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Rhinobatos sainsburyi n.sp. and *Aptychotrema timorensis* n.sp. —Two New Shovelnose Rays (Batoidea: Rhinobatidae) from the Eastern Indian Ocean

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ABSTRACT. Two new shovelnose rays, *Rhinobatos sainsburyi* n.sp. and *Aptychotrema timorensis* n.sp., are described from the continental shelf off northwestern Australia. *Rhinobatos sainsburyi* belongs to an unresolved supraspecific complex that includes the type of the genus, *R. rhinobatos* (Linnaeus), and at least 9 other species that occur in the Indo-Pacific. *Rhinobatos sainsburyi* differs from these species by a combination of morphometry, squamation and colour. *Aptychotrema timorensis*, a third valid member of an endemic Australian genus, differs from its congeners in morphometry, and in having a narrower snout apex, fewer caudal vertebrae, and white spots on its dorsal surface.

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In 1978 the Commonwealth Scientific and Industrial Research Organisation (CSIRO) initiated a decade long research program to investigate fish community structure off northwestern Australia to assist in the management of a Taiwanese trawl fishery in the area. As the fish fauna was poorly known at that time, the initial phase of the field-based program focused on describing the fauna and its distribution. An emphasis was placed on the consistent and accurate identification of species across all surveys. Specimens were photographed fresh and identifying features noted to produce dossiers for each species. Dossiers were assembled by family-group into durable 6 ring-bound folders for use at sea. This reference was used to refresh the identification skills of field staff before each cruise and was upgraded and enhanced as additional material was examined. This work led to the publication of a field guide to the main demersal shelf fishes of north and northwestern Australia (Sainsbury *et al*., 1985). The program also led to the discovery of many new fishes, including new elasmobranchs. Two new species of shovelnose rays (Rhinobatidae), caught during these surveys, are described and figured below.

Materials and methods

Morphometrics follow a standard developed for the family at a recent FAO-funded workshop on batoid morphological and meristic techniques (Paris, March 2002) and explained in Last *et al*. (2004). Specific measurements of the nasal region of *Rhinobatos* include the three main circum-nasal structures: an anterior nasal flap (nasal valve of Norman, 1926) bordering the inner margin of the nostril; a posterolateral nasal flap originating along the lateral margin of the anterior (incurrent) aperture and extending variably along the lateral margin of the nostril; and a posterior nasal flap mainly bordering the posterior (excurrent) nasal

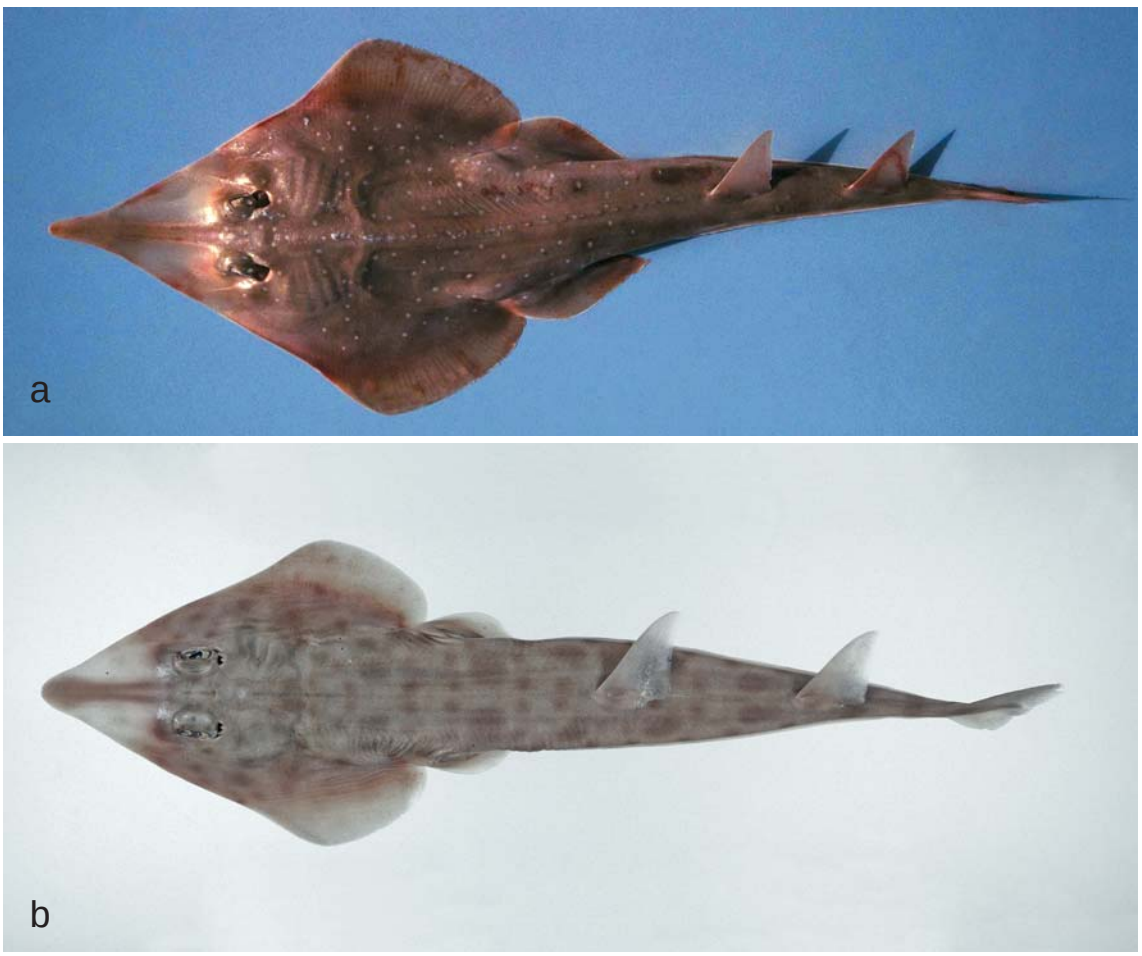

Plate 1. (*a*) Dorsal view of the holotype of *Aptychotrema timorensis* n.sp. (CSIRO CA1258), 582 mm TL, female, Timor Sea, eastern Indian Ocean. (*b*) Dorsal view of the holotype of *Rhinobatos sainsburyi* n.sp. (CSIRO H.4041-04), 506 mm TL, mature male, off northwestern Australia, eastern Indian Ocean.

aperture. Measurements follow methods widely used for sharks (Compagno, 1984) with refinements, including: snout length—direct length from the snout tip to the bony nasal capsule adjacent the orbit (forward of eye socket); spiracle length—greatest length of the main cavity; preoral length—direct length from the snout to the posterior edge of upper jaw at its symphysis; mouth width—taken across the exposed width; and, pelvic-fin insertion to dorsal-fin origin—horizontal distance from the pelvic base to the origin of the first dorsal-fin. Meristics were taken mainly from radiographs; nasal lamellae counts were taken from the posterior half of the nasal capsule where possible. Comparative material included three specimens of *R. hynnicephalus*: HUMZ 34844, adolescent ♂, 489 mm TL; HUMZ 66224, ♀, 602 mm TL; and HUMZ 109478, ♀, 476 mm TL. Types are held in the ichthyological collection of the CSIRO, Hobart (CSIRO). Other institutional abbreviations follow Leviton *et al*. (1985).

Aptychotrema timorensis n.sp.

Figs. 1,2, Plate 1*a*, Table 1

Aptychotrema sp.—Gloerfelt-Tarp & Kailola, 1984: 31, fig. (of CSIRO CA1258).

Aptychotrema sp. 2.—Sainsbury *et al*., 1985: 44–45, fig. (of CSIRO CA1258).

Aptychotrema sp. A.—Last & Stevens, 1994: 284, 285, pl. 40, figs. (of CSIRO CA1258).

Type material. HOLOTYPE: CSIRO CA1258, female, 582 mm TL, 10°14'S 130°03'E, north of Bathurst Island, Northern Territory, 124 m, 8 Jul. 1980.

Diagnosis. An *Aptychotrema* distinguished by the following combination of characters: disc relatively large, broadly wedge-shaped, with a narrowly pointed snout; orbit diameter equal to interorbital width; tail short, about 1.1 times precloacal length; mouth small, precloacal length about 8 times mouth width; first dorsal-fin short, length 6% TL, about 2.3 times in interdorsal distance; dorsal-fin apices angular; caudal fin short, dorsal margin 12% TL; pelvic fin large, length about 2.8 times width; post-synarcual vertebral centra 156; nasal lamellae 27; ventral tip of snout not black-tipped; and dorsal surface covered with small, white spots.

Description. Disc broadly wedge shaped, angular anteriorly, angle anterior to eyes about 55°; outer margins broadly rounded, narrowly rounded distally, length 1.31 times width. Pelvic fins elongate, long-based, base length 1.46 times inner margin; total length 1.58 times their base length, 2.78 times width; anterior margin weakly convex, apex broadly rounded, posterior margin almost straight. Tail depressed, broad anteriorly, tapering; in cross-section nearly flat below, rounded above; tail length from anterior cloaca 1.14 times precloacal length, 1.11 times disc length, 5.51 times width at pelvic-fin insertions; tail width 2.20 times depth at pelvic-fin insertions, 1.89 at first dorsal-fin origin, 1.72 at second dorsal-fin origin. Dermal fold lateral on tail, originating about eye diameter behind free rear tip of pelvic fin, reaching just behind ventral caudal-fin origin; fold moderate, its width uniform along interdorsal space.

Head long, ventral length 29.7% TL; snout moderately long and bluntly pointed; preoral snout length 3.42 times mouth width, 6.93 times internarial distance, 1.65 times dorsal caudal-fin margin, 5.18 times distance from nostril to margin of disc; preorbital snout length (direct) 3.19 times interspiracular length, 5.21 times orbital diameter, 5.26 times interorbital width; interorbital space slightly concave, width moderate; eyes moderately small, not elevated or protruding, orbital diameter 1.51 times spiracle length, 1.01 times interorbital width. Spiracle subrectangular, size moderate; no folds on posterior margin. Nostril small, transverse, nasal flaps moderately developed; anterior aperture oval, width exceeding length; nostril length 2.39 times anterior aperture width, 1.53 times anterior nasal-flap base length, 0.65 times in distance from nostril to edge of disc, 0.87 times internarial distance. Anterior nasal flap narrow with long, slender process anteriorly, tapering with crenulate margin posteriorly; flap base 1.45 times its width at process, 1.56 times anterior aperture width; inserted near innermost margin of nostril; distance between insertions of flaps 2.87 in greatest distance across nostrils, 1.10 in minimum internarial distance; process of flap about twice as long as wide, bluntly pointed distally, weakly overlapping posterolateral nasal flap and determining posteromesial margin of anterior aperture. Posterolateral nasal flap lobe-like, broadest anteriorly, length 3.73 times width; originating at lateral extremity of anterior nasal aperture, extending posteromesially as a free fold almost to innermost edge of nostril. Posterior nasal flap weakly lobe-like laterally, base length 4.52 times its width, reaching innermost margin of nostril as thin fold; width 0.46 of anterior aperture width, 0.83 of posterolateral nasal-flap width. Nasal lamellae 27. Mouth narrow, width 2.34 times nostril length, 8.03 in precloacal length; positioned over hind margin of orbit; jaws strong, thick. Upper jaw strongly convex, arched; deep preoral groove demarcating upper lip, strongly arched, following profile of upper jaw; lower lip pronounced, postoral groove well developed, no ridges of strongly corrugated skin on chin; weak, short lateral grooves around corners of mouth. Teeth small, blunt, crowns rhomboidal with weak, pointed posterior cusps; teeth quincuncial, about 76 rows in upper jaw; upper and lower jaw teeth similar in shape and size. Gill openings s-shaped, fifth less so; length of third gill slit 1.60 in nostril length, 6.07 in distance between fifth gill slits; distance between first gill slits 1.43 times distance between fifth gill slits; distance between fifth gill slits 3.28 times internarial distance, 1.62 times mouth width, 0.32 of ventral head length.

Dorsal-fins moderately upright, apices angular; anterior margins weakly convex, posterior margins almost straight; free rear tips forming right angle, not produced; first dorsal-fin slightly taller than second, length of first 0.94 times its height, base length 1.87 times inner margin length; second dorsal-fin length 1.10 times its height, base length 2.26 times inner margin length. First dorsal-fin well behind pelvic-fin insertion, interspace 1.28 times interdorsal distance; interdorsal space relatively short, 1.56 times second dorsal-fin height, 2.29 times base of first dorsal-fin, 1.59 times interspace between second dorsal-fin insertion and upper origin of caudal fin; 1.45 times tail width at first dorsal-fin origin. Caudal fin relatively small, short, dorsal caudal margin 2.02 times preventral margin length.

Dermal denticles small, close-set, covering entire body and fins; surfaces uniform, coarsely granular but becoming enlarged slightly in some regions; slightly enlarged mid-dorsally on disc and tail. Thorns present around preorbit, postorbit, spiracle, scapular region and along dorsal midline;

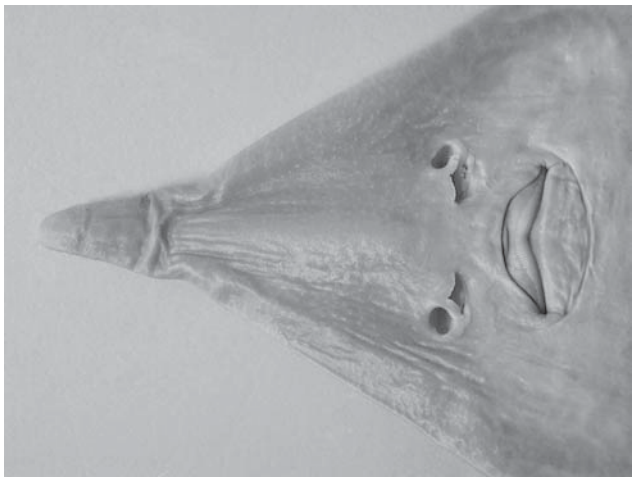

Fig. 1. Ventral view of the snout of the holotype of *Aptychotrema timorensis* n.sp. (CSIRO CA1258).

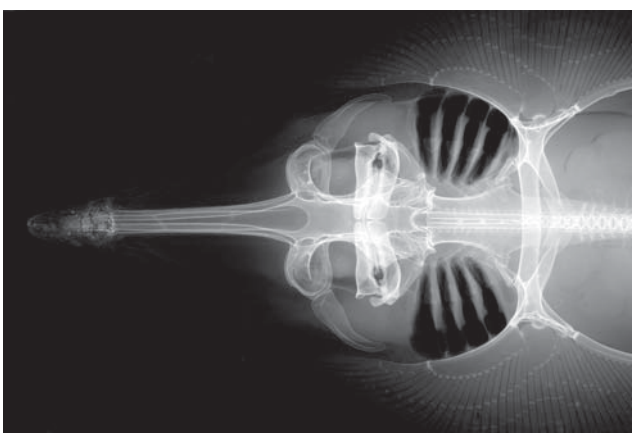

Fig. 2. Radiograph of the chondrocranium of the holotype of *Aptychotrema timorensis* n.sp. (CSIRO CA1258).

mostly of similar size, crowns very short, globular, tips mostly blunt; bases embedded; single row of irregularly, mostly widely, spaced thorns extending from just behind head to near origin of first dorsal-fin; evident as enlarged denticles on interdorsal midline; median thorns uniform in size, about 29 in single series; two widely separated scapular thorns on each side, their sizes variable but similar to those of dorsal midline; pair of slightly enlarged globular denticles near snout tip.

Prebranchial sensory pore patch indistinct, extending posteriorly to first gill slit. Postscapular sensory canals deeply embedded, not undulated anteriorly, almost reaching pectoral-fin insertions; sensory pores not evident; sensory canal not forming a shallow groove.

Rostral cartilage moderately robust, weakly constricted near midlength, length about 64% of length of neurocranium; rostral appendix expanded, narrowly rounded apically, posterior margin short, strongly concave. Precerebral anterior fontanelle broad, acorn-shaped, extending forward from just posterior to rostral base to rostral appendix; dorsal edges of fontanelle well defined, narrowly separated near base, becoming considerably more constricted anteriorly; ventral edges not detectable; cranial roof lacking posterior fontanelle. Nasal capsules small, ovoid, length shorter than width, their transverse axes laterally directed; width across nasal capsules 1.2 times nasobasal length of cranium (base of rostrum to occipital condyles); basal plate moderate, its minimum width about 4.5 times in nasobasal length. Antorbital cartilage sickle-shaped, elongate, curved posteriorly; junction with nasal capsule relatively narrow, at posterolateral margin; its lateral extension greatly exceeding length of nasal aperture; apex bluntly pointed, margin not truncate or concave; without an anterior process. Postorbital process poorly developed, width across process 1.40 times in nasobasal length; preorbital process weak.

Pectoral skeleton with 19–20 propterygial, 7 mesopterygial, 3–4 neopterygial, 26–28 metapterygial, 56–58 total radials; anterior radials of propterygium falling slightly short of nasal capsules. Total pelvic radials 24; one greatly enlarged radial on the puboischiadic bar; 23 basipterygial radials. Vertebral column with 165 total centra (synarcual and free), 156 post-synarcual centra; 9 synarcual centra; 28 monospondylous precaudal centra, all except last two with ribs; 91 diplospondylous precaudal centra, 37 diplospondylous caudal centra.

Live coloration. Dorsal surface brownish with a scattering of pale, widely spaced spots, extending from eye to caudal fin; spots smaller than pupil of eye, often with dusky outer borders; spots paired on shoulder, above pectoral- and pelvic-fin insertions, before first dorsal-fin, on anterior bases of pelvic and dorsal fins, and near free rear tip of pectoral fins. Uniformly pale ventrally; no dark markings on snout tip.

Size. To at least 582 mm TL.

Etymology. Named after the type locality of this poorly known species (i.e. the Timor Sea). Spotted shovelnose ray is the most regularly used common name.

Distribution. Timor Sea, off Melville Island (Northern Territory) at about 120 m depth.

Remarks. Members of the Australian endemic genus *Aptychotrema*, which are distinct from all other rhinobatids, are in need of revision as published data are limited for all species. They possess the following characters that may prove useful in defining the group: no internasal flap; deep preoral groove present; jaws strongly arched in both sexes; small, transverse nostrils with fewer lamellae and ovoid nasal capsules; anterior nasal flap inserted near posterior extremity of nostril, at margin or penetrating slightly into internarial space; posterior nasal flap extending to posterior extremity of nostril; rostral cartilages well-separated basally, constricted anteriorly; prebranchial sensory pore patch obscure, extending posteriorly to first gill slit; postscapular sensory canal long; no spiracular folds; and antorbital cartilage of chondrocranium elongate, sickle-shaped with a bluntly pointed apex and no anterior process.

This ray was first documented by Sainsbury *et al*. (1985) who had difficulties identifying it to a species. Its status as an unnamed taxon was initially confirmed by the author in Gloerfelt-Tarp & Kailola (1984) and later by Last & Stevens (1994). Two other nominal species, *A. rostrata* (Shaw & Nodder) and *A. vincentiana* (Haake), are currently recognized as valid (Last & Stevens, 1994). These species, which are similar to each other in appearance, have either a plain dorsal surface or are covered by large, dusky blotches rather than white spots. One of these, *A. vincentiana*, is partially sympatric with *A. timorensis*. As well as having a

Table 1. Morphometrics for holotype (CSIRO CA1258) of *Aptychotrema timorensis* n.sp. and holotype (CSIRO H.4041-04) and five paratypes (CSIRO H.757-01, H1050-03, H1091-01, H1091-03, H1091-04) of *Rhinobatos sainsburyi* n.sp. Values are expressed as a percentage of total length, TL.

	A. timorensis	***R. sainsburyi***		
	holotype	holotype	paratypes	
			min	max
total length, TL (mm)	582	506	376	557
disc width—maximum)	36.7	29.5	31.1	31.9
disc length	48.0	38.2	39.2	40.5
head length—dorsal)	23.8	19.6	18.8	20.8
head length—ventral)	29.7	24.7	23.3	26.7
snout length—presocket)	17.7	13.9	13.1	14.7
orbit diameter	3.4	4.2	3.7	4.1
spiracle length	2.2	2.2	2.3	2.4
orbit and spiracle length	4.6	4.7	4.6	4.9
interorbital width	3.4	3.0	3.3	3.9
interspiracular width	5.6	5.4	5.2	5.8
preoral length	19.9	16.4	15.5	17.9
mouth width	5.8	5.6	5.0	5.4
prenarial distance	16.4	12.2	12.0	13.6
nostril length	2.5	4.1	3.5	4.0
anterior aperture—width)	1.0	1.2	1.0	1.2
anterior nasal flap—base length)	1.6	2.6	2.4	2.7
anterior nasal flap—width)	1.1	1.7	1.4	1.5
posterolateral nasal flap—total length)	2.2	3.4	3.2	3.4
posterolateral nasal flap—width)	0.6	0.7	0.6	0.8
posterior nasal flap—base length)	2.2	3.2	2.7	3.0
posterior nasal flap—width)	0.5	1.2	0.9	1.0
distance across anterior nasal apertures	7.5	8.5	8.2	9.0
internarial distance—minimum)	2.9	2.5	2.3	2.6
distance between anterior nasal flaps	2.6	2.3	2.0	2.2
distance from nostril to disc margin	3.8	2.8	2.8	3.4
third gill opening—width)	1.5	1.3	1.2	1.4
distance between first gill openings	13.4	11.6	11.6	12.8
distance between fifth gill openings	9.4	8.5	8.8	9.3
pelvic fin—length	17.6	13.7	14.3	15.2
pelvic fin—anterior margin length	9.5	8.9	8.5	8.8
pelvic fin—width	6.3	5.7	5.2	5.8
pelvic fin—base length	11.2	6.9	7.4	9.4
pelvic fin—inner margin length	7.6	8.4	5.9	6.9
first dorsal fin—length	6.0	7.7	7.2	7.6
first dorsal fin—anterior margin length	9.1	11.4	10.8	11.6
first dorsal fin—height	6.3	8.1	7.6	7.9
first dorsal fin—base length	4.0	4.8	4.8	5.0
first dorsal fin—inner margin length	2.1	2.7	2.5	2.8
second dorsal fin—length	6.5	7.4	7.3	7.5
second dorsal fin—anterior margin length	8.9	10.5	10.0	10.6
second dorsal fin—height	5.9	7.3	6.6	7.2
second dorsal fin—base length	4.6	4.9	5.0	5.2
second dorsal fin—inner margin length	2.0	2.3	2.0	2.4
caudal fin—dorsal margin	12.0	14.1	13.7	14.6
caudal fin—preventral margin	6.0	6.6	6.5	7.0
snout to first dorsal-fin origin	64.6	53.5	54.3	55.8
snout to second dorsal-fin origin	78.0	73.3	72.6	73.8
snout to upper caudal-fin origin	87.6	85.8	85.1	86.4
snout to lower caudal-fin origin	89.7	87.4	86.7	87.7
snout to pelvic-fin origin	41.9	34.8	35.2	36.8
snout to anterior vent	46.7	37.5	38.9	40.5
pelvic-fin insertion to dorsal-fin origin	11.7	10.7	10.0	11.1
interdorsal distance	9.2	14.5	13.2	13.4
caudal peduncle length—dorsal)	5.8	7.5	7.6	8.0
body width—pelvic insertion (tail)	9.7	10.7	10.1	11.0
disc width—anterior orbit	17.8	16.5	16.6	18.2
body width—first dorsal-fin origin	6.3	10.7	9.8	11.0
body width—second dorsal-fin origin	3.8	5.3	5.2	5.7
body depth—maximum (scap)	4.9	5.5	4.6	5.2
body depth—pelvic-fin insertion	4.4	4.8	4.5	5.0
body depth—first dorsal-fin origin	3.4	4.2	3.8	4.1
body depth—second dorsal-fin origin	2.2	2.6	2.5	2.7

more broadly rounded snout apex, *A. vincentiana* appears to have a relatively smaller disc (length 42–43% vs 48% TL in adults), slightly smaller orbit (interorbital width 1.1–1.4 vs 1.0 times orbit diameter); longer tail (length 1.2–1.5 vs 1.1 times precloacal length); larger mouth (precloacal length 6.5–6.9 vs 8.0 times mouth width); longer first dorsal-fin (horizontal length 7.1–7.4% vs 6.0% TL, about 1.7–2.0 vs 2.3 times in interdorsal distance); less angular dorsal-fin apices; longer caudal fin (dorsal margin 14–15% vs 12% TL); and smaller pelvic fin (length 2.3–2.6 vs 2.8 times width). *Aptychotrema rostrata* and *A. vincentiana* typically have a dark marking at the ventral apex of the snout that is lacking in *A. timorensis*. The smaller caudal fin of *A. timorensis* is evidenced by fewer vertebral centra (caudal centra 37 vs 39–44 in *A. rostrata* n = 9, and 42–46 in *A. vincentiana*, n = 18).

Rhinobatos sainsburyi n.sp.

Figs. 3,4, Plate 1*b*, Table 1

Rhinobatos sp. 1.—Gloerfelt-Tarp & Kailola, 1984: 29, fig. (CSIRO CA2863, NW of Port Hedland, Western Australia).
Rhinobatos sp. 4.—Gloerfelt-Tarp & Kailola, 1984: 30, fig. (CSIRO CA1257, NE of Monte Bello Is, Western Australia).
Rhinobatos sp. 1.—Sainsbury *et al*., 1985: 44, pl. (CSIRO CA2863, NW of Port Hedland, Western Australia).
Rhinobatos sp. 2.—Sainsbury *et al*., 1985: 44, pl. (CSIRO CA1257, NE of Monte Bello Is, Western Australia).
Rhinobatos sp. A.—Last & Stevens, 1994: 284, 289, pl. 39, figs.

Type material. HOLOTYPE: CSIRO H.4041-04, mature male, 506 mm TL, 19°29'S 117°35'E, NE of Cape Lambert, Western Australia, 70 m, 1 Sep. 1995. PARATYPES: CSIRO CA1129, ♀, 490 mm TL, 18°38'S 119°19'E, NE of Bedout Island, Western Australia, 125 m, 6 Jun. 1980; CSIRO CA3901, mature ♂, 489 mm TL, 18°54'S 117°44'E, NW of Port Hedland, Western Australia, 148 m, 30 Jan. 1983; CSIRO H.743-01, ♀, 595 mm TL, 20°19'S 115°03'E, west of Monte Bello Islands, Western Australia, 92 m, 12 Oct. 1986; CSIRO H.757-01, immature ♂, 376 mm TL, 19°00'S 118°03'E, NW of Port Hedland, Western Australia, 116 m, 22 Oct. 1986; CSIRO H.1048-01, mature ♂, c. 460 mm TL, 18°37'S 118°20'E, south of Rowley Shoals, Western Australia, 137 m, 25 Sep. 1987; CSIRO H.1050-03, ♀, 542 mm TL, 18°52'S 118°38'E, north of Port Hedland, Western Australia, 100 m, 26 Sep. 1987; CSIRO H.1058-02, ♀, 434 mm TL, 19°04'S 118°11'E, NW of Port Hedland, Western Australia, 86 m, 26 Sep. 1987; CSIRO H.1090-01, ♀, 532 mm TL, 19°38'S 117°06'E, north of Nickol Bay, Western Australia, 70 m, 3 Oct. 1987; CSIRO H.1091-01, ♀, 530 mm TL, 19°53'S 116°06'E, NW of Dampier Archipelago, Western Australia, 66 m, 4 Oct. 1987; CSIRO H.1091-03, ♀, 503 mm TL, 19°53'S 116°06'E, NW of Dampier Archipelago, Western Australia, 66 m, 4 Oct. 1987; CSIRO H.1091-04, ♀, 557 mm TL, 19°53'S 116°06'E, NW of Dampier Archipelago, Western Australia, 66 m, 4 Oct. 1987; CSIRO CA1253, mature ♂, 531 mm TL, 9°52'S 129°14'E, north of Joseph Bonaparte Gulf, Northern Territory, 158 m, 9 Jul. 1980.

Diagnosis. A *Rhinobatos* distinguished by the following combination of characters: disc wedge-shaped, its dorsal surface scaled but without thorns; snout short, snout length

Fig. 3. Ventral view of the snout of the holotype of *Rhinobatos sainsburyi* n.sp. (CSIRO H.4041-04).

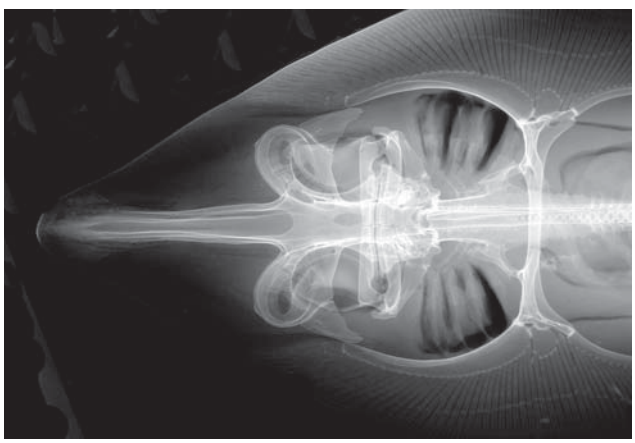

Fig. 4. Radiograph of the chondrocranium of the holotype of *Rhinobatos sainsburyi* n.sp. (CSIRO H.4041-04).

2.5–2.6 times interspiracular distance; orbit moderately large, diameter 1.6–1.9 times spiracle length; nostrils oblique, length 1.4–1.6 times internarial distance; anterior nasal-flaps inserted well into internarial space, but never almost united near ventral midline; posterior nasal flaps broad; ridges of rostral cartilage well-separated dorsally and almost parallel; prebranchial sensory-pore patch narrow, extending to first gill slit; distance between first gill slits 1.3–1.4 times distance between fifth gill slits; distance between fifth gill slits 2.5–2.9 times in ventral head length; postscapular sensory canal long, not grooved, extending more than three-quarters distance to pectoral-fin insertions; moderately tall dorsal-fins; pelvic-fin inner margin distinctly longer than its base in mature males but shorter than base in females; interdorsal distance more than 2.5 times first dorsal-fin base; outer spiracular fold distinctly larger than inner fold; dorsal margin of caudal fin about 2.0–2.2 times preventral margin; 162–171 post-synarcual vertebral centra; about 50 nasal lamellae; and dorsal disc plain brownish or with faint dusky blotches or fine dark spots.

Description. Disc wedge shaped, angular anteriorly, angle anterior to eyes about 66°; outer margins broadly rounded, narrowly rounded distally, length 1.29 in mature ♂ holotype (1.24–1.29 in 5 paratypes) times width (Table 1). Pelvic fins relatively short, relatively short-based in mature ♂, base length about 0.82 of inner margin (much longer in paratypes, 1.07 times in young ♂ paratype, 1.22–1.60 times in 4 ♀ paratypes); total length 1.98 (1.92 and 1.60–1.81) times their base length, 2.42 (2.64–2.85) times width; anterior margin weakly double concave, apex broadly rounded, posterior margin convex. Tail slender; in cross-section nearly flat ventrally, rounded dorsally; tail length from anterior cloaca 1.67 (1.47–1.57) times precloacal length, 1.64 (1.47–1.55) times disc length, 5.83 (5.43–6.02) times body width at pelvic-fin insertions; tail width 2.23 (2.16–2.28) times depth at pelvic-fin insertions, 2.53 (2.40–2.73) at first dorsal-fin origin, 2.02 (2.04–2.32) at second dorsal-fin origin. Dermal fold ventrolateral on tail, originating slightly anterior to free rear tip of pelvic fin, reaching just behind ventral caudal-fin origin; fold well developed, maximum width in interdorsal space about a half width of posterior nasal flap.

Head rather short, ventral length 24.7% (23.3–26.7%) TL; snout short and narrowly rounded; preoral snout length 2.95 (2.98–3.29) times mouth width, 6.59 (5.98–7.25) times internarial distance, 1.16 (1.09–1.23) times dorsal caudal-fin margin, 5.78 (4.80–5.76) times distance from nostril to margin of disc; snout length (direct) 2.60 (2.46–2.59) times interspiracular length, 3.31 (3.30–3.58) times orbit diameter, 4.61 (3.74–4.06) times interorbital width; interorbital space almost flat, rather narrow; eyes moderately small, not elevated or protruding, relatively larger in mature ♂, orbit diameter 1.90 (1.59–1.77) times spiracle length, 1.39 (1.06–1.15) times interorbital width. Spiracle lunate, moderately large; two weakly compressed spiracular folds on posterior margin, innermost fold half or less length of outer fold; distance between bases of folds subequal to length of inner fold. Nostril moderately large, oblique, nasal flaps well developed; anterior aperture subrectangular to ovoid, width well exceeding length; nostril length 3.47 (3.01–3.54) times anterior aperture width, 1.56 (1.37–1.56) times anterior nasal-flap base length, 1.44 (1.04–1.27) times distance from nostril to edge of disc, 1.64 (1.37–1.63) times internarial width. Anterior nasal flap broad with long, bluntly pointed process anteriorly; flap base 1.56 (1.67–1.94) times its width at process, 2.22 (2.02–2.45) times anterior aperture width; inserted well into internarial space, not at nostril margin, distance between their insertions 3.75 (3.73–4.51) in distance between lateral margins of anterior apertures, 1.09 (1.07–1.24) in internarial width; process of flap about twice as long as wide at its base, overlapping posteromesial edge of posterolateral nasal flap and determining inner margin of anterior aperture. Posterolateral nasal flap lobe-like, width uniform along most of hind margin of anterior aperture, length 4.78 (4.38–5.68) times width; originating at lateral extremity of anterior nasal aperture, extending posteriorly as free fold (below anterior fold and above posterior fold along lateral margin of nostril) to about level of insertion of anterior nasal flap. Posterior nasal flap strongly lobate, base length 2.57 (2.72–3.18) times its width, not reaching end of nostril, inserted well forward of posterior tip; width subequal to anterior aperture width, 1.74 (1.22–1.65) times posterolateral nasal-flap width. Nasal lamellae 51. Mouth moderately wide, width 1.36 (1.37–1.46) times nostril length, 6.73 (7.33–7.78) in precloacal length; positioned just in advance of hind margin of orbit; jaws not greatly thickened. Upper jaw weakly double concave, upper lip arched slightly, no preoral groove; lower lip pronounced,

not separated from post-oral groove by ridges of strongly corrugated skin; weak lateral grooves around corners of mouth. Teeth small, blunt, crowns rhomboidal with weak, pointed posterior cusps; teeth quincuncial, about 80 rows in upper jaw; upper and lower jaw teeth similar in shape and size. Gill openings weakly s-shaped (apart from fifth); length of third gill slit 3.18 (2.68–2.96) in nostril length, 6.63 (6.72–7.10) in distance between fifth gill slits; distance between first gill slits 1.35 (1.26–1.41) times distance between fifth gill slits; distance between fifth gill slits 3.42 (3.47–4.09) times internarial distance, 1.53 (1.67–1.82) times mouth width, 2.51–2.94 times in ventral head length.

Dorsal-fins of moderate size, relatively upright; semi-falcate, apices narrowly rounded rather than angular; anterior margins convex distally, posterior margins concave; free rear tips forming right angle; first dorsal-fin marginally taller than second, length of first 0.95 (0.92–1.00) times its height, base length 1.79 (1.72–1.88) times inner margin length; second dorsal-fin length 1.02 (1.02–1.11) times its height, base length 2.12 (2.04–2.58) times inner margin length. First dorsal-fin relatively close to pelvic-fin insertion, interspace 0.74 (0.75–0.83) times interdorsal distance; interdorsal space relatively short, 2.00 (1.86–2.01) times second dorsal-fin height, 3.04 (2.68–2.79) times base of first dorsal-fin, 1.94 (1.66–1.77) times interspace between second dorsal-fin insertion and upper origin of caudal fin. Caudal fin small, dorsal caudal margin 2.13 (1.97–2.19) times preventral margin length. Mature clasper slender, relatively short, inner length of right clasper about 13% TL (left malformed in holotype); tip acute, glans weakly expanded.

Dermal denticles minute, close-set, covering entire body; posterior portions of dorsal and caudal fins naked; thorns and tubercles absent; dorsal surface with narrow series of slightly enlarged, flat-top denticles around eye, along midline, and on scapular; these denticles most pronounced before eye and in nuchal and prenuchal regions; preorbital patch strongly demarcated from those covering orbit. Ventral surface uniformly covered in minute denticles, including upper lip edges, near insertion of anterior nasal flap, below posterolateral and posterior nasal flaps, and on tail beneath pelvic fins, and most of claspers.

Prebranchial sensory pore patch relatively narrow, extending posteriorly to level of first gill slit. Postscapular sensory canal long, not undulated anteriorly, terminating about an eye diameter from pectoral-fin insertions; canal deeply embedded, not forming shallow groove; sensory pores originating anteriorly from very short branches derived from main canal, pores becoming confluent with canals posteriorly.

Rostral cartilage broad, relatively short, length about 61% of length of neurocranium; rostral appendix expanded, broadly rounded apically, posterior margin long, weakly concave. Precerebral anterior fontanelle broad, extending forward from just posterior to rostral base to rostral appendix; dorsal edges of fontanelle well defined, widely separated, almost parallel; ventral edges almost united anteriorly, more constricted than dorsal edges; cranial roof with small oval posterior fontanelle, located well behind precerebral fontanelle. Nasal capsules moderately large, their transverse axes anterolaterally directed; width across nasal capsules 1.20 times nasobasal length of cranium (base of rostrum to occipital condyles); length of nasal capsule about equal to its width; basal plate narrow, its minimum width 4.52 times in nasobasal length. Antorbital cartilage subtriangular, short; junction with nasal capsule broad, posterolateral; lateral extension short, equal to or shorter than length of nasal aperture; apex blunt, margin truncate to concave, without anterior process. Postorbital process well developed, bifurcate, posterior extension very pronounced, width across process 1.51 times in nasobasal length; preorbital process well developed.

Pectoral skeleton with 29–31 (25–31, in 10 paratypes) propterygial, 6 (6–8) mesopterygial, 1 (1–3) neopterygial, 25–27 (25–27) metapterygial, 61–65 (59–65) total radials; anterior radials of propterygium extending forward of nasal capsules by about 10.5% of rostral length. Total pelvic radials 1+24+1; first greatly enlarged, on puboischiadic bar; 24 basipterygial radials; clasper calcified. Vertebral column with 181 (175–185) total centra (synarcual and free), 168 (162–171) post-synarcual centra; 13 (12–16) synarcual centra; 23 (23–26, mainly 23–24) monospondylous centra, only last centrum of holotype without ribs; 101 (98–105) diplospondylous precaudal centra, 44 (39–45) diplospondylous caudal centra.

Live coloration. Body pale yellowish brown dorsally, with dense cover of faint dusky blotches (blotches sometimes absent or more golden in paratypes); somewhat paler near hind margin of pectoral fin; paler yellowish to white on lateral snout, anterior edge of orbit, lateral cutaneous fold of tail, and between ridges of rostral cartilage; nasal capsules not sharply demarcated from lateral snout; snout tip and fins plain. Ventral surface uniformly white; no dark tip on snout apex.

Size. To at least 595 mm TL; males mature at 460 mm but immature at 376 mm TL.

Etymology. In acknowledgment of the efforts of Dr Keith Sainsbury who planned and managed the initial trawl fish surveys of the continental shelf of northwestern Australia. His foresight in recognizing the need for documenting the fauna before attempting to address more management oriented questions is exemplary. This pioneering research has provided an excellent regional biological baseline that would otherwise be unavailable for regional marine management. Goldeneye shovelnose ray is the most regularly used common name.

Distribution. Known from northern and northwestern Australia, from the Timor Sea (NW of Melville Island, Northern Territory) south to the Monte Bello island group (North-West Shelf) in 66–200 m but mostly collected shallower than 150 m.

Remarks. *Rhinobatos sainsburyi* was initially identified as two unspecified species of *Rhinobatos* based on colour differences in two field guides (Gloerfelt-Tarp & Kailola, 1984; Sainsbury *et al*., 1985). Some individuals are spotted and others are plain but there are no other obvious morphological differences between these forms and intermediate colour patterns exist.

This species belongs to a poorly defined subgroup of the genus *Rhinobatos* Linck characterized by having widely separated, submarginal insertions of the anterior nasal flap, and the dorsal ridges of the rostral cartilages rather well

separated and subparallel to each other. This group, which includes the type species of the genus, *R. rhinobatos* (Linnaeus), is represented in the Indian Ocean by five species, *R. rhinobatos*, *R. annandalei* Norman, *R. lionotus* Norman, *R. holcorhynchus* Norman, and *R. punctifer* Compagno & Randall, and in the western Pacific Ocean by three species, *R. schlegelii* Müller & Henle, *R. formosensis* Norman, and *R. hynnicephalus* Richardson. Recent studies (Last and others, unpublished) suggest that additional undescribed species exist in the region and the ranges of nominal taxa are smaller than first thought.

The body shape of *Rhinobatos sainsburyi* is distinct within the group. Of related species, using Norman's (1926) key, it is closest to *R. hynnicephalus* from the Japanese Archipelago, in having a snout length between 2.3–3.0 (2.5–2.6 in *R. sainsburyi*) times interspiracular distance, preoral length 2.8–3.0 (2.9–3.3) times width of mouth, small inner spiracular fold, disc with rudimentary denticles, and being pale brownish dorsally. It differs significantly, from similar-sized specimens of *R. hynnicephalus* from Japan and Taiwan (HUMZ 34844, 66224, 109478) in having a shorter snout (in adults, 13.1–13.9% vs 15.0–16.2% TL), shorter predorsal distance (53.5–55.8% vs 57.3–60% TL), and dorsal-fins relatively more widely spaced (base of pelvic fin to origin of first dorsal-fin 0.7–0.8 vs 1.0–1.2 times interdorsal distance).

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References

Compagno, L.J.V., 1984. FAO species catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of the shark species known to date. Part 1. Hexanchiformes to Lamniformes. FAO Fisheries Synopsis 125 4(1) 1–249.

Gloerfelt-Tarp, T., & P.J. Kailola, 1984. *Trawled Fishes of Southern Indonesia and Northwestern Australia*. Australian Development Assistance Bureau; Directorate General of Fisheries, Indonesia; German Agency for Technical Cooperation, 406 pp.

Last, P.R., L.J.V. Compagno & K. Nakaya, 2004. *Rhinobatos nudidorsalis* sp. nov., a new species of shovelnose ray (Batoidea: Rhinobatidae) from the Mascarene Ridge, central Indian Ocean. *Ichthyological Research* 51(2).

Last, P.R., & J.D. Stevens, 1994. *Sharks and Rays of Australia*. Australia: CSIRO, 513 pp.

Leviton, A.E., R.H. Gibbs Jr., E. Heal & C.E. Dawson, 1985. Standards in herpetology and ichthyology: part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985(3): 802–832.

Norman, J.R., 1926. A synopsis of the rays of the family Rhinobatidae, with a revision of the genus *Rhinobatus*. *Proceedings of the Zoological Society of London* 1926(62): 941–982.

Sainsbury, K.J., P.J. Kailola & G.G. Leyland, 1985. *Continental Shelf Fishes of Northern and North-western Australia. An Illustrated Guide*. Canberra: CSIRO Division of Fisheries Research, Clouston & Hall, Peter Pownall Fisheries Information Service, 375 pp.

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