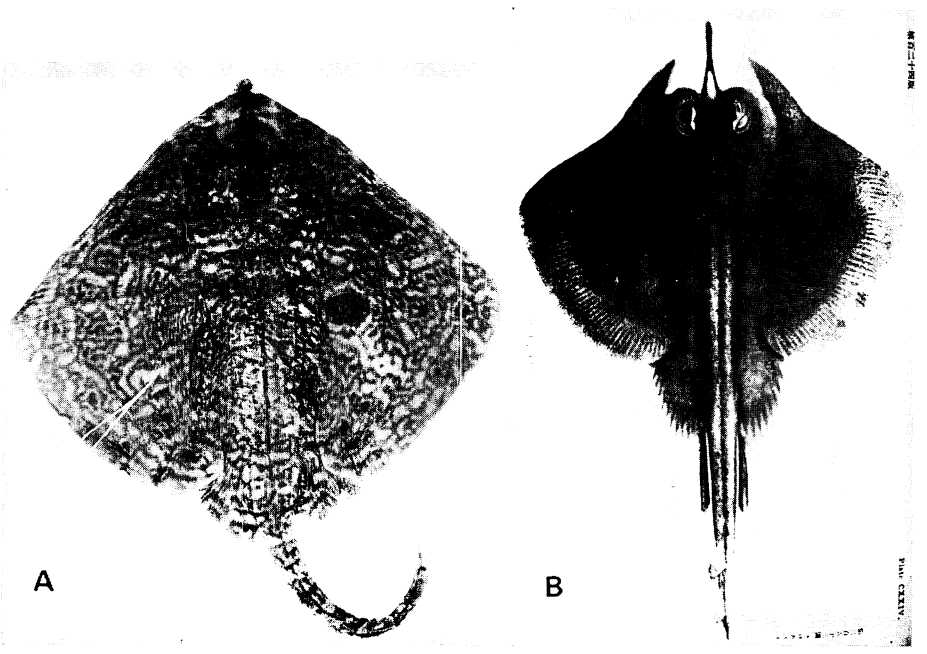

Fig. 26. A, holotype of *Raja katsukii* Tanaka, ZUMT 13755, adult female, 403 mm TL, west coast of Aomori Pref.; B, syntype of *R. tobae* Tanaka after Tanaka (1917: pl. 353), ZUMT 7433, adult male, 467 mm TL, Toba, Mie Pref., the specimen was lost.

unique among the western North Pacific skates, but also rare among all the skate species around the world, of which clasper skeletons were so far investigated. Another species that also has a bipartite ventral terminal clasper cartilage is the eastern North Atlantic *Raja undulata* Lacepède (see Stehmann, 1970: pl. 8). Further studies must be made to elucidate why the ventral terminal cartilage of both species became bipartite. Apart from the bipartite ventral terminal clasper cartilage, *R.* (*O.*) *kenojei* differs from *R.* (*O.*) *acutispina* and *R.* (*O.*) *schmidti* in the following: 1) ventral sensory pores absent on abdominal region (present in the latter two species); 2) slit present in clasper (absent); 3) terminal bridge clasper cartilage obscure externally (apparent); 4) anterior fenestra of scapulocoracoid vertically elliptical (almost circular). *Raja* (*O.*) *kenojei* differs from *R.* (*O.*) *boesemani* and *R.* (*O.*) *hollandi* in: 1) snout less pointed, dorsal head length less than 4.89 times the interorbital width (pointed, more than 4.81 times the interorbital width in the latter two species); 2) procaudal tail length less than 19.5% of TL and less than 41.3% of tail length (more than 21.1% of TL and more than 41.4% of tail length); 3) postdorasl tail length less than 5.9% of TL, less than 12.4% of tail length, less than 29.2% of dorsal head length and usually less than 1.5 times the D_2 base length (more than 6.5% of TL, more than 12.7% of tail length, more than 28.8% of dorsal head length and almost always more than 1.5 times the D_2 base length); 4) ventral sensory pores forming V-shaped pattern at mid-length of metapterygium (never forming such pattern); 5) slit present in clasper (absent); 6) terminal bridge clasper cartilage obscure externally (apparent); 7) scapluocoracoid vertically expanded, its height 87.3% of its length (horizontally expanded, 53.3–57.7%); 8) anterior fenestra of scapulocoracoid vertically elliptical (almost circular). *Raja* (*O.*) *kenojei* differs from *R.* (*O.*) *meerdervoortii* in: 1) dorsal head length less than five times the interorbital width (more than five times in the latter species); 2) orbit length less than interorbital width (more than interorbital width); 3) often more than 4 nuchal thorns (always less than 3); 4) tail depressed (roundish); 5) disc without yellowish spots (with yellowish spots); 6) a pair of dark rings present at centrer of pectorals in young (no dark rings present on disc even in young); 7) tooth rows in upper jaw more than 43 (less than 43); 8) total length of adults exceeds

Fig. 27. Juvenile male of *Raja* (*Dipturus*) *pulchra*, MTUF 25892, 199 mm TL, collected off Hakodate, Hokkaido.

38 cm (maximum total length less than 37 cm). A pair of dark rings at center of pectorals is also present in young *R.* (*D.*) *pulchra* (see Fig. 27). However, young of both species are distinguished by the longer snout and shorter and more depressed tail in *R.* (*D.*) *pulchra*.

Raja (*O.*) *kenojei* possesses constant characters on the one hand, viz., a pair of dark rings at center of pectorals in young; ventral sensory pores forming V-shaped pattern at midlength of metapterygium; and ventral terminal clasper cartilage bipartite, but shows a considerable variation in the length of snout, interdorsal and postdorsal space and in the coloration patterns of upper side of disc. In particular, representatives occurring along the Pacific coast of northern Japan from Choshi northwards to Shiranuka, differ from those in other areas in possessing bluntly angled and extremely translucent snout; numerous nuchal thorns; upper side of disc with evenly distributed dark specks or reticulate pattern. These populations correspond to what Ishiyama (1958b, 1967) described as *R. fusca*. Moreover, in this area no other *Raja* (*Okamejei*) species have been recorded. Judging from these characters and geographical evidence, it seems likely that these population might have become an isolated local form. It is still uncertain, however, whether or not these morphotypes could require a subspecific grouping.

Distribution. Based on published data and the present material, *R.* (*O.*) *kenojei* occurs from Hakodate, Hokkaido, through the East China Sea to the South China Sea as far south as Amoy, at depths from 20 to 230 m.

Raja (*Okamejei*) *meerdervoortii*
Bleeker, 1860
(Japanese name: Medama-kasube;
English name: Big-eye skate)
(Fig. 28)

Raja meerdervoortii Bleeker, 1860: 66 (descr. in Latin without illustr.; type locality: Nagasaki, Japan; remarks).

Raja meerdervoortii: Duméril, 1865: 555 (copied from Bleeker, 1860); Boeseman, 1979: 279, pl. 8 (remarks).

Raja kenojei (not of Müller et Henle, 1841): Bleeker, 1858: 42 (in part).

Raja (*Okamejei*) *macrophthalma* Ishiyama, 1958b: 363, fig. 76 (descr.; in key; remarks; type locality: Miya Fish Market, Aichi Pref.).

Raja macrophthalma: Ishiyama, 1950: 35, fig. 1 (egg-capsule); Lindberg and Legeza, 1959: 120, fig. 74 (copied from Ishiyama, 1958b); ISJ, 1981: 460 (listed); Dolganov, 1983: 57, fig. 80 (in key); Masuda et al., 1984: 13, pl. 14-D (descr.); Okamura and Machida, 1986: 21, fig. 5 (descr.).

Raja (*Okamejei*) *macrophthalma*: Ishiyama, 1967: 16, fig. 4, pls. 6 and 7 (descr.; range; ecology); Ishihara and Ishiyama, 1986: 278, fig. 8 (listed).

Raja sp. P: Ishiyama, 1958a: 14 (egg-capsule).

Material examined. Holotype, RMNH 7432, adult male, 320 mm TL, Nagasaki, Japan, in the Bleeker Collection; holotype of *R. macrophthalma*, MTUF 25150, adult male, 346 mm TL, off Miya, Aichi Pref., March 13, 1950, collected by R. Ishiyama; 9 paratypes of *R. macrophthalma*: 3 adult males: MTUF 25051, 337.5 mm TL, Shizuoka Pref., 1954; MTUF 25053, 345 mm TL, East China Sea, 1954; MTUF 25149, 338 mm TL, Tsukiji Fish Market, Tokyo, 1954; 4 adult females: MTUF 25151, 326 mm TL, southern Hyuga-nada, Sept. 27, 1954: MTUF 25152, 356 mm TL, Yawatahama, Ehime Pref., March 15, 1954; MTUF 25155, 315 mm TL, off Mishima, Shizuoka Pref., Dec., 1954; MTUF 25880, 323 mm TL, collected with MTUF 25155; 1 young male, MTUF 25882, 126.5 mm TL, collected with MTUF 25152; 1 young female, MTUF 25881, 204 mm TL, collected with

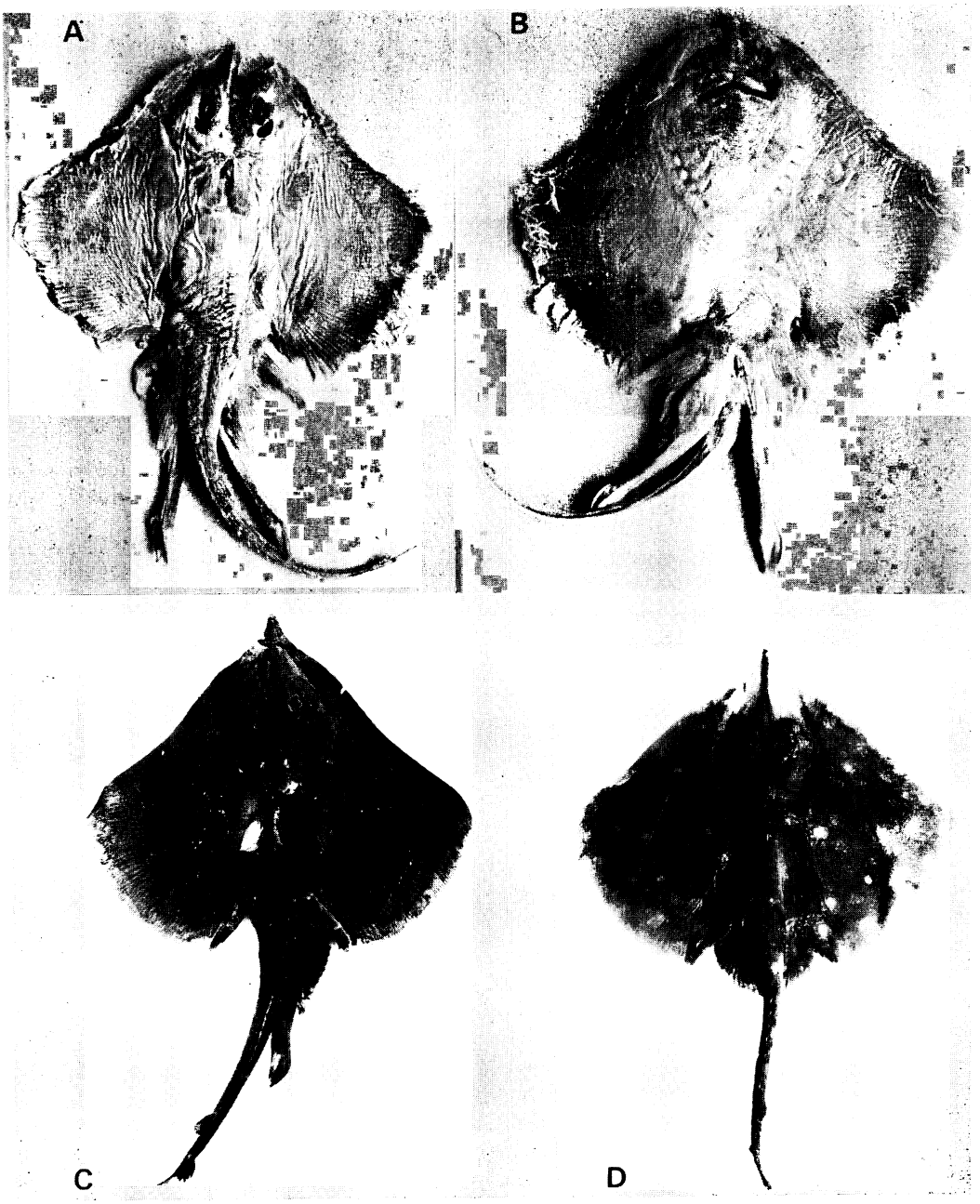

Fig. 28. *Raja* (*Okamejei*) *meerdervoortii*. A, B, holotype, RMNH 7432, adult male, 320 mm TL; C, holotype of *R. macrophthalma* Ishiyama, MTUF 25150, adult male, 346 mm TL; D, MTUF 25989, young female, 216 mm TL.

MTUF 25152, all collected by R. Ishiyama; 2 adult males: HUMZ 34917, 314 mm TL, Sea of Genkai, Oct. 12, 1952, 50–150 m depth; HUMZ 34964, 336.5 mm TL, collected with HUMZ 34917; 3 adult females: HUMZ 34965, 340.5 mm TL, collected with HUMZ 34917; HUMZ 34967, 318 mm TL, collected with HUMZ 34917; HUMZ 48310, 351 mm TL, off Mimase, Kochi Pref., Oct. 6, 1972; 1 young male, HUMZ 34972, 224 mm TL, collected with HUMZ 34917; 2 young females: HUMZ 34914, 301.5 mm TL, col-

Table 12. Counts and measurements (mm) of *Raja* (*Okamejei*) *meerdervoortii*.

	Holotype	Holotype of *R. macrophthalma*	Paratypes of *R. macrophthalma*									
	♂ RMNH 7432	♂ MTUF 25150	♂ MTUF 25051	♂ MTUF 25053	♂ MTUF 25149	♀ MTUF 25151	♀ MTUF 25152	♀ MTUF 25155	♀ MTUF 25880	♂ HUMZ 34964	♀ HUMZ 34965	% of TL
Total length	320	346	337.5	345	338	326	356	315	323	336.5	340.5	—
Disc length	161.5	194	200	187	187	182	197	179.5	178.5	188	189	54.2–57.0
Disc width	200	224.5	234	218.5	218	223.5	231.5	212.5	208	213	220	63.3–68.6
Snout to maximum disc width	107.3	114	125	107	112	107	111	106	106	111	105	30.1–33.7
Dorsal head length	51.5	72	74	69.4	71.2	72	79	74.4	71.6	70.3	74.1	20.1–23.6
Preorbital snout length	29.1	48.6	49.7	46.2	48	48.8	55.6	50.6	50.4	46.2	50.8	13.4–16.1
Orbit length	13	13	15.9	13	13.5	14.5	14	15.6	14.7	14	14.3	3.8– 5.0
Interorbital width	13.5	12.6	13.5	11.1	12	12	13.5	11.7	11.3	11.2	12.3	3.2– 3.9
Spiracle length	9	9.3	10	9.8	10	10.4	9.4	9.2	8.5	8.3	8.8	2.1– 3.2
Interspiracular width	22.5	24.1	23.3	22.3	22	22.5	25.4	22.5	22.2	22.5	22.5	6.5– 7.2
Ant. orbit rim to spiracle end	—	20	19.6	17.9	18.2	17.7	18.6	17.4	16.5	17.8	17.7	5.1– 5.8
Procaudal length	61.5	65.5	42.1	65	61	62.5	62	58.5	68.1	63	56.2	16.5–21.1
D_1 base length	14	12.5	16.6	18.2	16.6	15.6	15.6	14.8	15.3	15	15.2	3.6– 5.3
D_1 vertical height	—	9.3	12.2	10.3	10.6	10	10.6	11	9.1	13.5	12.1	2.6– 4.0
D_2 base length	15	12.7	12.5	15.4	15.9	15.4	16.1	14.4	14.1	13	13.1	3.7– 4.7
D_2 vertical height	—	9.3	13.8	8.6	10.3	9.5	10.5	7.9	9.2	12	10.4	2.5– 3.6
Interdorsal distance	18	19.5	13	12.9	12.3	15	14.4	13.8	17.7	16.2	11.2	3.3– 5.6
Postdorsal length	13.5	20.3	—	19.4	14.8	17.2	19.4	16	19.8	19.1	17.3	4.4– 6.1
Caudal fin vertical height	—	3	—	3.8	3.8	3.5	3.1	2.6	3.8	4	3.8	0.8– 1.3
Lateral tail fold length	—	122	—	125	120	119	121	102	121	124	117	33.9–37.5
Precaudal body length	152	170	175.5	174	170.5	170.5	188	171	167	170	176.5	49.1–54.3
Tail length	168	176	162	171	167.5	155.5	168	144	156	166.5	163.5	45.7–50.9
Ventral head length	76.5	101.5	101	96	96.2	89.3	101.5	95	91.5	98	97	27.4–30.2
Preoral snout length	29	50	51.5	48.2	50	50.1	56.6	54.3	53.5	48	51.6	13.9–17.2
Mouth width	28.5	28.5	29.7	28	26.5	27.2	26.5	25.3	25.5	25	25	7.3– 8.3
Prenarial snout length	20	38.4	37.8	36.3	39.2	39.4	44.5	41.8	40.5	37.4	42.7	10.7–13.3
Internarial width	22.5	24.1	24	23	23.8	23.7	25.6	24	24	23.2	24.7	6.6– 7.6
Nasal curtain length	12.5	18.9	20	17.3	18.1	16.1	18.1	16.9	15.7	17.2	14.5	4.2– 5.4
Over 1st gill slits (outer rims)	56.2	57	59	54.5	53	58	60	55.5	56	56	61.5	15.7–18.3
Ant. pelvic lobe length	42.3	37.5	40.7	36.8	36.1	35.8	39.1	33.9	27.8	33.9	33.4	8.6–11.4
Post. pelvic lobe length	54	51	63.3	60.5	56.9	48.9	48.7	47.5	44.4	60.1	50.1	13.7–18.4
Clasper length	88.3	91	89	83.5	85.5	—	—	—	—	89	—	24.2–27.0
Tooth rows in upper jaw	40	41	38	40	39	38	38	36	40	39	41	
Vtr	25	26	—	—	—	—	—	26	25	—	—	
Vprd	38	41	—	—	—	—	—	37	38	—	—	
Cranium length	—	76	—	—	—	—	—	—	—	—	—	
Rostral cartilage length	—	39	—	—	—	—	—	—	—	—	—	
Prefontanelle length	—	28	—	—	—	—	—	—	—	—	—	
Cranium width	37.5	38.5	—	—	—	—	—	—	—	—	—	
Interorbital width	12	12	—	—	—	—	—	—	—	—	—	
Ant. fontanelle length	17.5	19.5	—	—	—	—	—	—	—	—	—	
Post. fontanelle length	14.5	16	—	—	—	—	—	—	—	—	—	

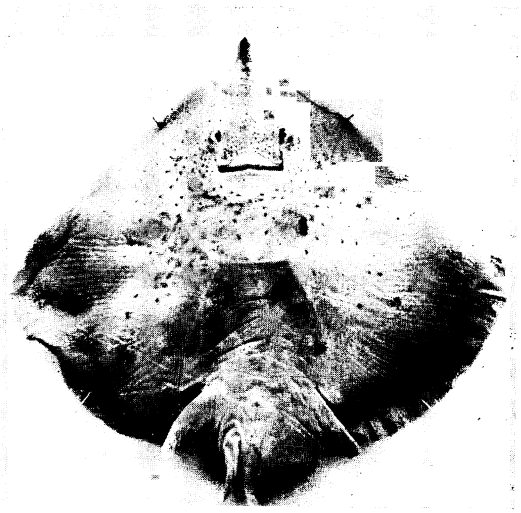

Fig. 29. Ventral side of *Raja* (*Okamejei*) *meerdervoortii*, MTUF 25989, showing ventral sensory pore patterns.

lected with HUMZ 34917; MTUF 25989, 216 mm TL, East Chin Sea, 1984.

Diagnosis. A small-sized *Raja* (*Okamejei*) species with a maximum total length of about 320–370 mm in both sexes. Snout pointed, dorsal head length 5.33–6.36 times the interorbital width. Tail roundish, its length longer, or shorter than precaudal body length. Procaudal tail length 16.5–21.1% of TL and 34.4–43.7% of tail length. Postdorsal tail length 20.8–28.2% of dorsal head length and mostly less than 1.5 times the D_2 base length. 1–2 nuchal thorns in males and 1 or 3 in females, and female nuchal thorns often arranged in triangle. Prickes only developed on both sides of snout tip, both dorsals and caudal fin in both sexes, and in adult males additionally anterior margin of dorsal side of disc prickly. Many small yellowish spots scattered over entire dorsal side of disc. A pair of small white spots present at posterior center of pectorals, which change to dark spots after formalin preservation. Ventral sensory pores absent on abdominal region. Several sensory pores assembled to form V-shaped pattern at midlength of metapterygium. Dorsal lobe of clasper with pseudorhipidion, cleft and slit, ventral lobe with rhipidion, shield, sentinel, spike and funnel. Tip of spike distally elongated and close to tip of funnel. Scapulocoracoid rather horizontally expanded, its height 66.4% of its width. Posterodorsal margih of scapulocoracoid deeply concave. Length of egg-capsule excluding horns 35–40 mm. Tooth rows in upper jaw 36–43. Vtr, 25–27; Vprd, 37–41.

Description. Meristic counts and morphometric measurements of the holotype and the new material are given in Table 12.

External features: Disc rhombic, its greatest width in posterior half, at 54.4–62.5% of disc length. Snout hard and pointed, dorsal head length 5.33–6.36 times the interorbital width; preorbital snout length 65.6–71.4% of dorsal head length; interorbital width usually less than orbit length. Tail stout and roundish, longer or shorter than precaudal body length; procaudal tail length 16.5–21.1% of TL and 34.4–43.7% of tail length; both dorsals equal in size, separated by a distance of more than half of D_1 base length and sometimes more than D_1 base length; postdorsal tail length 4.4–6.1% of TL, 8.0–12.7% of tail length, 20.8–28.2% of dorsal head length, and mostly less than 1.5 times the D_2 base length; caudal fin moderately developed, its height more than width of lateral tail folds; underside of tail tip with a keel; lateral tail folds narrow and originating near root of tail. Mouth arched, with 38–43 parallel rows of pointed teeth in upper jaw in males and 36–41 rows of flattened teeth in quincunx in females; mouth width 45.7–58.1% of preoral length; internarial width 57.5–63.5% of prenarial length; distance between first gill slits (outer rims) 74.4–83.5% of dorsal head length.

Squamation: Dorsal surface of disc with thorns and prickles; nuchal thorns 1–2 in males and 1 or 3 in females; female nuchal thorns often arranged in triangle; orbital thorns 5–6; interdorsal thorns 2–4; 3 rows of tail thorns in males and 3 or 5 in females; lateral tail thorns, if present, arranged in irregular series; alar and malar thorns well developed in adult males, both thorn fields connected; prickles developed only on snout tip and both dorsals in both sexes; in adult males, anterior margin of disc including areas between alar and malar thorns also with prickles; caudal fin sometimes prickly. Ventral side entirely smooth or only prickly on snout tip.

Coloration: Dorsal ground color dark brown; snout translucent lighter; many small yellowish spots scattered over entire dorsal side of disc; a pair of smaller white spots present at posterior center of pectorals; they change to dark spots after formalin preservation; dark specks may be present here and there on disc. Ventral side

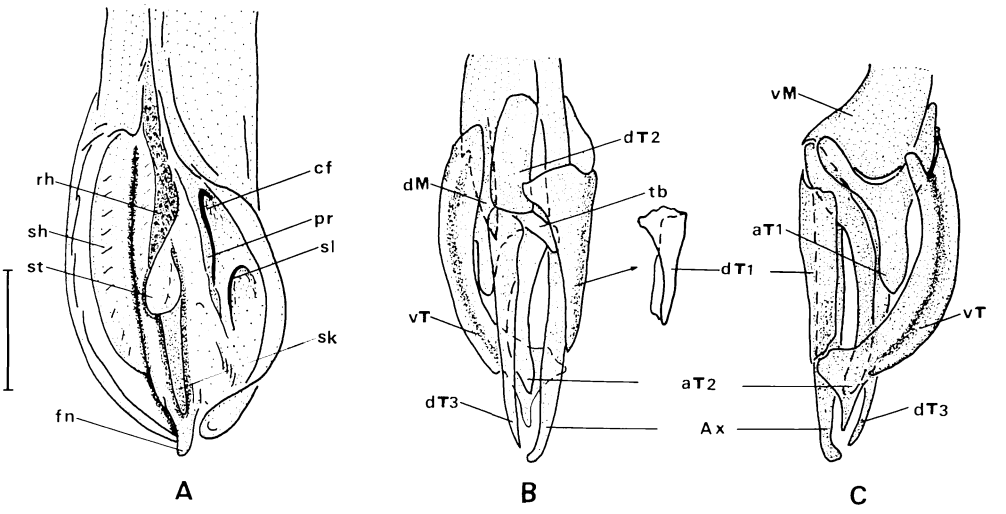

Fig. 30. Left clasper of *Raja* (*Okamejei*) *meerdervoortii*, MTUF 25053. A, clasper components (clasper glans opened); B, clasper skeleton in dorsal view; C, clasper skeleton in ventral view. aT1 and aT2, accessory terminals 1 and 2; Ax, axial cartilage; cf, cleft; dM, dorsal marginal; dT1–dT3, dorsal terminals 1 to 3; fn, funnel; pr, pseudorhipidion; rh, rhipidion; sh, shield; sk, spike; sl, slit; st, sentinel; tb, terminal bridge; vM, ventral marginal; vT, ventral terminal. Scale indicates 10 mm.

almost whitish, except for snout tip and margin of disc, which are sometimes dusky brown.

Ventral sensory pores: Rather sparsely distributed on anterior half of disc; absent on abdominal region and pelvic lobes; several pores apparent at midlength of metapterygium and forming V-shaped pattern; another few pores present near postero-lateral edges of pectoral girdle (Fig. 29).

Clasper: Slender with pointed tip, its length 48.8–56.1% of tail length; dorsal lobe with pseudorhipidion, cleft and slit; ventral lobe with bilobed rhipidion, shield, sentinel, spike and funnel; tip of fn triangular; sk elongated distally, its tip close to tip of fn (Fig. 30A).

Clasper skeleton: Consists of 3 dorsal terminal, 2 accessory terminal, terminal bridge, ventral terminal, 2 marginal and axil cartilages: tip of dM bifurcated, lateral longer tip forming pr externally; medial tip only slightly produced; dT1 semirectangular, rotated onto ventral side and united with vT; dT2 boot-shaped, proximally united with dM at above tip of dM, and distally united with Ax by tb and with dT3; dT3 long and slender, extending to tip of Ax; longer tip of dM and dT1 forming cf externally; tb obscure externally; vT J-shaped, lateral convex ridge running along entire length of cartilage and forming sh externally; medial ridge of vT twisted about 90 degrees through entire length of cartilage, tip of which forming fn externally; anterior notch of vT moderately developed; aT1 Y-shaped with two proximal arms and one distal arm; tip of distal arm forming st externally; aT2 rod-like, as long as dT3, extending far beyond tip of aT1 and forming sk externally; aT3 absent (Fig. 30B, C).

Cranium: Measurements are given in Table 12. Length of rostral cartilage 51.3% of cranium length; prefontanelle length 36.8%; cranium width 50.0%; interorbital width 15.8%; length of anterior fontanelle 25.7%; length of posterior fontanelle 21.1%. Anterior fontanelle arrowhead-shaped with distinct anterior margin and flat posterior margin; posterior fontanelle gourd-shaped; both fontanelles almost equal in length (Fig. 31).

Scapulocoracoid: Measurements are given in Table 13. Almost rectangular with one anterior fenestra, one postdorsal foramen and one postventral foramen; scapulocoracoid rather horizontally expanded, its height 66.4% of its length; anterior fenestra almost circular; postdorsal and postventral foramina horizontally elliptical and almost equal in length; posterodorsal margin highly elevated, angled at about 90 degrees and deeply concave (see Ishihara and Ishiyama, 1986: fig. 8-E).

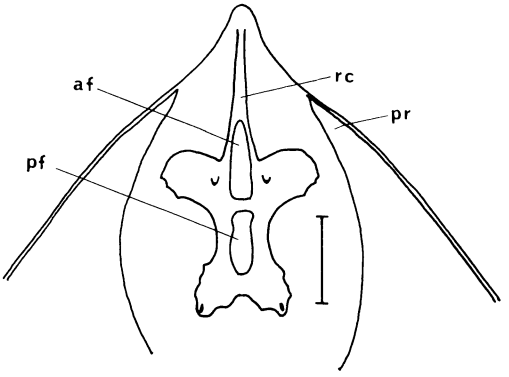

Fig. 31. Cranium of *Raja* (*Okamejei*) *meerdervoortii*, MTUF 25150, holotype of *R. macrophthalma*, adult male, 346 mm TL. af, anterior fontanelle; pf, posterior fontanelle; pr, pectoral radials; rc, rostral cartilage. Scale indicates 20 mm.

Table 13. Measurements (mm) of the left scapulocoracoid of *Raja* (*Okamejei*) *meerdervoortii*, MTUF 25150.

Character		% of greatest length
Greatest length	25.6	100
Greatest height	17.0	66.4
Premesocondyle length	12.9	50.4
Postmesocondyle length	12.7	49.6
Anterior fenestra length	7.8	30.5
Anterior fenestra height	7.5	29.3
Postdorsal foramen length	6.5	25.4
Postdorsal foramen height	4.7	18.4
Postventral foramen length	5.3	20.7
Postventral foramen height	2.5	9.8
Height of rear corner	11.6	45.3

Egg-capsule: Measurements are given in Table 14. Almost rectangular with horns on each corner; lateral edges slightly convex; bases of horns stout; posterior horns longer than anterior ones; both anterior and posterior horns curved inwards; both margins concave; apron and lateral keel indistinct (Fig. 32).

Remarks. Since Boeseman (1979) suggested that *R. meerdervoortii* Bleeker, 1860 is not only a distinct species but also probably a senior synonym of *R. macrophthalma* Ishiyama, 1958, the present author re-examined the holotype of *R. meerdervoortii* at the RMNH in 1985. Although the holotype has a somewhat broken snout and its coloration is faded, the clasper structures and ventral sensory pore pattern showed that it is conspecific with *R. macrophthalma* (see Fig. 28 and Table 12 for comparison of the holotypes of both species).

Bleeker (1860) described *R. meerdervoortii*

Fig. 32. Egg-capsule of *Raja* (*Okamejei*) *meerdervoortii* extracted from MTUF 25880, 37.0 mm in length excluding horns.

Table 14. Measurements (mm) of the egg-capsule of *Raja* (*Okamejei*) *meerdervoortii* extracted from MTUF 25880.

Character	
Length (without horns)	37.0
Width: maximum	24.2
minimum	16.6
Ant. horn length	17.2
Post. horn length	24.0
Ant. apron width	3.4
Post. apron width	4.4
Keel width	—

without a figure. Later, Jordan and Fowler (1903) misidentified their specimen of *R. kenojei* as *R. meerdervoortii*, because they did not compare the specimen with the holotype of *R. meerdervoortii* (see the remarks on *R.* (*O.*) *kenojei*). Ishiyama (1958b) synonymized *R. meerdervoortii* with "*R. kenojei*" (=*R. kwangtungensis*) without a convincing argumentation and at the same time used the scientific name *R. porosa meerdervoortii* for one of the two subspecies of *R. porosa* (=*R. kenojei*). Moreover, he described another new species, *R. macrophthalma*, in the same paper. This irritating concept for the systematics of the Japanese *Raja* species has been accepted by many authors. However, the present study shows that *R. meerdervootii* is a valid species, different from *R. kwangtungensis* and the senior synonym of *R. macrophthalma*.

Raja (*O.*) *meerdervoortii* is distinguished from the other five species of the western North Pacific *Raja* (*Okamejei*) by having simple rod-like accessory terminal 2 clasper cartilage, which is not bifurcated and forming clasper component spike. In addition, *R.* (*O.*) *meerdervoortii* differs from *R.* (*O.*) *acutispina* and *R.* (*O.*) *schmidti* in the following: 1) interdorsal distance more than half of D_1 base length (less than half in the latter two species); 2) postdorsal tail length usually more than D_2 base length (always less than D_2 base length); 3) maximum total length less than 37 cm (more than 36 cm); 4) ventral sensory pores absent on abdominal region (present); 5) slit present in clasper (absent); 6) terminal bridge obscure externally (apparent); 7) posterodorsal margin of scapulocoracoid deeply concave (never concave). *Raja* (*O.*) *meerdervoortii* additionally differs from *R.* (*O.*) *boesemani* and *R.* (*O.*) *hollandi* in: 1) orbit length usually longer than interorbital width (as long as interorbital width); 2) procaudal tail length less than 21.1% of TL and less than 43.7% of tail length (more than 21.1% of TL and more than 41.4% of tail length); 3) postdorsal tail length less than 6.1% of TL, less than 12.7% of tail length, less than 28.2% of dorsal head length and almost always less than 1.5 times the D_2 base length (more than 6.5% of TL, more than 12.7% of tail length, more than 28.8% of dorsal head length and usually more than 1.5 times the D_2 base length); 4) ventral sensory pores forming V-shaped pattern at midlength of metapterygium (sensory pores sparsely distributed at midlength of metapterygium); 5) slit present in clasper (absent); 6) terminal bridge obscure externally (apparent). *Raja* (*O.*) *meerdervoortii* differs from *R.* (*O.*) *kenojei* in the eight characters mentioned above and regarding the bipartite ventral terminal clasper cartilage in the latter species.

Distribution. Based on published data and the present material, *R.* (*O.*) *meerdervoortii* occurs from Mishima, Shizuoka Pref., Pacific coast of Japan to the East China Sea as far south as the northernmost parts of the Okinawa Trough, and the Sea of Genkai at depths from 70 to 90 m.

Key to the North Pacific subgenera and species of *Raja*

Key to subgenera

1a. Scapular thorns present on disc and arranged in triangle.....subgenus *Amblyraja* Malm

1b. Scapular thorns absent on disc.....2

2a. Rostral cartilage long, its length from tip to axils of nasal capsules usually more than 60% of dorsal head length; only one row of tail thorns in males and three or five in females; total length of adults usually more than 55 cm; tail sometimes expanded at midlength; ventrally, prickles often also covering areas other than only the snout; ventral side of disc generally darkish; trunk vertebrae 30–35; anterior fontanelle of neurocranium without distinct anterior margin; dorsal tip of medial ridge of ventral terminal clasper cartilage only weakly developed, thus funnel absent in clasper; length of egg-capsule, excluding horns, more than 65 mm.....subgenus *Dipturus* Rafinesque (=*Tengujei* Ishiyama)

2b. Rostral cartilage shorter, its length less than 60% of dorsal head length; three rows of tail thorns in males and three or five in females; total length less than 55 cm even in adults; tail always gradually tapering rearwards; ventrally, prickles only developed on snout region; ventral side of disc generally whitish; trunk vertebrae 25–30; anterior fontanelle of neurocranium with distinct anterior margin; dorsal tip of medial ridge of ventral terminal clasper cartilage well developed, thus funnel present in clasper; length of egg-capsule, excluding horns, less than 65 mm.....

.....subgenus *Okamejei* Ishiyama

Key to species of subgenus *Dipturus*

1a. Caudal fin low, its height equalling maximum width of lateral tail folds; underside of tail tip flat without a keel; a pair of dark rings present at center of pectorals in young; sentinel of clasper spoon-shaped.....2

1b. Caudal fin rather high, its height more than maximum width of lateral tail folds; underside of tail tip with a keel; dark rings absent on center of pectorals even in young; sentinel of clasper rod-like.....4

2a. Snout narrowly elongated, dorsal head length more than four times the interorbital width in adults; 2–6 nuchal thorns; disc without any color pattern, except for a pair of faint dark rings at center of pectorals; ventral side dusky; prickles covering also skin posterior to gill slits; ventral sensory pores distributed from head onto anterior pelvic lobes and areas aside cloaca; terminal bridge clasper cartilage visible externally, separating two clefts in clasper; spike of clasper apparent, as long as sentinel; egg-capsule with distinct horns and containing only one embryo.....*R.* (*D.*) *rhina* Jordan et Gilbert

2b. Snout broadly elongated, dorsal head length less than four times the interorbital width even in adults; usually 1 nuchal thorn only; disc with more or less distinct color markings including a pair of faint dark rings at center of pectorals; ventral side usually whitish or light greyish, but never dusky; prickles absent on skin posterior to gill slits; ventral sensory pores distributed only anterior to pelvic girdle; terminal bridge clasper cartilage not visible externally, thus only one cleft present in clasper; spike of clasper underlies sentinel and much shorter than sentinel; egg-capsule without distinct horns and containing more than two embryos.....3

3a. Prickles covering dorsal side of disc also posterior to snout and tail, and ventrally covering snout, interbranchial and abdominal regions, and lobes of pelvics; thornlets present at axils of pectorals dorsally; dark round markings inside a pair of dark rings in young, and in adults, a pair of dark large round markings, surrounded by small yellow spots present at center of pectorals.....*R.* (*D.*) *binoculata* Girard

3b. Prickles only developed on snout dorsally, as well as ventrally; thornlets absent on disc; a pair of dark brown rings at center of pectorals in young without dark inner markings, and the rings change to light blotches, or fade with growth; dorsal side of disc mottled with additional dark reticulate patterns in adults..*R.* (*D.*) *pulchra* Liu

4a. Both sides of disc and tail uniformly dark purplish-brown or greyish-brown; dorsals usually set close together; anterior lobe of pelvics long, inserting very deep notch; in adults, prickles covering dorsal side of disc also beyond snout, and covering almost entire ventral side of disc.....*R.* (*D.*) *gigas* Ishiyama

4b. Dorsal side of body dark brown, ventral side lighter; dorsals widely separated; anterior lobe of pelvics short, inserting shallow notch; even in adults, prickles covering only both surfaces of snout and/or skin posterior to gill slits 5

5a. Dorsal side of disc mottled with many light markings of various sizes; a pair at center of pectorals largest of these; prickles absent on skin posterior to gill slits; ventral sensory pores never extended rearwards to areas lateral to cloaca.....*R.* (*D.*) *kwangtungensis* Zhu

5b. Dorsal side of disc with faint color markings or plain colored; prickles present on skin posterior to gill slits; ventral sensory pores extended to areas lateral to cloaca.....6

6a. Lateral tail folds rather indistinct; tail gradually tapering rearwards; snout extremely pointed, dorsal head length more than 6.5 times the interorbital width and margins of snout tip almost parallel; postdorsal tail length more than 80% of D_2 base length .....*R.* (*D.*) *tengu* Jordan et Fowler

6b. Lateral tail folds distinct; tail expanded laterally at midlength; snout less pointed, dorsal head length less than 6.5 times the interorbital width and margins of snout tip diagonal: postdorsal tail length less than 80% of D_2 base length.....*R.* (*D.*) *macrocauda* Ishiyama

Key to species of subgenus *Okamejei*

1a. Ventral sensory pores rather large and dense-

ly distributed on entire ventral side of disc, except for posterior margins.....2

1b. Ventral sensory pores tiny and rather sparsely distributed on disc, and absent on abdominal region.....3

2a. Snout pointed, dorsal head length 5.5–6.0 times the interorbital width; dark specks densely distributed over the disc dorsally and usually forming reticulate patterns; at center of pectorals those specks sometimes marked off from white markings which sometimes surrounded by dark rings; a few additional pairs of smaller white markings present behind those at center of pectorals; ventral sensory pores distributed rearwards beyond pelvic girdle to areas lateral to cloaca; total length of adults 35–43 cm..... .....*R.* (*O.*) *acutispina* Ishiyama

2b. Snout bluntly angled, dorsal head length 4.0–4.5 times the interorbital width; dark specks rather sparsely distributed and more distinct, sometimes forming reticulate patterns; in young, a pair of dark rings present at center of pectorals, with dark specks inside the ring, but those rings tend to fade with growth; ventral sensory pores lacking on pelvic girdle; total length of adults 45–50 cm.....*R.* (*O.*) *schmidti* Ishiyama

3a. Postdorsal tail length usually more than 1.5 times the D_2 base length; ventral sensory pores sparse at midlength of metapterygium and never forming V-shaped pattern there 4

3b. Postdorsal tail length usually less than 1.5 times the D_2 base length; ventral sensory pores assembled to form V-shaped pattern at midlength of metapterygium.....5

4a. Interdorsal distance usually shorter than D_1 base length; dark specks of upper side of disc unevenly distributed and here and there assembled to form rosette-like patches; a pair of dark rings as large as orbits usually apparent at pectoral axils, and sometimes an additional pair of dark rings present at center of pectorals; no light spots present on disc.....***R.*** **(*O.*)** ***boesemani*** sp. nov.

4b. Interdorsal distance usually longer than D_1 base length; dark specks of upper side of disc evenly distributed and never forming any patterns; no dark rings present at pectoral axils nor on pectoral center; many small yellowish spots present on disc..... ....*R.* (*O.*) *hollandi* Jordan et Richardson

5a. Snout rather bluntly angled, dorsal head length 3.6–4.9 times the interorbital width; orbit diameter less than, or equal to interorbital width; 2–16 nuchal thorns; tail depressed; middorsal area and posterior margin of disc sometimes prickly in adult females; a pair of dark rings present at center of pectorals in young, which change to light or dark markings with growth; another pair of large white markings (darkish after formalin preservation) present behind those on pectoral center and the posterior markings with a few inner small dark spots; disc sometimes with dark specks, which sometimes form reticulate patterns; tips of sentinel and spike of clasper placed close together; tooth rows in upper jaw more than 43; total length of adults 35–52 cm ....*R.* (*O.*) *kenojei* Müller et Henle

5b. Snout pointed, dorsal head length 5.3–6.4 times the interorbital width; orbit diameter equal to or greater than interorbital width; 1–2 nuchal thorns in males, and 1 or 3 in females; three female nuchal thorns set as triangle; tail slender and roundish; prickles only covering both surfaces of anteriormost tip of snout and anterior margin of disc in both sexes; no rings present at center of pectorals even in young; may small yellowish spots present on upper side of disc; a pair of white specks present at posterior center of pectorals additionally (darkish after formalin preservation); tip of spike of clasper elongated distally, reaching far beyond tip of sentinel; tooth rows in upper jaw less than 43; total length of adults 32–37 cm .....*R.* (*O.*) *meerdervoortii* Bleeker

Comparative material

1. *Raja* (*Dipturus*) *binoculata* Girard, 1856
   1 adult female, MTUF 25241, 988 mm TL, 58°47′N, 152°01′W, 133.5 m depth, Sept. 1, 1984; 2 young females: ZMH 3771, 175.5 mm and 206.5 mm TL, Puget Sound, March, 1967; 1 clasper sample, SIO-62-393 D122; 1 egg-capsule, BCPM 986-60.
2. *Raja* (*Dipturus*) *gigas* Ishiyama, 1958
   4 paratypes: MTUF 25886, young male, 371.5 mm TL, no data; MTUF 25888, young male, 308.5

mm TL, no data; MTUF 25885, young female, 425.5 mm TL, no data; MTUF 25887, young female, 368.5 mm TL, no data; 1 adult female, MTUF 25059, 1145 mm TL, 30°0′N, 128°21′E, 900 m depth, Feb. 2, 1978; 3 young males: MTUF 25058, 445 mm TL, collected with MTUF 25059; USNM 137886, 281 mm TL, off Hermanos I., 18°32′30″N, 122°01′E, Nov. 12, 1908; FAKU 37401, 249 mm TL, off Totoro, Miyazaki Pref., Nov. 11, 1965.

3. *Raja* (*Dipturus*) *macrocauda* Ishiyama, 1955
4 paratypes: MTUF 25909, adult female, 970 mm TL, off Owase, Mie Pref., March, 1951; MTUF 25883, young male, 411 mm TL, off Miya, Aichi Pref., March, 1951; FAKU 111535, young female, 606.5 mm TL, off Kochi, Kochi Pref., Feb. 18, 1944; MTUF 25884, young female, 493.5 mm TL, collected with MTUF 25883; 1 young male, FUMT P10514, 850 mm TL, off Choshi, Chiba Pref., 600–700 m depth, Feb. 2, 1984.

4. *Raja* (*Dipturus*) *pulchra* Liu, 1932
1 adult male, HUMZ 35033, 937.5 mm TL, off Hakodate, Hokkaido, June 2, 1972; 6 young males: HUMZ 35068, 214 mm TL, no data; HUMZ 92010, 218.5 mm TL, off Omu, Hokkaido, 44°40′N, 142°50′E, 41 m depth, July 12, 1981; MTUF 25889, 205.5 mm TL, off Hamada, Shimane Pref., 1954; MTUF 25890, 225.5 mm TL, collected with MTUF 25889; MTUF 25891, 191.5 mm TL, off Tsuiyama, Hyogo Pref., 1954; MTUF 25892, 199 mm TL, off Hakodate, Hokkaido, July 20, 1956; 1 young female, HUMZ 33307, 700 mm TL, Volcano Bay, 42°17′N, 140°44′E, May 18, 1968.

5. *Raja* (*Dipturus*) *rhina* Jordan et Gilbert, 1881
2 adult males: FSFL NB434, 824.5 mm TL, 59°30′N, 145°37′W, 155–1,000 m depth, June 27, 1979; FSFL NB542, 1054 mm TL, 55°24′N, 134°50′W, 100–1,000 m depth, Aug. 20, 1980; 1 adult female, FSFL NB330, 1031 mm TL, 56°30′N, 152°04′W, 145–780 m depth, June 27, 1979; 1 young male, HUMZ 49361, 561 mm TL, no data; 1 young female, MTUF 25240, 780.5 mm TL, no data; 2 juvenile males, ZMH 2356, 115 and 140 mm TL, Seattle Marine Aquarium, March, 1963; 1 egg-capsule, BCPM 986-61.

6. *Raja* (*Dipturus*) *tengu* Jordan et Fowler, 1903
Holotype, SU 12912, adult male, 1105 mm TL, Matsushima Bay, Miyagi Pref., 1901; 6 young males: FAKU 111498, 392 mm TL, no data; MTUF 25910, 390 mm TL, off Kasumi, Hyogo Pref., May 23, 1952; MTUF 25911, 403 mm TL, collected with MTUF 25910; MTUF 25912, 336 mm TL, no data; FSFL EA069, 466 mm TL, 32°34′N, 128°15′E, 332 m depth, Feb. 12, 1975; USNM 137885, 287 mm TL, off Boguato I., 12°51′40″N, 123°26′15″E, March 11, 1909; 5 young females: FAKU 111512, 685.5 mm TL, off Totoro, Miyazaki Pref., Apr. 13, 1954; FSFL EA011, 686.5 mm TL, 32°27′N, 128°27′E, 398 m depth, Feb. 12, 1975; MTUF 25882, 407 mm TL, collected with FAKU 111512; MTUF 25913, 307.5 mm TL, collected with MTUF 25910; MTUF 25914, 358.5 mm TL, off Funakawa, Akita Pref., Apr. 24, 1952.

7. *Raja* (*Okamejei*) *acutispina* Ishiyama, 1958
Holotype, FAKU 111488, adult male, 407.5 mm TL, off Shimane Pref., Dec. 3, 1952; 3 paratypes: FAKU 111489, adult female, 404.5 mm TL, off Mishima, Sea of Japan, Dec., 1954; MTUF 25158, adult male, 403 mm TL, no data; MTUF 25915, adult male, 365 mm TL, Wakasa Bay, Kyoto Pref., Apr. 16, 1952; 9 adult males: FAKU 111541, 398 mm TL, off Kyogasaki Pen., Kyoto Pref., 80 m depth, June 20, 1979: FAKU 111542, 384 mm TL, collected with FAKU 111541; FAKU 111543, 409 mm TL, collected with FAKU 111541; HUMZ 33695, 350 mm TL, 31°0′N, 126°0′E, Apr. 6–11, 1968; HUMZ 33776, 400 mm TL, collected with HUMZ 33695; HUMZ 37623, 303 mm TL, off the north-west coast of Borneo, 6°16′N, 108°49′E, 118 m depth, Nov. 14, 1973; MTUF 25054, 334 mm TL, no data; MTUF 25157, 282 mm TL, East China Sea; RMNH D2501, paralectotype of *R. kenojei*, 400 mm TL, Nagasaki; 1 young female, HUMZ 34872, 365 mm TL, Sea of Genkai, 50–150 m depth, Oct. 12, 1952.

8. *Raja* (*Okamejei*) *schmidti* Ishiyama, 1958
Holotype, FAKU 111499, adult male, 509 mm TL, Bungo Strait, between Ehime and Oita Prefs., March 20, 1950; 8 paratypes: 4 adult females: FAKU 111496, 443.5 mm TL, Oita Pref., 1952; MTUF 24628, 487 mm TL, off Totoro, Miyazaki Pref., 1952; MTUF 24629, 510 mm TL, collected with MTUF 24628; MTUF 25130, 509 mm TL, no data; 1 young male, MTUF 15172, 316 mm TL, collected with MTUF 24628; 3 young females: MTUF 24630, 440.5 mm TL, collected with MTUF 24648; MTUF 24631, 391 mm TL, off Miya, Aichi Pref., 1952; MTUF 25173, collected with MTUF 24631; 2 young males: MTUF 25147, 374 mm TL, no data; MTUF 25238, 396.5 mm TL, off Kii-nagashima, Mie Pref., Jan. 21, 1985; 1 young female, MTUF 25239, 431.5 mm TL, collected with MTUF 25238.

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北西太平洋産ガンギエイ属魚類の分類学的再検討

石原　元

北西太平洋産ガンギエイ属 *Raja* の標本を，この海域のほぼすべての nominal species の type 標本と比較した結果，従来イサゴガンギエイとされていた種は新種 *R.* (*Okamejei*) *boesemani* であることが明らかとなった．北西太平洋産オカメエイ亜属 *R.* (*Okamejei*) の中でこの種は，尖った吻，長い procaudal および post-dorsal length，広い interdorsal distance，体盤上の黒色粒状斑点，縦扁した scapulocoracoid を持つことなどで，キテンカスベ（新称）*R.* (*O.*) *hollandi* Jordan et Richardson に極めてよく似ていて，Ui (1929) 以来両種は混同されてきた。しかしイサゴガンギエイはキテンカスベと，ややせまい interdorsal distance，黒色粒状斑点が集合した rosette-like patches，胸びれ腋部の 1 対の黒色 ring，前側方突起が長く延長する atr 1 clasper cartilage，scapulocoracoid に円形の anterior fenestra を持つことなどで区別される．

Raja porosa Günther, *R. fusca* Garman, *R. japonica* Nyström, *R. tobae* Tanaka, *R. katsukii* Tanaka, *R. meerdervoortii* sensu Jordan and Fowler (1903) はいずれも *R.* (*O.*) *kenojei* Müller et Henle の junior synonym であることが判明したので，コモンカスベの学名は *R.* (*O.*) *kenojei* となる。*Raja* (*O.*) *meerdervoortii* Bleeker は valid な種で，メダマカスベ *R. macrophthalma* Ishiyama の senior synonym であることが明らかと。なったガンギエイ *Raja kenojei* sensu Okada et al. (1935) は *R.* (*Dipturus*) *kwangtungensis* Zhu の junior synonym と判明した。以上のことから Ishiyama (1967) が記載したテングエイ亜属 *R.* (*Dipturus*) 4，オカメエイ亜属 *R.* (*Okamejei*) 7，計 11 種の内 5 種は学名が変更される．本論文の 1 新種を加えて北西太平洋には，テングエイ亜属 5，オカメエイ亜属 6，計 11 種のガンギエイ属魚類が分布することになった．この 11 種に北東太平洋産テングエイ亜属の 2 種，*R.* (*D.*) *binoculata* Girard と *R.* (*D.*) *rhina* Jordan et Gilbert を加えた 13 種の検索表を作成した．

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訂　　正・Errata

魚類学雑誌 34 巻3号に以下の誤りがありました．お詫びして訂正いたします．

Japanese Journal of Ichthyology, 34(3), contents: cover page 1, left column, 13th line, read "津本欽吾" for "津本欽呉".

Ishihara: page 242, left column, synonym list, 8th line, read "*Raia fusca*" for "*Raja fusca*".

Page 269, legend for Fig. 25, 2nd line, read "30 cm" for "30 mm".

Page 285, right column, 2nd paragraph, 9th line, read "明らかとなった." for "明らかと。なった".

Nakabo et al.: page 290, right column, abstract in Japanese, 6th line, read "朝鮮鰯" for "朝鮮鯑行".