

## Sixgill stingray *Hexatrygon bickelli* collected from Tosa Bay (Rajiformes: Hexatrygonidae)

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The deep-sea stingray genus *Hexatrygon* Heemstra and Smith, 1980 is unique among rajiforms in having six gill openings (Nelson, 1994). Heemstra and Smith (1980) described *H. bickelli* from a single specimen washed up on a beach in South Africa, and established a new family and suborder based on its anatomical characteristics. Subsequently, four *Hexatrygon* species have been described on the basis of specimens from Hong Kong and Taiwan, though only one or two specimens were used in each original description: *H. longirostra* (Chu and Meng, 1981), *H. yangi* Shen and Liu, 1984, *H. brevirostra* Shen, 1986 and *H. taiwanensis* Shen, 1986. Although these species were thought to be separable from *H. bickelli* mainly by their snout length and shape, the original authors did not refer to its morphological change with growth. Smith and Heemstra (1991) examined newly born, juvenile and adult *Hexatrygon* specimens from Hawaii and South Africa, and revealed that this species exhibited a wide range in the relative length of the snout, strongly indicating that *H. bickelli* is the only valid species in the genus. Compagno and Last (1999) concluded the genus was probably monotypic.

On 1st April 2004, a large sixgill stingray was trawled from Tosa Bay off Saga Town, at about 120 m depth. The specimen is described herein as the first record of *Hexatrygon bickelli* from Tosa Bay. In addition, the scientific names given or applied to this fish by Japanese, Taiwanese and Chinese ichthyologists are discussed.

Measurements and counts follow Hubbs and Ishiyama (1968), and Heemstra and Smith (1980).

The specimen was fixed and preserved in 10% formalin, and was deposited in the Laboratory of Marine Biology, Faculty of Science, Kochi University (BSKU).

### *Hexatrygon bickelli* Heemstra and Smith, 1980

Japanese name: Mutsuera-ei

(Figs. 1-3, Table 1)

*Hexatrygon bickelli* Heemstra and Smith, 1980: 6 (holotype from southern coast of South Africa); Smith and Heemstra, 1986: 142; Smith and Heemstra, 1991: 142 (additional specimens from Hawaii and South Africa); Cheng and Zheng, 1987: 39 (key); Compagno and Last, 1999: 1477; Compagno, 1999: 494 (list); Compagno, 2000: 582 (list).

*Hexatrematobatis longirostrum* Chu and Meng in Zhu *et al.*, 1981: 111 (holotype from off Hong Kong, 300-1,000 m).

*Hexatrygon longirostra* : Ishihara and Kishida, 1984: 452; Nakaya, 1984a: 73, 1984b: 15; Yamada, 1993 (key): 142; Chave and Mundy, 1994: 308 (list, underwater photo. and observation, off Hawaii, 750-950 m); Nishida, 1997: 57 (photo. specimen from East China Sea); Chave and Malahoff, 1998: 61, 95 (list, underwater photo. and observation, off Hawaii, 750-970 m); Ishihara *et al.*, 1998: 17 (underwater video, Akinoshima, Ohshima Island, Izu Islands, 38 m); Senou and Hara, 2000: 1 (underwater photo. from Osezaki, Suruga Bay, 15-20 m; KPM-NI 4551, 1 specimen from Miyukigahama, Odawara, Sagami Bay); Yamada, 2000: 175 (key), 2002: 175 (key).

*Hexatrygon yangi* Shen and Liu, 1984: 111 (holotype from off Hong Kong, 350-1,000 m); Yamada and Tagawa, 1988: 1 (photo. specimen from East China Sea, 500 m); Chen and Joung, 1993: 82 (key).

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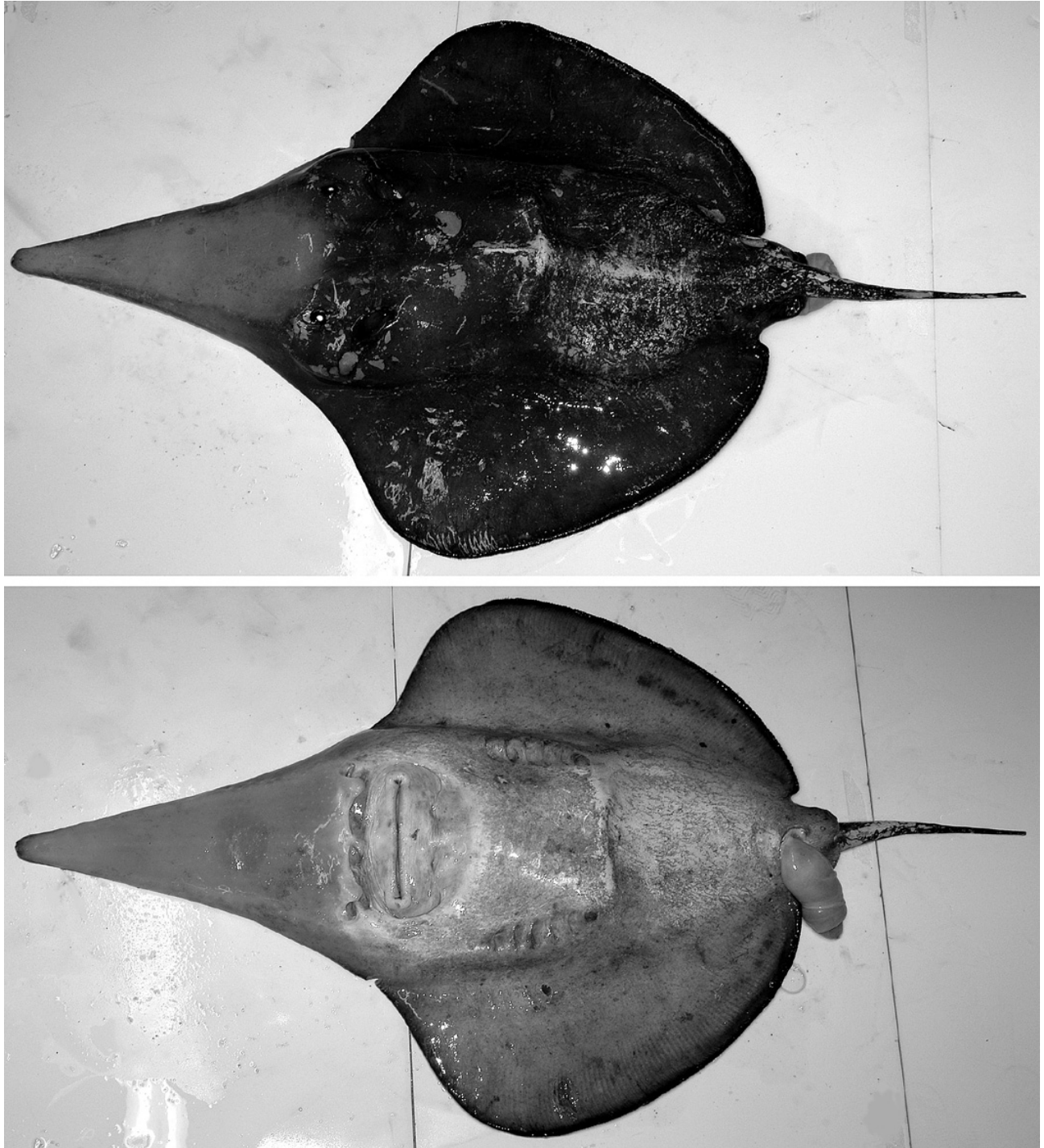


Fig. 1. Dorsal and ventral views of *Hexatrygon bickelli*, BSKU 87842, female, 1117+ mm TL, 664 mm DW.

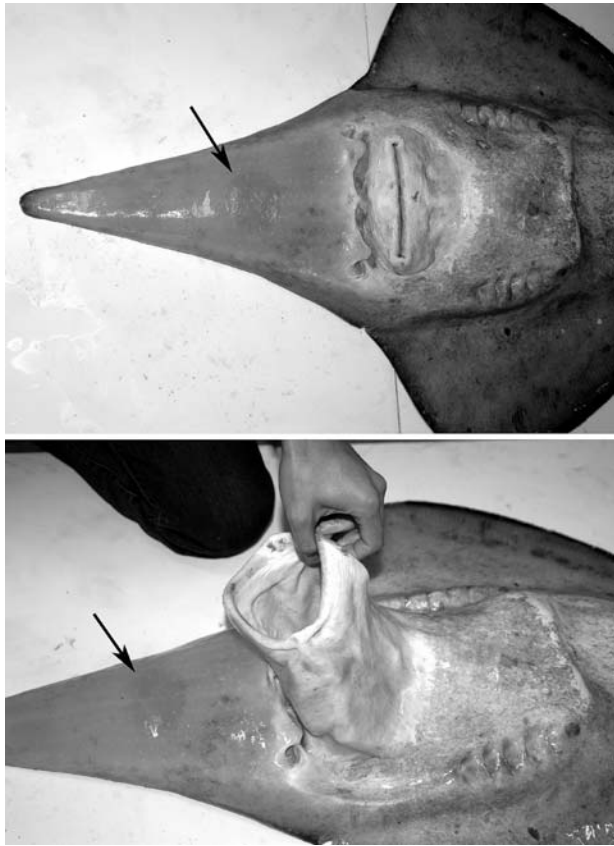


Fig. 2. Ventral views of snout (upper) and protruded jaws (lower) of *Hexatrygon bickelli*, BSKU 87842. Each arrow indicates a round patch of mucous organs on the surface.

*Hexatrygon taiwanensis* Shen, 1986a: 175 (holotype from Tung-kong fish market, south-western coast of Taiwan, 370 m); Chen and Joung, 1993: 81 (key).

*Hexatrygon brevirostra* Shen, 1986b: 106 (holotype from Tung-kong fish market, south-western coast of Taiwan, 362 m); Chen and Joung, 1993: 81 (key).

*Hexatrygon longirostrum*: Deng *et al.*, 1988: 57 (key).

*Hexatrygon* sp. A: Last and Stevens, 1994: 445 (5 specimens from off Finders Reef, Queensland and from Exmouth Plateau to Shark Bay, 900-1,120 m).

#### Material examined

BSKU 87842, 1 specimen, female, 1117+ mm TL (posterior end of caudal lost), 664 mm disk width (DW), 1st April 2004, Saga fishing port, Saga Town, Kochi Prefecture, ca. 120 m (Tosa Bay off Saga Town), bottom trawl.

#### Description

Measurements and counts are shown in Table 1. Disk heart-shaped, heavy and watery. Smooth skin

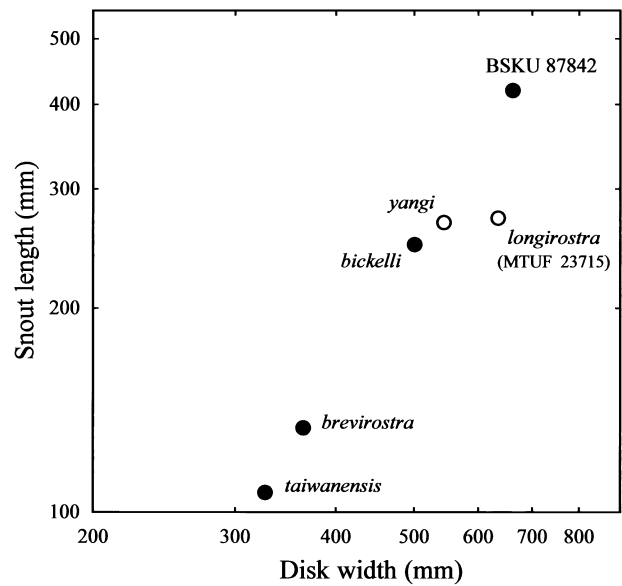


Fig. 3. Relationship between snout length (SnL) and greatest disk width (DW) in five nominal *Hexatrygon* species and the present specimen (BSKU 87842, 664 mm DW, 420 mm SnL). Data taken from the original descriptions of *H. bickelli* from South Africa (500 mm DW, 249 mm SnL), *H. yangi* from Taiwan (545, 267), *H. brevirostra* from Taiwan (365.2, 132.5), and *H. taiwanensis* from Taiwan (326, 106.8). Data for *H. longirostra* from the East China Sea (633, 272) taken from Ishihara and Kishida (1984). Open and solid circles indicate male and female, respectively.

lacks thorns and denticles. Snout elongated triangular, translucent, gelatinous, highly flexible. Eyes very small. Wide interspaces between eyes, spiracles and nostrils. Spiracles large about three times length of eyeball, positioned well behind eyes. Pelvic fin very small. Ampullae of Lorenzini and a round patch of dense mucus organs (indicated by arrows on Fig. 2) on ventral surface of snout. Nasal curtain wide. Mouth extremely protrusible ventrally. Tooth rows on upper and lower jaws 74 and 73, respectively. Six gill openings. Single stinging spine on tail, but broken near the base. Disk uniformly dark brown dorsally, pale brown to whitish ventrally with dark brown margins. Snout translucent, slightly brownish dorsally with dark margins. Eyes black. A round patch on ventral surface of snout pale orange in fresh specimen, white in preservative. Mouth white. Tail dark brown.

#### Distribution

East China Sea off Tokara Island; Pacific Ocean

**Table 1.** Comparison of characters between the holotype of *Hexatrygon bickelli* Heemstra and Smith, 1980 and the present specimen from Tosa Bay, Japan

	This study		Heemstra and Smith (1980)	
	BSKU 87842		<i>bickelli</i> (Holotype)	
	mm		mm	
Total length	1117+	% of DW	1030	% of DW
Disk length	867	134.0	640	128.0
Disk width (DW)	664		500	
Body depth	90	13.9	77	15.4
Head length	515	79.6		
Snout tip to anterior end of cloaca	840	129.8	600	120.0
Snout tip to end of pelvic fins	920	142.2	660	132.0
Snout tip to base of tail spine	1000	154.6	765	153.0
Preoral length	405	62.6	265	53.0
Prenarial length	375	58.0	243	48.6
Snout length	420	64.9	249	49.8
Mouth width	128	19.8	88	17.6
Distance between. lateral edges of nostril	183	28.3	138	27.6
Internarial width	104	16.1		
Nostril length	38	5.9	31	6.2
Distance from nostril to mouth	48	7.4	27	5.4
Distance from nostril to edge of disk	60	9.3	51	10.2
Nasal curtain length	74	11.4		
Interorbital width	147	22.7	117	23.4
Eyeball length	19.3	3.0	13.2	2.6
Eye diameter (transverse)	9.8	1.5	8	1.6
Pupil diameter	7.2	1.1	4.4	0.9
Least distance from eye to spiracle	34	5.3	41	8.2
Least distance between spiracles	141	21.8	101	20.2
Distance between. lateral ends of spiracles	199	30.8	152	30.4
Spiracle length	57	8.8	31	6.2
Width of 1st gill-opening	21	3.2	13	2.6
Width of 2nd gill-opening	27	4.2	14	2.8
Width of 3rd gill-opening	24	3.7	14	2.8
Width of 4th gill-opening	27.5	4.3	13	2.6
Width of 5th gill-opening	26	4.0	10	2.0
Width of 6th gill-opening	16.7	2.6	7.5	1.5
Distance between. 1st gill-openings	212	32.8	128	25.6
Distance between. 6th gill-openings	170.5	26.4	112	22.4
6th gill-opening to anterior end of cloaca	223	34.5	203	40.6
Width of tail at end of pelvic fins	30	4.6	35	7.0
Tail thickness	21	3.2	28	5.6
Tail width at base of spine	18.8	2.9	13	2.6
Tail depth at base of spine	16.3	2.5	17	3.4
Teeth rows on upper jaw	74		52	
Teeth rows on lower jaw	73		56	

off Shikoku Island (Tosa Bay); Pacific Ocean off Honshu Island (Wakayama, Aichi, Suruga and Sagami Bays, and Izu Ohshima); Indo-West and Central Pacific from South Africa to Hawaii, shore to continental slopes at depths from 15 m to 1,120 m (present study; Compagno and Last, 1999; Senou and Hara, 2000).

### Remarks

Most proportional and morphological characters of the present specimen agree well with those of the holotype of *H. bickelli* except for some proportional measurements that include the snout (Table 1), and the number of stinging spines. In all nominal *Hexatrygon* species and the present specimen, the length of snout (snout tip to front margin



of eye) shows a distinct positive allometry against the greatest disk width (Fig. 3). This change related with growth strongly supports the recent consensus of some authors that *H. bickelli* is the only valid species in the genus (Smith and Heemstra, 1991; Compagno and Last, 1999). Although the plot of *H. longirostra* on Fig. 3 seems to be distant from others, the MTUF (Museum, Tokyo University of Fisheries) photograph indicates that this specimen has an unnaturally shrunk snout (Ishihara and Kishida, 1984: fig. 2). Hence, the length of snout of this specimen seems to be underestimated. In this paper, we use *H. bickelli* as a valid name for the sixgill stingray. However, a revisional study based on a large sample size is needed for a clear understanding of the morphological variation in the nominal *Hexatrygon* species, and hence the taxonomy of the genus.

*Hexatrygon longirostra* from Okinawa Trough off the Tokara Islands is the first-recorded *Hexatrygon* in Japanese waters (Ishihara and Kishida, 1984; Nakaya, 1984a). Yamada and Tagawa (1988) obtained a single, probably young specimen of *Hexatrygon* from the East China Sea, and identified it as *H. yangi*. Japanese ichthyologists have regarded the Japanese *Hexatrygon*, except Yamada and Tagawa's (1988) record, as *H. longirostra* (Yamada, 1993, 2000, 2002; Ishihara, 1996; Nishida, 1997). Four additional *H. longirostra* specimens were known from the Pacific coasts off Honshu Island and the East China Sea of the Tokara Islands, southern district of Japan: East China Sea (Nishida, 1997), Sagami Bay (Senou and Hara, 2000), off Wakayama Prefecture (Goto, pers. com.) and off Irago Cape, Aichi Prefecture (Ishihara, pers. com.; Tanaka, 2003). Moreover, two swimming individuals of *H. longirostra* were observed by SCUBA divers at Akinoshima, Ohshima Island, one of the Izu Islands (Ishihara *et al.*, 1988), and Osezaki facing Suruga Bay (Senou and Hara, 2000). However, we think that the Far East *Hexatrygon* is also represented only by *H. bickelli*, and the present specimen fills a gap in its previous distribution in Japan from between the Pacific coasts off Honshu Island and from the East China Sea.

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土佐湾で採集されたムツエラエイ *Hexatrygon bickelli*  
(エイ目ムツエラエイ科)

遠藤広光\*・町田吉彦

和文要旨 2004年4月1日に高知県佐賀町沖の土佐湾の水深約120mにおいて、佐賀漁協の小型底曳き網漁船により、1個体のトビエイ亜目魚類(BSKU 87842, 体盤長867mm, 体盤幅664mm)が漁獲された。この標本は鰓孔が6対、吻が長くて寒天質に富む、眼が極めて小さい、噴水孔は大きくて眼からやや離れた後方に位置する、尾棘を持つことにより、ムツエラエイ科のムツエラエイ *Hexatrygon bickelli* Heemstra and Smith と同定された。日本周辺において、本種はトカラ列島沖の沖縄舟状海盆、和歌山沖、愛知沖、相模湾で各1個体の標本が採集され、伊豆大島沖の水深38mおよび伊豆半島大瀬崎の水深15-20mで遊泳個体がダイバーにより観察および撮影されているにすぎず、土佐湾から初めて報告される。ムツエラエイ属には、*H. bickelli*, *H. longirostra*, *H. yangi*, *H. taiwanensis*, *H. brevirostra* の5種が記載されているが、おもに吻の長さや形状がその識別形質とされていた。その後、これらの形質は成長に伴い変化することが示唆され、*H. bickelli* のみが有効種と考えられている。しかし、日本では *H. longirostra* の学名が広く使われてきた。本報告で既知標本の体盤長と吻長の関係を調べたところ、吻は明瞭な優成長を示すことが判明した。この結果は、本属が1種のみを含むとする最近の見解を支持する。

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