

ATOLL RESEARCH BULLETIN

No. 84

Atoll News and Comments

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December 31, 1961

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The following articles are included in this issue of the Bulletin. The articles are arranged in the order in which they appear in the Bulletin.

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Atoll News and Comment

Although the intention was to include, in each issue of the Bulletin, a short section on items of current interest, various circumstances made it inconvenient to do so in the last several issues. Hence the present article is more extensive than intended and some of the items are decidedly out of date. It is hoped that this will not occur in the future. It is also hoped that readers will continue to send in current items of interest to those concerned with coral atolls.

The present issue of the Atoll Research Bulletin has been seriously delayed and, consequently, some of the articles have been on hand for a deplorably long time. Apologies are hereby offered to the authors.

Recent and current investigations

Christmas Island:

Considerable work is either in progress or planned on Christmas Island, taking advantage of its status as an atomic proving ground, with attendant ease in communication and availability of facilities. Dr. David I. Blumenstock made a fairly extensive visit there in June 1960, studying weather phenomena and hydrography. He plans another visit as soon as circumstances permit. Dr. Philip Helfrich of the University of Hawaii, makes frequent visits, working on marine biological problems. Mr. Philip Ashmole, of the Edward Grey Institute, Oxford University, is planning an extended expedition to Christmas Island in 1962 to study the breeding cycles of sooty terns and other sea birds and to relate them to seasonal fluctuations of plankton abundance in the waters around the island.

Leeward Hawaiian Islands:

Prof. M. D. F. Udvardy, of the Zoology Department, University of British Columbia, writes of an 8 day expedition to Laysan Island in July 1959. The party included, in addition to himself, George D. Butler, Jr., Richard E. Warner, and Charles Daniel. Investigations included work on entomology, observations on behavior and a census of monk seals, observations on Laysan duck and finch, shearwaters and other birds, weather observations, collection of the flora, and vegetation mapping. Observations were made in relation to the nature and development of biotic communities. It is of interest that Dr. Udvardy seems to concur with our idea that the simplicity of atoll biota may help in understanding biotic communities generally. We are looking forward with great interest to the series of papers planned to report the results of this expedition.

As a continuation of the above mentioned observations, a 10-man expedition visited Laysan following the Tenth Pacific Science Congress, September 1961. Participants were Dr. A. Starker Leopold, Dr. Miklos D. F. Udvardy, Dr. Robert L. Usinger, Dr. George D. Butler, Jr., Dr. Charles H. Lamoureux, Dr. Martin Vitousek, Mr. Edward C. Jestes, Mr. Richard E. Warner, Mr. David H. Woodside and Mr. Ronald L. Walker. In addition to a week on Laysan, short visits were made to Kure and French Frigate Shoal. Transportation was furnished by the U. S. Coast Guard.

Midway Island--albatrosses and the jet age:

We can report that, as of October 2, 1961, the threatened slaughter of gooney birds on Midway Island by the U. S. Navy has not yet taken place. When the plan to eliminate these albatrosses because of the hazard of collisions between them and planes was publicized in 1959 such a protest arose from organizations and individuals that the action was deferred. Investigations were carried out to see if the birds could not be frightened or coaxed away from the runways.

A number of ideas were tried out, including the use of various noise-makers, smoke, and "habitat improvement" on nearby Kure Island, designed to attract the Midway albatross population to Kure. These had little or no effect. Leveling the small dunes near the runway and asphaltting the ground, to eliminate the updrafts of air on which the birds soar and to make the ground unattractive for the birds, was also initiated. These measures were remarkably successful, in terms of reduced number of birds soaring over the runway and in terms of reduced number of collisions with planes. If and when this operation is completed, it may eliminate the collisions without eliminating the birds. The other measures do not seem to be promising. We hope that the suggestion of planting Casuarina on Laysan and other nearby atolls "to make them more attractive to the albatrosses" will not be carried out.

In the summer of 1961 Dr. Harvey I. Fisher studied the Midway albatrosses, both from the standpoint of population dynamics and that of experimenting with possible "imprinting" of young birds by moving them to a new location, to see if they tend to return to the new location for breeding when they reach maturity.

One of the disturbing things reported by Mr. Chandler Robbins, Fish and Wildlife Service biologist who has been handling the Midway investigation, is a general irritation among the personnel stationed at Midway with the noises made by birds of various sorts and especially with the burrowing habits of the shearwaters. This has resulted in a certain amount of killing and harassment of the birds. There may be some connection between this and the reported recent reduction of the Midway albatross population, attributed to accident and vandalism. It appears, as also demonstrated by the negative correlation between people and seabirds in the Marshall Islands, that sea birds and people do not very successfully occupy the same habitats.

Mr. Robbins has prepared a report on the success of leveling experiments and on the current situation involving these birds which will soon be issued in the Fish and Wildlife Service Special Scientific Reports; nos. 38, January 1958, and 44, July 1959 includes earlier information.

Wake Island:

In September 1961 after the Tenth Pacific Science Congress, Dr. Bruce Halstead, director of the World Life Research Institute, conducted a scientific party to Wake Island to collect poisonous fish, in continuation of his previous studies of the "ciguatera" poisoning problem. Participants were Dr. and Mrs. Halstead, Drs. Donald Hessel and Richard Beltz, chemists, Messrs. Don Ollis and Robert Rutherford, photographers

and Miss M.-H. Sachet. The latter concentrated on the land ecology of the atoll, continuing observations made by F. R. Fosberg in 1951, 1952 and 1953 (see ARB no. 67, 1959). Insects and some reef animals, soil samples and especially herbarium specimens of land plants were collected.

Jaluit Atoll:

A follow-up study of the recovery of Jaluit from the effects of Typhoon Ophelia, January 1958 (see ARB 75) was undertaken in October 1960, by a party composed of Dr. David I. Blumenstock, Charles G. Johnson, Harold Rehder, and F. R. Fosberg, again under the auspices of the office of Naval Research and the Pacific Science Board. Marked changes were noted in some aspects, though the results of the typhoon are still very obvious in others. Coconut replanting has been completed and the economy of the people is well on its way back to normal. A preliminary note has been published summarizing the results of this visit (Nature 189(4765): 618-620, 1961) and it is hoped that a more extensive report can be completed soon.

Rongelap Atoll, Marshall Island:

As noted in Atoll Res. Bull. 70. p. 3, the University of Washington Radiation Biology Laboratory has extended its studies of fallout-contaminated areas in the northern Marshall Islands to some of the terrestrial aspects of the problem. Repeated expeditions under the direction of Dr. Edward E. Held have visited Rongelap Atoll and information on radioactivity levels in soils, land animals, and land plants has been collected. A detailed study of the soils of the atoll has been undertaken, and some experimental work to detect possible effects of low level radioactivity on plants has been done. Conversation with members of several of the expeditions indicates that the morbid appearance of many of the plants in the vegetation of the northern islets of Rongelap, observed in 1956 and reported in Atoll Res. Bull. 61, 1959, has persisted. This has been the object of some attention by the group, but as yet no convincing explanation has been advanced.

A paper by R. F. Palumbo and F. G. Lowman on the occurrence of antimony-125, Europium-155, Iron-55 and other radionuclides in Rongelap Atoll soil, has been issued as Report no. UWFL-56, by the Technical Information Service Extension, Oak Ridge, Tenn. At the IXth International Botanical Congress, Montreal, August 1959, R. B. Walker and E. E. Held presented a paper on radiocaesium in plants grown on Rongelap Atoll soils. R. F. Palumbo presented one at the same occasion on the differences in uptake of radioisotopes by marine and terrestrial organisms. Held has since published an abstract on Observations on two land crabs in the Marshall Islands (Bull. Ecol. Soc. Amer. 41: 51-52, 1960), presented at the meeting of the Ecological Society of America, Western Section, Eugene, Ore., June 14, 1960. It may be noted that the "crabs" referred to are the coconut crab and a hermit crab, rather than land crabs. S. P. Gessel, E. E. Held and R. B. Walker presented a paper on nitrogen studies of Rongelap atoll soils at the Tenth Pacific Science Congress. Other results should not be long in coming.

The notes on the condition of the vegetation on the northern islets of Rongelap by Dr. Baruch Blumberg, mentioned in ARB 70, p. 3, have been published by Blumberg and Conard as an addendum to a report by Conard, et al., on a Medical survey of Rongelap people five and six years after exposure to fallout, BNL 609 (T-179), pp. 85-86, 1960. Since this paper was published in a very obscure place, not likely to be seen by any student of atoll vegetation, it is reproduced below,* minus the map and photo.

These observations and those mentioned above by the radiation Biology Laboratory scientists make it obvious that the abnormal condition of the vegetation of the northern Rongelap islets is not merely a temporary phenomenon induced by climatic vicissitudes or accidental wave wash, and that the cause is not known. While we do not insist that there is any connection with the Castle fallout, as suggested in ARB 61, no better explanation seems to have been offered, at least none that is satisfactory to those familiar with the normal character and behavior of atoll vegetation. We have not seen any detailed outline of the plans and procedures of the present ecological study by the Radiation Biology Laboratory group, but there seems to be no indication that several of the possible lines of approach previously suggested to the U. S. Navy Radiological Defense Laboratory and by them to the AEC have been tried. Although so much time has elapsed that much of the evidence may have been lost, it still would seem appropriate to study in detail the condition of individual plants of the most affected species, of all ages from newly germinated seedlings to old and obviously injured plants, to excavate root systems and find whether the poor condition of the shoots is matched by corresponding pathology of the roots, to determine, histologically, the nature of the injury and the tissues affected, and to see if there is any unusual concentration of radioactive substances in these or any other tissues in the injured plants. There seems little point in devoting any more attention to Scaevola and Tournefortia (Messerschmidia), since both the Fosberg and Blumberg reports note that these plants completely failed to show the pathological conditions observed in other species. Finally, a detailed survey of the present condition of all species of plants on the different islets of Rongelap, by someone who is thoroughly familiar with their normal appearance under similar climatic conditions, should obviously be made and published so that an unbiased assessment of the situation could be made by anyone interested. It may be added that the pages of this Bulletin are open for preliminary publication of any available data on this problem and that such publication might serve an immediate purpose in stimulating new ideas.

*A note on the vegetation of the

northern islets of Rongelap Atoll, Marshall Islands, March 1959

B. S. Blumberg and R. A. Conard

"Fosberg^{1,2} reported changes in the vegetation of the northern islets of Rongelap Atoll (observed in 1956) which he inferred might have been associated with the radioactive fallout that occurred on this atoll in 1954. During the medical survey of the Rongelap people³ carried out in March 1959, an opportunity arose to visit some of these islets and to

re-examine the vegetation. A helicopter was available for transportation, which permitted general and detailed air examination as well as two short ground surveys. The northern islets were estimated to have received a radiation dose of ≈ 3000 r. The islets of Naen and Gegen were examined in greatest detail. The most striking feature observed from the air was the generally gray color of much of the vegetation, in contrast to its normal green color. Ground surveys revealed that Scaevola sericea was common and normal in appearance. Many of the Guettarda speciosa appeared to be in poor condition (Figure A-2). In some, all or nearly all the leaves were gone from the terminal 1 to 12 in. of the branches, and other leaves were yellowed and shriveled. In other Guettarda, nearly all the leaves were gone, and the bushes appeared completely dead. More than 50% of the Guettarda were affected in whole or part. In one area of Naen several hundred yards inland from the ocean beach, there was a field of ≈ 30 Guettarda, all of which were dead. Some young Pisonia grandis were seen which appeared to be in good condition. Mature Pisonia were seen which were partially defoliated, but these did not appear to be greatly different from those seen on Rongelap Islet on the southeast corner of Rongelap Atoll. None of the mistletoe-like clumps described by Fosberg were observed. Several Ochrosia oppositifolia were seen with nearly complete defoliation, which appeared dead. A small grove of coconut trees near the center of Naen Islet contained 4 to 5 dead trees within a radius of ≈ 300 yards, which were decapitated at heights 5 to 12 ft above the ground with no evidence of axe or machete marks. Two 2-headed coconut trees were seen, one with fronds that were mostly brown and appeared dead growing from the trunk ≈ 12 ft below the true crown of the tree. Several trees had dry and shriveled fronds, and ≈ 6 had deformed bulges 4 to 8 ft below the crown with apparently normal growth above the bulges.

"Photographs of the affected vegetation were examined by Dr. Fosberg, and he stated that the changes were similar to those he had previously reported.

"It is not possible to evaluate the cause of the changes from the present observations. More extensive and detailed botanical and ecological surveys will be necessary, both on the islands that received radiation and on those that did not, to determine whether the changes seen bear any relation to fallout. In particular, it should be noted that these observations were made during the dry season.

"We are indebted to Professor Frank Richardson of the University of Washington for identifying the plants, and to Commander W. Lyons, USN, for his assistance in taking the photographs.

References

1. Fosberg, F.R., Nature 183, 1448 (1959).
2. Fosberg, F.R., Atoll Research Bulletin 61, 1-11 (1959).
3. Conard, R.A. et al., Medical Survey of Rongelap People, March 1958, Four Years After Exposure to Fallout, BNL 534 (T-135)."

Caroline Atolls:

During the summer of 1960 Dr. Harvey A. Miller, of Miami University, Oxford, Ohio, led an expedition to collect material and to study certain aspects of cryptogamic botany and wood anatomy on the Caroline Islands. The active personnel on this trip were Dr. Miller, Henry O. Whittier, Less S. Dutton, Ernani G. Menez, and Alnus Oruetamor. The schooner Collegiate Rebel served as base of operations and transported the party between islands. Extensive collections of bryophytes and marine algae, and some wood samples with herbarium vouchers were prepared. The wood samples were shipped to the U. S. National Herbarium, the bryophytes to Miami University, and the algae to the University of Hawaii. In addition to the high islands a number of atolls were visited, including Mokil, Oroluk, Namonuito, Puluwat, Ifaluk, Sorol, and Pulu Anna. An outcome of this investigation is the undertaking, by Mr. Whittier, of the preparation of a bryoflora of the Micronesian atolls. In addition to the collections mentioned above, which were the principal objectives of the trip, Dr. Miller informs us that a collection of vascular plants was made on Mokil.

Ulithi Atoll:

On November 30, 1960, Ulithi was hit by Typhoon Ophelia (second of this name in Micronesia) and badly battered. In view of the interest of the Coral Atoll Program in the effects of typhoons on atolls, the Pacific Science Board and the Office of Naval Research sent a party made up of David I. Blumenstock, Charles G. Johnson, and William A. Lessa to Ulithi in January 1961, to survey the damage. Since Lessa had previously done ethnological work on Ulithi it was especially fortunate that he could be a member of the party. A summary of observations is being prepared for publication in Science, and it is hoped that a full report may be available for this Bulletin in the not too distant future.

Laccadive Islands and Minicoy:

Information has been received, through the Unesco Humid Tropics Programme, that the Botanical Survey of India, Western Circle, has carried out a collecting mission to the Laccadive and Minicoy atolls. No further details are available except that the herbarium specimens received have been incorporated into the Western Circle Herbarium, at Poona.

Alacran Reef:

Although the Pacific Science Board's Coral Atoll Program has functioned mostly in the Pacific, its scope extends throughout the tropical areas where coral atolls and similar islands exist. Therefore it is with great interest that we call attention to rather extensive studies of Alacran Reef, north of Progreso, Yucatan. The vegetation of this atoll was described in some detail by C. F. Millspaugh following a visit in 1899.

From 1955 to 1961, a number of expeditions from various institutions have visited and worked on Alacran, making it, by now, one of the better known atolls. Most of this work is as yet unpublished but several manuscripts are in press, including one by F. Bonet and J. Rzedowski on the

vegetation and one by L. Huerta Musquiz on the marine flora which have been submitted for publication by the Escuela Nacional de Ciencias Biologicas in Mexico City. Louis Kornicker and colleagues have published an excellent map of Alacran Reef and a general descriptive paper, including preliminary lists of animals found there (Inst. Marine Sci. Pub. 6: 1-22, 1959).

Work carried out during the summers of 1959 and 1960 may be indicated by quoting as follows from a letter, dated March 28, 1961, from Dr. J. T. Conover, chief scientist of the Duke University party:

"A bio-geological survey of Alacran Reef, Yucatan, was undertaken by the University of Texas and Duke University as cooperating institutions each supported by separate National Science Foundation grants (U. of T., NSF-G 8902; Duke U., NSF-G-12333). An account of the objectives and work of the University of Texas group in 1959 is given in a paper by Kornicker, Bonet, Cann and Hoskin in Vol. 6, 1959, Publ. Inst. Mar. Sci. The objectives of Kornicker's group were to study the bio-geologic genesis of a living reef and later to compare the results with fossil reefs and paleoecological considerations.

"The first summer (1959) Kornicker's group devoted their time to a general survey of Alacran atoll with emphasis on the geological features, the atoll profile and the general nature of the living communities. The second summer (1960) Kornicker and Boyd concentrated their attention on microatoll growth and sedimentary features related to the living communities around the sand cays. Charles Hoskin studied the distribution of grain size and mineral forms of calcium carbonate in the various facies of the entire atoll. Robert Folk and an assistant examined the sedimentation features of the sand cays with special consideration of the clastics and their distribution and orientation.

"The botanists, Conover and Perkins, measured the standing crop of the principle living plant communities by species population throughout the atoll along 10 transects. These data revealed the existence of a number of distinct community zones which reflect the growth character of the atoll. Results from this study provided an estimate of the living standing crop of benthic plants (not including the Zooxanthella in the polyp colonies), both non-calcareous and calcareous, with and without the lime incrustation by weight, in gms/m^2 / species. It was discovered that the windward slope of the atoll was firmly cemented by an extensive mantle of encrusting coralline algae. There was no lithothamnion ridge community, but in its place a sparsely populated, unconsolidated subtidal platform composed of loose blocks, boulders, cobbles and smaller fractions of coral and algal rubble. Even in the lagoon no deep deposits of sand were observed since all types of bottom were subtended by coarse fragments of coral-algal rubble (unconsolidated), no matter where the botanists drove in their coring tubes in the shoal waters. The nature of the deep channel bottoms may differ from these findings for shoal water facies. Also the features in the lagoons, reported in 1959 as patch reefs, were recognized as true faros, or microatolls, with similar growth features to the atoll's own characteristics. Benthic plant production is very high on the atoll, and contributes a large fraction of the calcium carbonate composing the

reef. An honest estimate of the amount of lime contributed by plants and animals in the living communities is one of the objectives of this study. Charles Hoskin is providing data on the subfossil and fossil estimates based on sediment analysis. Dr. Bonet intends to obtain a deep core from Alacran in the near future to provide additional data.

"Incidental to the major objectives, the nature of growth of micro-atolls or faros was investigated by the botanists. High temperatures and widely fluctuating salinities in the microlagoons of the faros suggested one possible reason for the scant life in these shallow sand-filled basins. The natural growth and death cycle related to age of the communities has been suggested as another reason. The exhaustion of nutrients in these small systems is another. Further studies on microatoll growth characteristics will be undertaken in the summer of 1961. It is believed that a shallow, faro-choked lagoon such as that at Alacran and in the Maldives atolls, may be related to the possible high transport rate by wind driven currents. These provide high nutrient levels, oxygenation, and perhaps warmth in winter (air temperatures go to freezing some days during the passage of a "norther" over Alacran) and cooling in summer provided by the exchange, as well as furnish spores and polyp larvae for seeding.

"Collections were made by Perkins of 5 representatives of the Phaeophyta at daily intervals over a month to study the lunar periodicity of their reproductive cycles on Alacran.

"Over 430 field numbers of benthic plants, a number of plankton tows, (which were surprisingly rich) and dredged samples from the bank in 35 fathoms of water were obtained during the five week survey.

"Data were obtained at each station (quadrat) including salinity, temperature, light (in ft candles), turbidity, depth and notes on the sedimentation features."

Participants were as follows:

Geologists: William Behrens, Fernando Bonet, Donald Boyd, Glen Cosh, Augustus Cotera, Robert L. Folk, Miles Hayes, Charles Hoskin, Edward Klován, Louis S. Kornicker, Walter Pusey, Thomas Wright, and Amado Yanez; Botanists: John T. Conover, Laura Huerta M., and William Dana Perkins. Institutions represented were the University of Mexico, Instituto de Geologia, Mexico, University of Texas, University of Wyoming, Columbia University, Instituto Polytecnico, Mexico, Rice Institute, Rutgers University, and the University of Rhode Island.

Dr. Brian Logan, of Texas A. & M., visited Alacran, as well as the other cays on the Campeche Shelf, in February, 1960, in the course of his work on the Pleistocene history of the Campeche Shelf.

The summer of 1961 saw a continuation of work on Alacran, with several parties in the field. Dr. Bonet, with his assistant, Sr. Yanez, and a party of drillers, drilled a hole through several hundred feet of sediments on Perez Islet. Dr. Charles Hoskin, with Prof. Don Winston and Harold Illich, made sedimentation studies and collected marine animals. Dr. John T. Conover, Prof. Harold Humm, Bruce Welch, and K. M. S.

Aziz studied algae and marine ecology. F. R. Fosberg made a brief survey of terrestrial ecological features and vegetation, as well as a collection of plants, with the object of comparing Alacran with Pacific atolls. Of special interest was the opportunity to compare present vegetation with that recorded in 1899 by Millspaugh. Change has been extreme.

The Atolls off British Honduras:

Until last summer among the least known atolls in the world were Turneffe, Lighthouse, and Glover's reefs, off the coast of British Honduras. In 1960 and again in 1961 these were visited by David Stoddart, of the Geography Department, Cambridge University. Detailed maps were made of many of the cays as well as collections of the plants growing on them. The processes of physiographic change were studied. A general report, mentioning briefly this work, as well as a popular book (see Recent Literature below), was issued on the 1959-60 Cambridge University Expedition. Detailed reports are expected. Meanwhile, Hurricane Hattie has swept these atolls. It is hoped that Mr. Stoddart will be able to return and compare the present physiography with his detailed maps, and further elucidate the role of hurricanes in shaping the cays.

Recent Literature

Two new journals of interest to the Coral Atoll Program have recently been launched. One of these is a quarterly called Pacific Insects, published by the Bishop Museum and edited by J. Linsley Gressitt. It includes systematic papers on insects of the Pacific Basin, some of which undoubtedly will treat atoll forms. None of the papers in the first number (1959) seem to record any atoll species. We have not seen the later numbers, though at least two volumes have appeared to date. An adjunct series to Pacific Insects, Pacific Insects Monographs, "devoted to monographs and other works too large for the journal", will be issued irregularly. Two numbers have appeared, the second of which (1961) is a review paper by Dr. Gressitt on Problems in the Zoogeography of Pacific and Antarctic Insects. This has a direct bearing on the insects of the Pacific coral atolls and an appendix by Miss Setsuko Nakata contains a record of a phasmid from Ebon Atoll.

Of the series, Insects of Micronesia, published under the same auspices, and containing many records of atoll insects, some parts of volumes, including two introductory volumes and 38 systematic treatments, have appeared to date.

The second journal is Cahiers du Pacifique, published at the Muséum National d'Histoire Naturelle, Paris, to contain material in all scientific and cultural fields touching the Pacific and lands bordering it. The Cahiers appear at irregular intervals, and of the three numbers published so far all contain articles of interest to students of coral atolls. The first number (Dec. 1958) has a paper on coral islands in the Tuamotus by Gilbert Ranson and a bibliography relative to coral in the Pacific for 1957-1958. In the second (June 1960) is a detailed history

of Clipperton Island, by M.-H. Sachet, including a comprehensive bibliography of works relating to or mentioning this easternmost atoll in the Pacific. In the third number (June 1961) are a summary of modern oceanographic researches in the South Pacific by Michel Legand and an article on the Great Barrier Reef and the Capricorn Group by P.-H. Fischer. In the latter are a map and description of Heron Island. In addition to original papers and review articles, each issue contains reviews of recent publications, news of the Pacific, and bibliographies on special subjects.

Next to the Great Barrier Reef of Australia, the reef complex of New Caledonia is perhaps the most important in the world, and it had so far remained rather poorly known. It is a pleasure to report that an extensive program of study of this reef has now been initiated by the French and is actively being pursued. Details are given in no. 3 of Cahiers du Pacifique.

We wish again to call attention to The Elepaio, Journal of the Hawaiian Audubon Society, and to emphasize that this little publication is becoming a major place of publication for information on atoll ecology, especially that of the Hawaiian atolls. In recent numbers E. P. Wilson describes the situation on Midway, which he visited in company with Chandler Robbins who was checking on results of the Navy's efforts to reduce the gooney bird hazard to aircraft; W. R. Smythe writes about monk seals on Laysan; Charles Hanson reports observations on Midway, with especial reference to the trouble between the Navy and the albatrosses; Richard Warner discusses Midway and Laysan in an article on the present status of the avifauna of the Hawaiian Islands; and Hubert and Mable Frings contribute a long article entitled Problems of Albatrosses and Men on Midway Islands. Here, in non-technical language, is a substantial amount of information on atoll ecology, and especially on the distressing situation on Midway discussed above.

Natural history of Ifaluk Atoll: Physical environment, by Joshua I. Tracey, Donald P. Abbott, and Ted Arnow, B. P. Bishop Museum Bull. 222: 1-75, 1961. This, the first of the series of reports of the Pacific Science Board Ifaluk Expedition, in 1953, is a fine piece of work. It includes a short description of the atoll, with photographs, followed by chapters on the physical environment and on the geology and hydrology. Under physical environment, climate and tides are discussed--thus this chapter heading refers to the environment of, rather than on, the atoll. Under geology and hydrology are sections on the geology of the islands, hydrology, reefs and lagoons, and a summary of geologic history. All of these subjects are treated in substantial detail, and well illustrated by photos, diagrams and maps. Separate large geological and sedimentary maps, and cross sections are provided. The detailed logs of the wells dug for an investigation of the hydrology provide much information on the soils which are briefly discussed. Very considerable attention is paid to the nature and material of the sediments, with descriptions and histograms showing the size, distribution and biological origin of the major constituents. No chemical analyses are reported. Earlier stands of the sea and changes in the outline, area and position of the islets are discussed at length. In most respects the information presented will provide an admirable basis for comparison with similar data from other atolls. This volume will certainly serve for a long time as a model, and for an indication of what can be accomplished in a relatively short visit to an atoll.

Dr. T. Goreau has written a short paper (Endeavour 20: 32-39, 1961) summarizing current knowledge and describing his own work on the mechanisms of calcium deposition and the role of zooxanthellae or endozoic algae in reef corals. The work was done on Jamaica reefs rather than on atoll reefs, but is of extreme importance in understanding reef ecology. It also includes a short bibliography of pertinent papers of a more technical nature.

In a paper on The role of algae in the formation of beach rock in certain islands of the Caribbean, Robert W. Krauss and Raymond A. Gallo-way conclude that algae play no direct role in the formation of this interesting rock, so characteristic of coral islands. They do not exclude the possibility of an indirect influence of algae in the process by means of their influence on carbon dioxide content of the water, or acidity. The paper appeared as Caribbean Beach Studies, Technical Report No. 11, Part E, from the Coastal Studies Institute, Louisiana State University, 49 pp., March 20, 1960. The distribution of these reports is unfortunately limited.

A major contribution to coral reef ecology has recently appeared, which stems in part from work initiated under the Pacific Science Board Coral Atoll Program, a paper by Robert W. Hiatt and Donald Strasburg on Ecological relationships of the fish fauna on coral reefs of the Marshall Islands (Ecol. Monogr. 30: 65-127, 1960). This brings together observations on the behavior, feeding habits, and stomach examinations of 233 species of reef-inhabiting fish collected on the Bikini Resurvey, the Arno expedition, and at the Eniwetok Laboratory, 2,051 fishes in all, 1185 of them collected at Arno Atoll. In addition the observations of Randall on the Onotoa Expedition are extensively cited. After placing this enormous amount of data on record in systematic order, the authors arrange the fish and discuss them according to habitat groups, then list them according to trophic levels, and finally, diagram and briefly describe the food web in the Marshall Islands reef ecosystem. Thus, not only is there presented here an impressive quantity of the raw materials of coral reef ecology, but the work constitutes an important step in the generalization of such information.

From Dr. George Scheer we have received three papers, two of them reporting results of the Xarifa expeditions, concerning the developmental history of stony corals, the other on the history of coral research, with a considerable bibliography. One of the papers is in Die Naturwissenschaften 10: 238-239, 1960, the others in Bericht 1958/59 Naturwiss. Verein Darmstadt 37-67, 1959.

Early attempts of Mormon missionaries to establish their church in southeast Polynesia, including the Tuamotus are described by Professor S. G. Ellsworth in a booklet entitled Zion in Paradise (1-35, Logan, Utah, 1959). Dr. Ellsworth, Associate Professor of history at Utah State University, is carrying on studies of the diaries of early Mormon missionaries in the Pacific, and we expect that this is only the first of many additions to literature on the atolls visited by these hardy people.

A brochure entitled Coastal Geography (anonymous, unnumbered, 17 pp., National Academy of Sciences--National Research Council, 1961) embodies the report of a Conference on Coastal Geography, held by an ad hoc

panel under the auspices of the NAS-NRC Committee on Geography, March 20-21, 1961. A very interesting program of research on coastal problems was proposed, but work on coral atolls was not mentioned; yet, because of the geographical nature of atolls, all problems involving them would seem to be coastal.

Harry Ladd has brilliantly summarized, for the non-specialist, current ideas and research on the geology and marine ecology of reefs and atolls in a well illustrated article entitled Reef Building (Science 134: 703-715, 1961). Results of the Eniwetok drilling are emphasized, with a cross sectional diagram, and a proposal for deep drilling on Midway Island is described, with a discussion of its significance. Mention should also be made of a paper by Ladd on the Origin of the Pacific Island Molluscan Fauna (Am. Jour. Sci. 258-A: 137-150, 1960), which has profound implications for the paleogeography and biogeography of the Pacific. His main thesis in this paper is that the Indo-Pacific marine fauna, instead of having originated in the Indonesian region and migrated into the Pacific may have originated in the Pacific and migrated into the Indonesian area.

Very worthy products of atoll investigations are popular books, that give the non-scientific public some insight into the hardships and hard work of expeditions, as well as the fascinations and satisfactions thereof. We saw this in Bates and Abbott's Coral Island. Now we have just received "From the Cam to the Cays", by David Carr and John Thorpe, an account of the Cambridge University Expedition to British Honduras, 1959-60, published by Putnam, London, 1961. This is a well written, well illustrated, and interesting account which makes good reading, and includes a chapter on Turneffe and Lighthouse atolls, which are little enough known and seldom visited by scientists. This chapter was written by our friend and correspondent David Stoddart, geographer from Cambridge University.

The greatest of all coral reefs, or rather, complexes of coral reefs, is the Great Barrier Reef of Australia, lining the Queensland Coast from Torres Strait to the Tropic of Capricorn. It has excited and intrigued the imagination of those interested in the sea and its beauties and mysteries since Captain Cook discovered it, became trapped in its maze of channels, and almost lost the tiny but famous Endeavour, in which he made his first voyage around the world. Many books have been written about this great reef, as well as innumerable scientific papers. The Great Barrier Reef Committee was organized by the Royal Geographical Society of Australasia to promote scientific investigations of it. The area includes about 200 flat coral islands or cays, some of which, such as Low Isles, have been carefully studied. The cays have much in common with the islets of oceanic atolls and their study sheds light on many ecological problems of atolls. On one of them, Heron Island, the Great Barrier Reef Committee maintains a laboratory, while on another, Green Island, there is an underwater observatory, providing excellent facilities for continuing study.

A magnificent introduction to this great ecological phenomenon has now been provided by Keith Gillett and Frank McNeill in, The Great Barrier Reef and Adjacent Isles, published by the Coral Press, Paddington, Sydney, Australia in 1959. This book of almost 200 pages describes the reef and

its islands in popular but accurate language, and is illustrated with magnificent photos. The main part, however, is devoted to descriptions and illustrations, many of them beautiful colored plates, of the animals likely to be found by visitors. After a visit to Heron Island, guided by this book, we can testify to its usefulness and readability.

We also welcome the appearance of Prof. Obermüller's beautifully illustrated work on the geology and mineralogy of Clipperton Island as one of two papers in a special volume entitled "Recherche géologique et minérale en Polynésie Française", Paris, 1959, published by L'Inspection Generale des Mines et de la Géologie. The other work in the same volume, by Professor Aubert de La Rue, deals with the high islands of the Society, Marquesas, and Austral Groups with only brief mention of their surrounding reefs. It contains a liberal series of the author's magnificent photos, including a good one of beachrock.

Attention of atoll students is directed to a series of "library summaries" and "library brochures" on Pacific island and Pacific area geography, and other subjects of geographical interest in the Pacific, prepared for the Pacific Missile Range, Point Mugu, Calif., under the direction and editorial supervision of Dr. William L. Thomas, Jr., of the Geography Dept., University of California, Riverside, Calif. This series, of which we have seen 27 booklets, issued between July 1960, and January 1961, is difficult to refer to, as the booklets are not numbered, no publisher is indicated, and no mention is made of where or whether they are available or to whom. They do not bear any indication of security classification, however.

Each booklet contains a summary of available published information, with liberal quotations from sources which are listed in a bibliography. The work seems to be competently done, under the authorship of one or more compilers for each booklet, well organized, and clearly presented in offset reproduction, with maps and photos. In addition to a number of high islands, the following atolls are treated either by summaries or brochures: Taongi, (Pokak) Kapingamarangi, Cocos (Keeling), Majuro, Eniwetok, Johnston, Wake, Canton, and Midway. The only apparent difference between a summary and a brochure seems to be that the latter is regarded as more complete.

Matters of general interest

The outstanding recent scientific event in the Pacific area has been the Pacific Science Congress, held in Honolulu in August 1961. Although no programs were devoted specifically to coral atoll problems, many of the symposia and contributed papers touched on or had an important bearing on these problems. Notable among these were symposia on Man's Place in the Island Ecosystem, Pacific Basin Biogeography, Modification of Biotic Balance of Island Faunas and Floras, Plants and the Migrations of Pacific Peoples, Land Tenure in the Pacific, and Pacific Island Terraces: Eustatic? The published papers of these symposia will appear in due course either in the proceedings of the Congress or in appropriate journals. Some abstracts are available in the volume entitled Abstracts of Symposium Papers, distributed at the beginning of the Congress.

In the annual report for 1959 of the Institut de Recherches pour les Huiles et Oleagineux (IRHO), p. 20, is an announcement of the establishment on Rangiroa Atoll of a coconut experiment station with a staff of a director and two professional scientists. A paper entitled The improvement of the coconut palm production on the atolls of the Tropical Pacific was presented by Y. Fremond of the IRHO, in the Tropical Crops Improvement symposium at the Tenth Pacific Science Congress, dealing with the work and plans of this station. We await with interest the results of these investigations on the culture of this important atoll crop.

We are informed that Dr. Herold Wiens' massive work of integration of knowledge on coral atolls, written during the last several years as a major step in the Pacific Science Board's Coral Atoll Program, will soon be published by Yale University Press. It should enable us to view the field and to determine what should be done next.

Bulletin readers may be interested to know that an International Society of Tropical Ecology has recently been organized, under the leadership of Indian ecologists, to promote research and training in tropical ecology and to improve communication among those interested in the subject in different parts of the world. An inaugural meeting was held in January 1960, at Bombay, India, on the occasion of the Indian Science Congress; reports of the meeting were published in the first number of the society's Bulletin. This Bulletin is published at irregular intervals and two numbers have appeared so far. Books and monographs also may be published later. Membership is open to all who are interested in tropical ecology; the society is to be represented by vice presidents and national committees in countries other than India. Correspondence should be addressed c/o Central Botanical Laboratory, 10 Chatham Lines, Allahabad, India. Fees and dues are: admission \$2.00 U. S. or 0/15/0 Sterling; individual membership \$5.00 or 1/15/0; institutional membership \$7.00 or 2/10/0; life membership \$70.00 or 25/0/0; applications and checks should be sent to the treasurer. In America correspondence may be addressed to and checks made out to F. R. Fosberg, senior vice president and U. S. representative (Pacific Vegetation Project, % National Research Council, Washington 25, D. C.). Those interested in coral atoll ecology are cordially invited to join.

Errata in Bull. 74, Birds of the Gilbert and Ellice Islands Colony
by Peter Child

- p. 3, par. 1, line 11: instead of "last-names" read "last named".
- p. 4, line 2: instead of "Peter's" read "Peters'".
- p. 4, last-but-one paragraph, line 2: instead of "of" read "or".
- p. 4, last-but-one paragraph, line 2: instead of "bikeman" read "Bikeman".
- p. 13, under 12 Sula sula: instead of "Keta" read "Kota".
- p. 23, last paragraph, line 3: instead of "freedly offered" read "freely offered".
- p. 31, line 4: instead of "thousand" read "thousands".