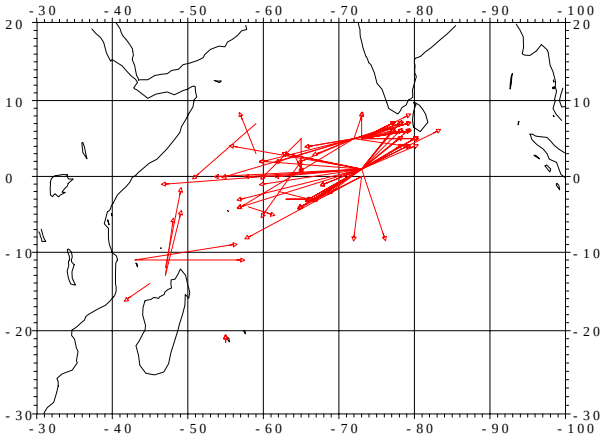
# A Proposal for an Indian Ocean Tropical Tuna Tagging Programme




*Final draft submitted to the IOTC Scientific Committee, december 2000*

# A Proposal for an Indian Ocean Tropical Tuna Tagging Programme (IOTTP)

(Developed by the Working Party of Tagging, Seychelles September 2000)

### *Introduction*

The rapid increase in catches of tropical tunas (yellowfin, skipjack and bigeye) in the Indian Ocean over the last decade (Figure 1) has highlighted the need for effective management strategies designed to ensure sustainable exploitation of these resources.

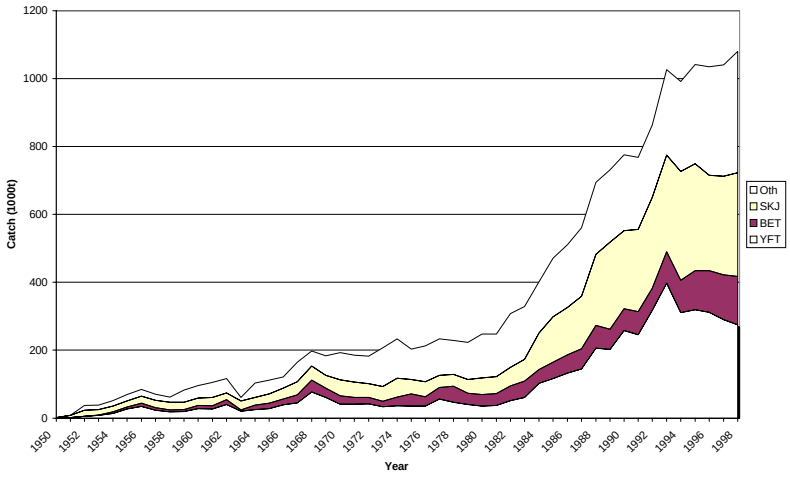



***Figure 1****: Yearly catches of yellowfin, skipjack, bigeye and of other tuna species in the Indian Ocean*

With a total catch in 1999 of over 700,000 tonnes and an estimated value of over US$2 billion (value at landing), the Indian Ocean tuna fishery is one of the world's biggest. Although European Union, Japanese and Taiwanese fleets take the bulk of the catch, the tuna resources are also of enormous importance to various Indian Ocean coastal and island states (such as Maldives, Seychelles, Madagascar, India, Sri Lanka, Oman, etc.). In these countries revenue earned from artisanal catches and/or licenses is often vital to both the national economies and to food production.

Despite the value and importance of the resources, the stock assessments essential for management for all of the key species remain inadequate and unreliable. This is largely because the key biological and population dynamics parameters essential for building stock assessment models remain unknown, or at best poorly understood. In the absence of reasonable stock assessments, the precautionary approach dictates that a more cautious attitude to management is required (FAO Expert Consultation 2000). Thus, even though stock assessments of bigeye are inconclusive, concerns have arisen over the status of bigeye stocks following a huge increase in the catch of juvenile bigeye associated to FADs in the Western Indian Ocean as well as a reduction in average weight and long term declines in longline catch rates (IOTC Scientific Committee Report 1999). This has lead the IOTC to

introduce a project for a time and area moratorium limiting purse seine fishing on floating objects in order to decrease catches of juvenile bigeye.

In 1999, the IOTC Scientific Committee agreed that a well-designed, large scale tagging experiment was the best and most cost effective means of collecting much of the data required to improve the stock assessments of the major tropical tuna species. Such large scale tagging programmes have been very successful in the western Pacific Ocean and data from tagging programmes are critical elements of stock assessments in the SPC Standing Committee on Tunas and Billfish.

The IOTC Working Party on Tagging (WPT) met in September 2000 to discuss and document the objectives and implementation of an Indian Ocean tagging programme.

Our purpose in developing this summary document is to present a coherent argument to potential donors for a large-scale tagging programme on tropical tunas in the Indian Ocean. Thus, the objectives of this document are to:

1. demonstrate the links between key management issues and the proposed tagging programme;
2. summarize the expected key outputs from a basin-scale tagging programme throughout the Indian Ocean;
3. provide an overview of the organizational and logistical requirements for a successful programme, and
4. provide an indicative budget.

A detailed discussion of each element of the prospectus is provided in Annex.

### *Key management issues and the need for a tagging programme*

Table 1 provides an overview of important management issues for the IOTC that would be addressed by the proposed tagging programme. Although the list is by no means exhaustive, it is clear that the results of the tagging programme will have far-reaching implications on the ability of the Scientific Committee to respond to key questions from the IOTC.

The lack of reliable stock assessments for the tropical tunas, as well as swordfish, in the Indian Ocean creates a major problem for the IOTC. Without an adequate understanding of the status of stocks, the Commission is left to decide whether the rapid increases in effort and catch over the last decade should be allowed to continue, and whether even the current levels of catch are sustainable.

There is unanimous agreement within the IOTC Scientific Committee that the need for improved stock assessments and scientific advice to the Commission is urgent. This is to avoid the overexploitation of stocks of tropical tuna

species that has often been seen in other oceans. For this reason, it is critical that a tagging programme should begin as soon as possible.

Further complicating matters for the IOTC and the Scientific Committee is the proliferation of drifting fish aggregating devices (FADs) in both the eastern and western Indian Ocean. Since 1992, FADs have increased the catch rates of purse seine fleets very significantly. The high catches of small yellowfin and bigeye around FADs in the western Indian Ocean have raised the question of whether FAD fishing is more likely to lead to unsustainable catches than purse seine operations based on unassociated schools. A related concern is the effect high purse seine catches of small fish on FADs is having on longline, purse seine and artisanal fisheries for yellowfin and bigeye which target larger and mature size classes. There is no evidence from other parts of the world that FADs increase the biological productivity of tuna stocks in an area. Thus, it seems a distinct possibility that increasing the vulnerability of fish to purse seine fleets may have a very significant effect on tuna stocks. To assess this objectively however, we urgently need information on the dynamics of tunas around FADs – e.g. how fast they aggregate, how long they remain in residence, their movement patterns between FADs and the factors that affect the attraction of FADs. All of these questions would be addressed by a component of the proposed tagging programme.

***What will a tagging programme deliver?***

In the 1990s. a very well-planned and implemented Regional Tuna Tagging Project in the Central and Western Pacific, funded by the EU and run by the Secretariat for the Pacific Community in the Western Pacific, provided a wide range of valuable data that have been fed directly into stock assessment models integrating spatial and temporal parameters and provide more realistic estimates of population dynamics. The data also permitted the study of interactions between fisheries and areas. It is anticipated that this broad scale and comprehensive programme will provide for the main Indian Ocean tuna stocks data to address the following issues:

- Crucial model parameters necessary for stock assessment, i.e. age specific estimates of natural and fishing mortality;
- Structure of stocks and movement of Indian Ocean tropical tunas;
- Exploitation rates and differential vulnerability by area and gear;
- Influence of FADs, seamounts and areas of elevated vulnerability on the movement and exploitation of Indian Ocean tunas, particularly of juvenile yellowfin and bigeye aggregated to drifting FADs;
- Data useful for estimating rates of fishery interaction.
- Life history parameters, i.e. growth rates, and validated age estimates.
- Role of the oceanographic and bathymetric environment on movement and exploitation of Indian Ocean tunas.

***Where and when will the programme take place?***

The complexity and scale of questions to be addressed by the tagging programme dictate that it should be conducted over the entire Indian Ocean basin, involving at least three years of field tagging. The programme is expected to last five years, including initial phases and tag recuperation.

The broad geographical basis is required to determine:

- the nature and extent of movement of all the key species throughout the Indian Ocean;
- interactions between surface and longline fisheries throughout the Indian Ocean;
- levels of exploitation across the entire range of stocks; and
- age- and area-specific population parameters.

Tagging over a three-year period is required to:

- tag individual cohorts over sequential years, an important element in estimating age specific fishing and natural mortality; and
- ensure that regardless of major climatic variability (El Niño/La Niña), tags can be released throughout the geographic range of the fisheries and across the size range of each species.

Tuna tagging programmes throughout the world have historically tagged fish less than three years old, principally because these age classes occur in large schools on the surface, where they are available to pole and line catching boats. However, only small numbers of fish are recaptured after more than 2-3 years at liberty when only young fish are tagged because of natural and fishing mortality and tag shedding. This makes the estimation of age specific population parameters problematic. As one of the core objectives of the proposed programme is to provide estimates of these parameters over a broad range of sizes/ages, the programme will tag a wide a range of sizes/ages in each species, using a variety of tagging platforms.

***Time lines and organizational requirements***

Table 2 provides an overview of the time lines for the planned tagging programme.

Given the urgent requirement for stock assessments, we propose to begin tagging in 2002. A number of small training, exploratory tagging and promotional pilot projects would begin as soon as possible as precursors to the main programme (c.f. Table 3). These would be funded outside the programme budget. The total cost of this planned pilot tagging that should be done as soon as possible is US $434,000.

Given the ocean-basin scale of the field work, the tagging programme will need to be a multi-national effort. All IOTC members and co-operating non-

contracting parties would be approached to assist with the programme. However, we propose that IOTC would take the lead role of programme co-ordination through the formation of a special Tagging Programme staff unit. The unit would comprise the following staff:

1. Chief Scientist - Co-ordinate the programme, senior staff supervision, data analyses, reporting.
2. Field Co-ordinator, - Responsible for field logistics, tagging protocols, supervision of tagging staff.
3. 4 Senior Tagging technicians.
4. Promotions/Liaison/support officer.

As in-country support for the tagging programme (e.g. Oman and Iranian support in the Oman Sea, Indonesian and Australian support in the eastern Indian Ocean etc) would be essential for its success, an important role for the IOTC Secretariat and the Chief Scientist would be to garner broad support.

Similarly, support by in-country scientists would be very useful through the data analysis phase of the programme. To promote contributions/support, we recommend that the IOTC request support from members and co-operating non-contracting parties through the Scientific Committee for co-ordination of local tagging and scientific support of the tagging programme.

***Logistical requirements***

The proposed tagging programme is both complex and highly ambitious in terms of its logistical planning and implementation. Employing the experience of the highly successful, EU funded, Regional Tuna Tagging Project run by the Secretariat for the Pacific Community in the Central and Western Pacific, the WPT has developed a provisional work plan and logistical framework on which to base estimates of budget and manpower requirements. The key elements of the work plan include:

- use of two major pole and line tagging platforms, based in the east and west of the Indian Ocean supported by a range of smaller vessels to be used for specialist tagging activities (e.g. longline/handline releases, Maldives in-country tagging etc );
- application of conventional, archival and satellite tag technology;
- a commitment to standardized methodology to produce a high standard of tag releases;
- a thorough and ongoing publicity and liaison effort to maximize reporting of tag recaptures and provision of high quality size and location data;
- comprehensive data analyses incorporating the integration of results across the time and spatial scales for which data will be collected.

Each of the major costs of this large tagging programme are given as table 4 of this report. The total cost of this planned IOTTP is US $18.788 million (its major components are summarized in Figure 2).

### *Conclusion*

The Indian Ocean Tuna Tagging Programme (IOTTP) has been designed to provide data that is urgently required for the development of reliable stock assessments for the major tuna stocks of the Indian Ocean.

We are proposing to base the IOTTP on the approaches taken by the two very successful, European Union-funded, Regional Tuna Tagging Programmes run by the Secretariat for the Pacific Community (SPC) in the Western Pacific in the early 1980s and 1990s. There are many similarities between what we are proposing and the SPC programmes – in the logistical requirements, target species and analytical procedures required for processing the data. Thus, we have every reason to believe that the IOTTP, to be run by the IOTC secretariat and its member countries, will be successful in meeting its broad ranging objectives.

There is a strong case to be made that the sooner we start an IOTTP the better. Many of the stocks of tropical tuna species in the Indian Ocean have come under very high levels of exploitation in the 1990s, and at this point stock assessments are not able to determine whether the levels of exploitation are sustainable. A tagging programme will provide the data that is needed to make this evaluation. Given the lag between release of tags and adequate numbers of returns to allow analysis of key population parameters, we believe it is essential that the IOTTP should start immediately.

The cost of the six-year IOTTP, and associated pilot studies, is estimated at US$18.5 million. This amounts to less than 1% of the annual landed value of the fishery (knowing that the total value of the fishery is much higher than this figure). Given the immense social and economic value of the fishery throughout the Indian Ocean, we believe this level of investment is fully justified. To delay this essential programme and wait until stocks are clearly in decline before acting would be contrary to the philosophy and treaties underpinning responsible fisheries management in the 21st century.

We are now faced with the question of who should fund such a programme. In identifying the key requirements and developing a prospectus and logistical plan for the IOTTP, we have concluded that the responsibility to fund programme lies principally with the industrialised countries that take the vast majority of the catch of the key tropical tuna species in the Indian Ocean.

Table 1: Overview of important management issues addressed by the IOTTP.

| **Management Issues** | **Current scientific responses to management issues** | **The role of a tagging programme in improving scientific responses to management issues** |
|---|---|---|
| 1. What is the likelihood that the recent rapid increases in catches of small yellowfin and bigeye on FADs are having significant negative impacts on the Indian Ocean populations of these species? (B,Y) | Very difficult to answer because:<br>• Critically inadequate understanding of key biological parameters (age specific M& F, growth etc) lead to:<br>• Inadequate stock assessment for any of the species | • Tagging data will provide estimates of growth, age specific fishing and natural mortality….. for input into stock assessment models.<br>• Tagging data can also be used to estimate exploitation rates for each species, and as such provide allow the Scientific Committee to determine whether current levels of fishing are likely to lead to significant population decline. |
| 2. Are there too many boats fishing in the Indian Ocean? (B,Y,S) | | |
| 3. Is the Indian Ocean basin the appropriate management unit for each of the key species? | As the stock structure of all key species remains uncertain, it is not possible to determine this with any confidence. | • Data on movement patterns provided by a well-designed, ocean basin-wide tagging programme will provide a basis for determining the stock structure of all species tagged. |
| 4. What is the influence of FADs on the distribution and efficiency of the Indian Ocean purse seines fishery? | Unknown, because the influence of FADs on the movement and exploitation of tropical tunas in the Indian Ocean is unknown. | • Within a tagging programme a core objective would be to determine the movement patterns and residency of fish at FADs and to examine the interactions between FADs, |
| 5. What is the efficiency of time-area closures as a management tool for tropical tunas in the Indian Ocean? | Without information on residency, movement patterns and mixing rates it is not possible to evaluate this. | • As above, data from a tagging programme would allow scientists to advise managers on the likely impact of time-area closures, taking into account the residence times, movements patterns and rates of fish within different portions of the Indian Ocean. |
| 6. What is the level of interaction between skipjack fisheries in the central and western Indian Ocean? | Largely unknown because little to nothing is known about residency, movement patterns and mixing rates of any species in the Indian Ocean<br>Also the vertical movement of yellowfin and bigeye in the Indian Ocean poorly understood. | • A critical output of a basin-scale tagging programme would be to provide data with which to examine the nature and extent of interactions between the many different sectors of the Indian Ocean tropical tuna fishery.<br>• Archival and pop-up satellite tags will provide the necessary information on habitat preferences of yellowfin and bigeye, and how these may change with age. |
| 7. What are the nature and level of interactions between purse seine and longline fisheries. (B,Y) | | |

Table 2: Chronological diagramme of the planned IOTTP activities.

| | | Pilot Study | | | IOTTP | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ***Year 0*** | | ***Year 1*** | ***Year 2*** | ***Year 3*** | ***Year 4*** | ***Year 5*** | ***Year 6+*** |
| Funding agreement by donors | **yes** | | ***yes*** | | | | | | |
| Tagging WG | | 1 WG early in year 0 | | 1 WG early in year 1 | 1 WG | 1 WG | 1 WG | final symposium | |
| Tagging equipment | | initiate: early year 0 | | full scale | maintenance | maintenance | maintenance | | |
| Bait supply | | Bait studies | | organize access to bait | yes | yes | | | |
| Main tagging by P&L vessel | | | | | yes | yes | | | |
| Small scale tagging | | Small scale Tagging | | | yes | yes | yes | | |
| Tagging by sport fishers | | initiate | | full scale | full scale | full scale | full scale | full scale | |
| Training of technicians | | initiate | | full | | | | | |
| Publicity & Communication | | initiate | | full publicity | full publicity | lower publicity | lower publicity | lower publicity | lower publicity |
| Rewards and lotteries | | initiate | | yes | yes | yes | yes | yes | yes |
| | | | | | | | | | |
| IOTC Scientific staff | | 1 study coordinator | | Chief scientist | Chief scientist | Chief scientist | Chief scientist | Chief scientist | |
| IOTC Scientific staff | | | | Field coordinator | Field coordinator | Field coordinator | Field coordinator | Field coordinator | |
| IOTC Scientific staff | | | | Support officer | Support officer | Support officer | Support officer | | |
| IOTC Scientific staff | | | | | 4 tagging technicians | 4 tagging technicians | | | |
| National tagging coordinators | | yes | | yes | yes | yes | yes | yes | |

Table 3: Proposed budget for the PILOT study 2001 (in thousands of US dollars)

| **Type of cost** | **Cost** |
|---|---|
| Seychelles LL tagging | 30 |
| La Réunion LL tagging | 45 |
| Sport fishery tagging | 60 |
| Oman tagging | 20 |
| Maldives tagging | 20 |
| Mayotte tagging | 25 |
| Pole & Line Seychelles tagging | 50 |
| Tags, tagging equipment and accessories | 15 |
| Small scale publicity | 10 |
| Tagging expert salary | 120 |
| Contingency 10% | 39.5 |
| **Total budget** | **434.5** |

Table 4: Budget summary for the tagging programme (IOTTP) *(in thousands of US dollars)*

| | ***Year*** | | | | | |
|---|---|---|---|---|---|---|
| ***Type of cost*** | **1** | **2** | **3** | **4** | **5+** | **Total** |
| Small vessels: Longline, artisanal & scientific | | 200 | 200 | 200 | | 600 |
| Sport fishery tagging: coordination & support | 40 | 10 | 10 | 10 | 10 | 80 |
| Tags, tagging equipment and accessories | 170 | 45 | 45 | | | 260 |
| Rewards and lottery for recoveries | | 100 | 100 | 100 | 50 | 350 |
| IOTC technical and scientific staff | 370 | 930 | 930 | 370 | 370 | 2 970 |
| Publicity and communication | 80 | 10 | 10 | 10 | 50 | 160 |
| Training of tagging technicians | 10 | 10 | 10 | 10 | | 40 |
| Support salaries of tagging staff | | 100 | 100 | 100 | | 300 |
| Travels costs | 50 | 100 | 100 | 100 | 50 | 400 |
| Meetings | | 20 | 20 | 20 | 50 | 110 |
| *Large P&L East rental & running cost* | | *1 500* | *1500* | | | *3 000* |
| *Large P& West rental & running cost* | | *4 000* | *4 000* | | | *8 000* |
| *Archival tags* | | *250* | *250* | *250* | | *750* |
| Bait supply | | 20 | 20 | 20 | | 60 |
| Contingency | 72 | 729.5 | 729.5 | 119 | 58 | 1 708 |
| **Total** | **792** | **8 024.5** | **8 024.5** | **1 309** | **638** | **18 788** |

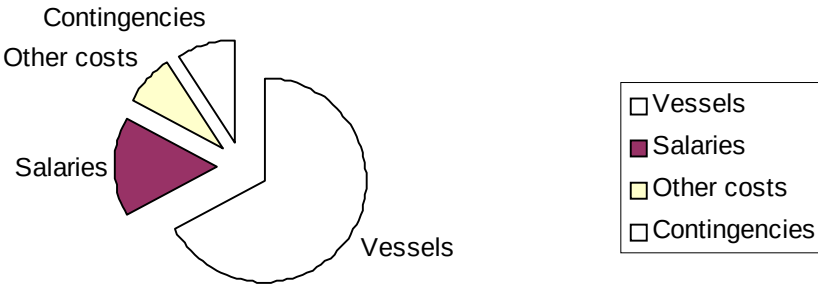



Figure 2: Synthetic diagram showing the main chapters of the IOTTP planned budget (total budget of US$18.788 million)