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GUIDE FOR PREPARING FISHERIES AND MARINE SERVICE SCIENTIFIC AND TECHNICAL REPORTS

by

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This is the first Manuscript Report from the
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ABSTRACT

Cook, D. G., J. M. Reinhart, and J. Watson. 1977. Guide for preparing Fisheries and Marine Service Scientific and Technical Reports. Fish. Mar. Serv. MS Rep. 1426: 18 p.

Publications of Fisheries and Marine Service reports is the responsibility of regional establishments. To meet their different needs, and to ensure efficient documentation and retrieval of the voluminous information reported, an attempt is made to rationalize and standardize the series nationally. The form, function, and distribution of four series of reports are discussed: Technical -- for reporting new information of broad interest; Manuscript -- for reporting new information of regional interest; Data -- for archiving raw data; Industry -- for interpreting scientific and technical information that may be applied. Instructions are given for preparing camera ready manuscripts for each series.

Key words: Reports: Technical, Manuscript, Data, Industry; format, preparation.

RÉSUMÉ

Cook, D. G., J. M. Reinhart, and J. Watson. 1977. Guide for preparing Fisheries and Marine Service Scientific and Technical Reports. Fish. Mar. Serv. MS Rep. 1426: 18 p.

La publication des rapports du Service des pêches et des sciences de la mer est la responsabilité des cadres régionaux. Nous voulons ici rationaliser et uniformiser les séries à l'échelle nationale, afin de satisfaire à des besoins différents et d'assurer une documentation et une recherche documentaire efficaces de l'information volumineuse contenue dans ces rapports. Nous examinons la forme, le fonction et la distribution de quatre séries de rapports: Rapports techniques -- pour la publication de connaissances nouvelles d'intérêt général; Rapports manuscrits -- pour la publication de connaissances nouvelles d'intérêt régional; Données -- pour la conservation de données brutes; Rapports à l'industrie -- pour l'interprétation de connaissances scientifiques et techniques susceptibles d'application. Nous décrivons la façon dont les manuscrits doivent être préparés pour chaque série.

INTRODUCTION

This report contains guidelines for authors and typists preparing manuscripts for the Fisheries and Marine Service's (FMS) series of Scientific and Technical Reports. We drafted the guidelines to help responsibility centers publish reports that are internally consistent, easy to retrieve, esthetically pleasing, and economical to produce.

Recently, it became necessary to bring the Service's report literature under more reasonable bibliographic control. Several major organizations within FMS that previously published separate reports were amalgamated, and FMS became the input center for the FAO-IOC Aquatic Sciences and Fisheries Information System (ASFIS). A major requirement of the FMS Scientific Information and Publications Branch, which coordinates Canada's input to ASFIS, is to arrange for the documentation and indexing of all relevant Canadian reports for Aquatic Sciences and Fisheries Abstracts, the major product of ASFIS. Rather than have separate reports for each branch and region of FMS it was considered most effective for ease of retrieval and user satisfaction to have reports that were Service- rather than Branch-oriented and numbered nationally rather than regionally.

What follows is a model of the recommended format for these reports.

PUBLICATION PROCEDURE

Individual FMS establishments finance and arrange the printing and distribution of all report series. Directors and group leaders have an editorial responsibility (to ensure accuracy of content and format) for reports issued by their establishment, and, in consultation with authors, assign reports to the most appropriate series.

The Scientific Information and Publications Branch (formerly the Office of the Editor) coordinates the series nationally to produce an annual index of the total output of FMS scientific and technical articles. Prior to publication, a completed "Record of Scientific Report" (form 081-9000; replaces form P. 501) is sent by the issuing establishment to this Branch where a national series number is assigned and each report is documented and indexed. Assignment of report numbers by telephone is discouraged. After printing has been completed, copies of reports are required by this Branch as follows:

Tech. Rep.	MS Rep.	Data Rep.	Ind. Rep.
10	4	4	4

The Technical Report series is already a well established, widely distributed medium for descriptive articles. It is increasingly difficult to accommodate such work in the primary scientific literature; therefore authors outside the Fisheries and Marine Service may seek publication in the Technical Reports. We encourage this wider use of the report literature. External authors should arrange for publication with the most appropriate (in terms of geography, or area of interest) FMS establishment which becomes the issuing establishment and follows the normal procedures outlined above. Financial and other arrangements are negotiated by the authors and the issuing establishment's Director who has, for this purpose, full editorial jurisdiction.

Significant cost savings can be achieved by micropublication (Fig. 1). Microfiche is stored, distributed, and reproduced more easily and economically than hard copy. Therefore, wherever possible we recommend that issuing establishments arrange for at least that part of a production run intended for routine distribution to libraries and research institutions to be in microfiche. Hard copy can then be produced on demand by individual libraries.

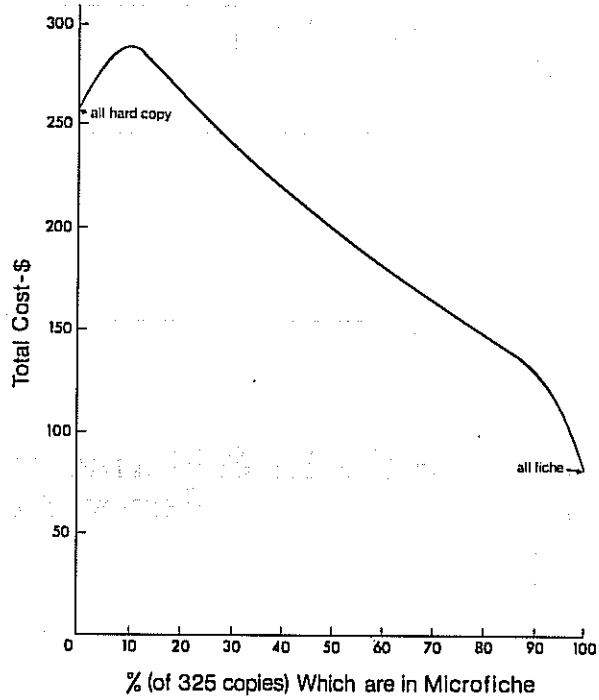

Fig. 1. Relationship between approximate total costs (production and postage) of a 70 page report (325 copies) and the proportion of copies to be produced as microfiche (based on January 1975 prices). Data courtesy of M. P. Latremouille (Bedford Institute of Oceanography, Dartmouth, N.S.).

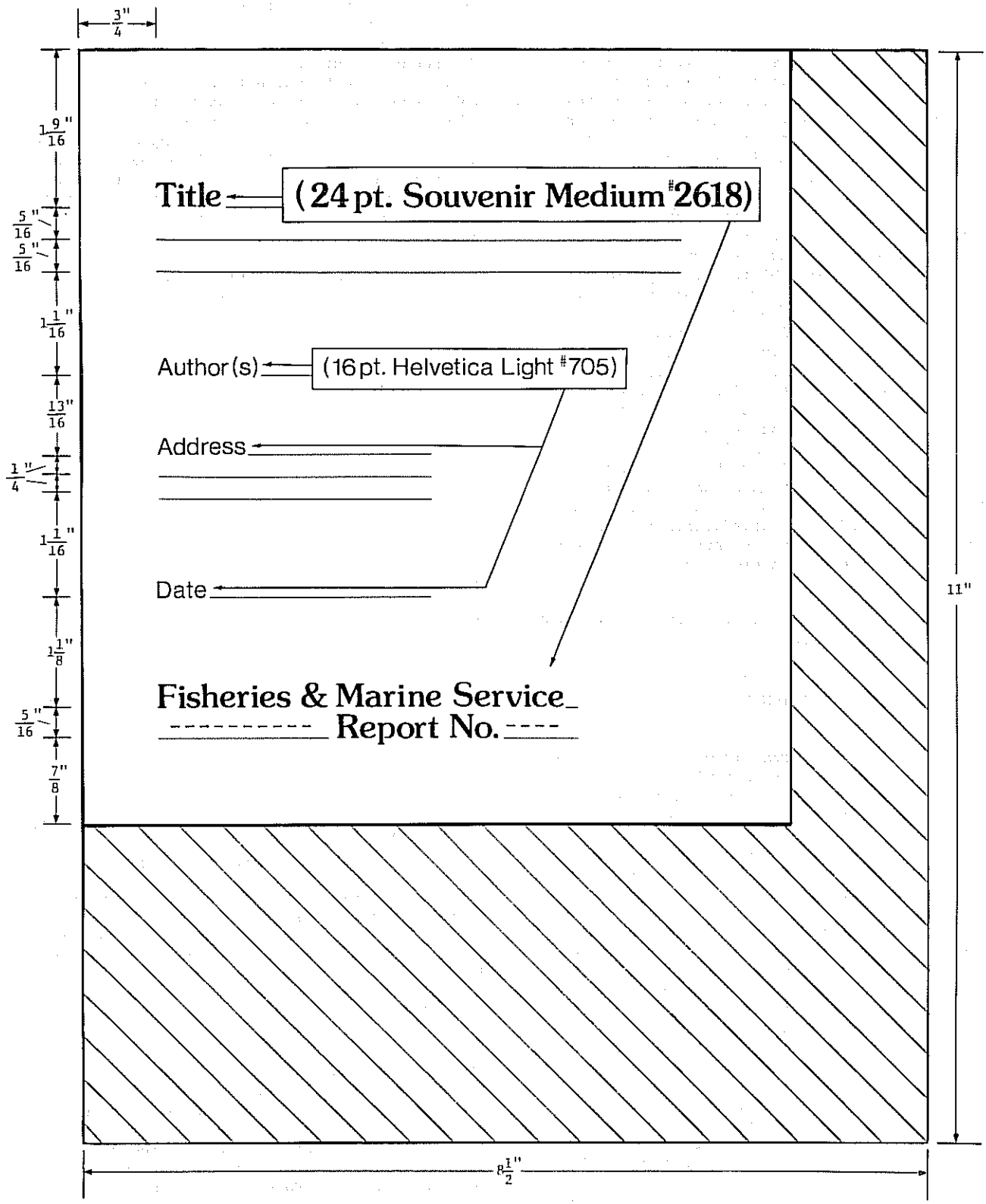

Fig. 2. Layout of the front cover, and recommended Lettraset® type faces, point sizes, and stock numbers for the various information elements.

ORGANIZATION OF MANUSCRIPT

FRONT MATTER

The information recorded in the preliminary pages of the report serves to characterize the work for archivists, abstracting services, and potential readers. To ensure that the desired audience can be made aware of the report, and that librarians can locate it, the documentation materials (series title, number, and date; authors; report title) and indexing components (abstract; key words) must be recorded accurately and in a consistent format. Hence all FMS Reports must contain the first four elements discussed below, which have been freely adapted from the ANSI (1974) guidelines on producing scientific and technical reports.

Because they are not part of technical content, these front pages are numbered in lower case Roman numerals.

Cover

To reflect the common departmental origin and national character of the FMS Reports, a uniform design has been adopted for the front cover of all series, each of which has a distinguishing color (Tech. Rep. - orange; MS Rep. - green; Data Rep. - brown; Ind. Rep. - blue). Information on the front of the cover consists (from top to bottom) of the report title, authors, issuing establishment's address, date, and series title and number. We recommend that Lettraset® instant lettering be used in the preparation of cover artwork as shown in Fig. 2. See the front of this report for the new cover design and information format. Inside the cover, a brief explanation of the history, function, and scope of the particular series appears.

Printing of the new covers, bearing the departmental logo and the inside explanatory material, will be arranged for all Fisheries and Marine establishments by the Scientific Information and Publications Branch, and distributed directly by the printer. A reserve supply will be maintained by this Branch.

Title page

This, page *i* of all reports, is the main instrument of documentation; therefore completeness and accuracy are essential. All the information necessary to identify and locate the report is typed centered in the following order (from top to bottom): the series title and report number; date (month and year); title of report; author(s); author's mailing address; sponsoring institution's report number. Again, page *i* of this report can be used as a model for the format.

Reports written in French should have the report title, date, and sponsoring institution's report number in French; series titles are the same for both languages, as are their abbreviations that appear in the bibliographic strips of Abstracts and Résumés.

The reverse of the title page (page *ii*) is usually left blank, but a Preface (see below) may appear here if applicable.

Addresses

In most cases the author's address and the sponsoring establishment's address are the same; therefore the latter is given in an abbreviated form. However, when the authors are from outside the Fisheries and Marine Service the full name and address of the sponsoring establishment should appear after its internal report number.

When two or more of the authors have different addresses, we recommend the following procedure. If one author, regardless of seniority, belongs to the sponsoring establishment, then this address should appear below the authors' names; addresses for the other authors should be indicated by footnotes placed below the sponsoring establishment's internal report statement. Otherwise place the senior author's address below the authors' names, and the rest in footnotes.

Contents page

For the convenience of the reader, the main headings are listed on page *iii*. First grade headings (see p. 00) are typed flush left, and second, third, and fourth levels are indented 3, 6, and 9 spaces respectively. It may be appropriate to omit the fourth, and possibly the third grade headings, especially in a lengthy report. This is a matter of judgment for the authors, who should balance the needs of their readers with the increased costs and inconvenience of an exhaustive table of contents.

After the last regular item of the table of contents (usually the bibliography or Appendices) a list of illustrations, or tables, or both, may be presented, but only if this is deemed necessary for understanding the organization of the report. Unnecessary repetition of figure and table captions only adds to production costs and wastes resources.

Abstract

The abstract serves a double function. It contains a summary of the major results and conclusions of the report for the reader, and is the main instrument for information retrieval. Indexers, abstracting services, and computerized information retrieval systems have their own requirements, and we have attempted to combine the necessary elements into a self contained unit (currently used in the Journal of the Fisheries Research Board of Canada) which consists of three parts. *Because of its diverse and critical functions we stress the importance of accuracy and a uniform format for this information.*

Table 1. Comparison of the form, primary function, and intended audience of the various Fisheries and Marine Service Report series.

Series	Form	Function	Audience	Recommended first production run
Technical	Analytical or descriptive	Report new information; preliminary analyses.	National or international	350
Manuscript	Analytical or descriptive	Report new information; preliminary analyses.	Regional	50
Data	Data tabulations or printouts	Archive scientific data (no analysis).	Individuals with specialist interest	25
Industry	Interpretive or applied	Summarize, interpret, or recommend.	Primary and secondary industry.	50-500 (as needed)

The three parts of the abstract are presented in the following order: 1) the bibliographic strip is a complete citation of the work as it would appear in a list of references, and consists of the authors, date, report title, series title (correctly abbreviated), report number, and the number of pages; 2) the summary of major results and conclusions; brevity and clarity are important in this section (see also Appendix 1); 3) a list of up to ten key words, or index descriptors, concludes the abstract; see FAO (1976) for a standardized list of descriptor terms.

Preface

It may be necessary or desirable to indicate prominently the relationship between the work reported and previous work, current studies, or planned investigations. Such a preface may be appropriate, for example, if the work is part of a series, or a component of a broadly based investigation, the results of which may be published in diverse media.

TECHNICAL CONTENT

Which series?

The body of a report is designed to communicate new scientific information, document scientific data, summarize existing knowledge for selected groups, institutions, or industry, and to offer technical recommendations. The primary function and the intended audience of a report determines the series to which it belongs (Table 1).

Although an individual report may serve any combination of these functions, the divisions will be fairly clear in most cases. Problems that may arise most often in assigning reports to the appropriate series are:

1. Technical or Manuscript? The authors, in consultation with their department head and director, should decide, on the basis of the nature and significance of the information reported, who is likely to use the report. A local or restricted potential audience (one that can be reached effectively through personal mailing lists) indicates a Manuscript Report. Other descriptive or case history studies (see Stevenson 1976) of broader or more general interest are appropriate as Technical Reports.

2. Technical Report with extensive data tabulations, or separate Technical and Data Reports? Three factors should be considered:

a) Usefulness of the data. Generally, data specifically required to substantiate analyses should appear in the Technical Report either as Tables or Appendices; raw data that are considered worth archiving but are not specifically required for substantiating analyses should be published as Data Reports.

b) Extent of the data and cost considerations. A significant proportion of production costs consists of set-up charges for total runs of 50 copies or less. However, with increased number of pages per report the costs per printed page rise far less steeply for small production runs than for large runs (see Fig. 3). Therefore, producing a separate data report is sound economically only if the data are extensive (more than 20 pages or 25% of the total report). By definition Manuscript Reports are only produced in small quantities; therefore there is no economic advantage in producing separate Manuscript and Data Reports.

c) Desired control over data. Publication in the Technical and Manuscript Reports constitutes open publication, and any data therein can be freely used by other workers. However, Data Reports are restricted in that workers can cite the data only after receiving the authors' or issuing establishment's written permission.

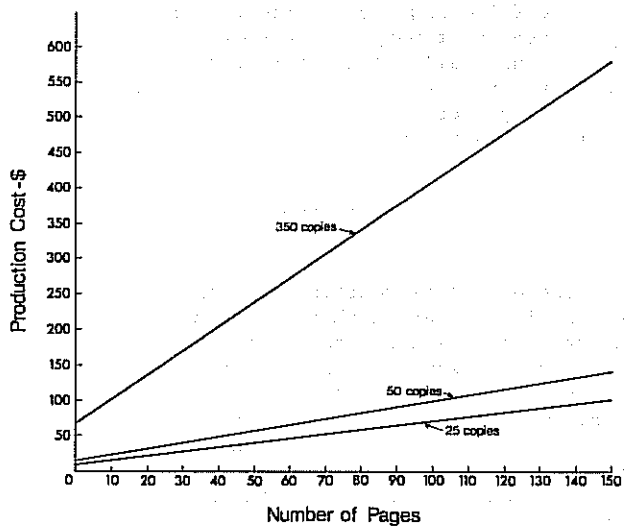

Fig. 3. Approximate relationship between total production costs (based on December 1975 prices) and the number of pages in a Technical Report (production run -- 350 copies), Manuscript Report (50 copies), and Data Report (25 copies). Data courtesy of A. S. Hourston (Pacific Biological Station, Nanaimo, B.C.).

General format

This, and the following four sections deal with matters of manuscript format common to all series.

Manuscripts should be typed single spaced for photoreproduction. The final report should be printed on both sides of the page to conserve resources.

Because it saves space, is easy to read, and is aesthetically pleasing, we recommend a double column format for all reports (for example, see Sutterlin et al. 1976). Manuscripts should be typed according to the dimensions given in Fig. 4, and photoreduced 20% to produce a total width of 6.7 inches (17 cm) of printed matter. At this degree of reduction, an IBM typewriter with a 12 pitch Courier typeface gives acceptable results. Use of the new generation of typewriters that have a memory and can justify right hand margins is encouraged.

Headings

Terse, informative subtitles or headings guide the reader through a work by elucidating its organization. To achieve this effectively, headings of a given rank or importance should be easily recognizable and consistent.

Use centered capital letters for first level headings, flush-left capitals for second rank, flush-left lower case italics (or underlined Roman) for third rank, and lower case italics idented 3 spaces for fourth level heads. That is:

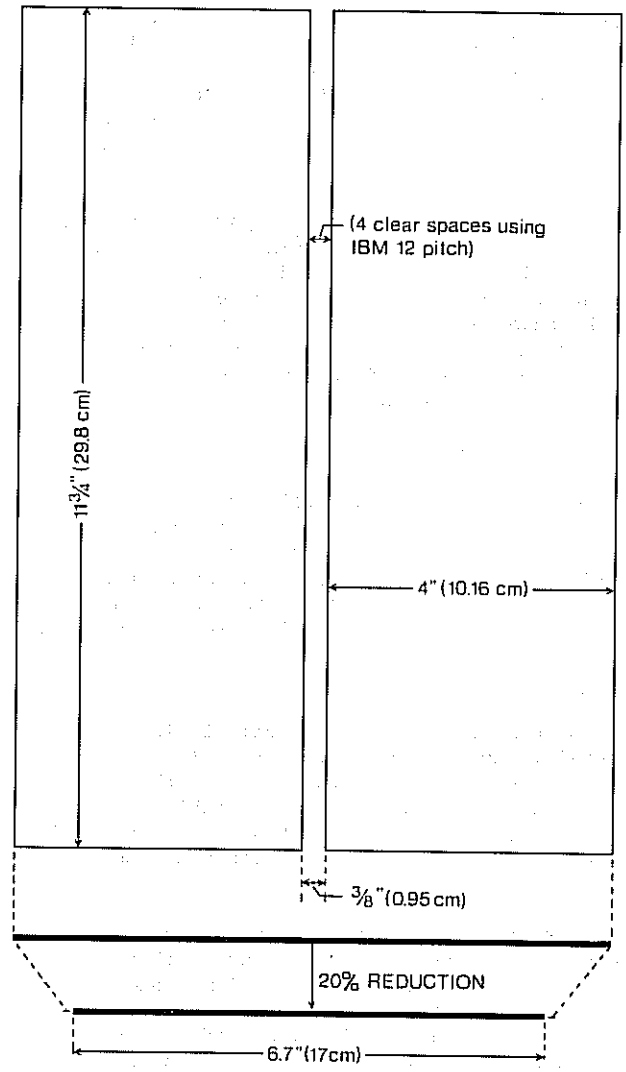

Fig. 4. Layout and dimensions of double column format for the preparation of camera ready manuscripts; to be reduced 20% by the printer.

FIRST

SECOND

Third

Fourth

Headings are listed, without change, to the third or fourth level (as appropriate) in the table of contents.

Illustrations

All figures should be numbered consecutively in Arabic numerals, and subdivisions indicated with lower case Roman letters. An informative, complete, and self contained caption is required for each illustration; preferably type this immediately beneath the

figure. Provide clear labels and scales on all figures: graphical axes and their scales are particularly important; for microscopical drawings or photomicrographs, scale bars rather than magnification factors are essential. To remain easily legible all letters and numerals should be no less than 1 mm high after reduction.

Line drawings are best prepared 30 to 50% larger than their desired printed size; plan illustrations bearing in mind the final (printed) width of one or two columns. Use black Indian ink and press-on letters and symbols (not typed characters) on a good quality white board or tracing paper for the best results. A useful guide for authors wishing to prepare illustrations was prepared by Allen (1976).

Generally place each illustration in the text close to where it is first mentioned. In some cases (eg. where a series of figures would interrupt the text), it may be better to present all illustrations together between the references or tables (see below) and appendices.

Tables

Number each table consecutively in Arabic numerals, and provide a complete self contained caption (see also Appendix 1). As with illustrations, either place each table in the text close to its first citation, or present all tables together between the references and figures or appendices.

Structure tables as simply as possible and include only essential data. Ensure that all units are included, either in column heads or in footnotes (designated by superscript lower case letters). Avoid: 1) ruled lines if spacing effectively separates columns and rows; 2) tables with many columns and few rows which may have to be printed at 90^{o} to normal text -- try turning columns into rows and vice versa; 3) very long tables that must be folded out -- these have to be tipped into the final report by hand and are therefore expensive -- try breaking up the table into a number of separate tables, or setting up the table so that each page is self contained.

If it is necessary to reproduce computer tabulated data, notify the computer department that tables will be printed and request a sharp printout with good contrast and undamaged characters.

Formulae and equations

Define all mathematical symbols at their first use; list symbols and their definitions as a text table if they are numerous. Equations should be indented or centered, and separated from the text by a double space top and bottom. If they are referred to in the text, or form part of a series, number equations 1), 2), 3), etc. flush right.

The following four sections each contain the statement of purpose, documentation information, and availability that is printed on the inside front cover of all reports. This is followed by a brief outline of the usual organization of each type.

TECHNICAL REPORTS

These reports contain scientific and technical information that represents an important contribution to existing knowledge but which for some reason may not be appropriate for primary scientific (i.e. *Journal*) publication. Technical Reports are directed primarily towards a world wide audience and have an international distribution. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Fisheries and Marine Service, namely, fisheries management, technology and development, ocean sciences and aquatic environments relevant to Canada.

Technical Reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report will be abstracted in *Aquatic Sciences and Fisheries Abstracts* and will be indexed annually in the Service's index to scientific and technical publications.

Numbers 1-456 in this series were issued as Technical Reports of the Fisheries Research Board of Canada. Numbers 457-700 were issued as Department of the Environment, Fisheries and Marine Service, Research and Development Directorate Technical Reports. The series name was changed with report number 715.

Details on the availability of Technical Reports in hard copy may be obtained from the issuing establishment indicated on the front cover.

Organize as you would any scientific paper (see CBE (1972) and Appendix 1). The report will usually contain the following elements in order: Introduction, Materials and Methods, Results, Discussion, Acknowledgments, References (Tables, Figures, Appendices -- as appropriate). To avoid repetition or to achieve a more logical development, it is often better to combine the Results and Discussion and use topic subheadings.

MANUSCRIPT REPORTS

These reports contain scientific and technical information that represents an important contribution to existing knowledge but which for some reason may not be appropriate for primary scientific (i.e. *Journal*) publication. They differ from Technical Reports in terms of subject scope and potential audience: Manuscript

Reports deal primarily with national or regional problems and distribution is generally restricted to institutions or individuals located in particular regions of Canada. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Fisheries and Marine Service, namely, fisheries management, technology and development, ocean sciences and aquatic environments relevant to Canada.

Manuscript Reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report will be abstracted by *Aquatic Sciences and Fisheries Abstracts* and will be indexed annually in the Service's index to scientific and technical publications.

Numbers 1-900 in this series were issued as Manuscript Reports (Biological Series) of the Biological Board of Canada and, subsequent to 1937 when the name of the Board was changed by Act of Parliament, as Manuscript Reports (Biological Series) of the Fisheries Research Board of Canada. Numbers 901-1425 were issued as Manuscript Reports of the Fisheries Research Board of Canada. The series name was changed with report number 1426.

Details on the availability of Manuscript Reports in hard copy may be obtained from the issuing establishment indicated on the front cover.

These reports are organized the same as Technical Reports.

DATA REPORTS

These reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of Data Reports reflects the broad interests and policies of the Fisheries and Marine Service, namely, fisheries management, technology and development, ocean sciences and aquatic environments relevant to Canada.

Numbers 1-25 in this series were issued as Fisheries and Marine Service Data Records by the Pacific Biological Station, Nanaimo, B.C. The series name was changed with report number 26.

Data Reports are not intended for general distribution and the contents must not be referred to in other publications without prior written clearance from the issuing establishment. The correct citation appears above the abstract of each report.

The organization of these reports is largely determined by the form and nature of the data. Generally the following sections precede the data presentation: Introduction; Methods (field, laboratory, data manipulation); Acknowledgments; and References.

INDUSTRY REPORTS

These reports contain the results of research and development that are useful to industry for either immediate or future application. Industry Reports are directed primarily towards individuals in the primary and secondary sectors of the fishing and marine industries. No restriction is placed on subject matter and the series reflects the broad interests and policies of the Fisheries and Marine Service, namely, fisheries management, technology and development, ocean sciences and aquatic environments relevant to Canada.

Industry Reports may be cited as full publications. The correct citation appears above the abstract of each report. Each report will be abstracted in *Aquatic Sciences and Fisheries Abstracts* and will be indexed annually in the Service's index to scientific and technical publications.

Numbers 1-91 in this series were issued as Project Reports of the Industrial Development Branch, Technical Reports of the Industrial Development Branch, and Technical Reports of the Fisherman's Service Branch. The series name was changed with report number 92.

Details on the availability of Industry Reports in hard copy may be obtained from the issuing establishment indicated on the front cover.

A flexible organization determined by the substance and intended audience of the report characterizes this series. Generally the language and presentation should be designed for the nonscientist; state the problem, provide background information, present the appropriate technical material, and make specific, pratical recommendations wherever possible.

ACKNOWLEDGMENTS

We thank Dr. A. S. Hourston (FMS, Nanaimo, B.C.) and his Publications Committee for their extensive work on determining FMS subpublication requirements, M. P. Latremouille (Bedford Institute of Oceanography, Dartmouth, N.S.) for the information on microfiche publication, and Ms. C. Rusk for preparing the figures and the cover design.

REFERENCES

Allen, A. 1976. Steps toward better scientific illustrations. Allen Press, Lawrence, Kansas. 32 p.

ANSI. 1974. Guidelines for format and production of scientific and technical reports. American National Standards Institute. Z39.18-1974: 16 p.

CBE. 1972. Council of Biology Editors, Committee on Form and Style. CBE style manual. 3rd edition. American Institute of Biological Sciences, Washington, D.C. 297 p.

FAO. 1976. Thesaurus of terms for aquatic sciences and fisheries. FAO Fish. Circ. 344: 242 p.

Stevenson, J. C. 1976. Editorial. J. Fish. Res. Board Can. 33: 2697-2698.

Sutterlin, A. M., P. Harmon, and H. Barchard. 1976. The culture of brook trout in salt water. Fish. Mar. Serv. Res. Dev. Tech. Rep. 636: 21 p.

APPENDIX 1: PREPARING JOURNAL ARTICLES FROM THESES

(Note: This guide, prepared initially for new authors writing for the Journal of the Fisheries Research Board of Canada, has proven useful even to seasoned authors. Specific examples are taken from the Journal, but they are equally applicable to articles for the Technical and Manuscript Reports.)

Consider first what in the thesis is documented adequately for publication in a primary journal. M.Sc. theses may have no publishable material, and most merit no more than a Note; even Ph.D. theses may merit no more than a Note or two. As the aims of the traditional thesis and the primary journal differ greatly, most theses require major reorientation for publication. In most manuscripts from theses that we receive, the main problem is to concentrate on the advance in science and exclude what was learned primarily for its training value.

Unless you wrote the thesis for publication in a primary journal, it is best to rewrite it rather than attempt to revise it. Try stating in one sentence what the advance in science is, and limit the report to what is essential in conveying the message. In brief, have the abstract zero in on the important new knowledge; the introduction, on the distinctive promise of your work for an advance in science, the background information being limited largely to that needed in defining the problem; the materials and methods, on the framework for getting answers to the questions concerned in the purpose of the work; the findings, on answers to the questions; and the discussion, on the contribution of the work and other interpretation of the findings.

ORGANIZATION

Organize the manuscript on the basis of the purpose or scope of the study as stated in the introduction. Especially, have the title and headings in harmony with the purpose.

Before writing any of the manuscript, list tentative headings in as few ranks as possible. Rework them until they appear to allow logical development for the reader; usually, chronological order is not effective. The findings will be more readily appreciated if you give methods, findings, and discussion in separate sections. If the work was observational rather than experimental, preferably use subject headings rather than "Results." If it is necessary to combine some of the methods with the findings, give general methods under "General methods" and particular methods and findings under subject headings; if it is appropriate to include some discussion, give further discussion under "General discussion."

Organize tables and figures to facilitate comparisons, grouping related data in as few tables and figures as feasible. As far as possible, make the tables and figures clear without reference to the text.

Begin sections and paragraphs with generalizations that lead readily to the particulars. Giving a conclusion first and then supporting it, for example, not only improves readability but also facilitates assessment by other scientists. Failure to consistently give the most newsworthy generalizations first is one of the most prominent shortcomings in presentation in manuscripts from theses.

See that everything in each section is relevant to the heading, and everything in each paragraph to the topic (opening) sentence.

Before writing any paragraphs, try writing the topic sentences for all of them and arranging these in appropriate order.

PARTS OF THE MANUSCRIPT

Limit the title to what is documented in the manuscript.

Begin the abstract with the main conclusion from the study. Support it with the relevant findings, as nearly as possible in the terms in which observations or measurements were made. Limit details of methods to those needed in understanding what was done, and work them into statements of findings. Treat other important conclusions similarly.

Limit the introduction largely to the scope, purpose, and rationale of the study. Limit review of literature and other background information to what is needed in defining the problem or setting the work in perspective. Try beginning with the purpose or scope of the work, defining the problem next, and adding guideposts useful in orienting the reader.

Limit the information on materials and methods to what is needed in judging whether the findings are valid. To facilitate assessment, give all the information in one section when possible (for small type in the *Journal*). Refer to the literature concerning descriptions of equipment or techniques already published, detailing only adaptations. Often, it helps to begin statements on procedures with a phrase indicating the purpose, such as "To determine ..." If the section is long, consider using subheadings corresponding to headings for the findings.

Limit the results to answers to the questions concerned in the purpose of the work, and digest them as comprehensively as possible. Give the findings as nearly as possible in the terms in which the observations or measurements were made and so avoid confusion between facts and inferences. Refer to tables and figures in

generalizations on them, and avoid restating in the text what is clear from the titles.

Limit discussion to giving the main contribution of the study and interpreting particular findings, including comparisons with those of other workers. To avoid text-book-like passages, lead from your work to literature rather than vice versa. Limit speculation to what you can support with reasonable evidence.

Limit acknowledgments to those concerning scientific and technical assistance, use of materials and equipment, financial support, and criticism of the manuscript.

In listing references to literature, give the information recommended by the Style Manual for Biological Journals for the various sorts of publication situations.

EXAMPLES OF VARIOUS PARTS

Abstracts

GENERAL

Avoid redundancies, vague or unnecessarily complex terms, and sentences that would probably have to be reread. Use one term consistently for the one concept. As a rule, use the past tense for findings as well as for methods. Avoid text-book-like passages, especially in the introduction and discussion. If you use statistical analysis as an aid in assessing data, keep the statistics subordinate to the biology.

See the Style Manual for Biological Journals, other guidebooks, and recent issues of the *Journal* for further guidance.

Before typing the manuscript for submission to the Editor, check it throughout for inconsistencies in content, both between text and tables or figures and within the text.

OTTO, R. G. 1971. Effects of salinity on the survival and growth of presmolt coho salmon *(Oncorhynchus kisutch)*. J. Fish. Res. Board Can. 28: 343-349.

Salinity tolerance of juvenile coho salmon *(Oncorhynchus kisutch)* increased markedly during the period from approximately 1½ mo after emergence from the gravel to the onset of the smolt transformation, except for a decline in the fall. In January, salinity tolerance ceased to limit dispersal to the sea. The limiting effects of high salinities on survival were less for larger fish than for smaller individuals and were substantially reduced by a period of exposure to dilute salinities. Growth rate, food intake, and gross food conversion efficiency had the highest values at salinities of 5–10‰ throughout the presmolt period. The results are discussed in relation to the feasibility of using saltwater impoundments as a management tool in increasing coho production.

FUJIHARA, M. P., AND R. E. NAKATANI. 1971. Antibody production and immune responses of rainbow trout and coho salmon to *Chondrococcus columnaris*. J. Fish. Res. Board Can. 28: 1253-1258.

Active immunity to *Chondrococcus columnaris* disease was established in coho salmon *(Oncorhynchus kisutch)* approximately 3 mo old by oral vaccination with heat-killed cells. Average agglutinating titers were 1:17 for control survivors and 1:168 for the orally vaccinated salmon. When rainbow trout *(Salmo gairdneri)* approximately 3 mo old were exposed in a trough to *C. columnaris* present as a natural contaminant in Columbia River water, 52% of the fish died during the first 6 wk of the test. Fish that survived the exposure were generally resistant to subsequent challenge. Many age 1 + rainbow trout that survived the *C. columnaris* infection as juveniles, when sampled after several months of reexposure to the disease, were immune carriers of the pathogen and developed agglutinating antibody titers ranging from 1:80 to 1:640. Titers up to 1:5120 were developed in disease-free yearling rainbow trout by parenteral vaccination.

UTHE, J. F. 1971. A simple field technique for obtaining small samples of muscle from living fish. J. Fish. Res. Board Can. 28: 1203–1204.

A method for obtaining small samples of muscle from living fish is described. The procedure employs a modified Silverman biopsy needle and samples of approximately 40 mg are obtained. Survival rate in a group of fish held in aquaria and periodically biopsied is excellent. Quantitative mercury analyses were carried out on multiple biopsy samples from a group of fish and the precision of the results is as good as that obtained when analyses were carried out on excised portions of muscle.

Introduction

In this study, salinity tolerance and the effects of increased salinity on growth were investigated in juvenile coho salmon (*Oncorhynchus kisutch*) that had not undergone smolt transformation, a physiological phenomenon associated with pre-adaptation for marine life (Hoar 1958). Many coho emigrate to the sea upon transformation; however, a major proportion of the hatch emigrates shortly after emergence from the redd (April–June) and lesser numbers go to sea throughout the remainder of the pre-smolt period. This presmolt emigration is believed to result from intraspecific competition for food and space (Chapman 1962; Mason and Chapman 1965). Records compiled by Chapman (1962) for a number of Washington and British Columbia streams indicate that the number of pre-smolt emigrants greatly exceeds that of smolts in many instances. Evidently half or more of the total emigrants are presmolt, fish that have not undergone the physiological pre-adaptation for marine life. The ability of the pre-smolt emigrants to adapt to increased salinities is therefore of interest, particularly in view of their potential contribution to the fishery.

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This paper describes the results of laboratory exposure of rainbow trout (*Salmo gairdneri*) approximately 3 months old to *Chrondrococcus columnaris*, and demonstrates the development of natural immunity and immune carriers among the survivors. In addition, the development of agglutinating antibodies in rainbow trout approximately 1 year old through parenteral vaccination, and an immune response in coho salmon (*Oncorhynchus kisutch*) approximately 3 months old by oral vaccination with heat-killed *C. columnaris* cells, are described.

The mortality of rainbow trout approximately 3 months old and chinook salmon (*Oncorhynchus tshawytscha*) of a similar age in our hatchery has been directly associated with: population density of fish, the start of warm river temperatures, and isolation of large numbers of *C. columnaris* organisms from the trough river water and fish (Fujihara et al. 1964). Diseased fish have been found in the rearing troughs concurrently with isolation of the pathogen from river fish, and when river temperatures increase to 10–12.8 C the disease can be controlled in the laboratory by reduction of the water temperature; however, a practical means of preventing the disease does not exist.

Duff (1942) demonstrated the feasibility of orally vaccinating cutthroat trout (*Salmo clarki*) against *Aeromonas salmonicida* (furunculosis disease). Oral and intraperitoneal vaccination of brook trout (*Salvelinus fontinalis*) (Snieszko and Friddle 1949) and oral vaccination of coho salmon (Spence et al. 1965; Klontz 1967, 1968) against furunculosis have been investigated but the results have been inconclusive. Various antigens of *A. salmonicida* are being investigated by Anderson (1969) to determine which of the antigens are of primary importance in inducing protective immunity in rainbow trout.

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This is a description of a rapid technique, readily used in the field, for obtaining small samples of muscle from living fish. It was devised to measure the mercury content of the same fish at various intervals. Though blood samples have been used to monitor various characteristics over a period of time, no feasible method has previously been reported for using other tissues in this way. In a group of fish held in aquaria and periodically biopsied by the new technique, no mortalities have occurred to date.

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This study was made to determine the magnitude of changes in the blood lactic acid concentration of the alewife, *Alosa pseudoharengus*, during passage through a pool and weir fishway. The alewife is an abundant anadromous species that crowds into Nova Scotian rivers in May each year to spawn. Fish passage facilities have been provided at many natural and man-made river obstructions for this and other anadromous species.

The effect of fishway ascent on blood lactic acid concentrations has been studied in several species of anadromous salmonids (Collins et al. 1963; and Conner et al. 1964), but similar work on the alewife has not been reported previously (Love 1970).

TABLE 2. Percentages of offensive acts (total 1016) initiated and received by four brook and four cutthroat trout in each of five 15-mm size groups in large stream-channels, December 1969–March 1970.

Fish size range (*mm*)	Percentage initiated	Percentage received
	Brook trout	
100–115	0 0	9.4
116–130	3.0	14.0
131–145	9.4	10.2
146–160	7.5	8.0
161–175	17.4	0.9
Total	37.3 (378 acts)	42.5 (432 acts)
	Cutthroat	
100–115	0.8	21.2
116–130	10.3	15.0
131–145	13.9	13.6
146–160	12.7	6.6
161–175	25.0	1.1
Total	62.7 (638 acts)	57.5 (584 acts)
Grand total	100.0	100.0

TABLE 2. Condition coefficients for tagged and untagged northern pike according to sex, Kinosao Creek, 1968.

	Untagged	Dart-tagged	Disc-tagged
		Males	
No. fish	65	69	33
Coefficient	3.05±0.029[a]	2.95±0.024[b]	2.95±0.033[b]
		Females	
No. fish	70	78	28
Coefficient	3.17±0.033	3.13±0.030	3.08±0.042

[a]One standard error of mean.
[b]Difference from the value for untagged significant at $P<0.05$ (t = 2.54 and 2.01).

TABLE 4. Average and (in parentheses) ranges for weight and DDT (*p,p'* DDT and *p,p'* DDE), oil, and water contents of raw and cooked fillets and offal (whole fish minus the fillet) of bloaters and yellow perch (In each cooking test, eight bloaters or six yellow perch were used).

Cooking method and form	Weight (*g*)	DDT (*ppm*)	Oil (%)	Water (%)
		Bloater		
Fried in corn oil				
Raw fillet	77.2 (62.8–103.1)	8.0 (5.2–11.4)	27.9 (24.1–31.4)	57.5 (54.1–61.5)
Cooked fillet	54.8 (40.6–81.1)	2.2 (1.3–3.8)	12.5 (8.9–20.8)	66.8 (57.2–70.0)
Offal (raw)	125.8 (97.7–173.5)	5.2 (3.1–8.1)	29.6 (22.9–41.6)	57.3 (47.5–62.6)
Fried in lard				
Raw fillet	60.7 (49.1–73.6)	10.7 (7.3–18.2)	30.7 (22.8–36.5)	59.2 (50.9–62.1)
Cooked fillet	41.6 (32.7–54.1)	3.9 (2.5–5.7)	12.4 (6.7–16.8)	65.1 (57.8–73.1)
Offal (raw)	101.4 (80.2–131.9)	7.7 (5.7–9.3)	24.4 (20.8–29.0)	61.3 (56.9–64.3)
Broiled				
. . .				
		Yellow perch		
Fried in corn oil				
Raw fillet	36.8 (32.5–44.5)	0.3 (0.1–0.5)	0.6 (1.0–0.2)	78.6 (76.7–79.1)
Cooked fillet	26.6 (18.5–39.0)	0.4 (0.1–0.6)	3.9 (2.7–5.9)	71.2 (64.8–74.8)
Offal (raw)	124.3 (87.0–181.0)	6.4 (3.3–9.0)	10.7 (8.4–12.6)	70.2 (66.8–73.4)
Broiled				
. . .				

Text Tables

From August 2 to 8, 1967, 98 largemouth bass were marked with spaghetti tags and 103 with Fraser's tag at Nogies Creek, Ontario. The percentages of fish marked by these methods, which were recaptured at least once from 1967 through 1970, did not differ significantly ($P > 0.05$) in any of these years. The numbers recaptured at least once in the various years, and (in parentheses) the expected numbers along with the chi-square values, were:

Year	1967	1968	1969–70
Spaghetti tag	9(10.7)	23(23.8)	7(5.8)
Fraser's tag	13(11.2)	26(25.0)	5(6.1)
Chi-square	0.54	0.066	0.45

Therefore, there is no evidence of a difference in either tag losses or tagging mortality between the two groups of fish tagged by these methods.

Losses of tags of each type from largemouth bass appeared to be few. The total losses of the two tags from 1967 through 1969 were:

Years after tagging	0	1	2	Total
No. of recaptures	268	264	64	596
Tags lost (%)	0	9.0	17.2	5.9

Figures

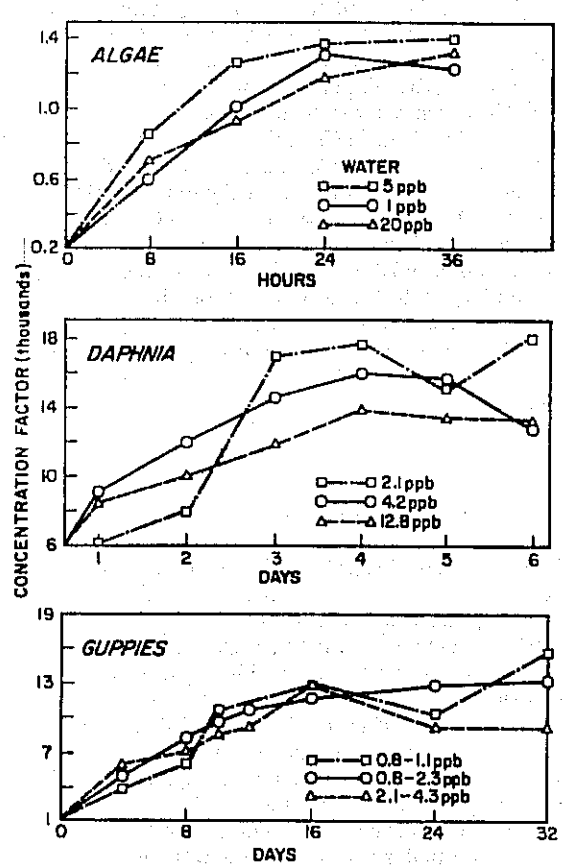

FIG. 4. Concentration factors for algae, *D. magna* and guppies exposed to different concentrations of dieldrin in water. Concentration factors for algae and *D. magna* were calculated on a dry-weight basis and those for guppies on a wet-weight basis.

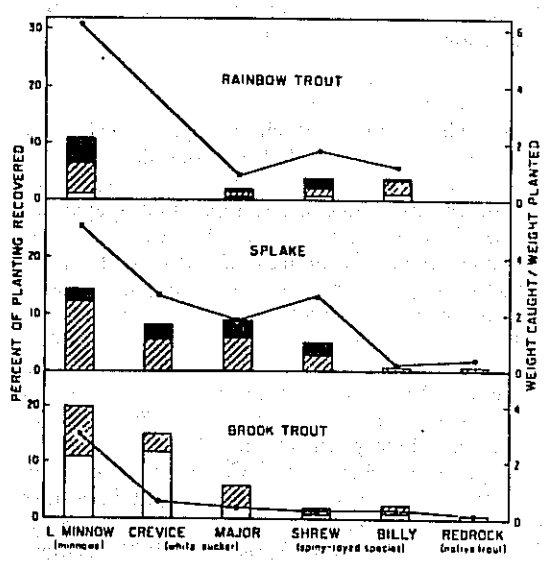

FIG. 2. Mean recoveries (histograms) from annual plantings of the three salmonids in lakes having different resident fishes, and (polygrams) ratios of weight recovered to weight planted. Clear areas in histograms, recoveries in year of planting; hatched areas, in next year; and black areas; in later years. Main resident species in the lakes are shown in parentheses.

Discussion (topic sentences)

The most enigmatic aspect of *M. rubrum* is the nature of the pigmented bodies within the ciliate and the functional and theoretical evolutionary significance of the condition. Formerly there was no direct evidence for the presence of chloroplasts. From pigment studies, gross morphological resemblance, and functional aspects determined from field experiments, it had been deduced that the pigmented bodies within *M. rubrum* were entire, endosymbiotic cryptomonad cells (Parsons and Blackbourn 1968; Barber et al. 1969). Our study has shown that true chloroplasts are present in association with mitochondria and membrane systems not belonging to the ciliate. However, no nuclei were observed in association with these chloroplast/mitochondrial complexes despite the examination of hundreds of sections with the electron microscope. In this connection Bary and Stuckey (1950) failed to demonstrate the presence of nuclei in the complexes using the Feulgen technique and we were also unable to do this employing aceto-carmine staining. If nuclei are present in the vicinity of the chloroplasts they must be extremely reduced in size and, presumably, function. In addition, the thylakoid characteristics of the chloroplasts do not match those of any of the cryptomonads studied so far.

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Generalized curves of chlorophyll *a* periodicity under both low and high light conditions derived from our experimental results (Fig. 5) are compatible with the results of others. The apparent discrepancies in the literature are resolved by examining the available pre-history of light intensity and photoperiod for each observation. For example, increases in chlorophyll in the light period reported by Gibor and Meehan (1961), Terborgh and Thimann (1964), Edmonds (1965), Eppley and Coatsworth (1966) and Jorgensen (1966) were found under experimental light intensities ranging form 250 to 300 ft-c. Increases in chlorophyll in the dark reported by Yentsch and Reichert (1963), Castenholz (1964) and Yentsch (1965), were found when light intensities between about 800 and 1500 ft-c were used to grow the cultures. Beale and Appleman (1971) demonstrated that in *Chlorella*, chlorophyll is present at high concentrations when light is limiting for growth and in low concentrations when light is abundant. Our results were quite similar.

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Information on the utilization of Miramichi-produced salmon from this study, which involved extensive finclipping of smolts, is similar to that reported by Saunders (1969) on 5 years of tagging Northwest Miramichi smolts at the Curventon fence. Expressing Saunders' tag recaptures as percentages gives, for the 1005 tagged smolts released, an average survival rate of the same order, namely 2.4%. Of the survivors in Saunders' study, 48% were taken in commercial fisheries and 20% by anglers, and 32% represented potential spawning escapement. The corresponding figures for Northwest finclipped smolts in my study, 62, 10, and 28%, entailed somewhat higher recovery by commercial fisheries and lower recovery by angling. Both studies showed that many Miramichi-produced salmon were taken by commercial fisheries near Newfoundland as well as around the Maritime Provinces, and especially in the vicinity of the Miramichi. Neither study showed any angling recaptures outside the home river, confirming that Atlantic salmon do not tend to wander into freshwater sections of other than their natal river. The same is shown by the extremely small exchange of finclipped salmon between Northwest and Southwest counting fences (Table 3).

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This and other studies in northern Idaho suggest that stream gradient may influence the distribution of brook and cutthroat trout in streams inhabited sympatrically. Although cutthroat trout may live in areas of low water velocity (below about 6 cm/sec) in Idaho when not associated with brook trout (Bjornn 1957), they did not inhabit this environment in sustained sympatry with brook trout in Crystal Creek. The gradients in Crystal and Hoodoo Creeks, in which densities of brook trout have increased over the years, were less than 3%. Bachmann (MS 1958) found brook trout in portions of Crystal Creek with low stream gradient, while cutthroat trout became more abundant upstream as the gradient increased. In a tributary of the St. Joe River, Idaho, brook trout occupied the downstream portion with a gradient below 4%, while cutthroat trout increased in numbers upstream as the gradient increased (MacPhee 1966).

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The ranges of temperatures preferred by prespawning brook sticklebacks in the laboratory gradient and the experimental stream (14.9-20.2 C and 15.6-21.1 C) are similar to that required by the species for successful reproduction. Reproduction activity occurs between 15 and 19 C, and outside this range nest building and courtship are seriously impaired (Winn 1960; Reisman and Cade 1967). Braekevelt and McMillan (1967) found that prolonged exposure to temperatures above 20-22 C caused cessation of spawning and atresia of mature oocytes. Lamsa (1963) reported a sudden downstream movement of brook sticklebacks in a small stream when water temperatures during spring exceeded 19 C. Reproductive activities require a narrower range of temperatures than most other activities, and response to temperature was less precise after reproduction.

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