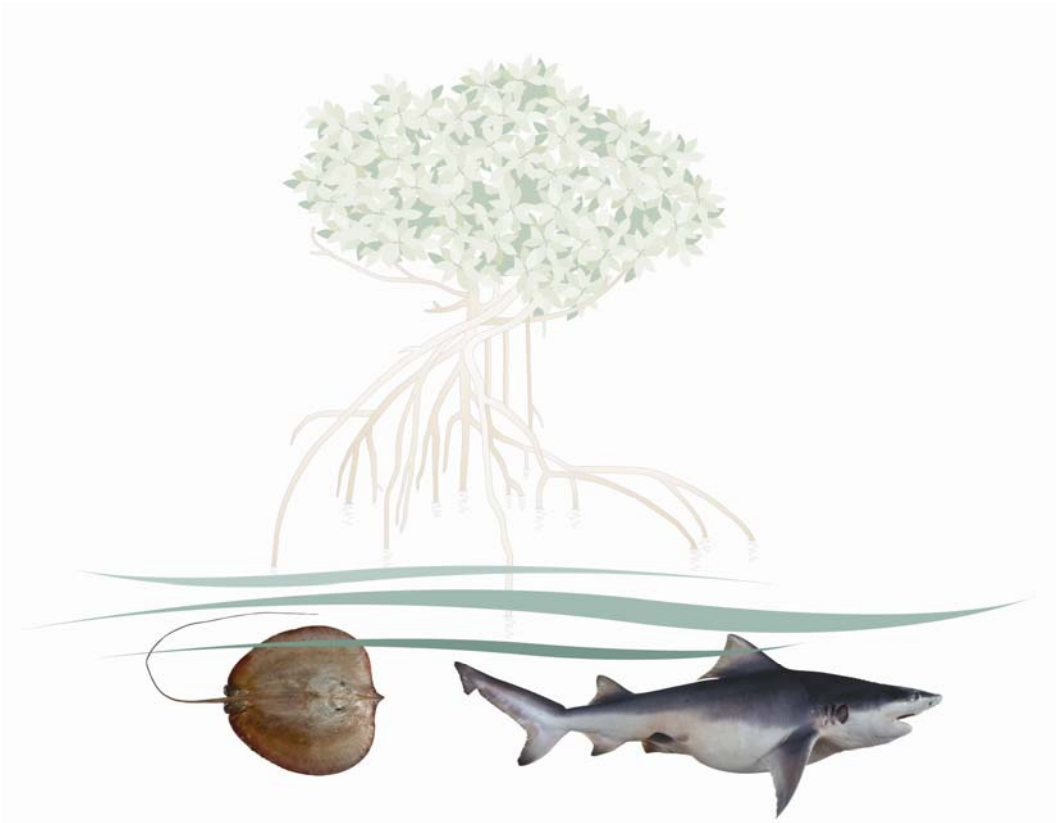

DESCRIPTIONS of NEW
AUSTRALIAN
CHONDRICHTHYANS

EDITORS:
P. R. LAST • W. T. WHITE • J. J. POGONOSKI

CSIRO MARINE AND ATMOSPHERIC RESEARCH PAPER NO. 022

CSIRO

Suggested citation:

Last, P.R., Motomura, H. & White, W.T. (2008a) *Cephaloscyllium albipinnum* sp. nov., a new swellshark (Carcharhiniformes: Scyliorhinidae) from southeastern Australia, pp. 147–157. *In:* P.R. Last, W.T. White & J.J. Pogonoski (eds). Descriptions of new Australian Chondrichthyans. *CSIRO Marine & AtmosphericResearch Paper 022*, 358 pp.

Cephaloscyllium albipinnum sp. nov., a new swellshark (Carcharhiniformes: Scyliorhinidae) from southeastern Australia

Peter R. Last[1], Hiroyuki Motomura[2] & William T. White[1]

[1]CSIRO Marine & Atmospheric Research, GPO Box 1538, Hobart, TAS, 7001, AUSTRALIA
[2]The Kagoshima University Museum, 1–21–30 Korimoto, Kagoshima 890–0065, JAPAN

ABSTRACT.— A new species of swellshark, *Cephaloscyllium albipinnum* sp. nov., is described based on material from the outer continental shelf and upper continental slope of southeastern Australia. *Cephaloscyllium albipinnum* has a parapatric distribution with another large swellshark, *C. laticeps*. These species can be distinguished by a combination of coloration and meristics. *Cephaloscyllium albipinnum*, which belongs to a subgroup of swellsharks with a colour pattern dominated by dark dorsal saddles and blotches (rather than being strongly mottled or variegated), has an egg case with a smooth surface. In comparison, the egg cases of *C. laticeps* are unique within the genus in possessing a series of thick transverse ridges. Other Australian saddled swellsharks have narrower saddles with larger interspaces, as well as subtle differences in body shape. A deepwater swellshark from New Zealand, *C. isabella*, also has well defined saddle-like markings but differs from Australian species in having a distinctive stellate saddle between the spiracles, and larger and more widely spaced denticles.

Key words. Scyliorhinidae – *Cephaloscyllium albipinnum* – swellshark – new species – Australia

PDF contact: john.pogonoski@csiro.au

INTRODUCTION

Last & Stevens (1994) identified 7 *Cephaloscyllium* species from Australian waters of which 5 were considered to be undescribed. One of these species, known as the whitefin swellshark (*C.* sp. A *sensu* Last & Stevens), occurs off southeastern Australia where it is parapatric with an abundant inshore species, *C. laticeps* (Duméril, 1853). *Cephaloscyllium* sp. A was taken during the first deepwater fishery resource surveys off southern Australia but was mistaken as a variant of *C. laticeps* (Last & Harris, 1981). It was subsequently misidentified and figured as *C. nascione* Whitley, 1932 by Compagno (1984) and May & Maxwell (1986), which presumably led to its inclusion as that species in an Australian Pisces checklist (Paxton *et al*., 1989). *Cephaloscyllium nascione* is now considered to be a junior synonym of *C. laticeps* (Last & Stevens, 1994, Hoese *et al.*, 2006). Whitley's (1932) swellshark, which was named *C. isabella nascione*, was thought to be a subspecies of the New Zealand swellshark, *C. isabellum* (Bonnaterre, 1788). However, the New Zealand species differs from all Australian swellsharks in colour pattern and denticle morphology.

Cephaloscyllium sp. A is a common bycatch in trawl fisheries of southeastern Australia. New South Wales catches, thought to be of *C.* sp. A but probably of *C.* sp. C *sensu* Last & Stevens, declined by more than 30% over a 20 year period (Barratt & Kyne, 2003). *Cephaloscyllium* sp. A has been rated as near threatened by the IUCN (Barratt & Kyne, 2003), and despite confusion with *C.* sp. C., this rating is probably appropriate. This new species is formally described and compared closely with *C. laticeps*, *C. isabellum* and *C. umbratile* Jordan & Fowler, 1903.

METHODS

Morphometric characters were selected to facilitate comparisons of the new *Cephaloscyllium* species with the sympatric *C. laticeps*. Our methods generally followed a widely adopted scheme for elasmobranchs (Compagno, 1984, 2001), but focused on direct rather than horizontal measurements. The holotype (CSIRO H 5314–11) and 6 paratypes (CSIRO CA 58, CSIRO CA 4500, CSIRO H 1328–01, CSIRO H 1328–02, CSIRO H 3866–01 and CSIRO H 5940–01) of the new species, 8 specimens of *C. laticeps* (CSIRO CA 4501, CSIRO H 1264–13, CSIRO H 1330–01, CSIRO H 1333–01, CSIRO H 2649–01, CSIRO H 3547–01, CSIRO H 3574–01 and CSIRO H 3850–05) and two specimens of

C. isabellum (NMNZ P 5454 and NMNZ P 20991) were measured in full (Table 1). Meristics were taken from radiographs of the holotype and 12 paratypes (CSIRO CA 58, CSIRO CA 4498, CSIRO CA 4500, CSIRO H 985–04, CSIRO H 1328–01, CSIRO H 1328–02, CSIRO H 1329–01, CSIRO H 3579–01, CSIRO H 3704–03, CSIRO H 3704–04, CSIRO H 3866–01 and CSIRO H 5940–01) of the new species, 9 specimens of *C. laticeps* (CSIRO CA 4501, CSIRO H 1264–12, CSIRO H 1332–01, CSIRO H 1333–01, CSIRO H 1334–01, CSIRO H 1339–01, CSIRO H 2341–01, CSIRO H 2649–01 and CSIRO H 3547–01) and 4 specimens of *C. isabellum* (NMNZ P 5454, NMNZ P 20971, NMNZ P 20978 and NMNZ P 20991). Meristics were obtained separately for trunk (monospondylous), precaudal (monospondylous + diplospondylous to origin of upper lobe of caudal fin) and caudal (centra of the caudal fin) vertebrae. In the description, morphometric and meristic values for the holotype are given first followed in parentheses by the ranges of the measured paratypes. Morphometric methods for egg cases follow those described by Ebert *et al*. (2006) and are presented for both the new species and *C. laticeps* (see Table 2). Type specimens and comparative material are deposited in the Australian National Fish Collection, Hobart (CSIRO), and ichthyological collections of the South Australian Museum (SAMA) and Museum of New Zealand, Te Papa Tongarewa (NMNZ); their registration numbers are prefixed with these acronyms.

Cephaloscyllium albipinnum sp. nov.

Figs 1, 2, 3a; Table 1, 2

Cephaloscyllium sp. A: Last & Stevens, 1994: pp 170, 192, key fig. 44, fig. 26.20, pl. 23; Compagno *et al.*, 2005: pp 219, 220, pl. 36.

Cephaloscyllium nascione: Gomon *et al.*, 1994: pp 136, 137, figs 104, 105.

Holotype. CSIRO H 5314–11, adult male 1013 mm TL, east of Maria Island, Tasmania, 42°38′ S, 148°26′ E, 445–463 m, 01 May 2000.

Paratypes. 15 specimens. CSIRO CA 58, immature male 638 mm TL, north-east of Flinders Island, Tasmania, 39°27′ S, 148°33′ E, 240–300 m, 28 Nov 1976; CSIRO CA 4498, female 421 mm TL, CSIRO CA 4499, female 475 mm TL, Australia, 21 Jan 1986; CSIRO CA 4500, female 590 mm TL, east of Maria Island, Tasmania, 42°39′ S, 148°25′ E, 462–480 m, 17 Apr 1984; CSIRO H 985–04, female 446 mm TL, east of Maria Island, Tasmania, 42°40′ S, 148°24′ E, 428–460 m, 30 Oct 1984; CSIRO H 1328–01, immature male 737 mm TL, CSIRO H 1328–02, female 619 mm TL, west of Cape Sorell, Tasmania, 42°10′ S, 144°43′ E, 546–548 m, 17 July 1983; CSIRO H 1329–01, immature male 700 mm TL, south-west of King Island, Tasmania, 40°34′ S, 143°29′ E, 480–510 m, 12 Oct 1983; CSIRO H 1331–01, female 587 mm TL, off Strahan, Tasmania, Jan 1976; CSIRO H 3579–01, female 271 mm TL, east of Disaster Bay, New South Wales, 37°17′ S, 150°19′ E, 139–141 m, 30 Nov 1993; CSIRO H 3704–03, female 245 mm TL, CSIRO H 3704–04, female 223 mm TL, east of Disaster Bay, New South Wales, 37°19′ S, 150°18′ E, 139–143 m, 08 Aug 1994; CSIRO H 3866–01, female 1025 mm TL, east of Green Cape, Tasmania, 37°12′ S, 150°20′ E, 126–135 m, 23 Nov 1994; CSIRO H 5940–01, female 632 mm TL, west of Point Hibbs, Tasmania, 42°40′ S, 144°45′ E, 460 m, 21 Aug 2002; CSIRO T 1310, female 231 mm TL, off Port Davey, Tasmania, 146 m, Jan 1979. Egg cases. CSIRO T 1953, egg case, east of Maria Island, Tasmania, 80 m, 24 Sep 1979; CSIRO T 1959, two egg cases, east of Schouten Island, Tasmania, 120 m; CSIRO H 6623–01, egg case, south of Tasman Island, Tasmania, ca. 43° S, ca. 148° E, 30 Oct 2002.

Other material. CSIRO C 4786, immature male 762 mm TL, east of Batemans Bay, New South Wales, 35°39′ S, 150°45′ E, 350–400 m, 30 Aug 1976; CSIRO CA 3325, adult male ca. 950 mm TL, Great Australian Bight, Western Australia, 33°17′ S, 128°23′ E, 310–320 m, 03 Dec 1981; CSIRO H 986–01, immature male 574 mm TL, east of Maria Island, Tasmania, 42°39′ S, 148°26′ E, 460–480 m, 15 June 1984; CSIRO H 1327–01, female 774 mm TL, west of Cape Sorell, Tasmania, 42°13′ S, 144°44′ E, 554–612 m, 06 July 1983; CSIRO H 1337–01, juvenile male 370 mm TL, west of Kangaroo Island, South Australia, 36°01′ S, 135°44′ E, 365–409 m, 27 Nov 1984; CSIRO H 3588–01, adult male ca. 895 mm TL, east of Green Cape, New South Wales, 37°19′ S, 150°18′ E, 135–139 m, 18 June 1993; CSIRO H 3850–01, juvenile male 339 mm TL, CSIRO H 3850–02, juvenile male 336 mm TL, east of Disaster Bay, New South Wales, 37°16′ S, 150°19′ E, 139–145 m, 18 Sep 1994; CSIRO H 5929–01, female ca. 938 mm TL, east of Maria Island, Tasmania, 42°40′ S, 148°30′ E, 460 m, 23 Oct 2002.

DIAGNOSIS.— A large *Cephaloscyllium* with the following combination of characters: head height 8.6–13.5% TL, trunk width 16.1–23.8% TL; first dorsal-fin origin usually forward of mid pelvic-fin base; prenarial length 4.5–5.1% TL; preorbital snout length 1.4–1.7 times prenarial length, 2.5–3.1 in prepectoral length, 6.3–6.9 in prepelvic length; long snout-vent length, 48.1–52.4% TL; nostril width 2.4–2.7% TL; wide eye–spiracle space, 1.0–1.4% TL; large pectoral fin, height 12.6–13.6% TL, posterior margin length 12.0–13.6% TL; tall anal fin, height 3.8–4.4% TL; anal–caudal space 4.0–5.6% SL; precaudal length 74–78% TL; interdorsal space 6.3–7.6% TL; teeth near symphysis of upper jaw with 3–5 cusps; flank denticles mainly weakly tricuspidate; no greatly enlarged denticles on back; adult clasper long, to 8.8% TL, almost reaching anal fin, interspace about 4.4 in anal-fin base; 121–126 vertebral centra; high tooth count, 90–116 teeth in each jaw; upper half of body with strong pattern of saddles and blotches; 9–10 dark, transverse dorsal markings on body and tail, interspaces between them narrow; interspiracular saddle subequal to eye and spiracle length; large circular blotch over and

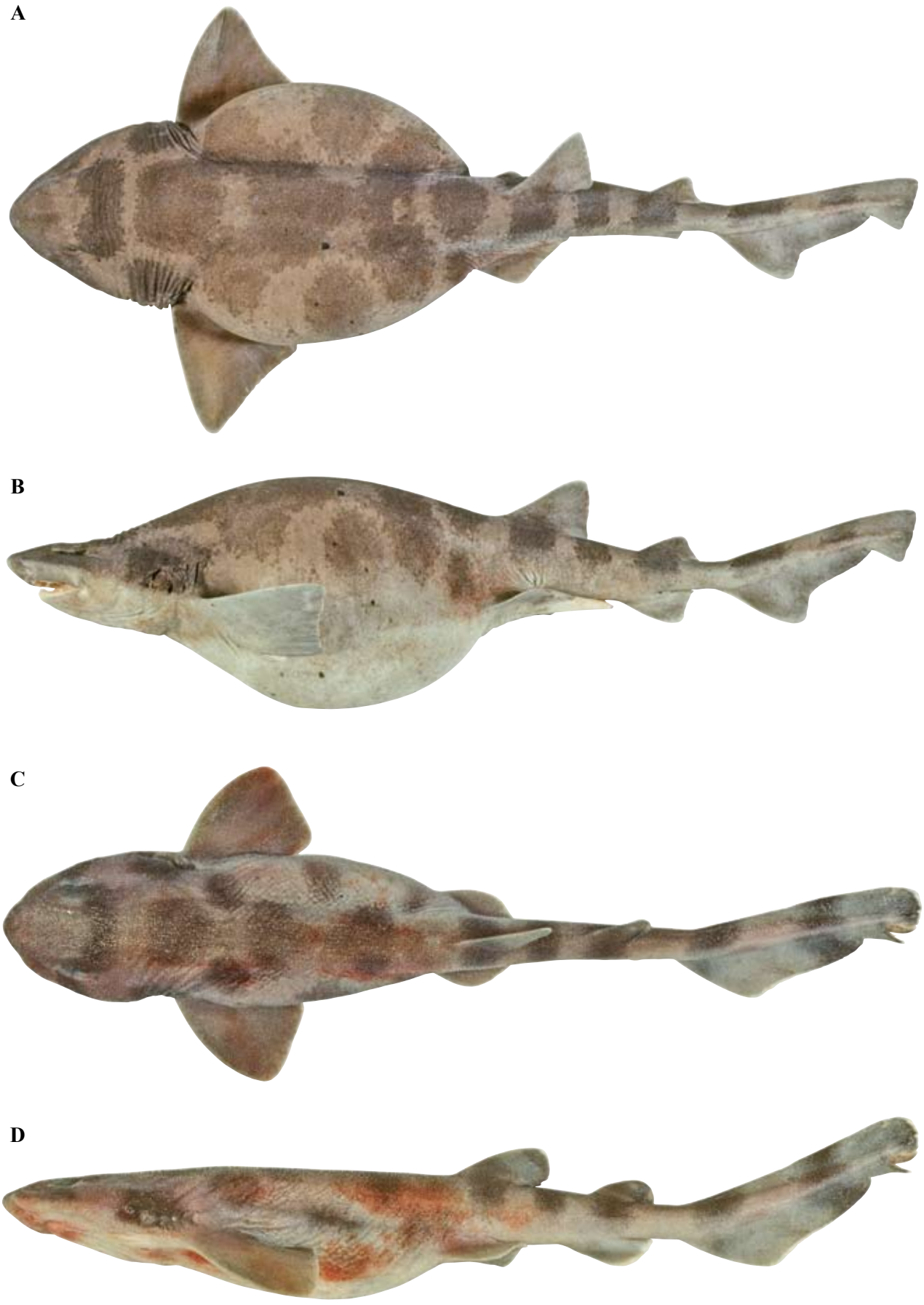

Figure 1. *Cephaloscyllium albipinnum* sp. nov.: A. dorsal view, B. lateral view of holotype (CSIRO H 5314–11, adult male 1013 mm TL); C. dorsal view, D. lateral view of juvenile paratype (CSIRO H 3579–01, female 271 mm TL).

above gill slits; and fins with variably developed, narrow pale margins.

DESCRIPTION.— Body robust anteriorly, belly often greatly expanded, tapering gradually behind first dorsal fin. Head strongly depressed, short and very broad, length 23.2 (21.5–23.6)%, width 17.9 (16.9–18.7)% TL; widest just forward of 1st gill slit; broadly parabolic in dorsoventral view, bluntly pointed in lateral view; lateral angle of suborbital shelf usually weakly defined; supraorbital crest thick; gill slits dorsolateral; last two slits over pectoral-fin base (third gill slit over pectoral-fin origin in some paratypes), slightly closer together than slits 1–3; first three slits subequal in length, last two decreasingly smaller (fourth gill slit only slightly smaller than third in smallest whole paratype, CSIRO T 1310). Snout moderately rounded to bluntly pointed, length 3.24 (2.91–3.14) in head length. Eye dorsolateral, slit-like, length 2.13 (1.77–2.33) in snout; suborbital groove well-developed, much longer than eye; orbito-spiracular groove usually discontinuous; interorbital width 0.89 (0.80–0.91) of snout, 2.87 (2.33–2.70) in head length. Spiracle very small, subcircular to suboval, well separated from eye; dorsolateral on head, length 16.0 (14.3–21.6) in interorbital width. Anterior nasal flap expanded laterally, overlapping outer lobe but not reaching mouth, posterior margin usually entire, sometimes weakly fringed; internarial width slightly larger than nostril width. Mouth relatively long and broad, width 2.07 (2.10–2.93) times length; roof of mouth and tongue usually papillose; labial furrows absent; postoral groove short, deep, straight or concave (extending ventrolaterally from each corner of mouth). Upper jaw teeth of adult male holotype small, recurved medially, with 3 cusps and basal grooves; first pair of lateral cusps well-developed, sometimes with additional 1–2 rudimentary lateral cusplets; central cusps not greatly extended near symphysis, much longer than lateral cusps near mouth corners; symphysial groove deep. Lower jaw teeth in adult male holotype subequal in size to those near symphysis of upper jaw, recurved medially; lateral cusps of posterior teeth not better defined than those anteriorly; 6 rows or so at symphysis greatly reduced, about a quarter size of those adjacent. Teeth in upper jaw of largest female paratype (CSIRO H 3866–01) usually with 3 main cusps, often with 1–2 short cusplets on each side; central cusp near symphysis only slightly larger than lateral cusps, only slightly smaller than central cusp of adult male; central cusp near angle of jaw barely longer than those laterally. Flank denticles of adult male very small, semi-erect, usually weakly tricuspidate, apices broadly pointed; well separated, not imbricate, reasonably similar in size; crown with a well-developed median ridge, lateral ridges short and obvious; denticles of adult female (CSIRO H 3866–01) also similarly sized, subequal to male holotype; crowns of female with much better developed medial and lateral ridges; denticles of smallest juvenile paratype (CSIRO T 1310) hirsute, slender, upright, pungent, not imbricate, well separated, those on midline of back not enlarged, similar in size to those on sides; no greatly enlarged denticles on mid surface of body or fins. First dorsal fin raked slightly, apex bluntly rounded (more narrowly rounded in smaller paratypes), posterior margin truncate (slightly convex in smallest paratypes); much larger than second dorsal fin; origin usually slightly to well forward of mid pelvic-fin base, pre-first dorsal length 50.9 (48.3–51.8)% TL. Second dorsal fin low, weakly subtriangular, pre-second dorsal length 66.8 (63.6–67.2)% TL; anterior margin almost straight, apex broadly rounded, posterior margin moderately concave (variable in paratypes, weakly concave to weakly convex); origin well behind anal-fin origin, insertion almost over anal-fin insertion. Anal fin distinctly larger than second dorsal fin, taller, apex broadly rounded in juvenile CSIRO T 1310 (usually more narrowly rounded in adults). Pectoral fins moderately large, anterior margin moderately convex, its length 15.7 (15.4–16.3)% TL; apices narrowly rounded, posterior margin weakly concave to truncate, inner margin mostly convex, free tip bluntly angular to narrowly rounded; anal-fin length 0.94 (0.97–1.31) times pelvic–anal space.

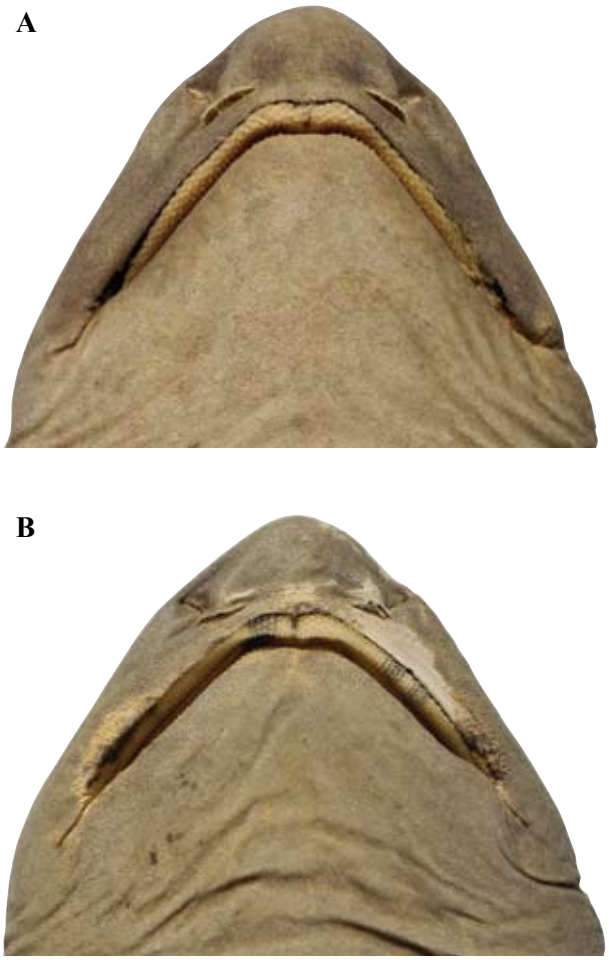

Figure 2. Ventral view of head of *Cephaloscyllium albipinnum* sp. nov.: A. holotype CSIRO H 5314–11 (adult male 1013 mm TL); B. paratype CSIRO H 3866–01 (adult female 1025 mm TL).

Table 1. Morphometric data for the holotype of *Cephaloscyllium albipinnum* sp. nov. (CSIRO H 5314-11), with ranges provided for the 6 measured paratypes, and ranges provided for *C. isabellum* and *C. laticeps*. Measurements expressed as a percentage of total length.

	C. albipinnum sp. nov.			***C. isabellum***		***C. laticeps***	
	Holotype	Paratypes		(n=2)		(n=8)	
		Min.	Max.	Min.	Max.	Min.	Max.
Total length (mm)	1013	590	1025	469	652	360	874
Precaudal length	77.4	74.3	77.7	76.8	79.0	76.3	78.9
Pre-second dorsal length	66.8	63.6	67.2	65.5	67.5	63.6	67.9
Pre-first dorsal length	50.9	48.3	51.8	50.7	52.3	48.9	51.2
Head length	23.2	21.5	23.6	21.2	22.3	20.6	23.0
Pre-branchial length	19.2	17.9	18.9	17.7	18.2	17.3	18.8
Pre-spiracular length	11.7	11.2	11.8	11.4	11.4	10.3	11.6
Preorbital length (horizontal)	6.2	5.6	6.4	5.6	6.2	5.0	5.9
Preorbital length (direct)	7.2	7.2	7.7	7.4	7.6	6.8	7.5
Preoral length	4.2	3.6	4.2	4.0	4.3	3.6	4.2
Prenarial length	4.7	4.5	5.1	4.7	4.7	4.4	4.7
Pre-pectoral length	21.8	19.0	22.2	19.9	20.2	18.9	21.7
Pre-pelvic length	49.1	45.9	49.2	46.0	46.8	43.8	46.7
Pre-vent length	52.1	48.1	52.4	50.7	50.9	47.2	50.2
Pre-anal length	64.9	60.8	64.2	62.7	65.4	60.9	64.9
Interdorsal space	7.6	6.3	7.6	6.8	7.6	6.7	8.7
Dorsal–caudal space	5.3	4.8	6.0	6.0	6.0	5.0	7.2
Pectoral–pelvic space	21.0	17.7	22.3	17.2	19.5	15.6	20.3
Pelvic–anal space	9.9	7.5	9.9	8.6	10.0	7.1	10.8
Anal–caudal space	4.4	4.0	5.6	5.0	5.5	4.1	5.2
Eye length	3.4	3.2	4.1	3.3	3.8	3.2	3.7
Interorbital width	8.1	8.1	9.6	8.8	9.1	7.7	9.4
Nostril width	2.5	2.4	2.7	2.5	3.1	2.3	3.1
Internarial space	3.3	3.1	3.8	3.0	3.0	2.9	3.2
Anterior nasal flap length	1.2	0.9	1.3	1.3	1.3	0.9	1.4
Spiracle length	0.5	0.4	0.6	0.8	0.8	0.4	0.9
Eye–spiracle space	1.4	1.0	1.2	0.8	1.2	0.8	1.2
Mouth length	6.3	4.7	6.2	4.7	4.8	3.8	5.1
Mouth width	13.0	11.8	14.1	10.2	11.4	10.5	12.9
First gill slit height	3.2	2.3	3.3	2.2	2.5	1.7	2.6
Fifth gill slit height	2.0	1.5	2.0	1.3	1.9	1.3	1.7
Head height	13.0	8.6	13.5	9.7	12.0	9.3	11.6
Trunk height	18.3	9.5	15.8	11.4	11.8	8.8	15.4
Caudal peduncle height	2.9	2.7	3.0	2.7	3.0	2.7	3.7
Head width	17.9	16.9	18.7	14.3	15.8	15.3	18.0
Trunk width	23.0	16.1	23.8	14.2	15.4	13.9	21.3
Caudal peduncle width	2.8	2.3	2.6	2.8	2.9	2.6	3.2
Pectoral fin - length	14.9	14.3	15.4	15.3	15.4	15.5	17.9
Pectoral fin - anterior margin	15.7	15.4	16.3	15.4	15.8	15.7	18.8
Pectoral fin - base	10.4	9.5	11.0	9.6	10.5	9.7	11.7
Pectoral fin - height	13.6	12.6	13.6	13.1	13.3	12.9	15.2
Pectoral fin - inner margin	5.3	5.3	5.8	5.7	5.9	5.5	7.0
Pectoral fin - posterior margin	13.1	12.0	13.6	12.2	13.1	12.4	14.9

Table 1. cont'd

	C. albipinnum sp. nov.			*C. isabellum*		*C. laticeps*	
	Holotype	Paratypes		(n=2)		(n=8)	
		Min.	Max.	Min.	Max.	Min.	Max.
Pelvic fin - length	12.1	10.1	11.8	12.1	12.6	10.8	14.1
Pelvic fin - anterior margin	6.5	5.9	6.9	7.3	7.9	6.3	8.1
Pelvic fin - base length	7.7	6.5	8.7	8.5	8.6	7.3	10.7
Pelvic fin - height	6.5	5.0	6.5	6.0	6.2	5.4	6.8
Pelvic fin - inner margin	4.7	3.0	4.5	4.0	4.2	2.7	5.3
Pelvic fin - posterior margin	8.0	6.8	8.4	6.8	6.9	7.0	9.3
Clasper outer length	8.8	0.0	0.0	9.7	9.7	8.3	9.3
Clasper inner length	12.1	0.0	0.0	13.4	13.4	14.0	14.2
Clasper base width	2.0	0.0	0.0	2.1	2.1	2.0	2.1
First dorsal fin - length	11.2	10.5	11.8	10.4	10.6	10.7	12.1
First dorsal fin - anterior margin	11.3	10.9	12.5	10.4	10.6	10.7	12.0
First dorsal fin - base length	8.5	7.9	9.1	7.6	8.1	8.2	9.7
First dorsal fin - height	7.1	6.3	7.1	5.9	6.1	5.4	6.7
First dorsal fin - inner margin	2.5	2.2	3.0	2.6	3.2	2.2	2.8
First dorsal fin - posterior margin	6.8	5.7	6.8	5.2	5.5	5.7	7.2
Second dorsal fin - length	8.1	7.6	8.4	8.3	8.6	8.0	9.4
Second dorsal fin - anterior margin	6.2	5.4	7.1	6.4	6.8	6.3	7.8
Second dorsal fin - base length	5.2	5.0	5.8	5.6	5.8	5.5	7.0
Second dorsal fin - height	3.1	2.7	3.4	3.3	3.3	3.1	3.7
Second dorsal fin - inner margin	2.9	2.4	2.7	2.9	2.9	2.5	2.9
Second dorsal fin - posterior margin	4.0	3.1	3.8	3.4	3.7	3.3	4.6
Anal fin - length	9.3	9.3	10.4	10.0	10.1	10.1	11.5
Anal fin - anterior margin	8.3	7.3	8.5	9.0	9.3	9.2	10.1
Anal fin - base length	6.5	6.8	7.9	7.3	7.8	7.7	9.3
Anal fin - height	4.4	3.8	4.4	3.9	4.0	3.6	4.6
Anal fin - inner margin	2.9	2.4	2.8	2.5	2.8	2.4	2.9
Anal fin - posterior margin	4.8	3.9	4.9	3.5	3.8	3.2	5.0
Caudal fin - dorsal margin	22.5	22.1	25.3	21.2	23.0	20.7	23.4
Caudal fin - preventral margin	10.4	9.2	10.7	10.9	11.4	11.4	12.6
Caudal fin - lower postventral margin	3.3	2.6	3.5	2.6	3.3	2.6	3.3
Caudal fin - upper postventral margin	7.9	7.9	9.7	7.7	7.7	6.0	7.2
Caudal fin - subterminal margin	3.9	3.2	5.1	4.0	4.5	3.9	5.5
Caudal fin - terminal margin	6.0	5.7	6.6	6.5	7.0	5.6	7.8
Caudal fin - terminal lobe length	6.6	6.6	7.8	7.1	8.1	6.4	8.6
Second dorsal origin–anal origin	1.1	1.1	2.6	1.7	2.1	2.0	3.2
Second dorsal insertion–anal insertion	0.6	0.2	0.9	0.4	0.8	0.3	1.1

Pelvic fins small, length 12.1 (10.1–11.8)% TL. Claspers cylindrical, elongate, robust, almost reaching anal-fin origin, ventral surface covered with denticles; pelvic fins united to dorsobasal surface of clasper, incomplete apron joining claspers just posterior to cloaca. Caudal fin large, with a distinct ventral lobe; terminal lobe well developed, deep, its posterior margin truncate to moderately convex (narrow and broadly rounded in smallest paratype). Teeth in upper jaw about 115 (90–116); in lower jaw about 109 (97–110). Monospondylous vertebrae 48 (45–48 in 11 paratypes); precaudal 81 (79–82); total 126 (121–126).

EGG CASES.— Eggs cases large (98–116 mm in length, excluding horns), smooth, glossy, without transverse or longitudinal striations or ridges; not constricted; somewhat flattened, height 21.2–26.7% ECL, posterior

Table 2. Morphometric data for egg cases of *Cephaloscyllium albipinnum* sp. nov. and *C. laticeps*. Measurements expressed as a percentage of egg case length (ECL).

	C. albipinnum sp. nov. n=4			***C. laticeps*** n=3		
	Mean	Min.	Max.	Mean	Min.	Max.
Egg case length (mm)	103.7	98.2	115.9	127.1	125.7	129.8
Posterior case width	44.5	38.5	50.6	39.0	37.3	40.9
Anterior case width	32.4	28.3	37.7	25.4	24.7	26.0
Anterior border width	28.3	25.1	32.7	21.7	20.9	22.5
Posterior border width	12.3	9.6	16.5	3.9	3.1	4.7
Egg case height	23.7	21.2	26.7	23.2	21.8	24.3

width 38.5–50.6% ECL; lateral flanges extending entire length of egg case, thick, rounded (not T-shaped). Anterior border nearly straight, broad; anterior horns relatively short, curved strongly inwards but not touching; tendrils long, wiry, tightly coiled. Posterior border much narrower, concave, width 2.0–2.6 in anterior border width; posterior horns moderately long, curved strongly inwards, overlapping; tendrils very long, wiry, highly convoluted, tightly coiled. Egg cases, in alcohol, are uniformly pale yellowish in colour.

COLOUR.— Preserved specimens: Upper surface and sides above level of pectoral-fin medium greyish brown with multiple darker, greyish brown saddles and blotches; coloration not variegated with white and dark markings; saddles not edged with paler lines or spots. Nine to ten darker cross-markings on body and caudal fin; a broad, weakly crescentic interspiracular saddle (greatest thickness subequal to combined eye and spiracle length); suborbital bar similar in colour, disjunct from interspiracular saddle, expanded ventrally (width at edge of head greater than interspiracular saddle); four additional, large predorsal markings on midline, weakly separated from each other and sometimes partly coalesced in large adults; first blotch on midline usually largest, centred over gill slits and anterior pectoral fin; second blotch on midline mostly over inner margin of pectoral fin and extending posteriorly; third blotch on midline before dorsal-fin origin; broad saddle situated between second and third blotches, sometimes connected to second blotch; enlarged lateral blotch over posterior base of pectoral fin, sometimes connected to first and second medial blotches at their basal extremities; enlarged blotch over gill slits, delineated ventrally by paler ventral coloration, extending well above dorsal extremities of gill slits to above eye level; two diffuse-edged blotches on sides, at mid belly and above pelvic-fin origin. Two to three saddles in region of dorsal fins; broad saddles below each dorsal fin, their width subequal to fin bases; sometimes with an additional interdorsal saddle, its origin near insertion of first dorsal fin; saddles penetrating onto bases of dorsal fins, more extreme in second dorsal fin than first. Caudal fin with two well-developed bars; first bar originating just behind origin of dorsal lobe; posterior bar inserted just anterior to insertion of ventral caudal lobe, extending further ventrally than anterior bar; indistinct dark terminal marking on terminal lobe. All fins with variably developed narrow pale margins, usually most pronounced on posterior upper margin of pectoral fin, lower lobe of caudal fin, and posterior margins of pelvic and anal fins; usually thinner but well pronounced on dorsal-fin margins of juveniles. Pectoral and pelvic-fin dorsal surfaces and anal fin similar to dorsal surface of body, becoming slightly darker away from fin base; ventral surface of pectoral and pelvic fins paler than dorsal surface, sometimes with a darker posterior region. Ventral surface of body dark in adults, slightly paler than dorsal surface (sometimes with light and dark blotches; juveniles distinctly paler, often almost white). Claspers mostly whitish, with some greyish areas; mouth mostly

Figure 3. Egg case: A. *Cephaloscyllium albipinnum* sp. nov. (CSIRO H 6623–01); B. *Cephaloscyllium laticeps* (CSIRO T 1679–05).

Figure 4. *Cephaloscyllium laticeps:* A. dorsal view, B. lateral view of adult (CSIRO H 1264–13, adult female 820 mm TL); C. dorsal view, D. lateral view of juvenile (CSIRO H 5926–01, juvenile male 370 mm TL).

Figure 5. Dorsal view of: A. *Cephaloscyllium isabellum* (NMNZ P 5454, adult male 652 mm TL); B. *Cephaloscyllium umbratile* (CSIRO H 6295–22, immature male 330 mm TL).

pale, occasionally with enlarged black blotches. Colour pattern of small juveniles (CSIRO T 1310 and CSIRO H 3579–01) almost symmetric, more regular and better defined than in adults.

SIZE.— Material examined ranges from 198–1025 mm TL for females and 336–1013 mm TL for males. Smallest adult male ca. 895 mm TL and largest immature male 762 mm TL.

DISTRIBUTION.— Known from the outer continental shelf and upper continental slope of southeastern Australia from off Batemans Bay, New South Wales (35°39′ S, 150°45′ E) westward to the Great Australian Bight, Western Australia (33°17′ S, 128°23′ E), including Tasmania south to at least Maria Island (42°40′ S, 148°25′ E) on the east coast and Point Hibbs off the west coast (42°40′ S, 144°45′ E), at depths of 126–554 m.

ETYMOLOGY.— Derived from the combination of the Latin *albi* (white) and *pinna* (fin) in allusion to the distinctive white fin margins. Vernacular: Whitefin Swellshark.

REMARKS.— *Cephaloscyllium albipinnum* differs markedly from other nominal Australian species of the genus *Cephaloscyllium* in colour pattern. Unlike new species treated earlier in this series (Last *et al*., 2008), *C. speccum* Last, Séret & White, 2008 and *C. signourum* Last, Séret & White, 2008, which both have a strongly variegated pattern, *C. albipinnum* has a strong pattern of plain dark blotches and saddles. *Cephaloscyllium cooki*, a small member of the genus attaining only about 300 mm TL, also has saddle-like markings but these are white edged. Another dwarf species, *C. fasciatum*, has fine, dark, linear markings. *Cephaloscyllium albipinnum*, and a parapatric congener *C. laticeps*, are the two largest Australian species, both attaining 1 m or more in length. However, the coloration of *C. laticeps* is more strongly variegated, denticles on the juveniles are larger, and its egg cases have well-developed transverse ridges (otherwise with smooth surfaces). The genetic barcode of *C. albipinnum* differs from those species that have been analysed, i.e. *C. fasciatum*, *C. laticeps*, *C. pictum*, *C. speccum* and *C*. sp. C (Ward *et al*., submitted).

A New Zealand species, *C. isabellum*, and a western North Pacific species, *C. umbratile*, also have very different colour patterns to *C. albipinnum* (see Fig. 5). *Cephaloscyllium isabellum* has less extensive subdorsal saddle-like markings and the interspiracular saddle terminating in a broad narrow bar with a lateral extension above and behind the gill slits. These saddle-like markings are much less well defined and narrower than in juveniles

and adults of *C. albipinnum*. Juveniles of *C. isabellum* have larger and more widely spaced denticles on the back and males mature at a smaller size (650 mm vs. >850 mm TL in *C. albipinnum*). The juveniles of *C. umbratile* have 3 primary predorsal saddles (vs. 4–5 in *C. albipinnum*) that are weakly demarcated from their pale interspaces by lighter borders (vs. not demarcated), no distinct blotch over the gill slits (vs. present), and denser denticles.

Comparative material.

Cephaloscyllium isabellum: 4 specimens. NMNZ P 5454, adult male 652 mm TL, north of D'Urville Island, New Zealand, 40°24′ S, 174°26′ E, 110 m, 12 May 1971; NMNZ P 20971, female 240 mm TL, east of Chatham Islands, New Zealand, 43°27′ S, 176°27′ E, 140–155 m, 26 May 1987; NMNZ P 20978, immature male 259 mm TL, east of Chatham Islands, New Zealand, 43°38′ S, 175°51′ E, 234–245 m, 25 May 1987; NMNZ P 20991, female 469 mm TL, east of Chatham Islands, New Zealand, 43°39′ S, 175°53′ E, 220–248m, 24 May 1987.

Cephaloscyllium laticeps: 16 specimens. CSIRO CA 4501, female 564 mm TL, Australia; CSIRO H 1264–12, adult male 796 mm TL, CSIRO H 1264–13, pregnant female 820 mm TL, north of Maria Island, Tasmania, 42°33′ S, 148°15′ E, 81–82 m, 07 Apr 1988; CSIRO H 1330–01, adult male 806 mm TL, west of Cape Grim, Tasmania, 40°47′ S, 144°16′ E, 93 m, 21 Feb 1979; CSIRO H 1332–01, female 368 mm TL, Tasmania; CSIRO H 1333–01, immature male 360 mm TL, east coast of Tasmania, 20 June 1978; CSIRO H 1334–01, female 293 mm TL, Frederick Henry Bay, Tasmania, 42°54′ S, 147°36′ E, 14 m, 21 July 1983; CSIRO H 1339–01, immature male 305 mm TL, west of Tasman Island, Tasmania, 43°17′ S, 147°50′ E, 101–121 m, 02 Dec 1983; CSIRO H 2341–01, female 473 mm TL, Bathurst Harbour entrance, Tasmania, Oct 1988; CSIRO H 2649–01, female 422 mm TL, north of Maria Island, Tasmania, 42°32′ S, 148°12′ E, 530 m, 13 July 1990; CSIRO H 3547–01, adult male 874 mm TL, east of Lakes Entrance, Victoria, 37°56′ S, 148°12′ E, 42 m, 30 July 1993; CSIRO H 3574–01, female 422 mm TL, Bass Strait, Victoria, 38°36′ S, 148°22′ E, 106–118 m, 28 July 1993; CSIRO H 3850–05, immature male 546 mm TL, east of Disaster Bay, New South Wales, 37°16′ S, 150°19′ E, 139–145 m, 18 Sep 1994; CSIRO H 5926–01, immature male 370 mm TL, North Bruny Island, Tasmania, 43°03′ S, 147°22′ E, 21 m, 25 Sep 2002; CSIRO T 1701–01, female 198 mm TL, southern Tasmania, 02 Feb 1980; SAMA A 1761, immature male 195 mm TL, out of Anxious Bay, South Australia, 27 Feb 1981. Egg cases. CSIRO T 1425, 2 egg cases, Bruny Island, Tasmania, ca. 43°17′ S, 147°18′ E, 15 m, 17 Aug 1983; CSIRO T 1679–05, egg case, off Triabunna, Tasmania, ca. 42°30' S, 148° E, 15 Feb 1981; CSIRO T 1960, egg case, off Tamar River mouth, Tasmania.

Cephaloscyllium umbratile: 3 specimens. CSIRO H 6295–22, immature male 330 mm TL, Tashi fish market, Taiwan, 24 May 2005; CSIRO H 5611–04, immature male 205 mm TL, CSIRO H 5611–08, immature male 300 mm TL, Tashi fish market, Taiwan, 01 Aug 2000.

ACKNOWLEDGEMENTS

This research project was supported by the Wealth from Oceans (WFO) Flagship. The new species was first identified in a study of the Australian chondrichthyan fauna (Last & Stevens, 1994), funded by the Fisheries Research Development Corporation (FRDC). Sincere thanks go to John Stevens (CSIRO) for his pioneering work on Australian sharks and rays, Alastair Graham (CSIRO) for assembling data on Australian materials, John Pogonoski (CSIRO) for editorial comments and assisting with radiographs, Andrew Stewart (NMNZ) for providing specimens and data for New Zealand specimens, Louise Conboy and Thor Carter (CSIRO) for photographing specimens, Bob Ward and Bronwyn Holmes (CSIRO) for their continuing support on the genetic barcoding of Australian fishes, and Tim Fountain (CSIRO) for preparing radiographs and obtaining meristic information. Thanks also go to Ken Graham (NSW Fisheries), David Ebert (Moss Landing Marine Laboratories, U.S.A.) and George Burgess (Florida Museum of Natural History, U.S.A.) for collection of material. Most material of the new species was collected by the FRV *Courageous*, FRV *Soela* and FRV *Southern Surveyor* during surveys off southeastern Australia. We thank all scientific participants and crew of these voyages for their assistance.

REFERENCES

Barratt, P.J. & Kyne, P.M. (2003) *Cephaloscyllium* sp. nov. A. *In*: IUCN 2006. *2006 IUCN Red List of Threatened Species*. www.iucnredlist.org. (downloaded on 14 August 2007).

Bonnaterre, J.P. (1788) *Tableau encyclopédique et méthodique des trios règnes de la nature*. Ichthyologie. Paris, 215 pp.

Compagno, L.J.V. (1984) FAO Species Catalogue. Vol. 4, Sharks of the World. An annotated and illustrated catalogue of shark species known to date. *FAO Fisheries Synopsis* No. 125. vol. 4, pt. 2 (Carcharhiniformes), pp. x, 251–655.

Compagno, L.J.V. (2001) *Sharks of the World: an annotated and illustrated catalogue of shark species known to date. Volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes)*. FAO, Rome, 269 pp.

Compagno, L.J.V., Dando, M. & Fowler, S. (2005) *A Field Guide to Sharks of the World*. Harper Collins Publishing Ltd., London, 368 pp.

Duméril, A.H.A. (1853) Monographie de la tribu des Scylliens ou Roussettes (poissons plagiostomes) comprenant deux espèces nouvelles. *Revue et Magasin de Zoologie, Series 2* **5:** 8–25; 73–87; 119–130.

Ebert, D.A., Compagno, L.J.V. & Cowley, P.D. (2006) Reproductive biology of catsharks (Chondrichthyes: Scyliorhinidae) off the west coast of southern Africa. *ICES Journal of Marine Science* **63:** 1053–1065.

Gomon, M.F., Glover, J.C.M. & Kuiter, R.H. (1994) *The Fishes of Australia's South Coast.* State Print, Adelaide, 992 pp.

Hoese, D.F., Bray, D.J., Paxton, J.R. & Allen, G.R. (2006) Fishes. *In*: P.L. Beesley & A. Wells (eds) *Zoological Catalogue of Australia Volume 35. Parts 1–3.* Australian Biological Resources Study and CSIRO Publishing, 2248 pp.

Jordan, D.S. & Fowler, H.W. (1903) A review of the elasmobranchiate fishes of Japan. *Proceedings of the United States National Museum* **26:** 593–674.

Last, P.R. & Harris, J.G.K. (1981) New locality records and preliminary information on demersal fish faunal assemblages in Tasmanian waters. *The Papers and Proceedings of the Royal Society of Tasmania* **115:** 189–209.

Last, P.R., Séret, B. & White, W.T. (2008) New swellsharks (*Cephaloscyllium*: Scyliorhinidae) from the Indo-Australian region, pp. 129–146. *In:* P.R. Last, W.T. White & J.J. Pogonoski (eds). Descriptions of new Australian Chondrichthyans. *CSIRO Marine & Atmospheric Research Paper 022,* 358 pp.

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

May, J.L. & Maxwell, J.G.H. (1986) *Field Guide to Trawl Fish from Temperate Waters of Australia*. *Revised Edition*. CSIRO, Melbourne, 492 pp.

Paxton, J.R., Hoese, D.F., Allen, G.R. & Hanley, J.E. (1989) *Zoological Catalogue of Australia. Vol. 7. Pisces, Petromyzontidae to Carangidae.* Australian Government Publishing Service, Canberra, 665 pp.

Ward, R.D., Holmes, B.H., White, W.T. & Last, P.R. (2008) DNA barcoding the chondrichthyans of Australasia. *Marine and Freshwater Research*, **59:** 57–71.

Whitley, G.P. (1932) Studies in ichthyology. No. 6. *Records of the Australian Museum* **18:** 321–348.