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LONG-TERM TAGGING OF BIGEYE TUNA IN THE EQUATORIAL PACIFIC OCEAN IN SUPPORT OF STOCK
ASSESSMENT AND MANAGEMENT

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Secretariat of the Pacific Community and the Inter-American Tropical Tuna Commission

LONG-TERM TAGGING OF BIGEYE TUNA IN THE EQUATORIAL PACIFIC OCEAN IN SUPPORT OF STOCK ASSESSMENT AND MANAGEMENT

A Proposal by the Secretariat of the Pacific Community and the Inter-American Tropical Tuna Commission

Bigeye tuna are captured throughout the equatorial Pacific by purse seine and longline. They are targeted by longliners in this region, but are of lesser importance to the purse seine fishery, which generally targets skipjack and yellowfin tuna. However, purse seine catches throughout the equatorial Pacific have increased greatly since the early 1990s, when the use of drifting fish aggregation devices became widespread. Stock assessments for both the western and central Pacific (WCPO, west of 150°W) and eastern Pacific (EPO, east of 150°W) indicate that bigeye tuna spawning biomass has been reduced to around 20% of unfished levels, and that management actions are required to avoid further depletion.

Currently, fisheries in the WCPO are managed by the Western and Central Pacific Fisheries Commission (WCPFC), while those in the EPO are managed by the Inter-American Tropical Tuna Commission (IATTC). Stock assessments are routinely conducted by the Secretariat of the Pacific Community (SPC) (the WCPFC's scientific services provider) and the IATTC for these regions separately. However, recent bigeye tuna tagging in the central Pacific indicates that substantial mixing of bigeye between the two regions occurs, and it is widely agreed that the regional assessments should be complemented by a Pacific-wide approach.

The current assessments of bigeye tuna in the Pacific are subject to considerable uncertainty. The causes of this uncertainty include:

- The data typically available for stock assessment – catch, effort, catch-per-unit-effort and size data – are generally uninformative regarding absolute levels of stock biomass, and consequently fishing mortality.
- To date, simplistic assumptions regarding stock structure (essentially, separate populations in the WCPO and EPO) have been required in stock assessments. It is well known that this assumption is false and that some level of mixing occurs. It is not clear to what extent the levels of mixing observed from recent bigeye tuna tagging might bias stock assessment results.
- The rate of natural mortality, a key parameter in stock assessments, is difficult to estimate and is assumed in WCPO and EPO bigeye assessments. Furthermore, there is a lack of solid information on how natural mortality might vary with fish size or age.
- Bigeye tuna growth rates, which are influential parameters in the stock assessments, are not well known. In particular, the sizes of the oldest age classes of fish in the population are difficult to estimate and are often assumed in assessments.

To address these sources of uncertainty, it is proposed to undertake systematic annual bigeye tuna tagging surveys across the equatorial Pacific, utilizing the now-proven technique of capturing and tagging bigeye tuna (and to a lesser extent yellowfin and skipjack tuna) from aggregations associated with the equatorial Tropical Atmosphere Ocean (TAO) array of oceanographic moorings (Figure 1).

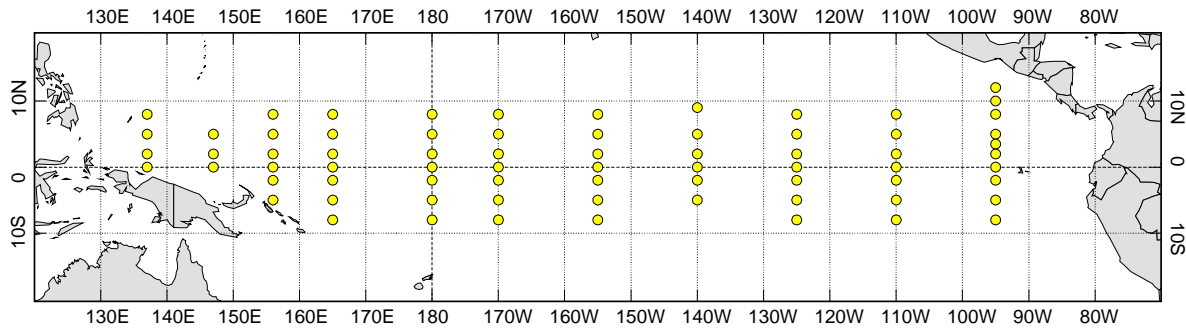


Figure 1. TAO moorings in the equatorial Pacific.

It is proposed that 4-5 tagging cruises per year be undertaken using fishing vessels equipped for bigeye tuna dangle/short troll-line fishing. Each cruise would conduct tagging operations on 2-3 lines of TAO moorings. The operational objective would be to tag and release approximately 20,000 bigeye tuna per year with plastic dart tags (PDTs) and 400 bigeye tuna per year with electronic archival tags (ATs). Tag releases would be distributed as evenly as possible over most if not all of the lines of TAO moorings shown in Figure 1.

If sustained over a number of years, the tagging operation would generate a wealth of new data that would specifically address the uncertainties noted above:

- Tag recapture data, with appropriate measures taken to ensure and confirm a high reporting rate of recaptured tags, provides direct, time-series information for stock assessments on the rates of exploitation and by inference, absolute stock size. Used in this way, the tagging data would be similar to fishery-independent survey data that are frequently used to enhance assessments for groundfish and small pelagics.
- Data on bigeye tuna movement collected during the recent central Pacific tagging work conducted collaboratively by SPC and IATTC would be significantly enhanced by the recaptures of PDTs and ATs. These data would allow more realistic assumptions regarding Pacific-wide stock structure of bigeye to be employed in assessments. Data on movement, particularly the detailed tracks of individuals tagged with ATs, would also allow more detailed assessments of the efficacy of existing and proposed spatial management measures.
- Tagging data are acknowledged as probably the only means of estimating the natural mortality rates of tunas. A time series of tagging data would allow estimation of age-specific natural mortality to be integrated into the assessment models.
- Tagging data also provide information on the growth of tunas through observations on the lengths at release and recapture of the tagged fish. As longer-term recaptures occur, critical

observations of the size of older bigeye tuna will occur and allow this source of uncertainty to be reduced.

Proposed Budget

The annual budget proposed to undertake this work is summarized below.

Table 1. Proposed annual budget by major cost items.

Budget Category	USD
Vessel charter	610,000
Tags and related equipment	340,000
Tag recovery	390,000
Travel	50,000
Administrative costs	100,000
TOTAL	1,490,000