

REPORT OF THE
Workshop Course on Fish Stock Assessment Techniques

**ICES Headquarters
4–9 February 2002**

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1 INTRODUCTION

1.1 Participants

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Peeter Ennet	Estonia
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Joel Vigneau	France
Christopher Zimmerman	Germany
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Sara-Jane Moore	Ireland
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M. E. Keyda	Russia
Sergey Bakanev	Russia
Vasili Sokolov	Russia
Yuri Kovalev	Russia
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Jose Castro Panpillion	Spain
Max Cardinale	Sweden
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1.2 Terms of reference

At the 89th ICES Statutory Meeting it was decided that a **Workshop Course on Fish Stock Assessment Techniques [WKCFAT]** (Co-Chairs: C.L. Needle, UK; and C.D. Darby, UK) would be held at ICES Headquarters, from 4-9 February 2002 to:

- 1) teach a course covering evaluation of data consistency, estimation of the state of a stock using XSA/ICA, projection of stock status, and report writing with emphasis on ACFM requirements;
- 2) establish the second course to be held in the spring of 2003.

WKCFAT was required to report by 15 March 2002 for the attention of the Resource Management and Living Resources Committees, and ACFM.

2 WORKSHOP SUMMARY

The Workshop was intended to provide an opportunity for participants to explore assessment techniques and some of the tools available for their application. In particular the Workshop focussed on tools to perform age-structured analyses and stock abundance estimation, calculate reference points in the context of the Precautionary Approach, and carry out forecasts.

The Workshop examined of a wide variety of methods and datasets, in order to make the syllabus as appropriate to participants from as many different backgrounds as possible, and to ensure direct relevance to the work they will be

expected to undertake in Working Groups. Model description, fitting procedures and the communication of results were covered. Discussion sessions held throughout the Workshop served to clarify technical questions on the use of the methods and common practices in stock assessment.

The example datasets used were as follows:

Stock	Years	Ages	Number of fleets	Source
North Sea whiting	1960–2000	0–12+	11	ICES (2001b)
North Sea plaice	1957–2000	1–15+	4	ICES (2001b)
North Sea sole	1957–2000	1–15+	4	ICES (2001b)
Irish Sea cod	1968–2000	1–7+	7	ICES (2001a)
West of Scotland haddock	1965–2000	1–8+	4	ICES (2001a)

3 SESSION SUMMARIES

3.1 Introduction

The basic theory of fish stock assessment was presented, in terms of justification, underlying models, and standard approximations. The evolution of VPA tuning and Separable models was discussed.

3.2 Separable VPA and Laurec-Shepherd tuning

The development of Separable VPA models (Pope and Shepherd 1982) was described. The method was shown to provide a useful filter for examining catch-at-age data in isolation, before tuning, as high individual residuals may indicate data anomalies. By partitioning the data (e.g. fitting the model for a specific period), the method can be used to investigate changes in the exploitation pattern over time.

The Laurec-Shepherd VPA tuning method (Pope and Shepherd 1985) is one of many *ad hoc* tuning algorithms that derive estimates of fishing mortality-at-age in the final year from an analysis of fleet disaggregated catchability at age. The algorithms have no formal statistical basis and are based on an iterative process, which relies on the convergence properties of VPA. The method provides a useful introduction to the understanding of the assessment problem and was used as a filter for examining the catch-per-unit-effort tuning series before progressing to more complicated tuning models.

3.3 Statistical catch-at-age methods (ICA)

In the Integrated Catch-at-age Analysis (ICA; Patterson and Melvin 1993) model, the last x years of the available catch-at-age matrix are fitted by a separable model. The earlier years in the data set are modelled by a conventional VPA, estimated backwards using the first year of the separable model as the starting point. ICA is widely used in ICES assessments of pelagic stocks, principally because it permits the use of non-age-structured biomass tuning indices. The theory and implementation of the ICA method was described, and the fitting of the model to example data sets demonstrated. Participants then examined the application of ICA to their sample datasets, looking at a notional "best" assessment, and examining the effect of different model settings and parameters on outputs.

3.4 Extended Survivors Analysis (XSA)

Extended Survivor Analysis (XSA; Shepherd 1999), an extension of Survivors Analysis (Doubleday 1981), focuses on the relationship between catch-per-unit-effort (CPUE) and population abundance, allowing the use of a more complicated model for the relationship between CPUE and year-class strength at the youngest ages. XSA is widely used in ICES assessments of demersal stocks. The detailed algorithm is presented in Darby and Flatman (1994). The methodology was described and the fitting of the model to an example data set demonstrated. Participants fitted the model to one of their chosen data sets and carried the results forward into projections and Precautionary Approach reference point estimation. Retrospective analysis was used to examine the temporal consistency of the estimates from the specified XSA model.

3.5 Short-term forecasts and yield-per-recruit

The use and estimation of short-term forecasts (for the provision of quota advice) and yield-per-recruit analyses (for long-term equilibrium modelling) was investigated. The theory of these approaches was presented and hands-on experience attained using the example datasets and the ICES standard software (MFDP and MFYPR, Smith 2000a, 2000b; the Aberdeen Suite, Reeves and Cook 1994).

3.6 Stock-recruitment modelling

The history and derivation of several of the most widely-used stock-recruitment models was presented, along with their advantages and disadvantages. Several methods of estimating parameters were compared and contrasted. Participants determined the most suitable model for their example dataset.

3.7 Medium-term projections

The use of medium-term (5- to 10-year) projections to frame strategic fisheries management was discussed. The current methodologies were presented, along with potential drawbacks therein and possible alternatives. Hands-on experience using a variety of standard tools was promoted.

3.8 Reference points

A key concept in implementing a precautionary approach is defining limit and target reference points. Limit reference points set boundaries which are intended to constrain harvesting within safe biological limits, whilst target reference points are intended to meet management objectives. The justification and estimation of a range of target and reference points was examined.

4 CONCLUSIONS

The practical value of the Workshop is hard to determine, until such time as participants have begun to make regular contributions to ICES assessment Working Groups. However, feedback from participants to the course convenors and the ICES Fishery Advisor would suggest that the course was well-structured and well-presented, and that participants found the course to be a worthwhile exercise that would bear repetition.

Several technical and logistic problems arose during the running of a meeting that included a wide variety of software, hardware platforms and operating systems. The difficulties have provided useful feedback to the developers of the systems and the course tutors, and future courses should be facilitated by the experience gained from this pathfinder. The provision of adequate ICES computing and secretarial support should be considered a priority when planning for these courses, given their stated importance to the realisation of the ICES mission.

It may be beneficial for future courses to take a half-step back from exclusive instruction in software packages currently used in ICES, and look more closely at the underlying assumptions and mechanisms of these packages via simple spreadsheet modelling exercises. Interest has also been expressed in tuition in new assessment methodologies such as TSA (Kalman filter), but to be feasible this must await the production and certification of a user-friendly and robust implementation of the TSA method.

5 RECOMMENDATIONS

This first meeting of WKCFAT was greatly over-subscribed, with around 20–30 individuals expressing an interest in attending who were not able to, due to resource restrictions. Given this, it would seem appropriate to plan for at least one more course. Indeed, the frequency with which new assessment scientists are being sent to Working Groups suggests that it may be necessary to institute an annual course (funds permitting).

In the first instance, it is recommended that a second **Workshop Course on Fish Stock Assessment Techniques [WKCFAT]** (Co-Chairs: C.L. Needle, UK; and C.D. Darby, UK) be held at ICES Headquarters, from 29 January – 5 February 2003 to:

- a) teach a course covering evaluation of data consistency, estimation of the state of a stock using XSA/ICA, projection of stock status, and report writing with emphasis on ACFM requirements;
- b) consider the utility of a third course, to be held in the spring of 2004.

WKCFAT will report by XX/XX/2003 for the attention of the Resource Management and Living Resources Committees, and ACFM.

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