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5.—The Western Australian psolid holothurian *Ceto cuvieria* (Cuvier)

By DAVID L. PAWSON*
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Abstract

A unique species of psolid holothurian formerly known as *Stolinus cataphractus* Selenka, with 15 tentacles, five large radially placed oral valves, extremely numerous ventral tube feet and more than 25 Pollan vesicles, is redescribed here. Its apparent identity with a species illustrated by Cuvier in 1817 necessitates a change of name to *Ceto cuvieria* (Cuvier). Definite locality data are given for the first time; the species is known from three localities in south-west Australia. On the basis of gross morphological characters, *Ceto cuvieria* is sharply distinguished from all other members in the family Psolidae.

Introduction

Holothurians of the family Psolidae are not a conspicuous element in the Australian fauna. Clark (1946) recorded five species from Australia, while more than 75 species are known from world seas. Included in the Australian fauna is a species known only from Western Australia, which is unique in having 15 tentacles, and in having the strongly arched dorsal surface of the body covered by a thick leathery skin, which overlies the dorsal scales. Clark (1946) referred to the species as *Stolinus cataphractus* Selenka, and noted that its locality data are inexact at best.

Through the courtesy of Drs. W. D. L. Ride and R. George of the Western Australian Museum I received for study a large collection of dendrochirotid holothurians from Western Australia, and included in the collection were six specimens of "*Stolinus cataphractus*". Study of earlier literature shows that at present the species is incorrectly named, and that a psolid holothurian figured by Cuvier (1817) is undoubtedly conspecific with it. The opportunity is taken here to redescribe the species, and to make the necessary name changes.

For access to material, I am particularly grateful to Drs. W. D. L. Ride and R. George of the Western Australian Museum and Miss Ailsa M. Clark of the British Museum. I thank Miss Clark, Dr. D. J. G. Griffin (Australian Museum) and colleagues at the Smithsonian Institution for helpful discussions on the status of some holothurian names.

The correct name for "*Stolinus cataphractus*":

Cuvier (1817, 1830) illustrated a holothurian on Pl. XV, fig. 9 (reproduced in fig. 1, here) in his "Regne Animal", and called the species *Holothuria cuvieria*. On page 239, Cuvier makes the following statement (original in French):

"*H. squamata*, Müll., Zool. Dan., X, 1,2,3. A small species inhabiting European seas; those of hot climates produce larger ones (1)"

The (1) refers to the footnote which reads as follows:

"Those which Péron calls the *Cuvieries*" It is evident from Cuvier's illustration of *Holothuria cuvieria* that this species is the psolid from Western Australia (compare figs. 1 and 2 here). Both Bell (1882) and Lampert (1885) were aware that this was so, but Bell rejected the early species name, while Lampert referred to the species as *Psolus cuvieria* Jäger.

In the terms of the International Code of Zoological Nomenclature the species *Holothuria cuvieria* Cuvier is valid, but as Bell (1882) has pointed out, Blainville (1821) and Brandt (1835) were incorrect in citing Cuvier (or Peron in Cuvier) as the author of the genus-name *Cuvieria*, using Cuvier's footnote as a basis for their decision.



Figure 1.—Original illustration of *Holothuria cuvieria*. From Cuvier (1830); pl. XV fig. 9.

Jäger (1833) was the first to diagnose the genus *Cuvieria* for the echinoderms, and he included two species, which he referred to (p. 20) as "*Sp. 1 Squamata* Müller . . ." and "*Sp. 2 Cuvieria . . . Cuvier . . .*" The species *cuvieria* is the type-species of the genus *Cuvieria* by absolute tautonymy, according to Article 68 (d) of the Code.

Cuvieria Jäger is preoccupied (by *Cuvieria* Lesueur and Petit, 1807). Nevertheless the name persisted in use as a senior synonym in the holothurians for many years (e.g. Studer, 1877; Bell, 1881). Gistel (1848) was apparently aware of the precarious position of the

* Department of Invertebrate Zoology, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

echinoderm genus-name *Cuvieria*, and (p. viii) proposed a replacement name, *Callisto*, as follows:

"*Cuvieria* (Agass. prodr. echin.): *Callisto*, N."

Unfortunately *Callisto* is also preoccupied (by *Callisto* Stephens, 1834), and thus is not available for echinoderms. Later in the same work (p. 174), Gistel (1848) proposed another new name for *Cuvieria*, as follows:

"*Cuvieria* (*H. squamata*, Müll.): *Ceto* (mihi)."

As the above was included in his section "Echinodermata" (p. 175), and as the name *H. squamata* Müller is obviously used in reference to the holothurian of that name, it is obvious that Gistel was referring to the echinoderm genus-name *Cuvieria*, and not to any other homonyms. There is also little doubt in my mind that *Ceto* is in fact being proposed here as a replacement for *Cuvieria*. Gistel may or may not have been aware that *Callisto* was preoccupied, but this now has no bearing on the case.

It may be argued that it was Gistel's intention to provide the name *Ceto* for *Holothuria squamata* only, and that the species name *cuvieria* should not be construed as belonging in the genus *Ceto*, but it would seem more logical to assume that *Ceto* was proposed simply to replace the genus name *Cuvieria*, and as the species *cuvieria* is ipso facto the type-species of *Cuvieria* then the combination *Ceto cuvieria* is valid.

Later authors have referred to the Western Australian species by various names (see synonyms below), and it is indeed remarkable that a species which is known from so few specimens (approximately six specimens, not including the collection described here) has been referred to under 6 generic names, and no less than 11 binomial combinations.

It has been suggested by some colleagues that the name *Stolinus cataphractus* Selenka, 1868 should be applied to this species; it is referred to as such by Clark (1946). If this step were taken, it would require application to the International Commission on Zoological Nomenclature for suppression in the interest of stability of the names *Holothuria cuvieria* Cuvier and *Ceto* Gistel. Clark (1946) did not have occasion to study specimens of this species, and did not present a case for maintaining the name *Stolinus cataphractus*. I feel that the interests of stability would best be served by retention of the name *Ceto cuvieria*, because it definitely fixes the identity of the species named *Holothuria cuvieria* by Cuvier, because *Ceto* is, as far as I can determine, a perfectly valid generic name, and because the troublesome names *Cuvieria*, *Callisto*, *Stolinus*, *Hypopsolus* and *Theelia* are thereby reduced to the status of junior synonyms. The use of the incorrect name *Stolinus cataphractus* by Clark (1946) does not appear to be sufficient justification for retention of that name.

Order Dendrochirotida Grube, 1840 (restricted Pawson and Fell, 1965)

Family Psolidae Perrier, 1902

Ceto Gistel, 1848

Cuvieria Jäger, 1833, p. 20 (preoccupied by *Cuvieria* Lesueur and Petit, 1807); type-species *Holothuria cuvieria* Cuvier, by absolute tautonymy.

Callisto Gistel, 1848, p. viii; replacement name for *Cuvieria* Jäger (preoccupied by *Callisto* Stephens, 1834).

Stolinus Selenka, 1868, p. 110; type-species *cataphractus* Selenka, by monotypy.

Psolus (*Hypopsolus*) Bell, 1882, p. 648; type-species *ambulator* Bell, by monotypy.

Theelia Ludwig, 1892, p. 350 (preoccupied by *Theelia* Schlumberger, 1891).

Type-species: *Holothuria cuvieria* Cuvier. (By original tautonymy).

Diagnosis: Psolids with five conspicuous radially placed oral valves. Anus with five or more inconspicuous valves. Sole with extremely numerous tube feet in all three radii, and scattered in two interradii. Large dorsal scales covered with leathery skin. Dorsal surface with scattered pores which contain tube feet, and which pass through or between scales. Tentacles 15. More than 25 Polian vesicles.

Content of the genus *Ceto* and status of *Cuvieria porifera* Studer:

Ceto is here regarded as monotypic. Studer (1877) described *Cuvieria porifera* from Royal Sound, Kerguelen Island, 65 fathoms. He diagnosed the species as follows:

"Dorsum medium alepidotum, sulcis deussatis corrugatum, interstitus 1-2 porosis, granulis raris munitis, margine squamis 1-2 porosis tectum. Facies ventralis mollis, ambulacris marginalibus, mediano nullo. Color fuscus. Hab. Kerguelen."

Theel (1886, p. 130) noted that the description is "... very summary and unsatisfactory. The species is possibly identical with Bell's *Psolus ambulator*" (*Psolus ambulator*=*Ceto cuvieria*; see synonymy below). Ludwig (1892) essentially repeated Theel's suggestion, and in a later paper (1898) synonymized the two "species" under the name *Theelia porifera*. Subsequently, some authors have come to regard *porifera* as a synonym of the species here referred to as *cuvieria*. Others, of whom the most recent is Clark (1946), have maintained that they are distinct.

The presence of very numerous tube feet in the midventral radius of *Ceto cuvieria* immediately separates that species from *porifera*, in which Studer (1877, p. 452) notes that the midventral radius is naked. I have not been able to examine material of *Cuvieria porifera*, and until more material becomes available, the status of the species is problematical. It is possible, however, that *Psolidium incertum* (Theel) from the vicinity of Kerguelen Island is synonymous with *Cuvieria porifera*. In his original description, Theel (1886, p. 86) notes that *P. incertum* has a naked midventral radius and that the dorsal

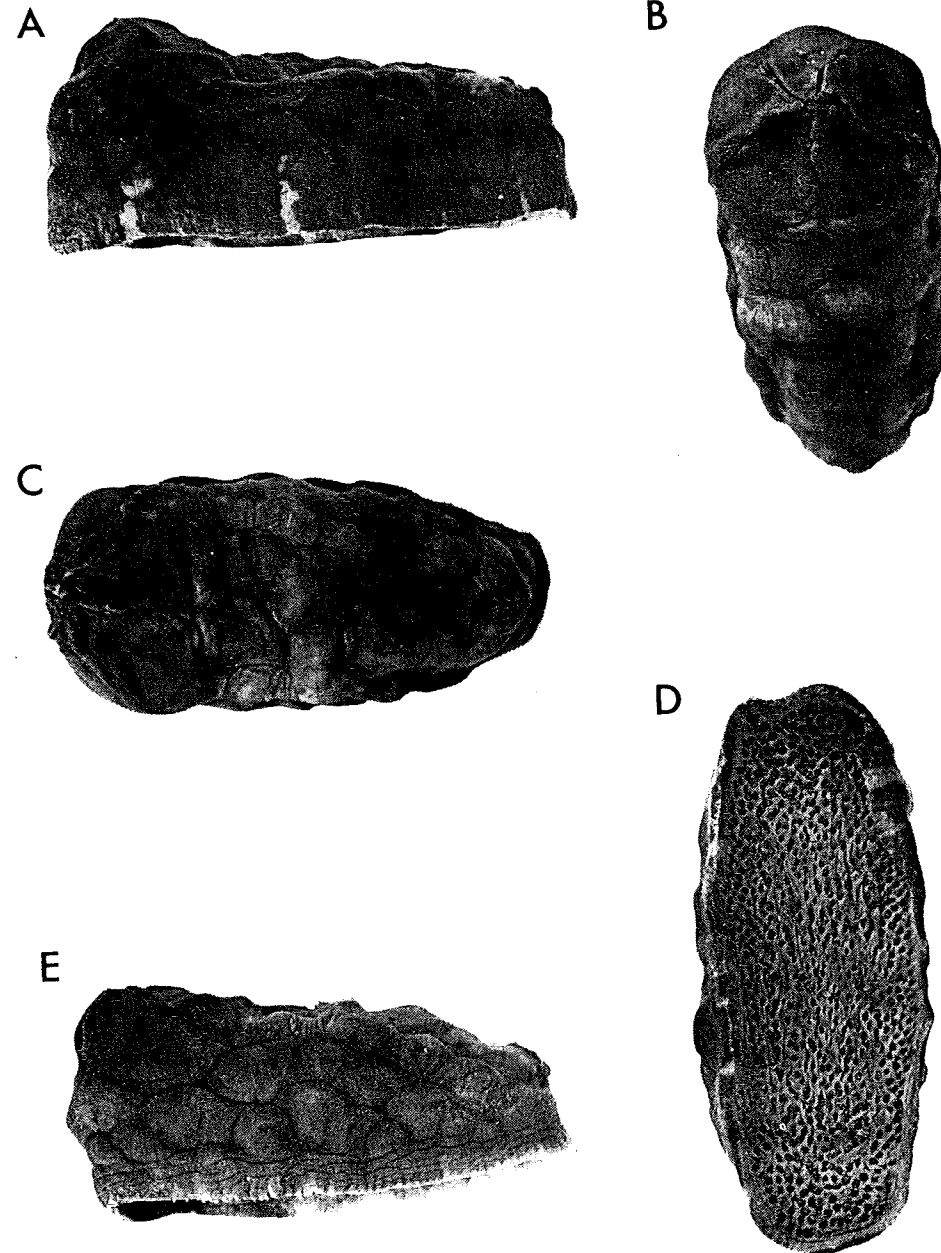


Figure 2.—*Ceto cuvieria* (Cuvier). A. Lateral view, 71mm specimen from locality 2. B. Oral view, 63 mm specimen from locality 1. C. Dorsal view, 63 mm specimen from locality 1; note dorsal pores. D. Ventral view, 71 mm specimen from locality 2. E. Lateral view, 63 mm specimen from locality 1, showing conspicuous dorsal pores.

scales carry one, two or three small pores. As both species are from the same general locality, and as both share the morphological features discussed above, the evidence for uniting them is quite strong. At least, the species *poriferus* should be referred to the genus *Psolidium*. The synonymy of the species is given here.

***Psolidium poriferum* (Studer)**

Cuvieria porifera Studer, 1877, p. 452; 1879, p. p. 123.

Psolus poriferus: Lampert, 1886, p. 122; Theel, 1886, p. 130; Lampert, 1889, p. 854.

Theelia porifera (part): Ludwig, 1898, p. 52.

Theelia ambulatrix: Erwe, 1913, p. 358.

The synonymy of *Ceto cuvieria* is now as follows:

***Ceto cuvieria* (Cuvier)**

Figures 1-3

Holothuria cuvieria: Cuvier, 1817, pl. 15 fig. 9; Blainville, 1821, p. 315; 1834, p. 192.

Cuvieria cuvieria: Jäger, 1833, p. 20.

Stolnus cataphractus: Selenka, 1868, p. 110, pl. 8 figs. 1,2; Clark, 1946, p. 413.

Psolus cuvierius: Semper, 1868, p. 63, 240.

Psolus (Hypopsolus) ambulatrix: Bell, 1882, p. 648, pl. 48 fig. 2.

Psolus ambulatrix: Lampert, 1885, p. 118; Theel, 1886, p. 131.

Psolus cuvieria: Lampert, 1885, p. 121.

Psolus cataphractus: Theel, 1886, p. 131.

Theelia ambulatrix: Ludwig, 1892, p. 350; 1894, p. 136, Erwe, 1913, p. 358.

Theelia cataphracta: Ludwig, 1892, p. 350.

Theelia porifera (part): Ludwig, 1898, p. 52.

Diagnosis: As for the genus (see above).

Remarks: Only approximately six specimens of this species have been recorded. Selenka (1868) had access to two specimens, and the remaining authors (Cuvier, 1817; Bell, 1882; Theel, 1886; Erwe, 1913) apparently each had one specimen at his disposal.

Material Examined: Six specimens from three localities, as follows:

1. Smith Rock, Recherche Archipelago, Southwest Australia, 15-37 fathoms (27-66 metres), 2 Feb., 1960, coll. R. W. George on "Bluefin", 2 specimens.

2. Four miles off Dunsborough, Geographe Bay, Western Australia, 55 feet (16.5 metres), 18 April, 1960, coll. B. R. Wilson, 3 specimens.

3. Three miles off Dunsborough, Western Australia, 50 feet (15 metres), 20 Dec., 1961, coll. B. R. Wilson and R. Slack-Smith, 1 specimen.

Description

External features: Total length of sole 58-71 mm. All specimens but one (locality 3) with tentacles retracted. Body elongate, oval, with well-defined flat sole; dorsal surface arched, mouth anterior dorsal, surrounded by five conspicuous radially placed triangular oral valves;

less conspicuous anus posterior dorsal surrounded by five or more very small valves (Fig. 2c). Expanded specimen with 15 richly branched tentacles, all of approximately equal size. Colour in alcohol variable; specimens from localities 2 and 3 dark brown to black dorsally, with scattered grey-brown patches dorsally and laterally. Sole uniformly dark grey to grey-brown or black. Specimens from locality 1 mottled and variegated dark grey or greyish white dorsally; sole dark grey to greyish-white. In expanded specimen from locality 3, tentacles and introvert uniformly black.

Dorsal surface of body extremely thick (2-3 mm), consisting of several large scales up to 1 cm in diameter, overlain by thick leathery rugose skin filled with calcareous deposits. Scattered on dorsal surface but tending to be concentrated in areas of dorsal radii are pores, through which pass small tube feet, which are often retracted. Pores either single, or in pairs, sometimes superficially resembling echinoid diplopores. In greyish coloured specimen from locality 1, pores conspicuous, black, approximately 0.5 mm in diameter. In other specimens pores less conspicuous against darker coloured background. On dorsal surface of greyish specimen are 27 pores; of these 8 are located close to anal aperture. This total of 27 includes a single pore on each of the large oral valves; in some specimens, the pores are more frequently double than single; this is especially noticeable on the oral valves. Dissection shows that well developed tube feet pass either between large dorsal plates, or through them. The holes which pass through the plates, often take a meandering course.

Dorsal surface fringed toward ventral surface by numerous smaller plates; these form well-defined edge to dorsal surface, delimiting it from sole.

Sole thick, leathery, with extremely numerous tube feet, which are closely aggregated at anterior and posterior ends of sole and along lateral ventral radii. They are less numerous near centre of sole, but are nevertheless present in large numbers on midventral radius and scattered all over interradial areas. Tubefeet highly retractile, and can be retracted deep into sole, leaving conspicuous holes. Scattered around sharp ventral edge of dorsal surface are small tubefeet, which are presumably sensory.

Internal features: Dissection rendered extremely difficult by thickness of dorsal body wall and sole. Internal anatomy presents many unusual features, which will form subject of later paper. One specimen (female) dissected; briefly, major features are as follows:—

Gut typical, with single coil. Respiratory trees well developed, short, less than $\frac{1}{2}$ body length with numerous branches. Stone canal short, terminating in nodular madreporite located on right side of dorsal mesentery. Polian vesicles numerous, 28 being regularly scattered around posterior edge of calcareous ring. Vesicles bulbous, large, up to 10 mm in length.

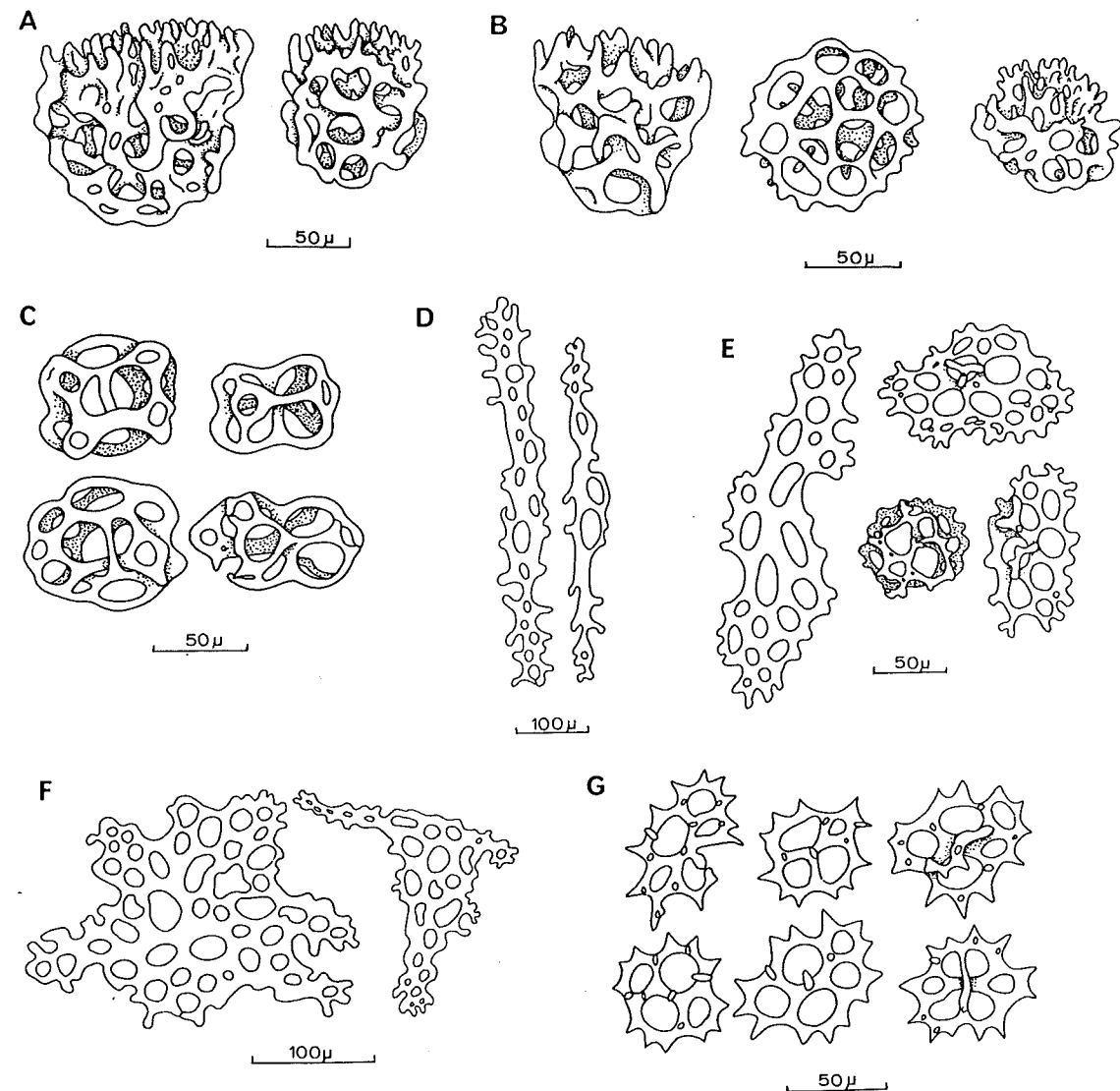


Figure 3.—*Ceto cuvieria* (Cuvier). A. Cup-shaped deposits from dorsal surface of body. B. Simpler types of cup-shaped deposits from sole. C. Open meshwork deposits from dorsal surface of body. D. Perforated rods from stems of tentacles. E. Deposits from tube feet. F. Smaller plates from branches of tentacles. G. One- to two-layered deposits from stems of tentacles.

Retractor muscles short, well developed, attaching to radial longitudinal muscles by means of a muscular membrane at a level slightly posterior to oral valve complex. Radial longitudinal muscles thin straps. Circular muscles well developed, thrown into ridges about 2-4 mm apart.

Gonad a bunch of unbranched caeca up to approximately 20 mm long, originating anteriorly at level of posterior edge of oral valves. Caeca contain eggs approximately 0.8 mm in diameter. Genital duct short, opening to exterior mid-dorsally within crown of tentacles.

Calcareous deposits: Scales on dorsal surface rounded, smooth, extremely thick (1.8 mm), joined to each other by flexible leathery integument. Overlying massive dorsal plates are two kinds of deposits. First type are longer than broad, consisting of an open meshwork of calcite (Fig. 3C) somewhat reminiscent of the hourglass-shaped deposits in some species of *Lissothuria* (see Pawson, 1967). These are extremely numerous, averaging 93 μ in length. Also present and also extremely numerous are second type, dense deposits, approximately cup-shaped, with one end rounded and the other truncate (Fig. 3A). Cup consists of a dense and intricate network of calcite. Truncate surface carries numerous rounded projections. Average length of cups 105 μ ; average greatest width, across truncate portion, 90 μ .

Sole contains "cups" which show some similarities to those of dorsal surface, except that cup portion is generally shorter, and sole spicules tend to be somewhat flatter than those from dorsal surface. However, as in cups of dorsal surface, one side of cup is rounded, while other carries numerous short projections, and entire spicule is composed of complex network of calcite (Fig. 3B). Average diameter across greatest width of cups is 96 μ . No "hourglass-shaped" deposits found in sole.

Tubefeet of sole with well-developed 1-2 layered end plates approximately 800 μ in diameter. These are surrounded by smaller perforated plates which may be simple and one-layered or two-layered (Fig. 3E), and vary greatly in size. Dorsal tube feet apparently lack end plates but do contain numerous one-layered perforated plates, polygonal to circular, 136 μ in average length.

Branches of tentacles armored with massive curved plates with numerous perforations, the plates variable in shape, up to 1.1 mm long. Numerous smaller, simpler plates (Fig. 3F), greatly variable in shape and size, also present. Stems of tentacles contain elongate perforated rods (Fig. 3D) and also perforated one-to two-layered "buttons" with marginal and surface projections (Fig. 3G). All obviously derived from a four-holed form, in which two holes are larger than others.

Additional material: British Museum (Natural History) specimen No. 63.9.23.32, (holotype of *Psolus (Hypopsolus) ambulator* Bell, 1882). Specimen virtually identical to those described above. Cups in sole slightly smaller (average diameter 88 μ) than those in Western Australian Museum specimens.

Distribution: Until now, no definite locality data have been available for this species. Jäger (1833), Selenka (1868), Bell (1882), Theel (1886) and Ludwig (1898) merely cite "Australia" as the locality for their material. Erwe (1913) described a single specimen from the collection of the museum at Perth, Western Australia. The present records definitely establish the fact that the species occurs off South West Australia, in depths of 15-66 metres.

Remarks

The major morphological features of the present specimens agree in large part with those described by Selenka (1868), Bell (1882) and Theel (1886). None of these authors, however, called attention to a most conspicuous feature of this species, and that is that the oral valves are radial in position, while in all other psolids with large oral valves they are interradial. Further, although both Bell (1882) and Theel (1886) described the pores in the dorsal surface of the body, neither noted that the pores contain well-developed tube feet. The feet can be completely retracted within the pores, and usually they are retracted so that they are not visible without dissection. The most remarkable feature of the internal anatomy is the presence of a large number of Polian vesicles. Selenka (1868) noted that a "large number" (p. 111) of Polian vesicles are present, while in the specimen dissected here, there are 28 vesicles.

The relationships of *Ceto cuvieria* are not clear. Within the Psolidae, the cosmopolitan genus *Psolidium* Ludwig and the New World tropics genus *Lissothuria* Verrill also carry tube feet on the dorsal surface of the body, and the latter genus has hourglass-shaped deposits (see Pawson, 1967) which show some similarities to those of the present species. But the presence in *Ceto cuvieria* of radially placed oral valves, a large number of Polian vesicles, 15 tentacles, and a thick leathery skin overlying the scales sharply distinguish the species from all others in the family Psolidae.

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