ARCHIVAL TAGGING OPERATIONS WITHIN TAGFAD PROGRAMME IN THE WESTERN INDIAN OCEAN

J-P. Hallier[1]

1. BACKGROUND

Together with the large scale RTTP, that will be using chartered pole-and-line vessels, tagging operations are also conducted at a small scale level or for specific objectives by IOTC or by IOTC member states but in collaboration with IOTC and within the general framework of the IOTTP.
The objectives of these operations are :

- To tag large size tunas (Yellowfin and Bigeye – YFT & BET) that are not easily available to pole-and-line gear (Oman, Seychelles, Mayotte);
- To tag in areas unsuitable for the pole-and-line vessel such as Maldives, Laccadives or La Reunion;
- To tag around Mayotte during the purse seine fishing season (March-May) and off-season (October-November) medium to large size yellowfins caught by handlines under Fish Aggregating Devices (FADs) or in free schools;
- To tag on the Coco-de-Mer seamount to better understand tuna dynamics on this very productive seamount;
- To deploy sonic tagging to estimate the behaviour of tuna associated to FADs as in the FADIO programme that started in 2002;
- To deploy archival tagging to study the dynamics of tunas in and outside the FADs fishing zones as in the TAGFAD programme that started mid-2003.

Since 2002, several sources of funding were made available to IOTC (from FAO –IPTP funds, EU, China and Japan) that are used to finance some of these operations totally or partially. For FADIO, funds are mainly coming from EU DG-Research. For TAGFAD, they are coming from EU-DG-Fish and from IRD and IEO/AZTI. But some financial and technical supports from IOTC are put into both programmes. FADIO and TAGFAD received also some financial and technical support from Purse Seine (PS) boat owners and associations.

2. FIRST TAGFAD CRUISE

The first TAGFAD cruise took place in October (1^{st} – 20^{th}, 2004) for archival tags released on medium size YFT and BET associated to FADs and some dart-tagging on the same species plus skipjack. This was a joined effort by IRD, IEO and AZTI with the collaboration of IOTC and CSIRO.

The two main objectives of TAGFAD programme are:

- To tag 200 medium to large yellowfin and bigeye (larger than 60 cm) using ***internal archival tags***. The target is to tag an equal number of yellowfin and bigeye. These tags are recording depth, temperature and light (allowing an estimation of positions after recoveries of the tags) and internal body temperature. It is assumed that the parameters recorded by the archival tags will allow evaluating when each tuna is associated with a FAD or swimming freely. The tagging of 210 archival tags will need several campaigns at sea.
- To tag small tunas (from the three same species), on an opportunistic basis, using dart tags, as a function of practical free time left by priority 1. One of the goals of this traditional tagging is to compare the recovery rate of dart and of archival tags.

[1] IRD scientist, UR THETIS, CRHMT BP 171 34203 – Sète France E-mail : Jean-Pierre.Hallier@ird.fr

Results achieved during the first cruise:

- All together, 66 tunas were released, 50 with Dart tags and 16 with archival tags (Tuna caught, dart-tagged and archival-tagged by species are given in table 1).
- Tags were released either on buoys given by purse seiners, or FADs or LOGs found by the chartered vessel (Indian Ocean Explorer), or on the Coco de Mer Seamount, or on Free schools.
- To catch tunas associated to FADs proved to be more difficult than expected and in the future a lot of effort should be devoted to improve the total tuna catch, the catch of medium size yellowfin and bigeye, the state of the fish in order to decrease the number of tuna rejected for tagging that are too injured.
- The cooperation of boats' owners and PS captains played an important role in the completion of this cruise as 49 buoys codes were available to TAGFAD. Only 11 were fished as a large number of buoys never gave proper positions (15) or were too far according to our limited speed and time. Furthermore, buoys life span was found to be short (9.7 days with a SD of 7.2). Therefore buoy collection was a never ending task for staff ashore and on board.

Table 1 : Tuna caught, dart-tagged & archival tagged by species and their percentage of the total caught (TAGFAD01)

	Yellowfin		Skipjack		Bigeye		TOTAL	
	Number	% total caught	Number	% total caught	Number	% total caught	Number	% total caught
Caught	83		3		24		110	
D-Tagged	38	45.8		0	12	50.0	50	45.5
A-Tagged	10	12.0		0	6	25.0	16	14.5
Total tagged	48	57.8	0	0	18	75.0	66	60.0

3. RECAPTURES

So far, only one fish was recaptured. This is a yellowfin tagged with dart and archival tags. It is surprising that only one fish out of 66 was recaptured (1.5 %). Several hypothesis can be put forward to explain such low return :

- Tagging occurred in areas were purse seiners were either few or not present. Consequently, these fish cannot be caught rapidly. Considering their small sizes for most of them, they experienced high natural mortality.
- As most archival tagged tunas were part of a training scheme, the tagging mortality might have been high. However, this should not be the case of the only dart tagged tunas. None of those have been returned so far.
- As the large tagging operations are not yet underway, it is possible that crews and stevedores are not yet well aware of the presence of tagged fish and consequently do not pay much attention.

The only recapture is a yellowfin tuna tagged on October 11th at 7:11 am with a 53 cm FL at 1°09 N and 51°16 E. This tuna was associated to a PS buoy. It was recaptured on November 4th (24 days later) by a purse seiner fishing on a FAD schools at 0°40 N – 46°48 E. Data were unloaded and revealed that the fish was thrown in brine on November 3rd at 5:42 pm. This day, the PS has fished on a FAD school at 0°54 N – 52°14 E. The average depth, sea and body temperatures with the minimum and maximum values are given in table 2.

Table 2: Depth, sea and body temperature of the yellowfin recaptured (archival tag, TAGFAD01)

	Depth (m)	Sea temperature (°C)	Body temperature (°C)
Average	32.1	27.0	27.6
Minimum	0.5	10.3	21.6
Maximum	401.0	29.7	29.1
Standard deviation	23.83	1.36	0.71

The distribution of the depths of the fish is illustrated in figure 1. It shows that the fish swam most of its time in the first 50 m; it dove only seven times at depths of 200 m or lower and even reached 401 m. Most of these deep dives occurred at sunset (Figure 2). The distribution of the sea temperatures is shown on figure 3 and of body temperatures on figure 4. As the fish spent most of its time (82 %) at depth of less than 50 m, it is not surprising that its body temperature is above 27°C most of the time (84 %); the lowest body temperature was 21.6°C (Table 1). It was registered on October 29th 2004 when the yellowfin dives down to 355 m and remains in sea water with temperatures lower than 20°C during 12 mn (lowest sea temperature was 10.25°C). Then, its body temperature dropped from 28.3°C to 21.6°C. Then it swam up in warmer surface waters and its body temperature increased from 21.6°C to 28.15°C in 23 mn. Consequently, its temperature cold up twice as fast as it warm up. The profile of the temperature with the depth is given in figure 5; it shows a deep thermocline around 100 m.
This means that this juvenile yellowfin remain almost all time above the thermocline. The first day, its behaviour was atypical probably a follow up of the trauma due to its catch and tagging and the three following days it always remained in the first 50 m. But it never remained steady, always swimming rapidly up and down. The fourth day after its tagging, it started to show movements with more amplitude down to 100 m with a little bit less movement at night than during the day. The day with movements of the most amplitude was on October 22th from 12:00 to 17:00 diving rapidly from 30-40 m to below 100 m (up to 179 m). The down and up movement durations were between 1 and 5 mn when the swimming durations in the surface layer lasted from 10 to 15 mn. These up and down movements accelerate from 17:30 to 18:45. From the 21st to the 29th October, the fish dove down to 200m or below every evening at sunset (Figure 2). Why this fish show these dramatic and regular deep dives ? Was it chased by a predator ? There are also few occasions where some deep dives occurred in the morning: the 30th of October at 7:36 with a sudden dive at 186 m, November 1st at 9:06 down to 187 m and the next day at 8:00 down to 192m.
Actually, it is difficult to distinguish different behaviour that could be link to the association or not of this fish to FADs. We know that it was tagged when associated to a FAD and according to the fisherman that found the tagged yellowfin, it was recaptured when associated to a different FAD. More analyses and recaptures are necessary before one can eventually make a distinction in its behaviour between FAD associated and non-FAD associated yellowfins.

4. WHAT NEXT ?

TAGFAD funds from EU were on an annual budget, consequently usable in 2003. The requirement of new funds for 2004 in order to charter a vessel for new campaigns was not accepted by EU. The remaining tags stored in a fridge in SFA, to better preserve the battery life, are waiting opportunities to be used. Some will be used this summer by AZTI on northern bluefin tuna in the Bay of Biscaye but most of them will be released in the Indian Ocean. We plan to release some during the longline campaigns planned by SFA from September to December this year. We also expect to release the rest during the RTTP cruises that will start before the end of this year.

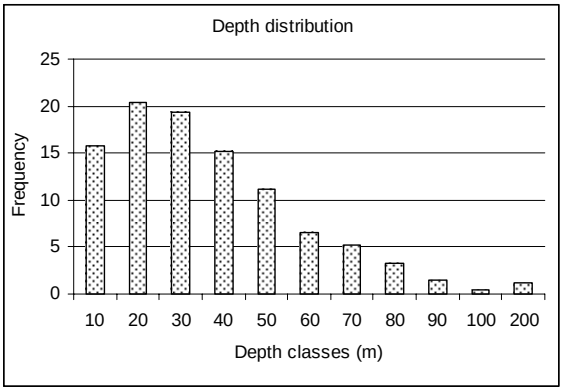

Figure 1 : Depth distribution frequency

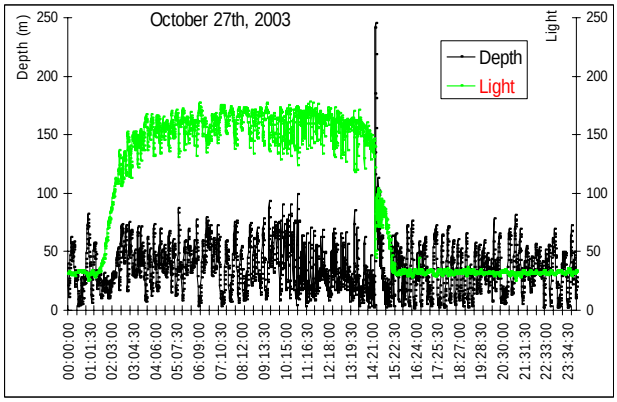

Figure 2 : Depth and light distribution on October 27th, 2004

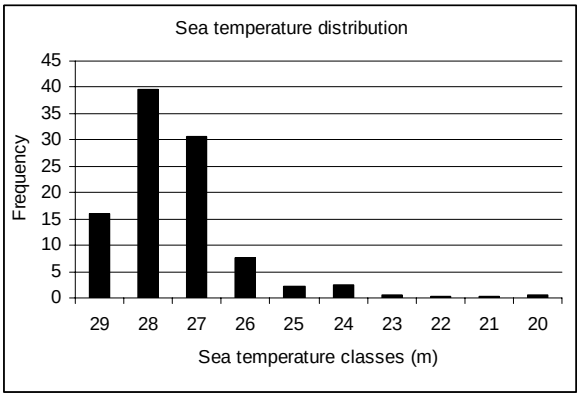

Figure 3 : Sea temperature distribution frequency

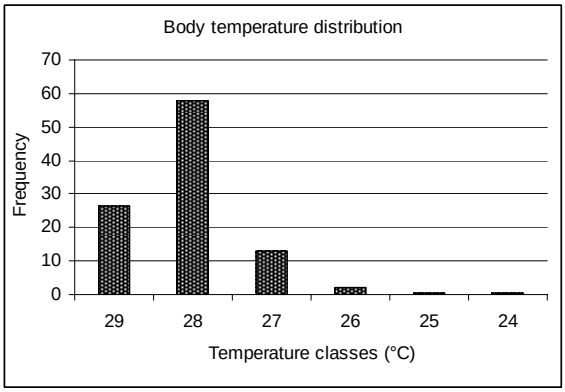

Figure 4 : Body temperature distribution frequency

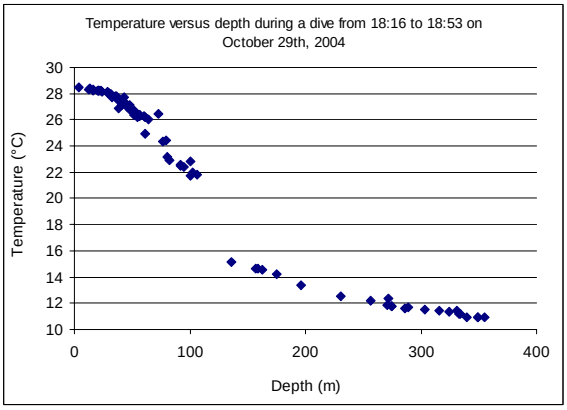

Figure 5 : Temperature and depth