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Some Notes on the Early Life Stages of the Pacific Pomfret, *Brama japonica*, and Other Bramidae from the Central North Pacific Ocean

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Fishes of the percoid family Bramidae are widespread, occurring in all tropical and temperate seas but, with the exception of the two most abundant species of the genus *Brama*, are poorly studied (Mead, 1972). The biology of the family is best known in the Atlantic Ocean and much less so in the Pacific. In particular, information is limited regarding the reproduction and early life history of North Pacific bramids. For many years, nearly all knowledge on Pacific bramids was contained in Mead's impressive 1972 monograph. Since then, Kinoshita (1988) has presented larval descriptions of western North Pacific bramids, a new genus and species from the South Pacific have been described (Yatsu and Nakamura, 1989), and a few studies have been conducted on the biology and distribution of *Brama japonica* (Pacific pomfret, shimagatsuo), a major species taken in the North Pacific drift-net fisheries (Shimazaki, 1989).

Knowledge of the biology of *B. japonica* has grown considerably with the expansion of the commercial salmon and squid drift-net fisheries across the North Pacific Ocean. Although pomfret are not the target of these fisheries, the substantial number of *B. japonica* taken incidentally has stimulated increased interest in and research on the resource. Studies of pomfret distribution based upon drift-net catch data (Neave and Hanavan, 1960; Hitz and French, 1965; Machidori and Nakamura, 1971) provided the basis for the seasonal migration patterns suggested by Shimazaki and Nakamura (1981) (Fig. 1). Briefly adult *B. japonica* are known to occupy feeding grounds in North Pacific subarctic waters above 40°N latitude during the summer months. The species is then hypothesized to migrate south to subtropical spawning areas within the North Pacific Transition Zone between 20°N and 40°N latitude. Based upon gonadosomatic index (GSI) values, Yoon and Shimazaki (1981) predicted *B. japonica* to

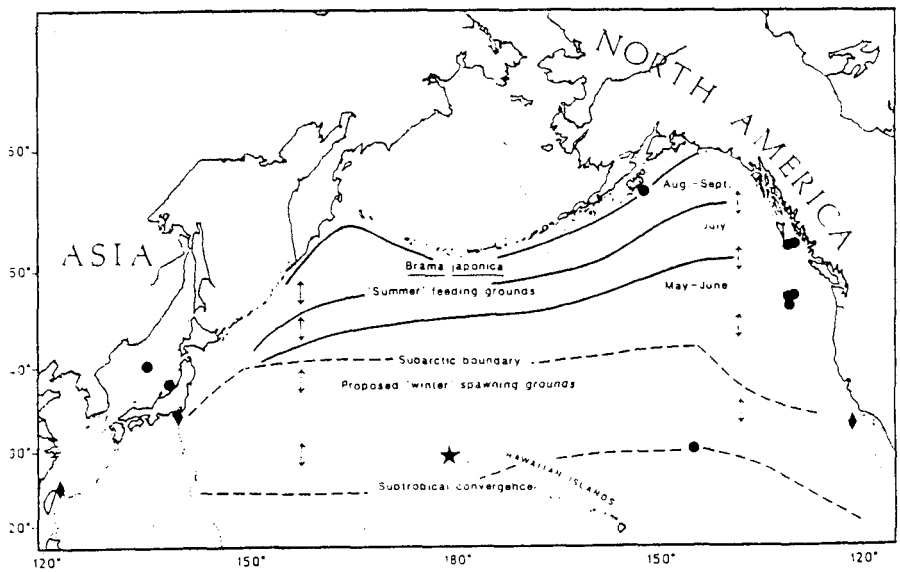

Fig. 1. Distribution of *Brama japonica* and *Taractes asper* in the North Pacific. The asterisk indicates the Southeast Hancock Seamount (29°47′N, 179°03′E), where early stages of four bramid species were collected. Circles indicate *T. asper* <200 mm SL; diamonds indicate *T. asper* >200 mm SL. The seasonal distribution of *B. japonica* (adapted from Shimazaki and Nakamura, 1981) is indicated by solid and broken lines.

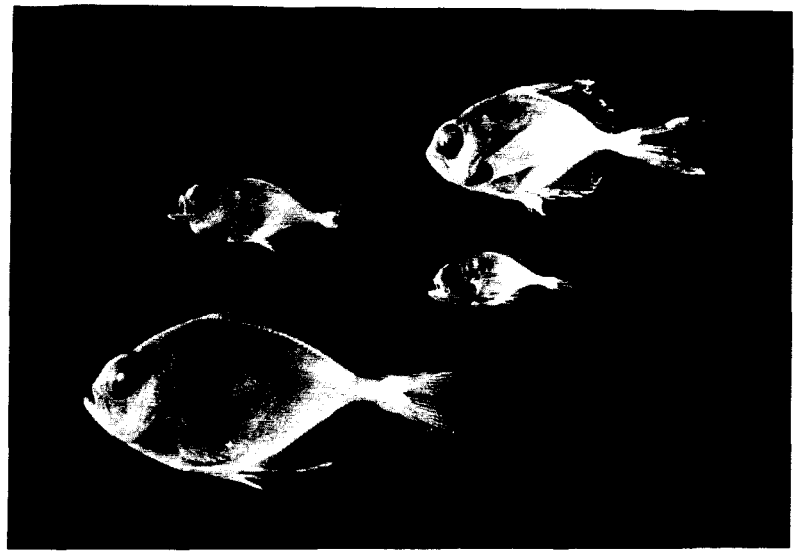

Fig. 2. Juvenile *Brama japonica* from the Southeast Hancock Seamount: 15.1, 19.5, 26.0, and 38.6 mm

be protracted multiple spawners during the winter months of December-April and from early June-July. Wada and Murata (1985) also reported that GSI values tend to be lowest in August and to rapidly rise during October-November.

In this note, we discuss collections that provide new insight into bramid reproduction and distribution in the central North Pacific Ocean.

Materials and methods

Micronekton and plankton samples were collected at the Southeast (SE) Hancock Seamount (29°47′N, 179°03′E). Micronekton samples were collected with a 1.8 m Isaacs-Kidd midwater trawl (IKMT) (February 1985, November 1986, April 1987, January 1988, July-August 1988, and October 1988), a 60 m^2 Marinovich trawl (September and November 1986), and a 100 m^2 Oregon State University (OSU) rope trawl (November 1988). Bramid eggs and larvae were collected in plankton samples using a 1 m^2 opening-closing Tucker trawl (July 1984 and February 1985), a 0.49 m^2 Manta (neuston) net (January 1988), and a 60 cm bongo net (January 1988). To determine whether the densities of larvae at the seamount and in the surrounding ocean differed, paired sets of samples were taken directly above the seamount summit and at stations 20 km to the west of the summit in July 1984 and February 1985.

All samples were preserved in 10% form and sorted for bramid larvae and juveni laboratory. Bramid eggs were removed samples taken in January 1988, but eggs routinely sorted from the samples. Specir identified by the criteria of Mead (1972) a shita (1988). They were also compared ern Pacific specimens of *B. japonica* from fornia Cooperative Oceanic Fisheries Inv (CALCOFI).

Results and discussion

Brama japonica, Pacific pomfret, shima

Our collections of large larvae and juver *japonica* at SE Hancock Seamount suppoi pothesis of Shimazaki and Nakamura (1981 subtropic region is indeed a winter spawnin the Pacific pomfret. Thirteen larval and ju *japonica* (Fig. 2), 8.1–38.6 mm standard len were collected over and near the seamount s horizontal and oblique IKMT tows at ≤ ≤250 m (usually 75–135 m; Table 1). All b the young pomfret were collected in Febru and January 1988, although sampling was c in all months except March, May, and IKMT tows in January-February, 14 in Ap July-August, and 33 in October-Novem

single 32.5 mm SL specimen was collected in April 1987.

Collections of 11 bramid eggs and 62 larvae from plankton samples taken near the seamount in February 1985 and January 1988 (Tables 2, 3) also support the hypothesis of winter spawning of *B.*

Table 1. Collection data for *Brama japonica* in 1.8 m Isaacs-Kidd midwater trawl tows at the Southeast Hancock Seamount. S = captured on seamount summit; W = captured 20 km west of the seamount summit.

SL (mm)	Date	Start time	Tow duration (min)	Max. depth fished (m)	Location
8.1	16 Jan. 1988	2321	67	110	S
9.0	12 Feb. 1985	2114	62	72	W
9.4	12 Feb. 1985	0555	46	117	S
9.6	12 Feb. 1985	2258	57	135	W
10.6	12 Feb. 1985	2114	62	72	W
11.2	16 Jan. 1988	2321	67	110	S
13.9	12 Feb. 1985	2114	62	72	W
15.1	13 Feb. 1985	0612	46	119	W
19.5	13 Feb. 1985	0612	46	119	W
26.0	13 Feb. 1985	0612	46	119	W
28.5	28 Jan. 1988	2304	69	250	S
32.5	19 Apr. 1987	2155	56	200	S
38.6	28 Jan. 1988	2115	69	250	S

Table 2. Collection data for *Brama japonica* captured with a 1 m^2 Tucker trawl at the Southeast Hancock Seamount in February 1985. D = day sample; N = night sample. Except where noted otherwise, data were from a series of paired samples taken to compare the occurrence of larvae over and away from the seamount during day and night. Eight tows at depths of 100–200 m were excluded, because no *Brama* were collected.

D/N	Depth (m)	20 km west of the seamount				Above the seamount summit			
		Date	Start time	Larvae/ 1000 m^3	SL (mm)	Date	Start time	Larvae/ 1000 m^3	SL (mm)
D	0– 25	4	0916	2.61	4.2–5.9	9	0848	2.33	3.8– 3.9
D	0– 25	4	1145	1.10	10.0	9	1046	2.35	3.2– 3.9
D	25– 50	4	0859	0		9	0830	2.27	4.9– 9.9
D	25– 50	4	1122	0		9	1028	2.19	10.5–11.2
D	50–100	4	1022	2.06	4.0–5.9	9	0932	0	
D	50–100	4	1354	0		9	1346	1.09	3.7
D	0– 50	4	1045	0		9	0950	2.31	2.8– 3.8
D	0– 50	4	1416	1.20	3.6	9	1404	1.12	4.4
D	0–100	4	1315	0		9	1248	2.21	4.3– 8.4
D	0–100	4	1530	0		9	1515	0	
N	0– 25	8	2032	0		9	2030	0	
N	0– 25	8	2224	1.07	3.6	9	2235	0	
N	25– 50	8	2011	3.11	3.4–6.0	9	2012	5.36	3.3– 6.6
N	25– 50	8	2207	2.12	3.6–3.6	9	2217	1.15	3.8
N	50–100	8	2106	1.12	2.9	9	2113	2.13	3.9–10.5
N	50–100	9	0010	1.15	8.1	10	0038	0	
N	0– 50	8	2125	2.19	3.9–7.0	9	2145	0	
N	0– 50	9	0030	0		10	0100	0	
N	0–100	8	2330	0		10	0000	0	
N	0–100	9	0145	0		10	0215	0	
D[1]	0– 50	23	0047	4.71	3.0–9.7				
D[1]	0–100	23	0012	1.24	3.9				

[1] Data are from other sample series not completely sorted for bramid larvae.

japonica in this region. No *Brama* larvae were collected in 51 plankton samples in July 1984.

We suggest that most of the eggs and larvae collected during the winter were *B. japonica*, based on known adult distributions and the proportions of juveniles in our collections. Nine large (7.0–11.2 mm SL) larvae were identified as *B. japonica* with certainty. The eggs and smaller larvae lacking fin rays could not be unequivocally identified, but myomere counts (36–42; 73% with 38–39; one each with 36 and 42) indicate that they are *B. japonica*, *B. orcini*, or *Taractes asper*. A single adult *B. orcini*, which has a tropical distribution in >18.3℃ water opposing the temperate distribution of *B. japonica* (Mead, 1972), reportedly was caught at the seamount during summer (Humphreys et al., 1984). Sea surface temperatures at the seamount were 16.5°–18.4℃ in February 1985 and 17.8°–19.4℃ in January 1988.

Bramid larvae collected with opening-closing nets were all taken at depths of 0–100 m, with none in eight tows at 100–200 m and most at 0–50 m (Table 2). The vertical distribution of the larvae indicates that they occur throughout the mixed layer (0–90 m as determined from XBT casts) without evidence of diel migration. This mixed layer distribution is further supported by the capture of most juveniles from the IKMT in tows at <120 m (Table 1).

Catches of *Brama* larvae during February 1985 over the seamount summit were not significantly different from catches 20 km to the west (Wilcoxon paired-sample test, $P > 0.05$; Table 2). Bramids thus probably spawn throughout the area and not specifically at seamounts, as demonstrated by larvae and juveniles captured in this region far from any shallow topographic feature (Mead, 1972; Loeb, 1979a, b).

Historically, winter spawning of *B. japonica* in this region is supported by the capture of 10 larvae at 31°–33°N, 166°–174°W in March-May 1933 (Mead, 1972). Loeb (1979a, b) reported the capture of 52 larval *B. japonica* near 28°N, 155°W. Unfortunately, except for three individuals collected in September 1968 (Loeb, 1979b), no information on seasonality of capture has been presented. During ichthyoplankton surveys conducted by the CALCOFI cruises, bramid larvae (primarily *B. japonica*; H. G. Moser, personal communication, May 1990) were collected throughout the year in the eastern North Pacific off California, with peak numbers of larvae captured in January, July, and October (see Ambrose et al. (1988) data references). Although our IKMT sampling also was conducted during summer in 1984, 1987, and 1988, we have no evidence of the hypothesized June-July spawning period. This may reflect that pomfret occupying waters toward the eastern Pacific (i.e. west longitudes) spawn later in the year than their western counterparts. Adult pomfret captured around 35°–45°N, 140°–175°W had high GSI values in June-July and completed spawning in late July, but fish sampled to the west at 30°–40°N, 160°–170°E had GSI values indicating the end of spawning in May (Yoon and Shimazaki, 1981).

Taractes asper, rough pomfret, manzai-uo

Three juvenile *T. asper*, 14.5, 15.8, and 20.5 mm

Table 3. Collection data from positive tows for *Brama japonica* captured above the summit of the Southeast Hancock Seamount with a 60 cm bongo net and 0.49 m^2 neuston net during January 1988. Bramids were absent in 16 other bongo net and 3 other neuston samples. No samples were collected away from the summit during this cruise. Bramid eggs were not identified from most samples.

Date	Start time	Depth (m)	Number of larvae	SL (mm)
14	Night (0115)	0– 1	3	3.0–4.5
14	Night (0540)	0–100	6	3.3–5.9, 4 eggs
14	Night (2015)	0– 1	2	3.5–3.8
14	Night (2254)	0– 1	4	2.6–3.8
15	Night (0247)	0– 1	3	4.2–4.8
15	Night (0508)	0– 1	2	3.6–3.7
17	Night (2036)	0– 50	4	3.1–3.5, 3 eggs
15	Night (0009)	0–100	1	3.8
15	Night (0356)	0–100	2	3.1–4.5, 3 eggs
15	Night (0605)	0–100	3	3.4–5.1
15	Night (2008)	0–100	3	3.2–5.2, 1 egg
18	Night (0503)	0–100	1	3.6

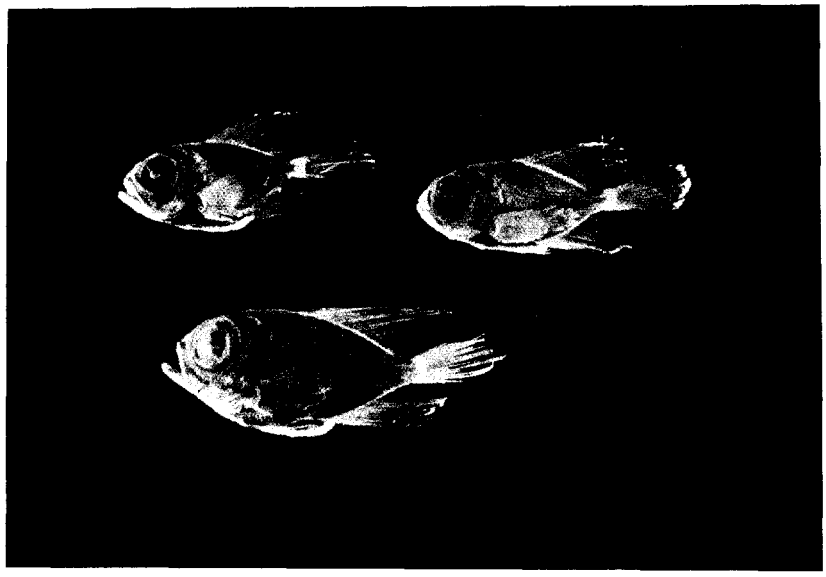

Fig. 3. Juvenile *Taractes asper* from the Southeast Hancock Seamount: 14.5, 15.8, and 20.5 mm SL.

SL (Fig. 3), were collected 20 km west of the SE Hancock Seamount summit in February 1985, 0612–0658 h, in a horizontal 1.8 m IKMT tow at about 119 m depth. This is the first record of the species from a specific locality in the central North Pacific, extending the known range of the species by about 3900 km. Borets and Sokolovskij (1978) included *T. asper* in the ichthyoplankton collected from the northern Hawaiian Ridge and the Emperor Seamounts but did not report capture locations.

Historically, very few occurrences of *T. asper* have been reported in the North Pacific (Fig. 1). Except for two large specimens taken at 30°N, 145°W (Mead, 1972—not shown on distribution map in monograph), *T. asper* previously have been reported in the North Pacific from only the continental shelf and slope waters of Asia and North America. Since Mead (1972), records include only a large 373 mm SL individual taken off the Queen Charlotte Islands (Peden and Ostermann, 1980), nine adults (291–392 mm SL) caught off the west coast of British Columbia (Peden and Jamieson, 1988), a 258 mm SL adult from the southern coast of Hokkaido, Japan (Amaoka et al., 1989), a 169 mm SL specimen off California (Pavlov, 1989), and, most recently, five adults from the shelf off southern Oregon (OSU cat. no. 6588).

The February capture supports speculation that, like *B. japonica*, *T. asper* may also be a subtropical winter spawner (Mead, 1972; Kinoshita, 1988).

Pterycombus petersii, prickly fanfish, ryûgû-no-hime

Because records of juvenile *Pterycombus petersii* from this region are virtually nonexistent, also noted here is the capture of a small (26.1 mm SL) individual with a 60 m^2 Marinovich herring trawl in November 1986.

Pteraclis aesticola, Pacific fanfish, benten-uo

Twenty-four larval and juvenile *Pteraclis aesticola* (2.3 to 47.2 mm SL) were collected during July-November. Larvae were only collected in July 1984, suggesting that this species spawns during the summer in this region.

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Literature cited

Amaoka, K., K. Nakaya and M. Yabe. 1989. Fishes of Usujiri and adjacent waters in southern Hokkaido, Japan. Bull. Fac. Fish. Hokkaido Univ., 40(4): 254–277.

Ambrose, D. A., R. L. Charter, H. G. Moser and B. S. Earhart. 1988. Ichthyoplankton and station data for California Cooperative Oceanic Fisheries Investigations survey cruises in 1981. NOAA Tech. Memo. NMFS-SWFC-112, 170 pp.

Borets, L. A. and A. S. Sokolovskij. 1978. Species composition of the ichthyoplankton of the Hawaiian submarine ridge and the Emperor Seamounts. Pages 43–50 *in* Izvestiya of the Pacific Ocean Scientific Research Institute for Fisheries and Oceanography (TINRO). Fisheries oceanography, hydrobiology, biology of fishes and other denizens of the Pacific Ocean. Vol. 102. (English translation by W. G. Van Campen for the Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Transl. No. 105, 10 pp.)

Hitz, C. R. and R. R. French. 1965. Occurrence of pomfret (*Brama japonica*) in the northeastern Pacific Ocean. Fish. Indust. Res. 3: 1–7.

Humphreys, R. L., Jr., D. T. Tagami and M. P. Seki. 1984. Seamount fishery resources within the southern Emperor-northern Hawaiian Ridge area. Pages 226–236 *in* R. W. Grigg and K. Y. Tanoue, eds. Proceedings of the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands, May 25–27, 1983, University of Hawaii, Honolulu, Hawaii. Vol. 2. UNIHI-SEAGRANT-MR-84-01.

Kinoshita, I. 1988. Bramidae. Pages 487–496 *in* M. Okiyama, ed. An atlas of the early stage fishes in Japan. Tokai Univ. Press, Tokyo. (English translation by W. G. Van Campen for the Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Transl. No. 130, 25 pp.)

Loeb, V. J. 1979a. Larval fishes in the zooplankton community of the North Pacific central gyre. Mar. Biol., 53: 173–191.

Loeb, V. J. 1979b. Vertical distribution and development of larval fishes in the North Pacific central gyre during summer. Fish. Bull., U.S., 77: 777–793.

Machidori, S. and S. Nakamura. 1971. Distribution and some biological informations of pomfret (*Brama rait*) in the northwestern North Pacific Ocean. Bull. Far. Seas Fish. Res. Lab., (5): 131–145.

Mead, G. W. 1972. Bramidae. Dana Rep., (81): 166 pp.

Neave, F. and M. G. Hanavan. 1960. Seasonal distribution of some epipelagic fishes in the Gulf of Alaska region. J. Fish. Res. Bd. Can. 17: 221–233.

Pavlov, Y. P. 1989. Some data on the morphometrics and distribution of species of the genus *Taractes* (Bramidae) in the Pacific Ocean. Voprosy Ikhtiologii, (4): 660–662. (English translation in J. Ichthyol., 29: 164–166.)

Peden, A. E. and G. S. Jamieson. 1988. New distributional records of marine fishes off Washington, British Columbia and Alaska. Can. Field. Nat., 102: 491–494.

Peden, A. E. and W. Ostermann. 1980. Three fish species previously unknown from marine waters off British Columbia. Syesis, 13: 215–217.

Shimazaki, K. 1989. Ecological studies of the pomfret (*Brama japonica*) in the North Pacific Ocean. Pages 195–205 *in* R. J. Beamish and G. A. McFarlane eds. Effects of ocean variability on recruitment and an evaluation of parameters used in stock assessment models. Can. Spec. Publ. Fish. Aquat. Sci., 108.

Shimazaki, K. and S. Nakamura. 1981. Ecological studies of the pomfret (*Brama japonica* Hilgendorf). 1. The seasonal distributional pattern and ecological considerations. Res. Inst. North Pac. Fish., Hokkaido Univ., Special Vol.: 91–103. (In Japanese with English abstract.)

Wada, T. and M. Murata. 1985. Distribution and biological characteristics of pomfret, *Brama japonica* Hilgendorf, in the Pacific Ocean off northern Japan. Bull. Hokkaido Reg. Fish. Res. Lab., (50): 1–12.

Yatsu, A. and I. Nakamura. 1989. *Xenobrama microlepis*, a new genus and species of bramid fish, from subantarctic waters of the South Pacific. Japan. J. Ichthyol., 36(2): 190–195.

Yoon, T. H. and K. Shimazaki. 1981. Ovarian maturation of the Pacific pomfret, *Brama japonica* Hilgendorf, in the North Pacific Ocean. Res. Inst. North Pac. Fish., Hokkaido Univ., Special Vol.: 79–90. (In Japanese with English abstract.)

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北太平洋中部から採集されたシマガツオ科の仔稚魚

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北太平洋の Southeast Hancock Seamount から，シマガツオ科のシマガツオ，マンサイウオ，ヘンテンウオの3種の卵，仔稚魚を採集した．採集データに基づき，これらの産卵期，分布などを論議した．