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Exploration of the Sea

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REPORT OF THE ICES STUDY GROUP ON ZOOPLANKTON PRODUCTION

Plymouth, United Kingdom, 21-24 March 1994

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1. Opening of the meeting

The Study Group met from 21 to 24 March in Plymouth, UK, with the terms of reference (C. Res. 1993/2:51) to:

- a) review the results of the seagoing and laboratory workshops;
- b) review the draft Zooplankton Methodology Manual;
- c) evaluate and recommend standardization and improvement of methods;
- d) review plans for the Laboratory workshop on *Calanus*.

The meeting was opened at 10 am on Monday 21 March at Plymouth Marine Laboratory. The chairman thanked Dr. Roger Harris for his kind offer to host the meeting and for the practical arrangement in this respect.

The meeting was attended by 11 participants from 6 countries (Annex I). The chairman was glad to see that so many were able to take time from their busy schedules to contribute to the work and progress of the SG. He noted with some regret, however, that many members of the SG had sent their apologies for not being able to attend. One reason for this is cruise activities in spring. The *Calanus* workshops in Oslo and Bergen in April (C. Res. 1993/2:52, 2:53) were also reasons for non-attendance of several members who were not able to participate both in the SG meeting and the workshops.

The chairman reviewed briefly the correspondence with members of the SG.

2. Adoption of the agenda

The draft agenda was adopted as the agenda for the meeting (Annex II).

Arrangements were made for producing the report from the meeting and rapporteurs for the various agenda points were appointed (1-3 and 8-10 - Skjoldal; 4 - Postel; 5 - Sameoto; 6 - Lenz and Skjoldal; 7 - Nichols).

3. Results from Acartia workshop, October 1993

A workshop for intercomparison of methods for determination of growth rate of copepods was held at the field station of the University of Bergen at Espegrend from 11-20 October 1993. The workshop was organized by Prof. Ulf Båmstedt and was attended by 14 scientists, Ph.D. students and technicians from Norway, Spain, Finland, Iceland, Denmark and Sweden.

The workshop used cultures of *Acartia clausi* at 12 and 18 °C as the basis for the intercomparison experiments. The main work was done with two sets of cultures, one comprising late copepodites and adults and the other comprising late nauplii and early copepodite stages. These cultures were followed for about one week and the growth of the copepods was described by a variety of techniques.

The development of the stage composition and the size of the individual copepods were described with microscopic analysis, video recordings and image analysis, and silhouette photography. Growth was also estimated from egg production measurements. Feeding and clearance rates were determined from incubation experiments using chlorophyll, microscopic cell counts and Coulter counter, and gut fluorescence. Other measurements included respiration rate, enzymatic ETS and ATC activities, and RNA and DNA concentrations.

A report of the results from the workshop had been compiled by the organizer and was made available to the meeting. This report contained draft reports from the various participants describing results from the various techniques. However, a thorough intercomparison analysis of the results remained to be done. It was the intention of the organizer and the participants of the workshop to have that done with the aim to have the results published as a peer-reviewed paper.

Based on the preliminary results the workshop appears to have been a successful exercise. The Acartia workshop was intended as a preparatory exercise to be followed by a more extensive workshop based on *Calanus*. The results from these two workshops need to be seen in conjunction, and the meeting felt that they would provide an important input and basis for the SGs work with the methods evaluation and preparation of the methodology manual.

4. Plans for Calanus workshop, April 1994

A workshop on Calanus will take place at the Biological Field Station of the Department of Fishery and Marine Biology of the University of Bergen, at Espesgrend, Norway, from 15 to 30 April 1994. The workshop is carried out in the framework of the SGZP and is organized by Prof. Ulf Båmstedt. The main purpose is to evaluate methods of measuring growth and secondary production of zooplankton, using the calanoid copepod *Calanus finmarchicus* as a model organism. The workshop is linked to the effort by the SG in providing recommendations for standardisation in secondary production measurements.

It is planned to use six different combinations of experimental conditions:

(1) three Calanus cohorts with different dominant developmental stages and abundances, and (2) two different food levels. The measurement program will include determination of rates of metabolism, measured as respiration and excretion, grazing and egestion. Rate of egg production, gonad maturation, egg hatching success, stage distribution, rate of moulting, size, and biochemical composition will be measured in relation to reproduction and growth. Results will be obtained on population, individual and cellular levels. For the latter various enzyme activities and RNA/DNA ratio will be measured.

The workshop provides a good opportunity for exchange of ideas and knowledge. More than 10 of the about 25 participants are Ph.D. students mainly from the Nordic countries, and the workshop will give them a good chance to get qualified practical supervision from experts.

5. Results from seagoing workshop, June 1993

The main discussions were centered on a comparison of the results of the size categories of zooplankton (<1 mm, 1-2 mm, > 2 mm, fish, krill and shrimp) collected with the MOCNESS and BIONESS. All sample data for both types of gear were plotted for day and night tows versus depth. Discussions dealt with differences due to the different mesh size in the samplers as well as the effect of different speed. First impressions indicated that the smallest category was highest in the MOCNESS with the fine (180 μ m) nets. The BIONESS appeared to capture larger numbers of fish, krill and shrimp during both day and night. However, much more work has to be done before any conclusions can be made on the effectiveness of the two types of gear.

Data from the LHPR and WP2 nets were looked at. The LHPR profiles were similar to that of the MOCNESS AND BIONESS. Comparisons between the LHPR and the OPC could not be made at this time since a conversion factor to

convert OPC data to biomass needs to be calculated. This will be done by Steve Coombs. The results of the catches of different sizes of zooplankton with different mesh sizes in the WP2 net showed large differences, however these data will be look at in detail to see if the differences are real.

No data were presented from the other samplers, but a time table for the complete analysis of the comparison of all types of gear was agreed on. All data will be presented to Doug Sameoto by 15 May 1994 for analysis, which are to be completed by 1 November 1994.

The comparisons between the acoustic data and net catches cannot be done until the acoustic data are reprocessed. Tor Knutsen and Peter Wiebe have agreed to be responsible for this.

A poster will be prepared for the Plymouth symposium in August detailing the purpose, methods and preliminary results of the seagoing workshop.

The following people were identified as responsible for quality control of the data from various gear:

| <u>Name:</u> | <u>Gear:</u> |
|-----------------------|--------------------------|
| POSTEL | WP2, MULTINET, CALCOFI |
| SKJOLDAL | HUFSA |
| SAMEOTO | BIONESS |
| KNUTSEN and KAARTVEDT | MIK, YT, IK, MT, MOCNESS |
| WIELAND | GULF-III, OPC |
| COOMBS | LHPR |
| HAY | CPR |

Discussions were held dealing with various factors that can influence the capture of different sizes and kinds of zooplankton as well as sample handling procedures that can effect the variance in the size of the sample. These handling influences were suggested to be as important as the natural spatial variability seen in the zooplankton distributions.

A protocol for the use of different types of samplers under various conditions and for various purposes will be drafted based in part on the results of the seagoing workshop. Suggestions will be made as to directions for research on sampler improvement and possible new design.

Discussions of possible recommendations for CORE sampling routines using a simple type of net were held, but there was no agreement as to the value of such recommendations. This idea will need further discussion within the working group.

Recommendations dealing with mesh size, mouth to filtration area, speed of tow, color of net, and washing of nets was considered important enough to be

restated in the new manual. The problem of extrusion of animals from the net is another area that will be dealt with in the manual.

Methods of measuring biomass were discussed with the merits of sieves versus photographic methods considered and these will be dealt with in the manual.

6. Standardization and improvements of methods

At the second meeting of the SG in Las Palmas the issue of standardization was discussed. A list of methods that were considered potential candidates for standardization or improvement, was produced (Annex III to the Las Palmas meeting report). This list was accepted as basis for the further discussion of this issue at the present meeting. Introducing the issue, the chairman underlined that the aim was to identify persons who could take the responsibility for producing drafts of proposed standard protocols. These drafts could serve as the basis for further discussion and correspondence among experts.

The work with the standardization and standard protocols needs to be closely linked with the drafting of the chapters of the manual. As far as possible main authors for the chapters should be given the responsibility to lead the discussion concerning the standard protocols.

A two day seminar was held 12-13 June 1993 on board R/V "Johan Hjort", at the end of the seagoing workshop. At this seminar the issue of standardization and improvements of methods for sampling and determination of biomass and abundance was discussed. A draft report from the seminar by Uwe Kils, Peter Wiebe and Doug Sameoto was distributed at the meeting. It was agreed that this report should be finalized and made available as a working document for the further discussion of the issue of standardization and improvement in the SG.

Proposed JGOFS standard protocols for determination of mesozooplankton biomass and grazing rate were presented by Roger Harris. These protocols were general guidelines to the methodological approaches and were annotated with comments from several researchers within the JGOFS program.

The proposed JGOFS protocol for determination of mesozooplankton biomass recommended depth-stratified sampling with an appropriate opening-closing net system (e.g. BIONESS, MOCNESS, a.o.) or vertical hauls with a WP2 net. The recommended mesh size was 200 μm . The protocol prescribed size fractionation by wet-sieving the samples with 200 μm , 1000 μm , and 2000 μm sieves, followed by splitting the fractions into aliquotes for determination of dry weight, carbon, and taxonomic composition of the samples.

There was agreement that a similar protocol for sampling and determination of mesozooplankton biomass should be elaborated as part of the SGs work. The following points were discussed and the SG agreed that they should be taken into

account when drafting the standard protocol for sampling:

- * A flexible approach to sampling is recommended, with depth-stratified sampling with an appropriate device, or vertical net hauls, or oblique tows. Further guidance should be given as comments as to when vertical or oblique hauls are to be preferred. The WP-2 net should be used as a standard net for vertical tows.
- * 200 μm should be the standard mesh size.
- * The protocol should specify that the R-ratio (filtering area (=openings) /mouth opening) should exceed a given value.
- * The coloration of the net should be specified.
- * Flowmeter should be used and calibration procedures specified.

Doug Sameoto was given the task to draft a proposed protocol as a basis for further discussion.

For determination of mesozooplankton biomass in net samples, a wet sieving procedure with subsequent determination of dry weight was considered the most appropriate approach as a standard for routine applications. Size fractionation of the mesozooplankton should follow a system of logarithmic size classes which facilitates comparisons of biomass spectra across a wide size range of plankton. A simple fractionation may be to use 1000 μm screen to separate small and large mesozooplankton, with the possibility to use additional screens of 500 μm and 2000 μm to have better resolution of the size spectrum.

An alternative approach to determination of mesozooplankton biomass is to derive taxonomic composition and size distribution from analysis based on silhouette photography, and to convert this to biomass using established size-weight relationships for dominant taxa. The advantage of this method is that it can give more information on the size and taxonomic composition. For certain applications such as comparisons with acoustic records, this may make the silhouette photography technique the preferred method. Wider application of silhouette photography should be encouraged.

The common unit for reporting zooplankton biomass should be dry weight. Ash-free dry weight can be a better unit, particularly in cases where there is a high proportion of gelatinous zooplankton with a high salt content. The standard protocol should contain guidelines for including ashing of some samples in order to determine conversion factors from dry weight to ash-free dry weight. In cases where biomass is determined in units other than dry weight (e.g. carbon, nitrogen, phosphorus), or where biomass determined as dry weight is to be compared to other units, there is a need for conversion factors. The standard protocol should contain guidelines to how conversion factors should be

determined or which established conversion factors should be used.

Lutz Postel was given the task to draft a standard protocol for determination of zooplankton biomass in net samples, including size fractionation and conversion factors.

A proposed standardized procedure for determining egg production of copepods was included as Annex V to the report from the 1993 meeting of the SG in Las Palmas, as a basis for further discussion. Jeff Runge had provided comments to this procedure, emphasizing the role of cannibalism as a source of error. As for the other methods, there is a need to have a further discussion among experts before an agreed version of the egg production method can be reached. The meeting decided to ask Jeff Runge to take the lead in the further discussion of the egg production method.

The draft JGOFS protocol for determination of grazing by mesozooplankton was presented by Roger Harris. This protocol recommends 24 or 48 h station occupancy with sampling by vertical net haul, every 2-4 h. Through measurements of gut pigment content, the diurnal feeding pattern and gut clearance rates are determined as a basis for calculation of assimilation efficiency and defecation rate of the zooplankton community. The protocol is written in general terms and contains no detailed description of how gut pigment content is to be measured. There is also a lack of consensus in the scientific community as to the usefulness of the gut pigment technique. A different protocol based on radioisotope method has been used in the JGOFS Equatorial Pacific studies.

It was felt that despite the difficulties involved, the SG should pursue the issue of considering standardization of grazing methods. Concerning the gut pigment method, it was suggested that a protocol should contain recommended procedures for both measuring gut pigment content and for calculating ingestion and defecation rates from such measurements. Such calculation may require that determination of gut passage time is included as a calibration procedure in the protocol.

There is a wide variety of methods used for determination of grazing and clearance rates based on incubation of zooplankton in closed or flow-through containers. While it may be difficult to recommend a standard protocol, it was felt that general guidelines as to container size, densities of zooplankton, etc., may be useful to narrow the range of variation and make results more comparable.

Roger Harris was given the task to draft proposals for standardized methods for determination of gut pigment content, grazing and clearance rates, based on the JGOFS protocols, for further discussion within the SG.

There is a need to consider standardization of methods for determination of metabolic rates of zooplankton. This will be further discussed in the context of

the laboratory workshops and evaluation of results from them. There are several biochemical techniques which seem promising for determination of metabolic activities and growth of zooplankton. The techniques are at the testing level and it is too early to suggest standard protocols. One exception is ETS activity which has been in use for a number of years. The meeting decided to ask Ulf Båmstedt to draft a proposal for a standard protocol to be further discussed among experts.

7. Zooplankton Methodology Manual

The chapter headings, main chapter authors, associate authors and detailed contents were listed in Annex VIII and IX of the Report of the second meeting of the Study Group (Anon, 1993). None of the chapters has yet been completed although progress has been made with some sections. Most of the proposed main authors have now been contacted and as a result some changes to the list are necessary. There was further discussion of the potential contributions from associate authors which also resulted in modifications to that list. It was decided that a chapter on Population Genetics, with Ann Bucklin as the main author, should be added to the contents list. The revised list of chapter headings, main authors and proposed associate authors is given in Annex III.

The format of the manual will be in three parts:

I. A review of methodology related to sampling, Chapters 1 - 13.

II. Standard protocols - to be published as an appendix to the manual and possibly also made available as leaflets.

III. CD ROM system for making available large volumes of information or data which would otherwise be too large to publish. For example raw data from the laboratory and seagoing workshops, models, videos of gear in operation or laboratory techniques could be made available in this format.

Parts I and II will form the published manual. For part I there will be a limit of 20 pages (ca. 10.000 words) per chapter, excluding references. There will be some further discussion on standardizing the protocols at the *Calanus* workshop in Bergen (April 1994) and at the Zooplankton Symposium in Plymouth in August 1994.

The thirteen proposed chapters of the manual group readily into three main subject headings; Chapters 2-6, abundance biomass and distribution; Chapters 7-10, processes, rates and behaviour; Chapters 11-13, population dynamics and modelling. A coordinating editor for each of the three groups was appointed; Chapters 2-6 - Jürgen Lenz, Chapters 7-10 - Mark Huntley, Chapters 11- 13 - Hein Rune Skjoldal.

Once the list of main authors has been established, and all have agreed to participate, a letter of instruction will be sent to each one. This will detail their responsibilities, including the requirement to produce standard protocols, and

the proposed timetable for publication.

It was agreed that the main authors should be given some freedom to organize the exact details of their chapters using the contents list as a guideline. They would be responsible, in consultation with the coordinating editor for their chapter, in deciding on the required contribution from each associate author. They would also be free to approach other potential contributors with the agreement of their editor.

Once the list of contributors has been agreed a letter of invitation would be sent by the Study Group Chairman.

An address list of main authors including Fax number and E-mail address of all the contributors will be compiled by the Chairman and made available as necessary.

There was some discussion on the details of the chapter contents and it was generally agreed that the previous list provided a good framework. A more detailed plan, for the Introduction, on the general aspects of zooplankton classification was put forward by J. Lenz. This contained a useful definition of size classes which the Study Group agreed to follow. This plan led to some discussion on whether the manual should include the sampling of microzooplankton, which includes some of the juvenile stages (eggs and nauplii) of copepods. It was agreed that the manual should give some guidance on such sampling, but that the manual should mainly cover the mesozooplankton size range.

A new timetable for the various stages in the production of the manual was agreed as follows.

- a) Main authors agreed.
Completion - April 1994.
- b) Letters of instruction to main authors and invitations to associate authors.
- c) Agreed details of the final contents list and individual tasks allocated to associate authors.
b) and c) to be completed by July 1994, for agreement at an ad hoc meeting in August 1994.
- d) First draft of all Chapters completed.
Completion - January 1995.
- e) Review of each Chapter by the coordinating editors to check content, style and consistency.
Completion - June 1995 (targeted at a proposed SG meeting in Woods Hole in late June 1995)

f) External reviewing of the Chapters. Reviewers to be selected by the coordinating editors.

Completion - November 1995.

g) Publication of the Manual and Standard Protocols.

Completion - Mid 1996.

8. Further plans

It has been an aim to complete the work of the SG in 1994. Due to the time required for analysis of results from the workshops and for completion of the methodology manual, it will be necessary to extend the work to 1995.

The timetable for completion of the manual was given in the former section. A summary timetable for the various activities related to the work of the SG is given as Annex IV. A list of actions with responsibilities identified and deadlines is given as Annex V.

The SG recommends that it should meet at Woods Hole, USA, from 19 to 23 June 1995 with the following main tasks:

- 1) Review results from the laboratory and seagoing workshops
- 2) Complete the evaluation of methods
- 3) Review and prepare for finalization the draft Zooplankton Methodology Manual.
- 4) Review and recommend standardized procedures and guidelines to be included as a part of the methodology manual.

The ICES Zooplankton Symposium in Plymouth, 15-19 August 1994, is an event where many of the members of the SG and authors of the Methodology Manual will be present. Three posters will be presented describing:

- a) the Manual
- b) results from the seagoing workshop and
- c) results from the laboratory workshops.

The symposium offers an opportunity to conduct informal discussions concerning the SGs work, particularly the issue of standardization and improvement of methods. It is the intention to convene an ad hoc meeting of the SG during the time of the symposium.

9. Any other business

Roger Harris and John Gamble gave a brief account of the planning for the ICES Symposium on Zooplankton which will be held in Plymouth, 15-19 August 1994. The response to the call for papers have been good and a large number of zooplankton scientists are planning to attend the symposium. A program has

been made with invited speakers in the morning and two parallel sessions on the same general topic in the afternoon. The 5th day (19 August) is devoted to presentations from GLOBEC International.

Hein Rune Skjoldal presented information on a Symposium on the Ecology of Fjords and Coastal Waters which will be held in Tromsø, Norway, from 5 to 9 December 1994 to mark the end of the Mare Nor research program. A second announcement is being sent out and a final deadline of 15 June is set for further oral or poster presentations.

Information was distributed on the Workshop on the Trans-latitudinal Study of *Calanus finmarchicus* in the North Atlantic arranged by Charles Miller and Kurt Tande in Oslo, 6-8 April 1994. A number of position papers have been produced which form a useful review of existing knowledge and research tasks concerning *Calanus finmarchicus*. The aim of the workshop is to develop a detailed plan for a study of this species in the North Atlantic.

10. Closing of the meeting

Before closing the meeting, arrangements were made for finalizing the report. The chairman would receive remaining contributions from the rapporteurs preferably by e-mail, and edit a draft version of the report after Easter. A final version of the report will be made and sent to ICES.

The meeting was closed at 1600 on Thursday 24 March. The chairman thanked Roger Harris for his hospitality and arrangements for the meeting. He further thanked the participants for their effort and willingness to contribute to the successful completion of the work of the SG.

LIST OF PARTICIPANTS

| | |
|----------------------|---------------------|
| Jean-Pierre Bergeron | Nantes, France |
| Steve Coombs | Plymouth, UK |
| John Gamble | Plymouth, UK |
| Roger Harris | Plymouth, UK |
| Tor Knutsen | Bergen, Norway |
| Jürgen Lenz | Kiel, Germany |
| John Nichols | Lowestoft, UK |
| Lutz Postel | Warnemünde, Germany |
| Doug Sameoto | Dartmouth, Canada |
| Hein Rune Skjoldal | Bergen, Norway |
| Peter Wiebe | Woods Hole, USA |

AGENDA

1. Opening of the meeting
2. Adoption of the agenda
3. Results from Acartia workshop, October 1993
4. Plans for Calanus workshop, April 1994
5. Results from seagoing workshop, June 1993
6. Standardization and improvements of methods
 - a) Sampling and biomass
 - b) Acoustics
 - c) Optics
 - d) Processes and rates
7. Zooplankton Methodology Manual
8. Further plans
9. Any other business
10. Closing of the meeting

PROVISIONAL LIST OF MAIN AND ASSOCIATE AUTHORS.

ZOOPLANKTON METHODOLOGY MANUAL

| <u>CHAPTER</u> | <u>MAIN AUTHOR</u> | <u>ASSOCIATE AUTHORS</u> |
|--|--------------------|--|
| 1. INTRODUCTION | Lenz | Huntley, Skjoldal |
| 2. SAMPLING AND EXPERIMENTAL DESIGN | Skjoldal | Wiebe, Gamble |
| 3. SAMPLING of ZOOPLANKTON | Sameoto | Wiebe, Kramer, Nichols, Coombs, Båmstedt, Heath, Hernroth, Lutz Postel. |
| 4. BIOMASS AND ABUNDANCE | Postel | Schneider, Berman, Weibe, Coombs, Bamstedt. |
| 5. ACOUSTICAL METHODS | Wiebe Holliday | Stanton, Dalen, Simmonds, Greene |
| 6. OPTICAL METHODS | Kils | Herman, Davis, Strickler, Berman, Lenz, Schulze |
| 7. FEEDING | Båmstedt | Huntley, Harris, Head, Hirche, Schnack-Schiel, Daro, Mayzaud, Conover |
| 8. GROWTH | Runge | Bergeron, Tande, Huntley, Poulet, Miller, Franz, Kimmerer, Clarke, Hirche, Kiørboe, Hernández-Leon |
| 9. METABOLISM | Ikeda | Schneider, Le Borgne, Torres, Hernández-Leon, Postel |
| 10. BEHAVIOUR | Paffenhöfer | Busky, Yen, Strickler, Bollens, Tiselius, Alcaez, Kaartvedt, Marasse Dahle |
| 11. POPULATION GENETICS | Bucklin | |
| 12. POPULATION DYNAMICS | Aksnes | Franz, Davis, Durbin, Caswell, Matthews, Miller, Tande, Wood |
| 13. MODELLING | Frost | Evans, Vinogradov, Nival, Gurney, Giske, Slagstad, Steele, Cushing, Denman, Barreta, Fasham, Franz |

TIME TABLE FOR ACTIVITIES FOR COMPLETION OF THE WORK OF THE SG

1994

- 15-30 April Laboratory workshop on *Calanus* for intercomparison of methods for determining growth of zooplankton, Bergen.
- 15-19 August ICES Zooplankton Symposium. Informal discussions and ad hoc meeting of the SG concerning standard protocols and Methodology Manual - Plymouth, England.
- Autumn Workshop for evaluation and summary of results from the laboratory workshop on *Calanus* in Bergen and a similar US GLOBEC workshop at Hawaii in April 1994.
- Autumn Drafting of the Zooplankton Methodology Manual.

1995

- January 1st draft of Manual.
- January-June Review and further drafting of the Manual.
- 19-23 June 4th meeting of the Study Group on Zooplankton Production, Woods Hole. Final review of Manual and standard protocols.
- September Final report from Study Group to ICES Statutory Meeting.
- 30 November Final draft version of Manual to printer.

1996

- Summer Printed version of Zooplankton Methodology Manual.

LIST OF ACTIONS

| Task | Deadline | Responsibility |
|---|-----------|--|
| <i>Report of results from the seagoing workshop</i> | | |
| Quality checked data sets (biomass, macrozooplankton/micronekton) | May 94 | Tor Knutsen |
| Species enumeration | August 94 | Hein Rune Skjoldal |
| Description and analysis of results | Nov. 94 | Peter Wiebe Doug Sameoto Lutz Postel |
| * Acoustics | | |
| * Gear intercomparison | | |
| * Rate measurements | | |
| Final edited version of report | Feb. 95 | Hein Rune Skjoldal & Lutz Postel |
| <i>Report of results from the laboratory workshops</i> | | |
| Arrange meeting for evaluation and publication of results | Aug. 94 | Ulf Båmstedt & Mark Huntley |
| Publication of results from <i>Acartia</i> and <i>Calanus</i> workshops | Spring 95 | Ulf Båmstedt |
| <i>Poster presentations at ICES Symposium</i> | | |
| Methodology manual | | Hein Rune Skjoldal |
| Results from seagoing workshop | | John Nichols |
| Laboratory workshops | | Ulf Båmstedt |
| <i>Standard protocols</i> | | |
| Draft proposals | August 94 | Doug Sameoto Lutz Postel Jeff Runge Roger Harris Lutz Postel |
| * Sampling | | |
| * Biomass determination | | |
| * Egg production | | |
| * Grazing | | |
| * Incubations | | |

| | | |
|-----------------------------------|---------|--------------|
| Discussions | June 95 | Main authors |
| Final adoption and recommendation | June 95 | SGZP |

Zooplankton Methodology Manual

| | | |
|--|-----------|--|
| Letter describing the intended structure and content of the manual | April 94 | Hein Rune Skjoldal |
| Correspondence with main authors and contributing authors | June 94 | Hein Rune Skjoldal, Mark Huntley & Jürgen Lenz |
| Detailed plans for the content and writing of each chapter. | August 94 | Main authors |
| 1st draft | Dec. 94 | Main authors |
| "Internal" reviews completed | June 95 | Editors |
| Penultimate draft reviewed and approved | June 95 | SGZP |
| "External" peer reviews completed | Oct. 95 | Editors |
| Final draft to printer | Nov. 95 | Editors |
| Printed version | Summer 96 | |