Attachment G

Australia's Revised Proposal for a Joint Experimental Fishing Program for Southern Bluefin Tuna

14 April 1999

II CPUE BASED EXPERIMENT

This proposal is an update of the cpue component of Australia's proposal dated 22 March 1999 taking into account the decision to restrict the experiment to Statistical Area 8 and incorporating the vessel deployment scheme proposed on 25 March 1999. Information on costs has been added.

0 Objectives

To reduce uncertainty in the SBT stock assessment by generating a fishery-independent index of abundance.

Uncertainty associated with the current fishery-dependent indices of abundance based on commercial cpue data has been identified as an important source of uncertainty in the stock assessment. The proposed experiment aims to reduce this uncertainty by creating a fishery-independent index that will circumvent some of the uncertainties associated with the existing fishery-dependent indices. In particular, a fishery-independent index eliminates the uncertainty associated with lack of information on cpue in areas that are not fished commercially (the constant squares/variable squares issue).

Age-specific fishery-dependent cpue-indices derived from longline data are currently the main source of information used to tune the VPA. The interpretation of fishery-dependent cpue as an index of abundance is confounded by a large number of factors. They include highly concentrated distribution of fishing effort in time and space and expansions and contractions in the areas fished. Recent experiences in a number of fisheries (eg northern cod) have highlighted the potential dangers in relying on fishery-dependent cpue indices for tuning VPAs. There is a growing realisation that use of fishery-dependent cpue indices in stock assessments should be minimised and that there is an urgent need to develop more reliable tuning indices. A fishery-independent cpue index is one way of achieving this. The tagging component of the proposed joint EFP is another. A combination of two fishery-independent abundance indices should put future SBT stock assessments on a much firmer footing.

Since the experiment estimates an abundance index directly, the range of hypotheses which encompasses the relevant remaining uncertainties is represented by the distribution of each index value rather than a set of discrete alternative hypotheses. The experiment will narrow the range of plausible hypotheses by obtaining a probability distribution for each index value.

Uncertainties associated with interpretation of commercial cpue will be reduced for each year in which a fishery-independent index is obtained and used to tune the VPA models. The uncertainty associated with the estimation of the index will depend on the variance of the estimate. This will be evaluated each year and, if necessary, adjustments can be made in the design to achieve a more desirable level of precision.

The proposed experiment is aimed at providing an additional index of abundance starting now and extending forward into the future. However, to the extent that the experiment provides information on the relationship between fish density in commercially fished and unfished areas, it may also potentially reduce uncertainty associated with the existing abundance indices. This would require the development of an agreed method for extrapolating present information to the past.

In particular, the experimental design can provide an estimate of the ratio of fish density in unfished to fished areas ("R") as defined in the Japanese proposal of 19 March 1999. Because fishing locations are determined by an objective random sampling scheme rather than by the vessels, the estimate of R obtained from this experiment does not suffer from the bias introduced through vessels preferentially seeking areas of high fish density. As with the fishery-independent index, the precision of the estimate of R can be evaluated each year.

A. Overall Structure

It is proposed that the experiment be repeated each year for three years. This is the minimum period necessary to obtain an index of relative abundance that can usefully be incorporated into the stock assessment. During this period the experiment will be subject to ongoing evaluation as described under 'Decision Rules'. At the end of the three-year period, a full evaluation of the experiment will be carried out to assess the costs and benefits of continuing the program.

Since the objective of the survey is to achieve an index of relative abundance for the entire stock, it is important to develop an overall structure that will achieve representative sampling. It is proposed that the general structure of the survey will be a two-stage stratified sampling approach. Ideally, the survey would cover the entire region considered to be SBT. However, practical constraints will restrict the survey to Statistical Area 8.

For a given time period (month), the portion of the Statistical Area considered to be the SBT habitat (i.e. all one degree squares in which SBT have been caught) will be divided into strata based on the historical mean number of operations in each 5 x 5 degree square. The amount of effort expended in each stratum will reflect the relative sizes of the strata. Within each stratum, vessels will be directed to commence an operation in particular 2 x 2 degree squares selected according to a random sampling scheme.

B. Area and Season

Area

In this revision we have reduced the area surveyed from the entire region to Statistical Area 8.

Season

Practical constraints relating to the availability of vessels dictate that the survey will take place in July and August.

1 Vessel Deployment Method

The approach is illustrated using Statistical Area 8 in July. The same approach would be used for August.

The stratification for Statistical Area 8 in July is shown in Figure 1. The relative amount of effort in each stratum reflects the relative sizes of the strata as indicated in Table 1.

Table 1. Number of 1 x 1 degree squares where SBT have been caught historically in Statistical Area 8 in July. (From Attachment E, EFPWG(1), Table 8.2) Numbers are indicative only.

Stratum	Number of 1 x 1 degree squares where SBT have been caught historically	Percentage
1	25	8
2	46	16
3	61	21
4	68	24
5	48	17
6	40	14
Total	280	100

Within each stratum, vessels will be directed to commence an operation in particular 2 x 2 degree squares selected according to a random sampling scheme.

2 Number of Survey Vessels

The target number of operations is as follows:

Area 8, July 330 operations
Area 8, August 330 operations

The number of operations per stratum in Area 8 for July will therefore be:

Stratum	Number of 1 x 1 degree squares where SBT have been caught historically	Percentage	Number of operations
1	25	8	26
2	46	16	52
3	61	21	70
4	68	24	80
5	48	17	56
6	40	14	46
Total	280	100	330

The number of operations is such that the expected number of operations in any 2 x 2 square is greater than 2, ie a high percentage of the 2 x 2 squares will be sampled at least once during the experiment and the majority will have more than one operation.

This number of operations will require 15 vessels.

The number of vessels required will be reassessed after the first year based on an empirical evaluation of the trade-off between precision and the number of vessels. The experimental design is such that the expected value of the index should be independent of the actual number of participating vessels (i.e. it should be unbiased). The number of participating vessels should only affect the precision.

Vessels also need to make a commitment to participate in the program for more than one year to ensure continuity of the survey results.

E. Data to be Collected

Standard catch, effort and size data plus gear configuration information in line with the standard RTMP data collection for vessels with and without observers.

F. Observers

Observers are considered an essential component of the data collection and monitoring process required for this EFP. Observers are essential not only for verifying the catch, effort and size data but also for collecting more detailed information for interpreting the CPUE data collected in the EFP. To ensure that the integrity, independence and any appearance of conflict of interest within the observer data, it is proposed that the observer portion of the EFP be a collaborative program coordinated by the CCSBT Secretariat. Observers would be selected based on an assessment of their qualifications irrespective of nationality. The detail criteria would be developed based on the past experience within each party on conducting longline observer programs. All observers should participate in a common training program and being using the same data collection forms and manuals. It is also critical that individual briefings and debriefings take place before and after any extensive observer deployment..

Ideally, as high as possible observer coverage as possible should be sought for the EFP. This is not only to ensure the highest confidence in the results, but more importantly to collect a greater quantity of data for comparison of catch rates among vessels participating in survey. Given the small number of vessels involved, 100% observer coverage is proposed.

G. Analysis Methods

Calculation of index

A mean and variance will be obtained for each stratum j in each month according to the following formulae:

$$CPUE_j = \frac{\sum_{i=1}^{n_j} C_{ij}}{\sum_{i=1}^{n_j} E_{ij}}$$

where C_{ij} is the catch of the ith operation, E_{ij} is the effort associated with the ith operation and n_j is the number of operations in stratum j for the month being considered.
(Note: When each operation involves the same effort (number of hooks), this formula is identical to calculating the cpue for each operation and averaging over the operations.)

VAR(CPUE) = the approximate value of the variance of a ratio as given by Kotz and Johnson (1982). [to be inserted in later draft]

An overall mean and variance will then be obtained by weighting the values for each stratum by their area and averaging across months.

This process will be repeated each year to provide an annual index of abundance.

Incorporation into stock assessment

The EFP index will be incorporated into the stock assessment in a similar way to existing indices. This will become possible when two values (1999 and 2000) are available but is unlikely to contribute significantly to the stock assessment until at least 3 annual values are available. The impact of the EFP index will increase over time.

A weight of 1 will be given to the EFP index in the stock assessment. This weight can be changed with the consensus of all parties.

I. Estimated Costs

The rationale for the costing of this proposal is as follows:

The proposal involves 660 operations over July/August. Assuming 1 operation per day and 44 fishing days, 15 vessels would be required to conduct the experiment.

An estimated catch rate of 0.25t/day has been used. This figure is based on the fact that a reasonable proportion (50%) of the 2 x 2 squares the vessels would be required to fish in would be squares that vessels were required to fish in the 1998 EFP or in the recent historical commercial fishery. As such the expected catch rates would be similar in those squares and in the other squares we have assumed that catch rates would, on average, be 25% of that in the fished squares. Based on an average catch rate of 0.25t/day a total catch of 165t is estimated.

Using $16,000 as the per vessel/day costs the total costs of the experiment is estimated at $14.9m ($16,000/day by 15 vessels by 62 days).

The value of the catch is estimated at $5.5m based on an average price of $33/kg.

The net cost of the experiment is therefore $9.4m. This equates to around 1429t of fish.