

STOCK ASSESSMENT METHODS

PROPOSED PROJECTS FOR 2005/06

<u>Code</u>	<u>Title</u>	<u>Priority</u>
SAM2005/01	Catch-at-age estimation	High
SAM2005/02	Effects of climate on commercial fish abundance	High

Project: Catch-at-age estimation

Project Code: SAM2005/01

Start Date: 1 October 2005

Completion Date: 30 September 2006

Vessel Use: None

Overall Objectives:

1. To improve estimation methods for catch-at-age from commercial and research fishing.

Specific Objectives:

1. To recommend methods for eliminating bias in catch-at-age estimation for commercial fisheries.
2. To establish an estimator for proportions at age that has optimal properties.

Rationale:

General

Stock assessment models use data inputs from a variety of sources. Fisheries independent surveys (trawl, acoustic etc.) are used to determine relative indices of abundance. Data to estimate age frequencies can be obtained from trawl surveys, shed-sampling or observer samples. The latter two sources provide catch-at-age estimates for the commercial catch, whereas trawl survey data relate to the fish population, albeit confounded by the trawl survey selectivity. Catch-at-age distributions or age frequencies have been found to dominate the output of stock assessment models because of the greater abundance of such data and the statistical assumptions used. In research project SAM2003/02 the appropriate weighting of catch at age data in the assessment models has been investigated. In research project SAM2004/01 the objective is to determine whether effort should be directed to reduce the variance either in the tails or the centre of the age distributions.

This project continues studies on the use of catch at age data, looking at sources of bias in objective 1 and looking at the properties of the estimator used in the second objective. Because of the importance of these data in the complex mathematical models used to assess our most valuable fisheries (e.g. orange roughy, hoki, snapper), this project has a high priority.

Objective 1

Shed-sampling data may provide biased estimates of catch-at-age due to growth of fish during the period of the fishery especially if a single age-length key is used. Problems with growth can be eliminated if sampling is directly for age, but this can be more expensive than the combination of length sampling and an age-length key. Observer samples collected at sea may also have problems with the growth of fish during the period of the fishery. However, there is the additional problem of how to post-stratify the samples.

Sources of bias in the estimation of catch-at-age distributions need to be identified and analysed. Methods of mitigating or eliminating the bias should be reviewed and/or developed. This project is aimed at providing relevant recommendations. The recommendations should be supported by a literature review, appropriate analysis, and illustration of relevant principles in one or two case studies.

Objective 2

The sampled shots typically vary substantially in size and the percentages sampled are not necessarily the same. If it could be assumed that each sample was a simple random sample from the population (total catch) then the sampling percentages are irrelevant and each fish should have equal weight. However, it is well known that ages within shots and within landings tend to be correlated. Hence such an un-weighted estimator may be unsatisfactory if sampling percentages differ. Conventionally ages from a sample have been weighted by the inverse of the sampling percentage and some samples carry much greater weight than other samples. This weighting regime would be appropriate in the hypothetical case that ages within shots were perfectly correlated i.e. all the same. As the correlation is not perfect, the inverse sampling percentage weighting may cause unnecessarily high variance; some other weighting regime may be better. The aim of this objective is to obtain a proportion at age estimator with optimal properties.

Cost Recovery Information:

The percentage allocation for this project (based on an assessment of research effort according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001) is as follows:

- all fishstocks except shellfish

The project is estimated to cost between \$50,000 — \$100,000.

Project: Effects of climate on commercial fish abundance

Project Code: SAM2005/02

Start Date: 1 October 2005

Completion Date: 30 September 2006

Vessel Use: None

Overall Objectives:

1. To examine the possible effects of climate on fishery yields and abundance indices for commercial fisheries around New Zealand.

Specific Objectives:

1. To examine the possible effects of climate on fishery yields and abundance indices for commercial fisheries around New Zealand.

Rationale:

General

Throughout the world, important commercial fish stocks have declined and in some cases collapsed, and in most cases over-fishing has been cited as the main causal factor. However, it is recognised that climate may play a major role in determining stock productivity, largely through effects on recruitment and distribution. For example, low recruitment associated with warmer temperatures has been a major contributory factor in the large-scale decline of North Sea cod, a species that prefers cold temperatures. Conversely, some other species that prefer warm temperatures, such as European sea bass and red mullet, have increased in distribution and abundance in the North Sea, despite the numerous and diverse established fisheries.

In New Zealand, warmer sea temperatures in recent years have been implicated in the reduced recruitment in the western stock of hoki (a relatively cold-water species), and may also be associated with an increase in abundance of warmer-water species, such as john dory. Better understanding of the species likely to benefit or suffer under different climatic regimes would assist in medium-term planning of fisheries research and management.

Objective 1

The data necessary to describe trends in fisheries include catches, commercial fishery catch per unit effort indices, and abundance indices from research vessel surveys.

These data can be collated from existing published sources, such as the fisheries' plenary report, or research survey reports, and should include a wide range of species.

Several climate indices are available, ranging from local records of sea temperatures, through to satellite imagery of sea surface temperatures etc. in the New Zealand region, and ultimately

to large-scale indices of climate such as El Nino. These data are available from recent published reports, and often from dedicated climate centre web-sites.

Correlations between the various fishery and climate indices should be investigated. The aim will be to determine the species, and assemblages of species, which show the clearest relationships with climate, and to identify the direction of these relationships. Where relevant, hypotheses concerning the nature of the effect that climate may have on the species should be reviewed, in order to evaluate the likelihood of the relationship being valid.

Cost Recovery Information:

The percentage allocation for this project (based on an assessment of research effort according to rule 9 (2) of the Fisheries (Cost Recovery) Rules 2001 is as follows:

- all fishstocks.

The project is estimated to cost between \$0 — \$50,000.