

## Opisthobranch molluscs from the Chagos Archipelago, Central Indian Ocean

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The 1996 Chagos expedition collected 128 specimens of opisthobranch gastropods representing at least 50 species, of which only 41 species are described in this paper: two cephalaspideans both belonging to the genus *Chelidonura*, two sacoglossan species of *Thuridilla*, one sea hare with problematic taxonomy, and 36 species of nudibranchs. Of the nudibranchs, all the sub-orders are represented by one or two species only except the dorids, which comprise the majority of the collection. Two species are allocated to genus only, one species each of *Phyllidiopsis* and *Dermatobranchus*, while two species are similar to known species. Numerous species of Phyllidiidae were collected, but only 10 are confidently assigned to a taxon. The taxonomic identities of *Hoplodoris pustulata*, *Dendrodoris tuberculosa*, *Phyllidiopsis xishaensis* and *Phyllidiella striata* are defined and discussed. There are four new distribution records for the Indian Ocean and several species are of interest as they have been rarely recorded.

KEYWORDS: Chagos, Indian Ocean, opisthobranchs, systematics, taxonomy, zoogeography.

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### Introduction

The opisthobranch fauna of the Chagos is not well known. There have been several previous collections of molluscs from the archipelago, but the number of opisthobranchs adequately described is limited: lists of shelled marine molluscs were reported upon by a number of French malacologists (Poisson, 1953). J. Stanley Gardiner visited the Chagos during the Indian Ocean Percy Sladen Trust Expedition on board HMS *Sealark* in 1905 (Gardiner, 1936); his collection of nudibranchs was described, with one plate of illustrations, by Eliot (1910). Taylor's (1971) expedition to Diego Garcia resulted in a collection of molluscs, but no opisthobranchs, and Sheppard (1984) visited the Chagos during the Joint Services Expedition of 1978–79, also collecting shelled molluscs; she produced a list including seven species of opisthobranchs. Thus, only six records of opisthobranch species from the

Chagos have been supported by taxonomic descriptions and illustrations, of which only one, *Phyllidia varicosa*, was also present in this collection; the other five species are:

- *Marioniopsis cyanobranchiata* (Rüppell and Leuckart, 1831): Indo-West Pacific: Red Sea and South Africa to the Philippines (Yonow, 2000).
- *Asteronotus cespitosus* (van Hasselt, 1824): Indo-West Pacific: Red Sea (Yonow, 2000) and East Africa to Hawaii (Gosliner *et al.*, 1996).
- *Discodoris fragilis* (Alder and Hancock, 1864): Indo-West Pacific: Red Sea, East and South Africa to Hawaii (Yonow and Hayward, 1991).
- *Discodoris mauritiana* (Bergh, 1889): Indo-West Pacific: Tanzania to Japan (Yonow and Hayward, 1991).
- *Kentrodoris rubescens* Bergh, 1876: Indo-West Pacific: East Africa to the Palau Islands and the Philippines (Marcus, 1976; Yonow, 1984).

The nearest regions to Chagos where the opisthobranch fauna has been sampled are the Maldives (Eliot, 1906a (and Laccadives); Marcus and Marcus, 1960; Yonow, 1994a), Sri Lanka (Kelaart, 1858, 1859; Alder and Hancock, 1864 (and India); Farran, 1905; Eliot, 1906b (and India); Eliot, 1909; White, 1948; Yonow, 1984); the Seychelles (Eliot, 1910); Madagascar, Mauritius, and Réunion (Quoy and Gaimard, 1832; Bergh, 1889; Risbec, 1929; Marcus and Marcus, 1970; Yonow and Hayward, 1991), Christmas Island (Wells *et al.*, 1990) and Western Australia (Jensen and Wells, 1990; Jensen, 1993; Wells and Bryce, 1993; Jensen, 1997). Each of these collections yielded a substantial number of new species, contributing to our knowledge of a rich Indian Ocean fauna.

During 4 weeks of the 1996 Chagos Expedition, 128 specimens of opisthobranchs were collected from the archipelago. These represent at least 50 species, although only 41 are discussed here; the remaining phyllidiids have been retained for consideration in an ongoing review of this family. Two species were recorded by colour photographs only. One species was named during the course of this work: *Hoplodoris estrelhado* Gosliner and Behrens, 1998 was described from the Pacific and Western Australia, and its discovery from Chagos extends its distribution significantly. Two species, *Nembrotha cf. lineolata* and *Dermatobranchus* sp. must await further material before formal description is possible. *Phyllidiopsis* sp. is one of several similar species, but a review of the species complex is beyond the scope of this work.

## Methods

The two junior authors took part in The Friends of the Chagos 1996 Expedition, participating in the first 4 weeks of the expedition (5 February to 7 March 1996). Opisthobranch molluscs were collected by hand during the course of scuba-diving activities, carried out between the following dates in the following locations (figure 1): Salomon Atoll (8–18 February 1996), Peros Banhos Atoll (19–28 February and 4 March 1996), Great Chagos Bank (29 February 1996 to 3 March 1996), and Victory Bank (3 March 1996).

In most cases opisthobranchs were photographed *in situ* by R.C.A.; after collection opisthobranchs were kept alive in seawater containers while drawings and notes were made by S. G. B., prior to relaxing by freezing, and preservation in formaldehyde. All lengths are given as total length, measured while alive, unless stated

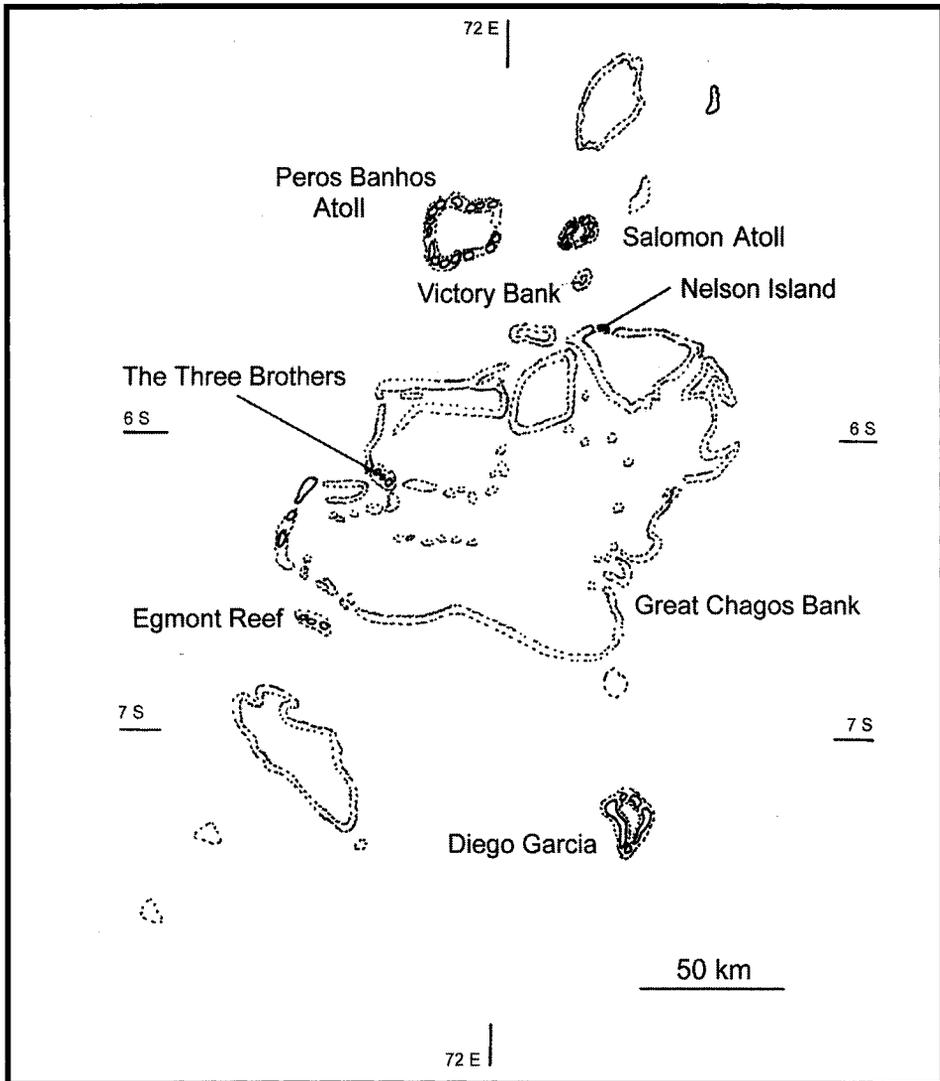


FIG. 1. Map of the Chagos Archipelago.

otherwise. All specimens of species seen only once or twice were collected but only a few specimens of species deemed common were collected. Phyllidiid nudibranchs in particular were not collected in proportion to their abundance.

In the laboratory, each specimen was examined and matched with its corresponding photographs and collecting notes. Preserved specimens were measured where necessary and are described. The radulae of several specimens were dissected out, the tissue removed with a weak solution of bleach, rinsed in fresh water, stained and flattened with lignin pink in lactophenol, and rinsed and stored in 100% alcohol prior to preparation for SEM. All specimens are deposited in the Natural History Museum, London (accession no. 2350).

## Systematics

*Chelidonra punctata* Eliot, 1903  
(figure 2a)*Chelidonura hirundinina* var. *punctata* Eliot, 1903a: 336, pl. 13, figure 2.*Chelidonura punctata*: Marcus and Marcus, 1970: 190, figures 29–31; Yonow and Hayward, 1991: 4, figure 4f.

*Material.* Chag/96/1a, b: both 50 mm; inside Ile Boddam, Salomon Atoll; 8 February 1996; at 16 m depth. Chag/96/74a, b: 22 mm, 24 mm; Three Brothers, Great Chagos Bank; 29 February 1996; at 17 m depth.



(a)



(b)



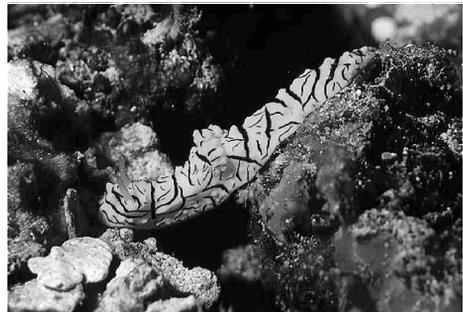
(c)



(d)



(e)



(f)

FIG. 2. (a) *Chelidonura punctata* Chag96/1: 50 mm. (b) *Chelidonura sandrana* Chag96/54: 13 mm. (c) *Thuridilla bayeri* Chag96/93: 15 mm. (d) *Aplysia* cf. *parvula* Chag96/18: 10 mm. (e) *Nembrotha lineolata* Chag96/62: 65 mm. (f) *Notodoris minor* Chag96/84a: 21 mm.

*Description.* The body was dark brown, appearing almost black, with bright orange spots and dots; these orange markings extended on to the ventral surface (figure 2a). Fine white edges were present on the parapodia, becoming less distinct and grey anteriorly. The body was slender, smooth and velvety. The left tail process was distinctly longer than the right, with orange spots in the larger specimens and without spots in the smaller. The head shield was trilobed anteriorly.

In formaldehyde specimens retain much of their original colour: the black is reduced to a fine dusting and the orange internal organs are visible through the shell and the skin. Orange pigment spots remain distinct and are present on both shields, both parapodia and on the sole. The head is distinctly trilobed. The shells of two specimens (96/74) are clearly visible and these specimens have been transferred to 70% alcohol.

*Geographic distribution.* Western Indian Ocean: East Africa (Eliot, 1903a), Madagascar (Marcus and Marcus, 1970), and Mauritius (Yonow and Hayward, 1991). In addition to this first record from the Chagos we have a new record from the Maldives (coll. R. C. Anderson and S. G. Buttress, 1996).

*Remarks.* This rarely recorded but distinctive species is similar only to *C. castanea* Yonow, 1994 from the Maldives (Yonow, 1994a) which is chocolate brown with apricot spots and a four-lobed head (see also photograph in Debelius, 1996: 132).

***Chelidonura sandrana* Rudman, 1973**  
(figure 2b)

*Chelidonura sandrana* Rudman, 1973: 208, figures 4, 5; Yonow, 1992: figure 3; Yonow, 1994a: 100, figures 2E, 4A, B; Yonow, 1994b: 144, figure 2A–C.

*Material.* Chag96/54a, b, c: 13 mm, 8 mm, 8 mm; inner reef of Petit Ile Mapou, Peros Banhos Atoll; 22 February 1996; at 14 m depth.

*Description.* All three specimens of this minute species were jet black, with only a small area of cream anteriorly; head shield with three lobes anteriorly (figure 2b). The parapodia were held tightly against the body and did not meet mid-dorsally. The left posterior process was extended into an elongated filament, more than half of body length in largest specimen (apparently broken in one of the smaller specimens).

*Geographic distribution.* Western Indian Ocean: from the Red Sea (Yonow, 1994b), Zanzibar (Rudman, 1973) and the Maldives (Yonow, 1992, 1994a).

*Remarks.* This species is usually common where it occurs, on fine silty/sandy substrata. A similar species was noted from Western Australia (Wells and Bryce, 1993), which differs in being much larger, 20 mm, brownish and covered in irregular yellowish flecks with a concentration on the tip of the head shield. *Chelidonura sandrana* is either completely black or with petaloid orange and white patterns, and with or without cream anteriorly.

***Thuridilla bayeri* (Marcus, 1965)**  
(figure 2c)

*Elysia bayeri* Marcus, 1965: 270, figures 5, 6; Carlson and Hoff, 1978: 91, figures 4, 5b, 6a, b. *Thuridilla bayeri*: Jensen, 1992: 273; Gosliner, 1995 (part): 1, figures 1a, b, 2a–c. *Thuridilla* cf. *bayeri*: Yonow, 1994a: 104, figures 5a, 6a.

*Material.* Chag96/70: 20 mm; inner reef, Petit Ile de la Passe, Peros Banhos Atoll; 28 February 1996; at 9 m depth. Chag96/93a, b: 16 mm, 15 mm; on sand near inner reef of Ile Vache Marine, Peros Banhos Atoll; 4 March 1996; at 22 m depth.

*Description.* These slender specimens were intricately patterned (figure 2c). The body was dark, with numerous fine white stripes laterally and ventrally; approximately a dozen were visible when viewed from the side. These white stripes expanded slightly at intervals along their lengths; the expansions of adjacent or alternate stripes coincided, giving the appearance of faint vertical barring laterally. There were about a dozen such bars, which appeared to be aligned with the parapodial undulations. The second and third expansions down from the parapodial edge were yellow, or alternately white and yellow, while the fourth line was alternately white and brilliant blue; there were thus about six or seven elongated blue patches submarginally as noted by Yonow (1994a). The parapodial edges were moderately undulated and edged with white; the inner surfaces of the parapodia were bright rust red. Rhinophores large, approximately one-fifth of the body length, with blunt tips. The white lateral stripes extended on to the rhinophores, continuing to the tips; the black ground colour extended only on to the base of the rhinophores before fading to white in the mid-section and then reappeared as brick red stripes distally; the overall appearance was of white rhinophores with red tips.

The three specimens are variously contracted in preservative, but the linear pattern is visible on the outer surfaces, the black as a fine speckling of very dark green. The edges of the parapodia, the anterior edge of the foot and the rhinophores are unpigmented. Inside the parapodia, the pattern, again composed of speckles, is of thicker very dark green to black lines and lighter olive green lines. In two specimens (96/70 and larger of 96/93), the body cavity contains eggs.

*Geographic distribution.* Indo-West Pacific: Seychelles (Gosliner, 1995) and the Maldives (Yonow, 1994a) to Guam (Carlson and Hoff, 1978) and the Marshall Islands (Marcus, 1965).

*Remarks.* This species shows considerable colour variation, with two colour forms occurring in the Indian Ocean: with or without blue spots on the head and with or without black and orange banding on the inside of the parapodia. A similar species is dark brown to black with cream or white lines on the parapodia, head and rhinophores and was described as *T. ratna* (Marcus, 1965). The latter is common in the Pacific, but has also been recorded from the Indian Ocean: one specimen from Madagascar (Gosliner, 1995), six from Thailand (Jensen, 1992) and one from the Seychelles (P. Kemp, colour slides). Gosliner (1995) placed *T. ratna* in the synonymy of *T. bayeri*, but recognized separate colour forms in his descriptions and illustrations. Jensen (1992, 1998) maintained the two species as distinct on the basis of colour pattern, radular morphology and differences in the reproductive system, as well as differences in habitat (the two rarely occur together), and in size of egg capsules, indicating differing development patterns.

***Thuridilla livida* (Baba, 1955)**

*Elysia livida* Baba: Carlson and Hoff, 1978: 100, figures 10c, d, 13.

*Thuridilla livida*: Jensen, 1992: table 1, p. 277; Gosliner, 1995: 11, figures 1c, 8, 9.

*Material.* Chag96/31: 8 mm; outer reef of Ile de la Passe, Salomon Atoll; 14 February 1996; at 15 m depth.

*Description.* A slender, brightly coloured species. Body brown with a series of coloured bands following parapodial margins. The margin was orange, the central band black and the inner band light blue. Orange band present laterally on head. The rhinophores were brown basally and white distally.

The minute preserved specimen is green only on the parapodia, preserved as a network of fine speckles; the eyes are clearly visible.

*Geographic distribution.* Indo-West Pacific: from Aldabra and South Africa (Gosliner, 1995) to Guam (Carlson and Hoff, 1978).

***Aplysia cf. parvula* Guilding in Mörch, 1863**  
(figures 2d, 3a, b)

*Aplysia fasciata* Poiret: Yonow, 1994a: 104, figure 4G.

*Aplysia cf. parvula*: Yonow, 2000: 94, figure 3, pl. 7.

*Material.* Chag96/18: three specimens approximately 10 mm; outer reef of Ile de la Passe, Salomon Atoll; 12 February 1996; at 19–20 m depth.

*Description.* Body dark brown, with grey margins to parapodia and grey tips to rhinophores and oral tentacles (figure 2d). White stippling absent. Parapodia enlarged, upstanding and strongly undulated, originating separately anteriorly and meeting as a low rim on the tail. Rhinophores and oral tentacles large and erect.

The three preserved specimens are well relaxed; the rolled rhinophores and oral tentacles are visible, with black pigment remaining within the tubes. The eyes are visible on all specimens and there is dark brown pigment variably remaining as a dusty covering along the edge of the foot and its sole on all specimens, in wrinkles

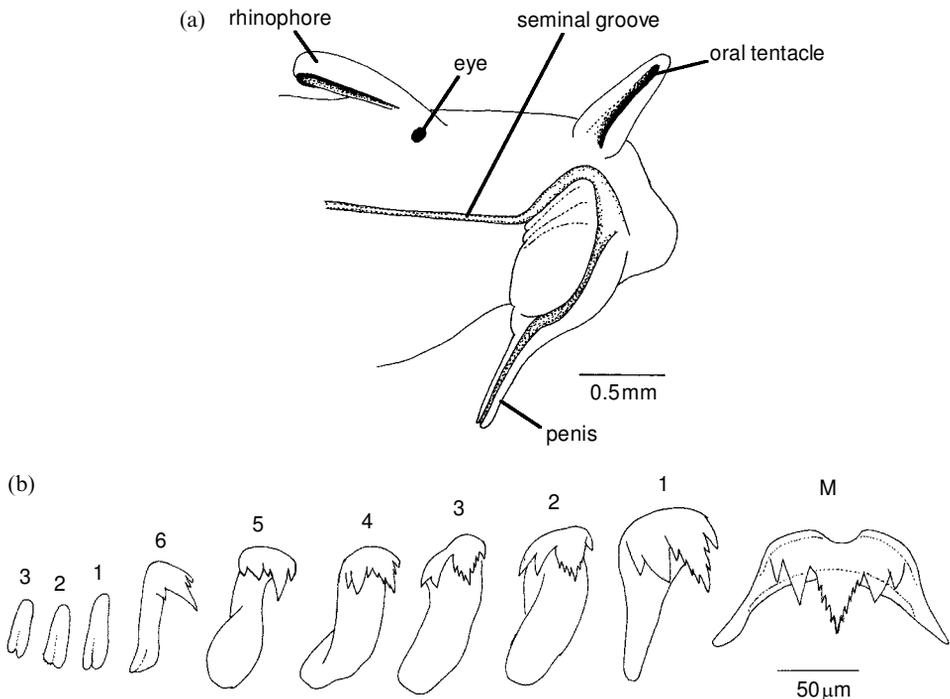


FIG. 3. *Aplysia cf. parvula* Chag96/18. (a) Extruded penis. (b) Radular teeth drawn with *camera lucida*.

of the body and around the submarginal inner edge of the parapodia of two specimens and in patches on the body of two. The parapodia remain high and frilled around the shell, which is heavily calcified and yellowish brown in all specimens. One specimen has been transferred to 70% alcohol to preserve the shell; it measures  $4 \times 3$  mm. The radula of this specimen has a formula of  $25 \times 5.7.1.7.5$ . The main cusps of the median and laterals 1–4 are serrated, while the marginals are reduced to simple plates. The penis was partly everted in a second specimen: the base is bulbous and the penis stiff and straight. The seminal groove is clearly visible (figure 3a). The radular formula of this specimen is  $22 (+ 3) \times 3.6.1.6.3$ , and is figured here (figure 3b).

*Geographic distribution.* Western Indian Ocean: Maldives (Yonow, 1994a) and the Red Sea (Yonow, 2000).

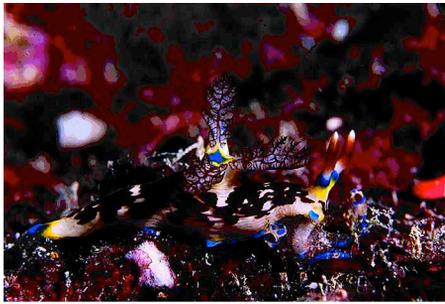
*Remarks.* The radula and shell of these specimens are very similar to those of *A. parvula* from Mauritius (Yonow and Hayward, 1991; figure 5c) and *A. gracilis* Eales, 1960 (later synonymized with *A. fasciata* by Eales, 1979), but body shape and colours differ considerably. In this species the parapodia are fused, forming a low rim on the tail, whereas in *A. parvula*, they are upstanding and join high up posteriorly. Although colour is variable in species of *Aplysia* and varies with age and diet, the specimens described here, listed in the synonymy, and additional material (two specimens from the Maldives, R.C.A. and S.G.B.) are consistently deep brown to black, sometimes with white speckling, with pale or lilac edges to the smaller parapodia. Both this species and *A. parvula* produce ink on disturbance, but live in completely different habitats despite similarities in size: this species is found on coral or rock faces covered in secondary colonizers exposed to moderately strong currents (e.g. photograph in Sharabati, 1984). Similarities and differences in shell shape, radula and penis were discussed in detail in Yonow (2000).

***Nembrotha lineolata* Bergh, 1905**  
(figures 2e, 4a, 5, 6A)

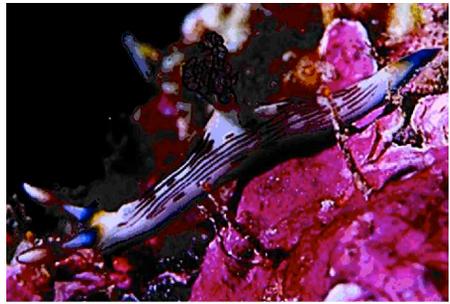
*Nembrotha lineolata* Bergh, 1905: 199, 200, pl. 2, figures 10, 11; Baba, 1976b: 131, figures 1, 2.  
*Nembrotha cf. lineolata*: Wells and Bryce, 1993: 84, figure 96.

*Material.* Chag96/62: 65 mm; inner reef, Ile du Coin, Peros Banhos Atoll; 25 February 1996; at 22 m depth; coll. J. McGlade (radular preparation). Chag96/63: 45 mm; inner reef, Ile Monpatre, Peros Banhos Atoll; 26 February 1996; at 5 m depth. Six individuals not collected: two together on sand, inner reef of Petite Ile de la Passe, Peros Banhos, 28 February 1996; at 19 m depth; three (only one photographed), Ile Fouquet, Peros Banhos, 4 March 1996, at 15 m depth; one photographed on inner reef wall, Ile Vache Marine, Peros Banhos Atoll; 4 March 1996; at 12 m depth.

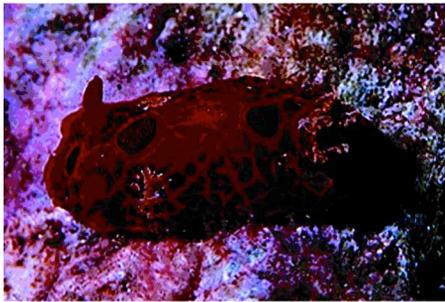
*Description.* Dorsum white with chocolate brown markings; in the smaller specimen stripes were visible but patches of brown were also present (figure 4a); in the larger specimen most of the dorsum was covered with one almost continuous chocolate brown patch (figure 2e). Foot with blue marginal and yellow submarginal bands; similar blue and yellow bands around rhinophore sheaths and bases of gill plumes. Rhinophores reddish brown with white tips. Gills tripinnate, white with reddish brown markings.



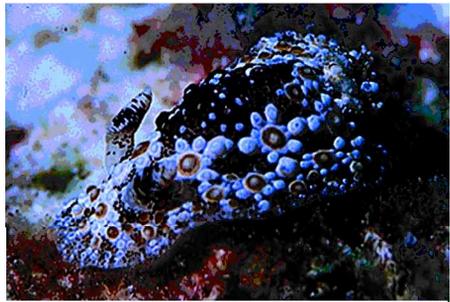
(a)



(b)



(c)



(d)



(e)



(f)



(g)



(h)

FIG. 4. (a) *Nembrotha lineolata* Chag96/63: 45 mm. (b) *Nembrotha* cf. *lineolata* Chag96/95: 14 mm. (c) *Aldisa pikokai* Chag96/90: 18 mm. (d) *Hoplordoris estrelyado* Chag96/89: 15 mm. (e) *Taringa luteola* Chag96/69: 25 mm. (f) *Chromodoris* cf. *leopardus* Chag96/34: 34 mm. (g) *Dendrodoris tuberculosa* Chag96/7: 140 mm. (h) *Dermatobranchus albus* Chag96/45: 12 mm.

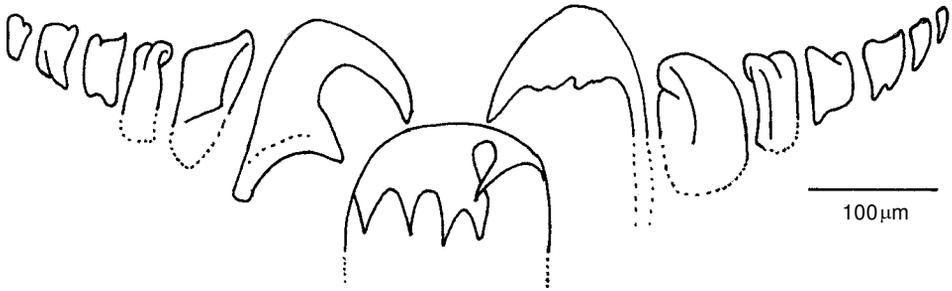


FIG. 5. *Nembrotha lineolata* Chag96/62: tracing of SEM negatives, radula row 10/11.

The preserved specimens retain the dark pigment on the back and the blue violet around the rhinophores, gills, head, foot and tail; only the 45 mm specimen has lost some blue along the middle portion of the foot. No yellow remains in the specimens, nor the red on the rhinophores. The gill rachides retain the same dark pigment as in life. The radula is asymmetrical along its complete length: the base of the right lateral is perpendicular to the cusps while the broad base of the left lateral lies over the cusp of the next tooth (figure 5). The left lateral is simply hooked while the right has two or three subsidiary cusps and is deeper. There are five and six plate-like marginals decreasing in size to a tiny scale-like outermost tooth on the left and right sides, respectively. The median has four cusps which are rather longer than usual: the inner one on the right is bifid, as usual for the genus, but is crossed over by the outer one (figure 6A). The formula is  $32 (+ 4) \times 5.1.1.1.6$ .

*Geographic distribution.* Indo-West Pacific: originally described from Indonesia (Bergh, 1905), *N. lineolata* is rare in the Indian Ocean; Eales (1938) described a specimen from the Kuria Muria Islands, off the southern Omani coast, and Wells and Bryce (1993) illustrated the species from Western Australia. All other records are from the western Pacific Ocean.

*Remarks.* Although *N. lineolata* usually has thin brown lines, the two specimens and the photographed animals all bear the characteristic hallmarks of the species: white or yellowish body with brown lines (which may be thick and run together), the foot edged in violet/blue and yellow, red rhinophores with white tips, violet/blue and yellow rhinophore sheaths and gill bases, and red and white gills. There has been some confusion in the past over a number of similarly coloured species; this is a large species complex, with some species yet to be described (e.g. see photographs in Gosliner *et al.*, 1996, Debelius, 1996 and Rudman, 1998). A good table of differences between named species is presented in Cervera *et al.* (1996) to which one can add further details to the descriptive account of *N. lineolata*: the white tips on the rhinophores and the white on the gills. A similar species, *N. purpureolineata*, has orange red rhinophores with violet (not white) tips and lacks the yellow submarginal band around the foot. The species described and illustrated as *N. purpureolineata* by Baba (1976b: 132, figures 3, 4), and illustrated by photographs in Gosliner (1987: cover) and Debelius (1996: 178, lower photo) is in fact a fifth undescribed species belonging to the same complex (see also below). Specimen 96/63 was photographed *in situ* (figure 4a), feeding on lilac ascidians, while another individual was photographed on white ascidians.

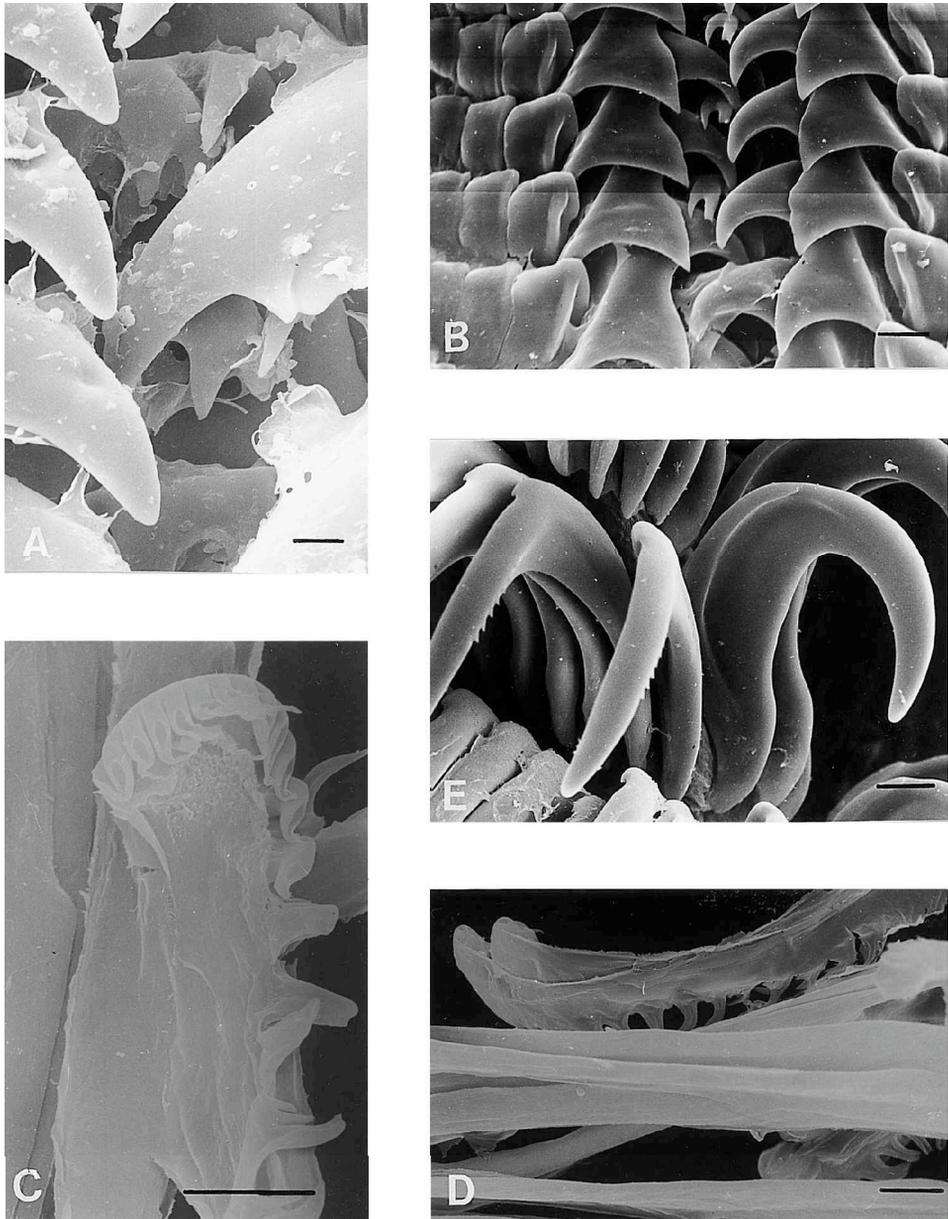


FIG. 6. SEM of radular teeth. (A) *Nembrotha lineolata* Chag96/62, scale = 10  $\mu$ m. (B) *Nembrotha* cf. *lineolata* Chag96/95, scale = 20  $\mu$ m. (C, D) *Aldisa pikokai* Chag96/90, scale = 5  $\mu$ m. (E) *Hoplodoris estrelgado* Chag96/89, scale = 20  $\mu$ m.

***Nembrotha* cf. *lineolata*** Bergh, 1905  
(figures 4b, 6B)

*Material.* Chag96/95: 14 mm; inner reef Ile Vache Marine, Peros Banhos Atoll; 4 March 1996; at 22 m depth.

*Description.* The body was creamy white with thin brown lines, which were thicker on the dorsum (figure 4b). Rhinophore sheaths and gill base blue-violet marginally and yellow submarginally. Edge of foot blue-violet with yellow only on the tip of tail. Rhinophore clubs half red, half white posteriorly; stalks white. Three gills white with red edges to stalks and pinnae.

The preserved specimen is minute, 4×2 mm. The body is opaque creamy fawn with several dark brown longitudinal lines on the dorsum and sides. There is a dark (?blue) pigmented band around the margin of the foot, the rhinophore pockets, the oral tentacles and the base of the gills. The specimen was dissected to remove the radula, and violet pigment was present on the oral tube and buccal bulb: this pigment was absent in the dissected specimen of *Nembrotha lineolata*. The radular formula is 4–5.1.1.1.5–4; the radula was broken so the number of rows could not be established. The median bears two small outer cusps and two large median ones, of which the right is minutely bifid (figure 6B).

*Geographic distribution.* Indo-West Pacific: Seychelles (colour photograph P. Kemp), Australia (Rudman, 1998) and Indonesia (colour photographs R. C. A. and S. G. B.).

*Remarks.* A similar colour pattern is published in Rudman (1998), and is seen in colour slides from the Seychelles (P. Kemp) and Bali, Indonesia (R. C. Anderson and S. G. Buttress, 1995). This species belongs to the complex described above, a number of which have been tabulated by Cervera *et al.* (1996). It is differentiated from *N. lineolata* (above) in lacking the yellow submarginal band on the foot and in having the distal half of the rhinophores white instead of just the tip; it differs from *N. purpureolineata* (as in Wells and Bryce, 1993) in lacking the deep red lamellae and purple tips to the rhinophores, and having just the edges of the gills red instead of the whole structure; it also differs from *N. rutilans* (as in Wells and Bryce, 1993) in having bicoloured (purple and yellow) rhinophore sheaths and gills instead of uniformly purple ones. A fifth species appears to be characterized by a cream and orange body with medium thick brown lines, a milky violet foot, deep red rhinophores with purple bases and purple sheaths, and uniformly red gills with pale violet and cream bases (see Baba, 1976b: 132, figures 3, 4, and photographs in Gosliner, 1987 and Debelius, 1996, all as *N. purpureolineata*).

The radula conforms with the diagnosis of the genus, although the teeth are tiny, one-fifth to one-half the size of those of other species, but the specimen was also very much smaller. Aberrations and variations of the teeth of nembrothids make the radula important only for generic diagnoses. Colour pattern seems to be the most important feature in distinguishing species at present, and this specimen may well prove to belong to an undescribed species.

***Notodoris minor* Eliot, 1904**

(figure 2f)

*Notodoris minor* Eliot, 1904b: 84, pl. 3, figures 1a–g; Wells and Bryce, 1993: 91, figure 106; see also Yonow, 1994a: 106, table 4.

*Material.* Chag96/36: preserved 10×2×2 mm; reacted with formaldehyde and covered in tiny globules; coll. A. Jolliffe in Salomon Atoll on 14 February 1996 on algae. Chag96/84a, b: 32 mm specimen from 23 m depth on sand (26×6×8 mm

preserved, black-tipped rhinophores) and 21 mm specimen from 8 m depth on rubble (19×4×6 mm preserved, yellow rhinophores); south side of Nelson Island, Great Chagos Bank; third individual not collected; 3 March 1996. Chag96/86: 14×13×3 mm high preserved, reacted with formaldehyde; Middle Brother, Great Chagos Bank; 2 March 1996; at 17 m depth.

*Description.* The body was hard and nobbly, bright yellow with black lines and streaks: the longer, thicker lines tended to cross the dorsal surface almost perpendicular to the midline; the thinner, shorter streaks tended to lie at oblique angles to the midline (figure 2f). Rhinophores medium yellow with black tips, the latter indistinct or absent in some specimens.

*Geographic distribution.* Indo-West Pacific: from Zanzibar (Eliot, 1904b) to Queensland and New Caledonia (Yonow, 1994a). In addition to this record from the Chagos, we have a new record from Réunion (colour slide by M. Parmentier; tips of rhinophores dark, perhaps green but not black).

*Remarks.* The three species of yellow *Notodoris* were reviewed by Yonow (1994a) based on a survey of the literature and on Paris and London museum specimens. *Notodoris minor* appears to be rare, and this record of five animals from Chagos is unusual. *Notodoris minor* is normally very large, more than 100 mm in length, and the two juveniles present in this collection are the smallest specimens collected to date. Gosliner *et al.* (1996) record it as feeding on the yellow sponge *Leucetta primigenia* Haeckel, 1872, whereas the two larger specimens here were found on sandy substrata and the smallest in algae.

***Aldisa pikokai* Bertsch and Johnson, 1982**

(figures 4c, 6C, D)

*Aldisa pikokai* Bertsch and Johnson, 1982: 208, figures 1, 2, 6–8; Millen and Gosliner, 1985: 209, figures 6H, 12.

*Halgerda rubra* Bergh: Kay and Young, 1969: 194 (part).

*Material.* Chag96/90: 18×7 mm; Three Brothers, Great Chagos Bank; 2 March 1996; at 8 m depth.

*Description.* The red dorsal surface was smooth but with numerous raised red ridges forming a pattern of reticulations, the resulting polygons of which were smaller marginally than medially (figure 4c). The raised ridges did not extend on to the mantle margin. The marginal depressions contained numerous black dots, whereas those medially contained few, with the exception of three roughly circular pits, one anterior to the rhinophores, one posterior to the rhinophores, and the third anterior to the gills. A pair of irregular light brown patches was present laterally, level with the second median dark pit. The rhinophore stalks and clubs were red, while the gills were light red with a light brown margin; tubercles were present around the rim of the gill pocket. The ventral surface was smooth, red with no markings either on the foot or hyponotum; the semi-circular head did not have oral tentacles and anterior foot margin was bilaminate without propodial tentacles.

It was not possible to determine the radular formula: the long bristle-like teeth, measuring approximately 280 μm, were tangled and impossible to count. The serrations at the distal end are present only on one side of the tooth; they continue around the tip and appear to be hollow (figure 6C, D).

*Geographic distribution.* Central Indian Ocean to Central Pacific: this is the first record of this species since its original description from Hawaii (Berstch and Johnson, 1982).

*Remarks.* The genera *Aldisa* and *Sclerodoris* are similar (both are tuberculate, ridged and/or pitted) and have been reviewed by Millen and Gosliner (1985) and Rudman (1978), respectively. Species of *Aldisa* are small, usually less than 30 mm, and characterized also by the lack of oral tentacles, the bilaminar foot margin and the presence of tubercles around the rim of the gill and rhinophore pockets. The radula is aberrant for dorids; the long hair-like teeth with broad bases and spatulate serrated ends are unique to the genus *Aldisa*. This specimen is very different from the other 10 species of *Aldisa* and is identical to *A. pikokai* except for black dots present in the polygonal hollows (absent in the type descriptions) and reddish gills (creamy white in the type). *Aldisa pikokai* is the only one of the three red/orange species of *Aldisa* which has a network of interconnecting ridges; the other two red/orange species are tuberculate. *Sclerodoris tuberculata*, small specimens of which resemble *A. pikokai*, is an extremely variable species which is covered in small tubercles with projecting spicules (the caryophyllidia); the hyponotum has patches of purple brown and the variously coloured rhinophores are tipped with white. Additionally, all specimens have blotches of white resembling coral sand, as do some specimens of *A. pikokai*; Bergh's (1905) figure of *Halgerda rubra* (a synonym of *S. tuberculata*) is identical to photographs of our specimen of *A. pikokai*.

***Halgerda tessellata* (Bergh, 1880)**

(figure 11a)

*Halgerda tessellata* Bergh: Rudman, 1978: 65, figures 4c, d, 6; Carlson and Hoff, 1993: 16, figures 1–3.

*Material.* Chag96/30a, b: 15 mm, 25 mm; outer reef, Ile de la Passe, Salomon Atoll; 14 February 1996; at 8 m depth.

*Description.* The body was orange-yellow, with a reticulate pattern of raised ridges on the dorsal surface forming incomplete triangular shapes (figure 11a). The areas between the ridges were dark brown with many small white spots. The foot was orange-yellow with a very dark brown, almost black, line on the metapodium. The long rhinophores had elongated tips; the clubs were dark brown, and the stalks were translucent cream with a thick dark brown line posteriorly. The orange rhinophore sheaths were short, and the gills were white, each with the rachis coloured dark brown externally.

*Geographic distribution.* Indo-West Pacific: East Africa (Eliot, 1905) to Australia (Rudman, 1978), Micronesia (Bergh, 1880) and Guam (Carlson and Hoff, 1993).

*Remarks.* *Halgerda tessellata* has brown marks in the junction between the foot and mantle and a median line on the top of the metapodium. These are absent in the preserved material from Chagos but present in two specimens from Kenya (Yonow, unpublished, 10 and 25 mm preserved lengths); two specimens from the Maldives (11 and 15 mm preserved lengths, coll. R. C. Anderson and S. G. Buttress, 1996) are completely faded except for a little dark speckling in the dorsal depressions.

***Halgerda willeyi*** Eliot, 1903

(figures 7, 11b)

*Halgerda willeyi* Eliot, 1903c: 372, pl. 32, figure 5; Yonow, 1990: 293, pl. 13.? *Chromodoris pulchella* (?) (*sic.*) Bergh, 1873a: figure only: pl. 25, figure 11.

**Material.** Chag96/77a, b: 29 mm (20 × 15 mm preserved, slightly curled; radula preparation), 12 mm (11 × 10 mm preserved, slightly curled); outer reef of Middle Brother, Great Chagos Bank; 1 March 1996; at 24–25 m depth.

**Description.** Body translucent white with series of raised yellow-orange ridges on the dorsum (figure 11b). These ridges were symmetrical, enclosing a double series of six depressions; these depressions each contained a longitudinal black streak, flanked in the larger specimen by thin yellow streaks. The intersections of the ridges were marked by tubercles. Many black lines were present around the edge of the mantle, mostly radiating outwards to meet the mantle edge at right angles. Rhinophores long: lower two-fifths of club translucent and central fifth yellow anteriorly; distal two-fifths of club dark brown; posterior dark brown line on translucent stalk. Rhinophore sheaths short, orange. Gills white, with dark brown lines externally.

The preserved specimens have lost all traces of orange pigment but the black remains on the mantle, hyponotum, foot and rhinophores; the rhinophores are extended in both specimens. The radula was dissected out of the larger specimen, and there were no markings on the membranes; often species of *Halgerda* have a dark covering or pigmentation on the bulb. The formula is 44–45 × 35.0.35. All the teeth are hook-shaped: the central ≈ 14 on each side are as small and crowded as in *H. iota* Yonow, 1994. There are no bristles on the marginals, which are very reduced hooks (figure 7).

**Geographic distribution.** Indo-West Pacific.

**Remarks.** *Halgerda willeyi* is usually very large, up to 90 mm (Yonow, 1990), and has white rhinophores and gills with black speckles distally and spots proximally. Large specimens differ in having yellow ridges surrounding depressions which contain mainly longitudinal black and yellow markings, and yellow lines and yellow tubercles around the margin in addition to the perpendicular black lines. The radula of the

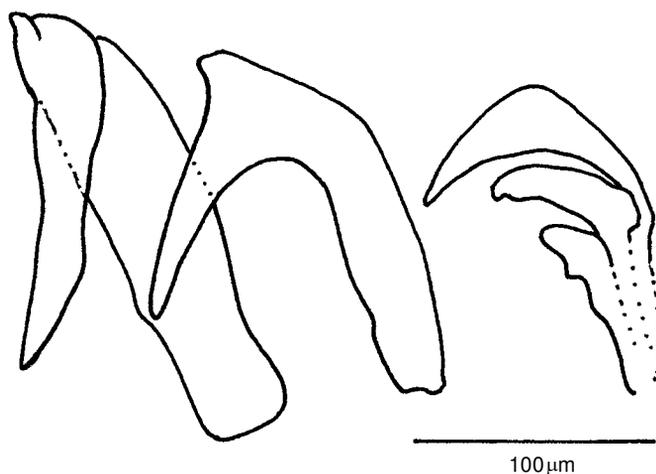


FIG. 7. *Halgerda willeyi* Chag96/77: tracing of SEM negatives, last five teeth of half row 27.

Chagos specimen is similar in formula and tooth shape to that of a 55 mm specimen from the Red Sea with formula  $41 \times 36-38.0.38-36$  (Rudman, 1978).

*Halgerda elegans* Bergh (1905: taf. 2, figure 4a only; recently redescribed by Gosliner and Fahey, 1998) is similar to these specimens: small, approximately 15 mm, with orange-yellow ridges, only black perpendicular lines around the margin, and brown-black rhinophores; however the outer laterals of the radula are pectinate. The figure of *Chromodoris pulchella* ? Bergh looks like *H. willeyi* and may well be a synonym. There is no description, and there are no figures of the radula.

Photographs of two animals together from the Seychelles (P. Kemp) show a deep orange colour on the dorsum and rhinophores; the smaller of the two is identical to these from Chagos while the larger has more black lines on the dorsum and is more yellow in colour. On both individuals, the dark perpendicular lines on the foot are visible. The Chagos specimens and the Seychelles individuals appear to be juveniles of *H. willeyi*, which therefore shows ontogenetic variation: small specimens are distinguished by a very regular and symmetrical pattern with a central longitudinal ridge, deep orange rhinophore and gill bases and pocket rims, and solid black and orange pigment on the rhinophore clubs.

***Hoplodoris estrelyado*** Gosliner and Behrens, 1998  
(figures 4d, 6E, 8)

*Hoplodoris estrelyado* Gosliner and Behrens, 1998: 280, figures 1A, 2, 3.

*Material.* Chag96/89: 15 mm; Three Brothers, Great Chagos Bank; 2 March 1996; 6 m; coll. F. Stewart.

*Description.* The dorsal surface was covered with small raised tubercles (figure 4d). Centrally there were approximately 10 red-brown tubercles, partially surrounded by much smaller white pustules. Peripherally there were two concentric rows of circular daisy-like patterns, composed of a central fawn tubercle with a yellow rim surrounded by white tubercles. The mantle skirt was thin, covered in brown speckling. The rhinophores were mottled brown and white: stalk and lower

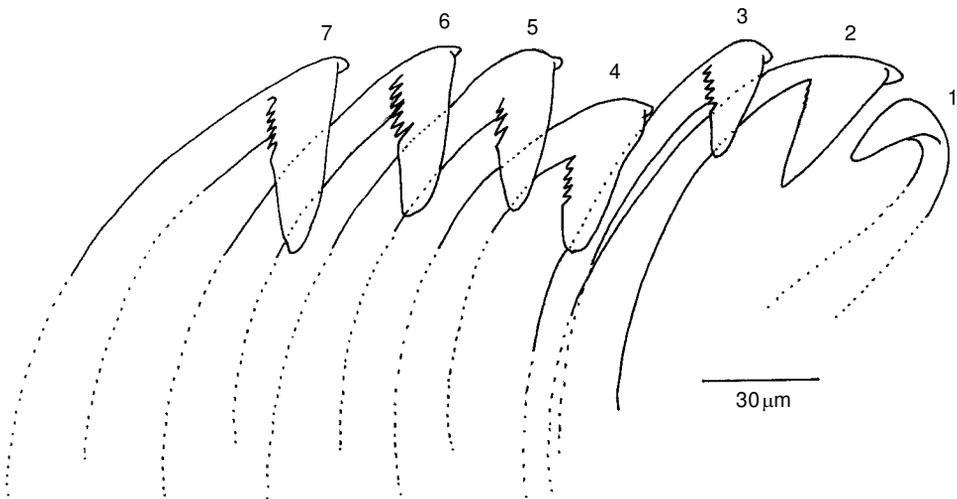


FIG. 8. *Hoplodoris estrelyado* Chag96/89: tracing of SEM negatives, first seven teeth of row 9.

third of club translucent, middle third darker brown, and distal third and tips white. Six white gills.

The single specimen is badly preserved. It is fairly soft in comparison to *H. pustulata* (*H. nodulosa* auctt., see discussion below). The dorsum is tuberculate and the spicules are not visible due to reaction of the mantle with formaldehyde. The mantle margin is very thin, unlike the thicker margin of *H. pustulata*. The six gills, of which the posteriormost are divided, are pale pink, and the dorsum retains a few patches of dense brown pigment spots. The rhinophore pockets appear to be tuberculate (but not distinctively so as in *Carminodoris armata* Baba, 1993). Ventrally, nothing is distinguishable except that the foot is tapered posteriorly and both the hyponotum and the foot have speckles of brown pigment spots. The radular formula is  $18 \times \approx 39.0.39$  and the sinuously hooked teeth are large,  $110 \mu\text{m}$  in height. The teeth have a distinct flange on their bases and denticles on the outer sides of the cusps (figures 6E, 8).

*Geographic distribution.* Central Indian Ocean (this record) to Central Pacific: Western Australia, Vietnam, the Philippines and the Marshall Islands (Gosliner and Behrens, 1998).

*Remarks.* Externally, the dorsal pattern of daisies is distinctive, as is the deep brown speckling especially on the thin margin. The radula formula is difficult to compare as Gosliner and Behrens (1998) did not state the size of their dissected animal: they gave a radula formula of  $26 \times 65.0.65$ . However, tooth shape and size are almost identical: measurement of the height of a tooth in their SEM is just over  $106 \mu\text{m}$ . Although the species is clearly recognized, the generic placement is fraught with difficulties: in describing *Hoplodoris novaezelandiae*, Miller (1991) listed only two congeners: the type species *H. desmoparypha* Bergh and *H. nodulosa* (Angas), which he considered to include *H. pustulata* (Abraham). He considered the species described by Kay and Young (1969) as *H. nodulosa* as different from his definition of *H. nodulosa* but failed to recognize that *H. nodulosa* and *H. pustulata* were distinctly different species, and that Kay and Young (1969) were in fact describing true *H. nodulosa*. Baba (1993) described two new species (belonging to the genus *Carminodoris*) comparing them to *Hoplodoris nodulosa*/*Hoplodoris pustulata*: he noted Kay and Young's (1969) specimen as being different from his, and additionally noted that the original description of *H. nodulosa* by Angas (1864) was also different from his material. Jensen (1994) described *Hoplodoris* cf. *pustulata* and discussed the similarity between the original description of *H. nodulosa* and Kay and Young's specimen, both of which were different from hers.

A search through the literature reveals that both Baba and Jensen were correct in their observations noting the similarities between Angas' *H. nodulosa* and Kay and Young's specimens, and the differences between these two and other descriptions and photographs of '*H. nodulosa*' (e.g. photographs in Bertsch and Johnson, 1981, Willan and Coleman, 1984 and Wells and Bryce, 1993). It appears that the epithet *H. nodulosa* (Angas) has been commonly used for a species which is in fact *H. pustulata* (Abraham) and that in synonymizing the two, Miller (1991), Thompson (1975) and Burn (1969) amongst others, were in error. Allan (1947, 1959) did, however, correctly identify her specimens as *H. pustulata*. Although the original description of *H. nodulosa* by Angas is brief, it can be recognized as having a bare patch without tubercles in the centre of the mantle, and was so recognized and described in detail by Kay and Young (1969). This appears to be the only true subsequent record of *Hoplodoris nodulosa* (Angas); Gosliner and Behrens (1998)

separated the two as 'Australian' and 'Hawaiian' *H. nodulosa*. All other descriptions and photographs of *H. nodulosa* (other than those of Angas, 1864 and Kay and Young, 1969) should be referred to *Hoplodoris pustulata* (Abraham), which is broader anteriorly than *H. nodulosa*, has a completely tuberculate dorsum (*H. nodulosa* lacks tubercles centrally), and a darker area centrally where the tubercles are present but not ringed with white as they are marginally. Ventrally there are brown patches or speckling as in *Hoplodoris estreyado*. These characters are confirmed by three specimens in the Swansea collections (Yonow, unpublished): one from Zanzibar (1995, 30 mm preserved), one from the Red Sea (1995, 30 mm alive), and one from Ambon (Rumphius Biohistorical Expedition (RBE), 1990, 17 mm preserved). All three are speckled as well as faintly pustulose ventrally. The Zanzibar and Red Sea specimens appear to be the first Indian Ocean records of *H. pustulata* (Abraham), which seems quite common in the West Pacific (*H. nodulosa* *auctt.*). Anatomically the two species also differ: *H. nodulosa* has unarmed penis and accessory glands while *H. pustulata* has a penis with spines and an accessory gland with a stylet (Burn, 1969; Thompson, 1975; Miller, 1991; Gosliner and Behrens, 1998).

***Taringa luteola* (Kelaart, 1858)**

(figures 4e, 9A–C, 10a)

*Doris luteola* Kelaart, 1858: 103; 1859: 299.

? (*sic.*) *Thordisa caudata* Farran, 1905: 340, pl. 2, figures 18, 19.

*Trippa luteola*: Eliot, 1906b: 658, pl. 42, figure 4.

*Taringa luteola*: Gosliner and Behrens, 1998: 286, figures 1B, 4, 5.

*Material.* Chag96/69: 25 × 8 mm; inner reef of Ile Diamant, Peros Banhos Atoll; 27 February 1996; at 6 m depth.

*Description.* The body was roughly rectangular in shape, covered with numerous tiny pustules; the ground colour was cream with several yellow patches and streaks forming a ring around gill pocket and two lines running from the rhinophores to the gills. The mantle margin was deep yellow (figure 4e). Rhinophores sparsely lamellate, very long in comparison to body size; very dark brown but fading at the base. Six long gills, with pale grey rachides, brown pinnae and yellow pinnules. The oral tentacles and foot were white.

The preserved specimen is soft and translucent pinkish white. The long stalks of the rhinophores retain an ochre hue, while the 18–19 lamellae are speckled with black. The six gill rachides also retain black specks. The tubercles on the mantle skirt are spiculose; the spicules stick out of the sides and tops of most tubercles. The rhinophore pocket margins appear undulated. Ventrally the sole is smooth. The anterior edge is bilaminar and the upper one notched centrally; the short digitiform oral tentacles are visible behind the notched lamina (figure 10a). The radular formula is 30 (+ 2–3) × 30.0.30 with a median thickening. The teeth are simply hooked with a small denticle on the cusp on all teeth and a groove or flange on the large broad base which forms a hump or peg on the top of the teeth (figure 9A–C). There is a rapid increase in size in the first dozen teeth, then a gradual increase to the last-but-two or three. All the teeth have denticles and a flange, which might have been difficult to see without SEM; the very reduced outermost two or three teeth are still

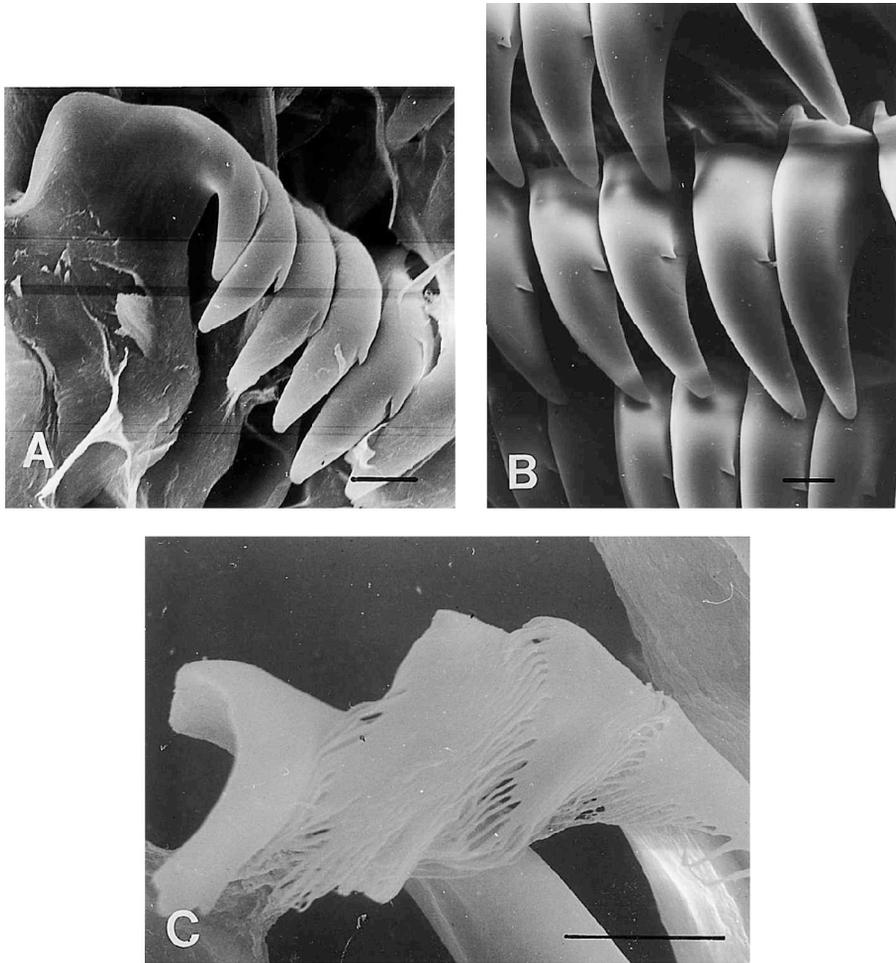


FIG. 9. SEM of radular teeth, *Taringa luteola* Chag96/69, scales 10  $\mu\text{m}$ . (A) First few laterals. (B) Teeth in mid-row. (C) Last four marginals.

very difficult to distinguish unless greatly magnified. The three outermost laterals have long bristles instead of denticles on the cusps.

*Geographic distribution.* Western Indian Ocean; this is the fifth record of this unusual species, also known from Sri Lanka (Kelaart, 1858; Farran, 1905), Madagascar (Gosliner and Behrens, 1998) and Tanzania (Eliot, 1906b).

*Remarks.* In his original description from Sri Lanka, Kelaart (1858) implied that he found it frequently in shallow water, and described the egg ribbon as 'light green in two narrow tape-like convolutions'. However, we have only a single specimen, as did Farran; Eliot just had two specimens, as did Gosliner and Behrens (1998). Both Eliot and Farran gave identical radular formulae,  $38 (+ 2) \times 39.0.39$ , and descriptions of the teeth: 1–10 were smaller with a small denticle on the top and a ridge or flange on the base. The outermost two or three teeth were very reduced, with a tuft of bristles at their tips. Gosliner and Behrens' (1998) two specimens were 15 and 22 mm preserved, one of which had a radular formula of

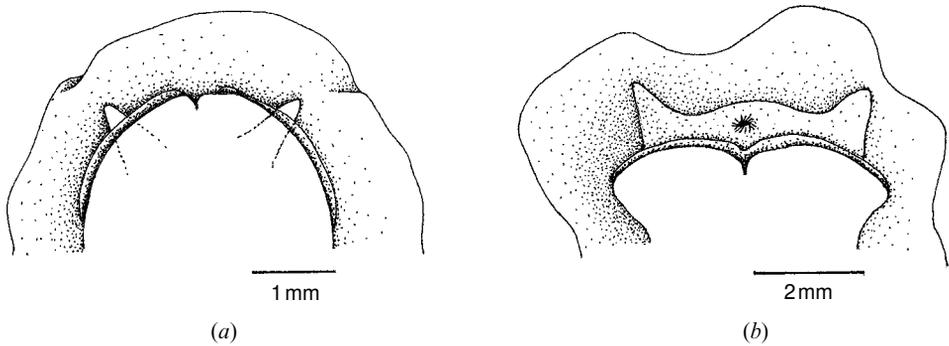


FIG. 10. (a) *Taringa luteola* Chag96/69: ventral view of head. (b) *Chromodoris* cf. *leopardus* Chag96/34: ventral view of head.

28×37–39.1.39–37. Unconventionally, they counted the median thickening as a tooth although it had no particular form.

***Cadlinella ornatissima*** (Risbec, 1928)  
(figure 11c)

*Cadlina ornatissima* Risbec, 1928: 163: figure 47, pl. 8, figure 4.

*Cadlinella ornatissima*: Baba, 1949: 147, pl. 22, figure 80; Risbec, 1953: 90, figures 45, 48, 49; Rudman, 1984: 246, figures 1H, 8, 95–97.

*Material.* Chag96/9: 14 mm; in cave on inner reef of Nelson Island, Great Chagos Bank; 3 March 1996; at 20 m depth.

*Description.* A brightly coloured species with a deep yellow mantle covered with many pink-tipped, near-spherical tubercles; smaller and more numerous white ones were concentrated around the mantle margin. Rhinophores white and very long. Gills white.

*Geographic distribution.* Indo-West Pacific: recorded only from Tanzania (Rudman, 1984) in the Indian Ocean and otherwise from New Caledonia (Risbec, 1928, 1953), Japan (Baba, 1949) and the Great Barrier Reef (Rudman, 1984).

*Remarks.* This species is rarely recorded in the scientific literature. It is easily recognized by its combination of bright orange mantle, pink-tipped rounded tubercles and extremely long white rhinophores. Until recently there has been only one named species of *Cadlinella*, but two species have recently been described from New Caledonia (Rudman, 1995) and Japan (Baba, 1996). A further two undescribed species have been photographed in the Red Sea (Debelius, 1996 as *C. ornatissima*) and Norfolk Island (South Pacific: Coleman, 1989: 44 as *C. ornatissima*). These differ significantly in external morphology and colour pattern from *C. ornatissima*, which is very constant, and from *C. hirsuta* Rudman, 1995 and *C. subornatissima* Baba, 1996. *Cadlinella hirsuta* is yellow with very long, tapering, white papillae; *C. subornatissima* is yellow centrally and white marginally with conical papillae. The Red Sea species is white with yellow reticulations and a narrow bright yellow margin, and the fusiform or digitiform tubercles are red to pink-red for their distal half. The South Pacific species is bright yellow like *C. ornatissima* but has tapering tubercles rather than round-ended cylindrical or spherical ones, suffused with very pale pink. Perhaps more significantly, the rhinophores are bright yellow.

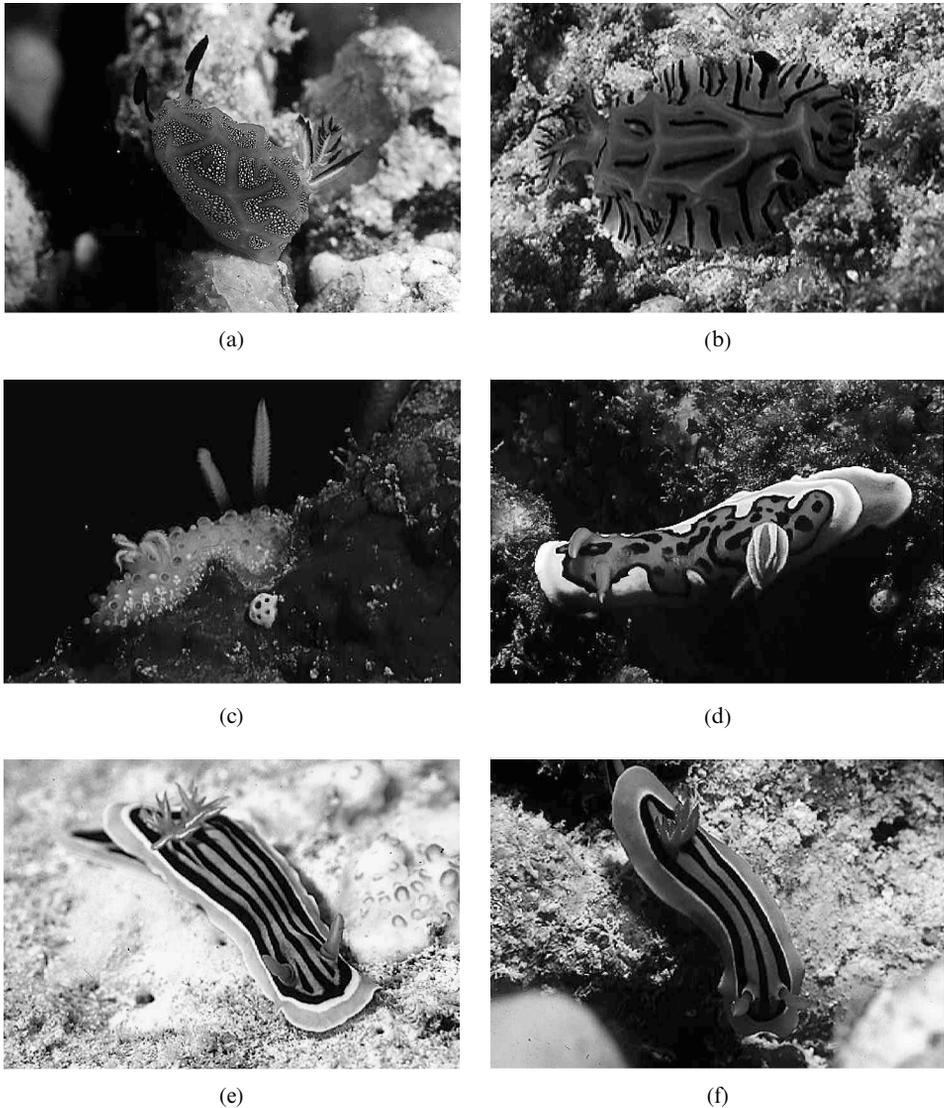


FIG. 11. (a) *Halgerda tessellata* Chag96/30b: 25 mm. (b) *Halgerda willeyi* Chag96/77b: 12 mm. (c) *Cadlinella ornatissima* Chag96/91: 14 mm. (d) *Chromodoris gleniei* Chag96/73: 42 mm. (e, f) *Chromodoris quadricolor* Chag96/52b and Chag96/87: 40 mm.

***Chromodoris geminus* Rudman, 1987**

*Chromodoris geminus* Rudman, 1987: 384, figure 39G; Yonow, 1989: 294, pl. 6; Yonow and Hayward, 1991: 13, figure 12E.

*Material.* Colour photograph of a single individual by M. Spalding: outer reef, Nelson Island, Great Chagos Bank; March 1996.

*Description.* Photograph of dorsal surface clearly shows typical coloration of this species: a yellow-fawn dorsum, many violet ocellations with blue white rims, and four marginal bands. These comprise a thin white margin, a wider grey-fawn

submargin followed by a cream band, then a bright orange-yellow band encircling the central region.

*Geographic distribution.* Red Sea (Yonow, 1989) and Indian Ocean: Mauritius (Yonow and Hayward, 1991), Tanzania, Réunion, and one specimen from Christmas Island (Rudman, 1987).

***Chromodoris gleniei*** (Kelaart, 1858)

(figure 11d)

*Chromodoris gleniei* (Kelaart): Rudman, 1987: 391; Yonow, 1994a: 115, figure 10E.

*Material.* Chag96/73: 42×12 mm; Middle Brother, Great Chagos Bank; 29 February 1996; at 20 m depth.

*Description.* The body was broadly oval. The mantle margin was white with a submarginal grey band, followed by a white band which contained faint yellow patches. The central area was orange-brown with an undulating dark border; this contained numerous irregular dark brown markings. Rhinophores and gills orange; gills with pale rachides. Foot translucent with an opaque white ventral margin.

*Geographic distribution.* Western Indian Ocean: Tanzania (Rudman, 1987), the Maldives (Yonow, 1994a) and Sri Lanka (Kelaart, 1858).

***Chromodoris quadricolor*** (Rüppell and Leuckart, 1830)

(figures 11e, f, 12A, B)

*Doris quadricolor* Rüppell and Leuckart, 1830: 31, pl. 9.

*Chromodoris quadricolor*: Rudman, 1977: 370, pl. 1B rt, figure 19; Rudman, 1982b: 213; Yonow, 1989: 296, pl. 8.

*Material.* Chag96/16: 37 mm; inner reef between Ile du Sel and Ile Jacobin, Salomon Atoll; 12 February 1996; at 10 m depth. Chag96/42: 22 mm; inner reef of Ile Diamant, Peros Banhos Atoll; 19 February 1996; at 5 m depth. Chag96/51: 32 mm; inner reef of Grand Ile Mapou, Peros Banhos Atoll; 21 February 1996; at 4 m depth. Chag96/52a, b, c: live lengths not recorded; inner reef of Grand Ile Mapou, Peros Banhos Atoll; 21 February 1996; at 10 m depth; only three of nine individuals on patch of *Halimeda* algae collected. Chag96/87: 40 mm; inner reef of Nelson Island, Great Chagos Bank; 3 March 1996; at 26 m depth (radular preparation).

*Description.* Mantle wide, but not undulated, with a broad orange margin, the very edge of which was pale, and a thin submarginal white band (figure 11e, f). Dorsal surface blue and black striped: one black band enclosed the area and one black median stripe ran back from rhinophores to anterior margin of gill pocket; in some specimens a pair of black stripes (continuous or incomplete) extended from behind the rhinophores to the sides of the gill pocket; in a few specimens additional black streaks were also present; the number of black stripes thus varied from three to five, with additional streaks. Rhinophores orange; gills orange with limited fine white speckling on edges of plumes. Foot with orange ventral margin and blue and black stripes laterally.

The seven preserved specimens are very similar indeed, all retaining all the colours on the body and foot, with deeper orange gills and rhinophores. The radular formula of specimen 96/87 (40 mm alive) is 82 (+ 3–4)×62.0.62. The teeth are all denticulate on their outer sides (figure 12A, B).

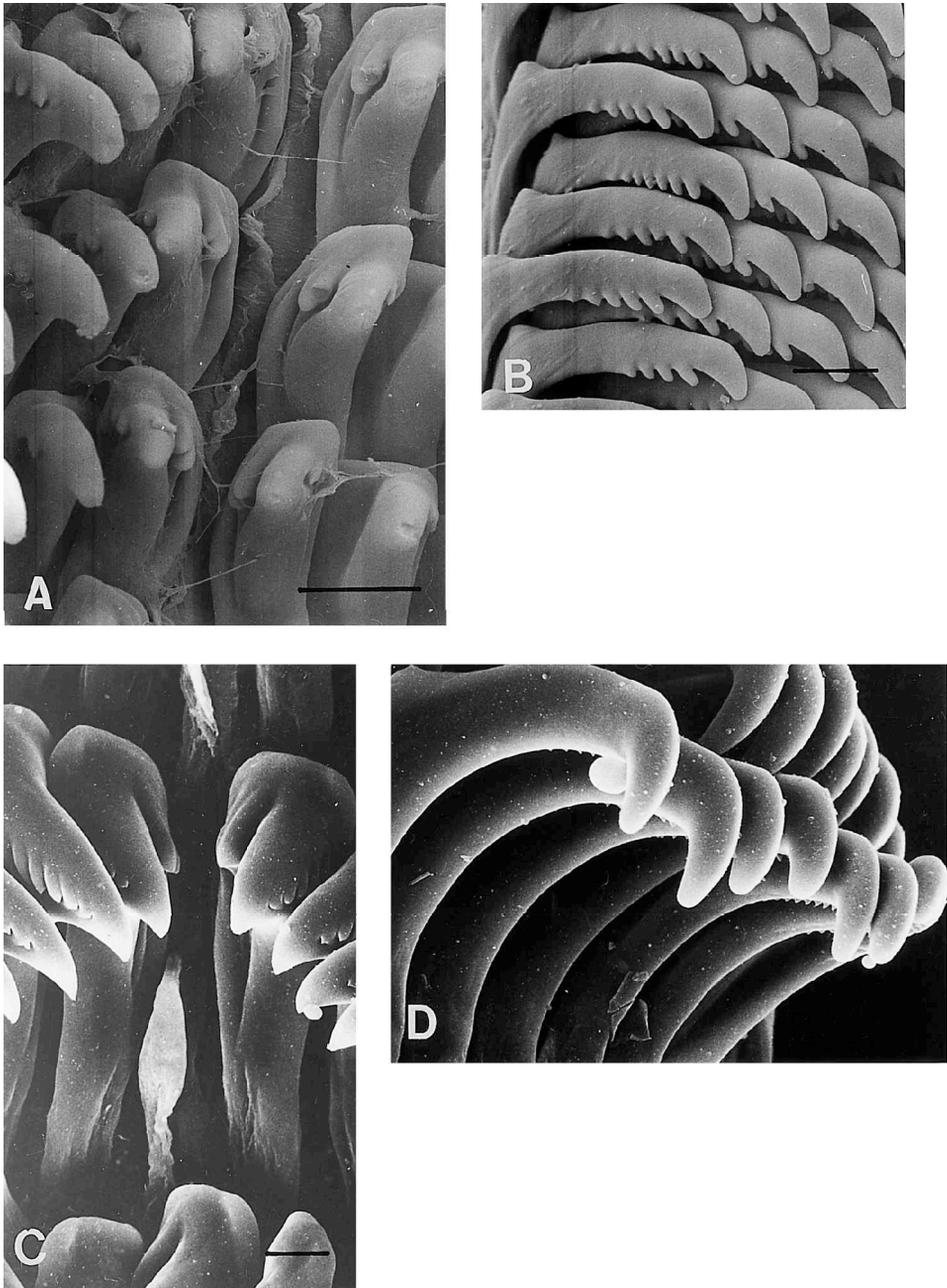


FIG. 12. SEM of radular teeth. (A, B) *Chromodoris quadricolor* Chag96/87, scales 20  $\mu\text{m}$ . (C, D) *Chromodoris* cf. *leopardus* Chag96/34, scales = 10  $\mu\text{m}$ .

*Geographic distribution.* Western Indian Ocean: *Chromodoris quadricolor* has been recorded only from the Red Sea (Yonow, 1989) and Tanzania (Rudman, 1977, 1982b), so this record represents a significant range extension.

*Remarks.* The variations in these specimens are within the range of variations seen in the Red Sea specimens, where the species is extremely abundant. In addition

to our seven specimens, we have another 13 notebook records of this species from Chagos. These specimens are easily confused with *C. elisabethina* Bergh; however, the latter has a basically blue dorsum, with fewer thinner black lines. *Chromodoris elisabethina* has a darker suffusion of blue behind each rhinophore and in the centre of the mantle, and the margin is yellow, quite different in colour from the orange rhinophores and gills. In *C. quadricolor*, the gills, the rhinophores and the margin are all the same bright orange colour, although the gills and rhinophores may be darker than the margin. The radular formulae and teeth shapes are very similar in both species (Rudman, 1982b): a 20 mm preserved *C. elisabethina* has  $70 \times 64.0.64$  while a 25 mm (alive) *C. quadricolor* had  $60 \times 60.0.60$ .

***Chromodoris tennentana* (Kelaart, 1859)**

(figure 13a)

*Chromodoris tennentana* (Kelaart): Rudman, 1987: 364, figures 23, 32, 35, 36.

*Material.* Chag96/61:  $18 \times 4$  mm; coral bommie east of Ile Poule, Peros Banhos Atoll; 25 February 1996; at 7 m depth.

*Description.* Mantle with irregular purple margin and broad cream submarginal band which contained raised orange patches. Central area of notum brown with numerous black spots, each ocellated with white. Rhinophore clubs brown with white tips; stalks translucent. Gills grey and white.

The preserved specimen is soft and well relaxed. It is translucent white and the dark gut is clearly visible through the body wall. The orange pigment spots around the mantle edge remain as patches and the mantle glands are extremely clear as evenly distributed groups around the edge, just in from the margin; they are absent in front of the rhinophores.

*Geographic distribution.* Western Indian Ocean: recorded from Tanzania and Sri Lanka as *C. cavae* Eliot and *C. vicina* Eliot; this record from Chagos is a new locality. It is not uncommon in the Seychelles (photographs of several individuals and one specimen  $8 \times 5$  mm alive; coll. P. Kemp, 1992).

*Remarks.* *Chromodoris tennentana* is a large species, growing to more than 60 mm in length (preserved measurement, Eliot, 1904a). The orange spots in the white submarginal band of our specimen are slightly raised; this had not been noted in previous descriptions.

***Chromodoris cf. leopardus* Rudman, 1987**

(figures 4f, 10b, 12C, D, 13b)

*Material.* Chag96/34: 34 mm; outer reef Ile Takamaka, Salomon Atoll; 15 February 1996; at 9 m depth (radular prep.). Chag96/78a, b: 25 mm, 18 mm; outer reef, Middle Brother, Great Chagos Bank; 1 March 1996; at 8 m depth. Chag96/80: 20 mm; Three Brothers, Great Chagos Bank; 2 March 1996; at 5 m depth; coll. F. Stewart (no photographs).

*Description.* Body soft and fleshy with wide mantle. Ground colour cream with two large irregular chocolate brown patches: one encircled the rhinophores and the second included the gill pocket, the rim of which was white; these two patches were separated by a cream band across the mid-body, but joined by a thin isthmus of chocolate brown in two specimens (figures 4f, 13b). Three to eight purple-black spots with white ocellations; fewest spots in smallest specimen, most in largest. Mantle edge pale purple; cream band with faint yellow patches encircling the notum

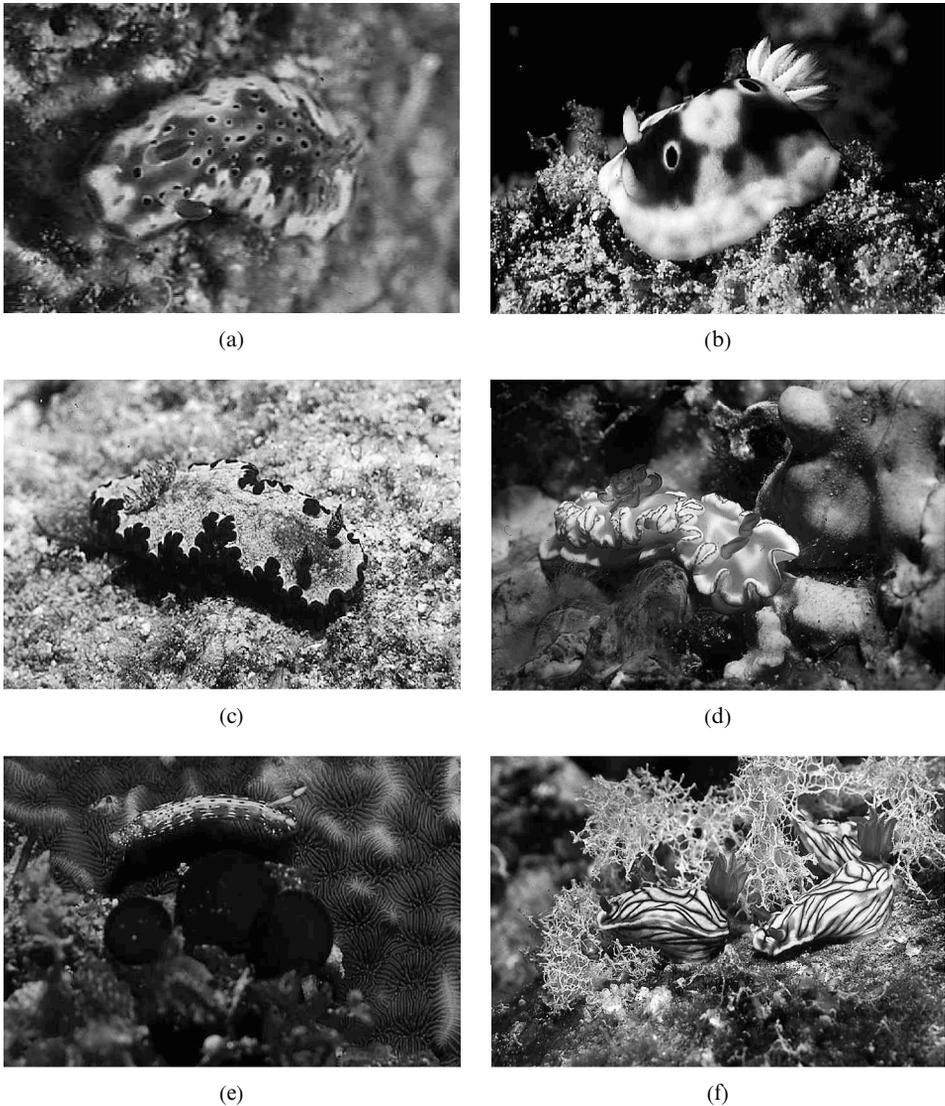


FIG. 13. (a) *Chromodoris tennentana* Chag96/61: 18 mm. (b) *Chromodoris* cf. *leopardus* Chag96/78. (c) *Glossodoris cincta* Chag96/59: 27 mm. (d) *Glossodoris symmetricus* Chag96/50: 26 mm. (e) *Hypselodoris maculosa* Chag96/60: 11 mm. (f) *Hypselodoris nigrostriata* Chag96/58: approx. 25 mm.

submarginally. Rhinophores white with faint purple tips; gills white with light purple line down distal half of rachis and light purple tips to gill plumes.

The preserved specimens are violet-purple in colour, dorsally and ventrally, with orange patches and spots on the dorsum and on top of the foot, coinciding with brown pigment and purple-black spots on the photographs. The gills and rhinophores have the same dense purple hue as the body; the rim around the gill pocket is distinctly raised in each specimen. Ventrally, the anterior portion of the foot is bilaminate and both are notched medially. The head is visible with a puckered mouth and short digitate oral tentacles (figure 10b). When the radula was dissected

out (96/34) the body cavity was pinkish red and the granular digestive gland was deep red. The radular ribbon was distinctive, with the oldest 10–15 rows dark brown, the next 25–35 paler and the remainder transparent. The radular formula is  $52 \times \text{min. } 62.0.62$ , with a very distinct median thickening (figure 12C). The first lateral has two or three rather plump denticles on the inner surface and up to six denticles on the outside. The remaining laterals are hooked with  $\approx 11$  denticles on the outer sides (figure 12D).

*Geographic distribution.* Unassigned in table 1.

*Remarks.* This species resembles dark specimens of *Risbecia tryoni* (Garrett, 1873), *Chromodoris tennentana* (q.v. p. 854) and *C. leopardus* Rudman, 1987; however, it differs in details of colour pattern and body shape. These specimens from Chagos have white rhinophores and white gills with a light purple line apically like *C. leopardus*: *Risbecia tryoni* and *Chromodoris tennentana* have brown rhinophores; the former has cream gills with brown edges, and the latter has grey and white gills. Unfortunately, colour details in life of the foot were not noted, but the orange spots on the preserved material imply brown pigment or black spots, which are present in both *C. leopardus* and *R. tryoni*; the foot of *Chromodoris tennentana* is white with an outer row of purple spots and inner row of yellow spots. However, only *C. tennentana* has a similar cream submarginal band with orange patches. The body and radular teeth shapes assign this species to the genus *Chromodoris* and are virtually identical to those of *C. leopardus*: a preserved 24 mm specimen had a formula of  $78 (+ 5) \times 78.0.78$  while a living specimen measuring 59 mm had a formula of  $74 (+ 2) \times 61.0.61$  (Rudman, 1987). Our specimen of 34 mm when alive had a formula of  $52 \times > 62.0. > 62$ . The Chagos material cannot be definitively assigned to *C. leopardus*, a Pacific species, because of significant differences in colour pattern. *Chromodoris leopardus* has spots of dark pigment arranged in open square shapes whereas these specimens have large solid spots. Additionally, the submarginal band of orange patches is absent in *C. leopardus*. Finally, the preserved specimens (including one without photographs and only brief colour notes) differ significantly from the preserved specimens of *C. leopardus* examined from Ambon (Yonow, 2001) in being completely purple.

***Glossodoris cincta* (Bergh, 1888)**

(figure 13c)

*Glossodoris cincta* (Bergh): Rudman, 1986a: 149, numerous figures; Yonow, 1994a: 120, figure 10H.

*Material.* Chag96/59: 27 mm; on rubble near bommie east of Ile Poule, inside Peros Banhos Atoll; 23 February 1996; at 7 m depth. Chag96/82: 25 mm; Three Brothers, Great Chagos Bank; 3 March 1996; at 5 m depth. Chag96/92a, b: 37 mm, 35 mm; Victory Bank; 3 March 1996; at 8 m depth.

*Description.* The body is solid and the mantle edge undulated, with a noticeably enlarged permanent fold mid-laterally on both sides. The mantle edge appeared dark green from a distance, but comprised an outer royal blue margin and an olive green submarginal band (figure 13c). The dorsal surface was pustular and mottled pinkish brown, speckled with white and yellow dots; there was a darker central field extending from the rhinophores to the gills. The foot was dark pink, mottled with white-tipped pustules, with thin bright blue and olive green marginal bands. Rhinophores were

dark brown speckled with white; white midline present anteriorly and (in one specimen) posteriorly. Gills pale brown, with fine dark edges.

The preserved specimens are all well relaxed; they retain the red marbling on the dorsum and the blue and green margins on the mantle and foot. The colour pattern on the gills and rhinophores also remains. All specimens have stained their formaldehyde preservative yellow to yellowish brown.

*Geographic distribution.* Indo-West Pacific: Red Sea (Yonow, 1989) and western Indian Ocean (Yonow and Hayward, 1991; Yonow, 1994a) to Christmas Island (Indian Ocean), north Australia and the Philippines (Rudman, 1986a).

*Remarks.* This species is well known, occurring in several colour morphs: these specimens conform with the Red Sea and western Indian Ocean form which has a mottled red dorsum, an olive green submarginal and thin blue marginal line. In life the gills vibrated constantly in specimen 96/59, a feature also noted for the specimens from East Africa and the Philippines (Rudman, 1986a), and typical of numerous species of *Glossodoris*. Specimen 96/92 was photographed *in situ* on a black sponge (cf. specimen from Maldives on purple sponge in Yonow, 1994a: figure 10H).

***Glossodoris symmetricus* Rudman, 1990**  
(figure 13d)

*Glossodoris symmetricus* Rudman, 1990: 275, figures 1C, 6D, 8A, 9D, 10A–D, 11, 12.

*Material.* Chag96/50: 26 mm; inner reef of Grand Ile Mapou, Peros Banhos Atoll; 21 February 1996; at 4 m depth. Chag96/64: 13 mm; inner reef of Ile Monpatre, Peros Banhos Atoll; 26 February 1996; at 6 m depth.

*Description.* The body was stout but soft and fleshy; the mantle edge was very undulated, with a prominent mid-lateral fold on each side. The colour was semi-translucent, pale olive-fawn; the margin was marked with a fine, slightly broken orange-red rim; the foot had an extremely fine, continuous, orange-red rim (figure 13d). There was a broad opaque cream-to-white submargin to both the foot and the mantle. An indistinct yellow band was present between the white submarginal band of the mantle and the olive-fawn of the dorsum, most obvious on the larger specimen. An opaque creamy white band encircled the gills and a symmetrical double cross pattern was present on the dorsum; these two patterns were not complete in the smaller specimen. Rhinophores and gills orange-red.

One preserved animal (96/50) is opaque pink: the very fine mantle frill is breaking up, but the mantle glands are visible as white spheres packed together in a wide continuous band, so much so that one part of the detached mantle looks like an egg ribbon. The smaller specimen (96/64) retains its fine crenulated mantle edge but there are no glands visible; the body colour is opaque cream and the dark gut is visible.

*Geographic distribution.* Indo-West Pacific: this is the first collection of this species since its original description from Réunion, Papua New Guinea and the Marshall Islands (Rudman, 1990); photographic records from the Seychelles (P. Kemp; also in Debelius, 1996) and Oman (Debelius, 1996) may be referred to this species.

*Remarks.* Our specimens are identical in external morphology and colour to the type, but differ in two small details: in both specimens, the orange pigment on the mantle edge is slightly broken, present alternately as dark and faint dashes and spots, and there is a continuous very fine red line present around the edge of the foot.

***Hypselodoris maculosa*** (Pease, 1871)

(figure 13e)

*Hypselodoris maculosa* (Pease): Rudman, 1986b: 340, figure 11, J; Yonow, 1989: 302, pl. 21; Wells and Bryce, 1993: 114, figure 142.

*Hypselodoris decorata* Risbec, 1928: 152, figure 43, pl. 7, figure 4; Rudman, 1984: 195, figure 57.

*Material.* Chag96/60: 11 mm; coral bommie east of Ile Poule, Peros Banhos Atoll; 23 February 1996; at 9 m depth.

*Description.* Dorsal surface orange marginally and cream medially, with a complex pattern of pink and white spots, respectively, and fine white lines. Rhinophores large, white with an orange band approximately one-third from the tips. Gills white with orange tips and bases. Foot translucent white, but with numerous pink and white dots posteriorly, giving it the appearance of having a pink tail.

*Geographic distribution.* Indo-West Pacific: recorded from the Red Sea (Yonow, 1989), East Africa and Christmas Island to South China and Tahiti in the Pacific (Risbec, 1928; Rudman, 1986b); collected in the Seychelles (P. Kemp, 1992) and photographed in the Maldives (R. C. Anderson and S. G. Buttress, 1995).

*Remarks.* This species has some variation in colour pattern, but is easily recognized by its distribution of red spots and wavy white lines on cream centrally, and white spots on red marginally. The rhinophores are characteristically long, banded with orange, although the orange bands may vary in number from one to three.

***Hypselodoris nigrostriata*** (Eliot, 1904)

(figures 13f, 14)

*Chromodoris nigrostriata* Eliot, 1904a: 394 (part), pl. 24, figures 5, 6.

*Chromodoris tenuilinearis* Farran, 1905: 342, pl. 3, figures 11–15; Vayssière, 1912: 51, pl. 1, figure 13, pl. 3, figures 39–42.

*Hypselodoris nigrostriata*: Rudman, 1977: 364, pl. 1f, figures 1, 2, 11E.

*Material.* Chag96/58a, b, c: 24 mm (15 mm preserved), 27 mm (17 mm preserved), 29 mm (20 mm preserved; radular preparation); underside of coral bommie, east of Ile Poule, inside Peros Banhos Atoll; 23 February 1996; at 7 m depth. Two other individuals at same location not collected.

*Description.* Body smooth, robust and richly coloured: yellow with numerous black lines overlaid with purple (figure 13f). These purple and black lines covered the dorsal surface and sides of the foot, but did not include the mantle edge, which was plain yellow. Foot with pale purple marginal band. Rhinophores and gills brilliant orange-crimson. The radula had more than 70 rows of teeth with at least 65 teeth per row. The first lateral is tricuspid while the rest are bifid but not denticulate (figure 14).

*Geographic distribution.* Western Indian Ocean: Tanzania (Eliot, 1904a; Rudman, 1977) and Gulf of Aden (Vayssière, 1912) to Sri Lanka (Farran, 1905).

*Remarks.* The three specimens are similar in colour pattern to the original description from Zanzibar (Eliot, 1904a) and those redescribed from Tanzania (Rudman, 1977). Rudman's specimens differed slightly in having orange and white gills instead of uniformly deep orange as in these specimens. The teeth of the Chagos specimen conform with those figured by Rudman (1977), except that the base is much larger, as figured by Farran (1905), especially in the outermost teeth. The specimens were found together on a spiculose sponge covered in small tubeworms on the underside of a coral bommie (sample collected but unidentified).

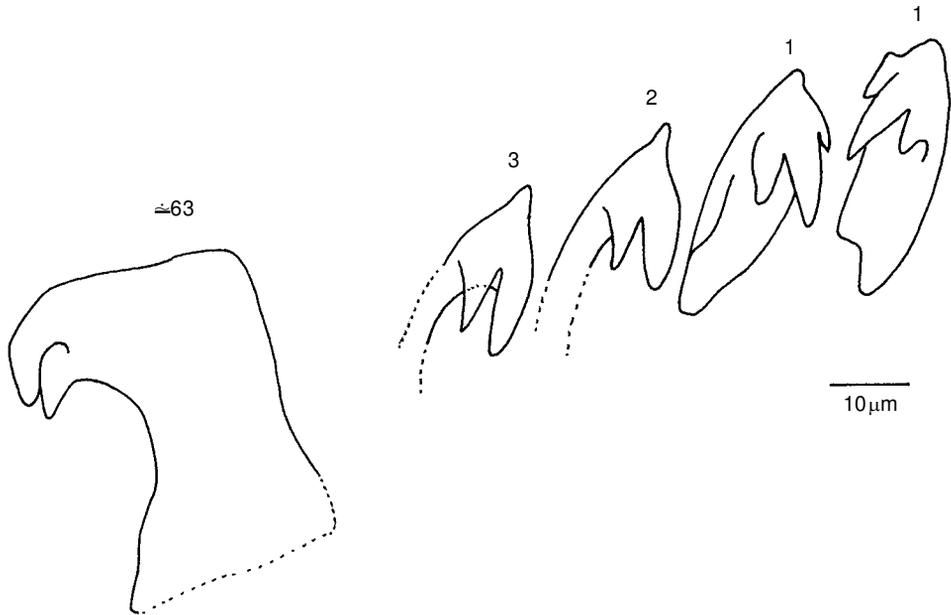


FIG. 14. *Hypselodoris nigrostriata* Chag96/58: tracing of SEM negatives, lateral teeth of row 30.

***Dendrodoris tuberculosa*** (Quoy and Gaimard, 1832)  
(figures 4g, 15)

*Doris tuberculosa* Quoy and Gaimard, 1832: 248, pl. 16, figures 1, 2; Alder and Hancock, 1864: 127, pl. 29, figures 8–10.

*Dendrodoris tuberculosa*: Hirano, 1992: figure 2A, B.

**Material.** Chag96/7: 140 mm (60 mm pres. length); inner reef, Ile Boddam, Salomon Atoll; 10 February 1996; at 17 m depth.

**Description.** Large, fleshy, brown coloured (figure 4g). Dorsal surface with many large fleshy compound tuberculate complexes, each of which had many folds and tubercles; central complexes larger than lateral ones. Central tubercle of each complex higher than ring of surrounding ones, each with orange pimple at apex, followed by series of folds to base. Lateral tubercles alternately brown and pale (almost cream). The tubercular complexes were densely packed with no bare mantle between them, giving each complex a polygonal outline. Mantle edge finely frilled. Underside of mantle brown, with numerous white spots surrounded by a black line (figure 15). Rhinophores with long stalk and very angled club; lamellae brown, with white midline almost invisible distally and double basally. Gills brown with pale edging to plumes.

**Geographic distribution.** Probably Indo-West Pacific: reliable records from India (Alder and Hancock, 1864), Zanzibar (Eliot, 1904c), New Guinea (Quoy and Gaimard, 1832) and Japan (Hirano, 1992).

**Remarks.** Taxonomically, this group of large warty dendrodorids is a difficult one, and Edmunds and Preece (1996) discussed this at length. Their specimen from the Pitcairn Islands (central Pacific) is different from ours and would be better assigned to *D. carbunculosa* Kelaart, which has warty nodules, 'larger ones rising from a raised tubercular ringed base'. The original description of the foot and

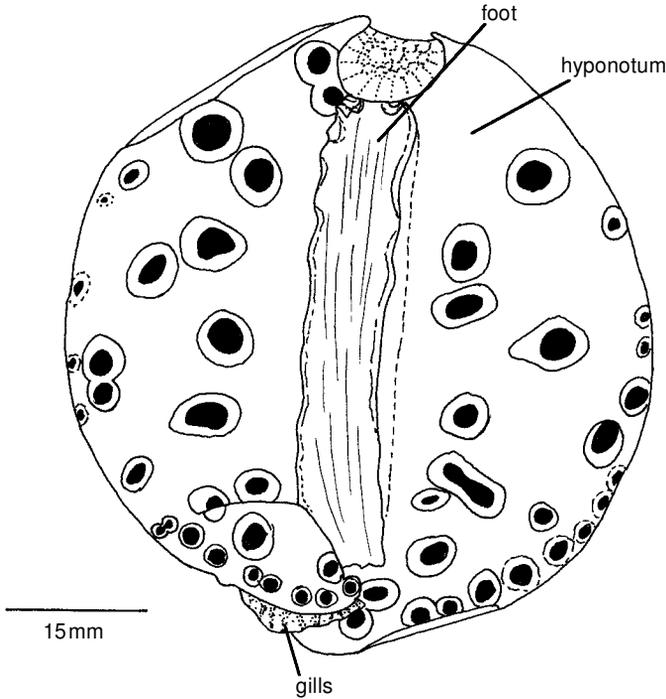


FIG. 15. *Dendrodoris tuberculosa* Chag96/7: ventral view.

hyponotum makes no mention of the vivid spots, and Edmunds and Preece's specimen therefore fits the description of *D. carbunculosa* precisely. Our specimen is identical to Quoy and Gaimard's *D. tuberculosa*, which has 'turretted tubercles ... and completely packed dorsum' (trans.) with the spots on the hyponotum, and can safely be assigned to this taxon. Numerous specimens have been described under a suite of names which includes *D. pustulosa* Alder and Hancock and *D. rugosa* Pease. At present, two species can be recognized: *D. tuberculosa* with multi-compound, contiguous tubercles dorsally and white spots ventrally, and *D. carbunculosa* with tuberculate 'discs' containing rings of compound tubercles around a central compound tubercle; the 'discs' are spaced out on the rather dark mantle, as described by Edmunds and Preece. Most descriptions of these dendrodorids are from the Pacific, but are based on more than one specimen, with and without spots, and with variable tubercle types, so they cannot be considered further here. Both species may co-exist in these localities, but precise descriptions of individuals are necessary before a revision can be attempted. When handled, the animal left the fingers coated with a sticky secretion of mucus. It was found and photographed on *Goniopora* coral.

***Fryeria marindica*** (Yonow and Hayward, 1991)  
(figure 16a)

*Reyfria marindica* Yonow and Hayward, 1991: 23, figures 10C, D, 13E.

*Fryeria marindica*: Brunckhorst, 1993: 45, pl. 5B, C; Yonow, 1996: 509, figure 13A–F.

*Material.* Chag96/24a, b: 24 mm, 18 mm; outer reef between Ile Boddam and Ile Poule, Salomon Atoll; 13 February 1996; at 10 m depth. Chag96/27: 24 mm; coral bommie inside Salomon Atoll; 13 February 1996; at 12 m depth.

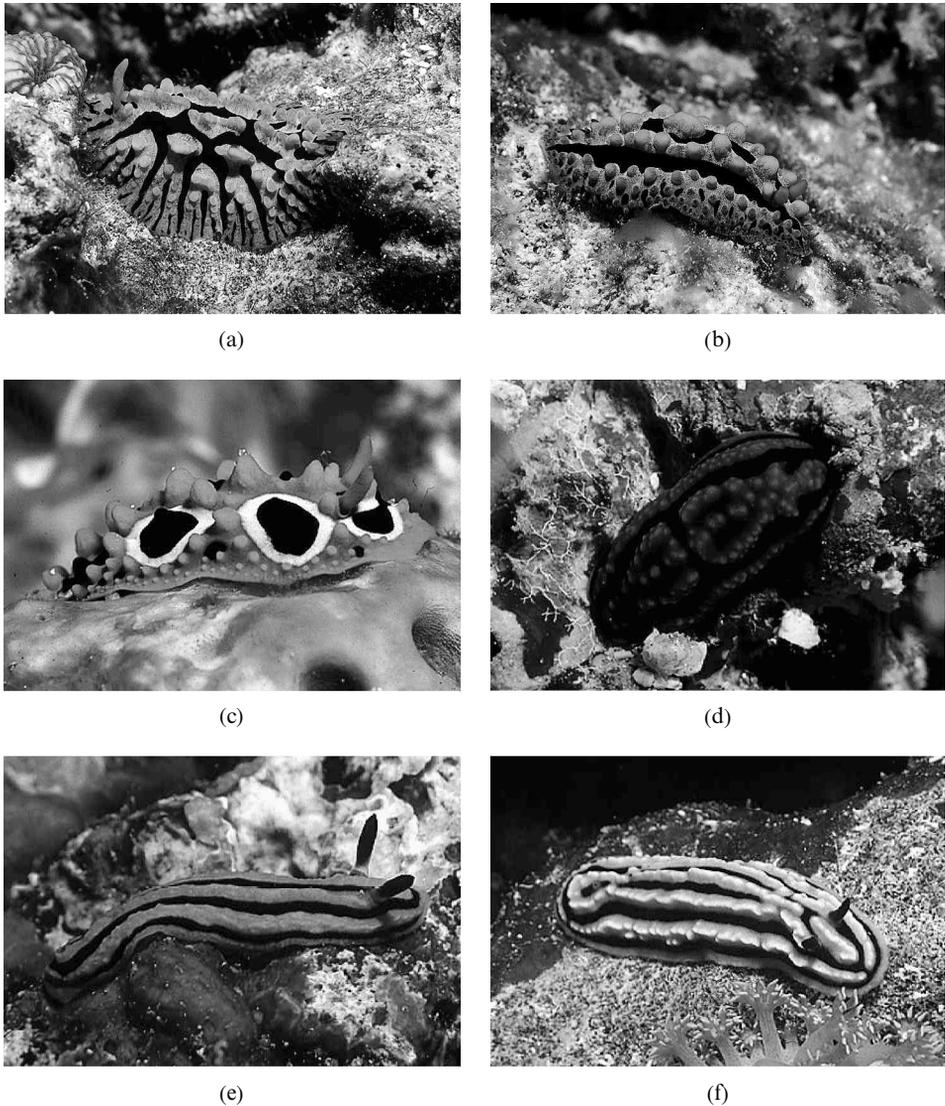


FIG. 16. (a) *Fryeria marindica* Chag96/27: 24 mm. (b) *Phyllidia coelestis* Chag96/43b: 28 mm. (c) *Phyllidia multituberculata* Chag96/29: 27 mm. (d) *Phyllidiella meandrina* Chag96/35: 18 mm. (e) *Phyllidiella rosans* Chag96/48: 15 mm. (f) *Phyllidiella striata* Chag96/2: 35 mm.

*Description.* Ground colour pale blue. Raised median ridge with orange tubercles; orange tubercles almost continuous in smallest specimen; interrupted in two places by the joining of the two longitudinal black stripes in specimen 96/27. Two black stripes, one on either side of median ridge, with five to seven rays extended to the mantle edge; additional black streaks between these rays. Rhinophores yellow.

*Geographic distribution.* Indian Ocean: from Mauritius to Western Australia (Yonow, 1996).

*Remarks.* Following its original description, *F. marindica* has been redescribed and illustrated by Brunckhorst (1993) and Yonow (1996). The Chagos specimens agree more closely with the western Indian Ocean colour morph, in which the black markings are clearly based on two longitudinal black lines. The eastern Indian Ocean specimens tend to lose the longitudinal lines, and retain transverse ones which are wavy and taper at the ends.

***Phyllidia coelestis* Bergh, 1905**

(figure 16b)

*Phyllidia coelestis* Bergh, 1905: 182, pl. 3, figure 16; Lin, 1983: 152, pl. 1, figure 3; Brunckhorst, 1989: 37, numerous figures; Brunckhorst, 1993: 30, pl. 1F, H.

*Phyllidia nobilis*: Farran, 1905: 345, pl. 3, figures 16, 17.

*Phyllidia elegans*: Edmunds, 1972: 82, figure 4B.

*Phyllidia alia* Yonow, 1984: 224, figures 6C, D, 7A, 8F, G.

NOT *Phyllidia picta* Pruvot-Fol, 1957: 110, figures 5–12 (as per Brunckhorst, 1993) (= *Fryeria picta*; see Yonow, 1996).

*Material.* Chag96/32: 12 mm; outer reef, Ile de la Passe, Salomon Atoll; 14 February 1996; at 15 m depth. Chag96/43a, b: 32 mm, 28 mm; inner reef, Ile Diamant, Peros Banhos Atoll; 19 February 1996; at 3 m depth. Chag96/46: 16 mm; outer reef, Ile Diamant, Peros Banhos Atoll; 20 February 1996; depth not recorded; no photographs taken. Chag96/53a, b: 25 mm, 22 mm; inner reef, Ile Mapou, Peros Banhos Atoll; 21 February 1996; at 9 m depth; no photographs taken. Chag96/67: 35 × 15 mm; coral bommie, east of Ile Poule, Peros Banhos Atoll; 25 February 1996; at 9 m depth; no photographs taken.

*Description.* Ground colour pale granular blue. Three longitudinal black stripes, one on the midline interrupted by yellow tubercles; the two laterals were continuous but did not meet anteriorly between the rhinophores. Variable number of rounded, yellow tubercles arranged longitudinally; fewest in smallest specimen but otherwise no obvious correlation with size. Small black flecks peripherally. Rhinophores slightly deeper yellow than tubercles.

*Geographic distribution.* Indo-West Pacific: Sri Lanka (Yonow, 1984 as *P. alia*), the Seychelles (Edmunds, 1972 as *P. elegans*) and South Africa (Gosliner, 1987 as *P. varicosa*) to Fiji (Brunckhorst, 1993).

*Remarks.* Brunckhorst (1989, 1993) redescribed and illustrated this species; the majority of his material was from the Pacific, where it also appears to be relatively common.

***Phyllidia multituberculata* Boettger, 1918**

(figure 16c)

*Phyllidia multituberculata* Boettger: Yonow, 1996: 487, figures 2, 3, 4B.

*Material.* Chag96/29: 27 mm; outer reef, Ile de la Passe, Salomon Atoll; 14 February 1996; at 22 m depth.

*Description.* Bright orange, with seven white-edged black patches, three on each side and one anteriorly. Several black spots around periphery and two on midline. Dorsum with numerous orange tubercles, largest on midline and smallest near mantle edge. Rhinophores long, orange; anus on orange tubercle.

*Geographic distribution.* Indian Ocean: Mauritius and the Seychelles (and one specimen from Indonesia; Yonow, 1996).

*Remarks.* This species has been recently re-established (Yonow, 1996) and the Chagos specimen is virtually identical to the one illustrated in her figure 2A from the Seychelles. This specimen from Salomon Atoll was found and photographed on a reddish orange sponge which had large osculae; on this substratum it appeared to be well camouflaged.

***Phyllidia varicosa* Lamarck, 1801**

*Phyllidia varicosa* Lamarck: Eliot 1910: 435.

*Phyllidia arabica* Ehrenberg: Yonow, 1996: 495, figures 7, 8.

*Material.* Chag96/17: 8 mm; outer reef, Ile de la Passe, Salomon Atoll; 12 February 1996; at 20 m depth. Chag96/33: 80 mm; outer reef, Ile de la Passe, Salomon Atoll; 14 February 1996; at 8 m depth. Chag96/41a, b: 55 mm, 30 mm; inner reef, Ile Boddam, Salomon Atoll; 18 February 1996; at 11–13 m depth; smaller specimen coll. G. Heiss.

*Description.* Body black, with three raised light blue-grey ridges which were topped with deep yellow tubercles. Numerous short peripheral tuberculate ridges perpendicular to margin. Digitiform rhinophores deep yellow. Sole of foot grey with broken black line medially in all specimens.

*Geographic distribution.* Indo-West Pacific: from the Red Sea and South Africa to Hawaii (Yonow, 1996).

*Remarks.* Previously collected from the Chagos by Gardiner and reported by Eliot (1910), Yonow (1996) noted that the specimen was collected at ‘Solomon Is., Indian Ocean’ but this was in error for Salomon Atoll, Chagos. There has been some controversy regarding the validity of this name for this species (Yonow, 1986; Brunckhorst, 1993; Yonow, 1996), in particular the apparent absence of a black line on the figure of the sole of the holotype of *P. varicosa*, long thought lost, and its presence in *P. arabica* Ehrenberg and all subsequent descriptions. The recent rediscovery of the holotype of *P. varicosa* in the MNHN (Paris; no registration number) and the confirmation that it does have a black line on the sole now resolves this issue (Willan *et al.*, 1998).

***Phyllidiella meandrina* (Pruvot-Fol, 1957)**  
(figure 16d)

*Phyllidia meandrina* Pruvot-Fol, 1957: 113, figures 22, 23; Yonow and Hayward, 1991: 21, figures 10E, 13B.

*Phyllidia nobilis*: Bergh, 1889: 860, taf. 84, figures 11, 18.

*Phyllidiella nobilis*: Edmunds, 1972: 79 (part), figure 3B.

*Material.* Chagos 96/14: 25 mm; inner reef between Ile Jacobin and Ile du Sel, Salomon Atoll; 12 February 1996; at 11 m depth. Chag96/35: 18 mm; outer reef, Ile Takamaka, Salomon Atoll; 15 February 1996. Chag96/39e, j: 37 × 14 mm, 24 mm; Salomon Atoll, 13–15 February 1996. Chag96/68: 27 mm; outer reef, Ile Manoele, Peros Banhos Atoll; 27 February 1996; at 12 m depth.

*Additional material.* Syntype: Pruvot-Fol (1957), Mauritius, 18 × 7 mm preserved (BMNH 1887.6.7.10); Trou aux Biches, Mauritius, 18 mm preserved; Belle Mar Plage, Mauritius, 42 × 9 mm (BMNH acc. no. 2350, Yonow and Hayward, 1991).

*Description.* Elongated in shape, with characteristically pointed tubercles. Four to six rings of tubercles with confluent bases medially (figure 16d). The black pattern

tended to follow the outer edges of the tubercles closely, creating a scalloped effect around the pink bands. Small ring posterior to the anus. Central rings enclosed by up to three pink tuberculate bands; smooth pink edge. Rhinophores black. Ventrally, foot sole evenly spotted with grey and notched anteriorly (see also Pruvot-Fol, 1957: figure 23). Head sometimes visible and the rounded oral tentacles are tipped with black which may spread laterally on either side of the groove, but more often only outside it.

*Geographic distribution.* Western Indian Ocean: Mauritius (Yonow and Hayward, 1991), Seychelles (Edmunds, 1972), South Africa (Gosliner, 1987) and the Maldives (Yonow, unpublished).

*Remarks.* Brunckhorst (1993) placed *P. meandrina* in the synonymy of *P. annulata* Gray. His study focused on the western Pacific, and the synonymy of the Indian Ocean species *P. meandrina* with the West Pacific *P. annulata* seems unjustified. *Phyllidiella annulata* (Gray, 1853) is a Pacific species recorded from the Tuamotu-Gambier archipelago (Gray, 1853, 1857; Marcus and Marcus, 1970; Lord Hood's Islands = Gambier Islands), the nearby Pitcairn Island group (Edmunds and Preece, 1996) and Guam (Carlson and Hoff, 1973 and personal communication). Brunckhorst (1993) records additional material from Java and Fiji, but his specimen from Réunion is probably *Phyllidiella meandrina*. *Phyllidiella annulata* differs in having a central row of three or four rings of also very angular tubercles; this region, and the anus and rhinophores, is enclosed by a band consisting of smaller rings followed by two or three series of isolated single tubercles. There are no continuous encircling ridges as in *P. meandrina*, which also has a scalloped pattern: this is depicted precisely by Bergh (1889: pl. 84, figures 11, 18) and Edmunds (1972: figure 3B), and in the photographs published by Gosliner (1987: figure 153) and Yonow and Hayward (1991: figure 13B).

The specimen in the Natural History Museum (BMNH 1887.6.7.10) was examined: it measured 18×7 mm and is the specimen figured by Pruvot-Fol (1957); it must be taken to be the sole type specimen although the label states it is the syntype (from Mauritius, coll. Robillard). The submarginal edge bears a row of pink tubercles, as in these specimens. The internal organs were missing, but a dissection of the Belle Mar Plage specimen confirms the generic placement of the taxon.

### ***Phyllidiella rosans* (Bergh, 1873)**

(figures 16e, 17a)

*Phyllidia nigra* Pease, 1868: 80, pl. 9, figure 5 (pre-occupied by *P. nigra* van Hasselt, 1824).

*Phyllidia rosans* Bergh, 1873b: 139 (67), pl. 9, figures 1–4, pl. 10, figures 1–18.

*Phyllidia soria* Marcus and Marcus, 1970: 174, figures 53, 54.

*Phyllidiella rosans*: Brunckhorst, 1993: 56, pl. 6a–D.

NOT *Phyllidia bourgini* Risbec, 1928: 57, figure 2, pl. 1, figure 1; 1953: 12, figure 3 (same specimen as Risbec, 1928).

NOT *Phyllidiopsis* cf. *striata*: Edmunds, 1972: 83 (part), figures 3D, G. (as per Brunckhorst, 1993) (= *Phyllidiella zeylanica*, *q.v.* p. 868).

NOT *Phyllidia mediocris* Yonow and Hayward, 1991: 20, figures 11C–E, 13A (as per Brunckhorst, 1993) (= *Phyllidiella striata*, *q.v.* p. 866).

*Material.* Chag96/9: 20 mm; outer reef, Ile Anglais, Salomon Atoll; 11 February 1996; at 12 m depth. Chag96/23: 17 mm; outer reef between Ile Boddam and Ile

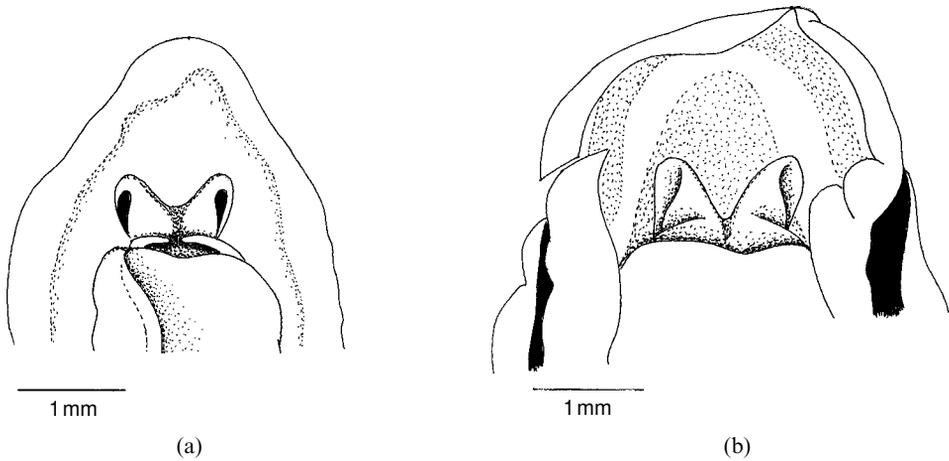


FIG. 17. (a) *Phyllidiella rosans* Chag96/23: ventral view of oral tentacles. (b) *Phyllidiella striata* Chag96/5: ventral view of oral tentacles.

Poule, Salomon Atoll; 13 February 1996; at 10 m depth. Chag96/39a, b: 13 mm, 15 mm; Salomon Atoll; 13–15 February 1996. Chag96/48a, b: 13 mm, 15 mm; outer reef, Ile Diamant, Peros Banhos Atoll; 20 February 1996; at 22 m depth. Chag96/72b: 16×6 mm; outer reef, Peros Banhos Atoll; 27 February 1996; coll. A. Jolliffe.

*Description.* Body with three longitudinal raised but smooth pink ridges and four black lines; surrounding low pink ridges up to three in number, coalescing anteriorly and posteriorly. The median extended to just in front of the rhinophores, where it expanded slightly. Rhinophores black with pink sheaths. Ventrally, most of the specimens had a dusting of black along the top edge of the foot, and a black patch on the posterior end of the sole. The head and oral tentacles were also dusted with black (figure 17a).

*Geographic distribution.* Indo-West Pacific: the Maldives and Réunion to Hawaii and Tahiti (Brunckhorst, 1993).

*Remarks.* It appears that *Phyllidiella rosans* (Bergh, 1873b) and *Phyllidiella nigra* (Pease, 1868) are not as tuberculate as their original descriptions indicated, and (with *Phyllidiella soria* Marcus and Marcus, 1970) are in fact one species originating from Tahiti. This species is characterized by the smooth pink ridges bearing a crest in larger specimens: three central longitudinal ones and up to three encompassing rings which converge anteriorly and posteriorly. Large specimens can be almost round in shape. The grey spots on the sole noted by Brunckhorst (1993) are concentrated submarginally, and there is frequently a black patch on the distal end of the sole. Brunckhorst (1993) had additional material from the Maldives and Réunion; certainly this species is extremely common in the Maldives (Yonow, unpublished). The specimens from Chagos range from 13 to 20 mm and are smaller than those from the Pacific, which are 18–35 mm (Brunckhorst, 1993). It is noteworthy that despite many earlier collections in the Indian Ocean, this species was only recently recorded, despite being abundant when present.

***Phyllidiella striata* (Bergh, 1889)**  
(figures 16f, 17b, 18a)

*Phyllidiopsis striata* Bergh, 1889: 866, taf. 84, figures 23, 24.

*Phyllidiopsis striata* ? (*sic.*): Eliot, 1906a: 563.

*Phyllidia nobilis*: Edmunds, 1972: 79 (part), figures 3A, F.

*Phyllidia empelia* Yonow, 1984: 223, figures 6, 7B, 8A, B (not *P. zeylanica* as per Brunckhorst, 1993).

*Phyllidia mediocris* Yonow and Hayward, 1991: 20, figures 11C–E, 13A (not *P. rosans* as per Brunckhorst, 1993).

**Material.** Chag96/2: 35 mm; inner reef, Ile Boddam, Salomon Atoll; 8 February 1996. Chag96/5: 18 mm; outer reef, Ile Anglais, Salomon Atoll; 10 February 1996; at 20 m depth. Chag96/8: 17 mm; outer reef, Ile Anglais, Salomon Atoll; 11 February 1996; at 8 m depth. Chag96/13 and Chag96/15: both 30 mm; inner reef between Ile Jacobin and Ile du Sel, Salomon Atoll; 12 February 1996; at 8 m and 12 m depth. Chag96/21 and Chag96/22: 26 mm and 21 mm; outer reef between Ile Boddam and Ile Poule, Salomon Atoll; 13 February 1996; at 15 m depth. Chag96/28: 26 mm; coral bommie inside Salomon Atoll; 13 February 1996; at 14 m depth. Chag96/38: 35 mm; coral bommie inside Ile Anglais, Salomon Atoll; 15 February 1996; at 12 m depth. Chag96/39d: 28×16 mm; Salomon Atoll; 13–15 February 1996. Chag96/49: 28×12 mm; outside reef, Ile Diamante, Peros Banhos Atoll; 20 February 1996. Chag96/66: 29×8 mm; inner reef, Ile Monpatre, Peros Banhos Atoll; 25 February 1996; at 22 m depth.

**Additional material.** Le Morne, Mauritius, 18×5.5 mm; Grand Baie, Mauritius, 14×5 mm and 15×5 mm; Trou aux Biches, Mauritius, 18 mm (BMNH acc. no. 2350, Yonow and Hayward, 1991).

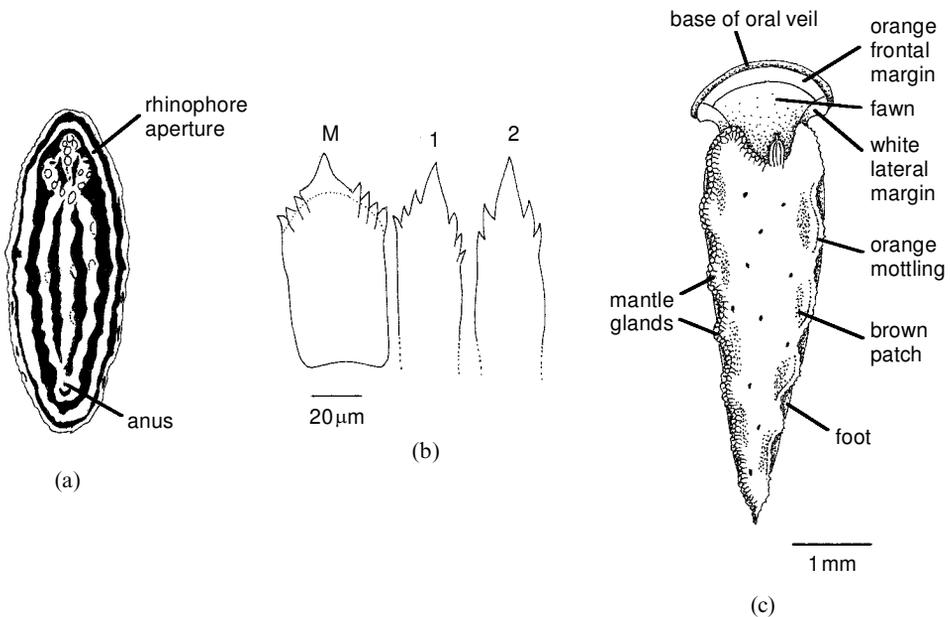


FIG. 18. (a) *Phyllidiella striata*: tracing of Bergh (1889) taf. 84, figure 23. (b) *Scyllaea pelagica* Chag96/55: radular teeth drawn with *camera lucida*, row 1. (c) *Dermatobranchus* sp. Chag96/85: dorsal view: composite drawing from life and *camera lucida* (based on preserved length of 6 mm).

*Description.* Dorsum very long and thin. Three central pink tuberculate ridges, which may be broken, met behind the rhinophores; the two laterals were bent outwards to the rhinophores (figure 16f). Single medial patch or ring of tubercles in front of the rhinophores; ring of tubercles behind the anus. First encompassing pink band may be a double row of tubercles; up to two more single rows of tubercles encircling mantle. Ventrally, the foot is pale and there is no black dusting on its top surface, although the gills are edged in black (figure 17b). Additional internal characters are the dusty black band on the oral tube and a very thick pharynx; other details are as described for the genus (Brunckhorst, 1993: 17). The swollen anus is black.

*Geographic distribution.* Western Indian Ocean: Sri Lanka (Yonow, 1984), Mauritius (Bergh, 1889, Yonow and Hayward, 1991), Seychelles (Edmunds, 1972) and the Maldives (Eliot, 1906a; R. C. Anderson, S. G. Buttress and N. Yonow, personal observations).

*Remarks.* The epithet *Phyllidiella striata* Bergh is correctly recognized for this species for the first time since Eliot (1904a). The animal commonly called *Phyllidiopsis striata* is in fact *Phyllidiopsis xishaensis* (q.v. p. 870). Bergh's figure (1889: pl. 84, figure 23) is identical to specimen 96/2 and both are reproduced here (figures 16f and 18a, respectively). Eliot (1906a) recognized the similarities between his single specimen from the Maldives and Bergh's figure and stated clearly that the foot and gills were lighter than the dorsum (unlike *Phyllidiopsis xishaensis* in which there is a black line on the hyponotum beneath the gills). Eliot described three white lines on a blackish dorsum and white patches at each end. This is similar to Bergh's figure and to approximately 25 specimens recently collected from the Maldives (Yonow, unpublished). At present, we consider the variation within the species to be restricted to continuous or broken tuberculate pink ridges and either a patch or ring anteriorly; the posterior ring appears to be a constant feature in all specimens examined. Small specimens can be confused with *Phyllidiella rosans* but differ in having tuberculate ridges which are often broken, and lacking the black pigmentation on the foot and oral tentacles. Additionally, *Phyllidiella striata* is long and thin, while *Phyllidiella rosans* is broadly oval. There are several other pink and black specimens in this collection which are vaguely similar but do not have the above combination of characters; these will be considered in a further work. Bergh's species is re-established, and assigned to *Phyllidiella*, in part due to the presence of distinct oral tentacles which, as Bergh states, are 'shorter and plumper than those of *Phyllidia varicosa*' (trans., 1889: 866): these are certainly not a characteristic of *Phyllidiopsis*, which he defined as '*brevissima affixa*' (Bergh, 1875: 661; 1876: 380). The pharynx of this Chagos specimen was exactly as in Brunckhorst's (1993) figure of *Phyllidiella pustulosa*, the type species of the genus: a long thickened tube with a dorsal split, which confirms this species as belonging to the genus *Phyllidiella* and not *Phyllidiopsis*. Of concern is the lack of glands on Bergh's figure of the pharyngeal bulb (pl. 84, figure 24); however, these were very small and attached by extremely fine ducts in specimen 96/49; the arrangement of the digestive system was otherwise identical to that in Bergh's figure.

*Phyllidia empelia* Yonow, 1984 is here reassigned to *Phyllidiella striata*: Brunckhorst (1993) correctly recognized it as *Phyllidiella*, but wrongly as *Phyllidiella zeylanica* (no colour slides of the Sri Lanka specimens exist, as stated by Brunckhorst, 1993). The elongated body shape, with anterior and posterior rings, and the rhinophores are characteristic of *Phyllidiella striata* and not *Phyllidiella zeylanica* (q.v. p. 868). The 'pink tubercles tending to ridges' are also characteristic of

*Phyllidiella striata*. The three central ridges are very broken up, but that they converge behind the rhinophores is clear. *Phyllidiella zeylanica* is not like this; there are no groups or rings, and the central pattern is extremely linear. The oral tentacles of *P. empelia* are like those of *Phyllidiella striata* and not black or of the form peculiar to *Phyllidiella zeylanica*.

*Phyllidia mediocris* Yonow and Hayward, 1991 from the type locality of Mauritius is also reassigned to *Phyllidiella striata* on the basis of its dorsal pattern and lack of black pigmentation on the foot which is present in *Phyllidiella rosans*, to which Brunckhorst (1993) assigned this species. The rhinophores with few lamellae and the oral tentacles figured match those figured for *P. empelia*, and for these specimens.

Following the recognition of this species, the specimen figured by Edmunds (1972: figure 3A, F) clearly also belongs to *P. striata* and not *P. zeylanica* as assigned by Brunckhorst (1993). The anterior and posterior rings are present in his specimen and never occur in *P. zeylanica*. *Phyllidiella striata* has a pointed appearance while *P. zeylanica* has a rounded appearance with a truncated anterior end: the body shape of the former is long and thin while that of the latter is distinctly oval (see below for further discussion).

### ***Phyllidiella zeylanica* (Kelaart, 1858)**

(figure 19a)

*Phyllidia varicosa*: Risbec, 1929: 49, figures 10–16 (not figures 6, 7b, 8a, b as per Yonow, 1996). *Phyllidiopsis* cf. *striata*: Edmunds, 1972: 83 (part), figure 3D, G (not *P. rosans* as per Brunckhorst, 1993).

NOT *Phyllidia empelia* Yonow, 1984: 223, figures 6, 7B, 8A, B (as per Brunckhorst, 1993) (= *Phyllidiella striata*, *q.v.* p. 866).

*Phyllidiella zeylanica*: Yonow, 1996: 502, figure 10.

**Material.** Chag96/3: 26 mm; Salomon Channel, Salomon Atoll; 9 February 1996; at 6 m depth (no photograph). Chag96/11: 36 mm; outer reef, Ile Anglais, Salomon Atoll, 11 February 1996; at 15 m depth. Chag96/19: 24 mm; outer reef, Ile de la Passe, Salomon Atoll; 12 February 1996; at 19 m depth. Chag96/39h: 33 × 13 mm; Salomon Atoll; 13–15 February 1996.

**Description.** All specimens have the classic hallmarks of *P. zeylanica* (figure 19a): the squared appearance of the anterior end of the animal, the curled-under edges of the mantle, the few, spaced lamellae on the long rhinophores, and the rather peculiar mouth-oral tentacle arrangement; these characters remain in the preserved specimens. The faintly tuberculate areas are pink and the smooth bands black. The long rhinophores are black, tapered and bent back slightly over the dorsum.

**Geographic distribution.** Indian Ocean: East Africa to Christmas Island (Yonow, 1996).

**Remarks.** Specimen 96/11 is almost identical to Edmunds' figure (1972: figure 3D); both are unusual in having broken longitudinal lines. Brunckhorst (1993: 56) assigned Edmunds' specimen to *Phyllidiella rosans* but *P. rosans* bears smooth, usually continuous, pink ridges (*q.v.* p. 864). Furthermore, in Edmunds' drawing of the ventral anterior end, the arrangement is the same as in the drawing of *P. zeylanica* (Yonow, 1996: figure 10C); however, Edmunds did state that the oral tentacles were grey, not black.

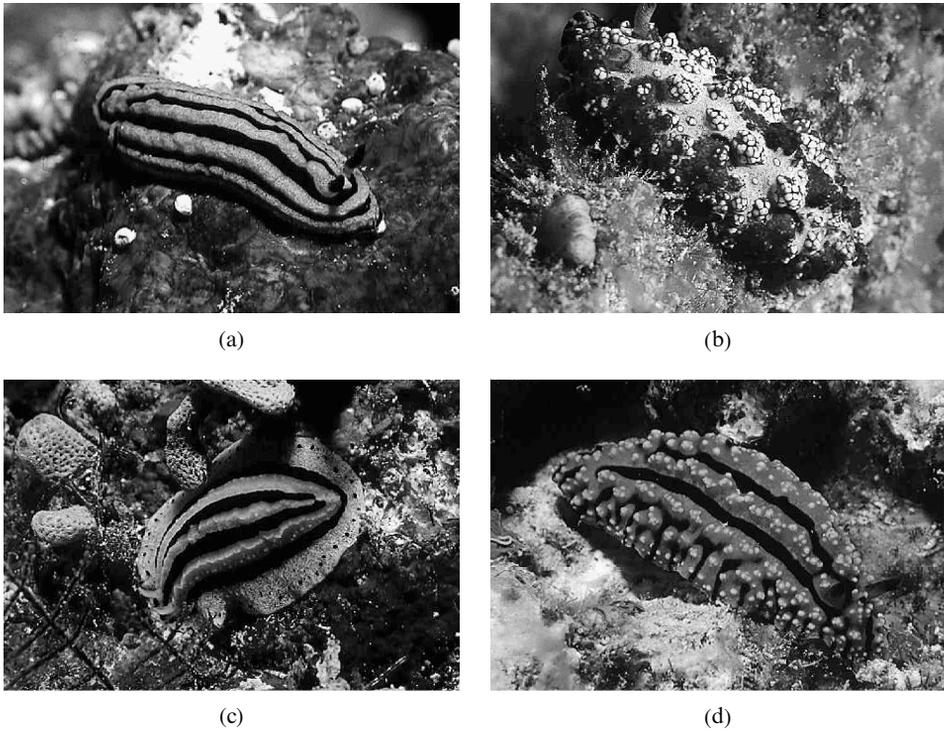


FIG. 19. (a) *Phyllidiella zeylanica* Chag96/19: 24 mm. (b) *Phyllidiopsis cardinalis* Chag96/75: 38 mm. (c) *Phyllidiopsis xishaensis* Chag96/26: 18 mm. (d) *Phyllidiopsis* sp. Chag96/65: 37 mm.

***Phyllidiopsis cardinalis* Bergh, 1875**

(figure 19b)

*Phyllidiopsis cardinalis* Bergh: Eliot, 1904c: 284; Gosliner and Behrens, 1988: 308, figures 1B, 3; Brunckhorst, 1993: 63, numerous figures.

*Phyllidia tuberculata* Risbec, 1928: 59, figure 3, pl. 1, figure 2; 1953: 12.

**Material.** Chag96/75: 38 × 16 mm; Three Brothers, Great Chagos Bank; 29 February 1996; at 20 m depth. Chag96/81: live length not recorded; curled, approx. 25 mm preserved; Three Brothers, Great Chagos Bank; 2 March 1996; at 22 m depth.

**Description.** Dorsal surface with numerous large complex tubercles and smaller simple ones. Colour mottled cream, brown and yellow in specimen 96/75 (figure 19b), red-brown in specimen 96/81. Mantle margin cream or yellow with black or dark green spots. Yellow anal papilla. Ventral surface of foot deep yellow with irregular brown spots around periphery. Rhinophores short, pale yellow with green tips.

The preserved animals retain the three rows (not two as in Brunckhorst, 1993) of multicomound tubercles. Both specimens are uniformly very dark, a reddish black; the formaldehyde is tinted pink.

**Geographic distribution.** Indo-West Pacific. *Phyllidiopsis cardinalis* is well known from the Pacific but has been rarely recorded from the Indian Ocean: Eliot (1904c) recorded four specimens from Zanzibar; Gosliner and Behrens (1988) had one specimen from Aldabra, and Brunckhorst (1993) had two specimens from Western Australia and three from Réunion. N. Y. has photographs of one individual from

the Seychelles (P. Kemp) and of one individual from the Red Sea (J. Hinterkircher), both of which constitute new records.

*Remarks.* Specimen 96/75 was found close to a species of brown and yellow sponge; underwater this nudibranch appeared very similar to the sponge. Neither were seen at other localities and the sponge has not been recognized in any photographic guide (R. C. A. and S. G. B.).

***Phyllidiopsis xishaensis* (Lin, 1983)**

(figure 19c)

*Phyllidia xishaensis* Lin, 1983: 153, pl. 1, figure 2.

*Phyllidia varicosa*: Bergh, 1905: 181, pl. 17, figure 8.

*Phyllidiopsis striata*: Wells and Bryce, 1993: 146; Brunckhorst, 1993: 69, pl. 8D–F.

*Material.* Chag96/6: 14 mm; outer reef, Ile Anglais, Salomon Atoll; 10 February 1996; at 12 m depth. Chag96/26: 18 mm; outer reef between Ile Boddam and Ile Poule, Salomon Atoll; 13 February 1996; at 8 m depth. Chag96/47: 12 mm; outer reef, Ile Diamante, Peros Banhos Atoll; 20 February 1996; at 23 m depth.

*Description.* Ground colour pale blue to white with four longitudinal black stripes, the inner two joining anteriorly between the rhinophores, the outer two joining anteriorly and posteriorly (figure 19c). Black stripes separated by three pale blue to white ridges: the median ridge is simple, the outer two are doubled. Numerous small black spots present peripherally on the margin. Rhinophores lamellate, pale ochre in colour. Ventrally, the sole and the hyponotum are pale grey, and there is a black line on the hyponotum beneath the gills.

*Geographic distribution.* Indo-West Pacific: from the Maldives and Seychelles (Yonow, unpublished) to Indonesia (Bergh, 1889), China (Lin, 1983) and the Marshall Islands (Brunckhorst, 1993).

*Remarks.* This distinctive species is widely known as '*Phyllidiopsis*' *striata*; however, *Phyllidiella striata* (Bergh, 1889) is a species quite distinct from *Phyllidiopsis xishaensis*, and is also present in this collection from Chagos (see above). *Phyllidiopsis xishaensis* was first described and illustrated by Bergh (1905: 181) but not recognized as a new species; he described a tiny specimen (9 mm) with 'black behind the gills' (trans.) from Siau Island (Indonesia) as *Phyllidia varicosa* Lamarck although 'the foot sole is greyish white' (trans.): *P. varicosa* has a black line on the sole. The figure of this specimen (Bergh, 1905: pl. 17, figure 8) is identical to the figure of a new species described by Lin (1983) as *Phyllidia xishaensis*. As Lin was describing an old preserved specimen (collected in 1958), the rhinophores, described as grey, had probably lost their ochre colour. The external pattern of this species is unmistakable (see Brunckhorst, 1993 and photographs in Wells and Bryce, 1993 and Coleman, 1989) and, since *Phyllidiella striata* and *Phyllidia varicosa* are misidentifications, the first available name is *Phyllidiopsis xishaensis*. This is the first record for the Indian Ocean.

***Phyllidiopsis* sp.**

(figure 19d)

*Phyllidiopsis krempfi* Pruvot-Fol: Brunckhorst, 1993: 66, pl. 8A.

*Material.* Chag96/65: 37 × 16 mm; inner reef, Ile du Coin, Peros Banhos Atoll; 25 February 1996; at 10 m depth; collected by Frank Stewart. Chag96/71: 39 mm; inner reef, Ile Diamant, Peros Banhos Atoll; 27 February 1996; at 10 m depth.

*Description.* Pink, with four longitudinal black stripes dorsally and numerous black transverse marginal streaks. Numerous complex, compound tubercles on dorsum, with pale pink tips. Rhinophores black, the bases pink anteriorly.

*Geographic distribution.* Indo-West Pacific: Red Sea (Yonow, unpublished), South Africa, and Thailand, Java and Indonesia (Brunckhorst, 1993). Also known from Sri Lanka: this record is based on a photograph by R.C.A. taken in April 1995 near Trincomalee on the east coast of Sri Lanka (not the west coast as stated in Debelius, 1996: 270).

*Remarks.* This species has been referred to *Phyllidiopsis kremphi* Pruvot-Fol, 1957 by Brunckhorst (1993); however, examination of Pruvot-Fol's specimens, description and illustration show Brunckhorst's specimens of his new species *Phyllidiopsis fissuratus* to be more similar to Pruvot-Fol's species than those specimens he assigned to *P. kremphi*. Clearly this difficult species complex needs further work.

### *Scyllaea pelagica* Linnaeus, 1758

(figure 18b)

*Scyllaea pelagica* Linnaeus: Thompson and Brown, 1981: 441, figures 3, 4.

*Material.* Chag96/55: four specimens approximately 18 mm; on floating *Sargassum* weed, inside Peros Banhos Atoll; 22 February 1996. Chag96/56: 23 mm; collection details as above. No photographs.

*Description.* The preserved specimens, although flattened, appear identical to the photograph in Wells and Bryce (1993: 173; figure 223): the body is translucent and the organs within are opaque white; the brown radula and jaws are visible. The orange pigment spots remain on the preserved material. The two pairs of cerata with the gills on the mesial surface are squared in shape, irregularly lobed on their distal edges, and the dorsal flap posterior to the cerata is large and bears gills, ending bluntly at the short metapodium. In the smallest specimen (the only specimen without orange spots), the rows of teeth in the radula are clearly visible at  $\times 80$  magnification. When removed, examination provided a formula of  $17 (+ 3) \times 24-25.1.25-24$  (figure 18b). There are no colour notes or photographs, but preserved body shape is identical to those illustrated by Baba (1949), Marcus and Marcus (1963) and Thompson and Brown (1981).

*Geographic distribution.* *Scyllaea pelagica* is considered semi-planktonic, associated with the floating oceanic alga *Sargassum*. It has been recorded under numerous names from all areas of the world, including Antarctica, southern Britain and the western Atlantic (see Thompson and Brown, 1981).

*Remarks.* Numerous species and varieties of *Scyllaea* have been described, all of which are found in *Sargassum* and analogous floating habitats. Odhner (1936) has synonymized the majority into five species, distinguished by colour, shape and internal characteristics such as the radula, stomach plates and liver masses. Following Eliot's (1906b) example, Odhner's (1936) primary distinctions between the species were in radula ribbon width, narrow (16-17 lateral teeth) or broad (20+ lateral teeth). This specimen, with 24-25 laterals, clearly falls into the second group, which contains three species distinguished partly by colour and size. *Scyllaea pelagica* is the most common and the largest, characterized by blue patches or small spots and squared cerata. The other two species with a broad radula are *S. marmorata* Alder and Hancock, 1864 and *S. viridis* Alder and Hancock, 1864. The former, redescribed

by Eliot (1906b), is more similar to *S. pelagica* but has a shorter neck and longer metapodium, and the four cerata are oval rather than angular; colour is darker but with the same dark and light pallial margin pigmentation and a row of yellow tubercles on each side. *Scyllaea viridis* is certainly distinct, very long and thin with a proportionately very long neck and metapodium, uniformly green in colour. Both species are known only from the original specimens.

Odhner (1936) placed *S. pelagica* of Farran (1905) in *S. marmorata* while Thompson and Brown (1981) considered it conspecific with *S. pelagica*. Eliot (1906b) considered the radular teeth of both species indistinguishable, and Farran thought that *S. pelagica* and *S. marmorata* closely resembled each other, suggesting 'that there are hardly sufficient grounds for regarding the latter as a distinct species'. Until further material of *S. marmorata* is available, no conclusion may be drawn regarding the probable conspecificity of these two species.

The body shape and radular formula of these Chagos specimens conform with descriptions and illustrations of *S. pelagica* consulted (Baba, 1949; Marcus and Marcus, 1963; Thompson and Brown, 1981). Without colour notes or photographs it is not known whether or not they had the typical blue markings in life.

***Dermatobranchus albus*** (Eliot, 1904)

(figures 4h, 20A)

*Pleuroleura alba* Eliot, 1904b: 104.

*Dermatobranchus albus*: Edmunds and Thompson, 1972: 229, figure 4.

*Material.* Chag96/45: 12 mm; outer reef, Ile Diamant, Peros Banhos Atoll; 20 February 1996; at 22 m depth (radular preparation). Chag96/94: 13 mm; outer reef, Ile Poule, Peros Banhos Atoll, 4 March 1996; at 22 m depth; coll. A. Jolliffe, no photographs.

*Description.* Notum with series of 13 longitudinal ridges; cream coloured, with black interspaces (figure 4h). The pale ridges alternated between high continuous ones (the median ridge and odd-numbered ridges) and low interrupted ridges (particularly anteriorly); peripheral ridges not as high as other odd-numbered ridges and ran into the orange mantle edge. Rhinophores bulbous with vertical lamellae; stalks white with orange stripes posteriorly and anteriorly; lamellae white, with black in between; tips white. Mantle edge speckled grey-brown ventrally; foot white with orange-yellow margin.

Specimen 96/45 is badly preserved and was used for the radular preparation. Specimen 96/94 is in better condition: the dorsum is black with greyish ridges, and the sides, sole and oral veil are completely white. The glands (marginal sacs and pores of Baba, 1992) are visible in ventral view through the body wall but the gill lamellae are indistinguishable. The radula was damaged during SEM preparation but contains more than 20 rows  $\times 7-8.1.1.1.8-7$  teeth. The median has one large central cusp and 12-13 denticles on each side of the cusp; the laterals have one major cusp medially and 14-15 denticles laterally; the seven or eight marginals are simply hooked (figure 20A).

*Geographic distribution.* Western Indian Ocean: Zanzibar (Eliot, 1904b) and mainland coast of Tanzania (Edmunds and Thompson, 1972).

*Remarks.* This striking species is recorded for only the third time; it was originally described from two specimens from Zanzibar (Eliot, 1904b) and subsequently two additional specimens were reported from the Tanzanian coast

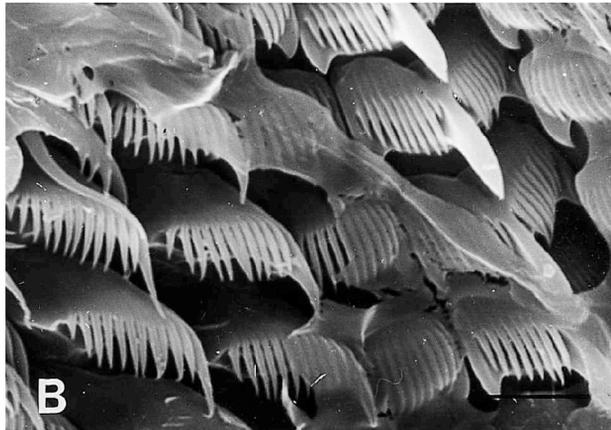
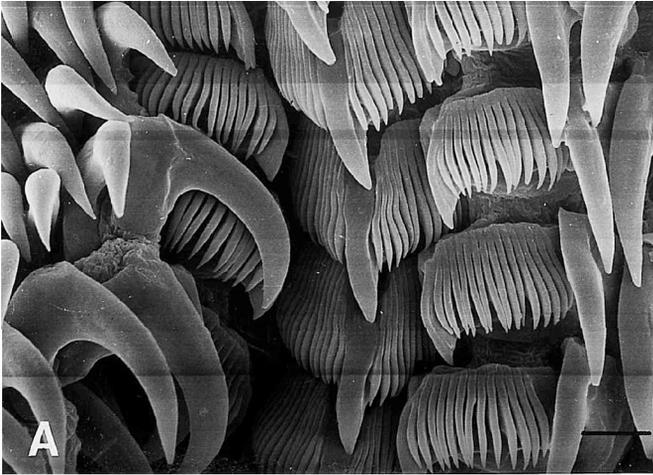


FIG. 20. SEM of radular teeth. (A) *Dermatobranchus albus* Chag96/45, scale = 10  $\mu\text{m}$ . (B) *Dermatobranchus* sp. Chag96/85, scale = 10  $\mu\text{m}$ .

(Edmunds and Thompson, 1972). These ranged in size from 9 to 16 mm in life. Edmunds and Thompson's (1972) material was found amongst the roots of *Cymodocea* (eel grass) in sand; in contrast, the Chagos specimens were both found on the steep outer reefs of the islands, rather deeper at 24 m.

***Dermatobranchus* sp.**  
(figures 18c, 20B)

*Material.* Chag96/85: 9 mm (6 mm preserved length); inner reef, Nelson Island, Great Chagos Bank; 3 March 1996; at 23 m depth; no photographs.

*Description.* Elongated tapering body; dorsum mottled pale brown with some black specks and two longitudinal rows of four brown patches, and orange mottling peripherally (figure 18c). Single rhinophore with orange bulb and white tip. Oral veil fawn with white lateral margins and orange frontal margin.

The mantle of the preserved specimen is very pointed posteriorly and deeply

notched anteriorly, where it appears continuous. The foot is completely folded together longitudinally and so the mantle edges, which remain extended, could be viewed with reflected light: they are undulated and contain beaded glands along both edges and meeting at the posterior tip. No gills are visible. The specimen is mature and contains ovotestes with developing oocytes. The radula was folded over during SEM preparation, so the rows could not be counted; however, the rest of the formula is 5.1.5. The median has seven to nine denticles on each side of the main cusp; the lateral teeth bear a sharp median cusp and 10–12 elongated lateral denticles (figure 20B).

*Geographic distribution.* Unassigned in table 1.

*Remarks.* Externally, the single (small) specimen appears similar to two (large) species: *Pleurophyllidiella horatii* Eliot (1903b: 251) from East Africa and *Dermatobranchus (Pleuroleura) nigropunctatus* Baba (1949: 160, pl. 30, figures 113, 114; Baba, 1976a: 10, figure 8) from Japan. These two species appear to be the same: despite the geographical separation, salient details are similar: a ridged dorsum, grey or olive ground colour with darker patches on each side, with scattered black spots. The margins of the body and oral veil were salmon or orange as were the rhinophores. The foot was truncated anteriorly and narrowly pointed posteriorly. The Chagos specimen differs in lacking ridges and lacking the complete orange margin around the mantle, but this may be a factor of size. The teeth and radular formulae of the East African (75 mm: 30×50.1.50) and Japanese specimens (60–100 mm: 30×42.1.42 and 35×55.1.55) are similar to each other, although Baba described denticles on the outer edge of the first lateral only and Eliot described them on the inner edge of the first three laterals. However, the radular formula of this specimen is completely different, having only five teeth per half row instead of 40–55 and all the teeth denticulate on their outer sides.

Although there are numerous described species of *Dermatobranchus*, the species described from East Africa and Japan and the specimens from Chagos are united externally by the presence of two series of patches laterally, scattered black spots and orange markings. The only other species with any of these features is *D. semistriatus* Baba, which has very fine ridges, is grey-yellow with black spots, each spot surrounded by an ocellus, and with black rhinophores. However, the radula of this Chagos specimen appears unique among species of *Dermatobranchus* in having few laterals, of which all are denticulate. The specimen is too poorly preserved to describe in more detail, but probably represents an undescribed species.

### ***Flabellina bicolor*** (Kelaart, 1858)

*Eolis bicolor* Kelaart, 1858: 115.

*Coryphella ornata* Risbec, 1928: 266, pl. 11, figure 1; 1953, 143, figure 98a.

*Flabellina bicolor*: Gosliner and Willan, 1991: 97, figures 1A, 2–5.

*Material.* Photographs of single individual; approximately 10–15 mm in length; outer reef, Ile de la Passe, Salomon Atoll; 12 February 1996.

*Description.* Photographs depict an elongate body, transparent and opaque white. Cerata in six clusters, with the suggestion of faint orange bands near the distal ends. Oral tentacles long, opaque white with two translucent bands proximally and possibly orange distally. Rhinophores orange.

*Geographic distribution.* Indo-West Pacific: Red Sea (Yonow, 2000) and South Africa to Hawaii (Gosliner and Willan, 1991).

*Remarks.* The family Flabellinidae has been reviewed recently by Gosliner and Willan (1991).

***Pteraeolidia ianthina*** (Angas, 1864)

*Pteraeolidia ianthina* (Angas): Yonow, 1994a: 127, figure 17D; Yonow, 2000: 125, pl. 35.

*Material.* Chag96/4: 15 mm; Salomon Channel, Salomon Atoll; 9 February 1996; at 6 m depth. Chag96/10: 20 mm; outer reef, Ile Anglais, Salomon Atoll; 11 February 1996; at 15 m depth. Chag96/25: 25 mm; outer reef, between Ile Boddam and Ile Poule, Salomon Atoll; 13 February 1996; at 13 m depth. Chag96/44: 22 mm; outer reef, Ile Diamante, Peros Banhos Atoll; 20 February 1996; at 15 m depth. Chag96/57: length not recorded; inner reef, Ile du Coin, Peros Banhos Atoll; 22 February 1996; at 4 m depth, with two additional individuals (photographed).

*Description.* Body very elongated and narrow. Dorsal coloration cream to brown, with bright blue median line. Many series of cerata, with more in the longer individuals. Cerata bulbous and longitudinally striated; coloration variable, from fawn with limited blue streaks to almost entirely blue or purple. Rhinophores fawn with white specks and purple tips or distal band. Oral tentacles long, white with three purple bands; opaque white to lime green area at base.

*Geographic distribution.* Indo-West Pacific: Red Sea and South Africa to Hawaii (Yonow, 1994a, 2000).

*Remarks.* Rudman (1982a) reported the presence of zooxanthellae, visible as brown speckling on the head, body and cerata. The morphological adaptations to these symbionts are seen in the well-spaced clusters of cerata, each cluster a large fan-shape; not only do the cerata not shade each other, but they do not shade the zooxanthellae in the body either. The presence of zooxanthellae partly explained why *P. ianthina* was rarely found on a food source. Subsequently, Willan (1989) published a short note on *P. ianthina* found feeding on the hydroids *Halocordyle distincta* (Goldfuss) and *Ralpharia magnifica* Watson. The question still remains, however: from which species does the aeolid collect its zooxanthellae and how does it acquire them?

***Phestilla melanobrachia*** Bergh, 1874

*Phestilla melanobrachia* Bergh, 1874: 1, taf. II, figures 1–14; Yonow, 1994a: 126, figure 17A; Yonow, 2000: 122, pl. 38.

*Material.* Chag96/88: 25 mm; cave on inner reef, Nelson Island, Great Chagos Bank; 3 March 1996; at 23 m depth.

*Description.* Ground colour deep orange-red. Rhinophores simple, long and tapering, deep orange-red. Digitiform cerata orange, with orange-red tips.

*Geographic distribution.* Indo-West Pacific: South Africa and Red Sea to Hawaii (Yonow, 1994a, 2000).

*Remarks.* This species is normally found associated with dendrophyllid corals. The single specimen was found on the floor of a cave; it is possible that it was dislodged from corals on the cave roof by exhaust bubbles. Members of the genus tend to be medium-sized aeolids and have evolved to feed on corals. As a result, they lack the cnidosacs in the cerata, which have been replaced by enlarged gland cells. Three species are known: *P. melanobrachia* and *P. minor* Rudman are Indo-West Pacific in their distributions and *P. lugubris* (Bergh) (as *P. sibogae* Bergh *auctt.*) occurs throughout the Indo-Pacific.

## Conclusions

This account of the opisthobranch fauna of Chagos includes 41 species, and the results of this work are two-fold, taxonomic and biogeographic. It is probable that the number of species recorded does not accurately represent the taxonomic diversity of the Chagos archipelago as many habitats were not sampled. The implications of the misidentification of several commonly recorded species are discussed. In the case of *Hoplodoris estrelyado* a major problem regarding the identity of its most commonly recorded congener is identified. The conclusion is presented that a previous synonymy was unfounded, and that *H. pustulata* and *H. nodulosa* are both valid and distinct taxa. Unfortunately, to compound the confusion, the wrong name was assigned to the most common species, which should be known as *H. pustulata*. The differences between the two are described, and *H. estrelyado* is shown to differ considerably from both. Similarly, *Phyllidiella striata* is correctly recognized for the first time, redescribed and defined, and illustrated, and the species commonly known as *Phyllidiopsis striata* is assigned to the first available name, *Phyllidiopsis xishaensis*. Questions are posed on the identity of a small aplysiid recorded only recently from the Red Sea (Yonow, 2000), the Maldives (Yonow, 1994), and now Chagos. Various internal characters were examined and proved to be similar to those established for *A. parvula*; however, a consistently different colour pattern and a preference for exposed reef habitats, instead of shallow sea grass communities preferred by *A. parvula*, suggest that they may belong to different taxa. A further two species, unassigned to species, are described and illustrated: *Nembrotha* cf. *lineolata* has been recorded from the west Pacific previously, but *Dermatobranchus* sp. is known only from one badly preserved specimen from Chagos. Further material from other localities of the *Chromodoris* cf. *leopardus* colour pattern is required before a decision can be made on its true identity. *Phyllidiopsis* sp. belongs to a species complex which needs careful revision before specimens can be attributed to a taxon.

The biogeographical importance of the Chagos archipelago as a remote island group in the centre of the Indian Ocean is highlighted by UNEP/IUCN (1988): it contains the largest expanse of undisturbed reef in the Indian Ocean, and has the highest known diversity of corals and molluscs in the province. In total, 46 species of opisthobranchs have been recorded from the Chagos; this is comparable with, for example, the 35 non-phyllidiids recorded from the Maldives (Yonow, 1994) using a similar sampling regime. Both collections were made in reef slope habitats by scuba diving, but in common to the two are only one species out of five cephalaspideans, one out of three sacoglossans, and one out of two anaspideans. Surprisingly, no notaspideans were recorded from Chagos, although several species occur ubiquitously in reef habitats in the Indian Ocean. Of the nudibranchs, by far the largest suborder in each collection, the overlap is again minimal. The most common species in Chagos was *Chromodoris quadricolor*, which was not recorded from the Maldives, while *C. boucheti* and *C. tritos* were the most common species in the Maldives but were not recorded from Chagos. In contrast, the phyllidiids showed more overlap: *Fryeria marindica*, *Phyllidia varicosa*, *Phyllidiella rosans*, *Phyllidiella striata* and *Phyllidiella zeylanica* occurred frequently at both island groups. *Aldisa pikokai* is recorded for the first time since its original description from Hawaii; *Glossodoris symmetricus* is also collected for the first time since its original description from Réunion and the West Pacific; and several species rarely recorded from the Indian Ocean are described: *Thuridilla livida*, *Notodoris minor*, *Cadlinella ornatissima*, *Phyllidiopsis cardinalis*, *Phestilla melanobrachia* and

Table 1. Biogeographical distributions of opisthobranch species recorded from Chagos.

Zoogeographic area	Opisthobranchs number	Opisthobranchs percentage
Indo-West Pacific	26	59.1
Western Indian Ocean	11	25.0
Indian Ocean (IO)	4	9.1
Central IO to central Pacific	2	4.5
Circumtropical	1	2.3
Unassigned	(2)	—
Total	44	100.0

*Dermatobranchus albus*. A summary of the biogeographical distributions of the species of opisthobranchs recorded from Chagos by Eliot (1910) and in this work is presented in table 1 recording numbers of species for each region.

Faunal systematic studies on opisthobranchs, although deemed old fashioned, all provide new species, new rediscoveries and new distribution records, and clearly demonstrate the need for more work of this nature (e.g. Edmunds, 1972; Rudman, 1977; Yonow, 1986–2000; Jensen, 1994, 1998; Edmunds and Preece, 1996). The current trend for describing new taxa as single publications provides information on species diversity and phylogenetic relationships, but faunal and systematic studies are fundamental to define patterns of distribution, endemism and biogeography on a larger scale.

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