

REPORT ON SCOR WORKING GROUP 23  
ZOOPLANKTON LABORATORY METHODSIntroduction

Of the activities recommended by the working group at its Washington meeting in March 1968, the following have received major attention:

1. The experimental program on plankton fixation and preservation, mainly in liquids, the results of which will ultimately be incorporated in;
2. A manual on zooplankton fixation, preservation and storage.

Dr. Steedman has supervised the experimental program, with the assistance of Drs. Beers and Tokioka, and the coordination of the WG chairman. Working group members have participated in the execution of various projects. However, the success of this work has been possible only because Dr. Steedman has devoted so much of his time, both to the program at the Smithsonian Oceanographic Sorting Center (where his holidays have been spent) and in his own department at Bath. Now technical staff have been trained and can assume part of the burden.

Description of Activities

The following summary and outline are extracted from Dr. Steedman's report of 10 August 1970:

Summary of the year's work - August 1969 to July 1970

"Comparison of a large variety of different fixatives on various plankters has been made, and the effects of an even larger number of preservatives have been followed and closely examined.

In any project of this size and complexity it is natural that some aspects may fall behind in the rate of development. This is partly true of calcareous plankters, and to some extent of oily plankters, but the coming year should produce clear answers to these problems. Ctenophore fixation and preservation still leaves something to be desired.

The effects of formaldehyde in almost all of its variations, as well as a variety of formaldehyde donors, and with many buffers, have been observed with great care, and a considerable reduction in the strength of its solutions should be possible. The most satisfactory buffer has yet to be decided.

At the Smithsonian Institution Oceanographic Sorting Center some 500 solutions have been devised and used; more than 5,000 pH readings have been made at regular intervals; approximately 5,000 visual and low power binocular observations have been made, and some hundreds of whole mounts and tissue sections have been produced."

Outline of work for the year - August 1970 to July 1971

"When the new series of fixatives and preservatives are produced, on the basis of data obtained over the past year, specimens will be treated for a minimum of 6 months and will then be referred to specialists in the appropriate groups for their appraisal. Several samples will be submitted.

At the same time chapters of the UNESCO handbook will be compiled leaving appropriate

space for specialist comment. By July 1971 it is hoped to have most of the chapters completed in rough draft.

It is also intended to pass on to all members of WG 23 either the fluids themselves or the formulae in the hope that they will have time to test them without undue delay. This corroboration is an essential feature of the work. It will involve considerable postage, packaging, and expense."

### Description of the Activities

The experiments have been made almost exclusively at the Smithsonian Oceanographic Sorting Center (SOSC), Washington, D.C., and at the University of Bath, at both institutes under the personal leadership of Dr. Steedman. The experiments conducted at the SOSC were initiated during the summer of 1968, and at the University of Bath in April 1969. Dr. Steedman has made several journeys to the SOSC Washington, D.C., to initiate and later to supervise the work there.

The duration of the two projects is anticipated to be approximately three years each, the effects of the various methods being impossible to see or evaluate in a short period of time. The series of experiments comprise 20-25, each of about 40 single experiments each.

In addition to the two main centers, attempts are made to follow up parts of the main program at the following places: at IOBC, Cochin, India; at the Sorting Center in Singapore, headed by Dr. Tham Ah Kow; in Bangkok, Thailand; and in Japan. Dr. Steedman visited the above institutions (also Scripps, California) in May-June 1969, and Vagn Hansen in December 1968 and November 1969. So far no effort has been made in Thailand, whereas the efforts made at the other regional laboratories are highly appreciated, in Japan and at Scripps especially in the field of biomass determination. The main series of experiments at both SOSC and Bath University have been somewhat hampered by problems concerning personnel, facilities and surprisingly enough, also by lack of bulk quantities of fresh zooplankton. Many institutes have given valuable help in supply of zooplankton material.

The expenses for travel have been paid by SCOR, UNESCO, SOSC, and Danish Government sources. Per diem for Dr. Steedman during his stays at SOSC has been paid by the Smithsonian. Salaries for technical staff have come from SOSC, and NERC (U.K.); UNESCO has contributed to secretarial assistance for Dr. Steedman, and a photomicroscope has been supplied by the Royal Society, London. In general, financial support from U.S.A. and U.K. sources has been granted in accordance with the period needed for proper evaluation of the experiments.

### Evaluation of the Program

In spite of the above mentioned difficulties which also could be anticipated in such a multi-lateral supported program, the project must be considered to have given adequate results. The present two main operational centers should be able to come out during 1971 with results such as proposed by WG 23 in 1968. This is especially the case for the below aspects:

1. Test on buffers in liquids.
2. Effects of classical fixatives as well as recently developed organic compounds tested in several combinations.
3. Criteria for quality of fixation and preservation of specific groups of plankters and tissues (the latter by histological and cytological effects on tissues) also through electron microscopy studies.

The main outline of the results of the program should be so advanced that a report can be made available in 1971. The report should at an early date be distributed for comments to selected experts. The report will form the basis of a handbook, possibly to be published by UNESCO in the series of Monographs on Oceanographic Methodology. However, before publication, other of the

recommendations of WG 23 should materialize: The workshop on zooplankton fixation and preservation recommended by WG 23 should be held.

### Recommendations

1. The Working Group should continue its present work till the experiments can be evaluated and the results be reported, by the end of 1971 or the beginning of 1972. Travel grants for Dr. Steedman's visits to SOSC should be envisaged, and the chairman should be enabled to visit Dr. Steedman in 1971 for discussion of the final report.
2. A workshop should be organized for exchange of information and for application of methods of fixation and preservation. The draft report on the present experiments carried out under the supervision of Dr. Steedman should be critically analyzed before publication. Recent methods, such as deep dry freezing done in mass scale in medicine and food technology, should be discussed and applied to fresh zooplankton during the workshop. Participants should include a few planktonologists, and experts from such fields as medicine, pathology, histology, and food technology, perhaps 10-12 in number. The meeting might be in U.K. West Germany or U.S.A.; adequate facilities and space must be available for the activities of the workshop. Sponsorship by SCOR and UNESCO would be appropriate.
3. Results of the present experiments conducted by WG 23 should be published by UNESCO in the series Monographs on Oceanographic Methodology. The proceedings of the workshop should be included as an annex to enable planktologists to evaluate the results which may serve as a guideline for future research at institutional and individual levels.
4. Although experiments have been initiated on the determination of zooplankton biomass, it is not clear that conclusive results can be obtained at the present level of activity. A report on this problem should be prepared by Drs. Beers and Hansen, for consideration by the SCOR Executive Committee in 1971.
5. In view of the important role of microzooplankton in the secondary production of the ocean, the SCOR Executive Committee should consider whether problems of microzooplankton fixation and preservation should be considered by a separate working group.

Vagn Hansen, Chairman  
Phuket, 11 August 1970

ANNEX V

### REPORT ON SCOR WORKING GROUP 27 DEEP-SEA TIDES

There have been no formal meetings for the last two years, but the time may be ripe for a new review.

Theoretical efforts to compute the global tides by Pekeris in Israel, Hendershott in the United States, and Zahel in Germany have made considerable progress. I have not learned of the recent results in the Soviet Union where similar work is underway. It is my impression that a meaningful comparison between deep-sea calculations and deep-sea measurements is only a short time away. The boundary dissipation problem has not been solved, but it now looks as if the total energy in the oceans is rather larger than had been estimated; so the relative dissipation is not quite so dramatic. Some connection between the age-old problem of the age of the tides and