

TRIBOLODON NAKAMURAI, A NEW CYPRINID FISH FROM THE MIDDLE PART OF HONSHU ISLAND, JAPAN

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ABSTRACT. - *Tribolodon nakamurai*, a new species of Cyprinidae is described from the middle part of Honshu Island, Japan. This species is distinguished from its congeners by the following combination of characters: mouth terminal, large; lower jaw large, its tip anterior to the tip of upper jaw lower jaw large and long, lower jaw length 10.4-12.2% of SL; head large, its length 26.1-28.9% of SL; caudal peduncle deep, its depth 8.9-10.3% of SL; snout long, its length 8.7-9.8% SL; interorbital distance wide, its width 7.1-8.3% SL; total lateral line scales, 84-96; predorsal scales, 46-54; scales between dorsal fin origin and lateral line, 19.5-22.5; circumpeduncular scales, 34-40 and total gill rakers, 9-12.

KEY WORDS. - *Tribolodon nakamurai*, Cyprinidae, Japan.

INTRODUCTION

The cyprinid genus *Tribolodon* Sauvage, 1883, is characterized by an elongated and somewhat compressed body, a pointed snout, obliquely opened mouth, no barbels, two rows of pointed pharyngeal teeth, small scales (about 60 to 100 scales on lateral line), the anal fin with seven branched rays, originating behind a vertical line from the dorsal fin insertion. It contained three species, viz., *T. brandtii* (Dybowski, 1872), *T. ezoe* Okada & Ikeda, 1937 and *T. hakonensis* (Günther, 1877) (Nakamura, 1963, 1969; Hosoya, 1993). *Tribolodon brandtii* and *T. hakonensis* are distributed in the Amur basin to the eastern part of the Korean Peninsula in the eastern Eurasian Continent and Sakharin Island to central Honshu Island, Japan. *Tribolodon ezoe* is distributed in the Amur basin and Sakharin Island to central

Honshu Island, Japan (Sakai, 1995).

Nakamura (1963, 1969) reported an undescribed species in the genus *Tribolodon* from the Aganogawa River on the slope of Honshu Island facing the Japan Sea. He pointed that it was distinguished from the other species of the genus *Tribolodon* by the shape of its mouth. This undescribed species has been recorded from the rivers flowing into the Japan Sea on central Honshu Island viz., the Koyoshigawa, Mogami-gawa, Agano-gawa and Shinonogawa Rivers (Sakai et al., 1991; Honma, 1991). Hanzawa & Taniguchi (1982a, b) suggested that Nakamura's taxon differed genetically from the other three species. Although many Japanese ichthyologists (Sawada, 1984; Hosoya, 1993) recognized it as a distinct species, it was not formally described until now.

METHODS

Methods of counts and measurements follow Doi & Taki (1994), except for the length of lower jaw which was measured from the anterior tip of dentary to the posterior end of anguloarticular. The institutional abbreviations follow Leviton et al., (1985).

Tribolodon nakamurai, new species

(Figs. 1, 2 & 3a)

Tribolodon sp. Nakamura, 1963: 127-129, fig. 57; Nakamura, 1969: 208, color pl. 2 (bottom), pl.127 A-E; Sawada, 1984: 56, pl. 56-D & E; Hosoya, 1993: 224.

Material examined. - Holotype — NSMT-P 19584, 382.2 mm SL, Japan, Honshu, Fukushima Pref., Yugawa, Agano-gawa River at Kitada, 37°35'N 139°51'E, 12 May 1980.

Paratypes – BMNH 2000. 6. 9:1, 1 ex., 397.2 mm SL, collected with holotype; AMS I. 39840-001, 1 ex., 412.3 mm, collected with holotype; MNHN 2000-1426, 1 ex., 437 mm SL, collected with holotype; NSMT-P 19583, 1 ex., 415.5 mm SL, collected with holotype; NSMT-P 19594, 1 ex., 320.9 mm SL, Japan, Honshu, Fukushima Pref., Tadami-gawa River at Owase, 2 May 1961; NSMT-P 19595, 1 ex., 244.2 mm SL, Japan, Honshu, Fukushima

Pref., Agano-gawa River system, Junction of Tadami-gawa River and Otani-gawa River, 14 Jun.1962; NSMT-P 19596, 1 ex., 323.4 mm SL, Japan, Honshu, Fukushima Pref., Agano-gawa River system, Junction of Tadami-gawa River and Otani-gawa River, 15 Jun.1962; NSMT-P 35002-35004, 3 ex., 291.5-454.2 mm SL, Japan, Honshu, Yamagata Pref., Mogami-gawa R. at Shirataka, 38°13'N 140°6'E, Sep.1990; NSMT-P 41965, 1 ex., 384.3 mm SL, Japan, Honshu, Yamagata Pref., Mogami-gawa River at Kawanishi, 18 Mar.1990; USNM 359036, 1 ex., 392.9 mm SL, collected with NSMT-P 35002. ZRC 46160, 1 ex., 447.0 mm SL, Honshu, Niigata Pref., Shinano-gawa River at Thokamachi, 6 May 1994.

Diagnosis. - *Tribolodon nakamurai* differing from congeners by combination of following characters: mouth terminal, large; lower jaw large, tip anterior to the tip of upper jaw lower jaw large and long, lower jaw length 10.4-12.2% of SL; head large, length 26.1-28.9% of SL; caudal peduncle deep, depth 8.9-10.3% of SL; snout long, length 8.7-9.8% SL; interorbital distance wide, width 7.1-8.3% SL; total lateral line scales, 84-96; predorsal scales, 46-54; scales between dorsal fin origin and lateral line, 19.5-22.5; circumpeduncular scales, 34-40; total gill rakers, 9-12.

Description. – Counts and measurements of holotype are followed by those of the range in parentheses. The counts and measurements are given in Tables 1 and 2.

Table 1. Meristic characters of *Tribolodon nakamurai*

	Holotype	Frequencies*, **	n*
Branched dorsal fin rays	7	7(13)	13
Branched anal fin rays	8	7(2), 8(11)	13
Total pectoral fin rays	18	16(1), 17(7), 18(5)	13
Total pelvic fin rays	10	9(1), 10(10), 11(2)	13
Lateral line scales	85	79(1), 84(1), 85(2), 86(2), 87(1), 89(1), 90(1), 91(2), 92(1)	13
Scales on caudal fin	4	3(1), 4(9), 5(3)	13
Total lateral line scales	89	84(1), 88(1), 89(2), 90(1), 91(2), 93(1), 94(2), 95(2), 96(1)	13
Predorsal scales	54	46(1), 47(1), 48(1), 49(4), 50(3), 51(2), 54(1)	13
Scales above lateral line to origin of dorsal fin	22.5	19.5(6), 20.5(5), 21.5(1), 22.5(1)	13
Scales below lateral line to origin of anal fin	14.5	12.5(1), 13.5(3), 14.5(7), 15.5(1)	12
Scales below lateral line to insertion of pelvic fin	13.5	12.5(3), 13.5(3), 14.5(7)	13
Circumpeduncular scales	39	34(1), 35(1), 36(2), 37(1), 38(4), 39(2), 40(1)	13
Gill rakers on upper limb	2	2(12), 3(1)	13
Gill rakers on lower limb	8	7(4), 8(6), 9(3)	13
Total gill rakers	10	9(4), 10(6), 11(2), 12(1)	13

*Holotype and paratypes

**Numbers in parentheses indicate number of specimens

Table 2. Morphometric characters of *Tribolodon* species

	<i>Tribolodon nakamurai</i>				<i>Tribolodon brandii</i>			<i>Tribolodon e:oe</i>			<i>Tribolodon hakonenis</i>		
	Holotype	Range*	Mean*	n*	Range	Mean	n	Range	Mean	n	Range	Mean	n
Standard length	382.2	244 - 454		13	306 - 381		12	179 - 279		10	226 - 330		11
% of standard length													
Head length	26.1	26.1 - 28.9	27.3	13	22.7 - 24.1	23.4	12	27.0 - 31.7	28.7	10	22.7 - 31.7	26.3	11
Head depth	14.3	14.3 - 15.6	15.0	13	13.8 - 14.9	14.4	12	15.6 - 18.2	16.6	10	13.8 - 18.2	15.6	11
Body depth	19.4	17.4 - 22.5	20.1	13	19.2 - 23.5	21.3	12	21.8 - 25.4	23.3	10	19.2 - 25.4	22.4	11
Body width	15.1	13.1 - 15.9	14.6	12	12.7 - 15.2	14.2	12	14.3 - 18.2	15.8	10	12.7 - 18.2	15.1	11
Caudal peduncle length	21.3	19.9 - 22.3	20.9	13	19.3 - 22.4	20.6	12	20.6 - 24.1	22.3	10	19.3 - 24.1	21.5	11
Caudal peduncle depth	9.6	8.6 - 10.3	9.5	13	9.3 - 10.5	9.8	12	10.8 - 12.3	11.3	10	9.3 - 12.3	10.7	11
Predorsal length	52.9	51.9 - 54.8	52.9	13	49.9 - 53.1	51.5	12	52.2 - 61.7	54.8	10	49.9 - 61.7	53.9	11
Preanal length	71.7	66.3 - 73.8	71.6	13	68.8 - 72.5	70.5	12	67.1 - 79.9	70.4	10	67.1 - 79.9	71.5	11
Prepelvic length	50.5	47.8 - 53.4	50.4	13	47.4 - 50.4	48.7	12	50.9 - 62.4	54.7	10	47.4 - 62.4	52.4	11
Length of last simple dorsal fin ray	16.9	14.5 - 17.5	16.6	12	13.5 - 15.9	15.4	12	16.9 - 18.9	17.6	10	13.5 - 18.9	16.4	10
Length of last simple anal fin ray	13.4	10.6 - 14.0	12.7	12	11.4 - 13.6	12.4	12	11.6 - 13.4	12.4	10	11.4 - 13.6	12.5	11
Pectoral fin length	16.6	15.2 - 17.6	16.4	13	14.0 - 17.5	16.2	12	16.4 - 18.4	17.6	10	14.0 - 18.4	16.7	11
Pelvic fin length	14.1	12.2 - 15.2	13.8	13	11.7 - 13.5	12.8	12	13.1 - 15.6	14.5	10	11.7 - 15.6	13.5	11
Length of upper lobe of caudal fin	19.9	19.9 - 22.7	21.4	9	20.2 - 22.5	21.4	11	22.5 - 26.7	23.8	9	20.2 - 26.7	22.8	10
Length of lower lobe of caudal fin	20.7	19.3 - 21.8	20.6	9	19.4 - 22.3	20.8	11	22.7 - 26.5	24.2	9	19.4 - 26.5	22.7	10
Snout length	8.7	8.7 - 9.8	9.1	13	7.7 - 8.7	8.2	12	9.5 - 12.0	10.5	10	7.7 - 12.0	9.4	11
Orbit diameter	3.5	3.2 - 4.2	3.6	13	3.2 - 3.7	3.5	12	4.1 - 4.8	4.5	10	3.2 - 4.8	4.0	11
Postorbital length	14.4	14.4 - 15.8	15.2	13	12.1 - 13.1	12.6	12	13.9 - 16.3	14.7	10	12.1 - 16.3	13.8	11
Interorbital length	7.4	7.1 - 8.3	7.7	13	8.3 - 9.4	8.9	12	8.8 - 10.8	9.7	10	8.3 - 10.8	9.3	11
Length of lower jaw	10.6	10.4 - 12.2	11.2	13	6.7 - 8.7	7.9	11	9.9 - 11.7	10.6	10	6.7 - 11.7	9.2	11

*Holotype and paratypes

Branched dorsal fin rays 7 (7); branched anal fin rays 8 (7 - 8); pectoral fin rays 18 (16 - 18); pelvic fin rays 10 (9 - 11); lateral line scales 85 (79 - 92) + scales on caudal fin 4 (3 - 5) = total lateral line scales 89 (84 - 96); predorsal scales 54 (46 - 54); scales above lateral line to origin of dorsal fin 22.5 (19.5 - 22.5); scales below lateral line to origin of anal fin 14.5 (12.5 - 15.5); scales below lateral line to insertion of pelvic fin 13.5 (12.5 - 14.5); circumpeduncular scales 39 (34 - 40). Gill rakers large, canine-like, coarsely set; 2 (2-3) on upper limb, 8 (7 - 9) on lower limb, 10 (9 - 12) in total.

Body elongated, somewhat compressed; greatest depth at origin of dorsal fin, depth 5.2 (4.7 - 5.7) in SL; body width 6.6 (6.3-7.6) in SL. Caudal peduncle long, length 4.7 (4.5 - 5.0) in SL, 199.7-236.1% of the depth of caudal peduncle. Scales small, proximal half covered by skin.

Head large, its length 3.8 (3.5 - 3.8) in SL, depth 7.0 (6.4- 7.0). Snout pointed, long, length 3.0 (2.8 - 3.1) in head length (HL). Nostril nearer to anterior margin of eye than tip of snout. Mouth terminal, large; lower jaw large, tip anterior to tip of upper jaw; lower jaw length 2.5 (2.3 - 2.6) in HL. Eye small, orbit diameter 7.4 (6.7 - 8.6) in HL. Interorbital distance wide, slightly concave, width 3.6 (3.4 - 3.9) in HL. Postorbital length 1.8 (1.8 - 1.9) in HL.

Origin of dorsal fin slightly anterior to midpoint of body. Predorsal length 1.9 (1.8 - 1.9) in SL. Insertion

of pelvic fin slightly anterior to origin of dorsal fin. Prepelvic length 2.0 (1.9 - 2.1). Outer margin of dorsal fin concave. Outer margin of anal fin straight or slightly rounded. Last simple dorsal and anal fin rays segmented, not osseous. Length of last simple dorsal fin ray 5.9 (5.7 - 6.9) in SL. Length of last simple anal fin ray 7.5 (7.1 - 9.4) in SL. Pectoral fin longer than pelvic fin; pectoral fin length 6.0 (5.7 - 6.6) in SL. Pelvic fin length 7.1 (6.6 - 8.2) in SL. Caudal fin small; length of upper lobe of caudal fin 5.0 (4.4 - 5.0) in SL, lower lobe of caudal fin 4.8 (4.6 - 5.2) in SL.

Coloration. - Freshly dead specimen in breeding dress (Fig. 2) — Back dark gray, belly white. Two wide black bands running on side of body, separated by lateral line; upper band running from gill opening to end of caudal peduncle, lower band running from gill opening to above anal fin origin. One wide red band running posteriorly from cheek to mid-body, forming lower edge of lower black band, extending further posteriorly to lower caudal fin base; narrow region between two black bands orange. Dorsal and caudal fins black. Proximal half of anal fin red, distal half white. Ventral side (outer side) of pectoral fin red. Pelvic fin pale red.

Color in alcohol (Fig. 1) — Brown, belly light brown. Two wide dark brown bands running on side of body, separated by lateral line; upper band running from gill opening to end of caudal peduncle, lower band running from gill opening to above anal fin origin. Dorsal and caudal fins dark brown.

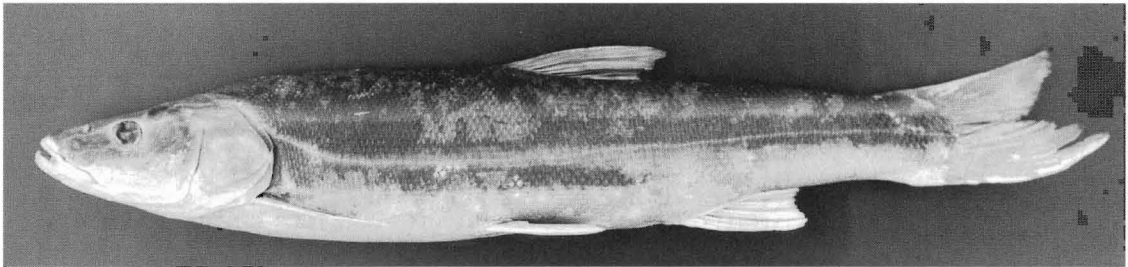


Fig. 1. *Tribolodon nakamurai*, NSMT-P 19584, holotype, 382.2 mm SL, Japan, Honshu, Fukushima Pref., Agano-gawa River system, junction of Tadami-gawa River and Otani-gawa River.

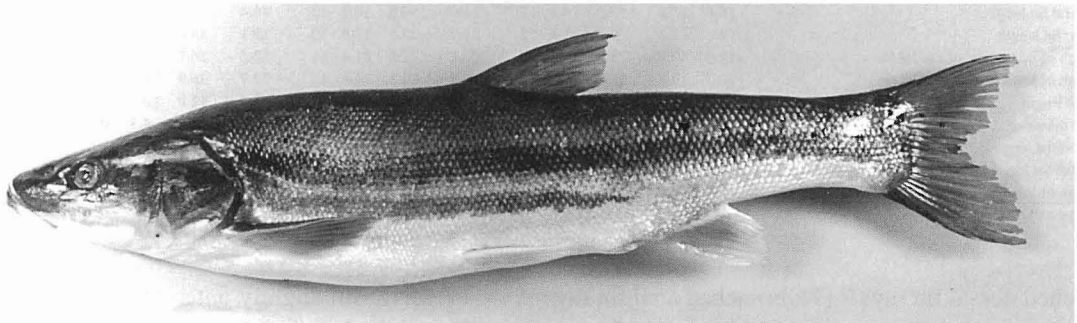


Fig. 2. *Tribolodon nakamurai*, about 410mm SL, Japan, Honshu, Fukushima Pref., Agano-gawa River system, junction of Tadami-gawa River and Otani-gawa River (not reserved).

Dorsal side (inner side) of pectoral fin dark brown, ventral side (outer side) light brown. Anal and pelvic fins light brown.

Distribution. — Middle part of Niigata to southern Akita Prefectures, Honshu Island, Japan: Koyoshi-gawa River system, Mogami-gawa River system, Agano-gawa River system and Shinano-gawa River system (Nakamura, 1963,1969; Kurawaka, 1977; Sakai et al., 1991).

Etymology. — In honor of Dr. Morizumi Nakamura (1914-1998), in recognition of his contribution to our knowledge of the classification of Japanese cyprinid fishes.

DISCUSSION

Tribolodon nakamurai, new species, is distinguished from the other three species of *Tribolodon* by the position of its mouth (terminal in *T. nakamurai* vs. sub-terminal in *T. hakonensis*, *T. brandtii* and *T. ezoe*), large lower jaw (its length 10.4-12.2 in *T. nakamurai* vs. 6.7-11.7 in *T. hakonensis*, 6.7-8.7 in *T. brandtii* and 9.9-11.7 in *T. ezoe*), position of nostril

(its position nearer to anterior margin of eye than tip of snout in *T. nakamurai* vs. midpoint between anterior margin of eye and tip of snout in *T. hakonensis*, *T. brandtii* and *T. ezoe*) and number of scales between dorsal fin origin and lateral line (19.5-22.5 in *T. nakamurai* vs. 15.5-17.5 in *T. hakonensis*, 14.5-17.5 in *T. brandtii* and 16.6-18.5 in *T. ezoe*) (Fig. 3, Tables 2, 3).

Tribolodon nakamurai is distinguished from *T. hakonensis* in having more total lateral line scales (84-96 vs. 73-82), more predorsal scales (46-54 vs. 33-37), a large head (26.1-28.9% SL vs. 23.4-24.8% SL) and a long lower jaw (10.4-12.2% SL vs. 8.4-9.7% SL). *Tribolodon nakamurai* is distinguished from *T. brandtii* in having more predorsal scales (46-54 vs. 35-36), more circumpeduncular scales (34-40 vs. 29-32), fewer total gill rakers (9-12 vs. 12-14), a large head (26.1-28.9% SL vs. 22.7-24.1% SL), a long snout (8.7-9.8% SL vs. 7.7-8.7% SL) and a long lower jaw (10.4-12.2% SL vs. 6.7-9.7% SL). *Tribolodon nakamurai* is distinguished from *T. ezoe* in having more lateral line scales (84-96 vs. 71-78), a lower caudal peduncle (8.6-10.3% SL vs. 10.7-12.3% SL) and a narrow interorbital width (7.1-8.3% SL vs. 8.8-10.8% SL).



Fig. 3. *Tribolodon* heads. Left top, *T. nakamurai*, NSMT-P 19584, holotype, 382.2 mm SL; left bottom, *T. brandii*, NSMT-P (SK) 3293, 342.7 mm SL; right top, *T. ezoe*, NSMT-P 14643, 279.0 mm SL; right bottom, *T. hakonensis*, NSMT-P 52625, 329.5 mm SL.

Table 3. Selected meristic characters of *Tribolodon* species.

	Total lateral line scales																n											
	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		87	88	89	90	91	92	93	94	95	96	
<i>T. nakamurai</i>															1				1	2	1	2		1	2	2	1	13
<i>T. brandii</i>				1			1		2		3		1	1	1													10
<i>T. ezoe</i>	1		1	2	1	2	2	1																				10
<i>T. hakonensis</i>			2		1		2	1		2	2	1																11

	Predorsal scales																n										
	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48		49	50	51	52	53	54				
<i>T. nakamurai</i>															1	1	1	4	3	2			1				13
<i>T. brandii</i>				1	1	5	2	3																			12
<i>T. ezoe</i>							2	2	1	1	1	1		1	1												10
<i>T. hakonensis</i>	5	3				1																					11

	Circumpeduncular scales										n		
	29	30	31	32	33	34	35	36	37	38		39	40
<i>T. nakamurai</i>						1	1	2	1	4	2	1	12
<i>T. brandii</i>	4	5	3										12
<i>T. ezoe</i>		1	1	4	4	2	1						10
<i>T. hakonensis</i>			1	3	1	2	3	1					11

	Total gillrakers							n
	9	10	11	12	13	14		
<i>T. nakamurai</i>	4	6	2	1			13	
<i>T. brandii</i>				3	6	1	12	
<i>T. ezoe</i>			1	2	6	1	10	
<i>T. hakonensis</i>			2	1	2	4	9	

Genetic differentiations were found between *T. nakamurai* and the other three species by Hanzawa & Taniguchi (1982a, b) who showed that the largest genetic distance was scored between *T. nakamurai* (as *T. sp.*) and *T. hakonensis* and the closest between *T. brandtii* and *T. ezoe* based on the 32 loci tested. Sakai (1995) also showed that the largest genetic distance was scored between *T. nakamurai* (as *T. sp.*) and *T. hakonensis*, and the closest between *T. brandtii* and *T. ezoe* based on 21 loci from 12 enzymes. These results strongly support the hypothesis that *T. nakamurai* is a distinct and valid species.

Watanabe (1998) showed the distribution data for 73 primary freshwater fishes of Japan. Based on his data, *T. nakamurai* is only species occurring in the small limited area of the Japan Sea side of Honshu Island. This unique distribution pattern of *T. nakamurai* suggest that its probably evolved from a relict population of *T. ezoe* relictly at the middle part of Japan (Sakai, 1995).

Comparative materials examined. – *Tribolodon hakonensis*: NSMT-P 52625, 11 ex., 225.7-329.5mm SL, Japan, Honshu, Kyoto Pref., Maizuru Bay at Ohoba; *Tribolodon brandtii*: NSMT-P (SK) 3293, 12 ex., Japan, Honshu, Gunma Pref., Tone-gawa River system, Karasu-gawa River; *Tribolodon ezoe*: NSMT-P 14643, 10 ex., Japan, Hokkaidou, Lake Panke.

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