16 Ascension Island's Hermatypic but Non-Reef Building Corals

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Introduction

Ascension Island lies approximately 8° south of the equator at 07° 57′S, 14° 22′W, 145 km west of the centre line of the mid-Atlantic Ridge. The nearest land to it is the similarly diminutive island of St Helena, some 1,130 km to the south-east, whilst the continental land masses of West Africa and Brazil are approximately 1,500 km and 2,400 km distant respectively. Ascension, therefore, has the peculiar distinction of being one of the most remote islands in the world.

The island is triangular in shape, being 14 km from east to west and 11.2 km from north to south (Fig. 16.1a, b). The coastline is about 45 km long and very rugged (Fig. 16.2), enclosing a land area of approximately 90 km^2 (35 mile^2). Much of the island's surface is pock-marked by volcanic peaks, craters and vast flows of lava (known locally as 'clinker'), solidified into extremely hard rock formations. In the sublittoral, rock surfaces are dominated by encrusting coralline algae and not, as one might expect, by corals. There are no coral reefs at all at Ascension and just five species of scleractinian coral have been recorded.

A Brief History of the Area

The island was first discovered by the Portuguese explorer Joao da Nova in 1501 and named Conception. However, this name was never publicised and it was re-named Ascension two years later by Alphonse D'Albuquerque (Packer 1983). To seafarers over the following 300 years it became known as a place where ships could take on supplies of turtle meat, as did Capt. James Cook in 1775 on HMS Resolution during his second world voyage of discovery. When, in 1815, Napoleon Bonaparte was imprisoned on St Helena, a small British garrison was stationed on Ascension in order to prevent the French from mounting a possible rescue attempt and the island has been continuously inhabited ever since. Around 1900, the first submarine telegraph cable was laid from Cape Town via St Helena, Ascension, the Cape Verde islands and on to the UK, establishing the presence of Cable and Wireless Ltd. on the island. In 1942 the US Army built an airstrip in the south-west of the island (known as Wideawake), followed by the establishment of a NASA tracking station in the 1960s. The BBC installed radio communications equipment and aerials to be able to relay World Service broadcasts from London to Africa and South America at around the same time. By 1980, the island could boast of having the greatest number of satellite dishes per unit area in the world! Ascension also acted as an important staging post for the transport of troops and equipment to and from the Falklands during the conflict in 1982. The RAF continues to have a base on the island to support its regular flights to the Falklands.

History of Research

Few marine biological studies had taken place at Ascension prior to the 1970s. Some small collections of echinoderms (obtained from dredged material) were made during the late 1800s and from visits made by Antarctic research vessels during the first half of the twentieth century. In 1971, Dr R.B. Manning of the US National Museum of Natural History (Smithsonian Institution) visited the island and made extensive collections of invertebrates, particularly of crustaceans, molluscs and echinoderms (Rosewater 1975). A second Smithsonian expedition was undertaken in 1976, with collections being made of shallow water marine invertebrates (Pawson 1978). In 1979, Drs J. Price and D. John from London's Natural History Museum investigated near-shore macroalgal communities (Price and John 1980). A few years later in 1985, a UK diving expedition (of which the author was a co-leader) set about cataloguing and photographing as many of the island's sublittoral habitats and invertebrates as

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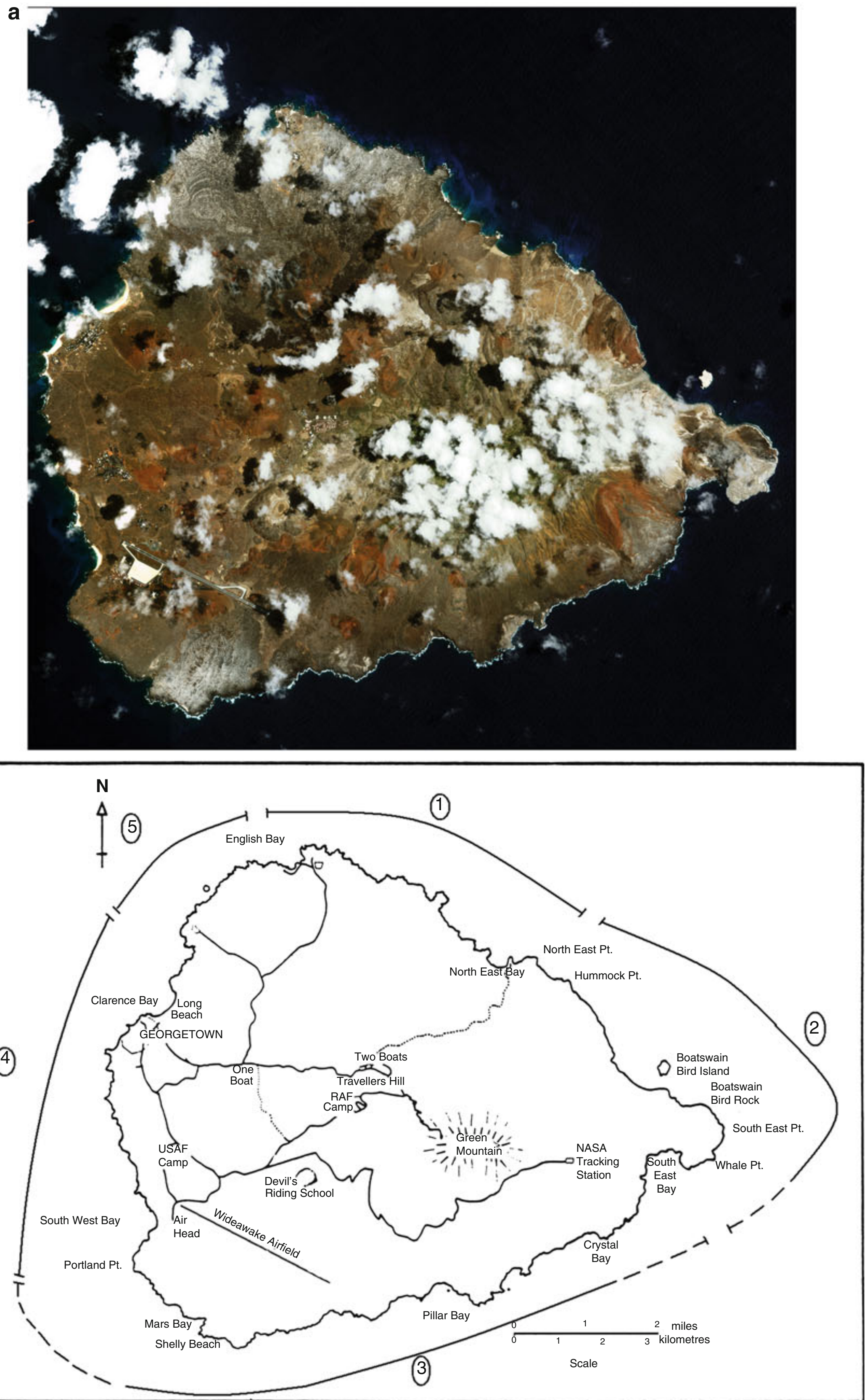

Fig. 16.1 (**a**) Satellite view of Ascension Island. Satellite Image (c) Space Imaging. (**b**) Map of Ascension showing coastal locations mentioned in the text and the five near-shore sectors (as identified by Irving 1989), determined by predominant sublittoral habitat types. Illustration: J. Taylor)

Fig. 16.2 Dramatic yet stark coastal scenery off Ascension's south coast (Photo: R.A. Irving)

possible during a five week visit (Irving 1989). Subsequent studies have catalogued the larger Crustacea (Manning and Chace 1990) and collections of Porifera are being studied at present (pers. comm., C. Goodwin and R. van Soest).

At the time of writing, a major UK diving expedition to the island is underway, organised by the UK's Shallow Marine Surveys Group. The expedition aims to add to what is already known of the benthic habitats, species and marine biogeography, to produce a field guide to marine invertebrates, algae and fish; to report on the status of marine endemics; to report on the potential impacts of climate change; and to assist the Ascension Island Government in developing future biodiversity strategies for their shallow marine environment (http://www.smsg-falklands.org).

The Island Today

Ascension Island is part of the British Overseas Territory of St Helena, Ascension and Tristan da Cunha. In December 2011 its population numbered 873 (FCO website 2012). All three islands are overseen by a Governor (based in St Helena), although Ascension has its own island-based Administrator. Since April 2002 the island's revenue has derived from locally raised taxes, import duties, the sale of philatelic stamps and (since October 2010) the sale of fishing licences. The UK Government remains responsible for Ascension Island's external relations, defence and internal security.

Ascension is an important breeding site for the green turtle *Chelonia mydas* (between 6,000 and 15,000 nests are made each year) and for various species of sea bird, notably the sooty tern or wideawake *Onychoprion fuscatus* and the Ascension frigatebird *Fregata aquila*. In 2001, the British Government gave the Royal Society for the Protection of Birds (RSPB) £500,000, to rid Ascension Island of feral cats that had decimated the once huge seabird population, one of the world's most important breeding colonies. By early 2003 four species of seabird had already re-colonised the mainland (from their refuge on Boatswain Bird Island) as breeding species and predation on the sooty tern population had been eliminated. However, since the eradication of feral cats, the rat population has increased, as have rabbits, both of which are now subject to control programmes. A small Conservation Department comprising three core staff was created in 2001 and a National Park at Green Mountain was established in 2005.

Geological Background and Physical Parameters

Ascension is volcanic in origin, with at least sixty vents or ash cones of varying size. The last eruption is thought to have taken place about 600 years ago. Much of the coastal margin consists of basaltic or trachytic lava flows, with Green Mountain (roughly in the centre of the island) being principally formed of the latter. In geological terms it is a relatively young island: radioactive dating suggests a maximum age of 1.5×10^6 y B.P. (Bell et al. 1972), but many of the lower-lying lava flows are known to be younger ($0.22–0.47 \times 10^6$ y B.P.). By comparison, St Helena has an age in the region of 20×10^6 y B.P.

For the most part, the island is influenced by the westward-flowing South Equatorial Current, which normally flows close to the surface. However, the island is also affected from time to time by the usually deeper-flowing (and colder) Southern Equatorial Counter-Current. The interaction of these two currents gives rise to localised turbulence, gyres and eddies which combine with upwellings in near-shore waters caused by the seabed topography, giving rise to considerable mixing of the water types.

Although the prevailing wind direction is from the south-east, the whole coastline is exposed to severe wave action at some time during the year (particularly from January to March). The least wave-exposed sites appear to be at English Bay in the north and north of Porpoise Point in the north-east. The tidal range is small (0.9 m) with tides being more or less regularly semi-diurnal (Price and John 1980). Seawater temperatures have a fairly narrow range, being slightly warmer (24–26°C) from February to May and cooler (22–24 °C) from August to November. The clarity of the coastal waters is generally very good (vertical visibility typically being 25–40 m), though the situation can change dramatically after one of the sudden though infrequent rainstorms which affects the island from time to time (Irving 1989). The results of sediment smothering after such a storm were apparent in rockpools in South West Bay in October 1985 when several dead *Favia gravida* colonies were observed (Taylor and Irving 1986).

Seabed Types

Near-shore areas of the seabed can be roughly divided into five main sectors. These are described below in clockwise order around the coast, starting in the north-east (Fig. 16.1b).

Sector 1: English Bay to North-East Bay

This is an area of massive outcrops of bedrock. Terraces and underwater cliffs are frequent, often with small caves or underhangs. The bedrock outcrops are separated by areas of coarse sand, occasionally with patches of mearl.

Sector 2: Hummock Point to Crystal Bay

This is the most exposed sector of the island, characterised by steep to vertical bedrock close inshore. Some localised shelter from the wind is provided behind Boatswain Bird Island and Rocks. Seabed profiles extending out from the coast range from wave-cut platforms, cliffs and screes to the vertical face of South-East Head, which drops to 38 m before meeting sand and mearl. At Hummock Point, the sand (unusually volcanic rather than maerl in origin) slopes away very steeply from about 24 m. (The boundary between sectors 2 and 3 can only be estimated, as few dives have been undertaken in this area on account of the frequent heavy swell).

Sector 3: Crystal Bay to South-West Bay

This area is dominated by boulder slopes composed of massive boulders of a minimum diameter of 3 m. Areas of scoured, outcropping bedrock have been recorded from two sites, with very few loose boulders. In many cases, the bedrock is undercut or pocked, providing daytime shelter for echinoids.

Sector 4: South-west Bay to Pyramid Point

The shallow shoals of the west coast have smaller and less prominent bedrock outcrops than other sectors. This is the least exposed part of the open coastline, especially the central area around Georgetown. However, the seasonal rollers which strike the island from the west each year make this still an exposed coastline in any UK understanding of the term. Mearl is abundant in the bays along the west coast.

Sector 5: Pyramid Point to White Rock Cove

This stretch of coast is bounded by low cliffs, many with breeding noddies and boobies. Sublittorally, there are steep boulder slopes extending to 24–28 m depth, where maerl is present overlying coarse maerl-sand. In places the boulders are very massive, whilst elsewhere smaller boulders are fused together with coralline algae. A wave-cut platform is typically present above the boulder slope, of varying width. At 8–10 m below sea level, the vertical walls of the platform are much undercut with caves and arches. This shallow area is both scenic and (relatively) biologically rich.

None of the above-mentioned sectors could be described as being fundamentally different from any of the others, any apparent differences being dependent upon a different mix of habitat types and associated species, rather than the presence or absence of either. In addition to these gross sector distinctions, certain locations stand out within them as being different from the surrounding seabed. These generally result from a combination of local topography and conditions. Most notable of these are Porpoise Point (probably the most sheltered site around the island) and English Bay (Taylor and Irving 1986).

Table. 16.1 Characteristic sublittoral species assemblages (After Irving 1989)

Predominant habitat type	Characteristic species assemblage	Locations (octants) where recorded
A. Bedrock		
(1) Shallow, wave-affected (particularly in the SE)	The zoanthid *Palythoa* sp. (Fig. 16.5) on upward-facing surfaces. Encrusting sponges prominent. Bivalve mollusc *Lopha* common.	Boatswain Bird Rock (E)
		Spire Rock (E)
(2) Shallow, vertical faces	A diversity of sponges and ascidians, usually in small patches, with encrusting lithothamnia. The echinoid *Diadema antillarum ascensionis* is likely to be present in holes.	Klinka Bay (N)
		Pyramid Point (NW)
(3) Underhangs, under boulders and shallow caves	The encrusting coral *Madracis decactis* (Fig. 16.3), solitary corals, *Astrangia solitaria* (Fig. 16.4) and *Rhizosmilia* sp. cf. *gerdae*, black coral *Antipathes* sp., and the zoanthid *Parazoanthus swiftii* (Fig. 16.5). Often with squirrelfish *Holocentrus* spp. present in or close to caves.	Widespread around all coasts. This community has the greatest invertebrate species diversity and richness.
B. Boulder slopes	Upper surfaces dominated by encrusting and columnar lithothamnia. The encrusting corals *Siderastrea radians* and *Madracis decactis* common as various colour morphs. Moray eels (especially *Lycodontis moringa* and *Muraena pavonina*) common.	South West Bay (SW)
		Lady's Loo (N)
		Archer Point (N)
C. Maerl, as		
(1) Branched 'hedgehogs'	With small filamentous blue-green algae and much coarse sand being visible.	Porpoise Point (NE)
		North East Point (NE)
(2) Cobbles	In beds, 5+ cobbles deep, with little visible sand. Occasionally with the fan shell *Pinna* and the conch *Strombus*.	Portland Point (SW)
		Pyramid Point (NW)
		Pillar Point (SE)

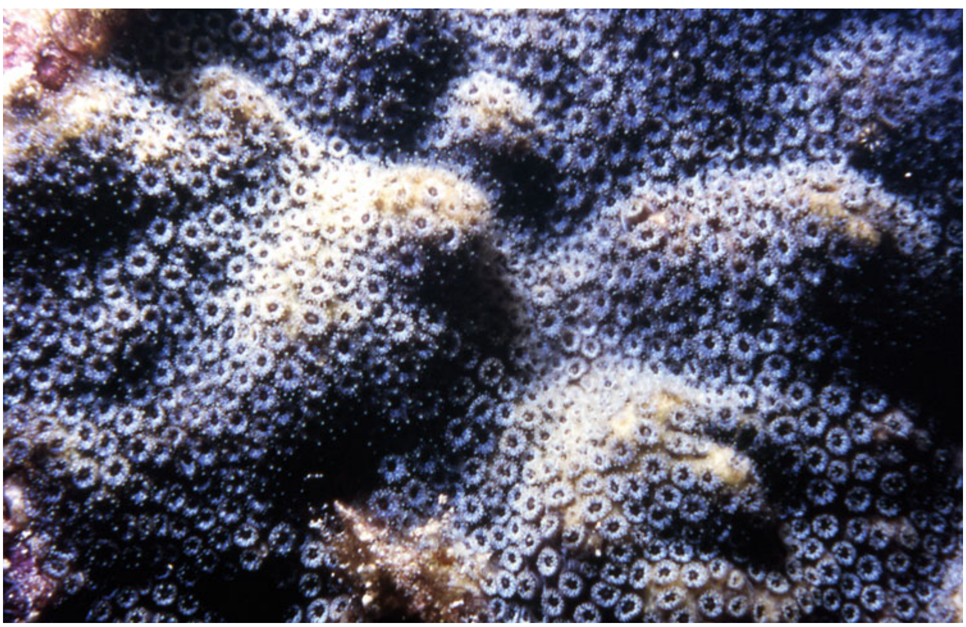

Fig. 16.3 The encrusting coral *Madracis decactis* (Photo: R.A. Irving)

Biological Characteristics

Sublittoral Community Types

Ascension has clear waters, barren rock (though frequently covered with the encrusting coralline algae lithothamnia) and large numbers of fishes, particularly of the triggerfish *Melichthys niger* (known as the blackfish). The sublittoral communities around the island are generally indistinct, although characterised by a low species diversity and abundance, particularly of sessile invertebrates. These impoverished communities are typically present in small patches, giving rise to a complex mosaic of types. However, certain species assemblages appear to be fairly consistent (Table 16.1).

Coral Fauna

There are no coral reefs at Ascension and in this respect the island resembles tropical West Africa (Price and John 1980). The coral fauna itself is extremely limited. Those scleractinian

Table 16.2 Species of Scleractinia (stony corals) and Milleporidae (fire 'corals') found during the Operation Origin expedition in 1985

Species	Description	Habitat notes	Location (octant)	Depth (bsl)	Zoogeographical notes
Madracis decactis (Fig. 16.3)	Thin, encrusting coral. Various-coloured polyps, from green to purple (when viewed under water).	On upper surfaces of bedrock is relatively shallow water.	White Rock (N) Pyramid Point (NW)	10–13 m	Caribbean & NE coast of Brazil. Also W. Africa and Cape Verde islands.
Favia gravida	Faviid coral. Grey-green coloured polyps.	Present in *Typhlatya* pools.	Shelley Beach (S)	0 m	Known from Brazil, West Africa and St Helena
Siderastrea radians	Large polyp coral.	Present on upper surface of bedrock, with algae growing around perimeter	Catherine Point (W)	16 m	Amphi-Atlantic but not off Brazil
Astrangia solitaria (Fig. 16.4)	Cup corals (brown/white)	Present on the undersides of bedrock and boulders.	Pyramid Point (NW) Pillar Point (SE) Archer Point (N) Spire Rock (E)	10–26 m	Western Atlantic, from Bermuda across the Caribbean to NE Brazil
Rhizosmilia sp. cf. *gerdae*	Cup coral (boulder)	Present under overhangs and on underside of cobble.	Spire Rock (E) Powerhouse Cove (N)	10–15 m	Insular Straits of Florida
Millepora alcicornis	Fire coral	In small patches on open areas of bedrock		10–15 m	Caribbean, Florida, Brazil and Cape Verde Islands
Millepora complanata	Fire coral	In small patches on open areas of bedrock		8–12 m	Caribbean, Florida, Bahamas and Venezuela

Fig. 16.4 The starfish *Linckia guildingii* with the brown coral *Astrangia solitaria* (Photo: R.A. Irving)

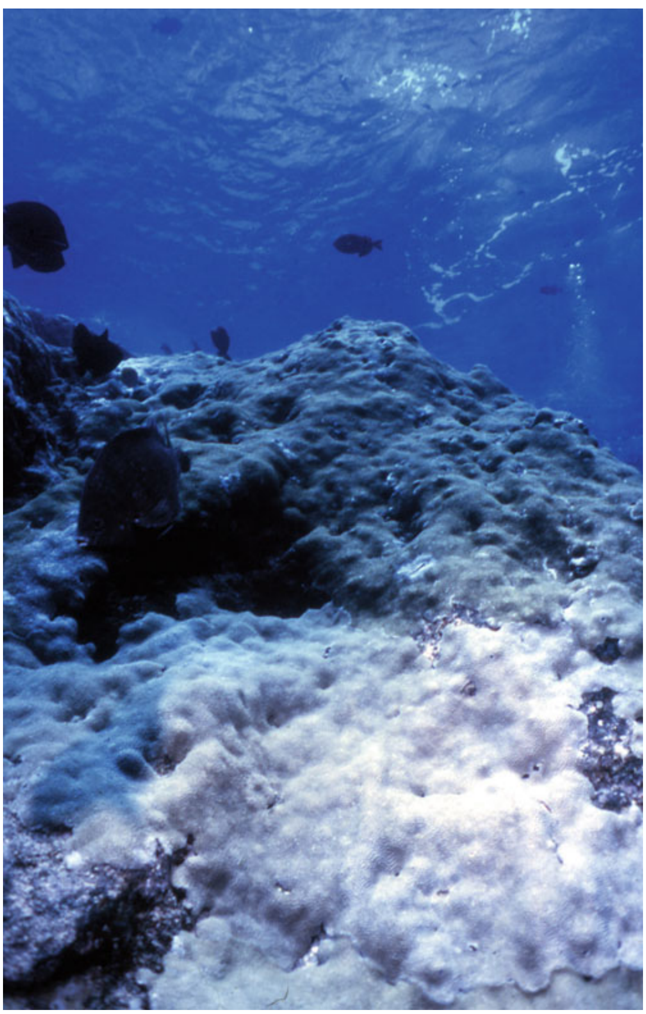

Fig. 16.5 Shallow bedrock covered with the zoanthid anemone *Palythoa* sp (Photo: J. Taylor)

corals which are present (Table 16.2, Figs. 16.3 and 16.4) are either ahermatypic encrusting forms (just three species were distinguished by the author from his visit in 1985) or are solitary/cup coral forms. Two species of fire coral (Hydrozoa: Milleporidae) were also recorded. The colonial relative *Palythoa* is also present in large sheets (Fig. 16.5).

Other Sublittoral Taxa

Ascension's sublittoral fauna is noticeably impoverished. The blackfish *Melichthys niger* (Fig. 16.6) deserves special mention on account of its surprising abundance, its cosmopolitan diet and its voracious grazing ability. There can be little doubt that the large numbers of these fishes have a significant effect on the local ecology. This species in particular, and probably the sea urchins *Echinometra lucunter polypora* in the sublittoral fringe and *Diadema antillarum ascensionis* in slightly deeper water, manage to keep in check the possible colonisation of rock surfaces by settling larvae. During daylight hours, when the blackfish rule supreme, the *Diadema* urchins hide away in holes and crevices, but under cover of darkness large numbers emerge to graze the miniscule epibionts which may remain on rocky substrata. 70% of the diet of blackfish seems to consist of algae (Randall and Klausewitz 1973; Price and John 1980). Only blue-green algae appear to be avoided by their grazing behaviour, and those macroalgal and sessile invertebrate species growing in places which are inaccessible to blackfish.

Fig. 16.6 The blackfish *Melichthys niger* is surprisingly colourful when seen close up (Photo: J. Taylor)

Biogeographic Background

With its isolated position in the middle of the Atlantic, Ascension lies a very long way from potential source areas of recruitment along the coastal fringes of both West Africa and Brazil, its nearest continental land masses. This fact alone has restricted the number of species that have reached the island. The majority of invertebrate species (including corals) have their centres of distribution centred on the Caribbean and/or the coast of Brazil with very few associated with West African faunas. This is true for most fishes: 30% of the 71 species of near-shore fishes are only recorded from the western and central Atlantic, whereas just 7% are recorded from the eastern and central Atlantic (Lubbock 1980).

Endemic Species

The number of endemic species which have been reported from Ascension is relatively low, reflecting the overall paucity of species diversity around the island. Two species of caridean shrimp are known to be endemic to Ascension, confined to isolated intertidal pools on the island's south coast, *Procaris ascensionis* and *Typhlatya rogersi*. *Procaris ascensionis* was described as being one of the most primitive living members of the Caridea yet discovered; and *Typhlatya rogersi* was described as the first species of that genus to have been collected outside the Gulf of Mexico and the Caribbean and the first known from salt water (Chace and Manning 1972).

Rosewater (1975) recorded a total of 89 species of molluscs from the island of which 6% occur at both Ascension and St Helena. For echinoderms 4 of the 25 species recorded (16%) are restricted to both Ascension and St Helena and just one species, the sea cucumber *Holothuria manningi*, is endemic to Ascension (Pawson 1978).

Despite the apparent abundance of fish life, the number of recorded near-shore fishes recorded from Ascension (71) is low for a tropical island (Lubbock 1980), attributed to the island's isolation and to low habitat diversity. 16% of these species are believed to be endemic to Ascension (Lubbock 1980) including the resplendent angelfish *Centropyge resplendens*; Apollo damselfish *Chromis* sp.; Lubbock's yellowtail damselfish *Stegastes lubbocki*; Ascension goby *Priolepis ascensionis*; white hawkfish *Amblycirrhitus earnshawi*; marmalade razorfish *Xyrichtys blanchardi*; seabream *Diplodus ascensionis*; and the Ascension wrasse *Thalassoma ascensionis*. A further 17% are known to be endemic to both Ascension Island and to St Helena. These are relatively high levels of speciation, a fact which can largely be assigned to the islands' isolation.

Conclusion

The low diversity of Ascension's sublittoral fauna appears to be largely the result of the island's isolation. Those sessile invertebrates which have managed to reach the island have only survived by avoiding the attention of the grazers, particularly the urchins (e.g. *Diadema antillarum ascensionis* and *Echinometra lacunter*) and the grazing fishes (e.g. the sergeant-major *Abudefduf saxitilis* and the ubiquitous blackfish *Melichthyes niger*). Typically this means these sessile species have become established in crevices, small caves or on the underside of overhangs. Besides the widespread cover of encrusting coralline algae ('lithothamnia') on most open rock surfaces, extensive sheets of zoanthid anemones *Palythoa* spp. appear to have filled the ecological niches where hermatypic corals might be expected to be, presumably a result of being either sufficiently distasteful or indigestible to would-be grazers. This lack of hermatypic corals also decreases the number of available habitats one might expect to find in the shallow sublittoral of a tropical island, and consequently the diversity of species too.

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