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SUMMARY OF ACTIVITIES CONDUCTED WITHIN AOTTP IN 2016 AND 2017

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SUMMARY

Activities leading to the development of the AOTTP tag and release database are described. AOTTP has now tagged 60,000 fish in the Atlantic. More than 8,000 fish have been double-tagged, while around 4500 have been marked chemically to improve aging of recovered fish. 300 electronic tags (pop-ups and internals) have been deployed, providing information on tuna migrations and habitat preferences. Tag-recovery and awareness raising infrastructures have been set up in ten countries, and more than 10,000 conventional tags have been recovered (ca 20% recovery rate). Posters, t-shirts, and caps, to incentivise tag-recovery, have been designed in four languages. Age, sex and weight samples have been taken from more than 400 recovered fish. Relational databases and smartphone applications for populating them have been designed, developed and implemented. More than 60 colleagues from developing countries have been trained in all aspects of tagging at sea, tag-recovery, and data transmission methodologies.

RÉSUMÉ

Les activités à l'origine de l'élaboration de la base de données de marquage et remise à l'eau de l'AOTTP sont décrites dans le présent document. Jusqu'à présent, l'AOTTP a marqué 60.000 poissons dans l'Atlantique. Plus de 8.000 poissons ont fait l'objet d'un double marquage, alors qu'environ 4.500 ont été marqués chimiquement afin d'améliorer la détermination de l'âge du poisson récupéré. Un total de 300 marques électroniques (pop-up et interne) ont été apposées, ce qui a fourni des informations sur les migrations et les préférences en matière d'habitat des thonidés. Les infrastructures de récupération des marques et de sensibilisation à la récupération des marques ont été mises sur pied dans dix pays et plus de 10.000 marques conventionnelles ont été récupérées (près de 20% du taux de récupération). Des affiches, des t-shirts et des casquettes, servant à encourager la récupération de marques, ont été conçus en quatre langues. Des échantillons ont été prélevés sur plus de 400 poissons récupérés afin de déterminer leur âge, sexe et poids. Des bases de données relationnelles et des applications pour smartphones visant à les alimenter ont été conçues, développées et mises en œuvre. Plus de 60 collègues de pays en développement ont été formés dans tous les aspects des méthodologies du marquage en mer, de la récupération de marques et de la transmission des données.

RESUMEN

Se describen en este documento las actividades que han dado lugar al desarrollo de las bases de datos de marcado y recuperación de marcas del AOTTP. Hasta la fecha el AOTTP ha marcado 60.000 peces en el Atlántico. Se han marcado más de 8.000 peces con dos marcas, aunque unos 4500 han sido marcados químicamente para mejorar la determinación de la edad de los peces recuperados. Se han colocado 300 marcas electrónicas (pop-up e internas), que han facilitado información sobre migraciones y preferencias de hábitat de los túnidos. Se han establecido las infraestructuras de marcado - recuperación y de concienciación en diez países y se han recuperado más de 10.000 marcas convencionales (una tasa de recuperación de aproximadamente el 20%). Se han diseñado carteles, camisetas y gorras para incentivar la recuperación de marcas en cuatro idiomas. Se han recogido muestras de edad, sexo y peso de más de 400 peces recuperados. Se han diseñado, desarrollado e implementado bases de datos relacionales y aplicaciones para los smartphones para alimentarlas. Más de 60 colegas de países en desarrollo han sido formados en todos los aspectos relacionados con el marcado en el mar, la recuperación de marcas y las metodologías de transmisión de datos.

KEYWORDS

Bait fishing, Spatial variations, Purse seining, Tagging mortality, Fishery Management, Fishery surveys

1 Introduction

The overall objective of the Atlantic Tuna Tagging Programme (AOTTP) is to contribute to food security and economic growth of the Atlantic developing coastal states by ensuring sustainable management of tropical tuna resources in the Atlantic Ocean. The specific objective of this programme is to provide evidence based scientific advice to developing coastal states, and other Contracting Parties, to support the adoption of effective Conservation and Management Measures (CMMs) in the framework of the International Commission for the Conservations of Atlantic Tunas (ICCAT). This will be achieved through improving the estimation, derived from tag-recapture data, of key parameters for stock assessment analyses, i.e. growth, natural mortality, movements and stock structure, etc.

AOTTP is a 5 year project that began in June 2015. The overall budget is 15 million euros. It is funded by the European Union, ICCAT CPCs and Collaborators. Contracts above a value of 60,000 euros awarded by ICCAT since June 2016 are listed in **Appendix 1**. All acronyms used in this report are described in **Appendix 2**.

2 Material and Methods

Eleven boats have so far been used by ICCAT/AOTTP to tag fish in the eastern Atlantic: the Acoriana (Azores), the Grand Primero (Canary Islands), the Macizo (Canary Islands), the Aita Fraxku (Senegal), the TarrynAmy (South Africa), the Estrela Delva (Brazil), the Katsushio Maru 8 (Brazil), The Thavisson III (Brazil), the Tuburao Tigre (Brazil), the Aldebaran I (Brazil), and the Ponta Calhau (Madeira). By far the majority are pole and line vessels which is the best way to tag large numbers of tropical tuna and release them with an acceptable chance of survival.

Since June 2016, vessels deployed by ICCAT-AOTTP and partners have done 59 tagging cruises over the tropical Atlantic spending 536 days at sea, corresponding to 30 % of the 1800 day target. Trained tagging teams have been deployed on all vessels and all the cruise reports detailing the activities, problems and recommendations are available from ICCAT (**Table 1**). Since June 2016 12 trips have been organised around the Azores, 11 around the Canary Islands, 7 in the Gulf of Guinea region, 4 off Senegal, 11 off South Africa, 11 off Brazil, and 3 around Madeira.

AOTTP is using Hallprint Ltd plastic-tipped PDAT, 150mm 'conventional' tags. Desert Star and Wildlife Computers supplied AOTTP with 40 Seatag 3D and 95 Mini PAT-348C pop-up tags, respectively, while Lotek Wireless provided 400 (LAT 2810) and 40 ARCGEO-9 internal tags. The 95 Wildlife Computers Mini PAT-348Cs were found to have a technical problem in July 2016 and were recalled for repairs which has delayed their deployment. Desert Star tags had then to be deployed in their stead. During October 2016, however, a fault was also noted in the Desert Star tags causing them to transmit corrupted data to the satellite and the remaining tags were recalled for replacement. The tags that were successfully deployed, but failed to report adequate data, will be replaced by Desert Star. Analyses on the performance of all the electronic tags are ongoing.

All tagging is following the same ICCAT/AOTTP protocols, and detailed manuals and tutorials have been produced and are available from ICCAT. Tagger training courses were run between 17 and 18 May 2016 in Dakar, between 19 and 20 May 2016 in Abidjan, between 15 and 16 June 2016 in the Canary Islands, on August 3rd 2016 in Dakar for the INDP scientist, and on February 2nd 2017 in São Tomé and Principe. Similarly AOTTP-ICCAT Contractors in South Africa organised training in Capetown between 23 and 27 January, while in Brazil training was done between 2 and 4 April 2017 and attended by 8 people.

AOTTP has developed awareness and tag-recovery activities in all of the most important Atlantic coastal states based on analyses of tropical tuna landings by port. Awareness and publicity campaigns have now been designed and implemented in the following ten countries: Açores Islands (Portugal), Canary Islands (Spain), Mauritania, Senegal, Cabo Verde, Ghana, Cote d'Ivoire, South Africa, Brazil and Uruguay. Specific officers (TROs) and staff have been selected in each location to develop and implement the activities. Awareness activities began before the tagging started and are ongoing. TROs also have continuous access to an online system, developed by AOTTP, to track all the released tags so they can instantly ascertain the status of a tag, e.g. has it already been recovered or has the reward already been paid? The system is proving a very useful tool to verify the information provided by the tag-finders, helping avoid mistakes, duplications, and double payments of rewards.

Tagging and recovery data are collected, and transmitted to ICCAT/AOTTP using an Android smartphone Application, based on the Memento system. Specific tagging and tag-recovery templates have been designed in four languages (French, Spanish, Portuguese and English). After introducing the data into a smartphone using the relevant template, data are immediately uploaded to ICCAT via Telegram Messenger. The *AOTTP Tagging* and

AOTTP Recovery groups, set-up in Telegram Messenger must be used for submitting information/data collected and for resolving any problems and clarifying any questions. The system facilitates rapid upload of data, harmonising the codes (e.g. species) used. Another advantage is that it allows immediate feedback between taggers, TROs and AOTTP-ICCAT management. All AOTTP partners and colleagues are thus part of a '*digital communication network*' effecting continuous communication and exchange of information and ideas between all partners in the project.

3 Results

3.1 Tagging of tunas

AOTTP tagging at sea began at the end of June 2016 around the Azores. Since then tagging continued around the Canary Islands, off West Africa, off South Africa, off Brazil and most recently around the Madeiran Islands. So far a total of 55977 tropical tuna across locations, species and size-ranges have been tagged and released (e.g. **Figure 1** & **Tables 2-5**).

224 have been released for a second time (R-2) and 2 for a third (R-3). The overall distribution between the three main tropical species is well-balanced with: BET at 27%; SKJ at 38%; and YFT at 34%. Two neritic species (LTA and WAH) are also being targeted by AOTTP. So far only 762 LTA (1%), and 23 WAH (0%) have been tagged against an overall target of 10,000. LTA is of particular interest to West African coastal communities and will be more actively sought for tagging during phase 2.

Figure 1 summarises the total numbers of tropical tuna tagged by AOTTP/ICCAT since June 2016 using 'hexagonal bins'. The maps show that the majority of the tuna tagged so far have been off West Africa in the territorial waters of Mauritania, Senegal, The Republic of Guinea, Cabo Verde Islands, and over the Sierra Leone Seamounts which are in the High Seas (**see also Tables 3** and **4**). In **Table 3** the Atlantic Ocean is divided into 4 quadrants on 10ºN and 30ºW to reflect spatial divisions used in past tagging simulation studies. Substantial gaps remain, most notably the eastern Gulf of Guinea/Gabon/Northern Angola, The Caribbean Sea and the North-West Atlantic. In **Figures 2,3, and 4** the spatial distribution of tagging of BET, SKJ, and YFT respectively are plotted for 2016 and 2017 by month. Since the migration behaviours and biology of tropical tuna are influenced by the seasons it is informative to consider, not only where the fish were tagged and released, but also the specific time of year. No fish have yet been tagged, for example, off West Africa in May, June or September.

Size-ranges, or length-frequencies, of individuals tagged and released have been systematic overall so far (**Table 5**) although very large BET and YFT individuals have proved difficult to catch, and there is much variability among locations and seasons. The failure to catch the largest individuals is probably a function of the baitboat metier that is being used during AOTTP, which typically catches smaller or mid-size individuals.

AOTTP is using a range of electronic tags to study the migrations, and habitat preferences of tropical tuna. Two different brands of pop-up type tag (Desert Star and Wildlife Computers) were bought, and one make of internal (Lotek). 31 x Desert Star tags, 263 x Lotek internals, and 71 x Wildlife computers tags have so far been deployed (**Table 6**). The pop-up tags were programmed (50:50 mix) to release after 90 days and 180 days. Retention times have been disappointing (see **Appendix 3** for a full list). For the Wildlife Computer tags mean retention times of 30 days have been recorded with a maximum of 94 days observed so far. Nevertheless useful data are being returned. Retention rates in South Africa, for example, have been relatively high and tracks showing the migrations of large yellowfin tuna between Atlantic and Indian Oceans are emerging (**see Figure 2**).

Twenty percent (24,000) of the 120,000 target are being double-tagged by AOTTP so that 'tag-shedding' rates can be estimated. Up to now 8612 have been double-tagged, translating to 36% of the overall target, although the percentage varies among the species (**Table 7**) with, for example, 26% BET having been double-tagged, but only 13% SKJ. These imbalances will need to be redressed during Phase 2.

During the AOTTP programme 10,000 fish are being targeted for 'chemical tagging', which means they will be injected with a chemical marker that allows their otoliths (or other hard parts) to be 'read', and aged more easily. Chemically tagged fish always carry a red spaghetti tag, marked with 'KEEP WHOLE FISH'. When a fish with a red tag is reported, TROs arrange to buy the fish, pay any reward etc. take, store and process the biological samples, and ultimately determine the age of the fish from the hard-parts. Out of the 10,000 target, a total of 3994 (or 40%) have been chemically tagged and released (**Table 11**).

3.2 Recovery of tags and transmission to ICCAT Secretariat

Since the AOTTP project began, the overall number of valid conventional tag recoveries is 10,037 (**Table 8** and **Figure 8**) translating to an overall recovery rate of *ca* 20% which is more than twice the amount (9%) forecast in the AOTTP Grant Contract budget.

'Reporting' rates are estimated during 'tag-seeding' experiments whereby 'false' tags are surreptitiously inserted into tuna at various points in the tuna value chain. Subsequently everything else remains the same (ie. fishers, dockers find the tags, rewards are paid, and data sent to ICCAT) but the procedure allows an estimate of the number of tags that might have been 'missed' between capture and market. The TROs are running the tag-seeding experiments in West Africa. So far 110 'false' tags have been placed in fish in a variety of locations. The overall AOTTP reporting rate is 67% but this figure varies substantially among the 3 species and the location at which the tag-seeding experiment was done.

Recoveries of the electronic, internal/archival tags have been relatively low (**Table 9**) with an overall return rate of only 4.6% observed although returns from BET have been much higher (**Table 10**) than in YFT. One tag (ATP86659) was recovered in West Africa after being inside a fish for nearly 3 months. The tuna in question was a 73cm YFT, tagged on board Aita Fraxku on the 24th January 2017, and recovered (84cm in length) on 12th April 2017. After delivery to ICCAT HQ a large data-set was successfully extracted (available at 15 second intervals) from this tag. A single month of data, aggregated by hour, is plotted in **Figure 5** which shows the pronounced diurnal vertical migration behavior of the fish during this period.

A further statistic used in estimating population size from large-scale fish tagging programs is the 'tag-shedding rate'. The number of tags shed after tagging can be estimated for all areas and species since *ca* 20% of the tuna released are double-tagged. So far 1890 recovered tagged tuna were double tagged. The tag-shedding rates for the four species with recovery data are summarised in **Table 11**. The overall tag-shedding rate is 6% but there are differences between species. In particular the rates of tags shed from the right side of the fish are much higher in all species than that observed for the left side. It would thus be interesting to evaluate these data in more detail against the specific tagging campaigns, since it is possible that, by changing operational tagging protocols, tag-shedding rates could be reduced.

The recovery rates of chemically tagged fish reflect what is being observed for the AOTTP conventional tags (**Tables 8 & 10**) suggesting that the procedure has no particular impact on post-release mortality. So far 234 BET, 137 SKJ and 327 have been recovered from which AOTTP TROs have purchased, and taken biological samples from 218 of these chemically marked fish (red tags) representing all size classes, the three species, and both genders (**Table 12**). Other biological information like body-weight, state of sexual maturity, and stomach contents are complementing these analyses. The samples have all been processed, stored, and preserved in the laboratory facilities of AOTTP project counterparts.

During the FAD moratorium period during January and February 2017 AOTTP tagged 8,760 tropical tuna overall and 1,877, or 27%, of those have been recovered. Actually inside the FAD moratorium area AOTTP contractors managed to tag 3,436 fish (920 BET, 701 SKJ & 1,797 YFT). During the moratorium a total of 24 were recovered inside; all reported by baitboat. However, most of these recoveries were tagged and released *outside* the moratorium area, and only a handful of fish that were tagged inside have yet been recovered.

4 Discussion & Conclusions

4.1 Tagging and recovery

AOTTP has an overall objective to tag and release at least 120,000 individual fish in the tropical Atlantic. The majority of tuna have been tagged in the NE and SE Atlantic with relatively few so far in the SW and almost none yet in the NW. Tagging is ongoing in the SW (Brazil & Uruguay). The distribution of tag-releases by species is fairly even overall (**Table 2**) with BET being the least frequently tagged so far with only 14943individuals. BET is the species, out of the 3 tropicals, with the most threatened stock status and it will, therefore, be important to target more BET during Phase 2. Length classes are well represented up to 100 cm (**Table 5**), but special effort will be invested in tagging individuals of all species bigger than 100 cm FL in the next months.

A total of 1890 recovered tagged tuna were originally double-tagged. The overall target is 24,000 (20%), so for each species AOTTP should be double-tagging 8,000. Proportionally, double-tagging targets have been met almost exactly for YFT, exceeded for BET, but are short so far for SKJ (**Table 7**). Tag-shedding results are similar to what has been observed in previous tagging campaigns. The overall AOTTP target for chemical tagging is 10,000 fish, or 3,333 (8%) for each species. Proportionally these targets have been exceeded (e.g. 1,221 BET, 1,220 SKJ and 1,550 have already been chemically-tagged) so AOTTP will need to distribute the chemically tagged fish carefully during Phase 2.

For AOTTP Phase 1 the target was set at 72,500, the spatial distribution reflecting the recommendations in the AOTTP Feasibility Study and Grant Contract. Contractors began tagging in the Azores in June this year (2,775 tagged, target 4,500) and followed in a clockwise direction around the Atlantic with The Canaries (6,526 tagged, target = 6,500), Mauritania-Guinea (11,237 tagged, target = 11,000), Gulf of Guinea (26,829 tagged, target = 22,000), and South Africa (218, target=6,500). Tagging is ongoing in Brazil and Uruguay (8,084 tagged, target = 13,000) and Phase 2 has begun in Madeira/Azores (2,000 tagged, target = 4,500). During 2017 twenty fish will also be fitted with miniPATs in the territorial waters of USA. In February ICCAT signed a contract to tag 9,000 fish in the territorial waters of Venezuela as part of the Phase 1 target. Unfortunately, however, the political situation in Venezuela has caused a substantial delay. The Contractor has been discussing a change of emphasis to Trinidad and Tobago but there is yet no news.

AOTTP Coordination began to plan Phase 2 tagging in March 2017 and at that time an outline timetable was agreed with the AOTTP Steering Committee. Calls for Tender for the eastern Gulf of Guinea and Azores/Madeira were launched in April and May this year with the intention that Phase 2 tagging would begin in summer and autumn 2017. Unfortunately no offers were received for the Gulf of Guinea, while a proposal for the Azores/Madeira Region was awarded. A new Call for Tender for Phase 2 tagging is now being prepared for publication and there is now an opportunity to discuss how these tags should be distributed both spatially and temporally. The situation in the Caribbean (Venezuela) is a serious concern, while in South Africa, the Phase 1 tagging targets were missed by a long way due to poor fishing and weather, and AOTTP is not planning to return there.

Data so far gleaned from all the electronic tags have been disappointing (**Appendix 3**). The recalls by both Desert Star and Wildlife Computers pop-up tags in 2016 seriously affected our ability to alternate their deployment which would have allowed us to compare their performance more accurately. Retention times for all of the pop-up tags have been in general much shorter than for which they were programmed. One Desert Star tag was retained for 180 days but the maximum time we have seen for the Wildlife Computers tags is only *ca* 90 days. Retention times have varied by location with the longest being seen in South Africa and the shortest in Brazil where rapid post-release mortality (predation) has been an issue. The data actually extracted from the Wildlife Computers tags are, however, relatively comprehensive and diving patterns and geographic tracks are straightforward to ascertain. Desert Star tags, however, store less time-series data less frequently, and the geographic tracks that we have managed to estimate from them have, so far, been comparatively crude. Recovery rates for the internal tags have been much lower than we have seen for the conventional tags which may reflect mortality caused by the surgical procedure (**Table 11**). When the internal tags are actually recovered, however, the data are of excellent quality and particularly detailed (observations 15 seconds) behavioural patterns of the tuna can be elucidated. All the electronic tags are very expensive, however, and a decision based on Phase 1 performance, therefore, needs to be made (at this stage) before any further funds are invested by AOTTP in electronic tagging.

Recovery percentages of the conventional tags are higher than in previous tagging programmes in the Atlantic Ocean with particularly high proportions of YFT being returned. AOTTP data quality (release and recovery locations, length measurements etc.) is also acceptable overall, with an improvement over previous Atlantic campaigns. For the tag-seeding experiments the preliminary overall reporting rate of 67% is below the 85% target set out in the AOTTP Grant Contract. The results, however, are variable, the trend is upwards and many more experiments are scheduled. In similar tuna tagging programs in other oceans, reporting rates of: 1% (Atlantic); 61% (Western Pacific Ocean); and 95 % (Indian Ocean) have been recorded. It is, however, difficult to compare reporting rates between oceans, fleets, and periods because of confounding due to varying geographical distributions, fishing and landing operations. Nevertheless, AOTTP reporting rates are average overall; and at similar levels to those observed in the Western Pacific Ocean. A coordination meeting with the TROs will be held in West Africa in either the third or fourth quarter 2017 during which the issue will be discussed.

After having set up tag-recovery activities in most of the important landing ports for tropical tuna, AOTTP will now begin to expand activities into CPCs, areas and fleets which are not yet formally involved in the programme. This activity will predominantly target awareness-raising and possibly tagging (by observers) among longline vessels and personel which tend to operate in more central areas of the Atlantic. Longline landings of tropical tuna are substantial, and larger fish also tend to be caught; important for AOTTP growth-rate estimation, in particular. The longliners are mostly operated by Asian CPCs (Japan, South Korea) and a Concept Note for engagement with them has been prepared.

Preliminary analyses of the tag recoveries in the FAD moratorium area, closed to FAD fishing during January and February 2017, are interesting appear to demonstrate that fishing mortality was much lower in the moratorium area. There is thus a strong incentive to further develop the analysis of this information.

4.2 Revised log-frame

AOTTP progress is being monitored using, 'verifiable indicators' (e.g 'Number of tuna tagged'). The majority of these indicators are defined in the AOTTP Logical Framework Matrix and will not change throughout the project. At this stage, however, we propose to revise/update the following indicator for each of the tropical tuna species (BET, SKJ, and YFT) that are assessed by the SCRS:

- Uncertainty around reference points (B/B_{MSY} and F/F_{MSY})

AOTTP data will thus contribute to reductions in uncertainty around the stock assessments by improving the accuracy of biological parameter estimation. Identifying how knowledge gained under AOTTP can reduce uncertainty will be one of the key outcomes of the project, and can also be thought of as, 'the Value of Information'. This clarification of 'End Targets', together with a clear workplan, will help ICCAT/AOTTP and DG-DEVCO achieve its objectives. The following End Target for all 3 tropical species (**see Table 13**) is therefore proposed:

- *Reduce 'cloud' of uncertainty around the Kobe phase plot (see **Figure 9**).*

If the uncertainty can be reduced in a meaningful way it follows that the stocks can be managed closer to their Maximum Sustainable Yield, meaning that fishery yields can be higher with the same level of risk of, say, depleting the stock. Note, however, that it is difficult to specify the exact amount by which the uncertainty can be reduced as there are 'subjective' factors which cannot be quantified such as the particular type of model being used.

4.3 Capacity building and data-analyses

Capacity building is a very important component of the AOTTP project. Scientists and technicians, particularly from our developing country partners have already been trained in all aspects of tagging at sea, tag recovery and awareness raising activities. However, now that a rich mark-recapture dataset is beginning to accumulate, training and capacity development in all aspects of tagging data analyses, biological parameter calculation and their eventual incorporation into population assessment models will need to be planned.Activities *A2.2-Tagging-data analyses* and *A3.3-Training in data analyses* in the orgininal AOTTP Grant Contract are the most relevant. A2.2 refers to, 'analyses by scientific consultants to estimate missing key parameters for stock assessments' and will start in Quarter 3 2018. Calls for Tender for this work will be drafted in early Q2. Activity A3.3 is the capacity building element of the data analytical work whereby, 'dedicated workshops will be organised to reinforce the capacity of ICCAT developing member states in data analyses, interpretation and development of scientific advice'. Indicators include numbers of workshops and participants. This work was not scheduled to start until Quarter 4 2018 in the original Grant Contract. AOTTP Coordination, however, believes that by then it will be too late for a successful Final Symposium and proposes, instead, to arrange three study visits/workshops: one in Q4 2017; one in Q1 2012; and one in Q2 2018.

In general, the research and data-analytical work on the AOTTP database will be driven by the priorities of the ICCAT SCRS and Commission. All work will be integrated within ICCAT/SCRS's annual cycle of SCRS Working Groups according to ICCAT's Management Framework. Detailed planning will, therefore, be adjusted according to the requirements of the SCRS and ICCAT Commission, which can and will eventually change throughout the program life span. Initially, for example, the SKJ stock assessment work was planned for 2018, but during the 2016 Commission meeting it was decided that the priority for that year would instead be BET.

The annual cycle of work can, however, be broadly articulated as follows:

1. ICCAT-AOTTP will collect the tag-recovery data, check and validate them, pay rewards, and store them in a relational database at ICCAT.
2. ICCAT-AOTTP will present basic summary statistics (tag release and recovery frequencies, tag-shedding rates, times at liberty and reporting rates) from the tag-recapture database to the relevant SCRS Working Groups each year. In 2017 it will be at the Tropical Species Group Intersessional Meeting (4-8 September 2017) and at the SCRS Plenary in the first week of 2-6 October 2017.
3. Based on these statistics the SCRS will take decisions on research, management and capacity building priorities within their annual workplans. These will then be facilitated and organized by ICCAT-AOTTP once formally endorsed by the Commission. We would expect the plan to start with studies into growth, migration and mortality increasing in sophistication as data accumulate.
4. Once approved by the Commission, capacity building/training activities will include both the estimation of key biological parameters (growth rates, mortality, and migration) and stock assessment modeling. The activities and training will be developed gradually and systematically by ICCAT-AOTTP.

5. In 2017/2018 the SCRS will identify specific research questions to be addressed and, if necessary, ICCAT-AOTTP will then launch Calls for Tender for relevant scientific data analyses. We anticipate that at least one of these targeted studies will focus on providing a risk analysis framework that identifies the effect of uncertainty on management objectives, evaluating the relative value of the different sources of information being collected by ICCAT-AOTTP.
6. Together with SCRS, ICCAT-AOTTP will organize the AOTTP Final Symposium in mid-2020 where all the work will be presented and written up into a Conference Proceedings Series.

In conclusion, AOTTP is making good progress. There remain gaps in the tag-distribution, particularly in the Caribbean Sea and NW Atlantic. Nevertheless it should be possible to deal with these issues during Phase 2.

5 Acknowledgements

A tagging programme such as AOTTP depends on the hard work and dedication of fishing skippers and crews, financial administration officers, and tagging and tag-recovery teams around the Atlantic. We therefore thank the ICCAT Secretariat (particularly Driss Meski, Antonio Moreno, Miguel Neves dos Santos, and Paul de Bruyn) for overseeing the administration of the project, the skippers and crews of the Acoriana, the Grand Primero, the Macizo, the Aita Fraxku, the TarrynAmy, the Estrela Delva, the Katsushio Maru 8, The Thavisson III,the Tuburao Tigre, the Aldbaran I and the Ponta Calhau for their work in finding fish, catching bait and their cheerful help given to the tagging teams on board. At least 65 scientists and technicians (too many to list) have endured all manner of adverse conditions, and cramped living quarters, at sea in order to tag tuna for AOTTP, and are owed an enormous debt of thanks. The AOTTP Steering Committee have provided much help and advice during the project (e.g. Driss Meski, David Die, Shannon Cass-Calay, Hilario Murua, Monin Justin Amande, and Paulo Travassos), and note that some are also involved in AOTTP tagging and recovery activities. Funding from the European Union (DG-DEVCO), ICCAT CPCs and Collaborators is gratefully acknowledged as is the substantial support to the AOTTP project given by AOTTP Project Officer, Isabelle Viallon.

Table 1. Tagging campaigns by location.

Location	*Number*
Azores	12
Brazil (Ariea Branca)	2
Brazil (Cabo Frio)	5
Brazil (Fernando de Noronha)	2
Brazil (Itajai)	1
Brazil (SP & SP)	1
Canarias	11
Golfo de Guinea	7
Madeira	3
Senegal	4
South Africa	11

Table 2. Number of tag-releases by species and release stage code.

	R-1	*R-2*	*R-3*	*Total*
BET	14821	121	1	14943
BLF	9	0	0	9
BON	6	0	0	6
FRI	1	0	0	1
LTA	761	1	0	762
SKJ	20944	36	0	20980
WAH	23	0	0	23
YFT	19076	66	1	19143
Total	**55641**	**224**	**2**	**55867**

Table 3. Number tag releases by quadrant.

	NE	*NW*	*SE*	*SW*
BET	7704	1	6325	912
BLF	0	0	9	0
BON	2	0	0	4
FRI	0	0	1	0
LTA	370	0	358	34
SKJ	11642	0	7098	2145
WAH	1	0	21	1
YFT	3921	0	13279	1940
Total	**23640**	**1**	**27091**	**5036**

Table 4. AOTTP numbers of fish tagged by Exclusive Economic Zones.

Table continues below

Species	Brazilian EEZ	Cape Verdean EEZ	Ghanaian EEZ	Guinea Bissau EEZ	Guinean EEZ	High Seas	Ivory Coast EEZ	Liberian EEZ
BET	816	1709	10	163	538	5291	374	179
BLF	5	0	0	0	0	0	4	0
BON	4	0	0	0	0	0	0	0
FRI	0	0	0	0	0	1	0	0
LTA	34	0	0	62	49	247	12	0
SKJ	1940	212	8	78	660	6180	455	112
WAH	22	0	0	0	0	0	0	0
YFT	1814	269	140	591	1088	10433	933	336
Total	**4635**	**2190**	**158**	**894**	**2335**	**22152**	**1778**	**627**

Table continues below

Mauritanian EEZ	Portuguese EEZ (Azores)	Portuguese EEZ (Madeira)	Senegalese EEZ	Sierra Leonian EEZ	South African EEZ
455	181	0	1589	304	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	1	0	357	0	0
2006	2587	51	1499	69	108
0	0	0	1	0	0
1033	1	1	2158	116	127
3494	**2770**	**52**	**5604**	**489**	**235**

Spanish EEZ (Canary Islands)	Uruguayan EEZ
3329	4
0	0
2	0
0	0
0	0
4920	0
0	0
78	22
8329	**26**

Table 5. Length-frequencies of released tuna (R-1, valid) by species.

cms	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130	130-140	140-150	150-160	160-170	170-180
BET	5	1355	4995	4044	3244	678	214	195	40	21	6	3	0	2	2	5
FRI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
LTA	1	47	562	148	1	1	0	0	0	0	0	0	0	0	0	0
WAH	0	0	0	1	0	0	0	1	1	4	6	4	6	0	0	0
YFT	2	5516	7969	3050	1556	495	230	131	30	9	8	15	31	17	8	5

Table 6. Electronic tag releases by species.

	DS-SeaTag-3D-PSAT	Lotek-2810	MiniPAT-348C
BET	25	88	2
SKJ	0	9	0
YFT	6	166	69
Total	**31**	**263**	**71**

Table 7. Number of fish double-tagged and released by species.

	BET	BLF	BON	FRI	LTA	SKJ	WAH	YFT	Total
Double	3038	1	0	1	112	2350	2	3108	8612
Single	11905	8	6	0	650	18630	21	16035	47255
%	**26**	**12**	**0**	**-**	**17**	**13**	**10**	**19**	**18**

Table 8. Total conventional tag-recoveries ('RCF' only) by species.

	BET	BLF	BON	FRI	LTA	SKJ	WAH	YFT	Total
Total	3248	0	0	1	157	2210	0	4421	10037
%	22	0	0	100	21	11	0	23	20

Table 9. Internal electronic tag releases, recoveries and recovery-percentages by species.

	Releases	Recoveries	%
BET	88	7	8
SKJ	9	0	0
YFT	166	5	3

Table 10. Chemically tagged totals by species.

	BET	LTA	SKJ	YFT
Releases	1221	3	1220	1550
Recovered	234	0	137	327
%	**19.2**	**0**	**11.2**	**21.1**

Table 11. Tag-shedding rates (%) by species

	BET	FRI	LTA	SKJ	YFT
Lost_Left	1	0	0	2.6	1.3
Lost_Right	2.8	0	11.8	5.7	5

Table 12. Biological samples collected.

	F	M	U
BET	31	39	1
SKJ	37	31	0
YFT	33	46	0
Total	**101**	**116**	**1**

Table 13. Revised indicative List of indicators (Note that while it is not possible to estimate the reduction of uncertainty that could be brought by tagging data, improvements in our knowledge on biological parameters, stock structure and movements will improve the estimate of references points. Also the uncertainty around the reference points for YFT increased due to 'pooling' the output of model 1).

Indicator.name	Unit		Baseline	Current	End target
Uncertainty around reference points B/B_{MSY} & F/F_{MSY} for YFT	Number	Value	B/B_{MSY}: 0.85 (0.61-1.12) F/F_{MSY}: 0.87 (0.68-1.40) Median (10^{th}-90^{th} percentiles)	B/B_{MSY}: 0.95 (0.71-1.36) F/F_{MSY}: 0.77 (0.53-1.95) Median (10^{th}-90^{th} percentiles)	Reduce 'cloud' of uncertainty around the Kobe phase plot by x%
		Date	2011	2016	2021 (next assessment)
Uncertainty around reference points B/B_{MSY} & F/F_{MSY} for BET	Number	Value	B/B_{MSY}: 1.01 (0.72-1.34) F/F_{MSY}: 0.95 (0.65-1.55) Median (10^{th}-90^{th} percentiles) Production model (Logistic) results represent median and 80% confidence limits	B/B_{MSY}: 0.67 (0.48-1.2) F/F_{MSY}: 1.28 (0.62-1.85 Median (10^{th}-90^{th} percentiles)	Reduce 'cloud' of uncertainty around the Kobe phase plot by x%
		Date	2010	2015	2018 (next assessment)
Uncertainty around reference points B/B_{MSY} & F/F_{MSY} for SKJ	Number	Value	B/B_{MSY}: likely > 1 (E stock) / probably close to 1.3 (W stock) F/F_{MSY}: likely < 1 (E stock) / probably close to 0.7 (W stock).	B/B_{MSY}: likely > 1 (E stock) / probably close to 1.3 (W stock) F/F_{MSY}: likely < 1 (E stock) / probably close to 0.7 (W stock).	Reduce 'cloud' of uncertainty around the Kobe phase plot by x%
		Date	2014	2014	2020

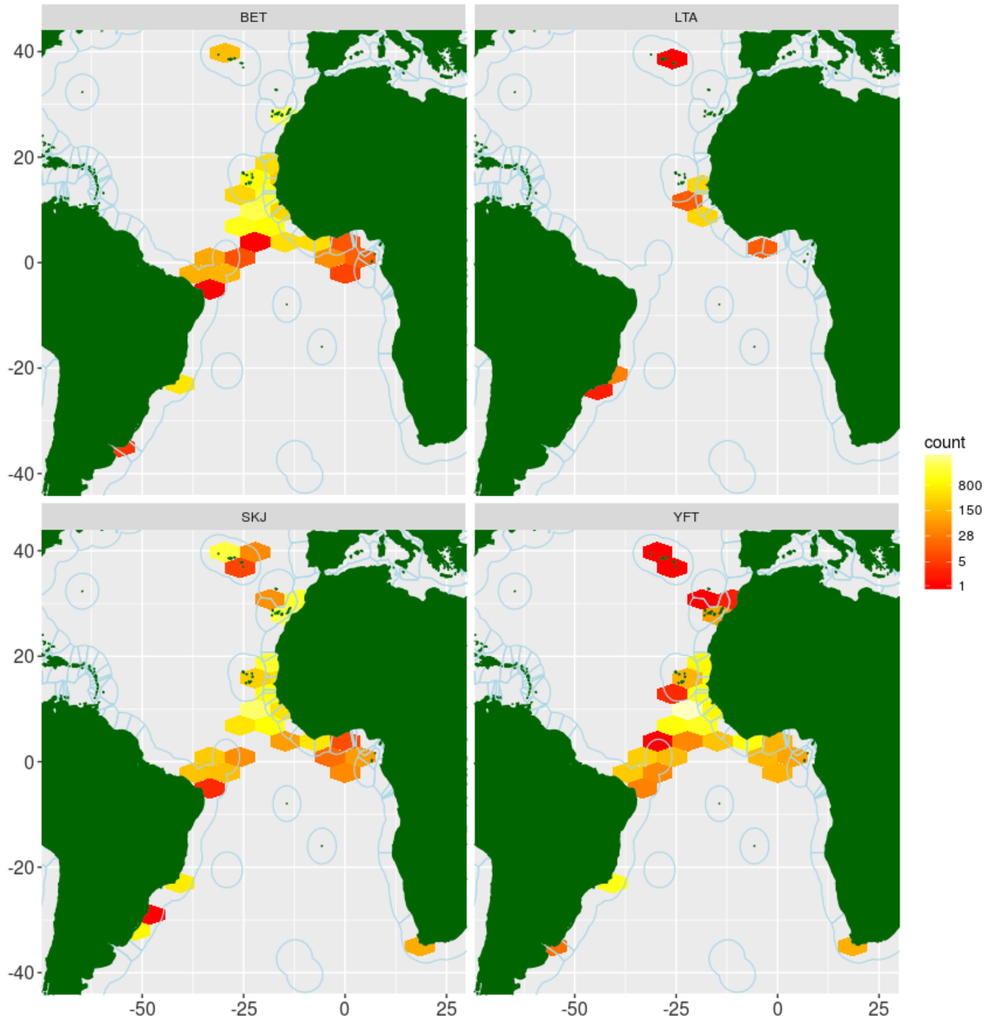

Figure 1. Distribution of tropical tuna (by species) tagged and released by ICCAT-AOTTP between June 2016 and September 2017

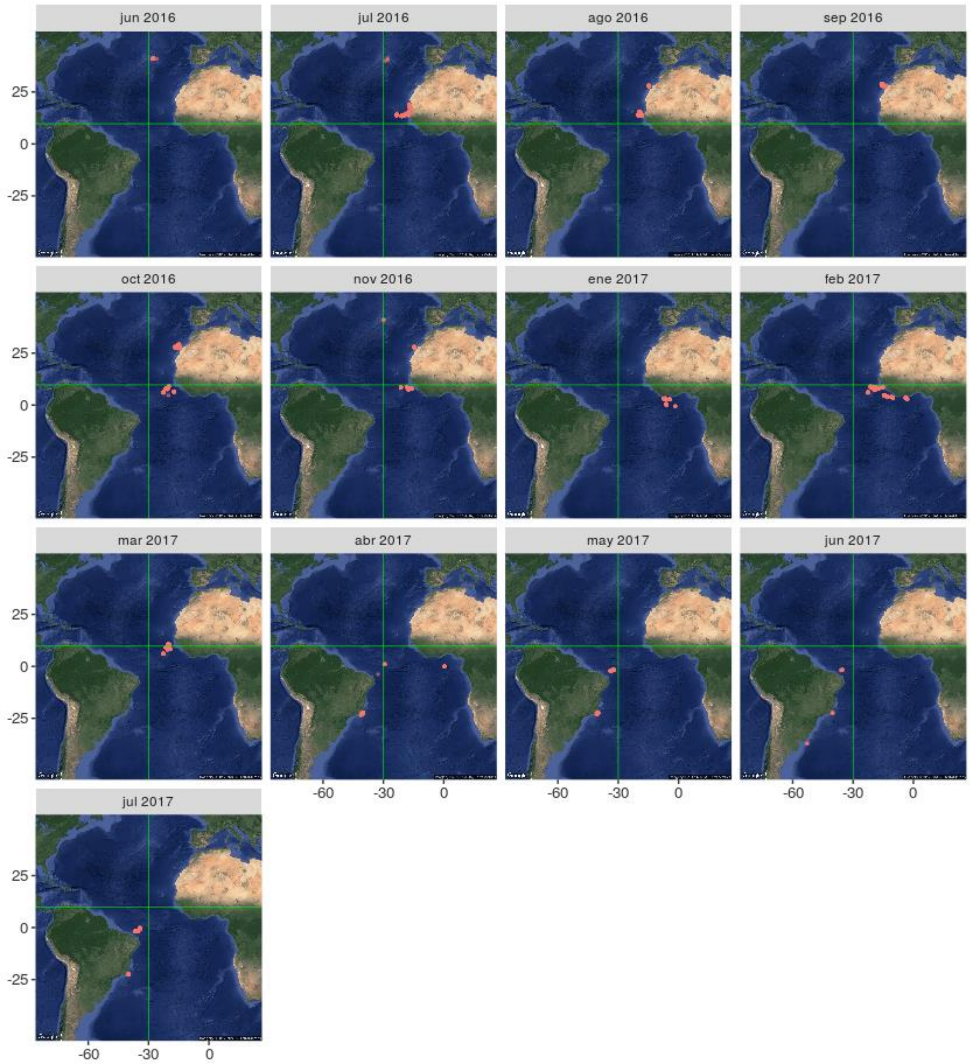

Figure 2. Monthly distribution of BET tagged and released by ICCAT-AOTTP between July 2016 and September 2017

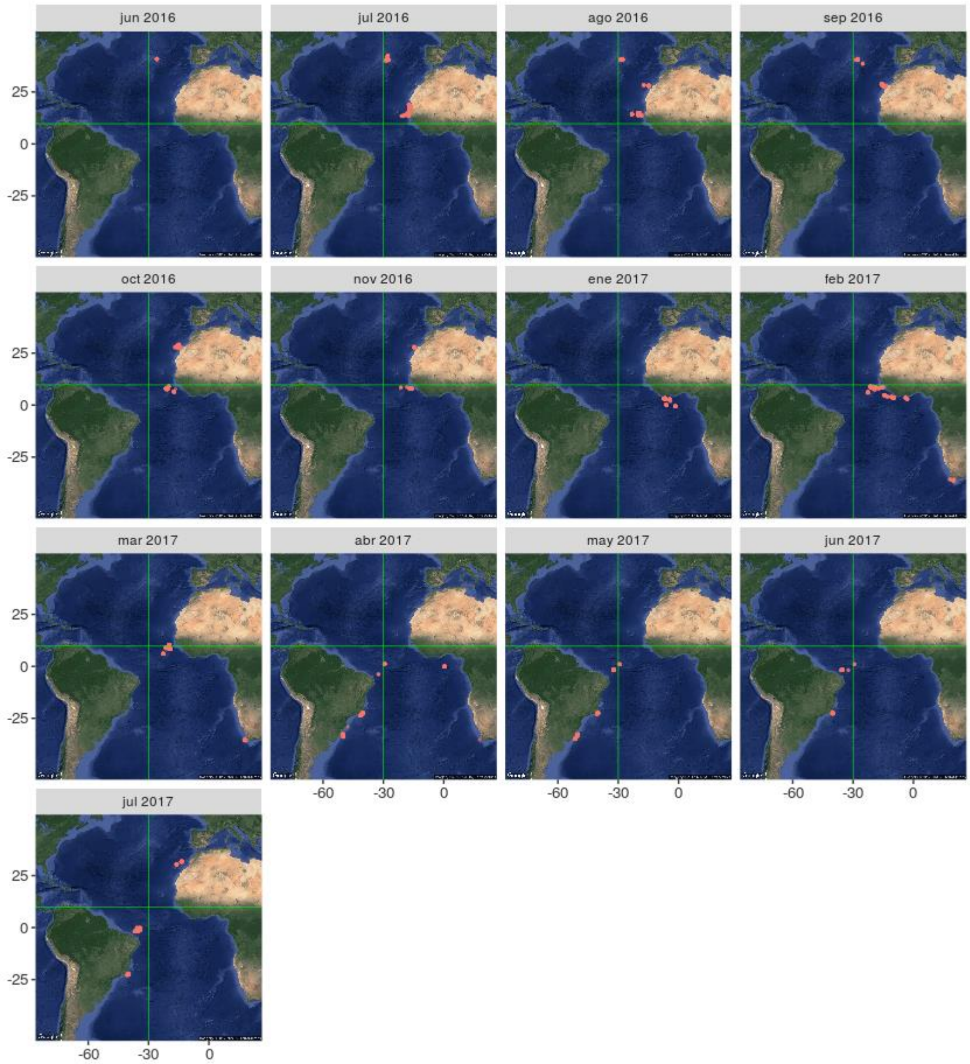

Figure 3. Monthly distribution of SKJ tagged and released by ICCAT-AOTTP between July 2016 and September 2017

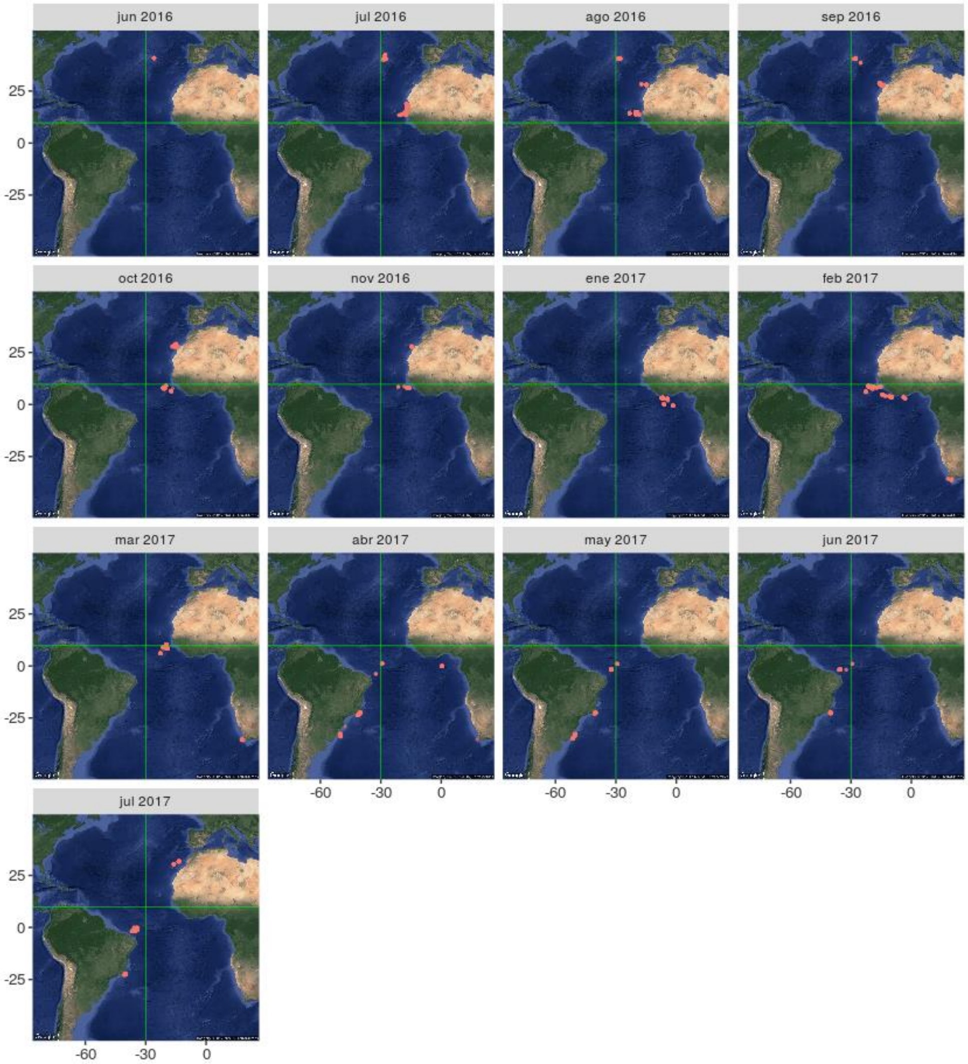

Figure 4. Monthly distribution of YFT tagged and released by ICCAT-AOTTP between July 2016 and September 2017.

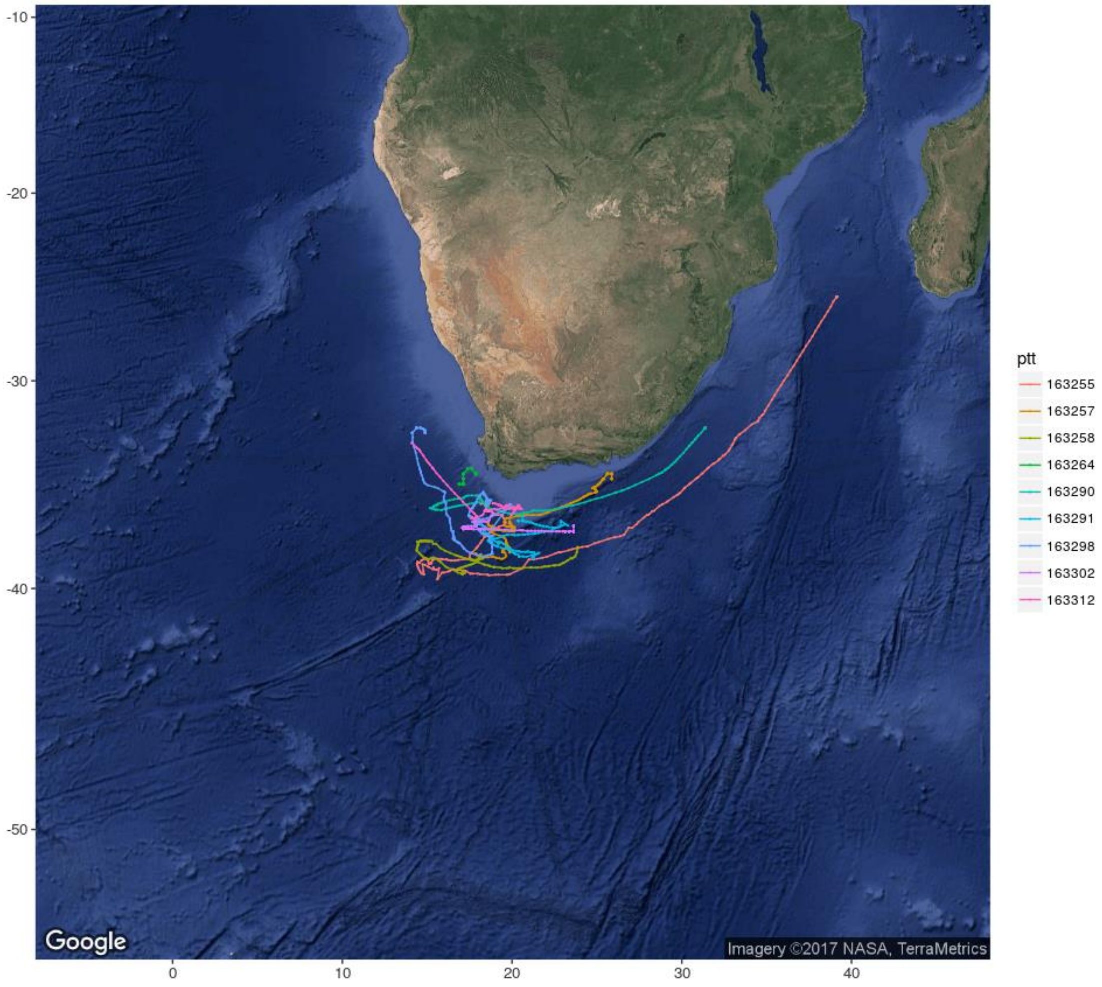

Figure 5. Migrations of Yellowfin tuna tagged off South Africa in February 2017.

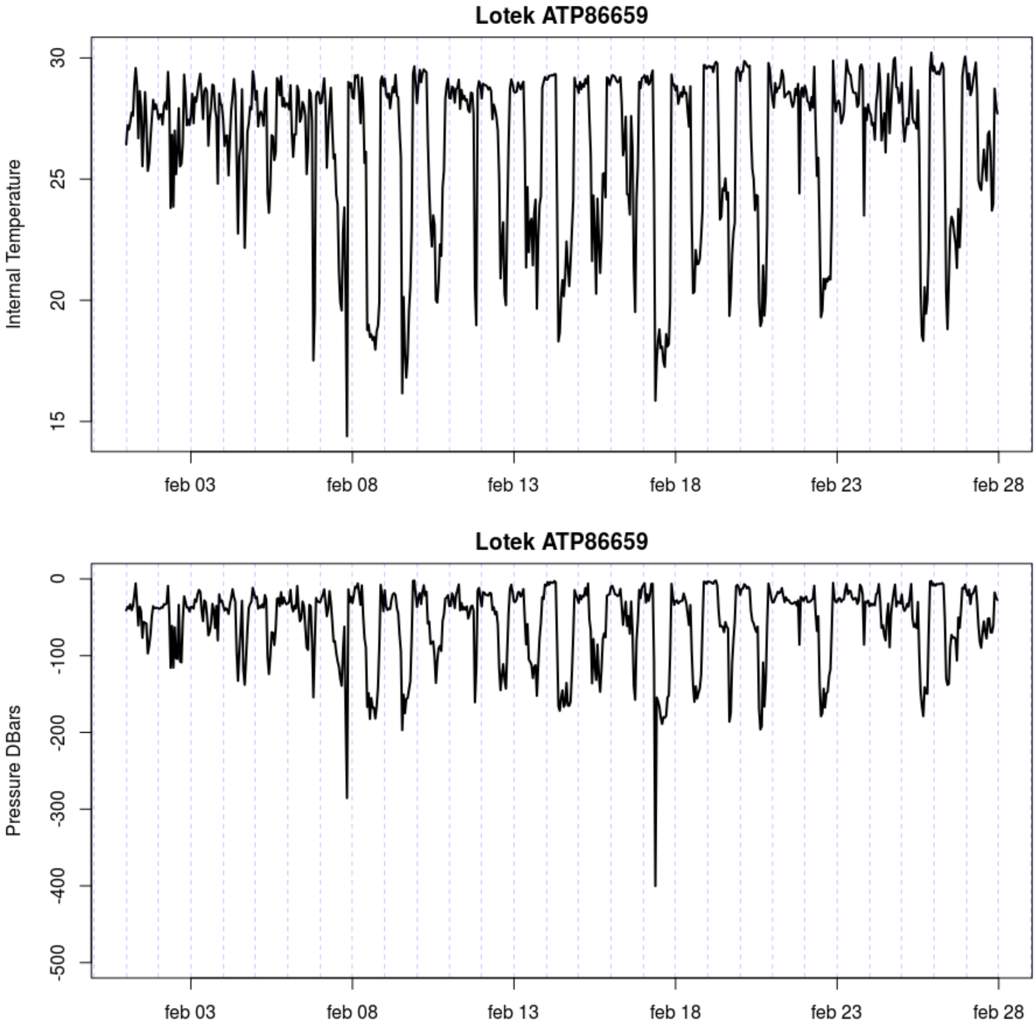

Figure 6. Temperature and depth profiles of YFT tuna tagged off West Africa.

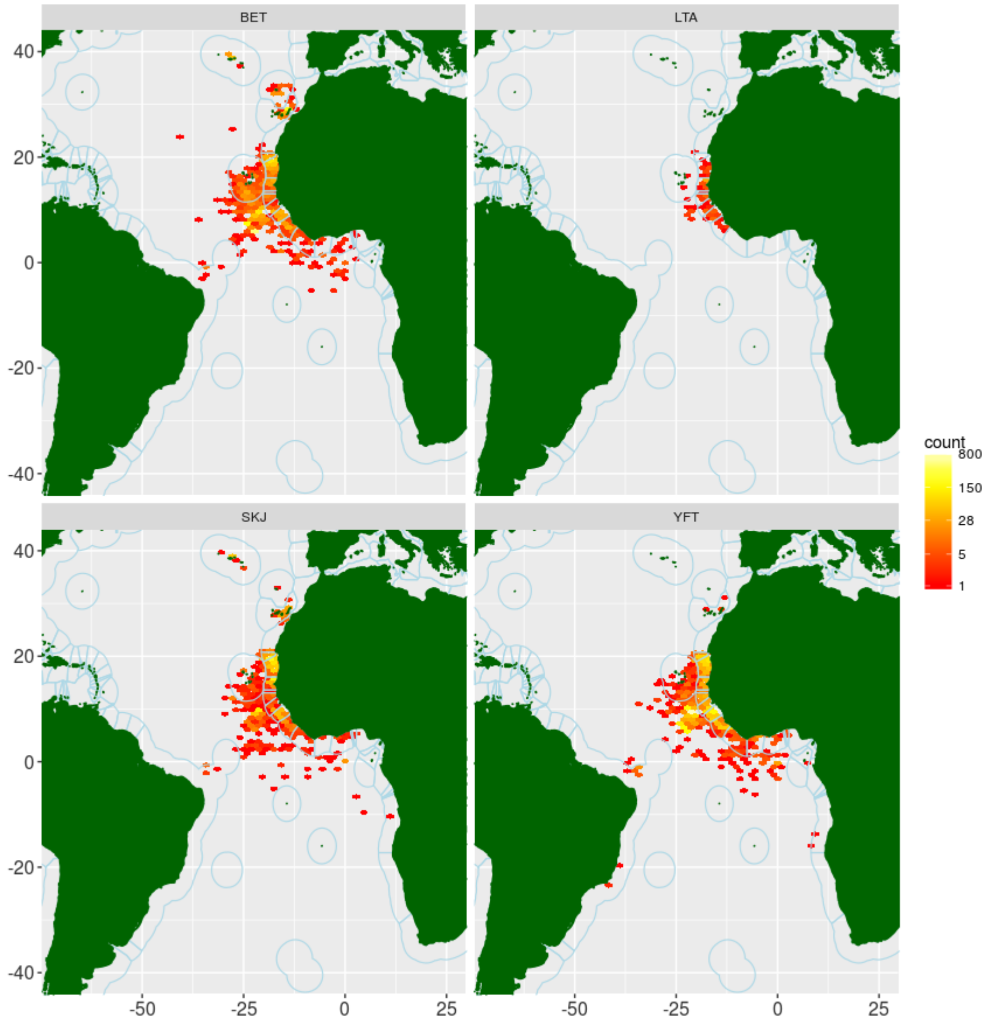

Figure 7. Spatial distribution of tropical tuna recovered by AOTTP between June 2016 and September 2017.

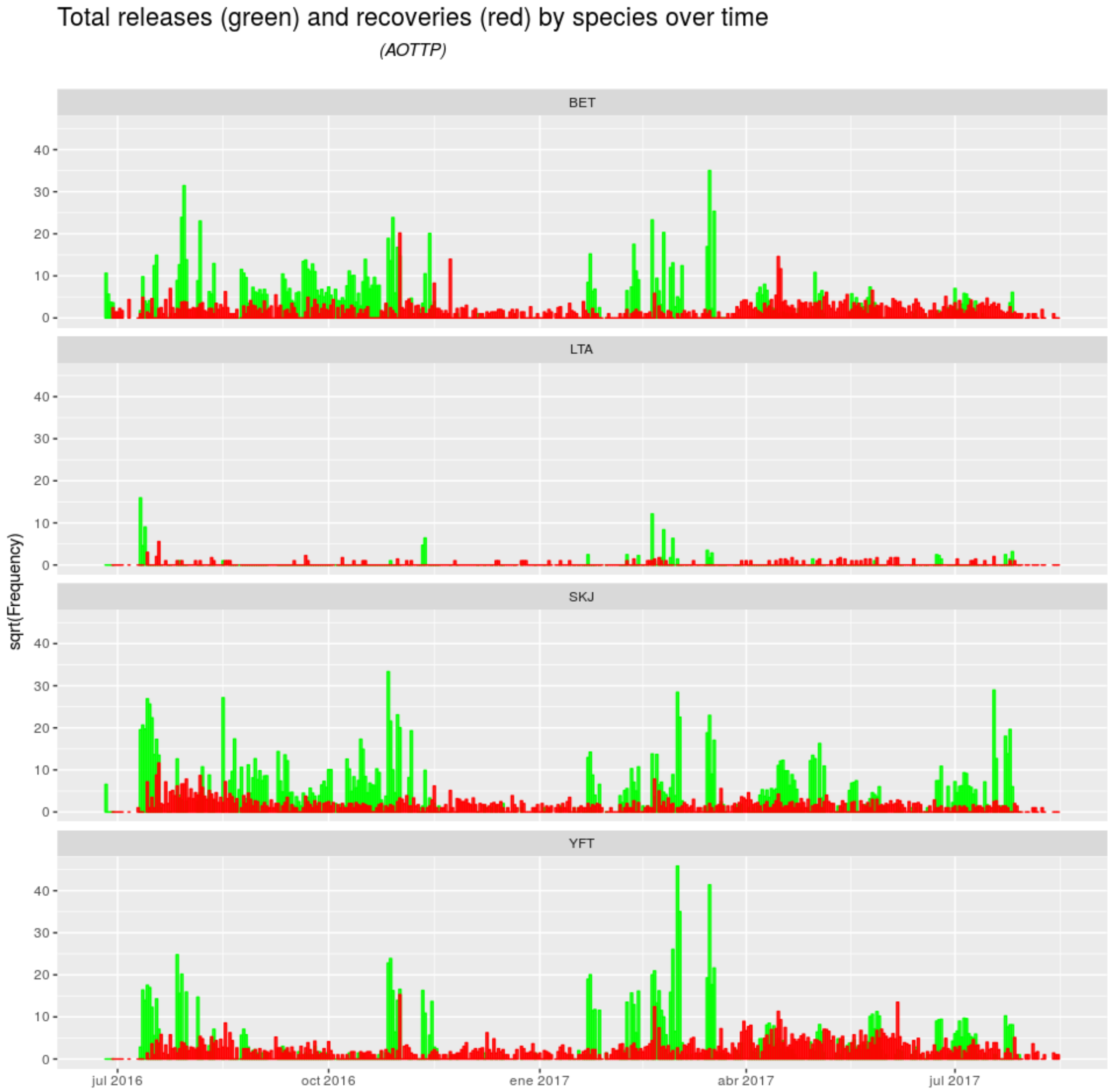

Figure 8. Total ICCAT/AOTTP releases (green) and recoveries (red) over time by species (BET=bigeye, LTA=little tunny, SKJ=skipjack, YFT=yellowfin). The numbers have been square-root transformed so they can be seen on the same axes.

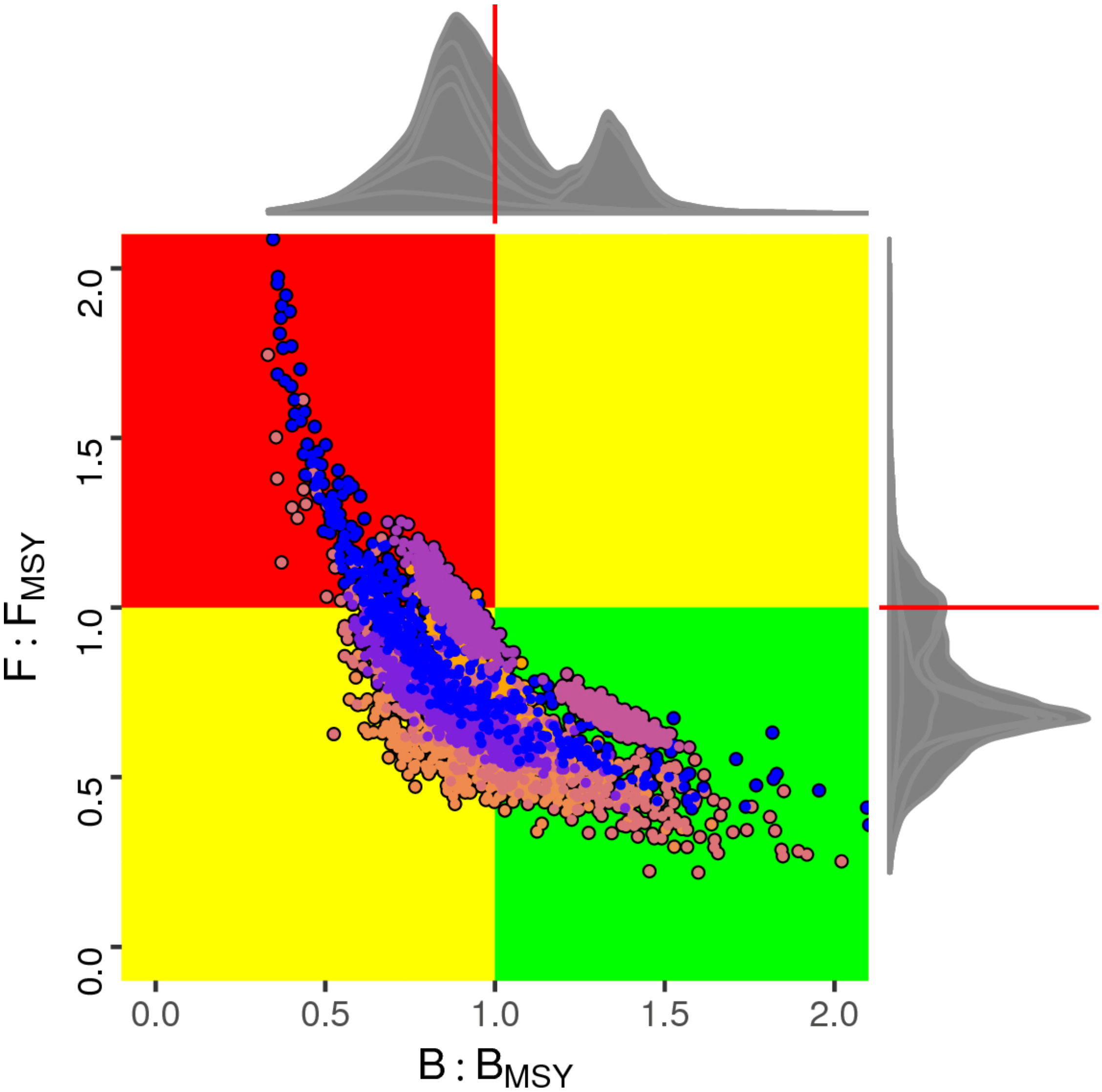

Figure 9: Kobe phase plot from 2017 yellowfin assessment.

Appendix 1

List of contracts (>60,000 euros) awarded by ICCAT between June 2016 and June 2017

Date	*Supplier*	*Objective*	*Award procedure*	*Total*
8/1/2016	CRO-CI ABDIJAN	Recovery activities in the East Atlantic	INTERNATIONAL CALL FOR TENDER	264,628 €
8/1/2016	CRODT DAKAR	Recovery activities in the East Atlantic	INTERNATIONAL CALL FOR TENDER	132,824 €
10/5/2016	MARINE FISHERIES RESEARCH "MRFD"	Recovery activities in the East Atlantic	INTERNATIONAL CALL FOR TENDER	60,150 €
11/3/2016	HALLPRINT Pty Ltd	Stainless steel head dart tags and applicator tips	3 QUOTES REQUESTED	95,079 €
11/14/2016	SERVIGIS	IT consultant for AOTTP database	CALL FOR TENDER	48,370 €
1/5/2017	FADURPE LED CONSORTIUM	Tagging activities in the West Atlantic	INTERNATIONAL CALL FOR TENDER	665,460€
1/25/2017	CAPRICORN MARINE ENVIRONMENTAL (Pty) Ltd	Tagging activities in South East Atlantic	INTERNATIONAL CALL FOR TENDER	217,684 €
2/28/2017	PROYECTOS BIOLOGICOS Y TECNICOS S.L. (PROBITEC)	Tagging activities off North West Atlantic	INTERNATIONAL CALL FOR TENDER	433,400€
4/11/2017	LARGE PELAGIC RESEARCH CENTER // TAG A TINY	Tagging activities in North West Atlantic	INTERNATIONAL CALL FOR TENDER	62,688 €
5/25/2017	FADURPE LED CONSORTIUM	Awareness and tag recovery campaign for the Atlantic in Brazil	3 QUOTES REQUESTED	70,000 €

Appendix 2

List of Acronyms used in the Report

AOTTP	Atlantic Ocean Tropical tuna Tagging Programme
AZTI	Centro Tecnologico experto en innovacion marina y alimentaria
BET	Bigeye tuna (*Thunnus obesus*)
BLF	Blackfin tuna (*Thunnus atlanticus*)
BON	Atlantic bonito (*Sarda sarda*)
CIPA	Research Centres. Centro de Investigacao Pesqueira Aplicada (CIPA) de Bisseau
CLPA	Comite Local de la Peche Artisanale (Senegal)
CRO – CI	Centre Recherches Oceanologiques (Cote d'Ivoire)
CRODT	Centre Recherches Oceanologiques de Dakar (Senegal)
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)
DAFF	Department of Agriculture, Forestry and Fisheries (South Africa)
DEPAq	Departamento de Pesca e Aquicultura (Brazil)
DG-DEVCO	Directorate-General for International Cooperation and Development
DG-MARE	Directorate-General for Maritime Affairs and Fisheries
EEZ	Exclusive Economic Zone
FADURPE	Fundacao Apolonio Salles de Desenvolvimento Educacional
FSSD	Fisheries Scientific Survey Division (Ghana)
FM	Fausses marques
FRI	Frigate tuna (*Auxis thazard*)
IATTC	Inter-American Tropical Tuna Commission (USA)
ICCAT	International Commission for the Conservation of Atlantic Tunas
IEO	Instituto Espanol de Oceanografia
IMAR	Instituto do Mar
IMROP	Institute Mauritanien de Recherches Oceanographiques et des Peches (Sao Tome and Principe)
INDP	Instituto Nacional para Desenvolvimento das Pescas (Cabo Verde)
IRD	Institute de recherche pure le developpment
ISRA	Institute Senegalais de Recherches Agricoles
LATEP	Laboratorio de Tecnologia Pesqueira (Brazil)
LPRC	Large Pelagic Research Center (USA)
LTA	Little tunny *(Euthynnus alletteratus*)
MFRD	Marine Fisheries Research Division (Ghana)
MFV	Motor Fishing Vessel
MSE	Management Strategy Evaluation
PAD	Port Autonome de Dakar (Senegal)
PROBITEC	Proyectos Biologicos y Tecnicos (Spain)
RV	Research Vessel
SC	Steering Committee
SCRS	Standing Committee on Research and Statistics
SKJ	Skipjack tuna (*Katsuwonus pelamis*)
SPC	Pacific Community (New Caledonia)
tRFMO	Tuna Regional Fisheries Management Organizations

TRO	Tag Recovery Officer
UPV	Universidad Politecnica de Valencia (Spain)
UFERSA	Universidade Federal Rural de Semiarido (Brazil)
UFPRE	Universidade Federal de Pernambuco (Brazil)
UPV	Universidad Politecnica de Valencia (Spain)
YFT	Yellowfin tuna (*Thunnus albacares*)

Appendix 3

Wildlife computers tag release summary

Ptt	*DeployDate*	*DataDays*	*ReleaseType*
163236	16-May-2017	15	Too Deep
163255	03-Apr-2017	63	Floater
163257	03-Apr-2017	42	Floater
163258	03-Apr-2017	43	Floater
163259	03-Apr-2017	94	Interval
163260	17-May-2017	5	Too Deep
163262	25-May-2017	21	Premature
163264	03-Apr-2017	6	Premature
163265	06-Jun-2017	34	Floater
163266	18-Mar-2017	26	Floater
163269	18-Mar-2017	33	Floater
163270	01-Jun-2017	32	Premature
163271	13-May-2017	2	Too Deep
163273	05-Jun-2017	48	Floater
163275	08-Apr-2017	8	Premature
163276	18-Mar-2017	24	Floater
163277	07-Jun-2017	36	Floater
163281	21-Feb-2017	27	Premature
163282	16-May-2017	18	Floater
163283	18-Jan-2017	20	Premature
163284	18-Jan-2017	16	Premature
163285	18-Jan-2017	38	Premature
163287	21-Feb-2017	47	Premature
163289	21-Feb-2017	16	Premature
163290	03-Apr-2017	48	Floater
163291	03-Apr-2017	45	Pin Broke
163293	21-Feb-2017	10	Premature
163294	21-Feb-2017	10	Premature
163295	21-Feb-2017	24	Floater
163296	03-Apr-2017	86	Premature
163298	10-Apr-2017	53	Floater
163299	21-Feb-2017	10	Floater
163300	30-Apr-2017	4	Too Deep

163301	18-Mar-2017	27	Floater
163302	03-Apr-2017	51	Pin Broke
163303	21-Feb-2017	21	Premature
163304	17-May-2017	35	Floater
163306	21-Feb-2017	26	Premature
163307	18-Mar-2017	32	Floater
163308	21-Feb-2017	8	Premature
163309	21-Feb-2017	25	Floater
163310	21-Feb-2017	28	Floater
163311	21-Feb-2017	18	Premature
163314	21-Feb-2017	28	Floater