NOTES ON SOME RARE AND LITTLE KNOWN MARINE INVERTEBRATES FROM THE AZORES, WITH A DISCUSSION OF THE ZOOGEOGRAPHY OF THE REGION

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ARQUIPÉLAGO

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We briefly comment on the occurrence of the following marine invertebrate species in Azorean waters: the molluscs *Pleurobranchus testudinarius, Aplysia fasciata, Diaphorodoris luteocincta, Discodoris atromaculata, Platydoris argo, Polycera elegans, Tambja ceutae*, the crustaceans *Lysmata nilita, Eualus occultus, Aristaeomorpha foliacea, Aristeus antennatus, Cycloes cristata, Pilumnus hirtellus, Polybius henslowii*, the phoronid *Phoronis* cf. *hippocrepia*, the echinoderm *Brissus unicolor* are all new records. Some notes are also made on the bivalve *Pteria hirundo*, the crustaceans *Plesiopenaeus edwardsianus, Liocarcinus marmoreus, Plagusia depressa, Inachus phalangium, Albunea carabus*, the echinoderm *Centrostephanus longispinis*, and the tunicate *Clavelina lepadiformis*. The 16 new records confirm the well established concept of the "Mediterranean character" of the littoral fauna and flora of the Azores.

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Descreve-se brevemente a ocorrência das seguintes espécies de invertebrados marinhos das águas açoreanas: os moluscos *Pleurobranchus testudinarius, Aplysia fasciata, Diaphorodoris luteocincta, Discodoris atromaculata, Platydoris argo, Polycera elegans, Tambja ceutae*, os crustáceos *Lysmata nilita, Eualus occultus, Aristaeomorpha foliacea, Aristeus antennatus, Cycloes cristata, Pilumnus hirtellus, Polybius henslowii*, o foronídeo *Phoronis* cf. *hippocrepia*, o equinoderme *Brissus unicolor*, sendo todos novos registos para a Região. Fizeram-se também algumas observações sobre: o bivalve *Pteria hirundo*, os crustáceos *Plesiopenaeus edwardsianus, Liocarcinus marmoreus, Plagusia depressa, Inachus phalangium, Albunea carabus*, o equinoderme *Centrostephanus longispinis* e o tunicado *Clavelina lepadiformis*. Os 16 novos registos confirmam o conceito bem estabelecido de a fauna e flora litoral dos Açores terem "características Mediterrâneas".

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INTRODUCTION

A photographic survey of the shore fishes and of the larger marine invertebrates in coastal waters of the island Faial was carried out during September 1989, from November 1990 to June 1991, and in July 1992. Some of the species encountered during this survey have either not yet been reported for the Azores or (presumably because of lack of collecting in the appropriate habitat) have been considered rare despite being common. Some such cases are described here. Specimens of several other species of unknown identity were sent to specialists who will report on them in the course of their work.

We are also taking the opportunity to include data on some crustaceans present in the collection of the Department of Oceanography and Fisheries (DOP), University of the Azores at Horta.

Contribution No. 13 from the "Expedition Azores 1989"

METHODS

Individuals of most species were photographed underwater and collected for later identification. Photographs are stored in a slide collection at the

DOP. Specimens are stored in the collection of the DOP. In some cases, preserved specimens were sent to specialists for identification or confirmation of identification (see Acknowledgements).

RESULTS

Mollusca

1) *Pleurobranchus testudinarius* Cantraine, 1840

This large and colourful opisthobranch can be found at a depth of 15 m and deeper in the vicinity of Horta, Faial island. During daytime it hides in cracks in the rock face, below stones, and in caves. At night it emerges into the open. Young animals are a brilliant orange colour with violet polygonal lines around the humps on the back, large ones are deep purple with a white rim (Figs. 1 and 2). The species is widespread in the Mediterranean Sea (CATANEA-VIETTI 1986) and has also been recorded from Brazil (MARCUS 1970).

2) *Aplysia fasciata* Poiret, 1789

A single large individual of this species was seen spawning at Cais do Pico, north coast of Pico island, at a water depth of 2 m, at the end of June. The species was also observed in a rock pool at Feteira, Faial island in 1986 (S.J. Hawkins, pers. comm.). It is known from the Mediterranean Sea and in the Eastern Atlantic from the British Isles to Angola and the Cape Verde Islands (ORTEA & MARTINEZ 1990).

3) *Diaphorodoris luteocincta* (M. Sars, 1870)

Frequently seen in Horta harbour at 5 to 9 m depth, during daytime. The species seemed to appear in June and to have disappeared by July. It is known from the Mediterranean Sea and in the eastern Atlantic from Norway to northern Spain (J. Ortea, pers. comm.).

4) *Discodoris atromaculata* (Bergh, 1880)

A single individual of this species, which is frequently called *Peltodoris atromaculata*, was seen at a depth of 28 m at Monte da Guia, Faial. The species is known from the Mediterranean Sea and in the eastern Atlantic from the French coast to the Canary Islands (J. Ortea, pers. comm.).

5) *Tambja ceutae* Garcia Gomez & Ortea, 1988

This nudibranch has recently been described from the Strait of Gibraltar (GARCIA GOMEZ & ORTEA 1988) and is only known from the type locality. It can be identified by its distinctive colour pattern (Fig. 3). It was found frequently during daytime on rocks between algae, at depths of 8 to 15 m at the shores of Faial and Pico. A specimen has been deposited in the invertebrate collection of the California Academy of Science.

6) *Platydoris argo* (Linné, 1767)

This species was occasionally seen at Monte da Guia, Faial, at depths of 10 to 25 m. The species is known from the Western Mediterranean Sea and in the eastern Atlantic from the French coast to the Canary Islands (J. Ortea, pers. comm.).

7) *Polycera elegans* (Bergh, 1894)

The species, frequently called *Greilada elegans*, was seen in Horta harbour and on the coasts of Faial at depths of 5 to 25 m. Some animals apparently were eating bryozoans. The species seemed to appear in June and to have disappeared by July. It is known in the Mediterranean Sea from the Adriatic to Gibraltar and in the eastern Atlantic from Ireland to Gibraltar (THOMPSON 1988; J. Ortea, pers. comm.).

8) *Pteria hirundo* (Linné, 1758)

The presence of this species at the Azores has been recorded by DROUËT (1858) and by JEFFREYS (1878-1885). It has apparently been considered rare in the past. It is, however, commonly found attached to stout bushes of living *Antipathes* sp. at 25 m to 50 m depth (and presumably deeper) on the submarine slopes of Monte da Guia, a volcanic cone close to Horta, Faial. Because of its distinctive shape, the species is unmistakable. Voucher specimens have been deposited

in the collection of the DOP. The species occurs in the Mediterranean Sea and in the eastern Atlantic from England to the Canary Islands (NORDSIECK 1969).

Crustacea

9) *Liocarcinus marmoreus* (Leach, 1814).

The presence of this species at the Azores has been noted by numerous authors, but all these references appear to be based on a single specimen (found dead on the shore) in the museum Afonso Chaves at Ponta Delgada (BARROIS 1888, MILNE EDWARDS & BOUVIER 1899). The species is quite common in the small sandy bay of Porto Pim, Faial. Specimens are deposited in the collection of the DOP. The CANCAP expedition collected two specimens on sandy bottom east of Flores island (FRANSEN 1991). The species occurs from the British Isles and Helgoland to southern Portugal. (CHRISTIANSEN 1969) and in the Mediterranean Sea (HOLTHUIS 1987).

10) *Plagusia depressa* (Fabricius, 1775)

A fresh moult of this species (deposited in the collection of the DOP) found at 3 m depth inside the "Caldeirinhas" of Monte da Guia is the only evidence of this species encountered. Its presence in the Azores was noted by FIGUEIRA (1960). Local fishermen know it and confirm that it is quite rare. This is in contrast to Madeira where the species is so common that it is regularly collected and eaten. The species has an amphiatlantic distribution; in the eastern Atlantic it has been recorded from Morocco to Angola (MANNING & HOLTHUIS 1981).

11) *Cycloes cristata* (Brullé, 1837)

This species is occasionally encountered on sand, for example in front of Espalamaca cliff, Faial, at a depth of 15 m. It differs from *Calappa granulata* (the other member of the family Calappidae recorded from the Azores) in having many small pinkish to violet spots (Fig. 4), whereas *Calappa granulata* has large orange spots. The species is known from the Cape Verde Islands, the Canary Islands, and Madeira (DEN HARTOG 1987). *Cycloes cristata* is here recorded from the Azores for the first time.

12) *Inachus phalangium* (Fabricius, 1775)

Individuals of this species were occasionally seen between the stones forming the outer wall of the marina inside Horta harbour, at a depth of about 5 m. A voucher specimen is in the collection of the Senckenberg Museum at Frankfurt. In his Table 1 giving the known distribution of the decapod crustaceans of the Cape Verde Islands, TÜRKAY (1982) does not list the Azores for this species, which is common in the Mediterranean and the eastern Atlantic. It has been reported for the Azores by BARROIS (1888). The CANCAP expedition found one individual on the south coast of S. Miguel island (FRANSEN 1991).

13) *Pilumnus hirtellus* (Linné, 1761)

The species is common in shallow water on rocky substrate. A specimen has been deposited in the collection of the Senckenberg Museum at Frankfurt, another specimen is at the DOP. In his Table 1 giving the known distribution of the decapod crustaceans of the Cape Verde Islands, TÜRKAY (1982) does not list the Azores for this species, which is common in the Mediterranean and the eastern Atlantic. Apparently, we are here reporting it from the Azores for the first time.

14) *Polybius henslowii* Leach, 1820

A dead individual of this species was found drifting inside Horta harbour. It was identified by Dr. M. Türkay and now is in the collection of the Senckenberg Museum at Frankfurt. According to MANNING & HOLTHUIS (1981) this pelagic species is known from the North Sea and British Isles south to Morocco and from the Mediterranean Sea. For the Azores, this appears to be the first record.

15) *Albunea carabus* (Linné, 1758)

The first and so far only record of the species at the Azores was made by FIGUEIRA (1960). The collection of the DOP contains two specimens,

one collected by Helena Krug 20.03.1983 in sandy substrate in the bay of Porto Pim, Faial island, and another collected later by the R/V "Geralda" off the islets of Feteira, Faial island, at a depth of 32 m. The species ocurrs in the Mediterranean Sea and in the eastern Atlantic from Liberia to Ghana (MONOD 1956).

16) *Lysmata nilita* Dohrn & Holthuis, 1950

The species is known from the Mediterranean Sea and the Canary Islands (MORENO BATET et al. 1982). It can be recognized by its distinctive pattern of vertical stripes (see Fig. 3b in MORENO BATET et al. 1982). It was observed and photographed in a large cave at 35 m depth on the slope of Monte da Guia. This is the first record for the Azores and the second record for the species outside of the Mediterranean.

17) *Eualus occultus* (Lebour, 1936)

An individual of this small shrimp was found in a pile of stones at 8 m depth on the muddy bottom of Horta harbour. The specimen was identified by Dr. M. Türkay and now is in the collection of the Senckenberg Museum at Frankfurt. This species lives in the Mediterranean Sea and in the eastern Atlantic from Norway south to Morocco (LAGARDÈRE 1971, SMALDON 1979). This is the first record of the species for the Azores.

18) *Aristaeomorpha foliacea* (Risso, 1827)

The DOP collection contains one specimen caught by R/V "Geralda" 10.07.1980 at Baixa São Mateus, Pico island, at a depth of 320 m. This is the first record of the species from the Azores. It was found south of Porto Santo, Madeira archipelago, by the CANCAP expedition (FRANSEN 1991). This amphiatlantic species has been recorded from the Mediterranean Sea and, in the eastern Atlantic, from the Bay of Biscaya to N.W. Africa (HOLTHUIS 1980).

19) *Aristeus antennatus* (Risso, 1816)

One individual of this shrimp, never before recorded from the Azores, was found by Eusménia Serpa while sampling *Phycis phycis* for the DOP. The shrimp was in the mouth of the fish that had been caught by R/V "Guernica" south of Faial island 17.07.1988. The known distribution of the species ranges from the continental slope of Portugal to the Cape Verde Islands and the Mediterranean (HOLTHUIS 1980).

20) *Plesiopenaeus edwardsianus* (Johnson, 1867)

This deepwater prawn, with the type locality at Madeira, was caught in the Azores on several occasions from 1888 to 1902 by the yachts of Prince Albert I of Monaco "l'Hirondelle" and "Princess-Alice." There are no reports of this species in the literature after this time. In the collection of the DOP, there are two specimens of this species. One was caught in the channel between S. Jorge and Pico islands at a depth of 1000 m on 25.04.1986 by M.J. Simas, and another was caught by longline fishery off Calheta, south coast of Pico island on 26.11.1991, at a depth between 864 and 1000 m. The species probably is not rare at these depths. The eastern Atlantic distribution of this amphiatlantic species is from Portugal to South Africa; it has not yet been recorded from the Mediterranean Sea (HOLTHUIS 1980).

Phoronida

21) *Phoronis* cf. *hippocrepia* Wright, 1856

In the harbour of Horta, Faial, at depths of 4 to 8 m, colonies of up to several cm diameter were common on rocks in 1991. They could, however, not be found again in summer 1992. From macrophotos taken, the species can be identified as *Phoronis hippocrepia* with some confidence. The only other possibility would apparently be *P. ijimai* known from the Pacific, but whose presence in the Atlantic cannot be excluded (C.C. Emig, pers. comm.). *Phoronis hippocrepia* has a nearly world-wide distribution (EMIG 1976) but for the Azores this is apparently the first record.

Echinodermata

22) *Brissus unicolor* (Leske, 1778)

In his paper on the echinoderms of the Azores, MARQUES (1983) does not list this species. Empty tests are frequently seen on sandy bottom. Specimens have been deposited in the dry collection of the DOP. The species occurs on both sides of the Atlantic and in the Mediterranean Sea. The eastern Atlantic distribution is from Gibraltar to Cape Verde Islands (TORTONESE 1965).

23) *Centrostephanus longispinis* (Philippi, 1845)

We can confirm the remarks by MARQUES (1983) that the long-spined sea urchins in the Azores (at least those along the coasts of Faial seen by us) are a black colour morph of *Centrostephanus longispinis* and not *Diadema antillarum* (PHILIPPI, 1845). We have never seen *Diadema antillarum* in the Azores. The black colour morph of *Centrostephanus longispinis* is common inside the harbour of Horta and occasionally encountered in sheltered places along the slopes of Monte da Guia. The species occurs in the Mediterranean Sea and in the eastern Atlantic from Morroco to Gulf of Guinea (TORTONESE 1965).

Tunicata

24) *Clavelina lepadiformis* (Müller, 1776)

In her work on the aplousobranch ascidians of the Azores, MONNIOT (1974) notes that in 1971 this species was found only inside Ponta Delgada harbour, S. Miguel island, but not in other places well studied by her such as Horta harbour, Faial island. The species is now quite common inside Horta harbour (Fig. 5) and also occurs in the Monte da Guia marine reserve near the harbour. Like many other species of ascidians, it has probably been transported to the Azores attached to boats (MONNIOT & MONNIOT 1983) and is now spreading between islands the same way. The species is known from western Norway to France and the Mediterranean Sea (MILLAR 1966).

DISCUSSION

Each newly recorded species can be considered a test case for the theories on the zoogeography of the area in question. The crab *Cycloes cristata* is an eastern Atlantic species previously known from Madeira to the Cape Verde Islands. The other 15 species reported here as "new for the Azores" also occur in the Mediterranean Sea. This is in accordance with the general concept that the shallow water marine fauna and flora of the Azores is closely related to that of the Mediterranean Sea. Despite the fact that a branch of the Gulf stream arrives at the Azores as the Azores Current (see KLEIN & SIEDLER (1989)) there is only a very low affinity of the species to the western Atlantic. This has been noted as early as 1888 for crustaceans (BARROIS 1888) and since then repeatedly for other groups (sponges: BOURY-ESNAULT & LOPES 1985, MOSS 1992; gastropods: GOFAS 1990; scyllarid lobsters: MARTINS 1985; echinoderms: MARQUES 1983; fishes: BRIGGS 1970, 1974; algae: PRUD'HOMME VAN REINE 1988). The shallow water faunas of the more southern islands such as Madeira, the Canary Islands or, in particular, the Cape Verde Islands and Sao Tomé, show a much higher affinity to the Caribbean fauna than does that of the Azores (and this, too, was already noted by BARROIS in 1888). Examples of "Caribbean" species absent from the Azores but present in the more southern islands are the garden eel *Heteroconger longissimus* (cf. SALDANHA et al. 1986), the scaly blenny *Labrisomus nuchipinnis* (cf. WIRTZ & HELLINGER 1987), the long-spined sea urchin *Diadema antillarum* and its symbiotic shrimp *Tuleariocaris neglecta* and the reef lobster *Enoplometopus antillensis* (cf. WIRTZ et al. 1988), the pufferfish *Canthigaster rostrata* (cf. SHIPP 1990) and many other species.

Why are there not more western Atlantic species in the littoral of the Azores? Theoretically, there are two possibilities: a) they do not arrive there, for instance because their planctonic larval stage is too short, or b) they do arrive at the Azores but do not find suitable living conditions. Current evidence, meager as it is, favours the second possibility: larvae of the western Atlantic lobsters of the genera *Panulirus* and *Parribacus* were caught in plankton tows near the Azores (SIMS 1968) but adult animals of these genera do not live at the Azores; an individual of the blenny *Hypleurochilus fissicornis* known from Brazil and Uruguay was found in the water of a ship pump near the Azores and presumed to have been drifting in Sargassum (and was therefore subsequently

described as *Blennius fucorum*) but adult animals of this species are not known from the Azores (H. Bath, pers. comm). The Azores probably do not offer suitable living conditions for some of the Caribbean species carried there by the Gulf Stream; with winter minimum temperatures of 14 °C, the Azores are perhaps simply too cold for them.

The amphiatlantic crab *Plagusia depressa* may be a case illustrating the difficulty (hypothesized by us) for tropical western Atlantic species to survive at the Azores. While it is very rare in the Azores, it is a common species further south at Madeira.

The only western Atlantic species known by us to live at the Azores but not (yet) reported from the more southeastern Atlantic islands is the Antillean tunicate *Distaplia corolla* (Fig 6). It is found in and near Horta harbour and apparently was transported there by yachts (MONNIOT & MONNIOT 1983; and Cl. Monniot pers. comm.). CORNELIUS (1992) suggested that many hydrozoan species might have been transported from the Western Atlantic to the Azores by rafting. However, these species have a widespread occurrence throughout the Atlantic.

How then did the western Atlantic species not existing in the Azores arrive at the more southeastern Atlantic islands? They would either have to bypass the Azores and continue to travel for a much longer time or they would have to take a different route, perhaps via fast equatorial counter currents. The fact that amphiatlantic species are so much more common in the equatorial region and get progressively rarer towards the north argues for such a southern connection.

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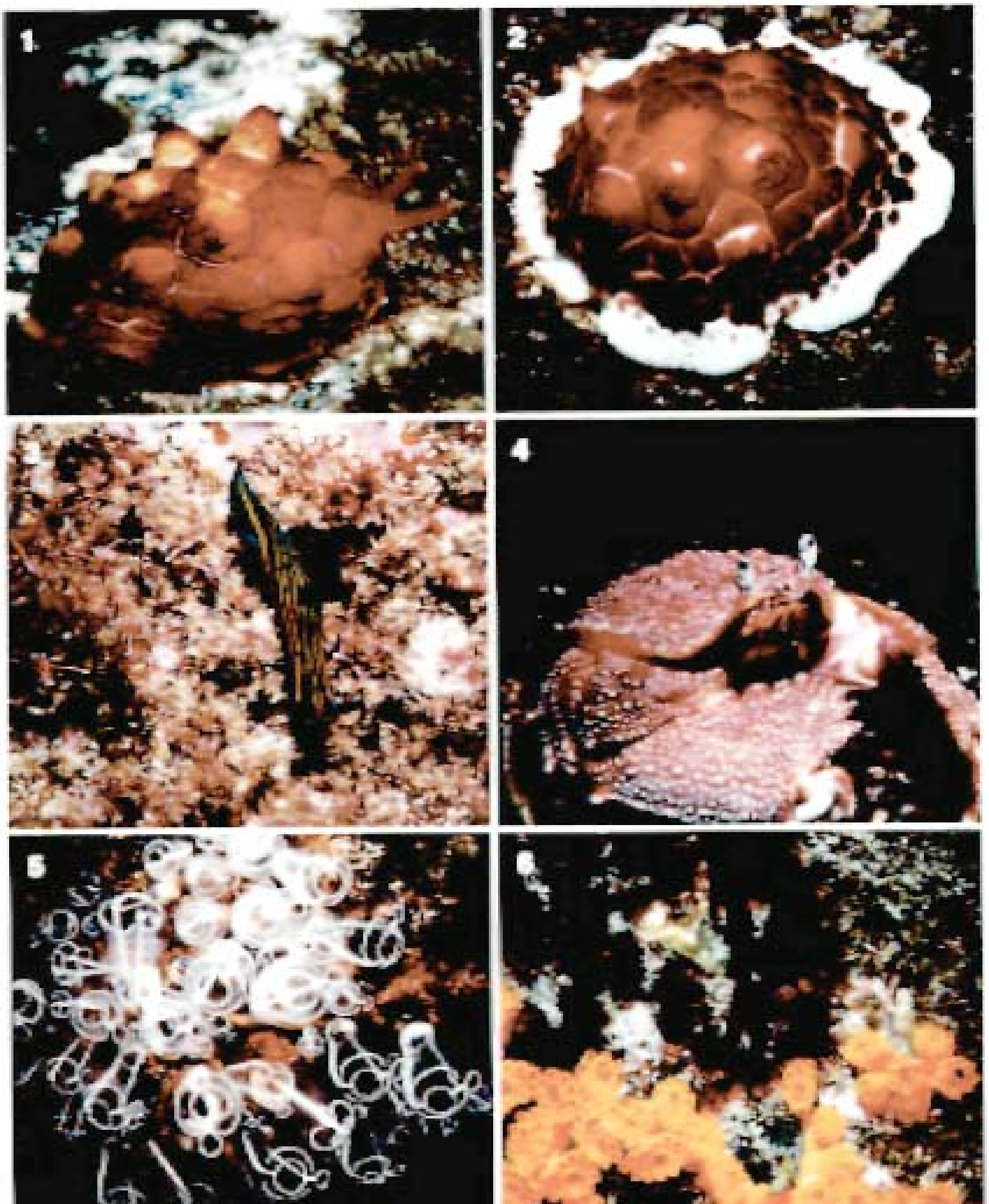

Figs. 1-6. 1. *Pleurobranchus testudinarius*, juv. 4 cm. 2. *Pleurobranchus testudinarius*, adult, 22 cm.
3. *Tambja ceutae* 4. *Cycloes cristata* 5. *Clavelina lepadiformis* 6. *Distaplia corolla*