

JOURNAL OF THE  
MARINE BIOLOGICAL ASSOCIATION  
OF THE UNITED KINGDOM



THE PLYMOUTH LABORATORY

VOLUME 48, No. I

(issued February 1968)

CAMBRIDGE  
AT THE UNIVERSITY PRESS  
1968

Price £5 net

(U.S.A. \$16.75)

*Annual Subscription for Volume (of three parts); £14 (U.S.A. \$47.00)*

# 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

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 JAMES GRAY, Kt., C.B.E., M.C., Sc.D.,  
LL.D., F.R.S.

Prof. Sir JAMES GRAY, Kt., C.B.E., M.C., Sc.D.,  
LL.D., F.R.S.

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

E. H. E. HAVELOCK, C.B., C.B.E.

Dr A. G. HUNTSMAN

G. M. GRAHAM, C.M.G., O.B.E.

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.Sc.,  
D.F.C., D.Sc., LL.D., F.R.S.

### Honorary Members

Prof. Sir JAMES GRAY, Kt., C.B.E., M.C., Sc.D.,  
LL.D., F.R.S.

Miss MARIE V. LABOUR, D.Sc.

Dr A. C. REDFIELD

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

Prof. G. THORSON, D.Phil.

E. H. E. HAVELOCK, C.B., C.B.E.

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

Dr A. G. HUNTSMAN

Prof. L. A. ZENKEVITCH

## COUNCIL

### Elected Members

Prof. R. B. CLARK, Ph.D.

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

G. E. R. DEACON, C.B.E., D.Sc., F.R.S.

C. E. LUCAS, C.M.G., D.Sc., F.R.S.

Prof. J. M. DODD, Ph.D.

J. W. LUND, D.Sc., F.R.S.

R. S. GLOVER

Prof. R. A. MORTON, D.Sc., F.R.I.C., F.R.S.

Prof. Sir JAMES GRAY, Kt., C.B.E.

Prof. G. E. NEWELL, T.D., D.Sc.

M.C., Sc.D., LL.D., F.R.S.

J. C. SWALLOW, Ph.D.

J. P. HARDING, Ph.D.

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

Rear Admiral Sir EDMUND G. IRVING, K.B.E., C.B.

### Governors

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

S. SMITH, Ph.D. (Cambridge University)  
EDWARD HINDLE, Sc.D., F.R.S. (British  
Association)

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

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

Prof. B. KATZ, M.D., D.Sc., F.R.S. (Royal Society)

Prof. E. J. DENTON, Sc.D., F.R.S.  
(Physiological Society)

*Hon. Treasurer:* Sir EDWARD R. 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)

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

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.

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

(Phycologist)

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

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

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

N. A. HOLME, M.A. (Zoologist)

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

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

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

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

B. L. ROBERTS, B.A. (Physiologist)

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

J. GREEN, Ph.D (Phycologist)

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

Prof. E. J. DENTON, Sc.D., F.I.Biol., F.R.S. (Physiologist),

Royal Society Research Professor of Bristol University