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REPORT OF THE STUDY GROUP ON ZOOPLANKTON PRODUCTION

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INTRODUCTION

At the 1990 Statutory Meeting in Copenhagen, a theme session on "Recent developments in the measurement of zooplankton production rates" was held, convened by Dr. J. C. Gamble and Mr. H. R. Skjoldal. Based on discussions in the Biological Oceanography Committee, the Council decided to establish a Study Group to continue the work started with the Theme session. The Study Group on Zooplankton Production (SGZP) was to work by correspondence in 1991 and meet in Bergen in the spring of 1992.

The start of work in the SG has been delayed. One practical difficulty has been the slow and not yet completed nomination of members to the group.

The present report presents plans for the further progress of work in SGZP. These are proposals from the chairman and have not yet been fully discussed among the SG members.

Terms of reference

The terms of reference as given in C. Res. 1990/2:45 were:

A Study Group on Zooplankton Production will be established under the chairmanship of Mr. H. R. Skjoldal (Norway), will work by correspondence in 1991, and will meet in Bergen in the spring of 1992 to:

- a) **review existing methods for measuring biomass and production processes;**
- b) **make proposals for improvement and standardization of methods, and prepare a methodological manual;**
- c) **consider the need for laboratory and sea-going workshops to intercalibrate experimental methods and evaluate new technology;**
- d) **report on the progress in the scientific and commercial development of new sampling techniques.**

The Study Group will report progress to the Biological Oceanography Committee at the 1991 Statutory Meeting.

The mandate is extensive and demanding. The first two points are clearly interlinked. Based on a review of existing methods, we must consider possibilities for improvements and recommend selected standardized procedures for central methods for determination of zooplankton biomass and production. These will form the basis for the

methodological manual.

We are asked to consider the need for laboratory and sea-going workshops to intercalibrate experimental methods and evaluate new technology. I interpret this to mean that if deemed necessary, we are also to arrange such workshops as part of our evaluation and recommendation of standardized procedures.

Membership

At present, members are nominated from 5 countries. The members are:

- Dr. O. S. Astthorsson, Iceland
- Mr. A. Gislason, Iceland
- Dr. K. Brander, UK
- Dr. J. C. Gamble, UK
- Mr. S. Hay, UK
- Prof. J. Lenz, Germany
- Dr. D. Malley, Canada
- Dr. M. Paranjape, Canada
- Dr. D. Sameoto, Canada
- Dr. U. Båmstedt, Norway
- Dr. N. Swanberg, Norway
- Mr. H. R. Skjoldal, Norway (chairman)
- Mr. E. Ona, Norway
- Mr. S. Sundby, Norway
- Mr. K. Tande, Norway

It is my intention to broaden the membership of the SG. I will approach delegates and experts from ICES countries that have not yet nominated members to our study group. Suggestions from the present members are appreciated on this point.

Products from the SG

I would like to organize the work of the SG with specific publications identified as the final products from the SG. I suggest that we should aim for the following possible publications or reports:

- * A review paper on zooplankton studies in marine ecological research, with emphasis on concepts and "model" requirements, and possibilities and limitations of methods for determination of zooplankton biomass and production.
- * A report and/or review paper on physiologically, biochemically or experimentally based methods for determination of zooplankton production and related activities.
- * A report and/or review paper on technologically based methods for determination of zooplankton biomass and production.

* A zooplankton methodological manual containing recommended standardized procedures and overviews of other methods which for various reasons cannot be recommended standardized at present.

Organization of Subgroups

The task to review existing methods is comprehensive as a suite of diverse techniques has to be considered. The methods fall in two broad categories. The first category consists of experimentally based methods for determination of rate of production or some underlying process (respiration, excretion, growth, ingestion, etc.). The second category consists of technologically based methods for determination of distribution, biomass and behaviour. These include acoustic methods, methods based on video or photography, image analysis and pattern recognition, in situ particle counters, etc.

The two categories of methods that need to be reviewed will require expertise of somewhat different types. I therefore suggest that the initial preparatory work and reviewing take place in two subgroups which are internally more homogenous than the whole SG. These subgroups, the experimental subgroup and the technology subgroup, should be chaired by two persons selected from the members of the SG.

The two subgroups should produce review papers or reports based on their review of methods.

Workshops

The need for workshops must be viewed in connection with our tasks to evaluate methods and suggest improvements and standardization, including evaluation of new technology. I feel we are in much the same situation as one were in the field of biological effects techniques in pollution monitoring a few years ago. There were many potential promising methods being tested and promoted by the same people who developed them. Practical workshops where methods were intercompared helped in my view to bring this field forward through a more objective evaluation of the methods.

I consider it a useful exercise to hold such workshops. If the members agree, we should plan to have them arranged next year ~~in order~~ to use the results for our evaluation and recommendation on methods. Reflecting the two categories of methods indicated above, I see the need for two workshops:

1. Workshop on experimental methods for determination of zooplankton production.
2. Workshop on technological methods for determination of zooplankton biomass.

There will be limited time available for planning the workshops. For this reason

we are prepared to arrange both workshops in Norway. This should not discourage anyone, however, from considering and suggesting other possibilities.

The first workshop, on experimental methods, could be arranged as a laboratory workshop at the experimental facilities that are available at the former Biological Station of the University of Bergen. This laboratory is located at a fjord 20 km south of Bergen and has facilities for laboratory and mesocosm experiments as well as easy access to the nearby fjord and coastal environments. This workshop will be hosted by the Institute of Fisheries and Marine Biology at the University of Bergen (Prof. Ulf Båmstedt) with support from the Institute of Marine Research.

The second workshop, on technological methods, is proposed as a seagoing workshop. We are planning to use one of the research vessels of the Institute of Marine Research, R/V "G. O. Sars" or the new R/V "Johan Hjort". A final decision on allocation of ship time will be taken in November. These ships are equipped with Simrad EK 500 echosounders with 2 or 3 frequencies and the Bergen Integrator System for storing and treating the collected data. The echosounders can also be mounted on a towed vehicle. The ships can accommodate about 20 scientists in addition to the ship crew.

The seagoing workshop is planned as a cruise of about 10 days duration to the shelf area at Møre on the west coast of Norway. In this area we are presently conducting research on plankton dynamics and herring recruitment within the framework of MARE NOR (The North Norwegian Coastal Ecology Program). From this and earlier studies we have a fairly good knowledge of the system and the plankton populations in this area. Three different environments can be reached within a restricted area: deep fjords, shelf, and the slope which drops off steeply into the Norwegian Sea basin. There are characteristic deep scattering layers of myctophid fishes, pelagic shrimps and krill. Of the krill species, *Meganyctiphanes norvegica* and *Thysanoessa longicaudata* are typically found over deeper water while *Thysanoessa inermis* is common in shallower shelf water.

The timing of the workshops need to be considered by the SG. We suggest that the Experimental workshop could be held some time in June next year. At this time of the year a diverse zooplankton community is available in the fjord environment, with both small and large copepods present. It is also a good time from a practical and logistical point of view to arrange the workshop in Bergen. The seagoing workshop could be arranged in July. At this time of the year gelatinous zooplankton are present as are larger fish larvae. The dominant zooplankton herbivores such as *Calanus finmarchicus* are still present in the upper layer.

The success of the workshops will in part depend on the scientists that we can get to participate in the workshop. I would therefore like to have suggestions of people who you consider potential participants, including scientists that are not presently members of the SG. One difficulty with ICES workshops is the lack of

funding for participants. I will attempt to get some funding from Norway that can be used to support key participants who otherwise have difficulty in getting financial support for their participation. A final decision on the workshops should await the further planning in order to have a better basis for judging their likely outcome and success.

Meeting of the Study group in spring 1992

The study group is to meet in Bergen in spring 1992. At this meeting an important item on the agenda will be to review existing methods and start preparation of the methodological manual. A second important point will be to reach a final decision on the workshops. If we agree that one or both workshops should be held in 1992, we will need to finalize the plans for the workshops. A third point on the agenda will be to examine recent developments of new technology and sampling techniques.

With the extensive reviewing we have to do, I consider that we need at least 4 days for the SG meeting. Tentatively I like to suggest that we meet from 30 March to 2 April next year. If we have to change the dates I prefer to have the meeting earlier rather than later.

Further activities and timetable

I will use the ICES Statutory Meeting to discuss the work of the study group with delegates and SG members who might be present at the meeting. The first issue will be to finalize the membership of the study group. Based on the extended membership I will try to arrange the suggested division in two subgroups and appoint chairmen of these. This should be done within 1 November.

The first phase of reviewing existing methods should start in the subgroups and outlines (or drafts if possible) of review papers or reports should be ready for the SG meeting in spring 1992.

I will in consultation with the subgroup chairmen and members prepare an outline of contents for the methodological manual. I propose that I and the subgroup chairmen act as editors for the manual and that we identify authors among the members, supplemented where necessary with people from outside the SG, responsible for writing specific procedures or chapters of the manual. Authors of chapters should be clearly displayed in the final product as an incentive to strong contributions to our common goal. The outline of the manual and the further progress of work need to be discussed at the spring meeting.

It has been suggested that the zooplankton manual might be a common product from ICES and other international organizations such as IOC and SCOR. Working in consultation with the ICES secretariat I will approach these organizations to see if and how we can cooperate.

The workshops must be further planned during autumn and winter. The first and most important issue will be to get preliminary lists of people who are interested and able to participate. We are prepared to continue the local preparations and planning so that the workshops can be arranged in 1992 from a practical point of view. A final decision on whether and when to arrange the workshops must be taken at the Bergen meeting in spring, but we need an indication of members views in good time prior to this meeting to facilitate the planning, particularly regarding participants.

A lot of work will remain to be done after the meeting in spring 1992. We need to continue the review of methods, with emphasis on recommendations concerning standardization and new technological developments. The results from the eventual workshops will provide information which can be important in this respect. There will in my view be a need for continuing the work of the SG also in 1993. We would need to meet that year to review the results of the workshops and drafts of review papers/reports and the manual. We should have as a firm aim, however, that the work must be completed in 1993 and the final results reported to the Statutory Meeting that year.