

## THE REDISCOVERY OF *HALITYLE REGULARIS* FISHER (ECHINODERMATA : ASTEROIDEA)

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and

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### ABSTRACT

New information on the morphology and colour of *Halityle regularis* Fisher is given, and its known geographic range is extended from the Philippine Islands to the eastern and western coasts of Australia, the east coast of Africa, and Madagascar. The synonymy of *H. anamesus* H.L. Clark with *H. regularis* is substantiated.

### INTRODUCTION

*Halityle regularis*, from the Philippines, was described by Fisher in 1913, and *Culcitaster anamesus*, from Western Australia, by H.L. Clark in 1914. The genera were synonymized by Fisher (1919) and the species by Döderlein (1935), without comment by the latter.

The species was previously known only from the Philippines (Fisher, 1913, 1919; Domantay and Roxas, 1938) and from an unknown locality in Western Australia.

Recently, further specimens of *H. regularis* were collected in the waters of the Philippines, the east and west coasts of Australia, the east coast of Africa and Madagascar. The discovery of *H. regularis* in eastern Australian

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waters immediately raised the question of the status of the Western Australian species. This new material has enabled a reappraisal of the nominal species within this genus. Fifteen specimens have been examined by us, and their data, plus those for the holotype, are included in this paper. Enquiries have failed to locate the third specimen mentioned by Fisher, 1919. Only the type (USNM 32634), illustrated by Fisher and one without locality (USNM 40867) remain in the USNM collection.

Although the morphology of *H. regularis* has been well described and illustrated by Fisher (1913, 1919), details of the colour and appearance of the living starfish have not been available until now. When alive, *Halityle regularis* bears some resemblance to its close relative *Culcita*, having the same general shape and similar dorsal colouring; this may be why such a large and conspicuous shallow water asteroid was not described until 1913, and why it has gone unnoticed since. The underside of this starfish is, however, very different from *Culcita*, and has a spectacular colour pattern which distinguishes the genus at a glance.

Abbreviations used in this paper:

AM	= Australian Museum, Sydney
BMNH	= British Museum (Natural History)
JCU	= James Cook University of North Queensland, Townsville
MCZ	= Museum of Comparative Zoology, Harvard
NMNZ	= National Museum of New Zealand, Wellington
USNM	= United States National Museum, Washington
WAM	= Western Australian Museum, Perth
IIOE	= International Indian Ocean Expedition
(H)	= holotype

Measurements of R were made to the arm end, not to the end of the ambulacral furrow.

Order VALVATIDA Perrier, 1884  
Suborder GRANULOSINA Perrier, 1894  
Family OREASTERIDAE Fisher, 1911  
Genus *Halityle* Fisher, 1913  
*Halityle regularis* Fisher  
(Plate 1, a-d)

*Halityle regularis* Fisher, 1913 : 211.  
*Culcitaster anamesus* H.L. Clark, 1914 : 144-146, pl. XIX.  
*Halityle regularis* Fisher, 1919 : 362-366, pl. 94,  
 figs 7, 7a; pl. 95, fig. 10; pl. 98, fig. 1; pl. 99, figs 1, 2; pl. 100, figs 2, 3.  
*Halityle anamesus* (H.L. Clark), Fisher 1919 : 362.  
*Halityle regularis* Fisher, Döderlein, 1935 : 108.  
*Halityle regularis* Fisher, H.L. Clark, 1946 : 109.  
*Halityle anamesus* (H.L. Clark), H.L. Clark, 1946 : 109.  
*Halityle* Hyman, 1955 : 334, fig. 140 [*H. regularis* Fisher].  
*Halityle regularis* Fisher, Clark and Rowe, 1971 : 34, 53.

### Material Examined

Fifteen specimens as follows: One specimen, channel between Heron I. and Wistari reef, Queensland, 34 m, A.K. O'Gower, 16.XII.1970, NMNZ Ech. 1828; one specimen on sandy rubble, Keppel Bay, Queensland, 3 m, pres. N. Coleman, -.IX.1974, AM J8662; one specimen, 20 km NE of Townsville, Queensland, trawled at 24 m, R.A. Birtles, 3.VIII.1974, JCU; one specimen, no locality, USNM 40867 (identified by W.K. Fisher); one specimen, 1.6 km north of Malanipa I., Basilan Straits, Sulu Archipelago, Philippines, 11 m, lithothamnion, B.R. Wilson on *Pele*, 12.II.1964, WAM 147-71; two specimens off Somalia coast, 9°41'N, 51°03'E, trawled at 60-70 m, R.U. Gooding on *Anton Bruun*, stn 9-445, IIOE, 16.XII.1964, ident. F.H.C. Hotchkiss, USNM E13719; one specimen, in alcohol, off Somalia coast, 10°03'N, 51°15'E, trawled, 59-61 m, *Anton Bruun*, stn 9-448, IIOE, 17.XII.1964, ident. F.H.C. Hotchkiss, USNM E13720; one specimen, North Kenya Banks, east Africa, dredged at 91 m, A.J. Bruce on R.V. *Manihine*, cr. 333, stn dr. 16, 10.XII.1971, BMNH 1974.2.6.22; one specimen, SW of Isles Mitsio, near Nosy Bé, Madagascar, 13°02.5'S, 48°21.5'E to 13°00.5'S, 48°22.5'E, trawled, 59-45 m, R/V *Vauban*, coll. A.G. Humes, 19.VI.1967, det. J.F. Clark, MCZ 4302; two specimens, SW of Isles Mitsio, near Nosy Bé, Madagascar, 13°02.5'S, 48°21.5'E to 13°05.5'S, 48°20.5'E, trawled, 59-38 m, R/V *Vauban*, coll. A.G. Humes, 19.VI.1967, det. J.F. Clark, MCZ 4303; one specimen, near Isles Mitsio, NE of Nosy Bé, Madagascar, 13°05'S, 48°22.5'E to 13°05'S, 48°21.5'E, 30 m, coll. A.G. Humes, 18.VIII.1967, det. J.F. Clark, MCZ 4296; *H. anamesus*, Holotype, said to be from Western Australia, WAM 13-62; one specimen, near Sunday I., Exmouth Gulf, W.A., trawled at 12-18 m, R. Rowe on *Jurabi*, -.VIII.1973, WAM 228-73.

### Description

The specimens are massive, with short, broadly based arms, inflated

abactinal and concave actinal surfaces, (Pl. 1). R/r varies from 1.18 to 1.66. The sides are perpendicular and there are up to 22 superomarginal plates and 40-50 inferomarginals, in each arc. The abactinal surface bears no spines or tubercles, but the stellate plates are joined by slightly raised, slender trabeculae, which divide the surface into regular triangular papular areas, grouped in adjacent hexagons. At the centre of the disc the hexagons may form a large pentagon.

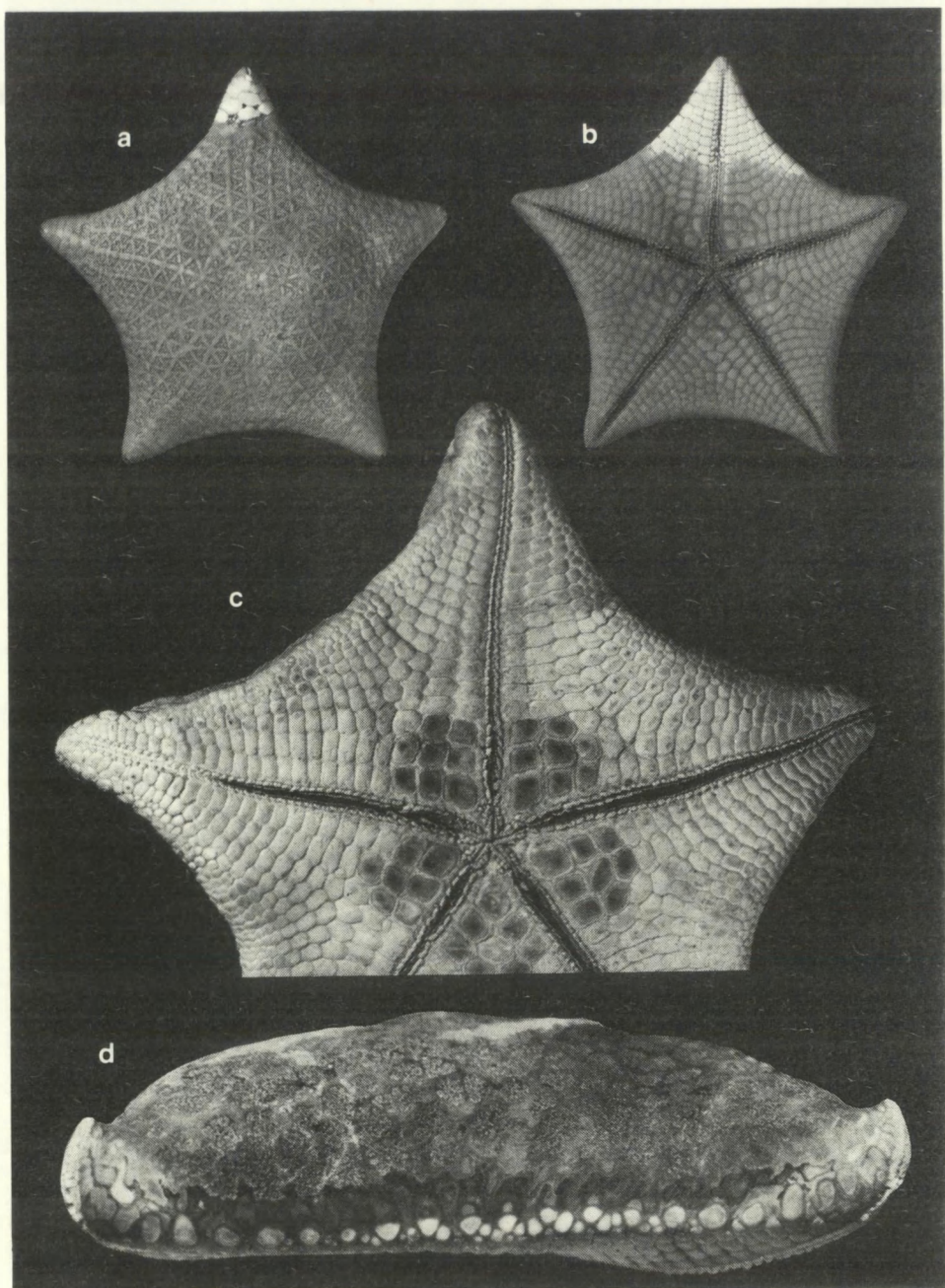
The whole abactinal surface is finely granular, with scattered minute granuliform pedicellariae. The actinal intermediate plates are clearly outlined by sutural grooves, and their slightly tumid surfaces are covered with a close mosaic of unequal, flattish granules and occasional sunken pedicellariae. The plates are arranged in three regular chevrons of transversely oblong plates, with an odd plate at the apex, followed by about 6 less regular chevrons of radially elongate, hexagonal plates without an unpaired interradiial plate. Towards the margin they become smaller and less regularly arranged, tending to impinge on the lateral wall of the disc between the lower edge of the proximal inferomarginal plates. Near the mouth are 4-8 slightly larger rhombic plates, each of which is surrounded by a double or triple row of spaced granules and pedicellariae forming a kind of frame. These plates are flat, or slightly concave, with a very close compacted mosaic of flat granules; near the margins, pit-like spaces occur between the granules. Together, the plates form a striking stellate-pentagonal pattern centred on the mouth (Pl. 1,c).

The adambulacral plates bear a perpendicular furrow comb of 8-11 slender, closely adpressed, flat spines, behind which are 2 or 3 short, domed spines with wrinkled tips. The mouth spines number 12-15. The end of each ray is turned upwards, and there is a small sharp, wide-based spine borne on the terminal plate. This spine is lost from most of the large specimens and was not included in the description of the holotype.

### Variations

There is considerable variation in the shape of *Halityle*. The Philippine specimens and the two Queensland examples from Townsville and Heron Island have high lateral walls to the disc, formed by the vertical extensions of the superomarginal plates. The other Australian specimens, and those from Madagascar, have less well developed superomarginals, and the lateral walls are consequently lower.

The number of inferomarginal plates also varies (Table I), and in the larger Australian specimens their size is reduced and their placement somewhat irregular owing to intercalation and overgrowth by plates from the oral



**Plate 1:** *Halityle regularis*. *a*, *b* abactinal and actinal views of Somalia specimens (R = 57 and 61 mm); *c* actinal surface of Exmouth specimen (R = 161 mm); *d* lateral view of Townsville specimen (R = 160 mm) showing the intercalation of actinal plates between the reduced inferomarginal plates.

surface (Pl. 1,d). Both sets of marginal plates are partly concealed by thick granular skin in the median interradiar areas in the specimens from Western Australia, Keppel Bay and Madagascar.

The specimens range in size from R of 54 mm to 162 mm, but there is remarkably little change during growth.

Even the smallest specimen (R = 54 mm, from Madagascar) has a skeletal meshwork of small plates joined by trabeculae but near the ends of the rays the last 3 or 4 radial and adjacent lateral plates are larger, somewhat tumid and joined by short trabeculae. Like the larger Madagascar specimens the inferomarginals are obscured by actinal plates but the superomarginals are visible although covered by thick granular skin.

Variation in the R to r ratio (Table I) is not dependent on size but the ratio of R to arm width (20 mm from the tip) does increase with size reflecting the extended and relatively narrow arms of very large specimens.

There is considerable variation in the abundance of pedicellariae among the specimens examined but their shape varies little. There are few granuliform pedicellariae in each aboral papular area in the types of *Halityle regularis*, *H. anamesus* and in the Keppel Bay, Exmouth and Kenya specimens but they are numerous in the Basilan and Somalia specimens. On the inferomarginal plates small pedicellariae are abundant on all but the east African specimens in which they are scarce or wanting while in the Basilan specimen some are elongated, corresponding to three granules in length. On the actinal intermediate plates bivalved pedicellariae corresponding to one to three granules in length are numerous on all but the east African specimens. Large lanceolate pedicellariae occur outside and sometimes between the groups of subambulacral spines. These pedicellariae are somewhat irregular in shape but most frequently square tipped or pointed. In the types of *H. regularis* and *H. anamesus* both square and pointed pedicellariae are found.

The number of papular pores per area increases with size from 20 to 30 in the smallest specimens to about 100 in the largest. The type of *H. regularis* has 50 to 70 pores in an area.

The material at hand shows three colour variations, but no colour notes are available for the Somalia specimens; they are now 'museum colour' with the four prominent oral interradiar plates light orange with a deeper orange border. The Kenya specimen, although faded, has four prominent violet plates, outlined with orange granules, near the mouth interradially.

In the Heron Island specimen the trabeculae of the abactinal surface and sides were maroon in the living animal, and the triangular papular areas were conspicuously lighter, being orange-yellow with spots of dark maroon

TABLE 1. Data from 16 specimens of *Halityle regularis*.

Locality	Reg. No.	R	r	R : r	Arm width at 20 mm	Ratio R : Arm W	No. of inferomarginals
Madagascar	MCZ 4302	54	37	1.46	38	1.42	26
Somalia	USNM E13719	57	40	1.43	28	2.04	24
Somalia	USNM E13719	61	41	1.49	27	2.26	32
Somalia	USNM E13720	73	48	1.52	21	3.48	30
Madagascar	MCZ 4303	86	73	1.18	50	1.70	35
Madagascar	MCZ 4303	95	78	1.21	56	1.70	37
Kenya	BMNH 1974.2.6.22	93	64	1.45	24	3.87	28
Philippines	USNM 32634 (H)	122	89	1.37	40	3.05	40
Philippines	USNM 40867	126	90	1.40	42	3.00	40
Philippines	WAM 147-71	139	100	1.39	38	3.66	40
Madagascar	MCZ 4296	150	90	1.66	30	5.0	40
Keppel Bay	AM J8662	154	95	1.62	30	5.13	48
Heron I.	NMNZ 1828	154	96	1.60	34	4.53	50
Townsville	JCU	160	105	1.52	34	4.70	40
Exmouth	WAM 228-73	161	100	1.61	28	5.75	43
Western Australia	WAM 13-62 (H)	162	102	1.59	28	5.78	48

pigment. The actinal surface was very strikingly coloured in a distinct pattern. The inferomarginal and bordering intermediate plates were maroon, but this colour lightened to pink on the underside proper, although the sutural grooves between the plates remained dark. The mouth spines, adambulacral furrow combs, and the row of tubercular spines behind, were pure white, and the tubefeet orange. At the tip of each arm there was a lens-shaped patch of orange either side of the ambulacral groove, and the terminal spines were also orange. The stellate group of plates at the mouth angles were bright violet, and each plate was surrounded by a band of vivid orange.

The dried Keppel Bay specimen is brown with the stellate group of violet plates near the mouth angles bordered by orange granules.

The colour of the Philippine specimen, WAM 147-71, was recorded shortly after preservation. The plates and trabeculae of the aboral surface were a rich purple, the papular areas pale yellow; the central four to six plates near the mouth angles were orange and the adambulacral spines dirty white.

The colour of the Exmouth, W.A., specimen, WAM 228-73, was recorded when the asteroid was received frozen at the Western Australian Museum.

The aboral surface was a uniform bright orange, the oral surface light apricot orange and the furrow spines cream. The eight plates near the mouth angles were bright violet bordered by a band of orange granules.

### Distribution

*Halityle regularis* is now known from the Philippine Islands south to about the tropic of Capricorn on both east and west coasts of Australia, and from the coasts of east Africa and Madagascar. It may be expected to occur along the northern shore of the Indian Ocean. The species is still known from a few widely distributed specimens, taken in fairly shallow water (3 to 90 m). The substrate, where recorded, was sandy rubble, coral or lithothamnion.

### Remarks

The new material of *Halityle regularis* agrees well with Fisher's (1913, 1919) descriptions. The size range now available shows that there is little morphological change throughout growth. The arms become slightly longer and narrower with increasing size and the marginal plates, prominent in most small and medium sized specimens, tend to be obscured by thick skin and intercalated by actinal plates in very large specimens.

The most startling new feature of the specimens is their fresh colour, particularly that of the oral surface.

Fisher's description of the living colour of the types as "maroon red on ventral surface; darker on dorsal surface" was of course second-hand, being based on notes recorded by the collectors on board the USFS *Albatross* while in Philippine waters. Considering that the colour notes on the *Albatross* specimens are few and far between in Fisher's report, and that there is not even a mention of the spectacular colours of such genera as *Asterodiscus* and *Oreaster*, one must assume that the notes on *Halityle* were minimal. Among the Australian specimens, the one from Heron Island is closest to the above description, with the exception of the spectacular violet plates near the mouth, which were not mentioned by Fisher. Although the general colour is variable, there is some constancy in the colour of the plates near the mouth: violet in the Kenyan and Australian examples, and bright orange in the Philippine and Somalia specimens.

The second nominal species, *H. anamesus* (H.L. Clark), synonymized with *H. regularis* Fisher by Döderlein (1935), was originally described under the new generic name of *Culcitaster*. Fisher (1919) subsequently synonymized that genus with *Halityle* but did not comment on the status of the species.



Döderlein listed *H. anamesus* in the synonymy of *H. regularis* without comment and apparently without examining any specimens. Observations on the present specimens show that despite considerable difference in appearance between the types of *H. regularis* and *H. anamesus*, due to concealment of the inferomarginal plates by the overgrowth and intercalation of actinal plates and increase in skin thickness over the superomarginals in the latter, the differences are a matter of degree rather than a real difference. Fisher noted the intercalation of actinal plates among the inferomarginals in an incipient form in the type. The specimens examined show great variation in this feature which is most obvious in very large Australian specimens but was also seen in the four Madagascar specimens which ranged in size from R of 54 mm to 150 mm whereas it is not at all evident in the other four east African examples (Pl. 1, a,b).

The present study therefore confirms Döderlein's hitherto unsubstantiated view that *Halityle anamesus* is a junior synonym of *H. regularis*.

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