



## **Report of the Sixth Session of the IOTC Working Party on Tagging**

**Victoria, Seychelles, 19-23 July 2004**

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## 1. OPENING OF THE MEETING

The Sixth Meeting of the Working Party on Tagging (WPT) was opened on 19 July 2004 in Victoria, Seychelles, by the Chairman, Dr. Alain Fonteneau, who welcomed the participants (Appendix I).

The Agenda for the Meeting was adopted as presented in Appendix II.

The list of documents presented to the meeting is given in Appendix III.

## 2. CURRENT STATUS OF TAGGING FUNDING AVAILABLE AT THE SECRETARIAT

The Executive Secretary of IOTC made a brief presentation of the current status of the IOTTP funding. There are separate funding components for the main phase of IOTTP and for the pilot and small-scale tagging operations.

The EC is to provide €200,000 annually over the next five years to fund well defined tagging projects, to be coordinated by the IOTC Secretariat with technical support from the WPT (Document IOTC-2004-WPT-05). Following the production of a report for the 2003 pilot study on tagging, it is proposed to spend the funds in 2004 on several small-scale tagging operations (IOTC-2004-WPT-04, IOTC-2004-WPT-05).

Japan funds around \$US82,000 per year for (conventional) tagging work in the Indian Ocean. In 2003 this fund supported a range of initiatives, including pilot and small-scale tagging of tropical tunas in Mayotte and Indonesia; and construction of coastal FADs and live bait surveys in the Seychelles. In 2004, tagging (yellowfin tuna) and training of technicians will continue in the Mayotte area (IOTC-2004-WPT-08).

During this agenda item, Japanese officials announced that Japan would increase the above funding to around \$US250,000 per year for three years beginning in 2004 to fund conventional tagging in the eastern Indian Ocean area.

## 3. CURRENT STATUS OF THE EU-DG-DEV FUNDED PROGRAMS

The Executive Secretary of IOTC made a brief presentation on the current status of the large tagging programme being sponsored by the EU-DG-DEV development fund.

The WPT noted:

- The terms of reference for the Chief Coordinator position has been developed and Expressions of Interest have been called. Tenders for this position are expected around 9 August 2004 and a decision on the successful tenderer is expected to be made by 15 August.
- The TOR's for the services of vessels and tagging staff have also been drawn up. The program tender is to contain three components: a Project Management Unit (comprising 1 publicity officer, 1 administration assistant, 3 cruise leaders and 3 tagging technicians), Vessel 1 and Vessel 2. Consultancy firms will be able to bid for one or all the lots.
- The need for support from National Institutions (a total of 10 people at all times - to be coordinated and trained by the Chief Coordinator). The WPT stressed the need for continuity of participants, but acknowledged that it will be a substantial commitment for National Institutes to provide staff over a period of several years.

- Conventional tags are able to be sourced from suppliers outside the ACP.

The WPT recommended that the IOTC officially contact the National institutions and encourage their participation and request that people be made available for the program.

The Executive Secretary IOTC also requested feedback from the WPT on the size of the initial budget required for the program (refer to IOTC-2004-WPT-06), including the level of at-sea-allowance that might be offered to participants

The WPT applauded the IOTC's commitment to manage the tender evaluation process using best practices and with great transparency, noting that technical criteria are to play a dominate role in the evaluations.

The WPT agreed for the need to prioritise the tagging by area, species and tuna-size, rather than merely tagging 80,000 tuna (as stated in the RTTP). The WPT briefly discussed the need for an incentive program (*e.g.* a points system) that would encourage skippers to tag BET in preference to YFT and SKJ. The WPT briefly discussed various systems and proposed the following system of relative values:

Relative value	Size and species
1	SKJ
2	<10 kg YFT
3	<10 kg BET
5	>10 kg YFT
10	>10 kg BET

The WPT acknowledged the potential merits of such a system and recommended that development of a points system along these lines should be explored.

Overall, the WPT agreed that it is highly desirable that the RTTP be allowed to proceed largely on a technical basis and not get besieged by administration and bureaucracy.

#### **4. LARGE-SCALE TAGGING PROSPECTS IN THE EASTERN INDIAN OCEAN**

The WPT noted that while there are major plans for tagging work in the western Indian Ocean, there is relatively little tagging taking place or planned for the eastern Indian Ocean. Furthermore, the WPT acknowledged that the rates of recaptures in this area are likely to be relatively low given the low level of fishing.

A presentation was made on the SEAFDEC tuna tagging program in the eastern Indian Ocean (Document IOTC-2004-WPT-15). This work (with funding support from the Japanese Government) was conducted using the MV SEAFDEC (a purse seiner equipped with FADs), from 22 October – 28 November 2003. The program used the standard IOTC gear, with some modifications to the applicator. A total of 1,000 tuna (930 YFT and 70 SKJ) were tagged and released from seven fishing stations. To-date one YFT has been recaptured. In 2004/05, the program plans to tag 1,400 YFT and BET in the same area.

The scientists from India signalled their interest in tagging work in the Andaman Sea area and a desire to collaborate with the SEAFDEC program in the near future.

Document IOTC-2004-WPT-02, described the results of a Japanese feasibility experiment for tagging in the eastern Indian Ocean. The work concluded that:

- Milkfish was available and robust species for tagging work.
- Floating objects were scarce and therefore may not be useful in tagging operations in this area.
- Skipjack caught by trolling were often damaged, so their survival after tagging may be low.

- Free swimming schools were relatively easy to find. It might be possible to release 1500-3000 SJK per 20 days fishing using a pole and line fishing vessel equipped with a bird radar.
- If FADs with enough fish are available, it might be possible to release 100-200 BET and 100-200 YFT in a 20 day period using jigging and handline with live bait.

The WPT noted the report by Australian and Indonesian scientists on a study exploring the feasibility of developing and implementing a pilot collaborative tagging program (using conventional tags) for tunas caught by artisanal and small-scale commercial fisheries in western Indonesia (eastern Indian Ocean) (Document IOTC-2004-WPT-01). The aims, outcomes and a proposed methodology have been abbreviated from the original document and are given below.

Aims:

1. Obtain information about the fisheries.
2. Establish whether there were any suitable vessels for pole and line fishing charter.
3. Establish whether there were any vessels suitable for use as a 'mother vessel' during proposed tagging operations.
4. Identify possible sources of live-bait.
5. Discuss with senior staff within West Sumatra Provincial Fisheries Office and Bungus Port Authority about collaborating on the proposed tagging program.

Outcomes:

- Skipjack, eastern little tuna, frigate tuna, bullet tuna, and longtail tuna make up the majority of the catch landed in West Sumatra (approx 40 % each of total pelagics). "Tuna" (mostly juvenile yellowfin up to 55 cm FL) make up around 20 -30% of the catch.
- FADs ("rumpon") are the focus of fishing activity for the troll-line and hand-line vessels.
- Tunas are landed all year round at Bungus, with no obvious peak season. However, the period August – December is considered to be the best period for tuna fishing in the Mentawai Strait because of calmer sea conditions.
- There are no pole & line vessels anywhere along the West Sumatra coast. The majority of fishing vessels are troll-line, some hand-line, and the remainder lift-net vessels.
- The 'average' troll-line vessel is 16 – 17m in length, constructed of wood, and powered by a 30 – 40 HP inboard motor. The average length of their fishing trip is 14 days and they carry 4 – 5 crew. They routinely land 3 – 4 tonnes of fish at each landing.
- The lift-net vessel fishery operating out of Padang/Bungus offers strong possibilities as a source of live-baitfish (*e.g.* anchovy, sprat, and sardine species) for tagging operations.
- Both West Sumatra Provincial Fisheries Office and Bungus Port Authority expressed strong support for collaborating with RCCF/IOTC/CSIRO in developing and implementing a trial tagging program, based at Padang/Bungus. They view such a program as a valuable capacity building opportunity for local fishers. They currently run one such capacity building program where deepwater handline fishers have been 'imported' from Gorontalo in northern Sulawesi to provide training to local hand-line fishers for catching larger pelagics (primarily adult yellowfin) around the FADs.

- Several options for a 'mother vessel' - to fulfil the role as accommodation and office for tagging staff during tagging operations - have been explored. It may be possible to charter a patrol vessel in collaboration with the Directorate of Marine and Fisheries Resources Surveillance (DGMFRS), or one of the many motor vessels operated by privately owned surfing charter companies based in Padang (the former being the preferred option). RCCF's research vessels were investigated as mother-vessel options, but none were found to be suitable.

Proposed methodology:

The following plan of operation for a pilot tagging program was provided as a starting point for discussions. It is considered achievable at a reasonable cost:

1. Develop a formal proposal in full collaboration with West Sumatra Provincial Fisheries Office and Bungus Port Authority.
2. Charter one or two 'good quality' local troll-line vessels, modified to enable pole and line fishing.
3. Charter a 'mother vessel' to act as a floating base during tagging operations.
4. Charter the services of one or more lift-net vessels to catch species suitable for live-bait and construct a floating pen(s) for holding the bait during the tagging period.
5. 'Import' at least two skilled pole and line fishers from eastern Indonesia to fish on the tagging vessels, but also to provide on-board training to local fishers in pole and line operations
6. Man each tagging vessel with two scientific staff drawn from the collaborating scientific institutions participating in the program to coordinate and participate in tagging operations.
7. Focus tagging activities on the FADs in the southern half of Mentawai Strait (FADs under control of West Sumatra Provincial Fisheries Office and Bungus Port Authority).
8. Padang/Bungus would be the primary base and return point for provisioning.
9. The period of tagging activities will be largely funding dependent. Suggested period for this trial is 6 – 8 weeks, with one or more changes in tagging staff during that period.

The authors indicated that they would like feedback and suggestions from the WPT on the operational plan with the view to developing and implementing a full proposal for a pilot collaborative program.

Japanese, Indonesian and Australian Scientists are currently collaborating on the design, implementation and analyses of the project. MOU's will be developed soon, and the project could start in November 2004. The WPT encouraged IOTTP to also collaborate in this work by allocating funds from the new Japanese tagging fund. The WPT recommended that work in the eastern Indian Ocean should be complementary to the RTTP (planned for the western Indian Ocean area).

The WPT welcomed the news that the Japanese RV *Nippon Maru* will be collaborating with the IOTTP this year. This purse seine vessel has proved to be an efficient tagging boat in recent years.

## **5. STATUS OF PILOT AND SMALL-SCALE TAGGING ACTIVITIES CURRENTLY IN THE EASTERN AND WESTERN INDIAN OCEAN: PROSPECTS FOR LATE 2004 AND 2005**

During 2002, 2003 and the first 6 months of 2004, nine pilot and small-scale tuna tagging projects were conducted in the eastern and western parts of the Indian Ocean (Table 1). Seven of these projects (four pilot projects and three small-scale projects) were under the IOTTP; and two were independent but associated projects (Refer to document IOTC-2004-WPT-11).

Work was undertaken on seven occasions in the western Indian Ocean to obtain information on growth parameters, movements, exploitation rates and interactions between fisheries. During these projects, 2086 fish were tagged and released (55% of YFT, 40% of SKJ, 2% of BET and 3% other species). To-date, 26 fish have been recaptured (1.29%, Table 2).

### **Small-scale tuna tagging project in French waters of Mayotte**

Document IOTC-2004-WPT-04 described a pilot tuna tagging project implemented in 2002 in Mayotte (Comoros) to study the feasibility of a small-scale tuna tagging programme in the area. Following this successful experiment, a small-scale project was organized to take place during the fishing season in the Mozambique Channel, *i.e.* between March and June 2004 (IOTC-2004-WPT-13). This programme, funded under by the EU DG Fish, aimed to tag between 300 and 400 medium size yellowfin tunas. However, after the first week catches were so low that the target was lowered to 150 fish. The reason for the low catches was probably due to availability (rather than inexperience) - purse seine vessels fishing in the same area also experienced low catch rates during the same period.

After three months of the project and 25 trips, 104 tunas were tagged and released (an average of 4.2 tagged tunas per trip). Tagged tunas were between 56 and 126 cm, with an average of 96 cm for YFT. This tagging project was novel in that local fishermen were asked to catch tuna and to sell them directly onboard to the tagging team.

Less than one month after the last cruise, 22 fish were recaptured and reported to the Service des Pêches de Mayotte. To-date, the reporting rate of this programme is very high (21.15%). The programme will continue during the second fishing season in the area in October-November.

The WPT recommended that the tagging program should have more publicity and the reward system should be enhanced in the neighbouring Comoro Islands as this Country has been catching large quantities (>5000t annually) of the same large-sized YFT tagged by the Mayotte program.

### **Small-scale tuna tagging project in the Republic of Maldives**

Maldives has already conducted two successful tuna tagging projects, in 1990 and 1993-95. The local pole and line fishery provides a cost-effective means of tagging and releasing large numbers of high quality fish. New tagging activities were recommended by the WPT in 2002 and 2003 with the aim of quantifying the level of interaction between the Maldivian skipjack fishery and the western Indian Ocean purse-seine fishery. A Letter of Agreement was signed between the IOTC and the Republic of Maldives to conduct a small-scale tuna tagging project in December 2003 and tag 5 000 tunas before June 2004 (IOTC-2004-WPT-04). The lack of trained personnel at the Marine Research Centre of the Republic of Maldives was a constraint and the project had to be postponed. However, the equipment was tested and the technicians were trained during a single day trip (in May 2004). 199 tunas (186 SKJ and 13 YFT) were released during this trip and so far four have been recovered (IOTC-2004-WPT-03). During this trip, 427 kg of bait was obtained from a small lagoon at night by fishers using lights.

Posters and recovery forms were sent to the inhabited islands and other strategic locations to encourage the cooperation of the fishermen.

A trip to the northern areas of the Maldives is planned for July/August 2004. It is planned to tag more than 2 000 fish if the fishing is good.

This project will be renewed in 2005 with the same objectives.

### **Small-scale tuna tagging project in Indian waters of the Lakshadweep islands**

In September 2003, an agreement was made with the Government of India, to organize (in Indian waters) a small-scale tuna tagging project (Document IOTC-2004-WPT-10). The plan is to tag 5 000 tunas from three different platforms: local pole and line vessels, local handline vessels and a longline research vessel. The tagging program will require the Indian scientists and technicians to be trained in tagging methods. This training could be done by the well qualified team of the Maldivian MRC in early September 2004. A national correspondent in the Lakshadweep area will provide information on the program to fishers and distribute rewards upon the recovery of tagged fish.

The WPT were advised that the Letter of Agreement has not yet been approved by the legal office at FAO, and as a consequence the project is on hold. The WPT noted that tagging in Lakshadweep should be highly cost-effective. Moreover, this tagging activity, strongly related to the small-scale tuna tagging project in the Maldives, should take place at the same time, *i.e.* during the fishing season in the area, late August early September 2004. The WPT strongly supports this project and looks forward to the administrative details being completed as soon as possible.

## **Perspectives of New Projects**

### **Pilot or small scale tuna tagging programme in Iranian waters**

Iran has previously indicated its willingness to carry out tagging activities, and the IOTC is ready to study a proposal for a small-scale tagging project in Iranian waters. The presence of medium-sized YFT in Iran's waters makes this a particularly attractive proposition because this size of YFT is not found in most other fisheries. The WPT noted that the main gears used in Iran are driftnet and purse-seine, neither of which is ideal for tuna tagging. However, the WPT strongly encourages Iranian scientists to undertake a pilot tagging project in their waters.

### **Pilot or small scale tuna tagging programme in Yemen**

New information on the Yemen tuna fishery, indicates that more than 30 000 t of tuna is caught every year. Moreover, the fishing techniques used in this area, small pole and line (similar to the Maldivian techniques) should enable tagging to be carried out. Yemen (in the Arabian Sea) is potentially a very important tagging area, and should be a suitable place to implement a small scale tuna tagging project.

IOTC signalled its intention to send one of its staff members to Yemen soon to evaluate the feasibility of organizing a tagging programme in the Yemenite waters. The WPT supported this intention.

### **Small-scale tuna tagging programme in South African waters**

South Africa, given that it lies between the Atlantic and Indian Oceans, should be a very good place to tag tunas and obtain some high value data. However, the WPT noted that the pole and line fishery is active only in the Atlantic Ocean, and a project in the Indian Ocean would involve the expense of chartering a boat from the Atlantic to work in the Indian Ocean. An alternative means of obtaining information from South African waters could be through the cooperation of sport, artisanal and semi-industrial fishermen.

## **Conclusion**

The WPT recognised with satisfaction the progress and implementation of the pilot and small-scale programmes over the last year, and encourages this work to continue, and for National scientists to explore new tagging opportunities in the Indian Ocean. Furthermore, the WPT indicated its willingness to assist in the review of any new proposals for such work.

Table 1. Description of past and present projects related to or associated with IOTTP.

Projects	Type	Dates	Main goals	Gear
Evaluation des potentialités de marquage à Mayotte	Pilot project	May 2002	Assess the possibility of undertaken a pilot project around Mayotte (Comoros) to tag medium and large YFT	Handline / Troll-line / Longline
IOTC tuna tagging consultancy in Seychelles	Pilot project	October 2002 March 2003	Test the possibility of tagging in the Seychelles waters using small longliners as platforms and using several fishing techniques	Handline / Troll-line / Longline
IOTC tuna tagging consultancy in the Sultanate of Oman	Pilot project	March 2003	Test the possibility of tagging the medium size YFT in the Omanese waters.	Handline
NRIFSF	Pilot project	January – March 2004	Tag 2000 tunas (600 YFT, 1200 SKJ, 200 BET) in the EIO	Troll-line / Pole and line / Rod and Reel / Longline
SEAFDEC	Small-scale project	November – December 2003	Tag 1000 tunas using a purse-seiner in the EIO	Purse-seine
Programme de marquage à petite échelle à Mayotte	Small-scale	March – June 2004	Tag 400 medium and large size YFT around Mayotte during the fishing season using the fishermen's boats	Handline / Troll-line
Small-scale project in the Republic of Maldives	Small-scale project	August 2004	Tag 5000 tunas around Maldives north atolls to analyse interactions with the PS fleet	Pole and line
TAGFAD	Associated	October 2003	Tag with archival tags 200 tunas around drifting FADs to study the behaviour of tunas around floating objects	Troll-line
FADIO	Associated	2004 -2006	Tag with sonic and archival tags tunas around artificial drifting and anchored FADs to study the behaviour of tunas around floating objects	Troll-line

Table 2 : Releases and recoveries made during the different projects undertaken under or associated with the IOTTP.

Project	Species	Release of tagged fish	Recovery of tagged fish	Reporting rate
Mayotte Pilot	YFT	15	3	20%
	SKJ	3	0	0
	BET	1	0	0
	<b>Subtotal</b>	<b>19</b>	<b>3</b>	<b>15,78%</b>
Seychelles	YFT	13	0	0%
	SKJ	1	0	0%
	BET	1	0	0%
	<b>Subtotal</b>	<b>15</b>	<b>0</b>	<b>0%</b>
Oman	YFT	0	0	0%
	SKJ	0	0	0%
	BET	0	0	0%
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>0%</b>
Japanese	YFT	20	0	0%
	SKJ	572	0	0%
	BET	23	0	0%
	<b>Subtotal</b>	<b>593</b>	<b>0</b>	<b>0%</b>
SEAFDEC	YFT	930	1	0,1%
	SKJ	70	0	0%
	BET	0	0	0%
	<b>Subtotal</b>	<b>1000</b>	<b>0</b>	<b>0%</b>
Mayotte Small-scale	YFT	101	22	21,78%
	SKJ	3	0	0%
	BET	0	0	0%
	<b>Subtotal</b>	<b>104</b>	<b>22</b>	<b>21,15%</b>
Maldives	YFT	13	0	0%
	SKJ	186	0	0%
	BET	0	0	0%
	<b>Subtotal</b>	<b>186</b>	<b>0</b>	<b>0%</b>
TAGFAD	YFT	48	1	2,08%
	SKJ	0	0	0%
	BET	18	0	0%
	<b>Subtotal</b>	<b>66</b>	<b>1</b>	<b>1,15%</b>
FADIO	YFT	11	0	0%
	SKJ	1	0	0%
	BET	2	0	0%
	Other	54	0	0%
	<b>Subtotal</b>	<b>68</b>	<b>0</b>	<b>0%</b>
<b>TOTAL</b>	<b>YFT</b>	<b>1151</b>	<b>27</b>	<b>2,35%</b>
	<b>SKJ</b>	<b>836</b>	<b>0</b>	<b>0%</b>
	<b>BET</b>	<b>45</b>	<b>0</b>	<b>0%</b>
	<b>Other</b>	<b>54</b>	<b>0</b>	<b>0%</b>
	<b>TOTAL</b>	<b>2086</b>	<b>27</b>	<b>1,29%</b>

## 6. THE ISSUE OF LIVE BAIT IN THE EASTERN AND WESTERN INDIAN OCEAN

### New elements in the various potential areas: Indonesia, Maldives, India (Lakshadweep), Chagos, Seychelles, Oman, Kenya and Tanzania, Madagascar

Recent information from Yemen indicates that good catches of yellowfin are being taken by handline and gillnet, and apparently there is some potential for bait resources. While Yemen is open to collaboration, there could be some security issues that need to be addressed. The IOTC Secretariat indicated it proposes to send some staff to Yemen to investigate their tuna fisheries.

Oman, presents a similar situation in term of tuna and bait availability, and it could be an alternative to Yemen.

Madagascar has potential in terms of bait and tuna resources (as proven in the 1970's by the Japanese pole-and-line fishery). However, most of the bait species are quite fragile, and this would limit the duration of trips at sea.

The coasts from the north of Mozambique to the south of Kenya apparently offer many bait opportunities, but the range of species, and their respective hardiness and quantities have yet to be evaluated.

Obtaining bait and permission to fish tuna off Chagos should be relatively straight forward — with the exception of the areas near the navy bases.

Lakshadweep and Maldives have the potential to be good sources of bait as they have very active artisanal pole-and-line fisheries that use local baits. Two small-scale tagging operations will soon be conducted in these two countries under the auspices of IOTC (the one in Maldives will start in August 2004) using local boats fishing near shore. As the RTTP vessels will be tagging in the offshore areas of Indian/Maldives waters (beyond the reach of the local boats), these countries should be approached to determine if purchasing bait from the local fishermen is possible. While some of the main bait species (*Spratelloides gracilis* and *Encrasicholina heteroloba* — Document IOTC-2004-WPT-03) are known to be fragile (*i.e.* are unlikely to survive handling and transportation offshore), other bait species available in the Maldives, such as Caesionidae, may be more robust. In the Maldives, there are few bait holding facilities, although some fishermen are known to keep bait overnight inside their nets for use the next day (almost all trips are day trips).

In addition to Lakshadweep, other areas along the Indian coast might also be able to provide a source of bait for the RTTP. The WPT encouraged Indian scientists to assist on this matter by making available any information on the availability of potential baits (species, sizes, seasons, areas and abundance). If bait prospects along the Indian coast look good, then it could be beneficial for the RTTP vessels to have direct bait fishing and tuna fishing rights all along the Western coast of India and in the offshore area of Lakshadweep.

Considering the uncertainties surrounding the bait availability, the WPT recommended that the IOTC organize a bait expert to prepare a report on the potential of the different bait species available in the region (as soon as possible).

### **Capture and stocking of live baits around Seychelles and in other areas.**

There is no live bait fishery in Seychelles; however, various experiments on bait and pole-and-line fishing in Seychelles have been well described (*e.g.* Cort, 1982, Stequert, 1982).

With support from the Spanish Government, the Seychelles Fishing Authority and the IOTC plan to survey the availability of baits from the Seychelles; firstly for the local longline fishery (to reduce the need to import foreign frozen baits), and secondly for the RTTP vessels. This is a three-month project, using the expertise of a Spanish master-fisherman. The fishing gear needed (nets, sonar, baitfishing equipment, lights, etc) and vessel chartering fees are being funded by the IOTC following a 2003 WPT recommendation. The project is on hold at the moment due to implementation delays arising from the change of Government in Spain.

Document IOTC-2004-WPT-12 describes the Seychelles FADs project funded by IOTC. The main objective of this project is to set FADs around Seychelles Plateau off the Mahé coast to attract small fish that can be used as bait. The first operation was started in 2003 with four FADs made of local materials. However, the FADs soon disappeared — either lost at sea or stolen. New FADs were built with a stronger design (the first metre of rope was replaced with a chain) and three of these FADs were put in place in 2004. In addition to attracting baits, the project aims to attract some larger pelagic fish such as dolphinfish for local fishermen. To-date, small aggregations of baits and dolphinfish have been observed. A submerged FAD has also been set up but with the same results so far. Diving and monitoring is still continuing. The WPT thanked SFA for their efforts and strongly encouraged them to continue with this work.

If the FAD experiments are successful and the bait surveys are positive, then IOTC envisages that bait holding cages could be set up to stock bait for the RTTP vessels. This would build on the cage project work undertaken with ARDA (presented to the WPT in 2003).

Overall, the WPT was encouraged by this work, but noted that the boats for the RTTP vessels should arrive before the end of 2004 and the above trials and surveys will not have been concluded by this time.

### **Live bait farms.**

Another possibility that was raised to overcome some of the difficulties in bait availability was to obtain some bait from fish farms. This idea is based on the use of *Chanos chanos* in some Asian longline fisheries and in some tagging operations conducted by SPC in the Western Pacific. Some preliminary information on the potential of farm fish in Mayotte was obtained during a mission of IOTC consultants to Mayotte in May 2003 (Hallier *et al.*, 2003). The infrastructure is still active and, apparently, it should be relatively straightforward to organize farm-reared bait from Mayotte (*C. chanos*, from seed imported from Taiwan). The WPT recommended that IOTC should obtain a quotation for purchasing *Chanos* from Mayotte.

### **Accessibility of live boats to participating countries.**

There are two different ways for the RTTP vessels to gain access to live baits. The first, and probably the most plausible, is to obtain access rights to fish for bait in the coastal waters of the participating countries. The other way is to purchase bait from local fishermen.

It should be stressed that it will almost always be more efficient (especially in terms of maintaining bait survival rates) for vessels to catch their own supplies of baits. This option would require that the boats have the legal rights to anchor near coasts to fish for bait, then for tunas in the adjacent offshore waters (EEZ).

The necessary steps to do this should be started quickly as it will take time to develop the agreements. The WPT recommend that negotiations with the countries concerned be started by IOTC (as opposed to the Chief Coordinator) as soon as the RTTP vessels have been identified.

### **Artificial bait.**

Document IOTC-2004-WPT-INF03 provided information on trials of artificial bait produced by a Japanese company. When thrown into the sea, the baits sink, and a starch pencil-shaped section is freed and 'swims' to the surface. Trials were conducted from baitboats but in conjunction with livebait, consequently it was difficult to ascertain the efficacy of the baits. However the baits are apparently being used on some purse seiners (in the absence of a FAD) and have maintained tuna schools at the surface. Artificial baits may help reduce the use of live bait. WPT recommended that Japan investigate the possibility of donating several hundred thousand artificial baits to the RTTP for use in trials.

### **Conclusion and recommendations to ensure availability of live bait for baitboats**

The availability of bait is a major constraint to any large-scale tagging operation. This is of particular concern for tagging operations in the Indian Ocean where bait resources are not well known and, unfortunately, also appear to be scarce. The WPT supported the actions taken by IOTC to collaborate with different parties to tackle this important problem. The WPT supports any actions that can help to improve bait availability to the RTTP vessels.

## **7. CURRENT SIMULATIONS AIMING AT DEFINING A PLAN FOR THE LARGE SCALE TAGGING OPERATIONS**

In response to recommendations from the WPT in 2003, two simulation models have been developed to assist in the design of tagging schedules and evaluation of schedule alternatives when logistical problems arise (such as problems in the availability in bait in certain areas or very low reporting rates).

A spatially disaggregated and age-structured model was described in document IOTC-2004-WPT-09. It is based on a population model using seven regions, four fisheries and four time periods. The model has been applied to the yellowfin fishery and will be extended to the two other species in the future. Thirty four age classes are taken into account in each quarter. A transition matrix is used to represent movements, which are restricted to occur between two adjacent zones. While movement

rates (coefficients of the matrix) are fixed and seasonal movements are not modelled, the coefficients can be changed to test various assumptions of movement. Stochasticity is incorporated at various levels in the model (growth, natural mortality, movements). The model is tuned by comparing the predicted age-distributions by zones and fishery to the observed ones. Once a satisfactory parameterization has been achieved, the model is used to compare tagging scenarios in terms of how well the simulated tagged population mixes with the untagged population.

The WPT acknowledged that the work undertaken had been substantial and should provide interesting outputs. The WPT noted that it is difficult to validate distributions and movements of yellowfin in the Indian Ocean given that the paucity of movement data at this stage. It was suggested that seasonality be incorporated in the model because this is a well known characteristic of tropical tuna fisheries in the Indian Ocean. And that some zones be split to obtain a finer spatial resolution (*e.g.* zones 2 and 3 could be split into east and west regions) — to better reflect how tagging is likely to be conducted. The WPT also suggested that other outputs parameters useful to a tagging operation (in addition to measures of tag mixing within the untagged population) be identified and tested.

An environmentally driven advection-diffusion-reaction model coupled with a spatialised statistical stock-assessment model was described in document IOTC-2004-WPT-14. This model has been further developed and applied to the skipjack stock since it was first presented to the WPT in 2000 (Document WPT-00-02). It will be extended to the two other tropical stocks in the next few months.

The framework includes three components to simulate tag-recapture scenarios of tunas in the Indian Ocean. The simulation component estimates fishing effort distributions of the fleets by location and time, and recovery rates (by location and time) for various tagging plans. This component uses an advection-diffusion-reaction model in which fish movements are driven by mean observed sea surface temperature, dissolved oxygen concentration, prey distribution and marine currents. Other environmental inputs can also be used. The model has a one degree spatial resolution and a one day time step. It is tuned using known fish distributions and observed catches.

The second component uses bootstrap techniques to incorporate stochasticity into the results and estimate confidence for recovery data sets for a given tagging scenario.

The third component, the observation component, uses an age-structured compartmental spatial stock-assessment model and simulated tagging data to estimate the parameters such as rates of movement, natural mortality and catchability by fleet and areas. This enables tagging scenarios to be compared.

Preliminary results of tagging scenarios based on the European purse seine fleet, seasonal distribution, catches and size frequencies (of the three species), as well as potential constraints such as the availability of bait in various regions were presented.

The WPT noted that the fine-scale spatio-temporal resolution of the model may assist the analysis of data from fish that are re-captured soon after tagging. This may happen when the tagging vessels operate close to the PS fishing fleet.

The WPT gave feedback on ways to improve the modelling approach and suggestions of new potential tagging scenarios to be tested.

A small working party was formed to identify the types of operational questions that are likely to arise during the RTTP and, therefore, the types of outputs expected from the above simulation models. The report from this group is provided in Appendix IV. The working party anticipate that the following questions (either specifically or generically) are likely to be asked during the RTTP:

- What are the consequences of bait being available only in the Mozambique Channel ?
- What are the consequences if longline reporting rates are very low ? (for example what is the value of tagging large fishes in this case ?)
- How important is to tag in Somalia ?

- At what stage in the Somalia fishing season should tagging take place ?
- What results might be expected from tagging medium-sized fishes in the Arabian Sea ?
- What are the advantages of tagging small and large YFT off South Africa ?
- What interactions are there likely to be between the purse seine and longline fisheries ?
- Should tagging be attempted simultaneously in Somalia and Maldives ?
- Where should tagging take place so estimates of transfer rates between eastern and western Indian Ocean can be made ?
- Should the tagging boats work together to tag a lot of fish in several areas, or work separately to tag fewer fish but cover a larger number of areas ?
- What will happen if tagging is based on PS CPUE's compared to catch distributions ?

The small working party recommended that IOTC provide funds to support the ongoing development of the models.

The WPT acknowledged that testing of the models is problematic as there are few available data on the distribution and movements of the tuna species. The WPT recommended that both models be expanded to include the three tropical tuna species; incorporate reproductive migrations of YFT, and take into account environmental conditions in deep waters that influence BET distribution and movements.

For a better estimation of movement parameters, the group also recommended that, as far as possible, tagging be undertaken in the core of the populations distribution (to achieve a better estimation of diffusion coefficient) and in peripheral zones where stronger environmental gradients seasonally occur (to achieve a better estimation of advection coefficients).

The WPT noted that tagging for the RTTP could begin in early 2005 and it would be useful to have some simulation tools before this time. The WPT noted that the models were in the early stages of development and encouraged the researchers to continue their work, to take note of the above questions and change their models where necessary to be able to answer such questions. The WPT also recommended that the researchers should work collaboratively to expedite the development of the models.

## **8. FINALISATION OF THE TUNA TAGGING MANUAL**

Document IOTC-2004-WPT-INF01 described the Maldives Tuna Tagging Manual used to support the tagging operations conducted in Maldives. At the request of the WPT in 2003, this document was updated. It now provides an overview of the preparation and implementation of tagging in Maldives, and contains information on otolith extraction and how to distinguish between juvenile yellowfin and bigeye (IOTC-2004-WPT-01b). The WPT acknowledged the excellent work that went into preparing the manual and its timely release — in time for the commencement of a new tagging programme in Maldives.

Document IOTC-2004-WPT-INF02 is the IOTC Tuna Tagging Manual that describes the techniques of dart tagging and program requirements in respect to vessels, fishing gear, tagging equipment and data recording. It covers a range of tagging methods including the deployment of electronic tags (sonic, archival and pop-up). There is also a reward and publicity section. The WPT now considers this document to be the major reference document for all IOTC tagging operations. The WPT also recommend that experiences and information from other relevant tagging initiatives such as the Maldivian tagging, purse seine tagging, as well as tagging in sport fisheries be included in the manual in the future.

The WPT noted that the manual is soon to be published and recommended that it be disseminated to all the countries involved in the tagging programs.

## **9. STATUS OF THE PROJECTS RELATED TO THE IOTC TAGGING: TAGFAD AND FADIO**

TAGFAD (Document IOTC-2004-WPT-07) is a €380 000 project funded by EU-DG-FISH with the financial and technical support from Spanish and French purse seine boat owners. The objective is to study yellowfin and bigeye tuna behaviour around FADs using archival tags. This a joint programme between IRD, IEO and AZTI with the collaboration of SFA, IOTC and CSIRO. 210 archival tags have been purchased from Wildlife Computers. The first cruise was undertaken in October 2003, but there were difficulties catching tunas associated with FADs with the fishing gears available (troll line and handline mainly) — especially large-sized tuna that are preferred because the archival tags are large. In total, only 16 tunas were released with archival tags and 50 with dart tags. To-date, only one yellowfin with an archival tag has been recaptured (23 days after being tagged). The data from the tag has been down loaded and has provided useful information on the behaviour of the fish.

Some of the remaining tags will be used during an experimental cruise planned for September - December 2004 by SFA around Seychelles (when it is hoped to capture some large yellowfin and bigeye). The left over tags will be made available for the large-scale tagging programme, for tagging fish associated with FADs (as per the EU-DG-FISH objectives).

FADIO is a project funded by EU-DG Research for the period 2003-2006. Its main objectives are to study the behaviour of tuna and other fish (*e.g.* dolphinfish, shark, wahoo) around drifting FADs and to design an electronic FAD that will monitor the abundance of fish around it. Two campaigns have already been completed in 2003 and 2004, and more campaigns are planned. This project is also complementary to the 'Smart FAD' project of PFRP in Hawaii (anchored FADs), to TAGFAD and IOTTP.

The first two surveys involved long-range sonar, echosounder and visual underwater observations. Passive acoustic data and environmental data (CTD) were also recorded. Acoustic tagging was performed during the last cruise (Feb 2004), with a total of 37 fish were tagged (10 YFT, 2 BET, and dolphinfish, wahoos, sharks) on two FADs. Listening stations have been attached under these FADs to detect the presence of tagged fish. The first data have been collected, but unfortunately, the two FADs could not be recovered as they apparently drifted too far eastward. The next cruises will use new prototypes of ARGOS listening stations, and a buoy equipped with an autonomous sonar.

Data collected from listening stations in the Hawaii project showed that the residence time of individual tunas at moored FADs can range from a few hours to up to 3 months. FADIO will examine if this pattern is similar on drifting FADs.

The sonar and echo sounder data indicates that small fish (<60 cm) tend to stay close to the FADs, while larger fish appear to stay further away (up to 500-800 m from the FADs).

Considering the high complementarity between FADIO and IOTTP objectives, FADIO is requesting the support of IOTC for the purchasing of 60 sonic tags (US\$18 500).

The WPT noted that the FADIO project is studying fish behaviour around FADs and this effort should not be duplicated within the RTTP. A strong relationship between IOTTP and FADIO is encouraged.

## **10. A POLICY FOR ARCHIVAL TAGS IN THE IOTTP**

### **Possible priority given to archival and *pop-up* tags**

A major objective of the RTTP using conventional tags is to provide data that ultimately improves the level of confidence in tropical tuna stock assessments. However, the estimation of some of the input parameters can greatly benefit from data provided by archival or pop-up tags. In particular, the new process and habitat based models require data on vertical behaviour, environment preference and

movement of tuna. The WPT noted that electronic tags are capable of providing such information, but to obtain a useful amount of data, it will be necessary to tag more than the 200 fish planned in the RTTP. Furthermore it is necessary to clarify what information is required as sonic, archival and pop-up tags provide different range of data possibilities.

### **What species, size and tag locations should be targeted**

Yellowfin and bigeye are to be the target species for electronic tags. Skipjack will not be targeted. Archival and pop-up tags are large so their use is limited to medium to large sized fish.

Mayotte and Coco de Mer seamounts are considered to be good places to deploy archival tags, especially on yellowfin, as high recovery rates can be expected. In the absence of large-scale tagging in the eastern Indian Ocean, pop-up tags may provide the best opportunities for getting information on the west-east movements of tunas. Maldives with an already well organized tagging infrastructure is also a good candidate for the deployment of electronic tags.

Some WPT members thought that the development of an electronic tagging program would benefit from the information expected to be obtained from the first phase of RTTP recoveries. However, other members felt that electronic tagging should be implemented as soon as possible — especially to take advantage of the RTTP infrastructure (2 vessels for 2 ½ years, with experience tagging crew, a well publicized campaign).

The WPT proposed that a task force should prepare, before the next Scientific Committee meeting, a detailed and well justified plan for an electronic tagging program — including a budget and a description of the expected outputs. It is envisaged that such a plan could be used to attract funds to expand the deployment of these tags in the near future.

### **Optimal number of tags**

The WPT noted that the planned deployment of 200 electronic tags in the RTTP is insufficient and at least 1000 tags should be deployed. The WPT acknowledged, however, that the costs associated with this number of tags (about €1000 000) and the corresponding rewards for their recovery were prohibitive within current budgets.

## **11. OPTIMISING TAG RETRIEVAL**

The WPT concurred that the success of a tagging programme should be measured by the number of tags recovered and the quality of the data obtained, not merely by the number of fish tagged. To achieve a good return rate of tags, an effective publicity campaign and a well organized tag collection and reward delivery system is necessary.

### **Possible new guidelines (Document IOTC-2004-WPT-INF04)**

A reward system should provide for an immediate payment of the reward to the finder. It has been agreed that a reward will consist of a T-shirt, a cap or cash. The amount of the cash reward will be fixed according to the cost of living in each country. For instance, in Seychelles, the reward will be Rs 50 (US\$ 8) for a dart tag and Rs 300 for an archival tag. Some WPT members were concerned that the reward for electronic tags was too low given their cost and the high value of the information they provide. The WPT recommended that the reward amount for electronic tags be reconsidered.

The WPT strongly recommend that the IOTC and RTTP work with correspondents, boat owners and the cannery staff to obtain information on the destination of catches. At the Seychelles cannery, fish can be traced back to a particular vessel.

The Seychelles cannery's reward policy is that no money rewards are provided inside the cannery. For the stevedores in Seychelles, rewards will be given to a team not on a personal basis. Other incentives could be a reward for the team reporting the most tags. Lotteries will be organized yearly.

The various reward and incentive schemes will have to be monitored very closely to determine whether they are having a negative impact on tag returns.

## **Low tag returns rates from longliners**

Return rates from large, deep-freeze longliners have been low in most tagging projects. It was noted that the most effective method for estimating reporting rates from longline vessels requires observers on the vessels. And unless observer programs are established for the longline fleets, or other methods developed, the data from longliners will be incomplete.

The WPT noted that in ICCAT, 10 % observer coverage on longliners is mandatory, but this is not the case in the Indian Ocean. WPT also recalled that CCSBT requires observer coverage from its participants fishing for SBT in the Indian Ocean; however, SBT is fished in only a small area of the Indian Ocean. An effective observer programme for BET and YFT on longliners the Indian Ocean could only be set up if the IOTC adopted a regulation to do so.

WPT recommended that the IOTC contact CCSBT and ask them to encourage their observers to assist in the return of tags to the RTTP.

The WPT also recommended that the Scientific Committee should consider the implementation of an observer programme on board longliners working in the tropical Indian Ocean in order to improve the level of recaptures.

## **Prize draw and other incentives**

As noted above special prizes and lotteries need to be organized to encourage the return of recaptured tunas and associated data. The WPT noted that this will be the responsibility of the tag recovery and publicity officers recruited within the Project Management Unit of the RTTP.

## **New 2004-2005 publicity campaign**

Noting that a lack of publicity was probably a major cause of the poor recapture rates experienced by the SEAFDEC tagging operation in the Eastern Indian Ocean in 2003, and the 2004 seeding experiment started in Seychelles, the WPT agreed that publicity campaign's need to be developed as soon as possible.

The first batch of Indian Ocean Tuna Tagging Programme T-shirts has been received by the IOTC. Some WPT members indicated that they would investigate alternative sources for producing the T-shirts.

## **IOTTP logo and posters**

IOTTP posters written in different languages of the region were displayed at the meeting and supplies of posters are beginning to be distributed.

## **Tag retrieval in the region's ports**

The WPT recalled that only about one-third of the purse seine catch is unloaded in Victoria, Seychelles. The remaining catch is either transhipped in Seychelles or in other ports (Antsiranana, Maurice, Mombasa, etc..). Retrieving tags from Mombasa's port may be problematic as it a private port and not easily accessible.

The WPT reiterated that, as much as possible, a return should consist of the actual fish and its tag.

The WPT recommended that when receiving logbooks, SFA staff should ask if any tagged fish have been found. This question should also be asked by the IOTTP national correspondent or its representatives at all the unloading ports or calling ports used by purse seiners and longliners.

Furthermore, national statistics should include the final destination of the catch.

## **Tag retrieval in canneries**

The management of the Seychelles cannery will give instructions to their staff that all tagged fish will have to be declared, and put aside for collection by RTTP staff. The WPT noted that lower returns could be expected from those operations that distribute their tuna to a number of different

small canneries (this occurs in Spain and Thailand). In Thailand, tuna canneries are located in different areas of the country, such as Bangkok and its adjacent area, and Songkhla and Phuket Provinces.

In Mauritius, the infrastructure of the Albion Fishery Research Centre has proved in the past (PTR project) its ability to conduct a retrieval tag system in Port Louis. The retrieval of recaptures from canneries will be important and be the responsibility of the RTTP tag recovery and publicity officers.

### **Conclusions on optimising tag retrieval**

The IOTC Secretariat stated that all recapture data are confidential and will never be used in any way against a skipper or a boat owner.

The WPT strongly supports the work of IOTC to maximise tag and data retrievals.

## **12. ESTIMATION OF RECAPTURE RATES OF TAGGED TUNA**

### **Seeding operations from purse seiners by observers**

Seeding experiments have been carried out in which dead tunas are tagged at sea then put into fish holds to get an estimate of the levels of return rates one might expect following processing (unloading / transshipping / processing in canneries). An experiment was conducted in March 2004 under the EU observer programme monitoring purse seine by-catch. Five tagged tunas were seeded in the holds of a purse seiner by an AZTI observer (SKJ, YFT, BET, king mackerel). The vessel unloaded its catch onto a reefer but no tags were recovered.

As the EU observer programme is on-going, seeding experiments will continue. While noting that not all fleets may be tested (for example, observer coverage of French vessels has not yet been implemented), the WPT recommended that the number of seeding experiments should be increased. To this end, the use of crew members or skippers to do the seeding should be investigated. The WPT noted that industry participants might need to be dissuaded from colluding with their stevedore colleagues in order to obtain the reward by deceit.

Tags used in seeding experiments should have a strong anchor. The IOTC Secretariat has investigated the use of PIT tags, but these tags are currently not feasible because the PIT detection range is too low.

Overall, the WPT strongly recommended that all observers on vessels should routinely (following IOTC procedures) undertake seeding experiments and calculate factory retrieval rates.

### **National correspondents activities**

National correspondents have begun to be identified. These people will assist the tagging program with in-country publicity, and to a lesser extent tag returns, data handling and issuing of rewards (see Document IOTC-2004-WPT-INF04). It was recalled that the activities of the national correspondents are considered as a National contribution by the member countries to the RTTP.

The WPT recommend that IOTC should closely oversee the choice of the national correspondents and the definition of their responsibilities.

### **Double tagging rates**

The WPT reiterated its belief that double-tagging rates should not restrict overall tag release numbers but should be conducted to a level that will allow robust estimates of taggers, species and size specific shedding rates.

## 13. OTHER ISSUES

### Additional data to be collected during tagging campaigns

The WPT recognised that two RTTP vessels operating in the Western Indian Ocean for 2 ½ years provides a rare opportunity to collect a wide range of data and recommends that as much as possible, full use of the data collecting opportunities be made. The WPT noted however, that any additional activities should not in any way jeopardize the main tagging objective of the RTTP.

A range of environment data could be collected, including thermo-profiles of the surface layers using XBT; currents using ADCP, and acoustic data recorder (echo-sounder) to detect the deep scattering layer. While the terms of reference for the two vessels include provisions for such data to be collected, the exact data collecting capabilities of the vessels are not yet known. Once the RTTP vessels have been identified, scientists can give their feedback on what data might be collected (with existing equipment, or new equipment if extra funds can be found).

Each RTTP vessel will be able to accommodate an extra scientist. These 'extra' scientists will be able to bring whatever equipment they require for their research as long as it does not disrupt the tagging operations. While each research proposal will be evaluated on its merits, research projects directly related to the objectives of the tagging project will have priority.

### Management and analysis of tagging and recapture data; online access to the tagging files for national correspondents

Data will be available to all scientists according to the procedures described in the 2003 WPT report.

Given the great importance of analysing the tag data from the RTTP, the WPT strongly recommended that funds to enable the participation of postgraduate students from participant countries (especially developing countries) should be encouraged. This recommendation is particularly oriented towards financing students' internships, PhDs or post-doctorate contracts for young scientists from the countries involved in the RTTP.

IOTC scientists and especially those from developing countries should be involved as much as possible in the analysis of the data. All publications produced using the IOTTP data should be cleared through the IOTC and the PMU, and they should clearly acknowledge the contribution of the IOTTP.

Historical tagging data should be made available to the IOTTP database.

### FINSS Database is ready (formerly known as WINTUNA)

The FINSS (Fisheries Integrated Statistical System) database is functioning. The WPT recommended that these data be made available in various forms in a website.

### Sport fishery tagging

Tag recoveries from sport fishery tagging programmes have provided useful information, *e.g.* on long distance migrations. The WPT recalled its discussions in 2003 and agreed that tagging by sports fishers should be encouraged in a few selected localities only, at the moment. For example, localities where tagging of tuna and billfish has already been conducted for some time (*e.g.* South Africa, Australia, Seychelles and Mauritius), or areas with possibilities for tagging fish that cannot be tagged in any other way (*e.g.* medium-sized yellowfin off Tanzania or Oman). Although some sports fishers sell their catch (*i.e.* it is an important source of income), compensation should not be paid for fish tagged and released since this might encourage claims for compensation without tagging. One approach that has proved successful in the Pacific was to make use of sports fishing operations with dedicated visits by a programme tagging team led by a fisheries scientist. This could allow relatively large numbers of fish to be tagged under specific protocols.

### Future activity of the WPT

The WPT recommend the formation of a small group of four to five people to act as an advisory task force to the IOTTP.

The future of the WPT was briefly discussed and it was decided that this matter should be addressed by the Scientific Committee.

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**APPENDIX II – AGENDA**

- 1- Opening of the meeting and adoption of the agenda
- 2- Status of the “tagging” funds available at the Secretariat
- 3- Status of the EU-DG-DEV funded project
- 4- Perspectives for large scale tagging in the Eastern Indian Ocean
- 5- Status of the pilot and small scale tagging activities currently ongoing in the Eastern and Western Indian Ocean, and developments planned/recommended for late 2004 and 2005.
- 6- The issue of live bait in the Eastern and Western Indian Ocean
- 7- Ongoing simulations implemented to plan future large scale tagging
- 8- Completion of the tuna tagging manual
- 9- Status of the projects related to IOTC tagging: TAGFAD and FADIO
- 10- Guidelines for archival tagging in IOTTP
- 11- Optimization of tag retrieval
- 12- Evaluation of tagged tuna recapture rates
- 13- Other issues

## APPENDIX III – LIST OF DOCUMENTS

DOCUMENTS	TITLES
IOTC-2004-WPT-01	A Collaborative Tuna Tagging Program of the West Coast of Sumatra, Indonesia: A feasibility Investigation and an initial operational plan. <i>Craig Proctor, Kusno Susanto and Tom Polacheck</i>
IOTC-2004-WPT-02	Results of feasibility experiment for tagging in the eastern Indian Ocean by Japan using No.2 Taiken-Maru. <i>Hiroaki Okamoto, Mike Ogura and Tsutomu Nishida</i>
IOTC-2004-WPT-03	Status of the Maldives Pilot Tuna Tagging Programme (December 2003 – June 2004). <i>M. Shiham Adam</i>
IOTC-2004-WPT-04	Pilot and Small-scale Tagging of Tropical Tunas in the Indian Ocean. 2003 Project Revised for the European Community. <i>IOTC Secretariat</i>
IOTC-2004-WPT-05	Reinforcing the regional management of tropical tunas through an integrated research programme. <i>IOTC Secretariat</i>
IOTC-2004-WPT-06	Devis Programme de Démarrage. Financial plan. 01/08/04 – 31/12/04. <i>IOTC Secretariat</i>
IOTC-2004-WPT-07	Achival tagging operations within Tagfad programme in the Western Indian Ocean. <i>Jean-Pierre Hallier</i>
IOTC-2004-WPT-08	Pilot And Small-Scale Tagging Of Tropical Tunas In The Indian Ocean. Project Proposal For Japan. <i>IOTC Secretariat</i>
IOTC-2004-WPT-09	A Spatiallydisaggregated and age structure model for simulating the design og the Indian Ocean Tuna Tagging Experiment. <i>M. Shiham Adam</i>
IOTC-2004-WPT-10	Present status of IOTC pilot project on tuna tagging in Indian Waters. <i>V.S Somvanshi</i>
IOTC-2004-WPT-11	Summary of Tagging operations in the Indian Ocean. Pilot and Small-scale Tuna Tagging Programmes. <i>IOTC Secretariat</i>
IOTC-2004-WPT-12	Coastal Aggregating devices around Mahe Island (Seychelles) to increase live bait catchability. <i>R. Aumerruddy, V. Lucas and B. Wending</i>
IOTC-2004-WPT-13	Small scale tuna tagging program in Mayotte Island. Tagging results realized from 22 <sup>nd</sup> March to 21 <sup>st</sup> June 2004. <i>Johanna Herfaut and Olivier Abellard with the collaboration of Jean-Pierre Hallier and Bertrand Wending</i>
IOTC-2004-WPT-14	Simulation of tag-recapture experiments in the Indian Ocean: A habitat based model applied to the Skipjack population. <i>Caroline Gamblin, Olivier Maury, Alain Fonteneau, Jean-Pierre Hallier</i>
IOTC-2004-WPT-15	Tuna Tagging Program in the Eastern Indian Ocean by Tuna Purse Seine; MV SEAFDEC. <i>Anurak Loog-on, Sayan Promjinda, Sutee Rajaruchithong, and Somboon Siriraksophon</i>
IOTC-2004-WPT-INF01	Maldives Tuna Tagging Manual. <i>R. Charles Anderson, M. Shiham and Ali Waheed</i>
IOTC-2004-WPT-INF01b	Maldives Tuna Tagging Manual Illustration. <i>R. Charles Anderson, M. Shiham and Ali Waheed</i>
IOTC-2004-WPT-INF02	IOTC Tuna Tagging Manual Tropical Tuna fisheries. <i>Jean-Pierre Hallier</i>
IOTC-2004-WPT-INF03	Indroduction to the artificial baits: Effective for the IOTC tagging project? <i>Wataru Fujii, Shogo Sugiura, Akiyoshi Hosokawa, Jean-Pierre Hallier and Tom Nishida</i>
IOTC-2004-WPT-INF04	List of things done since last meeting (June 2003). <i>IOTC Secretariat</i>

## APPENDIX IV – REPORT FROM THE SMALL SUBGROUP DISCUSSING SIMULATION MODELS

A small subgroup met separately to precise the tagging scenarios to be tested and to help improving the realism of both simulation models. The subgroup agreed that a tagging scenario basically corresponds to one question or to a problem to be tested. Several questions were asked to help defining alternative scenarios :

- What will happen if bait is only available in the Mozambique Channel ?
- What will happen if longline reporting rate appears to be very low ? What is the value of tagging large fishes in this case ?
- How important is to tag in Somalia ?
- What is best : tagging at the beginning or at the end of the Somalia fishing season ?
- What will bring tagging medium fishes in the Arabian Sea ?
- Is it useful or not to tag small and large YFT off South Africa ?
- Is there a better scenario to estimate interactions between ps and bb ? Shall we try to tag simultaneously in Somalia and Maldives ?
- Where should we tag to estimate transfer rates between eastern and western Indian Ocean ?
- Should the tagging boat work together (*i.e.* release more tags but in the same areas) or work separately (*i.e.* release less tagged fish but in a larger number of areas).
- What will happen if tagging boats follow the ps CPUE distribution instead of following the catches distribution ?

The problem of parameterizing the stock distribution in the eastern part of the Indian Ocean in the case of the simpler compartment model has been raised since little information is available in those zones. The more pragmatic way to proceed is probably simply to remove those zones from the analysis.

All the scenarios developed by the two modelling groups are based on tagging with a single boat. The subgroup recommended to take advantage of the fact that two boats will be available for tagging in implementing scenarios were the two boats are working independently.

A boat could for instance follow the purse seiners fishing zones when the other could stay 6 months in the Mozambique Channel and the other 6 months at the Coco de Mer seamount.

For a better estimation of movement parameters, the group also recommended that, as far as possible, tagging be undertaken in the core of the populations distribution (to achieve a better estimation of diffusion coefficient) and in peripheral zones where stronger environmental gradients seasonally occur (to achieve a better estimation of advection coefficients).

Finally, the group recommended that IOTC help completing the simulation work by supporting financially the work necessary to complete the tagging scenarios testing for the three species as well as the development of a convivial interface and a detailed documentation so that the simulation tools can be used during the whole tagging program.