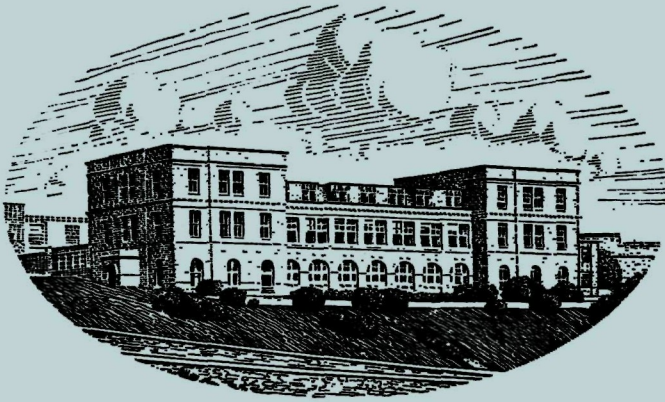


**JOURNAL OF THE
MARINE BIOLOGICAL ASSOCIATION
OF THE UNITED KINGDOM**



THE PLYMOUTH LABORATORY

VOLUME, 46 No. 3
(issued October 1966, and completing Volume 46)

**CAMBRIDGE
AT THE UNIVERSITY PRESS
1966**

Price Eighty shillings net

(U.S.A. \$13.50)

Annual Subscription for Volume (of three parts); £11 (U.S.A. \$35.00)

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM

PATRON

H.R.H. THE PRINCE PHILIP DUKE OF EDINBURGH, F.R.S.

OFFICERS AND COUNCIL

President: Prof. A. L. HODGKIN, Sc.D., F.R.S.

Vice-Presidents

The Earl of IVREAGH, K.G., C.B., C.M.G., F.R.S.
Prof. A. V. HILL, C.H., O.B.E., Sc.D., LL.D.,
F.R.S.
Sir EDWARD J. SALISBURY, Kt., C.B.E., D.Sc.,
LL.D., F.R.S.
Major E. G. CHRISTIE-MILLER

Prof. Sir JAMES GRAY, Kt., C.B.E., M.C., Sc.D.,
LL.D., F.R.S.
G. M. GRAHAM, C.M.G., O.B.E.
Prof. Sir ALISTER C. HARDY, Kt., D.Sc., F.R.S.
C. M. YONGE, C.B.E., D.Sc., F.R.S.
Rear Admiral Sir EDMUND G. IRVING, K.B.E., C.B.
Prof. C. F. A. PANTIN, Sc.D., D.Sc., Dr Univ., F.R.S.

Honorary Members

Dr H. B. BIGELOW
E. H. E. HAVELOCK, C.B., C.B.E.
Prof. Sir ALISTER C. HARDY, Kt., D.Sc., F.R.S.
Dr A. G. HUNTSMAN

Dr A. C. REDFIELD
Prof. G. THORSON, D.Phil.
C. M. YONGE, C.B.E., D.Sc., F.R.S.
Prof. L. A. ZENKEVITCH

COUNCIL

Elected Members

Prof. D. J. CRISP, Ph.D.
G. E. R. DEACON, C.B.E., D.Sc., F.R.S.
Prof. J. M. DODD, Ph.D.
Prof. G. E. FOGG, Ph.D., F.R.S.
F. C. FRASER, C.B.E., D.Sc., F.R.S.
R. S. GLOVER
Prof. Sir JAMES GRAY, Kt., C.B.E.
M.C., Sc.D., LL.D., F.R.S.

Rear Admiral Sir EDMUND G. IRVING, K.B.E., C.B.
Prof. E. W. KNIGHT-JONES, Ph.D.
Prof. O. E. LOWENSTEIN, D.Sc., F.R.S.
C. E. LUCAS, C.M.G., D.Sc., F.R.S.
J. W. LUND, D.Sc., F.R.S.
Prof. C. F. A. PANTIN, Sc.D., D.Sc., Dr Univ., F.R.S.
C. M. YONGE, C.B.E., D.Sc., F.R.S.

Governors

W. C. TAME (Ministry of Agriculture, Fisheries
and Food)
The Worshipful Company of Fishmongers:
Sir EDWARD CHADWYCK-HEALEY, Bt., M.C.
Col. Sir JOHN G. CAREW POLE, Bt., D.S.O., T.D.
The Hon. HUGH WALDORF ASTOR, J.P.
Prof. Sir ALISTER C. HARDY, Kt., D.Sc., F.R.S.
(Oxford University)

S. SMITH, Ph.D. (Cambridge University)
EDWARD HINDLE, Sc.D., F.R.S. (British
Association)
Prof. G. P. WELLS, Sc.D., F.R.S. (Zoological
Society)
Prof. B. KATZ, M.D., D.Sc., F.R.S. (Royal Society)
Prof. A. V. HILL, C.H., O.B.E., Sc.D., LL.D., F.R.S.
(Physiological Society)

Hon. Treasurer: Sir EDWARD CHADWYCK-HEALEY, Bt., M.C., The Mill House,
Hook, Basingstoke, Hants.

Secretary: J. E. SMITH, Sc.D., F.R.S., The Laboratory, Citadel Hill, Plymouth, Devon

SCIENTIFIC STAFF

Director: J. E. SMITH, Sc.D., F.I.Biol., F.R.S.

D. P. WILSON, D.Sc., F.I.Biol., F.R.P.S. (*Zoologist*)
L. H. N. COOPER, D.Sc., F.R.I.C., F.G.S., F.I.Biol.,
F.R.S. (*Chemist*)
G. M. SPOONER, M.B.E., M.A., F.R.E.S. (*Zoologist*)
MARY W. PARKE, D.Sc., Ph.D., F.L.S., F.I.Biol.
(*Botanist*)
P. G. CORBIN, B.A. (*Zoologist*)
J. A. C. NICOL, D.Sc., M.A., D.Phil. (*Experimental
Zoologist*)
N. A. HOLME, M.A. (*Zoologist*)
G. R. FORSTER, B.Sc. (*Zoologist*)

F. A. J. ARMSTRONG, F.R.I.C. (*Chemist*)
E. D. S. CORNER, M.Sc., Ph.D. (*Biochemist*)
A. J. SOUTHWARD, D.Sc., Ph.D. (*Zoologist*)
T. I. SHAW, M.A., Ph.D. (*Physiologist*)
J. V. HOWARTH, B.Sc. (*Physiologist*)
Q. BONE, M.A., D.Phil. (*Zoologist*)
G. T. BOALGH, B.Sc., Ph.D. (*Botanist*)
G. W. BRYAN, B.Sc., Ph.D. (*Zoologist*)
A. G. DAVIES, B.Sc., Ph.D. (*Physical Chemist*)
P. E. GIBBS, B.Sc., M.A. (*Zoologist*)
P. R. DANDO, B.Sc. (*Special appointment, Biochemist*)

J. H. WICKSTEAD, D.Sc., Ph.D., Ministry of Overseas Development (*Zoologist*)

Prof. H. O. DENNIS, Sc.D., B.A., B.Sc., Ph.D., F.I.Biol., F.R.S. (*Physiologist*),

Royal Society Research Professor of Bristol University

JOURNAL OF THE MARINE BIOLOGICAL ASSOCIATION
INSTRUCTIONS FOR THE PREPARATION
OF MANUSCRIPTS

TITLE

The title of the paper should be kept as short as possible.

The name of the author at the beginning of the paper should be followed only by senior qualifications.

TEXT

Manuscripts must be typed (double-spaced) on one side of the paper, leaving ample margins, with the folios numbered. Words to be printed in italic should be underlined. The first mention of Latin names of species should be followed by the authority, except where reference is made to a work in which the authority appears (e.g. *Plymouth Marine Fauna*).

Manuscripts should be as concise as possible. Undue length will undoubtedly lead to delay in publication as the paper will be returned to the author for shortening.

All linear measurements and weights should be in the metric scale.

For symbols and abbreviations, the recommendations of the Royal Society (1951) are followed.

TABLES

Tables should be set out on separate sheets numbered in Arabic numerals, and given a concise heading.

TEXT-FIGURES

Text-figures should be in black ink. It is important to make the lines sufficiently black. Areas to be mechanically stippled should be indicated by light-blue pencil shading.

No drawing should be so large that it must be reduced to less than one-third of its original size. The degree of reduction need not be inserted by the author.

The size of the printed area of the *Journal* page is 18 × 12 cm. The maximum size for a full-page figure (with legend) is 19½ × 13½ cm.

Lettering, numerals, etc., should be marked clearly in blue pencil and indicating the position in which they are to be inserted by an arrow in blue pencil. This should be kept to a workable minimum, all details being included in the legend.

Axes and graduation marks on graphs must be inked in. The lines on graph paper

are not normally reproduced, and should be blue or faint grey.

Legends for figures must be typed all together on a separate sheet, and not inserted on the actual illustrations.

Text-figures are numbered in arabic numerals, and referred to in the text as 'Fig. 1', etc. Where there is a plate containing several figures, the text-figures are referred to as 'Text-fig. 1', etc.

All line-drawings are printed as text-figures, as well as photographs for which fine detail is not required.

PLATES

Photographs should be on smooth-surfaced paper, semi-matt or glossy. The edges of the photograph must be trimmed square. It is important that the background in the photograph be of a uniform tone and free from blemishes. Where several photographs make up a single plate, they are numbered 'Fig. 1', etc.

SUMMARY

Each paper must be accompanied by an informative Summary, giving the main results of the work published.

REFERENCES

References are listed alphabetically at the end of the paper. The full title of the paper must be given. Titles of papers, but not of books, are decapitalized. Titles of Journals are abbreviated as in the *World List of Scientific Publications* (4th ed., 1963 on). Volume (Vol.), Band (Bd.), or Tome (T.) numbers are in Arabic numerals. Where a volume appears in parts the part need only be specified where each has separate pagination. References to books should include the publisher. Citations in text to be given by author's name followed by date in brackets.

Examples:

MARSHALL, S. M., NICHOLLS, A. G. & ORR, A. P., 1939. On the growth and feeding of young herring in the Clyde. *J. mar. biol. Ass. U.K.*, Vol. 23, pp. 427-55.

RUSSELL, F. S. & YONGE, C. M., 1928. *The Seas*. 379 pp. London: Frederick Warne.

Authors are requested to see that their manuscripts are in finished form and completely ready for publication so that corrections may be reduced to a minimum, and these are confined as far as possible to the first proof. If the cost for corrections exceeds a reasonable figure, the author is liable to be charged to the full extent of the excess.

The Journal of General Microbiology

Editors: B. C. J. G. KNIGHT and A. F. B. STANDFAST

Contents of Volume 44, No. 3, September 1966

- N. Okafor.** Ecology of micro-organisms on chitin buried in soil.
- P. J. Mill.** Phosphomannans and other components of flocculent and non-flocculent walls of *Saccharomyces cerevisiae*.
- R. C. S. Woodroffe and B. E. Wilkinson.** The antibacterial action of tetrachlorsalicylanilide.
- R. C. S. Woodroffe and B. E. Wilkinson.** Location of tetrachlorsalicylanilide taken up by *Bacillus megaterium*.
- C. J. Bradish and J. B. Kirkham.** The morphology of vesicular stomatitis virus (Indiana C) derived from chick embryos or cultures of BHK21/13 cells.
- M. Hutchinson, K. I. Johnstone and D. White.** Taxonomy of the acidophilic thiobacilli.
- D. E. Bradley.** The fluorescent staining of bacteriophage nucleic acids.
- R. C. Lawrence.** The oxidation of fatty acids by spores of *Penicillium roqueforti*.
- B. Weiss and G. Turian.** A study of conidiation in *Neurospora crassa*.
- L. R. Hill.** An index to deoxyribonucleic acid base compositions of bacterial species.
- M. Goldner, C. M. Jakus, H. K. Rhodes and R. J. Wilson.** The amino acid utilization by phase I *Bordetella pertussis* in a chemically defined medium.
- A. H. Vajdic, M. Goldner and R. J. Wilson.** The amino acid use in cultures of phase I *Bordetella pertussis* during growth in chemically defined media.

The subscription price is £5 net per volume of 3 parts, single parts 45s. each, plus postage. Four volumes will be issued each year. Orders should be sent to

CAMBRIDGE UNIVERSITY PRESS
BENTLEY HOUSE, 200 EUSTON ROAD, LONDON, N.W.1

THE JOURNAL OF ECOLOGY

EDITOR: P. GREIG-SMITH

VOL. 54, No. 2

JULY 1966

- T. C. Whitmore. The social status of *Agathis* in a rain forest in Melanesia.
- P. J. Grubb and T. C. Whitmore. A comparison of montane and lowland rain forest in Ecuador. II. The climate and its effects on the distribution and physiognomy of the forests.
- J. H. Belcher, E. M. F. Swale and J. Heron. Ecological and morphological observations on a population of *Cyclotetta pseudostelligera* Hustedt.
- C. D. Monk and J. T. McGinnis. Tree species diversity in six forest types in north central Florida.
- D. N. McVean. Ecology of *Chondrilla juncea* L. in south-eastern Australia.
- P. B. Cavers and J. L. Harper. Germination polymorphism in *Rumex crispus* and *Rumex obtusifolius*.
- J. R. Packham, A. J. Willis and L. W. Poel. Seasonal variation of some soil features and the ecology of Kennel Field, Warwickshire.
- R. M. M. Crawford. The control of anaerobic respiration as a determining factor in the distribution of the genus *Senecio*.
- W. D. Clayton. Vegetation ripples near Gummi, Nigeria.
- D. U. U. Okali. A comparative study of the ecologically related tree species, *Acer pseudoplatanus* and *Fraxinus excelsior*. II. The analysis of adult tree distribution.
- W. T. Williams and J. M. Lambert. Multivariate methods in plant ecology. V. Similarity analyses and information-analysis.
- J. N. R. Jeffers and S. B. Boaler. Ecology of a miombo site, Lupa North Forest Reserve, Tanzania. I. Weather and plant growth, 1962-64.
- S. B. Boaler. Ecology of a miombo site, Lupa North Forest Reserve, Tanzania. II. Plant communities and seasonal variation in the vegetation.
- C. H. Gimingham, N. M. Pritchard and R. M. Cormack. Interpretation of a vegetational mosaic on limestone in the island of Gotland.
- D. Walker. Vegetation of the Lake Ipea region, New Guinea Highlands. I. Forest, grassland and 'garden'.
- BIOLOGICAL FLORA OF THE BRITISH ISLES
D. Welch. *Juncus squarrosus* L.

Subscription price £9. 9s. per volume of three parts (single parts 70s. each)

BLACKWELL SCIENTIFIC PUBLICATIONS LTD.

5 ALFRED STREET · OXFORD

THE JOURNAL OF ANIMAL ECOLOGY

EDITORS: O. W. RICHARDS and J. B. CRAGG

VOL. 35, No. 3

OCTOBER 1966

- G. H. I. Rothschild. A study of a natural population of *Conomelus anceps* (Germar) (Homoptera: Delphacidae) including observations on predation using the precipitin test.
- J. S. Gray. Factors controlling the localizations of populations of *Protodrilus symbioticus* Giard.
- J. B. Nelson. Population dynamics of the gannet (*Sula bassana*) at the Bass Rock, with comparative information from other *Sulidae*.
- Michael Smyth. Winter breeding in woodland mice, *Apodemus sylvaticus*, and voles, *Clathronomys glareolus* and *Microtus agrestis*, near Oxford.
- William Bloek. Seasonal fluctuations and distribution of mite populations in moorland soils, with a note on biomass.
- Margaret M. Penney. Studies on certain aspects of the ecology of *Nebria brevicollis* (F.) (Colioptera, Carabidae).
- Christina L. Negus. A quantitative study of growth and production of unionid mussels in the River Thames at Reading.
- J. H. Stone. The distribution and fecundity of *Sagitta enflata* Grassi in the Agulhas current.
- P. J. Hunter. The distribution and abundance of slugs on an arable plot in Northumberland.
- F. J. Ebling, A. D. Hawkins, J. A. Kitching, Louise Muntz and Vivien M. Pratt. The ecology of Lough Ine. XVI. Predation and diurnal migration in the *Paracentrotus* community.
- Reviews; Abstracts.

Subscription price £8 per volume of three parts (single parts 50s. each)

BLACKWELL SCIENTIFIC PUBLICATIONS LTD.

5 ALFRED STREET · OXFORD

PROCEEDINGS OF THE MALACOLOGICAL SOCIETY OF LONDON

Vol. 37, Part 2, August 1966

£1. 5s. net, or \$4 U.S.

CONTENTS

- M. Edmunds.** *Teshia digitata* gen. and sp.nov., a dorid nudibranch from Ghana.
M. Edmunds. Defensive adaptations of *Stiliger vanellus* Marcus, with a discussion on the evolution of 'nudibranch' molluscs.
A. D. Berrie. Growth and seasonal changes in the reproductive organs of *Lymnaea stagnalis* (L.).
E. G. Driscoll. Hinge structure and shell perforation in an Upper Palaeozoic nuculoid genus.
E. R. Trueman, A. R. Brand and P. Davis. The effect of substrate and shell shape on the burrowing of some common bivalves.
E. R. Trueman. The cardinal ligament of the Tellinacea.
J. J. D. Greenwood. A preliminary note on aspects of the variation of *Lehmannia marginata*.
K. H. Read. *Littorina littorea* without shells; a further note.

Annual subscription (three parts) 60s. (\$10) post free.

BLACKWELL SCIENTIFIC PUBLICATIONS LTD.

5 Alfred St., Oxford

Journal of CELL SCIENCE

Formerly The Quarterly Journal of Microscopical Science

The *Journal of Cell Science* is devoted to all aspects of the study of cells. The scope of the journal is wide, and papers dealing with the entire range of investigations of cell organization, including accounts of advances in the relevant techniques, will be acceptable. Thus, in addition to studies of the structure and functions of plant and animal cells and their extra-cellular products (for example, cell walls, cuticles), papers will be published on such topics as cell growth and division, cell movements and interactions, and cell genetics. Contributions concerned with aspects of morphogenesis at the cellular and subcellular levels will also be acceptable. Studies of the organization of micro-organisms will be welcomed, as will papers dealing with the study of viruses, in so far as they are relevant to an understanding of cell organization (for example, those dealing with cell virus interactions). Cytochemical papers will be acceptable, but histochemical work, in which the emphasis is on the localization of substances at the tissue level, will not ordinarily be included. Occasional review articles will be published.

Subscriptions: £8 per volume of 4 parts, post free; single parts 50s. postage extra. Copies may be ordered from your bookseller, or direct from the publishers:

CAMBRIDGE UNIVERSITY PRESS, Bentley House, 200 Euston Road, London, N.W.1



CAMBRIDGE

Cambridge Monographs in Experimental Biology, 14

The Neurochemistry of Arthropods

J. E. TREHERNE

This book, the first detailed account of the chemistry of the nervous system of an invertebrate animal group, will be of interest to a wide variety of biologists.

30s. net

The Littoral Fauna of the British Isles

Fourth Edition

N. B. EALES

In this new edition the line drawings have been rearranged so that the explanations face them in each case. A section of half-tone illustrations has been added and minor changes made throughout the text.

50s. net

CAMBRIDGE UNIVERSITY PRESS

THE JOURNAL OF EXPERIMENTAL BIOLOGY

Edited by SIR VINCENT WIGGLESWORTH and J. A. RAMSAY

Vol. 45, No. 1

30s. net

October 1966

HARMSEN, R. The excretory role of pteridines in insects.

MUNTZ, W. R. A. The photopositive response of the frog (*Rana pipiens*) under photopic and scotopic conditions.

JONES, M. D. R. The acoustic behaviour of the bush cricket *Pholidoptera griseoptera*. 1. Alternation, synchronism and rivalry between males.

BROKAW, C. J. Effects of increased viscosity on the movements of some invertebrate spermatozoa.

JONES, M. D. R. The acoustic behaviour of the bush cricket *Pholidoptera griseoptera*. 2. Interaction with artificial sound signals.

ROBERTS, M. B. V. Facilitation in the rapid response of the earthworm, *Lumbricus terrestris* L.

ODHIAMBO, THOMAS R. The metabolic effects of the corpus allatum hormone in the male desert locust. I. Lipid metabolism.

BENTLEY, DAVID R. and KUTSCH, WOLFRAM. The neuromuscular mechanism of stridulation in crickets (Orthoptera: Gryllidae).

ODHIAMBO, THOMAS R. The metabolic effects of the corpus allatum hormone in the male desert locust. II. Spontaneous locomotor activity.

JOHANSEN, KJELL and MARTIN, A. W. Circulation in a giant earthworm, *Glossoscolex giganteus*. II. Respiratory properties of the blood and some patterns of gas exchange.

CHAPPLE, WILLIAM D. Asymmetry of the motor system in the hermit crab *Pagurus granosimanus* Stimpson.

SKAER, R. J. and PICKEN, L. E. R. The pleated surface of the undischarged thread of a nematocyst and its simulation by models.

LAND, M. F. Activity in the optic nerve of *Pecten maximus* in response to changes in light intensity, and to pattern and movement in the optical environment.

HUGHES, G. M. The dimensions of fish gills in relation to their function.

Subscription for 1966, 80s. per volume of 3 parts, 2 volumes a year. Single parts 30s. net

Orders may be placed through your bookseller or direct with the

Cambridge University Press, Bentley House, 200 Euston Road, London, N.W. 1

Full particulars of the
JOURNALS

published by the
CAMBRIDGE
UNIVERSITY PRESS

may be had from

The Manager
Cambridge University Press
Bentley House, 200 Euston Road
London, N.W. 1

For details of the
**ADVERTISEMENT
RATES**

for this and other
journals published by
the Cambridge University Press
apply to the

PUBLICATION DEPT
CAMBRIDGE
UNIVERSITY PRESS
BENTLEY HOUSE
200 EUSTON ROAD
LONDON, N.W. 1

**PHYSIOLOGY
OF
ECHINODERMATA**

A collective effort by a group of experts,
edited by Richard A. Boolootian,
University of California, Los Angeles

General Biology of Echinoderms
H. Barracough Fell and David L. Pawson
Ecology of Crinoids
H. Barracough Fell
Ecology of Holothurians
David L. Pawson
Ecology of Echinoids
Hilary B. Moore
Aspects of Asteroid Biology
Howard M. Feder and Aage Møller Christensen
The Ecology of Ophiuroids
H. Barracough Fell
Echinoderms and the Control of Behavior in Associations
Demorest Davenport
The Complex Behavior of Echinoderms
Ernst S. Reese
Functional Morphology of the Water-Vascular System
David Nichols
The Respiratory Physiology of Echinoderms
A. Farmanfarmanian
Pigmentation
H. G. Vevers
The Comparative Biochemistry of Pigments
Denis L. Fox and Thomas S. Hopkins
The Coelomic Fluids and Coelomocytes
Robert Endean
Aspects of Nutritional Physiology
John Maxwell Anderson
Salinity Tolerance and Ionic Regulation
John Binyon
The Endoskeleton
David M. Raup
Growth, Autotomy, and Regeneration
Emery F. Swan
Photosensitivity
Masao Yoshida
Coordination of Spine Movement in Echinoids
Norman Millott
Light Production
Norman Millott
The Form and Functions of the Nervous System
J. E. Smith
Muscle Physiology
Keiichi Takahashi
Pharmacology
Charles B. Alender and Findlay E. Russell
Neurohumors and Neurosecretion
John H. Welsh
Reproductive Physiology
Richard A. Boolootian
Determinism of Sex
R. Delavault
The Gametes; Some Procedures and Properties
Albert Tyler and Betty S. Tyler
Physiology of Fertilization and Early Development
Albert Tyler and Betty S. Tyler
Amino Acid Metabolism in the Developing Embryo
Alberto Monroy and Rachele Maggio
On the Biochemical Constitution of Some Echinoderms
Arthur C. Giese

1966. Approx. 772 pages. Prob. \$45.00

INTERSCIENCE PUBLISHERS

a division of John Wiley & Sons, Inc.
605 Third Avenue, New York, N.Y. 10016
Glen House, Stag Place, London, S.W.1.



CAMBRIDGE

Recent Discovery Reports

Volume XXXIII: The development of the stolon in *Salpa fusiformis* Cuvier and *Salpa aspera* Chamisso

R. M. SAWICKI

Rothamsted Experimental Station, Harpenden

40s. net

Volume XXXIII: Distribution and life history of *Salpa thomsoni* Foxtton, with observations on a related species, *Salpa gerlachei* Foxtton

P. FOXTON

National Institute of Oceanography, Godalming

84s. net

Volume XXXIV: The distribution and life history of *Calanoides acutus* (Giesbrecht)

KEITH J. H. ANDREWS

National Institute of Oceanography, Godalming

37s. 6d. net

Forthcoming

Volume XXXIV: The distribution of *Parathemisto gaudichaudii* (Guer) with observations on its life history in the 0° to 20° E sector of the Southern Ocean

JASMINE E. KANE

Laboratory of Marine Radioactivity, Oceanography Museum, Monaco

About 25s. net

CAMBRIDGE UNIVERSITY PRESS