bay, Japan. The species was compared with *B. mcclellandi* Thompson, 1840 and *B. atlanticus* Goode and Bean, 1886, and regarded a subspecies of the latter (*B. atlanticus japonicus*), characterized by a more slender body and more numerous rays of vertical fins[1]. In a redescription[2], it was elevated to the species level but without justification. For many years, the validity of *B. japonicus* has been disputed, based on its similarity to other nominal forms, especially *B. atlanticus*, and confusion about the distinctiveness of some of its features. These two species are relatively elongate, compared with other *Bregmaceros* species, with nearly uniform dark pigmentation over much of the body.

Munro[3] described three larval specimens from off the coast of New South Wales, Australia as *B. japonicus*. He stated that for 21.0 and 22.4 mm specimens "Dorsal fin inserted noticeably behind anal origin" [for the holotype of *B. japonicus* (ZUMT 2015), "First dorsal inserted a little behind insertion of anal" in the original description[1], "first dorsal above insertion of anal" in the redescription[2], or "the first dorsal fin ray above fourth anal" in the later description[4]]. D'Ancona and Cavinato[5] regarded the Munro's observation as one of the diagnostic characters of *B. japonicus*, and recorded many specimens having dorsal fin generally starting 4 to 5 rays farther back than the beginning of the anal fin from the central Pacific near Fiji Is. in the east to the northern Indian Ocean in the west. However, it is doubtful whether the specimens of Munro[3] and D'Ancona and Cavinato[5] are *B. japonicus* in the strict sense since the number of pectoral fin rays (21) of the holotype[4] does not correspond with those of Munro (16 or 17)[3] and D'Ancona and Cavinato (17-20)[5]. On the other hand, Belyanina[6] considered *B. japonicus* to be a form of *B. atlanticus* by the fact that her specimens of *B. japonicus*, i.e., having the start of dorsal fin noticeably posterior to that of anal, had the same meristic characters

*1 United Graduate School of Agricultural Sciences, Kagoshima University, Faculty of Fisheries, 4-50-20 Shimo-arata, Kagoshima, 890-0056 Kagoshima, Japan.
*2 Present address: 1-48-8 Tamazato-danchi, Kagoshima, 890-0011 Japan.
*3 Faculty of Fisheries, Kagoshima University, 4-50-20 Shimo-arata, Kagoshima, 890-0056 Japan.
*4 Present address: 2-3-1-729, Nishinooka, Nishi-ku, Fukuoka, 819-0046 Japan.
*5 College of Charleston, Grice Marine Laboratory, Department of Biology, 205 Fort Johnson, Charleston, South Carolina, 29412 USA.

as *B. atlanticus*. However, the vertebral number of the holotype of *B. japonicus*, 56 in total[4], is outside that of *B. atlanticus* (less than 55 according to D'Ancona and Cavinato[5] and Belyanina[6]). Okamura[7] followed D'Ancona and Cavinato[5] in recognition of *B. japonicus* as a distinct species. In summary, it can be said the validity and even the morphology of *B. japonicus* are uncertain.

Following the original description[1], *B. japonicus* has not been recorded again from the type locality or from around Japan with certainty. Using specimens collected around Japan, inclusive of the type locality, this study redescribes in detail the morphology of *B. japonicus* and considers its validity.

Materials and Methods

The present materials are composed of a total of 37 specimens (41.5-131.7mm in standard length, henceforth SL) collected from eight areas along the Pacific coast of Japan between 1953 and 1997 with a trap or trawl net or unknown gears, preserved in 70% ethanol, and deposited in the Department of Zoology, National Science Museum, Tokyo (NSMT), the Department of Biology, Faculty of Science, Kochi University (BSKU), Tohoku National Fisheries Laboratory, and Fukushima Prefectural Fisheries Station (Fig. 1 and Table 1). Those of T1 of Tosa Bay were obtained at Mimase Fish Market. The specimens of Tohoku National Fisheries Laboratory and Fukushima Prefectural Fisheries Station are preserved in Kagoshima University Museum, Kagoshima University (KAUM) except two specimens (Table 1).

In addition to the above specimens, the holotype of *B. japonicus* (ZUMT 2015) was examined to verify or establish the

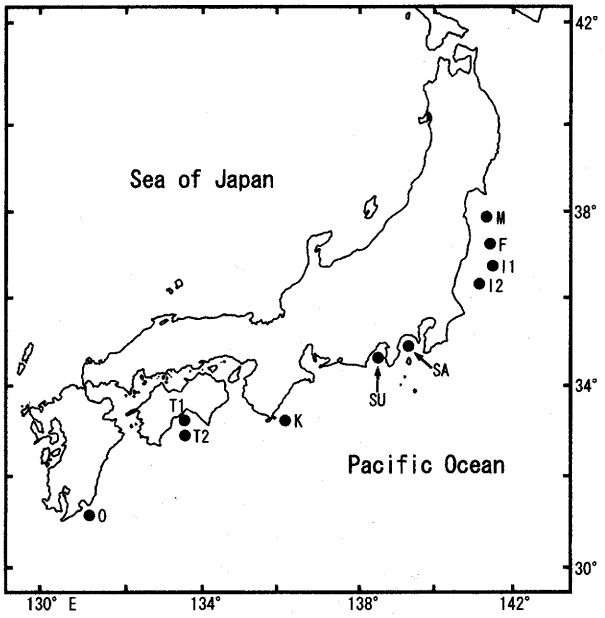

Fig. 1 Collection areas of *Bregmaceros japonicus* used in this study. O, off Oosumi Pen.; T1 and 2, Tosa Bay; K, off Kii Pen. ; SU, Suruga Bay; SA, Sagami Bay; I1 and 2, off Ibaraki Pref.; F, off Fukushima Pref. ; M, off Miyagi Pref.

Table 1. Collection data of the present specimens of *Bregmaceros japonicus*.

Area	No. of specimens	Range of SL, mm	Catalogue No.	Date(Month/Day/Year)	Method
off Oosumi Pen. (O)[1]	1	71.4	NSMT-P18965	2/10/1973	-
Tosa Bay (T1)[1]	5	77.0-87.6	BSKU03519-03523	-/-/1953	-
〃(〃)	1	121.5	BSKU04474	1/19/1955	-
〃(〃)	2	121.8,128.6	BSKU06989,06990	12/1-2/1956	-
〃(〃)	4	106.9-131.7	BSKU07148-07151	2/27/1957	-
〃(T2)[1]	1	67.3	BSKU22843	7/25/1974	Trawl
〃(〃)	1	69.5	BSKU23203	1/3/1975	-
〃(〃)	1	86.8	BSKU23054	1/26/1975	-
off Kii Pen.(K)[1]	1	41.5	NSMT-P45198	9/27/1984	Trap
Suruga Bay(SU)[1]	2	78.0,84.5	NSMT-P11141	4/11-12/1969	-
〃(〃)	1	79.3	NSMT-P19769	4/1/1967	Trawl
〃(〃)	1	77.0	NSMT-P49970	11/10/1996	-
Sagami Bay(SA)[1]	1	69.5	BSKU19024	11/15/1958	-
〃(〃)	1	80.3	BSKU19182	11/27/1960	-
〃(〃)	6	51.8-64.1	BSKU20300-20305	11/24/1972	-
〃(〃)	1	64.9	BSKU20359	11/26/1972	-
off Ibaraki Pref.(I1)[1]	3	41.7-44.5	KAUM-V-10-12	10/21/1996	-
off Ibaraki Pref.(I2)[1]	2	43.0,48.6	-	10/9/1997	-
off Fukushima Pref.(F)[1]	1	43.3	KAUM-V-9	10/19/1996	-
off Miyagi Pref.(M)[1]	1	48.8	KAUM-V-8	10/16/1996	Trawl

[1] Abbreviation in Fig. 1

states of morphological characters, including observations on the following new or re-evaluated characters described by Torii et al.[8] : opercle, scales, axillary flap, vertebrae, dorsal groove, and ventral flaps and groove.

Methods for counts and measurements and general terminology follow D'Ancona and Cavinato[5] and modified by Torii et al.[8] When the origin of dorsal fin was located between verticals through two different anal fin rays, its nominal position was assigned to the nearer fin ray. When indistinct externally, the opercle was observed after removing the overlying skin. The length of opercle between the upper and lower margins was measured along a line running through the middle of opercle; the length of shaft extending posteriorly from the posterior margin of opercle was measured along a line running through the middle of shaft from an intersection of the lines of opercle and shaft to tip of shaft. Because of difficulty in counting, exact values of longitudinal scales were rarely taken, and this count is minimally assessed. Since short medial rays of the pelvic fin are complexly branched and difficult to count, an exact count was obtained only on a few specimens cleared and stained with alizarin red S according to the methods of Potthoff[9]. Unpaired fin rays and vertebrae were counted and observed on radiographs. Institutional abbreviations are as listed in Eschmeyer[10] except KAUM (Kagoshima University Museum, Kagoshima University, Kagoshima, Japan).

Bregmaceros japonicus Tanaka, 1908

(English name: Japanese codlet; Japanese name: saiuo)

(Fig. 2)

Bregmaceros atlanticus japonicus Tanaka[1]: 42-44 (type locality: Sagami Bay).

Bregmaceros japonicus Tanaka[2]: 190-192; Jordan et al.[3]: 406; Masuda and Ozawa[4]: 266-268.

Holotype. ZUMT 2015, 66.9mm SL, Sagami Bay, Japan.

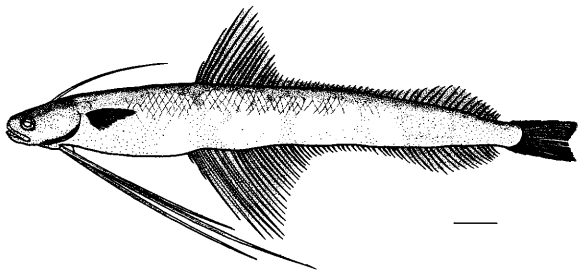

Fig. 2 *Bregmaceros japonicus* (BSKU 06989, 121.8 mm SL). *Bar* 1 mm.

Other specimens from which detailed morphological data were recorded. 12 specimens (41.5-128.6mm SL), all from Pacific coast of Japan. NSMT-P 11141 (2 specimens), 78.0-84.5mm SL, Suruga Bay, 11-12 April 1969; NSMT-P 18965, 71.4mm SL, off Oosumi Pen. (31° 12'N, 131° 42.4'E), 10 Feb. 1973; NSMT-P 19769, 79.3mm SL, off Oose, Suruga Bay, 1 Apr. 1967; NSMT-P 45198, 41.5mm SL, off east coast of Kii Pen. (33° 53'N, 136° 23'E), 27 Sep. 1984; NSMT-P 49970, 77.0mm SL, Suruga Bay (35° 00.41'-35° 00.86'N, 138° E), 10 Nov. 1996; BSKU 06989, 121.8mm SL, Mimase Fish Market, Kochi, 1 Dec. 1956; BSKU 06990, 128.6mm SL, Mimase F. M., 2 Dec. 1956; BSKU 19182, 80.3mm SL, Sagami Bay (35° 05.35'N, 139° 18.65'E), 27 Nov. 1960; BSKU 20359, 64.9mm SL, Sagami Bay (35° 10.1'N, 139° 28.8'E), 26 Nov. 1972; KAUM-V-9, 43.3mm SL, off Fukushima Pref. (36° 58.46'-36° 57.43'N, 141° 26.40'-141° 25.27'E), R/V Wakataka-Maru, 19 Oct. 1996; KAUM-V-11, 42.5mm SL, off Ibaraki Pref. (36° 32.09'-36° 30.85'N, 141° 01.05'-140° 59.80'E), R/V Wakataka-Maru, 21 Oct. 1996. Sex undetermined on all specimens.

Diagnosis. A species of *Bregmaceros* with the following combination of characters: head, body and all fins entirely covered by small dotted chromatophores; 14-15 transverse scales and 54-58 vertebrae; caudal fin slightly forked.

Description. All of the following are based on the holotype and the above 12 specimens examined in detail: the values of the holotype followed by those of 12 specimens (the counts and proportional data of all specimens in the parentheses). Meristics: dorsal rays ca. 56 and 53-59 (53-60); anal rays ca. 58 and 57-61 (56-64); abdominal vertebrae 14 and 14 (13-15); caudal vertebrae 42 and 40-44 (40-44); total vertebrae 56 and 54-58 (54-58); pectoral rays 21 and 19-22 (19-22); principal caudal rays 14 and 14 (14-15); total caudal fin rays 34 and 33-37 (32-37); transverse scales - (uncountable) and 14-15 (14-15); longitudinal scales - and 78-82 (76-82); pelvic rays 7 counted on cleared and stained two specimens: BSKU 07149 (106.9mm SL) and BSKU 20300 (54.7). Body proportions: in % of SL: head length 15.7 and 14.4-17.4 (14.1-17.4); longest pelvic ray length57.5 and 49.8-64.1 (49.8-64.2); maximum body depth 11.2 and 11.8-14.3 (11.2-14.3); caudal peduncle depth 5.5 and 4.1-5.8; occipital ray length - (broken) and 20.5-25.2 (19.4-26.1); pectoral fin length - and 9.7-11.6 (7.9-12.7); pre-dorsal length 36.0 and 35.4-39.3 (34.8-41.4);

pre-anal length 34.2 and 33.7-37.9 (33.7-41.0); pre-occipital length 13.1 and 7.9-13.3; dorsal base length 56.7 and 54.5-58.3; anal base length 58.5 and 53.8-61.6; in % of head length: snout length 28.6 and 18.7-27.8 (18.7-28.6); eye diameter 25.7 and 19.2-27.8 (19.0-27.8); upper jaw length 48.6 and 36.7-49.2 (33.3-49.2); inter-orbital width 27.7 and 21.7-27.8 (20.2-30.0); in % of pre-dorsal length: occipital ray length - and 55.2-66.7; in % of pre-anal length: pre-dorsal length 105.3 and 100.7-111.5 (100.4-111.5).

Body slightly compressed and elongate, highest at about anus and tapering gradually anteriorly and posteriorly. Snout round, and mouth oblique and subterminal. Interorbital a little elevated. Eye covered dorsally with adipose eyelid; two nostrils just before eye. Upper jaw slightly longer than the lower; its tip ending posteriorly below area between the center and posterior end of eye. Medium-sized conical teeth arranged irregularly in a band on upper jaw. An inner row of large conical teeth and an outer row of small conical ones on lower jaw. Vomer with about 10 transparent, minute conical teeth. Gill rakers reduced to transparent, medium to rather large conical teeth arranged irregularly on gill arch. A pair of wide dermal flaps along ventral contour from insertion of pelvic fin to posterior end of anterior lobe of anal fin; ventral groove bordered by the flaps before anus rather deep and scaleless with a longitudinal ridge, a little higher just behind insertion of pelvic fin and before anus, entirely along middle of the groove . Deep predorsal groove to house occipital ray along dorsal contour from behind insertion of occipital fin to origin of dorsal fin; no scales in the groove. Opercle (Fig. 3) slightly or distinctly round on its anterior margin, broad in width, tapering upward and downward and ending in a round upper margin and sharp and acute lower one, and on its upper half of posterior margin, with a broadly-based but slender and sharp-pointed, horizontally directed shaft; the ratio of length of shaft to that of opercle 106.5-134.1% (113.8 in the holotype). Axillary flap attached to shoulder girdle and half covered by pectoral fin (Fig. 4) crescent-shaped with a small projection on its lower half. A slender ray on occiput, its tip reaching just before origin of dorsal fin. Origin of dorsal fin base between verticals through second and fourth anal fin rays (between verticals through first and fourth rays in all specimens: for details, see the Remarks below). Dorsal and anal fins long in base and nearly identical in shape, both divided obscurely into three lobes: the anterior high and triangular, the middle low and consisting of rudimentary rays, and the posterior of moderate height. Pectoral fin mid-lateral; its posterior margin pointed and lowest four rays branched. Pelvic fins jugular in position, tip of its longest ray reaching about middle of anal fin base; outer three rays greatly elongated, their tips not branched; inner rays short, complexly branched. Caudal fin slightly forked ; branched rays 12 and doubly bifurcated at their tips, in which eight are supported by a bony plate composed of fused post-terminal vertebrae and hypurals. No scales on head. Scales (Fig. 5) under pectoral fin nearly round, small, cycloid and deciduous, with circuli concentric around focus on exposed part and longitudinally straight and truncated at anterior border on covered part. Lateral line beginning at about middle between upper edge of gill cover and insertion of occipital ray, running along dorsal margin from above posterior margin of gill cover to about

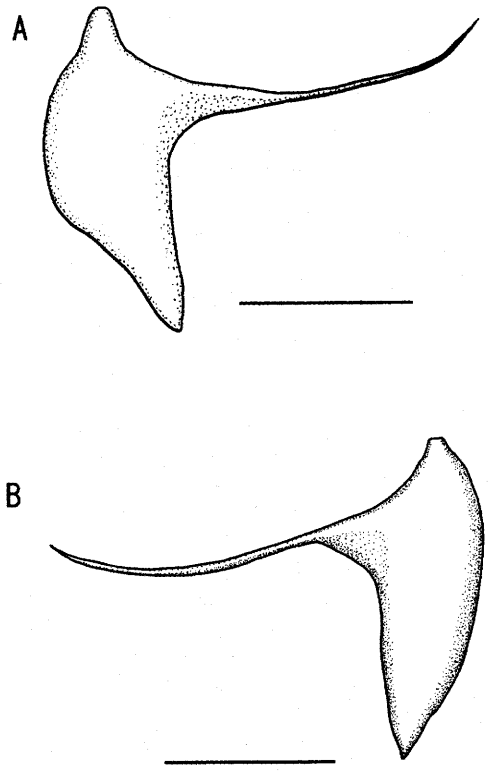

Fig. 3 Opercle of *Bregmaceros japonicus*. **A**, left side view of the holotype (ZUMT 2015), 66.9 mm SL; **B**, right side view of BSKU 20359, 64.9 mm SL. *Bars* 1 mm.

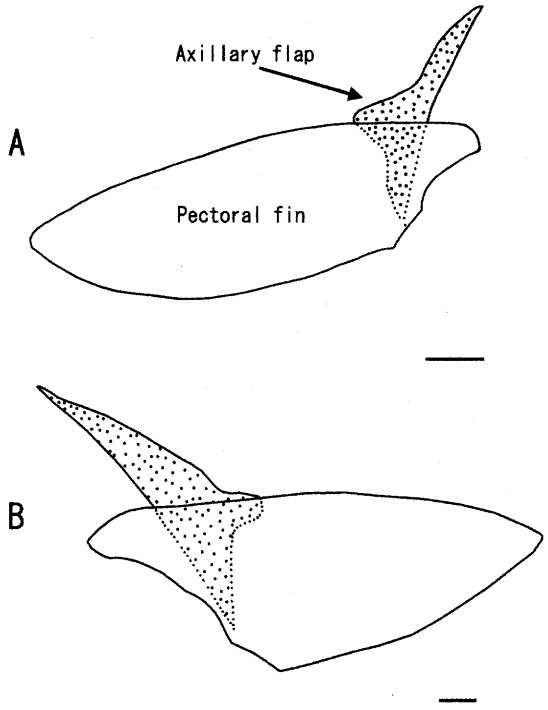

Fig. 4 Axillary flap of *Bregmaceros japonicus*. **A**, right side view of the holotype (ZUMT 2015); **B**, left side view of BSKU 06989, 121.8 mm SL. *Bars* 1 mm.

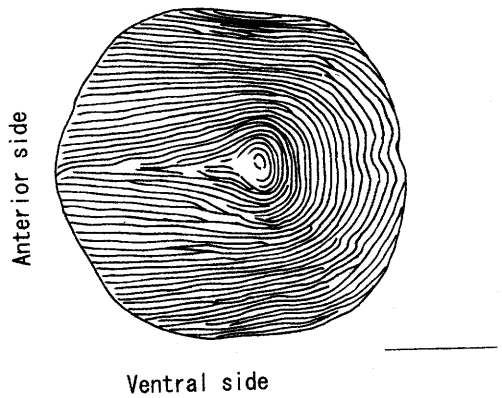

Fig. 5 Scale under pectoral fin of the holotype (ZUMT 2015) of *Bregmaceros japonicus*. *Bar* 0.5 mm.

posterior end of middle dorsal fin base, and, declining diagonally, ending shortly behind. Parapophysis of abdominal vertebrae short in base, canine-like in form, curving a little posteriorly from lateral view (Fig. 6). Base of neural spine broad and square from lateral view.

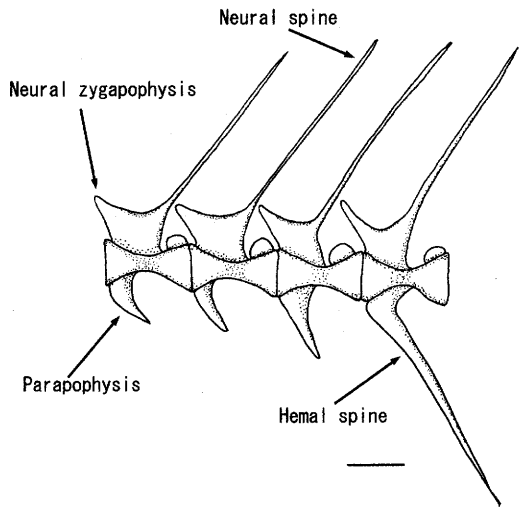

Fig. 6 Vertebrae (left side view) of *Bregmaceros japonicus* (BSKU 19182, 80.3 mm SL). *Bar* 1 mm.

Ground color of the specimens from yellow to dark brown. Head, body and all of the fins entirely covered by small dotted chromatophores with dark dorsal surface of head and body, much darker at around insertion of occipital ray. Chromatophores on dorsal part of body arranged in mesh-like pattern. On specimens smaller than about 50 mm SL, only proximal parts of dorsal, anal, pectoral and caudal fins dotted with chromatophores, but on those larger than about 85mm SL, all fins dotted entirely except the tips of elongated pelvic fin rays. Posterior portion of gill cover, first gill arch, and mouth cavity covered densely by small, dotted chromatophores or entirely brown-colored.

As seen in the above description as well as in Table 2, the holotype of *B. japonicus* and the present specimens are completely identical with each other in morphology except the shape of vertebrae which could not be observed on the type probably due to decalcification.

Distribution. Pacific coast of Japan from off Miyagi Pref. in the north to off Oosumi Pen., Kagoshima Pref., in the south.

Remarks. After Munro[3] who described "Dorsal fin inserted noticeably behind anal origin", the position of origin of dorsal fin base to anal fin ray seems regarded as one of the characters of *B. japonicus* (e.g., D'Ancona and Cavinato[5]). In this study, the position is located

Table 2. Comparison of meristic counts, body proportions (%) and origin of dorsal fin to anal fin ray among the holotype and present specimens of *Bregmaceros japonicus*

Specimen	Holotype[1]	Present specimen					
Locality	Sagami Bay	O[2]	T1 and 2[2]	K[2]	SU[2]	SA[2]	M,F,I1 and 2[2]
No. of specimens	1	1	15	1	4	9	7
SL(mm)	66.9	71.4	67.8-131.7	41.5	77.0-84.5	51.8-80.3	41.7-48.8
Dorsal	ca.56	55	53-60	55	53-57	55-59	54-56
Anal	ca.58	58	57-64	56	57-60	58-61	57-61
Abdominal Vert.	14	14	14	14	14	13-14	14-15
Caudal V	42	42	40-44	43	42-43	41-43	40-43
Total V	56	56	54-58	57	56-57	55-57	54-57
Pectoral	21	22	19-22	21	19-21	19-21	19-21
Caudal	34	32	32-35	34	33-37	32-35	33-36
Principal C	14	14	14	14	14	14	14-15
Transverse scales	-	ca.14	14-15	ca.14	14	14	ca.14-15
Longitudinal S	-	-	ca.78	-	ca.78-82	ca.80	ca.76-81
Head L/SL	15.7	15.1	14.1-17.1	17.4	15.1-15.9	15.2-17.4	15.2-17.2
Body D/SL	11.2	12.6	11.4-14.3	12.8	12.2-13.6	11.8-12.3	11.3-13.2
Occipital R.L/SL	-	25.2	19.4-26.1	20.5	22.5-24.5	19.5-23.4	19.8-22.8
Pre-anal L/SL	34.2	34.7	34.4-41.0	36.9	33.7-35.6	33.8-37.5	36.0-38.5
Pre-dorsal L/SL	36.0	37.8	36.4-41.4	37.1	35.7-38.0	34.8-38.2	37.9-39.3
Longest pelvic R.L/SL	57.5	50.7	56.1-64.2	55.9	58.0-61.8	49.8-57.8	50.4-55.5
Pectoral F. L/SL	-	11.6	9.6-12.7	11.3	10.1-11.5	8.7-12.0	7.9-11.1
Eye D/HL	25.7	19.4	19.5-27.1	27.8	19.2-23.3	19.4-24.3	19.0-24.3
Inter-orbital W/HL	-	25.0	21.4-30.0	27.8	21.7-25.4	23.3-28.4	20.2-26.6
Snout L/HL	28.6	21.3	20.0-25.2	27.8	18.7-26.7	20.0-26.7	20.0-26.6
Upper jaw L/HL	48.6	41.7	36.5-45.5	38.2	36.7-49.2	33.3-46.7	40.5-44.6
Pre-dorsal L/Pre-anal L	105.3	108.9	100.5-109.2	100.7	104.7-111.5	100.4-105.1	101.1-107.3
"Origin of dorsal fin to anal fin ray"	above 4th	3rd	2nd-4th	1st	3rd-4th	1st-4th	1st-2nd

[1] Masuda and Ozawa (1979)
[2] refer to Fig. 1 and Table 1

between verticals through the first and fourth anal fin rays: above the fourth in the holotype[4], third in the Oosumi specimen, second to fourth in the Tosa, first in the Kii Pen., third to fourth in the Suruga, first to fourth in the Sagami, and first to second in the Miyagi, Fukushima and Ibaraki Prefs which are combined since they are close to each other and continuous (Fig. 1). To examine the possibility of *B. japonicus* representing multiple species, the measured specimens are rearranged into four groups according to position of dorsal base origin with respect to anal fin ray (Table 3). The meristic counts are completely identical among the groups. Except Occipital ray length/ SL and Pectoral fin L/SL which are clearly different between the groups of first and fourth anal fin ray, all of the body proportions fully overlap among the groups and do not show any sign of the presence of multiple species. The two proportions are related to SL in Fig. 7. Pectoral fin L/SL increases up to about 70mm SL, then gradually decreases. Therefore, the difference between the groups of first and fourth anal fin ray can be attributed to a change with growth. On the other hand, Occipital R. L/SL is constant with growth. Both of the proportions of first and fourth ray groups are included in the range of those of second and third groups, therefore their difference seems due to a small number of specimens, especially only five in the first ray group (tip of

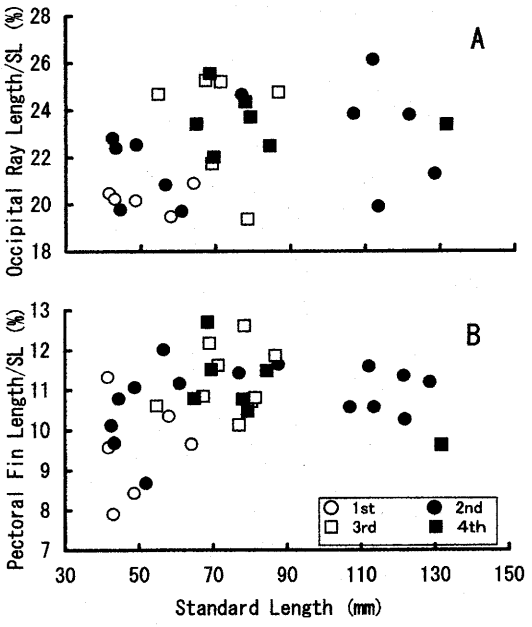

Fig. 7 Relationships between between occipital ray length/SL (%) and SL,**A**, and pectoral fin length/SL (%) and SL, **B**, by difference of anal fin ray below origin of dorsal fin base in *Bregmaceros japonicus*.

occipital ray was broken in one of six specimens in Table 3). The four groups in Table 3 do not show any difference concerning the pigmentation pattern described above. From the above comparisons, it can be concluded that there is no possibility of composite species in the present specimens, and

Table 3. Comparison of meristic counts and body proportions (%) among the specimens different in the position of origin of dorsal fin to anal fin ray in *Bregmaceros japonicus*.

Origin of dorsal fin to anal fin ray	above 1st	2nd	3rd	4th
No. of specimens	6	15	9	7
SL(mm)	41.5-64.3	42.5-128.6	67.3-86.8	64.9-131.7
Dorsal	54-58	53-60	53-59	53-58
Anal	56-61	57-64	57-61	57-62
Abdominal Vert.	13-14	14-15	14	14
Caudal V	42-43	40-44	41-43	42-43
Total V	55-57	54-58	55-57	55-57
Pectoral	19-21	19-22	19-22	19-22
Caudal	33-34	32-36	32-35	32-37
Principal C	14	14	14	14
Transverse scales	14-15	14	14	14
Longitudinal S	ca.77-81	ca.76-78	ca.80	ca.78-82
Head L/SL	15.2-17.3	14.1-17.4	14.9-16.5	14.0-17.1
Body D/SL	11.9-12.8	11.3-14.3	11.8-13.6	12.1-12.8
Occipital R.L/SL	19.5-20.9	19.7-26.1	19.4-25.8	22.0-25.5
Pre-anal L/SL	35.6-38.5	34.5-41.0	34.4-36.4	33.7-37.8
Pre-dorsal L/SL	35.7-39.1	35.5-41.4	36.2-38.9	34.8-39.1
Longest pelvic R. L/SL	50.4-57.8	50.6-64.1	50.7-64.2	49.8-61.8
Pectoral F. L/SL	7.9-11.3	8.7-12.0	10.1-12.6	9.6-12.7
Eye D/HL	19.4-27.8	19.0-24.3	19.2-27.1	22.4-27.6
Inter-orbital W/HL	21.6-28.4	20.2-30.0	21.7-28.4	21.4-27.3
Snout L/HL	20.0-27.8	20.0-26.7	20.2-26.7	18.7-24.3
Upper jaw L/HL	37.8-47.1	33.3-46.7	36.7-45.5	37.7-49.2
Pre-dorsal L/Pre-anal L	100.4-107.3	100.4-105.1	103.2-109.2	101.3-111.5

the position of dorsal base origin is not a species character of *B. japonicus*.

The position of dorsal base origin with respect to that of the anal fin is different among the collection areas as shown in Table 2. Limited to those of multiple specimens, it is above second to fourth anal fin ray in Tosa Bay, third to fourth in Suruga Bay, first to fourth in Sagami Bay (type locality of *B. japonicus*), and first to second in Miyagi, Fukushima and Ibaraki Prefs. In Fig. 8, the position is plotted against SL. Typically shown by Tosa Bay having a wide range of SL, the position does not change with growth in any areas. Therefore, the difference of the position of dorsal base origin can be considered to be individual variation, although there is a possibility of some level of consistent difference among areas as shown by Suruga Bay and Miyagi, Fukushima and Ibaraki Prefs.

Some authors, such as Belyanina[6], have taken a broad interpretation of intraspecific variation in *Bregmaceros* species and consequently synonymized some of the nominal species that are now known to be valid (see, for example, Masuda and Ozawa[4], Torii et al.[8], Harold and Johnson, in press). There has been some question as to whether or not *Bregmaceros japonicus* and *B. atlanticus* are distinct species, a situation actually initiated by Tanaka[1] who originally designated *B. japonicus* at the level of subspecies (*B. atlanticus japonicus*). Tanaka[2] apparently reconsidered the original designation,

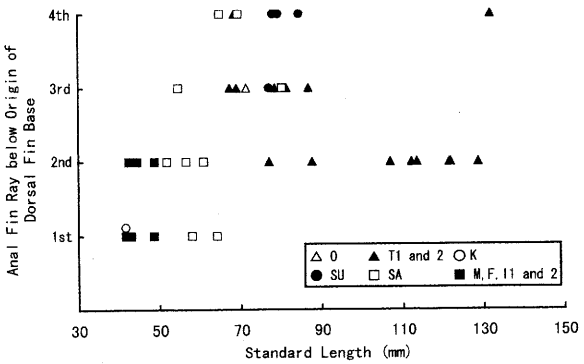

Fig. 8 Relationship between anal fin ray below origin of dorsal fin base and SL by collection areas in *Bregmaceros japonicus*. For the abbreviations of areas, refer to Fig. 1.

elevating to the level of species. We agree with Tanaka[2], and offer the following morphological character comparisions which distinguish *B. japonicus* from *B. atlanticus* (and from other congenerics). In comparison with *B. atlanticus* (seven specimens examined, including the holotype MCZ 32323), *B. japonicus* is distinctively different from *B. atlanticus* in transverse scales (14-15, as compared with 11-13), is slightly more elongate, as shown by the presence of more vertebrae (54-58, as compared with 53-56; D'Ancona and Cavinato[5] reported vertebral counts as low as 50 for *B. atlanticus* but we have not been able to verify such low values), and has more pectoral fin rays (19-22, as compared with 18-20 in *B.*

atlanticus). Some other differences include a ventrally acute and narrow opercle in *B. japonicus* compared with one in *B. atlanticus* that is relatively broad and subelliptical ventrally. Comparison of the axillary flap in these two species revealed little in the way of species distinctions.

B. japonicus is the seventh species described in the family. The first *B. mcclellandi* Thompson, 1840 and the third *B. atripinnis* (Tickell, 1865) are clearly distinct from *B. japonicus* in having black-colored pectoral, dorsal and caudal fins[8], the second *B. mirum* (Richardson, 1845) in having scales on cheek[8], the fourth *B. atlanticus* Goode and Bean, 1886 in the above characters, and the fifth *B. bathymaster* Jordan and Bollman, 1890 and the sixth *B. longipes* Garman, 1899, a junior synonym of *B. bathymaster* (Torii et al., unpublished) in having unpigmented ventral part of abdomen. Thus, it can be concluded that *B. japonicus* is valid.

Comparative materials examined. *Bregmaceros atlanticus* Goode and Bean: MCZ 32323 (holotype of *B. atlanticus*), 44.1 mm SL, Caribbean and Straits of Florida, R/V Blake stations 045, 150 and 262 mixed; USNM 47633 (paratype of *B. atlanticus*), 46.0 mm SL, Caribbean, off Nevis, R/V Blake station 151; USNM 256735 (one non-type specimen of *B. atlanticus*), 64.9 mm SL, Atlantic Ocean, off Bermuda, Bermuda Ocean Acre Cr. 12, Sta. 12-55N, 32° 11'N, 64° 10'W; USNM 325139 (two non-type specimens of *B. atlanticus*), 56.3-65.7 mm SL, Caribbean Sea, off Panama, R/V Oregon Sta. 78-3599, 09° 00'N, 81° 23'W;.USNM 325140 (two non-type specimens of *B. atlanticus*), 66.0-71.3 mm SL, 11° 46'N, 69° 15'W, Caribbean Sea, off Venezuela. *Bregmaceros bathymaster*: CSA-SU 427 (3 paratypes of *B. bathymaster*) 33.3-41.0 mm SL, 8° 16.30'N, 79° 37.30'W, Pacific coast of South America, Panama. *Bregmaceros longipes*: MCZ 28603; USNM 120248.

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