

## ***Pastinachus stellurostris* sp. nov., a new stingray (Elasmobranchii: Myliobatiformes) from Indonesian Borneo**

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**ABSTRACT.**— A new dasyatid stingray, *Pastinachus stellurostris* sp. nov., is described from a few specimens collected from Indonesian Borneo, near Pontianak (West Kalimantan). It shares with *P. solocirostris*, which occurs in the same bioregion, a similar disc shape and a spiny, angular snout. The first specimen collected was initially confused with *P. solocirostris* until molecular analysis indicated that two related species exist in the region. *Pastinachus stellurostris* can be distinguished from *P. solocirostris* in having broad, star-shaped (rather than narrow and lanceolate) denticles on the snout and a row of well-developed thorns along the mid-line of the back and tail (otherwise absent). It also differs slightly in disc morphometry and has a more slender ventral tail fold. This species was not collected in other recent surveys of Indo-West Pacific elasmobranchs, including eastern Indonesia, and its confirmed range is confined to the brackish/freshwater habitats of the Kapuas River estuary and in coastal parts of western Borneo. A similar ray collected in freshwater in the Bang Pakong River (Thailand) may be conspecific with this species.

**Key words:** *Pastinachus stellurostris* – new species – stingray – Dasyatidae – Borneo – Indonesia

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### INTRODUCTION

In July 2007, an adult male specimen of a new species of cowtail ray was collected at Sungai Kakap fish market near Sepuk Laut (Kalimantan) by an international research team led by Dr. Janine Caira during a survey of the biodiversity the Borneo chondrichthyans and their parasites. This species was initially misidentified by the field team as the Roughnose Stingray, *Pastinachus solocirostris* Last Manjaji & Yearsley, 2005, due to its strikingly similar morphology to that species, particularly in its relatively elongate disc and very angular, spiny snout. *Pastinachus solocirostris* is reasonably common in this bioregion so this specimen was dissected for parasites and discarded. Fortunately, due to the rigorous field collecting procedures adopted by the parasite team, where detailed images and tissue samples are taken from all potential parasite hosts dissected, important details of the morphology of this ray were retained. Molecular analysis by one of us, Gavin Naylor, later demonstrated that this specimen was not conspecific with *P. solocirostris*. This finding led to detailed scrutiny by the senior author of the excellent series of images available of this specimen, confirming that these two rays were also morphologically distinct.

A second specimen, identified as *P. solocirostris*, was independently collected by another of us (Fahmi) in 2005 on an earlier field trip to Kalimantan. It was deposited in LIPI's elasmobranch collection (Ancol, Jakarta) where it was later re-examined and confirmed to be conspecific with our new stingray. In 2009, a search for additional type material yielded two other specimens, including the adult male holotype and a large female. This new cowtail stingray is described and named below.

### METHODS

Characteristics of the disc (including squamation, tooth row counts and meristic counts) follow standards adopted by Compagno & Roberts (1982), Manjaji (2004), Last *et al.* (2006) and Manjaji-Matsumoto & Last (2006). Meristics were obtained from radiographs and morphometric methods generally follow Compagno & Heemstra (1984) and Last & White (2008). Additional characters were derived by Last *et al.* (2005) to account for characteristic features of the tail; the shape of the tail and its associated ventral skin fold are important in distinguishing different species of the genus *Pastinachus*

so tail widths and depth (height) were recorded at the origin and insertion of the skin fold, as well as at quartile intervals along its length. A paratype (CSIRO H 7110–01) was radiographed but meristic details were not available for other material due to difficulties in accessing all material from Indonesia. A non-type specimen (MTUF P 30003) from Thailand is included after the holotype in the meristics and in Table 1.

A total of 54 measurements, expressed as proportions of disc width (DW, see Table 1), were taken for the holotype and the two paratypes, as well as from another specimen from Thailand which is possibly conspecific. Molecular data has been extracted from a broader NADH analysis of the Borneo chondrichthyan fauna by G. Naylor, J. Caira and K. Jensen. In the molecular trees, field codes (prefixed by BO, BOD, CM, DF or KA) are provided for samples collected by Drs J. Caira and K. Jensen, and data and images for these specimens are available at <http://tapeworms.uconn.edu>.

Specimens examined are deposited at the Australian National Fish Collection, Hobart, Australia (CSIRO), the Museum Zoologicum Bogoriense, Cibinong, Indonesia (MZB), and the Tokyo University of Fisheries, University

Museum, Tokyo, Japan (MTUF). Field accession numbers for specimens collected on the NSF elasmobranch project (NSFEP) in Kalimantan, which were photographed but not retained, are prefixed with the letters KA. The comparative material of other *Pastinachus* species is extensive, and is based on additional non-retained field specimens, and material referred to in published and unpublished manuscripts prepared by one or more of the authors.

## FAMILY DASYATIDAE

### Genus *Pastinachus* Rüppell, 1829

**Type species.** *Raja sephen* Forsskål 1775, by subsequent designation

**SPECIES.**— *Pastinachus* includes five valid nominal species: *P. atrus* (Macleay, 1883), *P. gracilicaudus* Last & Manjaji-Matsumoto, 2010, *P. sephen* (Forsskål, 1775), and *P. solocirostris* Last, Manjaji & Yearsley, 2005, and *P. stellurostris* sp. nov.



**Figure 1.** *Pastinachus stellurostris* sp. nov., adult male holotype (MZB 18226, 422 mm DW, preserved): dorsal surface.



**Figure 2.** *Pastinachus stellurostris* sp. nov., female paratype (NCIP 6338, 413 mm DW, preserved): ventral surface.

***Pastinachus stellurostris* sp. nov.**

Figs 1–6, 7a, 8, 9, Table 1

**Holotype.** MZB 18226 (formerly NCIP 6339), adult male 422 mm DW, Sungai Pinyuh fish market, caught near Pemangkat (West Kalimantan), Indonesia, ca 01°10' N, 108°58' E, 05 Aug. 2009.

**Paratypes.** 2 specimens: CSIRO H 7110–01, adult male 415 mm DW, Flamboyan Market, Pontianak, West Kalimantan, Indonesia, 20 Oct. 2005; NCIP 6338, female 413 mm DW, collected with holotype.

**Other material.** 2 specimens: NSFEP KA 306 (specimen not retained), adult male 428 mm DW, near Sepuk Laut, West Kalimantan, Indonesia, 00°12'51.60" S, 109°05'00.30" E, 27 Jul. 2007; MTUF P 30003, immature male 235 mm DW, Bang Pakong River (ca 60 km from mouth), Thailand, 13 Nov. 1997.

**DIAGNOSIS.**— A relatively small *Pastinachus* with the following combination of characters: snout relatively acute, angle about 117°, covered to apex with enlarged denticles with broad stellate crowns; short pungent thorns along midline of tail before sting; nuchal thorns pearl shaped; disc length 93–98% DW; head length 44–45%

DW; preoral length 19–20% DW; distance between nostrils about 8% DW; distance between first gill slits 19–21% DW; tail compressed above midbase of ventral cutaneous fold, width 0.6–0.9 times its height; ventral fold relatively long and very slender, its length 1.1 times DW, 52–62 times its depth below its midbase; ventral fold depth 1–1.4 times tail height at its midbase; distance from cloaca to sting 1–1.1 times precloacal length; pectoral-fin radials about 117; post-synarcual monospondylous vertebral centra about 36; ventral fold much paler basally than distally.

**DESCRIPTION.**— Disc quadrangular, anteriorly angular and slightly produced; width slightly longer than length, 1.06 times length in holotype (1.02–1.08 in paratypes); axis of greatest width of disc barely in advance of nuchal thorns, 2.08 (2.06–2.11) times in distance from tip of snout to pectoral-fin insertion; body thickness 6.37 (6.62–6.78) times in disc width, barely raised above cranium (marginally more so above nuchal area); anterior margin of disc weakly concave beside eye, almost straight before apex; pectoral apex broadly rounded, posterior margin moderately convex, free rear tip narrowly rounded. Pelvic fin subtriangular; anterior margin undulate, concave near base, convex medially,

**Table 1.** Body proportions expressed as percentages of disc width for the adult male holotype (MZB 18226) of *Pastinachus stellurostris* sp. nov., and ranges for two paratypes from Borneo and a non-type specimen from Thailand (MTUF P 30003).

	Holotype	Paratypes (n=2)		MTUF specimen
		Min.	Max.	
Disc, width (mm)	422	413	415	235
Total length	334.6	319.6	351.8	402.9
Disc, length (direct)	94.3	92.8	97.6	94.6
Disc, thickness	15.7	14.8	15.1	16.2
Disc, end of orbit to pectoral insertion	57.8	57.3	59.1	58.4
Disc, snout to maximum width	38.3	39.4	40.0	44.9
Head length (direct)	44.3	43.7	45.1	45.8
Snout, preorbital (direct)	20.7	20.8	22.4	22.4
Snout, preoral (direct)	19.0	19.3	19.5	19.9
Snout, prenasal (direct)	15.3	14.7	14.8	14.9
Orbit diameter	4.7	4.4	4.8	4.8
Eye diameter	2.5	2.6	2.8	3.0
Inter-eye width	15.7	15.8	16.6	17.5
Orbit and spiracle length	9.2	8.7	9.8	10.0
Spiracle length	6.5	6.5	7.7	7.1
Interspiracular width	16.5	16.6	17.6	18.7
Mouth width	8.2	8.6	8.6	8.6
Nostril length	3.6	3.7	3.7	3.3
Nasal curtain, length	5.7	5.6	6.0	6.3
Nasal curtain, width	10.1	10.4	10.5	11.0
Internasal width	7.9	7.9	8.0	8.6
Width, 1 <sup>st</sup> gill slit	3.1	3.0	3.1	3.3
Width, 5 <sup>th</sup> gill slit	2.3	2.5	2.6	2.5
Distance between 1 <sup>st</sup> gill slits	20.7	19.0	20.8	21.9
Distance between 5 <sup>th</sup> gill slits	13.8	12.9	13.4	13.8
Pelvic fin, length	21.6	22.2	24.1	26.9
Pelvic-fin base, width	21.6	22.1	22.4	17.3
Tail width, axil of pelvics	11.9	11.7	11.8	11.5
Tail height, axil of pelvics	6.5	6.5	6.7	6.5
Tail width, base of sting	3.7	3.2	3.5	3.4
Tail height, base of sting	3.2	3.2	3.2	3.6
Ventral fold, length	110.2	109.9	111.6	123.4
Tail filament length	71.1	50.1	86.3	130.2
Tail width, fold origin	4.0	4.0	4.1	4.8
Tail depth, fold origin	3.1	3.0	3.2	3.7
Tail width, at 25% base length of fold	1.9	1.7	1.8	2.1
Tail depth, at 25% base length of fold	2.2	1.9	2.0	2.6
Fold depth, at 25% of its base length	2.3	2.3	2.5	3.9
Tail width, at mid-base length of fold	1.3	1.1	1.1	1.5
Tail depth, at mid-base length of fold	1.5	1.6	1.8	2.0
Fold depth, at its mid-base	2.1	1.8	2.0	5.1
Tail width, at 75% base length of fold	0.8	0.8	0.9	1.2
Tail depth, at 75% base length of fold	1.2	1.2	1.3	1.5
Fold depth, at 75% of its base length	1.2	1.1	1.3	4.3
Tail width, insertion of fold	0.7	0.6	0.7	1.0

**Table 1.** cont'd.

	Paratypes (n=2)			MTUF specimen
	Holotype	Min.	Max.	
Tail depth, insertion of fold	0.8	0.8	0.8	1.1
Fold origin-sting origin, length	2.3	2.0	4.1	5.4
Sting length	–	–	–	28.6
Snout to origin of cloaca	77.3	77.6	78.7	78.2
Cloaca origin to sting	77.0	80.0	84.0	78.1
Cloaca origin to tail tip	257.3	240.9	274.2	324.8
Cloaca length	6.5	6.7	6.7	6.0
Clasper, postcloaca length	25.9	–	26.3	13.0
Clasper, length from pelvic axil	13.5	–	14.4	4.7

almost straight posteriorly; posterior margin straight to weakly convex; apex angular; free rear tip broadly rounded; length moderate, 21.6% (22.2–24.1%) DW, subequal to width across fin base in holotype and male paratype (i.e. 0.99, 1.00), 1.09 times longer in female paratype. Tail moderately elongate, postcloacal tail 3.33 (3.06–3.53) times precloacal length; base depressed, width 1.81 (1.78–1.81) times height, weakly convex above and below, narrowly rounded laterally; tapering gently and evenly to origin of sting, width 1.29 (1.29–1.33) times height at fold origin; strongly tapering, naked post-sting groove on dorsal surface, tail slightly depressed at end of groove; at mid-fold moderately compressed, oval, width 0.86 (0.61–0.67) times height; at end of fold weakly compressed, width 0.92 (0.83–0.88) times height; finely filamentous, becoming depressed towards tail apex; no folds present along lateral margin of anterior pre-sting tail. Ventral cutaneous fold very slender, length 0.91 (0.90–0.91) in disc width, 2.34 (2.19–2.46) in postcloacal tail; origin 2.3% (2.0–4.1%) DW before sting origin; depth at quarter length 1.05 (1.22–1.26), at mid length 1.43 (0.99–1.24), at three quarter 0.98 (0.86–1.00) times tail height; margin of terminal quarter of fold not strongly indented in holotype, not terminating abruptly, continuing much more than orbit diameter along tail as a low, barely detectable ridge; distance from cloaca to sting origin 1.00 (0.94–0.97) in precloacal length; post-fold tail length 1.55 (1.29–2.19) in fold length, 3.62 (3.18–4.18) in tail length. No U-shaped clusters of sensory pores submarginal on posterior disc. Lateral line on ventral surface indistinct.

Snout moderately elongate, acute at apex with small, triangular apical lobe; angle 117 in paratype CSIRO H 7110–01; acutely subtriangular when viewed laterally, becoming strongly depressed towards apex, preoral snout length 2.31 (2.23–2.26) times mouth width, 2.41 (2.44–2.44) times internarial distance, 0.92 (0.93–1.02) times distance between first gill slits; direct preorbital snout length 1.92 (1.96–1.98) times interorbital length; snout to maximum disc width 2.61 (2.50–2.54) times in

DW; interorbital space very broad, weakly convex to flat; eyes small, dorsolateral, elevated and protruding slightly, ventral margin partly covered by thin, fleshy skin fold; orbit weakly fused into head, obvious, diameter 1.40 (1.49–1.59) in spiracle length, eye diameter 2.62 (2.50–2.70) in spiracle length; inter-eye distance 6.29 (5.84–6.09) times eye diameter length. Spiracles suboval, greatly enlarged, opening dorsolateral. Nostril slit-like, curved, directed posterolaterally; anterior margin fleshy; anterior nasal fold internal, thin, membranous; posterior lobe more greatly expanded and fleshy than anterior lobe, partly concealed beneath nasal curtain; oronasal groove present; internasal distance 1.93 (1.85–1.87) in prenasal length, 2.18 (2.15) times nostril length. Nasal curtain distinctly bilobed, relatively elongate, long, flat, with no obvious longitudinal medial groove, almost smooth, width 1.76 (1.76–1.85) times length, posterolateral apex recessible within lateral margin of oronasal groove; lateral margin slightly convex distally, smooth edged; posterior margin very finely fringed (obscure), strongly concave, following contour of lower jaw, overlaying symphysis of lower jaw when mouth closed. Jaws strongly asymmetric. Upper jaw very strongly arched, symphyseal part of jaw projecting posteroventrally, forming a perpendicular angle with anterior lateral teeth (jaw not dissected but appears to be typical of other members of the genus). Lower jaw interlocking upper jaw when mouth closed; mouth not protrusible; skin on chin not especially fleshy, weakly papillose to almost smooth; oral papillae and tooth morphology not examined.

Gill openings strongly S-shaped, forming a unfringed lobe; length of first gill slit 1.36 (1.18–1.20) times length of fifth gill slit, 2.68 (2.81–2.88) times in mouth width; distance between first gill slits 2.62 (2.40–2.62) times internasal distance, 0.47 (0.43–0.46) times ventral head length; distance between fifth gill slits 1.75 (1.64–1.68) times internasal distance, 0.31 (0.30) times ventral head length.

Dorsal disc mostly covered in denticles; main denticle band extending to disc margin anteriorly, to about distance equivalent to preorbital snout length from pectoral-fin apex, posterior part of disc with minute, widely spaced denticles; narrow naked strip extending anteriorly from pectoral-fin insertion; pelvic fins and claspers naked; rim of eye and posterior extremity merging into spiracle naked; denticles present on distal half of posterior wall of spiracle. Denticle band with 2 well-separated pearl thorns; thorns very similar in size, elevated above disc, separated by slightly less than their length, their dorsal margin strongly convex when view laterally; denticles on mid-disc and interorbital space distinctly larger than those laterally, also slightly more widely spaced than those laterally; denticles in lateral part of band similar in size, not becoming progressively smaller towards lateral margin of band; lateral margin of band with longitudinal denticle rows often separated by very narrow naked strips; denticles covering entire snout, less densely arranged than those on mid-disc, much larger than those along lateral margin but much smaller than those of mid-disc; denticle band merging with tail at pectoral-fin insertion, not truncate or laterally expanded. Tail with single row of small, variably spaced, pungent thorns; thorns short-based, semi-upright, short lanceolate, commencing above pelvic-fin insertion, decreasing in size posteriorly, merging in size with tail denticles before sting; entire



**Figure 3.** *Pastinachus stellurostris* sp. nov., female paratype (NCIP 6338, 413 mm DW, preserved): dorsal head.



**Figure 4.** Oronasal region of *Pastinachus stellurostris* sp. nov., adult male paratype (CSIRO H 7110–01, 415 mm DW, preserved).

dorsal and dorsolateral surfaces of tail covered with small denticles at tail base, tail band covering more than three quarters of dorsal surface of most of tail before skin-fold origin (but edges naked when viewed dorsally); denticle band descending ventrally just posterior to fold origin to cover most of lateral surface of tail; ventralmost portion adjacent tail fold naked; skin fold naked, smooth or with fine posteroventrally directed striae. Single irregular series of keel-like denticles along dorsal midline of tail behind sting; denticles sparse, elevated, upright, compressed, subtriangular, their height slightly taller than denticles of snout; denticles probably deciduous, midline of tail partly naked with scars demarcating position of lost denticles; main denticles of posterior tail seed-shaped, elongated longitudinally. Denticles on mid-disc stellate; crowns flat topped, barely raised, not significantly narrower than their bases. Denticles on anterior half of snout stellate in appearance, upright, widely spaced; crowns elevated, broad, with 3–5 obvious cusps, usually directed posterodorsally; ventral surface of disc, and tail forward of ventral fold, naked. Male holotype with stinging spine broken. Clasper strongly conical, slightly depressed, robust basally and tapering distally to a blunt point.

Meristic data for paratype CSIRO H 7110–01 (values for non-type from Thailand, MTUF P 30003 in parentheses): total pectoral radials 117 (about 114); propterygials 48–49 (about 50), mesopterygials 17–18 (about 14) and metapterygials 51 (about 50). Total pelvic radials 24. Total vertebral segments (centra, exc. synarcual) 161 (159); postsynarcual monospondylous centra 36 (36); diplospondylous centra about 125 (123).

**COLORATION.**— Holotype, when fresh: Uniformly dark brown dorsally, with a faint greenish tinge; suprascapular thorns pearly white; median thorns along tail slightly paler than rest of tail. Ventral surface usually with pinkish tinges from fresh blood; margin of disc and pelvic fins narrowly dusky; teeth orange brown, mouth

white; tail base whitish, greyish brown toward sting; ventral skin fold pale brownish blue, darkest distally. First specimen collected (KA 306, adult male) had a uniform, yellowish brown dorsal disc with a paler post-sting tail. In preservative (adult male paratype, CSIRO H 7110–01): Uniformly brown dorsally, slightly paler near pectoral apices and on naked part of tail beside denticle band; ventral surface mostly white, darker greyish black areas along edge of disc, more broadly on pelvic-fin margins, around cloaca, and at tip of clasper; ventral tail white with some dusky areas; ventral half of tail beside skin fold whitish, fold whitish basally with outer part bluish brown.

**SIZE.**— Attains at least 428 mm DW (adult male); two other adult males, 422 and 415 mm DW.

**ETYMOLOGY.**— Derived by combination of the Greek *stella* (starry) and Latin *rostrum* (snout) in allusion to the characteristic star-shaped denticles on the snout. Vernacular: Starrynose Stingray.

**DISTRIBUTION.**— Known from West Kalimantan in the vicinity of the Kapuas River estuary and near Pemangkat. Probably prefers shallow, fresh or brackish water habitats. Possibly misidentified locally as other species of *Pastinachus* and may be more widely distributed in parts of Borneo, and even Sumatra, where the habitat is suitable. A juvenile male (MTUF P 30003), collected about 60 km upstream from the mouth of the Bang Pakong River in Thailand, may represent the first record of this species outside Borneo. More specimens are needed from continental Asia to resolve this issue.

**COMPARISONS.**— *Pastinachus stellurostris* and *P. solocirostris* differ from other members of the genus in having an angular snout covered to its tip by enlarged



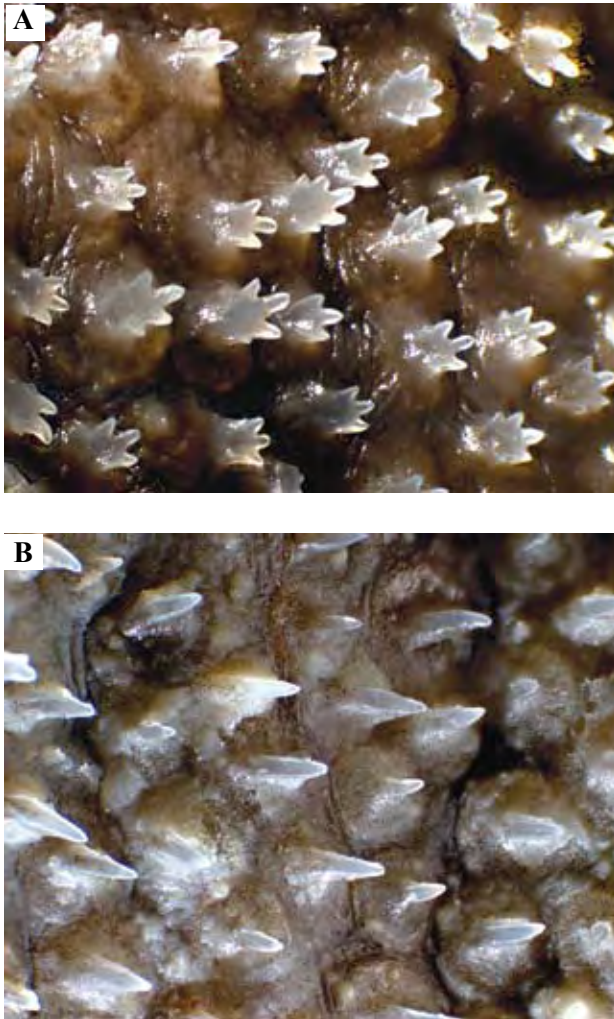
**Figure 5.** Mouth of *Pastinachus stellurostris* sp. nov., female paratype (NCIP 6338, 413 mm DW, preserved).



**Figure 6.** Squamation in the mid-scapular region of *Pastinachus stellurostris* sp. nov., female paratype (NCIP 6338, 413 mm DW, preserved).

spiny denticles (Fig. 7), and a relatively long slender ventral skin fold. *Pastinachus stellurostris* differs from *P. solocirostris* in squamation and also appears to differ in several morphometric characters. Along with *P. gracilicaudus*, they both have enlarged pearl-shaped suprascapular thorns, however, thorns along the midline of the tail are found in *P. stellurostris* and no other cowtail ray. Denticles at the snout tip of *P. stellurostris* are stellate (Fig. 7a) whereas they are simpler and more elongate to lanceolate in *P. solocirostris* (Fig. 7b). The eye of *P. stellurostris* also protrudes more than that of *P. solocirostris*. The following standard ratios are relatively smaller in *P. stellurostris*: head length 43.7–45.1% DW (47.1–50.9% DW); snout 20.7–22.4% DW (22.4–28.0% DW); preoral 19.0–19.5% DW (21.4–25.0% DW); prenasal 14.7–15.3% DW (16.6–19.2% DW); orbit and spiracle length 8.7–9.8% DW (10.4–11.0% DW); and nasal curtain length 5.6–6.0% DW (6.7–7.9% DW). Several width-related ratios are smaller in *P. stellurostris*: inter-eye width 15.7–16.6% DW (16.9–20.2% DW); interspiracular width 16.5–17.6% DW (17.5–19.8% DW); nasal curtain width 10.1–10.5% DW (11.4–13.9% DW); internasal width 7.9–8.0% DW (8.6–11.1% DW); and distance between 1<sup>st</sup> gill slits 19.0–20.8% DW (20.4–25.2% DW). In addition, the eye of *P. stellurostris* appears to be smaller (diameter 2.5–2.8% DW vs. 2.8–4.0% DW); distances from the snout to the point of maximum width of the disc (38.3–40.0% DW vs. 42.7–52.0% DW) and cloaca origin to sting (77.0–84.0% DW vs. 85.2–93.9% DW) shorter; and the post-sting tail is marginally more compressed (tail width at mid-base length of ventral fold 1.1–1.3% DW vs. 1.2–1.5% DW), with a much more slender ventral skin fold (depth at its mid-base 1.8–2.1% DW vs. 2.7–3.7% DW; depth at posterior quarter of its base length 1.2–1.3% DW vs. 2.2–4.0% DW). The pelvic-fin base is relatively broader in *P. stellurostris* (21.6–22.4% DW vs. 15.8–21.2% DW).

**REMARKS.**— Molecular data also confirmed that *Pastinachus stellurostris* and *P. solocirostris* are not conspecific. DNA sequence data were determined for the mitochondrial protein coding gene NADH2 for 13 specimens of *Pastinachus atrus*, 9 of *P. gracilicaudus*, 11 of *P. solocirostris* and one of *P. stellurostris* (GN 4600); a specimen of *Dasyatis zugei* was used as an outgroup. The sequence data were aligned and subjected to Maximum Likelihood Analysis using a General Time Reversible model with allowance for among-site rate variation and invariant sites. The resulting topology revealed 4 distinct clades representing 4 valid species of *Pastinachus* (Fig. 10). Interestingly, the variation within *P. atrus* from geographically disparate localities (Australia, Madagascar, Philippines, Indonesia and Malaysia) was comparable to levels observed within *P. solocirostris* or *P. gracilicaudus* taken from around the Island of Borneo.



**Figure 7.** Denticles of the snout tip of: A. *Pastinachus stellurostris* sp. nov., adult male paratype (CSIRO H 7110–01, 415 mm DW, preserved); B. *Pastinachus solocirostris*, CSIRO H 6219–01, female paratype 416 mm DW, preserved).



**Figure 8.** Lateral view of the tail of *Pastinachus stellurostris* sp. nov., adult male paratype (CSIRO H 7110–01, 415 mm DW, preserved), at the mid region of the ventral cutaneous fold.

The distribution of *P. stellurostris* in the region is unclear. A 235 mm immature male, collected in Bang Pakong River, Thailand (MTUF P 30003), is similar in morphology to the larger, type specimens of *P. stellurostris* from Borneo, most of which are adults. This specimen also possesses stellate denticles at the snout tip, a row of small thorns along the midline of the anterior tail, a long and very low skin fold, and large pearl-shaped thorns on the suprascapular region. Morphometric and meristic details are also similar to the types of *P. stellurostris*; the main differences being a markedly broader intereye (17.5% vs. 15.7–16.6% DW), interspiracular (18.7% vs. 16.5–17.6% DW), internasal distance (8.6% vs. 7.9–8.0% DW) and distance between the first gill slits (21.9% vs. 19.0–20.8% DW), longer pelvic fin (26.9% vs. 21.6–24.1% DW) but narrower base width (17.3% vs. 21.6–22.4% DW), much longer ventral fold length (1.23 vs. 1.10–1.12 times DW), and a broader posterior tail (its width 4.8% vs. 4.0–4.1% DW and depth 3.7% vs. 3.0–3.2% DW at origin of ventral fold) in the Thai specimen. The main difference between these forms is in the ventral disc and tail coloration; in the Thai specimen, the disc is largely dark brown with some pale areas (rather than almost entirely white) and the tail is uniformly dark brown (vs. almost entirely white with faint dusky areas). Ventral coloration can be an important species-level character in dasyatids so, for this reason, this specimen was omitted from the type series. More material from continental Asia is needed to assess possible conspecificity of these populations.

**Comparative material referred to in this paper:**  
*Pastinachus solocirostris*: CSIRO H 6219–01 (paratype), 416 mm DW, female, Sematan Fish Market, Sarawak, Malaysia, 15 May 2003.

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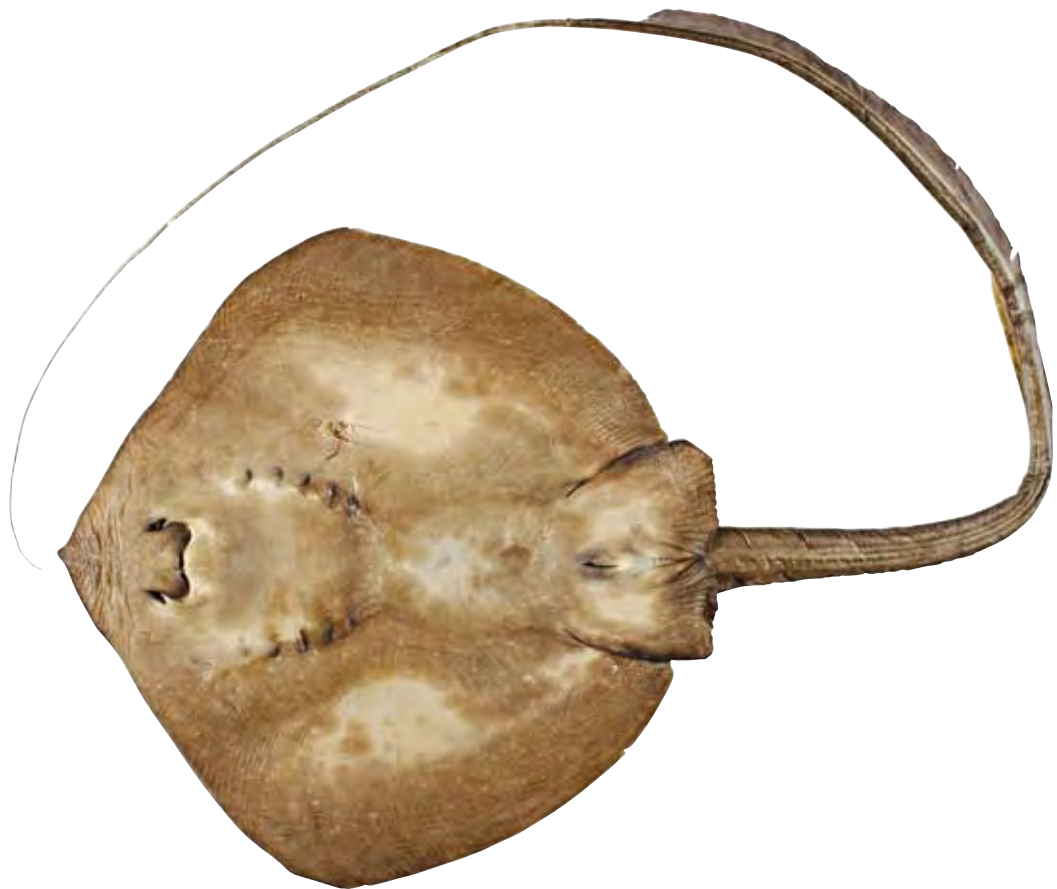
This research was partly supported by a National Science Foundation (NSF) funded survey (BS&I No. DEB 0103640) of the elasmobranchs of Borneo and their metazoan parasites. Many of the tissue samples were collected by Janine Caira (University of Connecticut),



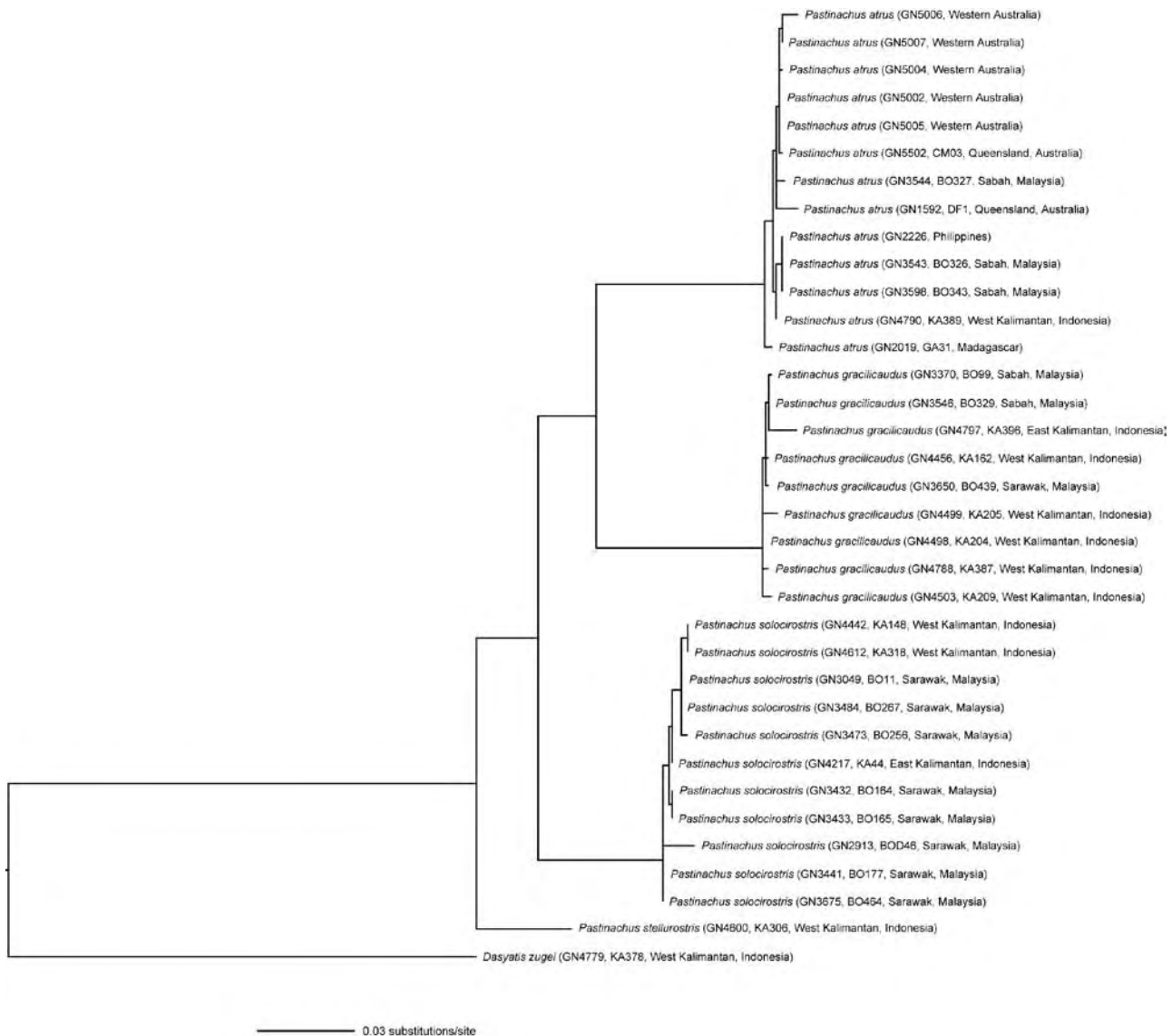
**A**



**B**



**Figure 9.** *Pastinachus* cf. *stellurostris*, immature male (MTUF P 30003, 235 mm DW, preserved), from Thailand: A. dorsal surface; B. ventral surface.



**Figure 10.** Maximum Likelihood Tree resulting from analysis of NADH2 DNA sequence data. Log Likelihood score for this tree was 3308.707 using a General Time Reversible model with accommodation for among site rate variation and invariant sites.

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