

DOE/EV/00703-T1-Vol. 2  
(DE67006111)

400303

# The Natural History of Enewetak Atoll

## Volume II Biogeography and Systematics

United States  
Department of Energy  
Office of Energy Research  
Office of Health and  
Environmental Research  
Ecological Research Division

Prepared by  
Office of Scientific and Technical Information  
U.S. Department of Energy

Edited by: Dennis M. Devaney  
Bernice P. Bishop Museum  
Honolulu, Hawaii

Ernst S. Reese  
University of Hawaii  
Honolulu, Hawaii

Beatrice L. Burch  
Bernice P. Bishop Museum  
Honolulu, Hawaii

Philip Helfrich  
University of Hawaii  
Honolulu, Hawaii

## Contributors

- A. Charles Arneson  
Scripps Institution of Oceanography, La Jolla, California
- Julie H. Bailey-Brock  
University of Hawaii, Honolulu, Hawaii
- Andrew J. Berger  
University of Hawaii, Honolulu, Hawaii
- A. J. Bruce  
Northern Territory Museum of Arts and Sciences,  
Darwin, N. T., Australia
- Beatrice L. Burch  
B. P. Bishop Museum, Honolulu, Hawaii
- Elizabeth H. Chave  
University of Hawaii, Honolulu, Hawaii
- C. Allan Child  
Smithsonian Institution, Washington, D. C.
- Robert S. Cox  
University of Michigan, Ann Arbor, Michigan
- Roger J. Cuffey  
Pennsylvania State University, University Park, Pennsylvania
- Bertha M. Cutress  
University of Puerto Rico, Mayagüez, Puerto Rico
- Charles E. Cutress  
University of Puerto Rico, Mayagüez, Puerto Rico
- Dennis M. Devaney (Deceased)  
B. P. Bishop Museum, Honolulu, Hawaii
- Paul H. Dunn  
Riverside Fire Laboratory, Riverside, California
- Lucius G. Eldredge  
University of Guam, Mangilao, Guam
- John S. Garth  
University of Southern California, Los Angeles, California
- Ray P. Gerber  
St. Joseph's College, North Windham, Maine
- Richard E. Grant  
Smithsonian Institution, Washington, D. C.
- Janet Haig  
University of Southern California, Los Angeles, California
- Scott Johnson  
University of Hawaii at Manoa, Honolulu, Hawaii
- E. Alison Kay  
University of Hawaii at Manoa, Honolulu, Hawaii
- Louis S. Kornicker  
Smithsonian Institution, Washington, D. C.
- Jens W. Knudsen  
Pacific Lutheran University, Tacoma, Washington
- Janet O. Lamberson  
U. S. Environmental Protection Agency,  
Newport, Oregon
- Judith C. Lang  
University of Texas at Austin, Austin, Texas
- Raymond B. Manning  
Smithsonian Institution, Washington, D. C.
- Gordon M. Nishida  
B. P. Bishop Museum, Honolulu, Hawaii
- Helen A. Randall  
B. P. Bishop Museum, Honolulu, Hawaii
- John E. Randall  
B. P. Bishop Museum, Honolulu, Hawaii
- Marjorie L. Reaka  
University of Maryland, College Park, Maryland
- Ernst S. Reese  
University of Hawaii at Manoa, Honolulu, Hawaii
- Don Reynolds  
Natural History Museum, Los Angeles, California
- Francis W. E. Rowe  
The Australian Museum, Sydney, Australia
- G. Allan Samuelson  
B. P. Bishop Museum, Honolulu, Hawaii
- Richard H. Titgen  
B. P. Bishop Museum, Honolulu, Hawaii
- Roy T. Tsuda  
University of Guam, Mangilao, Guam

## Contents

Chapter		Page
	Introduction <i>Beatrice L. Burch</i>	xvii
1	Marine Benthic Algae of Enewetak Atoll <i>Roy T. Tsuda</i>	1
2	Fungi of Enewetak Atoll <i>Paul H. Dunn and Don Reynolds</i>	11
3	Natural History of Terrestrial Vascular Plants of Enewetak Atoll <i>Janet O. Lamberson</i>	17
4	Recent Foraminifera and Nonplanktonic Protozoans <i>E. H. Chave and Dennis M. Devaney</i>	37
5	Porifera of Enewetak Atoll <i>Dennis M. Devaney</i>	49
6	Sea Anemones of Enewetak Atoll <i>C. E. Cutress and A. C. Arneson</i>	53
7	Octocorallia of Enewetak Atoll <i>Dennis M. Devaney</i>	63
8	Scleractinia (Stony Corals) of Enewetak Atoll <i>Dennis M. Devaney and Judith C. Lang</i>	67
9	Brachiopods of Enewetak Atoll <i>Richard E. Grant</i>	77
10	Reef-Dwelling Bryozoans of Enewetak Atoll <i>Roger J. Cuffey and Robert S. Cox</i>	85
11	Sipunculans and Echiurans of Enewetak Atoll <i>Dennis M. Devaney</i>	93
12	Platyhelminthes, Nemertea, and Nematoda of Enewetak Atoll <i>Dennis M. Devaney</i>	95
13	Polychaetes of Enewetak Atoll <i>Dennis M. Devaney and Julie H. Bailey-Brock</i>	97
14	Mollusca of Enewetak Atoll <i>E. Alison Kay and Scott Johnson</i>	105
15	Insects and Allies (Arthropoda) of Enewetak Atoll <i>G. Allen Samuelson and Gordon M. Nishida</i>	147
16	Pycnogonida of Enewetak Atoll <i>C. Allan Child</i>	179
17	Stomatopod Crustacea of Enewetak Atoll <i>Marjorie L. Reaka and Raymond B. Manning</i>	181
18	Cirripedia of Enewetak Atoll <i>Richard H. Titgen</i>	191

Chapter		Page
19	Nonplanktonic Copepoda of Enewetak Atoll <i>Dennis M. Devaney</i>	197
20	Lagoon Plankton of Enewetak Atoll <i>Ray P. Gerber</i>	203
21	Ostracoda (Myodocopina) of Enewetak Atoll <i>Louis S. Kornicker</i>	217
22	Crustacea Decapoda (Penaeidea, Stenopodidea, Caridea, and Palinura) of Enewetak Atoll <i>Dennis M. Devaney and A. J. Bruce</i>	221
23	Crustacea Decapoda (Brachyura and Anomura) of Enewetak Atoll <i>John S. Garth, Janet Haig, and Jens W. Knudsen</i>	235
24	Holothurians of Enewetak Atoll <i>Bertha M. Cutress and Francis W. E. Rowe</i>	263
25	Echinodermata Other than Holothurians of Enewetak Atoll <i>Dennis M. Devaney</i>	277
26	Protochordates of Enewetak Atoll <i>Lucius G. Eldredge</i>	287
27	Annotated Checklist of the Fishes of Enewetak Atoll and Other Marshall Islands <i>John E. Randall and Helen A. Randall</i>	289
28	Reptiles of Enewetak Atoll <i>Janet O. Lamberson</i>	325
29	Birds of Enewetak Atoll <i>Andrew J. Berger</i>	331
30	Mammals of Enewetak Atoll <i>Ernst S. Reese</i>	333
31	Miscellaneous Species Records of Enewetak Atoll <i>Richard H. Titgen and Beatrice L. Burch</i>	337
	Author Index	345
	Subject Index	347

## Introduction

Beatrice L. Burch

Bishop Museum, Honolulu, Hawaii 96817

The organization and coordination of the taxonomic section of this volume was initiated by Dr. Dennis M. Devaney of the Bernice P. Bishop Museum and was completed by Beatrice L. Burch after Dr. Devaney died in a tragic scuba-diving accident on August 13, 1983, as he was investigating shrimp offshore from the Big Island of Hawaii. His great interest in all invertebrates in the tropics was increased when the opportunity arose for him to work at the Mid-Pacific Research Laboratory at Enewetak Atoll. Devaney made his first collecting trip to the atoll in the early 1960s while he was still in graduate school. As the collection grew and taxonomy of the organisms became better known, it was soon apparent that the reference collection at Enewetak was becoming increasingly valuable. Devaney was pleased to participate in the Coral Reef Workshop held at the atoll in 1976, because he believed that the scleractinian coral collection was the key for the study of other organisms. The workshop brought together international coral specialists to establish species limits on this important and variable group. After the workshop was over, reference material from Enewetak was deposited in European and American museums for ready reference by a wider audience of scientists. Each year after the Coral Reef Workshop, Devaney went to Enewetak to curate the reference collection and to conduct his own research on echinoderms. At the same time, he encouraged the work of specialists to compile taxonomic and other research from Enewetak for this publication.

The diversity of the organisms at Enewetak made it difficult to find specialists to study all groups, so Devaney prepared several chapters himself. Unfortunately, most groups were collected in the course of other work such as physiology, toxicity, etc., and were not extensively collected by specialists for a particular taxonomic group.

The number of families, genera, and species reported in this volume either from the literature or from new records determined by the authors of this volume are presented in Table 1.

References in this volume show that some or much work was done on a particular taxon. Many groups remain

TABLE 1  
Taxonomic Groups at Enewetak Atoll

Taxon	No. of species	No. of genera	No. of families
Algae	238	106	40
Fungi	112	58	18
Vascular plants	123	97	48
Forams and nonplanktonic			
protozoa	279	144	58
Porifera	40	33	26
Actinaria	27	21	14
Octocorallia	31	17	12
Scleractinia	169	53	12
Brachiopoda	4	4	4
Bryozoa	84	61	39
Sipuncula	11	77	3
Echiura	2	2	2
Platyhelminthes	31	11	10
Nemertea	1	1	1
Nematoda	1	1	1
Polychaeta	132	110	34
Mollusca (fossil, recent)	1240	453	151
Insects and related			
arthropods	190	157	93
Pycnogonida	5	4	4
Stomatopoda	12	4	4
Cirripedia	40	7	6
Lagoon plankton	285	177	52
Ostracoda	10	10	5
Natantia	145	56	14
Reptantia	4	3	3
Anomura	76	29	10
Brachyura	293	114	16
Holothuroidea	20	11	5
Echinodermata other than			
Holothuroidea	97	65	32
Fishes of the Marshall			
Islands	815	338	92
Reptilia	9	9	5
Aves	41	27	12
Mammalia	9	7	6
Miscellaneous	124	87	40
Totals	4671	2284	902

to be worked on more thoroughly by specialists in particular fields, such as Botany or Zoology, which, at the present time, seem to be represented so lightly at Enewetak Atoll. By having a named reference collection, the researchers there were able to identify organisms used in their studies on biochemistry, ecology, productivity, animal or plant associations, physiology, immunology, radiobiology, growth rates, and reproduction. They were also able to make broad interpretations of reef chronology,

geochemistry, stratigraphy, and geographic distribution.

The checklist accompanying each chapter has a coded entry symbol placed before the generic designation to indicate (1) if the organism represents a newly recorded species for Enewetak or for the Marshall Islands, (2) if it is a fossil record, or (3) if it has some other reason to be so marked. The explanations for these codes follow each species checklist.

500243b