Report of the
Stock Identification Methods Working Group (SIMWG)

By Correspondence

Contents

1   Main tasks and participants

At its 2003 Annual Science Conference, ICES resolved that a Working Group on Stock Identification Methods (SIMWG), would meet by correspondence under the Chairmanship of Dr. K. Friedland (USA), Dr. J. Waldman (USA), and Dr. S. Cadrin (USA). The terms of reference indicated that the Working Group would complete its submission of "Stock Identification Methodology" for publication and advise on future meetings of the Working Group (Annex 1).

The Working Group met by correspondence in 2003-2004. Participants were as follows, with addresses given in Annex 2.

P. Abaunza	Spain
M. Bain	USA
M. Banks	USA
G. Begg	Australia
J. Brodziak	USA
S. Cadrin (Co-Chair)	USA
S. Campana	Canada
M. Fabrizio	USA
P. Fiske	Norway
C. Foote	Canada
K. Friedland (Co-Chair)	USA
O. Grahl-Nielsen	Norway
J. Grim	USA
C. Hammer	Germany
L.P. Hansen	Norway
J. Hare	USA
J. Hutchings	Canada
J.A. Jacobsen	Faroe Islands
M.-L. Koljonen	Finland
J. Liu	USA
R. Lund	Norway
K. MacKenzi.e.	UK
A. Magoulas	Greece
M. Masuda	USA
J. Pella	USA
R. Phillips	USA
M. Prager	USA
S. Saila	USA
S. Schroeder	USA
C. Schwarz	Canada
D. Secor	USA
K. Shertzer	USA
M. Sissenwine	USA
P. Smith	New Zealand
D. Swain	Canada
E. Volk	USA
J. Waldman (Co-Chair)	USA
R. Wilmot	USA
I. Wirgin	USA
C. Zimmermann	Germany

2 Stock identification methodology

The Working Group completed the volume on Stock Identification Methodology. All chapter manuscripts were submitted to Elsevier Academic Press and copyediting is in process. Production is expected to be completed by September 2004 for the ICES Annual Science Conference. The revised Table of Contents can be found in Annex 3, with notes on authorship.

3 Future meeting

The Working Group will meet via a theme session at the 2004 Annual Science Conference, presenting contributions on Stock Identification Methods (Annex 4). The WG did not identify the need for a meeting at this time, but would recommend that the subject remain on the terms of reference for future consideration.

4 Recommendation

The Working Group recommends:

The **Stock Identification Methods Working Group** [SIMWG] (Co-Chairs Dr. K.D. Friedland, Dr. J. Waldman, and S. Cadrin, USA) work by correspondence in 2004 to:

a) work with the publisher in producing "Stock Identification Methodology";

b) advise on the need for future meetings of the SIMWG, and prepare appropriate Terms of Reference if required.

SIMWG should report on progress to the Living Resources Committee at the 2004 Annual Science Conference.

5 Annexes

Annex 1 Terms of Reference

The **Stock Identification Methods Working Group** [SIMWG] (Co-Chairs K.D. Friedland, USA, J. Waldman, USA, and S. Cadrin, USA) will work by correspondence in 2003-2004 to:

a) work with the publisher in producing "Stock Identification Methodology";
b) advise on the need for future meetings of the SIMWG, and prepare appropriate Terms of Reference if required.

SIMWG will report by 31 May 2004 for the attention of the Living Resource Committee.

Supporting Information

Priority:	Essential. Stock structure is a fundamental requirement before any assessment or modelling on a stock level can be contemplated. Publication of a Stock Identification Methods, a compilation of methodological reviews, is the main initiative of the SIMWG and is nearing completion. The SIMWG wants to continue with this initiative and will seek the few remaining contributions to the Methodology in the coming year.
Scientific Justification:	SIMWG continues to make progress on the development of its Stock Identification Methodology. A publication agreement has been reached, contributors have agreed to produce final drafts.
Relation to Strategic Plan:	Stock structure and stock identification have been identified as part of the work programme of the Living Resources Committee.
Resource Requirements:	
Participants:	41
Secretariat Facilities:	
Financial:	
Linkages to Advisory Committees:	ACFM
Linkages to other Committees or Groups:	WGAGFM - Chairs of these two Working Groups corresponding to ensure that there is no unnecessary overlap in their work
	ACFM's response to the special request by IBFSC on a Research Plan for Central Baltic Herring advised that protocols detailed in the SIMWG publication should be applied.
	NWWG has requested SIMWG consider the problem of *Sebastes mentella* stock identification in the North Atlantic.
Linkages to other Organisations	
Cost Share	ICES: 100%

Annex 2 2003-2004 List of Participants

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Annex 3 Stock Identification Methods, Applications in Fishery Science

I. INTRODUCTION

1) Stock Identification Methods: an Overview – by S. Cadrin (National Marine Fisheries Service, USA), K. Friedland (Univ. Massachusetts, USA), J. Waldman (Hudson River Foundation, USA). A brief introduction to stock identification, including the historical development of the ICES Study Group.

2) Definition of Stocks: an Evolving Concept – by J. Waldman (Hudson River Foundation, USA). A more detailed introduction to the field, including technical definitions.

3) Fish Migration and the Unit Stock: Three Formative Debates – by D. Secor (Chesapeake Biological Laboratory, USA). A review of ecological and historical issues related to stock connectivity and metapopulations.

4) Environmental and Genetic Influences on Stock Identification Characters – by D. Swain, J. Hutchings and C. Foote (Canada Dept. of Fisheries & Oceans, New Brunswick). An overview on the major categories of stock identification approaches and their relative strengths for identifying stocks.

II. LIFE HISTORY TRAITS

5) The Use of Early Life Stages in Stock Identification Studies – by J. Hare (National Marine Fisheries Service, USA) A description of methods that examine geographic range and distribution during early life history, including planktonic stages, as well as juvenile and adult stages.

6) Life History Parameters –G. Begg (James Cook University, Australia). A review and critique of approaches that use differences in ontogenetic rates to distinguish stocks.

III. NATURAL MARKS-MORPHOLOGICAL ANALYSES

7) Morphometric Landmarks – by S. Cadrin (National Marine Fisheries Service, USA). A description of techniques used to measure and analyze general morphometry, including traditional multivariate morphometrics and more advance geometric analyses.

8) Morphometric Outlines – by K. Friedland (Univ. Massachusetts, USA). A review and critique of methods that describe shape of outlines for structures such as scales and otoliths, and how methods are used to distinguish individuals with differently shaped features.

9) Analyses of Calcified Structures-Texture and Spacing Patterns – by K. Friedland (Univ. Massachusetts, USA) and S. Cadrin (National Marine Fisheries Service USA). A review of methods used to analyze spacing patterns of circuli on scales, otoliths, and vertebrae through image analysis, including digital photomicrograph examples.

10) Meristics – by J. Waldman (Hudson River Foundation, USA). An evaluation of using the number of discrete morphological elements (e.g., number of vertebrae, fin rays) for identifying stocks, with illustrative examples.

IV. NATURAL MARKS-ENVIRONMENTAL SIGNALS

11) Parasites as Biological Tags – by K. MacKenzie (Aberdeen Marine Lab, Scotland) and P. Abaunza (Instituto Oceanografia, Spain). A summary of how parasitological analysis has been used to discriminate stocks.

12) Otolith Elemental Composition as a Natural Marker of Fish Stocks– by S. Campana (Canada Dept. Fisheries & Oceans, Nova Scotia). A review of rapidly developing techniques that use chemical composition of secreted hard parts to identify environmental differences and individuals that inhabited different habitats throughout their life history.

13) Fatty Acid Profiles as Natural Marks for Stock Identification – by O. Grahl-Nielsen (Univ. Bergen, Norway). A description of a relatively new method for determining different populations according to fatty acids in tissues, with demonstrations on finfish and marine mammals.

V. NATURAL MARKS-GENETIC ANALYSES

14) Chromosome Morphology – by R. Phillips (Washington State Univ., USA). A review and critique of techniques for detecting differences among stocks through inspection of chromosome form, including several example photomicrographs.

15) Allozymes – by M.-L. Koljonen (Fisheries Research Inst., Finland) and R. Wilmot (National Marine Fisheries Service, USA). A description of traditional electrophoretic methods with many examples of stock identification applications.

16) Mitochondrial DNA – by A. Magoulas (Inst. Of Marine Biology of Crete, Greece). A comprehensive review and protocol for detecting mitochondrial genetic characters and analyzing stock differences.

17) Use of Nuclear DNA in Stock Identification: Single-Copy and Repetitive Sequence Markers – by I. Wirgin (New York Univ. Medical Center, USA) and J. Waldman (Hudson River Foundation, USA). A review and critique of methods using single copy, coding and noncoding, repetitive nuclear DNA for stock identification.

18) Random Amplified Polymorphic DNA (RAPD) – by P. Smith (National Inst. Water & Atmospheric Research, New Zealand). A review of polymerase chain reaction and RAPD techniques, which have had a rapidly increased application for stock identification in recent years.

19) Amplified Length Polymorphic DNA (AFLP) – by J. Liu (Auburn Univ., USA). A description of a relatively new technique with great potential for stock identification, including a comparative review with other genetic approaches.

VI. APPLIED MARKS

20) Internal and External Tags – by J.A. Jacobsen (Faroe Islands) and L.P. Hansen (Norwegian Inst. For Nature Research). A summary and critique of conventional tagging methods and their application for identifying stocks.

21) Electronic Tags – by M. Bain (Cornell Univ., USA). A description of rapidly developing techniques involving telemetry and archival tags.

22) Otolith Thermal Marking – by E. Volk, S. Schroder, and J. Grimm (Washington Dept. of Fish & Wildlife, USA). A description of relatively new methods involving thermal signatures on fish otoliths with photomicrographs illustrating their application for stock identification.

VII. STOCK IDENTIFICATION DATA ANALYSIS

23) Experimental Design and Sampling Strategies for Mixed Stock Analysis – by M. Fabrizio (National Marine Fisheries Service, USA). A protocol for sampling and a description of how sampling issues affect precision and accuracy of stock composition analyses.

24) An Introduction to Statistical Algorithms useful in Stock Composition Analysis – by M. Prager and K. Shertzer (National Marine Fisheries Service, USA). An evaluation of methods used to determine the contributions of different stocks in mixed-stock samples.

25) Classical Discriminant Analysis, Classification of Individuals, and Source Population Composition of Mixtures – J. Pella and M. Masuda (National Marine Fisheries Service, USA). A description of linear discriminant analysis with focus on stock identification applications.

26) Neural Networks Used in Classification with Emphasis on Biological Populations – by S. Saila (Univ. Rhode Island, USA). An introduction to a relatively new method of data analysis with illustrative examples for identifying stocks.

27) Maximum Likelihood Estimation of Stock Composition – by J. Brodziak (National Marine Fisheries Service, USA). A review of stock identification applications using maximum likelihood to estimate contributions of different stocks in mixed-stock samples.

28) Estimation of Movement from Tagging Data – by C. Schwarz (Simon Fraser Univ., Canada). A description of analytical methods used to examine mark-recapture data for identifying stocks and quantifying interchange rates among stocks.

VIII. APPLICATION OF STOCK IDENTIFICATION DATA IN RESOURCE MANAGEMENT

29) Stock Identification for Conservation of Threatened or Endangered Species – by M. Banks (Oregon State Univ. USA). A summary of how information on stock structure is used in resource management decisions.

30) The Role of Stock Identification Data in Formulating Fishery Management Advice - by C. Hammer and C. Zimmermann (Inst. Sea Fisheries, Germany). A description of how information on stock structure is considered in advice on stock status and management alternatives.

31) Identifying Fish Farm Escapees – by P. Fiske, R. Lund and L. Hansen (Norwegian Inst. For Nature Research). A review of the issue of escaped fish from aquaculture operations and a protocol for monitoring methods.

Annex 4 2004 ASC Theme Session

Stock Identification Methods (Session EE)	
Conveners: Steven Cadrin, Kevin Friedland, and John Waldman	Stock identification is an interdisciplinary field that involves the recognition of self-sustaining components within natural populations. Stock identification remains a central theme in fisheries science and management. Indeed, the reliability of stock assessments and therefore the effectiveness of fishery management are severely limited for many principal fishery resources, because stock structure and delineation are uncertain. Despite its importance, stock identification remains one of the most confusing subjects in fisheries science for non-specialists.

The ICES Stock Identification Methods Working Group was established to review methodologies of stock identification and develop a protocol for the application of stock identification results. The Group was organized in an open format to invite a wide participation of experts on stock identification to summarize the various approaches. Over the last decade, the Group has compiled a volume of contributions aimed at synthesizing the many disciplines involved in stock identification and focusing on the application of results to fishery science and management. Contributors to the publication and other researchers or managers with expertise in stock identification approaches are invited to present case studies or reviews relevant to stock identification. |