

# EXAMINATION OF THE MOVEMENT OF THE YELLOWFIN, SKIPJACK AND BIGEYE AND ITS IMPLICATIONS FOR THE STOCK ASSESSMENTS OF THESE SPECIES

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## 1. CONTEXT

Recovered dart tags are giving in term of movement just a straight line between tagging and recovery. We don't have any information on when and how the fish swim from the release position to the recapture position. To know what the tagged fish is doing between tagging and release, how fast it swims, when and how deep we need data collected by electronic tags such as archival and popup tags. However with dart tags, at least we will know that the tagged fish is able to move between the two locations. This information is important for assessing the stock structure of these migratory species: yellowfin, bigeye and skipjack. This document is illustrated by maps showing the different movements inferred from the RTTP-IO dart tags recovered with position of recovery.

## 2. OVERALL MOVEMENTS

Figures 1a, b, c are giving the movement maps for yellowfin, bigeye and skipjack respectively while all RTTP-IO recovery positions are given in figure 2. The general aspects are (1) a large dispersion of the RTTP tagged tuna including some ocean crossing recoveries towards Indonesia; (2) the dispersion similarities between the three species but bigeye seems to move a bit less than the two other species especially skipjack and (3) the importance of the average distances travelled (cf. next §).

It is clear from these figures that there is only one single stock for each species: YFT, BET and SKJ from the Eastern Indian Ocean cannot be considered as belonging to separate stocks from those of the Western Indian Ocean.

The movements of the three species are also studied according to the different locations of their release: Mozambique Channel, Tanzania, Seychelles, Oman and International waters.

## 3. MOVEMENTS ACCORDING TO THE RELEASE AREA

### *3.1. Tuna tagged in the Mozambique Channel*

If we look in details to the positions of tuna tagged in the Mozambique Channel (Figures 3& 4) we can note: (1) very few fish moved south, but tuna fishing in the south of the Mozambique Channel is very

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limited at least by purse seiners; (2) there is a wide dispersion as large as the PS fishing grounds in the Western Indian Ocean and even beyond for SKJ as some were recovered by the Maldivian pole-and-line fishery (Figure 2b); (3) Movements are more limited for YFT (Figure 2b) than for SKJ (Figure 2b) and (4) The large number of YFT recovered in the Mozambique Channel (Figure 3) are a group of 45 fish caught very quickly after tagging by few PS vessels. BET are not represented as very few BET were tagged in this area; nevertheless their movements are similar to those of YFT.

If longline fleets were reporting recoveries we should have some reported in the South of the Mozambique Channel.

### *3.2. Tuna tagged off Tanzania*

The vast majority of the tuna were tagged off Tanzania coasts and very few off Kenyan South coasts. In figures 5 the dispersion of the three species is very similar to the dispersion given in figures 1 which is expected while considering the importance of Tanzania tagging among the total number of tagged tuna (nearly 80%). Therefore what was written for figures 1 and 2 is still valid for Tanzania. The distances travelled by BET are smaller than for the two other species. There is apparently no difference in the distances travelled between YFT and SKJ.

### *3.3. Tuna tagged off Seychelles*

Most fish tagged in Seychelles waters were tagged off the Amirantes and Farquhar archipelagos in the Western part. The displacements of these fish are given in figures 7 and the recovery positions in figure 8. These figures show: (1) a large part of the recoveries were done not far from the tagging place because this area is often fished by the PS as it is located in the centre of the PS fishery; (2) tuna moved towards the South in the Mozambique Channel, to the North all along the African coasts, towards the Arabian Sea and up to the Chagos, Maldives and the Eastern Indian Ocean; (3) few moved towards Tanzania. This central position of Seychelles is well illustrated by the star-oriented dispersion of the YFT and SKJ tagged in this region (Figure 7a and 7b). BET are not represented as very few BET were tagged in this area; nevertheless their movements are similar to those of the two other species.

### *3.4. Tuna tagged in International waters*

Fish tagged in International waters (Figures 9 and 10) are mostly coming from fish tagged between Seychelles and Tanzania and between Oman and Maldives. Those off Seychelles show the same star-oriented dispersion while those tagged South-East of the Arabian Sea are mostly moving south from west to east. Recoveries are coming mostly from EU purse seiners and Sri Lanka gillnetters. There few recoveries coming from Maldivian pole-and-line vessels, from Iran vessels and Taiwan longliners. The absence of north-oriented movements is expected as SKJ are very rare in the Arabian Sea.

### *3.5. Tuna tagged off Oman*

Only YFT were tagging off Oman coasts. Recoveries are either caught locally or moving from South-South-West to East-South-East (Figures 11 and 12). It is clear from this figure that at least some of the YFT along the coasts of Oman are later entering the PS fishery to the South. Furthermore, some YFT tagged south of the equator are moving north towards the Arabian Sea and even two were caught in the Arabian Gulf and another one off Yemen (Figure 5a). We are expecting more recoveries showing YFT movements in both directions in the next future. This should confirm that the YFT of the Arabian Sea belong to the same stock as the rest of the YFT of the Indian Ocean.

## **4. CONCLUSIONS**

The general picture given by these different figures is clear: YFT, BET and SKJ stocks cover the all Indian Ocean. Therefore their management has to be done accordingly. We are expecting more recoveries in the coming months and years that should reinforce this aspect. Trans-oceanic recoveries from West to East would be more pronounced if tuna fishing was more active in the Eastern Indian Ocean: all RTTP-IO recoveries in the Eastern Indian Ocean are coming from a few trips made by EU-Purse seiners.

Tagging in the Eastern Indian Ocean during IOTC small-scale operations was unfortunately low (783 YFT and 1271 SKJ distributed between Indonesia and Andaman Islands) and we have not yet registered recoveries apart from local ones by artisanal fishermen. However the distances to cover before some of these fish reach the purse seine fishing grounds in the Western Indian Ocean are very big therefore it is taking time.

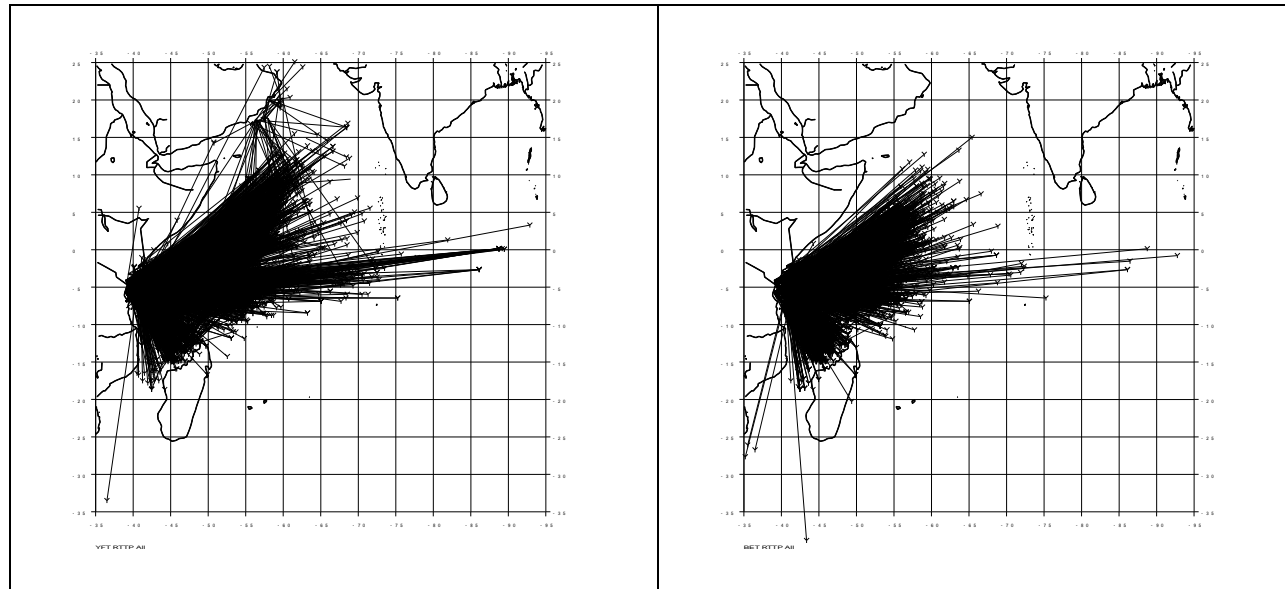


Figure 1a: Theoretical movements of YFT tagged by the RTTP-IO in the Western Indian Ocean

Figure 1b: Theoretical movements of BET tagged by the RTTP-IO in the Western Indian Ocean

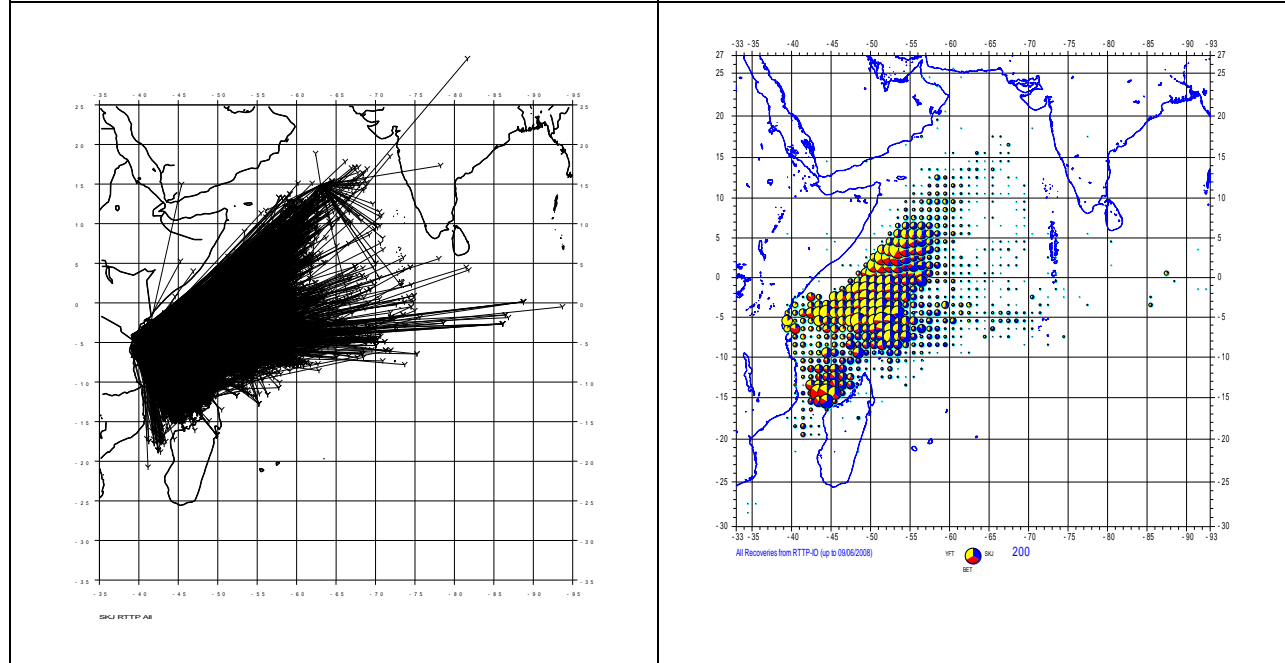


Figure 1c: Theoretical movements of SKJ tagged by the RTTP-IO in the Western Indian Ocean

Figure 2: Positions of all recoveries registered by the RTTP-IO in the Indian Ocean

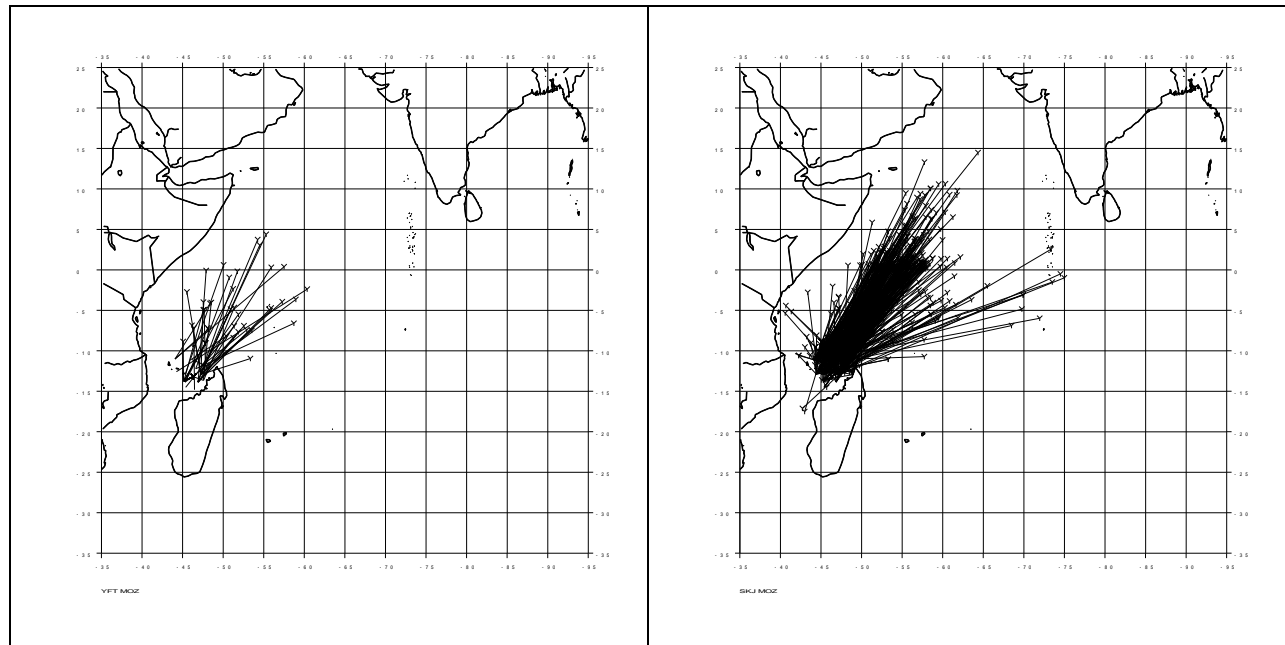


Figure 3a: Theoretical movements of YFT tagged by the RTTP-IO in the Mozambique Channel

Figure 3b: Theoretical movements of SKJ tagged by the RTTP-IO in the Mozambique Channel

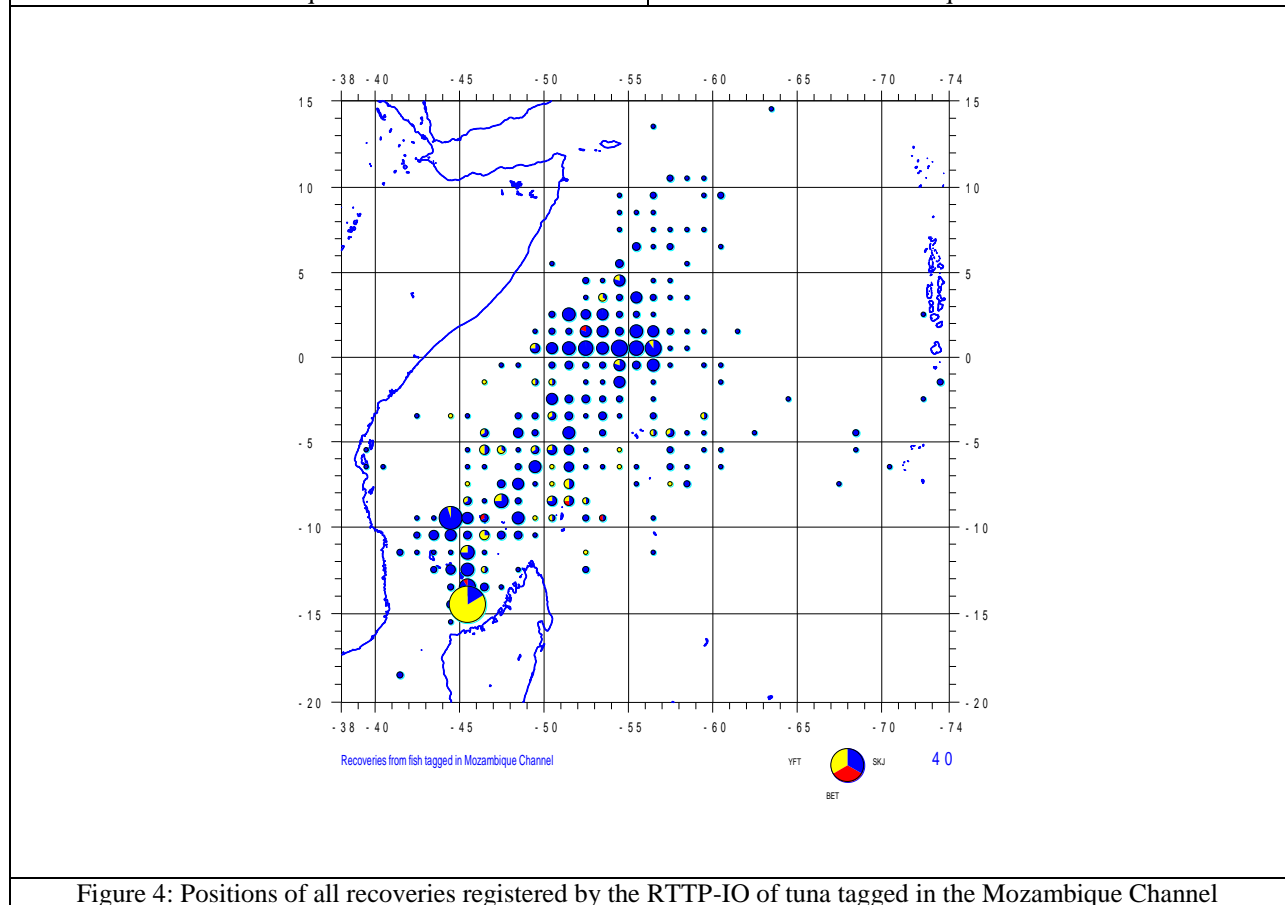


Figure 4: Positions of all recoveries registered by the RTTP-IO of tuna tagged in the Mozambique Channel

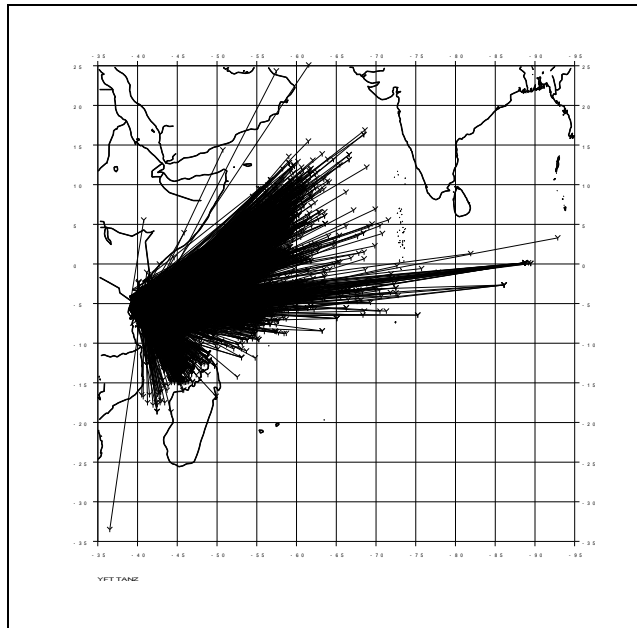


Figure 5a: Theoretical movements of YFT tagged by the RTPP-IO off Tanzania

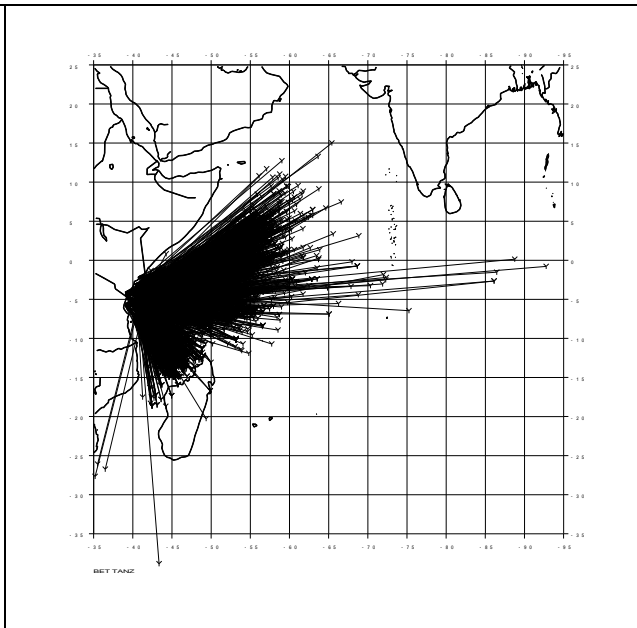


Figure 5b: Theoretical movements of BET tagged by the RTPP-IO off Tanzania

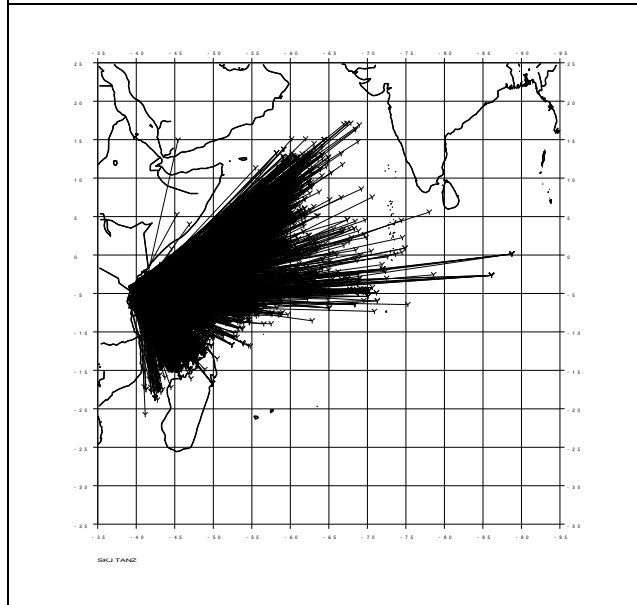


Figure 5c: Theoretical movements of SKJ tagged by the RTPP-IO off Tanzania

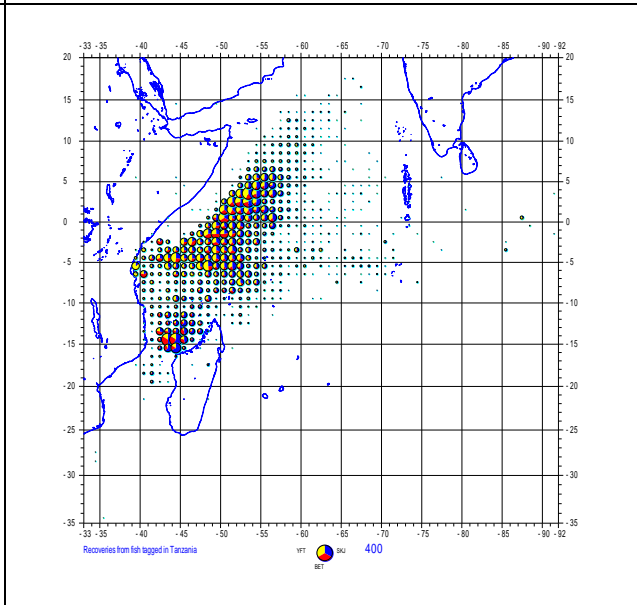


Figure 6: Positions of all recoveries registered by the RTPP-IO of tuna tagged off Tanzania

