

Fig. 15. *Bathyraja isotrachys*. A, holotype, BMNH 1887·12·7·3, immature female, 561.5 mm TL; B, MTUF 23943, adult male, 647 mm TL; C, HUMZ 67517, adult female, 702 mm TL.

Interorbital space narrow, less than 20% of head length. Tail much longer than precaudal body length in males and only slightly longer in females. Small caudal fin developed only on dorsal end of tail. One or no median nuchal thorns. Seventeen to 24 median tail thorns arranged at regular interspaces. Scapular and interdorsal thorns absent. Minute fine prickles covering almost entire dorsal surface of disc and tail. Both sides of disc and tail plum-brown. Pseudosiphon 1 present proximally near outer lateral edge of upper surface of clasper. Inner surface of dorsal

lobe of clasper with pseudorhipidion and cleft, that of ventral lobe with projection, sentina and knife-like sentinel. Neurocranium with relatively short rostral cartilage, its length 43.0% of cranial length. Vtr: 32–34, Vprd: 70–75.

Description. Meristic counts and morphometric measurements of the holotype and the other material are given in Table 6.

Redescription of the holotype. External features: Disc rhombic, its greatest width in posterior half 63.8% of disc length; anterior margins of disc nearly straight and slightly concave only at level

Table 6. Counts and measurements (mm) of *Bathyraja isotrachys*.

	Holotype ♀ BMNH 1887. 12.7.3	♂ MTUF 23710	♂ MTUF 23943	♂ MTUF 23944	♂ ZUMT 54181	♀ MTUF 23711	♀ MTUF 23712	♀ HUMZ 67517	In % of TL
Total length	561.5	703.5	647	664	636	723	762	702	—
Disc length	282	333.5	326.5	335.5	—	362.5	381	346	47.4-50.5
Disc width	337	422	420	432	380.5	433	454	429	59.6-65.1
Snout to maximum disc width	180	204	186	187	—	215	226	217	28.2-32.1
Head length	109	124.5	120	121	—	133.5	148	131.5	17.7-19.4
Preorbital snout length	74	78	80	80	—	89	103	90	11.1-13.5
Orbit length	19	18	21	21.5	—	25	22.5	20	2.6- 3.5
Interorbital width	19	24	20	20.5	—	24	26	24.5	3.1- 3.5
Spiracle length	13.5	19	17.5	17.5	—	19.5	18.5	19	2.4- 2.7
Interspiracular width	38	43	38.5	38.5	—	46	50	47	5.8- 6.8
D ₁ origin to tail tip	65	88	92	94	—	78.5	90	83	10.9-14.2
D ₁ base length	23.7	23.5	29	29.5	—	21	26	24	2.9- 4.5
D ₁ vertical height	9	12.5	15	13.5	—	13	11	11	1.4- 2.3
D ₂ base length	22.4	26.5	32	31	—	21	22.5	22	2.9- 4.9
D ₂ vertical height	9	13	16	15.5	—	13.5	12	12	1.6- 2.5
Interdorsal distance	0	4	8	8	—	4	8	5	0- 1.2
Caudal base length	19	32	23	25	—	33.5	33	29.5	3.3- 4.6
Caudal vertical height	3	2.5	3	4	—	3.5	4	4	0.4- 0.6
Lateral tail fold length	100	120	160	172.5	—	120	135	95	13.5-26.0
Preoral snout length	77	81	79	80	—	82	100	88.5	11.3-13.7
Mouth width	38	47	44	45	—	44	44	40	5.7- 6.8
Prenarial snout length	60	62	60	59.5	—	69	81.5	71.5	8.8-10.7
Internarial width	43	54	48	45	—	48.5	53	43.5	6.2- 7.7
Nasal curtain length	23	18	27	29	—	22.5	25.5	23	2.6- 4.4
Over 1st gill slits	99	122	102	103	—	126	128.5	126.5	15.5-18.0
Posterior pelvic lobe length	51	72	75	79	—	62.5	70.5	63	8.6-11.6
Anterior pelvic lobe length	65.5	86	93	92.5	—	92	99.5	93	11.6-14.4
Clasper length	—	168	151	155.5	—	—	—	—	23.3-23.9
Precaudal body length	261.5	323.5	287	296	—	355	368	343	44.3-49.1
Tail length	300	381	360	368	—	368	394	359	50.9-55.6
Tooth rows in upper jaw	31	26	37	37	—	25	27	23	—
Pseudobranchial folds	14.5	13	13	12	—	15	13.5	—	—
Vtr	33	34	33	32	33	34	32	33	—
Vprd	72	75	72	72	70	72	75	70	—
Cranium length	—	128	—	—	—	—	—	—	—
Rostral cartilage length	—	55	—	—	—	—	—	—	—
Prefrontanelle length	46	50	—	—	—	—	—	—	—
Cranium width	—	72	—	—	—	—	—	—	—
Interorbital width	—	25	—	—	—	—	—	—	—
Anterior fontanelle length	—	21	—	—	—	—	—	—	—
Posterior fontanelle length	—	32	—	—	—	—	—	—	—
Rostral appendix length	—	15.5	—	—	—	—	—	—	—

of nape. Snout wide and bluntly angled, pre-orbital snout length 67.9% of head length; orbit length 17.4% of head length and equal to inter-orbital space; interspiracular width twice as wide as orbit length. Tail longer than precaudal body length, its length 53.4% of TL; the two dorsals equal in size, confluent; length from D_1 origin to tail tip 21.7% of tail length; postdorsal length 6.3% of tail length; caudal fin low, only developed dorsally, its basal length about half of D_1 base length and its vertical height 16% of its basal length; lateral folds developed in posterior 1/3 of tail length. Mouth straight, with 31 rows of flattened teeth in quincunx in upper jaw; mouth width 49.4% of preoral snout length; internarial width 71.7% of prenarial snout length; nasal curtain length 38.3% of prenarial snout length, its rear margins fringed; distance between first gill slits 90.8% of head length.

Single median nuchal thorns and a row of 18 median tail thorns present; scapular and interdorsal thorns absent. Fine prickles covering entire dorsal surface of disc and tail, except for anterior pelvic lobes; prickles hooked on sides of tail. Ventral side of disc smooth; only part of tail below origin of D_1 with fine prickles.

Coloration: Dorsal side, including inner margin of orbit, uniformly dark brown. Ventral color somewhat lighter brown than dorsally; mouth area and entire ventral surface of tail somewhat dusky; mouth marked whitish.

Description of the other material. External features: Disc rhombic, wider in males than in females; greatest disc width in posterior half 55.8–62.7% of disc length; anterior margins nearly straight in females, slightly convex at level of orbits and concave at level of nape in males. Snout moderately produced, preorbital snout length 66.7–69.6% of head length in females and less so, 62.7–66.7% in males; interorbital space flat and narrow, 16.7–19.3% of head length; orbit length almost equal to spiracle length; pseudobranchial folds 11–16. Tail much longer than precaudal body length, its length 54.2–55.6% of TL in males, and only slightly longer, its length 50.9–51.7% of TL in females; the two dorsals equal in size, separated by distance of 17–31% of D_1 base length; length from D_1 origin to tail tip 21.3–25.6% of tail length; postdorsal length 6.4–9.1% of tail length; caudal fin low, only developed dorsally, its basal length 90–160% of D_1 base length,

and its vertical height 10–16% of its basal length; lateral folds developed in posterior 26.5–46.9% of tail length. Mouth straight, with 26–37 parallel rows of pointed teeth in upper jaw in males and 23–27 rows of flattened teeth in quincunx in females; mouth width 44.0–58.0% of preoral snout length; internarial width 60.8–87.1% of prenarial snout length; nasal curtain length 29.0–48.7% of prenarial snout length, its rear margins fringed; distance between first gill slits 85.0–98.0% of head length.

Median nuchal thorn usually absent, but in the specimen of HUMZ 67517, single median nuchal thorns present as in the holotype; 17–24 median tail thorns arranged at regular interspaces; scapular and interdorsal thorns absent. Fine prickles covering most of upper surface of disc and tail; prickles absent on anterior pelvic lobes; prickles present or absent on orbit, anteriormost tip of snout and caudal fin; prickles sparse above gill chamber and in pectoral centers of males. Ventral side smooth, except for the specimen of HUMZ 67517, in which the anterior 1/3 of tail is prickly. Alar thorns of male stout, hook-like and not retractable, arranged in 20–22 longitudinal and in 3–5 transverse rows.

Coloration: Both sides of disc and tail uniformly plum-brown; snout somewhat translucent; around mouth, at tip of anterior pelvic lobes and margins of cloaca and gill slits whitish; albinism seen in the specimen of MTUF 23712, which is light grey.

Clasper: Clasper relatively short, its length 41.9–44.1% of tail length; pseudosiphon 1 present proximally near out lateral edge of dorsal lobe; inner surface of dorsal lobe with pseudorhipidion and cleft, that of ventral lobe with projection, sentina and knife-like sentinel (Fig. 16A).

Clasper skeleton consists of 3 dorsal terminal, 1 accessory terminal, ventral terminal and axial cartilages: dorsal terminal 1 (dT1) large, its main portion quadrangular, anterior margin *elongate* and posterior margin flat; dT1 curved around clasper onto ventral side and united with ventral terminal, forming pseudosiphon 1 at outer lateral edge externally; small dorsal terminal 2 (dT2) and large 3 (dT3) firmly connected; tip of dorsal marginal (dM) pointed, forming pseudorhipidion externally; ventral terminal (vT) leaf-like with pointed anterior tip, overlying tip of

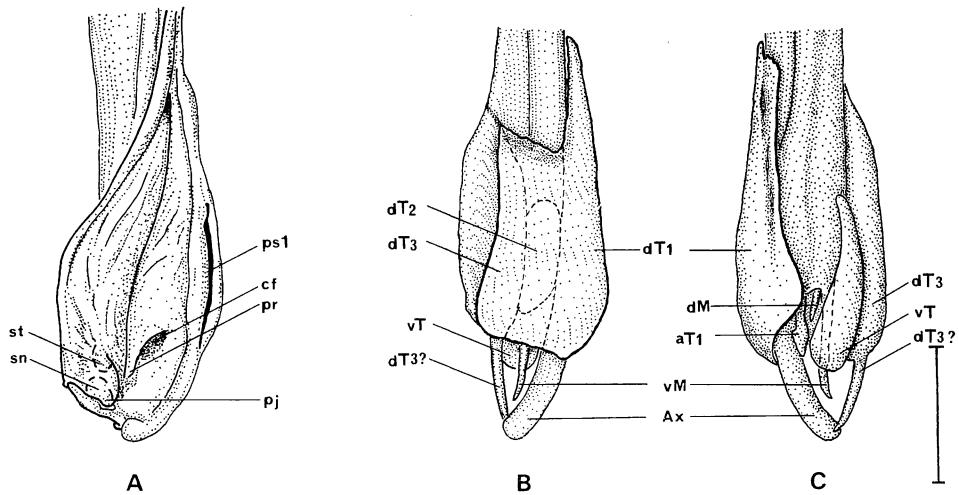


Fig. 16. Clasper of *Bathyraja isotrachys*, MTUF 23710, left clasper. A, clasper components (clasper groove opened); B, clasper skeleton in dorsal view; C, clasper skeleton in ventral view. aT1, accessory terminal 1; Ax, axial; cf, cleft; dM, dorsal marginal; dT1–dT3, dorsal terminals 1 to 3; pj, projection; pr, pseudorhipidion; ps1, pseudosiphon 1; sn, sentina; st, sentinel; vM, ventral marginal; vT, ventral terminal. Scale indicates 20 mm.

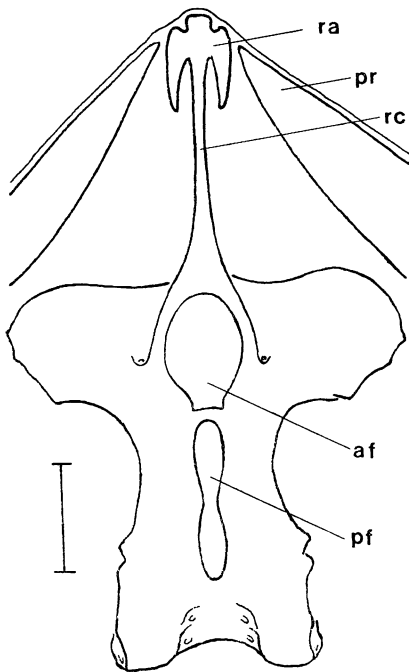


Fig. 17. Neurocranium of *Bathyraja isotrachys*, MTUF 23710, adult male. af, anterior fontanelle; pf, posterior fontanelle; pr, pectoral radials; ra, rostral appendices; rc, rostral cartilage. Scale indicates 20 mm.

ventral marginal and accessory terminal 1; tip of ventral marginal (vM) pointed, forming projection externally; accessory terminal 1 (aT1) with oval tip, forming knife-like sentinel externally; axial (Ax) spatulate distally (Fig. 16B, C).

Neurocranium (measurements based on the specimen of MTUF 23710): Length of rostral cartilage 43.0% of cranial length; prefontanelle rostral length 39.1%; cranium width 56.3%; least interorbital width 19.5%; length of anterior fontanelle 16.4%; length of posterior fontanelle 25.0%; length of rostral appendices 12.1%. Rostral cartilage nearly straight; anterior fontanelle spade-shaped, its length shorter than length of posterior fontanelle; posterior fontanelle gourd-shaped (Fig. 17).

Remarks. In 1977, the senior author obtained new material of skates which corresponded to the description of *Raja isotrachys* Günther, 1877, but not to the description of a species reported as this species by Tanaka (1927). After comparing thoroughly the holotype of *R. isotrachys* with the present material, it became clear that the present material was identical with *R. isotrachys* as originally described by Günther (1877). At the same time the present authors reexamined the specimen of ZUMT 14571, on which Tanaka (1927) described the "*R. isotrachys*". Comparison of the holotype

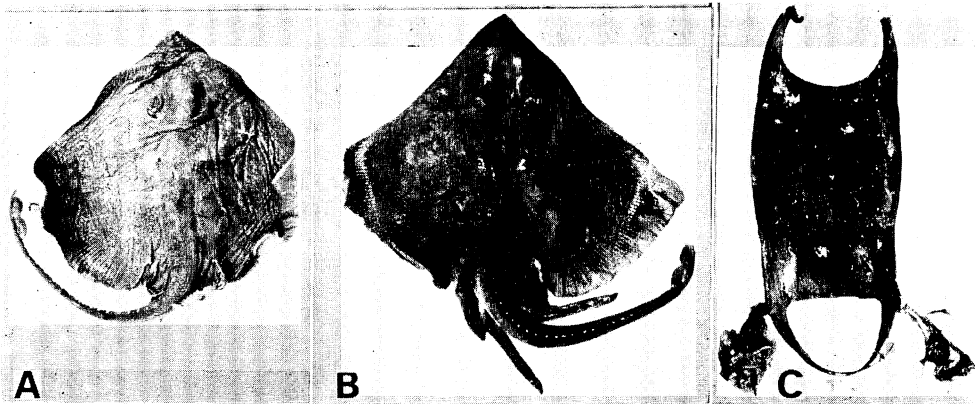


Fig. 18. *Bathyraja pseudoisotrachys* sp. nov. A, holotype, ZUMT 14571, immature male, 596 mm TL; B, paratype, HUMZ 68015, adult male, 985 mm TL; C, egg-capsule, collected off Monbetsu, 114.5 mm in length excluding horn.

of *R. isotrachys* with the specimen of ZMUT 14571 led the authors to conclude that the "*R. isotrachys*" of Tanaka (1927) should be considered as undescribed and will be described in the following pages.

The only congeners known to also possess both sides of body dark brown are among the North Pacific *Bathyraja*: *B. caeluronigricans*, *B. lindbergi*, *B. maculata*, *B. matsubarae*, *B. minispinosa*, *B. notoroensis* and *B. trachura*. However, *B. isotrachys* and *B. minispinosa* differ from other congeners in having a narrow interorbital space (less than 20% of head length). *Bathyraja isotrachys* differs from *B. minispinosa* in the following respects: 1) nuchal thorns one, if any present in the former (whereas one to four in the latter); 2) inner margin of orbit same color as remaining area of disc (inner margin of orbit whitish); 3) clasper with pseudosiphon 1 only (clasper with pseudosiphon 1 and 2).

Distribution. The specimens of this species for the present study were collected in the North Pacific from Hokkaido, Miyagi Pref., Chiba Pref., Shizuoka Pref. to the East China Sea at depths from 450 to 1,100 m. The specimens of MTUF 23943 and 23944 were collected from the Okinawa Trough, the southernmost record for *Bathyraja* species in the Asian region (see Fig. 2).

Bathyraja pseudoisotrachys sp. nov.

(Japanese name: Soko-gangie; New English name: Bottom skate)

(Fig. 18A, B)

Raja isotrachys (not of Günther, 1877): Tanaka, 1927:

670, pl. 155 (misidentification; descr., Muroran, Science Faculty Museum, Tokyo, No. 14571); Tanaka, 1931: 43 (listed, northern water of Japan); Matsubara, 1935: 19 (in key); Matsubara, 1936: 22, fig. 13 (descr.); Sato, 1937: 15 (listed, Akkeshi Bay, Hokkaido); Okada and Matsubara, 1938: 23 (in key); Ishiyama, 1950: 34, fig. 1 (egg-capsule, Monbetsu, Hokkaido).

Breviraja isotrachys (not of Günther, 1877): Ishiyama, 1952: 9 (in key); Hikita and Fukazawa, 1952: 84, fig. 124 (descr., Otaru, Hokkaido); Ishiyama, 1955: 276, fig. 4 (electric organ); Matsubara, 1955: 139 (in key); Ishiyama, 1958a: 12, fig. 9 (egg-capsule); Lindberg and Legeza, 1959: 132 (in part); Ueno, 1965: 410, fig. 7 (in key; descr.) Ueno, 1971 (listed, around Hokkaido); Hikita, 1981: 59 (listed, Shiretoko Pen., Hokkaido).

Breviraja (Bathyraja) isotrachys (not of Günther, 1877): Ishiyama, 1958b: 326, fig. 61 (descr., around Hokkaido; notes); Ishiyama, 1967: 46, fig. 13, pl. 20 (descr.; distribution).

Bathyraja isotrachys (not of Günther, 1877): Ishiyama and Hubbs, 1968: 408, fig. 12 (neurocranium; clasper); Hulley, 1970: 161 (refer. only); Stehmann, 1970: 152 (refer. only); Garrick and Paul, 1974: 361, table 5 (refer. only); Ishiyama and Ishihara, 1977: 88, table 5 (comparison); Shiogaki, 1982: 5 (listed, off Hachinohe, Aomori Pref.).

Holotype. ZUMT 14571, immature male, 596 mm TL, off Muroran Hokkaido, 1927, collected by Jutarō Katsuki.

Paratype. HUMZ 68015, adult male, 985 mm TL, off Erimo Pen., 42°19'N; 143°47'E, 295 m depth, May 25, 1977, collected by T. Kanayama. The type localities are shown in Fig. 2.

Diagnosis. A large *Bathyraja* species with

Table 7. Counts and measurements (mm) of *Bathyraja pseudoisotrachys* sp. nov.

	Holotype ♂ ZUMT 14571	Paratype ♂ HUMZ 68015	In % of TL
Total length	596	985	—
Disc length	308	532	51.7–54.0
Disc width	385	664	64.6–67.4
Snout to maximum disc width	185	314	31.0–31.9
Head length	124	201.5	20.5–20.8
Preorbital snout length	87	132.5	13.5–14.6
Orbit length	19	31.5	3.2
Interorbital width	21	38	3.5– 3.9
Spiracle length	17	27.5	2.8– 2.9
Interspiracular width	32	63	5.4– 6.4
D ₁ origin to tail tip	70	113	11.5–11.7
D ₁ base length	25	43	4.2– 4.4
D ₁ vertical height	13	25	2.2– 2.5
D ₂ base length	23.5	39	3.9– 4.0
D ₂ vertical height	12.5	28	2.1– 2.8
Interdorsal distance	4	9	0.7– 0.9
Caudal base length	17.5	20	2.0– 2.9
Caudal vertical height	4	7	0.7
Lateral tail fold length	114	325	19.7–33.0
Preoral snout length	86.5	134.5	13.7–14.5
Mouth width	32.6	61.5	5.5– 6.2
Prenarial snout length	70	102.5	10.4–11.7
Internarial width	37	62.0	6.2– 6.3
Nasal curtain length	19.5	43.0	3.3– 4.4
Over 1st gill slits	85	173	14.3–17.6
Posterior pelvic lobe length	64	133	10.1–13.5
Anterior pelvic lobe length	77.5	133	13.0–13.5
Clasper length	—	248	25.2
Precaudal body length	280	476	47.0–48.3
Tail length	316	509	51.7–53.0
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Tooth rows in upper jaw	26	26	
Pseudobranchial folds	13	15	
Vtr	33	37	
Vprd	75	81	
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Cranium length	119	—	
Rostral cartilage length	62	—	
Prefontanelle length	53.5	—	
Cranium width	62	—	
Interorbital width	20	—	
Anterior fontanelle length	22	—	
Posterior fontanelle length	24	—	
Rostral appendix length	—	—	

a maximum total length of about 1,000 mm. Greatest disc width in posterior half 59.0–60.1% of disc length. Preorbital snout length 65.8–70.2% of head length. Interorbital space narrow, less than 20% of head length, but much longer than orbit length in adults, slightly longer in young. Tail longer than precaudal body

length. Small caudal fin developed only on dorsal end of tail. Single scapular thorn on each shoulder. Median nuchal thorn present or absent. Twenty to 24 median tail thorns arranged at regular interspaces. Minute fine prickles covering almost entire dorsal surface of disc and tail. Dorsal side uniformly dark brown, ventral side

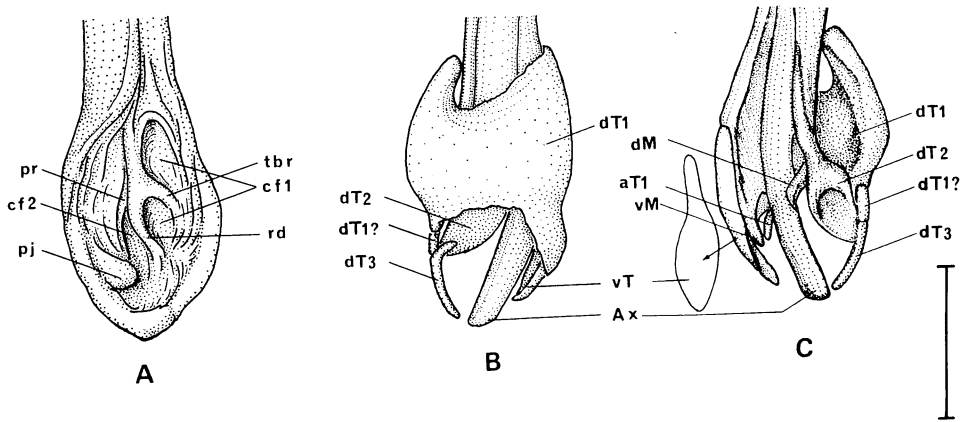


Fig. 19. Clasper of *Bathyraja pseudoisotrachys* sp. nov., uncatalogued sample, left clasper. A, clasper components (clasper groove opened); B, clasper skeleton in dorsal view; C, clasper skeleton in lateral view. aT1, accessory terminal 1; Ax, axial; cf1, anterior larger cleft; cf2, posterior smaller cleft; dM, dorsal marginal; dT1–dT3, dorsal terminals 1 to 3; pj, projection; pr, pseudorhipidion; rd, ridge; tbr, terminal bridge; vM, ventral marginal; vT, ventral terminal. Scale indicates 20 mm.

predominantly white. Pseudosiphon 1 absent. Inner surface of dorsal lobe with two clefts, terminal bridge, ridge and pseudorhipidion, that of ventral lobe with reduced projection only. Neurocranium with relatively long rostral cartilage, its length 52.1% of the cranial length. Least width of neurocranium relatively narrow, 16.8% of cranial length. Vtr: 33–37, Vprd: 75–81.

Description. Meristic counts and morphometric measurements of both the holotype and paratype are given in Table 7.

External features: Disc rhombic, its greatest width in posterior half 59.0–60.1% of disc length. Snout moderately produced, preorbital snout length 65.8–70.2% of head length; interorbital space not flat, and narrow, 16.9–18.9% of head length; orbit length 15.3–15.6% of head length; spiracles closely behind orbit, their length less than orbit length; pseudobranchial folds 13–15. Tail long and stout, its length 51.7–53.0% of TL; the two dorsals almost equal in size, separated by a distance of 16.0–20.9% of D_1 base length; length from D_1 origin to tail tip 22.2% of tail length; postdorsal length 3.9–5.5% of tail length; caudal fin low, only developed dorsally, its basal length 47–70% of D_1 base length and its vertical height 23–35% of its basal length; lateral folds developed in posterior 36.1–63.9% of tail length. Mouth slightly arched, with 26 parallel rows of pointed teeth in upper jaw in both holotype and paratype; mouth width 37.7–45.7% of preoral snout length;

internarial width 52.9–60.5% of prenarial snout length; nasal curtain length 27.9–42.0% of prenarial snout length, its rear margins fringed; distance between first gill slits 68.5–85.9% of head length.

Single scapular thorns on each shoulder; no median nuchal thorns in holotype, two median nuchal thorns in paratype; 20–24 median tail thorns arranged at regular interspaces; interdorsal thorns absent in holotype, single interdorsal thorns present in paratype. Dorsal surface of disc and tail densely covered with minute fine prickles, except for anterior pelvic lobes; prickles sparse in pectoral centers and absent on orbit in paratype. Ventral side smooth, except for some prickles on snout tip. Alar thorns of male stout, hook-like and not retractable, fully developed in paratype, arranged in 6–7 longitudinal and in 22 transverse rows.

Coloration: Dorsal side uniformly dark brown; distal region of anterior pelvic lobes whitish; sides of orbit somewhat whitish in paratype. Ventral side white; postero-lateral margin of pectorals, margin of pelvic, edges of claspers and margin of cloaca dark brown in paratype.

Clasper: Well matured in paratype, its length 48.7% of tail length; tip like a snake head in lateral view; pseudosiphon 1 absent; inner surface of dorsal lobe with two clefts, terminal bridge, ridge and pseudorhipidion; anterior larger cleft divided into two subparts by terminal bridge;

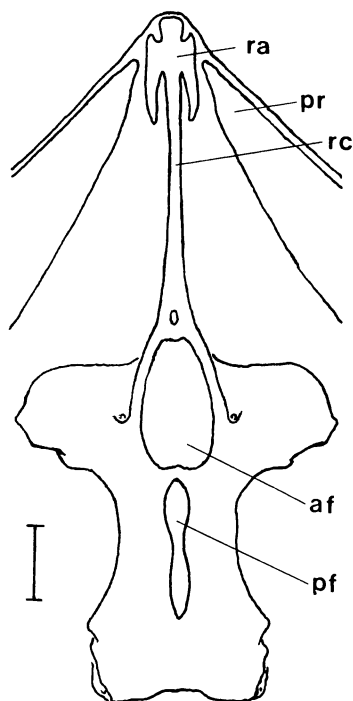


Fig. 20. Neurocranium of *Bathyraja pseudoisotrachys* sp. nov., holotype, ZUMT 14571, immature male, schematized in combination of the radiograph and the figure after Ishiyama (1958b). af, anterior fontanelle; pf, posterior fontanelle; pr, pectoral radials; ra, rostral appendices; rc, rostral cartilage. Scale indicates 20 mm.

posterior smaller cleft bordered by pseudorhipidion and ridge; inner surface of ventral lobe with rudimentary projection only (Fig. 19A).

Clasper skeleton consists of 3 dorsal terminal, 1 accessory terminal, ventral terminal and axial cartilages: dorsal terminal 1 (dT1) large and curious in shape; dT1 almost quadrangular but each of the four corners elongate; dT1 connected with dorsal terminal 3 posterodorsally and with ventral terminal posteroventrally; dorsal terminal 2 (dT2) also curious in shape, its dorsomedial margin concave; dT1 and dT2 forming larger cleft externally; dorsomedial margin of dT2 forming ridge externally; process arising from center of dT2 forming terminal bridge externally; dorsal terminal 3 (dT3) rod-like, connected with distal margin of dT2; tip of dorsal marginal (dM) pointed, forming pseudorhipidion externally; ventral terminal leaf-like,

connected with dT1 and axial; tip of ventral marginal (vM) pointed, forming projection externally; accessory terminal 1 (aT1) small, not forming sentinel externally; axial spatulate distally (Fig. 19B, C).

Neurocranium (measurements based on the radiograph of the holotype): Length of rostral cartilage 52.1% of cranial length; prefontanelle rostral length 45.0%; cranium width 52.1%; least interorbital width 16.8%; length of anterior fontanelle 18.5%; length of posterior fontanelle 20.2%. Rostral cartilage nearly straight; anterior fontanelle spade-shaped; posterior fontanelle gourd-shaped; the two fontanelles almost equal in length (Fig. 20).

Egg-capsule (collected off Monbetsu, Hokkaido): Measurements are given in Table 8. Egg-capsule almost rectangular with horn at each corner; anterior margin roundish, posterior margin flat; tip of anterior horns rolled, and that of posterior horns filamentous; lateral keel narrow, its width 6.3% of least width of capsule; surface rough with minute coarse prickles in numerous longitudinal rows; respiratory fissure near mid-length of each horn. Ground color of both sides plum-brown; lateral keel somewhat lighter (Fig. 18C).

Remarks. *Bathyraja pseudoisotrachys* sp. nov. has long been misidentified as *Raja isotrachys* Günther, 1877 since Tanaka (1927) described his "*Raja isotrachys*" (= in fact *B. pseudoisotrachys*) on the basis of the specimen of ZUMT 14571. Ishiyama (1958b) and Lindberg and Legeza (1959) pointed out the taxonomic problem that the holotype of *Raja isotrachys* has no scapular thorns on disc, whereas the subsequent specimens of the species have scapular thorns on the disc. The senior author examined the specimen of ZUMT 14571 in connection with the second sample of *Raja isotrachys* Günther, 1877 (see preceding revised description of *B. isotrachys*). The specimen of ZUMT 14571 considerably resembles the type of *R. isotrachys* in morphometric characters and dorsal squamation. However, the former differs from the latter mainly in having scapular thorns on disc. Thus the authors conclude that the "*Raja isotrachys*" of Tanaka (1927) is a distinct new species *Bathyraja pseudoisotrachys*.

This new species may have evolved on a peculiar evolutionary line among the North Pacific *Bathyraja*, because it has high vertebral counts (Vtr:

Table 8. Measurements (mm) of egg-capsule of *Bathyraja pseudoisotrachys* sp. nov. An egg-capsule (uncatalogued) collected off Monbetsu, Hokkaido.

Characters	
Length (without horns)	114.5
Width: maximum	81.0
minimum	71.5
Horn length: anterior	75.0
posterior	115.0
Apron width: anterior	10.5
posterior	—
Keel width	4.5

33–37, Vprd 75–81) and dT1 and dT2 are peculiar in shape forming cleft and ridge, but not forming pseudosiphon 1. The junior author overlooked the curious dorsal terminal 2 existing in this species, and thus did not describe or illustrate it among clasper components (Ishiyama, 1958b; 1967; Ishiyama and Hubbs, 1968).

Distribution. According to records, which could almost or entirely be verified, the species is distributed off Hokkaido (Tanaka, 1927; Sato, 1937; Ishiyama, 1950, 1958; Ueno, 1965, 1971; Ishiyama, 1967; Hikita, 1981), Aomori (Shiogaki, 1982) to Choshi (Ishiyama, 1958b). The paratype of the species was collected at a depth of 295 m.

Etymology. Inasmuch as this species has been currently misidentified as *B. isotrachys*, the Greek prefix “pseudo” (=false) is added to the species name “*isotrachys*”.

Bathyraja trachura (Gilbert, 1891)

(New Japanese name: Yasuda-kasube;

English name: Roughtail skate)

(Fig. 21)

Raja trachura Gilbert, 1891: 539 (without illustr.; type locality; *Albatross* St. 2923, Santa Barbara Channel, 1,504 m depth).

Raja trachura: Goode and Bean, 1895: 509 (listed); Garman, 1913: 344 (compiled).

Raja trachura: Gilbert, 1895: 398 (descr. of second specimen, Shumagin Is., Alaska); Jordan and Evermann, 1896: 75 (compiled); Townsend and Nichols, 1925: 6 (descr., *Albatross* St. 5694, southwest of Santa Barbara Is., California); Fowler, 1930: 502 (listed); Jordan, Evermann and Clark, 1930: 26 (listed); Schultz and DeLacy, 1935: 368 (range); Barnhart, 1936: 13 (compiled); Schultz, 1936: 132 (in key); Schultz and DeLacy, 1936:

214 (refer. only); Taranetz, 1937: 51 (in key); Wilimovsky, 1954: 128 (listed, Gulf of Alaska to California); Wilimovsky, 1958: 21 (in key); Grinols, 1965: 28 (listed, Alaska, Oregon and southern California); Miller and Lea, 1972: 44 (descr., north of Guadalupe I. to Bering Sea; in key; fig.); Quast and Hall, 1972: 4 (listed); Robins *et al.*, 1980: 14 (listed).

Raja microtrachys Osburn and Nichols, 1916: 142, fig. 1 (descr., type locality: Guadalupe I., AMNH 5198).

Raja microtrachys: Townsend and Nichols, 1925: 6 (correction of type locality: *Albatross* St. 5673, southwest of San Diego, California); Fowler, 1930: 502 (listed); Jordan, Evermann and Clark, 1930: 25 (listed); Grey, 1956: 99 (compiled); Miller and Lea, 1972: 211 (refer. only).

Raja (Bathyraja) trachura: Isakson *et al.*, 1971: 668 (listed, Amchitka I., Bering Sea).

Bathyraja trachura: Stehmann, 1978: 53 (refer. only); Allen, 1983: (in key); Eschmeyer *et al.*, 1983: 51, fig. 11, pl. 4 (descr.).

Material examined. USNM 46930, holotype, young female, 465 mm TL, *Albatross* St. 2923, Santa Barbara Channel, 1,504 m depth, 1888–1889, collected by C.H. Gilbert; 5 adult males: MTUF 24997, 818 mm TL, north of Aleutian Is., 54°20'N; 166°55'W, 750 m depth, Oct. 30, 1982; MTUF 24998, 826 mm TL, collected with MTUF 24997; MTUF 24999, 829.5 mm TL, north of Aleutian Is., 54°25'N; 166°34'W, 560 m depth, Nov. 3, 1982; MTUF 25000, 809.5 mm TL, north of Aleutian Is., 55°26'N; 168°23'W, 800 m depth, Oct. 20, 1982, all collected by K. Teshima; HUMZ 67853, 757 mm TL, south of Alaska Pen., 54°13'N; 161°03'W, 490 m depth, June 12, 1977, collected by T. Kanayama; 3 adult females: FSFRL NB247, 741.5 mm TL, near Queen Charlotte Is., 55°37'N; 135°04'W, 655 m depth, Aug. 2, 1979; FSFRL NB510, 805 mm TL, Gulf of Alaska, 59°34'N; 143°40'W, 570 m depth, Aug. 7, 1980; FSFRL NB598, 840 mm TL, near Attu I., 52°30'N; 172°57'E, 540 m depth, June 12, 1980, all collected by T. Sasaki; 2 young females: FSFRL ND578, 390 mm TL, near Amukla Pass, 52°23'N; 172°44'W, 500 m depth, Nov. 4, 1980; FSFRL ND616, 335.5 mm TL, near Amchitka I., 52°09'N; 178°36'E, 830 m depth, Sept. 26, 1980, each collected by T. Sasaki. The capture localities are shown in Fig. 1.

Diagnosis. A medium to large-sized species with a maximum total length of about 850 mm in both males and females. Greatest disc width in posterior half of disc 54.3–59.3% of disc length. Snout moderately produced, preorbital snout length 62.9–69.1% of head length. Interorbital space flat and wide, more than 20% of head length.

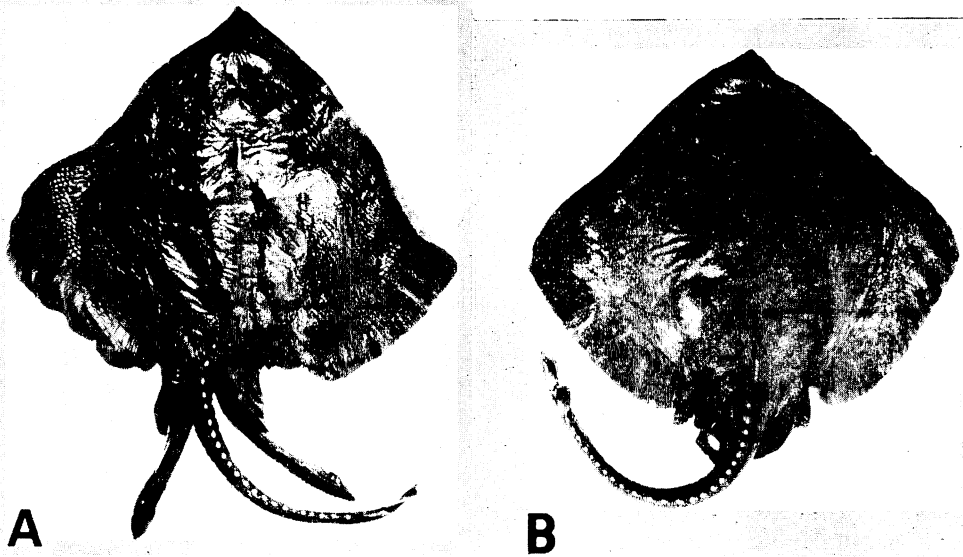


Fig. 21. *Bathyraja trachura*. A, MTUF 24999, adult male, 829.5 mm TL; B, FSFRL NB598, adult female, 840 mm TL.

Orbit length less than interorbital space and spiracle length. Tail short and stout, its length less than precaudal body length in adults. The two dorsals confluent or separated by short interspace. Small caudal fin developed on dorsal end of tail and extending to ventral side as a tiny frill. Median nuchal thorns usually absent, even if present, less than three. Twenty-one to 28 median tail thorns arranged at regular interspaces. Scapular and interdorsal thorns absent. Fine prickles covering almost entire dorsal surface of disc and tail. Both sides of disc and tail uniformly plum brown. Pseudosiphon 1 present proximally near outer lateral edge of upper surface of clasper. Inner surface of dorsal lobe of clasper with pseudorhipidion and cleft, that of ventral lobe without any component even in mature clasper. Neurocranium with relatively short rostral cartilage, its length 42.0% of the cranial length. Vtr: 32–37, Vprd: 62–66.

Description. Meristic counts and morphometric measurements of the holotype and the additional material are given in Table 9.

External features: Disc rhombic, its greatest width in posterior half of disc 54.3–59.3% of disc length; anterior margins of disc convex at level of orbits and concave at level of nape in males, whereas nearly straight in females. Snout moderately produced and bluntly angled, pre-

orbital snout length 62.9–69.1% of head length; interorbital space flat and wide, more than 20% of head length and much longer than orbit length; spiracles large, their length usually longer than orbit length; pseudobranchial folds 14–16. Tail short and stout, its length 47.9–51.2% of TL in adults; the two dorsals equal in size, confluent or separated by a distance of 6–18% of D_1 base length; length from D_1 origin to tail tip 21.2–28.4% of tail length; postdorsal length 5.1–10.9% of tail; caudal fin extending to ventral side as a tiny frill, its dorsal base length more than half of D_1 base length and its ventral base length less than 1/3 of dorsal base length; vertical height of caudal fin 14–32% of its basal length; lateral folds developed in posterior 80.7–90.2% of tail. Mouth weakly arched, with 26–33 parallel rows of pointed teeth in upper jaw in males, 30–35 rows of flattened teeth in quincunx in upper jaw in females; mouth width 50.4–70.4% of preoral snout length; internarial width 68.9–85.5% of prenarial snout length; nasal curtain length 28.8–42.7% of prenarial snout length, its rear margins fringed; distance between first gill slits 102.9–128.0% of head length.

Dorsal surface of disc and tail armed with thorns and minute fine prickles: single median nuchal thorns present in type, two indistinct ones in the specimen of MTUF 24997, but no thorns on disc

Table 9. Counts and measurements (mm) of *Bathyraja trachura*.

	Holotype ♀ USNM 46930	♂ MTUF 24997	♂ MTUF 24998	♂ MTUF 24999	♂ MTUF 24500	♂ HUMZ 67853	♀ FSFRL NB347	♀ FSFRL NB510	♀ FSFRL NB598	In % of TL
Total length	465	818	826	829.5	809.5	757	741.5	805	840	—
Disc length	235	430	454	462	440	396	394	420	435	50.5–55.7
Disc width	297.4	544	554	559	550	479	462	495	513.5	61.1–67.9
Snout to maximum disc width	135	238.5	259.5	274	250	223	214.5	232.5	246	28.9–33.0
Head length	88.1	151	150.5	170	155	143	153.5	158	168	18.2–20.7
Preorbital snout length	55.5	96.5	103.5	113	99.5	93.5	106	107	115	11.8–14.3
Orbit length	14.9	27	26	20.5	20.5	23	21	21	21	2.5–3.3
Interorbital width	19.3	34	36	36	37	30	32	32	35.5	3.9–4.6
Spiracle length	13.8	26.5	31	28.5	27.5	26.5	25	28	26.5	3.0–3.8
Interspiracular width	32.0	53	55	56	57	52.5	51	51	57	6.3–7.0
D ₁ origin to tail tip	54.0	92	107	99	113	80	80	84.5	95	10.5–14.3
D ₁ base length	20.0	30	33	34	32.5	28	30.5	30	33	3.7–4.3
D ₁ vertical height	6.9	21.5	29	25	23.5	17.5	18	18	20	1.5–3.5
D ₂ base length	17.5	29.5	34	34	36.5	29	28	25	33	3.1–4.5
D ₂ vertical height	9.3	—	27	28	25.5	18	17.5	18	22	2.0–3.4
Interdorsal distance	2.7	5	4	0	3	5	0	0	2	0–0.7
Caudal base length	16.1	26	38	28	43.5	19	23	26	25	2.0–4.6
Caudal vertical height	3.0	7	11	9	6	5.5	4	7	7.5	0.5–1.3
Lateral tail fold length	—	340	350	330	330	330	304.5	359	352	39.8–43.6
Preoral snout length	57.8	103	99.5	105.5	114	94.5	105	106	106.5	12.0–14.1
Mouth width	35.2	65	70	69.5	73.5	55.5	53	54.5	57	6.8–9.1
Prenarial snout length	45.0	78.5	82.5	88	86	73	83	90	90	9.6–11.2
Internarial width	37.5	63.5	70.5	71.5	62	59	58	63.5	62	7.4–8.6
Nasal curtain length	18.1	33.5	32.5	32.5	35	30	27	27	26	3.1–4.3
Over 1st gill slits	94.8	184	171.5	191	176	159	158	171.5	174.5	20.4–23.0
Posterior pelvic lobe length	37.5	99.5	114	101.5	103	91.5	65.5	72	72	8.1–13.8
Anterior pelvic lobe length	57	115	115	126	116	98	104	113	116.5	12.3–15.2
Clasper length	—	218	233	233.5	224	190.5	—	—	—	25.2–28.2
Precaudal body length	227	424	430	423	415	388	386	407	434	48.8–52.1
Tail length	238	394	396	406.5	394.5	369	355.5	398	406	47.9–51.2
Tooth rows in upper jaw	33	26	28	32	32	31	32	35	31	—
Pseudobranchial folds	—	12	15	15	15	—	15	15.5	15	—
Vtr	—	36	37	33	32	36	—	—	—	—
Vprd	—	64	63	64	62	66	—	—	—	—
Cranium length	—	—	157	—	—	—	—	—	—	—
Rostral cartilage length	—	—	66	—	—	—	—	—	—	—
Prefontanelle length	—	—	64	—	—	—	—	—	—	—
Cranium width	—	—	102	—	—	—	—	—	—	—
Interorbital width	—	—	35	—	—	—	—	—	—	—
Anterior fontanelle length	—	—	28	—	—	—	—	—	—	—
Posterior fontanelle length	—	—	40	—	—	—	—	—	—	—
Rostral appendix length	—	—	19	—	—	—	—	—	—	—

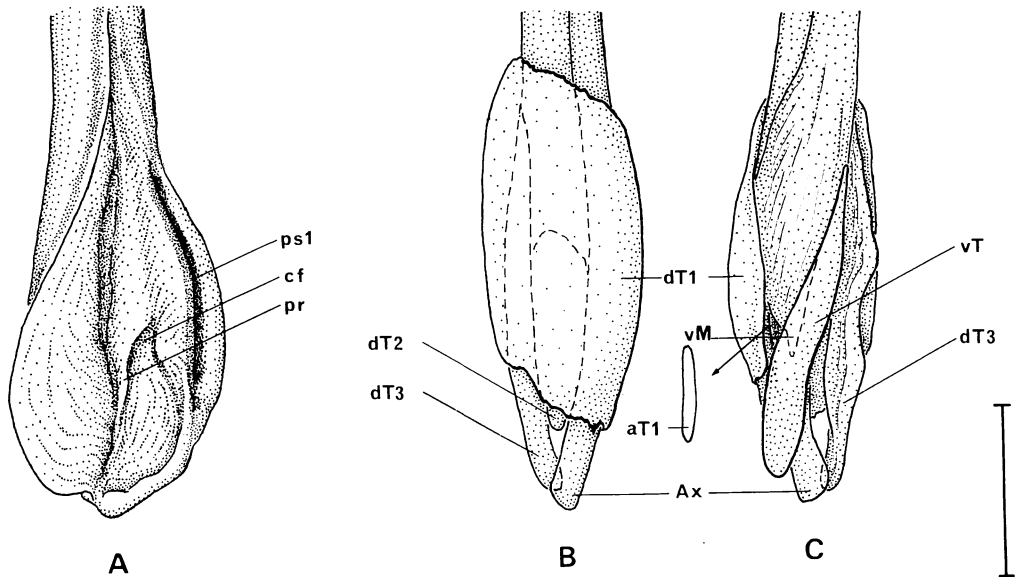


Fig. 22. Clasper of *Bathyraja trachura*, MTUF 24998, left clasper. A, clasper components (clasper groove opened); B, clasper skeleton in dorsal view; C, clasper skeleton in ventral view. aT1, accessory terminal 1; Ax, axial; cf, cleft; dT1–dT3, dorsal terminals 1 to 3; pr, pseudorhipidion; ps1, pseudosiphon 1; vM, ventral marginal; vT, ventral terminal. Scale indicates 20 mm.

in other specimens; 21–28 median tail thorns regularly spaced to origin of dorsal; interdorsal thorn absent. Prickles covering entire dorsal surface, except for orbits and both pelvic lobes; prickles sparse above gill chamber and in pectoral centers in adults. Ventral side smooth. Alar thorns of male stout, hook-like and not retractable, arranged in 20–24 longitudinal and in 4–8 transverse rows.

Coloration: Both sides of disc and tail uniformly plum-brown; tip of anterior pelvic lobes, margin of cloaca and five gill slits, and mouth area whitish; a large white blotch in interbranchial space of the specimen of MTUF 24997.

Clasper: Clasper with global tip, its length 51.6–58.8% of tail length; large pseudosiphon 1 present proximally near outer lateral edge of dorsal lobe; inner surface of dorsal lobe with pseudorhipidion and cleft; no component on inner surface of ventral lobe (Fig. 22A).

Clasper skeleton consists of 3 dorsal terminal, 1 accessory terminal, ventral terminal and axial cartilages: dorsal terminal 1 (dT1) large, almost parallelogrammic, curved around clasper onto ventral side and united with ventral terminal; dT1 forming pseudosiphon 1 externally; dorsal

terminal 3 (dT3) long and rod-like; dorsal terminal 2 (dT2) leaf-like, its length about half length of dT3 and its width twice as wide as width of dT3; dT2 united at both ends with dT3 and axial respectively; tip of dorsal marginal (dM) pointed, forming pseudorhipidion externally; ventral terminal (vT) leaf-like, its length almost equal to length of dT3; accessory terminal 1 (aT1) rod-like, not forming sentinel externally; tip of ventral marginal (vM) pointed, situated parallel to aT1, not forming projection externally; axial (Ax) spatulate distally (Fig. 22B, C).

Neurocranium (measurements based on the specimen of MTUF 24998): Length of rostral cartilage 42.0% of cranial length; prefontanelle rostral length 40.8%; cranium width 65.0%; least interorbital width 22.9%; length of anterior fontanelle 17.8%; length of posterior fontanelle 25.5%; length of rostral appendices 12.1%. Rostral cartilage nearly straight; anterior fontanelle spade-shaped; posterior fontanelle gourd-shaped and longer than anterior one (Fig. 23).

Remarks. Miller and Lea (1972) commented that Carl L. Hubbs regarded *Raja microtrachys* Osburn et Nichols, 1916 as a junior synonym of *R. trachura* Gilbert, 1891. The figure of *R.*

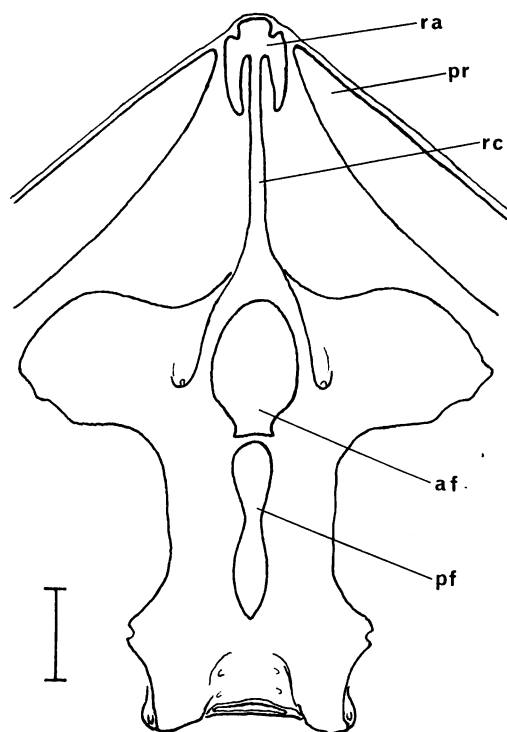


Fig. 23. Neurocranium of *Bathyraja trachura*, MTUF 24998, adult male. af, anterior fontanelle; pf, posterior fontanelle; pr, pectoral radials; ra, rostral appendices; rc, rostral cartilage. Scale indicates 20 mm.

microtrachys in the original description resembles *Bathyraja trachura*. Thus also the present authors consider *R. microtrachys* as a junior synonym of *B. trachura*. However, More detailed studies should be directed to these two species.

The only congeners known to also possess both sides of body dark brown are among the North Pacific *Bathyraja*: *B. caeluronigricans*, *B. isotrachys*, *B. lindbergi*, *B. maculata*, *B. matsubarae*, *B. minispinosa* and *B. notoroensis*. However, *B. trachura* differs from these congeners in the possession of a clasper without any components in the ventral lobe and in having low V_{pr} counts.

The Japanese name "Yasuda-kasube" is dedicated to the late Dr. Fujio Yasuda.

Distribution. This species was recorded from the Pacific coast of California (Gilbert, 1891; Townsend and Nichols, 1925), Alaska (Gilbert, 1895; the present specimens) and the Bering Sea (Isakson *et al.*, 1971; the present specimens). The specimens examined for the present study were

collected at depths from 490 to 1,504 m. This species is rather abundant in the western part of the Bering Sea, although many authors stated that the occurrence of this species was uncommon.

Key to the North Pacific *Bathyraja*

(The present key is based mainly on adult or subadult specimens)

- 1a. Scapular thorns present on disc2
- 1b. Scapular thorns absent8
- 2a. Tail length never exceeding precaudal body length; anterior margins of disc and inner margin of orbits with thornlets; lateral tail folds originating at origin of tail; dermal denticles present on inner surface of pseudosiphon 1.3
- 2b. Tail length usually longer than precaudal body length; disc without thornlets; lateral tail folds originating at midlength of tail; pseudosiphon 1 of clasper, if present, without dermal denticles on inner surface.5
- 3a. A row of median thorns continuous from scapular region to origin of dorsal; funnel present in clasper.4
- 3b. A row of median thorns from scapular region to origin of dorsal interrupted on trunk; funnel absent in clasper.
.....*B. smirnovi* (Soldatov et Pavlenko)
- 4a. Anteriormost tip of snout narrow and projected; dorsal surface of disc with numerous white spots and that of tail with white crossbars.*B. parmifera* (Bean)
- 4b. Anteriormost tip of snout wide and not projected; dorsal surface of disc and tail with neither white spots nor white crossbars.*B. simoterus* (Ishiyama)
- 5a. Snout long, preorbital snout length more than 75% of head length; interdorsal space wide, more than a half of D_1 base length; anterior part of ventral surface of disc with prickles; clasper with pseudosiphon 1.*B. aleutica* (Gilbert)
- 5b. Snout shorter, preorbital snout length less than 75% of head length; interdorsal space narrow, less than a half of D_1 base length; ventral surface of disc smooth, except for anteriormost tip of snout; clasper without pseudosiphon 1.6
- 6a. Interorbital space always wider than orbit length; ventral surface of tail almost entire-

- ly whitish.....7
- 6b. Interorbital space usually shorter than orbit length; ventral surface of tail almost entirely darkish.....
.....*B. interrupta* (Gill et Townsend)
- 7a. Maximum total length exceeds 950 mm; inner surface of dorsal lobe of clasper with two clefts, terminal bridge, ridge and pseudorhipidion, and that of ventral lobe with reduced projection only.....
.....*B. pseudoisotrachys* sp. nov.
- 7b. Maximum total length less than 900 mm even when matured; inner surface of dorsal lobe of clasper with pseudorhipidion and cleft only, and that of ventral lobe with projection, sentina and sentinel.....
.....*B. trachouros* (Ishiyama)
- 8a. Median tail thorns arranged at regular intervals.....9
- 8b. Median tail thorns arranged at irregular intervals.....20
- 9a. A row of median thorns from scapular region to origin of dorsal continuous.....
.....*B. lindbergi* Ishiyama et Ishihara
- 9b. A row of median thorns from scapular region to origin of dorsal interrupted on trunk, or no disc thorns present at all...10
- 10a. Ventral surface of disc and tail covered with prickles.....11
- 10b. Ventral side almost entirely smooth....13
- 11a. Disc with one to three median nuchal thorns.....*B. abyssicola* (Gilbert)
- 11b. No thorns at all on disc.12
- 12a. Interdorsal thorns present; posterior margin of five gill slits with prickles; lateral tail folds originating at midlength of tail*B. aguja* (Kendall et Radcliffe)
- 12b. Interdorsal thorns absent; posterior margin of five gill slits smooth; lateral tail folds originating at origin of tail.
.....*B. spinosissima* (Beebe et Tee-Van)
- 13a. Ventral ground color white; pelvic fins deeply incised.....
.....*B. diplotaenia* (Ishiyama)
- 13b. Ventral ground color dusky; pelvic fins moderately incised.....14
- 14a. Interorbital space narrow, less than 20% of head length.15
- 14b. Interorbital space wide, more than 20% of head length.....16
- 15a. Median nuchal thorns always present; inner margin of orbit whitish; clasper pointed distally, with both pseudosiphon 1 and 2; inner surface of ventral lobe of clasper with reduced projection only.....
.....*B. minispinosa* Ishiyama et Ishihara
- 15b. Median nuchal thorns usually absent, if present, a single one; inner margin of orbit colored as dorsal ground color; clasper roundish distally with pseudosiphon 1 only; inner surface of ventral lobe of clasper with projection, sentina and knife-like sentinel.....
.....*B. isotrachys* (Günther)
- 16a. Median nuchal thorns usually absent, if present, weak and less than three in number; caudal fin extending to ventral side of tail tip; inner surface of ventral lobe of clasper without any component.
.....*B. trachura* (Gilbert)
- 16b. Median nuchal thorns always present, strong and more than one in number; caudal fin developed only on dorsal end of tail; inner surface of ventral lobe of clasper with some components.....17
- 17a. Dorsal surface of disc scattered with many white markings.....
.....*B. maculata* Ishiyama et Ishihara
- 17b. Dorsal surface of disc without any white markings.....18
- 18a. Orbit length less than spiracle length; inner surface of ventral lobe of clasper without sentinel; maximum total length exceeding 1,200 mm
.....*B. caeluronigrincans* Ishiyama et Ishihara
- 18b. Orbit length as long as spiracle length; inner surface of ventral lobe of clasper with sentinel; maximum total length less than 1,050 mm.....19
- 19a. Dorsal ground color plum-brown; distance between distal margin of pseudosiphon 1 and clasper tip as long as length of pseudosiphon 1.....*B. matsubarai* (Ishiyama)
- 19b. Dorsal ground color greyish brown; distance between distal margin of pseudosiphon 1 and clasper tip longer than length of pseudosiphon 1.....
.....*B. notoroensis* Ishiyama et Ishihara
- 20a. Tail length always longer than precaudal body length; area above gill chamber with prickles; dorsal surface of disc scattered with many white markings; clasper with

- pseudosiphon 1.....*B. hubbsi* sp. nov.
 20b. Tail length usually less than precaudal body length; area above gill chamber smooth; dorsal surface of disc with dusky vermiculated patterns; clasper without pseudosiphon 1.....*B. violacea* (Suvorov)

Comparative material

1. *Bathyraja aguja* (Kendall et Radcliffe, 1912). USNM 65641, holotype, young female, 480 mm TL, *Albatross* St. 4653, off Aguja Point, 5°47'S, 81°24'W, 980 m depth, collected by W. C. Kendall and L. Radcliffe.

2. *Bathyraja aleutica* (Gilbert, 1895). USNM 48548, holotype, young male, 820 mm TL, *Albatross* St. 3257, north of Sannak Pass, Aleutian Is., 148 m depth, 1890, collected by C. H. Gilbert; 3 adult males and 3 adult females: MTUF 21973–21978, 1,058–1,156 mm TL, Bering Sea, 1963, collected by O. Kibesaki.

3. *Bathyraja caeluronigricans* Ishiyama et Ishihara, 1977. MTUF 21803, holotype, adult male, 1,206 mm TL, off Hachinohe, 41°0'N, 142°0'E, 300 m depth, Oct. 23, 1975, collected by the present authors; MTUF 21807, paratype, adult female, 1,154 mm TL, collected with the holotype.

4. *Bathyraja diplotaenia* (Ishiyama, 1952). FAKU 49463, holotype, adult male, 839 mm TL, off Erimo Pen., 41°40'N; 142°0'E, Oct. 18, 1948, collected by the junior author; Ishiyama 10947, paratype, adult female, 806 mm TL, off Kushiro, Hokkaido, Oct. 10, 1948, collected by the junior author.

5. *Bathyraja lindbergi* Ishiyama et Ishihara, 1977. MTUF 21820, holotype, adult male, 874 mm TL, Bering Sea, 57°47'N, 173°47'W, 570 m depth, June 12, 1963; MTUF 21823, paratype, adult female, 821 mm TL, Bering Sea, 57°15'N, 163°17'E, 160 m depth, July 5, 1963, each collected by O. Kibesaki.

6. *Bathyraja maculata* Ishiyama et Ishihara, 1977. MTUF 21870, holotype, adult male, 950 mm TL, Bering Sea, 59°10'N, 166°19'E, 450 m depth, May 22, 1963; MTUF 21871, paratype, adult female, 1,077 mm TL, Bering Sea, 61°07'N, 179°10'E, 245 m depth, July 2, 1963, each collected by O. Kibesaki.

7. *Bathyraja matsubarai* (Ishiyama, 1952). FAKU 49458, holotype, adult male, 1037 mm TL, off Erimo Pen., 41°30'N, 143°15'E, 830 m depth, May 20, 1951, collected by the junior author.

8. *Bathyraja minispinosa* Ishiyama et Ishihara, 1977. MTUF 21872, holotype, adult male, 768 mm TL, Bering Sea, 59°10'N, 166°19'E, 450 m depth, May 22, 1963; MTUF 21873, paratype, adult female, 711 mm TL, Bering Sea, 58°30'N, 175°10'W, 300 m depth, Oct. 20, 1962, each collected by O. Kibesaki.

9. *Bathyraja notoroensis* Ishiyama et Ishihara, 1977. MTUF 21817, holotype, adult male, 898 mm TL, off Notoro Pen., 44°0'N; 144°30'E, 600 m depth, Oct. 2–3, 1971, collected by the junior author; MTUF 21818, paratype, adult female, 968 mm TL, collected with the holotype.

10. *Bathyraja parmifera* (Bean, 1882). USNM 27651, holotype, adult female, 975 mm TL, Iliuliuk, Unalaska, Oct. 12, 1880, collected by T. H. Bean. 10 adult males and 6 adult females: MTUF 21911–21926, 864–994 mm TL, Bering Sea, 1962–1963, collected by O. Kibesaki.

11. *Bathyraja simoterus* (Ishiyama, 1967). FAKU 40136, holotype, adult male, 941 mm TL, Muroran, Hokkaido, 1938, collected by K. Matsubara.

12. *Bathyraja smirnovi* (Soldatov et Pavlenko, 1915). 5 adult males and 4 adult females: MTUF 21927–21935, 932–1,039 mm TL, Bering Sea, 1963, collected by O. Kibesaki.

13. *Bathyraja spinosissima* (Beebe et Tee-Van, 1941). SU 46500, holotype post-embryo male, 235 mm TL, south of Cocos Is., 4°50'N, 87°0'W, 1,400 m depth, June, 3, 1925, collected by W. Beebe and J. Tee-Van.

14. *Bathyraja trachouros* (Ishiyama, 1958). FAKU 49464, holotype, adult male, 878 mm TL, off Erimo Pen., 41°50'N; 143°20'E, May 19, 1951, collected by the junior author; FAKU 49465, paratype, adult female, 881.5 mm TL, collected with the holotype.

15. *Bathyraja violacea* (Suvorov, 1935). ZIAS 25073, 2 syntypes, immature males, 450, 500 mm TL, off west coast of Kamchatka Pen., 47–100 m depth, July, 1933, collected by E. K. Suvorov, only radiographs examined; 1 adult male and 1 adult female: MTUF 22030 and 22032, 641–713 mm TL, off Abashiri, 44°10'N; 144°20'E, 200–270 m depth, Oct. 2–3, 1971, collected by the junior author.

16. *Notoraja tobitukai* (Hiyama, 1940). FUMT P1558, holotype, immature female, 380 mm TL, Kumano-nada, Mie Pref., 60–500 m depth, April, 1940, collected by Y. Hiyama.

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- (HI: 10–11–203 Minamifujisawa, Fujisawa 251, Japan; RI: 1814 Yamaguchi, Tokorozawa 359, Japan)

北太平洋産ソコガンギエイ属の2新種並びに同海域産全種の検索表

石原 元・石山礼蔵

北太平洋からドロカスベ *Bathyrāja hubbsi* と、ソコガンギエイ *B. pseudoisotrachys* を新種として記載した。ドロカスベは体盤に肥大棘 thorn がなく、尾部肥大棘が等間隔に配列せず、背面全域が小棘 prickle におおわれることで、キタノカスベ *B. violacea* に最もよく似ている。両種は背面の斑紋、尾長、交接器の構成要素、腹椎骨数で区別される。田中(1927)は室蘭から得た標本を誤って *Raja isotrachys* Günther として記載していたことが判明した。従って前者ソコガンギエイは新種となり、後者はチャレンジャーカスベ(新称)とした。ソコガンギエイは背面の大小の棘の分布と、2個の cleft, terminal bridge, ridge といった特異な交接器の構成要素で、他の北太平洋産ソコガンギエイ類と区別される。*B. kincaidii* はベリングカスベ *B. interrupta* の同物異名とした。チヒロカスベ *B. abyssicola* とヤスダカスベ(新称) *B. trachura* の詳細な記載をした。本研究では北太平洋産ソコガンギエイ類を暫定的に21種と認め、その改訂検索表を作製した。

(石原: 251 藤沢市南藤沢 10–11–203; 石山: 359 所沢市山口 1814)