

SYSTEMATIC ACCOUNT OF INDIAN LOBSTERS COLLECTED DURING THE EXPEDITIONS OF FORV SAGAR SAMPADA

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MINISTRY OF EARTH SCIENCES, GOVERNMENT OF INDIA
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FOREWARD

As stated by the Convention on Biological Diversity, at least 40 per cent of the world's economy and 80 per cent of the needs of the poor are derived from biological resources. The unprecedented loss of biodiversity from the World Oceans is the key concern the humanity is facing while dealing with the sustainability of the ocean services. I am pleased to note that the Centre for Marine Living Resources & Ecology (CMLRE), Kochi is taking up the imperative task of documenting the diversity of deep-sea living resources of Indian EEZ, which would eventually help to assess not only the status of living resources within the country but also remain as a source of information about the genetic resources with biotechnological potential.

The present book "**Systematic account of Indian Lobsters collected during the expeditions of *FORV Sagar Sampada***" is an excellent compilation of taxonomic account of deep-sea lobsters found in Indian waters along with photographic illustrations and maps indicating sampling locations. The species included in this catalogue represent all major phylogenetic groups of true lobsters, and would also serve as a ready reckoner and field guide for the budding crustacean taxonomists and students in identifying the lesser-known deep-water forms. I wish to congratulate CMLRE in their endeavours on biodiversity documentation from the vast seas of our Nation.

(M. Rajeevan)

PREFACE

India is one of the most biodiverse nations on the planet with diverse marine ecosystems supporting an estimated 20,000 + animal species. The climate change coupled with human-induced disturbances through fishing, mining, tourism and pollution observed to impair their sustainability, in some cases lead to extinction. Although, several studies have been undertaken to document the biodiversity of the Indian waters (presently Indian Exclusive Economic Zone), they remained as patchy in terms of geographic coverage, thereby necessitating comprehensive surveys across the region for understanding discernible changes in biodiversity. In this regard, the “Resource Exploration and Inventorization System” sponsored by the Ministry of Earth Sciences, Government of India, and executed by the Centre for Marine Living Resources & Ecology, Kochi has been at the forefront of these efforts. Comprehensive surveys of the seas in the Indian EEZ by the CMLRE-owned Fisheries Oceanographic Research Vessel (FORV) Sagar Sampada have resulted in moderately large faunal collections that have been deposited in the Referral Centre of the CMLRE. The present work on the deep-sea and coral reef-associated lobsters is a part of a series of e-books on various groups of marine crustaceans collected on-board the FORVSS.

ACKNOWLEDGEMENTS

The authors are grateful to the Director, CMLRE, Kochi, India for providing an opportunity and facilities to carry out taxonomic studies on marine crustaceans. The study has been a part of the “Resource Exploration and Inventorization System” Project funded by the Ministry of Earth Sciences, Government of India. The authors are also grateful to the scientific staff and crew members of the FORV Sagar Sampada for meticulously collecting the samples. A special thanks to Shri. Shivam Tiwari, Ph.D. student, CMLRE for plotting the maps.

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INTRODUCTION

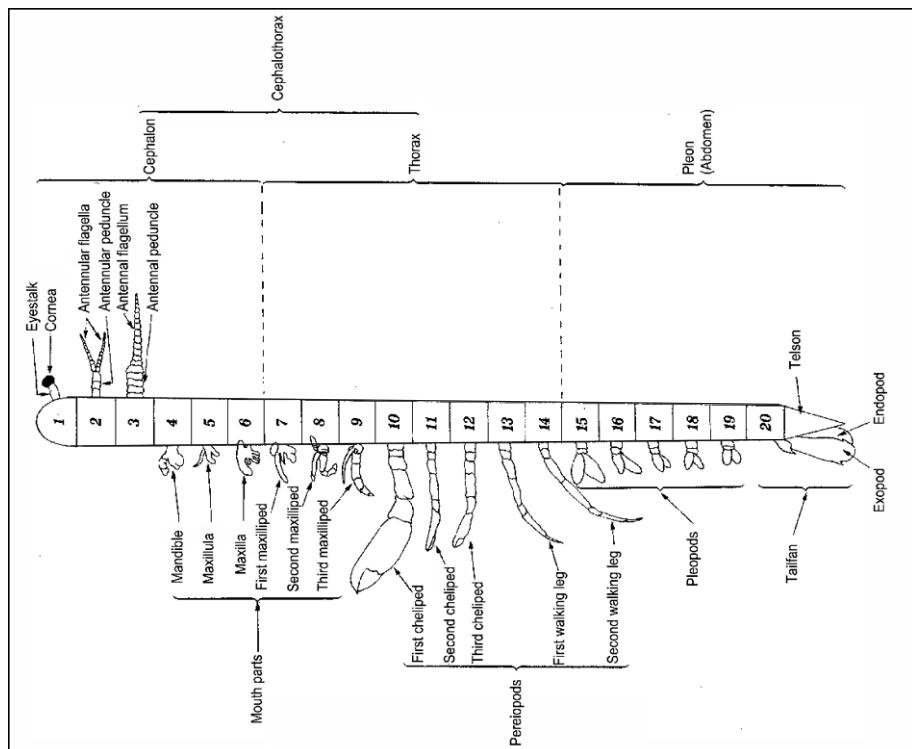


Fig. 1. Generalized diagram of a lobster (Infraorders Astacidea, Glypheidea, Achelata and Polychelida) indicating body parts (modified from Holthuis, 1991).

Marine lobsters are morphologically diverse crustaceans belonging to Class Malacostraca Latreille, 1802: Order Decapoda Latreille, 1802: Suborder Pleocyemata Burkenroad, 1963 (Chan, 2010) characterized by well-defined body divisions (cephalon (head), thorax and pleon (abdomen)) covered by a chitinous exoskeleton (Fig. 1). Each division comprises a definite number of somites

(segments), namely 6 cephalic, 8 thoracic and 6 pleonal bearing 6, 8 and 5 appendages, respectively. The posterior margin of cephalon fuses with one or more thoracic somites to form a dorso-ventrally depressed cephalothorax covered by a variedly ornamented carapace. The cephalon bears paired compound eyes, biramous antennules, variedly ornamented antennae, and a

uniramous mandibular palp. The first 3 pairs of thoracic appendages are flattened external mouth parts called maxillipeds, and the last 5 pairs are ambulatory appendages (pincer-like (chelate) or simple (non-chelate) called pereopods. The pleon comprises 6 movably interconnected somites bearing varied ornamentation, leaf-like appendages called pleopods, and a tail-fan comprising a well-calcified telson and appendages called uropods (Holthuis, 1991; Fig. 1). Sexual dimorphism is indicated by the position of the gonopores, which are present basally on the ventral surface of the 3rd pereopod (6th thoracic somite) in females and 5th pereopod (8th thoracic somite) in males. In addition, the first pair of pleopods in the males are modified to form copulatory stylets, whereas the females possess fan-shaped pleopods for carrying egg masses (Holthuis, 1991).

These organisms are classified into 4 separate Infraorders: **Astacidea Latreille, 1802** — “true lobsters” with a cylindrical carapace and first 3 pairs of chelate pereopods (Fig. 2); **Polychelida Scholtz & Richter, 1995** — “blind lobsters” with a flattened carapace, lack of cornea on the ocular peduncle and first 4 pairs of chelate pereopods (Fig. 3); **Achelata Scholtz & Richter, 1995** — lobsters lacking true chelae on the first 4 pereopods, telson broadly rounded posteriorly, posterior half of telson and uropods soft and flexible (Figs. 4, 5); **Glypheidea Van Straelen, 1925** — “Jurassic shrimps” with eyes located on a median elevation of

the cephalon (not dealt in this study). The latest number of known marine lobsters stands at 263 species and 4 species (Chan, 2019; Chang *et al.*, 2020a, 2020b; Yang and Chan, 2020).

Marine lobsters inhabit a wide range of depths from the intertidal zone to almost 3000 m, mostly on rocky substrates with cavities; several species construct burrows in muddy or sandy substrates, whereas few species inhabit eelgrass meadows (Holthuis, 1991). These organisms constitute an important link in the marine benthic food chain between macrophytes (MacArthur *et al.*, 2011) and top marine carnivorous fishes (Boudreau & Worm, 2010). They are known to play a “keystone” role in several intertidal and subtidal ecosystems owing to active predation on the dominant prey species, thereby positively influencing the abundance of lower trophic level organisms (Eddy *et al.*, 2014). They are potential ecological indicators of heavy metal pollution stress in marine ecosystems (Chou *et al.*, 2003), and also support economically important fisheries globally (Holthuis, 1991).

Commercially, these are the most valuable crustaceans supporting several artisanal as well as mechanized fisheries of the world (Holthuis, 1991). Most published literature pertaining to the taxonomy of the Indian lobster fauna dates back to the British colonial period, with a few recent publications resulting in lacunae in information on the taxonomy, habitat and geographical

distribution of these organisms, thereby necessitating detailed work on this aspect. This e-book provides brief illustrated accounts of lobsters collected on-board FORV Sagar Sampada from several locations in the Indian EEZ.

Historical background

Taxonomic studies on lobsters were initiated by Linnaeus (1758) with the following description of *Cancer gammarus* Linnaeus, 1758 (= *Homarus gammarus* (Linnaeus, 1758)) from the Swedish waters: "*C. macrourus, thorace laevi, rostro lateribus dentato: basi supra dente dupli.*" Substantial volumes of literature have been published over the subsequent 250 years.

With regard to the Indian waters, the studies from the colonial period have dealt with the documentation of lobster fauna of the region. Post-independence, however, the studies largely focussed, in addition to observational reports, upon the biological and fishery aspects of lobsters in the region and has been by Radhakrishnan *et al.* (2019). Hence, the following paragraphs provide accounts of published literature related to the species dealt in the present study.

The English zoologist and Director of the Indian Museum at Kolkata, Prof. James Wood-Mason, pioneered taxonomic studies on deep-water lobsters in India through several new discoveries and taxonomic revisions. He described a new genus and species of clawed lobster *Nephropsis stewarti* Wood-Mason, 1872

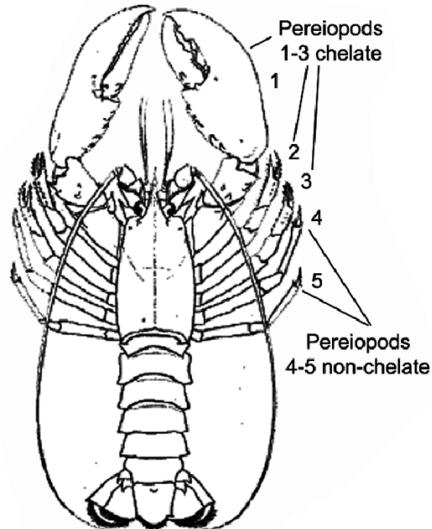


Fig. 2. Diagrammatic illustration of Infraorder Astacidea: Family Nephropidae (modified from Holthuis, 1991).

from the Andaman Sea (Wood-Mason, 1872, 1873, 1874a); proposed a new genus of clawed lobster *Thaumastocheles* Wood-Mason, 1874a for *Astacus zaleucus* Thomson, 1873 (Wood-Mason, 1874a); established a new family, Polychelidae Wood-Mason, 1874 for the deep-water blind lobster *Polycheles typhlops* Heller, 1862 (Wood-Mason, 1874b). The commissioning of the "Royal Indian Marine Survey Ship *Investigator*" in 1881 resulted in rapid advances in the discovery and taxonomic studies of deep-water lobsters. Wood-Mason (1885) briefly described *Nephropsis carpenteri* Wood-Mason, 1885 from the Bay of Bengal. In a report to the Government of India, Wood-Mason (1891) listed of deep-water crustaceans, including lobsters

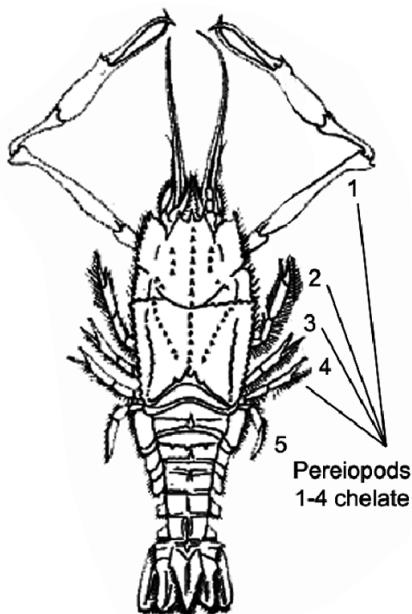


Fig. 3. Diagrammatic illustration of Infraorder Polychelida: Family Polychelidae (modified from Holthuis, 1991).

Pentacheles sp. (= *Pentacheles gibbus* Alcock, 1894, *Stereomastis cerata* (Alcock, 1894)). He, along with the British carcinologist Alfred William Alcock, reported several astacidean and polychelid lobsters from the Indian waters (Wood-Mason & Alcock, 1891). Subsequently, he prepared detailed illustrations of deep-sea crustaceans including the newly discovered clawed lobster *Nephrops andamanicus* Wood-Mason, 1892 (= *Metanephrops andamanicus* (Wood-Mason, 1892)). Wood-Mason & Alcock (1894) commissioned the illustrations of 1 astacidean and 4 polychelid taxa published by the Indian Museum.

Henderson (1893) studied the crustacean fauna of the coastal reefs of the British Indian territory and reported 1 scyllarid and 1 palinurid lobster.

Alcock (1894) provided a detailed description of the adult morphology and the developmental stages of *M. andamanicus* (Wood-Mason, 1892) collected from the Andaman Sea, and reported several species of astacidean and polychelid lobsters including 3 new species namely *Pentacheles gibbus* Alcock, 1894 and *P. cerata* Alcock, 1894 (= *S. cerata* (Alcock, 1894)) from the Andaman Sea, and *P. phosphorus* Alcock, 1894 (= *Stereomastis phosphorus* (Alcock,

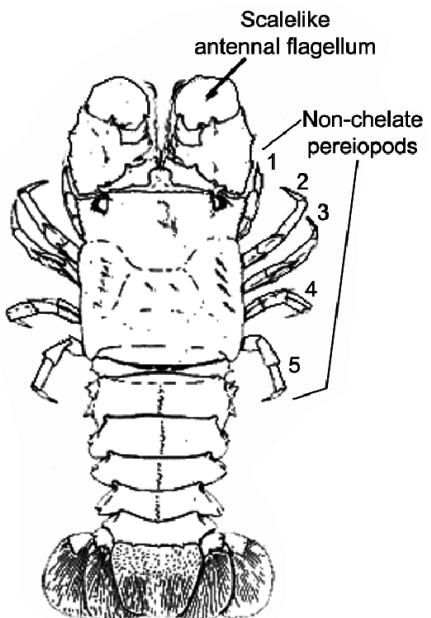


Fig. 4. Diagrammatic illustration of Infraorder Achelata: Family Scyllaridae (modified from Holthuis, 1991).

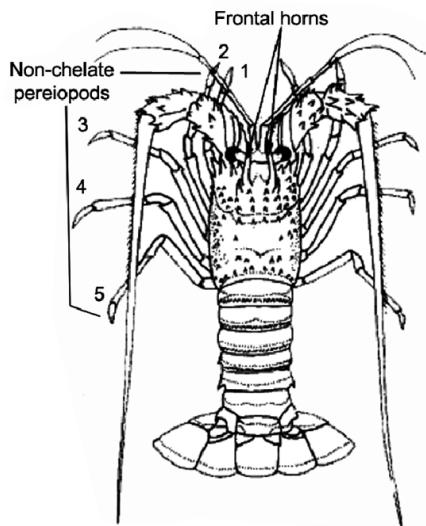


Fig. 5. Diagrammatic illustration of Infraorder Achelata: Family Palinuridae (modified from Holthuis, 1991).

1894)) from all the deep-waters off the Indian territory. Alcock & Anderson (1894) reported several species of astacidean, polychelid and achelate lobsters from the Indian waters, including *Arctus rubens* Alcock & Anderson, 1894 (= *Bathyarctus rubens* (Alcock & Anderson, 1894) from Sri Lankan waters. Anderson (1896) reported 3 astacideans and 2 polychelids from the Arabian Sea. Alcock (1898) published a list of deep-water crustaceans, including 6 astacideans, 8 polychelids and 2 achelate lobsters collected during the RIMS *Investigator* surveys. Alcock & Anderson (1899) briefly reviewed the deep-water crustacean fauna, including 3 astacidean and 2 polychelid lobsters, collected during the *Investigator* expeditions. Alcock's (1901a)

monograph of the macrurous crustaceans deposited at the Indian Museum, Kolkata, contained 7 nephropids (including *Nephropsis ensirostris* Alcock, 1901a from the Arabian Sea), 10 polychelids, 2 scyllarids and 1 palinurid lobster. Alcock's (1901b) zoological observations on the deep-water fauna, including lobsters collected during the RIMSS *Investigator* surveys, were published in a memoir titled "Zoological Gleanings from the Royal Indian Marine Survey Ship *Investigator*". Alcock (1901c) designated *M. andamanicus* as the type of the Order Decapoda and supplemented it with a thorough morphological and anatomical description. Alcock's (1902) memoir of his experiences during the RIMS *Investigator* expeditions contained an exclusive chapter dedicated to the systematics and biology of deep-water lobsters. In addition, these naturalists published illustrations of the deep-water lobsters deposited in the Indian Museum (Alcock & Anderson, 1895, 1896; Alcock & McArdle, 1901, 1903). Kemp & Sewell (1912) reported 2 species of polychelids from the southeastern Arabian Sea.

Prasad & Tampi (1959, 1966, 1968) studied the palinurid phyllosoma and scyllarid nisto larvae collected by fishery research vessels from the Laccadive seas. George & Rao (1965) reported the *N. carpenteri* collected off Kerala coast by the fishing vessels of the Indo-Norwegian project. Jones (1965) listed *P. sewelli* as a potential fishery source along the southwest coast of India. Silas (1965)

carried out detailed studies of the taxonomy and adult as well as larval morphology of the deep-sea lobster *Jasus frontalis* (H. Milne Edwards, 1837) from New Amsterdam Island in the Southern Indian Ocean, provided a comprehensive account of the geographical distribution of the genus *Jasus* Parker, 1883 and also presented a bibliography of this genus. George (1967) reported 2 new records of deep-water scyllarid lobsters *Scammarctus batei* (Holthuis, 1946) and *B. rubens* collected from commercial trawl landings along Kerala coast. Prasad & Tampi (1969) published a detailed account of the zoogeographical distribution of the palinurid and scyllarid lobsters of the Indian Ocean region. Rao & George (1973) studied the biology of the deep-water spiny lobster *Puerulus sewelli* Ramadan, 1938 from 200–305 m depths off Kerala coast and highlighted its commercial potential. Thomas (1979) reported *N. stewarti* from the Gulf of Mannar collected during exploratory cruises of the Norwegian-funded Integrated Fisheries Project. Prasad *et al.* (1980) studied the phyllosoma larvae from the Indian Ocean collected by the Dana Expedition 1928–1930. Kathirvel & James (1990) reported the distribution of palinurid and scyllarid larvae in the shallow coastal and shelf waters, respectively of the Andaman & Nicobar Islands. Kizhakudan & Thirumilu (2006) reported spiny deep-sea lobsters *Palinustus waguensis* Kubo, 1963 and *P. sewelli* from trawl landings at Chennai,

and also carried out biological studies of the former species. Jayaprakash *et al.* (2006) studied the deep-water trawl fauna collected from the shelf-break region off southwest India on-board FORV Sagar Sampada and reported the occurrence of *N. stewarti*. Dineshbabu (2008) studied the biology and fishery aspects of *N. stewarti* landed at Mangalore fisheries harbour and revealed morphometric differences between the sexes. Radhakrishnan *et al.* (2011) reported the first record of the deep-water astacid lobster *Enoplometopus macrodontus* T.-Y. Chan & P.K.L. Ng, 2008 from Indian waters based on specimens landed by commercial trawlers off Kerala coast. Jeena (2013) undertook DNA sequencing of 11 species including *L. somniosus* (Andaman Sea), *P. sewelli* (Arabian Sea) and *P. rugosus* (Bay of Bengal). Recently, Indian taxonomists collaborating with foreign experts have discovered a new deep-water slipper lobster *Petrarctus jeppeiaari* Yang, Biju Kumar & Chan, 2017 from the commercial trawl landings off southwestern India, and resolved the taxonomy of the *N. carpenteri* and *N. stewarti* species groups resulting in the discovery of new species from the Western Pacific regions (Chang *et al.*, 2020a, 2020b). Radhakrishnan *et al.* (2019) published a comprehensive book on the biological, fisheries and aquacultural aspects of lobsters wherein they listed 38 species.

MATERIALS AND METHODS

The present study area extended from 6°–23°N latitudes, and from 68°–94°E longitudes at 53–514 metres depths. Samples were collected on-board the FORV Sagar Sampada during cruise numbers 281, 316, 318, 321, 366, 372, 374, 378, 380, 398 in the Arabian Sea; 279, 291, 391 and 392 in the Bay of Bengal; 280, 292 (leg I), 292 (leg II), 334 (leg I), 334 (leg II), 349 (leg II), 367 (leg II), 388 in the Andaman waters.

Specimens were hand-picked from the catch, washed under running tap water to remove debris (wherever possible), photographed using an Olympus TG-5 field camera, and preserved in 10% formalin solution and/or 70% ethanol. These specimens were deposited as reference vouchers at the Referral Centre, Centre for Marine Living Resources & Ecology, Kochi. Taxonomic identification involved morphology, meristic counts, and morphological

measurements following the published identification keys for the families Nephropidae (Macpherson, 1990; Chang *et al.*, 2020a, 2020b), Palinuridae (Holthuis, 1991), Polychelidae (Galil, 2000) and Scyllaridae (Holthuis, 2002). Terminology used in the taxonomic descriptions follows the above-mentioned published literature.

Photographic plates of the diagnostic morphological characters were created using Adobe Photoshop version 6 programme. Maps depicting the locations of sample collections were plotted using the ODV and Adobe Photoshop version 6 programmes.

Abbreviation used in the text is as follows: CL – Carapace length, PI to PV – pereopods 1–5, TL – Total length. Number of antennal segments, thoracic sternites, pereiopods and pleonal somites expressed in Roman numerals.

SYSTEMATICS

Acanthacaris tenuimana Spence Bate, 1888
(Prickly deep-sea lobster)

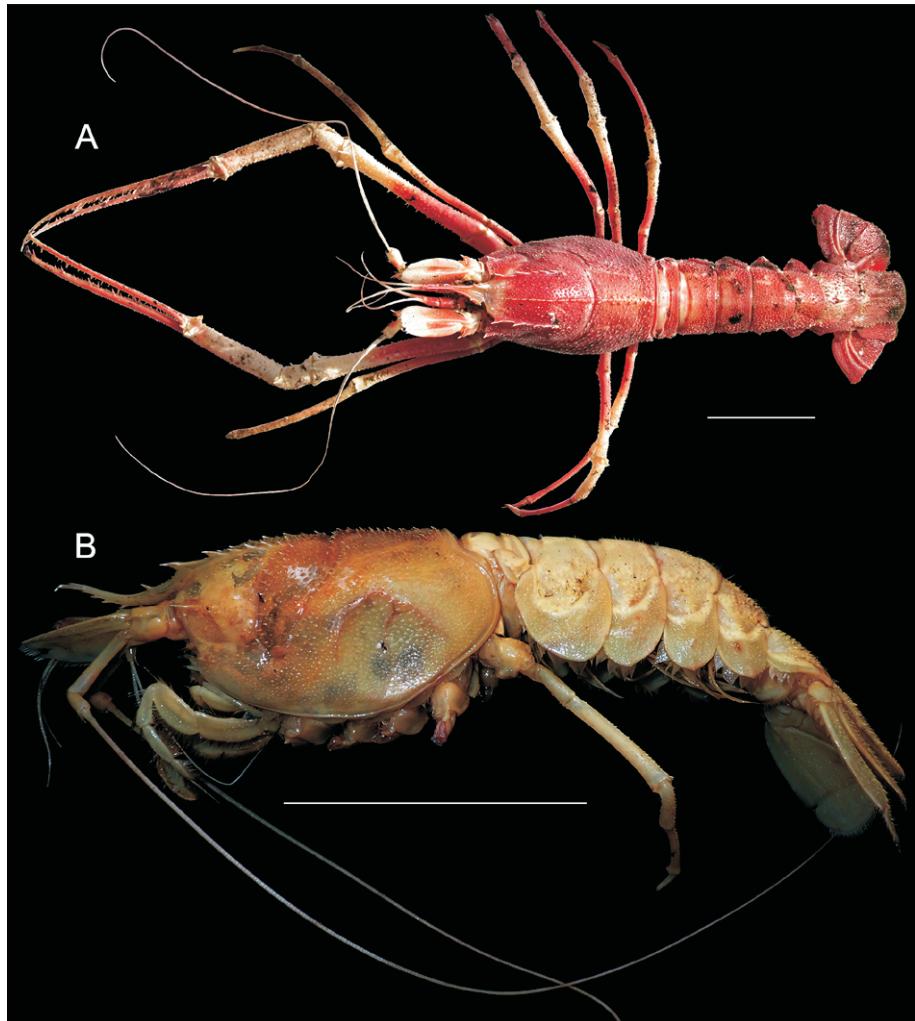


Fig. 6. *Acanthacaris tenuimana* Spence Bate, 1888 (southeastern Arabian Sea): A) Dorsal habitus (live colouration), 440 mm TL; B) Lateral habitus (preserved colouration), female, 282 mm TL. Scale: 100 mm.

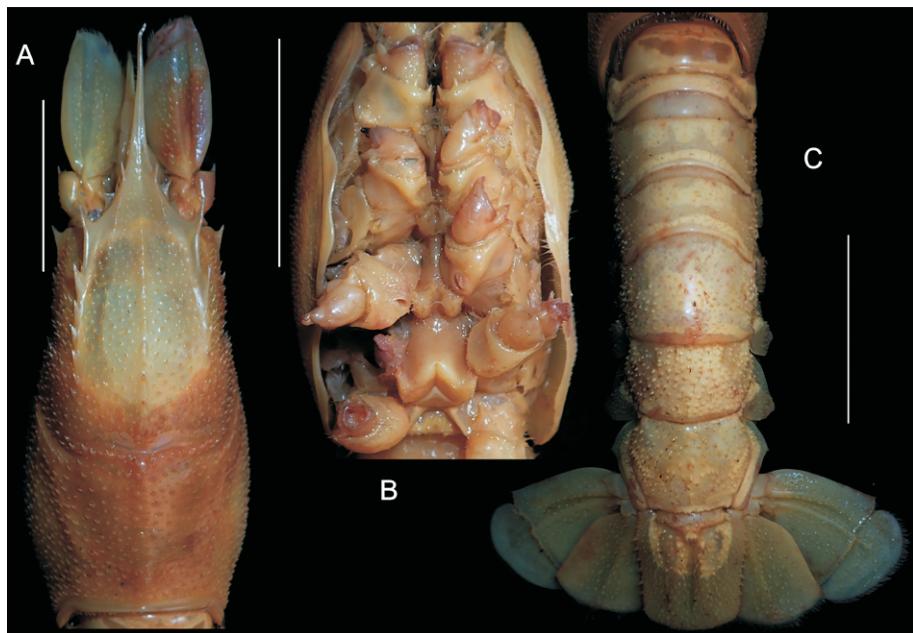


Fig. 7. *Acanthacaris tenuimana* Spence Bate, 1888: A) Dorsal carapace; B) Ventral sternum of female; C) Dorsal pleon and telson. Scale: 50 mm.

Infraorder Astacidea Latreille, 1802
 Superfamily Nephropoidea Dana, 1852
 Family Nephropidae Dana, 1852
 Subfamily Neophoberinae Glaessner, 1969
 Genus *Acanthacaris* Spence Bate, 1888
Acanthacaris tenuimana Spence Bate, 1888
 (Figs. 6A–B, 7A–C, 8)

Synonymy

Phoberus tenuimanus Spence Bate, 1888: 171, type locality: Arafura Sea, south off New Guinea, HMS *Challenger* stn. 191, 5°41'S, 134°04'30"E, 800 fathoms (= 1463 m) depth, green mud.

Acanthacaris tenuimana Spence Bate, 1888: pls. 21–22; Holthuis, 1974: 752; Fischer & Bianchi, 1984: 3 (list); Holthuis, 1984: unnumbered figs.; Phillips et al., 1980: 67; Fischer & Bianchi, 1984: NEPH Acant 2; Hayashi & Ogawa, 1985: 220, fig. 1; Burukovsky & Ckreko, 1986: 93, text-fig.; Macpherson, 1990: 293; Holthuis, 1991: 26 (key), 28, figs. 39b, 42; Griffin & Stoddart, 1995: 232, 254 (key), table 1; Chan, 1998: 984 (key), 987 (list), 988; Poore, 2004: 163 (key); Takeda & Nagai, 2004: 9, figs. 1, 2; Chan, 2010: 156 (list); Chan, 2019: 39 (list), fig. 2.1b; Radhakrishnan et al., 2019a: 111.

Phoberus caecus: Alcock, 1898: 33; Alcock, 1901a: 156; Alcock, 1902: 127, 168, 264 (not A. Milne Edwards, 1881).

Phoberus caecus var. *tenuimanus*: Alcock, 1901a: 156; Alcock & McArdle, 1903: pl. 60; Bouvier, 1925: 416.

Acanthacaris tenuimanus: Bruce, 1974: 303, figs. 1–2.

Phoberus caecus var. *sublevis* Wood-Mason in Wood-Mason & Alcock, 1891: 197, type locality: Laccadive Sea, southwest off Goa, RIMSS *Investigator* stn. 105, 15°02'N, 72°34'E, 740 fathoms (= 1354 m), grey ooze, coral mud with 12.5 per cent Foraminifera; Alcock & Anderson, 1894: 161; Anderson, 1896: 96.

Acanthacaris opipara Burukovsky & Musij, 1976: 1811, figs. 1–2, type locality: Southwestern Indian Ocean, off Durban, 29°57'06"S–29°52'05"S, 31°46'02"E–31°52'05"E, 830–850 m depth; Burukovsky & Ckrehko, 1986: 94, text-fig.

Acanthacaris opipera: Phillips et al., 1980: 67 (erroneous spelling).



Fig. 8. Geographical locations of collection of *Acanthacaris tenuimana* Spence Bate, 1888.

Acanthacaris sp.: von Cosel, 1987: 20, pl. 3F (colour photograph).

Phoberus brevirostris Tung, Wang & Z.-C. Li, 1985: 379, type locality: East China China, 29°00'N–29°30'N, 127°00'E–127°30'E, 300–900 m depth

Neophoberus caecus tenuimanus: Firth & Pequegnat, 1971: 81.

Diagnosis (modified from Spence Bate, 1888)

Body cylindrical, spinose (Fig. 6A, B). Rostrum < 0.5 CL, laterally complexed, strongly downcurved, bearing 1 pair of dorsal teeth, ventral teeth 4. Scaphocerite well-developed, antennal flagellum whip-like. Eyestalks reduced, close together under rostrum, cornea unpigmented. Carapace cylindrical, spinose, bearing median spinose carina, rostral base continues as submedian spinose carina up to mid-length of gastric region, spines progressively decreasing in size posteriorly; branchiostegal spine present (Fig. 7A). PI–PIII chelate; PI slender, longer than body, fingers 1.5 times palm length; PIV–PV simple (Fig. 7A). Pleon spinose, pleura of somites II–VI terminating in blunt angle; somite VI lateral margin bearing acute spine at mid-length with tip short of posterolateral margin (Fig. 7C). Female gonopores on PIII coxa, raised vulvae between PIV–PV (Fig. 7B). Telson lateral margins with 6 spines. Uropodal endopods and exopods bearing posterolateral spine, exopods with complete diaeresis (Fig. 7C).

Geographical distribution and habitat

South Africa, Mozambique, Madagascar, Lakshadweep Islands (India), Philippines, Indonesia, eastern Australia,

China Sea and Sea of Japan, at depths of 600–2161 m (Macpherson, 1990; Griffin & Stoddart, 1995). The present specimen was collected from the southeastern Arabian Sea at 1154 m depth (Fig. 8).

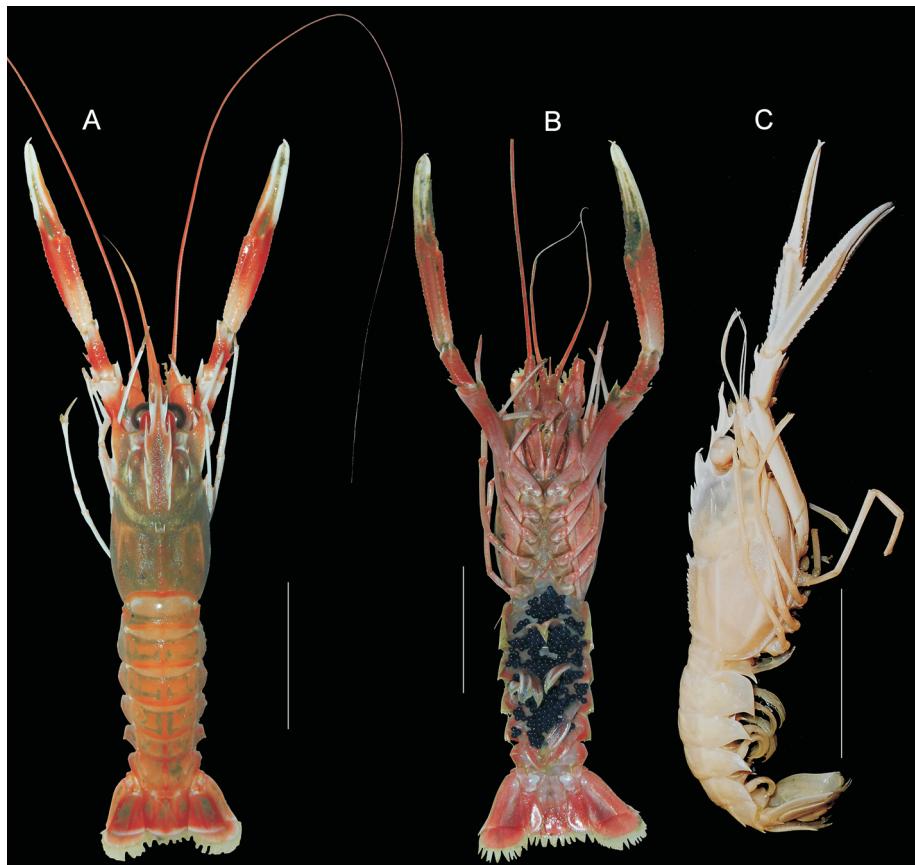
***Metanephrops andamanicus* (Wood-Mason, 1892)
(Andaman lobster)**

Fig. 9. *Metanephrops andamanicus* (Wood-Mason, 1892) (western Andaman Sea): A) Dorsal habitus (live colouration), female, 167 mm TL; B) Ventral habitus (live colouration); C) Lateral habitus (preserved colouration), male, 157 mm TL. Scale: 50 mm.

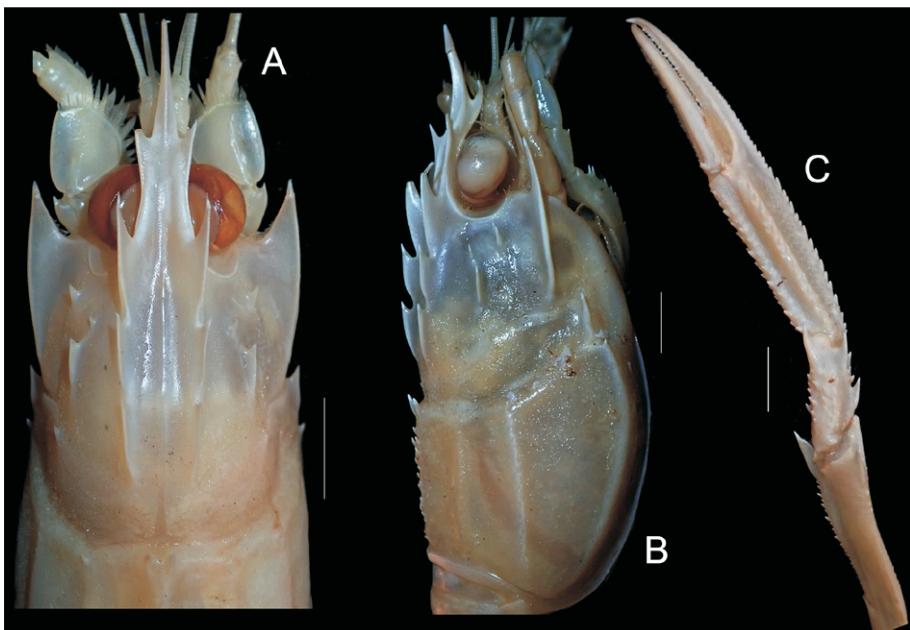


Fig. 10. *Metanephrops andamanicus* (Wood-Mason, 1892): A) Dorsal anterior carapace, antennules and antennae; B) Lateral carapace; C) Right PI, dorsal. Scale: 10 mm.

Infraorder Astacidea Latreille, 1802
 Superfamily Nephropoidea Dana, 1852
 Family Nephropidae Dana, 1852
 Genus *Metanephrops* Jenkins, 1972
Metanephrops andamanicus (Wood-Mason, 1892)
 (Figs. 9A–C, 10A–C, 11A–C, 12)

Synonymy

Nephrops andamanicus Wood-Mason, 1892: pl. 4; Alcock, 1894: 226, type locality: Andaman Sea, RIMSS *Investigator* stn. 115, 11°31'40"N, 92°46'06"E, 188–220 fathoms (= 344–403 m); Wood-Mason & Alcock, 1894: pl. 8, fig. 5; Ortmann, 1897a: 273; Balss,

1925: 207; Dragovich, 1969: 19; Jenkins, 1972: 162; Burukovsky, 1974: 111 (key); Burukovsky, 1983: 157; Sakai, 1978: 9, fig. 4.

Nephrops Andamanicus: Chun, 1900: 364, 500, fig. 368; Chun, 1903: 535.

Nephrops andamanica: Alcock, 1901b: 66; Alcock, 1902: 258, 260; Longhurst, 1970: 286.

Nephrops thomsoni var. *andamanica*: Alcock, 1901a: 153.

Metanephrops andamanicus (Wood-Mason, 1892): George, 1983: figs. 19, 20; Fischer & Bianchi, 1984: NEPH Metan 2; Chan & Yu, 1991: 22 (key), 32, pls. 2a, c, 4a, c, 6a, 7d; Holthuis, 1991: 64 (key), 66,

figs. 115, 120c, 128; Chan, 1998: 985 (key), 987 (list), 992, figs. 7, 8; Zarenkov, 2006: 94, fig. 20C–E; Chan, 2010: 156 (list); Chan, 2019: 40 (list); Radhakrishnan *et al.*, 2019a: 114.

Not *Nephrops andamanicus*: Gilchrist, 1921: 4; Gilchrist, 1922: 7; Gilchrist, 1925: 24; Calman, 1925: 22; Barnard, 1925: 127; Berry, 1969a: 5, fig. 1; Crosnier & Jouannic, 1973: 13 (= *Metanephrops mozambicus* Macpherson, 1990); De Man, 1916: 99, pl. 3, fig. 15; Holthuis, 1964: 71 (= *Metanephrops velutinus* T.-Y. Chan & H.-P. Yu, 1991).

Not *Nephrops andamanica*: Barnard, 1950: 528, fig. 99a; Sankarankutty &

Subramanian, 1976: 20, pl. 2; Kensley, 1981a: 29 (= *Metanephrops mozambicus* Macpherson, 1990).

Not *Metanephrops andamanicus*: Wear, 1976: 119, fig. 3f, g; Ivanov & Kuylov, 1980: 288; Anonymous, 1981: 3; Holthuis, 1984: unnumbered pages and figs.; von Cosel, 1987: 13 (= *Metanephrops mozambicus* Macpherson, 1990); Anonymous, 1954: 46; Jenkins, 1972: 162, 171; Chan & Yu, 1987: 184 (key); Carter *et al.*, 1983: 2, 4; Davis & Ward, 1984: 42; Bremner, 1985: 39, fig. 3; Ward & Davis, 1987: 93; Wallner & Phillips, 1988: 36; Macpherson, 1990: 294, figs. 2c–d,



Fig. 11. *Metanephrops andamanicus* (Wood-Mason, 1892): A) Dorsal pleon and telson; B, C) Lateral pleons of male and female. Scale: 10 mm.

3c-d (= *Metanephrops velutinus* T.-Y. Chan & H.-P. Yu, 1991).

Diagnosis (modified from Alcock, 1894)

Body cylindrical, generally smooth, finely pubescent (Fig. 9A–C). Rostrum 0.5 CL, gently downcurved, bearing 1 pair of large dorso-lateral teeth at mid-length, ventral margin with single curved tooth on distal half. Scaphocerite well-developed, antennal flagellum whip-like. Eyestalks reduced, close together under rostrum, cornea unpigmented. Carapace cylindrical, smooth between spines, post-rostral carina with 3 teeth, including supraorbital spines, extending to post-cervical groove; antennal spine large, wing-like, extending to hepatic groove, hepatic spine small; 1 pair of sharp spines behind post-cervical groove followed by pair of spinulose carinae; 1 pair each of submedian, intermediate and lateral carinae present (Fig. 10A, B). PI–PIII chelate, PI slender, shorter than body. PI merus inner margin weakly spinulose, terminating in long flattened spine; carpus bearing rows of dentate granules, large outer spine proximally, distal angles spinose; palm fluted with serrated carinae; fingers subequal to palm length (Fig. 10C). PIV–PV simple. Pleon sparsely pubescent, elevated portions smooth, somites II–V bearing distinct dorso-median carina flanked by



Fig. 12. Geographical locations of collection of *Metanephrops andamanicus* (Wood-Mason, 1892).

1 pair of submedian longitudinal grooves, elaborately sculptured (Fig. 11A); pleuron of somite II with strongly convex anterior margin, terminating in sharp angle in male, blunt in female, pleura of somites II–VI progressively smaller, terminating acutely in male (Fig. 11B), bluntly in female (Fig. 11C). Telson bearing 1 pair of submedian spines anteriorly, posterolateral margin bearing spine. Uropodal endopods and exopods bearing posterolateral spine, exopods with complete diaeresis (Fig. 11A).

Geographical distribution and habitat

East Africa, Andaman Sea, South China Sea, Indonesia and the Philippines, at depths of 250–750 m (Radhakrishnan *et al.*, 2019). The present specimens were collected from southeastern Bay of Bengal at 271–520 m depths, and western Andaman Sea at 441 m depth (Fig. 12).

***Nephropsis carpenteri* Wood-Mason, 1885**
(Ridgeback lobsterette)

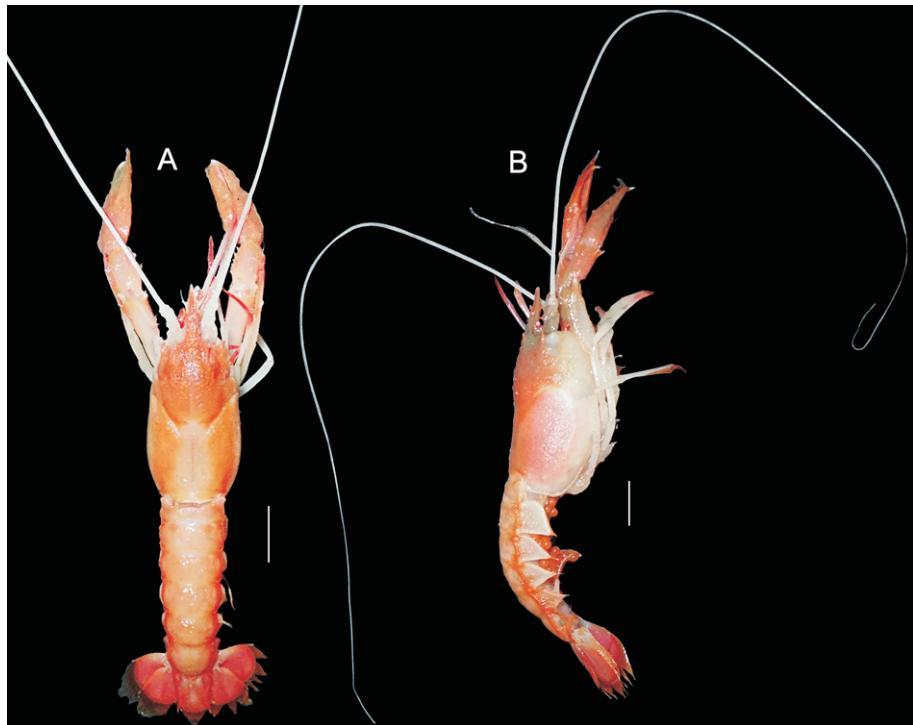


Fig. 13. *Nephropsis carpenteri* Wood-Mason, 1885 (southwestern Bay of Bengal), female, 72 mm TL: A) Dorsal habitus (live colouration); B) Lateral habitus (live colouration). Scale: 10 mm.

Infraorder Astacidea Latreille, 1802
 Superfamily Nephropoidea Dana, 1852
 Family Nephropidae Dana, 1852
 Genus *Nephropsis* Wood-Mason, 1872
Nephropsis carpenteri Wood-Mason, 1885
 (Figs. 13A–B, 14A–B, 15A–B, 16A–B, 17)

Synonymy

Nephropsis carpenteri Wood-Mason,

1885: 72; Alcock & Anderson, 1894: 161, type locality: Bay of Bengal, RIMSS *Investigator* stn. 162, 13°51'12"N, 80°28'12"E, 145–250 fathoms (= 265–458 m); Alcock & Anderson, 1896: pl. 27, figs. 2, 2a; Bouvier, 1925: 412; George & Rao, 1965: 333; Burukovsky, 1974: 109 (key); Burukovsky, 1983: 154; Phillips et al., 1980: 66; Macpherson, 1990: 302 (key), 316, figs. 5f, 11 e-f, 12, 16 f;

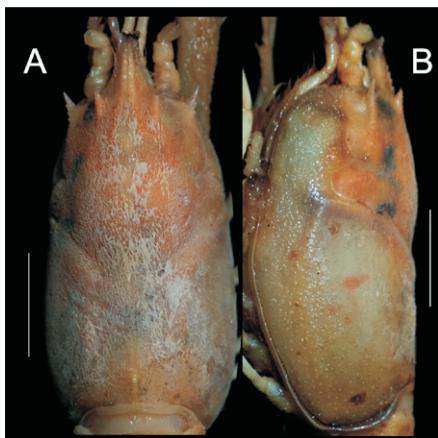


Fig. 14. *Nephropsis carpenteri* Wood-Mason, 1885: A) Dorsal carapace; B) Lateral carapace. Scale: 10 mm.

Holthuis, 1991: 33 (key), 39, fig. 56a, 69; Chan, 2010: 157 (list); Chan, 2019: 42 (list); Radhakrishnan *et al.*, 2019a: 111; Chang *et al.*, 2020a: figs. 2, 3C, D.

Nephropsis Carpenteri: Alcock, 1898:

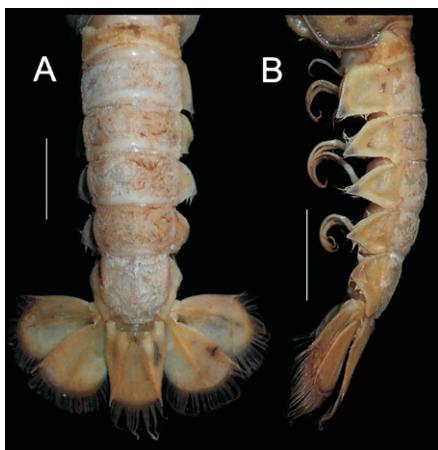


Fig. 16. *Nephropsis carpenteri* Wood-Mason, 1885: A) Dorsal pleon and telson; B) Lateral pleon and telson. Scale: 10 mm.

33; Alcock, 1901a: 158 (key), 160; Thompson, 1901: 17; Balss, 1914a: 83; Balss, 1925: 208; De Man, 1916: 97, 112 (key); Bouvier, 1917: 20.

Diagnosis (modified from Macpherson, 1990)

Body cylindrical, pubescent (Fig. 13A, B). Rostrum < 0.5 CL, gently deflexed bearing 1 pair of dorso-lateral teeth posterior to mid-length. Scaphocerite absent, antennal flagellum whip-like (Fig. 14A, B). Eyestalks reduced, close together



Fig. 15. *Nephropsis carpenteri* Wood-Mason, 1885: A) Right PI, dorsal; B) Right PI, mesial. Scale: 10 mm.

under rostrum, cornea unpigmented. Carapace cylindrical, granulose, with subdorsal carinae finely denticulate; supraorbital, antennal spines present; post-cervical groove V-shaped in dorsal view; intermediate and lateral carinae distinct. Distance between gastric tubercle and supraorbital spines 0.3 times distance between gastric tubercle and post-cervical groove. Distance between orbital margin and post-cervical groove 1.5–1.6 times distance between post-cervical groove and carapace posterior margin (Fig. 14A, B). PI carpus bearing 1 dorsal spine, inner surface with 2–3 spines at lower margin (Fig. 15A, B). PII

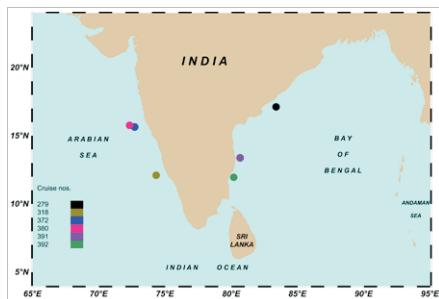


Fig. 17. Geographical locations of collection of *Nephropsis carpenteri* Wood-Mason, 1885.

carpus length 0.7–0.8 times palm length. PIV–PV simple. Pleon sparsely granulate, somites II–VI bearing distinct dorso-median carina; pleuron II anterior margin convex, lacking spine, terminating ventrally in blunt or sharp angle (Fig.

16A, B). Telson lacking erect basal dorso-median spine, posterolateral margin bearing spine. Uropodal endopods and exopods bearing posterolateral spine, exopods with complete diaeresis.

Geographical distribution and habitat

Southeastern Arabian Sea, Bay of Bengal and off Myanmar at 250–503 m depths (Chang *et al.*, 2020a). The present specimens were collected from the eastern Arabian Sea at 691–766 m depths, southeastern Arabian Sea at 326 m depth, southwestern Bay of Bengal at 433–458 depths, and western Bay of Bengal at and 567 m depth (Fig. 17).

***Nephropsis ensirostris* Alcock, 1901 (Gladiator lobsterette)**

Infraorder Astacidea Latreille, 1802
Superfamily Nephropoidea Dana, 1852
Family Nephropidae Dana, 1852
Genus *Nephropsis* Wood-Mason, 1872
Nephropsis ensirostris Alcock, 1901
(Figs. 18A–C, 19, 20A–B, 21A–B, 22)

Synonymy

Nephropsis ensirostris Alcock, 1901a: 158 (key), 162, pl. 1, fig. 2, type locality: Arabian Sea, north of Laccadives, 636 fathoms (= 1163 m) depth, green mud; Alcock & McArdle, 1903: pl. 58, figs. 1, 1a; Lloyd, 1907: 4; De Man, 1916: 97, 112

(key), 113; Bouvier, 1917: 20; Balss, 1925: 208; Burukovsky, 1974: 109 (key); Burukovsky, 1983: 153; Phillips *et al.*, 1980: 66; Macpherson, 1990: 302 (key), 303, figs. 5a, 6, 8a-b, 16a; Holthuis, 1991: 32 (key), 41, figs. 50, 51a, 71; Chan, 1998: 986 (key), 987 (list), fig. 12a; Zarenkov, 2006: 85, fig. 4; Chan, 2010: 157 (list); Chan, 2019: 42, fig. 2.1h; Radhakrishnan *et al.*, 2019a: 113.

Nephropsis suhmi: Ramadan, 1938: 125 (in part, only Stn 33) (not Spence Bate, 1888).

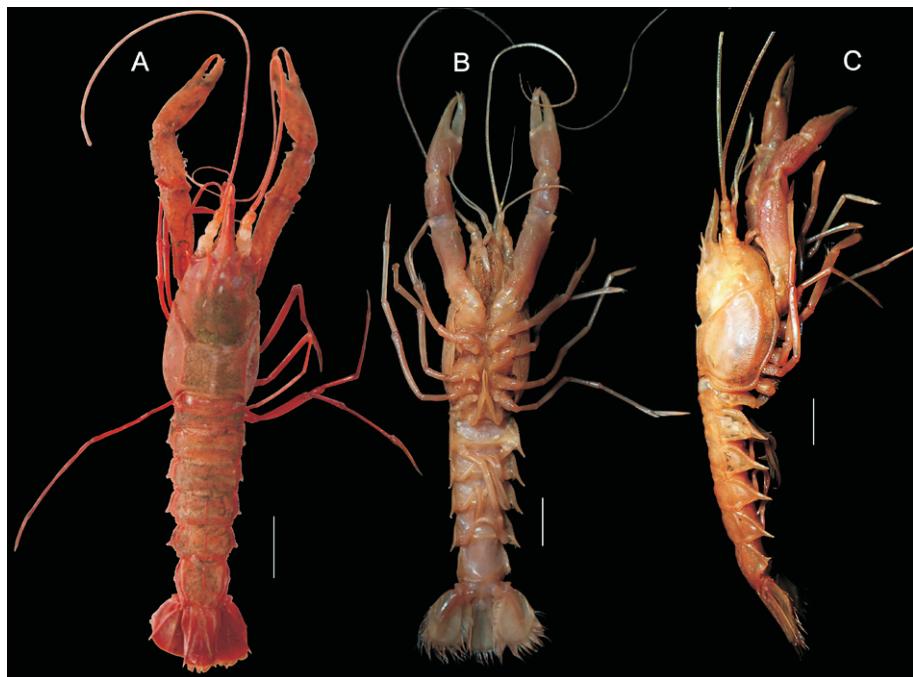


Fig. 18. *Nephropsis ensirostris* Alcock, 1901 (eastern Arabian Sea): A) Dorsal habitus (live colouration), 79 mm TL; B) Ventral habitus (preserved colouration), 107 mm TL; C) Lateral habitus (preserved colouration), 107 mm TL. Scale: 10 mm.

Diagnosis (modified from Alcock, 1901)

Body cylindrical, pubescent. Rostrum 0.5–0.67 CL, gently deflexed, lacking dorso-lateral teeth. Scaphocerite absent, antennal flagellum whip-like (Fig. 18A–C). Eyestalks reduced, close together under rostrum, cornea unpigmented. Carapace cylindrical, granulose, subdorsal carinae bearing spine at rostral base, another anterior to gastric tubercle; supraorbital, antennal spines present, pair of spines posterior to post-cervical groove; intermediate, lateral carinae

distinct. Distance between gastric tubercle and supraorbital spines 0.5 times distance between gastric tubercle and post-cervical groove. Distance between



Fig. 19. *Nephropsis ensirostris* Alcock, 1901 (southeastern Arabian Sea): Dorsal carapace, antennules and antennae. Scale: 10 mm.



Fig. 20. *Nephropsis ensirostris* Alcock, 1901 (southeastern Arabian Sea): A) Right PI, dorsal; B) Right PI, mesial. Scale: 10 mm.

orbital margin and post-cervical groove <2.0 times distance between post-cervical groove and carapace posterior margin (Fig. 19). PI carpus bearing anterodorsal, anteroventral spines, inner dorsal spine at mid-length, outer spine on terminal half, strong spine on inner margin near palmar articulation (Fig. 20A–B). PII carpus slightly longer than palm, PIV–PV simple. Thelycum raised, anterior incision shallow, posterior incision deep (Fig. 21A). Pleon sparsely granulate, somites II–IV bearing indistinct dorso-median carina, somites V–VI with distinct carina; pleuron II anterior margin moderately convex, lacking spine, terminating ventrally in long spine; pleura III–V

anterior margins less convex, terminating ventrally as long spine (Fig. 21B). Telson lacking erect basal dorso-median spine, posterolateral margin bearing spine. Uropodal endopods and exopods bearing

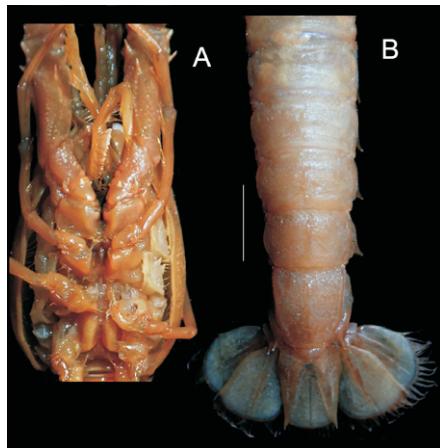


Fig. 21. *Nephropsis ensirostris* Alcock, 1901 (southeastern Arabian Sea): A) Ventral sternum of female; B) Dorsal pleon and telson. Scale: 10 mm.

posterolateral spine, exopods with incomplete diaeresis (Fig. 21B).

Geographical distribution and habitat

Gulf of Aden, Sri Lanka, southeast Arabian Sea, Indonesia and Philippines at 580–1160 m depths (Radhakrishnan *et al.*, 2019); also Bay of Bengal, Andaman Sea, depths of 315–1300 m (Macpherson, 1990). The present specimens were collected from the eastern Arabian Sea at 214 m depth and southeastern Arabian Sea at 950 m depth (Fig. 22).

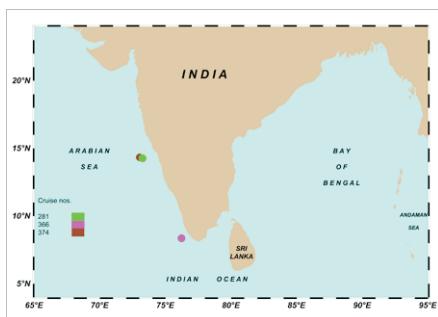


Fig. 22. Geographical locations of collection of *Nephropsis ensirostris* Alcock, 1901.

***Nephropsis rahayuae* S.-C. Chang, T.-Y. Chan &
A.B. Kumar, 2020a
(Rahayu's lobsterrette)**

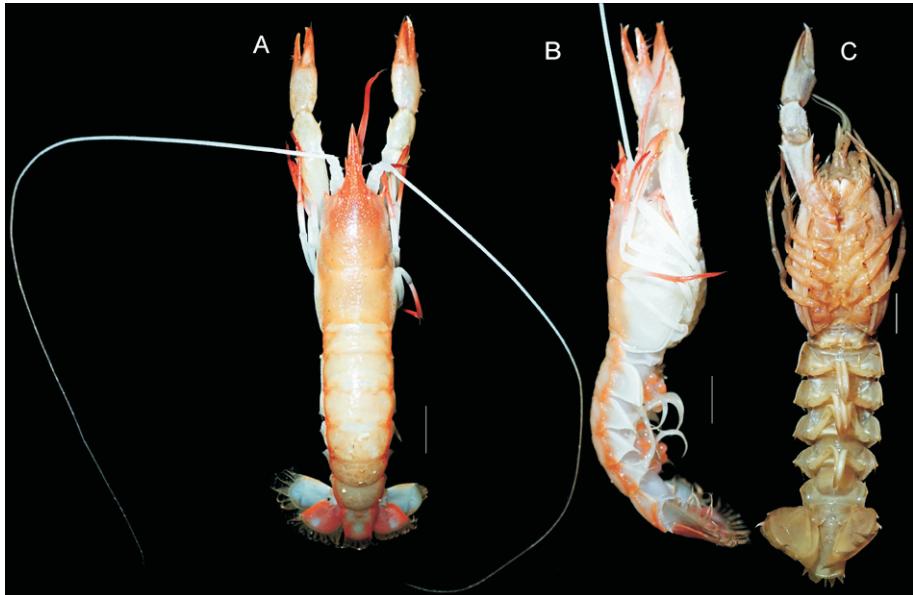


Fig. 23. *Nephropsis rahayuae* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020 (southeastern Bay of Bengal): A) Dorsal habitus (live colouration), female, 42 mm CL; B) Lateral habitus (live colouration), female, 42 mm CL; C) Ventral habitus (preserved colouration), female. Scale: 10 mm.

Infraorder Astacidea Latreille, 1802
Superfamily Nephropoidea Dana, 1852
Family Nephropidae Dana, 1852
Genus *Nephropsis* Wood-Mason, 1872
Nephropsis rahayuae S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020a
(Figs. 23A–C, 24A–B, 25, 26A–C, 27)

Synonymy

Nephropsis rahayuae S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020a: 52, fig. 1,

3A, B, type locality: south of Java, SJADES 2018, stn CP 33, 7°42.9122 S, 107°36.5592 E, 525–312 m depth.

Diagnosis (modified from Chang et al., 2020a)

Body cylindrical, pubescent. Rostrum > 0.5 CL, gently deflexed, bearing 1 pair of dorso-lateral teeth posterior to mid-length (Fig. 23A–C). Scaphocerite absent, antennal flagellum whip-like (Fig. 24A,

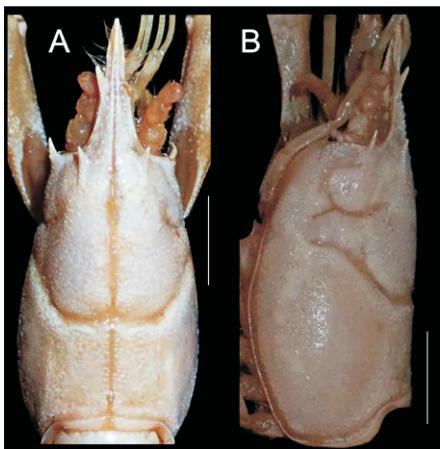


Fig. 24. *Nephropsis rahayuae* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020: A) Dorsal carapace, antennules and antennae; B) Lateral carapace. Scale: 10 mm.

B). Eyestalks reduced, close together under rostrum, cornea unpigmented. Carapace cylindrical, granulose, with subdorsal carinae finely denticulate;

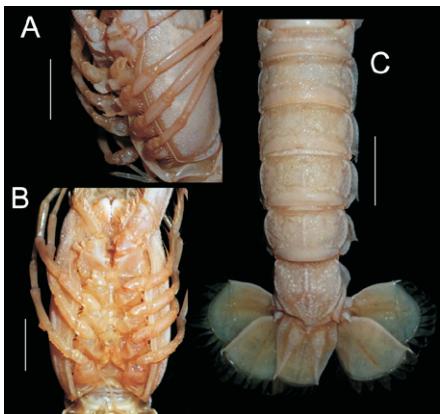


Fig. 26. *Nephropsis rahayuae* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020: A) Sub-lateral male sternum; B) Ventral female sternum; C) Right PI, sub-dorsa. Scale: 10 mm.

supraorbital, antennal spines present; post-cervical groove U-shaped in dorsal view; intermediate and lateral carinae indistinct (Fig. 24A, B). Distance between gastric tubercle and supraorbital spines about 0.3 times distance between gastric tubercle and post-cervical groove. Distance between orbital margin and post-cervical groove 1.5–1.6 times distance between post-cervical groove and carapace posterior margin. PI carpus bearing anteroventral spine, small subdistal spine on outer-lower margin, inner surface with distal spine on upper



Fig. 25. *Nephropsis rahayuae* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020: Right PI, sub-dorsal. Scale: 10 mm.

margin and subdistal spine at lower margin of carpus (Fig. 25). PII carpus 0.9–1.0 times palm length. PIII coxal process of male slightly flattened, with 1 spine near the articulation with the basis and another spine medially on the posterior border (Fig. 26A), Thelycum raised, with the anterior margin split into two lobes, incision on posterior margin wider (Fig. 26B). PIV–PV simple. Pleon sparsely granulate, somites II–IV bearing indistinct dorso-median carina, somites V–VI with distinct carina; pleuron II anterior margin strongly convex, lacking spine, terminating ventrally in blunt or sharp angle; pleura III–V anterior margins moderately convex, terminating ventrally

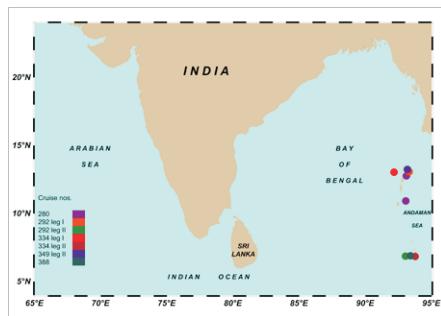


Fig. 27. Geographical locations of collection of *Nephropsis rahayuae* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020.

as long spine (Fig. 26C). Telson lacking erect basal dorso-median spine,

posterolateral margin bearing spine. Uropodal endopods and exopods bearing posterolateral spine, exopods with complete diaeresis (Fig. 26C).

Geographical distribution and habitat

Southwestern Java (Indonesia) at 312–525 m depths (Chang *et al.*, 2020a). The present specimens were collected from the southeastern Bay of Bengal at 213–388 m depths, and western Andaman Sea at 299–332 m depths (Fig. 27). **This is the first record from the Indian waters.**

***Nephropsis stewarti* Wood-Mason, 1872 (Indian Ocean lobsterette)**

Infraorder Astacidea Latreille, 1802
Superfamily Nephropoidea Dana, 1852
Family Nephropidae Dana, 1852
Genus *Nephropsis* Wood-Mason, 1872
Nephropsis stewarti Wood-Mason, 1872
(Figs. 28A–C, 29, 30, 31A–C, 32)

Synonymy

Nephropsis Stewarti Wood-Mason, 1872: 151, type locality: Andaman Sea, 260–300 fathoms (= 476–549 m depth); Wood-Mason, 1873: 60; Wood-Mason, 1874a: 40, pl. 4; Wood-Mason, 1876: 231; Wood-Mason, 1885: 71; A. Milne Edwards, 1874: pl. 20, figs. 1–3; Alcock, 1894: 230; Anderson, 1896: 96; Alcock,

1898: 33; Alcock & Anderson, 1899: 286; Alcock, 1901a: 158 (key), 159; Bouvier, 1917: 21.

Nephropsis stewartii: Alcock & Anderson, 1894: 161; Alcock & Anderson, 1896: pl. 27, figs. 1, 1a; Lloyd, 1907: 3, 6; Ramadan, 1938: 124, fig. 1; Thomas, 1979: 43.

Nephropsis stewarti: Stebbing, 1893: 206; Thompson, 1901: 17; Alcock, 1902: 148; Calman, 1925: 21; Bouvier, 1925: 412; Barnard, 1950: 531; Anonymous, 1954: 756, fig. 2179; Sewell, 1955: 203; Holthuis, 1956: 113; Thomas, 1979: 43; Fischer & Bianchi, 1984: NEPH Nephps 3; Holthuis, 1984: unnumbered pp. and figs.;

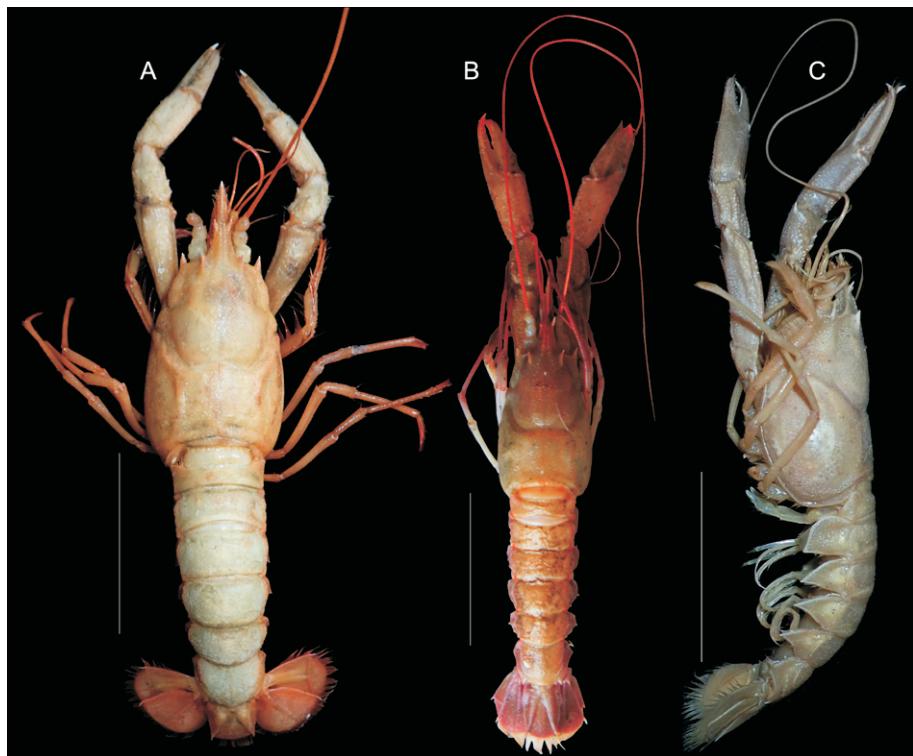


Fig. 28. *Nephropsis stewarti* Wood-Mason, 1872: A) Dorsal habitus: southeastern Arabian Sea (preserved colouration), female, 114 mm TL; B) Dorsal habitus: southeastern Bay of Bengal (live colouration), 150 mm TL; C) Lateral habitus (preserved colouration), 109 mm TL. Scale: 50 mm.

Hemming, 1959: 285; Sakai & Yamashita, 1968: 43, fig. h; Berry, 1969a: 45; Nishimura & Suzuki, 1971: 87; Crosnier & Jouannic, 1973: 13; Burukovsky, 1974: 109 (key); Burukovsky, 1983: 154; Miyake, 1975: 106, unnumbered fig.; Phillips *et al.*, 1980: 66; Kensley, 1981a: 29; Abele & Felgenhauer, 1982: 309, unnumbered fig.; George, 1983: 19; Fischer & Bianchi, 1984: NEPH Nephps 3; Macpherson, 1990: 302

(key), 312 (in part), figs. 5e, 10, 11c-d, 16e; Holthuis, 1991: 33 (key), 45 (in part), figs. 53, 80; Griffin & Stoddart, 1995: 255 (key), table 1; Chan, 1998: 987 (key, list), 991, fig. 14b; Poore, 2004: 163 (key); Zarenkov, 2006: 93 (in part); Chan, 2010: 157 (list); Chan, 2019: 42 (list); Radhakrishnan *et al.*, 2019a: 112, fig. 3.22; Chang *et al.*, 2020b: 40, figs. 1, 4A–F.

? *Nephropsis Stewarti*: Balss, 1925: 208.

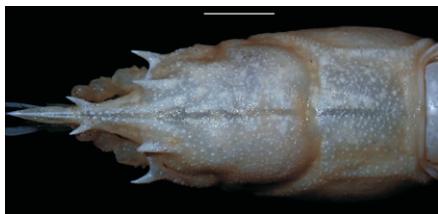


Fig. 29. *Nephropsis stewarti* Wood-Mason, 1872: Dorsal carapace, antennules and antennae. Scale: 10 mm.

Nephropsis sp.: Chun, 1900: 366, unnumbered fig.; Chun, 1903: 566, unnumbered fig..

Not *Nephropsis stewarti*: De Man, 1916: 97, 111 (key), 112, pl. 3, fig. 117 [= *Nephropsis serrata* Macpherson, 1993].

Not *Nephropsis stewarti*: Kubo, 1965: 629, fig. 1031; Miyake, 1982: 77, pl. 26, fig. 1; Baba, 1986: 153, 281, fig. 103; Chan & Yu, 1988: 8, pl. 1A; Chan & Yu, 1993: 83, n.n. photo; Holthuis, 1991 (in part); Wadley & Evans, 1991: 39, n.n. photo; Macpherson, 1993: 63; Chan, 1997: 415; Jones & Morgan, 2002: 83, n.n. photo; Davie, 2002: 391; Zarenkov, 2006: 93 (in part), fig. 19; Chang & Chan, 2019: 50 (in part), fig. 7 [= *Nephropsis grandis* Zarenkov, 2006].

Not *Nephropsis stewarti*: Macpherson, 1990: 312 (in part) [? = *Nephropsis grandis* Zarenkov, 2006 and/or *Nephropsis pygmaea* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020b]

Not *Nephropsis stewarti*: Chang & Chan, 2019: 50 (in part) [= *Nephropsis pygmaea* S.-C. Chang, T.-Y. Chan & A.B. Kumar, 2020b]

Not *Nephropsis stewarti*: Chang & Chan, 2019: 50 (in part), figs. 2C, D [= *Nephropsis serrata* Macpherson, 1993].

Diagnosis (modified from Wood-Mason, 1873)

Body cylindrical, pubescent. Rostrum 0.4–0.5 CL, gently deflexed, bearing 1 pair of dorso-lateral teeth near mid-length. Scaphocerite absent, antennal flagellum whip-like (Fig. 28A–C). Eyestalks reduced, close together under rostrum, cornea unpigmented. Carapace cylindrical, granulose, with subdorsal carinae granulate; supraorbital, antennal spines present; post-cervical groove U-shaped in dorsal view; intermediate and lateral carinae distinct. Distance between gastric tubercle and supraorbital spines about 0.4 times distance between gastric tubercle and post-cervical groove. Distance between orbital margin and post-cervical groove 1.2–1.5 times distance between post-cervical groove and carapace posterior margin (Fig. 29). PI carpus bearing distoventral, ventro-outer distal, and dorso-inner distal spines, inner surface with dorsal margin generally bearing 2–4 spines, outer surface without distinct spines (Fig. 30). PII carpus length 0.5–0.7 times palm length. PIII coxal



Fig. 30. *Nephropsis stewarti* Wood-Mason, 1872: Left PI dorsal view. Scale: 10 mm.

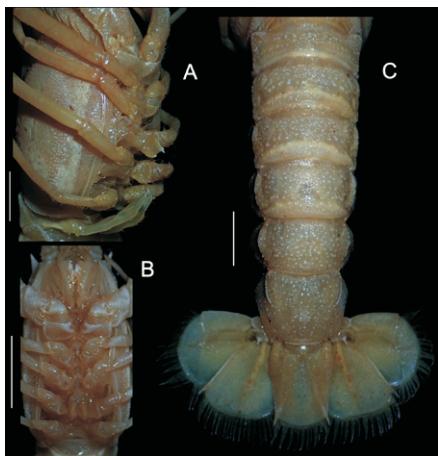


Fig. 31. *Nephropsis stewarti* Wood-Mason, 1872: A) Sub-lateral male sternum; B) Ventral female sternum; C) Dorsal pleon and telson. Scale: 10 mm.

process of male rounded, ending in a single, high, sharp tooth on outer surface near basal articulation (Fig. 31A). PIV–PV simple. Theylcum raised, lobes separated by wide incision, posterior margin wider than anterior margin, with deep incision (Fig. 31B). Pleon finely granulate, somites II–VI lacking dorso-median carina; pleura lacking spine on anterior margins, terminating ventrally into blunt to sharp spine (Fig. 31C). Telson lacking erect basal dorso-median spine, posterolateral

margin bearing spine. Uropodal endopods and exopods bearing posterolateral spine, exopods with complete diaeresis (Fig. 31C).

Geographical distribution and habitat

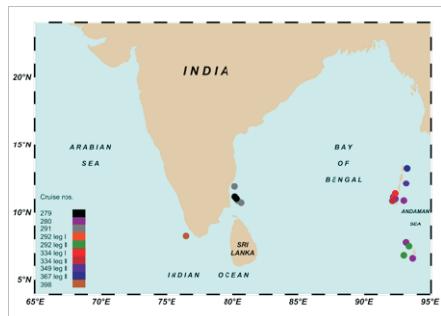


Fig. 32. Geographical locations of collection of *Nephropsis stewarti* Wood-Mason, 1872.

Eastern coast of South Africa to Andaman Sea, at 250–1720 m (Chang *et al.*, 2020b). The present specimens were collected from the southeastern Arabian Sea at 610 m depth, southwestern Bay of Bengal at 540–777 m depths, southeastern Bay of Bengal at 271–567 m depths, and western Andaman Sea at 213–635 m depths (Fig. 32).

***Nephropsis sulcata* Macpherson, 1990**
(Grooved lobsterette)



Fig. 33. *Nephropsis sulcata* Macpherson, 1990 (southeastern Arabian Sea): A) Dorsal habitus (preserved colouration), 90 mm TL; B) Ventral habitus (preserved colouration), 90 mm TL; C) Lateral habitus (preserved colouration), 90 mm TL. Scale: 10 mm.

Infraorder Astacidea Latreille, 1802
 Superfamily Nephropoidea Dana, 1852
 Family Nephropidae Dana, 1852
 Genus *Nephropsis* Wood-Mason, 1872
Nephropsis sulcata Macpherson, 1990
 (Figs. 33A–C, 34, 35, 36A–B, 37)

Synonymy

Nephropsis atlantica: Wood-Mason & Alcock, 1891: 197, Fig. 4; Alcock, 1894: 230; Alcock, 1898: 33; Alcock, 1901a: 158 (key), 161; Alcock & Anderson, 1894: 162; Anderson, 1896: 96; Stebbing, 1902a: 34; Stebbing, 1902b: 130;

Stebbing, 1910: 379; Gilchrist, 1918: 48; Balss, 1925: 208; Von Bonde, 1932: 59; Von Bonde & Marchand, 1935: 6; Barnard, 1950: 530, fig. 99b–e; Barnard, 1964: 12; Bruce, 1966: 223; Kensley, 1981a: 29; Baba *et al.*, 1986: 153, 282, fig. 103 (Not Norman, 1882).

Nephropsis sulcata Macpherson, 1990: 303 (key), 319, figs. 13 e-g, 14a-b, 15a-b, 16 g, type locality: South China Sea, MUSORSTOM 2, stn. CP 56, 13°53.7'N, 119°56.3'E, 970 m depth; Holthuis, 1991: 34 (key), 47, figs. 58, 84; Macpherson, 1993: 64, 65; Griffin &



Fig. 34. *Nephropsis sulcata* Macpherson, 1990: Dorsal carapace, antennules and antennae. Scale: 10 mm.

Stoddart, 1995: 235, 255 (key), fig. 1, table 1; Richer de Forges & Laboute, 1996: 66; Chan, 1997: 415; Chan, 1998: 987 (key, list), figs. 12b, 13; Zarenkov, 2006: 94, fig. 20A; Chan, 2010: 157; Chan, 2019: 43 (list); Radhakrishnan *et al.*, 2019a: 113.

Diagnosis (modified from Macpherson, 1990)

Body cylindrical, pubescent (Fig. 33A–C). Rostrum $>$ 0.5 CL, gently deflexed, bearing 2 pairs of dorso-lateral teeth, anterior pair at mid-length, posterior

pair between anterior tooth and supraorbital spine; median groove overreaching anterior pair of teeth. Scaphocerite absent, antennal flagellum whip-like (Fig. 34A). Eyestalks reduced, close together under rostrum, cornea unpigmented. Carapace cylindrical,



Fig. 35. *Nephropsis sulcata* Macpherson, 1990: Left PI dorsal view. Scale: 10 mm.

granulose, with subdorsal carinae finely granulate; supraorbital, post-supraorbital, antennal spines present; intermediate and lateral carinae distinct. Distance between gastric tubercle and supraorbital spines $<$ 0.5 times distance between gastric tubercle and post-cervical groove (Fig. 34A). PI carpus bearing large anterodorsal, small anteroventral spine, 2 anteroventral spines, one each on inner and outer margins, 2 spines on inner margin (Fig. 35). Thelycum anterior margin incised, posterior margin wider (Fig. 36A). PII carpus shorter than palm. PIV–PV simple. Pleon sparsely granulate, somites II–VI bearing distinct dorso-median carina; pleuron II anterior margin moderately convex, bearing short spine, terminating ventrally in long spine; pleura III–V anterior margins less convex, terminating ventrally as long spine (Fig. 36B). Telson lacking erect basal dorso-median spine, posterolateral margin

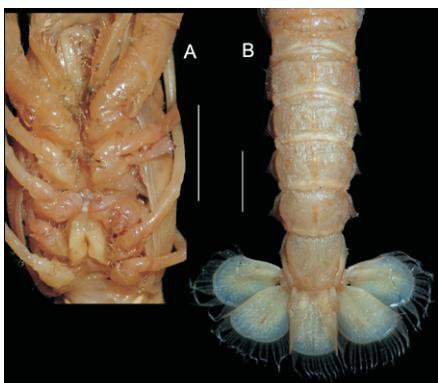


Fig. 36. *Nephropsis sulcata* Macpherson, 1990: A) Ventral sternum; B) Dorsal pleon and telson. Scale: 10 mm.

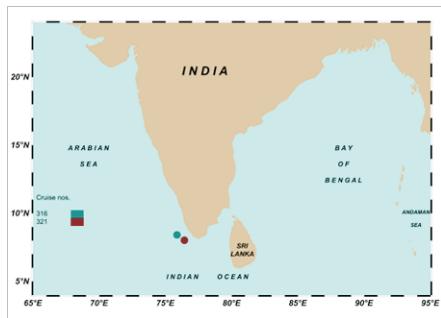


Fig. 37. Geographical locations of collection of *Nephropsis sulcata* Macpherson, 1990.

bearing spine. Uropodal endopods and exopods bearing posterolateral spine,

exopods with complete diaeresis (Fig. 36B).

Geographical distribution and habitat

Natal (South Africa), Madagascar, Laccadive Sea, the Philippines, South China Sea, north-western and eastern Australia, Coral Sea, New Caledonia and Chesterfield Islands at 415–1115 m (Macpherson, 1990; Radhakrishnan *et al.*, 2019). The present specimens were collected from the southeastern Arabian Sea at 1154–1245 m depths (Fig. 37).

***Linuparus somniosus* Berry & George, 1972 (African Spear lobster)**

Infraorder Achelata Scholtz & Richter, 1995

Family Palinuridae Latreille, 1802

Genus *Linuparus* White, 1847

Linuparus somniosus Berry & George, 1972

(Figs. 38A–B, 39A–C, 40)

Synonymy

Linuparus somniosus Berry & George, 1972: 18 (key), 18, text-fig. 1, pls. 1, 2, type locality: southwestern Indian Ocean, Northeast off Bazaruto Island, Natal, South Africa, 234 m depth; Fischer & Bianchi, 1984: PALIN Lin 1; Williams, 1986: 14, fig. 30; Holthuis, 1991: 111 (key), 112, figs. 209a, 211; Ng, 1992: 180,

figs. 1, 2; Wowor, 1999: 674, figs. 1, 2A, 3A; Chan, 2010: 158 (list); Tsoi *et al.*, 2011: fig. 3c; Chan, 2019: 44 (list); Kizhakudan *et al.*, 2019: fig. 9.8f, 9.13b–c; Radhakrishnan *et al.*, 2019a: 86; Radhakrishnan *et al.*, 2019b: table 5.2.

Diagnosis (modified from Berry & George, 1972)

Body cylindrical. Rostrum absent (Fig. 38A, B). Antennal segments 3 bearing randomly arranged spines, flagellum longer than carapace, multiarticulate, rigid. Eyestalks short, cornea terminal, as thick as peduncle, darkly pigmented. Carapace minutely granular, bearing 1 pair of supraorbital horns fused at base

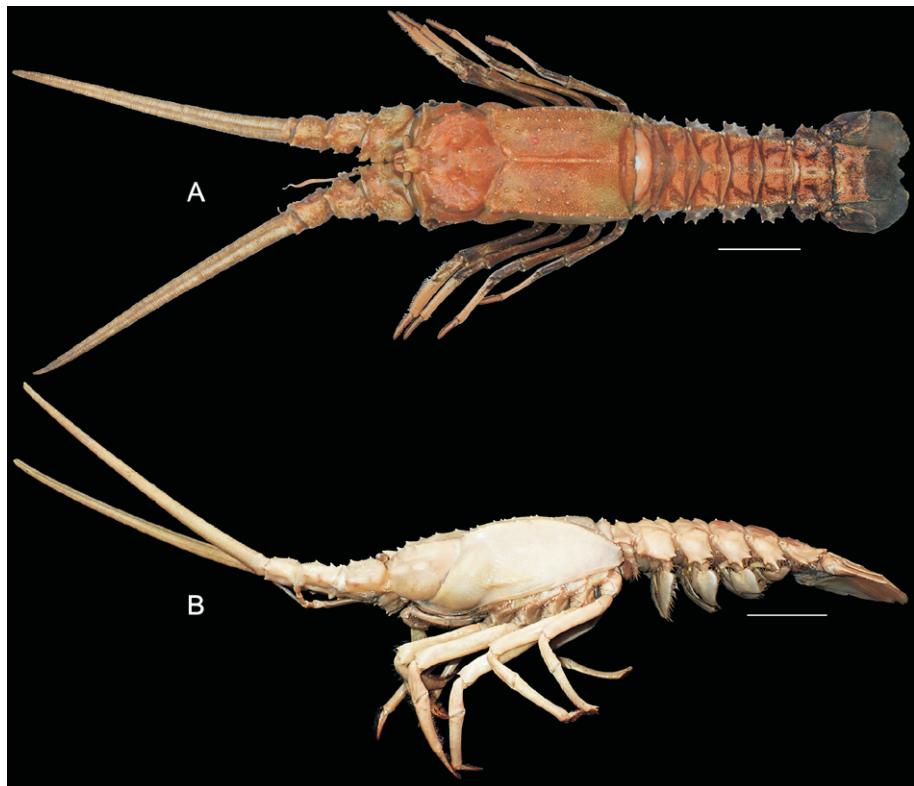


Fig. 38. *Linuparus somniosus* Berry & George, 1972 (western Andaman Sea): A) Dorsal habitus (live colouration), 300 mm TL; B) Lateral habitus (preserved colouration), female, 305 mm TL. Scale: 50 mm.

with 1 pair of small spines between them; gastric region bearing 3 conical spines, followed by 1 median spine, 2 rows of submedian spines, lateral pre-cervical carina bearing 4 spines; anterolateral margin bearing large spine followed 2 smaller spines; median carina behind post-cervical groove with 6 low tubercles, lateral carinae bearing 9–10 low spines, space between these carinae bearing randomly scattered sharp

tubercles; submarginal posterior groove wider medially than laterally, bearing double teeth (Fig. 39A). PI–PIV simple, PV propodal extension forming chela with dactylus (Fig. 38A, B), female gonopore on PIII coxa (Fig. 39B). Pleonal somite I bearing median spine dorsally, somites II–IV bearing anterior and posterior median spines and 1 pair of oblique submedian depressions, somite V bearing 4 or 5 spinules, somite VI

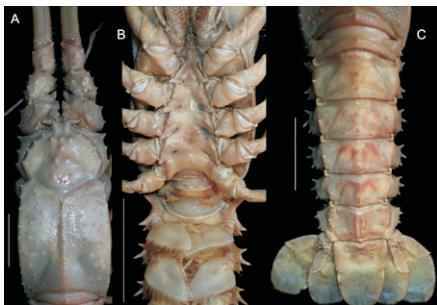


Fig. 39. *Linuparus somniosus* Berry & George, 1972: A) Dorsal carapace, antennules and antennae; B) Ventral sternum; C) Dorsal pleon and telson. Scale: 50 mm.

bearing 1 pair of granular submedian carinae joined anteriorly; pleural margins of somites I–V bearing 1, 3, 5, 4, 4 spines, respectively, that of somite VI bearing 3 spines and 2 or 3 denticles; bases of pleurae II–IV with 1 tubercle at mid-length, 1 tubercle on posterior half of pleuron V, 3 spinules on anterior half of pleuron VI; sternum I of female with vestigial pleopods (Fig. 39C). Telson subquadrate, longer than wide, calcified portion finely granulate; tail-fan flexible. Uropodal endopods and exopods bearing

oblique carina on calcified portion, posterolateral angle acute, posterior margin with 2 small tubercles (Fig. 39C).

Geographical distribution and habitat



Fig. 40. Geographical locations of collection of *Linuparus somniosus* Berry & George, 1972.

Southern and eastern coast of Africa, Andaman Sea, Strait of Malacca, and Java, Indonesia at 20–25 m and 100–400 m depths on sand and organic mud (Radhakrishnan *et al.*, 2019). The present specimen was collected from the western Andaman Sea at 299 m depth (Fig. 40).

***Puerulus angulatus* (Spence Bate, 1888)**
(Banded whip lobster)

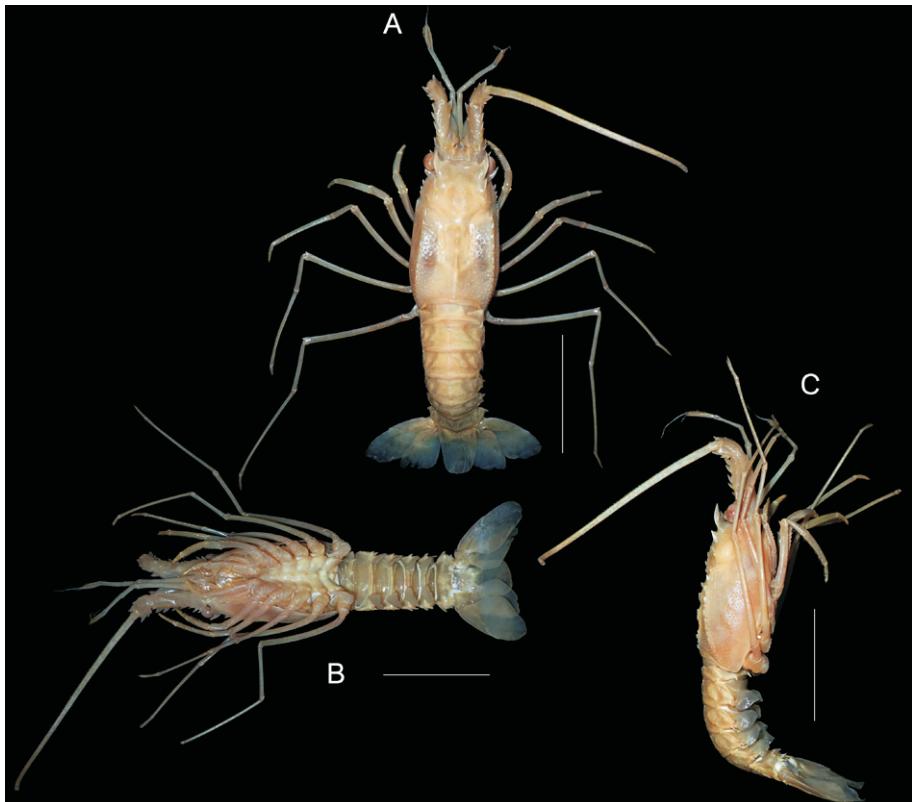


Fig. 41. *Puerulus angulatus* (Bate, 1888) (southeastern Bay of Bengal): A) Dorsal habitus (preserved colouration); B) Ventral habitus (preserved colouration); C) Lateral habitus (preserved colouration). Scale: 50 mm.

Infraorder Achelata Scholtz & Richter,

1995

Family Palinuridae Latreille, 1802

Genus *Puerulus* Ortmann, 1897b

Puerulus angulatus (Spence Bate, 1888)
 (Figs. 41A–B, 42A–B, 43A–B, 44)

Synonymy

Panulirus angulatus Spence Bate,
 1888: 81, pl. 11, figs. 2–4, type locality:
 Bismarck Sea, HMS *Challenger* stn 219,
 1°54'S, 146°39'40"E, 150 fathoms (= 275
 m) depth, coral mud.

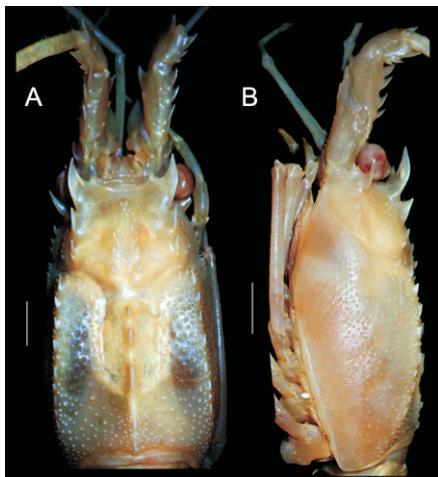


Fig. 42. *Puerulus angulatus* (Bate, 1888): A) Dorsal carapace; B) Lateral carapace. Scale: 10 mm.

Puer angulatus: Ortmann, 1891: 37; Belloc, 1959: 9.

Puerulus angulatus (Spence Bate, 1888): Calman, 1909: 442; Gruvel, 1911a: 1350; Gruvel, 1911b: 7, fig. 1; Bouvier, 1913: 78; Balss, 1925: 203; Holthuis, 1946: 110; Holthuis, 1956: 114; Hemming, 1958: 138; Holthuis, 1966: 267 (in part, part = *P. carinatus* Borradaile, 1910); Berry, 1969b: 247, pl. 1 fig. 2, pl. 2 fig. 2, pl. 3 fig. 2; Harada, 1980: 244, figs. 1, 2; Kensley, 1981a: 30; George, 1983: 16, 19 (key), 20; Baba, 1986: 155, 282, fig. 106; Williams, 1986: 25 (key), fig. 59A; King, 1988: 109; Williams, 1988a: 111 (key), unnumbered figs.; Williams, 1988b: 315; Chan & Yu, 1989a: 2, pl. 1; Holthuis, 1991: 161 (key), 162, figs. 300b, 301; Wadley & Evans, 1991: 31, unnumbered figs.; Griffin & Stoddart,

1995: 237, 257 (key); Chan, 1998: 1012 (key), 1014 (list), 1027, fig. 18b; Poore, 2004: 204; Chan, 2010: 159 (list); Chan, 2019: 46; Radhakrishnan *et al.*, 2019a: 3; Radhakrishnan *et al.*, 2019b: table 5.2.

Puerulus carinatus: Borradaile, 1910: 261, pl. 16, fig. 5; Ramadan, 1938: 133, figs. 6, 7; Holthuis, 1946: 110 (Not *Puerulus carinatus* Borradaile, 1910).

Puerulus gracilis Kubo, 1939: 316, figs. 1, 2.

Not *Panulirus angulatus*: Alcock & Anderson, 1894: 166; Alcock, 1899: 33; Alcock, 1901a: 185; Sewell, 1913: 350 (= *Puerulus sewelli* Ramadan, 1938).

Not *Puerulus angulatus*: de Man, 1916: 36, pl. 2, fig. 5. (= *P. velutinus* Holthuis, 1963).

Diagnosis (modified from Spence Bate, 1888)

Body sub-cylindrical (Fig. 41A–C). Rostrum absent. Antennular plate distinct, stridulating organ present, first segment not overreaching antennal peduncle, flagellum shorter than distal segment. Antennal segments III–IV rigid, bearing rows of large sharp lateral spines, flagellum long, multiarticulate, flexible (Fig. 42A). Eye well-developed, cornea pigmented. Carapace sub-quadrangular in cross-section, lateral margins perpendicular to dorsal surface bearing large suborbital spine and 3 spinules, cervical incision distinct, posterolateral margin granular. Pre-cervical dorsal surface largely smooth, post-cervical

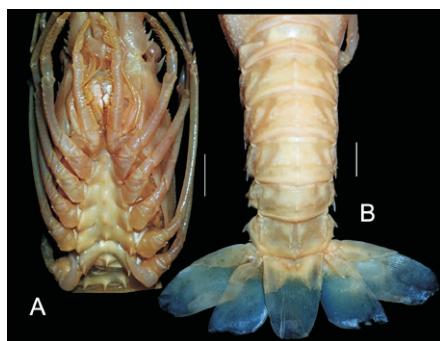


Fig. 43. *Puerulus angulatus* (Bate, 1888): A) Ventral sternum of female; B) Dorsal pleon and telson. Scale: 10 mm.

portion with distinct randomly scattered tubercles; 1 pair of supraorbital horns tapering to sharp point, single or bifid spine on anterior margin mesial to base, 3 progressively smaller teeth between horn and cervical groove; gastric region bearing median patch of spinules and 4 pairs of submedian spines; median post-cervical carina bearing 3 post-cervical and 2/3 intestinal teeth, lateral angular carina bearing 9–10 teeth, space between lateral carina and lateral margin bearing scattered granules (Fig. 42A, B). Thoracic sternites IX–XIV bearing median spine, sternites X–XIV bearing 1–2 lateral spines (Fig. 43A). PI–PV simple, progressively longer, meri bearing distal spine dorsally, PI–PII distal row of spines ventrally, male copulatory stylet on PV coxa, in females, PV propodal extension forming chela with dactylus (Fig. 41A–C). Pleonal somite I smooth, longitudinal median carina bearing 1 large anterior and 1 small posterior teeth, pleuron anterior margin

lobulated, terminating in posteriorly directed spine, sternite I with pair of submedian and intermediate spines; somites II–V with pair of intermediate oblique grooves anteriorly, transverse groove near posterior margin, longitudinal median carina bearing 2 teeth before and 1 tooth after transverse groove, pleura II–V terminating in 2 strong acuminate teeth, bearing oblique tuberculate carina, pleura III–IV bearing posterior marginal tooth in few specimens; somite VI with 2 carinae bearing 5–6 small submedian teeth converging posteriorly, posterolateral angle acuminate, separated from pleuron by tuberculate carina, pleuron VI terminating in 1 tooth (Fig. 43B). Telson subquadrate, longer than wide, calcified portion bearing pair of submedian spines and pair of diverging carinae bearing 3 spines each, lateral margin bearing spine at mid-length, posterolateral angle spinose; tail-fan flexible. Uropodal endopods and exopods calcified portion narrow, grooved medially, posterolateral margin spinose.



Fig. 44. Geographical locations of collection of *Puerulus angulatus* (Bate, 1888).

Geographical distribution and habitat

Mozambique, Zanzibar, Somalia, Bay of Bengal (off Nicobar Islands), Japan, Philippines, Taiwan, New Guinea,

northwestern and eastern Australia, western Tasman Sea at 200–500 m depths (Radhakrishnan *et al.*, 2019). The present specimens were collected from the southeastern Bay of Bengal at 271 m depth (Fig. 44).

***Puerulus sewelli* Ramadan, 1938 (Arabian whip lobster)**

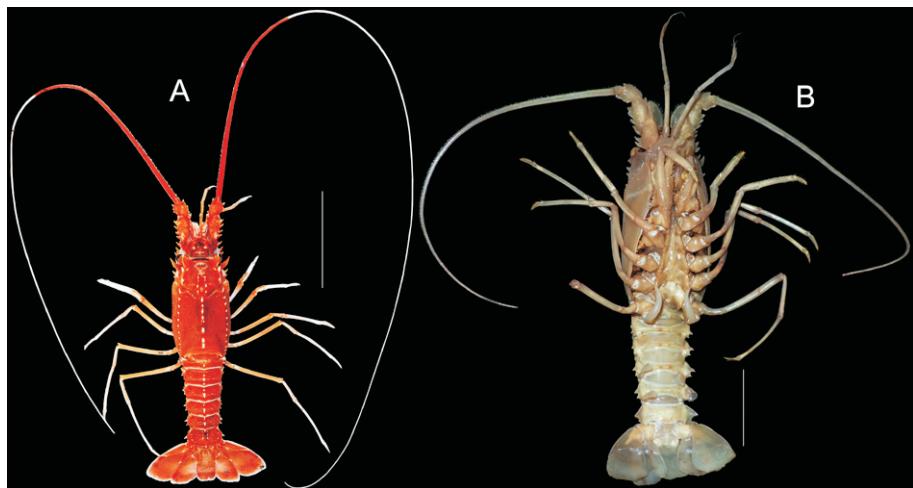


Fig. 45. *Puerulus sewelli* Ramadan, 1938 (southeastern Arabian Sea): A) Dorsal habitus (live colouration); B) Ventral habitus (preserved colouration). Scale: 50 mm.

Infraorder Achelata Scholtz & Richter, 1995

Family Palinuridae Latreille, 1802

Genus *Puerulus* Ortmann, 1897b

Puerulus sewelli Ramadan, 1938

(Figs. 45A–B, 46A–B, 47A–B, 48)

Synonymy

Panulirus angulatus: Alcock & Anderson, 1894: 166; Alcock, 1898: 33;

Alcock, 1901a: 185 (not *Panulirus angulatus* Spence Bate, 1888).

Puerulus angulatus Calman, 1909: 442 (p.p.); Sewell, 1913, p. 350.

Puerulus sewelli Ramadan, 1938: 128, figs. 3–5, type locality: Gulf of Aden, John Murray Expedition, HEMS Mabahiss, stn 24, 11°53'42"N, 51°13'12"E, 73–200 m depth, HEMS Mabahiss, stn. 194, 13°16'00"N, 46°20'24"E to 13°16'36"N,

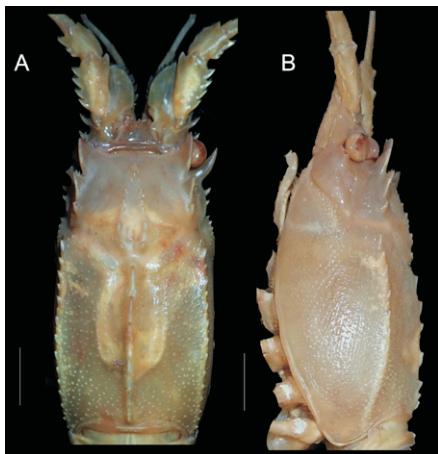


Fig. 46. *Puerulus sewelli* Ramadan, 1938: A) Dorsal carapace, antennules and antennae; B) Lateral carapace. Scale: 10 mm.

46°14'00"E, 220 m depth; Holthuis, 1946: 110; Sewell, 1955: 200, 201, 203; Jones, 1965: 1339 (note); Holthuis, 1966: 271; Prasad & Tampi, 1966: 339–341; Mohammed *et al.*, 1971: 208–215; Rao & George, 1973: 634–640; Fischer & Bianchi, 1984: PALIN Puer 1; Holthuis, 1991: 161 (key), 164, figs. 300d, 305; Anrose *et al.*, 2010: 162–164; Chan, 2010: 159 (list); Chan, 2019: 46 (list); Kizhakudan *et al.*, 2019: fig. 9.8f; Radhakrishnan *et al.*, 2019a: 84, fig. 3.9; Radhakrishnan *et al.*, 2019b: table 5.2.

Puerulus Sewelli: Oommen & Philip, 1974: 369–385.

Puer sewelli Belloc, 1959: 7–9, fig. 6.

Diagnosis (modified from Ramadan, 1938)

Body sub-cylindrical (Fig. 45A–B). Rostrum absent. Antennular plate

distinct, stridulating organ present, first segment not overreaching antennal peduncle, flagellum shorter than distal segment. Antennal segments III–IV rigid, bearing rows of large sharp lateral spines, flagellum long, multiarticulate, flexible (Figs. 45A–B, 46A–B). Eye well-developed, cornea pigmented. Carapace subquadrate in cross section, lateral margins perpendicular to dorsal surface bearing large suborbital spine and 2 spinules, cervical incision distinct, posterolateral margin granular (Fig. 46A–B). Pre-cervical dorsal surface largely smooth, post-cervical portion with distinct randomly scattered tubercles; 1 pair of supraorbital horns tapering to sharp point, single or bifid spine on anterior margin mesial to base, 2 progressively smaller teeth between horn and cervical groove; gastric region bearing median patch of spinules and 4 pairs of submedian spines; median post-cervical carina bearing 4–6 post-cervical and 3–4 intestinal teeth, lateral angular carina bearing 10 teeth, space

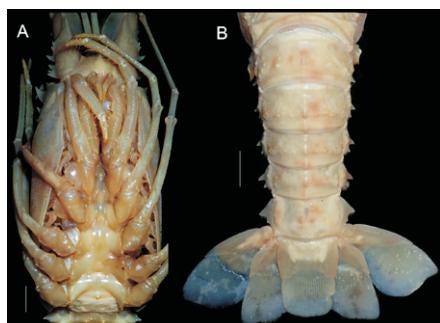


Fig. 47. *Puerulus sewelli* Ramadan, 1938: A) Ventral sternum; B) Dorsal pleon and telson. Scale: 10 mm.

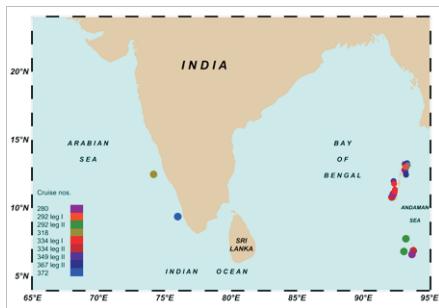


Fig. 48. Geographical locations of collection of *Puerulus sewelli* Ramadan, 1938.

between lateral carina and lateral margin bearing scattered granules (Fig. 47A–B). Thoracic sternites IX–XIV bearing median spine, sternites X–XIV bearing 1–2 lateral spines (Fig. 47A). PI–PV simple, progressively longer posteriorly, meri bearing distal spine dorsally, PI–PII distal row of spines ventrally, male copulatory stylet on PV coxa, in females, PV propodal extension forming chela with dactylus (Fig. 45A–B). Pleonal somite I smooth, longitudinal median carina bearing 1 large anterior and 1 small posterior teeth, pleuron anterior margin lobulated, terminating in posteriorly directed spine, sternite I with pair of submedian and intermediate spines; somites II–V with 1 pair of intermediate oblique grooves anteriorly, transverse groove near posterior margin, longitudinal median

carina bearing 2 teeth before and 1 tooth after transverse groove, pleura II–V terminating in 2 strong acuminate teeth, bearing oblique tuberculate carina; somite VI with 2 carinae bearing 5–6 small submedian teeth converging posteriorly, posterolateral angle acuminate, separated from pleuron by tuberculate carina, pleuron VI terminating in 1 tooth (Fig. 47B). Telson subquadrate, longer than wide, calcified portion bearing pair of submedian spines, followed by pair of diverging carinae bearing 3 spines each, lateral margin bearing spine at mid-length, posterolateral angle spinose; tail-fan flexible. Uropodal endopods and exopods calcified portion narrow, grooved medially, posterolateral margin spinose (Fig. 47B).

Geographical distribution and habitat

Off Somalia, Gulf of Aden, Pakistan, India and Myanmar at 73–450 m (Radhakrishnan *et al.*, 2019). The present specimens were collected from southeastern Arabian Sea at 449 m depth, southeastern Bay of Bengal at 160–535 m depths, and western Andaman Sea at 299–635 m depths (Fig. 48).

***Bathyarctus rubens* (Alcock & Anderson, 1894)**
(Deep-sea brown lobster)

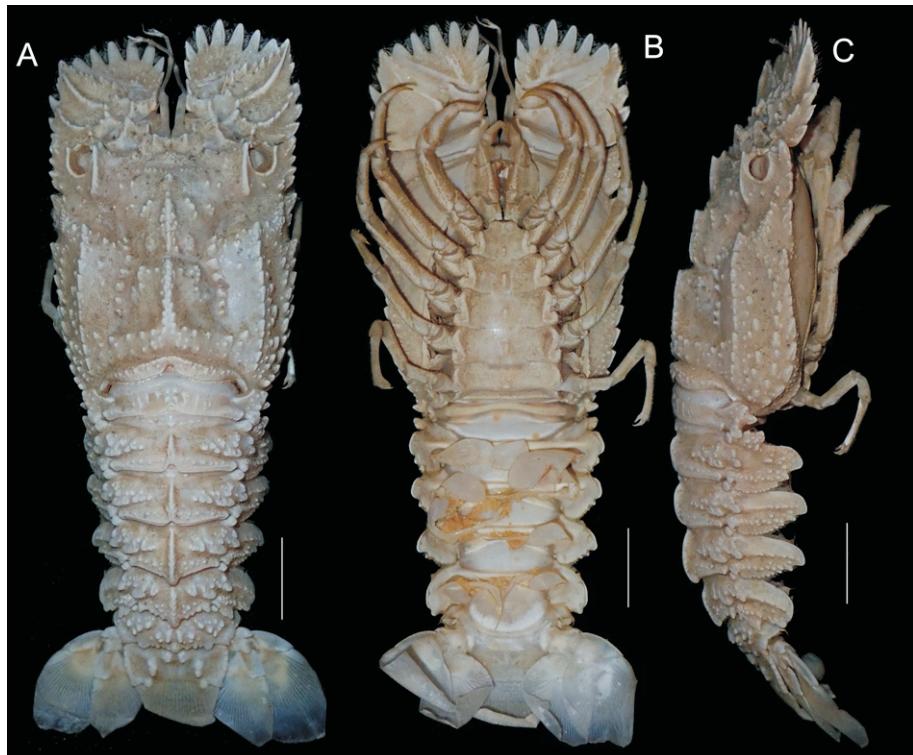


Fig. 49. *Bathyarctus rubens* (Alcock & Anderson, 1894) (western Andaman Sea), female, 75 mm TL: A) Dorsal habitus (preserved colouration); B) Ventral habitus (preserved colouration); C) Lateral habitus (preserved colouration). Scale: 10 mm.

Infraorder Achelata Scholtz & Richter,
 1995

Family Scyllaridae Latreille, 1825
 Subfamily Scyllarinae Latreille, 1825
 Genus *Bathyarctus* Holthuis, 2002
Bathyarctus rubens (Alcock & Anderson,
 1894)
 (Figs. 49A–C, 50A–B, 51A–C, 52)

Synonymy

Arctus rubens Alcock & Anderson,
 1894: 165, type locality: Gulf of Mannar,
 northwest of Colombo Lighthouse, RIMSS
Investigator stn 151, 142–400 fathoms (=
 260–732 m) depth; Anderson, 1896: 98;
 Alcock, 1898: 33; Alcock, 1901: 182.

Scyllarus rubens (Alcock & Anderson,

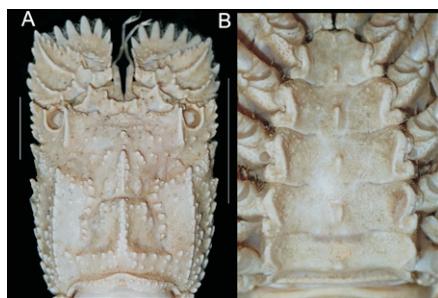


Fig. 50. *Bathyarctus rubens* (Alcock & Anderson, 1894): A) Dorsal carapace, antenniferous spines and antennae; B) Ventral sternum. Scale: 10 mm.

1894): De Man, 1916: 69; Bouvier, 1917: 105, 106; Bouvier, 1925: 447; Prasad & Tampi, 1969: 84; George, 1967: 434; Burukovsky, 1974: 107; Burukovsky, 1983: 150; Phillips *et al.*, 1980: 70; Holthuis, 1991: 217 (list); Chan, 2010: 160; Radhakrishnan *et al.*, 2019a: 93.

Bathyarctus rubens (Alcock & Anderson, 1894): Holthuis, 2002: 505 (key), 505, figs. 1–3, 66A, B; Poore, 2004: 209, fig. 59h; Chan, 2010: 160 (list); Chan, 2019: 48 (list); Radhakrishnan *et al.*, 2019a: 93.

Diagnosis (modified from Alcock & Anderson, 1894)

Body dorso-ventrally compressed (Fig. 49A–C). Rostrum blunt, elevated, rostral tooth lacking. Eyes well developed, orbital margin distinct, with elevated supra-orbital tooth. Small tubercle behind orbit. Carapace sub-quadrilateral, wider between the antero-lateral angles than posteriorly, antero-lateral angle

acuminate, lateral pre-cervical teeth 4, cervical incision distinct, 3 blunt teeth between cervical and post-cervical incisions, post-cervical incision wide, post-cervical spine short, 9 tubercles on posterolateral margin. Dorsal surface bearing two transverse rows of minute tubercles behind rostrum, anterior post-rostral carina bearing distinct pre-gastric tooth, tuberculated gastric tooth, flanked by transverse rows of tubercles; cervical groove with tubercles on posterior margin; median post-cervical carina tuberculated, bearing cardiac tooth; branchial carina commencing inner to orbit, bearing elevated tooth anteriorly, interrupted by cervical groove, post-cervical portion reaches posterior carapace margin, bearing 10 flattened tubercles; longitudinal row of 5 low tubercles between median post-cervical and branchial carinae, 2–3 irregular rows of tubercles between posterior branchial carina and lateral margin, posterior marginal carina minutely tuberculated (Fig. 50A). Antennules longer than antennae, flagellum overreaching distal antennal segment. Antennal flagellum reduced to 6 broad, flat segments, segment IV lateral margin divided into 3 teeth (excluding the apical tooth), mesial margin dentate, dorsal surface bearing 2 distinct, curved carinae, anterior carina terminating apically, posterior carina terminating at second lateral tooth, bearing 6/7 tubercles; segment V anterior margin bearing 2 teeth laterally, 1 mesial

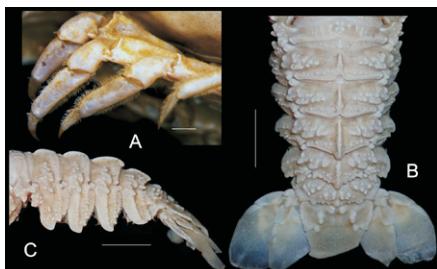


Fig. 51. *Bathymarctus rubens* (Alcock & Anderson, 1894): A) Pereopods II–V lateral view; B) Dorsal pleon and telson; C) Lateral pleon and telson. Scale: A–2 mm; B, C–10 mm.

tooth bearing carina; segment VI anterior margin divided into 7 teeth, outer 5 teeth with rounded margins, inner 2 teeth pointed, dorsal surface randomly tuberculate (Fig. 50A). Thoracic sternum anterior margin truncate, gently sinuous, bearing tubercle, located on horizontal plane at level of anterolateral teeth, all sternites with median tubercle, elongate on sternites I–IV somites, dentate on sternite V (Fig. 50B). PI–PV simple, PI–PIV propodi bearing ventral rows of setae, PV chelate in females, propodus with short distal spinule in males (Fig. 51A). Pleonal somite I flattened dorsally, with median notch posteriorly, pleuron I lateral margin reduced to tubercle, pleopod absent; somites II–IV with transverse groove over posterior half with flattened tubercles on either side, somites II–V bearing distinct median longitudinal carina, those on somites IV–V bearing postero-median tooth, postero-median tooth of somite IV higher than that of somite III, pleura II–V tips blunt rounded, directed posteriorly, pleuron II bearing distinct

tooth on anterior and posterior margins, pleura III–IV bearing tooth only on posterior margin, pleura II–V bearing transverse rows of small tubercle on posterior half; somite VI dorsal surface with 1 median and 2 submedian patches of squamiform tubercles, posterior margin bearing 3 large and 6 small teeth (Fig. 51C). Telson sub-rectangular, slightly longer than wide, with 1 pair of short sub-median, 1 pair of long intermediate ridges, posterior margin bearing 1 pair of short teeth behind intermediate ridge, postero-lateral angle acuminate; tail-fan soft, flexible. Uropodal exopod and endopod sub-triangular, longer than telson (Fig. 51B). Male gonopore on PV coxa, female gonopore on PIII coxa. Pleopods II–III subequal, thread-like in males, pleopod IV–V endopods reduced to small tubercles; in females, pleopods II–III broadly lamellar, pleopod IV–V exopods narrow lamellar, endopods thread-like.

Geographical distribution and habitat



Fig. 52. Geographical locations of collection of *Bathymarctus rubens* (Alcock & Anderson, 1894).

Mozambique, Madagascar, southeastern Arabian Sea, Gulf of Mannar, Sri Lanka, Indonesia, Philippines, including Australia, Chesterfield and Loyalty Islands, Vanuatu, Fiji, and New Caledonia at 183–732 m depths

(Radhakrishnan *et al.*, 2019). The present specimens were collected from the southeastern Arabian Sea at 327 m depth, southeastern Bay of Bengal at 402 m depth, and western Andaman Sea at 278–332 m depths (Fig. 52).

***Gibbularctus gibberosus* (de Man, 1905) (Dark-spot locust lobster)**

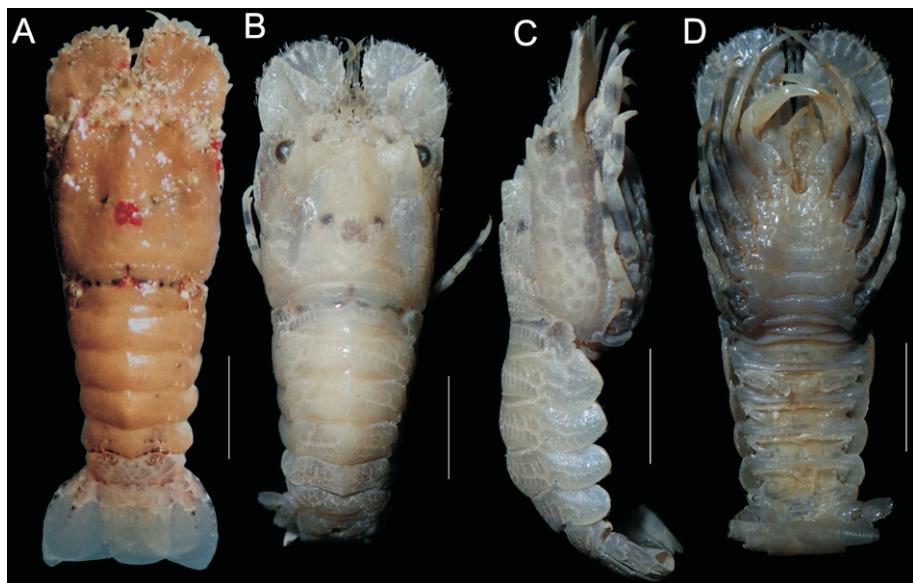


Fig. 53. *Gibbularctus gibberosus* (de Man, 1905) (southwestern Andaman Sea), female, 22 mm TL: A) Dorsal habitus (live colouration); B) Dorsal habitus (preserved colouration); C) Lateral habitus (preserved colouration); D) Ventral habitus (preserved colouration). Scale: 5 mm.

Infraorder Achelata Scholtz & Richter, 1995 (Figs. 53A–D, 54A–B, 55, 56A–B, 57)

Family Scyllaridae Latreille, 1825

Subfamily Scyllarinae Latreille, 1825

Genus *Gibbularctus* Holthuis, 2002

Gibbularctus gibberosus (de Man, 1905)

Synonymy

Arctus gibberosus de Man, 1905: 588, type localities: Sulu Sea, Philippines, off North Ubian, *Siboga* Expedition stn.



Fig. 54. *Gibbularctus gibberosus* (de Man, 1905): A) Dorsal anterior carapace, antennules and antennae; B) Lateral carapace. Scale: 2 mm.

99, 6°7.5'N, 120°26'E, 16–23 m; Indonesia, northeast of Misool, 164, 1°42.5'S, 130°47.5'E, 32 m.

Scyllarus gibberosus (de Man, 1905): De Man, 1916: 64, 68, 70, 90, pl. 3 fig. 14; Estampador, 1937: 496; 1959: 41; Holthuis, 1968: 288; McNeill, 1968: 25; Burukovsky, 1974: 107; Phillips *et al.*, 1980: 70; Burukovsky, 1983: 150; Vine, 1986: 107; Holthuis, 1991 (list); McWilliam *et al.*, 1995: 564; Chan, 1998: 1033 (list); Chan, 2010: 161 (list).

Scyllarus Gundlachii: Paulson, 1875: 96, pl. 12 fig. 5, 5a; Paulson, 1961: 102, pl. 12 fig. 5 [non *Scyllarus gundlachi* von Martens, 1872].

Scyllarus sordidus Nobili, 1905a: 160 [non *Scyllarus sordidus* Stimpson, 1858].

Arctus Nobilii De Man, 1905: 589.

Scyllarus Paulsoni Nobili, 1905b: 395; Nobili, 1906a: 88; De Man, 1916: 65, 68, 71.

Scyllarus Nobilii: Nobili, 1906b: 56, pl. 4, fig. 15; Bouvier, 1914: 704; Bouvier, 1915a: 188; De Man, 1916: 65, 68, 70.

Scyllarus nitidus Nobili, 1906b: 59, pl. 6, fig. 27.

Scyllarus paulsoni: Prasad & Tampi, 1969: 84; Phillips *et al.*, 1980: 70.

Scyllarus nobilii: Prasad & Tampi, 1969: 82; Michel, 1974: 256; Phillips *et al.*, 1980: 70.

Gibbularctus gibberosus (de Man, 1905): Holthuis, 2002: 624, fig. 69C, D. Chan, 2010: 217: 161 (list); Chan, 2019: 49 (list).

Diagnosis (modified from de Man, 1905)

Body dorso-ventrally compressed (Fig. 53A–D). Rostrum broad, margin bilobed, rostral tooth blunt. Eyes well-developed, orbital margin distinct (Fig. 54A). Small tubercle behind orbit. Carapace sub-quadrilateral, wider between the antero-lateral angles than posteriorly, antero-lateral angle blunt, pre-cervical tubercles 2, cervical incision distinct, 2/3 blunt teeth between cervical and post-cervical incisions, post-cervical



Fig. 55. *Gibbularctus gibberosus* (de Man, 1905): Ventral sternum. Scale: 2 mm.

incision narrow, post-cervical spine short, 5/6 small tubercles on posterolateral margin. Dorsal midline bearing small, low pre-gastric tooth, high, single-topped gastric tooth, low, broad, two-topped cardiac tooth and double row of 5 squamiform tubercles; branchial carina commencing inner to orbit, bearing 2 elevated rectangular teeth anteriorly, widely interrupted by cervical groove, 4 squamiform tubercles between posterior tooth and cervical groove, small tubercle located medially of branchial gap, post-cervical portion anteriorly terminating in blunt tooth, comprising 3 parallel rows of squamiform tubercles, few tubercles

between posterior branchial carina and lateral margin, posterior marginal groove narrow, flanked by 2 transverse rows of tubercles, posterior margin incised medially (Fig. 54A, B). Antennules longer than antennae, flagellum overreaching distal antennal segment. Antennal flagellum reduced to 6 broad, flat segments, segment IV anterior margin 7-toothed, lateral margin divided into 3 blunt teeth (excluding the apical tooth), dorsal surface bearing distinct, oblique carina terminating apically, outer half bearing curved row of tubercles originating from base of carina; segment V antero-internal angle bearing blunt tooth carinate dorsally segment VI margin

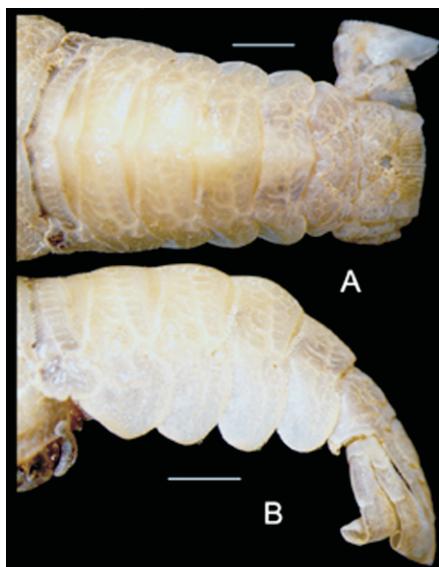


Fig. 56. *Gibbularctus gibberosus* (de Man, 1905): A) Dorsal pleon and telson; B) Lateral pleon and telson. Scale: 2 mm.



Fig. 57. Geographical locations of collection of *Gibbularctus gibberosus* (de Man, 1905).

divided into 7 teeth, outer 5 teeth with rounded margins, inner 2 teeth blunt (Fig. 54A). Thoracic sternum anterior margin emarginate, V-shaped, swollen, oblique carinae from anterolateral teeth converging medially, sternites lacking tubercle, posterior margin entire (Fig. 55). PI–PV simple, PI–PIV propodi lacking ventral setae, PIII propodus wider than other propodi, PV propodus in female with short distal spinule (Fig. 54B). Pleonal somite I anterior half smooth, transverse groove distinct, 20 short longitudinal grooves not extending to posterior margin, pleuron bilobed, margins crenulated, pleopod absent; somites II–V anterior half smooth, posterior half with arborescent pattern of narrow, deep central transverse groove with branched side grooves, confluence of halves arched

along midline, arch on somite IV higher than somite III; somites I–IV posterior margins deeply incised, somites V–VI ending in blunt median point; pleura II–V tips blunt rounded, directed ventrally, pleuron II bearing indistinct lobe on anterior margin, pleura II–V bearing arborescent pattern similar to tergites; somite VI dorsal surface bearing squamiform tubercles of various sizes (Fig. 56A–B). Telson sub-rectangular, slightly longer than wide, calcified portion bearing squamiform tubercles of various sizes; tail-fan soft, flexible. Uropodal exopod and endopod sub-triangular, longer than telson (Fig. 56A–B). Male gonopore on PV coxa, female gonopore on PIII coxa. Pleopods II–III broadly lamellar in female, pleopods IV–V narrow lamellar.

Geographical distribution and habitat

Red Sea to Madagascar east to the Ryukyu Islands, Philippines, Indonesia and New Caledonia at 12–57 m depths (Holthuis, 2002). The present specimen was collected from the southwestern Andaman Sea at 56 m depth (Fig. 57). This is a new record for the Indian waters.

***Petrarctus rugosus* (H. Milne Edwards, 1837)**
(Hunch-back locust lobster)

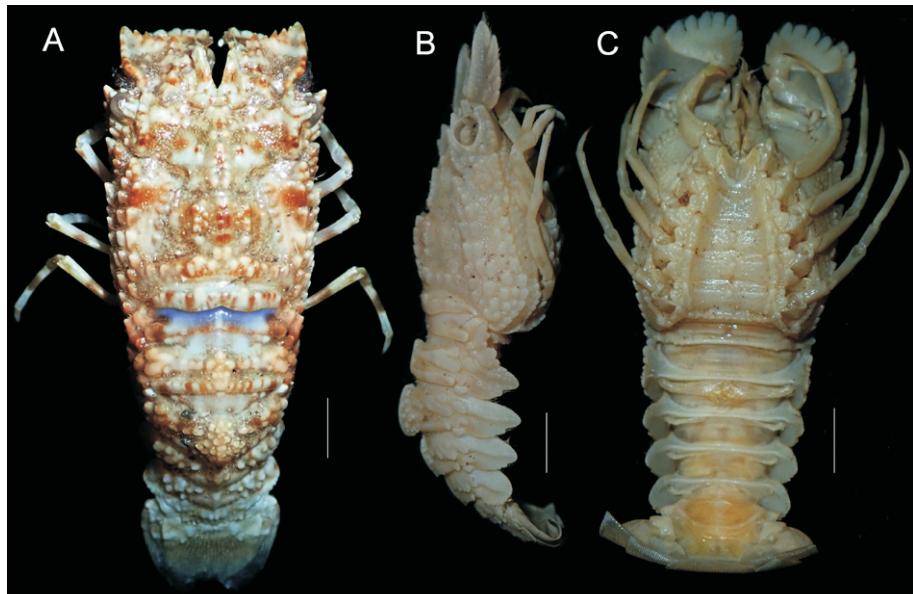


Fig. 58. *Petrarctus rugosus* (H. Milne Edwards, 1837) (southeastern Bay of Bengal), male, 37 mm TL: A) Dorsal habitus (live colouration); B) Lateral habitus (preserved colouration); C) Ventral habitus (preserved colouration). Scale: 5 mm.

Infraorder Achelata Scholtz & Richter, 1995
 Family Scyllaridae Latreille, 1825
 Subfamily Scyllarinae Latreille, 1825
 Genus *Petrarctus* Holthuis, 2002
Petrarctus rugosus (H. Milne Edwards, 1837)
 (Figs. 58A–C, 59A–B, 60, 61A–B, 62)

Synonymy

Scyllarus rugosus H. Milne Edwards, 1837: 283, type locality: Bay of Bengal, off Pondicherry, India; H. Milne Edwards,

1838: 168; White, 1847: 67; Morice, 1875: 110; Pfeffer, 1881: 47; Holthuis, 1946: 89, pl. 7 fig. c, pl. 8 fig. a, pl. 9 fig. c; Harada, 1962: 128; Naiyanetr, 1963: 68; Harada, 1965: 36; Holthuis, 1968: 288; Prasad & Tampi, 1969: 84; Stephenson *et al.*, 1970: 492; Berry, 1974: 13, 14; Burukovsky, 1974: 106; Tampi & George, 1975: 34, figs. 34–36; Naiyanetr, 1980: 22; Phillips *et al.*, 1980: 70; Prasad *et al.*, 1980: 83, fig. 10; Miyake, 1982: 84; Burukovsky, 1983: 149; Prasad, 1983: 144, fig. 3a; Chan &

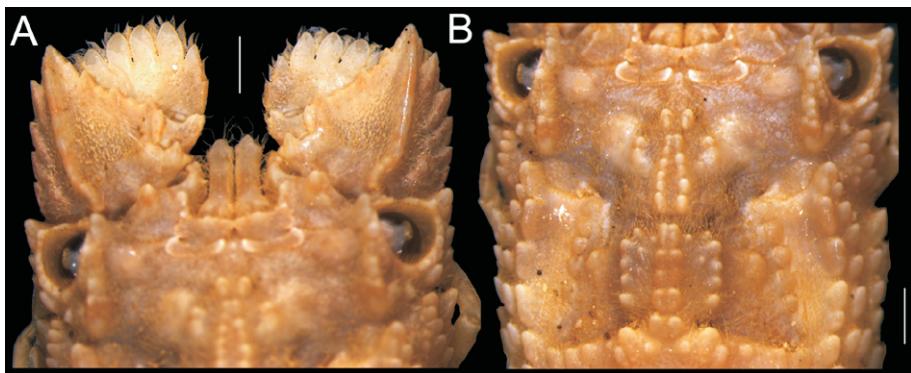


Fig. 59. *Petrarctus rugosus* (H. Milne Edwards, 1837): A) Dorsal anterior carapace, antennules and antennae; B) Dorsal carapace. Scale: 2 mm.

Yu, 1986: 150, pl. 1, pl. 8 fig. A, pl. 10 fig. C; Sekiguchi, 1986a: 1289-1291; Sekiguchi, 1986b: 15, 17; Sekiguchi, 1987a: 331; Sekiguchi, 1987b: 415, 417, 418, fig. 48; Sekiguchi, 1988: 3; Sekiguchi, 1989: 457; Barnett, 1989: 123, 126, fig. 3; Holthuis, 1991: 217 (list), 225, figs. 425, 426; Mutchacheep, 1992: 26; Chan & Yu, 1993: 201, coloured fig.; Huang, 1994: 564; McWilliam *et al.*, 1995: 564; Nguyễn Van Chung & Pham Thi Du, 1995: 105; Hu & Tao, 1996: 144, pl. 3 figs. 3, 4; Chan, 1998: 1033 (list), 1043, 3 figs. n.n.; Naiyanetr, 1998: 12, 44, fig.

Arctus tuberculatus Spence Bate, 1888: 70, pl. 10 figs. 1, 2; Doflein, 1900: 132; Lanchester, 1901: 557; Chan, 2019: 50 (list).

Scyllarus tuberculatus: Nobili, 1903: 12; Pearson, 1905: 90; De Man, 1916: 68, 89; Barnard, 1925: 123, pl. 10; Barnard, 1950: 560; Dawydoff, 1952: 136; Prasad & Tampi 1968: 116, fig.; Zarenkov, 1971: 167; Kensley, 1981a: 30; Huang, 1994:

564 [non *Scyllarus tuberculatus*: De Man, 1924: 53, fig. 18 (= *Scyllarus demani* Holthuis, 1946)]; Chan, 2010: 161 (list).

Scyllarus ragosus: Vine, 1986: 107.

Scyllarus spec. A? Berry, 1974: 13, figs. 36, 38, 45-47.

Scyllarus cultrifer: Hwang & Yu, 1983: 264, fig. 5 [non *Arctus cultrifer* Ortmann, 1897a].

Non *Arctus rugosus* Yokoya, 1933: 46, fig. 24 (= *Scyllarus brevicornis* Holthuis, 1946).

Petrarctus rugosus (H. Milne Edwards, 1837): Holthuis, 2002: 528 (key), 529, figs. 12, 13; Chan, 2010: 161 (list); Chan, 2019: 50 (list); Radhakrishnan *et al.*, 2019a: 94, fig. 3.13.

Diagnosis (modified from Milne Edwards, 1837)

Body stony, dorso-ventrally compressed (Fig. 58A-C). Rostrum blunt, bearing low dorsal tubercle, diverging rows of minute tubercles fused to low



Fig. 60. *Petrarctus rugosus* (H. Milne Edwards, 1837): A) Ventral sternum; B) Dorsal pleon and telson; C) Lateral pleon and telson. Scale: 2 mm.

carina. Eyes well-developed, orbital margin distinct, supra-orbital tooth elevated, 2/3 tubercles behind orbit. Carapace sub-quadrilateral, wider between antero-lateral angles than posteriorly, antero-lateral angle blunt, lateral pre-cervical teeth 2, cervical incision distinct, 3 blunt teeth between cervical and post-cervical incisions, post-cervical incision wide, double row of 10 tubercles on posterolateral margin. Dorsal surface lacking pre-gastric tooth, replaced by curved row of 2 tubercles, which continue as anterior submedian carinae with 2 tubercles; anterior post-rostral

carina comprising blunt broad gastric tooth, 2 rows of 5 moderately large tubercles each converging posteriorly; posterior post-rostral carina comprising distinct, two-topped cardiac tooth located behind deep cervical groove, 2 rows of 4 larger tubercles each, posterior submedian carinae with 4 tubercles; branchial carina commencing inner to orbit, bearing 2 tooth anteriorly, posterior tooth low, carina of 3 small tubercles, carina interrupted by cervical groove, post-cervical portion commencing with blunt tooth, double row of 6–8 blunt tubercles, space between it and lateral carina filled by tubercles; intermediate carina between posterior submedian and branchial carinae located near the latter, comprising 5 tubercles, large tubercle between submedian and intermediate carinae; 4 tubercles between cervical and post-cervical incisions; marginal groove wide, preceded and followed by transverse row of small tubercles, except large submedian pair, posterior margin bluntly incised (Figs. 59A–B). Antennules longer than antennae, flagellum overreaching distal antennal segment. Antennal flagellum reduced to 6 broad, flat segments, segment IV anterior margin divided into 5/6 teeth, lateral margin divided into 4–5 teeth (excluding the apical tooth) bearing dorsal carina, dorsal surface bearing sharp distinct, carina terminating apically; segment V anterior margin unarmed, lacking dorsal carina; segment VI anterior margin divided into

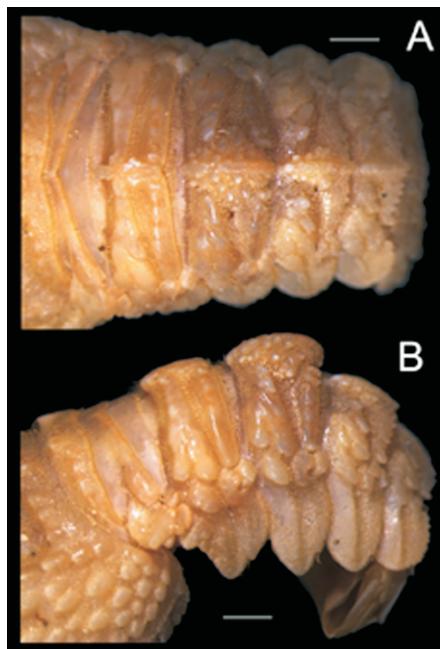


Fig. 61. *Petrarctus rugosus* (H. Milne Edwards, 1837): A) Dorsal pleon and telson; B) Lateral pleon and telson. Scale: 2 mm.

distinctly separated 7 teeth, outer 5 teeth with rounded margins, inner 2 teeth pointed (Figs. 59A–B). Thoracic sternum anterior margin deeply U-shaped, with narrow median incision, anterolateral teeth blunt, tubercle formed by anteriorly converging carinae, sternites II–V with median tubercle anteriorly, lateral margins elevated, posterior margin of last sternite tuberculated (Fig. 60). PI–PV simple, PI heavy, PII–PV slender (Fig. 58C), PIII propodus bearing rows of setae along dorsal and ventral margins, PII dactylus longest, PIII–PV pubescent basally, PV simple in males. Pleonal

somite I flattened dorsally, posterior margin incised, transverse groove laterally only, pleuron I short, margin irregularly lobate, pleopod absent; somites II–V with anterior half smooth, posterior half bearing elevated longitudinal carina medially (highest on somite III overhanging posterior margin, that of somite IV terminating in small posterior point), tubercles fused to carina giving it lobulated appearance; median carina flanked by pair of transverse carinae separated by deep groove, anterior carina smooth on somites II–III, lateral tip bilobed, posterior carina smooth, with crenulate margin on somites IV–V, somite II posterior margin with median emargination, somite VI tuberculate, posterior margin crenulate; pleura II–V bearing median carina, tips bluntly rounded, directed ventrally, posterior margins crenulate, pleuron II anterior margin crenulate (Fig. 61A–B). Telson sub-rectangular, slightly longer than wide, calcified portion bearing 2 pairs of bosses (anterior pair larger), 2 pairs of marginal teeth (outer pair broader); tail-fan soft, flexible. Uropodal exopod and endopod sub-triangular, longer than telson. Male gonopore on PV coxa (Fig. 61A–B). Pleopods II well-developed, pleopods III–V narrow.

Geographical distribution and habitat

Red Sea, Mozambique, northern Madagascar, Comoros, Socotra,



Fig. 62. Geographical locations of collection of *Petrarctus rugosus* (H. Milne Edwards, 1837).

Lakshadweep Islands, southeast coast of India, Thailand, Malaysia, Indonesia, Philippines, Vietnam, Taiwan, China and northern Queensland (Australia) at 20–60 m depths. The present specimens were collected from the southeastern Bay of Bengal at 61–62 m depths, and western Andaman Sea at 71 m depth (Fig. 62).

Polycheles typhlops Heller, 1862 (Blind lobster)

Infraorder Polychelida Scholtz & Richter, 1995

Superfamily Eryonoidea De Haan, 1841
[in De Haan, 1833–1850]

Family Polychelidae Wood-Mason, 1874b

Genus *Polycheles* Heller, 1862

Polycheles typhlops Heller, 1862

(Figs. 63A–C, 64A–B, 65A–B, 66)

Synonymy

Polycheles typhlops Heller, 1862: 392, pl. 1 figs. 1–6, type locality: Mediterranean Sea, off Sicily; Heller, 1863: 211, pl. 7 figs. 1–2; Carpenter & Jeffreys, 1870: 154; Wood-Mason, 1874b: 180; Wood-Mason, 1875: 134; Spence Bate, 1878a: 273; Spence Bate, 1878b: 563; Norman, 1878: 382 (p.p.); Norman, 1879: 175 (p.p.); Carus, 1885: 486; Norman, 1886: 7; Spence Bate, 1888: 100; Steindachner,

1891: 438; Stebbing, 1893: 200; Adensamer, 1898: 621; Senna, 1902: 332, fig. 7, pl. 18, figs. 1–11; Lo Bianco, 1903: 250; Magri, 1904: 7; Bouvier, 1905a: 480; Bouvier, 1905b: 3; Kemp, 1905: 7; Richard, 1907: 322; Kemp, 1910: 413; Pesta, 1912: 103; Kemp & Sewell, 1912: 24; Selbie, 1914: 12, pl. 1 figs. 1–13; Bouvier, 1915b: 2; Sund, 1915: 372; Williamson, 1915: 437; De Man, 1916: 6; Bouvier, 1917: 35, pl. 2 figs. 1–6; Pesta, 1918: 162, fig. 53; Miranda & De Rivera, 1921: 184; Stephensen, 1923: 67; Balss, 1924: 179, figs. 5, 8; Balss, 1925: 201, pl. 19; Bouvier, 1925: 433, fig. 9; Calman, 1925: 18; Dieuzeide, 1929: 103; Bolivar, 1930: 21, fig. 2; Seurat, 1930: 37; Santucci, 1931: 1; Santucci, 1932: 1; Miranda & De Rivera, 1933: 18; Santucci, 1933: 1; Schmitt, 1935: 172; Zariquey Cenarro,

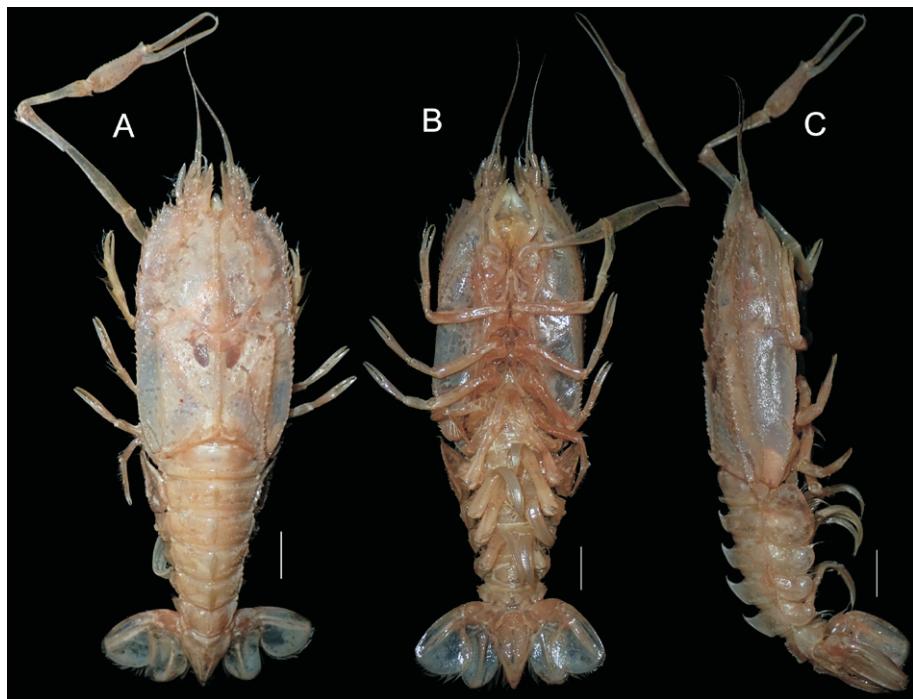


Fig. 63. *Polycheles typhlops* Heller, 1862 (Eastern Bay of Bengal), female, 115 mm TL: A) Dorsal habitus (preserved colouration); B) Ventral habitus (preserved colouration); C) Lateral habitus (preserved colouration). Scale: 10 mm.

1935: 6; Vilela, 1936: 224; Ramadan, 1938: 129; Bouvier, 1940: 75, pl. 2. fig. 5; Parenzan, 1940: 139 (list); Seurat, 1940: 145; Zarliquiey Alvarez, 1946: 99, figs. 123-124; Le Danois, 1948: 139, pl. 3; Barnard, 1950: 568; Dieuzeide, 1950: 46; Tortonese, 1951: 220; Bernard, 1953: 86; Marshall, 1954: 120; Peres & Picard, 1955: 51; Sewell, 1955: 203; Zarliquiey Alvarez, 1955: 407; Holthuis, 1956: 114; Springer & Bullis, 1956: 14 (p.p.); Dieuzeide & Roland, 1957: 19; Dieuzeide & Roland, 1958: 23; Hemming, 1958: 137; Holthuis & Gottlieb, 1958: 114; Longhurst, 1958: 32; Rossi, 1958: 7; Tortonese, 1958: 195; Tortonese, 1959: 448; Dieuzeide, 1960: 77; Forest & Gantes, 1960: 348; Maurin, 1962: 180; Zarliquiey Alvarez, 1962: 30, 33; Russell, 1962: 6; Tortonese, 1962: 112; Forest, 1963: 627; Lewinsohn & Holthuis, 1964: 54; Peres, 1964: 22; Torchio, 1964: 120; Bullis & Thompson, 1965: 8; Dawson, 1965: 1; Forest, 1965: 346; Grindley & Penrith, 1965: 286; Tortonese, 1965: 85; Kotthaus, 1966: 348, figs. 1-3; Allen, 1967: 55; Torchio, 1967: 122; Maurin, 1968a: 45; Maurin, 1968b: 479; Massuti,

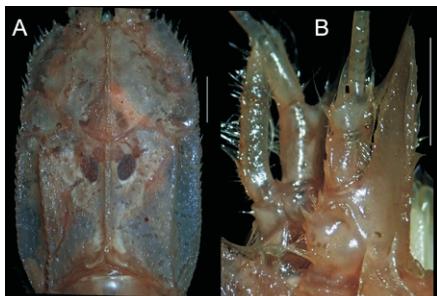


Fig. 64. *Polycheles typhlops* Heller, 1862: A) Dorsal carapace; B) Antennules and antennae. Scale: A – 10 mm; B – 5 mm.

1968: 306; Zariquey Alvarez, 1968: 209, fig. 86b; Berry, 1969a: 46; Števèiæ, 1969: 128; Carpine, 1970a: 135; Firth & Pequegnat, 1971: 50, figs. 9-10; Pequegnat *et al.*, 1971: 4; Rubio Lois, 1971: 10; Lagardere, 1972: 672, fig. 5; Relini-Orsi & Relini, 1972, fig. 5; Koukoura, 1973: 753; Relini, 1973: 29; Neves, 1974: 7; Thiriot, 1974: 344; Pastore, 1976: 107; Turkay, 1976: 26; Lagardere, 1977: 399; Voss & Jeuniaux, 1978: 127; Beaubrun, 1979: 35, figs. 15-16; Rodriguez, 1980: 194; Soto, 1980: 87; Burkenroad, 1981: 263; Moncharmont, 1981: 66; Kensley, 1981a: 29; Takeda, 1982: 74; Manning & Froglia, 1982: 321; Burukovsky, 1983: 134, fig. 178; George, 1983: 16; Ohta, 1983: 230; Riedl, 1983: 481, pl. 176; Lemaitre, 1984: 427; O'riordan, 1984: 322; Omori, 1985: 63; Baba, 1986: 157, pl. 107; Relini *et al.*, 1986: 156, tab. 4, fig. 4; Duris, 1987: 9; Garcia & Massuti, 1987: 75; Gonzalez-Gurriaran & Olaso, 1987: 328 (list); Holthuis, 1987: 297, fig. 2; Abello & Valladares, 1988: 98; Abello *et*

al., 1988: 41; Morgan & Jones, 1988: 15; Gonzales *et al.*, 1988: 28; Chan & Yu, 1989b: 166, pl. 1; Intes & Bach, 1989: 21; Cartes & Abello, 1990: 35; Števèiæ, 1990: 210; Cartes & Abello, 1992: 139; Cartes & Sarda, 1992: 1315; Falciai & Minervini, 1992: 134, pl. 9, fig. 3; Cartes, 1993: 32; Cartes *et al.*, 1993: 210; Chan & Yu, 1993: 105; Emmerson, 1993: 181; Kocatas & Katagan, 1993: 35; Rodriguez, 1993: 197 (list); Vaso & Gjiknuri, 1993: 397; Pipitone & Tumbiolo, 1993: 361 (list); Turkay, 1993: 284; Galil & Goren, 1994: 45, fig. 2b; Quackenbush, 1994: 85; Gonzalez Pérez, 1995: 126, fig. 65; Galil, 2000: 291 (key), 354, fig. 30; Ahyong & Brown, 2002: 77 (key); Poore, 2004: 152 (key), 156, fig. 41h; Follesa *et al.*, 2008: 731, fig. 1; Ahyong, 2009: 383 (key), fig. 2A; Chan, 2010: 162 (list); Chang *et al.*, 2013: 9, 13 (key); Bezerra & Ribeiro, 2015: 127, fig. 2; Chan, 2019: 51 (list), fig. 26a; Radhakrishnan *et al.*, 2019a: fig. 3.19.

Pentacheles agassizii A. Milne Edwards, 1880: 65, type locality: Caribbean Sea, off Grenada, *Blake stn 246*; Faxon, 1896: 155; Young, 1900: 441.

Polycheles doderleini Riggio, 1885: 103, pl. 3, figs. 1-5.

Pentacheles hextii Alcock, 1894: 237; Alcock, 1898: 35; Alcock, 1901a: 172; Alcock, 1902: 264; Alcock & Anderson, 1894: 165; Alcock & Anderson, 1895, pl. 10 fig. 2.

Polycheles agassizii: Faxon, 1895: 120.

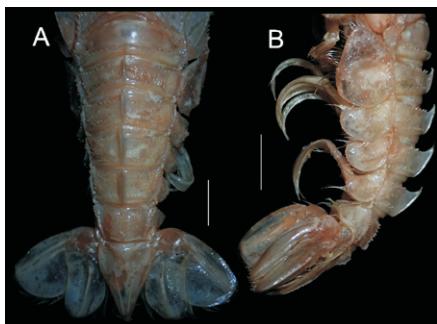


Fig. 65. *Polycheles typhlops* Heller, 1862: A) Dorsal pleon and telson; B) Lateral pleon and telson. Scale: 10 mm.

Polycheles agassizi: Bouvier, 1905a: 480; Bouvier, 1905b: 3.

Polycheles hexti: Bouvier, 1905a: 481.

Polycheles typhlops: Magri, 1911: 32; Bombace, 1968: 113; Relini-Orsi & Relini, 1972: 59 [erroneous spelling]

Polycheles intermedius Balss, 1914b: 599.

Polychelites typhlopis: Nobre, 1931: 246, fig. 137; Nobre, 1936: 153, pl. 51, fig. 130. [erroneous spelling]

Polycheles typhlops typhlops: Firth & Pequegnat, 1971: 51, fig. 7; Wadley & Evans, 1991: 27, pl. n.n.; Griffin & Stoddart, 1995: 242, figs. 6-8; Tiefenbacher, 1995: 5; Dawson, 1997: 13; Radhakrishnan *et al.*, 2019a: 104.

Polycheles typhlos: Arena & Greci, 1973: 164 [erroneous spelling].

Polycheles thyphlos: Arena & Greci, 1973: 173. [erroneous spelling].

Polycheles tiphlops: Froglia, 1976: 78 (list) [erroneous spelling].

Polycheles sp.: Gamo, 1980, pl. 7b;

Utinomi, 1983: 105.

Stereomastis nana: Miyake, 1982: 78, pl. 26 fig. 6 [non Smith, 1884].

Polycheles hextii: Holthuis, 1984: 4.

Polycheles thyphlops: Gonzalez-Gurriaran & Olaso, 1987: 329; Jacques, 1989: 4. [erroneous spelling]

Polycheles typhlops: Miyake, 1982, pl. 26 fig. 6. [erroneous spelling]

not Polycheles typhrops: Takeda, 1982, pl. 38.

Stereomastis artuzi Artüz, Kubanç & Kubanç, 2014 (unavailable name under Art. 16.4.2): 1247, figs. 2-7 (not *P. typhlops* Heller, 1862).

Diagnosis (modified from Heller, 1862)

Body dorso-ventrally compressed (Fig. 63A-C). Rostral spine single, antorse. Orbital sinus V-shaped, bearing short spine medially, internal margin pectinated, internal angle bearing spine, cornea absent. Carapace sub-quadrilateral, dorsal surface minutely granular, densely setose; lateral spination including 7/8 pre-cervical + 5 between cervical and post-cervical incisions + 20-22 spines posterior to post-cervical incision; dorsal spination including 7-9 irregularly spaced spinules on median post-rostral carina, 5 antorse spinules arranged in arc-shaped row on gastro-orbital carinae, 3-4 spinules on posterior margin of cervical groove between post-cervical and branchial carina, 11-12 pairs of spinules on median post-cervical



Fig. 66. Geographical locations of collection of *Polycheles typhlops* Heller, 1862.

carina, 16–18 spines on branchial carina, random spinules on region between post-cervical and branchial spines, 4–5 pairs of antorse spinules on posterior margin (Fig. 64A). Basal antennular segment proximally rounded, produced anteriorly to sharp point, antero-lateral margin bearing 2 spines; flagellum double whip-like, inner flagellum 3 times longer than outer flagellum. Scaphocerite lanceolate, setose, extending to base of antennal flagellum (Fig. 64B). Maxilliped III epipod rudimentary. PI largest, chelate; merus bearing 2 subdistal spinules on dorsal margin, ventral margin serrated; carpus bearing 2 subdistal spinules each on dorsal and ventral margins; propodus serrated on dorsal and ventral margins, 2 dorso-distal spinules posterior to dactylar articulation larger; fingers extremely slender, smooth, bent distally, cutting edges pectinated (Fig. 63A, B).

PII–PIV progressively shorter, slender, chelate; PII carpus with distal spinule on dorsal margin; PV shortest, simple in male, chelate in female (Fig. 63A, B). Pleon widest anteriorly, tapering posteriorly; somites I–V bearing mid-dorsal longitudinal carina, somites II–V bearing progressively larger antorse spines on carina, somite VI bearing pair of prominent denticulate carinae converging posteriorly; pleuron on somite I reduced, ovate; pleura II–VI with serrated margins, pleura II–V bearing curved mesial ribs, pleuron II ovate, largest (Fig. 65A, B); sternites II–V bearing median spinule. Telson elongate triangular, bearing median and 1 pair of lateral oblique carinae dorsally. Uropodal exopod bicarinate ventrally (Fig. 65B). In females, thelycal plates present between bases of PIV and PV (Fig. 63B). Pleopods I of male spatuliform, those of female lamellate.

Geographical distribution and habitat

Pacific, Atlantic and Indian oceans at 400–600 m depths (Galil, 2000). The present specimens were collected from the southeastern Arabian at 404–995 m depths, southeastern Bay of Bengal at 390–535 m depths, and western Andaman Sea at 441 m depth (Fig. 66).

***Stereomastis phosphorus* (Alcock, 1894)**
(Pink blind lobster)

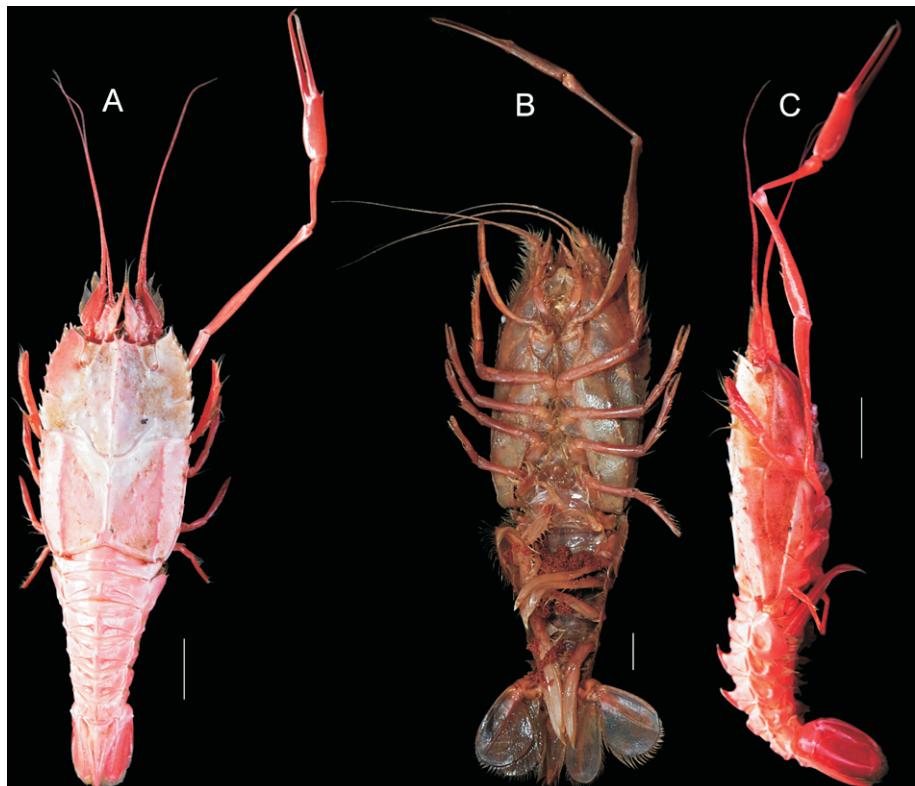


Fig. 67. *Stereomastis phosphorus* (Alcock, 1894) (eastern Arabian Sea): A) Dorsal habitus (live colouration), female, 73 mm TL; B) Ventral habitus (preserved colouration), 142 mm TL; C) Lateral habitus (live colouration), female, 73 mm TL. Scale: 10 mm.

Infraorder Polychelida Scholtz & Richter,
 1995

Superfamily Eryonoidea De Haan, 1841
 [in De Haan, 1833-1850]

Family Polychelidae Wood-Mason, 1874b
 Genus *Stereomastis* Spence Bate, 1888
Stereomastis phosphorus (Alcock, 1894)
 (Figs. 67A-C, 68A-B, 69A-B, 70)

Synonymy

Pentacheles phosphorus Alcock,
 1894: 240; type locality: Bay of Bengal,
 RIMSS *Investigator* stn 112, 13°47'30"N,
 92°36'E, 561 fathoms (= 1026 m) depth;
 Wood-Mason & Alcock, 1894, pl. 8, fig.
 2; Alcock & Anderson, 1894: 165;
 Anderson, 1896: 98; Alcock, 1901b: 74;

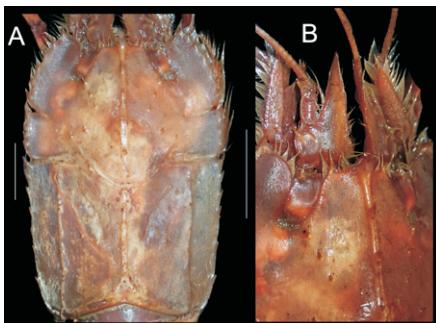


Fig. 68. *Stereomastis phosphorus* (Alcock, 1894): A) Dorsal carapace; B) Antennules and antennae. Scale: 10 mm.

Thomson, 1901: 18; Alcock, 1902: 134, 135; Lloyd, 1907: 6; Hansen, 1925: 142; Boas, 1939, fig. 1.

Polycheles phosphorus: Alcock, 1898: 77; Alcock, 1901a: 168; Calman, 1910: 59, fig. 38; Calman, 1911: fig. 46; Kemp & Sewell, 1912: 24; Balss, 1924: 177, fig. 2; Duncan, 1948: 69; Galil, 2000: 292 (key), 336, fig. 22 (part); Ahyong & Brown, 2002: 71, 77 (key), figs. 3C-D, 10, 11; Chan, 2010: 163 (list).

Stereomastis andamanensis: De Man, 1916: 16, pl. 1, figs. 2-2b (p.p.); Takeda & Hanamura, 1994: 31; Griffin & Stoddart, 1995: 244 (p.p.) [non Alcock, 1894].

Stereomastis phosphorus: Calman, 1927: 55, fig. 37; Dahl, 1954: 46; Firth & Pequegnat, 1971: 68; Monod, 1973: 126, figs. 40-44 (p.p.); Holthuis, 1984: 4; Ahyong, 2009: 384 (key); Chan, 2010: 163 (list); Chan, 2019: 52 (list); Radhakrishnan *et al.*, 2019a: 102.

not *Polycheles phosphorus*: Rathbun,

1906: 898 [= *P. surdus* Galil, 2000]; Galil, 2000: 336, fig. 22 (part) [= *Stereomastis galil* (Ahyong & Brown, 2002)]

not *Stereomastis phosphorus*: De Man, 1916: 15 [= *P. aculeatus* Galil, 2000].

not *Stereomastis phosphorus*: Griffin & Stoddart, 1995: 246 [= *P. aculeatus* Galil, 2000, *P. auriculatus* Bate, 1878, *P. surdus* Galil, 2000].

Diagnosis (modified from Alcock, 1894)

Body dorso-ventrally compressed (Fig. 67A-C). Rostral spine bifid, antorse. Orbital sinus U-shaped, bearing short tubercle medially, internal angle bearing spine, cornea absent. Carapace sub-quadrilateral, dorsal surface minutely granular, densely setose; lateral spination including 6/7 pre-cervical + 3-4 between cervical and post-cervical incisions + 6-7 spines posterior to post-cervical incision; dorsal spination including 5 (1+1+2+1) on median post-rostral carina, 5 antorse spinules arranged in arc-shaped row on gastro-orbital carinae, 1 median antorse spinule on posterior margin of cervical groove between post-cervical and branchial carina, 2 pairs of spinules on median post-cervical carina, 7-9 spines on branchial carina, 4-5 spinules behind oblique groove between post-cervical and branchial carinae, 1 pair of antorse spines on posterior margin (Fig. 68A). Basal antennular segment proximally rounded, produced anteriorly to sharp

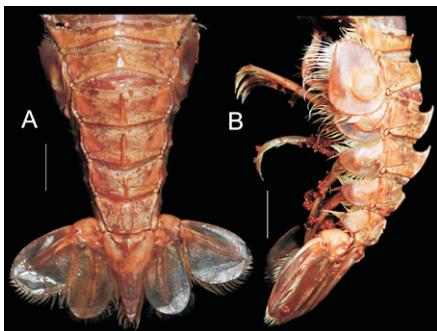


Fig. 69. *Stereomastis phosphorus* (Alcock, 1894): A) Dorsal pleon and telson; B) Lateral pleon and telson. Scale: 10 mm.

point, antero-lateral margin bearing spine; flagellum double whip-like, inner flagellum slightly longer than outer flagellum. Scaphocerite lanceolate, setose, anterior end extending almost to base of antennal flagellum (Fig. 68B). Maxilliped III epipod rudimentary. PI largest, chelate; merus bearing 2 proximal and 1 sub-distal spinule on dorsal margin, ventral margin serrated; carpus bearing subdistal spine each on dorsal and ventral margins; propodus serrated on dorsal and ventral margins, subdistal spinule posterior to dactylar articulation; fingers extremely slender, smooth, bent distally, cutting edges pectinated. PII–PIV progressively shorter, slender, chelate; PII carpus with distal spinule on dorsal margin; PV shortest, subchelate in male, chelate in female (Fig. 67A, B). Pleon widest anteriorly, tapering posteriorly; somites I–V bearing mid-dorsal longitudinal carina with antrorse spine, somites III–IV with larger spines, somite VI bearing pair of prominent denticulate

carinae converging posteriorly; pleuron on somite I reduced, ovate; pleura II–VI with serrated margins, pleura II–V bearing curved mesial ribs, pleuron II ovate, largest (Fig. 69A, B); sternites II–V bearing median spinule. Telson elongate triangular, bearing median and 1 pair of lateral oblique carinae dorsally. Uropodal exopod unicarinate ventrally (Fig. 69B). In females, thelycal plates present between bases of PIV and PV (Fig. 67B). Pleopods I of male spatuliform, those of female lamellate.

Geographical distribution and habitat

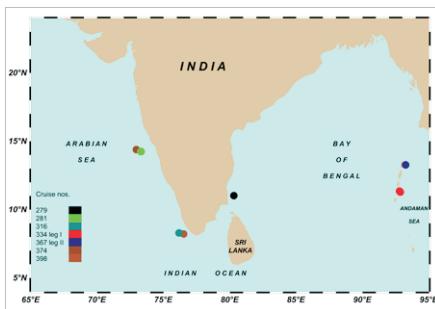


Fig. 70. Geographical locations of collection of *Stereomastis phosphorus* (Alcock, 1894).

Arabian Sea, Laccadive Sea, Gulf of Mannar, Sri Lanka, Bay of Bengal and Andaman Sea (Radhakrishnan *et al.*, 2019). The present specimens were collected from the eastern Arabian Sea at 214–957 m depths, southeastern Arabian Sea at 610–1078 m depths, southeastern Bay of Bengal at 645 m depth, and western Andaman Sea at 635–850 m depths (Fig. 70).

***Stereomastis sculpta* (Smith, 1880a)**
(Sculpted blind lobster)

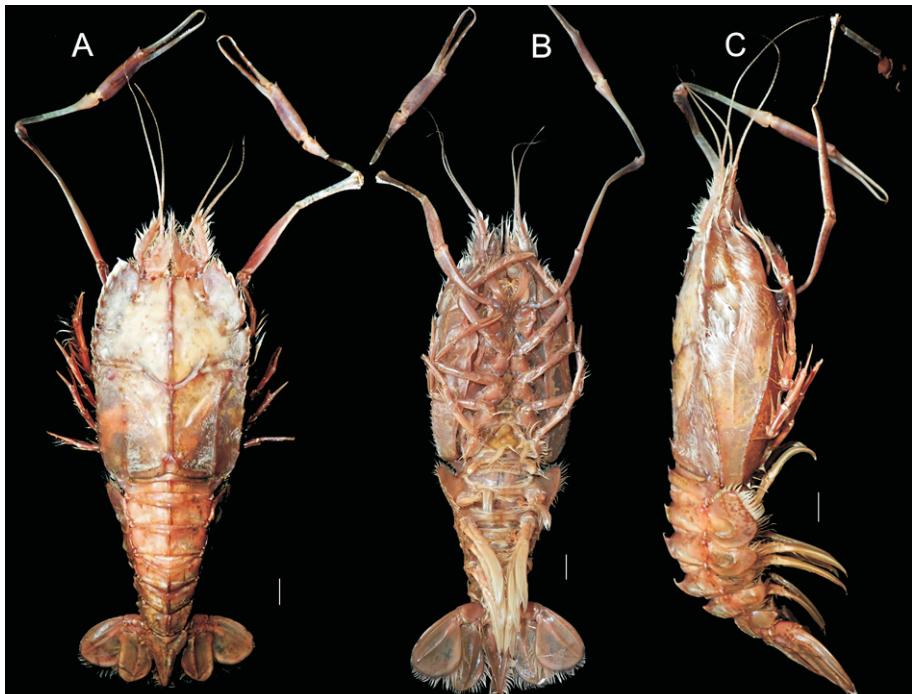


Fig. 71. *Stereomastis sculpta* (Smith, 1880) (southeastern Arabian Sea), female, 69 mm CL, 155 mm TL: A) Dorsal habitus (preserved colouration); B) Ventral habitus (preserved colouration); C) Lateral habitus (preserved colouration). Scale: 10 mm.

Infraorder Polychelida Scholtz & Richter, 1995
 Superfamily Eryonoidea De Haan, 1841 [in De Haan, 1833-1850]
 Family Polychelidae Wood-Mason, 1874b
 Genus *Stereomastis* Spence Bate, 1888
Stereomastis sculpta (Smith, 1880a) (Figs. 71A-C, 72A-B, 73A-B, 74)

Synonymy

Polycheles typhlops: Norman, 1878:

382 (p.p.); Norman, 1879: 175 (p.p.).
Polycheles sculptus Smith, 1880a: 346, pl. 7, figs 1-6; Smith, 1880b: 269; Faxon, 1893: 196; Faxon, 1895: 121, pl. C, fig. 2; Faxon, 1896: 155; Caullery, 1896: 385; Koehler, 1896: 721 (list); Alcock, 1901a: 170; Senna, 1902: 338; Stebbing, 1902a: 36; Bouvier, 1905a: 480; Bouvier, 1905b: 3; Joubin, 1905: 75, fig. 58; Bouvier, 1905c: 4; Hansen, 1908: 41; Stebbing, 1910: 377; Andrews, 1911: 56

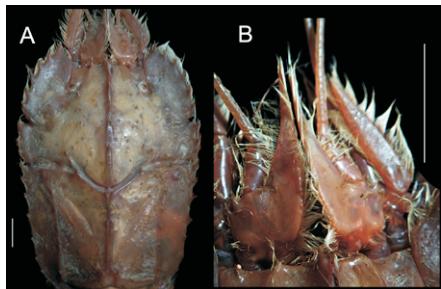


Fig. 72. *Stereomastis sculpta* (Smith, 1880): A) Dorsal carapace; B) Antennules and antennae. Scale: 10 mm.

428, figs. 11-15; Murray & Hjort, 1912: 538; Selbie, 1914: 18, pl. 2, figs. 1-9; Bouvier, 1915b: 2; Sund, 1915: 372; Williamson, 1915: 457; Bouvier, 1917: 51, pl. 3, fig. I; Balss, 1925: 201; Bouvier, 1925: 438, fig. 11, pl. 7, fig. 1; Boone, 1930: 86, pl. 23, fig. b; Miranda & Rivera, 1933: 17; Delphy & Magne, 1938: 83 (list); Boas, 1939: 4, figs. 3, 7-8; Zariquey-Alvarez, 1946: 99; Le Danois, 1948: 150 (list); Springer & Bullis, 1956: 14; Holthuis, 1962: 183; China, 1964: 111; Barnard, 1964: 12 (list); Peres & Picard, 1964: 105; Allen, 1967: 56; Peres, 1967: 519; Rodriguez, 1980: 194.

Pentacheles spinosus A. Milne Edwards, 1880: 66; Filhol, 1885: 139, fig. 44; Marshall, 1888: 267, fig. 88; Young, 1900: 442; Seeliger, 1901: 43; Bouvier, 1925: 438, figs. 11-12, pl. 7 fig. I.

Willemoesia leptodactyla: Giglioli, 1881: 358; Giglioli, 1882: 5; Giglioli, 1912: 186 [non Willemoes-Suhm, 1875].

Pentacheles sculptus: Smith, 1882: 23, pls. 3-4; Verrill, 1882: 364; Smith,

1884: 358 (list); Verrill, 1884: 653; Verrill, 1885: 554, pl. 34, fig. 152; Smith, 1886: 188; Smith, 1887: 607 (list); Agassiz, 1888: 42, fig. 239; Alcock & Anderson, 1899: 289.

Stereomastis sculpta: De Man, 1916: 8; Stephensen, 1923: 66; Calman, 1925: 18; Boone, 1927: 90; Calman, 1927: 55; Barnard, 1950: 572, fig. 105d; Holthuis, 1952: 11, fig. 3; Bernard, 1953: 87; Dollfus, 1956: 135 (list); Siversten & Holthuis, 1956: 41; Holthuis, 1962: 182; Squires, 1966: 2; Kensley, 1968: 29; Zariquey Alvarez, 1968: 210; Carpine, 1970a: 135 (list); Carpine, 1970b: 11 (list); Squires, 1970: 88, figs. 37-38; Firth & Pequegnat, 1971: 69; Relini-Orsi & Relini, 1972: 59, fig. 5; Relini-Orsi, 1973: 29; Lagardere, 1973: 93; Lagardere, 1977: 399; Thiriot, 1974: 344 (list); Williams & Wigley, 1977: 8; Beaubrun, 1978: 40, fig. 21; Baez & Andrade, 1979: 225, pl. 1 fig. 6; Pequegnat & Jeffrey, 1979: 72; Wenner, 1979: 441; Andrade & Baez, 1980: 262 (list); Kensley, 1981a: 29 (list); Kensley, 1981b: 60 (list); Burukovsky *et al.*, 1982: 523; Burukovsky, 1983: 134, fig. 179; Takeda & Okutani, 1983: 75; Holthuis, 1984: 4; Pohle, 1985: 21; Andrade, 1986: 45; Duris, 1987: 9; Holthuis, 1987: 297, fig. 2; Abello & Valladares, 1988: 98; Macpherson, 1988: 58, fig. 5b; Pequegnat *et al.*, 1990: 63; Squires, 1990: 360, figs. 190-191; Holthuis, 1991, fig. 169; Abello & Cartes, 1992: 109; Cartes & Abello, 1992: 139; Cartes & Sarda, 1992: 1315; Falciai & Minervini, 1992: 134; Cartes,

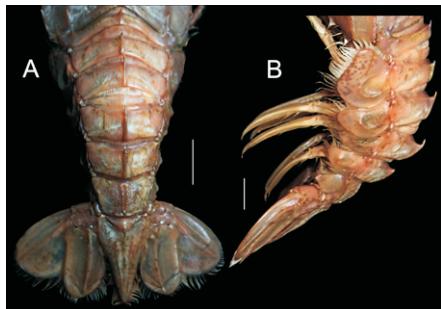


Fig. 73. *Stereomastis sculpta* (Smith, 1880): A) Dorsal pleon and telson; B) Lateral pleon and telson. Scale: 10 mm.

1993: 32 (list); Cartes *et al.*, 1993: 210; Emmerson, 1993: 181; Quackenbush, 1994: 85; Gonzalez Pérez, 1995: 126; Griffin & Stoddart, 1995: 248; Tiefenbacher, 1995: 8, fig. 3.

Stereomastis sculptus: Stebbing, 1917: 30.

Stereomastis sculpta: Firth & Pequegnat, 1971: 69; Wenner & Boesch, 1979: 131; Dawson, 1997: 21; Chan, 2019: 52 (list); Radhakrishnan *et al.*, 2019a: 103

Stereomastis andamanensis: Tung *et al.*, 1988: 45, fig. 45a-f.

not *Polycheles sculptus*: Bruun, 1950: 24, fig. 16 [= *P. talismani* Bouvier, 1917].

Not *Stereomastis sculpta*: Holthuis, 1952: 11; Longhurst, 1958: 32; Forest, 1963: 627; Macpherson, 1983: 48; Rocabado & Bas, 1984: 19 [= *P. talismani* Bouvier, 1917].

Not *Stereomastus sculpta*: Gauld, 1960: 63 [erroneous spelling] [= *P. talismani* Bouvier, 1917].

Not *Polycheles sculptus*: Del Solar, 1972: 11 [= *P. pacificus* Faxon, 1893].

Diagnosis (modified from Smith, 1880a)

Body dorso-ventrally compressed (Fig. 71A–C). Rostral spine bifid, antorse. Orbital sinus U-shaped, bearing short tubercle medially, internal angle bearing spine, cornea absent. Carapace sub-quadrilateral, dorsal surface minutely granulate, densely setose; lateral spination including 6 pre-cervical + 3 between cervical and post-cervical incisions + 7 spines posterior to post-cervical incision; dorsal spination including 4 (1+2+1) on median post-rostral carina, 5 antorse spinules arranged in arc-shaped row on gastro-orbital carinae, antorse spinule on posterior margin of cervical groove between post-cervical and branchial carina, 2 pairs of spinules on median post-cervical carina, 5 spines on branchial carina, no spines behind unarmed oblique branchial groove between post-cervical and branchial carinae, 1 pair of antorse spines on posterior margin (Fig. 72A). Basal antennular segment proximally rounded, produced anteriorly to sharp point, antero-lateral margin bearing 2 spines; flagellum double whip-like, inner flagellum slightly longer than outer flagellum. Scaphocerite lanceolate, setose, anterior end extending almost to base of antennal flagellum (Fig. 72B). Maxilliped III epipod rudimentary. PI

largest, chelate; merus bearing 2 proximal and 1 sub-distal spinule on dorsal margin, ventral margin serrated; carpus half as long as merus, bearing subdistal spine on dorsal and ventral margins; propodus serrated on dorsal and ventral margins, subdistal spinule posterior to dactylar articulation; fingers extremely slender, smooth, bent distally, cutting edges pectinated. PII–PIV progressively shorter, slender, chelate; PV shortest, subchelate in male, chelate in female (Fig. 71A, B). Pleon widest anteriorly, tapering posteriorly; somites I–V bearing mid-dorsal longitudinal carina with antrorse spine, somite IV with largest spine, somite VI bearing pair of parallel rounded carinae confluent posteriorly; pleuron on somite I reduced, ovate; pleura II–VI with serrated margins, pleura II–V bearing curved mesial ribs, pleuron II largest, anterior margin produced, triangulate (Fig. 73A, B). Telson elongate triangular, bearing median and 1 pair of lateral oblique carinae dorsally. Uropodal exopod

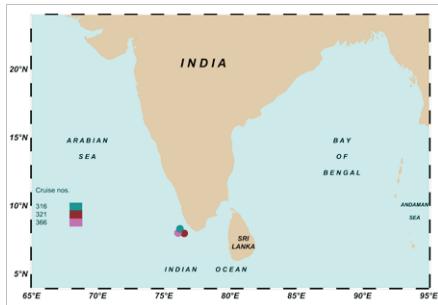


Fig. 74. Geographical locations of collection of *Stereomastis sculpta* (Smith, 1880).

unicarinate ventrally (Fig. 73B). In females, thelycal plates present between bases of PIV and PV (Fig. 68B). Pleopods I of male spatuliform, those of female lamellate.

Geographical distribution and habitat

Atlantic and Indo-Western Pacific Ocean regions (Galil, 2000). The present specimens were collected from the southeastern Arabian Sea at 1078–1420 m depths (Fig. 74).

SUMMARY

The deep-water and coral reef-associated lobster fauna of India was, until recently, known to be represented by 38 species including 21 achelate lobsters (11 scyllarids and 10 palinurids), 9 chelate lobsters (7 nephropids and 2 enoplometopids) and 8 blind lobsters (Radhakrishnan *et al.*, 2019). The present document based on the documentation of samples collected on-board the FORV Sagar Sampada provides systematic classification, detailed synonymy, morphological diagnosis and notes on geographical distribution and habitat (supplemented with photographic illustrations of diagnostic morphological characters and maps indicating sampling locations) of 16 species of deep-water and coral-reef associated lobsters. Among the species reported in this study, the deep-water lobsters *Nephropsis stewarti* and *Stereomastis phosphorus* were collected from the Arabian Sea, Bay of Bengal as well as the Andaman waters; *N. carpenteri* from the Arabian Sea and Bay of Bengal; *Puerulus sewelli*, *Bathyarctus rubens* and *Polycheles typhlops* from the Arabian Sea and the Andaman waters; *Acanthacaris tenuimana*, *N. ensirostris*, *N. sulcata* and *S. sculpta* were collected only from the Arabian Sea; *Metanephrops andamanicus*, *N. rahayuae*, *Linuparus somniosus* and *P. angulatus* were reported only from the Andaman waters. The 2 reef-associated lobsters *Gibbularctus gibberosus* and *Petrarctus rugosus* were reported only from the Andaman waters. The highlights of this study are 2 new geographical records of *N. rahayuae* and *G. gibberosus* for the Indian waters.

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