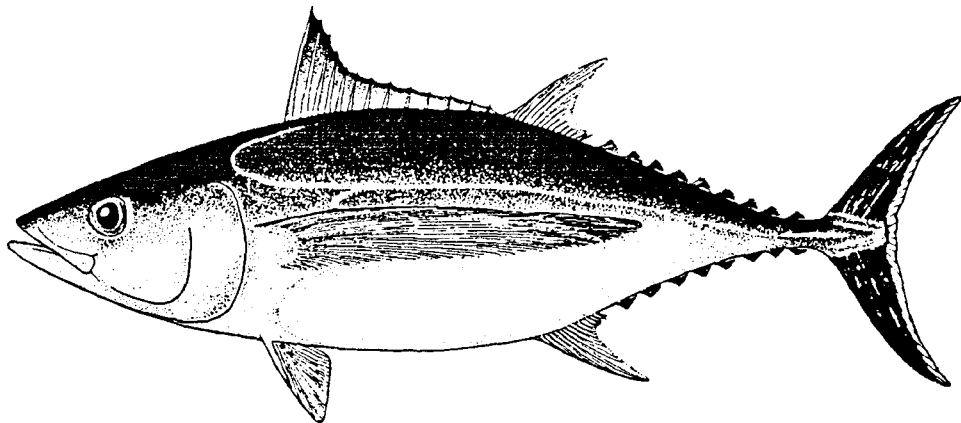




**Proposed research activities on  
South Pacific albacore during 1991-92**

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## 1. INTRODUCTION

The South Pacific Albacore Research Project was initiated by the Tuna and Billfish Assessment Program (TBAP) of the South Pacific Commission (SPC) during the late 1980's in response to the rapid developments in the fisheries for South Pacific albacore (*Thunnus alalunga*), and the unknown repercussions upon the long term productivity of this resource, and upon the state of local economies of South Pacific nations. The overall objective of this project is to provide assistance to SPC countries to develop, rationally exploit, and manage South Pacific albacore resources. More specifically, the activities conducted under this research project will serve to (i) provide estimates of vital statistics on population structure and demographic traits, (ii) develop an age structured model to estimate sustainable yield and exploitation rate, (iii) quantify the level of interaction between surface and longline fisheries, and (iv) formulate an optimal harvest strategy for the adaptive management of this resource.

In order to provide the information required, a variety of investigations and programmes were initiated during 1989, and are currently being conducted by the TBAP. These include a large scale tagging programme conducted on the main fishing grounds to generate data on stock/fishery dynamics, an observer programme to monitor fishing activities, a port sampling programme to conduct bio-sampling and monitor catch composition, laboratory studies to investigate particular characteristics of growth and reproduction, and computer simulation studies to predict the effects of specific management actions on stock productivity levels and to assess the influence of uncertainties on these predictions (Fig. 1).

There has been a considerable amount of information obtained from the various investigations and programmes conducted since 1989. The purpose of the present report is to provide a cursory review of the results obtained, and provide an outline of the proposed activities planned for the 1991-92 season.

## 2. TAGGING PROGRAMME

Tagging programmes aimed at generating information on the demographic traits of South Pacific albacore have been conducted each year since 1986 by investigators from the U.S., France, New Zealand and, in 1990-91, by SPC. The methodology used and some of the results obtained so far were reported by Labelle and Sharples (1991). During the 1986-1990 period, ~6800 fish were tagged and released, primarily from troll fishing vessels in the Subtropical Convergence Zone (STCZ: 35-40°S, 170-130°W), the coastal waters of New Zealand and in the Tasman Sea. During the 1990-91 season, an additional 3326 albacore were

tagged in the same regions as part of a joint venture between the TBAP and the New Zealand Ministry of Fisheries and Agriculture (MAF). Accounting for these, results in a total of ~10,130 tagged albacore released since 1986.

Information on the recovery of tagged fish has been provided on a volunteer basis by commercial fishermen, and through systematic sampling conducted at several canneries. A total of 11 tag recoveries have been reported to the various agencies since tagging activities began. The number of recoveries is simply not sufficient to provide useful data on migration patterns, and to determine if interactions exist between surface and longline fisheries. The number of recoveries needed for such purposes cannot be determined with certainty at this stage, but it is anticipated that at least 50-100 will be required for preliminary analyses. Thus, if information from tagging programmes is to be used for stock assessment purposes, additional tagging will be required.

The overall recovery rate associated with the 1986-1991 tagging activities is ~0.1%. Such a recovery rate is about 3% of the one associated with similar tagging operations conducted on albacore stocks in the North Pacific (Laurs *et al.* 1976). Attempting to identify the factors responsible for the relatively low recovery rate is largely a matter of conjecture at this stage. The four hypotheses considered to be the most plausible are; (a) the number of tags released is simply insufficient given the size of the population and/or the recovery effort, (b) tagged fish are not intercepted by the commercial fisheries because tagging effort is not sufficiently well distributed (c) tagged fish released are subject to high mortality rates soon after release because of the excessive stress caused by the tagging method, (d) a large portion of the tagged fish recovered are not reported to the SPC by fishermen for lack of incentive. Ideally, future tagging programmes should take measures to minimize the effects of these hypothesized factors.

With this approach in mind, an albacore tagging programme was designed for the 1991-92 season. The objective of this programme is to tag a total of 15,000 albacore in the STCZ, the coastal waters of New Zealand and the Tasman sea. The current plans are to place about six taggers on board commercial troll vessels for the duration of the fishing season (~4 months). While on board, they would tag/release a portion (~10-20%) of the albacore caught each day. The taggers would select only fish which are visibly uninjured and still vigorous after being brought on board. Taggers will be positioned on various vessels in such a fashion as to ensure that the three principal fishing regions are covered, and that tagging effort is distributed throughout the entire fishing period.

The tagging method used for the upcoming season will therefore be essentially the same as in previous years, but will be more cost-effective since no vessel will be chartered. Funds previously used for chartering a tagging vessel will now be used instead to compensate vessel captains for the fish that are tagged and released from their vessels. From a theoretical point of view, this new strategy also offers many advantages over those used previously. By conducting tagging operations on board several vessels simultaneously, a wider spatial and temporal distribution of tagging effort will be achieved (point *b* above). The number of tagged fish released during the season should also be considerably larger than in any previous season. The corresponding recoveries should provide a considerably greater amount of information on the growth rates and migration pattern within a given season, as well as information on the level of interaction between fisheries. Historical and current recovery rates could also be contrasted to provide more insight into the relationship between recovery rates and tagging effort levels (point *a* above). This approach should also allow taggers to be more selective when tagging fish, which should ensure that the tagged fish released are in top condition (point *c* above). Finally, by cooperating with commercial fishermen, the level of awareness towards the tagging programme will be increased, which hopefully will catalyze further participation to the tag recovery programme (point *d* above).

It should be noted that one of the major uncertainties affecting the reliability of the estimates generated by the tagging programme concerns the current level of mis-reporting and under-reporting associated with tag return information. As a result, the actual catch sampling rates and the corresponding distribution of sampling effort for tag recovery cannot be determined with certainty. Preliminary assessments based on the available tag return data and sampling statistics suggested that variation in sampling rates have a major influence upon certain mark-recapture estimates (such as stock size). Thus attempts will be made during the 1991-92 season to provide preliminary estimates of the fraction of the fish caught in various fleets that are examined for marks. This will be accomplished mainly through direct communication with officials of commercial fishing companies, and through a series of interviews with vessel skippers at the landing sites. Also, the six observers placed on board the vessels can serve as a control group for assessing the level of non-reporting in the fleet.

### **3. OBSERVER PROGRAMME**

The observer programme was initiated during 1988 to document and monitor the fishing activities of troll and driftnet vessels in the Tasman Sea, the STCZ and the coastal waters of New Zealand. The principal activities of the observers were to collect albacore size composition data, monitor by-catch composition in the troll fishery, estimate the occurrence of net damaged

albacore, and gather information on driftnet fishing in the South Pacific. The results obtained since 1988 have been described by Hampton *et al.* (1989, 1991), Sharples *et al.* (1991), Murray (1990) and Labelle and Murray (1991). These trends in fishing activity observed clearly indicate a reduction in driftnet fishing has occurred since 1989, and driftnet fishing has ceased since July 1991 in compliance with the U.N. Resolution. The resolutions will remain in force until a scientifically based management regime is in place. In view of this, the observer programme now focuses only on troll fisheries exclusively.

Recent trends in the South Pacific Albacore troll fishery were reported by Labelle and Murray (1991). Relative trends in average catch rates during 1990-91 in the Tasman Sea, New Zealand waters and the STCZ paralleled those observed previously, and catch per unit effort (cpue) were intermediate between those of the two previous seasons. Approximately 39,175 fish were measured this season for assessment of catch composition. This was less than last year, but still accounted for >80% of the catches obtained on the vessels monitored. The size compositions of the fish measured in the the Tasman Sea and the ECNZ are similar to those observed in previous years. By and large, albacore caught in the STCZ tend to be slightly larger than in the two other regions. The size composition of the fish caught during 1990-91 in the STCZ is unlike that observed during previous seasons, and was almost unimodal in structure. At this stage, the relative influences of fishing pressures and environmental conditions upon the structure of the population cannot be quantified, but further monitoring of fishing activities will provide additional insight into this matter.

It should be noted that the associated temporal and spatial level of resolution of length frequency data collected from troll vessels throughout the fishing season is much higher than is generally obtained from port sampling operations. As a result, these data can be relied upon to estimate growth rates based on the analysis of modal progressions by means of the MULTIFAN method (see Hampton *et al.* 1990). Furthermore, with the addition of length-at-age data, this information can be incorporated into age-structured models for stock assessment purposes. Therefore, the observer programme coverage of troll fishing activities will be expanded during 1991-92 season. This will be accomplished indirectly through the tagging programme since taggers working on board commercial fishing vessels will also conduct monitoring activities when they are not engaged in tagging operations.

#### **4. PORT SAMPLING PROGRAMME**

A port sampling programme was initiated in American Samoa in 1963 when the Bureau of

Commercial Fisheries (now the NMFS<sup>1</sup> Southwest Fisheries Center) began collecting data on catches off-loaded in American Samoa (Ito and Yamasaki 1988). The three data sources were cannery reports, vessel operators or their logbooks, and samples of albacore off-loaded in American Samoa. These records provide a valuable source of information for the assessment of trends in fishing patterns, total effort, cpue and catch composition.

In order to complement this coverage, sampling activities have recently been increased or initiated at other major South Pacific ports where albacore are landed. During the 1990-91 season, length measurements were collected from troll and longline catches landed in Papeete, (French Polynesia), at the PAFCO cannery in Levuka (Fiji), and in Noumea (New Caledonia). Logbook records were also collected at these locations on an opportunistic basis, mainly for in-season monitoring purposes and to cross-validate corresponding statistics received from various other agencies. While collecting length measurements, gonads and hard parts samples were also obtained for purposes of ageing and analysis of spawning periodicity. During the 1991-92 season, sampling activities will continue at the above locations. Given that major uncertainties exist with regards to the troll catch composition and tonnage unloaded at Westport and Greymouth (New Zealand), sampling activities at this port will be initiated mainly to monitor unloadings during the periods of peak activity (January - March).

One of the major objectives of port sampling operations will be to inform fishermen of the tagging programme in the hope of increasing the reporting rate. Interviews conducted recently with crews of longline vessels have indicated that many fishermen are still unaware of the tagging programme, and the procedure to follow when tags are recovered. Thus, port samplers will conduct interviews with vessel skippers upon landing, and provide information leaflets which clearly document the reporting procedure.

## 5. LABORATORY STUDIES

Bio-sampling activities of South Pacific albacore began in 1987 when NMFS scientists started to collect otoliths samples for ageing purposes (see Wetherall *et al.* 1989). Further sampling of hard parts was conducted by Murray and Bailey (1989) who used vertebrae ring counts for ageing purposes. The TBAP's involvement began in November 1989 when SPC staff went to Nuku'alofa in Tonga to set up a sampling regime for the collection of albacore gonads, size measurements and otoliths on board the Tonga longline vessel *Lofa*. Bio-sampling of albacore catches on board this vessel has been conducted periodically since then, and samples have been submitted on a regular basis to the SPC staff for processing. Additional samples of hard parts

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<sup>1</sup>National Marine Fisheries Service

(otoliths, vertebrae and spines) are also currently being collected by the TBAP staff each week while sampling longline catches in Noumea.

Preliminary analyses of the gonad sample data collected so far have indicated the seasonal trends in reproductive condition (Bailey 1991). More detailed investigations of reproductive trends are currently being conducted by the TBAP in cooperation with the NMFS scientists. Gonad samples are currently being subject to laboratory analyses to determine if there is a difference in maturity between the two sides of the ovary of the same fish, and if there is a difference between frozen and formalin-preserved oocyte diameters (see Anon 1991). Further questions about the reproductive biology of albacore will be addressed through laboratory investigations.

Additional vertebrae sample data were recently provided by scientists from the New Zealand Ministry of Agriculture and Fisheries (MAF) for further analysis of growth rates (Labelle 1991). The estimates of growth rates based on vertebral counts are in agreement with those derived from analysis of model progressions in length frequency histograms (see Hampton *et al.* 1990). However, growth rates proposed from such studies ( $\sim 0.5 \text{ cm}\cdot\text{month}^{-1}$  for 80 cm fish), are slightly less than the empirical estimates of growth rates based on tag recovery data. Furthermore, the time of first ring formation has still not yet been estimated with certainty, so vertebrae ring counts only provide a crude estimate of relative age. At the present time, simultaneous sampling of otoliths, vertebrae and fin spines is being conducted in Noumea. The otoliths samples will be subject to laboratory examination during 1992 for assessment of daily growth increments. The results could then be used to estimate the time of first ring formation, and thus allow for an assessment of the reliability of the corresponding length-at-age estimates.

With regards to stock structure, Lewis (1990) summarized the existing information. At the present time, there is considerable uncertainty as to the stock boundaries, and rate of exchange between the South Pacific and Indian Ocean populations. Plans to collect samples for electrophoretic studies are currently being evaluated, and hopefully, some sampling will be initiated during the 1991-92 season primarily for conducting comparisons with North Pacific and Indian Ocean stocks.

## 6. ANALYTICAL STUDIES

The development of an appropriate age structured model for stock assessment purposes has not been initiated so far, mainly because the emphasis so far was placed on the implementation of sampling and tagging programmes. However, there are plans to initiate work on the

formulation of this model during 1991-92, in cooperation with fisheries scientists from other agencies who have considerable knowledge in this field. It is hoped that the preliminary estimates of total yield, exploitation rates and stock status will be generated during 1992. Furthermore, plans have been made to conduct a modelling workshop on fishery/stock dynamics. The workshop has tentatively been scheduled for the 1992-93 season, and will most likely involve the participation of several scientists and agency officials who are knowledgeable of the South Pacific albacore fishery, and of potential management regimes that are being considered. One of the major objectives of this modelling exercise will be to quantify the level of interaction between fisheries based on information from the tagging programme and the SPAR database records. Another objective of this workshop will be to predict the effects of specific management actions on stock productivity levels, and assess the influence of uncertainties on these predictions. This workshop will thus serve to complement the stock assessment work conducted by means of the age structured model being developed. The results of such studies should assist in the formulation of an adaptive management regime for this resource.



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## 8. FIGURES

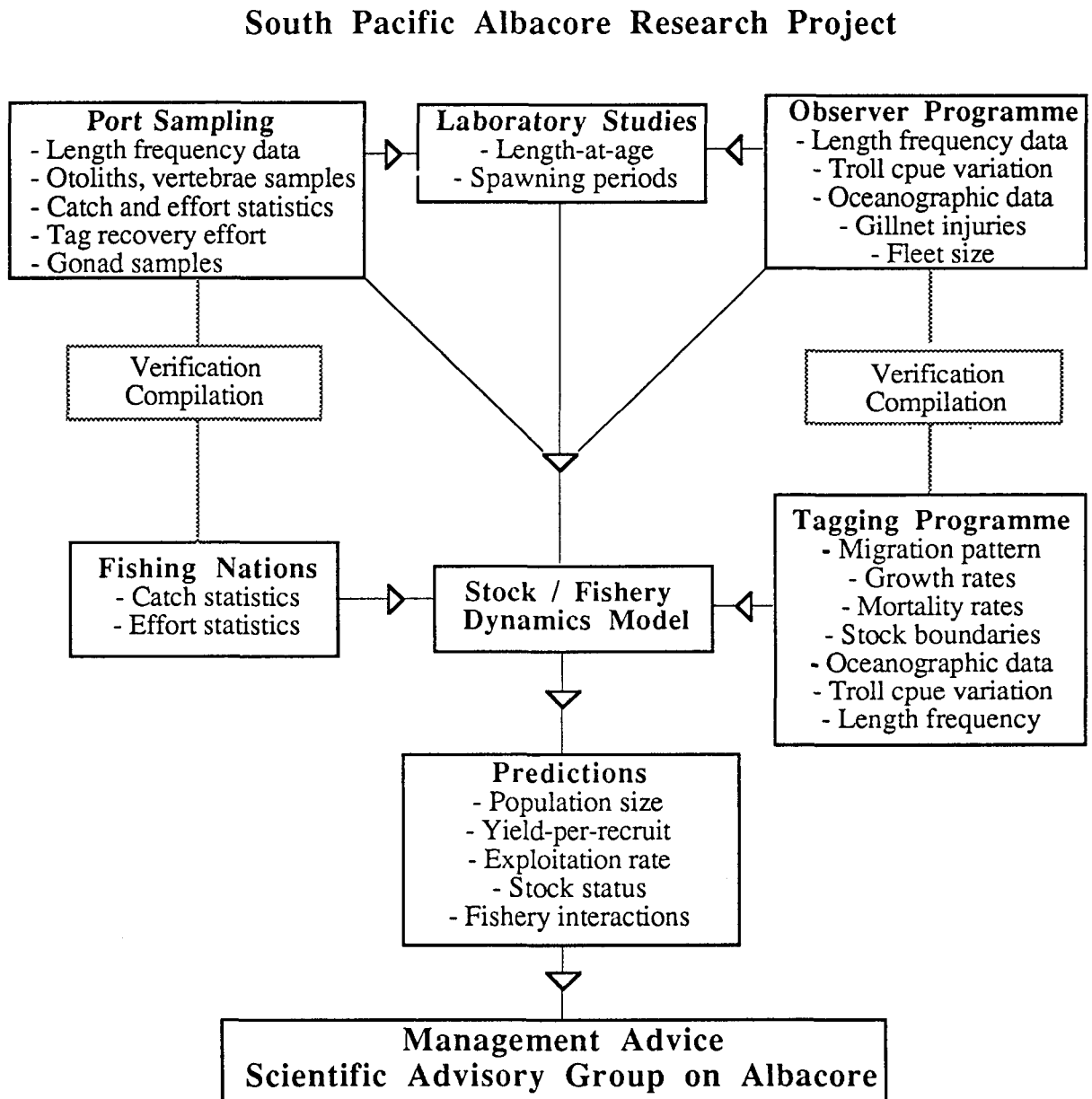


Figure 1. Schematic representation of the information flow obtained through the various programmes and investigations conducted by the TBAP for the assessment of South Pacific albacore resources.