

**ATOLL RESEARCH BULLETIN**

**NO. 334**

**CORALS OF THE EASTERN RED SEA**

**BY**

**ARNFRIED ANTONIUS, GEORG SCHEER**

**AND CLAUDE BOUCHON**

**ISSUED BY  
NATIONAL MUSEUM OF NATURAL HISTORY  
SMITHSONIAN INSTITUTION  
WASHINGTON, D.C., U.S.A.  
January 1990**

# CORALS OF THE EASTERN RED SEA\*

BY

ARNFRIED ANTONIUS<sup>1</sup>, GEORG SCHEER<sup>2</sup>

AND CLAUDE BOUCHON<sup>3</sup>

## ABSTRACT

Coral collections were made along the Saudi Arabian coastline of the Red Sea, from Haql in the north (Gulf of Aqaba), to Jizan in the south, including nearshore and offshore collecting sites. Corals were taken from all depth-zones in the Jeddah area (max. depth 65 m), but from shallow water only (max. depth 9 m) at all the other sites. The present collection consists of 146 species of Scleractinia, the octocoral *Tubipora musica*, and among hydrozoans 3 species of *Millepora*, and *Distichopora violacea*. 12 scleractinian species are new for the Red Sea: *Pocillopora cf. eydouxii*, *Acropora anthocercis*, *A. aspera*, *A. cerealis*, *A. divaricata*, *A. donei*, *A. echinata*, *A. monticulosa*, *Montipora peltiformis*, *M. turgescens*, *M. undata*, and *Porites australiensis*. Collections were made from 1981 through 1988.

## INTRODUCTION

A substantial amount of literature is available on the exploration of the Red Sea, as shown by MERGNER (1984) and VINE & SCHMID (1987). In addition, as part of the Indian Ocean, the Red Sea was studied by ROSEN (1971), SCHEER (1984), and SHEPPARD (1987). Valuable papers on numerous aspects of the Red Sea are also contained in the Proceedings of the Mabahiss/John Murray Internat. Symp., edited by ANGEL (1984). Other studies include KLAUSEWITZ's (1964) work on fishes, and SCHEER & PILLAI's (1983) descriptions of corals and coral reefs. References to most of the existing literature on the Red Sea are contained in these contributions.

-----  
\*) We dedicate this paper to the memory of the late Marie-Helene Sachet, a dear friend and admired colleague.  
-----

- 1 - Fac. Marine Science, K.A.A. Univ., Jeddah, Saudi Arabia.  
(Mail. addr.: Kupelwieserg. 5, A-1130 Vienna, Austria).
- 2 - Hess. Landesmus., Zoolog. Abt., Darmstadt, West Germany.
- 3 - Lab. Biol., Centre Univ., Pointe a Pitre, Guadeloupe.

We, therefore, will present only a brief review of coral research along the east coast of the Red Sea. The first biological investigations were undertaken by Peter FORSKAL who reached Jeddah in 1762 with the Danish "Arabia Felix" expedition. Besides plants and fishes, he also collected corals. Although he died from malaria in 1763 in Yemen, 26 species of corals were sent back to Copenhagen and were described posthumously by NIEBUHR (1775), and restudied by CROSSLAND (1941).

In 1825, Ehrenberg and Hemprich passed Jeddah on their way farther south, in an expedition described by STRESEMANN (1954). While Hemprich also fell pray to malaria, Ehrenberg sent back to Berlin 376 specimens of 62 species of corals from Suez, El Tur, and the southern Gulf of Aqaba (EHRENBERG 1834).

KLUNZINGER, although he collected in Koseir, Egypt, should be mentioned here because of his three volume publication on corals (1879), and description of a coral reef (1872). In 1888, FAUROT reported on corals from the Yemeni island of Kamaran.

During two expeditions (1895/96 and 1897/98) of the Austrian research vessel "Pola", MARENZELLER collected corals along the east coast of the Red Sea around Jeddah (see also: SCHEER & PILLAI 1983: 14, Fig. 1), and published his results in 1906.

Although working on the west coast, CROSSLAND's numerous contributions from 1907 to 1939 are too important to be neglected. His main work (1952) covers both Red Sea and Australian corals.

During the "Calypso" expedition, NESTEROFF (1955) and GUILCHER (1955) studied coral reefs of the Farasan Bank. Coral species were determined by Pichon, but this list was not published.

HASS (1961) directed the second "Xarifa" expedition in 1957/58, exploring coral reefs and collecting corals throughout the Red Sea (SCHEER 1971), with special emphasis on corals from the Sarso Islands (SCHEER 1967).

The hydroid-fauna at Port Sudan, Suakin, and Jeddah was investigated by MERGNER (1967).

In addition, the German "Meteor" expedition in 1964/65 supported some biological studies around the Sarso islands, documented by GERLACH (1967), KLAUSEWITZ (1967), SCHEER (1967), and SCHAEFER (1969).

In 1967, the Israeli Marine Biological Laboratory was founded at Eilat and initiated a large number of coral studies, such as LOYA & SLOBODKIN (1971) and LOYA (1972).

Also the Jordanian Marine Science Station, established nearby at Aqaba in 1973, gave many visitors an opportunity to work on corals and coral reefs, e.g. MERGNER & SCHUHMACHER (1974, 1981), MERGNER & SVOBODA (1977), MERGNER (1979, 1981), and BOUCHON (1980), as well as PICHON, JAUBERT, BOUCHON, & PETRON (1979, unpublished report).

Other studies include KUEHLMANN's (1970) work on reefs of Port Sudan and Massaua, and later (1976) at Port Sudan and Al Hudaydah on the Yemeni coast. Corals from many different Red Sea locations were described by SCHEER & PILLAI (1983).

A general review of the Saudi Arabian coast and its biogeographic subzones was given by ORMOND, SHEPHERD, PRICE, & PITTS (1984 a, b), while management-related aspects of these reefs are dealt with in an IUCN report by WELLS (1985). Reefs of the Saudi Arabian coast are also discussed in SHEPPARD & SHEPPARD (1985) and SHEPPARD (1985), and corals from this area are included in his list of Indian Ocean corals (SHEPPARD 1987).

The stony corals from the Saudi Arabian Red Sea described in this paper, were collected over a period of time extending from 1981 through 1988. The initial study consisted of a documentation of the coral communities in the Jeddah area by C.Bouchon and A.Antonius in 1982/83. This was reported as an oral presentation (BOUCHON & ANTONIUS 1983), which described a substantial collection of corals from all depth-zones.

Further studies by Antonius all focussed on human impact or pathology on coral reefs, and the coral collections were made with these objectives in mind rather than aiming at comprehensiveness. Since most of the syndromes studied are shallow water phenomena, the majority of the collections consists of shallow-water corals.

Some of the human impact studies (ANTONIUS 1984a), and most of the pathology studies (e.g. ANTONIUS 1984b, 1985a, 1985b, 1988b) were carried out in the Jeddah area. Later projects, however, encompassed the entire length of the Red Sea (see chart) and yielded a rich harvest of the major shallow water reef-builders, such as *Acropora* species and others (ANTONIUS 1987, 1988a, 1988c).

## THE RED SEA

The Red Sea, including the Gulf of Aqaba, is about 2,100 km long, with a maximum width of slightly over 300 km in the Farasan area, and extends down to depths of 2,600 m in the center off Jeddah, and 1,800 m in the Gulf of Aqaba. Thus, the Red Sea is a long and narrow, but deep water body (ANTONIUS 1988c).

Good water circulation (NEWMAN & MCGILL 1962) and exchange with the Indian Ocean diminishes the effect of extremes, such as temperature and salinity, and creates a suitable environment for coral reef growth (ANTONIUS 1984a). This is further enhanced by the climate. Both coasts of the Red Sea exhibit arid or semi-arid characteristics, with the result that there are no rivers entering the Red Sea.

Thus, water pollution today is restricted to urban-industrial areas, such as Haql, Yanbu, and Jeddah, where desalination plants create an artificial influx of polluted freshwater, but along most other expanses of the coast, the environment seems relatively undisturbed (ANTONIUS 1988c). However, latest observations indicate that even these comparatively healthy reef areas are beginning to show the first signs of deterioration (ANTONIUS, unpublished).

Reefs are developed as an almost continuous line of fringing reefs along the coast, along with a system of offshore patch and bank reefs. The distribution of offshore reefs is largely controlled by the presence of shallow platforms ("continental" shelf), which are part of the relief formed by local block-faulting.

Substantial platforms with numerous patch and bank reefs are located just south of Al-Wajh and Yanbu, as well as just north of Jeddah (Eliza Shoals); they are up to about 30 km wide.

Both Qunfudah and Jizan are bordered by the huge Farasan Bank, which is about 100 km wide and 500 km long, with the largest of all islands, the Farasan group, in the south.

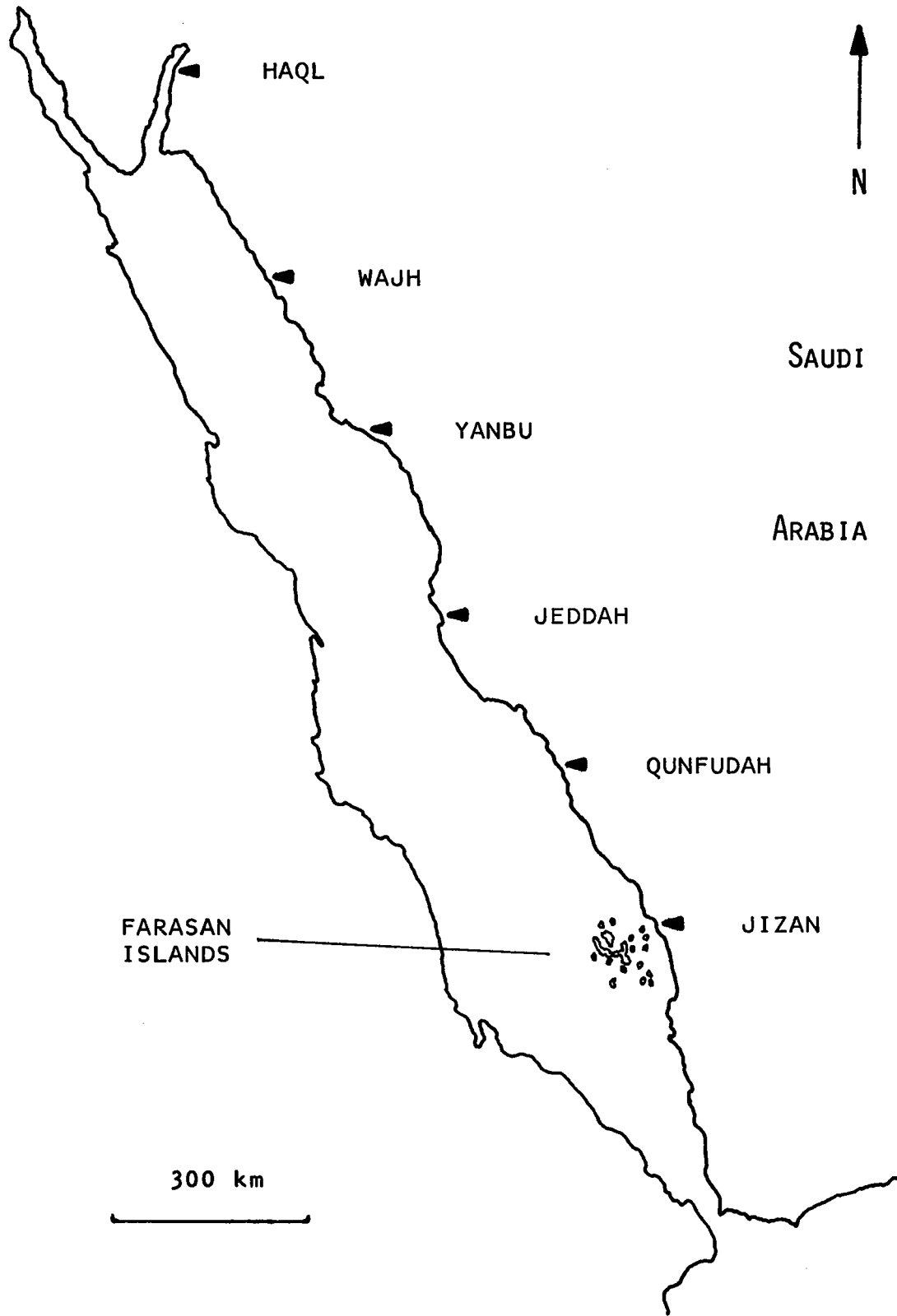


CHART of the Red Sea with the locations of the principal collecting sites in Saudi Arabia.

## THE COLLECTING SITES

## 1) Haql

At Haql in the Gulf of Aqaba collections were made at three sites of the fringing reef, at locations a) Lat.  $29^{\circ} 19' 40''$  N, Long.  $34^{\circ} 57' 00''$  E, and 3.5 km N of Haql Coast Guard Harbor; b) Lat.  $29^{\circ} 17' 24''$  N, Long.  $34^{\circ} 56' 00''$  E, and 1.4 km W of Haql Coast Guard Harbor; c) Lat.  $29^{\circ} 16' 55''$  N, Long.  $34^{\circ} 55' 00''$  E, and 3.5 km SSW of Haql Coast Guard Harbor. The reef face drops off to a sandy slope, on an incline that continues down to the central depth of the Gulf.

Corals were collected at the reef edge and reef slope in depths of 0.5 - 3 m.

## 2) Al-Wajh

Collections were made along the fringing reef at the entrance of Sharm al-Wajh, which is also the fishing-boat harbor of the original village. The location is Lat.  $26^{\circ} 13' 12''$  N, Long.  $36^{\circ} 27' 14''$  E, and 400 m W of al-Wajh Harbor. The fringing reef drops off vertically to about 20 m, then grades into a slope that continues down to a depth of 200 - 300 m.

Corals were collected along the reef edge in shallow water, 1 - 3 m deep.

## 3) Muraykhah S

This is an atoll-like reef complex of considerable size (about 12 km longest diameter), bordered by 300 - 1000 m deep water. Collections were made along the seaward side of the reef barrier, the site located at Lat.  $26^{\circ} 10' 26''$  N, Long.  $36^{\circ} 25' 12''$  E, and 5.9 km SW of Sharm al-Wajh entrance.

Corals were collected from the upper part of the reef face, between water depths of 1 - 7 m.

## 4) Muraykhah L

The same reef complex as No. 3, but collections were made at the lagoonward side of the barrier, located at Lat.  $26^{\circ} 10' 18''$  N, Long.  $36^{\circ} 25' 12''$  E, and 6.1 km SW of Sharm al-Wajh. The reef drops off to a 4 m deep, sandy lagoon floor.

Corals were collected along the edge of the reef barrier in shallow water, 0.3 - 2.5 m deep.

## 5) Yanbu

Collections were made at two patch reefs, one located at Lat.  $23^{\circ} 56' 24''$  N, Long.  $38^{\circ} 12' 36''$  E, and 1 km SW of King Fahad Port center, the other located at Lat.  $23^{\circ} 56' 12''$  N, Long.  $38^{\circ} 11' 18''$  E and 2.8 km SW of King Fahad Port center. The sides of both reefs drop off to a sandflat in about 20 m depth, but with deeper water (approx. 200 m) adjacent.

Corals were collected from the top and slope of both reefs in shallow water, 0.3 - 4 m deep.

## 6) Jeddah

The Jeddah collection came from numerous sites. Most of them were located on Eliza Shoals, a platform (about 20 m average depth, but with depressions and valleys of over 100 m depth in it) that is separated from the mainland by a 5 km wide and 400 m deep trough. The approximate center of the 20 km wide and 50 km long platform is located at Lat.  $21^{\circ} 45' N$ , Long.  $38^{\circ} 58' E$ , and about 40 km NW of Jeddah Islamic Port.

Another important collecting site was the fjord-like, 30 m deep Sharm Abhur, the entrance of which is located at Lat.  $21^{\circ} 42' 20'' N$ , Long.  $39^{\circ} 05' 10'' E$ , and 27 km NNW of Jeddah Islamic Port.

However, sporadic collections were made over an area spreading approximately 70 km to the N and 70 km to the S of Jeddah Islamic Port.

Corals were collected from the shallowest to the deepest parts of the reef zonation, comprising a depth range of 0.3 - 65 m.



## 7) Qunfudah

Collections were made at a nearshore bank reef called Jazirat as-Siqalah, located at Lat.  $19^{\circ} 04' 5''$  N, Long.  $41^{\circ} 04' 00''$  E, and 1.7 km SW of Qunfudah Port. The reef shows a large, very shallow top, with sides sloping off to a sand-bottom in 15 - 20 m depth.

Corals were collected from the edge of the reef and from the slope at a depth range of 1 - 6 m.

## 8) Jizan

Collections were made at a nearshore bank reef, located at  $16^{\circ} 54' 25''$  N, long.  $42^{\circ} 31' 55''$  E, and about 1 km NW of Jizan Port. The bank reef has a shallow crest on the seaward side, while the flat reef top gradually slopes to about 3 m depth landward. The reef rises up from a 5 - 7 m deep sand flat.

Corals were collected along the shallow ridge and at deeper parts of the reef top in depths of 0.5 - 3 m.

## 9) Habar

This is a relatively large, low sand island, surrounded by a wide, very shallow shelf area. Collections were made at widely scattered reef patches to the S of the island, located at Lat.  $16^{\circ} 53' 10''$  N, Long.  $42^{\circ} 25' 6''$  E, and 11 km E of Jizan Port. Patch reefs grow on a 1.5 - 2.5 m deep sand bottom.

Corals were collected from the top and sides of the patch reef area, at a depth range of 0.5 - 2 m.

## 10) Abu Shagur

This is a rocky cliff, home to many sea-birds, bordered by a shallow platform to the SW and a 60 m deep trough to the NE. Collections were made at a site located at Lat.  $16^{\circ} 55' 30''$  N, Long.  $42^{\circ} 17' 25''$  E, and 25 km WNW of Jizan Port.

Corals were collected on the NE slope of the island, throughout a depth range of 0.5 - 9 m.

## SYSTEMATIC LIST OF SPECIES

Containing: Anthozoa, Zoantharia, Scleractinia:  
 15 families, 48 genera, 146 species.  
 Anthozoa, Octocorallia, Stolonifera: 1 family, 1 genus,  
 1 species. Hydrozoa, Milleporina: 1 family, 1 genus,  
 3 spec. Hydrozoa, Stylasterina: 1 fam., 1 gen., 1 spec.

Column numbers 1 through 0 (= 10) represent the following  
 collecting sites (described in detail in  
 the preceding chapter):

1) Haql (fringing reef), 2) Al-Wajh (fringing reef),  
 3) Muraykhah S (seaward slope of barrier reef), 4)  
 Muraykhah L (lagoonward side of barrier), 5) Yanbu (two  
 patch reefs), 6) Jeddah (many fringing and patch reefs),  
 7) Qunfudah (bank reef), 8) Jizan (bank reef), 9) Habar  
 (patch reef), 10) Abu Shagur (fringing reef slope).

Right column symbols:

plus sign (+) = represented in Scheer & Pillai 1983

minus sign (-) = not listed in Scheer & Pillai 1983

numbers 1 - 23 = numbered comments at end of list

---

Class Anthozoa EHRENBERG 1834  
 Subclass Zoantharia de BLAINVILLE 1830  
 Order Scleractinia BOURNE 1900  
 Suborder Astrocoeniina VAUGHAN & WELLS 1943  
 Family Astrocoeniidae KOBAYASHI 1890

*Stylocoeniella guentheri* (BASS.-SM.1890) .....6..... +

Family Thamnasteriidae VAUGHAN & WELLS 1943

*Psammocora contigua* (ESPER 1795) .....6.8.. +

*Psammocora explanulata* v.d.HORST 1922 .....6..... +

*Psammocora haimeana* M.EDW.& HAIME 1851 .....6..... +

*Psammocora nierstraszi* v.d.HORST 1921 .....6..... +

*Psammocora profundacella* GARDINER 1898 1.....6..... +

Family Pocilloporidae GRAY 1842

*Stylophora pistillata* (ESPER 1795) .2...6..9. +

*Stylophora subseriata* (EHRENBERG 1834) .....6..... +

*Stylophora wellsii* SCHEER 1964 1..4.6..... +

*Seriatopora hystrix* DANA 1846 ...4.6..... +

*Pocillopora damicornis* (LINNAEUS 1758) .....56..... +

<i>Pocillopora cf. eydouxi</i> (M.EDW.& H.1860)	.....6.....	-
<i>Pocillopora verrucosa</i> (ELLIS & SOL.1786)	.....6.....	+
Family Acroporidae VERRILL 1902		
<i>Acropora anthocercis</i> (BROOK 1893)	1.3.....	1
<i>Acropora aspera</i> (DANA 1846)	.....6.....	-
<i>Acropora austera</i> (DANA 1846)	.....5.....	-
<i>Acropora cerealis</i> (DANA 1846)	1.....	-
<i>Acropora corymbosa</i> (LAMARCK 1816)	.....5.....	+
<i>Acropora cytherea</i> (DANA 1846)	1234..7...	2
<i>Acropora danai</i> (M.EDWARDS & HAIME 1860)	1...5.7...	-
<i>Acropora digitifera</i> (DANA 1846)	1.....9.	3
<i>Acropora divaricata</i> (DANA 1846)	1.34.....0	-
<i>Acropora donei</i> VERON & WALLACE 1984	1.....	-
<i>Acropora echinata</i> (DANA 1846)	.....6.....	-
<i>Acropora eurystoma</i> (KLUNZINGER 1879)	12.456....	+
<i>Acropora formosa</i> (DANA 1846)	.....7..0	-
<i>Acropora forskalii</i> (EHRENBERG 1834)	.....9.	+
<i>Acropora gemmifera</i> (BROOK 1892)	...4.6....	4
<i>Acropora granulosa</i> (M.EDW.& HAIME 1860)	.....6.....	+
<i>Acropora haimeii</i> (M.EDWARDS & HAIME 1860)	.....6.....	5
<i>Acropora hemprichii</i> (EHRENBERG 1834)	123.567...	+
<i>Acropora humilis</i> (DANA 1846)	..3.....	+
<i>Acropora hyacinthus</i> (DANA 1846)	...4.6....	+
<i>Acropora intermedia</i> (BROOK 1891)	.....6..9.	6
<i>Acropora monticulosa</i> (BRUEGGEMANN 1879)	.....7...	-
<i>Acropora nasuta</i> (DANA 1846)	.....5.....	+
<i>Acropora nobilis</i> (DANA 1846)	.....7...	+
<i>Acropora pharaonis</i> (M.EDW.& HAIME 1860)	..345.....	+
<i>Acropora polystoma</i> (BROOK 1891)	..34.67...	-
<i>Acropora scandens</i> (KLUNZINGER 1879)	.....6.....	7
<i>Acropora secale</i> (STUDER 1878)	1..4..7...	-
<i>Acropora squarrosa</i> (EHRENBERG 1834)	.....6.....	+
<i>Acropora valenciennesii</i> (M.EDW.& H.1860)	.....0	+
<i>Acropora valida</i> (DANA 1846)	12.4..7.9.	8
<i>Acropora vaughani</i> WELLS 1954	.....5.....	-
<i>Astreopora myriophthalma</i> (LAMARCK 1816)	.....6.....	+
<i>Montipora circumvallata</i> (EHRENBERG 1834)	....5...9.	+
<i>Montipora danae</i> BERNARD 1897	.....6.....	9
<i>Montipora erythraea</i> v.MARENZELLER 1906	.....6.....	10
<i>Montipora gracilis</i> KLUNZINGER 1879	.....5.....	+
<i>Montipora informis</i> BERNARD 1897	.....6.....	-
<i>Montipora monasteriata</i> (FORSKAL 1775)	.....6.....	+
<i>Montipora peltiformis</i> BERNARD 1897	.....6.....	-
<i>Montipora spongiosa</i> (EHRENBERG 1834)	.....9.	+
<i>Montipora tuberculosa</i> (LAMARCK 1816)	...4.....	+
<i>Montipora turgescens</i> BERNARD 1897	.....6.....	-
<i>Montipora undata</i> BERNARD 1897	.....9.	-
<i>Montipora verrucosa</i> (LAMARCK 1816)	.....6.....	+

## Suborder Fungiina VERRILL 1865

## Family Agariciidae Gray 1847

<i>Pavona cactus</i> (FORSKAL 1775)	.....6.....	+
<i>Pavona decussata</i> (DANA 1846)	.....6..9.	+
<i>Pavona diffluens</i> LAMARCK 1816	.....6.....	11
<i>Pavona divaricata</i> LAMARCK 1816	.....6.....	+
<i>Pavona explanulata</i> (LAMARCK 1816)	.....6.....	+
<i>Pavona maldivensis</i> (GARDINER 1905)	.....6.....	+
<i>Pavona varians</i> VERRILL 1864	.....6.8..	+

<i>Leptoseris explanata</i> YABE & SUGIY.1941	.....6.....	+
<i>Leptoseris hawaiiensis</i> VAUGHAN 1907	.....6.....	+
<i>Leptoseris mycetoseroides</i> WELLS 1954	.....6.....	+
<i>Leptoseris tenuis</i> v.d.HORST 1921	.....6.....	+
<i>Leptoseris yabei</i> (PILLAI & SCHEER 1976)	.....6.....	12

<i>Gardinoseris planulata</i> (DANA 1846)	.....6.8..	+
---	------------	---

<i>Pachyseris speciosa</i> (DANA 1846)	.....6.....	+
--	-------------	---

## Family Siderastreidae VAUGHAN &amp; WELLS 1943

<i>Siderastrea savignyana</i> M.EDW.& HAIM.1849	.....6.....	+
---	-------------	---

<i>Coscinaraea monile</i> (FORSKAL 1775)	.....6.....	+
--	-------------	---

## Family Fungiidae DANA 1846

<i>Cycloseris distorta</i> (MICHELIN 1843)	.....6.....	+
--	-------------	---

<i>Cycloseris patelliformis</i> (BOSCHMA 1923)	.....6.....	+
--	-------------	---

<i>Fungia danai</i> MILNE EDWARDS & HAIME 1851	.....5.....	+
--	-------------	---

<i>Fungia fungites</i> (LINNAEUS 1758)	.....6.8..	+
--	------------	---

<i>Fungia granulosa</i> KLUNZINGER 1879	.....6.....	+
---	-------------	---

<i>Fungia horrida</i> DANA 1846	.....6.....	+
---------------------------------	-------------	---

<i>Fungia klunzingeri</i> DOEDERLEIN 1901	.....6.....	+
---	-------------	---

<i>Fungia moluccensis</i> v.d.HORST 1919	.....6.....	+
--	-------------	---

<i>Fungia paumotensis</i> STUTCHBURY 1833	.....6.....	13
---	-------------	----

<i>Fungia repanda</i> DANA 1846	.....6.....	+
---------------------------------	-------------	---

<i>Fungia scruposa</i> KLUNZINGER 1879	.....6.....	+
--	-------------	---

<i>Fungia scutaria</i> LAMARCK 1801	.....56.....	+
-------------------------------------	--------------	---

<i>Ctenactis echinata</i> (PALLAS 1766)	....56.....	14
---	-------------	----

<i>Herpolitha limax</i> (ESPER 1795)	....56.....	+
--------------------------------------	-------------	---

<i>Podobacia crustacea</i> (PALLAS 1766)	.....6.....	+
--	-------------	---

## Family Poritidae GRAY 1846

<i>Goniopora klunzingeri</i> v.MARENZELLER 1906	.....6.....	+
---	-------------	---

<i>Goniopora planulata</i> (EHRENBERG 1834)	.....6....	+
<i>Goniopora savignyi</i> DANA 1846	.....6....	+
<i>Porites australiensis</i> VAUGHAN 1918	1..4.....	-
<i>Porites lobata</i> DANA 1846	1..4.67...	+
<i>Porites lutea</i> MILNE EDWARDS & HAIME 1851	1..4.6...0	+
<i>Porites nodifera</i> KLUNZINGER 1879	.....8..	+
<i>Porites rus</i> (FORSKAL 1775)	.2.4.6....	15
<i>Porites solida</i> (FORSKAL 1775)	1..4.6...0	+
<i>Alveopora allingi</i> HOFFMEISTER 1925	1.....	16
<i>Alveopora verrilliana</i> DANA 1872	.....6....	+
Suborder Faviina VAUGHAN & WELLS 1943		
Family Faviidae GREGORY 1900		
<i>Favia favius</i> (FORSKAL 1775)	1....6....	+
<i>Favia laxa</i> (KLUNZINGER 1879)	.2...6....	+
<i>Favia pallida</i> (DANA 1846)	1....6....	+
<i>Favia stelligera</i> (DANA 1846)	.2...6....	+
<i>Favites abdita</i> (ELLIS & SOLANDER 1786)	12...6....	+
<i>Favites chinensis</i> (VERRILL 1866)	.2...6....	17
<i>Favites complanata</i> (EHRENBERG 1834)	...4.6....	+
<i>Favites flexuosa</i> (DANA 1846)	12...6....	+
<i>Favites pentagona</i> (ESPER 1794)	.....6....	+
<i>Favites peresi</i> FAURE & PICHON 1978	.....6....	+
<i>Goniastrea pectinata</i> (EHRENBERG 1834)	1....6....	+
<i>Goniastrea retiformis</i> (LAMARCK 1816)	1...56..9.	+
<i>Platygyra daedalea</i> (ELLIS & SOLAND.1786)	.2...6..9.	+
<i>Platygyra lamellina</i> (EHRENBERG 1834)	.2...6....	18
<i>Platygyra sinensis</i> (M.EDW.& HAIME 1849)	.2...6....	+
<i>Leptoria phrygia</i> (ELLIS & SOLANDER 1786)	.....6....	+
<i>Oulophyllia crispa</i> (LAMARCK 1816)	.....6....	+
<i>Hydnophora exesa</i> (PALLAS 1766)	.....6....	+
<i>Hydnophora microconos</i> (LAMARCK 1816)	.....6....	+
<i>Plesiastrea versipora</i> (LAMARCK 1816)	.....6....	+
<i>Montastrea annuligera</i> (M.EDW.& HAI.1849)	.....6....	19
<i>Montastrea curta</i> (DANA 1846)	1.....	-
<i>Diploastrea heliopora</i> (LAMARCK 1816)	.....6....	+
<i>Leptastrea bottae</i> (M.EDWAR.& HAIME 1849)	.....6....	+
<i>Leptastrea purpurea</i> (DANA 1846)	.....6....	+
<i>Leptastrea transversa</i> KLUNZINGER 1879	1....6....	+

<i>Cyphastrea microphthalma</i> (LAMARCK 1816)	.2...6....	+
<i>Cyphastrea serailia</i> (FORSKAL 1775)	1....6....	+
<i>Echinopora gemmacea</i> (LAMARCK 1816)	12..56.8..	20
Family Oculinidae GRAY 1847		
<i>Galaxea fascicularis</i> (LINNAEUS 1758)	.....6....	+
Family Merulinidae VERRILL 1866		
<i>Merulina ampliata</i> (ELLIS & SOLAND. 1786)	.....6....	+
Family Mussidae ORTMANN 1890		
<i>Lobophyllia corymbosa</i> (FORSKAL 1775)	.2...6....	+
<i>Lobophyllia hemprichii</i> (EHRENBERG 1834)	.....6....	+
<i>Acanthastrea echinata</i> (DANA 1846)	.....6....	+
<i>Acanthastrea erythraea</i> (KLUNZINGER 1879)	.....6....	21
<i>Blastomussa merleti</i> (WELLS 1961)	.....6....	+
<i>Parascolymia vitiensis</i> (BRUEGGEM. 1877)	.....6....	22
Family Pectinidae VAUGHAN & WELLS 1943		
<i>Echinophyllia aspera</i> (ELL.& SOL. 1786)	.2...6....	+
<i>Oxypora lacera</i> (VERRILL 1864)	.....6....	+
<i>Mycedium elephantotus</i> (PALLAS 1766)	.....6....	+
Suborder Caryophylliina VAUGHAN & WELLS 1943		
Family Caryophylliidae GRAY 1847		
<i>Plerogyra sinuosa</i> (DANA 1846)	.....6....	+
<i>Gyrosmlia interrupta</i> (EHRENBERG 1834)	.....6....	+
Suborder Dendrophylliina VAUGHAN & WELLS 1943		
Family Dendrophylliidae GRAY 1847		
<i>Tubastraea aurea</i> (QUOY & GAIMARD 1833)	.....6....	+
<i>Tubastraea coccinea</i> (EHRENBERG 1834)	.....6....	+
<i>Tubastraea micranthus</i> (EHRENBERG 1834)	.....6....	+
<i>Turbinaria mesenterina</i> (LAMARCK 1816)	.....6.8..	+

Subclass Octocorallia HAECKEL 1866  
 Order Stolonifera HICKSON 1833  
 Family Tubiporidae EHRENBERG 1828

*Tubipora musica* LINNAEUS 1758 .2...6.... 23

Class Hydrozoa OWEN 1843  
 Order Milleporina HICKSON 1901  
 Family Milleporidae FLEMING 1828

*Millepora platyphylla* EHRENBERG 1834 .....6.... -

*Millepora exaesa* FORSKAL 1775 .....9. -

*Millepora dichotoma* FORSKAL 1775 .....6.... 23

Order Stylasterina HICKSON & ENGLAND 1905  
 Family Stylasteridae GRAY 1847

*Distichopora violacea* (PALLAS 1766) ...4.6.... 23

Total: 2 classes, 2 subclasses, 4 orders, 5 suborders,  
 18 families, 51 genera, 151 species.

Numbers in the right column refer to the following:

- 1) in SCHEER & PILLAI 1983 as synonym of *A. eurystoma*
- 2) in SCH.& P. listed as synonym of *A. hyacinthus*
- 3) in SCH.& P. as synonym of *A. humilis*
- 4) in SCH.& P. as synonym of *A. humilis*
- 5) syn. with *A. yongei* n.sp. in VERON & WALLACE 1984
- 6) syn. with *A. nobilis* after VERON & WALLACE 1984
- 7) in SCH.& P. as synonym of *A. pharaonis*
- 8) in SCH.& P. as *A. variabilis* (KLUNZINGER 1879)
- 9) in SCH.& P. as syn. of *M. meandrina* (EHRENBERG 1834)
- 10) in SCH.& P. as synonym of *M. ehrenbergi* VERRILL 1872
- 11) ident. by HEAD 1980 as *P. cf. diffluens*
- 12) in SCH.& P. as *Pavona yabei*
- 13) in SCH.& P. only mentioned
- 14) same as *Herpetoglossa simplex* s. WELLS 1966
- 15) in SCH.& P. as *P. (Synarea) undulata* (KLUNZ. 1879)
- 16) in SCH.& P. as *A. mortenseni* CROSSLAND 1952
- 17) in SCH.& P. as *F. acuticollis* (ORTMANN 1889)
- 18) in SCH.& P. as synonym of *P. daedalea*
- 19) in SCH.& P. only mentioned
- 20) including the formae *fruticulosa* KLUNZINGER 1879,  
*hirsutissima* M.EDW.& H., and *mammillosa* KLUNZ. 1879  
 = *E. forskaliana* s. WIJSM.-BEST 1980
- 21) same as *Symphyllia erythraea* after HEAD 1980
- 22) only mentioned in SCH.& P.
- 23) not mentioned in SCH.& P., but described for the Red  
 Sea in SCHEER 1967

## DISCUSSION

Since this paper resulted mainly from studies on coral reef health in the Red Sea, it may be appropriate to briefly comment on the outcome of these investigations. As outlined in ANTONIUS (1988c), there are three problem areas among generally healthy reefs in the eastern Red Sea. In order of severity of impact they are: Jeddah, Yanbu, and Haql. But there is also a general slow deterioration over time noticeable at these sites, which appears to be spreading to healthy coral reef areas as well (ANTONIUS, unpublished). Mainly due to the increasing volume of oil-shipments in the Red Sea, this decline of environmental quality is bound to accelerate in the future.

Under these circumstances, it seemed prudent to systematically catalogue all the collected material. Fortunately, today the coral fauna of the Red Sea is still rich, as shown by the almost incidental coral harvest of this study.

The northernmost collecting site, Haql (site no. 1), is situated at the northern end of the Gulf of Aqaba, close to the Jordanian border. No corals were known from here. However, comparable collections exist from reefs near the Marine Science Station south of Aqaba in Jordan where MERGNER & SCHUHMACHER (1974: tables 6 and 13) studied a coastal fringing reef and a fringing reef with a lagoon. They found 60 and 48 species of scleractinians respectively, belonging to 30 and 28 genera. Later they could increase this number to 90 species and 36 genera (MERGNER & SCHUHMACHER 1981: tables 1 and 4).

PICHON, JAUBERT, BOUCHON & PETRON (1979) also collected in reefs south of Aqaba and documented their list of corals with 95 species of 46 genera in an unpublished research report of Nice University. Also comparable are the coral collections from Eilat, which were described by LOYA & SLOBODKIN (1971: table 1, 94 species of 38 genera), as well as SCHEER & PILLAI (1983: 101 species of 40 genera).

Among the corals collected at Haql are 5 species which are not contained in any of the lists mentioned, and also were not previously reported from any other part of the Red Sea. They are: *Acropora anthocercis* (site nos.1,3), *Acropora cerealis* (site no.1), *Acropora divaricata* (site nos.1,3,4,10), *Acropora donei* (site no.1), and *Porites australiensis* (site nos.1,4).



The three collecting sites at Al-Wajh (site nos.2,3,4) can be considered as one site. The closest locality from which corals were collected before is Sanafir Island, where v.MARENZELLER (1906) found 9 species of 6 genera. South of Al-Wajh, at Sharm Abban, he collected 14 species of 12 genera.

Among the Al-Wajh corals, three species are new for the Red Sea, *Acropora anthocercis*, *Acropora divaricata*, and *Porites australiensis*, which were also encountered at Haql.

At the next site, Yanbu (site no.5), SHEPPARD & SHEPPARD (1985: Appendix 2) found 104 scleractinian species of 47 genera, which SHEPPARD (1987: Appendix 1, list of coral species, column 3) increased to 133 species and 48 genera. The present collection contains 7 more species which were not previously reported from Yanbu, but from other parts of the Red Sea.

Corals from Jeddah (site no. 6) were reported by v.MARENZELLER (1906), who described 38 species of 18 genera. SHEPPARD (1985: table 2) also collected here, but his list of corals contains all samples from 27 sites along the entire Jeddah to Jizan coastline. While his table 2 lists 91 species of 45 genera, his fig.6 shows that 83 species were from Jeddah. This list was augmented by SHEPPARD (1987: Appendix 1, list of coral species, column 4) to 93 species.

The present, very large collection of corals from the Jeddah area (site no.6) comprises 116 scleractinian species of 47 genera, with the addition of 5 non-scleractinians from 3 genera (*Tubipora*, *Millepora*, *Distichopora*). The collection contains 5 species not known from any other location of the Red Sea, i.e. *Pocillopora cf. eydouxi*, *Acropora aspera*, *Acropora echinata*, *Montipora peltiformis*, and *Montipora turgescens*.

The next collecting site further south is Qunfudah (site no.7). From here, v.MARENZELLER (1906) brought back 3 species, but a short distance to the north, at Mamuret el Hamidiye, he collected 18 species of 16 genera. SHEPPARD (1985: fig.6) reports 52 species from Qunfudah, but in his coral list does not specify which ones. The present collection contains 10 species of 2 genera, of which *Acropora monticulosa* has not previously been reported from the Red Sea.

The southernmost three collecting sites near Jizan (site nos.8, 9, 10) can again be combined. Together they yielded 23 species of 12 genera. New for the Red Sea is

*Montipora undata*, and *Acropora divaricata*, also found at Haql (site no.1) and Al-Wajh (site nos.3, 4). SHEPPARD (1985: fig. 6) collected 12 and 8 species respectively from two sites between Jizan and the Yemeni border, but without indicating which ones. Comparable collections were made at the Sarso Islands in front of Jizan. v.MARENZELLER (1906) published 9 species of 6 genera, and SCHEER (1967) 44 species of 20 genera, as well as *Tubipora*, *Millepora* (2 species), and *Distichopora*.

The present collection again shows how rich a coral fauna there is in the central Red Sea, but also in the Gulf of Aqaba. Toward the south, the number of species decreases significantly.

Twelve species listed here are new for the Red Sea: *Pocillopora cf. eydouxi* (site no.6); *Acropora anthocercis* (site nos.1,3); *Acropora aspera* (site no.6); *Acropora cerealis* (site no.1); *Acropora divaricata* (site nos.1,3,4,10); *Acropora donei* (site no.1); *Acropora echinata* (site no.6); *Acropora monticulosa* (site no.7); *Montipora peltiformis* (site no.6); *Montipora turgescens* (site no.6); *Montipora undata* (site no.9); and *Porites australiensis* (site nos.1,4).

From the Gulf of Aqaba (site no. 1) comes: *Alveopora allingi*.

Only in the central Red Sea (site nos. 5,6,7) occur: *Acropora vaughani*; *Montipora gracilis*; *Montipora informis*; *Pavona diffluens*; *Fungia repanda*; *Acanthastrea erythraea*; *Parascolymia vitiensis*; *Tubastraea coccinea*.

And exclusively in the southern Red Sea (site nos.8,9,10) were found: *Acropora valenciennesii*, and *Porites nodifera*.

While SCHEER & PILLAI (1983) described 180 species of 54 genera of hermatypic scleractinians from the Red Sea, SHEPPARD (1987: Appendix 1, list of coral spec. column 1) lists 221 species of 56 genera.

Now, 12 more species can be added, resulting in a total of 233 species of 56 genera of hermatypic Scleractinia from the Red Sea. Of these, 138 species (48 genera) are reported from the Gulf of Aqaba, 101 species (36 genera) from the northern Red Sea, 146 species (48 genera) from the central Red Sea, and 63 species (28 genera) from the southern Red Sea.

REFERENCES  
in the text

ANGEL, M.V. (edit.) (1984): Marine science of the North-West Indian Ocean and adjacent waters. (Proc. Mabahiss/John Murray Internat. Sympos. Egypt, 3-6 Sept. 1983). Deep Sea Research Part A, Oceanograph. Res. Papers 31 (6-8): 571-1035.

ANTONIUS, A. (1984a): Human impact on corals in fringing reefs near Jeddah, Red Sea. Proc. Sympos. Coral Reef Environ. Red Sea, K.A.A. Univ., Jeddah: 363-389.

ANTONIUS, A. (1984b): Korallenkrankheiten : Erstmals im Indo-Pazifik nachgewiesen. Umschau 23: 706-708.

ANTONIUS, A. (1985a): Coral diseases in the Indo-Pacific: A first record. P.S.Z.N.I: Mar. Ecol. 6: 197-218.

ANTONIUS, A. (1985b): Black Band Disease infection experiments on hexacorals and octocorals. Proc. Fifth Internat. Coral Reef Congr., Tahiti. Ant. Mus. EPHE, Moorea, 6: 155-160.

ANTONIUS, A. (1987): Survey of Red Sea coral reef health. I. Jeddah to Jizan. Proc. Saudi Biological Society 10: 149-163.

ANTONIUS, A. (1988a): Survey of Red Sea coral reef health. II. Haql to Jeddah. Proc. Saudi Biological Society. (in press).

ANTONIUS, A. (1988b): Black Band Disease behavior on Indo-Pacific reef corals. Proc. Sixth Internat. Coral Reef Symp., James Cook University, Townsville, Australia. (in press).

ANTONIUS, A. (1988c): Distribution and dynamics of coral diseases in the eastern Red Sea. Proc. Sixth Internat. Coral Reef Symp., James Cook University. Townsville, Australia. (in press).

BOUCHON, C. (1979): Quantitative study of the scleractinian coral communities of the Jordanian coast (Gulf of Aqaba, Red Sea): Preliminary results. Tethys 9: 243-246.

BOUCHON, C. & ANTONIUS, A. (1983): Coral communities of the reef formations near Jeddah (Saudi Arabia, Red Sea. Abstr. Symp. Internat. Soc. Reef Studies: 16.

- CROSSLAND, C. (1913): Desert and water gardens of the Red Sea. Cambridge, 158 pp., 40 pls.
- CROSSLAND, C. (1941): On FORSKAL's collection of corals in the Zoological Museum Copenhagen. Skr. Univ. Zool. Mus. Kobenhavn 1: 1-63, pls. 1-12.
- CROSSLAND, C. (1952): Madreporaria, Hydrocorallinae, Heliopora, and Tubipora. Sci. Rep. Great Barrier Reef Exped. 1928-29, 6: 85-257, pls. 1-56.
- EHRENBERG, C.G. (1834a): Beitrage zur physiologischen Kenntniss der Corallenthiere im allgemeinen, und besonders des rothen Meeres, nebst einem Versuche zur physiologischen Systematik derselben. Phys. Abh. Konigl. Akad. Wissensch. Berlin a. d. Jahre 1832: 225-380.
- EHRENBERG, C.G. (1834b): Uber die Natur und Bildung der Corallenbanke des rothen Meeres. Phys. Abh. Konigl. Akad. Wissensch. Berlin a.d. Jahre 1832: 381-432.
- FAUROT, L. (1888): Rapport a M. le Ministre de l'Instruction Publique sur une Mission dans la Mer Rouge (ile de Kamarane) et dans le Golfe d'Aden (Aden et Golfe de Tadjoura). Arch. Zool. Exper. et Gener. 2me ser., 6: 117-133.
- FENTON, H. & STEINITZ, H. (1967): Eilat - a natural marine research laboratory. Ariel, Rev. Arts Sci. Israel, 20: 61-72.
- FORSKAL, P. (1775): Descriptiones animalium, avium, piscium, insectorum, vermium, quae in itinere orientali observavit Petrus FORSKAL. Post mortem auctoris edidit Carsten NIEBUHR. Hauniae, 164 pp. (Corallia: p. 131-139).
- GERLACH, S.A. (1967): Bericht uber den Forschungsaufenthalt der Litoralgruppe auf der Insel Sarso (Rotes Meer). "Meteor" Forschungsergebn., Reihe D: 2-6.
- GUILCHER, A. (1955): Geomorphologie de l'extremite septentrionale du Banc Farsan (mer Rouge). Ann. Inst. Oceanogr., N.S., 30: 55-100, pls. 1-21.
- HASS, H. (1961): Expedition ins Unbekannte. Berlin/Frankfurt/Wien, 167 pp., 231 figs.
- HEAD, S.M. (1980): The ecology of corals in the Sudanese Red Sea. Append. IV: Taxonomic notes and identification criteria for the corals. Thesis, Cambridge University: 142-181, 441-471.

KLAUSEWITZ, W. (1964): Die Erforschung der Ichthyofauna des Roten Meeres. In: KLUNZINGER, C.B.: Synopsis der Fische des Rothen Meeres. Weinheim, Reprint, V-XXXVI.

KLAUSEWITZ, W. (1967): Die physiographische Zonierung der Saumriffe von Sarso. "Meteor" Forschungsergebnisse, Reihe D, H.2: 44-68.

KLUNZINGER, C.B. (1872): Zoologische Excursion auf ein Korallenriff des Rothen Meeres bei Koseir. Zeitschrift Ges. f. Erdkunde, Berlin 7: 20-56.

KLUNZINGER, C.B. (1879): Die Korallthiere des Rothen Meeres. 2: Die Steinkorallen. 1. Abschn.: Madreporaceen und Oculinaceen. Berlin, 88 pp., 10 pls. 3: Die Steinkorallen. 2. Abschn.: Astraeaceen und Fungiaceen. Berlin, 100 pp., 10 pls.

LOYA, Y. (1972): Community structure and species diversity of hermatypic corals at Eilat, Red Sea. Mar. Biol. 13: 100-123.

LOYA, Y. & SLOBODKIN, L.B. (1971): The coral reefs of Eilat (Gulf of Eilat, Red Sea). Sympos. Zool. Soc. London 28: 117-139.

MARENZELLER, E.v. (1906): Riffkorallen. (Exped. "Pola" in das Rote Meer 1895/96 - 1897/98). Denkschr. Math.-Naturwiss. Kl. Akad. Wiss. Wien 80: 27-97, pls. 1-29.

MERGNER, H. (1967): Über den Hydroidenbewuchs einiger Korallenriffe des Roten Meeres. Zeitschr. Morph. Okol. Tiere 60: 35-104.

MERGNER, H. (1979): Quantitative ökologische Analyse eines Rifflagenenareals bei Aqaba (Golf von Aqaba, Rotes Meer). Helgol. wissenschaftl. Meeresuntersuchungen 32: 476-507.

MERGNER, H. (1981): Man-made influences on, and natural changes in the settlement of the Aqaba reefs (Red Sea). Proc. Fourth Internat. Coral Reef Sympos., Univ. Philippines, Manila, 1: 193-207.

MERGNER, H. (1984): The ecological research on coral reefs of the Red Sea. Deep Sea Research, Pt.A, 31 (6-8): 855-884.

MERGNER, H. & SCHUHMACHER, H. (1974): Morphologie, Ökologie und Zonierung von Korallenriffen bei Aqaba (Golf von Aqaba, Rotes Meer). Helgol. wissenschaftl. Meeresuntersuchungen 26: 238-358.

- MERGNER, H. & SCHUHMACHER, H. (1981): Quantitative Analyse der Korallenbesiedlung eines Vorriffareals bei Aqaba (Rotes Meer). Helgol. wissenschaftl. Meeresuntersuchungen 34: 337-354.
- MERGNER, H. & SVOBODA, A. (1977): Productivity and seasonal changes in selected reef areas in the Gulf of Aqaba (Red Sea). Helgol. wissenschaftl. Meeresuntersuchungen 30: 383-399.
- NESTEROFF, W.D. (1955): Les recifs coralliens du Banc Farsan Nord (Mer Rouge). Ann. Inst. Oceanogr. 30: 46pp., 21 pls.
- NEWMAN, A.C. & MCGILL, D.A. (1962): Circulation of the Red Sea in early summer. Deep Sea Res., 8: 223-235.
- ORMOND, R., SHEPHERD, A.D., PRICE, A. & PITTS, R. (1984): Report on the distribution of habitats and species in the Saudi Arabian Red Sea. IUCN/MEPA, Kingdom of Saudi Arabia, Part 1: 123 pp., Part 2: 151 pp.
- PICHON, M., JAUBERT, J., BOUCHON, C. & PETRON, C. (1979): Inventory of the Scleractinians of the coral reefs of the Jordanian coast of the Gulf of Aqaba (Red Sea). Research Report, University of Nice: 1-5.
- ROSEN, B.R. (1971): The distribution of reef coral genera in the Indian Ocean. Sympos. Zoolog. Soc. London 28: 263-299.
- SCHAEFER, W. (1969): Sarso, Modell der Biofacies-Sequenzen im Korallenriff-Bereich des Schelfs. Senckenberg. marit. 50: 153-164.
- SCHEER, G. (1967): Korallen von den Sarso-Inseln im Roten Meer. Senckenberg. biol. 48: 421-436.
- SCHEER, G. (1971): Coral reefs and coral genera in the Red Sea and Indian Ocean. Sympos. Zool. Soc. London 28: 329-367.
- SCHEER, G. (1984): The distribution of reef-corals in the Indian Ocean with a historical review of its investigation. Deep Sea Res., Pt.A., 31 (6-8): 885-900.
- SCHEER, G. & PILLAI, C.S.G. (1983): Report on the stony corals from the Red Sea. Zoologica 133: 198 pp., 41 pls.
- SHEPPARD, C.R.C. (1985): Reefs and coral assemblages of Saudi Arabia. 2. Fringing reefs in the southern region, Jeddah to Jizan. Fauna Saudi Arabia 7: 37-58.

SHEPPARD, C.R.C. (1987): Coral species of the Indian Ocean and adjacent seas: a synonymized compilation and some regional distributional patterns. Atoll Res. Bull. No. 307: 32 pp.

SHEPPARD, C.R.C. & SHEPPARD, A.L.S. (1985): Reefs and coral assemblages of Saudi Arabia. 1. The central Red Sea at Yanbu al Sinaiyah. Fauna Saudi Arabia 7: 17-36.

STRESEMANN, E. (1954): HEMPRICH und EHRENBERG. Reisen zweier naturforschender Freunde im Orient, geschildert in ihren Briefen aus den Jahren 1819-1826. Abh. Dtsch. Akad. Wissensch. Berlin, Kl. Mathemat. u. Naturwissensch. Nr. 1: 1-177.

VINE, P. & SCHMID, H. (1987): Red Sea Explorers. London: 206 pp.

WELLS, S.M. (edit.) (1985): IUCN Directory of coral reefs of international importance. Saudi Arabia: 367-390.

#### REFERENCES

of the systematic list of species are all contained in SCHEER & PILLAI (1983), except the following, which are given here in abbreviated form :

BROOK, G. (1891): Ann. Mag. Natur. Hist. (6) 8: 458-471.

BROOK, G. (1892): Ann. Mag. Natur. Hist. (6) 10: 451-465.

ESPER, E.J.C. (1797): Nurnberg: 230 pp., pls 32-83. (p.1-65 publ. 1794, p.65-116 publ. 1795, p.117-168 publ. 1796, p.169-230 publ. 1797).

LAMARCK, J.B.P. de (1801): Paris, 1-432.

MICHELIN, H. (1843): Mag. de Zool., 5 (Zooph.): pl. 5.

STUTCHBURY, S. (1833): Trans. Linn. Soc. London 16: 493-497.

VERON, J.E.N. & WALLACE, C.C. (1984): Austral Inst. Mar. Sci., Monogr. Ser. 6: 485 pp., 1292 figs.

VERRILL, A.E. (1866): Proc. Essex Inst. Salem. 5: 33-50.

VERRILL, A.E. (1872): In DANA, J.D., London: 279-338.

WIJSMAN-BEST, M. (1977): Zool. Meded. Rijksmus. Natuurl. Hist., Leiden 5: 235-263, pls. 1-5.