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Short Communication

The coral reefs of Bazaruto Island, Mozambique, with recommendations for their management

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Abstract—Coral collections and qualitative observations were made on the Bazaruto coral reefs in the Parque Nacional do Bazaruto. A checklist of species found on the reefs is presented with descriptions of their nature. Both the Alcyonacea and Scleractinia are well-represented on the reefs and their biodiversity is discussed in a regional context. The reefs constitute a valuable resource for ecotourism and recommendations are made for their sustainable use.

INTRODUCTION

The coastline of Mozambique (Fig. 1) extends from 10°S to 27°S, encompassing a full spectrum of reef types, from the fringing and island reef complexes found on either side of the Mozambique-Tanzanian border (Hamilton & Brakel, 1984; Wells, 1988; Obura *et al.*, 2000; Rodrigues *et al.*, 2000a) to the high-latitude marginal reefs of southern Africa (Schleyer, 2000). The reefs in the Bazaruto Archipelago are concentrated primarily around Bazaruto Island (Fig. 2) and constitute a major attraction for the ecotourism industry that operates amongst the islands. They are isolated from those in northern Mozambique by the Sofala Banks off Beira, derived from the Zambezi delta, and from those to the south off Inhambane and in southern Mozambique (Fig. 1).

Bazaruto Island is the largest of the five islands in the Bazaruto Archipelago and these, together with some of the adjacent mainland, comprise a national park, the Parque Nacional do Bazaruto. The largest three islands were first proclaimed a Marine Protected Area (MPA) in 1971, with consolidation of the park into its present form in 2001.

The Archipelago is exposed to the warm waters of the Indian Ocean in the Mozambique Channel with mean monthly sea temperatures of 23-28°C (SADCO[1] data), salinities of 35.0-35.4‰ (SADCO[1] data) and a maximum tidal flux of 3.8 m (British Admiralty Chart 2932, 1972). The prevailing south to southeasterly winds generate swells of up to 5 m and the region is periodically subject to cyclones in the austral summer. On their eastern side, the larger islands have reefs exposed to deep water but, on the western, mainland side, a build-up of sediment has formed a shallow system of channels and seagrass beds.

Other than the work of Benayahu and Schleyer (1996), no published studies of the coral reefs have been undertaken in the islands, though certain sites were included in a national reef monitoring effort after severe coral bleaching caused by the 1998 El Ninõ Southern Oscillation in the Western Indian Ocean (see Schleyer, *et al.*, 1999; Obura, *et al.*, 2000; Rodrigues, *et al.*, 2000b). The following

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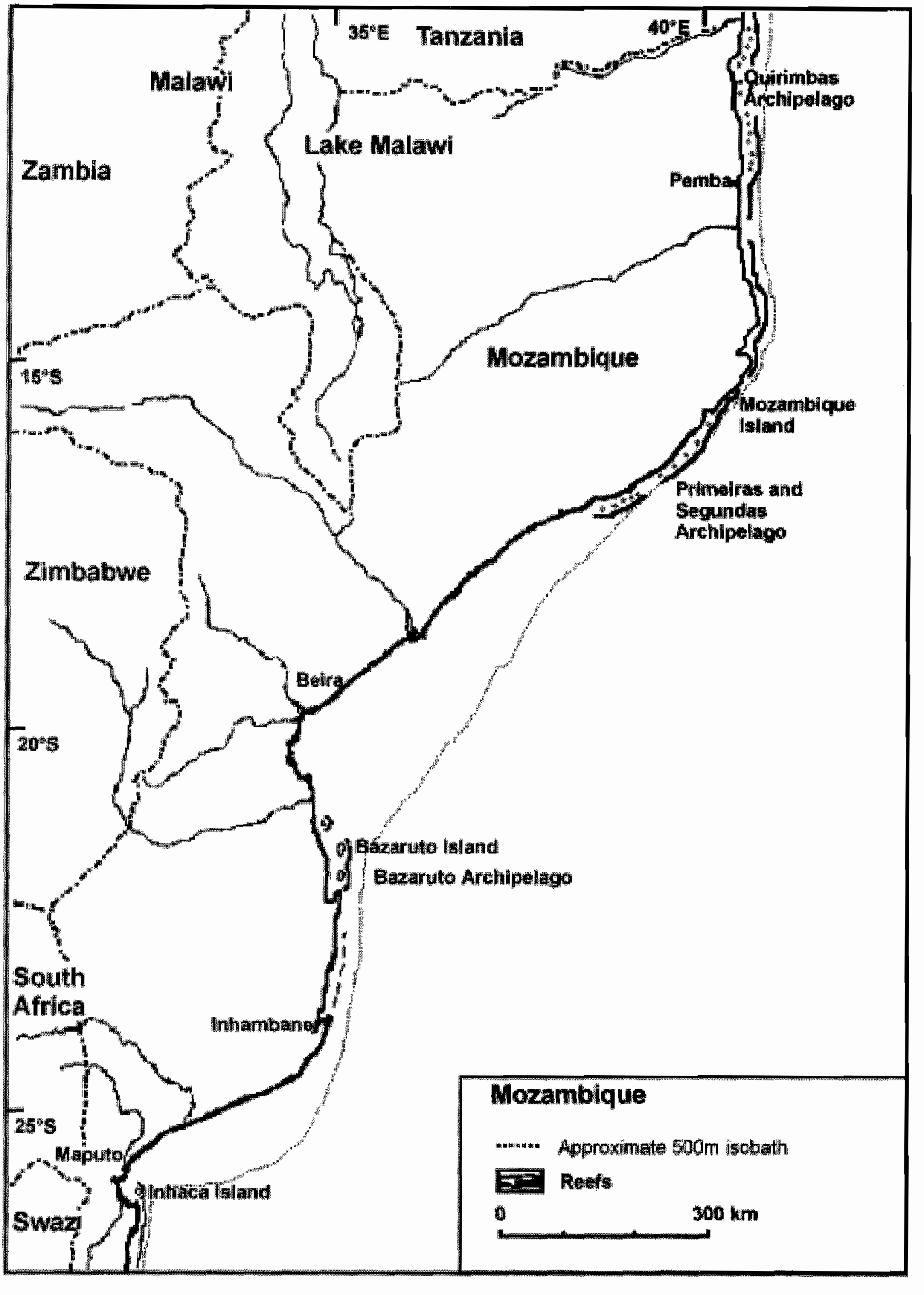

Fig. 1. Map of Mozambique showing its principal reef areas (from Schleyer, *et al.*, 1999)

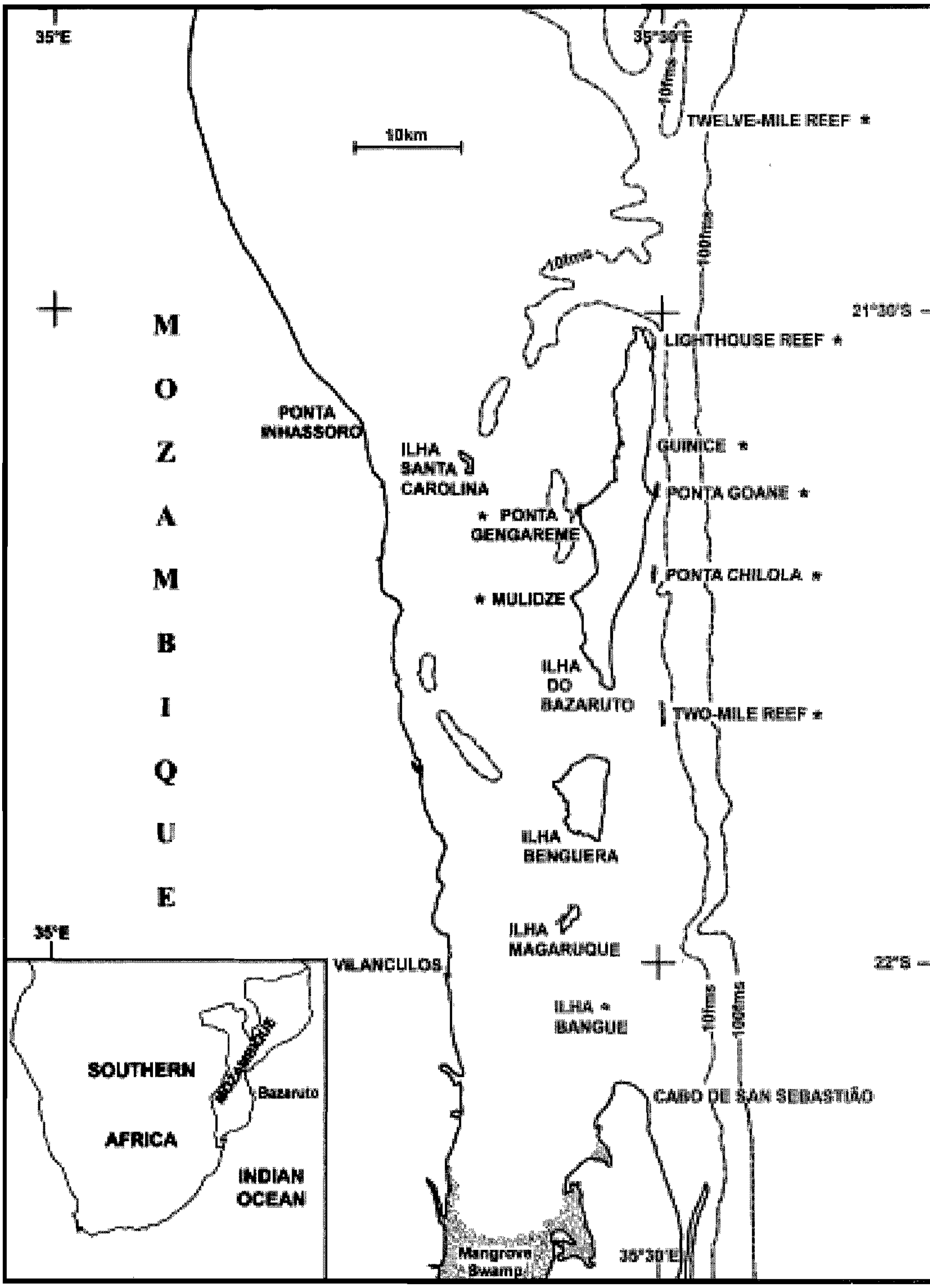

Fig. 2. Map of the Bazaruto Archipelago. Corals were collected for this study at the sites marked with an asterisk. Original chart isobaths were in fathoms as per figure (British Admiralty Chart 2932, 1972); 10 fms = 18 m, 100 fms = 180 m

account describes both the reefs and their benthic biodiversity, which were not substantially changed by the aforementioned El Ninõ bleaching, and provides recommendations for their management.

MATERIAL AND METHODS

Corals were collected by the first author using snorkel and SCUBA equipment on nine reefs off Bazaruto Island (Fig. 2) in January 1992, July 1993 and October 1994. These constitute the major coral-inhabited reefs in the Bazaruto Archipelago. Air transport limited the size of the collection and corals were only removed from the following sites: Twelve-mile Reef (21° 21'18" S; 35° 30'12" E), Outer Lighthouse Reef (21° 31'15" S; 35° 29'50" E), Inner Lighthouse Reef (21° 31'30" S; 35° 29'35" E), Guinice (21° 36'05" S; 35° 29'31" E), Ponta Goane (or Venges Reef; 21° 38'10" S; 35° 29'45" E), Ponta Chilola (or Xilola; 21° 42'13" S; 35° 29'54" E), the outer (21° 48'29" S; 35° 29'57" E) and inner sides of Two-mile Reef (21° 48'33" S; 35° 29'53" E), Ponta Gengareme (21° 39'32" S; 35° 25'46" E) and Mulidze (21° 42'59" S; 35° 25'56" E). The collection was thus representative rather than comprehensive, but notes within the text indicate the distribution of the organisms.

The scleractinian collection comprised over 200 specimens that were bleached after sampling in 1% sodium hypochlorite, washed, air-dried and identified in the laboratory using relevant literature and the reference collection at the Oceanographic Research Institute in Durban, South Africa. The Alcyonacea (over 70 specimens) were fixed in 4% formalin in seawater, rinsed in freshwater after 24 hours and then transferred to 70% ethyl alcohol. Sclerites for identification of the latter were obtained by dissolving the organic tissues of subsamples with 10% sodium hypochlorite. Microscopic examination and comparison of these with the literature and reference material was undertaken in the Department of Zoology, Tel Aviv University (Benayahu & Schleyer, 1996).

Operating conditions were stringent during the expeditions and precluded quantitative work. However, underwater photographs and field notes on the reefs have been used to provide qualitative descriptions of the reefs and their associated coral communities.

RESULTS

The collections initially comprised 27 species of Alcyonacea, as reported by Benayahu and Schleyer (1996), plus 99 species of Scleractinia and two Milleporina. Taxonomic revisions subsequently lead to a reduction in the number of the Alcyonacea. However, members of the Nephtheidae that are still under investigation have been provisionally included in the list and an additional alcyonacean soft coral was added during subsequent reef monitoring, bringing the total for this order to 29 (Table 1).

The reefs themselves proved variable in nature. They ranged in biogenic accretion from a sparse growth or thin veneer of corals on underlying Pleistocene sandstone substrata to true hermatypic reef formations. The former were similar to reef structures found further to the south that have been extensively studied in South Africa (Ramsay & Mason, 1990; Ramsay, 1996). However, while soft corals are more abundant than hard corals on reefs further south (Schleyer, 2000), the Scleractinia are both more abundant and diverse on the Bazaruto reefs. The reefs were categorised as follows:

Submerged sandstone reefs

The biggest of these features is a large reef between 18-25 m in depth that is twelve nautical miles NNE of the northern point of Bazaruto, hence the English name **Twelve-mile Reef.** It consists of flat rock substrata, dropping in fissures, gulleys and low walls to the surrounding sediment. The shallower reef top has a mixed coral community of which 1-2 m carpets of *Cladiella kashmani* and other soft corals are notable. However, in view of its depth, corals are relatively sparse and a number are ahermatypic (*Dendrophyllia* and *Tubastraea*) and azooxanthellate (*Dendronephthya*). The reef community is more mixed in the gulleys where sponges are also prominent, ascideans less so, and there is a sparse community of black corals (Antipatheria) and seafans (*Annella*).

Conversely, at the opposite extreme, **Ponta Gengareme** (or Zingarema) is found on the western shore of Bazaruto Island, and is a steep wall that falls away from a rock shelf just exposed

Table 1. Corals collected on the Bazaruto reefs

ALCYONACEA

Tubiporidae
Tubipora musica Linnaeus, 1758

Alcyoniidae
Cladiella australis (Macfadyen, 1936)
Cladiella kashmani Benayahu & Schleyer, 1996
Cladiella krempfi Hickson, 1919
Lobophytum crassum von Marenzeller, 1886
Lobophytum venustum Tixier-Durivault, 1957
Lobophytum patulum Tixier-Durivault, 1956
Sarcophyton flexuosum Tixier-Durivault, 1966
Sarcophyton gemmatum Verseveldt & Benayahu, 1978
Sarcophyton glaucum (Quoy & Gaimard, 1833)
Sarcophyton subviride (Tixier-Durivault, 1958)
Sarcophyton trocheliophorum von Marenzeller, 1886
Sinularia abrupta (Tixier Durivault, 1970)
Sinularia brassica May, 1898
Sinularia erecta Tixier-Durivault, 1945
Sinularia flexuosa Tixier-Durivault, 1945
Sinularia grandilobata Verseveldt, 1980
Sinularia gravis Tixier-Durivault, 1970
Sinularia heterospiculata Verseveldt, 1970
Sinularia leptoclados (Ehrenberg, 1834)
Sinularia macrodactyla Kolonko, 1926
Sinularia notanda Tixier-Durivault, 1966
Sinularia polydactyla (Ehrenberg, 1834)
Sinularia triangula Tixier-Durivault, 1970

Xeniidae
Anthelia glaucum (Lamarck, 1816)
Sansibia flava (May. 1889)
Xenia impulsatilla Verseveldt & Cohen, 1971

Nephtheidae
Dendronephthya sp.
Stereonephthea sp.

SCLERACTINIA

Acroporidae
Acropora anthocercis (Brook, 1893)
Acropora austera (Dana, 1846)
Acropora cf. *cerealis*
Acropora clathrata (Brook, 1891)
Acropora cytherea (Dana, 1846)
Acropora abrotanoides (Lamarck, 1816)
Acropora divaricata (Dana, 1846)
Acropora formosa (Dana, 1846)
Acropora gemmifera (Brook, 1892)
Acropora horrida (Dana, 1846)
Acropora hyacinthus (Dana, 1846)
Acropora retusa (Dana, 1846)
Acropora nasuta (Dana, 1846)
Acropora palifera (Lamarck, (1816)
Acropora robusta (Dana, 1846)
Acropora secale (Studer, 1878)
Acropora tenuis (Dana, 1846)
Acropora valida (Dana, 1846)
Astreopora myriophthalma (Lamarck, 1816)
Montipora aequituberculata (Bernard, 1897)
Montipora cf. *undata*
Montipora hispida (Dana, 1846)
Montipora monasteriata (Forskål, 1775)
Montipora peltiformis (Bernard, 1897)
Montipora tuberculosa (Lamarck, 1816)
Montipora venosa (Ehrenberg, 1834)

Agariciidae
Gardineroseris planulata (Dana, 1846)
Leptoseris explanata Yabe and Sugiyama, 1941
Leptoseris hawaiiensis Vaughan, 1907
Pachyseris speciosa (Dana, 1846)
Pavona cf. *clavus*
Pavona decussata (Dana, 1846)
Pavona minuta Wells, 1954
Pavona varians Verrill, 1864

Caryophiliidae
Gyrosmilia interrupta (Ehrenberg, 1834)

Dendrophyliidae
Dendrophyllia cf. *robusta*
Tubastrea micranthus (Ehrenberg, 1834)
Turbinaria frondens (Dana 1846)
Turbinaria mesenterina (Lamarck, 1816)
Turbinaria peltata (Esper, 1794)
Turbinaria reniformis (Bernard, 1896)

Faviidae
Cyphastrea serailia (Forskål, 1775)
Echinopora gemmacea Lamarck, 1816
Echinopora hirsutissima Milne Edwards and Haime, 1849
Echinopora lamellosa (Esper, 1795)
Favia favus (Forskål, 1775)
Favia pallida (Dana, 1846)
Favia speciosa Dana, 1846
Favia stelligera (Dana, 1846)
Favites abdita (Ellis and Solander, 1786)
Favites flexuosa (Dana, 1846)
Favites pentagona (Esper, 1794)
Goniastrea peresi (Faure and Pichon, 1978)
Goniastrea edwardsi Chevalier, 1971
Goniastrea pectinata (Ehrenberg, 1834)
Leptastrea transversa Klunzinger, 1879
Leptastrea purpurea (Dana, 1846)
Leptoria phrygia (Ellis and Solander, 1786)
Oulophyllia crispa (Lamarck, 1816)
Platygyra daedalea (Ellis and Solander, 1786)
Platygyra sinensis (Milne Edwards and Haime, 1849)
Plesiastrea versipora (Lamarck, 1816)

Table 1. Contd.

Fungiidae
Cycloseris sp. cf. *somervillei*
Fungia (Fungia) fungites (Linnaeus, 1758)
Fungia (Pleuractis) scutaria Lamarck, 1801
Fungia (Verrillofungia) cf. *concinna*

Merulinidae
Hydnophora exesa (Pallas, 1766)
Hydnophora microconos (Lamarck, 1816)
Hydnophora rigida (Dana, 1846)

Mussidae
Acanthastrea echinata (Dana, 1846)
Lobophyllia hemprichii (Ehrenberg, 1834)
Symphyllia valenciennesi Milne Edwards and Haime, 1849

Oculinidae
Galaxea fascicularis (Linnaeus, 1767)

Pectiniidae
Mycedium elephantotus (Pallas, 1766)

Pocilloporidae
Pocillopora damicornis (Linnaeus, 1758)
Pocillopora eydouxi (Milne Edwards and Haime, 1860)
Pocillopora verrucosa (Ellis and Solander, 1786)
Seriatopora hystrix Dana, 1846
Stylophora pistillata Esper, 1797

Poritidae
Goniopora cf. *columna* Dana, 1846
Goniopora lobata Milne Edwards and Haime, 1860
Goniopora somaliensis Vaughan, 1907
Goniopora stokesi Milne Edwards and Haime, 1851
Porites cylindrica Dana, 1846
Porites lobata Dana, 1846
Porites lutea Milne Edwards and Haime, 1851
Porites nigrescens Dana, 1846
Porites (Synarea) rus (Forskål, 1775)
Porites solida (Forskål, 1775)

Siderastreidae
Coscinaraea columna (Dana, 1846)
Coscinaraea monile (Forskål, 1775)
Horastrea indica Pichon, 1971
Psammocora contigua Esper, 1797
Psammocora digitata Milne Edwards and Haime, 1851
Psammocora haimeana Milne Edwards and Haime, 1851
Psammocora nierstrazi Horst, 1921
Psammocora profundacella Gardiner, 1898
Siderastrea savignyana Milne Edwards and Haime, 1850

MILLEPORINA

Millepora platyphylla (Hemphrich and Ehrenberg, 1834)
Millepora tenella (Ortmann, 1892)

at full low tide. This wall forms part of the perimeter of a deep hollow (17 m) encircled by sand bars on the inner side of Bazaruto. It is thus subjected to a strong tidal flux and is turbid. The corals found here are particularly sparse, consisting of the ahermatypes *Dendrophyllia* and *Tubastraea* and a few sediment-tolerant faviids, some small colonies of *Porites* and *Pocillopora*. The large bivalve, *Hyotissa hyotis*, is a notable inhabitant amongst colonies of *Dendrophyllia* under overhangs.

Submerged fringing reefs

A number of fringing reefs are found on the exposed, eastern side of Bazaruto Island. The substructure to these appears to be Pleistocene sandstone arising from a submerged coastline (see Ramsay, 1996). Typical amongst these are **Lighthouse Reef, Guinice, Ponta Goane, Ponta Chilola** and **Two-mile Reef.** All of these have similar attributes and fairly well-defined zonation, with the last-mentioned having some special attributes. The main features of the fringing reefs are described below:

- **The inner reef.** This consists of bommies and patches of reef in shallow water (5-15 m), the tops of which are nearly exposed at low tide. The area is subjected to strong tidal flushing. The coral community is varied and includes digitate, tabular and plate acroporids (e.g. *Acropora gemmifera, A. clathrata, A. cytherea* and *A. hyacinthus*) with patches of the staghorn corals *Acropora abrotanoides* and *A. robusta*. Encrusting genera such as *Echinopora* and sediment-tolerant faviids are also present. These are interspersed with colonies of *Pocillopora* and *Porites* (massive forms, as well as *P. cylindrica* and *P. nigrescens*). The Alcyonacea include the genus *Sarcophyton* and the more leathery species of *Sinularia* (*S. abrupta, S. gravis, S. macrodactyla*). Giant clams (*Tridacna* sp.), anemones (*Heteractis* sp.) and sponges (e.g. *Cliona* sp. and *Dysidea* cf. *herbacea*) add to the variety. Occasional colonies of the flexible gorgonian genus, *Rumphella*, are found here.

- **The shallow fringing reef top.** This constitutes the upper and outer edge of the reef and is subjected to swell-driven surge and tidal flux at all but the lowest of tides. As a result, thickets of staghorn coral (such as *Acropora abrotanoides*, *A. formosa* and *A. robusta*) flourish at the inner edge of this zone with an occasional colony of *Acropora palifera*. These are interspersed by some colonies of *Porites* and other corals but the former are dominant.
- **The outer reef.** This zone is exposed to the full force of the sea and prevailing long-shore currents. As a result, it is an area of high turbidity and sediment movement. The coral community in this zone is thus tolerant of these conditions but relatively sparse. Sediment-tolerant soft corals such as *Lobophytum crassum* and *Sinularia brassica* are relatively abundant here with faviids, some colonies of *Acropora clathrata* and species of *Turbinaria*, *Pocillopora*, *Echinopora* and *Montipora*. The azooxanthellate soft coral, *Dendronephthya*, is found on the upper, surge-swept shelves, and colonies of *Astreopora* and the ahermatype, *Tubastrea*, are found on bommies in the deepest reaches at the reef-sediment interface (20-25 m).

Two-mile Reef lies between Bazaruto and Benguera Islands (Fig. 2), and is more exposed to the sea than the preceding fringing reefs. It thus has all of the attributes of the latter, but in a more concentrated form. While its outer edge is as depauperate as this zone on the other reefs, it has a shallow (5 m) coral garden at its northern point that is particularly rich in staghorn corals and tabular and digitate acroporids. Inside and to the south are found the full spectrum of corals recorded in the region, including thickets of fire coral (*Millepora platyphylla* and *M. tenella*). Very large colonies of *Porites* (*P. solida* and *P. rus*) were found immediately south of this during the first expeditions but a crown-of-thorns starfish (*Acanthaster planci*) outbreak attacked these and adjacent staghorn thickets in subsequent years (Schleyer, 1998). The damage inflicted on *Porites* domes that were up to 3.5 m in diameter was followed by bio-erosion, and most had nearly disintegrated by the time of the last visit (unpub. data). There is a break in the middle of the reef and an interesting concentration of nodular colonies of *Goniopora stokesi* is found on the sediment in this gap.

Patch Reefs

Isolated small patches of reef are found at various other points around Bazaruto and off Santa Carolina. The coral communities tend to be sparse, and consist of sediment-tolerant and often transient faviids and alcyonaceans. The colourful starfish, *Pentaceraster mammilatus* and *Protoreaster lincki,* are often observed near these on the inside of Bazaruto, being associated with the adjacent sea grass beds. Mulidze (Fig.2), a locality where such patch reefs are found, is notable as it also has fossilised casts of an extinct worm. These artefacts are like stove-pipes in appearance and protrude from the sand at 7-10 m depth.

DISCUSSION

Coral diversity

Most of the corals found in the Bazaruto Archipelago have a wide Indo-Pacific distribution, a few being East African regional endemics. *Gyrosmilia interrupta* and *Horastrea indica* would fall into this category amongst the Scleractinia. The former extends from East Africa into the central Indian Ocean and Red Sea, while the latter is found only in East Africa and around Madagascar. A new soft coral species, *Cladiella kashmani*, was found in the Bazaruto Archipelago (Benayahu & Schleyer, 1996) and appears to be limited in its distribution to East Africa.

In terms of diversity, Bazaruto has slightly more hard coral species than the number found on South African reefs (99 vs 90; Riegl, 1996; Schleyer, 2000) but fewer soft corals, published figures for the latter being 27 vs 41 (Benayahu, 1993; Benayahu & Schleyer,1996). In both cases, the biodiversity is lower than that found in northern Mozambique (Riegl, 1996; Benayahu *et al.*, 2002) but it is of note that, in the case of the Alcyonacea, the attenuation in species with distance from the equator is counterpoised by a subsequent increase in soft coral diversity with the admixture of tropical and temperate waters further south (Benayahu *et al.*, 2002).

The reefs themselves are varied in structure and offer a range of diving experiences for the ecotourism industry. They are a valuable resource as they comprise an isolated node of reef development between the limited reefs in southern Mozambique and South Africa and the more extensive coral reefs north of Beira. While true reef accretion is found in the latter, the former are marginal in nature (see Schleyer, 2000), the Bazaruto reefs share attributes of both.

Management Issues

The most spectacular diving is to be found in the outer reef areas where large fish are encountered and on the shallow, fringing reef tops where an abundance of staghorn corals, with a diversity of other corals and colourful reef fish occur. While the former are resilient to recreational divers, staghorn corals and digitate acroporids on the latter reefs are particularly sensitive to diver damage.

The following recommendations have thus been formulated for their management. The principles upon which they are based is first outlined, providing the rationale behind them where applicable. These principles are in turn based on extensive experience of the reefs in southern Mozambique and South Africa, of their intensive use for ecotourism in KwaZulu-Natal, and on a study of reef damage in the latter area (Schleyer & Tomalin, 2000).

Diver competence

Sea conditions on the southern Africa coast are relatively turbulent, making the reefs more susceptible to diver damage compared to most other localities. Diver competence and behaviour must therefore be given greater attention than usual, leading to their emphasis in the recommendations that follow. As a first, general rule, the use of gloves by sport-divers should be strictly prohibited. The greatest damage caused by divers to a reef is from holding and colliding with corals, resulting in abrasion and breakage. If unprotected hands are a diver's first defence when swept onto a reef, avoidance becomes the preferred strategy and diver contact with the reef is reduced. This applies to all groups of divers, whether SCUBA or snorkel divers, or spear-fishermen.

Points specific to the different categories of diver follow:

- **SCUBA divers.** Buoyancy control is the main means whereby a SCUBA diver stays clear of the reef but is a skill which varies with diver competence. Reef management should take this into account and certain reefs should be restricted and made accessible only to divers of demonstrable competence, i.e. those who have dived recently and are experienced divers of advanced qualification. The Acropora-rich areas, particularly in the coral garden at the northern tip of Two-mile Reef, fall into this category.
- **Snorkel divers.** Some Bazaruto dive operators require snorkel divers to wear wet suits without weight belts. This ensures diver buoyancy and encourages a horizontal swimming posture. It is a commendable practice as it prevents novices from "walking" on the reef. Its only disadvantage is that, if a snorkel diver does duck dive to look at something, a hand-hold may be sought to stay underwater. Visits of large numbers of snorkel divers from passing cruise ships require specific management.
- **Spear-fishermen.** Spear-fishermen should avoid entering the sea over a reef, thus preventing coral damage from trampling or tangling with the spear-gun buoy line. The present park regulations preclude fishing activities by tourists close to the islands, hence this recommendation only applies to local, artisanal spear-fishermen.

Diver restrictions

The present prohibition on the removal of anything from the reefs by sport-divers and the restriction on spear-fishing to game-fish should be retained. Dive numbers are still nowhere near those attained at more popular localities on the southern African coast but consideration should be given to capping the dive numbers at a site if reef damage becomes a problem or if they approach limits recommended by Schleyer and Tomalin (2000).

Reef zonation

The following zonation for diving activities is recommended for the principal reef areas:

- **Outer reef areas.** These are generally subjected to the greatest water turbulence and their coral community tends to consist of robust and resilient species of soft and hard coral. Most are thus suitable as open areas for unrestricted diving.
- **Inner reef areas.** These areas are susceptible to diver damage where they are rich in branching *Acropora* species. Here diving should be restricted according to diver competence and, depending on their sensitivity, some areas should be closed.
- **Reef tops and coral gardens.** These are shallow areas in which plate, tabular, digitate and branching corals are susceptible to breakage by trampling and diving activities. Coral gardens are particularly popular with novice snorkel and SCUBA divers and such areas should be restricted to divers of competence, or even closed according to coral sensitivity.

Crown-of-thorns starfish

Consideration should be given to the eradication of crown-of-thorns starfish outbreaks, such as the one encountered on Two-mile Reef, in view of the small size of the reefs and the nature of the damage observed in the afore-mentioned case.

Boat operations

Boats should be prohibited from anchoring on or adjacent to the reefs to prevent anchor damage. Divers should be tendered from the surface at all times, enhancing their safety and providing further employment opportunities for training of the islanders as skippers. Permanent moorings should never be placed on the reefs. Apart from damage they cause on reefs in turbulent regions such as Bazaruto, when they are washed to and fro in the surge, they always focus diver entry with concomitant damage to a single locality.

Closed sites

The closure of reference monitoring sites and of sensitive sites is recommended. These will be invaluable for the assessment of the effects of reef use and as breeding *refugia*. The latter should always be in an up-current situation to promote recruitment on down-current reefs. Heavily dived areas should be closely monitored for excessive diver damage. Finally, it may be advantageous to select and zone the sites for closure in liaison with reputable dive operators within the Bazaruto ecotourism industry. This could result in a better product and would introduce elements of co-management that almost certainly would engender greater user support.

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REFERENCES

Benayahu, Y. 1993. Corals of the South-West Indian Ocean I. Alcyonacea from Sodwana Bay, South Africa. *Invest. Rep. Oceanogr. Res. Inst.,* (67): 1-16.

Benayahu, Y. & Schleyer, M. H. 1996. Corals of the south-west Indian Ocean III. Alcyonacea (Octocorallia) of Bazaruto Island, Mozambique, with a redescription of *Cladiella australis* (Macfadyen, 1963) and a description of *Cladiella kashmani* spec. nov. *Invest. Rep. Oceanogr. Res. Inst.,* (69): 1-22.

Benayahu, Y., Shlagman. A. & Schleyer, M.H. 2002. Corals of the South-west Indian Ocean VI. The Alcyonacea (Octocorallia) of Mozambique; with a discussion on soft coral distribution along south equatorial East-African reefs. *Israel Journal of Zoology* **48:** 273-283.

Hamilton, G.H., & Brakel, W.H. 1984. Structure and coral fauna of east African reefs. *Bull. Mar. Sci.* **34:** 248-266.

Obura, D., Mohammed, S., Motta, H. & Schleyer, M. 2000. Status of coral reefs in East Africa: Kenya, Mozambique, South Africa and Tanzania. In: Wilkinson, C. ed. Status of coral reefs of the world: 2000. Australian Institute of Marine Science (AIMS), Townesville: 65-76.

Ramsay, P.J. 1996. Quaternary marine geology of the Sodwana Bay continental shelf, Northern KwaZulu-Natal. *Bulletin of the Geological Survey of Southern Africa* **117:** 1-85.

Ramsay, P.J. & Mason, T.R. 1990. Development of a type zoning model for Zululand coral reefs, Sodwana Bay, South Africa. *J Coast. Res.* **6:** 829-852.

Riegl, B. 1996. Hermatypic coral fauna of subtropical southeast Africa: a checklist. *Pacific Sci.* **50:** 404-414.

Rodrigues, M.J., Motta, H., Whittington, M.W. & Schleyer, M.H. 2000a. Coral reefs of Mozambique. In: Mcclanahan, T., Sheppard, C. & Obura, D., eds. Coral reefs of the Indian Ocean: Their ecology and conservation. Oxford University Press, New York: 107-129.

Rodrigues, M.J., Motta, H., Pereira, M.A.M., Goncalves, M., Carvalho, M. & Schleyer, M.H. 2000b. Reef monitoring in Mozambique. I: The monitoring programme and 1999 report. Unpublished report, 65p.

Schleyer, M.H. 1998. Observations on the incidence of crown-of-thorns starfish in the Western Indian Ocean. *Reef Encounter* (23): 25-27.

Schleyer, M.H. 2000. South African coral communities. In: T. McClanahan, C. Sheppard & D. Obura, (eds). Coral reefs of the Indian Ocean: Their ecology and conservation. Oxford University Press, New York: 83-105.

Schleyer, M.H., Obura, D., Motta, H. & Rodrigues M-J. 1999. A preliminary assessment of coral bleaching in Mozambique. Unpublished Report. *S. Afr. Assoc. Mar. Bio. Res.* (168): 1-18.

Schleyer, M.H. & Tomalin, B.J. 2000. Ecotourism and damage on South African coral reefs with an assessment of their carrying capacity. *Bull. Mar. Sci.* **67:** 1025-1042.

Wells, S.M. 1988. Coral Reefs of the World. Vol. 2: Indian Ocean, Red Sea and the Gulf. UNEP. Nairobi; International Union for Conservation of Nature and Natural Resources, Switzerland.