

# Redescription of the Shortfin Pomfret, *Brama pauciradiata*, Based on Japanese Specimens (Actinopterygii: Perciformes: Bramidae)

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The shortfin pomfret, *Brama pauciradiata* Moteki, Fujita and Last, 1995, is redescribed based on six specimens collected off Mie Prefecture, Japan. Although this species was originally described based on 23 specimens collected off north-western and northeastern Australia and off Hawaii, the largest specimen measured 81.8 mm SL and most of the type series are juveniles of less than 50 mm SL. The present specimens include five much larger specimens, of 103.8–160.1 mm SL. Distinct differences observed in some proportional measurements between the type series and the present larger specimens are regarded as ontogenetic changes because the countable characters agree well with those of type series and because the pattern of transformation in body shape of the present specimens and the type series of *B. pauciradiata* is similar to that of its congeners. The distance from the lowest part of the base of the pectoral fin to the insertion of the pelvic fin, and also the pale caudal peduncle saddle of preserved specimens, were regarded as diagnostic characters in the original description, but these characters are shared with congeners. A female specimen of 155.0 mm SL (FRLM 42111) is regarded as representing the minimum size of maturity because of the condition of its oocytes. The distributional range of *B. pauciradiata* extends from the eastern Indian Ocean to a wide area of the western-central Pacific Ocean.

**Key Words:** *Brama pauciradiata*, Bramidae, Japan, adult morphometrics.

## Introduction

The genus *Brama*, the largest genus of the family Bramidae contains eight valid species and is characterized by the following combination of characters: upper lip not free anteriorly, and fused with snout near anterior nostril; dorsal fin originating behind head; interorbital region narrow; and anterior vertical fins not prolonged (Mead 1972; Last and Moteki 2001). *Brama pauciradiata* Moteki, Fujita and Last, 1995 was described on the basis of the holotype (76.1 mm SL) and 22 paratypes. The largest specimen is 81.8 mm SL and most of the type series are juveniles of less than 50 mm SL. Moreover, 16 specimens are partially damaged recovered as stomach contents of *Alepisaurus ferox* Lowe, 1833. In 2012 and 2013, six specimens of *B. pauciradiata* (57.6–160.1 mm SL) were collected from the Pacific coast of Mie Prefecture, central Japan, together with many individuals of *Brama orcini* Cuvier, 1831. Here we redescribe *B. pauciradiata* based on the six specimens, which include adults, and discuss the differences from the type series. The present specimens are the first records from Japan and the northernmost records for the species.

## Materials and Methods

Counts and measurements generally follow Hubbs and Lagler (1958). The counts of scale rows in longitudinal series follow Mead (1972). Standard length is measured from the anterior tip of the upper lip to the posterior margin of the hypural bone. Standard length and head length are abbreviated as SL and HL, respectively. Vertebral and vertical-fin-ray counts were made from soft X-ray photos. Cyanine blue was used for scale observation. Specimens examined in this study are deposited at the following fish collections: Australian National Fish Collection, Hobart, Australia (CSIRO); Fisheries Research Laboratory, Mie University, Shima, Japan (FRLM); National Museum of Nature and Science, Tsukuba, Japan (NSMT); and Museum Support Center, Smithsonian Institution National Museum of Natural History, Suitland, Maryland, USA (USNM).

**Material examined.** Six specimens, 57.6–160.1 mm SL, all caught by purse seine off southern coast of Mie Prefecture, central Honshu, Japan: FRLM 41953, 133.2 mm SL, 3 August 2012, collected by M. Okada; FRLM 42111, 155.0 mm SL, 6 September 2012, collected by M. Okada; FRLM 44446, 44447, two specimens, 157.5 and 160.1 mm SL, 13 February 2013, collected by M. Okada; FRLM 44452, 57.6 mm SL, 12 October 2012, collected by M. Okada; FRLM 45335, 103.8 mm SL, 26 June 2013, collected by D. Sasaki.

Table 1. Counts and measurements of *Brama pauciradiata*

	Smallest Japanese specimen FRLM 44452	Larger Japanese specimens <i>n</i> =5	Holotype* CSIRO H 3145-43	Paratypes as "juvenile" in Moteki <i>et al.</i> (1995) <i>n</i> =8	Paratypes as "subadult" in Moteki <i>et al.</i> (1995) <i>n</i> =2
Standard length (mm)	57.6	103.8–160.1 (141.9)	76.1	30.6–42.8 (38.2)	75.3–80.5 (77.9)
Counts					
Dorsal-fin rays	32	31–33 (31.6, 5)	30	30–32 (31.3, 8)	30
Anal-fin rays	25	23–24 (23.6, 5)	22	23–25 (23.9, 8)	23–24 (23.5, 2)
Pectoral-fin rays	20	19–20 (19.6, 5)	20	19–21 (19.5, 8)	20–21 (20.5, 2)
Scale rows in longitudinal series	53	52–58 (54.2, 5)	49	50–58 (54.8, 8)	53–54 (35.5, 2)
Scale rows above lateral line	8	7–8 (7.4, 5)	7	7–9 (8.1, 8)	8
Scales below lateral line	12	11–13 (12.0, 5)	12	12–14 (12.9, 8)	13
Pre-dorsal fin scales	26	27–28 (27.4, 5)	25	24–27 (25.5, 8)	25–27 (26.0, 2)
Gill rakers of upper arch	4	4–5 (4.4, 5)	2	3–5 (4.3, 7)	3–4 (3.5, 2)
Gill rakers of lower arch	11	10–11 (10.8, 5)	12	10–12 (11.3, 8)	10
Abdominal vertebrae	16	15–16 (15.6, 5)	16	16	
Caudal vertebrae	22	21–23 (22.0, 5)	21	21–22 (21.6, 8)	
Measurements					
As % of SL					
Fork length	114.3	107.6–110.6 (109.1, 5)	112	114.1–117.2 (115.7, 5)	111.0–112.5 (111.7, 2)
Body depth	47.3	41.2–42.8 (42.1, 5)	43.5	48.4–57.4 (52.0, 8)	43.1–44.0 (43.6, 2)
Body width	13.0	12.1–13.2 (12.6, 5)	12.0	10.4–14.0 (12.2, 8)	10.3–11.1 (10.7, 2)
Head width	13.0	12.3–13.1 (12.5, 5)	13.7	12.6–14.9 (14.0, 8)	13.7–14.1 (13.9, 2)
Pre-dorsal-fin length	41.6	36.4–39.6 (37.9, 5)	43.6	41.2–44.7 (43.5, 8)	41.6–43.2 (42.4, 2)
Pre-anal-fin length	58.6	59.4–61.7 (60.0, 5)	58.0	57.1–62.2 (60.2, 8)	57.7–58.2 (58.0, 2)
Distance from snout to insertion of pectoral fin	27.6	27.9–30.0 (29.2, 5)	31.4	28.8–31.8 (30.6, 8)	29.7–31.3 (30.5, 2)
Distance from snout to insertion of pelvic fin	38.8	39.4–41.4 (40.2, 5)	40.7	40.0–44.2 (41.6, 8)	39.7–42.0 (40.9, 2)
Dorsal-fin base length	55.2	54.9–58.5 (56.8, 5)	52.6	50.7–54.3 (52.3, 8)	54.5–56.4 (55.5, 2)
Anal-fin base length	42.9	37.5–40.9 (39.1, 5)	38.2	38.1–42.9 (41.2, 8)	36.4–38.0 (37.2, 2)
Distance from origin of dorsal fin to insertion of pectoral fin	30.7	25.7–26.7 (25.9, 5)	28.9	30.9–37.4 (34.2, 8)	25.7–26.2 (25.9, 2)
Pectoral-fin base length	9.0	7.3–8.3 (7.7, 5)	8.0	7.9–9.1 (8.7, 8)	7.5–7.8 (7.7, 2)
Distance from lowest base of pectoral fin to insertion of pelvic fin	10.2	11.1–13.1 (12.2, 5)	12.7	8.8–10.1 (9.4, 8)	11.1–11.2 (11.1, 2)
Distance from pelvic insertion to origin of anal fin	22.7	22.1–23.0 (22.4, 5)	20.6	20.7–25.1 (22.8, 8)	18.6–21.3 (20.0, 2)
Pectoral-fin length	32.1	28.3–32.4 (30.5, 5)	33.2	27.5–31.8 (29.8, 8)	31.1–31.5 (31.3, 2)
Pelvic-fin length	13.1	8.9–9.9 (9.2, 5)	11.2	13.2–18.4 (14.9, 8)	10.7–11.3 (11.0, 2)
Length of 5th dorsal-fin ray	15.5	12.3–14.4 (13.0, 5)	9.7	16.5–24.1 (19.7, 8)	11.0–13.7 (12.3, 2)
Length of 5th anal-fin ray	6.5	4.6–6.0 (5.1, 5)	6.8	7.2–11.1 (9.5, 8)	5.9–6.4 (6.2, 2)
Length of upper caudal lobe	29.1	26.8–31.2 (28.7, 5)	33.5	21.8–27.2 (24.0, 4)	27.4–28.1 (27.7, 2)
Length of lower caudal lobe	27.7	24.7–28.6 (27.2, 5)	33.8	20.1–25.1 (23.5, 4)	27.2–28.3 (27.8, 2)
Central caudal-fin length	12.2	8.8–10.7 (9.5, 5)	12.2	13.6–16.7 (15.3, 6)	11.5–12.2 (11.8, 2)
Caudal peduncle length	12.8	9.9–11.5 (10.6, 5)	13.7	12.9–13.8 (13.4, 8)	10.1–11.4 (10.8, 2)
Caudal peduncle depth	7.3	6.3–7.1 (6.7, 5)	6.7	6.8–8.4 (7.5, 8)	6.9–7.2 (7.1, 2)
Head length	29.2	27.3–28.2 (27.8, 5)	32.3	29.2–31.5 (30.6, 8)	31.3–31.6 (31.4, 2)
As % of HL					
Snout length	27.3	28.1–30.3 (29.5, 5)	26.0	21.5–26.3 (24.7, 8)	25.3–26.1 (25.7, 2)
Eye diameter	30.0	21.1–24.3 (22.9, 5)	27.2	33.8–38.8 (36.1, 8)	26.8–27.5 (27.1, 2)
Greater diameter of eye	31.0	24.4–26.6 (25.3, 5)	31.3	33.8–40.4 (36.9, 8)	29.5–34.6 (32.0, 2)
Interorbital width	25.6	25.2–28.9 (26.5, 5)	25.7	24.8–33.5 (29.2, 8)	21.1–22.9 (22.0, 2)
Upper-jaw length	46.9	47.7–49.0 (48.5, 5)	52	46.2–52.0 (49.6, 8)	47.7–48.9 (48.3, 2)

Figures in parentheses indicate mean values and sample size, respectively. \* Data from Moteki *et al.* (1995).

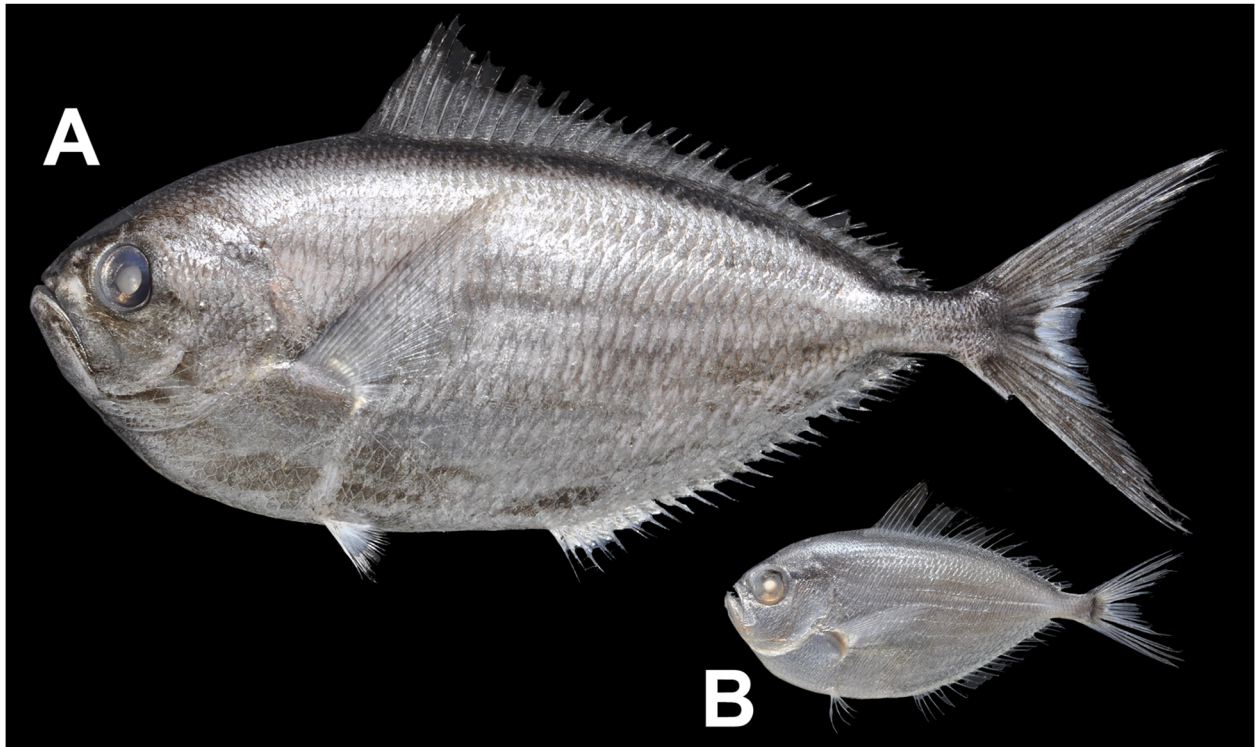


Fig. 1. *Brama pauciradiata*, caught off the southern coast of Mie Prefecture, Japan. A, FRLM 42111, 155.0 mm SL; B, FRLM 44452, 57.6 mm SL.

**Comparative material.** Holotype of *Brama pauciradiata*: CSIRO H 3145-43, 76.1 mm SL, Rowley Shoals, Australia, photograph only. Paratypes of *B. pauciradiata* (11 specimens, 30.6–80.5 mm SL): CSIRO H 3145-27, two of five specimens, 75.3–80.5 mm SL, same locality as holotype; NSMT-P 45796–45799, 45801, 45803, 45809, seven specimens, 30.6–42.8 mm SL, Coral Sea; NSMT-P 45811, 37.8 mm SL, eastern Indian Ocean. Non-type of *B. pauciradiata*: USNM 408845, 122.0 mm SL, Mindanao Island, Philippines, 20 March 2012, collected by J. T. Williams, K. E. Carpenter, T. Nanola, A. Lizano, and T. Potenciana, photograph only. Non-types of *Brama dussumieri* Cuvier, 1831 (six specimens, 27.4–138.1 mm SL): FRLM 45338, 127.4 mm SL, off southern coast of Mie Prefecture, Japan; NSMT-P 45752, 45753, two specimens, 27.4 and 33.8 mm SL, off Hawaii, 7°52'N, 172°34'W and 12°03'N, 159°19'W, respectively; NSMT-P 71315, 109.4 mm SL, off Cape Toi-misaki, Miyazaki Prefecture, Japan, 31°26'N, 131°40'E; NSMT-P 76464, 118.0 mm SL, off Yaeyama Islands, Okinawa Prefecture, Japan, 23°56'N, 124°29'E–23°52'N, 124°27'E; NSMT-P 106830, 138.1 mm SL, Tahiti, central Pacific Ocean. Non-types of *Brama japonica* Hilgendorf, 1878 (four specimens, 108.3–391.0 mm SL): FRLM 10749, 173.1 mm SL, off Okinawa-jima island, Japan, 27°25'N, 129°00'E; FRLM 45535, 45536, two specimens, 391.0, 348.0 mm SL, off southern coast of Mie Prefecture, Japan; NSMT-P 45739, 108.3 mm SL, western North Pacific Ocean, 36°24'N, 175°56'E. Non-types of *B. orcini* (six specimens, 50.2–171.0 mm SL): FRLM 41947, 41948, 41952, 42115, 44438, 45351, 50.2–171.0 mm SL, off southern coast of Mie Prefecture, Japan.

## Results

**Description of specimens collected from Japan.** Herein the “smallest specimen” is of 57.6 mm SL (FRLM 44452), and “larger specimens” are of 103.8–160.1 mm SL ( $n=5$ , see Material examined). Counts and measurements are shown in Table 1.

Body deep, strongly compressed, deepest in smallest specimen (47.3% SL), more slender (41.2–42.8% SL) in larger specimens (Fig. 1). Breast strongly convex but belly straight, forming abdominal keel; dorsal contour strongly convex in smaller specimens, less so in larger specimens. Head small, its length 29.2% SL in smallest specimen, relatively shorter (27.3–28.2% SL) in larger specimens (Fig. 1). Snout moderately acute, relatively long, nostrils located just at anterodorsal to eye; anterior nostril pore-shaped, slit-like posteriorly. Eyes large, elliptical vertically, with their centers located above tip of snout. Mouth somewhat large, oblique upwards; posterior margin of upper jaw rounded, situated behind vertical drawn through anterior margin of eye; mouth superior, distance between anterior tip of lower jaw and tip of snout one-quarter of eye diameter; distinct fold present on lower jaw, and posterior half of lower lip overlapped by upper jaw. Edges of preopercle and opercle smooth.

All teeth conical, somewhat recurved. In smallest specimen, upper jaw with three vertical teeth along outer edge and two rows of introrse teeth anteriorly, uniserial teeth posteriorly; lower jaw with two rows of introrse teeth anteriorly with enlarged second tooth in inner row, uniserial teeth

posteriorly. In larger specimens (103.8–160.1 mm SL), upper jaw with tooth-band with single row of vertical teeth along outer edge anteriorly, width of band gradually decreasing posteriorly; dentition of lower jaw generally similar to that of smaller specimen, with canine tooth on anterior inner row; villi covering interspace between teeth on both jaws. Tongue separated from floor of mouth, robust and rounded anteriorly.

Lateral line clearly visible in larger specimens, but unclear in smallest specimen, running from uppermost point of gill opening, then semicircularly at mid-body anterior to vertical drawn through base of anal-fin rays 20th to 21th, then straight along caudal peduncle.

Head and body covered with strongly adherent ctenoid scales except for naked snout, interorbital space, lower jaw, and around eye; numerous micropores present on those parts. Scale shape differing with body size: in smallest specimen, exposed areas of scales above lateral line and on belly small, needle-like spinules along their spine-like ctenii, scales below lateral line vertically elongated with short ctenii and large notch on mid-posterior margin, fins scaleless; in large specimens, needle-like spinules reduced, posterior margin of all scales with small ctenii, dorsal and anal fins mostly covered with elongate horizontal scales, caudal peduncle and area around base of caudal fin with smaller scales.

Dorsal fin single, originating behind level of base of last pectoral-fin ray in smallest specimen, but just at this level in larger specimens; anal fin originating below base of 10th dorsal-fin ray in smallest specimen, but below base of 12th to 13th ray in larger specimens; caudal fin strongly forked; both lobes elongate, upper one slightly longer than lower; pectoral fin long, its posterior tip somewhat rounded and reaching to level of fifth anal-fin ray base; anus located just behind posterior tip of appressed pelvic fin.

*Color when fresh* (Fig. 1): Head and body silvery gray, strongly darker dorsally, posterior margins of scales black except on ventral area; paler area on ventral one-third of caudal peduncle. Mouth cavity and tongue dark gray. Rays of dorsal fin pale white, membrane dark, margin prominent black; anal fin mostly pale, membrane somewhat dark posteriorly; caudal fin entirely dark with white margin centrally; pectoral fin relatively dark, pelvic fin transparent.

## Discussion

The present six specimens have 31–33 dorsal-, 23–25 anal-, and 19–20 pectoral-fin rays, 52–58 scales in longitudinal series, 7–8 scales above the lateral line, 11–13 scales below the lateral line, 26–28 predorsal scales, 4–5 gill rakers on the upper and 10–11 on the lower arches, and 15–16 abdominal and 21–23 caudal vertebrae. These values are lower than those of most species of *Brama*, but closely resemble those of *Brama pauciradiata*. Although the smallest specimen (57.6 mm SL) agrees well with type series of the species in all proportional characters except distances from the snout to the insertions of pectoral and pelvic fins,

the five larger specimens (103.8–160.1 mm SL) show distinct morphometric differences from the type series in fork length, body depth, pre-dorsal fin length, distance from the lowest base of the pectoral fin to the pelvic insertion, pelvic fin length, length of the 5th anal-fin ray, central caudal-fin length, head length, snout length, and eye diameter (Table 1). The species of *Brama* undergo transformation in body shape with growth in their juvenile and young stages whereby some proportional measurements, *e.g.*, relative body depth, head length, lengths of dorsal- and anal-fin rays, and central caudal-fin length, become reduced (Mead 1972). The pattern of transformation in body shape of the present specimens of *B. pauciradiata* is similar to that of its congeners reported by Mead (1972). Consequently, we regarded the proportional differences in body shape between the present large specimens and the type series of *B. pauciradiata* as ontogenetic changes; therefore, the present six specimens are identified as *B. pauciradiata*.

The “pale saddle”, regarded by Moteki *et al.* (1995) as one of the diagnostic characters of *B. pauciradiata*, actually occurs as well in *B. dussumieri* and *B. orcini*. Also, the proportional distance from the lowest base of the pectoral fin to the insertion of the pelvic fin overlaps with that of all other congeners (Mead 1972; Pavlov 1991; this study). That is why these characters were excluded from the diagnosis of *B. pauciradiata* in this study. On the other hand, the pointed and protruding snout is available for separation of this species from all of its congeners.

Of our specimens, FRLM 42111 (155.0 mm SL) and 44447 (160.1 mm SL) are female with developed oocytes, the larger of which in FRLM 42111 are 0.50–0.82 mm in diameter ( $n=10$ ). The spawning behavior of bramid fishes is mostly unknown, but Omori *et al.* (1997) examined the GSI (gonadosomatic index) and diameter of oocytes of *B. dussumieri* (nine specimens, 170.7–192.0 mm SL) from the western Pacific Ocean. They reported three distribution modes in oocyte diameter, the largest being 1.3–1.6 mm in diameter. They considered oocytes of  $\geq 0.6$  mm in diameter as having reached the vitellogenic or maturation phase, and the larger oocytes of our FRLM 42111 fall into this category. Vitellogenic oocytes are generally regarded as developing ovarian eggs that are expected to attain maturity and subsequently be ovulated during the breeding season (Kimura 1987; Kimura *et al.* 1989). In the original description of the present species, the largest three specimens (CSIRO H 3145-43 and 3145-27, 76.1–81.8 mm SL) were identified as subadult specimens due to their partially developed gonads, and the authors suggested that *B. pauciradiata* matures at a small size. It indeed matures at relatively small size compared to other species of *Brama*, but the size at female sexual maturity is about twice that of the “subadult” specimens in the original description.

*Brama pauciradiata* has been recorded from northwestern Australia in the Indian Ocean and northeastern Australia (the Coral Sea), and from the Hawaiian Islands in the Pacific Ocean. We collected it from the Pacific coast of Japan and confirmed it from Mindanao in the Philippines (USNM 408845, 122.0 mm SL). The Philippine specimen

can be identified as *B. pauciradiata* from its photograph by its having 31 dorsal- and 25 anal-fin rays, 51 scales in longitudinal series, and a relatively pointed and protruded snout. Consequently, we regard this species to be widely distributed in the eastern Indian Ocean and the western-central Pacific Ocean. The Japanese specimens are the northernmost record of the species. A new Japanese standard name, “Ohban-shima-gatsuo”, is proposed for it referring to the shape of body, which resembles an “ohban”, a large oval monetary gold plate used in Japan during its Medieval Period.

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