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A Second Record of the Deep-Water Skate *Notoraja subtilispinosa* from the Flores Sea, Indonesia

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The rajoid skate *Notoraja subtilispinosa* was recently described by Stehmann (1989) along with the resurrection of the originally subgeneric taxon *Notoraja* Ishiyama, 1958, at generic rank (type species: *Raja tobitukai* Hiyama, 1940). This species was based only on the early adolescent male holotype (415 mm TL) trawled by the MUSORSTOM-II expedition in November 1980 at 970 m depth off Manila in the South China Sea. Shortly after Stehmann's submission in March 1985 of his manuscript on *Notoraja*, the senior author was informed by Dr. Yoshihiko Machida of the Kochi University about a strange little skate trawled during a joint Indonesian-Japanese survey in 1985. When this specimen was made available for identification and study to the present authors it turned out to be a second record of *N. subtilispinosa* from much further south than the type locality. Unfortunately, although the original description of the latter species did not appear earlier than 1989, the second specimen from Indonesia could not be incorporated as a paratype. Hence, the second record of *N. subtilispinosa* will be described here and in part complement the original description. Internal meristics of the holotype were not available due to very poor calcification. All methods used herein are according to Stehmann (1989).

Notoraja subtilispinosa Stehmann, 1989
(New Japanese name: Hakuho-kasube)
(Figs. 1, 2)

Material examined. Juvenile female 270 mm TL. RV "Hakuho-maru", cruise KH-85-1, station B-2, 12 February 1985. 05°55.4′-54.4′ S, 119°29.5′ E; Flores Sea, south of Sulawesi; 558-593 m; 3 m S.-A. Beam Trawl. Collector: Dr. Y. Machida. Field collection number 292.

Description. Detailed morphometrics of external morphology and of cranium, as well as meristics, are given in Table 1.

The juvenile female from Indonesia generally conforms to the diagnosis of the adolescent male holotype (415 mm TL, MNHN 1985-134). A number of differences do exist, however, presumably correlated with the sex and size of both specimens, and these are given below.

The young female shows a more bluntly angled snout and a relatively wider and also somewhat longer disc. Anterior disc margins almost straight and only little longer than the posterior margins, so that the disc appears more symmetrically rhomboidal. The axis of maximum disc width is about 60% of disc length at the level of the shoulder girdle (Fig. 1).

Mouth with 70.1% of prenasal snout length and 94.5% of internasal width relatively wider than that of the holotype. Jaws almost straight (those of the male holotype moderately angled). Small teeth closely set in quincunx pattern; 33 rows in upper, 32 in lower jaw. Individual tooth broader than long with a transversally ovoid base and a flat crown bearing a very short conical cusp at inner corner. Cusps placed symmetrically medially in teeth near symphysis and shifted asymmetrically toward outer corner in more lateral tooth rows.

Anterior nasal flaps with very short fringes at outer edge. Outer margins of nasal curtain weakly undulated, being convex in anterior and concave in posterior half, and without lobelets and incisions. Any crenulated fold across posterior nasal curtain surface lacking; posterior margin strongly directed forward and finely crenulated along its short edge.

Tail longer than body, slender and gradually tapering toward its tip. In cross-section, a low and rather wide trapezoid anteriorly, semicircular posteriorly. Tail length to D1 about 45%, to tip 58% of TL and only 1.1 times the disc width. Lateral tail folds distinct along posterior two thirds of tail length originating about one orbit length posterior to pelvic tips and terminating at two thirds the postdorsal tail length. Two small dorsal fins of about equal size and shape closely set with a short space between them. Both fins about parallelogram-shaped, each with a steeply rising straight anterior margin and horizontally straight upper and straight posterior margins, the latter strongly inclined forward, with a long and pointed apex. A distinct upper caudal fold originating some distance behind D2 base end; the less deep lower caudal fold only about two thirds as long as

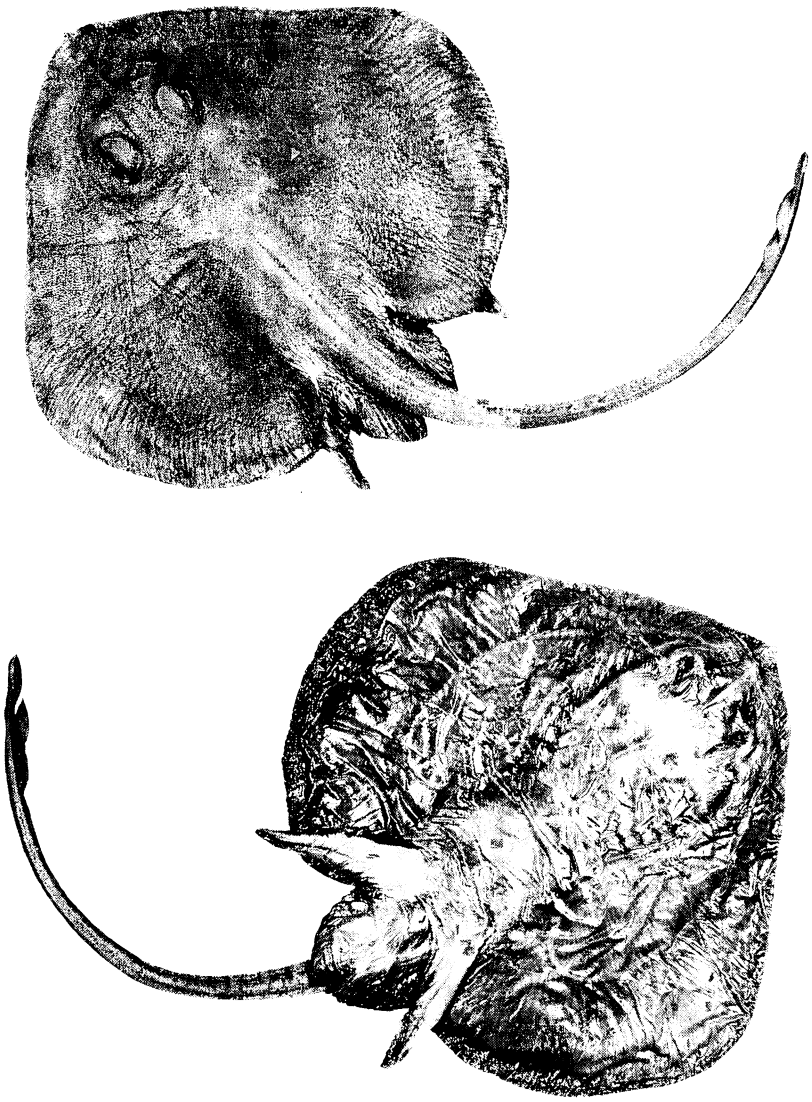

Fig. 1. Second specimen of *Notoraja subtilispinosa* in dorsal and ventral views. Juvenile female, 270 mm TL, Flores Sea.

the upper one.

Squamation of the young female exactly of the kind as characterized by the species name. Entire upper side very densely and evenly set with fine spinules, velvet-like to touch, except for smooth process at snout tip, narrow anterior and posterior disc edges and anterior pelvic lobes; posterior pelvic lobes with a central patch of spinules posteriorly. Sides of tail densely set with somewhat coarser spinules, the tips of the latter curved, encroaching onto lateral tail folds too. Both dorsal fins and upper caudal fold largely spinulose. A shallow median dorsal groove running from behind shoulder girdle onto anterior third of tail. This groove on body totally set with spinules like remainder of disc, but the spinules within the groove much more sparsely distributed from about pelvic axils on back of tail toward first dorsal fin. Along back of tail, flattening narrowly in posterior two thirds, an irregular double row of very small, clawlike curved thorns with strongly com-

pressed and smooth bases. About 35 thorns placed in each row within the groove and further on, decreasing in size posteriorly. No other thornlets or thorns on dorsal side. Interdorsal space with spinules only. Ventrally, disc and pelvic fins perfectly smooth. Underside of tail very different in being totally and densely set with curved spinules, including lateral tail folds, like those on tail sides. A smooth narrow wedge-shaped median stripe from origin of tail to level of pelvic tips.

Upper side of disc of the alcohol preserved specimen plain dusky bluish with some shading of brown. Back of trunk and tail somewhat marked off brownish. None of sensory canals and pores on disc marked by any color. Process at snout tip pale, as well as edges of pectoral and pelvic axils. Lateral tail folds blackish. Dorsal and caudal fins dusky bluish like disc but their apices blackish.

Underside of disc (Fig. 1) dusky bluish as above, but with centrally brown musculature, gills and intestines shining through semitransparent skin only loosely attached and appearing folded. Sensory canals vaguely indicated by pale greyish color. Jaws white, with a lighter greyish-brown transverse band running along lower jaw. Mouth cavity light. Nasal flaps and nasal curtain totally dark, underside of the latter also darkly pigmented. Anus with pale brownish margin, insertion of pelvic lobes similarly

Table 1. Morphometric measurements of the second specimen of *Notoraja subtilispinosa* from Indonesia in per cent of total length, of cranial proportions in per cent of nasobasal length (from X-ray), plus a few actual measures and meristics (most from X-ray). Corresponding data of the holotype (MNHN 1985-134) are also shown.

	Present specimen	Holotype
Total length	270.0 mm	415.0 mm
In per cent of total length		
Disc, width	53.3	46.3
length	46.7	43.9
Snout, preorbital length	11.6	11.6
preoral length	13.1	12.4
prenasal length	9.0	9.0
Orbit diameter	5.6	4.0
Interorbital width	3.4	3.3
Spiracle length	3.1	2.2
Interspiracular width	7.2	6.2
Orbit+spiracle	5.6	5.0
D1, height	1.5	1.5
base length	3.0	3.4
D2, height	1.7	1.5
base length	3.7	3.1
Distance D1—D2	0.7	0.0
C, upper base length	4.9	4.3
Tail, postdorsal length	5.7	5.0
height at V-tips	2.3	1.9
width at V-tips	3.1	2.9
height at D1—origin	1.0	0.8
width at D1—origin	1.1	1.0
Lateral tail fold length	35.6	52.3
Head length, ventrally	24.8	23.7
Mouth width	6.3	5.8
Internasal width	6.8	6.8
Nasal curtain, length	4.6	5.0
width each lobe	1.7	1.9
distance between lobes	4.2	4.5
Gill slits length, 1st	1.2	1.5
3rd	1.4	1.5
5th	1.0	0.9
Interbranchial width, 1st	13.0	11.5
5th	8.2	7.1
V, length anterior lobe	13.9	14.3
length posterior lobe	13.9	14.0
Snout to middle of anus	41.3	39.1
to axis max. disc width	27.8	28.9
Middle of anus to D1	45.6	48.7
to D2	48.9	52.0
to tail tip	58.0	59.8
Angle of snout	111°	94°
Tooth rows on upper jaw	33	35
Pseudobranchial folds l./r.	9/10	9/9
Vtr	26	?
Vprd	66	?
P-rays l./r.	65/65	?
V-rays l./r.	20/20	?
Nasobasal length	27.0 mm	38.3 mm
In per cent of nasobasal length		
Cranial length	192.6	190.6
Rostrum length	91.9	87.7
Max. cranial width	115.6	118.8
Interorbital width	34.1	34.5
Rostral base width	12.2	15.7
Min. width basal plate	27.4	30.3
Internasal width	14.8	12.3
Scapulocoracoid length (mm)	15.7	21.3
Pre-msc-length (mm)	6.1	8.5
Post-msc-length (mm)	9.6	13.0
Max. width shoulder girdle (mm)	35.5	?
pelvic girdle (mm)	22.5	?

marked. Pale spot at origin of tail along a loose fold connecting both pelvic axils. Underside of tail marked off by a medium brownish-grey, except for its blackish tip and lateral folds.

The holotype was largely de- or uncalcified, so that radiographs could not provide much skeletal information. The present female printed well on radiographs and thus offers additional descriptive information, though it has not been dissected at all.

Cranial features well in accordance with holotype. However, anterior half of rostral process and its delicate terminal appendices not shown up in radiographs but controlled by touch and under transmittent light. Except for these measurements, the other relevant cranial proportions given in Table 1. Rostrum relatively a little longer with 47.7% of total cranial and about 92% of nasobasal length. Width of rostral base somewhat narrower with only 12% of nasobasal length. Only tip of very narrow anterior fontanelle shown in radiographs, terminating about level with front edges of nasal capsules. The latter with nasobasal fenestrae indicated, and the almost straight posterior edges set at 62° angle to longitudinal cranial axis.

Radiographs of the scapulocoracoids clearly show an anterior bridge across the anterior fenestra, one large postdorsal and three small postventral foramina. The ratio of pre-msc-length : post-msc-length is 1 : 1.6. Maximum width of shoulder girdle 1.6 times that of pelvis.

Pelvic girdle (Fig. 2) with a massive transverse bar, two small iliac foramina each side, short and pointed prepelvic processes, and short inward and forward curving iliac processes. Anterior contour of the bar slightly convex, posterior contour a deep, evenly ellipsoid arc. Skeletal meristics, which were not available for the holotype, also given in Table 1.

Remarks. With regard to the interspecific comparison between *N. tobitukai* and *N. subtilispinosa*, as given by Stehmann (1989: 259), our examination of the second specimen of the latter species has necessitated some changes. In *N. subtilispinosa* the rear margins of the nasal curtain may be smooth or crenulated; a separate crenulated fold across posterior nasal curtain surface is not characteristic of this species but may rather be an individual abnormality of the holotype. The vertebral counts of *N. subtilispinosa* (Vtr: 26, Vprd: 66) are within the range of 24–27 Vtr and 63–70 Vprd given for *N. tobitukai* by Ishiyama (1958: table 9). Pectoral finray counts also

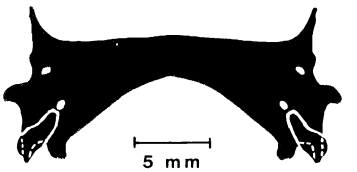

Fig. 2. Pelvic girdle of *Notoraja subtilispinosa* in dorsal view, juvenile female, Flores Sea. Somewhat schematized after radiograph.

appear to overlap, being 67 in *N. tobitukai* (ISH 30/84) and 65 in the female *N. subtilispinosa*. The validity of the genus *Notoraja* is thus also confirmed by the low (24–27) Vtr counts (vs. more than 29 in the genus *Bathyraja*) in this species and *N. tobitukai*.

N. tobitukai has so far been reported from relatively deep water (300–1,000 m) from off southern Japan to the Okinawa Trough (Nakaya, 1984) but may also occur further southward. The second record of *N. subtilispinosa* indicates a wider distribution beyond the South China Sea in the Southeast Asian deep water basins and on the slopes of that region, though possibly somewhat deeper than its congener.

Acknowledgments

The authors are indebted to Prof. Dr. O. Okamura and Dr. Y. Machida (Kochi Univ.), who made the specimen available for our investigation and kindly permitted to publish this second record. Gudrun Schulze (ISH) assisted technically and typed Table 1.

Literature cited

Ishiyama, R. 1958. Studies on the rajid fishes (Rajidae) found in the waters around Japan. J. Shimonoseki Coll. Fish., 7(2, 3): 193–394, pls. 1–3.

Nakaya, K. 1984. Chondrichthyes. Pages 36–77, 293–313 *in* O. Okamura and T. Kitajima, eds. Fishes of the Okinawa Trough and the adjacent waters. I. Japan Fisheries Resource Conservation Assoc., Tokyo, 414 pp.

Stehmann, M. 1989. Resurrection of *Notoraja* Ishiyama, 1958 and description of a new species of deep-water skate from the South China Sea, *Notoraja subtilispinosa* sp. nov. (Pisces, Batoidea, Rajidae). Pages 247–260 *in* J. Forest ed. Resultats des Campagnes MUSORSTOM, Vol. 4. Mem. Mus. Natn. Hist. Nat., (A), 143.

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ハクホウカスベ（新称）の2番目の記録

石原　元・Matthias Stehmann

東京大学海洋研究所研究船白鳳丸の1985年航海でスラウェシ南方のフローレス海の水深約600mからハクホウカスベ（新称）*Notoraja subtilispinosa* が採集された．本種はStehmann (1989) によりマニラ沖の南シナ海の水深 970m から holotype 1個体に基づいて記載され，本記録が2番目となる．原記載に欠けていた脊椎骨数，胸鰭・腹鰭条数，腰帯を記載した．また，原記載の diagnostic character である nasal curtain 後縁近くにある鋸歯状の皮褶は holotype の奇形に過ぎない事が判明した．なお，Stehmann (1989) はいくつかの重要な形質で本種とトビツカエイがソコガンギエイ属 *Bathyraja* 魚類とは異なるとしてトビツカエイ属 *Notoraja* をソコガンギエイ属から独立させた．本標本の腹椎骨数 (26) はトビツカエイのそれの変異 (24–27) に含まれるが，ソコガンギエイ属のそれの変異（29以上）には含まれず，この処置が妥当であった事が確かめられた．トビツカエイは北西太平洋の深海 (505–1,000m) に分布するのに対して，ハクホウカスベはインド・太平洋の中央部の深海 (600–970m) に分布すると考えられる．

（石原：113 東京都文京区弥生1–1–1　東京大学農学部水産学科；Stehmann：ドイツ連邦共和国ハンブルク水産研究所魚類部門）