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المؤتمر الدولى لعلوم البحار

البحـــر الاحمـــر

INTERNATIONAL CONFERENCE

ON

MARINE SCIENCE IN THE RED SEA

On the Occasion of the

50th Anniversary

of

AL-GHARDAQA MARINE BIOLOGICAL STATION

ABSTRACTS

Al-Ghardaqa, Red Sea
Arab Republic of Egypt
April 24-28, 1982

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S E S S I O N I

THE RED SEA ENVIRONMENT - GEOLOGY

I-1. SOME REMARKS ON THE TECTONIC EVOLUTION OF THE RED SEA AND GULF OF SUEZ SEDIMENTARY BASINS

M. Youssef Hassan and Omar H. Cherif
United Arab Emirates University
Al-Ain, United Arab Emirates

The authors introduce their views on the tectonic evolution of the Gulf of Suez and Red Sea sedimentary basins and the result over ten years of study of various stratigraphic sections in the Egyptian parts of these regions. Various tectonic phases have been recognized in the stratigraphic succession of the Gulf of Suez, starting from the Paleozoic up to the late Tertiary. On the other hand, the Red Sea basins seem to have started to be the site of active accumulation of sediments in late middle Miocene times and to have been subjected to various tectonic phases during the late Tertiary. These phases can be correlated with those of the Gulf of Suez. Each stage of the tectonic evolution of these basins is characterized by a particular sedimentary suite. In this paper each sedimentary suite is compared to characteristic sedimentary associations of the classical geosynclinal cycle, in an attempt to determine the possible sequence of sediments characterizing the early stages of the development of a rift prior to sea floor spreading. A comparison between the Gulf of Suez sedimentary basin and the Red Sea is also attempted.

I-2. INTERPRETATION OF AN AEROMAGNETIC SURVEY IN THE VICINITY OF ST. JOHN'S ISLAND, RED SEA

M. M. Khattab
Nuclear Materials Corporation
Cairo, Egypt

An aeromagnetic survey was made in the vicinity of St. John's Island, Red Sea. Two medium-intensity, magnetic anomalies (E-W strike) were used to interpret the depth, geometry, rock type and relationship of the Red Sea deformation pattern. These anomalies, located off the western and southern margins of the Island, when analysed using curve-fitting techniques, showed two causative bodies, probably basaltic. The first, buried 1.3 km below sea-level, is a 1 km wide and 1 km thick horizontal plate of finite strike; the second, buried 2.2 km below sea-level, is a 1 km wide steeply dipping thin dike and extends infiritely in depth and strike.

The calculated susceptibility contrast (0.010 cgs) and correlation of observed anomalies with mapped Quaternary basalt on the island may indicate basalt emplaced in shield-type rocks.

The induction (by the present magnetic field) of magnetic anomalies and the tie to St. John's Quaternary basalt (age range 0.9-1.5 m.y.) may set a maximum age of 0.7 m.y. for causative basalt. The observed anomalies, however, do not correlate with the Red Sea trough magnetic anomalies and do not show a symmetrical sea-floor spreading magnetic pattern.

The localized nature, diminished amplitude, and near E-W strike of magnetic anomalies may point to a distant basic source, either in the upper mantle or further east where high amplitude anomalies abound. This magma may have used E-W Quaternary tensile fractures caused by the prevailing (during the last 2 m.y.) NW-SE compression. Seismic

data at the same latitude - but equidistant from the Saudi Arabian shore - indicate a subsediment velocity of 7 km/sec, suggesting an inhomogeniety and/or a northerly translation of the Red Sea crust. This study shows that the application, everywhere, of a sea-floor spreading model for observed magnetic anomalies is not always geologically feasible.

I-3. MAPS OF THE ABSOLUTE GEOMAGNETIC FIELD COMPONENTS OF THE EASTERN DESERT OF EGYPT REDUCED TO THE EPOCH 1977.0

H. Deebes, A. H. Gouda, M. Fahim, and F. M. Ahmed
Helwan Institute of Astronomy and Geophysics
Helwan, Egypt

The absolute geomagnetic field components were measured along 7 profiles of total length of more than 3000 km covering the Eastern Desert roads. The sensitivity of measurements is 1.0 gamma for field intensities and 0.1 minute for declination. The measured values were reduced to the Epoch 1977.0 using Misallat geomagnetic station records. The standard maps of isomagnetic lines of the horizontal, vertical and total intensities together with the reduced map of declination are given.

I-4. SEISMICITY OF THE RED SEA COAST

R. Kebeasy
Helwan Institute of Astronomy
Helwan, Egypt

Abstract Not Available

I-5. EARTHQUAKES: A STUDY OF THE RED SEA REGION

Mohamed Fahim
Institute of Oceanography and Fisheries
Cairo, Egypt

Abstract Not Available

I-6. SOME TEXTURAL CHARACTERISTICS OF RECENT SEDIMENTS ALONG THE RED SEA COAST OF EGYPT

H. H. Mansour, E. R. Philobbos and A. El-Shater
Faculty of Science, Assiut University
Assiut, Egypt

The grain size and shape characteristics of Recent sediments at the entrance of seven valleys debouching into the Red Sea were investigated. These were compared with Recent tidal and beach sediments facing these valleys. The expected decrease in size and increase in roundness and sphericity when proceeding from the land towards the sea were recorded. A decrease in size and roundness from south to north in the beach and tidal areas was also observed and is attributed to either northwardly directed long shore currents or to longer transportation of clastics in the northern areas through longer valleys.

Although the different environments showed separate clusters on some bivariate plots of grain-size parameters, the techniques suggested by different investigators to distinguish the different environments using size parameters failed to identify the fluvial, beach and tidal environments.

I. 7. MINEROLOGY OF SOME RECENT SEDIMENTS ALONG THE RED SEA COAST

E. R. Philobbos, H. H. Mansour, and A. A. El-Shater
Assiut University
Assiut, Egypt

Abstract Not Available

I-8. STATISTICAL STUDIES ON THE DISTRIBUTION OF DEAD FORAMINIFERAL TESTS IN RECENT SEDIMENTS OF THE NOTHERN RED SEA

Omar H. Cherif, Wagdi Z. El Deeb and M. Youssef Hassan
United Emirates University
Abu Dhabi, United Emirates

Various multivariate statistical procedures are used to study the distribution of Recent dead foraminiferal tests in the northern Red Sea. Sixty-four samples yielding 156 foraminiferal species were used in these studies. The total number of tests belonging to each species was counted in each sample and correlation coefficients between the distribution of these species and various sedimentary and environmental parameters were computed. The parameters considered were: depth of the sea in each sample location, distance from the shore, and various sediment grain-size fractions provided by mechanical analysis of the samples.

The samples were classified by their foraminiferal content into various groups using cluster analyses, and maps were drawn to obtain the distribution of these groups.

The study showed that the distribution of the tests of only 13 species seems to be affected by depth and that the distribution of 10 species is affected from the shore. The distribution of many other species is strongly affected by the grain size of sediments. This suggests that most foraminiferal tests are strongly reworked within the sediments of the studied area. The maps drawn for the clustered groups of samples show on the other hand, a strong correlation with depth and distance from the shore. In spite of the fact that the distribution of many single species does not seem to correlate with these parameters, the overall constitution of the foraminiferal assemblages depends greatly on the depth and the distance of the sample from shore.

I-9. RED SEA ENVIRONMENTS DURING THE LAST 150,000 YEARS - THE GULF OF AQABA

Z. Reiss, B. Luz, A. Almogi-Lobin, E. Halicz, A. Winter and J. Erez
Institute of Earth-Sciences
The Hebrew University of Jerusalem
Jerusalem, Israel

Deep-sea core sequences from the Gulf of Aqaba and the northernmost Red Sea represent sediments deposited at a rate of 5-10 cm ky^{-1} over the last 150 ky, as calibrated against the stable oxygen isotope curve. Assemblages of planktonic and benthonic Foraminifera, Pteropoda and Coccolithophorida analyzed from these sequences show numerous shifts determined by changes in climate, sea level and strait dynamics during glacial-interglacial periods. At present, many of the components of these assemblages live in the Red Sea at the edge of their ecological tolerance under hypersaline and oligotrophic conditions. Thus, even small environmental changes to more extreme conditions in the past affected these taxa strongly. Since different groups are not influenced equally by the same ecological factors, their quantitative responses are, at least in part, diachronous, thus providing a multiple and relatively high-resolution ecostratigraphic framework. Ecological information and laboratory experiments on various taxa occurring in the cores coupled with stable oxygen isotope values indicate that during maximum glacial peaks temperature of the upper waters fell by about 4°C and salinity rose to more than 50‰. Generally, during glacial periods, the assemblages of planktonic and benthonic Foraminifera, Pteropoda and Coccolithophorida, as well as the $\delta^{18}O$ obtained from benthonic and planktonic Foraminifera point to a more stratified and especially more productive water column than during interglacials. The present-day "sea desert" environment was established approximately 4,000 years ago.

SESSION II

THE RED SEA ENVIRONMENT - PHYSICAL OCEANOGRAPHY

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II-10. EFFECT OF BOTTOM TOPOGRAPHY ON THE TIDE IN THE RED SEA

Gerges F. Soliman and Makram A. Gerges
Institute of Oceanography and Fisheries
Alexandria, Egypt

The paper presents a numerical analysis of the lunar semi-diurnal tide in the Red Sea using the modern approach of mathematical modelling.

The model considers the Red Sea as a basin open at its southern boundary, and assumes and oscillatin motion at this boundary through the Strait of Bab-el-Mandab. The coefficient of internal friction ($5x10^{-6}$ sec^{-1}) was used to maintain stable conditions during computations.

To estimate the effect of bottom topography on the tidal phenomenon, the Red Sea basin was assumed to be of constant depth (190 m). A comparison was made between these results and previous computations treating the Red Sea first as a basin having a real topographic nature and then as a long narrow canal.

The effect of depth variation on both of the amplitudes and phases of the tides was clearly demonstrated, particuluarly in the Gulf of Suez. It was also concluded that the irregularity of the bottom topography at the entrance of the gulf and the existence of a group of islands there obviously affect the tidal amplitudes in the gulf itself.

II-11. WIND-DRIVEN CIRCULATION IN THE RED SEA AS A HOMOGENOUS BASIN

R. K. Wassef, M. A. Gerges and G. F. Soliman
Cairo University & Institute of Oceanography and Fisheries
Cairo, Egypt

The hydrodynamical equations of motion were applied to study water circulation in the Red Sea. The sea was assumed as a homogenous layer with a uniform density. Different cases are considered to examine the effect of bottom topography, the seasonal variation of the wind stress and density distribution on water circulation in the Red Sea.

Gyratory motions characterize circulation patterns in the different seasons, but with different locations of the gyres. This type of circulation creates transverse movements giving rise to cross currents at some locations. The current patterns obtained clearly indicate their occurrence and could fairly well explain the temperature and salinity distributions in terms of their existence.

II-12. GREAT BITTER LAKE AS A BARRIER BETWEEN MEDITERRANEAN AND RED SEA FLOWS

S. M. El-Sharkawy and S. H. Sharaf-El Din
Institute of Oceanography and Fisheries & Alexandria University
Alexandria, Egypt

Five cruises were made during April 1966 to April 1967 to study the temperature, salinity and currents in the Great Bitter Lake. At ten stations, data were obtained at the surface and bottom at equal intervals of three meters.

The analyses showed a steady northward flow in the southern part of Suez Canal into Bitter Lake most of the year except in late summer. The maximum salinity (46.5%) in September is due to the combined effect of excess evaporation and dissolution of the salt bed of the Great Bitter Lake. Generally, the salinity of the lake is influenced by the residence time of water over the bottom salt deposits, the exchange of lake water with the Suez Canal, evaporation and meteorological conditions in the area.

The salt barrier has a minor effect on the salinity of the lake; the annual change in salinity is mainly due to the effect of evaporation. A rough calculation showed that the salinity increase of the lake water due to evaporation is about three times greater than that due to the salt bed.

The salt bed additionally works as a biological barrier against the transfer of species between the Mediterranean and Red Seas. The recent enlargement of the Suez Canel will increase the current, and thus decrease the time that the canal waters stay in the Great Bitter Lake.

..-13. HYDROGRAPHY OF THE RED SEA WATERS NEAR AL-GHARDAQA

Ali I. Beltagy
Al-Ghardaqa Marine Biological Station
Al-Ghardaqa, Red Sea, Egypt

Between November 1967 and August 1968 four cruises were made to the vicinity of Al-Ghardaqa. The spacial distribution of salinity, temperature and oxygen, as well as their seasonal variation, were studied. The study showed that water in the area had two main sources: the Gulf of Suez and the Red Sea proper. Mixing and evaporation within the area created another water body that occupied the central part of the area and flowed out to affect the Red Sea water mass at different depths. It is suggested that waters from the area may contribute to the formation of bottom water of the Red Sea.

Seasonal variation in the parameters measured were very clear and seasonality was reflected on the extent and formation of the central water body in the area.

II-14. HYDROGRAPHIC STUDIES OF RED SEA WATERS AT AL GHARDAQA, EGYPT

E. M. Hassan and Gerges F. Soliman
University of Qatar & Institute of Oceanography and Fisheries
Doha, Qatar; Alexandria, Egypt

Water samples were collected from eleven stations from Al-Ghardaqa shore to Shadean Island at the water surface and at depths of 5, 10, 25, 50, 100, 150 and 200 meters. The observations were made between February and May of 1968 during three cruises. The distribution of temperature and salinity was analysed and represented in charts.

The same region was surveyed again during the spring and summer seasons of 1981 to trace the water movements in that part of the Red Sea, and to measure the water exchange between the northern part of the Red Sea and the Gulf of Suez.

II-15. SOME OCEANOGRAPHIC FEATURES OF THE RED SEA AND GULF OF ADEN

S. Z. Qasim and R. Sen Gupta
Department of Environment & National Institute of Oceanography
New Delhi, India; Dona Paula, India

Abstract Not Available

S E S S I O N I I I

THE RED SEA ENVIRONMENT

CHEMICAL OCEANOGRAPHY
AND
POLLUTION

III-16. HYDROGRAPHY AND CHEMISTRY OF THE GULF OF SUEZ DURING SEPTEMBER 1966

Mohamed I. El-Sabh and Ali I. Beltagy
Al-Ghardaqa Marine Biological Station
Al-Ghardaqa, Red Sea, Egypt

A three-week cruise to the Gulf of Suez was undertaken during September 1966 on board the vessel R. S. Ichtiolog. The results obtained from hydrographic stations in the Gulf of Suez and 3 stations on the north-western part of the Red Sea indicate complex salinity and temperature distribution. Various chemical parameter measurements have not shown any particular trends. However, alternate strips of high and low phosphate and silicate concentrations were observed with high values in the deep waters of the eastern side of the gulf. The gulf waters were invariably saturated with oxygen, except in some deep stations. Oxidizable organic matter showed random distribution all over the area.

III-17. OIL POLLUTION IN THE EGYPTIAN RED SEA COAST

Rifaat G. M. Hanna
Red Sea Branch
Institute of Oceanography and Fisheries
Suez, Egypt

A simple weighing method using carbon tetrachloride as a solvent was used to determine the concentrations of tar balls and dissolved hydrocarbons in the sea water of the Egyptian Red Sea coast. The area concerned covers the coastal region from Ras Gharib down to the port of Qoseir.

Tar balls were collected by towing a neuston sampler made of zooplankton net material along the surface of the water for half an hour at each station at a speed of about four knots. Dissolved hydrocarbons were estimated from water samples taken in 3-liter sample bottles at a depth of one meter.

Tar concentrations in individual hauls ranged from 0.33 ug/m^2 for station No. 6 at Ghardaqa up to 1.08 mg/m^2 for station No. 4 at Ghubbel El Zeit. Individual tar balls were found to have weights ranging from 0.6 mg up to 1.9 g and sizes from 1 mm to 5 cm diameter; the largest being collected at Ras Gharib.

The highest mean concentrations of dissolved hydrocarbons were obtained at Ras-Shukheir, Ras Ghrib and Ghubbel El Zeit (95, 80 and 65 ug/L respectively). Minimum concentrations were obtained at Ghardaqa where no hydrocarbons were detected corresponding to less than 10 ug/L.

It is to be noted that the same pattern in the distribution of oil pollution is apparent in both sets of readings, that pollution increases going southward within the Gulf of Suez to reach a maximum in the Ras Shukheir-Ghubbel El Zeit area. Pollution levels then fall away to become fairly low at Ghardaqa, but then rise slightly again past Safaga to Qosier.

The high levels of pollution in the southern part of the Gulf of Suez correspond to the position there of the offshore oil fields, which are mostly in the areas of Ras Gharib and Ras Shukheir, and with more direct evidence that most of the oil pollution stems from procedures associated with the offshore production platforms in these oil fields. The subsequent distribution of this oil is most readily explained if it is assumed that the oil is carried south by the prevailing southerly current, but that some areas beyond the entrance to the Gulf of Suez are protected to a greater or lesser extent by projecting headlands and islands. Thus, certain locations of the inshore area around and immediately to the north of Ghardaqa would be especially protected by the projecting coastlines of Ras Ghanium and Ras Gemsa and by the cluster of islands which include Gubal and Shadwan.

III-18. ACTUAL SITUATION OF OIL POLLUTION IN THE ECOSYSTEM ALONG THE EGYPTIAN RED SEA COAST

H. Awad, P. Michel and A. El-Shazly
Nuclear Materials Corporation
Cairo, Egypt

Since the reopening of the Suez Canal in 1975, the petroleum production in the Egyptian territorial waters of the Red Sea - especially in the Gulf of Suez - and also transportation of the petroleum across the Canal of Suez, have significantly increased. As a consequence of these petroleum activities, intensive oil pollution can be clearly observed along the Egyptian Red Sea coast.

In spite of the above events, few studies (the majority of which are visual) have been carried out.

To evaluate actual oil pollution in the Red Sea ecosystem, 34 samples representing the dominant shore marine organisms (algae and molluscs) were collected in April 1981 from 8 stations extending from Suez to Safaja (500 km distant) and analysed by gas chromatography for total hydrocarbon content (THC).

Because of the variations in the collected species from various stations, it was difficult to establish a spatial comparison along the coast. However, at certain stations very high contents of hydrocarbons in some species could be detected such as: *Patella* sp. and *Nerita polita* with 1478.4 and 2976.5 mg of THC/kg (dry weight) respectively, collected from Ein Sokhna station; *Mactodea* sp. with 1277.5 mg of THC/kg, collected from Al-Ghardaqa station; and two species of fish, *Sardinella melanura* and *Leiognathus minutus* with 10876.9 and 6038.7 mg THC/kg of dry flesh, collected from Al-Ghardaqa station.

In general, it was noted that the THC determined in the different species collected from Al Ghardaqa station was higher than that found elsewhere.

III-19. ASSESSING POTENTIAL MARINE POLLUTION IN THE RED SEA

Khalil Hosny Mancy
University of Michigan
Ann Arbor, Michigan, USA

In view of it's unique features and geographical location, potential pollution problems in the Red Sea need to be carefully assessed. This should be part of a comprehensive regional program for the management of Red Sea resources. Critical areas of concern will be pollution from passenger and merchant shipping including oil tankers, oil platforms and drilling rigs, and waste and marine litter from industrial and domestic outfalls from offshore communities.

Strategies for Red Sea pollution monitoring should include the assessment of: (1) rates of release of material in the marine environment; (2) residence times in the affected regions, e.g., the Gulf of Suez and accessibility to the biological system; (3) contaminant distribution, e.g., concentration in sediment and bioaccumulation; and (4) possible impacts on marine resources, e.g., fisheries and recreation.

Special attention should be given to catastrophic inputs of pollutants caused by sinking of ships or the destruction of offshore installations by storms, accidents or military activities. For example, plans for handling (containment and removal) of oil spills from tankers or offshore rigs should be developed.

The paper provides procedures for the establishment of a Red Sea pollution monitoring program. This includes the selection of sampling sites and frequency; the analysis of certain pollutants, e.g., petroleum hydrocarbons; and data storage and retrieval. Emphasis is given to existing capabilities in Egypt and future needs.

III-20. A NEW TECHNIQUE FOR MEASURING DENITRIFICATION IN THE OCEANS: ITS IMPORTANCE AND APPLICABILITY TO THE RED SEA

Mohamed Ibrahim El Samra
Institute of Oceanography and Fisheries
Alexandria, Egypt

The importance of denitrification in the Red Sea, even in the hot brines having high salinity and temperature, has been proposed by many scientists.

Many different methods have been devised and are currently being used to evaluate and analyse the process of denitrification. A brief discussion of these methods is presented.

Types of denitrifiers in marine systems are mentioned and the annual total oceanic denitrification budget and combined nitrogen budget, especially that of Arabian and Red Seas, are discussed in relation to the balance sheets of combined nitrogen that have been presented by other workers.

Additionally, the paper describes the measurement of both denitrification "by C_2H_2 inhibition of N, O reduction" and nitrogen fixation "by reduction of C_2H_2 to C_2H_4" occurring simultaneously, in situ, in one sediment sample.

III-21. ABNORMAL RESPONSE OF ZOOXANTHELLAE PHOTOSYNTHESIS TO LOW CONCENTRATIONS OF PETROLEUM HYDROCARBONS

Baruch Rinkevich and Yossi Loya
Department of Zoology
George S. Wise Faculty of Life Sciences
Tel Aviv University
Tel Aviv, Israel

Branches of the hermatypic coral, *Stylophora pistillata*, were incubated with $Na_2C^{14}O_3$ in closed flasks placed at a 3-meter depth on the reef across from the Marine Biological Station at Eilat, Red Sea. These branches were exposed to different concentrations of water soluble fractions of Iranian crude oil for 24 hrs. (4.5 cc/l - 27.5 cc/l). This short-term exposure and the low concentrations of the WSF caused no mortality to corals or the symbiotic zooxanthellae. However, the sublethal effect was evident by a decrease in photosynthetic C^{14} products in the higher concentrations, while in the lower concentrations an increase was found in the photosynthetic activity. This phenomenon of enhancement of a physiological process (termed the Arndt-Shalt effect or hormesis) indicates indirect harmful effects of low concentrations of crude oil to the flora and fauna of coral reefs.

S E S S I O N I V

THE RED SEA ENVIRONMENT - BIOLOGY

IV-22. CORAL REEF COMMUNITY STRUCTURE AT AL-GHARDAQA, RED SEA

Edward S. Hodgson
Department of Biology
Tufts University
Medford, Massachusetts, USA

Studies on the coral reefs near Al-Ghardaqa, Red Sea, raise many unsolved questions that are of significance for understanding the structure and organization of reefs throughout the world. Early studies on deposition and breakdown of coral limestone at Abu Fanadir and nearby areas provided valuable insights concerning the undercutting and shaping of coral cliffs, but the exact roles of organisms involved in these processes are still in dispute. Interactions of alcyonarians and stony corals are particularly interesting in the Al-Ghardaqa area and may help explain the apparent competition between soft and hard corals as well as some zonations observed in other areas. Allelochemical interactions between species on the reefs at Al-Ghardaqa and elsewhere in the Red Sea have been indicated by many observations; however, the details of the mechanisms remain poorly understood. Behavioral and electrophysiological evidence obtained during analyses of some of these problems will be presented. Further research on the reef community structure should prove helpful for fisheries utilization and for conservation efforts.

IV-23. ASPECTS OF ADAPTATION OF HERMATYPIC CORALS AND THEIR ENDOSYMBIONTIC ZOOXANTHELLAE TO LIGHT

Z. Dubinsky, P. Falkowsky* and D. Sherf
Life Sciences Department
Bar-Ilan University
Ramat-Gan, Israel

Stylophora pistillata is the dominant hermatypic coral in intensely illuminated waters in the Gulf of Âqaba. Individuals of the same species, found in shaded crevices, look markedly darker than their high-light counterparts. While the number of zooxanthellae per unit area remains constant, the pigment content of the algal cells varies up to four-fold. This change is due to increase in size and the number of photosynthetic units.

The photosynthesis versus light curves of light- and shade-adapted corals differ in both quantum yield and light-saturated rate of photosynthesis.

Corals were successfully transferred from light to shade and vice versa, and adapted to their new light environments in about six weeks.

*Brookhaven National Laboratory, Upton, New York, USA

VI-24. SEASONAL CHANGES IN GROWTH RATES OF A RED SEA CORAL POPULATION

Yossi Loya
Department of Zoology
The George S. Wise Center for Life Sciences
Tel Aviv University
Tel Aviv, Israel

The linear growth of hermatypic coral, *Stylophora pistillata*, was studied in the northern Gulf of Aqaba, Red Sea in shallow water. The geometric mean radius ($\bar{r}$) of the colonies served as a criterion for successive growth measurements during a period of three years. The youngest colonies (size group $\bar{r}$ = 0.5 - 2.0 cm) exhibited a significantly faster growth rate during summer (10 - 15 cm 10^{-2} increase in $\bar{r}$ per month) than during winter (2.0 - 6.0 cm 10^{-2} increases in r per month). No significant differences in growth rates were recorded between larger size groups ($\bar{r}$ > 2.0 cm) between summer and winter periods. The average water temperature during the summer months is 25° - 26°C, while that of the winter months is around 20° - 21°C. *S. pistillata* starts to develop gonads during early summer and the age of first reproduction is around two years old. It is suggested that optimal summer water temperatures induce a faster growth rate in small colonies ($\bar{r}$ < 2.0 cm) which are not in a reproductive state. In larger colonies, however, it is suggested that during the summer energy is channelled into a build-up of sexual cells rather than growth and, hence, there is no significant difference in growth rates between summer and winter corals of the same size group.

IV-25. CONSUMPTION AND ASSIMILATION OF CORAL MUCUS BY THE BURROWING MUSSEL *LITHOPHAGA LESSEPSIANA*

Avi Shafir and Yossi Loya
Department of Zoology
George S. Wise Faculty of Life Sciences
Tel Aviv Universisty
Tel Aviv, Israel

The complex coral zooxanthalae may be regarded as a net autotroph and, as such, it is considered trophically as a source of primary productivity. Energy is tightly recycled within this complex but it is not 100% efficient, mainly due to loss by mucus secretion. Mucus "flocs" are being released to the water column as a result of extensive bacterial activity, coupled with water movement. The "flocs" become part of the POM and, hence, are potentially available as an energy source for various reef organisms.

Lithophaga lessepsiana burrows into skeletons of live colonies of *Stylophora pistillata* the commonest coral species of the Gulf of Aqaba. The mussel actively maintains an outlet to ambient water, a fact which enables it to spawn and filter feed. The pumping activity takes place on the tissue surface which is mucus rich.

To assess the impact of mucus consumption and assimiliation by *L. lessepsiana* a quantitative study consisting of field and laboratory experiments was conducted.

S. pistillata colonies were labelled in situ with $NaH^{14}CO_3$ for 24-48 hours, their mucus extracted into filtered sea water. Feeding experiments in controlled temperature conditions, ranging from 22° to $27^{o}C$ (reflecting season fluctuations in the Gulf) were carried out, pointing out a marked body size - temperature dependency of mucus consumption. Assimilation efficiency ranged between 40-48% for *S. pistillata* mucus as opposed to 29-32% when a concentrated medium of chlorella algae was used as a food source. The mucus of *Fungia*, which consists of long and thick flocs, was hardly consumed.

IV-26. ALTERNATE STABLE STATES OF POPULATIONS OF *ECHINOMETRA MATHAEI* (DE BLAINVILLE) (ECHINODERMATA: ECHINOIDA) IN THE GULF OF SUEZ AND THE GULF OF AQABA

John M. Lawrence
University of South Florida
Tampa, Florida, USA

Eleven species of echinoids have been reported to occur in both the Gulf of Aqaba and the Gulf of Suez. Nine species of echinoids are found in the Gulf of Aqaba, but not in the Gulf of Suez; another nine species are found in the Gulf of Suez, but not in the Gulf of Aqaba. This difference in distribution should have a basis in the physical and biological characteristics of the two gulfs. *Echinometra mathaei* (de Blainville) seems to grow faster, reach a larger size, and possibly live longer in the Gulf of Suez than in the Gulf of Aqaba. These two gulfs provide a unique opportunity to analyze the control of distribution, abundance and biological characteristics of echinoids.

IV-27. PRIMARY PRODUCTION IN THE CENTRAL RED SEA OFF JEDDAH

Naim M. Dowidar
Department of Oceanography
Faculty of Science
University of Alexandria
Alexandria, Egypt

Monthly measurements of phytoplankton production in the Red Sea were carried out for 12 consecutive months at one station located 8 km off Sharm Obhur, Jeddah, Saudi Arabia, where the water depth was about 750 meters.

Primary productivity was measured by in situ experiments using the C-14 method at the following depths: 0.2, 25, 50, 75, 100 and 150 meters. The standing crop of phytoplankton was measured by the chlorophyll a method.

The annual cycle showed two maxima, i.e., in winter and in summer. The integrated values of C-14 uptake in the euphotic zone (75 m) during these maxima varied between 51.75 mg $C/m^2/hr$ in January and 43.38 mg $C/m^2/hr$ in July. During these periods surface values varied between 1.25 mg $C/m^3/hr$ in January and 2.4 mg $C/m^3/hr$ in July. Apart from the periods of maximum production, high values of C-14 uptake occurred at sub-surface layers, mostly at 25 m depth. During autumn and spring, values of C-14 uptake were remarkably low, particularly in autumn; the minimum was 8.5 mg $C/m^2/hr$.

The distribution of chlorophyll a showed nearly the same pattern. Surface values varied between maxima of 0.51 mg/m^3 in January and 0.85 mg/m^3 in October. The integrated values under m^2 followed the same trend and ranged between 36.88 mg/m^2 in January and 5.13 mg/m^2 in October. The data are discussed in relation to the prevailing environmental conditions and species composition of phytoplankton.

IV-28. MICROPLANKTON DISTRIBUTION PATTERNS IN A TROPICAL MARINE ENVIRONMENT: GULF OF AQABA, RED SEA

Baruch Kimor
Israel Oceanographic & Limnological Research
Haifa, Israel

Standing crop estimations based on numerical abundance of Cyanophyta, Pyrrhophyta and Bacillariophyta of the phytoplankton and of the tintinnina of the microzooplankton in several segments of the water column were determined at a reference station in the Gulf of Aqaba, Red Sea, over a one-year period.

The highest numerical abundances of the leading species were recorded in the euphotic zone (200 m), gradually decreasing with depth. However, the Cyanophyta were limited to the upper 50-100 m while the Pyrrhophyta and Bacillariophyta were more evenly distributed in the water column (600 m depth).

The two seasonal peaks caused by Cyanophyta during the cooling of the surface waters in November and their warming in May-June alternated with the major peaks of Bacillariophyta and Phyrrhophyta during February and March when low homothermic conditions prevailed in the whole water column. The tintinnina followed closely the latter pattern, although they are known to feed chiefly on nannoplankton.

The summer months, characterized by a weakly-defined thermocline located between 200-400 m, showed a low production of Bacillariophyta and Pyrrhophyta in the euphotic zone, a pattern common also to other oligotrophic marine environments such as the Sargasso Sea.

IV-29. ANIMAL TREES, STONE PLANTS, AND TOY FISH: THE CHALLENGES AND SIGNIFICANCE OF CORAL REEF FISH COMMUNITIES

C. Lavett Smith
The American Museum of Natural History
New York, New York, USA

Reef environments are a renewable natural resource of great economic, aesthetic, and scientific value. The most important uses of reefs are fishing, tourism, research and exploitation or destruction through dredging, mining and construction activities. Accidental pollution, sometimes from distant sources, also threatens reef environments. The time has come not only to protect reefs but to manage them for the maximum benefit and sustainable yield. Because reef organisms have mobile life history stages, the most important part of any management attempt will be to set aside refuge areas that can serve as natural hatcheries and act as a source of organisms to replace those harvested and lost to natural mortality. Other uses can then be given appropriate priority on a local basis.

IV-30. ECOLOGY AND SOCIOBIOLOGY OF SYMPATRIC COEXISTENCE IN TWO SPECIES OF *DASCYLLUS* (POMACENTRIDAE)

Muki Spigel and Lev Fishelson
George S. Wise Faculty of Life Sciences
Tel Aviv University
Tel Aviv, Israel

The coral reefs of the northern Red Sea are the dwelling places for almost 30 species of fish of the Pomacentridae, and many of them coexist on the same site, utilizing the habitat in a very similar way. This paper deals with the question of how such coexistence of sympatric species occurs, especially in the Genus *Dascyllus* which are specialists occupying branching coral colonies.

As found out *D. aruanus* and *D. marginatus* form disruptive populations, organized in small harems of single males and groups of females, living permanently in *Stylophora* and *Acropora* corals. Each harem consists of 4 sexual casts, a -male, females, sex-changing fish and juveniles. The dynamics of the social structure are controlled by the presence or absence of a dominating male. In some 150 corals occupied by mixed groups of both species, only those females spawn of which the dominating male exists.

This paper describes the fish propagule settling mechanisms that produce such handicapped situations. An analysis is also presented showing how coral dispersion and predator pressure modulates such complicated reproduction and survival strategies.

IV-31. THE ROLE OF FISHES IN THE STRUCTURING OF CORAL REEF COMMUNITIES

Gerald J. Bakus
Allan Hancock Foundation
University of Southern California
Los Angeles, California, USA

Tropical reef fish are largely responsible for reducing the standing crops of benthic algae to relatively low levels. Rasping fish create a high degree of patchiness on coral reefs and contribute to high levels of species diversity. Concealment from potential fish predators by coral reef invertebrates takes place by boring and burrowing, symbiotic associations, nocturnal activities, and cyyptofaunistic concealment within the habitat. Protective and defensive mechanisms of exposed coral reef invertebrates include large size, more often skeletal and tube protection, rapid movement, cryptic coloration and form, and probably most frequently noxious, toxic and venomous defense mechanisms.

IV-32. ANALYSIS OF A CORAL REEF FISH COMMUNITY IN SHALLOW COASTAL WATERS OF NUWEIBA, GULF OF AQABA

A. Ben-Tuvia and A. Baranes
Department of Biology
The Hebrew University of Jerusalem
Jerusalem, Israel

A fish community was studied in an area covering about 500 square meters at a depth of 3-6 meters near Nuweiba, Gulf of Aqaba. During repeated underwater observations, counts were taken of the fishes encountered and their approximate sizes recorded in each of the following sections: (1) reef table; (2) fore-reef wall; (3) coral patch (knoll); and (4) flat patch covered by *Halophila stipulacea*. During the study some behavioral and dietary activities of the various species were observed. From the available data an estimate was made of the biomass of the diverse groups: residents and non-residents, herbivores, planktivores, carnivores, and omnivores. For identification and stomach content analyses, collections were made at similar nearby biotopes. In total, the presence of about 150 species was recorded in the investigated area.

IV-33. SAND-DIVING BEHAVIOR AND TERRITORIALITY OF THE RED SEA RAZOR FISH, *XYRICHTYS PENTADACTYLUS*

Eugenie Clark
Department of Zoology
University of Maryland
College Park, Maryland, USA

The behavior of the razor fish, *Xyrichtys pentadactylus*, was studied during June and July 1977 at Marsa el Mu.ibela on the east coast of the Gulf of Aqaba. A grid of 2400 m^2 was laid in the sand. The home ranges and territories of 11 males and 31 females of *X. pentadactylus* inhabiting the area were mapped. Individual males were easy to distinguish by the pattern of 4 to 6 large red spots over the gill region. One male may share its territory with as many as five females. Males defend their territories with an aggressive "confrontation run" (swimming parallel with erect dorsal fins) along the boundary between adjacent territories. Dominant females help defend territorial boundaries and it is suggested that such females have the potential of turning into males.

When threatened, *X. pentadactylus* dive into the sand and stay submerged for periods of 6 seconds to over 10 minutes. When threatened by a diver approaching along the sea bottom, the fish stays under the sand longer (about 2.5 to 2.8 minutes, 10 seconds to 5+ minutes, N = 181) than if a diver approaches downward from the surface (about 31 to 52 seconds, 6 seconds to 5+ minutes, N = 144).

Sexual behavior, mating, and intra- and inter-specific sharing of dive sites were observed. *X. niger* individuals, normally living outside the grid-study area, when chased by divers into the grid area dove into specific dive sites of *X. pentadactylus*. *X. niger* and 2 other species (not yet determined) of *Xyrichtys* were observed in deeper water and appeared to have larger territories than *X. pentadactylus*. Species of *Xyrichtys* are often associated with garden eel colonies.

IV-34. VARIATION IN *VINCIGUERRIA NAMBURI* (PISCES: PHOTICHTHYIDAE) WITH COMMENTS ON THE STATUS OF THE RED SEA POPULATION

Robert Karl Johnson
Department of Zoology
Field Museum of Natural History
Chicago, Illinois, USA

The photichthyid genus *Vinciguerria* contains four currently recognized species of which two, *Vinciguerria lucetia* (limited to the eastern Pacific) and *V. nimbaria* (broadly tropical-subtropical in all three oceans) are discussed in this paper. Evidence is presented that the population of *Vinciguerria* inhabiting the Red Sea is a third distinct species in this group. Specimens from the Red Sea differ in meristic, morphometric, qualitative and developmental characters from *lucetia*, and *nimbaria* but differ most notably in serial photophore and vertebral counts (Red Sea specimens exhibit the lowest total counts known for samples of *nimbaria*/*lucetia*). Marring this distinctiveness is the possibility of temperature effects on meristic character values and lack of synoptic (seasonal or geographic) material from the Red Sea. The possible conceptual importance of polytypy in *V. nimbaria* in terms of our understanding of broad scale patterns in open ocean distribution is mentioned.

IV-35. A NEW RECORD OF *SARDINELLA AURITA* VALENCIENNES, 1847 (TELEOSTEI: CLUPEIDAE) FROM THE EASTERN PART OF THE ARABIAN SEA: A POSSIBLE IMMIGRANT THROUGH THE RED SEA

S. Dutt and K. Varahala Raju
Department of Marine Living Resources
Andhra University
Visakhapatnam, India

Nine species of the genus *Sardinella* Val., 1847 have been recorded from the coastal waters of mainland India. In the course of a taxonomic study of *Sardinella* spp. from both coasts of India, *S. aurita* has now been recorded from Quilon on the west coast. It is most closely related to *S. longiceps* Val., 1847 but can be distinguished from the latter by its shorter head, shorter postorbital part of head, shorter predorsal, prepelvic and preanal length and by the lower number of gillrakers in specimens of the same length.

Although *S. aurita* is the most widespread of all the *Sardinella* spp. (being represented in the tropical Atlantic, the Mediterranean and the western central Pacific), it was only recently recorded from the Indian Ocean where it is believed to be replaced by *S. longiceps*. The present record of *S. aurita* in small numbers in the eastern part of the Arabian Sea leads one to hypothesis that it has perhaps spread southward from the eastern Mediterranean through the Suez Canal and Red Sea.

There are quite a few records of the migration of Red Sea fishes to the Mediterranean through what has been called Lessepsian migration, but relatively few studies of establishment of Mediterranean species in the Red Sea and further south in the Arabian Sea.

IV-36. BIOLOGICAL STUDIES ON FISHES OF FAMILY SERRANIDAE FROM THE NORTHWESTERN REGION OF THE RED SEA

M. Mohamed Ghorab*, A. Refai Baycumi and A. Ali Hassan*
Zoology Department, Faculty of Science
Ain Shams University* & Institute of Oceanography and Fisheries
Cairo, Egypt

In the present study, fishes belonging to the family Serranidae were collected from the northwestern region of the Red Sea. They were carefully studied and referred to their genera and species. Three genera and 13 species of the serranid fishes were studied. Three other species are still under investigation. Keys and geographic distribution are also given.

IV-37. A COMPARATIVE STUDY OF THE NATURAL RESISTANCE OF COMMERCIAL WOOD SPECIES AGAINST MARINE BORERS IN EGYPTIAN WATERS

M. A. Ghanem and A. A. Alsayes
National Research Center & Institute of Oceanography and Fisheries
Cairo, Egypt; Alexandria, Egypt

For many purposes wood is the ideal material of construction and often may be used without any protective treatment. The natural resistance in Egyptian waters of live common commercial woods against marine borers was investigated from June 1978 to May 1979. The results showed the superiority of labbeck and mahagony over pine and pitch pine in resisting marine borer attacks. The Suez area can be recommended as a good locality for testing wood as well as antiborer treatments.

IV-38. RED SEA PHOLADACEA - NEW TECHNIQUES, NEW PROBLEMS

Ruth D. Turner
Mollusk Department, Museum of Comparative Zoology
Harvard University
Cambridge, Massachusetts, USA

Red Sea bivalves have not been studied as thoroughly as the gastropods, and the pholadaceans have been virtually untouched. Gohar and Soliman treated the coral borers but these included only mytilids and gastrochaenids. Based on the literature (mainly concerning Aden) and specimens dissected from collecting panels exposed at Eilat only, eight species of Teredinidae and two Pholadidae are known from the Red Sea. Though the pallets and shells of the specimens on which these records were based were all examined, there now appear to be problems in the identification of some of them. Recent life history studies have revealed "look-alike-species" with different reproductive patterns which can only be distinguished when they are carrying young in the gills. *Lyrodus pedicellatus* (Quatrefages), *Lyrodus massa* (Lamy), and *Teredo furcifera* von Martens, all recorded from the Red Sea, are members of three different "species pairs". The ability to rear species through several generations in the laboratory, electron microscopy, and other new techniques are allowing refinement of the classification of these highly specialized borers and new insights into their evolution.

IV-39. THE GULF OF SUEZ: A FINGER OF TROPICAL MARINE LIFE IN A TEMPERATE REGIME

John S. Pearse
Center for Coastal Marine Studies
University of California
Santa Cruz, California, USA

The Gulf of Suez is the north-western-most portion of the vast Indo-Pacific tropical marine province. Almost all species in the gulf are found across the Indo-Pacific. Yet, because of its northerly position and shallow topography, the gulf is decidely temperate in character. Many widespread echinoderms reach the mouth of the gulf, but hardly penetrate the final 300 kilometers into it. At least one species, the sea urchin *Echinometra mathaei*, reproduces nearly year round at Al-Ghardaqa and most other areas of the Indo-Pacific, but only in the summer near the head of the gulf. The gulf environment may place extreme physiological stress on the resident species, particularly if there is open genetic exchange with more tropical populations. Identifying such stresses, and how they differentially affect different species, may provide important insight into problems of marine biogeography, dispersal, and the invasion of the Indo-Pacific species into the Mediterranean through the Gulf of Suez and the Suez Canal.

S E S S I O N V

RED SEA RESOURCES

V-40. APPLICATION OF LANDSAT SATELLITE IMAGES IN MAPPING RED SEA COASTAL AREAS, EGYPT

Mohamed Abdel Hady
Remote Sensing Center
Academy of Scientific Research and Technology,
Cairo, Egypt

Abstract Not Available

V-41. GEOLOGY OF THE RED SEA AND ITS BEARING ON MINERAL AND ENERGY RESOURCES

E. M. El Shazly
Nuclear Materials Corporation
Cairo, Egypt

The geology of the Red Sea is discussed from the Upper Proterozoic to the Holocene. There is evidence dating back from the Upper Proterozoic which illustrates the early history of the Red Sea. More substantial evidence is available which highlights its geological and tectonic development since the Cretaceous, and in particular since the Miocene when the Red Sea started to gain its independence from the Realm of the Tethys.

The constitution and thickness of the earth's crust underlying the Red Sea is of special significance in its geological and tectonic history, and accordingly in its mineral and energy resources. From its peripheries to the axial trough, the earth's crust changes from a continental to a thinner crust. The latter is interpreted by some scientists as an oceanic crust; the author believes that it is not, at present, an oceanic crust, but rather is moving in this direction, i.e., an oceanic crust is being born under the Red Sea axial trough.

The presence of a relatively thin crust initiates certain processes which lead to important manifestations of geothermal energy, hot brines and sediments with potentially economic mineral resources, fractionation of petroleum, recrystallization of olivine into gem peridot, etc. A broad view is presented regarding the mineral and energy resources of the Red Sea especially in relation to its geology and tectonics.

V-42. MINERAL RESOURCES AND THE DEVELOPMENT OF THE EGYPTIAN RED SEA COASTAL AREA

Atef H. Sabet
Egyptian Geological Survey and Mining Authority
Cairo, Egypt

More than 300 mineral deposits and ore occurrences are now known in Egypt. The annual production of mining activity during the last nine years shows that phosphates and Bahariya and Aswan iron ores make up nearly half of the national income from the mining industry, and that the various minerals mined from scattered small mines in the Red Sea hills in the Eastern Desert contribute only 4 to 5% of the total income. Among the various reasons for this are their small size, remote location away from the Nile valley and the lack of infrastructures, energy and water. This situation can be changed and even reversed if more attention is paid to the immediate exploitation of the relatively big mineral deposits for which the detailed exploration work has been completed, particularly the tin rare metal deposits of Abu Dabbab and Nuweibi, the ilmenite deposit of Abu Chalqa and the gold deposit at Barramiya. The yearly revenue of mining 1.8 million tons of Abu Dabbab ore, for example, is estimated to be 70 to 80 million dollars.

Since the aim of any developing country is to present for exploitation its mineral deposits required for the consumption of its developing industry for the exterior market, it is proposed to establish along the Red Sea coast seven mining centers, each covering a specific region, to enable exploitation of the scattered small mineral deposits in each region. This will promote the planning of the infrastructures of every region, considering the balance of the total demands for transport and communication facilitites, generation and distribution of energy supply settlements and living areas.

1-43. RECENT STUDIES OF DEEP SEDIMENTS FROM THE RED SEA HOT BRINE REGION: A PRELIMINARY REPORT

Atef A. Moussa
Institute of Oceanography and Fisheries
Alexandria, Egypt

Sampling was conducted in the Atlantis II deep and in the southern vicinity of the hot brines. Preliminary microscopic studies were made, on the basis of which, composition and texture of sediments were defined. Bromine, rubidium, and strontium contents were determined by x-ray fluorescence.

Sediment texture is uniform throughout the core, composed dominantly of silty clay. The main types forming the sedimentary sequence of the core are terrigeno-biogenous, terrigenous slightly metalliferous and terrigenous metalliferous sediments. The metalliferous layer is about 175 cm and was found near the base of the core. High values of Br and Rb were restricted to the metalliferous sediments. The highest SR values were found in the upper 50 cm of sediments. The results give some indication of the invasion in past geological times by hydrothermal solutions or a brine enriched by metals.

V-44. FRESH WATER AND ELECTRIC POWER FROM THE HOT BRINE ZONES IN THE RED SEA

Selim F. Estefan
National Research Center
Cairo, Egypt

Water shortages are likely to be particularly severe in the Egyptian Red Sea shore. Most surface waters in this area are already allocated, often for municipal use or partly for minor irrigated agriculture. Water availability and water quality impacts are, therefore, among the most critical associated with expanded energy and industrial developments. This is due to both physical and socio-political factors. If large-scale energy and mineral resource development does take place, water supplies are inadequate to meet the increased demands of all users over the next twenty years, and this will intensify existing political conflicts over water resource management.

Fortunately, "OTEC" technology seems promising to help provide both fresh water and power in the Red Sea province at reasonable cost.

It seems technically feasible to operate an "inverted" OTEC technique utilizing the thermal energy represented in the temperature gradient of 22.2°C between the upper and the intermediate layers of the hot brine to harness power engines, with some modifications required for corrosion control when treating brines of extremely high salinites. Large floating OTEC power plants, located opposite populated areas, could extract tremendous quantities of ocean thermal energy and transmit fresh water and electric power to the shore via pipes and submarine cables. Industrial, mining, and social developments of the entire Red Sea province could soon become a reality.

V-45. HYPERHALINE COMMUNITIES OF THE RED SEA AND ARABIAN PENINSULA AND POTENTIAL EFFECTS OF BRINE DISPOSAL

John T. Hardy
Marine Research Laboratory
Battelle, Pacific Northwest Laboratories
Sequim, Washington, USA

Bays, lagoons and pools of highly elevated salinity are common along the coasts of the Red Sea and Arabian Gulf. These natural environments provide models of the changes in biota which could result from brine disposal in nearshore areas. Studies in the Middle East indicate that as salinity increases beyond 70‰, some sea grass, invertebrate species and a few fish continue to thrive. However, in hyperhaline waters above 100 to 150‰, most species are eliminated and the resultant community consists of a few species of plankton, benthic algal mats and nematode worms.

Brine discharges from desalination plants and oil field separators are generally diluted rapidly with coastal waters. However, because they are of high density and frequently contain high concentrations of toxic substances, brine effluents can potentially result in harmful impacts on benthic marine communities.

V-46. RED SEA CRUSTACEANS OF ECONOMIC IMPORTANCE

M. M. A. El-Hawary
Institute of Oceanography and Fisheries
Alexandria, Egypt

There are a number of crustaceans in the Red Sea which are very important economically as a source of protein and of foreign currency. Some of these are: prawns, shrimps, lobsters, and crabs.

As a result of a sharp decline in the production of these crustaceans, efforts to increase the number of fisheries and to develop new methods and devices were begun in 1972. These are discussed by the author.

V-47. REPRODUCTIVE BIOLOGY OF THE SPEAR SHRIMP, *PARAPENEOPSIS HARDWICKII* (MIERES, 1878) (CRUSTACEA: DECAPODA: PENAEIDAE)

R. Nagabhushanam and G. K. Kulkarni
Department of Zoology, Marathwada University
Aurangabad, India

Monthly records of female *Parapeneopsis hardwickii* (Mieres, 1878) revealed that they breed throughout the year with high breeding activity during January to May. Seasonal biochemical changes in the ovary and hepatopancreas during the ovarian cycle showed that a considerable amount of energy is transferred from the hepatopancreas to the ovary during vitellogenesis. The blood glucose levels of shrimps showed a direct relationship with developmental stages of the ovary.

Effects of bilateral eyestalk extirpation and injections of eyestalk (ES), brain (Br) and thoracic ganglia (ThG) extract on the ovarian development of the eyestalkless and normal *P. hardwickii* were also investigated. There was a significant increase in the ovarian indices (OI) and ovarian diameters (OD) following ES ablation (Group II) and injections of BR (Group IV) and ThG (Group VII) extracts in the shrimps of Group II whereas a significant downfall in OI and OD was found after the administration of unboiled ES extract (Group V) when compared to normal control animals (Group I). Associated biochemical changes in the ovaries were estimated. There was a significant increase in total glycogen and lipid concentrations and decrease in protein content of shrimps in groups II, VI, and VII while a reverse condition was found in the forms of Group V. In normal shrimps of the second set of experiment a significant augmentation in OI and OD after BR (Group D) and ThG (Group E) extract injections was also observed, whereas, ES extract (Group C) reduced them considerably. A noteworthy hike in total glycogen and lipid content and a decline in protein quantity was noticed in the ovaries of shrimps in Groups D and E, but an antagonistic situation was observed in the ovaries of animals in Group C as compared to untreated normal control individuals (Group A).

V-48. MORPHOMETRIC STUDIES ON THREE SPECIES OF THE GENUS *SEPIA* FROM THE RED AND MEDITERRANEAN SEAS

Waheed M. Emam
Zoology Department, Faculty of Science
Ain Shams University
Cairo, Egypt

Specimens of the cuttlefish *Sepia savignyi* Blanaville, 1827, and *Sepia pharaonis* Winckworth, 1936 (common in the Red Sea); and *Sepia officinalis* Linn., 1758 (common in the Mediterranean Sea) were collected from January 1979 to December 1980 and studied morphometrically. Length-frequency, weight-length relationship, sex ratio, changes in body shape and shell measurements with age are discussed for each of the species. A total of 935 specimens were collected and 21 morphometric characters and indices were recorded. The material examined includes 222 specimens of *S. savignyi*; 267 of *S. pharaonis* obtained from the Suez Bay area, Red Sea; and 446 specimens of *S. officinalis* from Alexandria's eastern harbour on the Mediterranean Sea.

The morphometric data obtained from all of these studies will provide useful information for the identification and classification of most size groups of the species under investigation. In addition, they tend to illustrate differences between male and female animals which are not adequately presented in the literature. Such data are necessary because most taxonomic keys provide only values for adults or individual of the species considered.

V-49. CARCINOLOGICAL STUDIES IN PAKISTAN

Nasima M. Tirmizi and Quddusi B. Kazmi
Institute of Marine Biology
University of Karachi
Karachi, Pakistan

The paper gives an overview of the work done on the marine crustacea of Pakistan, particularly the higher crustacea viz. Stomatopoda and Decapoda. The studies carried out so far are mostly faunistic. It is evident from them that there is a dire need for taxonomic work...the fauna being almost unknown. To date, 19 species of stomatopods and about 250 of decapods have been obtained. They are housed in the Invertebrate Reference Museum (Karachi) which has been recently established.

Apart from taxonomic work, several species have been successfully reared under laboratory conditions through all the larval stages. Some anatomical and morphological studies have also been made. Work on post-larvae and juveniles is also in progress.

Very recently a project has been launched for the sole purpose of exploring the crustaceans inhabiting the mangrove swamps near Karachi.

V-50. PARASITE INVESTIGATIONS ON FISHES OF THE NORTHERN RED SEA

A. Diamant and I. Paperna
H. Steinitz Marine Biology Laboratory
The Hebrew University of Jerusalem
Eilat, Israel

Rapid development of extensive fish culture has emphasized the importance of fish disease as a major limiting factor in marine farming. A deepening knowledge gap has urged investigations of parasitic and microbial agents of warm water culture fishes. Studies aimed at increasingly efficient fish disease diagnosis and control have been carried out at the H. Steinitz Marine Biology Laboratory in Eilat for the past decade. Parasitological studies of regional Red Sea fishes were performed and the parasite fauna documented. Seasonal cycles of infection and epizootology of *Lernaeenicus cerebrus* (copepoda) parasitic on two species of atherinids were determined. Parasites of grey mullet were investigated, with special attention directed to *Heterophyes* spp. and its intermediate gastropod host, *Pirenella conica*. Parasitical investigations of rabbitfish (*Siganus* spp.) are presently under way to evaluate the host-parasite relationships and their impact on potential prospects of culturing these fish.

V-51. THE SHARK FAUNA OF THE RED SEA

Leonard J. V. Compagno
Tiberon Center for Environmental Studies
Tiberon, California, USA

The shark fauna of the Red Sea is remarkably depauperate, with 3 orders, 11 families, and only 29 species currently known. In contrast, the western Indian Ocean (FAO Fisheries Area 51) includes all 8 orders of living sharks, 23 families and at least 126 species. The Red Sea fauna is extraordinary in having no endemic shark species; no members of the orders Hexanchoformes, Squaliformes, Pristiophoriformes, Squatiniformes, and Heterodontiformes; virtually no deep water or benthic or oceanic species except *Zaprotomenon* (a species specialized for low oxygen levels); no members of the family Scyliorhinidae (a family particularly rich species in the western Indian Ocean); and a relatively universe coastal and epipalgic species. Fifty-two percent of the Red Sea species of sharks are in the family Carcharhinidae (far higher than in the western Indian Ocean which has 25% Carcharhinidae), 69% of the Carcharhiniformes, 14% in the order Lamniformes, and 17% in the Orectolobiformes. Epipelagic species or species that are both coastal and epilagic make up 17% of the Red Sea shark fauna, specialized bottom dwellers about 15%, deep water benthic or epibenthic species 3%, and coastal-literal-pelagic species the remainder.

V-52. THE TOXICITY MECHANSIM OF THE FISH TOXIN, PARDAXIN, ISOLATED FROM THE RED SEA FLATFISH *PARDACHIRUS MARMORATUS*

Naftali Primor and Jose A. Zadunaisky
Department of Physiology and Biophysics
New York University Medical Center
New York, New York, USA

The ichthyotoxic mechanism of pardaxin, the toxin isolated from the secretion of the Red Sea flatfish *P. marmoratus*, was studied in the dogfish shark, *S. acanthias*, and in the isolated gill-like epithelium of the teleost, *F. heteroclitus*.

In the shark, pardaxin administered in the bathing medium temporarily diminished the operculum rate and caused a severe struggling response. In addition, it caused a reversible leakage of urea and sodium between the shark and the seawater. However, when injected into the dorsal artery, pardaxin neither caused a struggling response nor inhibited the operculum rate. Further, no leak of urea or sodium was observed.

In short-circuited operculum epithelium, pardaxin inhibited the Na^+ influx of 2.2 μEq/cm^{-2}/hr.$^{-1}$. This was observed only when pardaxin was administered to the mucosal (seawater) side and not when given to the serosal (blood) side.

The evidence suggests that pardaxin elicits a net sodium influx which is the mechanism of its toxicity in fish.

V-53. PARDAXIN VERSUS DETERGENTS: A NEW APPROACH TO THE DEVELOPMENT OF SHARK REPELLANTS

Eliahu Zlotkin and Yechezkel Barneholz
Department of Zoology
The Hebrew University of Jerusalem
Jerusalem, Israel

The present study supplies preliminary data indicating that synthetic industrial detergents may serve as shark repellents. This finding was an outcome of two main speculative considerations. The first was an assumption that paradaxin (PMC), the toxic fraction derived from the shark repelling skin secretion of the Red Sea flatfish, *Pardachirus marmoratus* affects membranal phospholipids due to its amphipathic-surfactant properties. The second offered the employment of basic methods of behavioral toxinology based on natural and conditioned responses for the bioassaying of shark repellents.

PMC and seven industrial synthetic detergents were assayed for their lethality to pupfishes and repellency to young lemon sharks by prevention of feeding and termination of tonic immobility. It was shown that SDS was about 10 times more effective and TRITON X-100 was at least as effective as PMC.

The low price, extreme stability and modifiability of such substances justify further efforts for the development of a shark repellent.

V-54. FISHERIES IN THE RED SEA

Samir El-Mahdy
Turnkey Engineering Consultants
Agouza, Egypt

The author will examine: (1) the physical characteristics of the sea bed which affect marine life; (2) the present level of exploitation of fish and the potential for the future; and (3) a policy for development of fisheries and aquaculture.

V-55. FISHERIES OF THE RED SEA WITH SPECIAL REFERENCE TO PURSE SEINE FISHING

Ahmad Hamdy Shaheen, Samir Nakhla Faltas and Samy Fayek Youssef
Institute of Oceanography and Fisheries
Cairo, Egypt

The continental shelf of the Red Sea is composed of all of the Suez Gulf and a narrow uneven sea floor outside the gulf.

The fishing gears used until 1959 were mainly trawl nets; purse seine nets for catching pelagic fishes have been commercially used since 1960. The catch of seiners and trawlers contributed 90 to 99% of the Red Sea landings. Fishing in the Suez gulf is intensive and the catch per trip of first class boats had decreased as a consequence of the high number of fishing trips.

The annual catch per seiner decreased from 380 tons in 1963 to 35 in 1973, and increased later after the reopening of the fishing grounds. The catch per night of a seiner decreased with an increase in expanded effort. Therefore, it is proposed to decrease the number of licensed seiners to 35.

Foul Bay was noticed to be higher in pelagic fish abundance as its annual catch per seiner was 182 tons compared with 120 tons in the Gulf of Suez during 1980.

V-56. ADVANCES IN MARINE AQUACULTURE IN THE RED SEA

Hillel Gordin
Mariculture Laboratory
Israel Oceanographic and Limnological Research
Eilat, Israel

The work in the field of mariculture started in Israel in 1970. In 1973 an intensive research and development program was initiated on *Sparus aurata* as a candidate organism for mariculture.

Considerations for selecting this species are discussed.

The work at present in the Eilat Mariculture Laboratory concentrates on the following subjects: nutrition, controlled reproduction, larval rearing, fish disease and fish farming.

The state of the art of the *Sparus aurata* culture is described.

S E S S I O N V I

MANAGEMENT OF RESOURCES AND PROTECTION

VI-57. CONSERVATION OF SEA TURTLES OF THE RED SEA

John G. Frazier
Smithsonian Institution
Washington, D.C., USA

All five species of pantropical marine turtle are reported from the Red Sea, but only *Chelonia* and *Eretmochelys* are documented to nest. Available feeding habitat is suitable mainly for these two, and especially for *Eretmochelys* which is associated with active coral reefs. Populations have probably declined from direct exploitation and from habitat degradation as has occurred round the world, but little is recorded, and much basic information is needed. In the least, general surveys must be conducted. If the situation in the Red Sea is similar to that in the rest of the world, the animals represent a valuable renewable natural resource that is urgently in need of conservation. However, the lack of basic data makes rational management impossible.

VI-58. A STUDY OF LOCAL LEGISLATION FOR THE PROTECTION OF THE AQUATIC ENVIRONMENT

Ahmed I. El Ibyary
Institute of Oceanography and Fisheries
Cairo, Egypt

The modern world is confronted with the problem of air and water pollution as a consequence of progress in civilization. Whatever the efforts of scientists may be in the search for scientific solutions and treatments of pollution and the effects of pollutants and its hazards, they are not sufficient, per se, and need to be accompanied by legislation. There should also be a general awareness of keeping the environment clean and suitable for all living creatures.

This study is a preliminary attempt to shed light on Egyptian legislation aimed at controlling pollution of the aquatic environment and protecting society from the consequences of existing pollution.

VI-59. AN EGYPTIAN-UNITED STATES PROJECT FOR STUDY OF POLLUTION IN SALINE WATERS OF EGYPT

Gerald E. Walsh
Environmental Research Laboratory
U.S. Environmental Protection Agency
Gulf Breeze, Florida, USA

The Institute of Oceanography and Fisheries of the Egyptian Academy of Scientific Research and Technology, in conjunction with the U.S. Environmental Protection Agency (EPA), conducts studies on pollution of the saline waters of Egypt. Funded under EPA's PL-480 program, the research project entitled "Investigation of Level and Effects of Pollutants in Saline Lakes and Littoral Marine Environments" identifies effects of pollution at laboratories on the Mediterranean Sea, Red Sea and Lake Qarun. Basic studies on the biology and chemistry of each area are conducted and laboratory tests done on specific pollutants.

Pollution problems are different at each laboratory site, and research objectives have been planned with regard for local conditions and interests of staff researchers. At the laboratory in Alexandria, effects of pollution by industrial and municipal wastes in coastal lakes and the coastal Mediterranean are studied in the field and by laboratory bioassays. Extensive chemical analyses and a strong computer program complete the overall project. At the Red Sea, the laboratory at Al-Ghardaqa conducts field and laboratory studies on effects of oil on benthic and pelagic organisms and conducts chemical analyses for pollutants in water and sediments. Agricultural chemicals and their effects on production by plants and animals are studied in the field laboratory and at Lake Qarun, a saline inland lake. This research project, which began in late 1977, will continue into 1982. It is hoped that identification of pollutants and their effects on life in the saline waters of Egypt will lead to development of programs for pollution abatement in these highly productive environments.

VI 60. MANAGEMENT OF EGYPTIAN RED SEA MARINE RESOURCES

David A. Ferguson
Fish and Wildlife Service
U.S. Department of Interior
Washington, D.C., USA

Of the eight countries bordering the Red Sea, the Arab Republic of Egypt plays a dominant role in managing and protecting the resources of this region. The Egyptian portion of the Red Sea is examined in terms of its living natural resources, environmental problems and threats to the ecosystem. The government of Egypt's responses to these problems and some recommendations concerning the existing laws, policies and practices are discussed.

S E S S I O N V I I

REGIONAL COOPERATION AND DEVELOPMENT

VII-61. THE NEED FOR DEVELOPING REGIONAL COOPERATION

S. M. A. Tirmizi and N. M. Tirmizi
University of Karachi
Karachi, Pakistan

Almost all of the maritime nations of the world are facing an unprecedented challenge with respect to their marine resources and environment; developing nations, in particular, need special attention.

Pakistan has a coastline of 826 km stretching from the border of India to the border of Iran. It has already established an "Exclusive Economic Zone" up to 200 nautical miles under Pakistan Maritime Zones Act of 1976, and is in accordance with the Draft Convention on the Law of the Sea. We have thus acquired an additional maritime area of 140,000 square miles.

This considerably vast area is of particular interest to biological as well as physical oceanographers for several reasons. The untapped resources and unexplored areas offer: opportunities for research in many fields, the exchange of information through a data center, the study of animal life or natural resources, the assessment of stock, and the evolvement of a programme leading to better management of the seas.

The paper gives a brief resume of marine science in Pakistan. It also stresses the need for regional cooperation and mutual assistance from various interested agencies.

VII-62. A NORTH RED SEA RESOURCE PROJECT: A SCIENTIFIC AND ECONOMIC ENDEAVOR FOR THE DEVELOPMENT OF COASTAL MARINE PARKS AND MARICULTURE

Eugenie Clark and Helen C. Vanderbilt
Department of Zoology, University of Maryland
College Park, Maryland, USA

The extraordinary tropical coast of the north Red Sea includes the most unique, fragile and magnificent coral reefs in the world (e.g., Ras Mohamed at the southern tip of the Sinai peninsula). The rich concentration of marine life on the narrow continental shelf has already attracted hundreds of scientists and thousands of tourists and presents an extraordinary potential for the rapid development of tourism. The north Red Sea is surrounded by a harsh desert coast with no rivers and a rainfall of less than one inch per year. However, new ways to utilize a desert coast for mariculture projects present an exceptional opportunity for the development of another natural resource. It efficiently uses high salinity water and eutrophication of algae (usually considered detrimental) for the highly successful polyculture of fishes and oysters under conditions of intense sunlight. With proper management the north Red Sea could develop its enormous potential with indefinite use of its natural resources. Unfortunately, inadequately managed exploitation of this coast is already seriously damaging the coral reefs, and decimating the marine life. Mismanagement for short-sighted profits could ruin the area for the future. An immediate plan to protect the north Red Sea coastline while developing the great economic potentials of mariculture, tourism and industry is urgent. The authors propose a project to help develop marine parks and reserves while providing a non-destructive alternative to fishing on reefs through mariculture. Some logistic and financial aid is already available, further help is being sought from private and public sources.

VII-63. COOPERATIVE MARINE TECHNOLOGY PROGRAM FOR THE MIDDLE EAST

R. B. Abel and S. Z. El Sayed
New Jersey Marine Sciences Consortium
Fort Hancock, New Jersey, USA

For the past year, groups of scientists in Egypt, Israel, and the United States have been working in a loose cooperative pattern on marine and coastal problems of mutual interest to each other.

Scientists from twenty institutions in the three countries are sharing facilities, equipment, and data in conducting projects in fisheries, aquaculture, lakes management, and shore protection.

Many of the project tasks have their origin in problems caused by the Aswan Dam which, by cutting off a major supply of nutrients and sediment to the Mediterranean, has caused reductions in living resource stocks and drastic shore erosion.

This paper will describe work in progress in the various institutions, how it is addressed to the problems and issues, and the manner in which it is coordinated, under Agency for International Development sponsorship.

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TAGS: SCSA, PEPR, EG, IS, US
SUBJ: INTERNATIONAL CONFERENCE ON MARINE SCIENCE IN THE
- RED SEA APRIL 24-28, 1982

REF: (A) CAIRO 7114, (B) CAIRO 12066

1. SUMMARY: THE RED SEA CONFERENCE FUNDED BY THE U.S. OFFICE OF NAVAL RESEARCH (ONR) AND THE ACADEMY FOR SCIENTIFIC RESEARCH AND TECHNOLOGY (ASRT) WAS HELD TO CELEBRATE THE FIFTIETH ANNIVERSARY OF THE AL GHARDAQA MARINE BIOLOGICAL STATION. OVER 110 PARTICIPANTS FROM EIGHT COUNTRIES PRESENTED NEARLY SIXTY PAPERS ON MARINE SCIENCE IN THE RED SEA. AMONG THE PARTICIPANTS WERE 12 ISRAELIS AND 34 AMERICANS. THERE WERE NO REPRESENATIVES FROM OTHER ARAB COUNTRIES. TOPICS RANGED FROM RED SEA RESOURCES, ENVIRONMENT, AND POLLUTION TO MANAGEMENT OF RESOURCES AND PROTECTION AND REGIONAL COOPERATION AND DEVELOPMENT. THE ISRAELIS WERE WELL RECEIVED AND THE DISCUSSIONS BETWEEN THEM AND THE EGYPTIANS WERE MOST FRUITFUL. MANY PARTICIPANTS COMMENTED THAT THIS CONFERENCE WAS A GIANT STEP TOWARD NORMALIZATION OF RELATIONS BETWEEN EGYPTIAN AND ISRAELI SCIENTISTS. THE FACT THAT THE SINAI WAS RETURNED TO EGYPT DURING THIS CONFERENCE, IN ALL PROBABILITY, CONTRIBUTED TO THE SUCCESS OF THE CONFERENCE. END SUMMARY.

2. DR. IBRAHIM BADRAN, PRESIDENT, ASRT, OPENED THE RED SEA CONFERENCE HELD TO CELEBRATE THE FIFTIETH ANNIVERSARY OF THE ESTABLISHMENT OF THE MARINE BIOLOGICAL STATION AT AL-GHARDAQA. OTHERS WHO MADE OPENING REMARKS WERE CONFERENCE PRESIDENT AND ONE OF THE FOUNDERS OF THE STATION DR. M.A.F. GOHAR, CONFERENCE RAPPORTEUR AND DUKE UNIVERSITY PROFESSOR JOHN D. COSTLOW, DR. GERALD E. WALSH, ENVIRONMENTAL PROTECTION AGENCY (EPA), AND ONR ASSISTANT TECHNICAL DIRECTOR FOR OCEAN SCIENCE, DR. ROBERT S. WINOKUR, WHOSE AGENCY COSPONSORED AND PROVIDED MAJOR FUNDING FOR THE CONFERENCE. FYI: DR. WINOKUR'S PRESENCE AS A SENIOR ONR REPRESENTATIVE WAS APPRECIATED BY THE EGYPTIANS. (REF A). END FYI.

3. OF THE 109 REGISTERED PARTICIPANTS FROM EIGHT COUNTRIES (U.S.A., U.K., FRANCE, ITALY, INDIA, PAKISTAN, ISRAEL AND EGYPT), THIRTY-FOUR WERE AMERICANS AND TWELVE WERE ISRAELIS. THE NEARLY SIXTY PAPERS COVERED THE FOLLOWING TOPIC AREAS:
- RED SEA ENVIRONMENT
- GEOLOGY, PHYSICAL OCEANOGRAPHY
- CHEMICAL OCEANOGRAPHY AND POLLUTION, AND BIOLOGY
- RED SEA RESOURCES
- MANAGEMENT OF RESOURCES
- REGIONAL COOPERATION AND DEVELOPMENT

AS A PART OF THE PROGRAM, PARTICIPANTS VISITED THE MARINE STATION LABORATORIES, MUSEUM, AND SPLENDID LIBRARY. THERE WERE MANY EXCELLENT PAPERS PRESENTED, AMONG THOSE WITH THE BROADEST INTEREST WERE THE FOLLOWING: POLLUTION, MINERAL RESOURCES AND ENERGY, FISHERIES, MANAGEMENT OF MARINE RESOURCES, COOPERATIVE (ISRAELI/EGYPT) MARINE TECHNOLOGY PROGRAM, DEVELOPMENT OF COASTAL MARINE PARKS AND MARINE MARICULTURE. THE PAPER OF DR. EUGENIE CLARK, PROF. OF ZOOLOGY, UN. OF MARYLAND AND MRS. HELEN VANDERBILT WHICH INCLUDED A PROPOSAL TO MAKE RAS MOHAMED AT THE SOUTHERN TIP OF THE SINAI A NATIONAL MARINE PARK (REF B) WAS WELL RECEIVED. THIS PROPOSAL IS CURRENTLY UNDER CONSIDERATION BY THE EGYPTIAN PRIME MINNSTER'S COUNCIL ON ENVIRONMENTAL AFFAIRS.

4. AS WITH MANY PROFESSIONAL CONFERENCES, THE MOST MEANINGFUL EXCHANGES TOOK PLACE OUTSIDE THE CONFERENCE HALL. INFORMAL GATHERINGS AFTER DINNER OF MOST OF THE PARTICIPANTS PROVIDED A VENUE FOR EXCHANGE OF RESEARCH INTERESTS, COMMON PROBLEMS, AREAS OF MUTUAL INTEREST, AND TO DISCUSS POSSIBILITIES FOR CLOSE COLLABORATION. DR. ROBERT ABLE, NEW JERSY MARINE SCIENCES LABORATORY, AND DR. SAYED EL SAYED, TEXAS A AND M UN., HAD SEVERAL EVENING WORKING SESSIONS WITH THEIR EGYPTIAN AND ISRAELI COLLABORATORS TO DISCUSS THE AID-SPONSORED COOPERATIVE MARINE TECHNOLOGY PROJECT.

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5. THE CONFERENCE REPORT, WHICH IS BEING POUCHED TO THE DEPARTMENT (OES AND NEA) CONTAINING FIVE GENERAL RECOMMENDATIONS DRAFTED BY THE EXECUTIVE COMMITTEE, REFLECTS SOME OF THE ISSUES AIRED IN THE GENERAL DISCUSSIONS. RECOMMENDATIONS WERE MADE ON THE FOLLOWING TOPICS:

- 1. POLLUTION;
- 2. ESTABLISHMENT OF PROJECTED MARINE PARKS (E.G., RAS MOHAMED) IN THE RED SEA FOR EDUCATION, TOURISM AND/OR RESEARCH;
- 3. IDENTIFICATION OF AREAS OF RESEARCH ON RED SEA ENVIRONMENT AND RESOURCES;
- 4. REGIONAL COOPERATION
- 5. RESEARCH INFRASTRUCTURE ON THE RED SEA.

RECOMMENDATIONS ESSENTIALLY FOCUSED CONFERENCE ATTENTION ON THOSE AREAS CONSIDERED TO BE OF GREATEST SCIENTIFIC INTEREST, MUTUAL CONCERN, AND PRIORITY FOR CONTINUING AND FUTURE RESEARCH IN THE RED SEA. THE REPORT DID NOT SPECIFY RESPONSIBILITIES OR MODE OF ACTION OF INDIVIDUALS, INSTITUTIONS AND/OR GOVERNMENTS. CONFEREES AGREED THAT SIMILAR INTERNATIONAL CONFERENCES ON RED SEA MARINE SCIENCE SHOULD BE HELD ANNUALLY AND SUGGESTED THAT THE NEXT MEETING BE HELD TO COMMEMORATE THE E.R.S. MABAHITH (U.F. MAURFY) EXPEDITION, LAUNCHED BY EGYPT IN 1935. FURTHER, TO ENCOURAGE MARINE RESEARCH AMONG YOUNG SCIENTISTS, IT WAS RECOMMENDED THAT A PRIZE BE AWARDED EACH YEAR TO THE BEST RESEARCH ON THE RED SEA ACHIEVED WITHIN THAT PERIOD.

6. COMMENT: MOST IMPORTANT WAS THE FACT THAT THE EGYPTIAN AND ISRAELI SCIENTISTS WERE MEETING TOGETHER IN EGYPT WITH A SEEMINGLY SINCERE DESIRE FOR SCIENTIFIC COOPERATION. THE COMMON LANGUAGE WAS SCIENCE. THE COMMON INTEREST AND CONCERN WAS THE RED SEA. WHILE OTHER MEETINGS HAVE BEEN HELD IN EGYPT WITH SMALL NUMBERS OF ISRAELIS, THIS WAS THE FIRST TIME IN EGYPT WHERE CLOSE AMICABLE TIES WERE REALLY ESTABLISHED, PERHAPS BECAUSE OF THE RETURN OF THE SINAI. END COMMENT. ATHERTON