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Report on Sicklefin weasel shark *Hemigaleus microstoma* (Bleeker, 1852) (Carcharhiniformes: Hemigaleidae) from the Andaman Islands, Indian EEZ with DNA barcodes

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Abstract

The occurrence of sickle fin weasel shark *Hemigaleus microstoma* Bleeker, 1852 is reported here from Indian EEZ, off the Andaman Islands in the Bay of Bengal. Two specimens of total length (TL) 610 mm and 628 mm were caught by longline at depths 40-100 m. A detailed diagnostic description and morphometrics of *H. microstoma* and its comparison with previous literature is provided. COI DNA barcodes were generated for the collected specimens.

Keywords: Bycatch, DNA Analysis, Elasmobranchs, Morphometrics, Port Blair

Introduction

Chondrichthyan fishes are mainly exploited as bycatch in the commercial fishery, whereas artisanal and recreational fishing activities also contribute a minor share. Their selected life pattern makes them highly vulnerable, as a result of over exploitation and habitat degradation (Dulvy *et al*., 2014). Among the chondrichthyan fishing nations, India is one of the leading nations after Indonesia for past several years, with an estimated landing of 40,171 tonnes (CMFRI, 2018). Andaman Islands contribute considerably to shark catches of India. Kumar *et al*. (2018) updated the checklist of sharks of Andaman Islands containing 117 species. However, sharks and rays diversity of Andaman Islands are poorly studied.

The Weasel sharks of this small family Hemigaleidae (Carcharhiniformes) are coastal tropical sharks mainly inhabitant in the continental and insular shelf waters down to the depth of at least 170 m (White, 2009). The genus *Hemigaleus* consist of only one species, *Hemigaleus microstoma* (Compagno, 1988). Later, White *et al*. (2005) described a close species *Hemigaleus australiensis* from Australian waters. *Hemigaleus microstoma* enjoys wide distribution in the Indo-West Pacific region, mostly from Southern India and Sri Lanka in the west to Myanmar, Thailand, Indonesia, Taiwan, China and Philippines (Compagno, 1984, 1998; Weigmann, 2012). Further, they were recorded from Northern Australia (Compagno, 1984), and off Papua New Guinea (Last & Stevens, 1994). The present study reports the Sicklefin weasel shark *Hemigaleus microstoma* from the Andaman Islands.

Material and Methods

Hemigaleus microstoma samples were collected from Junglighat fish landing centre, Port Blair, South Andaman during weekly fish landing surveys, as bycatch of commercial vessel operating in the Andaman Sea. The specimens were collected at 40-100 m depths off the Ross Islands in longline operation by artisanal fishermen

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(Figure 1). Species identification follows Compagno *et al.* (2005). Mityutyo digital Vernier Calipers were used for morphometric measurements to the nearest millimeter (mm) following Compagno (1984). The body proportions of the specimen are presented as a percentage of total length and compared with previously published results for *H. microstoma* from Indo West Pacific region. The specimens were deposited in Zoological Survey of India (ZSI/ANRC-12963), Port Blair and Pondicherry University, Port Blair (PU/B92N).

Molecular methods are followed to generated species specific DNA barcodes. Tissue samples collected from fresh specimens were preserved in 95% Ethanol and stored in fridge for DNA extraction and sequencing. The total DNA was extracted by standard protocols (Miller *et al.*, 1988) and Ward *et al.* (2005) (Fish F1) for amplifying COI gene. The raw DNA sequences were edited and aligned using BioEdit sequence alignment editor version 7.0.5.2 (Hall, 1999). The sequences were submitted to NCBI, GenBank (Accession No: KU738846 and KU738847).

Results

Systematics

Family HEMIGALEIDAE

Genus ***Hemigaleus*** Bleeker, 1852

Hemigaleus microstoma (Bleeker, 1852)

Sicklefin weasel shark

1852. *Hemigaleus microstoma* Bleeker, *Verh. Batav. Genoot. Kunst. Wet.*, **24**: 46, Pl. 2, fig. 9.

1929. *Hemigaleus machlani* Herre, *Philippine Journal of Science*, **40**(2): 231.

1960. *Negogaleus brachygnathus* Chu, *Cartilaginous fishes of China*: **64**, Figs. 58-59.

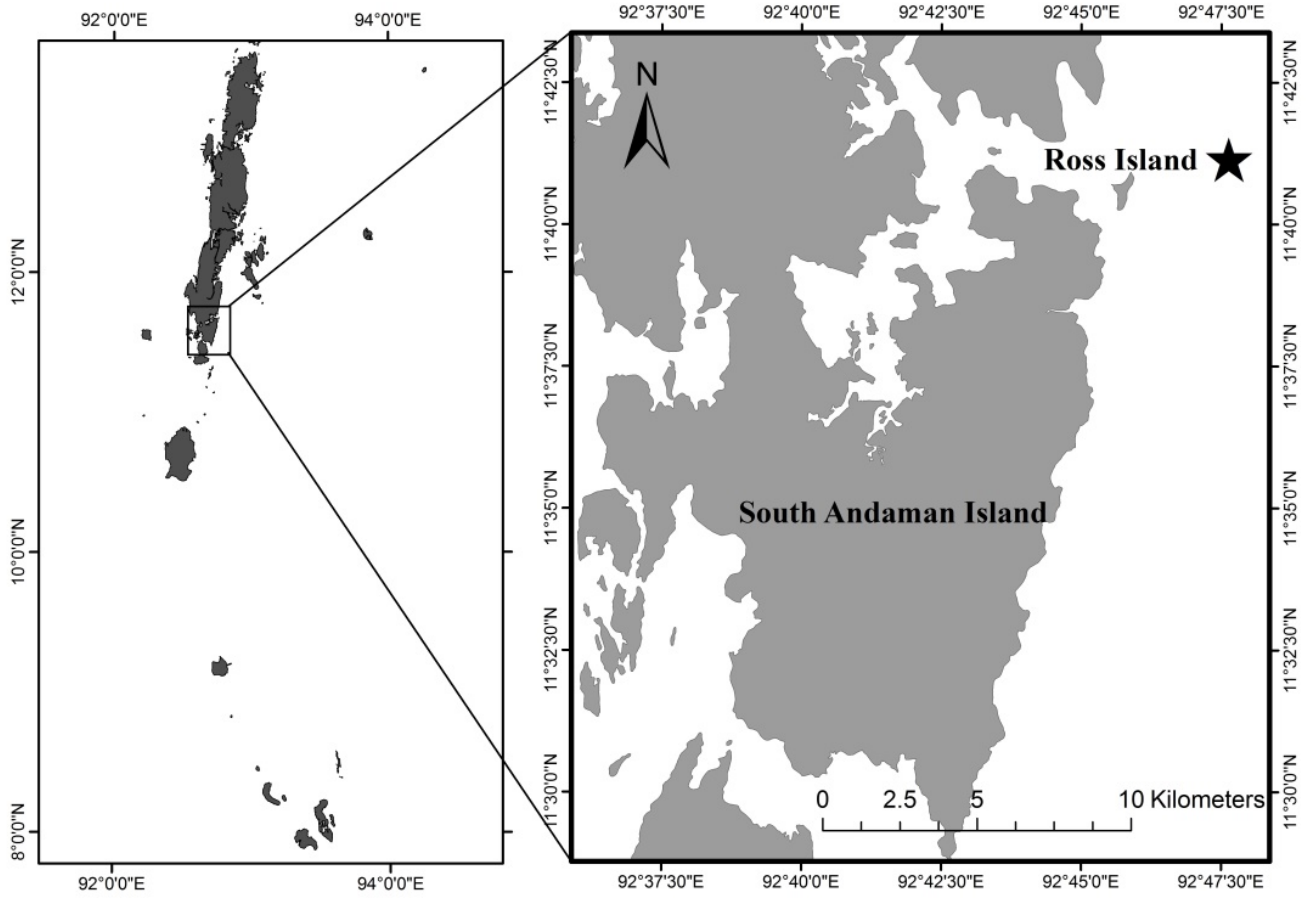

Figure 1. Map of the location where specimens of *Hemigaleus microstoma* were collected.

Syntypes: (2) BMNH 1867.11.28.173; Type locality: Indonesia

Material examined: 2 ex.; ZSI/ANRC-12963, Female, 610 mm TL, off Ross Island, Andaman Sea, 40 m depth, collected on 8 November 2016, by Bineesh K.K. from commercial longline vessel landed at Junglighat Fish landing centre; PU/B92N, Male, 628 mm TL, off Ross Island, Andaman Sea, 50 m depth, collected on 12 July 2018, by Ravi Ranjan Kumar and Bineesh K.K. from commercial longline vessel landed at Junglighat Fish landing centre.

Diagnosis: A small light grey to bronzy coloured shark with white spots on sides of the body. Strongly falcated pelvic fins, dorsal fins, and ventral caudal lobe; long rounded snout, short gill slits and very short arched mouth.

Description: Proportional measurements in percentile of Total Length (TL) are presented in Table 1. A slender shark with fairly rounded snout, tapering posteriorly; precaudal length 1.32–1.35 times total length (TL), 74.04–75.41% TL; head short, head length 18.7–19.1% TL, 1.19–1.72 in pectoral-pelvic space.

Moderately long head, length 0.6 in pectoral-pelvic space, 0.23 in precaudal length; moderately depressed and roughly trapezoidal in cross-section at eyes; prespiracular head region in lateral view nearly straight dorsally, later becoming convex above gills; post-oral head region slightly convex. Comparatively large oval shaped eyes, eye length 8.41 times the head length and positioned slightly dorsolateral on head. Spiracles were minute and their length much shorter than eye to spiracle distance, located dorsally to median level of eye; nictitating lower eyelids external. First gill slit is slightly smaller than next three but much longer than fifth, height of fifth 0.80 of first; height of first 6.5 in head and 1.29 of eye length. Anterior margin of gill slits undulate or slightly convex, upper margin almost in line with lower edges of eyes; gill filaments not visible from outside.

Mouth crescent-shaped and short; width 3.2 in head length; length 2.2 in width; large rounded tongue fills the buccal floor; buccal papillae absent; fairly long labial furrows present, upper furrow length 1.6 times lower furrow length. Nostrils are well in front of mouth and with large oval incurrent apertures lacking postero-larteral keels; its width 2.4 times in internarial space, 1.5 times in eye length, and 1.9 in first gill-slit opening; small excurrent oval apertures present.

Dorsal fins falcate and are fairly tall; anterior margin weakly convex, angular apically; posterior margin of D1 slightly concave; faintly slanted posteroventrally from apex, D2 moderately concave from apex to anteroventrally with straight inner margin; D1 origin slightly posterior to free rear tips of pectoral fins, whereas the insertion well anterior to pelvic-fin origins. Acutely pointed free rear tip of D2 terminates slightly anterior to anal-fin free rear tip and well in front of upper caudal-fin origin. Second dorsal fin height is 0.61 of first dorsal height; base length 0.67 of first dorsal-fin base length. First dorsal-fin base 2.1 in dorsal caudal-fin margin; fin height 1.22 in base length; inner margin 2.72 in height. Second dorsal-fin base length 1.4 in dorsal-caudal space; inner margin 1.44 in height, second dorsal-fin origin to anal-fin origin 6.19 in second dorsal-fin origin to pelvic fin midpoint. Pre and post dorsal ridges are absent,whereas interdorsal ridge present over half distance from first dorsal fin to second dorsal fin.

Dorsal fins are moderately tall and falcate; anterior margin weakly convex, angular apically; posterior margin of D1 slightly concave; faintly slanted posteroventrally from apex, D2 moderately concave from apex to anteroventrally with straight inner margin; D1 origin slightly posterior to free rear tips of pectoral fins; insertion well anterior to pelvic-fin origins, free rear tip of D2 acutely pointed and terminating slightly anterior to anal-fin free rear tip and well in front of upper caudal-fin origin; insertion about in level with fin apex. Second dorsal fin height is 0.61 of first dorsal height; base length 0.67 of first dorsal-fin base length. First dorsal-fin base 2.1 in dorsal caudal-fin margin; fin height 1.22 in base length; inner margin 2.72 in height. Second dorsal-fin base length 1.4 in dorsal-caudal space; inner margin 1.44 in height, second dorsal-fin origin to anal-fin origin 6.19 in second dorsal-fin origin to pelvic fin midpoint. Pre and post dorsal ridges are absent; interdorsal ridge extending just over half distance from first dorsal fin to second dorsal fin.

Anal fin slightly falcate with narrow apex, smaller than second dorsal fin; height 0.70 in second dorsal-fin height, base length 0.74 times second dorsal fin base length; anterior margin moderately convex; apex narrowly pointed with white tip; deeply notched posterior margin with acutely pointed free rear tip;positioned well in front of lower caudal-fin origin; inner margin nearly

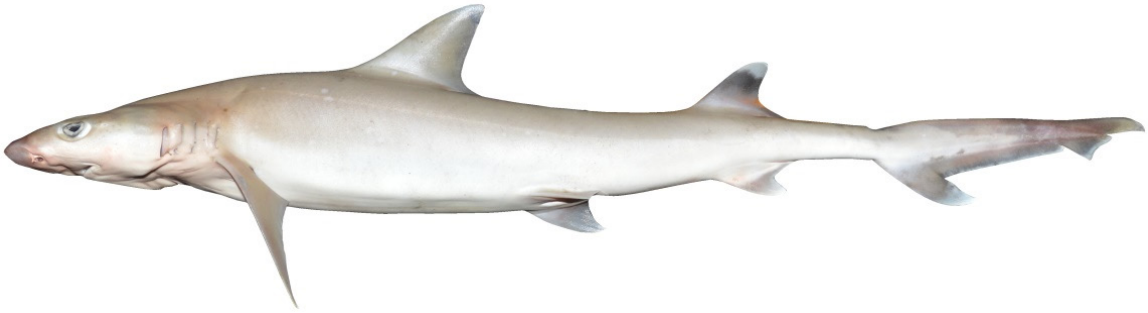

Figure 2. *Hemigaleus microstoma,* ZSI/ANRC-12963, 610 mm TL female.

Figure 3. *Hemigaleus microstoma* ventral view of the head, 610 mm TL female.

straight; preanal ridges indistinct. Anal fin origin slightly behind second dorsal-fin origin, also its insertion slightly behind second-dorsal fin insertion; anal fin base length 1.6 in anal-caudal space; fin height 1.41 in base length; inner margin 1.5 in height, 2.11 in base length.

DNA barcodes: DNA barcodes were generated for *Hemigaleus microstoma* for the first time from Indian waters and sequences were submitted to GenBank (KU738846, KU738847). Our sequence in GenBank had 100% similarity with *Hemigaleus microstoma* (EU398820) and 100% similarity in BOLD with *Hemigaleus microstoma* (BOLD: AAB3574).

Size and Biology: A total of 22 specimens of *Hemigaleus microstoma* of size ranges between 740-1095 mm (Females) and 450-920 mm (Males) were observed during fishery landings. Mostly caught in reef area gillnet/trawl/longline fishery where depth is less than 100 m. Feed mainly on Cephalopods (Octopus) and fin fishes (e.g. *Decapterus* spp, *Platax* spp).

Distribution and habitat: Hemigaleus microstoma is an uncommon shallow water shark found in Indian Ocean, northwest and western central Pacific. It is native to India, Sri Lanka, Myanmar, Thailand, Malaysia, Indonesia, Philippines, China, Taiwan and the Red Sea (Compagno, *et al*., 2005). The present records confirm the distribution in the Andaman Islands, India.

Discussion

Hemigaleus microstoma can be easily distinguished from its congener *H. australiensis* by differences in coloration, meristics, teeth, morphometrics and size at birth and maturity. Presence of white blotches on its body laterally (Figure 2) (vs. plain body without white blotches) and conspicuous white margins of the dorsal and pelvic fins as well as the anal fin and the ventral part of the caudal fin (vs. second dorsal and caudal fin are with dark margins and tips) (White *et al*., 2005).

Hemigaleus microstoma attains maturity in size much bigger than the *H. australiensis.* In the case of *H. australiensis*, males reach sexual maturity at 600 mm TL and females between 600–650mm TL; size at birth ranges between 260–280 mm TL (Stevens & Cuthbert, 1983). In contrast, *H. microstoma*, males reach maturity at about 750 mm TL and females from 750-780 mm TL (White, *et al*., 2009). Most of the females become sexually active between 450mm and 600 mm and all females above 750 mm up to 972 mm caught are being pregnant or spent (Compagno, 1984). Size at maturity recorded for *H. microstoma* from eastern Indonesia is 740–800 mm for females and >790 mm TL for males respectively,

Table 1. Morphometric data for the specimens of *Hemigaleus microstoma*, measurements expressed as percentage of total length

	ZSI/ANRC-12963 Female	*PU/B92N Male*
Total length	610	628
Pre caudal length	75.41	74.04
Pre second dorsal length	57.38	56.69
Pre first dorsal length	26.23	26.27
Head length	18.69	19.11
Pre branchial length	14.19	13.54
Pre spiracular length	10.11	9.47
Pre orbital length	6.28	5.95
Pre pectoral length	18.15	16.72
Pre pelvic length	42.62	40.61
Snout anterior vent length	44.26	46.97
Pre anal fin length	59.02	59.71
Interdorsal space	22.13	21.50
Second dorsal caudal space	10.62	10.03
Pectoral pelvic space	21.10	21.66
Pelvic anal space	11.66	13.38
Anal caudal space	10.01	10.35
Pre oral length	6.75	6.27
Eye length	2.82	2.53
Eye height	1.82	1.62
Inter gill length	4.55	6.14
First gill slit height	2.47	1.97
Second gill slit height	2.47	2.22
Third gill slit height	2.48	2.31
Fourth gill slit height	2.61	2.40
Fifth gill slit height	1.87	2.28
Pectoral anterior margin length	14.45	14.01
Pectoral base length	3.70	4.28
Pectoral height	11.60	13.54
Pectoral length	14.26	8.28
Dorsal caudal margin length	25.13	24.84
Pre ventral caudal margin length	11.11	10.67
Upper post ventral caudal margin length	11.73	11.78
Lower post ventral caudal margin length	4.07	5.89
Caudal fork width	5.69	5.25
Caudal fork length	7.57	7.48
Subterminal caudal margin length	3.58	3.16
Sub terminal caudal width	2.31	1.85
Terminal caudal margin length	5.92	7.96
Terminal caudal lobe length	8.42	9.39
First dorsal total length	12.64	12.74
First dorsal anterior margin length	13.82	13.54
First dorsal base length	9.13	9.71
First dorsal vertical height	13.87	10.03
First dorsal inner margin length	3.84	3.45
First dorsal posterior margin length	8.31	9.71
Second dorsal total length	9.75	9.24
Second dorsal anterior margin length	8.89	9.24
Second dorsal base length	7.26	6.85
Second dorsal vertical height	4.98	6.37
Second dorsal inner margin length	2.68	2.25
Second dorsal posterior margin length	4.77	5.10
Pelvic fin total length	8.12	7.17
Pelvic fin anterior margin length	7.90	7.32

Table 1. Continued.

	ZSI/ANRC-12963 Female	*PU/B92N Male*
Pelvic fin base length	5.06	5.25
Pelvic fin vertical height	4.79	5.25
Pelvic fin inner margin length	2.84	2.07
Pelvic fin posterior margin length	4.10	4.94
Head height at P origin	7.99	8.78
Trunk height at P base end	9.11	7.83
Abdomen height at first dorsal base end	9.47	10.33
First dorsal midpoint pectoral base end	11.33	13.96
Nostril width	1.94	1.59
Internarial width	3.64	3.12
Anterior nasal flap length	1.54	1.34
Spiracle length	0.22	0.13
Eye spiracle space	0.96	0.95
Head width at middle gill slit	7.50	7.85
Trunk width at pectoral base ends	8.41	9.46
Abdomen width at first dorsal base end	6.72	8.33
Tail width at pectoral base ends	5.57	6.40
Caudal peduncle width at caudal origin	2.07	2.44
Mouth width	5.51	6.88
Mouth length	1.67	2.27
Inter orbital space	6.70	6.25
Clasper length	-	3.55
Clasper width at base	-	0.80
Clasper width at tip	-	0.44

and the size at birth is 470–490 mm TL (White *et al.*, 2005). More specimens from Indian waters are required for the calculation of sexual maturity as well as for the comparison with other Indo Pacific stocks. Most of the measurements were within the range given by White *et al.* (2005) for *H. microstoma* for specimens from the Indo-Pacific region also in agreement with the measurements of Weigmann (2012). The present specimens show slight differences in some of the morphometric values like pre first dorsal length, pre pectoral length, anal-caudal space with the previous reports. The present report confirms the range extension of this species in the Southeast of the Bay of Bengal, i.e., Andaman Sea.

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References

CMFRI. 2018. Annual report 2017-18 Cochin, Central Marine Fisheries Research Institute, Kochi: 304.

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

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. Part 2 - Carcharhiniformes. *FAO Fish., Synop.,* **125**(4/2): 251-655.

Compagno, L.J.V. 1988. *Sharks of the Order Carcharhiniformes*. Princeton University Press, New Jersey, USA: 486.

Compagno, L.J.V. 1998. Hemigaleidae. In: K. E. Carpenter and Niem, V. H. (Eds.) *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific*. Volume 2. Cephalopods, crustaceans, holothurians and sharks FAO, Rome: 1305-11.

Dulvy, N.K., Fowler, S.L., Musick, J.A., Cavanagh, R.D., Kyne, P.M., Harrison, L.R., Carlson, J.K., Davidson, L.N.K., Fordham, S.V., Francis, M.P., Pollock, C.M., Simpfendorfer, C.A., Burgess, G.H., Carpenter, K.E., Compagno, L.J.V., Ebert, D.A., Gibson, C., Heupel, M. R., Livingstone, S. R., Sanciangco, J.C., Stevens, J.D., Valenti, S. and White, W.T. 2014. Extinction risk and conservation of the world's sharks and rays. *eLife*, **3**: 1-34. https://doi.org/10.7554/eLife.00590. PMid: 24448405, PMCid: PMC3897121.

Hall, T.A. 1999. BioEdit: A user-friendly biological sequence alignment editor and analysis programme for windows 95/98/NT. *Nucleic Acids Symp. Ser.*, **41**: 95-8.

Kumar, R.R., Venu, S., Akhilesh, K.V., Bineesh, K.K. and Rajan, P.T. 2018. First report of four deep-sea chondrichthyans (elasmobranchii and holocephali) from Andaman waters, India with an updated checklist from the region. *Acta Ichthyol. Piscat.*, **48**(3): 289-301. https://doi.org/10.3750/AIEP/02336.

Last, P.L. and Stevens, J.D. 1994. *Sharks and Rays of Australia*. CSIRO, Australia: 513. https://doi.org/10.2307/1446735.

Miller, S.A., Dykes, D.D. and Polesky, H.F. 1988. A simple salting out procedure for extracting DNA from human nucleated cells. *Nucleic Acids Res.*, **16**: 1215. https://doi.org/10.1093/nar/16.3.1215. PMid: 3344216, PMCid: PMC334765.

Stevens, J.D. and Cuthbert, G.J. 1983. Observations on the identification and Biology of Hemigaleus (Selachii: Carcharhinidae) from Australian Waters. *Copeia*, **2**: 487-97. https://doi.org/10.2307/1444394.

Ward, R.D., Zemlac, T.C., Innes, B.H., Last P.R. and Hebert, P.D.N. 2005. DNA barcoding Australia's fish species. *Philos. Trans. R. Soc. Lond., B Biol. Sci.*, **360**: 1847-57. https://doi.org/10.1098/rstb.2005.1716. PMid: 16214743, PMCid: PMC1609232.

Weigmann, S. 2012. Contribution to the Taxonomy and distribution of six shark species (Chondrichthyes, Elasmobranchii) from the Gulf of Thailand. *International Scholarly Research Network, ISRN Zoology*, Article ID 860768, https://doi.org/10.5402/2012/860768.

White, W.T. 2009. *Hemigaleus microstoma*. The IUCN Red List of Threatened Species 2009: e.T41816A10569394. Accessed on 12 July 2019. https://doi.org/10.2305/IUCN.UK.2009-2.RLTS.T41816A10569394.en.

White, W.T., Last, P.R. and Compagno, L.J.V. 2005. Description of a new species of weasel shark, Hemigaleus australiensis n.sp. (Carcharhiniformes: Hemigaleidae) from Australian waters. *Zootaxa,* **1077**: 27-49. https://doi.org/10.11646/zootaxa.1077.1.3.