

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

HANDBOOK OF PHYCOLOGICAL METHODS

ECOLOGICAL FIELD METHODS:

MACROALGAE

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

Also sponsored by the Phycological Society of America

Handbook of phycological methods
Culture methods and growth measurements
Edited by Janet R. Stein
(published 1973)

Handbook of phycological methods
Physiological and biochemical methods
Edited by Johan A. Hellebust and J. S. Craigie
(published 1978)

Handbook of phycological methods
Developmental and cytological methods
Edited by Elisabeth Gantt
(published 1980)

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

HANDBOOK OF PHYCOLOGICAL METHODS

ECOLOGICAL FIELD METHODS: MACROALGAE

EDITED BY

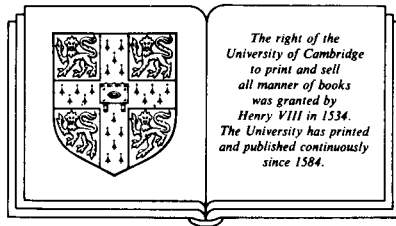
MARK M. LITTLER AND DIANE S. LITTLER

CURATOR OF BOTANY

RESEARCH ASSOCIATE

NATIONAL MUSEUM OF NATURAL HISTORY
SMITHSONIAN INSTITUTION, WASHINGTON, D.C.

SPONSORED BY THE
PHYCOLOGICAL SOCIETY OF AMERICA, INC.



CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE

LONDON • NEW YORK • NEW ROCHELLE
MELBOURNE • SYDNEY

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

CAMBRIDGE UNIVERSITY PRESS

Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo

Cambridge University Press

The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org

Information on this title: www.cambridge.org/9780521249157

© Cambridge University Press 1985

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 1985

This digitally printed version 2008

A catalogue record for this publication is available from the British Library

Library of Congress Cataloguing in Publication data

(Revised for vol. 4)

Main entry under title:

Handbook of phycological methods.

Vol. 2-4 published by Cambridge University Press,
Cambridge, New York.

Includes bibliographies and indexes.

Contents: [1] Culture methods and growth measurements,
edited by J. R. Stein – [2] Physiological and biochemical
methods, edited by J. A. Hellebust and J. S.

Craigie – [etc.] – [4] Ecological field methods,
edited by Mark M. Littler and Diane S. Littler.

1. Algology – Methodology – Collected works. I. Stein,
Janet R. II. Hellebust, J. A. III. Phycological
Society of America.

QK565.2.H36 589.3'028 73-79496

ISBN 978-0-521-24915-7 hardback

ISBN 978-0-521-06640-2 paperback

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

Contents

Contributors *page* viii Editors' preface *page* xi

Introduction *page* 1

I ENVIRONMENTAL SAMPLING AND MONITORING (MAJOR PARAMETERS)

- 1 Water motion 7
Mark W. Denny
- 2 Light 33
J. Ramus
- 3 Nutrients 53
Patricia A. Wheeler

II ASSESSMENTS OF POPULATIONS AND COMMUNITIES

- 4 Collection, handling, preservation, and logistics 67
Roy T. Tsuda and Isabella A. Abbott
- 5 Electrophoresis 87
Donald P. Cheney
- 6 Natural products chemistry: uses in ecology and systematics 121
James N. Norris and William H. Fenical
- 7 Destructive (harvest) sampling 147
Robert E. De Wreede
- 8 Nondestructive sampling 161
Mark M. Littler and Diane S. Littler
- 9 Remote sensing and mapping 177
T. Belsher, L. Loubersac, and G. Belbeoch
- 10 Subtidal techniques 199
Michael S. Foster, Thomas A. Dean, and Larry E. Deysher

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

vi

Contents

- | | | |
|----|--|-----|
| 11 | Equipment for conducting research in deep waters
<i>Sylvia A. Earle</i> | 233 |
| 12 | Demography
<i>A. R. O. Chapman</i> | 251 |
| 13 | Succession
<i>Michael S. Foster and Wayne P. Sousa</i> | 269 |
| 14 | Biomechanics
<i>M. A. R. Koehl and Stephen A. Wainwright</i> | 291 |
| 15 | Biogeographical analyses
<i>Louis D. Druehl and Robert G. Footitt</i> | 315 |

III ECOLOGICAL ENERGETICS

- | | | |
|----|---|-----|
| 16 | Respirometry and manometry
<i>Clinton J. Dawes</i> | 329 |
| 17 | Electrodes and chemicals
<i>Mark M. Littler and Keith E. Arnold</i> | 349 |
| 18 | The carbon-14 method for measuring primary productivity
<i>Keith E. Arnold and Mark M. Littler</i> | 377 |
| 19 | Measurement of photosynthesis by infrared gas analysis
<i>John A. Browse</i> | 397 |
| 20 | Carbon allocation
<i>Richard G. Buggeln</i> | 415 |
| 21 | Open-flow systems
<i>Donald W. Kinsey</i> | 427 |
| 22 | Growth patterns and rates
<i>Boudewijn H. Brinkhuis</i> | 461 |
| 23 | Calorimetry
<i>Thomas H. Carefoot</i> | 479 |
| 24 | Nutrient uptake
<i>Marilyn M. Harlin and Patricia A. Wheeler</i> | 493 |

IV BIOLOGICAL INTERACTIONS

- | | | |
|----|--|-----|
| 25 | Competition among macroalgae
<i>E. J. Denley and P. K. Dayton</i> | 511 |
| 26 | Herbivory
<i>Robert L. Vadas</i> | 531 |
| 27 | Pathology
<i>John H. Andrews and Lynda J. Goff</i> | 573 |

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)*Contents*

vii

V APPENDIX**List of suppliers** 595**VI INDEXES****Author** 601**Taxonomic** 616

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

Contributors

Abbott, Isabella A., Department of Botany, University of Hawaii, Honolulu, Hawaii 96822 (Chapter 4)

Andrews, John H., Department of Plant Pathology, University of Wisconsin, Madison, Wisconsin 53706 (Chapter 27)

Arnold, Keith E., Department of Biological Sciences, California State Polytechnic University, Pomona, California 91768 (Chapters 17, 18)

Belbeoch, G., COB (CNEXO), B.P. 337, 29273 Brest Cédex, France (Chapter 9)

Belsher, T. Antenne COB (CNEXO), Station Biologique, 29211 Roscoff, France (Chapter 9)

Brinkhuis, Boudewijn H., Marine Sciences Research Center, State University of New York, Stony Brook, New York 11794 (Chapter 22)

Browse, John A., Plant Physiology Division, Department of Scientific and Industrial Research, Palmerston North, New Zealand (Chapter 19)

Buggeln, Richard, G., Marine Sciences Research Laboratory, Memorial University of Newfoundland, St. Johns, Newfoundland, Canada A1C 5S7 (Chapter 20)

Carefoot, Thomas H., Department of Zoology, University of British Columbia, Vancouver, British Columbia, Canada V6T 2A9 (Chapter 23)

Chapman, A. R. O., Department of Biology, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4J1 (Chapter 12)

Cheney, Donald P., Department of Biology, Northeastern University, 360 Huntington Ave., Boston, Massachusetts 02115 (Chapter 5)

Dawes, Clinton J., Department of Biology, University of South Florida, Tampa, Florida 33620 (Chapter 16)

Dayton, P. K., Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California 92037 (Chapter 25)

Dean, Thomas A., Kelp Ecology Project, 531 Encinitas Blvd., Encinitas, California 92024 (Chapter 10)

Denley, E. J., Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California 92037 (Chapter 25)

Denny, Mark W., Hopkins Marine Station, Stanford University, Pacific Grove, California 93950 (Chapter 1)

De Wreede, Robert E., Department of Botany, University of British Columbia, Vancouver, British Columbia, Canada V6T 2B1 (Chapter 7)

Deysner, Larry E., Kelp Ecology Project, 531 Encinitas Blvd., Encinitas, California 92024 (Chapter 10)

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)*Contributors*

ix

Druehl, Louis D., Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6 (Chapter 15)

Earle, Sylvia A., California Academy of Sciences, San Francisco, California 94118 (Chapter 11)

Fenical, William H., Institute of Marine Resources, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California 92093 (Chapter 6)

Footitt, Robert G., Department of Biological Sciences, Simon Fraser University, Burnaby British Columbia, Canada V5A 1S6 (Chapter 15)

Foster, Michael S., Moss Landing Marine Laboratories, P.O. Box 223, Moss Landing, California 95039 (Chapters 10, 13)

Goff, Lynda J., Center for Coastal Marine Studies, University of California, Santa Cruz, California 95064 (Chapter 27)

Harlin, Marilyn M., Department of Botany, University of Rhode Island, Kingston, Rhode Island 02881 (Chapter 24)

Kinsey, Donald W., Australian Institute of Marine Science, Townsville, Queensland 4810, Australia (Chapter 21)

Koehl, M. A. R., Department of Zoology, University of California, Berkeley, California 94720 (Chapter 14)

Littler, Diane S., Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560 (Chapter 8)

Littler, Mark M., Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560 (Chapters 8, 17, 18)

Loubersac, L., COB (CNEXO) B.P. 337, 29273 Brest Cédex, France (Chapter 9)

Norris, James N., Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560 (Chapter 6)

Ramus, J., Botany Department and Marine Laboratory, Duke University, Beaufort, North Carolina, 28516 (Chapter 2)

Sousa, Wayne P., Department of Zoology, University of California, Berkeley, California 94720 (Chapter 13)

Tsuda, Roy T., Division of Bioscience and Marine Studies, University of Guam, P.O. Box EK, Agana, Guam 96910 (Chapter 4)

Vadas, Robert L., Departments of Botany and Plant Pathology and Zoology, University of Maine, Orono, Maine 04469 (Chapter 26)

Wainwright, Stephen A., Department of Zoology, Duke University, Durham, North Carolina 27706 (Chapter 14)

Wheeler, Patricia A., School of Oceanography, Oregon State University, Corvallis, Oregon 97331 (Chapters 3, 24)

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

Editors' preface

In 1967, a special editorial committee constituted by the Phycological Society of America proposed a four-volume handbook series that would treat culture methods and growth measurements, biochemical and physiological determinations, cytological procedures, and field-oriented techniques. The first volume of the proposed series, *Culture Methods and Growth Measurements*, was edited by Janet R. Stein (University of British Columbia), the second volume, *Physiological and Biochemical Methods*, by Johan A. Hellebust (University of Toronto) and James S. Craigie (National Research Council of Canada), and the third volume, *Developmental and Cytological Methods*, by Elisabeth Gantt (Smithsonian Institution). The three texts were published by Cambridge University Press in 1973, 1978, and 1980, respectively. All three treatments have been well received by the phycological community as valuable reference sources.

This handbook on ecological methods for macroalgae, with its field-oriented perspective, is the fourth volume in the series and follows the original concept proposed by the first editorial committee of the Phycological Society. The inclusion of planktonic microalgal techniques was contemplated, but the prior publication in 1978 of an excellent and thorough manual on ecological methods for phytoplankton research (edited by A. Sournia) fulfilled this requirement. The editing of the present volume began with the receipt of the first manuscript draft in 1981 and progressed slowly but consistently. We sincerely appreciate the cooperation and valuable help of the editorial committee throughout the time-consuming process of reviewing contributions to the volume, which augmented our own efforts considerably. The committee's suggestions of topics and contributors were instrumental in broadening the overall coverage, and their critiques, along with those of additional reviewers selected from among the phycological community, resulted in numerous significant improvements.

The final product, with 27 chapters contributed by 37 scientists, was possible only because of the synergistic cooperation among many individuals. We are extremely grateful for the enthusiastic efforts of the authors and for the high quality of their chapters. We regret

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

xii

Editors' preface

that, because of space and time constraints, many excellent potential contributors could not be invited to participate.

Gratitude is extended for the financial support of the Phycological Society of America. We also acknowledge the Department of Botany, Smithsonian Institution, for considerable logistic support and Cambridge University Press for patience, cooperation, and help.

The scholarly opinions expressed in this work are those of the authors, who were asked to cite materials and equipment that they currently use. Equipment items are listed for reference only, and their inclusion should not be construed as an endorsement over other materials available at the time of writing or developed since. Lists of suppliers and their current addresses are updated annually for the United States in *Science* (American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington, D.C. 20005) and for Canada in *Research and Development* (MacLean Hunter, 418 University Ave., Toronto 101, Ontario, Canada) and in *Laboratory Products News* (Southern Business Publications Ltd., 1450 Don Mills Rd., Don Mills, Ontario, Canada).

Mark M. Littler

Diane S. Littler

*Department of Botany
National Museum of Natural History
Smithsonian Institution
Washington, D.C.*

Editorial Committee

Keith E. Arnold, Department of Biological Sciences, California State Polytechnic University, Pomona, California, 91768

Boudewijn H. Brinkhuis, Marine Sciences Research Center, State University of New York, Stony Brook, New York, 11794

Robert E. De Wreede, Department of Botany, University of British Columbia, Vancouver, B.C., Canada V6T 2B1

Michael S. Foster, Moss Landing Marine Laboratory, P.O. Box 223, Moss Landing, California 95039

Janet R. Stein, Department of Botany, University of British Columbia, Vancouver, B.C., Canada V6T 2B1

General references

Gantt, E. (ed.). 1980. *Handbook of Phycological Methods: Developmental and Cytological Methods*. Cambridge University Press, Cambridge. 425 pp.

Cambridge University Press

978-0-521-06640-2 - Handbook of Phycological Methods - Ecological Field Methods: Macroalgae

Edited by Mark M. Littler and Diane S. Littler

Frontmatter

[More information](#)

Editors' preface

xiii

Hellebust, J. A., and Craigie, J. S. (eds.). 1978. *Handbook of Phycological Methods: Physiological and Biochemical Methods*. Cambridge University Press, Cambridge. 512 pp.

Sournia, A. (ed.). 1978. *Phytoplankton Manual*. UNESCO, Paris. 337 pp.

Stein, J. R. (ed.). 1973. *Handbook of Phycological Methods: Culture Methods and Growth Measurements*. Cambridge University Press, Cambridge. 448 pp.