

TRENDS IN THE RECOVERIES REGISTERED BY THE REGIONAL TUNA TAGGING PROJECT - INDIAN OCEAN

Jean-Pierre Hallier¹

General context

Regarding the general aspects of the tagging data and the overall recoveries one can refer to the document presented at the WPTDA (Seychelles, July 2008); in this document only the last trends in the tag recoveries are presented.

1. Recoveries overall, by species and by place of discovery

There were 25,804 recoveries from the RTTP-IO into the database on 03/10/2008 including:

- 12,171 SKJ or 47 % of all recoveries and giving a recovery rate of 15.6%;
- 8,719 YFT or 33.6 % of all recoveries and giving a recovery rate of 16.0%;
- 4,991 BET or 19.3 % of all recoveries and giving a recovery rate of 14.4%;
- Overall 25,911 recoveries giving an overall recovery rate of 15.4%.

Figures 1, 2 and 3 give the distribution of the recoveries per species in number (Fig. 1) and in percentage overall (Fig. 2) and with time (Fig.3). Species composition with time is fluctuating with a decrease proportion of skipjack to the advantage of bigeye and yellowfin. However bigeye percentage has decreased sharply since August 2008. This could be a seasonal decrease as in 2006 or an effect of the selectivity of the purse seine, largely the main recovery gear.

After the very high levels of recoveries in 2007, the number of recoveries has gone down from a top high level of 1,697 recoveries in July 2007 to the lowest number of 183 recoveries in February 2008. There is an improvement in March and a new peak in April 2008 when 1,039 recoveries are registered during the Mozambique PS fishing season. As tag release stopped at the end of August 2007, the down trend of the recoveries is expected. However this expected decrease is accentuated by the very low catch experienced by the purse seiners since June 2008 but numbers of recoveries for this period are still preliminary.

2. Recoveries by platform

Seychelles is still the main country of recovery (Figure 4) but its importance has been decreasing until the 2nd quarter of 2007 and then it remained more or less stable with 50 %. This decrease is mainly due to the increase of recoveries at sea while recoveries in Madagascar are fluctuating in relation with the importance of the PS Mozambique Channel fishing season. Recoveries in Mauritius decreased up to the 3rd quarter of 2006 then they remained very low. This figure as well as figure 5 illustrate the raise of the awareness of the PS fishermen (more recoveries at sea) and of the Seychelles stevedores (less recoveries in canneries in general and Mauritius in particular).

¹ Chief Coordinator of the RTTP-IO, c/o IOTC, P.O. Box 1011, Victoria, Seychelles E-mail : jph@iotc.org

3. Recoveries by gear

The overwhelming importance of recoveries from purse seine remains uncontested through the recovery period: 97.5 % overall. The increasing number of recoveries from the other gears is given in figure 6. One can notice that (1) each of all other gears are accounting for less than 1 % of all recoveries and (2) recoveries from longline gear are those progressing the most in the recent period. Until May 2008 these LL recoveries were yellowfin in majority but recently bigeye became the dominant species. It is recalled that starting from July 2008, the percentage of bigeye among the recoveries is going down (Figure 3). This is mainly due to (1) 97% of our recoveries are reported by purse seiners; (2) considering the size at tagging and the average growth rate of bigeye most of the tagged bigeye remaining at sea are now close to or above 100 cm; (3) catch of bigeye greater than 100 cm by purse seiners is low while they are recruited in the longline fisheries; (4) however report of recoveries by longliners is still low.

4. Recoveries by type of tag

The recovery rate between single and double-tagged tuna is exactly the same (15.6 %) but the recovery rate of OTC tagged tuna remained lower at 9.6 %. Tag seeding with white tags similar to the white tags implanted on OTC tagged tuna will start soon in order to test if this lower recovery rate is due to a lower reporting for these white tags: white tags would be less visible.

5. Average size at recovery

The average sizes of the recoveries per species and per quarter are given in figure 7 from the 2nd quarter of 2007 to the 3rd quarter of 2008. YFT show a rapid increase while SKJ has slow increases which are related to the respective fast and slow growth rates of the two species. BET is showing an intermediate position as the growth rate is between SKJ and YFT. However starting from the last quarter of 2007, the average size is almost stable at 70 cm. As noted previously there is a selectivity effect of the PS gear that is not fishing large BET and recovery of large BET by the LL gear are not sufficient to result in an increase of the average size of BET recoveries.

6. Time-at-Liberty

The log of the frequency of the time-at-liberty are given in figures 8 for all species combined and in figures 9a, b and c for YFT, BET and SKJ respectively. Tagged fish are grouped by year of tagging.

For all three tagging years, we don't notice a sharp occurrence of recoveries with short time-at-liberty but a more or less flat curve during the first 200 days followed by a steady decline. The general slope for the fished tagged in 2005 is remarkable. The position of the different curves is related to the tagging importance of each year with 2007 being the year with the largest number of tags (97,530) and 2005 with the lowest (21,752 – in 2006: 48,880).

The highest values of time-at-liberty of each curve are linked to the earliest tagging date of each year: about 1,180 days for 2005, 980 days for 2006 and 580 days for 2007 (considering the tagging dates, we cannot observed by October 2008 greater time-at-liberty).

The shape of the curves denotes an excellent and rapid mixing of the tagged fish among the rest of the stocks. This is also illustrated in the figures for each species (Fig. 9).

This achievement is rarely reached by other large-scale tagging projects because it is often very difficult to tag tuna away from the purse seine fleet. However the RTTP-IO managed to do it. The rapid and extended mixing of the tagged fish among the rest of the fish is an essential goal when using tagging data for stock assessment.

7. Rate of recovery per purse seine catch unit

In figure 10 are listed the average purse seine catch from January 2006 to August 2008 and the number of recoveries (all species) per 1000 Mt of PS catch. This recovery rate per catch unit is related to (1) the number of tagged fish present at sea; (2) their size distribution in comparison to the size distribution of the PS catch; (3) to the PS fishing area if the mixing is not reached. Since September 2007, no more tagged fish were released into the sea.

The recovery rates per catch unit and per month for each species are given in figures 11a, b and c for YFT, BET and SKJ respectively. They demonstrate the same results as for all species: a good mixing.

When the recovery rates per catch unit are compared (Figure 12) they appear similar for YFT and SKJ with an average of 19 and 22 /1000 MT respectively while they are much higher for BET (66 on average). This higher rate for BET can expressed a higher vulnerability of this species to PS when associated to log school. From 2005 to 2007, on average 93 % of the PS BET catch in number is made on log school.

8. Recoveries East of 75° E

During the RTTP-IO activity period, the PS almost always fished West of 75° E. But in 2006 and 2007 there are some minor PS catch East of 75°E with some recoveries;

- In January 2006, catch of 473 MT but no recoveries (at that time only 5454 YFT have already been released in the Mozambique Channel and off Tanzanian coast);
- In December 2006, catch of 1,771 MT and 46 recoveries (23 YFT or 64 YFT/1000 MT; 18 SKJ or 19 SKJ/1000 MT and 5 BET or 11 BET/1000 MT);
- In December 2007, catch of 1.093 MT and 2 YFT recoveries or 5 YFT/1000 MT.

In December 2006, the recovery rate per catch unit is average for SKJ, low for BET but very high for YFT. As the catch and the period are very limited it is difficult to draw conclusions on the transfer rate between the Western and Eastern Indian Ocean other than it exists.

9. OTC Recoveries and otolith collection

So far, 480 otoliths have been extracted from 145 BET, 219 YFT and 116 SKJ but only 369 of them are from OTC tagged tuna (127 BET, 140 YFT and 101 SKJ. Part of these otoliths has already been read by the LASAA Laboratory in Brest, France and results will be presented at the WPTT in October in Bangkok. The OTC and non-OTC otoliths par size and per species are given in figures 13a, be and c.

In order to better cover the largest size range, otoliths have already or will be collected for missing sizes: smaller than 45 cm for YFT and BET, between 74 and 100 cm for YFT and greater than 93 cm for BET and 150 cm for YFT. During the next PS fishing season on spawning YFT (December 2008 to March 2009) we are expecting to collect some large OTC tagged YFT and maybe some large BET

10. Quality of the data

For recoveries with time-at-liberty greater than 30 days if the length at recovery is smaller than the length at tagging one can be certain that an error exist on the measurement of the length either at tagging or at recovery. The percentages of these errors are given on figures 14 for the main recovery platforms:

- The overall error level is moderate at 5.3%;

IOTC-2008-WPTT-34

- The lower error level is for the recoveries made at sea; most of the time these fish are kept on board and later are measured in port by the RTTP-IO Tag Recovery Team;
- Seychelles and Madagascar are at the overall average;
- Mauritius with 12.1 % is the worst performing among the 8 platforms presented; among the four different locations where recovery data are collected in Mauritius, one is responsible for most of the bad data: Froid des Mascareignes.
- Thailand (9.9 %) as Mauritius is collecting recoveries from reefers and from canneries; the situation is improving.
- Tanzania and Comoros (8.5 and 8.9 %) are both collecting tags from artisanal fisheries and we all know how difficult is the recovery data collection in these wide-spread fishermen often illiterate.
- Kenya (6.6 %) is mainly collecting data from reefers, cannery and purse seiner unloading but also from artisanal fishermen.

The RTTP-IO is always devoting its efforts and its means in order to increase the quality of the data collected in every platform and in most places the quality is improving.

11. Attributing purse seine set data to recoveries made in port or at canneries

Apart from the recoveries made at sea, all recoveries from purse seiners made in port when the vessels are unloading or transferring their catch or in cold store or at canneries are linked to one or several well numbers from a given ship for a given trip. In canneries, the recovery can even sometimes be linked to several vessels. Once or twice a year, these well/ship data are linked to the purse seine logbooks in order to collect all date(s), position(s), catch and type(s) of school from the different sets involved.

The precision (or the dispersion) of the sets data have already been illustrated in previous papers, a few more information on this aspect are given in this document:

- A level of precision on the different dates attributed to one recovery has been estimated and is given in figure 15. It can be seen that 50% of all purse seine recoveries are associated to a unique date and 36 % more have dates which are at the most ± 2.5 % apart from the average date. This means that a large proportion of purse seine recoveries have an accurate or quite accurate date of recovery. Of course the use of these data according to their degree of precision will remain in the hands of the scientists using the data. All information permitting to choose the data are delivered together with the data.
- The purse seine catch is stratified by the type of school (free or log school) as species composition as well as species sizes are quite different between the two type of school. Therefore whenever possible the type of school is given for each purse seine recovery. When there are several sets of different types, the school type is called mixed. The distribution of the purse seine recoveries per type of school and per year are given in figure 16. One can notice that (1) as the recovery strategy in Seychelles improved the percentage of mixed school decrease from 53 % in 2005 to 30 % the following two years; (2) the percentage of free school remain low (4 %, 9 % and 8 % in 2005, 2006 and 2007 respectively) and (3) for 2008 the linkage between the well numbers and the purse seine logbooks has not been done yet.

12. Tag shedding

For the assessment of this important source of bias in the actual number of recoveries (the shedding of the tag), 16 % of the tagged tuna were released with two tags. First results were presented during the WPTDA last June. For the WPTT, no updated analysis was prepared. But the rate of tag shedding today is equal or even a bit lower than found during the June analysis as

more cleanup of the database has reduced a bit the number of shed tags. This analysis will be updated for the next stock assessment meeting.

2. CONCLUSIONS

The recoveries continue to be registered by the RTTP-IO but in decreasing numbers. However part of this decrease is linked to the low purse seine catch especially during the last recent months.

The overall recovery rate reach 15.4 % mid-October 2008 and it remains quite similar between species underlying close recovery rates between species.

The awareness of the purse seine fishermen (large increase of the percentage of recoveries found at sea) and of the stevedores produce a decrease in the proportion of recoveries made in canneries while altogether about 90 % of all recoveries are detected and reported to the RTTP-IO as proved by the IOTC tag seeding operation.

Recoveries from purse seiners are still very dominant but recoveries from other gears are slowly increasing and at a faster rate for longliners even if this number of LL recoveries is still too low as non-reporting rate is probably very high. The RTTP-IO is devoting a lot of effort towards longline fisheries.

It seems that purse seine low selectivity for large bigeye is starting to affect the number of BET recoveries from purse seiners. These large BET are then recruited into the longline fisheries but as mention previously reporting is still very low.

The distributions of the time-at-liberty reveal the effective and rapid mixing of the tagged tuna among the rest of the tuna population which is a very positive aspect for stock assessment studies.

Data quality is an everyday concern by the staff of the RTTP-IO and some aspects related to the data quality are presented and discussed, an approach not well publicized by other large-scale tagging projects.

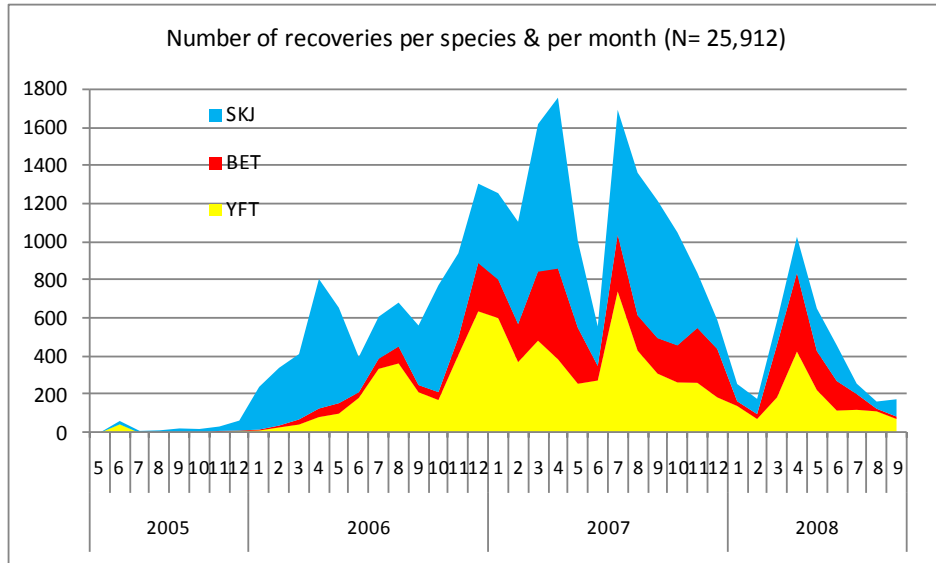


Figure 1: Number of recoveries per species and per month from May 2005 to September 2008 (Preliminary numbers from July to September 2008)

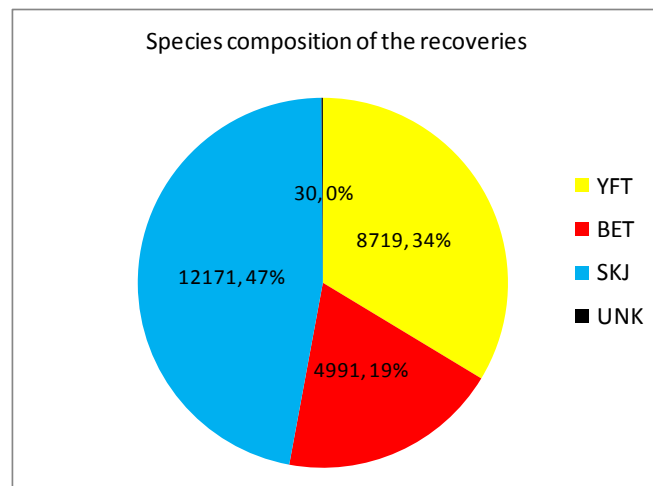


Figure 2: Species composition of the RTTP-IO recoveries up to 17/10/2008

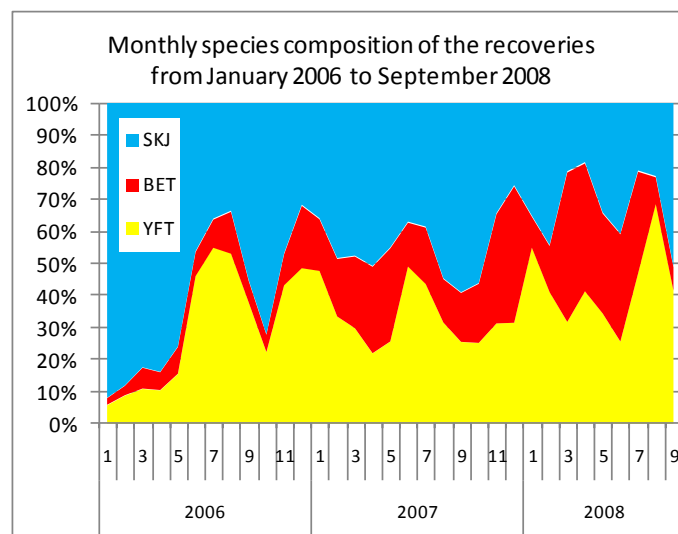


Figure 3: Monthly species composition of the RTTP-IO recoveries from January 2006 to September 2008 (preliminary from July to September 2008)

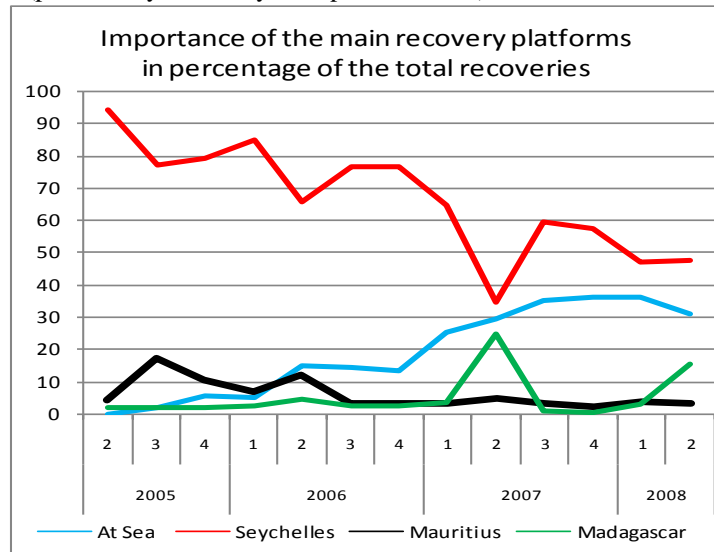


Figure 4: Distribution of the recoveries between the first four main platforms by quarter since the beginning of the RTTP-IO

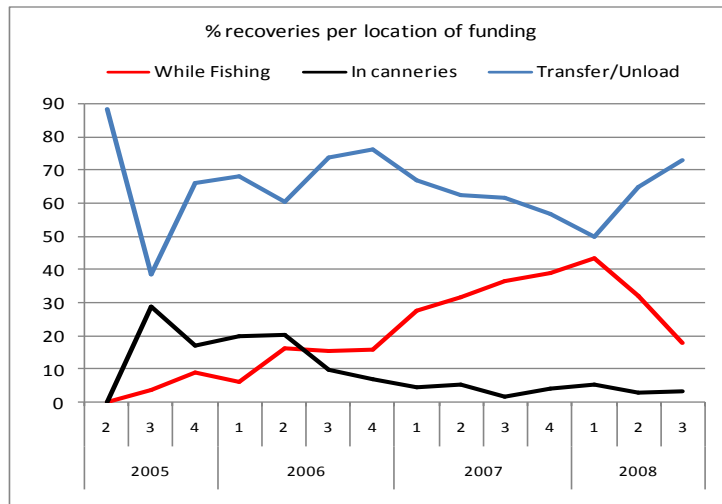


Figure 5: Distribution of the recoveries in three main locations since the beginning of the RTTP-IO (Quarter 3 of 2008 is still preliminary)

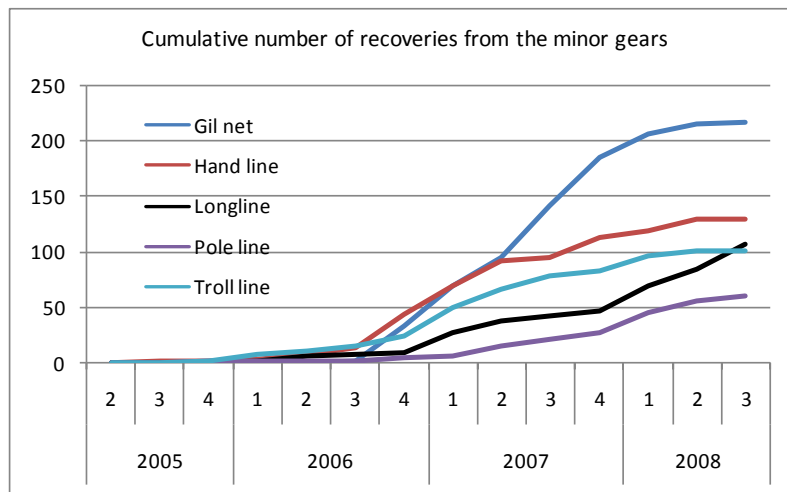


Figure 6: Cumulative number of recoveries from the minor gears since the beginning of the RTTP-IO

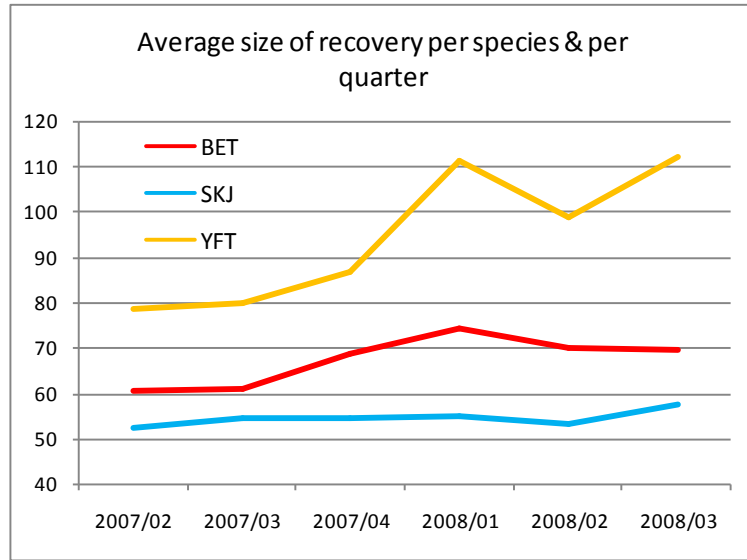


Figure 7: Average size of the recoveries per species and per quarter from quarter 2 of 2007 to quarter 3 of 2008

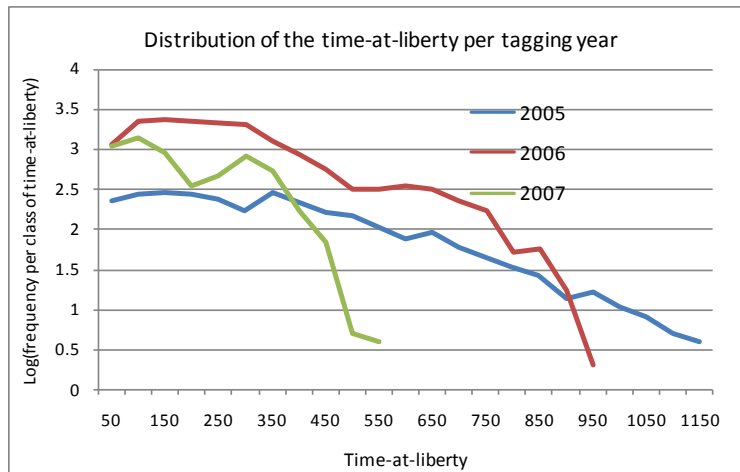


Figure 8: Distribution of the time-at-liberty for all species combined by tagging year

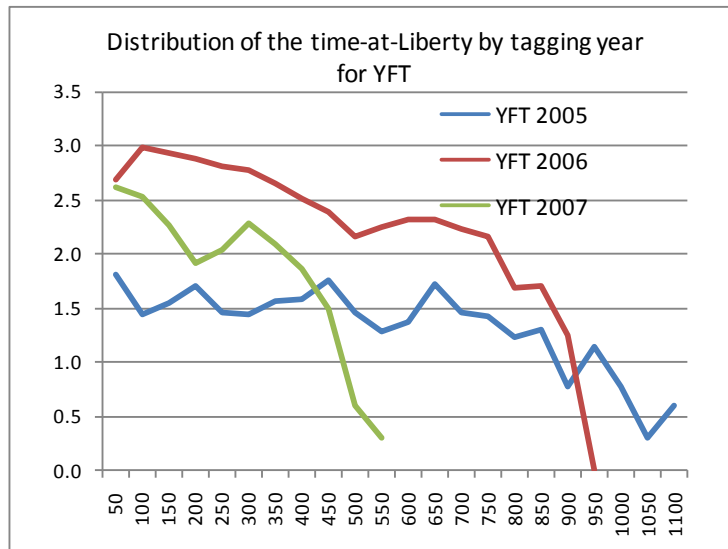


Figure 9a: Distribution of the time-at-liberty for YFT by tagging year

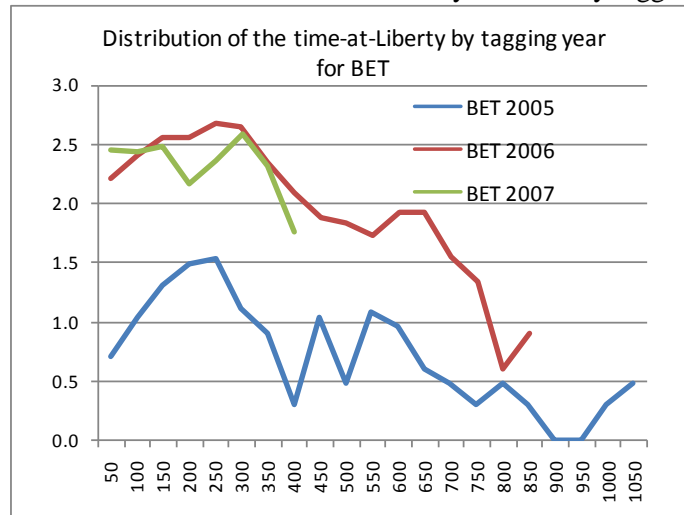


Figure 9b: Distribution of the time-at-liberty for BET by tagging year

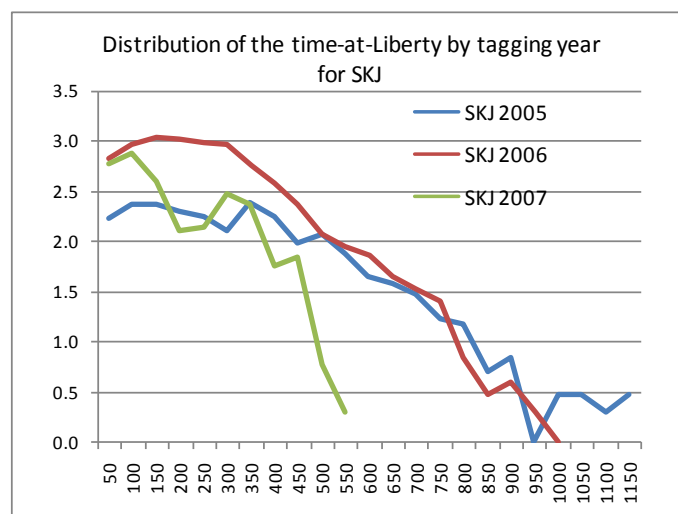


Figure 9c: Distribution of the time-at-liberty for SKJ by tagging year

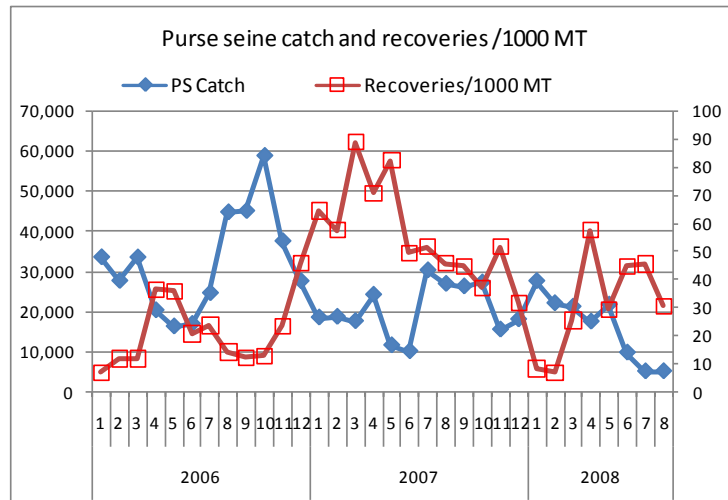


Figure 10: Purse seine catch and recovery rate (number of recovery per 1000 MT) for all species by quarter from January 2006 to August 2008

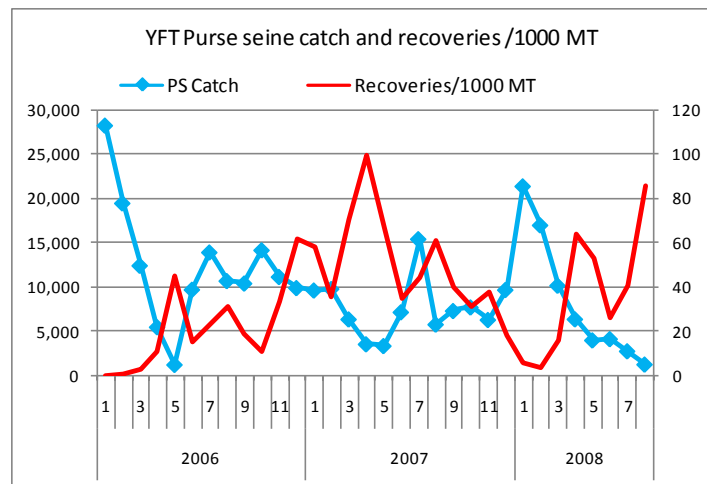


Figure 11a: YFT Purse seine catch and YFT PS recovery rate (number of recovery per 1000 MT) by quarter from January 2006 to August 2008

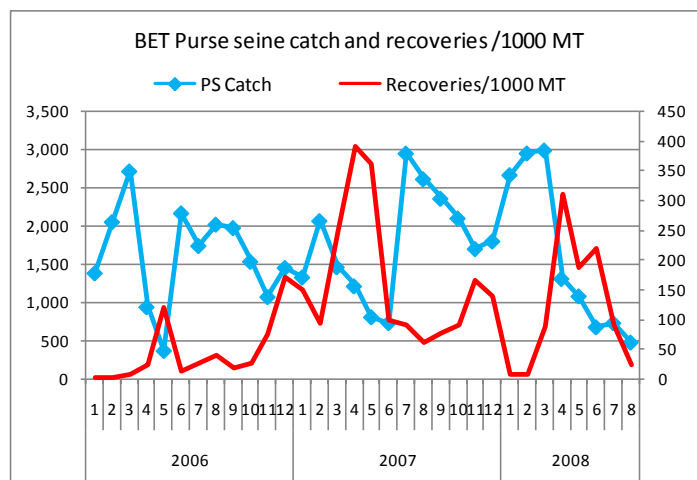


Figure 11b: BET Purse seine catch and BET PS recovery rate (number of recovery per 1000 MT) by quarter from January 2006 to August 2008

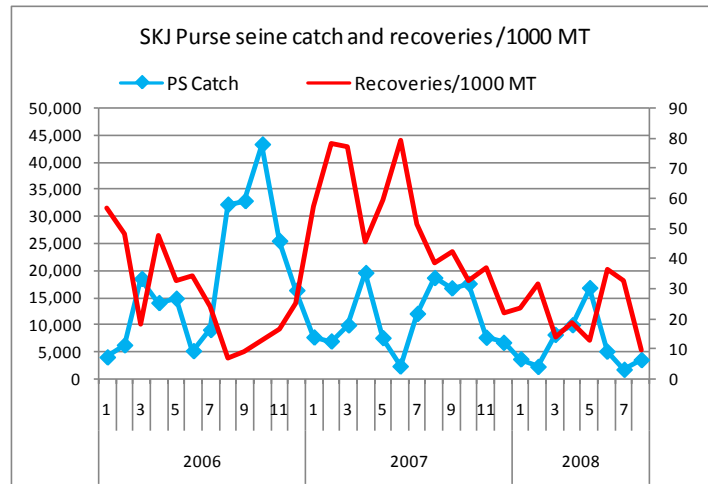


Figure 11c: SKJ Purse seine catch and SKJ PS recovery rate (number of recovery per 1000 MT) by quarter from January 2006 to August 2008

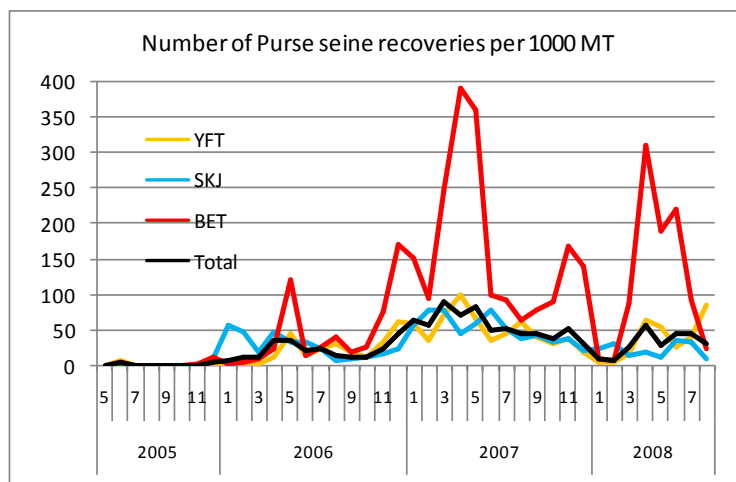


Figure 12: Recovery rate per 1000 MT from the purse seine fishery between May 2005 and August 2008 for the three species

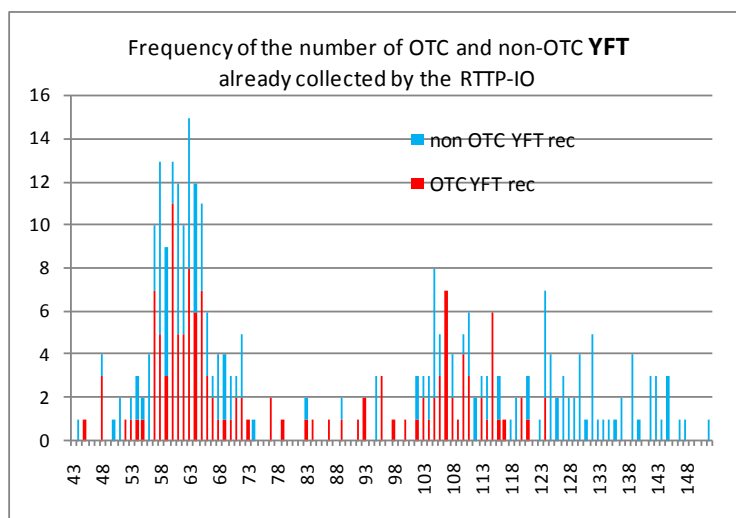


Figure 13a: Number of OTC and non-OTC otoliths sampled by size class from RTTP-IO YFT recoveries

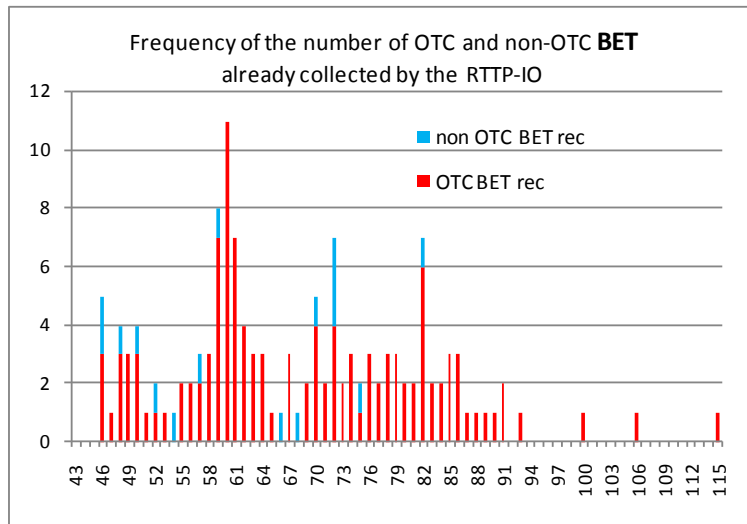


Figure 13b: Number of OTC and non-OTC otoliths sampled by size class from RTTP-IO BET recoveries

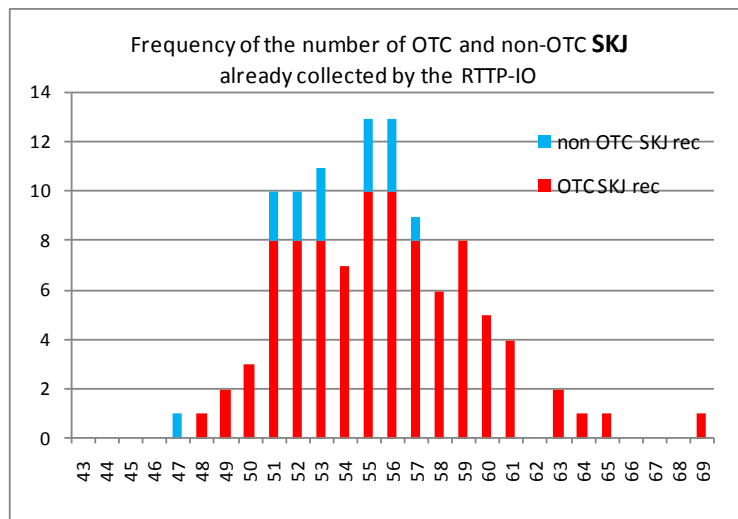


Figure 13c: Number of OTC and non-OTC otoliths sampled by size class from RTTP-IO SKJ recoveries

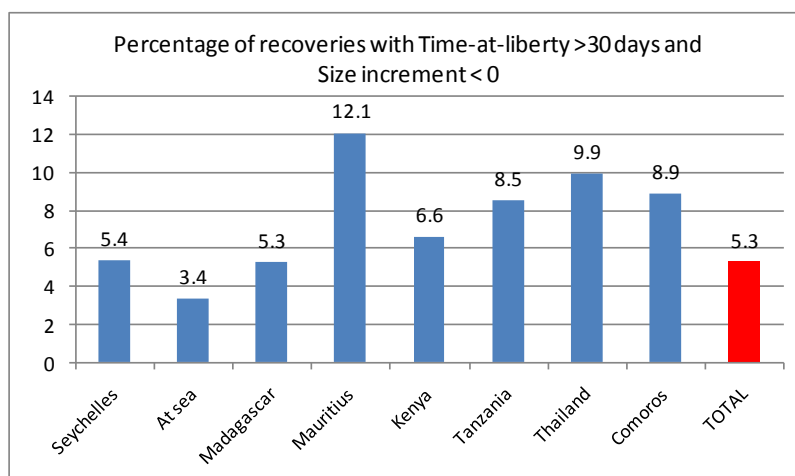


Figure 14: Percentage of recoveries with potential errors on length measurements by main recovery platforms

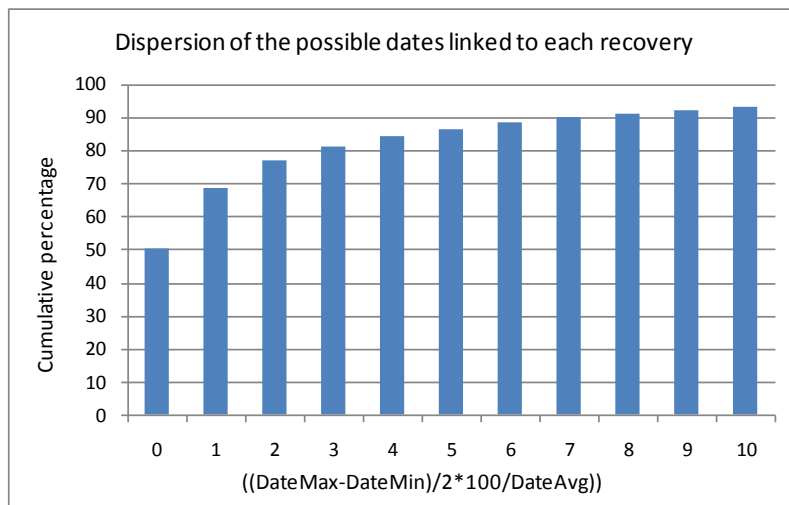


Figure 15: Measure of the dispersion of the dates attributed to recoveries from purse seiners

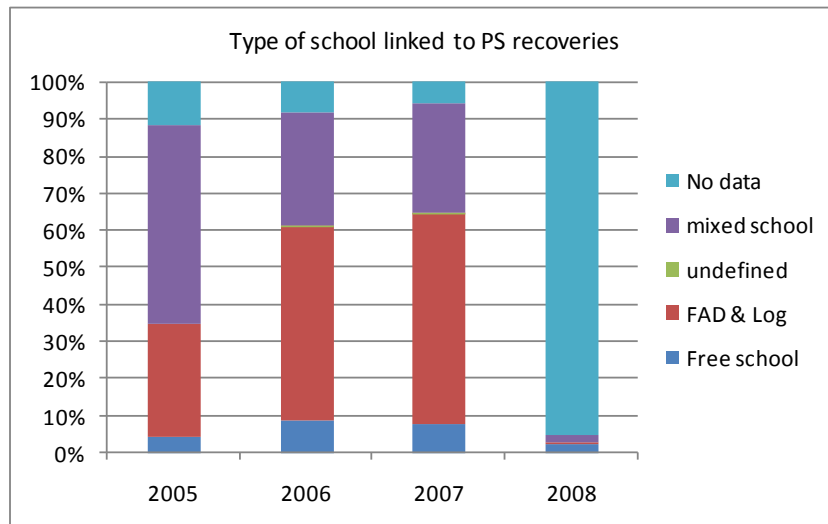


Figure 16: Distribution of the type of school associated to recoveries from purse seiners