Revision of the genus *Arctides* Holthuis, 1960 (Crustacea, Decapoda, Scyllaridae)

Lipke B. HOLTHUIS
Nationaal Natuurhistorisch Museum,
P.O. Box 9517, NL-2300 RA Leiden (The Netherlands)

Holthuis L. B. 2006. — Revision of the genus *Arctides* Holthuis, 1960 (Crustacea, Decapoda, Scyllaridae). *Zoosystema* 28 (2) : 417-433.

ABSTRACT
A revision is provided of the genus *Arctides* Holthuis, 1960, with a key to the three known species: *Arctides guineensis* (Spengler, 1799), *Arctides regalis* Holthuis, 1963, and *Arctides antipodarum* Holthuis, 1960. For each species the known references, a list of examined material, a redescription or recognition characters, and the known distribution is given, as well as general remarks.

KEY WORDS
Crustacea,
Decapoda,
Scyllaridae,
Arctides,
revision.

RÉSUMÉ
Révision du genre Arctides *Holthuis, 1960 (Crustacea, Decapoda, Scyllaridae).*
Une révision du genre *Arctides* Holthuis, 1960 est proposée, avec une clé pour les trois espèces connues : *Arctides guineensis* (Spengler, 1799), *Arctides regalis* Holthuis, 1963, et *Arctides antipodarum* Holthuis, 1960. Pour chaque espèce, on trouvera les références bibliographiques complètes, la liste du matériel examiné, une redescription ou l'énumération des caractères distinctifs, la distribution et des remarques générales.

MOTS CLÉS
Crustacea,
Decapoda,
Scyllaridae,
Arctides,
révision.

INTRODUCTION

The subfamily Arctidinae Holthuis, 1985 of the family Scyllaridae Latreille, 1825 consists of only two genera: *Scyllarides* Gill, 1898, with 13 species, and *Arctides* Holthuis, 1960, with three species. The present paper provides a revision of the smaller of these two genera.

ABBREVIATIONS

cb	carapace breadth;
cl	carapace length;
tl	total length;

AM Australian Museum, Sydney;
BMNH The Natural History Museum, London;
IMS Institute of Marine Science, Miami;
LACM Los Angeles County Museum, Los Angeles;
MCZ Museum of Comparative Zoology, Cambridge, Massachusetts;
MG Muséum d'Histoire naturelle, Genève;
MNHN Muséum national d'Histoire naturelle, Paris;
RMNH Nationaal Natuurhistorisch Museum (ex Rijksmuseum van Natuurlijke Historie), Leiden;
SMF Senckenberg-Museum, Frankfurt am Main;
USNM National Museum of Natural History, Smithsonian Institution, Washington, D.C.

SYSTEMATICS

Family SCYLLARIDAE Latreille, 1825

Genus *Arctides* Holthuis, 1960

Arctides Holthuis, 1960: 154. Gender: masculine.

TYPE SPECIES. — *Scyllarus guineensis* Spengler, 1799, by original designation.

DIAGNOSIS. — Carapace rather high, not depressed, quadrangular in outline, slightly longer than wide. Upper surface rough, with tubercles. Cervical, postcervical and branchiocardiac grooves, not very deep. Marginal groove distinct; with shallow cervical, but no postcervical incision on lateral margin which bears several teeth. Orbits on anterior margin of carapace close to anterolateral angles; distance between orbit and anterolateral angle less than 1/10 of distance between orbits, latter widely open anteriorly; intercalated plate poorly developed. Antenna not forming part of orbit. Upper surface of carapace without distinct carinae, with several teeth present. Rostral, pregastric and gastric teeth in median line; two submedian cardiac teeth on cardiac elevation; two teeth on branchial region behind cervical groove; and distinct postorbital tooth. No posteromedian tooth. Entire surface of carapace covered with small squamiform tubercles surrounded by short bristle-like hairs, some tubercles larger, even becoming tooth-shaped.

First abdominal somite with deep uninterrupted transverse groove filled with hairs. Following somites with anterior half smooth and posterior part with complex sculpturation resembling that of *Scyllarus arctus* (Linnaeus, 1758), but with grooves wider and sculpted figures more elevated.

Calcified part of telson with tooth on each posterolateral angle.

Distal part of antennular somite rather long, ending in two teeth placed close together at either side of median incision of segment.

Ultimate segment of antenna with many large and small teeth. Fourth segment with strong teeth on anterior and lateral margins.

Epistome, mouthparts and branchiae as in *Scyllarides*.

Pereiopods with first leg stronger than following ones. Dactyli naked, not flattened above. Fifth leg of female ending in chela.

Pleopods normal.

REMARKS

The genus contains three species, of which the oldest, *Scyllarus guineensis* Spengler, 1799, is the type by original designation.

Formerly the species of the genus *Arctides* were assigned to *Scyllarides*, but they differ in so many points that it proved necessary to erect a separate genus for them. The three species may be distinguished with the help of the following key.

KEY TO SPECIES OF THE GENUS *ARCTIDES* HOLTHUIS, 1960

1. Sculpturation of abdomen very distinct, naked parts elevated, separated by narrow hairy grooves. Median figures with broad lateral lobes. Naked area along posterior margin of somites II to V occupying almost half of the exposed length of the somites. Legs slender, propodus of second leg about five to six times as long as wide. Propodus, carpus and merus of second to fifth legs each with a coloured band. Smaller species, carapace length less than 70 mm 2
— Sculpturation of abdomen less distinct, partly obscured by hairs and tubercles. Hairy grooves between naked portions wide. Median figures elongate and narrow, usually much elevated above surface of the somites. Naked area along posterior margin of somites II to V occupying about 1/3 of length of posterior half of somite. Legs more robust, propodus of second leg about three times as long as wide. No coloured bands on the legs. Dactylus and propodus of first and second legs purplish with small white spots. Larger species, carapace length up to more than 100 mm ..... *A. antipodarum*

2. Two double-topped spinules behind gastric spine of carapace. Denticles of outer margin of last antennal segment small. Atlantic ..... *A. guineensis*
— A longitudinal row of three single spinules behind gastric spine. Denticles on outer margin of last antennal segment large. Indo-West Pacific region ..... *A. regalis*

Arctides guineensis (Spengler, 1799) (Figs 1; 2A)

Scyllarus Guineensis Spengler, 1799: 333, pl.

Scyllarus sculptus Latreille, 1818: 5, pl. 320, fig. 2. — Guérin-Méneville 1828: 416. — H. Milne Edwards 1837: 283. — Gibbes 1845: 70. — Heilprin 1888: 321; 1889: 150. — Verrill 1901: 329. — Chace 1937: 56.

"Phyllosoma of *Panulirus*(?)" – Bate 1888: 94, 95, 97, pl. 12c, fig. 1.

Scyllarides sculptus bermudensis Verrill, 1922: 30, pl. 7, fig. 1.

"A very different *Phyllosoma*" – Verrill 1922: 163, 164, pl. 3A, fig. 4.

Scyllarides guineensis – Holthuis 1946: 100 (p.p.).

Scyllarides guineensis bermudensis – Holthuis 1946: 100.

?*Scyllarus arctus* – Ramos 1951: 125. — Farrugio & Saint-Felix 1975: 17. Non *Scyllarus arctus* (Linnaeus, 1758).

Scyllarus guineensis – Holthuis 1960: 154.

Arctides guineensis – Robertson 1969: 143, figs 1-7. — A. Michel 1971: 472. — Burukovsky 1974: 102; 1983: 144. — Manning 1978: Scyllaridae, p. 3. — Markham & McDermott 1980: 1271. — Phillips *et al*. 1980: 71. — Friese 1984: 6. — Chace *et al*. 1986: 332, pl. 109, col. pl. 10, fig. 6. — Sekiguchi 1986: 1290; 1987: 331; 1988a: 273; 1988b: 346-348, figs 66, 67; 1989: 289. — Holthuis 1991: 176, figs 322, 325b, 326a, 329, 330. — Moe 1991: 171. — Polz 1996: 44, 45, fig. 2C.

Scyllarides nearctus – Farrugio 1975: 3, 5, 8, figs 8, 9. Non *Scyllarus nearctus* Holthuis, 1960.

Scyllarides nodifer – George & George 1979: 78, pl. 70, fig. 8. Non *Scyllarides nodifer* (Stimpson, 1866).

Parribacus antarcticus – Humann 1992: 158, 159, fig. Non *Parribacus antarcticus* (Lund, 1793).

Non *Scyllarus sculptus* – Whitelegge 1899: 155, pl. 29. — Coulon 1918: 18. — McNeill 1925: 327 (= *Arctides antipodarum*).

VERNACULAR NAME. — In Bermuda the name "Small Spanish Lobster" is used for this species.

MATERIAL EXAMINED. — **"Méditerranée".** Holotype of *Scyllarus sculptus* Latreille, 1818, cl *c.* 40 mm (MNHN).
Bermuda. Hungry Bay, VII-IX, F. G. Gosling, 1 ♂ (USNM). — No other locality data, received 12.V.1898, T. H. Bean, 1 ♂ lectotype of *Scyllarides sculptus bermudensis* Verrill, 1922 (USNM). — Brackish Pond Flats, 32°21'N, 64°47'W, in fish pot, 5.VIII.1917, leg. W. J. Crozier, 1 ♀ (MCZ). — From fish pot on outer reef, J. F. G. Wheeler, received 29.VI.1936, 1 ♂ cl 53 mm, det. F. A. Chace Jr. as *Scyllarides sculptus* (MCZ).
Bahama Islands. N of Green Cay, 14.XI.1959, Chaplin Bahama Exped., stn 513, 1 ♂ cl 28 mm (IMS).

REDESCRIPTION

Rostrum T- or V-shaped, constricted at base by ophthalmic somite. Rostral tooth small, but sharp and with black tip; pregastric and gastric teeth also sharply pointed, larger than rostral. Two double-topped flat tubercles behind gastric tooth. Two rather large, but sharp or blunt cardiac teeth on submedian region, and behind these, two converging rows of about four tubercles. Pair of spines present on each half of carapace behind cervical groove; outer pair placed on branchial carina, with some smaller spines behind. A strong spine slightly behind inner margin of orbit. Inner orbital margin with three strong pointed teeth, anterior smallest and placed somewhat more interiorly, next distinctly longer and stronger than third. Posterior margin of orbit with two teeth, the inner broadest and two-topped. Outer margin of orbit crenulate, ending in small sharp tooth, with second sharp tooth placed below it. Orbits widely open anteriorly, with very low intercalated plate between orbital angles. Orbit placed so close to lateral margin of carapace that outer orbital angle lies right next to anterolateral angle of carapace. Anterolateral angle sharp, directed obliquely forward and outward; following anterolateral teeth

four or five in number, small, some sharply pointed. Cervical incision distinct but not deep, resembling that of *Scyllarus* species. No postcervical incision. Behind cervical incision a sharply pointed strong tooth, and behind that nine to 11 likewise sharply pointed but smaller teeth, diminishing in size posteriorly. Cervical groove distinct laterally; otherwise, postcervical, and branchiocardiac grooves hardly noticeable. Marginal groove deep, wide. Posterior margin concave medially. Upper surface of carapace covered with small scale-like tubercles, among which a few larger. Apart from double row behind postcervical teeth, mentioned above, one transverse row of large and several of small tubercles before marginal groove, and some slightly smaller near posterior part of lateral margin. Between marginal groove and posterior margin, two or three transverse rows of tubercles surrounded by hairs giving the animal a rough pubescent appearance.

First abdominal somite with deep uninterrupted transverse groove, narrow throughout, becoming only slightly wider in extreme lateral part, filled with hairs and with anterior margin crenulate. Before and behind this groove, somite smooth. Pleuron roughened by scale-like tubercles and hairs, ending in acute tooth. Following somites with anterior half smooth, ending posteriorly in crenulated margin. Posterior half of somites with distinct arborescent sculpturing, similar to that in many *Scyllarus* species. Median line showing smooth lobulated figure from which a transverse hairy groove extends towards pleuron base. Posteriorly this groove shows curved short longitudinal side grooves. Anteriorly there is a lobulated pattern. Second to fifth somites with pleura ending in sharply pointed strong slender tooth, curved down and posteriorly; with a dark tip. Second somite with anterior margin of pleuron showing blunt tooth and being minutely serrate all over; third to fifth somites with larger part of anterior margins entire, each with one to three blunt teeth visible near base of distal tooth. Posterior margins of second to fifth pleura convex, with rather large, sharp teeth. A distinct gap between these posterior teeth and distal tooth, with next pleuron fitting in gap when abdomen curved. Sixth somite dorsally with squamiform tubercles and pubescence; each pleuron ending in a sharp, posteriorly curved point. Posterior margin of fifth and sixth somites crenulated, in the fifth it bears a sharp median spine.

Teeth of antennular somite diverging slightly.

Distal segment of antenna rounded, rather coarsely and regularly serrated along inner, anterior, and posterior margins; outer margin crenulate. Fifth antennal segment with three teeth on inner margin. Anterior margin of fourth segment with three or four large pointed teeth on inner half; outer margin minutely serrated. Anterolateral angle produced into strong, sharp tooth slightly directed inwards. Outer margin with two or three small proximal and four very large, sharply pointed distal teeth.

Anterior margin of epistome short, slightly concave with one or two rather short and broad teeth at either side.

Second and third maxillipeds provided with well developed exopod ending in multi-articulate flagellum.

First leg heavier than others, without carinae on propodus or carpus. Carpus with shallow dorsal groove. Merus with low dorsal carina ending anteriorly in short tooth. Lower border of propodus with longitudinal pubescent strip, and longitudinal pubescent groove on upper part of outer surface of that segment. Lower margin of outer surface of merus with several small tubercles, lower surface pubescent. Second pereiopods longest; propodus especially elongate, about five to six times as long as high. Carinae present on posterior four pairs of legs only on dorsal margin of merus; carinae indistinct, ending in tooth only on second to fourth legs. Hairy strips present on lower surface of merus of all legs, and propodus of all but last legs; with longitudinal pubescent groove on dorsal surface of carpus and on outer surface of propodus. Coxal process present on fifth but not on fourth leg. Sternum flat, with sunken areas between segments narrow and filled with hairs; every segment showing transverse row of tubercles. Large tubercle near base of each leg hardly larger than other tubercles.

Male pleopods well developed on somite II, gradually diminishing in size posteriorly. Abdominal sternites minutely denticulate.

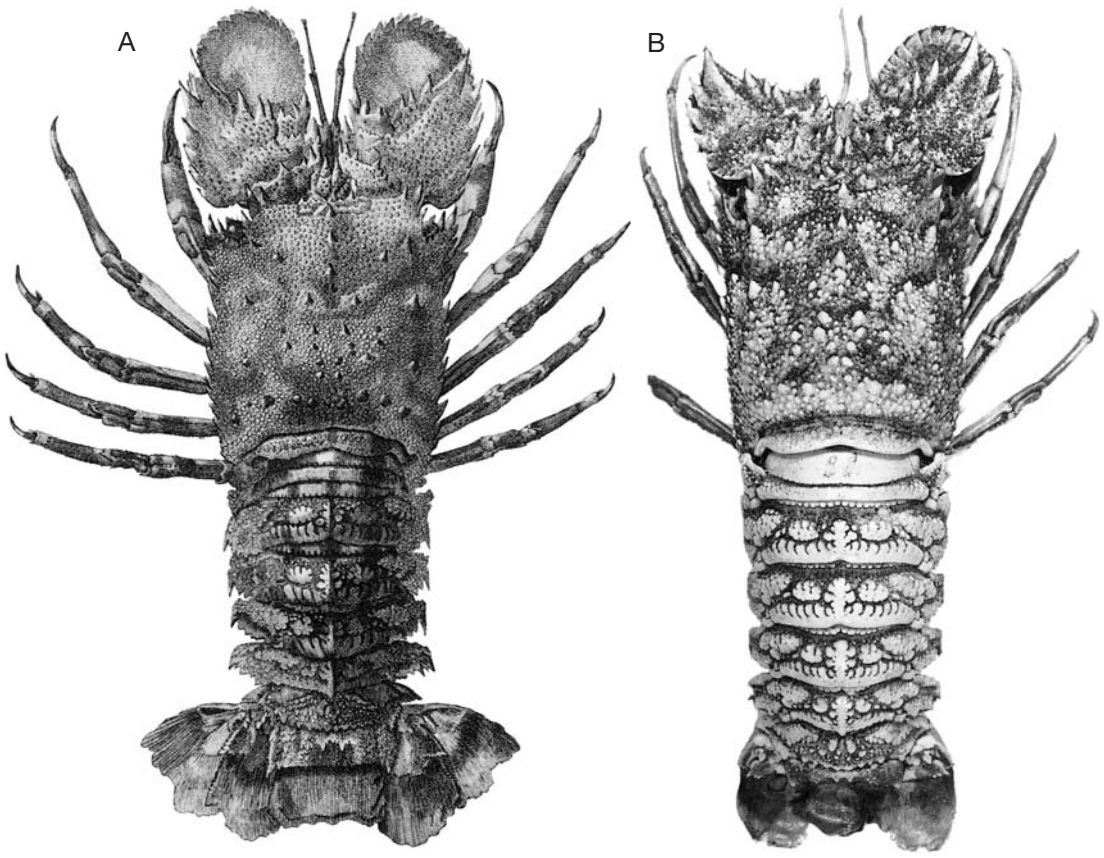

FIG. 1. — **A**, *Arctides guineensis* (Spengler, 1799), holotype of *Scyllarus guineensis* Spengler, 1799, after Spengler (1799); **B**, *A. guineensis*, holotype of *S. sculptus* Latreille, 1818, photo MNHN.

Colour

The colour pattern of the small Bahama specimen is similar to that of *Arctides regalis*. Verrill (1922: 30) described the colour of a living specimen from Bermuda as follows: "The colors, in life, are clouded with various shades of light brown, terra-cotta, and dull yellowish, mostly in irregularly placed patches". Also Spengler (1799) gave some indication of the colour of this specimen. The colour photograph published by Humann (1992: 159) shows an animal with the carapace very pale brown, almost whitish with a few darker spines; the area along the posterior margin is darker brown as is the visible area along the left lateral margin. The abdomen is also light but with a reddish tinge and some lighter and darker spots. The eyes are red with a black cornea. The last segment of the antenna has a rather large central whitish spot surrounded by a blue ring and with the margin, the teeth included, red. The fourth antennal segment has the same very pale brownish colour as the carapace with the marginal teeth reddish.

Size

The examined males from Bermuda and the Bahama Islands have cl 28, 44, 52 and 62 mm. Verrill (1922: 31) gave cl of one of his Bermuda specimen as 45 mm.

DISTRIBUTION

The type locality is given in Spengler (1799: 340) as: "Dens Faedreneland er Kysten af Guinea" (its

fatherland is the coast of Guinea). With Guinea probably the Gold Coast (= Ghana) West Africa is meant, where Denmark at that time owned some trade posts. We do not know whether or not this locality is correct; no other West African records are known for the species. The type locality of *Scyllarus sculptus* has not been mentioned in the literature. However, the type specimen (Fig. 1B) in the MNHN bears the locality label "Méditerranée". This unpublished locality indication very likely is incorrect as so far it is the only indication for this species from the Mediterranean, and it seems unlikely that this large and colourful species should not have been encountered in that well explored sea since 1818.

The species bas been reported with certainty from Bermuda (Verrill 1901, 1922; Chace 1937; Markham & McDermott 1980; Chace *et al*. 1986), the Crawl, Bermuda (Heilprin 1888, 1889). Verrill (1922: 31) mentioned that he saw a living specimen at the aquarium at Agars Island, Bermuda, but did not say positively that the specimen was collected there. The species has also been reported from E of Vauclin, Martinique (Farrugio 1975; ?Farrugio & Saint Felix 1975) and the Caribbean (George & George 1979). Robertson (1969) reported phyllosoma larvae of this species from an area roughly coinciding with the "Bermuda Triangle": his 74 specimens were collected in 20 stations covering an area between 22°50' to 33°02'N and 64°33' to 78°27'W. The present material extends the known range to the Bahama Islands. The species evidently is very rare or difficult to obtain, and may have a range much wider than we know it now. Bate's (1888) "Phyllosoma of *Panulirus*(?)", which, as Robertson (1969) pointed out belongs most likely to the present species, was collected off St. Thomas, West Indies. Ramos (1951: 125, 126) dealt with a scyllarid specimen in the collection of the Departamento de Zoologia da Secretaria da Agricultura of São Paulo, Brazil. This specimen had cb 16 mm and tl 45 mm. It was collected in 1897 and the only locality indication was given as "Brasil". It was identified as *Scyllarus arctus*. Ramos compared the specimen with Verrill's (1922) paper and came to the conclusion that its characters were quite typical and the sculpturations of the abdominal somites were identical with those shown in the photograph used in Verrill's plate VII. Ramos did not positively identify his specimen with the species figured by Verrill. Humann (1992: 158, fig.) figured the present species under the incorrect name *Parribacus antarcticus*; he gave the distribution as "Florida, Bahamas, Caribbean". This probably refers to the distribution of the true *Parribacus antarcticus* (Lund, 1793), and there is no indication where the photograph shown was taken.

Habitat

According to Verrill (1922: 30) the species "is taken in lobster pots off the outer reefs". Farrugio (1975) reported it from "fonds coralliens détritiques". The larvae were mostly taken at the surface, or were found in hauls that went from the surface to deeper water (nine times from 0-2 m to 0-30 m, once from 0-60 m, once from 0-122 m and once from 0-400 m).

Development

Robertson (1969) examined 74 phyllosomas of this species and figured stages 5-8, 10, 12, and 13, ranging in length from 6 to 59 mm. He also pointed out that the *Phyllosoma* from off St. Thomas, West Indies, that Bate (1888) considered to be a *Panulirus* larva actually belongs to *Arctides.* Bate's figure was copied by Verrill (1922: 163, 164, pl. 3A, fig. 4), who considered it "perhaps a different genus" from *Panulirus.*

Remarks

Spengler (1799) first described and figured this species. His figure is excellent (cf. Fig. 1A) and his description is unusually extensive for that time. A translation of Spengler's text (1799: 337 [line 4 from bottom]-340) is as follows:

"Description of a new species of lobster, *Scyllarus Guineensis.*

This *Scyllarus* has a very highly arched body, the curvature of which forms a semicircle, and as it is only slightly narrower behind than in front, it is cylindrical in shape. The carapace is entirely covered with pearl-like small shiny warts. The surface that carries these small warts shows in the posterior part a transverse row of larger and higher warts; where the carapace, because of the presence of shallow grooves, is raised in the middle,

there are many similar large warts among the little ones, forming a grotesque pattern. In the middle of the back, near the head more curved spines are placed at regular distances. Both lateral edges [of the carapace] which separate the dorsal part from the lower, are provided with warts and with small spines that are curved forward. The eyes are situated in the anterior part of the head on the anteriormost point of the lateral edge, [they are placed] in a deep cavity which in the most careful way is secured by a high raised edge with deeply incised points. Just below the eyes is the base of an appendix consisting of two leaves which are placed above each other and form the distinctive mark of this peculiar genus. They are supposed to be antennae although they have no resemblance to tentacles. At the anterior edge of the head beside and above the eyes, there is a triangular leaf divided in the middle and both lateral margins are incised, showing large and small teeth, they have a granular surface; this leaf covers the base of the strong segment of the upper antenna-leaf. This again is arched at the outer side and at the inner side it is straight, but both are incised at the outermost edges with sharp teeth. The lower leaf is connected with this by a strong segment, which is produced posteriorly towards the angle of the uppermost leaf and is partly covered thereby. It goes straight up, is dorsally arched, neatly bordered with small red teeth, which are placed among the hairs. Also the surface of the upper leaf of the antenna is a little raised and covered with little warts, but the lower leaf on the other hand is quite flat, smooth and shining. Between these two pairs of leaves, two little thin antennae are placed close to each other; they are standing on a stalk-like base and consist of three segments of which the two hindmost are long, the distal is small and short and ends in a small bundle of hair. The lower surface of the thorax shows the bases for the five pairs of feet ; these are connected with each other and fused with the body in a very neat figure, the outline of which is elongate conical, the central area is concave, with five pairs of parted raised oval little leaves which are regularly ornamented with small and big warts [the previous sentence makes little sense, are the thoracopods meant? There certainly are no small leaf-like processes on the thoracic sternum]. Each leg has four segments, the foremost being the shortest and consists mainly of a bent, sharp and in the end blue-coloured claw. The two foremost feet are twice as strong and thick as the remaining four pairs but on the other hand they are somewhat shorter and have neither scissors nor the so-called finger. The second pair is the longest, and after that the others become gradually smaller.

In the above mentioned paper [i.e. Lund 1793: 17-22] counsellor of justice Lund points out the fact that in the genus *Scyllarus* the first legs have neither scissors nor fingers, which could, together with the leaf-shaped antennae, serve as a genus character. On the other hand we find in three known species, [of the genus] the unusual character that they have such a chela on the hindmost feet; but neither *Scyllarus orientalis* nor the present species show this chela.

A most peculiar feature, which characterizes the genus Lobster [evidently the old genus *Cancer* as conceived by Linnaeus is meant] from all other animals, is that they have double genitalia. The present *Scyllarus*, which is a female, has these ventrally near the base of the first segment on both last legs, that show two round openings there. The same is also seen in *Scyllarus aequinoctialis* in my collection. In the other species of the lobster family the genital opening is on the second pair of legs.

The arched tail, which is supplied with many artistic, regularly dispersed ornaments, consists of six rings which closely overlap each other. The first ring is shoved below the end of the carapace to which it is fastened with both edges; because of the width of an incision [of the posterior margin?] a smaIl part of the ring is visible. This ring is divided by grooves into three narrow, shiny, smooth rings, the first and third of which are dentated on the anterior edge. The four following rings show raised grotesque figures of the loveliest symmetry, and are, I may say, fairly artistically shaped. Near the anterior edge there is a raised, smooth band or edge with rounded leaves. Just in the middle of the piece is a raised figure resembling a clover-leaf and on each side of it there is another oval ornament which is cut into leaves. This figure also shows other raised ornaments, and around its full width larger and smaller pearls are distributed. After this follows on each side a big grape-like ornament incised to form long drooping leaves and with deep teeth, also grape-like mounted, and in front of these it is armed with a long point, like a claw forming the closing of the ornaments. The surface on which the ornaments of these four rings are placed, is provided with round granules or warts and the colour is light yellow. The last ring, being the sixth, is united with the plates of the tail; it has a quite different figure to fit the shape of its surface; this figure is just as neat as those of the foregoing rings. The last ornament is a row of red pearls in a straight line close by the lowest leaf. The remaining surface is yellow, sprinkled with little grains. The five tail-plates are transparent and lengthwise lovely and finely striped. The middle one, which is completely straight at the end, is covered with quite fine hairs, and from above under the above-mentioned row of pearls sparsely and finely decorated with a large number of regular ornaments of a shell-like substance, as if with an artistic embroidery. In addition to the peculiar shape, which characterizes this lobster and distinguishes it from others, there is the beautiful bright-red carmine-like colour displayed by all the ornaments that are provided with points, as well as are the antennae, feet and partly also the carapace. The colour of these parts is still more heightened by the presence of yellow areas found here and there.

Its native land is the coast of Guinea."

Notwithstanding Spengler's (1799) claim that the type specimen was a female, it actually is a male as shown by: 1) the figure of the fifth legs; 2) Spengler's statement that this leg does not end in a chela; and 3) his description of the male openings on this fifth pair of pereiopods.

The species was dealt with for a second time when Latreille (1818) figured it without description under the name *Scyllarus sculptus*. The text for this illustration was later provided by Guérin-Méneville (1828). The locality of the original specimen of *Scyllarus sculptus*, which was also discussed by H. Milne Edwards (1857), was not known, but, as previously mentioned, the type which is still preserved in the MNHN, is labelled "Méditerranée", which seems an unlikely locality. The first definite record was that provided by Heilprin (1888, 1889), who reported the species from Bermuda. Also Verrill (1901, 1922) reported it from there. In the meantime *Arctides antipodarum* was reported from Australia by Whitelegge (1899) under the name *Scyllarus sculptus*. Verrill, who recognized the two species as distinct varieties incorrectly considered the Australian form to be the typical form, and named the Atlantic form *Scyllarides sculptus bermudensis*. He was followed in this by Holthuis (1946), who in a later paper (1960) changed his views and came to the conclusion that the Australian and Atlantic forms both are valid species. The Atlantic species has to bear the oldest specific name *guineensis* Spengler, 1799, of which *sculptus* Latreille, 1818, and *bermudensis* Verrill, 1922, are subjective synonyms. A new name, *Arctides antipodarum*, was given to the Australian species by Holthuis (1960).

Arctides regalis Holthuis, 1963
(Fig. 2B)

Scyllarus martensii – Edmondson 1933: 223 (p.p.); 1946: 258 (p.p.). — Matthews 1954: 205, figs 1, 2b, 3b, 5b. Non *Eduarctus martensii* (Pfeffer, 1881).

Arctides regalis Holthuis, 1963: 58; 1991: 177, figs 326b, 331, 332. — Tinker 1965: 46, pl. 11. — Johnson 1971: 98, figs 88-92. — A. Michel 1971: 472. — Burukovsky 1974: 102; 1983: 144. — C. Michel 1974: 256. — Monod 1975: 1008, fig. 4. — Laboute & Magnier 1978: 42, 115, col. fig. 120; 1979: 42, 115, col. fig. 120. — Phillips *et al*. 1980: 71. — Ingle 1982: 456, col. fig. — Friese 1984: 6, col. cover fig. — Sekiguchi 1986: 1290; 1987: 331; 1988b: 346, 348. — Lau 1987: 381. — Fielding & Robinson 1987: 32, col. fig. — Phillips & McWilliam 1989: 353, 357, 358. — Baensch & Debelius 1992: 574, col. fig. — Scott 1993: 61, col. fig. — Colin & Arneson 1995: 224, 225, col. fig. 1068. — Gosliner *et al*. 1996: 221, col. fig. — Polz 1996: 44. — Poupin 1996: 10, 76, 77. — Richer de Forges & Laboute 1996: 64, col. pl. 4a. — Chan 1998: 1041, fig. — Hoover 1998: 201, 244, 245, col. figs. — Nomura 1998: 114, fig. 2. — Debelius 1999a, b, 2000: 225, 3 col. figs. — Retamal 2000: 45, col. fig. 1. — Coutures 2001: 749, fig. 4. — Sekiguchi & Inoue 2002: 749. — Laboute & Richer de Forges 2004: 387, 2 col. figs.

?*Arctides antipodarum* – A. Michel 1971: 467, 471, 472 (larvae).

Regal Slipper Lobster – DeLuca & DeLuca 1976: 48, fig. — Rosenberg 1988: 105, col. fig.

Archides regalis – Johnson 1979: 327, col. fig.

Arctides sp. – Debelius 1983: 52, 53, col. fig.

Arctides antipodarum – Coleman 1991: 10, col. fig. Non *Arctides antipodarum* Holthuis, 1960.

VERNACULAR NAMES. — Regal Slipper Lobster (Tinker 1965), King's Hawaiian Lobster (Friese 1984), Rotband-Bärenkrebs (Baensch & Debelius 1992), Royal Spanish Lobster (Chan 1998), Cigarrón Regio (Debelius 1999a), Hawaii-Bärenkrebs (Debelius 2000). The other, likewise mostly artificial, names for the species listed by Tinker (1965), viz. Spanish Lobster, Shovel-nosed Lobster and Ula-papapa, evidently are used in Hawaii to indicate all or most Scyllaridae. Retamal (2000) mentioned that the native name for the species at Easter Island is "Rape-rape"; this name is also used for the other Scyllaridae of Easter Island. No true vernacular names for the species are known to me.

MATERIAL EXAMINED. — **Mauritius.** 1 juvenile, dry, cl 15 mm (MG). — Tombeau Bay, reefs, 5 m, I.1965, C. Michel, 1 ♀ cl 60 mm (RMNH).
La Réunion (as "Île Bourbon"). H. de Saussure, 1 ♀ cl 56 mm (MG). — Leg. Y. Plessis, 1 juvenile ♀ cl 17 mm (MNHN).
Maldives. Bought from aquariumshop in Frankfurt, Germany, H. Zetsche leg., 1 ♂ cl 40 mm (SMF).
New Caledonia. Lagoon near Nouméa, 1983, leg. Y. Magnier, 1 ♀ cl 55 mm (MNHN). — Lighthouse, Amédée Island, 22°35'S, 166°28'E, 20 m, diving, 1 ♂ cl 41 mm (MNHN). — Récif Toombo, 22°35'S, 166°29'E, outer slope of reef, 8-15 m, diving at night, 8.VIII.1977, 1 ♂ cl 49 mm (MNHN).

FIG. 2. — **A**, *Arctides guineensis* (Spengler, 1799), Bermuda, T. H. Bean leg., lectotype of *Scyllarus sculptus bermudensis* Verrill, 1922 (USNM), Mrs P. Hogue del.; **B**, *A. regalis* Holthuis, 1963, Hawaii, Mrs P. Hogue del.

Hawaiian Islands. Received 1.X.1957, S.W. Tinker, 1 ♀ paratype cl 41 mm (LACM). — Coconut Island, Kaneohe Bay, Oahu, reefs, IV.1959, L. Zukeran leg., P. Illg don., 1 ♂ cl 48 mm, holotype (RMNH).
Easter Island. 40 m, seen at night, L. Di Salvo (only colour photograph seen).

Recognition characters and comparison with *A. guineensis* and *A. antipodarum*

Arctides regalis is an Indo-West Pacific species much closer to the Atlantic *A. guineensis* than to *A. antipodarum*. In fact it resembles the former species so much that at first I thought them to be conspecific. Differences are as follows: 1) behind the gastric spine in *A. regalis* there is a longitudinal row of three single spinules, whereas in *A. guineensis* there are two two-topped spinules; 2) the smooth area along the posterior margin of the carapace reaches in the median area all the way to the marginal groove in *A. regalis*, whereas in the three specimens of *A. guineensis* examined there are two or three rows of tubercles in-between; and 3) the denticles on the inner margin of the last antennal segment are somewhat smaller in *A. regalis* than in *A. guineensis*.

Colour

The colour is shown in numerous published colour photographs of the species. The carapace is dark reddish covered by closely placed short black bristles; red spines, often pale yellowish distally with a small dark tip, protrude here and there through the field of bristles. A bright red colour is visible around the orbit; the teeth and spines there are carmine red with whitish tips. Also the lateral margins are reddish, while a reddish or slightly yellowish colour may be seen in the posteromedian region and in the middle of each half of the posterior margin; sometimes the posterior margin shows a distinct red band. The abdomen shows the same reddish colour, especially along the anterior and posterior margins, and on the pleura, the tips of which, however, are whitish or yellowish with a black extremity. The smooth anterior half of the somites as a rule shows two or three paler spots. The short hairs of the dorsal surface are black, they surround the elevated lobulated figures, which are red. The antennulae are uniformly red. The last three antennal segments are almost black dorsally with a rather wide sharply defined red margin. The black colour is most likely caused by the presence of closely placed very short black bristles. The legs are entirely red with the distal part of the dactylus yellowish, and a yellowish band in the distal part of the propodus; in the other segments the yellowish colour is confined to an (often small) spot just behind the articulation of the segments.

Size

The cl of the examined female specimens varies between 41 and 60 mm. The holotype male has cl 48 mm; the cl of the other males varies between 40 and 49 mm. The cl of the juveniles are 15 and 17 mm. Richer de Forges & Laboute (1996: 64) indicate the tl to be 150 to 200 mm; Colin & Arneson (1995) and Gosliner *et al.* (1996) give the length as 150 mm. Most other records have tl less than 170 mm, or 7 inches. Laboute & Richer de Forges (2004) give tl as 200 mm.

Distribution

The species is rather widely distributed throughout the Indo-West Pacific region. The type locality is a reef near Coconut Island, Kaneohe Bay, Oahu, Hawaiian Islands. The other records of the species are from Mauritius (C. Michel 1974; Debelius 1999a, b, 2000), La Réunion (Monod 1975), the Maldives (present record), Kushimoto, Wakayama Prefecture, Honshu, central Japan, 33°28'N, 135°45'E (Nomura 1998), New Caledonia (Laboute & Magnier 1978, 1979), southern part of New Caledonia (Richer de Forges & Laboute 1996), outer slope of Aboré Reef near Nouméa, New Caledonia (Coutures 2001), outer SW slope and the reefs of the Lagon Sud, New Caledonia (Laboute & Richer de Forges 2004), 16 miles E of Johnston Island (larvae, Johnson 1971), the Hawaiian Islands (Edmondson 1933, 1946; Tinker 1965; DeLuca & DeLuca 1976; Friese 1984; Fielding & Robinson 1987; Colin & Arneson 1995; Debelius 1999a, b, 2000), Palea Point, Oahu (Hoover 1998), Hanauma Bay, SE Oahu (Scott 1993), Maui, Hawaiian Islands (Debelius 1999a, b, 2000), Kona coast, Hawaii, Hawaiian Islands (Rosenberg 1988), Tuamotu Islands, Central Pacific (Poupin 1996), and Hotu Marotiri, Easter Island (Retamal 2000). From Easter Island (more precise locality

unknown) I have seen a very good unpublished colour photograph (see Material examined).

Habitat

Arctides regalis inhabits coral reefs; there are several records of it from outer reefs and more exposed reefs. The examined specimens were taken at depths of 5, 8-15, 22 and 40 m. Tinker (1965) reported it from depths of 150 feet (*c.* 50 m) or more on the outer edge of reefs. Richer de Forges & Laboute (1996: 64) mention depths of 5 to 15 m for this species. Hoover (1998) reported it from 30 feet (*c.* 10 m). Colin & Arneson (1995) from 20 m, and Retamal (2000) from 12 m depth. It has been reported from caves in reefs; Rosenberg (1988) took the species from submarine lava tubes. Laboute & Richer de Forges (2004) speak about its "habitat caverneux", and give the depth as 10-25 m.

Biology

Richer de Forges & Laboute (1996) characterize the species as "solitaire et farouche". However, Gosliner *et al.* (1996) note it to be "found in caves in groups of up to ten animals", and Debelius (1999a, b, 2000) provided a picture of a group of about 10 specimens, which he presumed to be "an unusual ?mating aggregation". The species is said to be nocturnal (Laboute & Magnier 1978, 1979); they "shy away from observers during daytime hours, but fully reveal their splendorous colors under the diver's light at night" (Johnson 1979); "a nocturnal scavenger" (Debelius 1999a). They are reported from caves in the exposed outside of coral reefs, where they often are found living on the sides and ceilings of these caves (Fielding & Robinson 1987). Rosenberg (1988) reported the species from "among orange tube coral" in lava tubes. According to Scott (1993) they "hunt snails, clams, shrimps, and crabs". Laboute & Richer de Forges (2004) mention its "timides pérégrinations nocturnes" and its very quick disappearance in the depths of its habitat when disturbed.

Development

Matthews (1954) dealt with the histology and formation of the spermatophore in this species, which he incorrectly identified as *Scyllarus martensii*. The juvenile from Mauritius (Geneva Museum) is a postlarval stage in which already some of the dorsal spines of the carapace are visible. The median tooth on the posterior margin of the fifth abdominal somite is sharp and well developed, while also two sharp teeth are present on the coxa of the fifth pereiopod. The tips of the pleura of the fourth and fifth abdominal somites are directed forwards. Coutures (2001) dealt with phyllosoma stage I. Johnson (1971) described and figured phyllosoma larvae of the VIIIth and IXth stages.

Remarks

Edmondson (1946: 258) reported upon a Hawaiian specimen of "*Scyllarus martensii*" of 4 inches (*c.* 100 mm) long. It is very probable that his specimen (the exact locality of which is unknown) belongs to the present species, with which in Hawaii it has more often been confused. Edmondson's remark that the species is not found in water of less than 32 fathoms (*c.* 58 m) evidently is based on Rathbun's (1906: 896) Hawaiian records of "*Scyllarus martensii*", which actually are *Eduarctus modestus* (Holthuis, 1960).

The Hawaiian material identified by Matthews (1954: 205) with *Scyllarus martensii*, judging by its size, evidently also is *Arctides regalis*. Tinker (1965: 46) already remarked on the confusion in Hawaii of *Scyllarus martensii* and the present species.

Tinker (1965) gave a short characterization of the species and an excellent photograph. Gorgeous colour photographs of the species were published by many later authors when it became more easy to take and publish underwater colour photographs.

The name *regalis* (royal) was given to the species in honour of Mrs Mary Eleanore King of Honolulu, Hawaii, in recognition of her many valuable contributions to the promotion of the study of marine biology.

Arctides antipodarum Holthuis, 1960
(Fig. 3)

Scyllarus sculptus – Whitelegge 1899: 155, pl. 29. — Coulon 1918: 18. — McNeill 1925: 327. Non *Scyllarus sculptus* Latreille, 1818.

Scyllarides guineensis – Holthuis 1946: 100 (p.p.). Non *Arctides guineensis* (Spengler, 1799).

Arctides antipodarum Holthuis, 1960: 154; 1991: 175, figs 325a, 327, 328. — Yaldwyn 1961: 1, 3, figs 1, 2. — Gillett & Yaldwyn 1969: 72, 74, fig. 42. — Healy & Yaldwyn 1970: 58, fig. 28. — A. Michel 1971: 467, 471, 472, fig. 6B. — George & Griffin 1972: 228, 230, fig. — Burukovsky 1974: 102; 1983: 144. — Coleman 1977: 133, col. fig.; 1994: 86, 87, col. fig. — Phillips *et al.* 1980: 71. — Sekiguchi 1988b: 346; 2000: 262. — Davie 2002: 440. — Poore 2004: 209, fig. 58b.

Arctites antipodum – Doak 1971: 88, 89, 110, col. pl. 42.

?*Scyllarides* sp. – George & George 1979: 78, pl. 70, col. fig. 7.

Non *Arctides antipodarum* – Coleman 1991: 104, col. fig. (= *A. regalis*).

VERNACULAR NAMES. — Red Flapjack (Healy & Yaldwyn 1970; Davie 2002), Shovel-nosed Crayfish (Healy & Yaldwyn 1970), Southern Shovel-nosed Cray (Doak 1971), Southern Shovelnosed Lobster (Coleman 1994). The (artificial) FAO name is Rough Spanish Lobster (Holthuis 1991; Poore 2004).

MATERIAL EXAMINED. — **Australia.** New South Wales, Port Stephens, don. AM, 1912.11.22.142, 1 ♂ (BMNH). — Off the coast near Sydney, IV.1955, don. AM, 1 ♀ paratype (RMNH). — Port Jackson, Sydney, don. AM, 1 ♂ (MNHN). — Off Malabar, S of Sydney, 80 fathoms (*c.* 146 m), III.1956, A. A. Racek, 1 ♂ holotype (RMNH). — La Perouse, Botany Bay, 1 ♂ paratype (AM).

DESCRIPTION

Rostrum T- or V-shaped, constricted at base. Rostral tooth sharp and small, but not smaller than sharp pregastric or gastric tooth; all three teeth with dark horny tips. Two cardiac teeth placed rather wide apart behind cervical groove, followed posteriorly by two converging rows of tubercles. Middle of each lateral half of carapace with single large spine behind cervical groove. A longitudinal row of spines becoming larger anteriorly, extending over branchial region; anterior spines slightly behind and more laterad to spine behind cervical groove. Inner margin of orbit bears three sharply pointed strong teeth; anterior smallest and placed slightly inward, next strongest, only slightly longer than the third (less slender than in *A. guineensis*) and bearing small additional posterior tooth. Posterior margin of orbit with two teeth, inner of these broad and two-topped, inner top being broader than outer. Outer margin of orbit crenulate. Strong pointed tooth placed behind inner margin of orbit; a second, smaller tooth about halfway between it and gastric tooth. Orbit widely open anteriorly; intercalated plate low, partly covered by lobe from inner orbital angle. Outer orbital angle ending in two sharp teeth, the anterior tooth very distinct and larger than posterior. Anterolateral angle of carapace placed next to outer orbital tooth, sharply pointed and directed forward and slightly outward. Four sharply pointed anterolateral teeth between anterolateral angle and distinct cervical incision. Ten or 11 posterolateral teeth, anterior much stronger than the rest. No postcervical incision although larger space between first and second posterolateral teeth could be considered as such. Cervical groove rather distinct. Branchiocardiac and postcervical grooves less clearly indicated. Marginal groove deep and wide. Posterior margin with concavity medially. Upper surface of carapace covered by small squames, and shorter and longer hairs, giving specimens shaggy appearance. Double or triple row of tubercles visible between marginal groove and posterior margin.

First abdominal somite with deep uninterrupted transverse rather wide hairy groove, abruptly narrowed on median 1/4 of length. Anterior margin crenulated. Pleura roughened by scale-like tubercles, that are absent from rest of somite. Following somites smooth anteriorly or provided with inconspicuous squamiform tubercles, posterior margins crenulated. Posterior half of abdominal somites with sculpturation like in *A. regalis* except for smooth, naked parts relatively much smaller and less sharply defined, and interspaces much wider and filled with hairs and tubercles. Appearance rough (much more than in *A. regalis* where naked parts occupy relatively larger space and are separated by narrow, hair-filled grooves). Central naked figure on somites narrow, raised (more than in *A. regalis*). Pleura of second somite relatively wider and shorter; tip placed behind middle, short and directed more posteriorly (in *A. regalis* tip elongate and directed more downwards, making pleura more slender). Other pleura less slender in *A. antipodarum*. Tips

of fifth pleura blunt. Teeth on antennular somite straight and parallel, their inner margins touching over larger part of their length. Antennae similar in the two species except that teeth on inner margin of last segment are larger and less numerous in *A. antipodarum* (8-9) than in *A. regalis* (12-13). Difference between larger inner and smaller outer teeth more distinct in *A. antipodarum* than in *A. regalis*. Fourth segment relatively shorter and wider in *A. antipodarum* than in *A. regalis*; teeth less slender, distal tooth not noticeably longer than next outer tooth in *A. antipodarum*.

First pereiopods similar to those of *A. regalis*. Second pereiopods differ, being much less elongate; propodus about three times as long as high. Apart from being less slender, the other legs strongly resemble those of *A. regalis*.

Sternum different from that of *A. regalis* in having tubercles better developed and grooves wider, being thereby less flat.

Pleopods of second abdominal somite of male as in *A. regalis*. Following pleopods with endopods reduced to bud. Abdominal sternites slightly more coarsely denticulate than in *A. regalis*.

Colour

The colour of preserved specimens is uniformly dark reddish with minute yellowish dots and short lines, which are partly obscured by the dark brown pubescence. This coloration extends over the entire upper surface of the body with the exception of the distal segments of the antennae which are pale reddish brown. The legs are purplish covered with numerous small round whitish dots. No coloured bands could be observed here. The brown pubescence of the entire body gives the animals a dark brown colour. Whitelegge (1899: 162) described the colour as follows: "The ground colour is greyish-yellow, in parts almost obliterated by crimson tints, central area of fifth joints of the outer antennae and the margins of the third joints wholly of this tint; the lateral borders and the posterior margins of the carapace, and pleon also, red. Meral joints of legs with a central transverse crimson band, extremities of legs purple or blue. Membrane of telson and uropods yellow, mottled with purple. Inferior surface of antennae yellow dotted with red. The legs red, dotted with yellow". Yaldwyn (1961: 4) gave the colour of a dead but not preserved specimen as follows: "A dull, mottled red and yellow, rather obscured by the overall covering of short brown setae associated with the tubercles and sculpturing. Two prominent bright red, dorsolateral patches stood out against the yellow background of the anterior half of the first abdominal segment".

FIG. 3. — *Arctides antipodarum* Holthuis, 1960, off Malabar, S of Sydney, Australia, 146 m, III.1956, leg. et don. A. A. Racek, ♂ holotype. Photo RMNH.

Size
The four examined males of this species have cl 89 to 105 mm, the female paratype has cl 91 mm. Whitelegge's (1899) adult male had cl 90 mm, Yaldwyn's (1961) adult female 97 mm.

DISTRIBUTION
The type locality is off Malabar, just S of Sydney, New South Wales, Australia. The species is known from SE Australia and New Zealand. The records in the literature are: Port Stephens, New South Wales, Australia (Whitelegge 1899); Newcastle, New South Wales (Whitelegge 1899; Coulon 1918); Port Jackson, Sydney, New South Wales (Whitelegge 1899); off Malabar, S of Sydney (Holthuis 1960); off Arid Island near Great Barrier Island, Hauraki Gulf, North Island, New Zealand (Yaldwyn 1961).

HABITAT
Little is known about the habitat of the species. The holotype was taken at a depth of 80 fathoms (*c.* 146 m), the New Zealand specimen reported upon by Yaldwyn (1961) was found "in approximately 10 to 15 fathoms of clear water".

BIOLOGY
According to Doak (1971) the females are in berry in October.

REMARKS
This species was first discussed in detail by Whitelegge (1899) as *Scyllarus sculptus* Latreille, 1818 (= *Arctides guineensis* (Spengler, 1799)). Also Coulon (1918) reported on a specimen of this species. In 1960, Holthuis showed that this species is different from *Arctides guineensis* (of which *Scyllarus sculptus* and *Scyllarides sculptus bermudensis* are synonyms) and erected a new species for it. Yaldwyn (1961) reported the species for the first time from New Zealand and gave a good description and figure of it, at the same time providing a key to the New Zealand Scyllaridae.

Dedication
It is a great pleasure to dedicate the present paper to Dr Patsy A. McLaughlin, as a token of appreciation for the help, cooperation and many discussions in the field of decapod taxonomy, and for many other kindnesses received during the more than 40 years of our aquaintance.

Acknowledgements
I am much indebted to the late Mrs Harriet I. Jörgensen of Universitetets Zoologiske Museum, Copenhagen, for the translation of the indeed quite difficult Danish text of Spengler's (1799) original description of *Scyllarus guineensis*.

This study was started in 1960 in the United States National Museum, when I was the guest there of the late Dr Fenner A. Chace Jr. His great help with my work and his many kindnesses are deeply appreciated. Mrs Patricia Hogue at that occasion made the excellent drawings published here as Figure 2A, B.

REFERENCES

BAENSCH H. A. & DEBELIUS H. 1992. — *Meerwasser Atlas. Die gemeinsame Pflege von wirbellosen Tieren und tropischen Meeresfischen im Aquarium*. Mergus Verlag, Melle, 120 p., figs.

BATE C. S. 1888. — Report on the Crustacea Macrura collected by H.M.S. *Challenger* during the years 1873-76. *Report on the Scientific Results of the Voyage of H.M.S.* Challenger*, During the Years 1873-76 (Zoology)*. Her Majesty's Stationery Office, London, 24, xc + 942 p., 76 text-figs, pls 11-150.

BURUKOVSKY R. N. 1974. — [*Keys for the Identification of Shrimps, Spiny Lobsters and Lobsters*]. Pishchevaya Promyshlennost Publishers, Moscow, 126 p., 189 figs (in Russian).

BURUKOVSKY R. N. 1983. — *Key to Shrimps and Lobsters*. Russian Translation Series. A. A. Balkema, Rotterdam, 5, xi + 174 p., 189 figs (English translation of Burukovsky 1974).

CHACE F. A. 1937. — Bermudian Crustacea. *The Bermuda Biological Station for Research. Reports of Officers for the Years 1935 and 1936*: 55-57.

CHACE F. A., MCDERMOTT J. J., MCLAUGHLIN P. A. & MANNING R. B. 1986. — Order Decapoda (shrimps, lobsters and crabs), *in* STERRER W. & SCHOEPF-STERRER C. (eds), *Marine Fauna and Flora of Bermuda. A Systematic Guide to the Identification of Marine Organisms*. John Wiley & Sons, New York; Chichester; Brisbane; Toronto; Singapore: 312-358, pls 101-118, col. pls 9-11.

CHAN T.-Y. 1998. — Lobsters. The living marine re-

sources of the western Central Pacific, 2 (cephalopods, crustaceans, holothurians and sharks). *FAO Species Identification Guide for Fishery Purposes*: 973-1043, figs.

COLEMAN N. 1977. — *A Field Guide to Australian Marine Life*. Rigby Ltd., Adelaide; Sydney; Melbourne; Brisbane; Perth, 223 p., figs.

COLEMAN N. 1991. — *Encyclopedia of Marine Animals*. Blandford, Villiers House, London, 323 p., col. figs.

COLEMAN N. 1994. — *Discover Underwater Australia*. National Book Distributors and Publishers, French Forest, 168 p., figs.

COLIN P. L. & ARNESON C. 1995. — *Tropical Pacific Invertebrates. A Field Guide to the Marine Invertebrates Occurring on Tropical Pacific Coral Reefs, Sea Grass Beds and Mangroves*. Coral Reef Press, Beverly Hills, vii + 296 p., 1354 col. figs, unnumbered black & white figs.

COULON L. 1918. — Les crustacés du Musée d'Histoire naturelle d'Elbeuf (supplément). *Bulletin de la Société d'Étude des Sciences naturelles d'Elbeuf* 36: 1-21.

COUTURES E. 2001. — On the first phyllosoma stage of *Parribacus caledonicus* Holthuis, 1960, *Scyllarides squammosus* (H. Milne Edwards, 1837) and *Arctides regalis* Holthuis, 1963 (Crustacea, Decapoda, Scyllaridae) from New Caledonia. *Journal of Plankton Research*, London 23 (7): 745-751, figs 1-4.

DAVIE P. J. F. 2002. — Crustacea: Malacostraca: Phyllopoda, Hoplocarida, Eucarida (Part I), *in* WELLS A. & HOUSTON W. W. K. (eds), *Zoological Catalogue of Australia* 19 (3A). CSIRO Publishing, Melbourne, xii + 551 p., figs.

DEBELIUS H. 1983. — Die grossen Krabbelmeister. *Tauchen, Internationales Unterwasser-Magazin*, Hamburg 6 (4): 50-57, 13 figs.

DEBELIUS H. 1999a. — *Crustacea Guide of the World. Atlantic Ocean. Indian Ocean. Pacific Ocean*. Ikan, Frankfurt, 321 p., col. figs.

DEBELIUS H. 1999b. — *Crustáceos del Mundo. Océano Atlantico. Océano Indico. Océano Pacifico*. M. & G. Difusión, S.L., Elche (Alicante), 321 p., col. figs.

DEBELIUS H. 2000. — *Krebs-Führer. Garnelen. Krabben. Langusten. Hummer. Fangschreckenkrebse weltweit*. Jahr Verlag, Hamburg, 321 p., col. figs.

DELUCA C. J. & DELUCA D. M. 1976. — *Pacific Marine Life. A Survey of Pacific Ocean Invertebrates*. C. E. Tuttle, Rutland, xiv + 66 p., figs.

DOAK W. 1971. — *Beneath New Zealand Seas*. Reed Books, Wellington; Auckland; Sydney; Melbourne, 113 p., 52 pls, 36 text-figs.

EDMONDSON C. H. 1933. — Reef and shore fauna of Hawaii. *Special Publications Bernice P. Bishop Museum* 22: 1-295, figs 1-163.

EDMONDSON C. H. 1946. — Reef and shore fauna of Hawaii. 2nd ed. *Special Publications Bernice P. Bishop Museum* 22: i-iii, 1-381, figs 1-223.

EVENHUIS N. L. 2003. — Dating and publication of the *Encyclopédie méthodique* (1782-1832), with special reference to the parts of the *Histoire naturelle* and details of the *Histoire naturelle des insectes*. *Zootaxa*, Auckland 166: 1-48, figs 1-4.

FARRUGIO H. 1975. — Clé de détermination commentée des langoustes et des scyllares de la Martinique. *Science et Pêche, Bulletin d'Information et de Documentation de l'Institut scientifique et technique des Pêches maritimes*, Nantes 247: 1-9, figs 1-9.

FARRUGIO H. & SAINT-FÉLIX C. 1975. — Étude des fonds de pêche du littoral atlantique martiniquais. Ressources, exploitation, prospectives. *Science et Pêche, Bulletin d'Information et de Documentation de l'Institut scientifique et technique des Pêches maritimes*, Nantes 251: 1-20, figs 1-14.

FIELDING A. & ROBINSON E. 1987. — *An Underwater Guide to Hawaii*. University of Hawaii Press, Honolulu, 156 p., 204 figs.

FRIESE U. E. 1984. — Crustaceans in the home aquarium. Part I. *Tropical Fish Hobbyist* 32 (6): 6, 8-16, 18, text-figs and fig. on cover.

GEORGE J. D. & GEORGE J. J. 1979. — *Marine Life. An Illustrated Encyclopedia of Invertebrates in the Sea*. G. G. Harrap & Co., London, 288 p., 49 text-figs, 128 pls.

GEORGE R. W. & GRIFFIN D. J. G. 1972. — The shovel nosed lobsters of Australia. *Australian Natural History*, Sydney 17: 227-231, 8 figs.

GIBBES L. R. 1845. — Catalogue of the collection of crustaceans in the cabinet of the Boston Society of Natural History. *Proceedings of the Boston Society of Natural History* 2: 69, 70.

GILLETT K. & YALDWYN J. 1969. — *Australian Seashores in Colour*. A. H. & A. W. Reed, Sydney; Melbourne; Wellington; Auckland, 112 p., 67 text-figs, 52 pls.

GOSLINER T. M., BEHRENS D. W. & WILLIAMS G. C. 1996. — *Coral Reef Animals of the Indo-Pacific. Animal Life from Africa to Hawai'i Exclusive of the Vertebrates*. Sea Challengers, Monterey, vi + 314 p., 1103 figs.

GUÉRIN-MÉNEVILLE F. E. 1828. — Scyllare, Scyllarus. Fab. *Encyclopédie méthodique. Histoire naturelle, Insectes* 10 (2).Veuve Agasse, Paris: 414-416 (for date of publication, see Evenhuis 2003).

HEALY A. & YALDWYN J. C. 1970. — *Australian Crustaceans in Colour*. A. H. & A. W. Reed, Sydney; Melbourne; Wellington; Auckland, 112 p., 57 text-figs, 52 pls.

HEILPRIN A. 1888. — Contributions to the natural history of the Bermuda Islands. *Proceedings of the Academy of Natural Sciences of Philadelphia* 1888: 302-328.

HEILPRIN A. 1889. — *The Bermuda Islands: a Contribution to the Physical History and Zoology of the Somers Archipelago. With an Examination of the Structure of Coral Reefs*. Academy of Natural Science of Philadelphia,

published by the author, 231 p., 17 pls, 11 pls in the text.

HOLTHUIS L. B. 1946. — The Stenopodidae, Nephropsidae, Scyllaridae and Palinuridae. The Decapoda Macrura of the *Snellius* Expedition. I. Biological results of the *Snellius* Expedition. XIV. *Temminckia*, Leiden 7: 1-178, text-figs 1, 2, pls 1-11.

HOLTHUIS L. B. 1960. — Preliminary descriptions of one new genus, twelve new species and three new subspecies of scyllarid lobsters (Crustacea Decapoda Macrura). *Proceedings of the Biological Society of Washington* 73: 147-154.

HOLTHUIS L. B. 1963. — Preliminary descriptions of some new species of Palinuridea (Crustacea Decapoda, Macrura Reptantia). *Proceedings Koninklijke Nederlandse Akademie van Wetenschappen* (C) 66: 54-60.

HOLTHUIS L. B. 1991. — Marine lobsters of the world. An annotated and illustrated catalogue of species of interest to fisheries known to date. *FAO Fisheries Synopsis* 13 (125): i-viii, 1-292, figs 1-459.

HOOVER J. P. 1998. — *Hawai'i's Sea Creatures. A Guide to Hawai'i's Marine Invertebrates*. Mutual Publishing, Honolulu, xviii + 366 p., col. figs.

HUMANN P. 1992. — *Reef Creature Identification. Florida, Caribbean, Bahamas*. New World Publications Inc., Jacksonville, 320 p., 22 unnumbered p., figs.

INGLE R. 1982. — Crustacea, *in* WALLS J. G. (ed.), *Encyclopedia of Marine Invertebrates*. Tropical Fish Hobbyist Publications Inc., Hong Kong: 514-662, 36 black & white, 164 col. figs (on pp. 364-553).

JOHNSON M. W. 1971. — The phyllosoma larvae of slipper lobsters from the Hawaiian islands and adjacent areas (Decapoda, Scyllaridae). *Crustaceana* 20: 77-103, figs 1-92.

JOHNSON S. 1979. — Hawaiian night life. *Sea Frontiers*, International oceanographic Foundation, Coral Gables, Florida 25 (6): 322-328, 9 figs.

LABOUTE P. & MAGNIER Y. 1978. — *Guide sous-marin de Nouvelle-Calédonie*. Les Éditions du Pacifique, Papeete, 160 p., unnumbered figs and figs 1-212.

LABOUTE P. & MAGNIER Y. 1979. — *Underwater Guide to New Caledonia*. Les Éditions du Pacifique, Papeete, 160 p., unnumbered figs and figs 1-212.

LABOUTE P. & RICHER DE FORGES B. 2004. — *Lagons et récifs de Nouvelle-Calédonie*. Éditions Catherine Ledru, Nouméa, 520 p., col. figs.

LATREILLE P. A. 1818. — Crustacés, arachnides et insectes. *Tableau encyclopédique et méthodique des trois Règnes de la Nature* 24: 1-38, pls 133-397 (for date of publication, see Evenhuis 2003).

LAU C. J. 1987. — Feeding behavior of the Hawaiian slipper lobster, *Scyllarides squammosus*, with a review of decapod crustacean feeding tactics on molluscan prey. *Bulletin of Marine Science*, Coral Gables, Florida 41 (2): 378-391, figs 1, 2.

LUND N. T. 1793. — Slaegten *Scyllarus*. Iagttagelser til Insekternes Historie. I. *Skrifter af naturhistorie Selskabet Kjobenhavn* 2 (2): 17-22, 1 pl.

MCNEILL F. A. 1925. — Crayfishes, *in* WILBERFORCE JOSE A. & CARTER J. (eds), *The Australian Encyclopaedia* 1: 326-328, 1 fig.

MANNING R. B. 1978. — Lobsters. *FAO Species Identification Sheets for Fishery Purposes*. Western Central Atlantic. Fishing Area 31, vol. 6: 1-4, 1-4, (1-8), 1-3, (1-10), 1-3, (1-9), figs.

MARKHAM J. C. & MCDERMOTT J. J. 1980. — A tabulation of the Crustacea Decapoda of Bermuda. *Proceedings of the Biological Society of Washington* 93: 1266-1276.

MATTHEWS D. C. 1954. — A comparative study of the spermatophores of three scyllarid lobsters (*Parribacus antarcticus*, *Scyllarides squammosus*, and *Scyllarus martensii*). *The Quarterly Journal of Microscopical Science*, London 95 (2): 205-215, figs 1-10.

MICHEL A. 1971. — Note sur les *Puerulus* de Palinuridae et les larves phyllosomes de *Panulirus homarus* (L.). Clef de détermination des larves phyllosomes récoltées dans le Pacifique équatorial et sud-tropical (décapodes). *Cahiers ORSTOM*, Paris, série Océanographie 9: 459-473, figs 1-6.

MICHEL C. 1974. — Notes on marine biology studies made in Mauritius. *Mauritius Institute Bulletin* 7 (2): 1-287.

MILNE EDWARDS H. 1837. — *Histoire naturelle des crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. 2. Librairie encyclopédique de Roret, Paris, 532 p.

MOE M. A. 1991. — *Lobsters. Florida – Bahamas – the Caribbean*. Green Turtle Publications, Plantation, 510 p., 99 figs.

MONOD T. 1975. — Sur quelques crustacés malacostracés de l'île de la Réunion. *Bulletin du Muséum national d'Histoire naturelle*, Paris, 3e sér., no 319, Zoologie 226: 1005-1032, figs 1-118.

NOMURA K. 1998. — Record of two rare lobsters collected from Kushimoto, middle part of Japan. *Nankiseibutu, the Nanki Biological Society* 40 (1): 113-115, figs 1, 2.

PHILLIPS B. F., COBB J. S. & GEORGE R. W. 1980. — General biology, *in* COBB J. S. & PHILLIPS B. F. (eds), *The Biology and Management of Lobsters*. Academic Press, New York; London; Toronto; Sydney; San Francisco, 1, 82 p., 23 figs.

PHILLIPS B. F. & MCWILLIAM P. S. 1989. — Phyllosoma larvae and the ocean currents off the Hawaiian islands. *Pacific Science*, Honolulu 43 (4): 352-361, figs 1, 2.

POLZ H. 1996. — Eine Form-C-Krebslarve mit erhaltenem Kopfschild (Crustacea, Decapoda, Palinuroidea) aus den Solnhofener Plattenkalken. *Archaeopteryx*, Jahreszeitschrift der Freunde des Jura-Museums Eichstätt 14: 43-50, text-figs 1-3, pl. 1.

POORE G. C. B. 2004. — *Marine Decapod Crustacea of Southern Australia. A Guide to Identification. With a*

Chapter on Stomatopoda by Shane Ahyong. CSIRO Publishing, Collingwood, ix + 574 p., 181 figs, 32 col. pls.

POUPIN J. 1996. — Crustacea Decapoda of French Polynesia (Astacidea, Palinuridea, Anomura, Brachyura). *Atoll Research Bulletin*, Washington, D.C. 442: i-iv + 1-114, 1 map.

RAMOS F. DE P. ANDRADE 1951. — Nota sôbre *Scyllarides brasiliensis* Rathbun e sua Ocorrência no Litoral do Estado de São Paulo. *Boletim do Instituto Paulista de Oceanografia* 2 (2): 125-133, pls 1, 2.

RATHBUN M. J. 1906. — The Brachyura and Macrura of the Hawaiian islands. *Bulletin of the U.S. Fish Commission* 23: 827-930, text-figs 1-79, pls 1-24.

RETAMAL M. A. 2000. — *Arctides regalis* Holthuis, 1963 (Scyllaridae, Arctidinae) una nueva "langosta chata" en aguas oceanicas chilenas. *Arctides regalis* Holthuis, 1963 (Scyllaridae, Arctidinae): a new record in Chilean oceanic waters. *Boletin de la Sociedad de Biologia de Concepción*, Chile 71: 45-47, col. fig. 1.

RICHER DE FORGES B. & LABOUTE P. 1996. — Langoustes, langoustines et cigales de mer de Nouvelle-Calédonie, *in* RICHER DE FORGES B. (ed.), *Les fonds meubles des lagons de Nouvelle-Calédonie (sédimentologie, benthos)*. ORSTOM Éditions, Paris 2: 45-82, text-figs 1-10, pls 1-4.

ROBERTSON P. B. 1969. — Phyllosoma larvae of a scyllarid lobster, *Arctides guineensis*, from the western Atlantic. Biological investigations of the deep sea, 48. *Marine Biology*, Berlin 4 (2): 143-151, figs 1-7.

ROSENBERG S. 1988. — Diving the lava tubes of Hawaii. *Sea Frontiers*, Coral Gables, Florida 34 (2): 100-105, 13 figs.

SCOTT S. 1993. — *Exploring Hanauma Bay*. A Kolowalku Book, University of Hawaii Press, Honolulu, vi + 90 p., figs.

SEKIGUCHI H. 1986. — Identification of late-stage phyllosoma larvae of the scyllarid and palinurid lobsters in the Japanese waters. *Bulletin of the Japanese Society of Scientific Fisheries* 52 (8): 1289-1294.

SEKIGUCHI H. 1987. — Life histories of the scyllarid and palinurid lobsters. 11. *Aquabiology*, Tokyo 9 (5): 330-335, figs 46, 47.

SEKIGUCHI H. 1988a. — Life histories of the scyllarid and palinurid lobsters. 16. *Aquabiology*, Tokyo 10 (4): 270-273, figs 63-65.

SEKIGUCHI H. 1988b. — Life histories of the scyllarid and palinurid lobsters. 17. *Aquabiology*, Tokyo 10 (5): 346-351, figs 66-68.

SEKIGUCHI H. 1989. — Life histories of the scyllarid and palinurid lobsters. 22. *Aquabiology*, Tokyo 11 (4): 288-293, figs 85-88.

SEKIGUCHI H. 2000. — Life histories of the scyllarid and palinurid lobsters. 83. *Aquabiology*, Tokyo 22 (3): 262-266, figs 1-4.

SEKIGUCHI H. & INOUE N. 2002. — Recent advances in larval recruitment processes of scyllarid and palinurid lobsters in Japanese waters. *Journal of Oceanography*, The Oceanographic Society of Japan 58: 747-757, figs 1-6.

SPENGLER L. 1799. — Beskrivelse af en nye Art Kraebs, *Scyllarus Guineensis. Det Kongelige Danske Videnskabers-Selskab Skrivter* (2) 5: 333-340, 1 pl.

TINKER S. W. 1965. — *Pacific Crustacea. An Illustrated Handbook on the Reef-Dwelling Crustacea of Hawaii and the South Seas*. Charles E. Tuttle Co. Publ., Rutland, 134 p., pls 1-52.

VERRILL A. E. 1901. — Recent papers relating to the fauna of the Bermudas. with some corrections. *The American Journal of Science*, New Haven (4) 11: 326-330.

VERRILL A. E. 1922. — Decapod Crustacea of Bermuda. Part II. Macrura. *Transactions of the Connecticut Academy of Arts and Sciences*, New Haven 26: 1-179, text-figs 1-12, pls 1-48.

WHITELEGGE T. 1899. — Note on *Scyllarus sculptus*, Latreille. *Records of the Australian Museum*, Sydney 3: 155-162, pl. 29.

YALDWYN J. C. 1961. — A scyllarid lobster, *Arctides antipodarum* Holthuis, new to New Zealand waters. *Records of the Dominion Museum*, Wellington 4 (1): 1-6, figs 1, 2.

Submitted on 9 May 2005;
accepted on 3 October 2005.