

Tuna Research and Monitoring in the South Pacific

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Introduction

Oceanic tuna stocks in the productive waters of the tropical western Pacific and adjacent Southeast Asian waters (eastern Indonesia, Philippines) now support the world's largest tuna fishery, producing well in excess of one million tonnes of primary market species of tropical tuna - skipjack, yellowfin and bigeye - per year. These catches supply half of the global processed tuna market and serve as an important food source and income earner for Pacific Island and Southeast Asian coastal states.

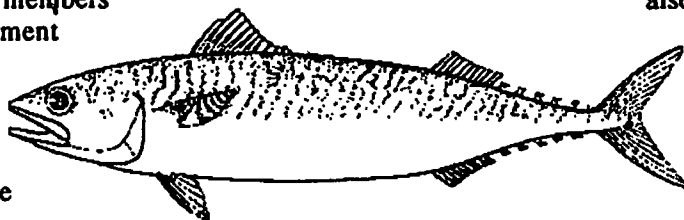
The catches are taken by a variety of gears - purse seine, longline, pole-and-line and others - predominantly deployed by an international fleet. The majority of the catch, however, is made within the 200-mile zones (EEZs) of coastal and island states.

The island countries of the South Pacific, because of their small size, manpower limitations and the need to work in a coordinated manner towards the management of highly mobile oceanic resources, have adopted a regional approach to the development and management of tuna resources, through two organizations based in the region:

- The Forum Fisheries Agency (FFA) is concerned with the implementation of intergovernmental fishery access and management agreements, and maximizing the economic benefit to island states from tuna resources within and adjacent to their EEZs. Established in 1979, FFA is an agency of the South Pacific Forum, with a membership comprising the 16 independent states in the region.
- The South Pacific Commission (SPC) provides scientific and technical advice, through its Fisheries Programmes, to island members relevant to the development and management of their fisheries resources. The Tuna and Billfish Assessment Programme (TBAP), the largest of these

programmes, is concerned with undertaking scientific research and providing advice on the biological status of regional tuna resources. Established in 1947, SPC has a membership of 27 countries/territories, comprising the Forum states, South Pacific territories of metropolitan states (France, USA, UK) and the metropolitan states themselves.

The research and monitoring function undertaken by the SPC/TBAP, whilst primarily serving the South Pacific island states, has implications extending beyond this region, in view of the shared nature of the highly mobile oceanic tunas. From a biological viewpoint, South Pacific stocks cannot be considered in isolation from those in adjoining Southeast Asian waters. Cooperative work with ASEAN countries in particular is encouraged through the Western Pacific Fisheries Cooperative Committee (WPFCC). Through informal research groupings such as the South Pacific Albacore Research Group (SPAR) and Western Pacific Yellowfin Research Group (WPYRG), research cooperation among scientists from island states and fishing nations has been fostered.



In economic terms, the bulk of the tuna catch from the South Pacific area, over 900,000 tonnes, now supplies Asian markets, either for the globally dominant canneries of Thailand, Indonesia and Philippines or the valuable fresh/frozen markets of Japan.

Tuna and Billfish Assessment Programme

The Tuna and Billfish Assessment Programme (TBAP) within the South Pacific Commission was established by the 1980 South Pacific Conference to continue the work initiated by its predecessor, the Skipjack Survey and Assessment Programme, and has as its goal the provision of assistance to SPC countries to develop, exploit rationally and manage the renewable oceanic resources of the region, the tuna resource constituting the single largest such resource available to these countries. The program has two components, research and statistical support. The research involves tropical tunas and more recently, albacore.

Tropical Tuna Research

Two studies are being undertaken, a regional tuna tagging project and an ongoing assessment of the fishery and the resources.

The Regional Tuna Tagging Project (RTTP) is a three-year project designed to provide practical answers to questions raised by tuna fisheries interaction and tuna exploitation generally within the region. The project will provide information on the population characteristics of yellowfin, skipjack and, to a lesser extent, bigeye, so that these questions can be addressed using various modeling approaches. Tagging has been carried out predominantly from the chartered Tuvaluan pole-and-line vessel, *Te Tautai*, although various locally based vessels have been used on an opportunistic basis for specific in-country components (which also contribute to the overall objectives on the project). The operations of the *Te Tautai* began in December 1989, following initial work in the Solomon Islands during the second half of 1989 on Solomon Taiyo Ltd pole-and-line vessels.

During the first year, tagging took place in the waters of Solomon Islands, Papua New Guinea, Federated States of Micronesia, Palau, the Philippines, Marshall Islands, Kiribati and Tuvalu, as well as international waters within the primary operational area (10°N-10°S, 125°E-180°E). Most tagging took place from the *Te Tautai*. In all, 48,263 tuna were tagged to the end of October 1990, comprising 16,909 yellowfin, 30,841 skipjack, 865 bigeye and 8 longtail tunas.

In the second year, tagging was carried out in Papua New Guinea, Federated States of Micronesia, Indonesia, the Philippines, Palau, Marshall Islands, Kiribati, Tuvalu, Solomon Islands, Australia (Coral Sea) and New Caledonia. The fishing conditions in 1991 continued to be excellent and have resulted in the tagging of a further 13,225 yellowfin, 56,750 skipjack, 4,801 bigeye and 74 longtail tuna as at the end of fishing activities on 7 December 1991.

These tag releases which now total over 115,000 (26% yellowfin) have been spread throughout the range of the western tropical Pacific tuna fisheries, although larger numbers have tended to be released in, or in the vicinity of, archipelagic waters, e.g., the Solomon Islands, Papua New Guinea and Indonesia.

The size distribution of releases has varied significantly according to the type of aggregation fished. In particular, FAD- and log-associated yellowfin tend to be smaller than seamount-associated or unassociated fish (Fig. 1). Skipjack and yellowfin 25-34 cm long have been tagged using smaller tags and applicators than those routinely used for tuna larger than 34 cm.

Tag Returns

The success of any tagging operation is largely dependent on the cooperation of fishermen and fish handlers in returning tags. Consequently, considerable effort is required to encourage the return of tags through initial publicity, provision of incentives (rewards) to return tags, periodic reinforcement of this incentive (lotteries, media publicity), feedback for tag returners and the establishment of standard reporting procedures.

Generally speaking, the response of

the various sources of tag recovery has been good, and in most cases excellent. As at 31 December 1991, 9,071 tag returns (7.9% of releases) have been received, comprising 2,391 yellowfin (7.9% of yellowfin releases), 6,473 skipjack (8.1% of skipjack releases) and 207 bigeye (4.1% of bigeye releases), and 2 longtail tuna.

Most of the returns were detected by tag finders on board the fishing vessels during catching or unloading, although fish detected in canneries or at transshipment facilities after unloading from the catcher vessel are also common. In many cases, it has been possible, with the cooperation

of the cannery/transshipment operators, to identify the catcher vessel and estimate an approximate location and date of recapture.

Returns by time at liberty (on a log scale) for yellowfin and skipjack are shown in Fig. 2. Both plots show a near-perfect log-linear attrition with time, even without correction for variations in catch or effort. This suggests that the standard tag-attrition models will be applicable to these data for spatially-aggregated analyses.

The much lower total attrition estimate for yellowfin is consistent with expectations that the average natural mortality rate of

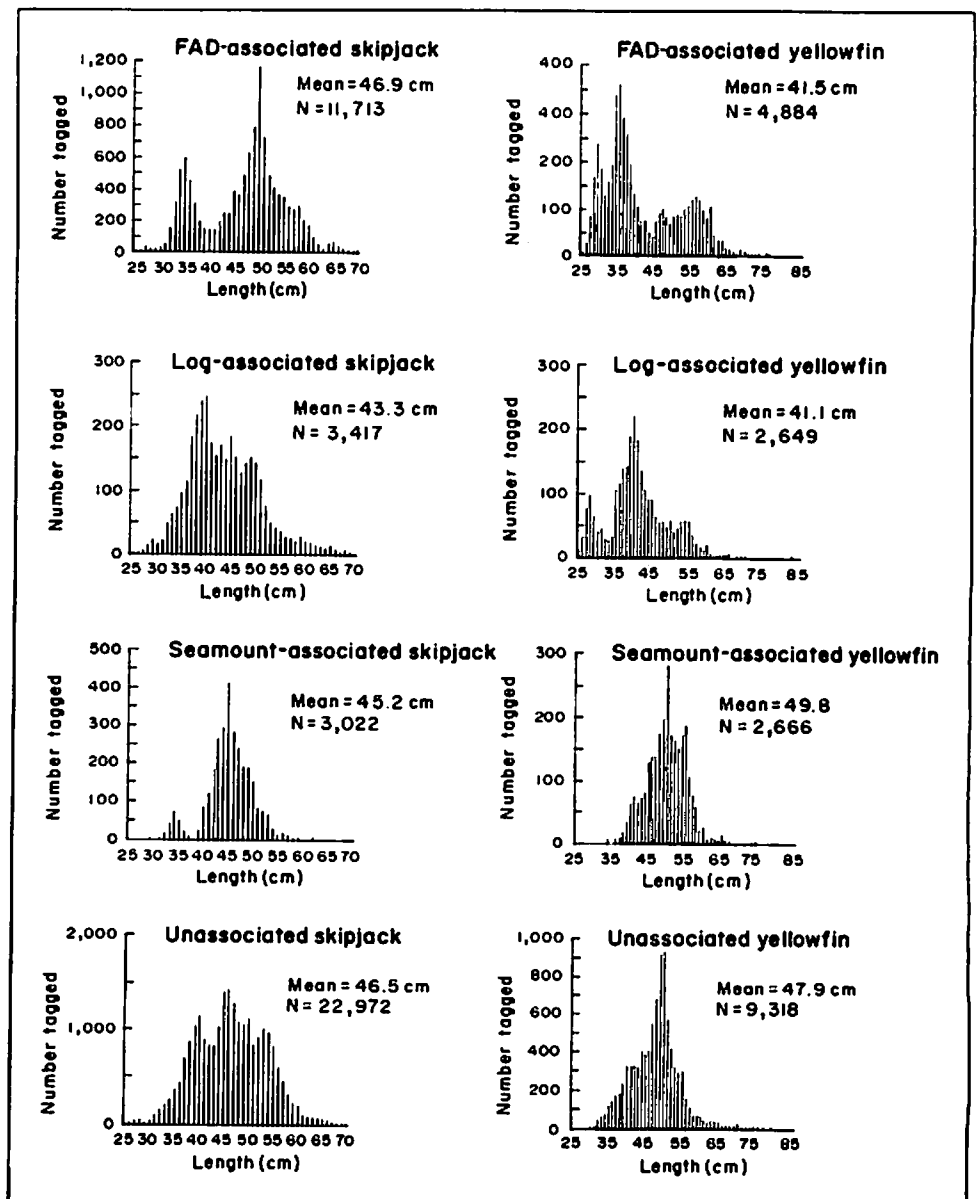


Fig. 1. Length-frequency histograms of tagged skipjack and yellowfin, by association.

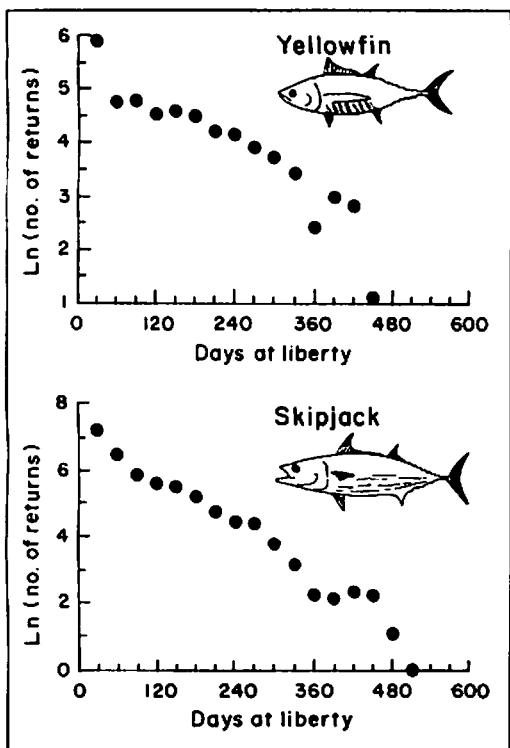


Fig. 2. Plots of the natural logarithm of yellowfin and skipjack tag returns, by 30-day periods at liberty. X-axis labels refer to the upper limit of each category.

yellowfin is substantially less than that of skipjack. Further analyses will be carried out at the completion of field work and when representative tag return data sets have been established.

For both skipjack and yellowfin, 70-80% of returns during the first 90 days after release were displaced less than 100 nautical miles away from the release point. The frequency of large displacements increased for fish at liberty 91-180 days (but more so for skipjack); for fish at liberty longer than 180 days, recapture within 100 nautical miles of release was relatively rare (1-3% of returns), with skipjack displacements of 300-500 and yellowfin displacements of 100-400 nautical miles most common. For all time-at-liberty categories, skipjack have substantially higher (30-60%) mean displacements than yellowfin, indicating more rapid and more frequent long-distance movements.

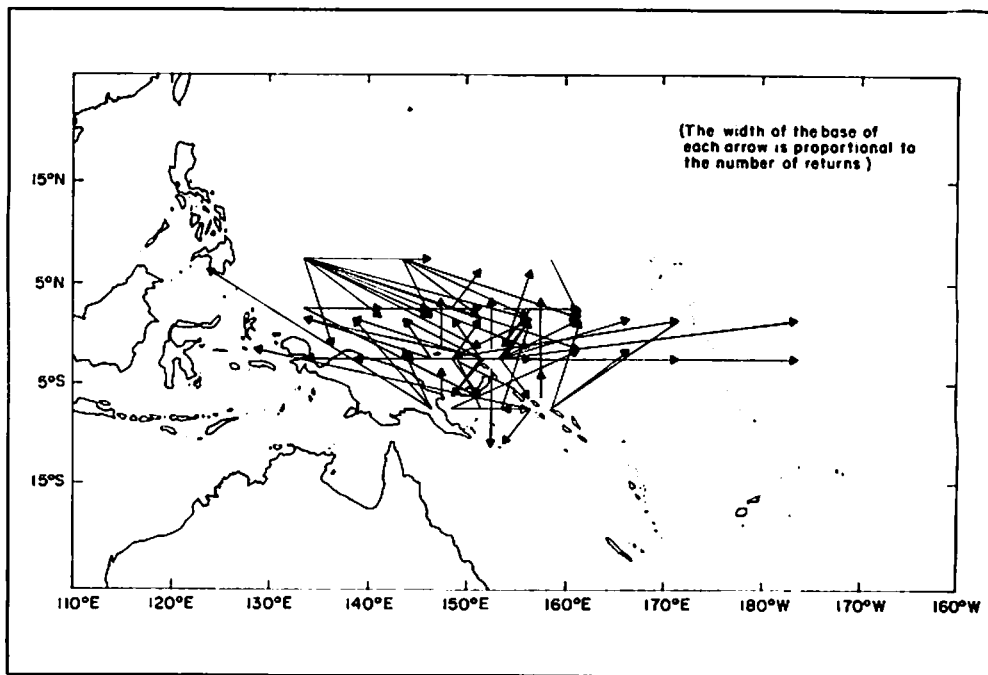


Fig. 3. Movements of tagged yellowfin between five-degree squares.

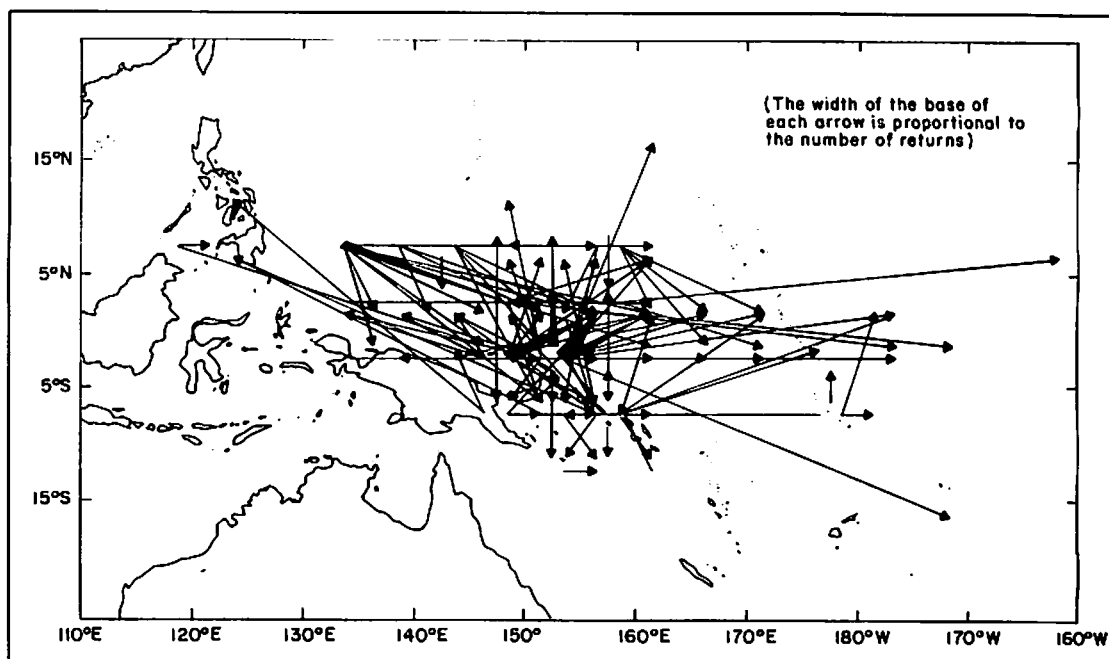


Fig. 4. Movements of tagged skipjack between five-degree squares.

Summaries of movements for yellowfin and skipjack are depicted in Figs. 3 and 4, respectively. For both species, large-scale movements in equatorial areas are essentially meridional, with maximum grand circle displacements of 1,974 nautical miles for yellowfin and 2,455 for skipjack. Most long-distance displacements for both

species have been from the PNG-Solomon Islands area (where most releases have occurred) to the east (Kiribati, Samoa) or to the west (Philippines, Indonesia).

Plots of yellowfin and skipjack length increments against time at liberty suggest that growth follows the von Bertalanffy model. Substantial effort on data screening

Table 1. Recent catch and CPUE trends for major western Pacific tuna fisheries. (PL: pole-and-line; PS: purse seine; LL: longline; PL CPUE in mt per day fished or searched; PS CPUE in mt per day fished or searched; LL CPUE in number per 100 hooks. CPUE estimates for 1990 are incomplete and should be regarded as preliminary.)

Year	Skipjack		Yellowfin		LL		Bigeye			
	PL	PS	PS	PS	LL	LL	LL	LL		
	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE
1987	146,915	4.0	295,085	11.3	148,101	4.8	40,414	0.80	32,467	0.46
1988	163,415	7.1	424,543	12.8	93,968	2.7	36,066	0.75	36,940	0.27
1989	148,385	6.1	427,803	11.0	156,494	4.7	36,480	0.71	28,833	0.38
1990	99,287	3.7	519,761	11.3	176,703	3.9	38,057	0.83	32,207	0.55

and editing will be required before reliable estimates of growth are obtained.

Assessing and Monitoring Levels of Exploitation of Commercially Important Tuna Species

Assessment of the status of tropical tuna stocks continues to be an important activity of the research project. Trends in total catch and catch per unit effort are monitored by species and fishery, and periodic status reports are prepared. Recent catch and CPUE trends for skipjack, yellowfin and bigeye are presented in Table 1.

The trends in skipjack CPUE give no indication that the resource is approaching full exploitation. Similarly, yellowfin do not show signs of overexploitation on the basis of these CPUE trends. There is currently insufficient information on which to base an assessment of bigeye stock status.

South Pacific Albacore Research

Increased effort was directed towards albacore in 1988, following increased catches of this species in a seasonal surface fishing at 35-40°S. Recent work on South Pacific albacore has included:

- i) staging the Third South Pacific Albacore Research (SPAR) Workshop, immediately preceding the Third Consultation on Arrangements for South Pacific Albacore Management;

- ii) coordinating an observer program during the 1990-91 surface fishery and during the 1991-92 season;
- iii) continuing sampling of albacore landings in the South Pacific, including port sampling in Noumea, onboard biological sampling on a Tongan liner, and plans to sample albacore landings in Fiji, American Samoa and Cook Islands;
- iv) continuing a medium-scale albacore tagging project, implemented during 1990-91 through the 1991-92 season, with a target of 15,000 releases in the seasonal surface fishery during December 1991-April 1992.

At the SPAR workshop, it was concluded that at the current reduced catch levels, there appears to be no immediate need for management action to further reduce fishing effort, although great uncertainty remains regarding yield potentials and fishery interactions. However, there are research needs for the future, including tagging studies, reproductive and age growth studies, continuation of observer work, and monitoring various aspects of the fisheries.

Statistics Project

Since its inception in 1981, the Tuna and Billfish Assessment Programme has maintained a database on industrial tuna fisheries in the region. The main sources of data have been daily catch and effort logsheets provided to SPC by member countries; the logsheets have been obtained

either from distant-water fishing nations (DWFNs) under access agreements or from vessels of domestic fleets.

The database is used extensively for research and monitoring purposes. The Tuna and Billfish Research Project uses the database to assess the state of exploitation of the stocks and to study interactions between the different fleets operating in the region. Monitoring of the fisheries is accomplished by the Fisheries Statistics Project through quarterly publication of statistics compiled from the database in the SPC Regional Tuna Bulletin and through detailed analyses of trends in catch and effort. Reports summarizing the data are sent back to member countries on a quarterly basis. For several member countries, the processed data are returned on diskettes for incorporation into databases which are maintained on computers within each country.



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