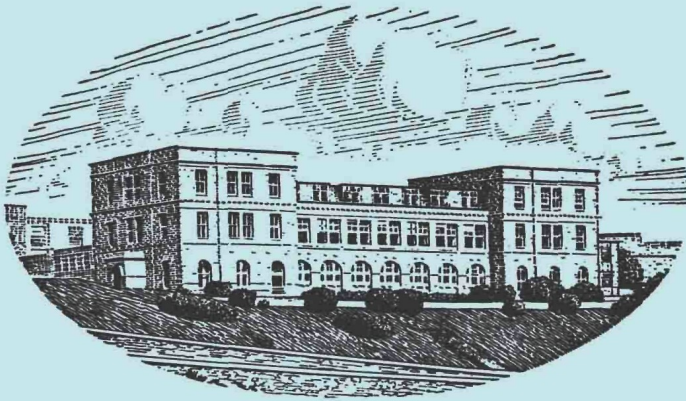


Member's Privilege Copy for personal use only

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



THE PLYMOUTH LABORATORY

VOLUME 57, No. 1

(issued February 1977)

JMBAAK 57 (No. 1) 1-284 (1977) 0025-3154

CAMBRIDGE UNIVERSITY PRESS

1977

THE 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. J. Z. YOUNG, D.Sc., F.R.S.

Vice-Presidents

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.

Prof. Sir ALISTER C. HARDY, Kt., D.Sc., F.R.S.

Sir C. MAURICE YONGE, Kt., C.B.E., D.Sc., F.R.S.

Rear Admiral Sir EDMUND G. IRVING, K.B.E., C.B.
Sir FREDERICK S. RUSSELL, Kt., C.B.E., D.S.C.,
D.F.C., D.Sc., LL.D., F.R.S.

Sir EDWARD R. CHADWYCK-HEALEY, Bt., M.C.

Sir J. ERIC SMITH, Kt., C.B.E., Sc.D., F.R.S.

Sir ALAN L. HODGKIN, O.M., K.B.E., Sc.D., F.R.S.

Honorary Members

Sir GEORGE E. R. DEACON, Kt., C.B.E., D.Sc.,
F.R.S.

Prof. Sir ALISTER C. HARDY, Kt., D.Sc., F.R.S.

Prof. A. V. HILL, C.H., O.B.E., Sc.D., LL.D., F.R.S.

Dr A. C. REDFIELD

Sir C. MAURICE YONGE, Kt., C.B.E., D.Sc., F.R.S.

COUNCIL

Elected Members

Prof. P. F. BAKER, Ph.D., F.R.S.

Prof. K. F. BOWDEN, D.Sc.

P. C. CALDWELL, D.Phil., F.R.S.

Prof. R. B. CLARK, D.Sc.

R. I. CURRIE

D. H. CUSHING, D.Phil.

Prof. J. M. DODD, D.Sc., F.R.S.

Sir JOHN A. B. GRAY, Kt., M.B., Sc.D., F.R.S.

R. H. HEDLEY, D.Sc.

Prof. G. J. HILLS, D.Sc.

Prof. F. G. T. HOLLIDAY, C.B.E.

Prof. O. E. LOWENSTEIN, D.Sc., F.R.S.

J. W. LUND, C.B.E., D.Sc., F.R.S.

J. H. STEELE, D.Sc.

Prof. Sir FREDERICK E. WARNER, Kt., D.Sc., F.R.S.

Governors

J. KELSEY (Ministry of Agriculture, Fisheries
and Food)

The Worshipful Company of Fishmongers:

Sir EDWARD R. 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. J. W. S. PRINGLE, M.B.E., Sc.D., F.R.S.
(Oxford University)

M. J. WELLS, Sc.D. (Cambridge University)

Prof. G. P. WELLS, Sc.D., F.R.S. (Zoological Society)

Prof. Sir BERNARD KATZ, Kt., M.D., D.Sc., F.R.S.
(Royal Society)

Prof. G. E. FOGG, Sc.D., F.R.S.

(British Association)

Prof. R. D. KEYNES, Sc.D., F.R.S.
(Physiological Society)

Hon. Treasurer: The Hon. HUGH WALDORF ASTOR, J.P., 14 Culross Street, London, W1Y 3HN

Secretary: E. J. DENTON, C.B.E., Sc.D., F.R.S., The Laboratory, Citadel Hill, Plymouth, PL1 2PB

SCIENTIFIC STAFF

Director: E. J. DENTON, C.B.E., Sc.D., F.R.S.

P. G. CORBIN, B.A. (*Zoologist*)

N. A. HOLME, Sc.D., M.A. (*Zoologist*)

G. R. FORSTER, B.Sc. (*Zoologist*)

E. D. S. CORNER, M.Sc., Ph.D. (*Biochemist*)

A. J. SOUTHWARD, D.Sc., Ph.D. (*Zoologist*)

E. I. BUTLER, C.Chem., F.R.I.C. (*Chemist*)

J. V. HOWARTH, B.Sc. (*Physiologist*)

Q. BONE, M.A., D.Phil. (*Zoologist*)

G. T. BOALCH, B.Sc., Ph.D. (*Phycologist*)

G. W. BRYAN, B.Sc., Ph.D. (*Zoologist*)

A. G. DAVIES, B.Sc., Ph.D. (*Physical Chemist*)

P. R. DANDO, B.Sc., Ph.D. (*Biochemist*)

P. E. GIBBS, B.Sc., M.A., Ph.D. (*Zoologist*)

B. L. ROBERTS, M.A., Ph.D. (*Physiologist*)

J. C. GREEN, B.Sc., Ph.D. (*Phycologist*)

D. K. GRIFFITHS, M.Sc. (*Physical Oceanographer*)

G. W. POTTS, B.Sc., Ph.D. (*Zoologist*)

J. B. GILPIN-BROWN, B.Sc., Ph.D. (*Zoologist*)

H. MEVES, M.D. (*Physiologist*)

M. WHITFIELD, B.Sc., Ph.D. (*Physical Chemist*)

M. R. CLARKE, B.Sc., Ph.D. (*Zoologist*)

R. P. HARRIS, B.Sc., Ph.D. (*Zoologist*)

P. M. HOLLIGAN, M.A., Ph.D. (*Biochemist*)

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

R. D. PINGREE, B.Sc., Dip.Ed., Ph.D., Institute of Oceanographic Sciences (*Oceanographer*)

D. R. TURNER, Post-doctoral Research Fellow (*Chemist*)

February 1977

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.

FIGURES

Figures should be in black ink. It is important to make the lines sufficiently black.

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.

Illustrations requiring lettering should not be drawn on Ethulon.

The size of the printed area of the *Journal* page is 20 × 13.5 cm. The maximum size for a full-page figure (with legend) is 21 × 14 cm.

Lettering, numerals, etc. should be marked clearly in pencil and the exact position in which they are to be inserted should be indicated. Symbols on the figure should be kept to a minimum and details given 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.

Figures are numbered in arabic numerals, and referred to in the text as 'Fig. 1', etc.

All line-drawings are printed as 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.

Divisions of plates, or separate figures on one plate, are indicated by capital letters.

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 given in full. 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:

- GOLDBERG, E. D., 1965. Minor elements in sea water. In *Chemical Oceanography*, vol. 1 (ed. J. P. Riley and G. Skirrow), pp. 163-196. New York: Academic Press.
- MARSHALL, S. M., NICHOLLS, A. G. & ORR, A. P., 1939. On the growth and feeding of young herring in the Clyde. *Journal of the Marine Biological Association of the United Kingdom*, 23, 427-455.
- 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 correction exceeds a reasonable figure, the author is liable to be charged the full extent of the excess.

SUBSCRIPTIONS

Journal of the Marine Biological Association of the United Kingdom is published quarterly. Single parts cost £13.00 net (US \$30.00 in the U.S.A. and Canada) plus postage.

Four parts form a volume. The 1977 subscription price of a volume (which includes postage) is £45.00 net (US \$105.00 in the U.S.A. and Canada).

Second class postage paid at New York, N.Y.

© The Marine Biological Association of the UK 1977

PERMISSIONS

For permission to reproduce material from *Journal of the Marine Biological Association*, please apply to the London or New York office of Cambridge University Press.

ISI Tear Service, 325 Chestnut Street, Philadelphia, Pennsylvania 19106, U.S.A., is authorized to supply single copies of separate articles for private use only.