ATOLL RESEARCH BULLETIN

No. 148

ISLAND NEWS AND COMMENT

Issued by

THE SMITHSONIAN INSTITUTION

Washington, D. C., U. S. A.

February 16, 1971

ISLAND NEWS AND COMMENT

Many papers recently submitted for publication in ARB have been in very sloppy condition and have given the editors a great deal of extra work. Some, though the contents were of interest and value, showed evidence of hasty preparation and low professional writing standards. We accepted most of these and tried to improve them so they would not be an embarrassment either to the authors or to the editors. Demands on our time are such that we cannot afford to continue to offer this service. Henceforth, manuscripts received in a condition that requires extensive editing will most likely be returned to the authors for revision.

Briefly, the editoral standards for manuscripts are as follows: They must be typed double-space on letter-size (approximately 8 1/2 x 11 inch--20.5 x 27.5 cm, the size of an ARB page) rather than legal or other outsize pages that will not fit in a letter-size filing drawer. The grammar must be reasonably good, the writing clear, and cross-references to the figures unambiguous. Figure captions must be clear and pertinent, and the figures should be listed. Above all, the bibliographic references should be in the form commonly used in the ARB--i.e. author, title, period, inclusive pages, comma, place of publication, comma, year, if a book; or author, title, journal abbreviation, period, series in Roman numerals, comma, volume in Arabic numerals, number in parentheses, colon, inclusive pages, comma, year. Anything added, not appearing in the item cited, should be enclosed in square brackets. Nothing should be underlined except Latin names. Carefully verify references by checking with the original publication so they will be correct to begin with.

We do not publish new taxa nor new combinations.

Articles on coral islands and reefs are given preference, but anything of ecological interest, in the broadest sense, on tropical islands is accepted if otherwise up to our standards.

NEWS

ALDABRA: A previous issue of Island News and Comment (ARB 126: 1969) gave an outline account of the progress of the Royal Society Expedition to Aldabra between August 1967 and March 1968 (Phases I-III). Since

March 1968 the Expedition has included five further phases, and finally terminated in September 1969, when the construction of a permanent research station began on the atoll. The first Director, Lt Cdr G. R. Lush, M.B.E., R.N., arrived to supervise construction of the laboratory and other buildings, together with a small assistant staff. It is hoped to have the Station functioning by June 1970, when places will be available for visiting scientists. Details of the facilities and of opportunities for fieldwork on this elevated atoll, which supports the largest population of the Giant Land Tortoise in the world (ARB 118: 1967), can be obtained from the Executive Secretary (ref. DJHG/ARB), The Royal Society, 6 Carlton House Terrace, London S.W.1. A liaison committee has been established between the National Academy of Sciences and Smithsonian Institution on the one hand and the Royal Society on the other to coordinate United States research proposals; this committee met in Washington for the first time in November 1969.

The following scientists have participated in Phases IV-VIII of the Expedition, in addition to those listed for earlier phases in ARB 126: 2-3. Some of these are visiting the atoll for the second or even third time, for long-term studies play an important part in the Royal Society's research program. Other scientists interested in following up particular lines of investigation are invited to correspond either with expedition members in the following list, or with the chief coordinator of the research program, Dr. D. R. Stoddart (Department of Geography, University of Cambridge, Downing Place, Cambridge, England), or with the Royal Society. The results of Phases I-III of the Expedition are now in press, and will be published as a volume of Phil. Trans. Roy. Soc. B during 1970.

Phase IV lasted from April to July 1968; Phase V Aug.-Nov. 1968; Phase VI Dec. 1968-Feb. 1969; Phase VII Feb.-June 1969; and Phase VIII June-Sept. 1969. During Phase V a visit was made to the atoll by the Chairman of the Aldabra Research Committee, Prof. T.S. Westoll, F.R.S.; the Director of the Nature Conservancy, Dr. M.E.D. Poore; and the overall leader of the Expedition, Dr. D.R. Stoddart.

W. J. Barnes, 34 Willowtree, Gilesgate Moor, Durham. Phase VI. Diving assistant and engineer.

Dr. C. J. Bayne, Museum of Zoology, University of Michigan, Ann Arbor, Michigan, 48104, U.S.A. (formerly The Marine Sciences Laboratories, Menai Bridge, Anglesey, Wales). Phase V, Aug.-Sept. 1968. Shallow water mollusca.

Dr. D. J. Bellamy, Department of Botany, University of Durham, South Road, Durham, England. Phase VI (leader). Reef front biota; phytosociology of land vegetation.

Dr. C. J. R. Braithwaite, Department of Geology, The University, Dundee, Scotland. Phase VIII. Mainland geology.

K. M. Brander, Fisheries Laboratory, Ministry of Agriculture, Fisheries and Food, Lowestoft, Suffolk, England (formerly Marine Science Laboratories, Menai Bridge, Anglesey, Wales). Phase V. Shallow-water polychaetes; plankton; studies of colonization of shallow-water marine substrates.

A. W. Diamond, Culterty Field Station, Newburgh, Aberdeenshire, Scotland. Phase VII (extended until Sept. 1969). Sea birds (continuing studies in Phases I-III).

Dr. E. A. Drew, Gatty Marine Laboratory, The University, St. Andrews, Scotland. Phase VI. Reef front biota, coral symbionts.

Dr. G. E. Farrow, Department of Geology, The University, Hull, England. Phase V. Growth increments in Tridacna; studies of geology of the elevated limestones; biogenic structures in soft substrates.

J. G. Frazier, Department of Zoology, University of Oxford, England. Phase VIII, extending to June 1970 (continuing work from Phases III and IV). Tortoise behavior, marine turtles.

J. C. Gamble, Marine Science Laboratories, Menai Bridge, Anglesey, Wales. Phase IV, remaining until Sept. 1968. Shallow-water mollusca.

R. D. T. Gaymer, Department of Zoology, The University, Bristol, England. Phase VIII. Problems of tortoise marking.

J. W. T. Grinter, 1 Prince Charles Flats, Ball Street, Paceville, Malta. Phase VII. General assistant.

Dr. R. N. Hughes, Dalhousie University, Halifax, Nova Scotia, Canada (formerly Marine Laboratories, Menai Bridge, Anglesey, Wales). Phase IV. Shallow-water marine biota.

W. F. Humphreys, Anti-Locust Research Centre, College House, Wrights Lane, London, W.8, England (formerly Marine Laboratories, Menai Bridge, Anglesey, Wales). Phase V. Shallow-water Echinodermata, especially ophiuroids; subsidiary study of leaf litter fauna.

D. J. Jones, Department of Botany, University of Durham, South Road, Durham, England. Phase VI. Reef front zonation; coral morphology in relation to currents.

Dr. W. J. Kennedy, Department of Geology, University of Oxford, England. Phase VIII. Mainland geology.

L. Kenyon, 37 Cranley Gardens, London, S.W.7, England. Phase VI. Underwater cinematography.

Dr. R. Lowery, Department of Zoology, Sir John Cass College, Jewry Street, London, E.C.3, England. Phase IV (leader). Blood parasites.

Dr. J. N. Lythgoe, Medical Research Council Vision Research Unit, Sussex University, Brighton, England. Phase VI. Fish zonation, behavior, and underwater vision.

A. A. Q. R. McLeod, Marine Science Laboratories, Menai Bridge, Anglesey, Wales. Phase V. Shallow-water Crustacea, especially Grapsus strigosus.

Mr. M. J. Penny, I.C.B.P., c/o Department of Agriculture, Victoria, Mahé, Seychelles (formerly Wildfowl Trust, Slimbridge, Gloucestershire, England). Phase VII (continuing from Phases I and II). Wading birds.

Dr. G. W. Potts, The Marine Laboratory, Citadel Hill, Plymouth, England. Phase V (leader). Fish ethology, concentrating especially on Labroides dimidiatus.

Dr. C. R. D. Reynolds, Department of Zoology, The University, Edinburgh, Scotland. Phase VII. Polymorphism in Littorina.

Dr. J. D. Taylor, Department of Zoology, British Museum (Natural History), Cromwell Road, London, S.W.7, England. Phase VIII (leader) (continuing work from Phases I and II). Land geology, especially paleoecology of marine mollusca.

S. Trudgill, Department of Geography, The University, Bristol 8, England. Phase VIII. Limestone solution rates and forms.

Dr. B. Whitton, Department of Botany, University of Durham, South Road, Durham, England. Phase VI. Reef-front biota; terrestrial blue-green algae.

ALDABRA NEWSLETTER, MARCH 1970: The Royal Society's Aldabra Committee has initiated a mimeographed newsletter which appears from time to time, to carry information of interest to those working on or interested in Aldabra. In this issue are notes of various sorts, of the general range covered by the news and literature sections of Island News and Comment of ARB. We will try not to duplicate or overlap except in matters of interest to a significantly wider audience than those concerned with Aldabra. Important in this issue is an appeal for books and reprints for the library of the new Aldabra Research Station and a list of items already contributed. Construction on the station is proceeding, but with usual delays and difficulties.

FRENCH NUCLEAR TESTS AT MURUROA, TUAMOTUS: During 1968 France exploded three atomic bombs (July 8, July 16, August 4) and two hydrogen bombs (25 August, 9 September) at her testing grounds in the eastern Tuamotus. A recent paper in Nature has reported the arrival of fresh

fission products from these tests in Japan, and it is interesting to note that the average speed of movement of the material in the atmosphere was about 12 km/h. This is comparable with the mean speed of the typhoons reaching Japan in August and September. These results are reported by T. Sotobayashi, T. Suzuki and A. Furusawa: "Inter-hemispheric transfer of fresh debris from French nuclear test in 1968", Nature, 224: 1096-1097, 1969.

According to a newspaper announcement, the French detonated the fourth in their current (1970) series of test shots on Mururoa in late June.

NOEL KRAUSS, Honolulu entomologist, writes that he has just returned from seven months general insect collecting in the Society Islands, Samoa, Tonga, Fiji, Gilbert Islands, Ellice Islands and the New Hebrides. The collections will be deposited in the Bishop Museum. We have received from Mr. Krauss a series of valuable bibliographies on some of these island groups. They were published by and are obtainable from the author.

NEW RADIOCARBON DATES FOR CORAL REEFS: Volume 11 (1969) of the journal Radiocarbon contains a number of reports of new radiocarbon dates from coral reef areas which bear particularly on problems of relative movements of land and sea in the late Pleistocene and Holocene. J. D. Buckley and E. H. Willis (pp. 53-105) report dates from Isotopes Inc., which include a series from slightly elevated conglomerate platforms and from reef flats at islands in the western Pacific (Ailinglapalap, Truk, Lukunor, Pingelap, Kusaie, Ebon and Jaluit). Dates from conglomerate ledges between 0.3 and 1.6 m above modern reef flats cluster between 1880 and 3250 yr BP. A further date, reported by B. Marsters, E. Spiker and M. Rubin (pp. 210-227) from U. S. Geological Survey determinations, gives an age of 2140 $\pm$ 200 yr BP for elevated reef at 0.6 m on Ifaluk Atoll. All these dates could be taken as confirmation of the hypothesis of a Holocene high stand of the sea: quite different interpretations have, however, been offered (see F. P. Shepard et al., Science, 157: 542-544, 1967, and J. I. Tracey, Jr., in U. S. Geol. Surv. Prof. Paper 600-A: 80, 1968).

An extremely interesting series of dates is provided by G. Delibrias, M. T. Guillier and J. Labeyrie (Gif Natural Radiocarbon Measurements III", pp. 327-344) for the upper portions of the Colette and Anemone boreholes at Mururoa Atoll in the Tuamotus. Only brief summary accounts of these boreholes have so far been published in C. R. hebd. Seanc. Acad. Sci., Paris, 263: 1946-1949, 1966 and 265: 1113-1116, 1967 (see also several papers in Cahiers du Pacifique 13: 47-74, 1969). The dates between 1 and 6 m depth cluster between 5000 and 6000 yr BP, with samples deeper than 7 m giving dates of 17,300 $\pm$ 800 yr or much older. These results are interpreted to indicate an old reef surface at -7 m, independently dated by uranium-

series methods at 120-160 thousand years BP. This surface was submerged at 8000 BP, and at about 5500 BP sea level rose rapidly from -6 to -1 m. One sample from Colette at + 0.8 m gives a date of 3020 ± 200, and one from Anémone at + 3 m a date of 3610 ± 200 yr BP. Again these appear to indicate a Holocene transgression.

Finally, a series of dates are reported by H. A. Polach, J. Chappell and J. F. Lovering (pp. 245-262) for samples from a suite of elevated reef terraces on the Huon Peninsula, New Guinea. Dr. Chappell believes that the width and height of individuals terraces results from interference or reinforcement between the continuous tectonic rise of the land during the Pleistocene and the eustatic variation of sea-level during this time. The first raised reef at c. 5 m is dated at roughly 6-7000 yr BP, the second at 20-23 m at c. 29,000 yr, and the third at 31-35,000 yr BP. Many of the older, higher samples, particularly of coral, yield anomalously young dates on account of recrystallization, and a study of this phenomenon is in preparation.

"OFFICIAL" TERMINATION OF PACIFIC OCEAN BIOLOGICAL SURVEY PROGRAM: From early 1963 through June 1970, the Department of the Army funded the Pacific Ocean Biological Survey Program which was administered through the Smithsonian Institution (see ARB 108:1, 1964 and 112:14, 1965). In addition to the major area of interest in the central Pacific, the Pribilof Islands in the Bering Sea, the Gulf of Panama and the islands and their surrounding waters off the coasts of California and of Baja California were surveyed. Field work was undertaken by sixty-one men, many of whom are determined to continue working with the data after funds run out on 30 June 1970.

In order to ensure continuity and no duplication of effort, work will be coordinated through Dr. Philip S. Humphrey, Director, Museum of Natural History, Lawrence, Kansas, for the next five years. The data assembled, and the zoological collections (birds, fishes, molluscs, reptiles, mammals, bird ectoparasites and some insects) will be kept at the Smithsonian Institution, and access to the data will be through Dr. Humphrey for the next five years, and to bird skins for the next two. The plant collections are held in the Department of Botany, University of Hawaii until duplicates can be distributed to other herbaria. In addition to the three Pacific Program contributions in this issue, we have published Bulletin 127: 1969 and anticipate publishing several more in the future. We plan also to keep ARB readers informed of publications and other activities that arise from the work of the project and the data accumulated.

PUKAPUKA (DANGER IS.): A correspondent in the Cook Islands writes that an Agriculture officer has visited Pukapuka, "carrying gallons of Dieldrin and Aldrin for spraying around coconut trees in Pukapuka. The palms are infested with termites which arrived in the Cook Islands from Australia in soil imported by Lever Brothers in 1904. Soil was brought to Suvarov, also to Nassau, Palmerston, and now Manihiki.

"What will be the runoff into the lagoons and reefs from these chemicals? Gallons and gallons are being sent, and apparently a large lot of the poison was sent several months ago. Can you imagine what this will do to the marine ecology around the atoll--the ecology of which is vital to a people almost entirely dependent upon it?.... "The amount of chemicals used there as far as I can determine was

5 gallons Aldrex (Aldrin) 20% emulsion
5 gallons Dieldrin (oildrex) 15% solution emulsion
50 lbs. Oildrex Dieldrin wettable powder 50%

"Perhaps with the sophisticated computers you people have up there you can work out probable effects on lagoon and reef life from the size of the island and lagoon. As far as I can tell the chemicals are mixed in 50 gallon drums diluted 2 tablespoonsful per gallon for dieldrin powder or 2 dessert-spoonsful per gallon for the emulsion, then sprayed at the base of all infected trees. Tree infection is 50%--and there are of course thousands of trees. Aldrin is used the same way."

RESEARCH AT HERON ISLAND: Research now in progress at the Heron Island Research Station on the Great Barrier Reef includes a study by Peter F. Sale of the School of Biological Sciences, University of Sydney, of the common Barrier Reef pomacentrid fish Dascyllus aruanus. Mr. Sale is investigating habitat selection by this species, and the behavioral mechanisms involved in it, with field observation complemented by laboratory experiment. The project began in November 1968.

STEVE DOMM, formerly at Heron Island, writes from Sydney that he is "temporarily working at the Australian Museum learning to identify most of the larger fishes of the southern Great Barrier Reef and doing some work on the Museum's coral collection to deepen my knowledge of corals based on 3 years field experience. I am currently working on papers concerned with the distribution of some fishes on the lee and windward of a reef and the different growth rates and forms of some corals on the lee and windward of a reef. I am awaiting the outcome of several grant proposals, which if successful will enable me to live on One Tree Island and with others from the Australian Museum study various aspects of reef ecology. We are also interested in making a study of the before and after effects on the fishes and corals resulting from a Crown-of-thorns (Acanthaster) attack."

REGIONAL VARIATION IN INDIAN OCEAN CORAL REEFS was the subject of a symposium held on May 28-29, 1970 at the Zoological Society, Regent's Park, London, sponsored jointly by the Royal Society and the Zoological Society. Sir Maurice Yonge and Dr. David Stoddart organized the symposium. There were participants from a number of countries, including Germany, France, India, and the U.S.A., as

well as Great Britain. Among other points, it was brought out that present records indicate a world maximum of coral genera in the western Indian Ocean, centering on Aldabra. This would seem to be more an indication of where collecting has been thorough. Papers were read on geomorphology as well as on biology and biogeography.

SECOND INTERNATIONAL SYMPOSIUM ON CORALS AND CORAL REEFS: Discussions are in progress between the Committee for International Symposia on Corals and Coral Reefs, the Great Barrier Reef Committee, and the Australian Government on the possibility of holding this symposium at the Heron Island Research Station, Queensland, Australia in August 1972. The Great Barrier Reef Committee has offered to act as host organization. We will publish further announcements on this as news becomes available.

INTERNATIONAL BIOLOGICAL PROGRAM: A memorandum dated June 13, 1969, circulated by Sir Maurice Yonge, points out that "coral reefs represent a 'Theme' within the Marine Section (PM)" of IBP, mentions three recent symposia held on topics related to coral reefs, and indicates that future symposia and field studies are planned by the PM section, in cooperation with other activities and expeditions. Information may be had and comments addressed to Sir Maurice Yonge, 13 Cumin Place, Edinburgh 9, U.K.

ENIWETOK TRIP: The Smithsonian Institution is unique in possessing a large corps of natural historians capable of studying all aspects of biological and geological oceanography and relating them to the marine ecosystem. Whereas interface research and free exchange of ideas between individuals is commonplace within the Institution, field symposia which bring together scientists of diverse disciplines have been few and restricted in scope. Development of the concept of an underwater seminar with participants representing diverse fields of biology and geology therefore constitutes a necessary and important step forward in the study of marine ecosystems.

In September of 1969, seven Smithsonian and Geological Survey SCUBA divers, specialists in fossil and living Molluscs, Echinoderms, Brachiopods, Arthropods, and environmental systems, joined specialists in marine Bryozoa and reef fishes from Penn State and Gulf Research, respectively, to participate in the first underwater seminar sponsored by the Smithsonian Institution in cooperation with the Atomic Energy Commission and the University of Hawaii. The site chosen for the study was Eniwetok Atoll in the Marshall Islands, a location with many unique advantages and well suited for our purposes. Eniwetok is typical of large Pacific Atolls in every way, and part of it has been set aside as a marine biological preserve. A significant contribution to our ecological knowledge of the atoll could be made in the time available. In addition, specialized studies of current interest--the Pacific starfish (Acanthaster) problem and possible latent effects of nuclear testing--could be meaningfully studied. Excellent logistical support

is available from the Air Force contingent on Eniwetok Island and its contracted support group, Kentron, Inc. All base facilities are freely available to visiting scientists. Adequate housing, good food, medical and laundry services, a vehicle, and various diving boats (staffed) capable of handling a large group were provided to us. In addition, we received the highest degree of cooperation from the commercial diving corps of Kentron, members of which accompanied us on trips as guides and backup safety divers, filled air tanks daily for the group, and provided backup equipment and repair facilities. The Eniwetok Marine Biological Laboratory, though poorly managed at the time, provided adequate research facilities, including salt water aquaria, for basic behavioral studies, specimen preservation or dissection during non-diving time. Consequently, each scientist's time could be fully applied to his studies in an efficient manner, and maximum information obtained for the short duration of the visit. Finally the relaxed, informal atmosphere of the entire operation was conducive to frequent and meaningful exchange of observational data and ideas, and to the construction of concepts regarding characteristics of various marine environments, organism adaptation to environmental parameters, community structure, and the total ecology of the atoll.

A typical seminar day began with breakfast at 6:30, followed by equipment check and loading for an 8-9 A.M. departure in the diving boat. Discussion on the way to the site centered around the expected environmental parameters of the location, organization of the dive, and individual research needs for the particular environment. The morning dive was commonly the deepest of the day, between 50 and 100 feet; the afternoon dive was the shallower but longer effort. Each dive was designed to test a different environment of the atoll, and the trip was long enough so that all major environments were sampled. Immediately after a dive, specimens were sorted, live individuals placed in aquaria, and other material sorted and passed around so that each scientist could observe the whole aspect of the fauna on a reef block or bottom sample, and then retrieve from it individuals within his speciality. Commonly a single reef block from, for example, a deep cave environment would provide interesting material for all scientists on board. In long discussions following each dive, the general characteristics of the selected environment, the functional morphology of organisms adapted to it, various diving experiences, and the composition of principal communities were reviewed--an extremely rewarding experience. The diving boat returned at 5 P.M., specimens were transferred to live tanks at the marine lab, and equipment washed and checked before dinner. Most evenings were spent in group discussion of the day's observation, or in the lab watching behavioral patterns of living specimens, identifying, preparing and packing specimens, and completing notes on the day's activities.

Preliminary results of the trip speak highly for the whole concept of the underwater seminar and suggest that this could be repeated in different areas with considerable impact on the experience of the staff.

All major atoll environments except deep lagoonal muds were examined and sampled by the entire group, and communities of macroorganisms broadly defined within them. In situ behavior of numerous organisms was recorded, and their adaptive features defined within the environment. For all sites, sediment samples were taken for microorganisms, as geological data defining sedimentary parameters, and as a test of the reflection of living communities in dead shell assemblages on the bottom--the potential fossil record. In two weeks the principal components of the biota were observed, and in some cases as the molluscs the known fauna for the Atoll was increased more than one-third. Rare discoveries include abundant brachiopods, bryozoans, and crinoids associated with stromatoporoid sponges and green algae in deep reef-face caves, and a bivalved gastropod. But the most meaningful result is a considerably broader comprehension of the interactions of organisms within the environment--the reef ecology--that every specialist took away with him. No other mean of communication between scientists has proven as effective as joint field experience such as this, and we highly recommend its perpetuation.

Several of the staff participating in the trip are planning or actually working on published or summary reports of their findings. The greatest recommendation for the concept of the underwater seminar is the fact that in two weeks of working and observing together, asking questions and proposing ideas, we learned more about the broad aspects of reef ecology and organism distribution than can be found in the compiled literature of the Pacific Islands.

E. G. Kauffman

ADVANCE REPORT ON THE FAIRBRIDGE NEW GUINEA CORAL REEF EXPEDITION: We have carried out (February-May 1969) a running reconnaissance, using two vessels (a 65-foot trawler and 42-foot launch), of the reefs and lagoons of the Trobriand Islands, Lusancay Group, D'Entrecasteaux Islands, the Louisiade Group (including the Conflict Group, Deboyne Is., Misima, Rossel and Tagula) and parts of the Papua Barrier Reef. We estimated that about 800 nautical miles of linear reefs are involved in this area east of New Guinea. The area covers about 75,000 square miles. Up till now there has been no oceanographic, geomorphic and ecologic survey of any of these reefs. Five hitherto unnamed and unmapped islands were discovered.

We carried out the following routine observations:

1. Bathymetry. Within reef lagoons, spot depths were obtained by echosounder approximately every 0.5 nautical mile. (Continuous recording was not possible on the simple type of equipment available.) Specifically in the Lusancay Group, in the Long Reef atoll and in the Conflict Group there were hitherto almost no soundings until now. Detailed tracings will be submitted.

2. Water temperature and salinity. Readings were made systematically throughout the expedition, and complete tables will be submitted.

3. Sediment samples. In every lagoon Petersen grab samples were obtained, wherever possible, where different lithologies were observed. Samples are being quartered and one complete set will be submitted. Sedimentological analyses are in progress. Some coring was attempted, but not very successfully owing to the coarse nature of most lagoonal floors.

4. Coral and other reef life. Organisms were collected systematically and ecologic traverses were made across reefs whenever conditions were suitable. Samples are now under study.

5. Fish. A representative of the Sydney Museum collected fish for taxonomic purposes and will report on them. The Director of Fisheries of the Papua and New Guinea Administration accompanied the expedition for most of the period and made observations on commercial fish potentials. Specific search was made for evidence of fish poisons. Two cats were kept as "official tasters." Not a single case of poisoning was obtained, although interrogated natives reported occasional cases in the regions. No systematic pattern emerged, but the details will be reported.

6. Hazards. (a) Shark: a masthead watch was maintained at all times when skin divers were in the water, and frequent sightings were made in the deeper channels. Most of the lagoons seemed to be rather shark-free.
(b) Stone-Fish: care was taken by divers to wear heavy gloves and rubber shoes and usually to carry a fish spear. Stone-fish anti-venin treatment was kept ready on both vessels, but no strikes were suffered.
(c) Portuguese Man-of-war : no trouble was experienced with stinging jelly-fish, which were locally reported to be hazardous at certain seasons.
(d) Coral poisons: with care (gloves, shoes, rubber wet suits, for exposed areas) coral stings and abrasions were kept under control, but could not be avoided completely. Slow healing of wounds was noted, as expected, in spite of the best medical treatment.
(e) Sea snakes: a specialist herpetologist joined the expedition to collect poisonous sea snakes. At all times anti-venin was kept available but no bite was received. A large number of snakes were captured alive and are now being studied.
(f) Crocodiles: these reptiles are no problem on the reefs and sand cays, but in spite of hunters are still quite numerous in the mangrove. An 18-year old girl was taken near our base on Kiriwina. They are hard to identify in daylight but at night the red eyes reflect flashlight beams.

A detailed scientific report is in preparation.

Rhodes W. Fairbridge

Prof. Fairbridge has kindly sent, also, a copy of his fascinating log of the expedition. It is very interesting reading and contains much geographical information, in addition to the day to day happenings of the expedition.

COMORO ISLAND BIRDS: We received the following letter and publish it for whatever interest it may have for our ornithological readers:

"In Atoll Research Bulletin No. 128 of August 15, 1969, A. D. Forbes-Watson gives as a new record of Fregata ariel [in the Comoros] on the basis of a sight record of a pair seen on 20 October, 1965, at Moheli.

I should like to draw attention to my paper "Observations by personnel of R. V. Atlantis II on islands in the Indian Ocean" published in "Sea Swallow", the Annual Report of the Royal Naval Bird Watching Society for 1967 in which two male Lesser Frigatebirds Fregata ariel and one female, seen in May 1965 at Grand Comoro, are reported. Between Grand Comoro and Mayotte we also saw a pair of Greater Frigatebirds Fregata minor, so it appears that both occur in the Comoros as they do at Aldabra, the nearest likely breeding station. Lesser Frigatebirds were also common about Nosi Be, Madagascar, and I believe that Michael Palmieri, our Third Officer, and an Honorary Investigator for the Smithsonian, collected some for George Watson, then of the Division of Birds.

You might not have heard of "Sea Swallow" but it would probably be of interest to readers of the Atoll Research Bulletin as articles appear on visits by Navy personnel and sea-going scientists to islands throughout the world and the coverage of oceans makes it invaluable to ornithologists with an interest in sea-birds. It is obtainable from:

The Editor, "Sea Swallow",
8 Little London,
Chichester, Sussex, England

Yours faithfully,

Roger Pocklington
Bermuda Biological Station for
Research

DEATHS: It is with deep regret that we have to announce the passing of eight of our friends and colleagues during the last several months.

Dorothy Carroll, eminent sedimentologist of the U. S. Geological Survey and co-author of ARB 113, died in January 1970. Her career began in Australia, but for over 15 years she was on the staff of the Survey, first in Washington, then in Menlo Park. She was a master

of analytical techniques for dealing with sediments and set up a sedimentology laboratory for the Survey.

Charles G. Johnson, geologist of the U. S. Geological Survey, for the last several years stationed in Denver. He had wide experience in Pacific geology and worked in the field in the Marshall Islands with the senior editor in 1956. A better companion for field work would be hard to find. His untimely death occurred December 1, 1969, at the age of only 55.

Mark Veevers-Carter, lessee of Astove Atoll, and enthusiastic island agriculturist, died in Mombasa in March. He had a deep practical knowledge of coral islands, was Director of Agriculture in the Seychelles for some time, lived on Remire Island for several years, and for the last several was attempting to make a flourishing farm and livestock establishment of Astove. Our deepest sympathy is extended to his widow, Wendy, and their children. We have not heard if they will stay on Astove.

Floyd A. McClure, universally acknowledged world authority on bamboos, died of a heart attack in his bamboo garden on April 15. He was always ready to help us with those refractory members of island floras, the bamboos, and was working on those of Ceylon, in collaboration with Tom Soderstrom at the time of his death. In addition to losing one of the most able and scholarly of botanists, we have lost one of the most gentle and admirable of men and one of the finest of friends. He was that rare sort of person, one with neither critics nor enemies.

Thomas Goreau, physiologist and scuba-diver extraordinary, and student of a new biotope--the deep outer slopes of coral reefs, failed to survive serious surgery followed by pneumonia on April 22. He was only 45 years old, but had established a world-wide reputation as a leading investigator of coral reefs. He brought a profound knowledge of physiology, adeptness in radio-isotype techniques, tremendous energy, and a scientific imagination of a high order to the field of reef biology. A fearless diver, almost to the point of undue risk-taking at times, he showed us that the deep outer slopes of reef islands had many secrets to be won by the courageous. He worked in Jamaica, in the Pacific, and in the Red Sea, amassing information of many kinds, all too little of which ever saw publication. He drove himself unmercifully, but insisted on a thoroughness that inevitably cut down his published output. His shoes will be hard to fill. Our deepest sympathies go to Nora, his widow, and we hope she will be able to see some of his unfinished work through, as she is an eminent physiologist in her own right. Above all, we feel the loss of a great friend.

Only a month before his death he had seen the realization of one of his dreams, the opening of his own marine laboratory by the University of the West Indies and the University of the State of New York, Stony Brook, in both of which institutions he held chairs. We hope this facility will develop as a fitting memorial to him.

Professor Hisakatsu Yabe died on 23 June 1969, at the age of 90 years. Professor Yabe made many contributions on the geology, palaeontology and geomorphology of coral reefs, both fossil and modern, in the Japanese islands and in the former Japanese mandate islands of the western Pacific. Most of his coral papers appeared after 1932, and in 1937 he made an extensive tour of western Pacific coral islands. Much of this work was published in collaboration with such workers as M. Eguchi, S. Hanzawa and R. Tayama. Perhaps Professor Yabe's best-known and most valuable contribution to reef studies was his systematic treatment of western Pacific corals published with T. Sugiyama, "Recent reef-building corals from Japan and other South Sea islands under the Japanese mandate", which appeared in two parts as Special Volume No. 1, Scientific Reports, Tohoku Imperial University (Geology), in 1936 and 1941, with 155 plates. There is an obituary of Professor Yabe by K. Hatai, including a bibliography of 394 papers, in Sci. Rep. Tohoku Univ. 2nd ser. (Geol.), 41(2): 109-128, 1969.

Chester K. Wentworth, eminent geologist and remarkable man, student of, among many things, island geological phenomena and processes, author of the geology of the Whippoorwill Expedition to the Line Islands, 1924, died on January 6, 1969, after a long crippling illness. A memorial of his life and work, and a partial bibliography of his papers, by Gordon A. Macdonald and Doak C. Cox was published in the Proceedings of the Geological Society of America, November 1969.

Dr. F. A. McNeill, co-author with Keith Gillett of "The Great Barrier Reef and adjacent isles" (Sydney: Coral Press Pty. Ltd., 1959) and for several decades a member of the staff of the Australian Museum, Sydney, died on 24 February 1969. His colleague G. P. Whitley contributes a brief memoir to the Australian Zoologist, 15: 214-223, 1969, together with a very full bibliography covering Dr. McNeill's many popular magazine articles on Barrier Reef topics, as well as his scientific papers. Some 175 items are listed. Dr. NcNeill was a member of the Great Barrier Reef Expedition of 1928-1929, and one of his last works was a report on the "Crustacea, Decapoda and Stomatopoda" of that Expedition (Sci. Rept. Gt. Barr. Reef Exped. 1928-1929, 7: 1-98, 1968).

SHORT PAPERS

MAPPING REEFS AND CAYS, A QUICK METHOD FOR THE SCIENTIST WORKING ALONE

by S. B. Domm

Introduction. In the absence of aerial photographs, the methods commonly used to map cays and small reefs are either the use of the plane table or chain and compass traverses. The former requires the use of at least two persons and the latter, while it can be done by one person, is time consuming and not suitable for mapping a reef which may be awash or underwater.

While working on the Great Barrier Reef of Australia, I have developed and used a method which is not really new, but does not appear to be well known. It enables one person to quickly map an area of up to approximately one mile across (perhaps even more), using equipment that is commonly available and relatively inexpensive. Being light weight and also highly portable is also a feature of the equipment used. The method requires relatively open country and does not take into account differences in height. The accuracy varies, but is easily capable of producing a good field map.

Equipment. The following items comprise all the equipment needed:

(1). A pair of binoculars or a telescope in which have been fitted a graticule or parallel cross hairs. This is usually done by having one etched on a small glass disk, which can be fitted behind the eyepiece and removed when not needed. The intercept of the graticule can be any desired size, however possibly the most useful would be a graticule interval of 1' to 100' which is commonly used with most plane table alidades. This means that when sighting on a foot graduated stadia rod (or staff), one foot as seen through the instrument (exactly the interval between the hairs of the graticule), equals 100' in distance from instrument to staff. The graticule interval can be anything, so long as the staff is graduated accordingly. The greater the distance the larger should be the interval, as it can be very difficult to distinguish small intervals at distances of over about half a mile.

The power of the telescope or binoculars depends on the distances that will be encountered when mapping. I use a pair of 20 X 50 binoculars (used normally with the graticule removed) and find them very good for sighting up to approximately half a mile. The graticule used is one giving 22.5' distance when sighting one foot on a staff, this is not ideal but was all I could obtain at the time. The telescope or binoculars must be used with a tripod, a light camera tripod being adequate.

(2). Prismatic sighting compass. For ease of reading I use a standard marine hand-bearing compass.

(3). Staff (stadia rod), can be either a standard surveyor's type, graduated in feet and tenths, or a home made staff with the desired graduations painted on. The staff could be in the form of two or three metal pipes telescoping into each other which could be expanded in the field and locked into place. Some method is necessary to hold the staff upright in a fixed position and a small spirit level is useful to help place it vertically.

(4). Hard-backed field note book and pencil.

Method. It is almost the reverse of using a plane table, in that the staff is used as with the plane table to determine the horizontal distance, but here the staff is permanently placed at the approximate center of the area to be mapped, and the person doing the mapping moves around the fixed staff. The staff and binoculars are used to determine the distance and the hand bearing compass to give a direction for each distance.

An outline of the method is a follows: given a sand cay covered by low vegetation to be mapped. To be included in the map are various topographical features, such as clumps of trees, depressions, etc. The diameter of the cay is approximately half a mile. First, the staff is set up near the center of the cay, or if the cay is large it is mentally divided up into sections and the staff fixed near the center of the first section. The staff is either tied to a tree or held in position with lines, and is as close as possible to being vertical. After the staff is in position one commences mapping from any convenient location (a clump of trees, the periphery of the cay, etc.). The proceedure is to first take a sight on the staff and record the intercept, then sighting the staff, its bearing is recorded, and finally any notes concerning natural features are also recorded. In a few minutes one has recorded distance, direction and comment. In this way one moves slowly around the cay mapping all features that are to be included in the map. An example of the first entry into one's note-book might be:

Station			
1	2.3	187	Sandy beach begins here.

If it becomes necessary due to increasing distance or blind spots because of vegetation in front of the staff, the staff can be moved. A suitable location is found and the distance and bearing are recorded of the first location from the proposed second location. The new location is then marked and the staff re-erected here. The mapping continues by sighting on the new position using a different numbering system to indicate that this is the second staff position.

The result is a book containing data that can be easily turned into a map by plotting on a large sheet of paper. The accuracy depends upon the instruments used and the care taken in making observations. Reading the staff can be difficult, especially if a wind causes it to sway. Under such conditions much care should be taken in siting the staff in a favorable location, or fixing it securely in place.

Magnetic north is easily determined from any of the bearings and true north by applying the appropriate variation to this. Plotting the data and drawing the map can be done at any time. After determining the scale desired on a sufficiently large piece of paper, the first staff location is indicated by a small dot, and the stations are drawn from this as a series of radiating lines. As each line is drawn, the distance is worked out from the stadia intercept and marked on the line. When all the lines are drawn the outline is sketched in (using the field comments to fill in) revealing the finished map when all is done.

Mapping a reef can be more difficult. If it has a lagoon the staff may be located on a patch reef within the lagoon. Mapping can be done either at low tide by walking around the reef margin, or during approximately mid-tide (with no more than about 2 1/2 feet of water over the reef) by traveling by small boat and landing at various intervals on the reef to take sights of the staff from the reef. Due to the constant movement, sighting from a small boat is seldom practicable. On windward parts of a reef it will usually be necessary to map only during low tide when one can walk on the reef.

This mapping method does not take into account any differences in elevation. Sand cays and coral reefs are usually very low structures having little relief, therefore this shouldn't seriously affect the overall usefulness of the method.

Working alone, I have found this method of mapping to be quick and reasonably accurate. A further advantage is that it doesn't require any specialized or expensive equipment. High powered binoculars are a standard research tool and a hand bearing compass is a common item of marine equipment. However, I experienced difficulty in having a graticule of the desired intercept fitted to a pair of binoculars. If the fitting is of a permanent nature it still shouldn't drastically interfere with the normal use of the instrument.

ISLAND CONSERVATION: Following are two short essays on conservation from Micronesia, which indicate a local appreciation of the values at stake as small islands are being "developed", dragged willy-nilly into the torrential stream of Western culture that threatens to overwhelm the world. Mrs. Falanruw, born in Guam, is an instructor in the Biology Department, University of Guam, Agaña, Guam. Mr. Kochi, native of Palau, is conservation officer, Palau District, Trust Territory of the Pacific Islands. We thought that our island readers might appreciate the thinking of two of their colleagues from Micronesia.

Conservation in Micronesia. Some people may feel that pollution, overpopulation and conservation are problems of the outside world which have not reached Micronesia. This is a dangerous belief as many of these problems are already upon us. We must become concerned now, for our land is so very small that we cannot afford to make ecological mistakes. On continents people have had at least a chance to learn from their mistakes, on our small islands, mistakes may bring immediate dire consequences. We have only one chance...

Now is the time to look at the problems of others and learn from them before we make the same mistakes in our own beloved Micronesia. Much of our island world is still in a relatively clean, productive state. Let's look ahead and keep it that way--other people do not have such a bright prospect.

There has been much talk about the political status of the Trust Territory. Whatever the peoples' choice, Micronesian integrity must be dependent on some degree of self sufficiency, which in turn is dependent on the utilization of indigenous resources. Micronesia is potentially a rich area. The coral reef is one of the most productive environments in the world biologically. Once our technology is developed enough to enable us to utilize this productivity Micronesian wealth will begin to be further realized. Let us learn to use our resources properly. Above all, let us not damage those resources before we learn how to use them.

It is generally held that Micronesian cultures were adapted to the island environment--how else could man have persisted on islands all these years. I feel that Micronesian cultures, at least in the past, not only allowed man to live on islands, but allowed islands to "live" with man--and so maintain their productivity for man's use.

Islands are fragile systems. They can be upset and their productivity greatly decreased. Their very life depends on a thin skin of living matter, coral polyps and cementing algae. Without the protection given by these organisms, the islands themselves would be washed away.

I have been told by a number of Micronesians that fish are not as plentiful as they once were. No one seems to know why. I think that this decrease in fish and other once more abundant resources can probably be traced to present day unwise use of the environment.

Why didn't this happen in the past? Certainly man has lived on Micronesian islands for thousands of years--and in some cases in very dense numbers. I feel that two factors are involved. First, original island man did not have a technology with which he could severely damage his ecosystem as he does today. He did however, have fire, poisons, and was in sufficient numbers to produce considerable wastes and compete with other life forms. It is possible that no other animal could have lived on islands in such biomass as early man. The reason

for this, and the second factor in the maintenance of a productive island ecosystem, I believe, is culture.

I believe that island man's culture formed a buffer between him and his environment, preventing him from destroying his island.

One of the most straightforward of island man's former practices keeping him and nature in balance was the limitation of the human population. If this was not done naturally by calamities such as typhoons, tidal waves, and droughts, it was done culturally by attempts at overseas voyaging, suicidal voyages, celibacy, prevention of conception, abortion, and infanticide.

Other cultural measures promoting the maintenance of a healthy island ecosystem were possibly the "conservation laws" of many islands. It is said that certain atolls or portions of islands were set aside to serve as reserves where turtles and other animals and plants might reproduce and thrive and so maintain their numbers. In some cases, bans might be put on harvesting in an area until it regained its former productivity. One such example is the "bungud of the lupuu" as is done on Yap. When fish become scarce and small, a sign is put up in the lagoon prohibiting certain kinds of fishing, or all fishing there. When fish have regained their former size and abundance, this ban is removed.

Some workers have suggested that the social structuring of islands is adaptive. Social structuring determines that some shall be supported better than others and that the island itself will not be damaged by over-exploitation of its resources.

Social stratification also results in a diversified use of the islands resources. If some items, such as turtles, are available only to the high classes while other foods such as eels are eaten only by low classes (as is the case in Yap), then both turtles and eels are protected from exploitation by all inhabitants of the island. This would tend to insure their continued productivity.

Another factor in making culture a buffer between man and his ecosystem is the complex way in which lands are held. Any number of people can have claims on a piece of land by virtue of living on it or cultivating it, or by possessing a name that goes with the land or by having one's ancestors born or buried on the land or by being a "father" type relative to a person having claim to the land, etc. Land ownership in Micronesia seems to have always been complex, and perhaps always a little disputed. This would seem to assure that the land could be used by a number of people and that it could not be over-exploited by any one person. The same situation would apply to the waters of the lagoon and near the reef as in many cases these waters, or fishing rights in these waters, belong to certain people.

There are other regulations requiring that property not be used for varying times after the death of a person connected with that property. This measure assures that land may lie fallow at times, an important factor in the maintenance of its productivity as well as the maintenance of a pool of "wild" elements in the flora and fauna.

How will these conservation practices be affected by the new land cadaster program and by the failure to acknowledge local ownership of lagoon waters?

It is doubtful that individual island inhabitants recognized that the social regulations of their culture were of ecological import. Certainly island man is not a frugal being. In fact, one of the few things that he strives for is to have an over-abundance of food. One of the most important things throughout Micronesia is to be able to throw a big feast. In planning this feast, one does not merely plan to have enough food but rather to have "too much enough." This abundance in the face of limited resources is truly a tribute to island man's ability to keep his balance with his island ecosystem.

Inasmuch as former conservation-valued practices were in the guise of religion, social stratification, taboos, etc., the young people of Micronesia today are not individually conservation-minded. Furthermore they live at a time when the populations of many islands are not as dense as they once were and resources appear to be relatively abundant. However the population of Micronesia is rapidly expanding, at a time when a higher standard of living is desired and at a time when ideals of equality of men are being promoted so that the former ways of life and social stratification will no longer exist to enable the island ecosystem to support as many people as it once did. The chances of destroying island resources loom ever greater.

It is essential to inculcate a sensitivity to the vulnerability of the island ecosystem into the present and future generations of Micronesians who once possessed such a cultural sense of conservation but who are in danger of losing it with the changing of their cultures. It is important that individuals come to appreciate the need for using their ecosystem wisely because, more and more, the way in which the Micronesian ecosystem is used will be a matter of individual choice.

M. Vernita C. Falanruw

Objectives and importance of conservation. I live in Iyebuki in Koror Town, but am more at rest in the forest, savannas, woods and jungle. I have a very personal relationship with the open land that I simply do not have with congested town surroundings.

I find rest and comfort in thicket and field--in the quiet rippling of a brook, the thundering solitudes of a waterfall, the silent scampering of woodland creatures, the calls of different birds, the sounds and the voices of nature that are apart from the things man builds and destroys.

I do need the great outdoors. So do we all--a fact often ignored as we stack population upon population in our town when thousands of every age compete for the limited green space available... as we seek to satisfy the compelling need for more space to grow in, without providing adequately for the protection and enhancement of the green and flowering lanscape that, once overrun, is lost.

Unless we develop and manage our land in harmony with nature we will live in barren communities.

We have the priceless Palauan heritage in the forest, savannas and the sea that belong to all the people. To assure that this great heritage is preserved, and denied to no one, is the primary responsibility of every individual citizen of Palau.

A bountiful and beautiful Palau is many things. It is the prosperity of its people...nature unspoiled and nature improved... well-tended forest, savannas, waters, all other resources, and a well-kept town... the spirit of a people intent upon improving life for themselves and for their children...all the accomplishments of individuals, private organizations, and governments.

In our designs for a more satisfying way of living, we must enrich our lands. We must:

1. Plant forests and improve existing woodlands and savannas.
2. Line the roadside and streambanks with grass and other foliage.
3. Build dams, and reservoirs for flood control, water storage, recreation, and for wildlife conservation.
4. Protect with terraces, and contour the agricultural lands, to stop erosion and to hold more water on the soil for better crops.
5. Secure the soil to the mountains and fields to keep rivers and streams free from silt and pollution.
6. We must know how to enhance the natural beauty of the forest, woodlands, terraces, savannas, and the sea while assuring a great bounty from the fields and the sea.
7. We must accomplish much which is beneficial through our use and conservation of the land and waters.

8. "Common Sense" must be used to know better from worse.
9. Stop pollution and use of dynamite that destroy marine life.
10. Clean garbage to reduce rat populations and avoid smells.
11. Prevent wildfire from destroying our lands.

Every responsible Palauan has his obligations as a conservationist. He must be born to the role. Even if he does no more than respect the natural landscape and the labor of those who work to maintain it, he is bound at least not to despoil nature's valuable gifts.

The "active conservationist" must be advanced beyond merely leaving nature alone and being careful not to thoughtlessly disturb it. Fortunately, more and more Palauans are becoming active conservationists--in their own yards and neighborhoods and in support of communities, villages, and also with efforts to make man's environment more attractive and pleasing.

If we do this, we will make our reward a rich one. We will have the satisfaction from playing a part in the continuing preservation and wise management of our cherished lands. Because our land is the provider of natural resources, we must realize that our great land is facing a more rapidly rising population than can easily maintain forest, and clean streams, rolling meadows, and carefully tended lands.

We all know man needs nature and nature needs man. So why don't we properly develop, preserve, and manage our land that it will be maintained intact in the long run into the future. This is the objective and work of conservation and wise use.

John S. Kochi

PUBLICATIONS

Leopold, E. B., Miocene pollen and spore flora of Eniwetok Atoll, Marshall Islands. Geological Survey Prof. Pap. 260-II: 1133-1185, pl. 304-311, 1969. We are delighted to see this long-awaited paper. In her very competent study of the micro-paleobotany of the deep drill-cores from Eniwetok, Estella Leopold has given us a glimpse back into the past of an atoll. Her interpretations of the pollen flora tell us a surprising amount about the conditions on the island during Miocene time. There seems little doubt that at certain periods the land surface was elevated well above the sea level. Plants grew there which are now found far to the west, only on land higher than sea level atolls. We have long had the idea that competent palynological studies are needed throughout the Pacific islands to elucidate floristic, phytogeographic and vegetational problems. This remarkable study makes this very clear and we hope that further development of capability for such work will take place in the immediate future.

Ladd, H. F., Tracey, J. I., Jr., and Gross, M. G., Deep drilling on Midway Atoll, Geological Survey Prof. Pap. 680-A: A1-A22, 1970. Harry Ladd may chalk up another in his string of major contributions to atoll geology with this paper. Two cores, through the limestone cap and into volcanic clays and basalt are described and their significance summarized in a section on Geological history of Midway. Subsidence of between 350 and 400 m, at least, is indicated, as in the basal clay are beds of lignite with abundant land-plant fossils. These are being studied by Estella Leopold and we expect another major addition to our understanding of the floristic and vegetational history of the Pacific Islands when her work is completed.

The introduction to the paper is a concise but very informative sketch of the regional geography and geology of the Leeward Hawaiian islands and of the Hawaiian region as a whole. The preliminary indications are that the lower limestones are of early Miocene age. At least 3 periods of emergence are indicated after the sea finally covered the volcanic rocks. Actually, the core diagram for the deeper "reef" hole, fig. 7, seems to indicate about 7 such emergences, but only 3 are mentioned in the geologic history, plus brief reference to two unconformities indicated in the diagram. Land shells (Endodontidae) were found between 137 and 165 feet depths.

The Hawaiian atolls have had a long and complex history, with great changes in local environmental conditions. Thus there have been ample time and suitable settings for much of the present complex Hawaiian biota to have evolved, perhaps even before the present high Hawaiian Islands had appeared. A bathymetric chart, plate 1, shows that the region of the Leeward Hawaiian atolls, rather than having a simple chain of 5 or 6 volcanoes now subsided to atoll status, comprises a whole swarm of ancient volcanoes mostly now indicated by seamounts, some of them flat-topped (guyots). The photos, including a beautiful colored air photo of the windward reef of Kure Atoll, and the maps and diagrams add enormously to the understandability of the paper.

Corner, E. J. H., ed., A discussion on the results of the Royal Society Expedition to the British Solomon Islands Protectorate 1965. Phil. Trans. R. Soc. (London) B, 255: 185-631, 1969. This magnificent and abundantly illustrated volume is a massive refutation of the idea that the day of expeditionary science as a productive endeavor is drawing to a close. The Royal Society Expedition to the Solomons was an impressive effort, involving 20 scientists, 3 local scientific visitors, 10 members of the ship's crew, and 35 local helpers in various ranks and categories. It lasted from June to December, 1965, visited 8 large islands or groups, and collected and studied most land and marine groups except the land vertebrates, fungi, and terrestrial microscopic algae.

This volume includes the proceedings of a three-day symposium held under the auspices of the Royal Society, March 27-29, 1968, to present in brief form the results of the study of collections and observations made by the expedition, and to discuss their ecological and biogeographical significance.

In all, 30 papers were presented and they are printed here with transcriptions of extensive discussions. The papers were grouped into a section on the general environmental characteristics, one on the land fauna, one on the marine biology, including reef and shore-line geomorphology, and one on the land flora. The papers vary in comprehensiveness and quality, but show vast diligence and great erudition. Their scope certainly indicates that the statement by Corner in the summary (p. 621): "We gathered so much information that, when it is published, the Solomons will become one of the better known groups of Pacific Islands" is clearly no exaggeration.

It is impossible, in any reasonable space, to critically review such a book. It seems best to say that, except for those concerned only with land vertebrates, anyone interested in island biology will find many papers that will amply reward his attention. To read carefully and digest the whole volume would take even a rapid reader a substantial amount of time.

It is regrettable that the Royal Society conservatively adheres to an outmoded format of a single colum 6 1/4 inches wide. In addition to being very uneconomical, it is distressingly fatiguing to the reader and greatly shortens his attention span.

Barkley, R. A., Oceanographic Atlas of the Pacific Ocean, Honolulu, University of Hawaii Press, 1-20, 156 Figs., 1969, $30.00. This important and attractive new Pacific atlas is concerned with physical properties of the waters between 10 m and approximately 2,000 m. Density, dissolved oxygen, salinity and temperature are plotted in fresh detail on trimonthly charts and on latitudinal and longitudinal sections.

The atlas incorporates some three million individual observations accumulated over half a century, processed and edited for the purpose. The author uses a distinctive notation, by plotting his variables on density surfaces (in sigma-t notation), and not on the isobathic ones most commonly encountered in marine atlases. Density also appears as the ordinate in 34 ocean sections. In a useful introduction, Barkley points to the distinct advantages of water density as the independent variable in charts and sections, including the depiction in clear detail of very steep gradients near the ocean surface despite the very small scale of whole ocean charts and sections. A trimonthly series of charts for the 10 m isobath is an exception to the use of density surface charts. Its inclusion permits direct comparisons with more conventional charts. Considerable pains have been taken

to illustrate with ten sample charts, the densities of observations behind the mean values plotted. At a glance data may be judged adequate off the coasts of Japan and California, to practically nonexistent in parts of the southern ocean. The critical user of this atlas may assure himself further of the quality of data in a sampling for each chart of fourteen ten-degree Marsden squares, scattered about the ocean and representing diverse geographical situations. Where data exist histograms have been included and arranged for convenient comparison, to show 1) density of observations in the square, and 2) distribution of observed values according to frequency classes.

All charts and histograms are reproduced in black and white; the sections in three colors, black, red, and shades of blue. Attractiveness and legibility are enhanced by the use of lines of balanced and contrasting boldness and by clear reproduction.

Barkley's atlas would find a useful place in the personal libraries of a good many readers of the ARB were its price at least a third lower. No research library concerned with marine subjects should be without it.

Bryce G. Decker

Maxwell, W. G. H., Atlas of the Great Barrier Reef. 1-258, Elsevier Pub. Co., Amsterdam, London, N. Y. 1968. $32.50. The Great Barrier Reef, lining much of the Queensland coast, is the most extensive, massive, and impressive organic reef feature on earth, at least in present times. It has been studied intensively by geologists and biologists for at least 80 years and more superficially much longer. Although it is not difficult to write an over-all treatise on such a phenomenon before much work has been done on it, it becomes nearly impossible after such an enormous amount of data has accumulated as is now available for the Great Barrier Reef. That one man had the courage to try it is remarkable and enormously to his credit. That he succeeded even reasonably well is even more so. Although the author is a geologist, this work is physical geography in the best and most professional sense.

After an introduction which rather inadequately summarizes the nature of reefs and environmental conditions favorable to their development, a regional geological picture is drawn that admirably sets the stage for geographic understanding of the occurrence of such a major earth feature. The nature and behavior of the water masses, and their relations to bottom topography follow, amply illuminated by charts and diagrams. The intensely interesting geomorphology of the area is well portrayed, and a lucid section on tides and their effects is provided. To complete the regional geography (physical) a chapter on the climate is included, but with little attempt to relate it to coral reef phenomena.

In chapter 6 we come to the real meat of the book. After a critical essay on reef classification and the establishment of a nomenclature suitable for discussion of the details of the Great Barrier Reef, the author describes and illustrates the morphology of the principal features of the Reef with great effectiveness, but without so much detail that would smother the reader. Maps and photos are provided in profusion and are well chosen and reasonably well reproduced. The atlas format chosen for the book is ideal for presenting this kind of information.

Considering that the coral reef is essentially a biological phenomenon, even though it produces geologic and geographic results, the chapter on Biological Observations is a disappointment. The overwhelming diversity of organisms clearly daunted the author when it came to attempting an interpretation of the synecology of the reef. He merely lists and illustrates the gamut of forms, with causal observations on the roles of some of them. This chapter will be useful in enabling the physical scientists using the book to roughly place the organisms he sees on the reef, but will be of relatively little help to the ecological biologist.

The chapter on Sediments is very thorough, with analyses and distribution maps showing an extremely complex series of facies patterns, undoubtedly reflecting the complex nature of the reef structure and its relation to the non-reef land-mass adjacent. The intricacy of the maps suggests thorough and detailed sampling, but no information is given on the sampling procedures used. Hence it is impossible to know just how much of the detail to ascribe to the data and how much to extrapolation. The analyses bring out very well the contribution of the different classes of carbonate-secreting organisms, both animals and plants. A textural analysis, illustrated by histograms and accompanying photos, is also very instructive. This chapter ends with a very brief consideration of sedimentation processes, based on the data presented.

It is indeed remarkable that the vast amount of information presented could lead only to less than 1 1/2 pages of Conclusions. This is perhaps the most severe criticism that can be leveled at the book--that the author seems much more able at analysis than at synthesis, and that the truly magnificent body of data amassed merit a better attempt at integration. One can also say that, although the reef is a feature of biological origin, biological processes are not much emphasized in the discussion.

The bibliography is meager, indeed, considering what has been published on the Great Barrier Reef. Presumably this indicates that by far the greater part of the data included in the Atlas are products of the author's own investigations.

Regardless of the above criticisms, this is a magnificent piece of work and an absolute necessity for anyone who proposes to do any serious work on the Great Barrier Reef, as well as of great interest and value for those concerned with coral reefs and islands generally. Any geographical library would be seriously deficient without a copy.

F. R. Fosberg

Kohn, A. J. and Robertson, R., The Conidae (Gastropoda) of the Maldive and Chagos Archipelagoes. Jour. Marine Biol. Assoc. India 8: 273-277, 1966. This is a report on collections made by the authors and a zoogeographic summary of the family for the area. 64 species are reported, all but one of them, Conus barthelemyi, widespread.

Kohn, A. J., Microhabitats, abundance and food of Conus on atoll reefs in the Maldive and Chagos Islands. Ecology 49: 1046-1062, 1968. Ecological study of the species listed in the above paper. Theoretical aspects, as well as empirical observations, are emphasized.

Kohn, A. J., Type specimens and identity of the described species of Conus. IV. The species described by Hwass, Bruguière and Olivi in 1792. Jour. Linn. Soc. (Zool.) 47: 431-503, 1968. A detailed study of the 125 names of Conus published in the Encyclopédie Méthodique in 1792. The study was based on descriptions, figures, specimens, and cited references. Most important, however, is the fact that this material was considered in light of a profound knowledge of the genus. The status of a great many names seems to be definitely settled. Conchologists and malacologists, as well as marine ecologists should be most grateful. This is an unglamorous but highly essential kind of work that makes possible sound zoological nomenclature.

Storr, J. F., Ecology and oceanography of the coral-reef tract, Abaco Island, Bahamas. G.S.A. Spec. Pap. 79: 1-98, 1964. A comprehensive and beautifully illustrated ecological description of a reef-tract in one of the coral reef groups closest to the U. S. It will inevitably serve as a text-book and a guide-book for American marine ecology students when their professors awaken to the fact that they have a remarkable demonstration area for field work almost in their front door-yard. Habitat factors and topography are described in detail, faunistically characterized zones defined, the distribution of plants and animals elucidated, and brief conclusions drawn as to the relationships of these phenomena.

Bakus, G. J., Energetics and feeding in shallow marine waters. Int. Res. Gen. Exper. Zool. 4: 275-369, 1969. This essay attempts to understand the ecological processes surrounding the production and consumption of organic matter on marine shores, and to compare this complex of processes and behavior in tropical and temperate waters. Coral reefs

characterize many tropical shores and are given much attention. The paper will unquestionably be the basis on which future research in this field will be built, and as such it amply merits the attention of marine ecologists planning to work on coral reefs.

Roads, C. H., Ormond, R.F.G., Campbell, A. C., and Polunin, N.V.C. Report on the 1969 Red Sea Expedition of the Cambridge Coral Starfish Research Group into the starfish Acanthaster planci. 1-11 + 24 pp., 1970. The above outsize title leaves little to be said about this interesting document, except that the authors did find and study apparently normal populations of the crown-of-thorns starfish. The report, though extremely preliminary, is interesting enough that anyone seriously concerned with the ecology of this destructive animal can scarcely afford not to read it. The expedition will be continued on an augmented scale in 1970. The Sudan coast of the Red Sea, including Wingate and Towarit barrier reef islands, is the area studied.

Robertson, W.B., Jr., Transatlantic migration of juvenile sooty terns. Nature 223: 632-634, 1969. A further installment of the results of Bill Robertson's continuing work on the sooty terns of Bush Key, Dry Tortugas, reports the results of an enormous banding effort. The amazing thing to come out of this is conclusive evidence that the juvenile terns from the Dry Tortugas colony migrate to the Gulf of Guinea, West Africa, returning sometimes during their first six years. The paper is fascinating. In the same context, the Smithsonian Institution's Center for Short-Lived Phenomena, on July 11, 1969, published a report by Bill Robertson of a massive failure of the 1969 sooty tern egg hatch on Bush Key. The cause is not evident.

Guilcher, A., L'Océanie. 1-295, Presses Universitaires de France, Paris, 1969. A general geography of the Pacific of which about one-third is devoted to Australia and New Zealand, so that the many archipelagoes of small islands are discussed in only two to a few pages each. The text is up-to-date and makes useful and informative reading. Illustrations include diagrams, maps, and photos. This small volume will be a good introduction to the Pacific for the general reader as well as a valuable reference for the specialist in need of checking some of his facts and figures.

Guilcher, A., et al., Les récifs et lagons coralliens de Mopelia et de Bora-Bora (îles de la Société). Mémoire ORSTOM 38: 1-103, 1969. Preceded only by a few preliminary papers, here are at last the main results of the 1963 Expedition (cf. ARB 100:1, 1963) led by Professor Guilcher, and sponsored by the Foundation Singer-Polignac and Centre National de la Recherche Scientifique. The report compares a small atoll and the barrier-reef of a high island in their morphology, sedimentology and water circulation. Further comparisons are made with other atolls and reefs. The memoir is generously illustrated with maps, graphs and air-photos. Results of the botanical studies are not included, and will be published separately. There is an English summary.

Société des Océanistes: The Journal for Dec. 1969, received a few months later, is devoted to the Missions in the Pacific and includes also the usual notes, reviews, and the latest installment (for 1968) of the Bibliographie de l'Océanie. This is vol. XXV, no. 25. Almost by the same mail no. 26 arrived, which is the first issue of a new series: the Journal will be quarterly from 1970 on, with nos. 26-29 to form vol. XXVI. This number has 92 pages as against 458 for no. 25, fonts and design (except for a new cover) remain the same. An index for 1960-69 will be included in vol. XXVI. We trust that the coverage will continue as in the first series so that in addition to the sciences related to Man in the Pacific, some attention will remain focused on his environment. The varied, eclectic and yet harmonious choice of topics in the Journal has always been one of its great assets. We wish it all possible success in its new format.

Cahiers du Pacifique: Two issues were received recently: No. 12, dated Dec. 1968 and 13, May 1969. Both include papers on French research on Mururoa and other Tuamotu atolls affected by the nuclear experiments of 1966-68. The field work started in 1964 (borings) and continued at least into 1967 and constitutes apparently a "before" phase of study of the atolls. Whether any "after" surveys have been made and the publication of their results planned is left unsaid. All these papers are also collected in one volume, "Mururoa," issued by the Direction des Centres d'Expérimentations Nucléaires, Service Mixte de Contrôle biologique, 1-333, 1969. Both Cahiers du Pacifique include the usual section of Nouvelles du Pacifique; no. 13 has also a number of articles on Pacific crustacea and fungi. As always, the Cahiers are lavishly illustrated, with line drawings, maps and plates including 4 in color.

Reefs of New Caledonia: The results of the 1960-63 Expedition to New Caledonia, sponsored by the Fondation Singer-Polignac, are being published as a series of Memoirs by the Fondation (ARB 112: 10, 1965; 117:4, 1966). Vol. 1, 1965, includes an account of the Expedition by B. Taine and a geomorphological description of the southern reef of the island by A. Guilcher (with English abstract). Vol. 3, 1968, by J. P. Chevalier, includes 3 papers on the geomorphology, modern reefs and fossil madreporaria of Maré I. in the Loyalty group, a raised atoll with two small basaltic islets in the lagoon. Vols. 2, 1964 and 4 (in press) include papers by various authors on the zoological collections and other observations of the Expedition. The first preliminary volume on Polynesian decapods has been followed by a second, by D. Guinot (1967), on Indo-Pacific edible crabs (not seen). All the volumes seen are very handsomely designed and illustrated.

Clipperton Island: Quite a number of mimeographed reports on the French observations made on Clipperton (see ARB 126: 4, 1969) have been received. One of the most recent, BIO-ECO No. 61, Jan. 1970, by P. Niaussat et al., concerns the microbiology of the Clipperton lagoon. Other subjects of research have been the biology of land crabs, birds, molluscs, and fish poisoning. Some of these valuable reports are mentioned, with annotations, in the recent Cahiers du Pacifique.

Les oubliés de Clipperton, by Claude Labarraque-Reyssac (1-249 +2, André Bonne, Paris, 1970) is a historical novel based on the ordeal of the Mexican garrison abandoned on Clipperton Island in 1914 after a change in government, and rescued only in 1917 when reduced to a dozen women and children. The author, French novelist and playwright, has made every effort to provide an authentic background to her story and the book includes a map, a photo and a short bibliography of the island.

Bermuda: Bermuda Biological Station for Research, St. George's West, Bermuda, asks us to mention the availability of a revised edition of H. B. Moore's Ecological Guide to Bermuda Inshore Water, B.B.S.R. Special Pub. 5, 1969, at $2.00 per copy. Sets of their Contributions, 7 volumes, 1903-1942, are still available at $100.00 per set. They have also just published their Special Publication 1, Distribution of Marine Algae about Bermuda, by Wm. Randolph Taylor and Albert J. Bernatowicz, 42 pp., 1969, $1.75. It lists the common shallow water species, with detailed localities, seasonal development and fruiting periods.

The Great Barrier Reef: W. J. Dakin's "The Great Barrier Reef, and some mention of other Australian coral reefs", first published in 1950, has been re-issued as a paperback in the series Walkabout Pocketbooks by Ure Smith Pty Ltd in Sydney and by Horwitz Group Books in London. The re-issue is of the second edition (1963), revised by Dr. Isobel Bennett of the University of Sydney. The paperback version is lavishly illustrated in both color and black & white, and sells for $ Aust. 1.50, about US $ 2.00.

Indian Ocean Bibliographies: The Central Marine Fisheries Research Institute, Mandapam Camp, India, has recently issued a "Bibliography of marine fisheries and oceanography of the Indian Ocean 1962-1967" as the first in a new series of Bulletins, 208 pp., 1968. The bibliography contains some three thousand citations, and is designed to bring up to date the "Partial Bibliography of the Indian Ocean", compiled by A. E. Yentsch and issued by the Woods Hole Oceanographic Institution in 1962 as part of the U. S. Program in Biology of the International Indian Ocean Expedition. The Indian bibliography follows the same arrangement as the earlier work, though unfortunately the section on Coral Reefs (Geology and Biology) has been omitted. Both bibliographies have an author index but no regional index. The Central Marine Fisheries Research Institute has also issued "An annotated bibliography on the breeding habits and development of fishes of the Indian region" as Bulletin 3: 154 pp., 1968.

Woodward, R. L., Jr., Robinson Crusoe's Islands: A history of the Juan Fernandez Islands. 1-272, 1969. We have not seen this book and do not even have a complete reference to it.

Domm, S. and A., A visitor's guide to Heron Island and the Capricorn Group, Great Barrier Reef, Australia. 1-48, [Sydney, 1969?], published and distributed by the authors. This is a simply written and very well illustrated guide to the geography and natural history of these islands at the southern end of the Great Barrier Reef. It should be in the hands of every visitor.

Amos, W. H., Limnology, an introduction to the fresh water environment. 1-40, Chestertown, Md., 1969. Describes fresh-water bodies and suggests research activities and methods. Well illustrated with diagrams and photos. Some of the types of investigation mentioned should be undertaken on the occasional fresh-water pools, swamps, marshes, and bogs on atolls, which have been little studied. We know even of a few fresh or almost fresh-water lagoons, as on Swain's, Washington, and Clipperton atolls.

Briefly noted items: By the time this issue appears, the Supplement to our Island Bibliographies will be closed to further additions and at least on the way to being printed. We have no intention to carry this enterprise farther, as it has consumed an inordinate amount of time and energy. We will, however, in each Island News and Comment number of ARB, list published items that come to our attention, and that we feel might be useful or interesting to ARB readers. We will not attempt to organize them, except alphabetically, nor to offer complete coverage, nor even pretend that we have seen and read all items.

Faure, H. and Roubet, C. Découverte d'un biface acheuléen dans les calcaires marins du golfe pléistocène de l'Afar (Mer Rouge, Ethiopie). C. R. Acad. Sci. Paris, 267 (D): 18-21, 1968.
Acheulian implement in place in reef elevated to 90 m, Danakil depression. DRS.

Franzisket, L. The atrophy of hermatypic reef corals maintained in darkness and their subsequent regeneration in light. Int. Revue Ges. Hydrobiol. 55: 1-12, 1970.

High, L. R., Jr. Storms and sedimentary processes along the northern British Honduras coast. Jour. Sed. Petrol. 39: 235-245, 1969.
Mainland coast.

Jeffrey, C. Coco-de-mer. New Scientist, no. 372: 34-37, 2 January 1964.

Kendall, C. G. St. C. and Skipworth, P. A. d'E. Geomorphology of a recent shallow-water carbonate province: Khor Al Bazam, Trucial Coast, Southwest Persian Gulf. G. S. A. Bull. 80: 865-892, 1969.
Describes coral reefs and mangrove swamps; photos. FRF.

Montaggioni, L. Répartition et zonation géomorphologique des structures récifales de 1'Ile Réunion (Océan Indien). C. R. Acad. Sc. Paris 270: 663-665, 1970.
An important, though brief description of the Réunion reefs, relating their characteristics to physical environmental factors. FRF.

Moore, J. G. and Fiske, R. S. Volcanic substructure inferred from dredge samples and ocean-bottom photographs, Hawaii. G. S. A. Bull. 80: 1191-1202, 1969.
May have some bearing on subsidence of islands. FRF.

Neumann, A. C., Gebelien, C. D. and Scoffin, T. P. The composition, structure and erodability of subtidal mats, Abaco, Bahamas. Jour. Sed. Petrol. 40: 274-297, 1970.

Randall, R. E. Vegetation and environment on the Barbados coast. Jour. Ecol. 58: 155-172, 1970.

Robertson, R. Review of the predators and parasites of stony corals, with special reference to symbiotic prosobranch gastropods. Pac. Sci. 24: 43-54, 1970.

Scoffin, T. P. The trapping and binding of subtidal carbonate sediments by marine vegetation in Bimini Lagoon, Bahamas. Jour. Sed. Petrol. 40: 249-273, 1970.

Shier, D. E. Vermetid reefs and coastal development in the Ten Thousand Islands, Southwest Florida. G. S. A. Bull. 80: 485-508, 1969.
Intertidal masses of Vermetus shells forming a reef rock. Geological study. FRF.

Seuss, Erwin. Calcium carbonate interaction with organic compounds. 1-153, PhD. Thesis, Lehigh Univ., 1968 (ONR Geophysics Br. N-onr-610 (07), report and contract No.).
Beachrock cementation?

Swinchatt, J. P. Algal boring: a possible depth indicator in carbonate rocks and sediments. G. S. A. Bull. 80: 1391-1396, 1969.
Interesting, but no evidence that author has any idea what algae are doing the boring. Does think boring takes place subtidally; no mention of terrestrial boring algae. FRF.

Taylor, J. D. and Lewis, M. S. The flora, fauna and sediments of the marine grass beds of Mahé, Seychelles. Jour. Nat. Hist. 4: 199-220, 1970.

Veeh, H. H. and Giegengack, R. Uranium-series ages of corals from the Red Sea. Nature, 226: 155-156, 1970.

Weydert, P. Les variations récentes du niveau marin et leurs influences sur la morphologie récifale dans la Baie de Tuléar (Sud-Ouest de Madagascar). C. R. Acad. Sc. Paris 268 (D): 482-484, 1969.
Ascribes reef morphology to recent eustatic shifts in sea level. Interesting. FRF.

Aldabra Bibliography Supplement: Since the publication of the "Bibliography of Aldabra" (Atoll Research Bulletin, 118: 127-141, 1967) many additional items have been traced. Some of these were omitted in error from the Bibliography literature search and have since been noted; more have been brought to my attention by correspondents (notably Mr J. F. G. Lionnet of Mahé, Seychelles); and finally, a number of items have been published since the Bibliography went to press.

I am sure that the Bibliography, even with these additions, is very incomplete. Hence I am circulating a Supplement so that members can check their own records and identify additional items not yet entered. I would be very glad if you could send them to me, so that they can be incorporated in a final version.

The criteria for inclusion of items remain rather loosely defined. In some cases descriptions of new taxa from Aldabra are included, in others not. Species lists are generally included, even when only a single record for Aldabra is contained in them. Much of the recent (1967-) literature is clearly ephemeral, but I have included it in the Supplement except in the case of such items as unsigned editorials and newspaper articles. In some cases I have been unable to check items in the Supplement and some of the citations are incomplete: I would be glad to have any corrections or changes to these.

D. R. Stoddart.

Anonymous. 1962. Aldabra Atoll. Seychelles Annual 1962: 25-27.

---------- 1964. The turtles and tortoises of the Seychelles. Seychelles Annual 1964: 23-27.

---------- 1967a. Exchange of Notes between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the United States of America concerning the availability for defence purposes of the British Indian Ocean Territory. London, 30 December 1966. Treaty Series No. 15 (1967). London: H.M.S.O., Cmnd. 3231: 1-11.

---------- 1967b. Aldabra. IUCN Bulletin, n.s., 2(4): 32.

---------- 1967c. The case for Aldabra: more is at stake on this Indian Ocean atoll than its giant tortoises and frigate birds. Economist, 595-596.

Arnoult, J., Bauchot-Boutin, M. L., and Roux-Estève, R. 1958. Les poissons de l'Ile Aldabra. Ann. Inst. Océanographique, 34: 47-90.

Barnacle, G. A. S. 1962. The land and freshwater shells of the Seychelles. J. Seychelles Soc. 1962 (2): 53-57.

Beamish, T. 1967. Saving Aldabra. The Listener, 78: 605-606.

Benson, C. W. 1969. The white-eye Zosterops maderaspatana (Linn.) of Menai Island, Cosmoledo Atoll. Bull. Brit. Ornith. Club, 89: 24-27.

Bernardi, G. 1968. Une nouvelle sous-espece d'Eureme floricola Boisduval (Lep. Pieridae). Bull. Soc. Ent. France, 73: 193.

Bigot, L. 1962. Les Pterophoridae des Iles Seychelles. Bull. Soc. Entom. France, 67: 79-88.

Blackman, R. A. A. and Pinhey, E. C. G. 1967. Odonata of the Seychelles and other Indian Ocean island groups, based primarily on the Bristol University Expedition of 1964-1965. Arnoldia, 3(12): 1-38.

Bolivar, I. 1924. Orthoptera Dictyoptera (Blattidae and Mantidae), and supplement to Gryllidae, of the Seychelles and adjacent islands. Ann. Mag. Nat. Hist., ser. 9, 13: 313-359.

Brown, N. 1967. Aldabra and the vandals: the defence argument. New Scientist, 36: 472-473.

Carcasson, H. 1964. New African butterflies. J. East African Nat. Hist. Soc. 24: 67-72.

Cardot, J. 1904. Les Leucobryacées de Madagascar et des autres îles austro-africaines de l'Océan indien. Bull. Herbier Boissier, Genève, sér. 2, 4(2): 97-118.

Champion, G. C. 1917. Coleoptera, Heteromera (excluding Tenebrionidae) from the Seychelles Islands and Aldabra. Ann. Mag. Nat. Hist., ser. 8, 19: 161-187.

Chave, G. J. 1967. The nuclear island of Aldabra--1975. R. Engin. Jour. (Chatham), 81: 321-329.

Cherbonnier, G. 1964. Aldabra l'île aux tortues géantes. Paris: Gedalge, 1-190.

Dajoz, R. 1969. L'atoll d'Aldabra, refuge des tortues géantes, sera-t-il épargné? Science progrès: la Nature, 3409 (Mai): 183-186.

Dixon, C. 1898. Lost and vanishing birds. London: John McQueen, 1-295.

Dupont, R. P. 1936-7. Quelques notes descriptives basées principalement sur les recherches du Professeur J. Stanley Gardiner et sur des observations personnelles, pouvant servir à mieux faire connaître la distribution, la formation, la structure et les ressources naturelles de quelques îles madréporiques de la mer des Indes. Rev. agric. Maurice, 89: 184-187; 90: 208-211; 94: 132-139.

---------- 1941. Quelques notes au sujet de l'importance économique des oiseaux de Mer dans les îles océaniques. Trans. Roy. Soc. Sci. Arts, Mauritius, Ser. C, 10: 2-11.

Esben-Petersen, P. 1927. Neuroptera: Chrysopidae of the Seychelles and adjacent islands. Ann. Mag. Nat. Hist., ser. 9, 19: 445-455.

FAO. 1968. Report to the Governments of Southern Yemen and the Seychelles Islands on the Green Turtle resource of South Arabia, and the status of the Green Turtle in the Seychelles Islands; based on the work of Dr Harold F. Hirth, FAO/TA Marine Turtle Biologist. Rome: Rep. FAO/UNDP(TA) (2467), 59 pp.

Fiddick, P. 1968. This is Aldabra: colour it pink because it belongs to you. Nova (London), January 1968: 36-38.

Fosberg, F. R. 1967. Unique Aldabra. Atlantic Naturalist, 22(3): 160-165.

Gaymer, R. D. T. 1967. Threat to Aldabra. Ibis, 109: 477.

---------- 1968. The Indian Ocean giant tortoise Testudo gigantea on Aldabra. Jour. Zool. 154: 341-363.

Grouvelle, A. 1918. Coleoptera: Ostomidae, Monotomidae, Colydiidae and Notiophygidae from the Seychelles and Aldabra Islands. Trans. Entom. Soc. London, 1918(1-2): 1-57.

Guérin, R. 1940-53. Faune ornithologique ancienne et actuelle des îles Mascareignes, Seychelles, Comores et des îles avoisinantes. Mauritius.

Guilcher, A. 1969. Aldabra et la protection des atolls. Norois, 16: 102-104.

Herbulot, C. 1962. Nouveaux Geometridae d'Aldabra. Rev. Fran. Entom. 29: 235-237.

Hillaby, J. 1967. High politics on tortoise island. New Scientist, 34: 584-585.

Honegger, R. E. 1967. The Green Turtle (Chelonia mydas japonica Thunberg) in the Seychelle Islands. Brit. Jour. Herpetol. 4:8-11.

Honegger, R. E. 1968. Les géants vont-ils quitter leur dernier refuge? Image du Monde (Lausanne), February 1968: 1-14.

---------- no date. Some notes and observations on giant tortoises Testudo gigantea Schweigger living and extinct of the Indian Ocean islands. World Wildlife Fund Project No 28. 30 unnumbered pages, typescript.

---------- no date. Some notes on wildlife and wildlife conservation on the Seychelles and other Indian Ocean islands. World Wildlife Fund Project No 28. 11 pp., typescript.

Hooker, J. D. and others. 1875. Petition to Sir Arthur Hamilton Gordon, Governor of Mauritius, from the President of the Royal Society, the President of the Royal Geographical Society, Charles Darwin, Richard Owen, John Kirk and Alfred Newton, requesting for the protection of the Giant Tortoise on Aldabra. Trans. Roy. Soc. Arts Sci. Mauritius, n.s. 8: 106.

Hutchinson, G. E. 1927. On new or little-known Notonectidae (Hemiptera-Heteroptera). Ann. Mag. Nat. Hist., ser. 9, 19: 375-379.

Jordan, K. 1914. Coleoptera: Anthribidae. Trans. Linn. Soc. London, ser. 2, Zool., 16 (Percy Sladen Expedition Reports, 5): 247-267.

Koenig, P. 1941. Notes additionelles. Trans. Roy. Soc. Arts Sci. Mauritius, 10: 11-17.

Legrand, H. 1961. Un curieux procédé de nidification du cardinal d'Aldabra Foudia aldabrana. L'Oiseau et R.F.O., 34: 161.

Lévi, C. 1961. Les spongiaires de l'île Aldabra. Ann Inst. Océanographique, 39(1): 3-32; Rés. Sci. Camp. Calypso, 5(2): 1-31.

Lionnet, J. F. G. 1952. Coral islands. Corona, 4(7): 260-262.

---------- 1967. Aldabra--great wild atoll of the Indian Ocean. Seychelles Bulletin, 70: 2-3.

Ludwigson, J. 1967. Aldabra--of tortoises and men. Defenders of Wildlife News, 42: 262-264; Science News, 92: 156-157.

Matthew, K. C. 1932. Research work on an outbreak of malaria at Assumption and Aldabra Islands in 1930. Victoria, Mahé: Government Printing Office, 14 p.

Maulik, S. 1917. Cassidinae and Bruchidae (Coleoptera) from the Seychelles Islands and Aldabra. Ann. Mag. Nat. Hist., ser. 8, 19: 144-147.

McKenzie, K. G. 1969. L'Atollo di Aldabra riservato alle richerche ecologiche. Enciclopedia della scienza e della tecnica Mondadori, annuario 1969, 16.

Meade-Waldo, E. G. B. 1908. Abbott's Rail. Avicult. Mag. 6(2): 219.

Melvill, J. C. 1909. Report on the marine mollusca obtained by Mr J. Stanley Gardiner, F.R.S., among the islands of the Indian Ocean in 1905. Trans. Linn. Soc. London, ser. 2, Zool., 13 (Percy Sladen Expedition Reports, 2): 65-138.

Müller, G. W. 1899. Die Ostracoden von Madagaskar und Aldabra. Abhand. Senckenb. Naturf. Gesellsch. 21: 257-296.

Muller, Y. 1957. Les aventures d'une parisienne dans 1'Océan Indien. Paris: Editions de la Pensée moderne, 206 pp.

Newman, W. A. 1967. A new genus of Chthamalidae (Cirripedia, Balanomorpha) from the Red Sea and Indian Ocean. Jour. Zool. 153: 423-435.

Peterson, R. T. 1968. A plea for a magic island. Audubon Mag., Jan.-Feb. 1968.

Regan, C. T. 1912. New fishes from Aldabra and Assumption collected by Mr J. C. F. Fryer. Trans. Linn. Soc. London, ser. 2, Zool., 15 (Percy Sladen Expedition Reports, 4): 301-302.

Sandberg, H. 1967. Het Atol Aldabra, een Museum van natuurlijke Historie: door defensie-plan van Amerika en Engeland bedreigd. Ooost en West: Maandblad over tropisch en subtropisch Gebeiden, 60(15): 11-14.

Sauzier, T. 1893. Les tortues de terre gigantesques des Mascareignes et de certaines autres îles de la mer des Indes. Paris: Masson, 1-32.

Scott, H. 1926. Coleoptera from the Seychelles and adjacent islands: Carabidae (supplement), Cryptophagidae (supplement), Dermestidae, Lymexylonidae, Rhipiceridae, Spnindidae, Throscidae, Brenthidae. Ann. Mag. Nat. Hist. ser. 9, 18: 50-76.

Smith, J. L. B. 1955. The fishes of the family Pomacanthidae in the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 377-384.

---------- 1955. The fishes of the family Anthiidae of the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 337-350.

---------- 1955. The fishes of the family Carapidae in the western Indian Ocean. Ann. Mag. Nat. Hist., ser. 12, 8: 401-416.

---------- 1955-58. The fishes of Aldabra, parts I-X. Ann. Mag. Nat. Hist., ser. 12, 8: 304-312, 689-697, 886-896, 928-937 (1955); ser. 12, 9: 721-729, 817-829, 888-892 (1956); ser. 12, 10: 395-400, 833-842 (1957); ser. 13, 1: 57-63 (1958).

---------- 1958. The genus Limnichthys Waite 1904 in African seas. Ann. Mag. Nat. Hist., ser. 13, 1: 247-249.

Southward, A. J. 1967. On the ecology and cirral behaviour of a new barnacle from the Red Sea and Indian Ocean. Jour. Zool. 153: 437-444.

Snouckart, S. van. 1935. Les pigeons du genre Alectroenas. Alauda, 7: 328-338.

Stoddart, D. R. 1967. Threat to Aldabra. Geog. Mag. 40: 800-808.

---------- 1968. The Aldabra affair. Biol. Conserv. 1: 63-69.

---------- 1968. The conservation of Aldabra. Geog. Jour. 134: 471-485; discussion 485-486.

---------- 1969. Islands as ecological laboratories. New Scientist, 41(640): supplement, 20-23.

---------- 1969. Retrospect and prospect of Aldabra research. Nature, 221: 1004-1006.

Thorpe, W. H. 1967. Aldabra and the vandals: the scientists' case. New Scientist, 36: 471-472.

Tixier-Durivault, A. 1966. Octocoralliaires. Faune de Madagascar, 21: 1-456.

Toulgoët, H. de. 1965. Descriptions d'Arctiidae nouveaux de Madagascar. Bull. Soc. Entomol. France, 70: 217-230.

Vinson, J. 1938. Catalogue of the Lepidoptera of the Mascarene Islands. Mauritius Inst. Bull. 1(4): 1-69.

Walsh, J. 1967. Aldabra: biology may lose a unique ecosystem. Science, 157: 788-790.

---------- 1967. Aldabra: reprieve for an island. Science, 158: 1164.

Williams, J. G. 1953. Review of Cinnyris souimanga with the description of a new race. Ibis, 95: 501-504.

Wright, C. A. 1967. The island of Aldabra. Proc. Roy. Inst. Gt. Brit. 41: 647-665.

Zinn, D. J. 1967. Can Aldabra be protected? Science, 157: 8.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1970 O - 407-172