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## THE DECAPOD AND STOMATOPOD CRUSTACEA OF ST PAUL'S ROCKS

by

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With two text-figures and one plate

### INTRODUCTION

Saint Paul's Rocks (Penedos de São Pedro e São Paulo) are a small group of rocky islets on the mid-Atlantic ridge near the equator, occupying an area of roughly 250 by 425 m. There is no vegetation and, apart from birds and invertebrates, the islands are uninhabited. The Cambridge Expedition to Saint Paul's Rocks visited the group from 16 to 24 September 1979 and made extensive collections of the terrestrial and marine fauna; these included a number of Crustacea. The Decapoda and Stomatopoda of St Paul's Rocks are the subject of the present paper.

Few detailed studies have been published to date on the Crustacea of St Paul's Rocks, largely because of the Rocks' remoteness and inhospitable nature. Crustacea, especially the common and conspicuous rock crab *Grapsus grapsus*, have been mentioned in several narratives and popular accounts, but the only material on which scientific reports have been based is that collected by H.M.S. "Challenger" in 1873. The Challenger reports mention eight species of Decapoda (5 Macrura, 1 Anomuran and 2 Brachyura) from St Paul's Rocks. The Cambridge Expedition collected nine species of Decapoda (2 Macrura and 7 Brachyura) and one species of Stomatopoda; in addition one macrurous decapod was observed but not collected. The total number of species of Decapoda now known from St Paul's Rocks amounts to fifteen (6 Macrura, 1 Anomuran and 8 Brachyura); Stomatopoda, not previously reported from the area, are represented by a single species.

The following text assembles all the published and unpublished information known to us on the Decapoda and Stomatopoda of St Paul's Rocks. The abbreviations cb., cl., and tl. have been used for carapace width, carapace length, and total length, respectively.

## DECAPODA

### Penaeidea

#### SERGESTIDAE

#### ***Sergestes edwardsii* Krøyer, 1855**

St Paul's Rocks records:

*Sergestes oculatus* — Bate, 1888: liv, 406; Murray, 1895: 340; Hansen, 1903: 65.

The six male specimens of *Sergestes oculatus* that Bate (1888) reported from the surface waters near St Paul's Rocks (collected on 27 August 1873) were no longer extant when Hansen (1903) re-examined the Challenger Sergestidae.

*Sergestes oculatus* Krøyer, 1855, usually is considered a synonym of *Sergestes edwardsii* Krøyer, 1855, a species known from a large part of the Atlantic (from about 40°N to 5°S). It is most likely that Bate's specimens belonged to that species.

*Sergestes edwardsii* is a pelagic species, being taken at night near the surface and descending to rather great depths in the daytime.

#### LUCIFERIDAE

#### ***Lucifer typus* H. Milne Edwards, 1837**

St Paul's Rocks records:

*Lucifer reynaudii* — Bate, 1888: liv, 466, pl. 84; Murray, 1895: 340.

Hansen (1919: 48-50) reviewed the confused taxonomy and nomenclature of the genus *Lucifer*, and came to the conclusion that in the Atlantic only two species are known with certainty: *Lucifer typus* H. Milne Edwards, 1837, and *L. faxoni* Borradaile, 1915. *L. reynaudii* H. Milne Edwards, 1837 is a synonym of *L. typus*. Hansen (1919: 53) assigned the material that Bate (1888) had identified as *Lucifer reynaudii* to *L. typus* "at least partim"; we can confidently accept that all of Bate's Atlantic *L. reynaudii*, including the St Paul's Rocks specimens indeed belong to *L. typus*. Bate did not indicate the number of specimens obtained near St. Paul's Rocks.

*Lucifer typus* is a pelagic species with a very wide distribution, occurring in the Atlantic at least from 42°N to 40°S and having also been reported from the Indo-West Pacific region.

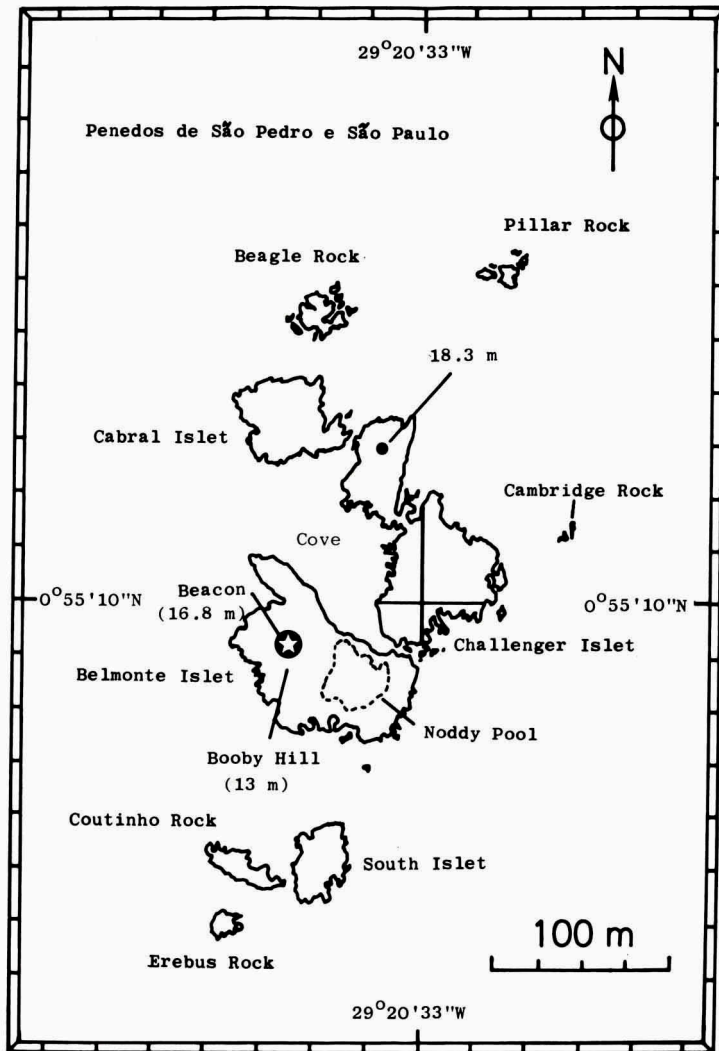


Fig. 1. Saint Paul's Rocks, Brazil.

**Lucifer faxoni** Borradaile, 1915

St Paul's Rocks records:

*Lucifer typus* — Bate, 1888: liv, 464, pl. 83; Murray, 1895: 340.

Hansen (1919: 48-50) made it clear that most Atlantic specimens until then referred to in the literature as *Lucifer typus* actually belonged to *Lucifer faxoni*, a species characterized by length of its eyes, which are far

shorter than the elongate eyes in true *Lucifer typus*. Bate's pl. 83 shows clearly the short-eyed species of *Lucifer* and his St Paul's Rocks material can therefore confidently be assigned to *Lucifer faxoni*.

Bate did not give any details of his material from St Paul's Rocks, except (on p.liv) that it was taken at the surface.

*Lucifer faxoni*, like *L. typus*, is a true pelagic species, although it usually is found closer to the coast than *L. typus*. The range of *L. faxoni* in the Atlantic extends from about 43°N to 23°S; the species has also been reported from the Indo-West Pacific region.

## Caridea

### ALPHEIDAE

#### **Synalpheus fritzmuelleri** Coutière, 1909

St Paul's Rocks records:

*Alpheus minus* — Bate, 1888: liv, 558, pl. 100 fig. 2; Murray, 1895: 340.

Material examined:

Sta. 14-4. Between Belmonte and South Islets; 25 m depth, in rubble trapped by boulders on steep slope; 22 September 1979; coll. A. Edwards, R. Lubbock and D. Lindsay. — 2 specimens.

The specimens agree well with Coutière's (1909: 35, fig. 18) original description of the species. One of us examined the two female specimens from St Paul's Rocks that Bate (1888) reported upon under the name *Alpheus minus*. These specimens are now preserved in the collection of the British Museum (Natural History), London, and were made available through the kindness of Dr. Raymond W. Ingle. These specimens, like the ones in the present collection, show the rostrum much narrower than the triangular orbital hoods. The stylocerite distinctly overreaches the basal segment of the antennula. The scaphocerite has a well developed blade. The outer tooth of the basicerite is sharp and reaches to the end of the basal antennular segment, the upper tooth is short, but distinct and sharp. The dactylus of the last three pereopods has the lower tooth broader than the upper and it makes a distinct angle with the upper tooth. The prominence on the posterior margin of the dactyl proximal of the lower tooth is small; it is more inconspicuous in the "Challenger" specimens than in those of the present collection. The specimens of the present collection show one or two blunt lobes on the upper distal margin of the palm; this is also true for one of the "Challenger" specimens, while the other shows in addition a small

spinule there. In the "Challenger" specimens the propodus of the ambulatory legs is wider than that in the present specimens and bears only 5 or 6 movable spines (8 or 9 in the present specimens). It is possible that these differences are due to age, sex, or individual variation.

*Synalpheus fritzmulleri* has a wide distribution in the tropical western Atlantic, ranging from North Carolina (U.S.A.) to southern Brazil, including the West Indies. It has also been reported from Baja California on the Pacific coast of Mexico. It is known from the following oceanic islands: Bermuda (Chace, 1972: 93) and Saint Helena (Chace, 1966: 629). The specimen from Fernando de Noronha that Pocock (1890: 518) reported upon as *Alpheus minor* Say forms part of the collection at the British Museum (Natural History) and was examined. The expectation that it might also be *Synalpheus fritzmulleri* proved incorrect, the specimen almost certainly belonging to *Synalpheus townsendi* Coutière, 1909.

#### HIPPOLYTIDAE

##### ***Lysmata amboinensis*** (De Man, 1888)

During the Cambridge expedition a specimen of what evidently was *Lysmata amboinensis* was observed in the Cove at a depth of 5 to 10 m, apparently in the company of a moray eel. The specimen was not collected but the striking and characteristic colour pattern of the species made the identification practically certain; also *Lysmata amboinensis* is already known to be a cleaning shrimp of moray eels.

The species, perhaps better known as *Lysmata* (or *Hippolysmata*) *grabhami*, is widely distributed in the warmer waters of the world. In the Atlantic it has been reported from the Bahama Islands, Florida (Florida Keys and the eastern Gulf of Mexico), Antigua, and the eastern Atlantic oceanic islands of Madeira and Annobon. In the Indo-West Pacific it has been reported from the Red Sea and East Africa to Japan and Polynesia. It is well known as a fish cleaner.

Hayashi (1975) was the first to show that De Man's (1888) *Hippolysmata vittata amboinensis* is the same species as *Hippolysmata grabhami* Gordon, 1935. As furthermore the genera *Lysmata* Risso, 1827 and *Hippolysmata* Stimpson, 1860 are currently synonymized, the correct name for the species is *Lysmata amboinensis*.

The present record of the species from St Paul's Rocks is the southernmost find in the western Atlantic. In the eastern Atlantic the species has been found slightly farther south, namely at Annobon, 1°24'S 5°37'E (Crosnier, 1971: 576).

## Macrura Reptantia

## PALINURIDAE

**Panulirus echinatus** Smith, 1869

## St Paul's Rocks records:

Small crayfish — Campbell, 1876: 39.

A small species of *Palinurus* — Wyville Thomson, 1877, vol. 2: 105.

A small *Palinurus* — Moseley, 1879: 74.

*Panulirus guttatus*, var. — Bate, 1888: liv, 78, pl. 10a; Murray, 1895: 340.

## Other records:

*Panulirus echinatus* S.I. Smith, 1869: 20, 39; Pocock, 1890: 516; Ortmann, 1891: 31; Rathbun, 1900: 151; Holthuis, 1946: 110; F. G. W. Smith, 1948: 48, 49; Holthuis, 1961: 223, fig. 1a; Solis Ramirez, 1963: 11, 14; Chace, 1966: 629, text-figs. 3, 4, pls. 1, 2; Fausto-Filho, 1966: 32; George & Main, 1967: 812, 813, 816; Fausto-Filho, 1968: 28; Coelho, 1969: 231; Fausto-Filho & Da Costa, 1969: 105, pl. 2; Giudicelli, 1971: 12; Coelho & Ramos, 1972: 159; Burukovsky, 1974: 101; Fausto-Filho, 1974: 7; Fausto-Filho, 1977: 75; Manning, 1978: Panul. 2 [ p. 2 ], fig.

*Palinurus* sp. ? Melliss, 1875: 204.

*Palinurus echinatus* — Pfeffer, 1881: 31.

*Panulirus guttatus* — Benedict, 1893: 540; Von Ihering, 1897: 156; Cunningham, 1910: 120; Lenz & Strunck, 1914: 291; Colman, 1946: 277; Paiva, 1961: 5; Paiva, 1961a: 1, 5.

*Senex guttatus* — Moreira, 1901: 17.

*Panulirus guttatus* var. — Bouvier, 1905: 1, 5; Faria & Silva, 1937: 43; Da Franca, De Lourdes Paes-Da Franca & Da Costa, 1959: 1, 2, 4, 13, 17, 19, 20, figs. 3, 5, 6, 7, 11-15, 24, 30; Da Franca, De Lourdes Paes-Da Franca & Da Costa, 1961: 2; Da Franca, De Lourdes Paes-Da Franca & Da Costa, 1962: 57; Postel, 1962: 142.

*Panulirus guttatus brasiliensis* Faria & Silva, 1937: 44, phot. 2, 6, 8, figs. 12-18.

*Palinurus guttatus* — Oliveira, 1951: 450.

*Panulirus laevicauda brasiliensis* — Neiva, 1964: 223.

*Panulirus* aff. *echinatus* — Postel, 1967: 404, 453, figs. 2, 5, 9, 11, 15.

Ascension Spiny Lobster — Phinizy, 1969: 27.

## Material examined:

Sta. 13-4. Cove; 10 m depth, in rock crevice; 22 September 1979; coll. A. Edwards and W. Armstrong. — 1 ovigerous female.

Sta. 14-4a. Between Belmonte and South Islets; 25 m depth, in rubble by cave mouth; 20 September 1979; coll. A. Edwards. — 1 carapace.

The specimen from Sta. 13-4 agrees fully with the published descriptions of the species. The transverse groove on the abdominal somites is interrupted on the third, fourth and fifth somites, but not on the second and sixth. On the pleura the transverse groove does not join the anterior groove on any of the somites. Only the pleura of the second and third abdominal somites show anterior teeth; apart from a strong tooth on the left second pleuron, all these teeth are very small.

The ovigerous female has a carapace length of 55 mm. On the sternum traces of a black spermatophore are still visible.

At St Paul's Rocks the species was found to be common in depths from 5 to 25 m, where it was found in crevices and caves, often several individuals shared a crevice. It was observed in the Cove and on the west sides of Cabral and Belmonte Islets. All previous reports of the species from St Paul's Rocks concern the specimens taken there by the "Challenger" Expedition in August 1873. Bate (1888: 78, pl. 10a) gave a good description and excellent illustration of the species. Moseley (1879: 74) reported on the "Challenger" St Paul's Rocks lobsters as follows: "A Rock-lobster, a small *Palinurus*, is very common about the rocks, and is to be seen clinging to the rock, having crawled just above the reach of the waves. I caught some of these in lobster pots which I set for them." Wyville Thomson's (1877, vol. 2: 105) narrative adds very little: "The lobster-pots were down during the night, but they yielded little except a small species of *Palinurus*". The only more accurate locality indication for the "Challenger" specimens is given by Campbell (1876: 39): "The lobster-pots which we sunk in the cove caught small crayfish".

Bate (1888) identified his material with some doubt as "*Panulirus guttatus*, var.". His description and figure make the identity of the specimens clear. One of us (L.B.H.) had the opportunity to examine some of Bate's specimens in the collection of the British Museum, viz. 1 ovigerous female (cl. 54 mm), and two females that both carried spermatophores (cl. 60 and 70 mm). All proved to be the true *Panulirus echinatus*.

*Panulirus echinatus* has repeatedly been confused with *Panulirus guttatus* (Latreille). The two species indeed resemble each other closely. In *P. guttatus*, however, the transverse and anterior grooves on the abdominal pleura are fused. The most reliable and most conspicuous difference, however, is found in the colour pattern: in *P. echinatus* all the segments of the pereopods are striped with pale longitudinal lines: a dorsal line is present on propodus, carpus and merus; furthermore the merus has two lateral stripes on each side and one ventrally; the carpus and the propodus each have one lateral line on each side and one ventrally. In *P. guttatus* only the propodus shows longitudinal stripes, all other segments being spotted with large pale spots. Both *P. echinatus* and *P. guttatus* have the dorsal surface of the carapace and abdomen spotted with light spots.

The distribution of the two species is also quite distinct; their ranges, so far as known, do not overlap (fig. 2). *Panulirus guttatus* is a West Indian species, being known from the following localities: Bermuda, Bahama Islands, southern Florida from Palm Beach to Key West, British Honduras,

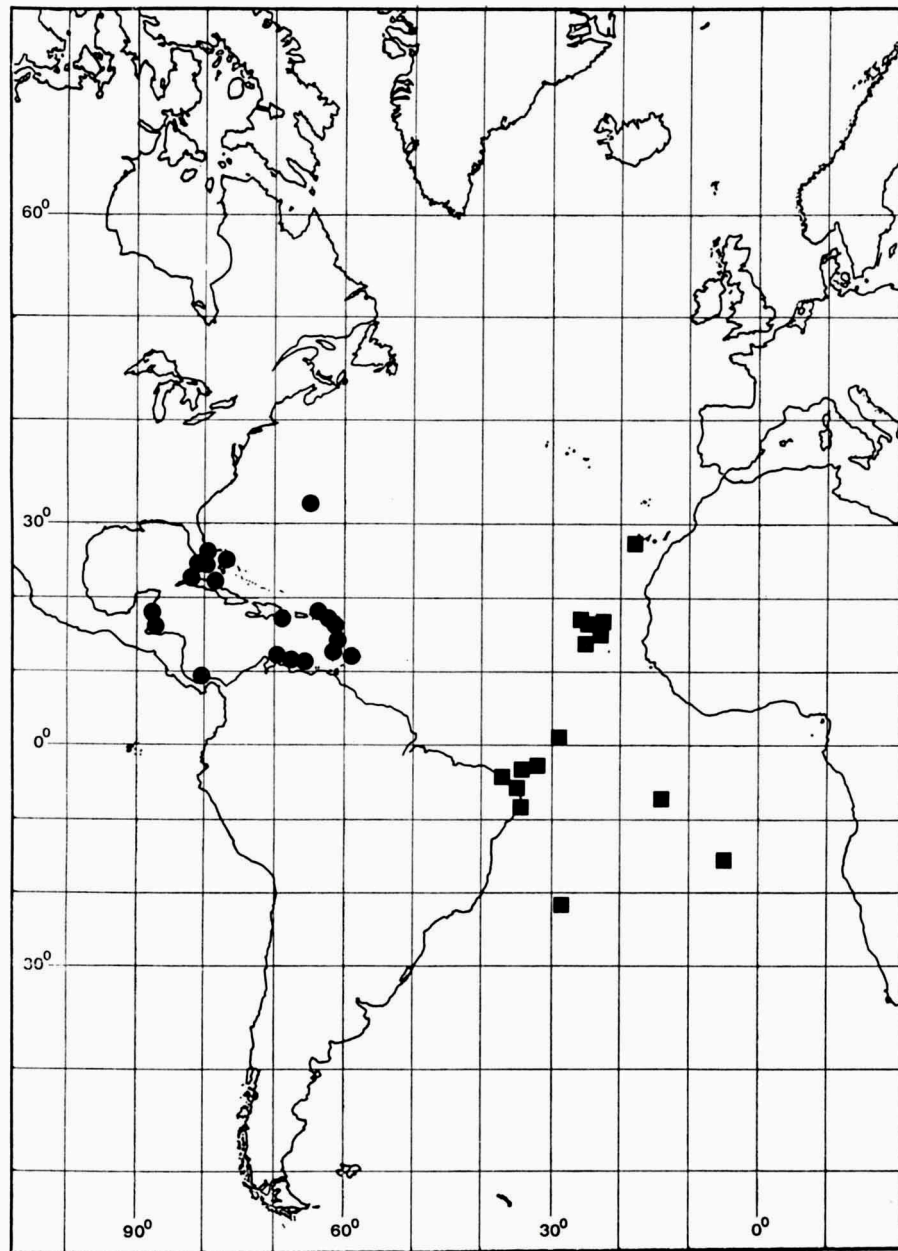


Fig. 2. The known distribution of *Panulirus guttatus* (Latreille) (circles), and *Panulirus echinatus* Smith (squares)



Cay Sal, Cuba, Haiti, Virgin Islands (St Thomas, St John), Netherlands Leeward Islands (St Martin, Saba, St Eustatius), Antigua, Barbuda, Guadeloupe, Dominica, Martinique, Barbados, Venezuela (Los Roques), Netherlands Antilles (Bonaire, Curaçao), and the Caribbean coast of Panama; the easternmost locality is Barbados.

The range of *P. echinatus* is far to the east of that of *P. guttatus*. It is known from the following localities:

Canary Islands: S.W. coast of Hierro near Punta Orchilla, 5-10 m depth, 7 September 1977, "Tydeman" Expedition. — 2 ♂♂ (cl. 147 and 152 mm), 2 ♀♀ (cl. 116 and 127 mm) (collection Rijksmuseum van Natuurlijke Historie, Leiden).

Cape Verde Islands: Porto Grande, São Vicente (Benedict, 1893), São Antão, São Vicente, Isla Razo, Sal, Boavista, Brava, Isla Rombos, São Tiago (Da Franca, De Lourdes Paes-Da Franca & Da Costa, 1959, 1961, 1962; Postel, 1966). One of us examined a very large male from Porto Grande, São Vicente, collected at Sta. 34 of the Danish 1945-1946 "Atlantide" Expedition, now preserved in the Zoologisk Museum, Copenhagen.

St Paul's Rocks: See above.

Fernando de Noronha: Fernando de Noronha (Pocock, 1890; Coelho, 1969; Fausto-Filho & Da Costa, 1969; Coelho & Ramos, 1972; Fausto-Filho, 1974). In the British Museum, Fernando de Noronha material reported upon by Pocock (1890) was examined: 1 ♂ (cl. 78 mm), 1 ovigerous ♀ (cl. 86 mm), 1 juvenile ♂ (cl. 32 mm), 1 juvenile ♀ (cl. 21 mm); a dry female (cl. 70 mm) in the British Museum collection labelled "South America" and collected by H. N. Ridley, might also belong to Ridley's Fernando de Noronha collection.

Atol das Rocas, Brazil: Atol das Rocas (also spelled Atoll das Rocas) (Faria & Silva, 1937; Fausto-Filho, 1966; Coelho, 1969; Fausto-Filho & Da Costa, 1969; Coelho & Ramos, 1972).

Ceará State, N.E. Brazil: Ceará State (Paiva, 1961a; Fausto-Filho & Da Costa, 1969; Fausto-Filho, 1977).

Rio Grande do Norte State, Brazil: Natal (Fausto-Filho, 1966; Fausto-Filho & Da Costa, 1969).

Pernambuco State, N.E. Brazil: Recife (S. I. Smith, 1869; Rathbun, 1900; Moreira, 1901; Faria & Silva, 1937; Holthuis, 1961; Paiva, 1961; Coelho & Ramos, 1972). In the U.S. National Museum, Washington, D.C., two male specimens from Recife were examined, viz. the one (cl. 49 mm) reported upon by S. I. Smith (1869) and the one (cl. 53 mm) mentioned by Rathbun (1900); both specimens have also been discussed by Holthuis (1961). Smith's (1869: 39) mention of the species from Pará evidently is

due to a mistake, Pernambuco (= Recife) being meant. Marcgraf's (1648: 185, fig.) figure of "Potiquiquiya" from Recife shows a Palinurid, but the description and illustration are insufficient to decide which species was meant. Among sketches of animals made during Marcgraf's stay in Brazil (1638-1644), now kept in the archives of the Leningrad branch of the Academy of Sciences of the U.S.S.R., there are two water colours of spiny lobsters, one clearly is *Panulirus echinatus* Smith, the other distinctly represents *Panulirus laevicauda* (Latreille). It is likely therefore that Marcgraf's Potiquiquiya is based on two species.

Ilha da Trindade, Brazil: Ilha da Trindade, 20°30'S 29°20'W (Oliveira, 1951).

Ascension: Ascension (Lenz & Strunck, 1914; Phinizy, 1969). The single specimen from Ascension reported upon by Lenz & Strunck (1914) is now in the Zoologisches Museum, Berlin, where thanks to the kindness of Dr. H.-E. Gruner this specimen, a large male, could be examined.

St. Helena: St. Helena (Melliss, 1875; Cunningham, 1910; Colman, 1946; Chace, 1966). The Zoologisk Museum, Copenhagen holds an ovigerous and a non-ovigerous female of this species, collected at Jamestown, St. Helena by Dr. Th. Mortensen during his 1929-1930 expedition. Both specimens carry a black spermatophore on the thoracic sternum.

Depth. — The species has been reported from depths between 0 and 35 m. The records are: 0-28 m (Coelho, 1969), 4-35 m (Giudicelli, 1971), 0-18 m (Coelho & Ramos, 1972), 2-25 m (Fausto-Filho, 1974), 5-25 m (present publication).

Remarks. — Apart from the doubtful record by Marcgraf (1648), the first mention of the species was by S. I. Smith (1869) who described it as a new species. Later authors have often synonymized Smith's species with *P. guttatus*. Bate (1888) used the name *P. guttatus* var. for it and was followed in this by many other authors. Faria & Silva (1937) considered their material from Atol das Rocas to be distinct from *P. guttatus* and identical with *P. echinatus*; they considered it a variety of *P. guttatus* and, quite unnecessarily, coined the new name *P. guttatus brasiliensis* for it. For some reason they thought their *P. guttatus brasiliensis* different from Bate's *P. guttatus* var. Neiva (1964: 223) in mentioning "*P[anulirus] laevicauda brasiliensis* (Rathbun)" possibly confused the names *Panulirus laevicauda* (Latreille) and *P. guttatus brasiliensis* Faria & Silva; so far as we know, M. J. Rathbun never used the epithet *brasiliensis* for any spiny lobster.

Size. — The ovigerous female collected by the Cambridge Expedition had a carapace length of 55 mm. Evidently the St Paul's Rocks population does not grow to large sizes. Moseley, Wyville Thomson and Campbell all charac-

terized the lobsters as "small". Bate gave the total length of a male as 190 mm and that of a female as 150 mm. The three "Challenger" females examined by us had carapace lengths of 54 to 70 mm. In comparing these sizes with those reported in the literature for specimens of this species from other localities, we find that those from Fernando de Noronha and Pernambuco also have the carapace length less than 100 mm and the total length less than 200 mm (Pernambuco cl. 49-68.5 mm, tl. 135-165 mm; Fernando de Noronha cl. ♂ 32-78 mm, cl. ♀ 21-86 mm), while the records from the other localities show much larger specimens (Canary Islands, cl. ♂ 147 and 152 mm, ♀ 116 and 127 mm; Cape Verde Islands, cl. ♂ 90-190 mm, ♀ 100-150 mm, tl. ♂ 210-390 mm, ♀ 240-350 mm; Ceará, cl. 97 mm, tl. 235 mm; Atol das Rocas, tl. ♂ 225-360 mm, ♀ 125-270 mm; Ascension, tl. ♀ 380 mm; St Helena, cl. ♀ 101 mm). As large series have not been measured from any of the localities except the Cape Verde Islands and Atol das Rocas, very little can be said about the actual size range of the various populations.

Vernacular names. — Various vernacular names have been given to this species. In St Helena the species is known as "Long Legs". Of the other vernacular names published, it seems likely that they are not true popular names but have been coined by scientists. For the Brazilian mainland the names "Lagosta pintada" (Fausto-Filho, 1968), "Lagosta roxa" and "Lagosta encarnadinha" (Paiva, 1961) are given and for the Cape Verde Islands the names "Lagosta vermelha" (Da Franca et al., 1959, 1961, 1962) and "Langouste brune des Iles du Cap Vert" (Postel, 1967).

## Anomura

### GALATHEIDAE

#### ***Munida sanctipauli*** Henderson, 1885

St Paul's Rocks records:

*Munida sancti-pauli* Henderson, 1885: 411; Henderson, 1888: 142, pl. 3 fig. 6; Murray, 1893: 339.

*Munida sanctipauli* was collected by the "Challenger" off St Paul's Rocks at a depth of 10 to 60 fathoms (= 18-110 m). At that time it was only known from the type locality, for which it was given the specific name *sancti-pauli*.

At present the species has been reported from off N.W. Africa (between 25°39' and 32°27'N), the Azores, the Canary Islands, the Cape Verde Islands and South Africa, in depths between 150 and 1385 m.

## Brachyura

## XANTHIDAE

***Domecia acanthophora*** (Desbonne, 1867)

## Material examined:

Sta. 14-4. Between Belmonte and South Islets; 25 m depth, in rubble trapped by boulders on steep slope; 22 September 1979; coll. A. Edwards, R. Lubbock and D. Lindsay. — 1 male, 1 female.

The two specimens are very small, both having a carapace length of 2.5 mm and a carapace width of 3.5 mm; they obviously are not quite adult. They undoubtedly belong to *Domecia acanthophora*, the only Atlantic species of the genus, as defined by Guinot (1964). It is impossible, however, owing to the small size and immaturity of the specimens, to decide whether they should be assigned to the western Atlantic *D.a. acanthophora* (Desbonne) or to the eastern Atlantic *D. acanthophora africana* Guinot, 1964.

Behind the outer lobes of the front there are 3 or 4 (in the male) and 4 or 5 (in the female) distinct spinules; in addition there are some very minute pointed granulations there. Behind the inner lobes similar granulations may be seen; in the female one or two of these granulations are slightly larger than the others.

The merus of the third maxilliped shows either just granules or a single spinule.

The distal median point of the thoracic sternum is approximately intermediate in shape between those of *Domecia a. acanthophora* and *D. acanthophora africana* as shown by Guinot (1964, figs. 15 and 16).

*Domecia a. acanthophora* is known in the western Atlantic from South Carolina (U.S.A.) and Bermuda to Pernambuco, Brazil, and from the West Indies. *D. acanthophora africana* has been reported from the Cape Verde Islands and the islands of Principe, São Thomé and Annobon in the Gulf of Guinea.

***Euryozius sanguineus*** (Linnaeus, 1771)

## Material examined:

Sta. 14-4. Between Belmonte and South Islets; 25 m depth, in rubble trapped by boulders on steep slope; 22 September 1979; coll. A. Edwards, R. Lubbock and D. Lindsay. — 1 juvenile female.

The specimen, a juvenile female, has the carapace 6 mm long and 9 mm wide. The front shows a deep median incision. The two lobes have a slightly concave anterior margin; a low, but distinct ridge runs close to and parallel

with the anterior margin. The anterior anterolateral margin of the carapace before the two anterolateral teeth is somewhat rim-like.

The carpus of the second and third pereopods has a tubercle on the inner part of the distal margin. The dactyli of the walking legs are quadrangular in transverse section with 4 longitudinal ridges. The propodus shows a groove on the anterior and posterior surfaces, that on the anterior being most distinct.

The colour of the animal is bright orange with the pincer tips black. On the carapace there are small pale spots on the sunken H-shaped central figure, while from the anterolateral ends of the H-shaped figure a line of such spots extends to the posterior margin of the orbits. Such small pale spots are also present on the front and in a narrow transverse band behind the orbit. The upper surface of the carpus and palm of the chelipeds likewise shows such small spots. The walking legs are slightly lighter orange than the carapace and chelipeds; carpus, propodus and dactylus bear a lighter ring distally; in the distal part of the merus there is a lighter spot. The lower surface of the body also is orange, perhaps a shade lighter than the dorsal colour, and the pale rings are less conspicuous.

A revision of the Atlantic species of *Euryozius* by Manning & Holthuis is in the press. Pending the publication of that revision we use here the oldest name for any Atlantic species for the present form.

The genus *Euryozius* is known from various islands in the Atlantic only: St Helena, Ascension, Annobon, the Cape Verde Islands, Madeira and the Azores. The present find of the genus at St Paul's Rocks fits very well into the overall picture.

Although the present specimen is not fullgrown, it seems to be closest to the species from St Helena and Ascension.

### ***Xanthodius denticulatus* (White, 1848)**

Material examined:

Sta. 13-4a. Cove; 5-8 m depth, in rubble at base of rock; 21 September 1979; coll. R. Lubbock. — 1 ovigerous female.

A pair of this species was observed, but only the ovigerous female collected. The carapace length of the specimen is 12 mm, the carapace width 18 mm.

The specimen agrees well with the published descriptions of the species. The front has the outer angles slightly produced: on the left this lateral tooth is not very conspicuous, but is more so on the right.

*Xanthodius denticulatus* is an amphi-atlantic species. In the western Atlantic it is known from Bermuda, the Bahamas and Florida to Maceio

(Brazil) and the Arolhos Archipelago (Brazil); it has also been found throughout the Caribbean area. In the eastern Atlantic it has been reported from Ghana and from the islands of São Thomé, Príncipe and Annobon in the Gulf of Guinea.

#### Xanthidae species

##### Material examined:

Sta. 12-4a. Noddy Pool, Belmonte Islet; 19 September 1979; coll. E. Goodburn. — 6 juveniles.

Sta. 14-4. Between Belmonte and South Islets; 25 m depth, in rubble trapped by boulders on steep slope; 22 September 1979; coll. A. Edwards, R. Lubbock and D. Lindsay. — 1 juvenile.

The specimens all are juveniles (carapace length 2.3 to 2.5 mm, carapace width 2.8 to 3.0 mm) and could not be identified.

#### GRAPSIDAE

##### **Grapsus grapsus** (Linnaeus, 1758)

##### St Paul's Rocks records:

*Grapsus* — Darwin, 1839: 10.

Crab — Ross, 1847: 16; Campbell, 1876: 38, 39; Swire, 1938: 63; Masch, 1966: 7.

*Grapsus strigosus* — Wyville Thomson, 1877: 105; Moseley, 1879: 70; Nicol, 1908: 3 (not *Grapsus strigosus* (Herbst)).

*Grapsus maculatus* — Miers, 1886: xxi, 255; Murray, 1893: 339.

Landerab — Wild, 1923: 80; Sachs, 1963: 3.

*Grapsus grapsus* — H. G. Smith et al., 1974: 91.

##### Material examined:

Sta. 12-4. Noddy Pool and nearby Belmonte Islet; 18 September 1979; coll. E. Goodburn. — 2 males, 3 females, 1 juvenile.

The carapace length of the males is 31 and 58 mm, that of the females ranges from 26 to 40 mm, and that of the juvenile is 11 mm; the respective carapace widths are: 36 and 66 mm (♂♂), 29 to 44 mm (♀♀), and 12 mm (juv.).

In most specimens the legs and the carapace are spotted with small whitish dots. The transverse striae on the branchial regions are lined with white; in old specimens these lines are complete, but with an irregular anterior margin; in the medium-sized and small specimens the white lines are broken up into spots.

At St Paul's Rocks the species is very common on land. Some individuals were observed eating flying fish (pl. 1 fig. 2); once they were seen clustered around the body of a dead booby (*Sula leucogaster* (Boddaert)), presumably eating it. They entered and left splash pools and were moderately common

in pools that were infrequently flushed. In frequently flushed pools they were rather less common. A few were observed in crevices just above the pink "Lithothamnion" zone (= top of the intertidal zone) on the exposed side of the Rocks; on the sheltered side they were significantly more common in such crevices and were often seen there walking about on the rock surface just above the "Lithothamnion" zone.

This very common and conspicuous species has attracted the attention of practically all visitors to St Paul's Rocks, often being characterized as "amusing" (Darwin, 1839; Campbell, 1876; Wyville Thomson, 1877; Moseley, 1879). The first published account of them, that we know of, is by Darwin (1839: 10): "It was amusing to watch how quickly a large and active crab (*Graspus*), which inhabits the crevices of the rock, stole the fish from the side of the nest [of a noddy tern], as soon as we had disturbed the parent birds". In the 2nd (1845: 10) and later editions of his work, Darwin added the following sentence: "Sir W. Symonds, one of the few persons who have landed here, informs me that he saw the crabs dragging even the young birds out of their nests, and devouring them". Rear-Admiral Sir William Symonds (1782-1856) must have made these observations around 1813, when he served, as Lt. William Symonds, in the West Indies and off the coast of Brazil, on H.M.S. "Pique", under the command of Capt. Hon. Anthony Maitland. It is quite possible that H.M.S. "Pique" assisted H.M.S. "Rhin", under command of Capt. Charles Malcolm, R.N., in surveying the islands; a map of the St Paul's Rocks, dated 1813, and made by Lt. George Crichton, R.N. of the "Rhin" is still extant.

The misspelling *Graspus* for *Grapsus* found in Darwin's (1839) account has never been corrected and we found it in all editions and translations of Darwin's Beagle narrative consulted by us (the most recent of these being one published in 1972).

The next expedition to visit St Paul's Rocks was the 1839-1843 voyage to the Antarctic of H.M.S. "Erebus" and "Terror" under Capt. Sir James Clark Ross. A landing on St Paul's Rocks was made then on 29 November 1839. Ross (1847: 16) described the *Grapsus* there as "a fierce and active crab, which appears to be a destructive enemy to their [= *Pelecanus Sula* and *Sterna stolidus* of which the modern names are *Sula leucogaster* (Boddaert) and *Anous stolidus* (Linnaeus) respectively] eggs".

The "Challenger" expedition spent three days (27-29 August 1873) at St Paul's Rocks, and many of the published accounts of this expedition, both scientific and popular, mention the present species. Sir C. Wyville Thomson (1877, vol. 2: 105) in his work on the general results obtained by the "Challenger" in the Atlantic gave the following account of the crabs

of the St Paul's Rocks: "All the crannies in the rock are inhabited by *Grapsus strigosus*, an amphibious crab, which we had already met with on several of the Atlantic islands. Its habits amused us greatly. It was much more wary than the birds — it was by no means easy to catch them, but they kept close round the luncheon baskets in large parties, raised up on the tips of their toes and with their eyes cocked up in an attitude of the keenest observation, and whenever a morsel came within their reach there was instantly a struggle for it among the foremost of them, and they ambled away with their prize wonderfully quickly with their singular sidelong gait, and a look of human smartness about them which has a kind of weirdness from its being exhibited through a set of organs totally different in aspect from those to which we usually look for manifestations of intelligence". Also one of the naturalists of the "Challenger" expedition, H. N. Moseley (1879: 70), published his observations on the St Paul's Rocks *Grapsus grapsus*: "In vast abundance, all over the rocks, crawls about a crab (*Grapsus strigosus*), the same as that already noticed at the Cape Verde Islands. This crab has been referred to by nearly all visitors to the rocks. It is far more wide-awake than the birds, and keeps well out of reach, being thus of some difficulty to catch. The crabs are all over the rocks, every crevice has several in it.

You are fishing, and you have put down at your feet a nice bait, cut with some care and difficulty from a fish sacrificed for the purpose. You are absorbed in the sport. A fish carries off your bait; you look down and see two crabs just disappearing into an impracticable crevice, carrying your choice morsel between them. You catch a fish and throw it down beside you. Before long you find a swarm of crabs round it, tearing morsels off the gills, using both claws alternately to carry them to their mouths; and a big old crab digging away at the skin of the fish, and trying to bite through it.

If a bird dies the crabs soon pick its bones, and I saw one old crab profiting by our having driven off all the old birds, and carrying off a young bird just hatched. The older crabs are richly coloured, with bright red legs. The crabs have odd ways, and curious habits of expressing anger, astonishment, suspicion, and fear, by the attitude of their claws. When two old crabs meet unsuspectingly in a crevice they dodge one another in an amusing way, and drawing their legs together strut on tiptoe.

In the tropics one becomes accustomed to watch the habits of various species of crabs, which there live so commonly an aerial life. The more I have seen of them the more I have been astonished at their sagacity. I had, I do not know why, always considered them as of low intelligence".



That the crabs also made an impression on the non-scientists of the "Challenger" is shown by the published accounts of two of her officers. Lord George Campbell (1876: 38, 39), in his "Log letters from "the Challenger" .", gave the following amusing account of his encounter with the St Paul's Rocks *Grapsus grapsus*, which is too interesting not to be quoted in full: "But the crabs, those cheeky, exasperating, but intensely amusing crabs! They swarm all over the rocks — everywhere — one instant invisible, hiding in the cracks and crannies, the next appearing, stealing up behind you and clawing a piece of bait or fish, much larger than themselves, and quietly making off. Catch a fish, throw it behind you, and in a few minutes a score of crabs are seen advancing warily, though not a crab may have been visible the second before. I solemnly declare I saw an ancient, crusty-coated crab come in the course of his peregrinations to a crack some two feet wide at least, which after girding up his loins, he deliberately jumped. Frighten an old noddy from her nest, and a crab will at once sneak up sideways, looking at you fixedly the while with its long stalked eyes, claw the disgorged fish, and make away with it rapidly; chase [p. 39:] it, and it is off like a shot, dropping the spoils. Some of us thought the crabs probably ate the young birds, but I saw no proof of this; on the contrary, I saw many unattended balls of fluff, and no crabs were at them. Neither, I imagine, can they crack the eggs; perhaps they manage it, however, somehow, for their cunning exceeds belief. But throw one into the sea, and watch its frantic efforts to reach the land, evidently knowing where safety lies; but you must first catch your crab alive, which is almost impossible, unless you can first wound it by a blow of a stick, or somehow. How hot and exasperated I got chasing them; how I didn't swear; how sitting down I soon saw one eye, and then one claw, and then the other eye appear over a ledge of rock; how it watched me; how I remained breathless and still; how I then slyly drew my stick along, and how, finally, I frantically struck at it; and how after all, I only stung my arm and didn't touch the crab! How, after cutting nice strips off a fish for bait, I after a few minutes turned round and found it all stolen; how I saw the robbers disappearing into cracks; how I threw my stick at one, and struck it by a piece of good luck; with what joy I threw it into the sea, and saw the fish rush at and devour it. Ha! revenge is sweet". In the following editions of his book, Campbell gave the same account with a few very minor changes in wording.

Also navigating sub-lieutenant Herbert Swire, whose personal narrative of the "Challenger" expedition was published as late as 1938, was quite impressed with the St Paul's Rocks *Grapsus*. After dealing with the birds he remarked: "The remaining inhabitants of these rocks are the crabs. These

Capt Sir John Ross [Sir James Clark Ross is meant] describes as 'very fierce and active', which is very true. Their agility is quite surprising; on seeing you approach they will scuttle off across the rock at railway speed, so that it is next to impossible to circumvent them in the open field, but they are evidently unaccustomed to that universal destroyer, man, for on reaching a chasm they just crawl over the edge and then stop, so that you have only to stoop over suddenly to complete their destruction by means of a stick. Some of them are very handsomely marked, and these are the largest kind, being about 4 inches in the shell; they steal the birds' eggs in the most open manner, and sometimes even walk off with the young birds. I came across one of these gentry with an eggshell, but on seeing me he bounded off across the rocks, eggshell and all, so that I was fain to give up the chase".

M. J. Nicoll, naturalist on board the yacht "Valhalla" of the Earl of Crawford, visited St Paul's Rocks on 17 and 18 December 1902, and gave the following account of *Grapsus grapsus* on the islands (Nicoll, 1908: 3): "As soon as we were ashore we noticed a vast number of crabs [footnote: *Grapsus strigosus*] crawling about in all directions. Some of these crabs were of a green colour; these were the smaller and more numerous, perhaps the younger ones, while others, which were larger, were of a bright vermilion".

The next account of the St Paul's Rocks *Grapsus* is by Wild (1923: 80), who was commander of R.V. "Quest" during Sir Ernest Shackleton's last Antarctic expedition. The expedition landed on St Paul's Rocks on 8 November 1921. Wild described the crabs as follows: "Animal life on the Rocks is composed of two varieties of birds, and landcrabs of which also there seemed to be two varieties, a large reddish-coloured species and a smaller one, dull green in colour... The food of the crabs also consists largely of flying-fish which have inadvertently flown ashore or been brought by the birds. The crabs are wonderfully active, moving rapidly sideways in either direction, and they are able to jump, which they do by gathering their legs under them and leaping squarely forward".

Sachs (1963: 3), who visited St Paul's Rocks on 18 March 1963 with R.V. "Chain" of the Woods Hole Oceanographic Institution, mentioned "a great number of land crabs", obviously referring to the present species. R.V. "Atlantis II" of the same institution visited the Rocks on 19 and 22 March 1966, and Mr. D. Masch, zoologist of the expedition, gave the following account of *Grapsus*: "Crabs were everywhere on the lower levels of the rocks — on vertical walls, in crannies, hiding under our feet as we stood on the uneven surface. They were in the pools, in the surf shining brightly red or dark green with red and white spots; they seemed equally

comfortable in or out of water, and they were all watching us. When one moved, crabs scuttled away in every direction, their legs rattling against the rocks sounding much like wind-blown leaves”.

On 7 May 1971 a short visit to St Paul's Rocks was carried out by biologists from the British Antarctic Survey, who visited the group with R.R.S. "Bransfield" on their way back from the Antarctic. Three hours (15h<sup>30</sup>-18h<sup>30</sup>) were spent on the islands and a report on the visit was published by H. G. Smith et al. (1974). *Grapsus grapsus* was described as follows: "The most obvious marine invertebrate inhabitants of the Rocks were the numerous vividly coloured crabs, *Grapsus grapsus* L., which have been extensively reported by previous expeditions (Wyville-Thomson, 1878; Wild, 1923). The 45 specimens collected showed considerable variation in size and dimorphism in colour, one having more green in the carapace; the specimens have been deposited with the British Museum (Natural History)".

The various statements whether or not the crabs attack young birds seem to be conflicting. Moseley reported that he observed a crab "carrying off a young bird just hatched", and also Swire mentioned that they "even walk off with the young birds". Campbell, however, denies that young birds are attacked by crabs. The explanation probably is that just hatched and still helpless young birds may fall prey to the crabs, but when they are larger "balls of fluff" they know how to defend themselves with their sharp beaks. Ross called them a destructive enemy of the eggs of boobies and noddies, and according to Swire they "steal the birds' eggs in the most open manner"; Campbell thought this unlikely, although not impossible.

Moseley and Wyville Thomson used the incorrect name *Grapsus strigosus* for the Challenger specimens of the present species. *Grapsus strigosus* (Herbst), now known under its correct name *Grapsus albolineatus* Lamarck, is an Indo-West Pacific species, different from *Grapsus grapsus*. Miers (1886) in his scientific report on the Challenger Brachyura correctly identified the St Paul's Rocks specimens as *Grapsus maculatus* Catesby, 1743. Catesby's name, however, being pre-Linnean, cannot be used; the correct name for the species is *Grapsus grapsus* (L., 1758). Nicoll (1908) evidently was led astray by Moseley's incorrect identification and also used the name *Grapsus strigosus*.

*Grapsus grapsus* has an extensive amphi-atlantic distribution and is also known from the Eastern Pacific (Baja California, Mexico to central Chile). In the western Atlantic the species is known from Bermuda, the Bahamas and Florida (U.S.A.) to the West Indies and Pernambuco (Brazil). In the eastern Atlantic its range extends from Morocco (perhaps Portugal) to South-West Africa. It is also known from numerous Atlantic islands:

Azores, Cape Verde Islands, islands in the Gulf of Guinea (Príncipe, São Thomé, Annobon), St Paul's Rocks, Fernando de Noronha, Ascension, St Helena, Ilha da Trindade.

***Pachygrapsus corrugatus*** (Von Martens, 1872)

Material examined:

Sta. 11-4a. Belmonte Islet; in rock pool encrusted with red algae; 17 September 1979; coll. E. Goodburn. — 1 female.

Sta. 11-4b. Belmonte Islet; in tidal rock pool; 22 September 1979; coll. E. Goodburn. — 1 female.

The two specimens, which have the carapace length 10 and 8.5 mm and the carapace width 12 and 10 mm respectively, agree fully with the published descriptions of this rare but characteristic species.

The animals were observed at St Paul's Rocks very occasionally on pink algal encrustations around infrequently flushed rock pools, and occasionally in frequently flushed rock pools. They were not seen elsewhere.

So far *Pachygrapsus corrugatus* has only been reported from the northern West Indies: Bahama Islands (Salt Cay near New Providence Island), Cuba, Puerto Rico and the Virgin Islands (St. Croix). Its occurrence at St Paul's Rocks thus is quite unexpected as the locality lies far outside the known range of the species.

***Plagusia depressa*** (Fabricius, 1775)

St Paul's Rocks records:

*Plagusia depressa* — Smith et al., 1974: 92, 95.

Material examined:

Sta. 11-4. Belmonte Islet; tidal rock pool; 18, 19, and 22 September 1979; coll. E. Goodburn, R. Lubbock and K. Wilson. — 3 males, 1 ovigerous female.

At St Paul's Rocks the species was found occasionally in infrequently flushed rock pools, and more commonly in frequently flushed rock pools. It was not observed anywhere else. H. G. Smith et al. (1974: 92) collected a specimen at St Paul's Rocks from a "vertical sided channel, 5-10 m deep, continuously damp with spray or waves". The species is more common than *Pachygrapsus corrugatus*, but distinctly less common than *Grapsus grapsus*.

*Plagusia depressa* is an amphi-atlantic species with a wide distribution. In the western Atlantic it is known from Bermuda, and North Carolina (U.S.A.) to the West Indies and Pernambuco (Brazil). In the eastern Atlantic its range extends from Morocco to Angola. It has been reported

from many Atlantic Islands: Azores, Madeira, Cape Verde Islands, islands in the Gulf of Guinea (São Thomé, Annobon), Fernando de Noronha, Atol das Rocas, Saint Helena.

#### MAJIDAE

##### **Mithraculus forceps** A. Milne Edwards, 1875

###### Material examined:

Sta. 9-4a. Cliff on west side of Belmonte Islet; 5 m depth; 23 September 1979; coll. R. Lubbock. — 1 ovigerous female.

Sta. 12-4a. Noddy Pool, Belmonte Islet; 19 September 1979; coll. E. Goodburn. — 1 carapace.

Sta. 14-4. Between Belmonte and South Islets; 25 m depth, in rubble trapped by boulders on steep slope; 22 September 1979; coll. A. Edwards, R. Lubbock and D. Lindsay. — 1 postlarva.

The ovigerous female has a carapace length of 11 mm and a carapace width of 13 mm; it agrees very well with the published descriptions of this species. The specimen from the Noddy Pool is represented by a carapace only (length 11 mm, width 12 mm). The identity of the postlarva is not quite certain.

*Mithraculus forceps* is a west Atlantic species and has been reported from Bermuda and North Carolina (U.S.A.) to the West Indies and Rio de Janeiro (Brazil). It has also been found at Fernando de Noronha (Fausto-Filho, 1974) and the Arquipélago dos Abrolhos (Rathbun, 1925).

##### „**Stenorhynchus spinifer**” Miers, 1886

###### St Paul's Rocks records:

*Stenorhynchus spinifer* Miers, 1886: 6, 7, pl. 1 fig. 2; Murray, 1895: 339.

A “single crushed and mutilated” adult male, collected by the “Challenger” at St Paul's Rocks, formed the basis for Miers' description of this species. The specimen had the rostrum broken and lacked all legs. It had been dredged at a depth of 10 to 80 fathoms (= 18 to 146 m).

So far as we know the species has not been reported upon since its original description, and its true identity is still uncertain.

#### STOMATOPODA

##### GONODACTYLIDAE

##### **Gonodactylus austrinus** Manning, 1969

###### Material examined:

Sta. 14-4. Between Belmonte and South Islets; 25 m depth, in rubble trapped by

boulders on a steep slope; 22 September 1979; coll. A. Edwards, R. Lubbock and D. Lindsay. — 1 male, 1 female.

The male has a total length of 28 mm, the female is 14 mm long. They probably are not yet fully grown.

The two specimens showed two submedian dark spots on the fifth thoracic somite dorsally, while on the dorsal surface of the first abdominal somite there are also two dark spots, which, however, are placed slightly more widely apart and which have a sharply defined colourless center. A transverse dark band extends over the rostrum and the anterior part of the carapace; a second transverse dark band is visible in the posterior third of the carapace. The merus of the raptorial claw shows two dark bands.

The species has been taken off the Caribbean coast of Honduras, Nicaragua and Panama; in Brazil it has been reported from Fernando de Noronha (Manning, 1969; Fausto-Filho, 1974) and the Arquipélago dos Abrolhos (Manning, 1969).

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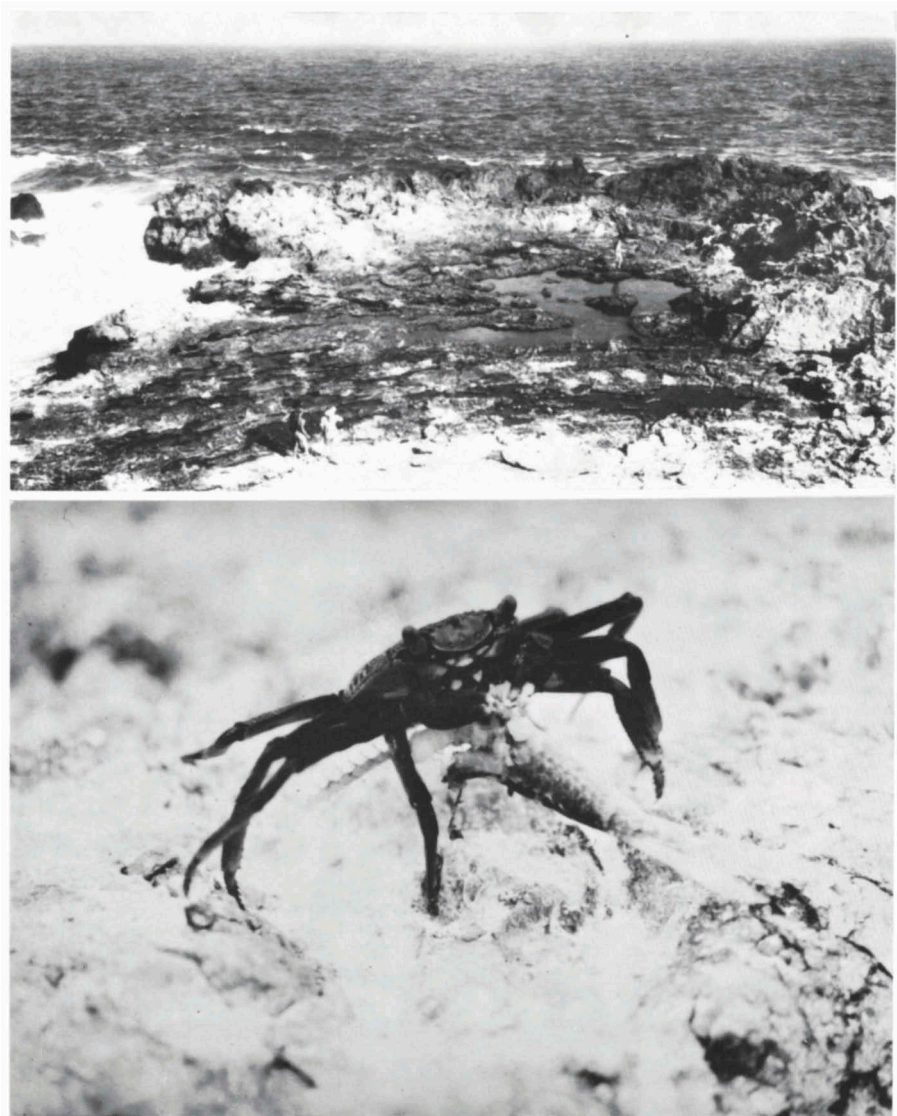
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Above. Noddy Pool area of Belmonte Island, St Paul's Rocks, September 1979.  
Below. *Grapsus grapsus* (L.) eating a flying fish, Belmonte Island, St Paul's Rocks, September 1979.