

PREFACE

This monograph is the outcome of investigations made by the staff of the Woods Hole Oceanographic Institution for the Bureau of Ships, Navy Department, during the years 1940-1946. Although rapid progress in the improvement of antifouling paints was being made by the Navy paint laboratories at the time the work was initiated, it was the belief of the Bureau that scientific knowledge of the fouling process, and of the way in which protective coatings acted, was inadequate. We were consequently instructed to explore the fundamental basis on which preventive techniques must rest, rather than to attempt directly to improve existing paint formulations. At the same time every opportunity was afforded to our staff to become familiar with current problems and the means being employed to solve them. On the termination of the work it has seemed desirable to collect the results of our experience and to review them in relation to the total existing knowledge of the subject.

Interest in the problems of fouling brings together an odd assortment of bedfellows. There are included the operators of vessels, naval architects and engineers, paint manufacturers, and all those concerned with the maintenance of ships and various underwater installations. Understanding of the phenomena requires the diverse talents of the biologist, chemist, and physicist. It has not been easy to prepare a book suitable for an audience with such varied viewpoints and technical preparation. Each chapter has been written with some particular group of readers primarily in view. In some cases the aim has been to meet the requirements of specialists by reviewing the technical details of a part of their subject; in others the intent has been to inform specialists of one sort about pertinent matters with which they may not be familiar.

For example, Chapter 9, "The Characteristics of the Principal Fouling Organisms," is designed to inform those unfamiliar with marine biology about the creatures which contribute to fouling. The following chapter, "Species Recorded from Fouling," on the other hand, is intended for the professional biologist and may have little interest to others. The reader's indulgence is invited in respect to this lack of unity in presentation. It is hoped that each will be able to skip judiciously those chapters unsuited to his needs.

The investigations at Woods Hole were initiated

under the direction of Dr. Selman A. Waksman at a time when interest centered on the role of bacterial and other slime films in influencing the subsequent development of fouling. After 1941 the work was guided by Dr. Alfred C. Redfield. Dr. Bostwick H. Ketchum was responsible for the actual conduct of the investigations throughout. Dr. Ketchum was greatly assisted, especially in the theoretical interpretation of the action of antifouling paints, by Dr. John D. Ferry. Dr. Louis W. Hutchins, assisted by the cooperation of the Coast Guard and the Bureau of Ordnance, conducted extensive field studies of the distribution of fouling organisms. In 1942 a testing station was established at the Marine Laboratory of the University of Miami, at Miami Beach. This station was conducted under the successive direction of Dr. Charles M. Pomerat, Dr. F. G. Walton Smith, and Mr. Charles M. Weiss. Special credit is due to Mr. Weiss for conducting the greater part of the experiments made at Miami. He is also responsible for most of the photographs illustrating this volume.

The following have collaborated on the various aspects of the work: Eleanor Adcock, Catharine G. Ayers, J. C. Ayers, Ruth S. Billard, D. D. Bonnet, Jean Bryant, D. E. Carritt, E. S. Castle, G. L. Clarke, M. W. Davidson, E. S. Deevey, Jr., Georgianna B. Deevey, Dorcas H. Delabarre, W. T. Edmondson, Barbara Mott Ferry, Mary F. Goffin, M. Hotchkiss, H. J. Humm, Helen S. Hutchins, W. M. Ingram, D. B. Johnstone, D. Jean Keen, G. F. Kelly, F. B. Laidlaw, G. L. Lee, R. G. Lunz, Jr., R. A. McLean, M. A. Miller, I. M. Newell, Elizabeth D. Orr, Zoé Ann Orr, J. Parker, Gale G. Pasley, Jr., Barbara B. Perkins, A. Phelps, C. E. Renn, Beatrice B. Reynolds, D. M. Reynolds, G. A. Riley, H. D. Russell, Margaret Scharff, G. T. Scott, A. Svihla, D. E. Todd, H. J. Turner, Sylvia A. Weare, Grace L. Winter, and D. J. Zinn.

The interest and support of Rear Admiral J. W. Fowler, under whose cognizance our studies were initiated, Rear Admiral T. A. Solberg, Captain H. A. Ingram, Captain Logan McKee, Commander A. E. MacGee, Lieutenant Commander E. F. Carlston, Mr. D. P. Graham, and Dr. Scott P. Ewing of the Bureau of Ships, are gratefully acknowledged.

The paint laboratories of the Navy Yards at Norfolk and Mare Island, of the Naval Research

Laboratory, and of the Bakelite Corporation provided many of the experimental formulations used in our studies. The interest and suggestions of the personnel of these laboratories have been most stimulating. Especial acknowledgment is made for encouragement and assistance from Captain A. S. Pitre, Mr. N. E. Adamson, Dr. A. L. Alexander, Mr. A. J. Wieth, Mr. V. H. Turkington, and Mr. John Saroyan. Mr. Arthur E. Burns, Jr., has actively participated in the development of the interpretations of the action of antifouling paints. He has also made available data, which were previously unreported, for inclusion in Chapters 16 and 18, and his suggestions concerning these chapters have been most valuable.

Valuable information on the fouling of underwater installations has been made available by the underwater ordnance sections of the Bureau of Ordnance and by the Office of Chief of Naval Operations. Particular acknowledgment is due to Commander C. J. Fish, whose interest was instrumental in arranging for a survey of the fouling occurring on coastal navigation buoys.

The text of this book has been prepared jointly by several members of the staff of the Woods Hole Oceanographic Institution, none of whom can claim complete credit for any particular part. The major labor of collecting and assembling material for the different chapters has fallen somewhat as follows:

- Chapters 1 and 2—A. C. Redfield and
L. W. Hutchins
- 3, 4, 5, 6—A. C. Redfield and
E. S. Deevy, Jr.
- 7 and 8—L. W. Hutchins

- Chapter 9—J. C. Ayers and
H. J. Turner
- 10—L. W. Hutchins
- 11 and 12—F. B. Laidlaw
- 13 and 14—B. H. Ketchum
- 15—J. D. Ferry
- 16—J. D. Ferry and
B. H. Ketchum
- 17—David Todd and
B. H. Ketchum
- 18, 19, 20—B. H. Ketchum
- 21 and 22—A. C. Redfield.

Final editing has been shared by Dr. Redfield and Dr. Ketchum, assisted in the preparation of the manuscript by Miss D. Jean Keen, Mrs. Vivien Brown, Mrs. Florence Mellor, and Miss Lois Vaetsch. The index was prepared by Mrs. Frederick C. Fuglister.

In addition to many of those previously mentioned, the following have read and commented upon various parts of the manuscript: Lieutenant-Commander M. V. Brewington, Dr. W. F. Clapp, Professor K. S. M. Davidson, Mr. R. Devoluy, Mr. R. J. Eckart, Dr. A. C. Elm, Mr. C. M. Jackson, Mr. F. L. LaQue, Dr. J. J. Mattiello, Professor S. E. Morison, Captain H. E. Saunders, and Dr. G. H. Young. Without wishing to involve them in any responsibility for the present publication, appreciation is here expressed for their helpful interest and advice.

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