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ISSUES RELATING TO THE RECOVERY OF TAGS AS PART OF THE PACIFIC TUNA TAGGING PROJECT

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EXECUTIVE SUMMARY

The Pacific Tuna Tagging Programme is a WPCFC endorsed project being implemented by SPC. This document summarizes the tag recoveries to date, including length, date, location, vessel name, flag, and fishing method. Missing data and/or data of reduced resolution/quality are identified. The current tag recovery rate is 11.4%, comprising the return of 11908 tags. The majority of tagged fish have been caught by purse-seine (>95 %) with greater than 50 % of captures occurring within 30 days of the fish being released. Approximately 43 % of returns had missing information or information of low resolution. The tag recovery activities planned for 2008 and 2009 are detailed in the document. Key activities include:

- The appointment of a database analyst with responsibilities for data quality control of the PTTP. Duties of the position will involve the regular examination of return data to identify missing and low resolution data and sources/areas/fisheries/vessels with low recovery rates.
- Expansion of the current publicity program to increase awareness of the PTTP, the importance of tag returns and ancillary information, the procedures for returning tags, and the rewards provided for verified returns.
- The role out of experiments to estimate the tag recovery rate in the fisheries of the WCPO. This will include high-reward analysis, catch monitoring analysis and tag seeding experiments.

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INTRODUCTION

The recovery of tagged tuna records, with the proper associated information, is one of the most critical and most difficult aspects of a tagging project. It is often the case, particularly in tagging programmes that tag recovery measures, though seemingly adequate, result in low recovery rates. Conventional and archival tagging projects rely on recaptures by the fishery to provide information. Consequently, attention to tag recovery procedures within fisheries is a high priority and industry cooperation throughout the range of the fishery and across all gear types is essential. It is therefore paramount that an appropriate amount of resources are deployed to encourage fishers to return tags together with accurate tag recapture details.

A number of tools can be used to help facilitate this cooperation including the distribution of tag recovery manuals (eg. Anderson et al. 2004; Athayde 2004) that cover in detail the process for collection of data associated with tag recovery so that industry and artisanal fishers understand the importance of tag recovery and its associated data. Using publicity, attractive rewards, lotteries and in-country tag-recovery officers (RO) to raise awareness, create incentive and make the recovery process easy. Implement tag-seeding experiments to verify rates of tag reporting and consequently identify area of low reporting. Tag recoveries can also be enhanced by continual data processing of tag releases and returns, eg. cross-checking tag-return data against other data sources (logsheet, vessel monitoring systems) to verify reported data and estimate missing data.

For the PTTP, a number of steps have been taken to ensure high reporting of recaptured tags and the full cooperation of industry and artisanal fishers throughout the very large region where PTTP tagged fish might be recovered, i.e. where fish are landed or processed. In this paper we document these arrangements and summarise the tag recovery efforts of the PTTP.

PTTP TAG RECOVERY PROGRAMME

Recovery procedures have been established in major tuna landing ports throughout the region and elsewhere utilising, for the most part, established catch monitoring programmes. A preliminary product-flow analysis (Table 1) provided important information with respect to the allocation of the tag recovery effort. As part of the Phase 1 tagging operations, tag recovery arrangements were established in Thailand, Philippines, Indonesia, Korea, Japan and in Pacific-Island unloading/trans-shipment locations. Arrangements have been put in place to obtain accurate length measurements of recaptured tuna through the provision of callipers, measuring decks and tag recovery forms.

IN-COUNTRY TAG RECOVERY OFFICERS

The WCPO tuna fishery, including Indonesia and the Philippines, covers a vast area. A network of tag recovery officers (RO) has been established at major processing plants and canneries in the region as well as in the fisheries management authorities of the respective countries covered under the project. Industry briefing, publicity, tag reward payment and data collection is focused through these ROs. A list of tag recovery officers and contact details is given in Annex 1.

Table 1. Preliminary product flow analysis of WCPO tuna catch. As an example the highlighted yellow areas show locations where the number of tuna processed is high for Chinese, Micronesian and Philippines fleets.

		Delivery location									
Fleet	Total Catch	Thailand	American Samoa	Japan	Philippines	Korea	NZ	PNG	Indonesia	Chinese Taipei	Total
China	48,660	17,600	30,000								47,600
FSM	27,505	45,200									
Japan	260,818	104,000		156,000							260,000
Kiribati	7,105			7,100							7,100
Korea	209,808	52,400	65,000			90,000					207,400
Marshall Is.	56,164	27,300									
Nether. Antilles		4,600									
NZ	16,438	8,300					8,400				16,700
PNG	220,079	120,000			20,000			60,000	2,000		202,000
Philippines	34,000	60,000			34,000						
Solomon Is.	16,100	15,000									
Chinese Taipei	195,039	144,000	30,000							20,000	194,000
USA	74,287	5,900	68,000								73,900
Vanuatu	73,232	73,000									73,000
Total	**1,239,235**	**677,300**	**193,000**	**163,100**	**54,000**	**90,000**	**8,400**	**60,000**	**2,000**	**20,000**	**1,081,700**

TAGGING PROJECT PUBLICITY

A publicity campaign has been carried out throughout the WCPO region to publicise the tagging project since the commencement of fieldwork in Phase 1. Publicity has occurred through tagging posters in various languages that have been distributed to landing ports and processing facilities, announcements in local newspapers and local radio as well as the personal contact of project staff with the fishing industry and local communities. Information sheets have also been distributed (eg. Annex 2). A website has also been established for the purpose of disseminating publicity and information about the project, and also as a means of collecting tag-recovery data (e.g., see http://www.spc.int/tagging). To maximise tag returns, publicity is targeted at canneries and unloading/transhipment points rather than at fishermen. Cannery workers are most likely to recover tags while handling fish or be in contact with personnel from fishing vessels who have recovered tags. This targeted publicity approach is likely to be more effective than a national publicity campaign aimed at the general public, whom have less of a chance of recovering tagged tunas. However, it is still important to make as many people as possible aware of the PTTP so as to be able to recover as many tags as possible with the proper associated information. The popular media has been used to publicise the PTTP to this later audience.

Articles for print media

Since the initial publicity campaign articles have been written for the local newspapers of PNG and the Solomon Islands (SI) prior to the commencement of the second leg fieldwork in PNG and again at the end of the first leg of fieldwork in SI. An article written by David Itano also featured in the April 2007 issue of Niugini Blue, a magazine for recreational sports fishermen in PNG. An article was written for the Pacific Islands Business magazine emphasising the scientific value of the tagging programme, its usefulness in fisheries stock assessment and fisheries management, the types of tags used in the project, the rewards offered for tag returns, the information requested from tag finders and the tag recovery procedure.

Posters

As part of the initial publicity campaign, tag reward posters were printed in several languages and distributed to various ports in the region as well as key tag recovery points in Thailand, Japan, Korea and the Philippines. The tag reward posters clearly state the tag types used, the species targeted, the tag recovery procedure, the rewards offered for tag returns, the tag return information requested and the contact details for tag returns. Posters were also been developed that summarised the tagging operations and the importance of tag recoveries for presentation at the Infofish tuna industry conference.

The posters also provide a mechanism to reinforce the tag recovery procedure and emphasise the need for quality data measurement and collection. The posters developed can be easily adapted for use in subsequent reinforcement of the need for accurate data collection.

Radio Media

At the completion of the first leg of fieldwork in PNG a radio announcement was aired on national radio to further publicise the tagging programme, utilising the capacity of radio media to reach artisanal fishermen and target groups (fishermen, cannery workers, portside employees, processors) in remote areas that otherwise had no access to the PTTP initial publicity campaign through the print media.

An interview has since been conducted with Radio Australia's Pacific Programme in April 2008, again utilising the greater 'reach' of radio to publicise the PTTP. The interviews followed the general format of the initial publicity campaign, emphasising the scientific value of the tagging project, its usefulness in fisheries stock assessment and fisheries management, the tag types used, the species targeted, the tag recovery procedure, the rewards offered for tag returns, the tag return information requested, the contact details for tag returns and emphasised the need for industry cooperation as well as individual cooperation in the collection of good quality data.

PTTP Website

A website was developed as part of the tag recovery programme for the purpose of disseminating publicity and information about the project, and also as a means of collecting tag-recovery data.

The PTTP website features a table of tag releases and recoveries, which is updated monthly. Trip reports of the various legs of fieldwork (cruise reports) in PNG, SI, the central Pacific and the current fieldwork targeting the greater western Pacific region are posted on the website. At the end of each month a summary on the progress of the PTTP is posted on the website. This monthly summary is currently being developed into a form of e-newsletter to be distributed to in-country tag recovery officers, cannery staff and other interested parties. The website interface is also being assessed for means to make it more accessible and 'user friendly'.

Incentive to declare tags

Tagging data is the only viable method for collecting independent tuna fishery data and is therefore extremely valuable. The following incentives are provided to encourage the return of tags:

- USD 10.00 for conventional tags;

- USD 50 for sonic tags;
- USD 250 for archival tags; or
- A shirt or cap if the tag finder does not want cash rewards.

MEETINGS WITH CANNERY STAFF AND INDUSTRY

In addition to the above, PTTP officers have also actively met with cannery staff and industry. This has included public presentations for fishermen and fishing organisations, processors, local representative groups, scientists and all users of the fishery. PTTP officers have visited Thailand, Philippines, Solomon Islands, Papua New Guinea, Indonesia, Marshall Islands, Palau, Federated States of Micronesia, Guam, Korea, Samoa and USA to discuss the project.

TAG RECOVERY MANUAL

A tag recovery manual is currently being drafted for key tag recovery points emphasising the need for quality data. It includes a section on identification of yellowfin and bigeye tuna in conditions where the fish have been kept in brine for long periods of time and species identification is more difficult

TAG RECOVERY DATA

So far 104 832 tags have been released and 11 908 of these have been recovered, as at 30 June 2008, with a tag recovery rate of 11.4% (Table 2). This rate is similar to the overall tag recovery rate for the RTTP of 12.5%. The number of releases is expected to increase as more tags are recovered from the recent releases in the Solomon Islands. Table 3 shows the total releases and recoveries for the RTTP.

Table 2. Total releases and recoveries of PTTP conventional tags, as at 28 July 2008.

	YFT	SKJ	BET	Total
Release (% Total)	38,730 (36.9%)	63,122 (60.2%)	2,980 (2.8%)	104,832
Recaptures (% Total)	4,575 (38.4%)	7,072 (59.4%)	261 (2.2%)	11,908
Recovery Rate (%)	11.8	11.2	8.7	11.4

Table 3. Total tag releases and recoveries RTTP.

	YFT	SKJ	BET	Other	Total
Releases (% Total)	40,075 (27.3%)	98,401 (67.1%)	8,074 (5.5%)	83	146,633
Recaptures (% Total)	4,950 (26.9%)	12,447 (67.7%)	975 (5.3%)	4	18,376
Recovery Rate (%)	12.4	12.6	12.2	0	12.5

There was an initial pulse in the tag recoveries following the first leg of tagging operations in Papua New Guinea followed by a two month period where no tags were recovered. Tag recoveries picked up again following the commencement of the second leg of tagging operations in Papua New Guinea and were followed by another slump in tag recoveries before picking up prior to commencement of the first leg of tagging operations in the Solomon Islands and have since maintained a fluctuating state (Figure 1).

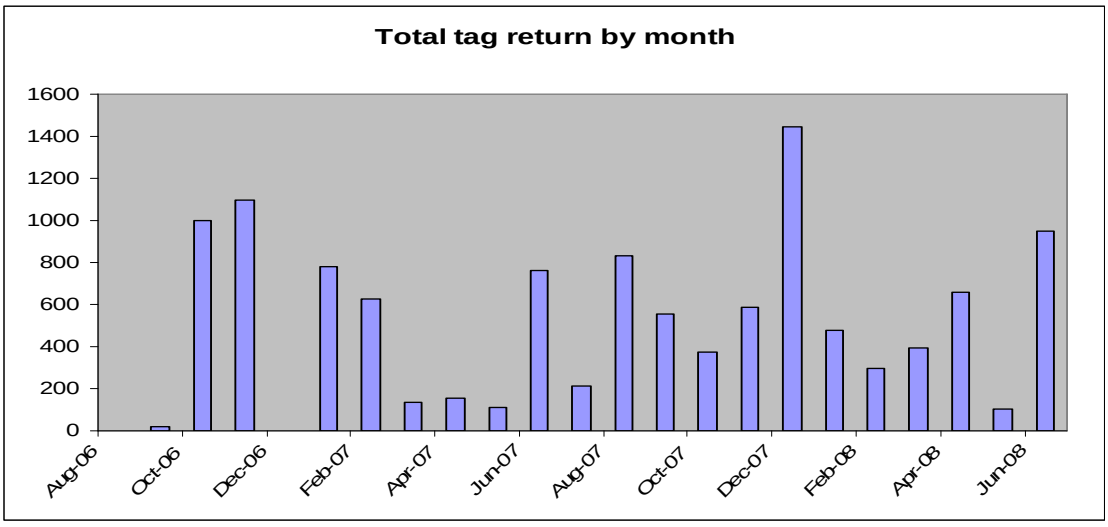

Figure 1. Tag returns by month of the PTTP as at 30 June 2008.

DATA TRENDS

The majority of tags have been recovered from Papua New Guinea and the Solomon Islands (Table 4), with 148 vessels contributing to tag recaptures. Overall, the majority of tag returns (>95%) were made by domestically flagged purse seine vessels (Table 4, Table 5) fishing in the Solomon Islands and in the waters of Papua New Guinea. Most of these were short-term recaptures of fish released on FADs and caught a short time later on the same FAD. This large number of recaptures could be indicative of the large numbers of tuna tagged in association with anchored FADs in areas of high fishing intensity for the two countries. Approximately 50% of the recaptured fish were at liberty for less than 30 days (Figure 2) indicating that tagged fish had limited timeframes for dispersal and mixing. This observation is supported by the small distances moved between release and recapture with most fish captured within 60 nm of there release location (Figure 3).

Table 4. Total tag recoveries by tag source (as of 28/07/08). Note totals for conventional tags also include the fish that were archival and sonic tagged.

Tag source	Tag type	Number
IATTC	Archival tags	1
Philippines (direct)	Archival tags	2
Philippines (Frabelle)	Archival tags	1
PNG (Frabelle)	Archival tags	7
PNG (Frabelle)	Archival tags	1
PNG (NFA)	Archival tags	1
PNG (other)	Archival tags	1
PNG (RD)	Archival tags	22
Solomin Islands (MFMR)	Archival tags	1
Solomon Islands (NFD)	Archival tags	3
Thailand	Archival tags	4
American Samoa	Conventional tags	18
China	Conventional tags	1
FSM	Conventional tags	3
IATTC	Conventional tags	135
Indonesia	Conventional tags	77
IOTC	Conventional tags	5
Japan	Conventional tags	273
Korea	Conventional tags	154

Marshall Islands	Conventional tags	1
Other	Conventional tags	7
Philippines (direct)	Conventional tags	368
Philippines (Frabelle)	Conventional tags	162
PNG (Frabelle)	Conventional tags	645
PNG (NFA)	Conventional tags	91
PNG (other)	Conventional tags	33
PNG (RD)	Conventional tags	5022
PNG (SST)	Conventional tags	181
Solomon Islands (MFMR)	Conventional tags	108
Solomon Islands (Global Investment)	Conventional tags	946
Solomon Islands (NFD)	Conventional tags	2545
Solomon Islands (other)	Conventional tags	23
Solomon Islands (Soltai)	Conventional tags	194
Tagging vessel	Conventional tags	23
Thailand	Conventional tags	892
Philippines (direct)	Sonic tags	1
PNG (Frabelle)	Sonic tags	1
PNG (RD)	Sonic tags	12
Solomon Islands (NFD)	Sonic tags	1
Thailand	Sonic tags	1
Total		**11967**

Table 5. Total tag recoveries by flag (as of 28/07/08). Note totals for conventional tags also include the fish that were archival and sonic tagged.

Flag	Tag type	Number
FM	Archival tags	1
KI	Archival tags	2
PG	Archival tags	30
PH	Archival tags	4
SB	Archival tags	4
Unknown	Archival tags	3
CN	Conventional tags	38
FJ	Conventional tags	1
FM	Conventional tags	11
ID	Conventional tags	85
JP	Conventional tags	293
KI	Conventional tags	13
KR	Conventional tags	340
MH	Conventional tags	8
NZ	Conventional tags	4
PA	Conventional tags	8
PG	Conventional tags	5589
PH	Conventional tags	976
SB	Conventional tags	2797
SY	Conventional tags	1
TW	Conventional tags	339
US	Conventional tags	26
VU	Conventional tags	920
Unknown	Conventional tags	458
PG	Sonic tags	12
PH	Sonic tags	2
SB	Sonic tags	1
TW	Sonic tags	1
Total		**11967**

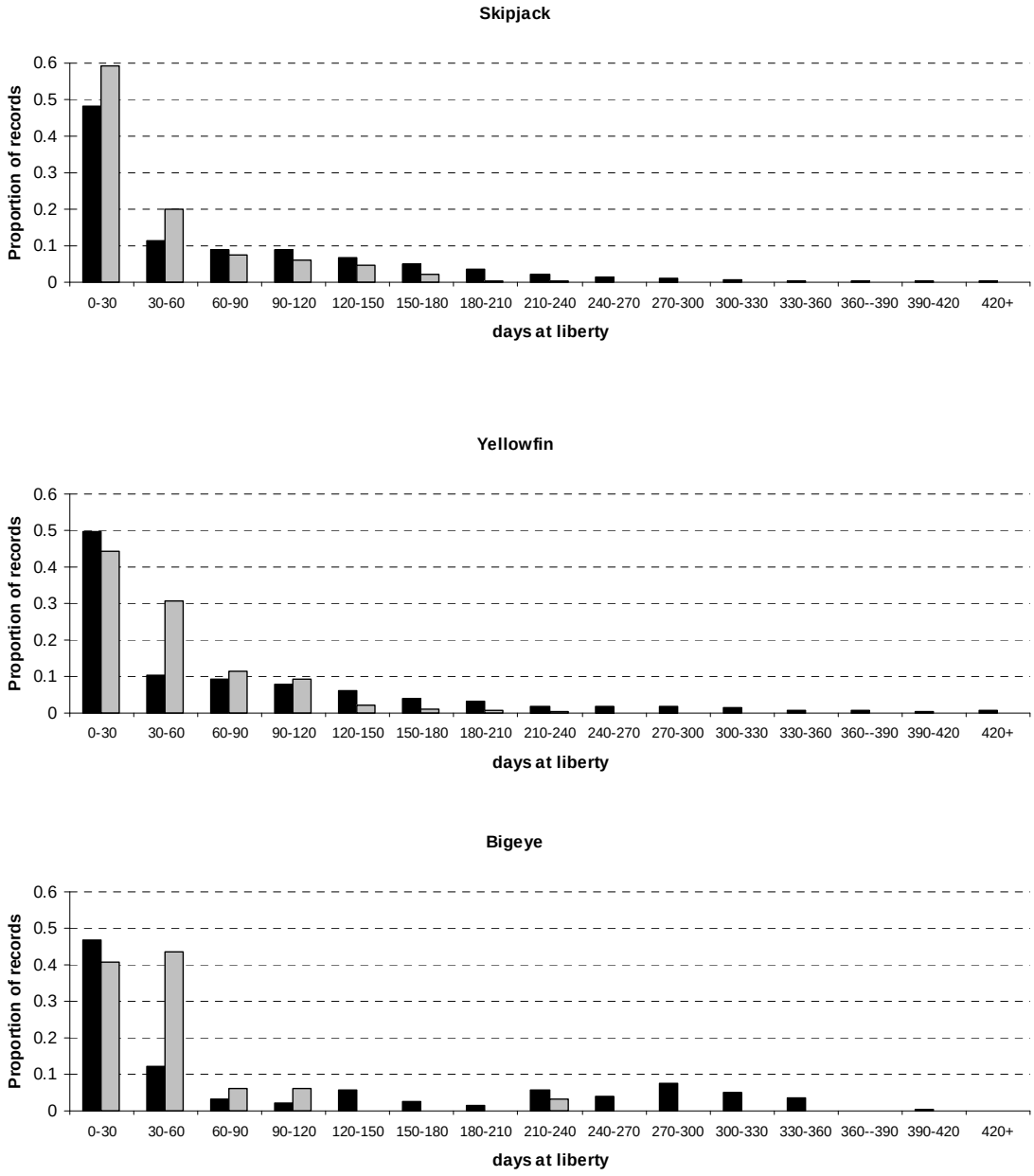

Figure 12. Proportion of time at liberty for conventionally tagged skipjack, yellowfin and bigeye (Black bars= PNG releases and grey bars = Solomon Islands releases).

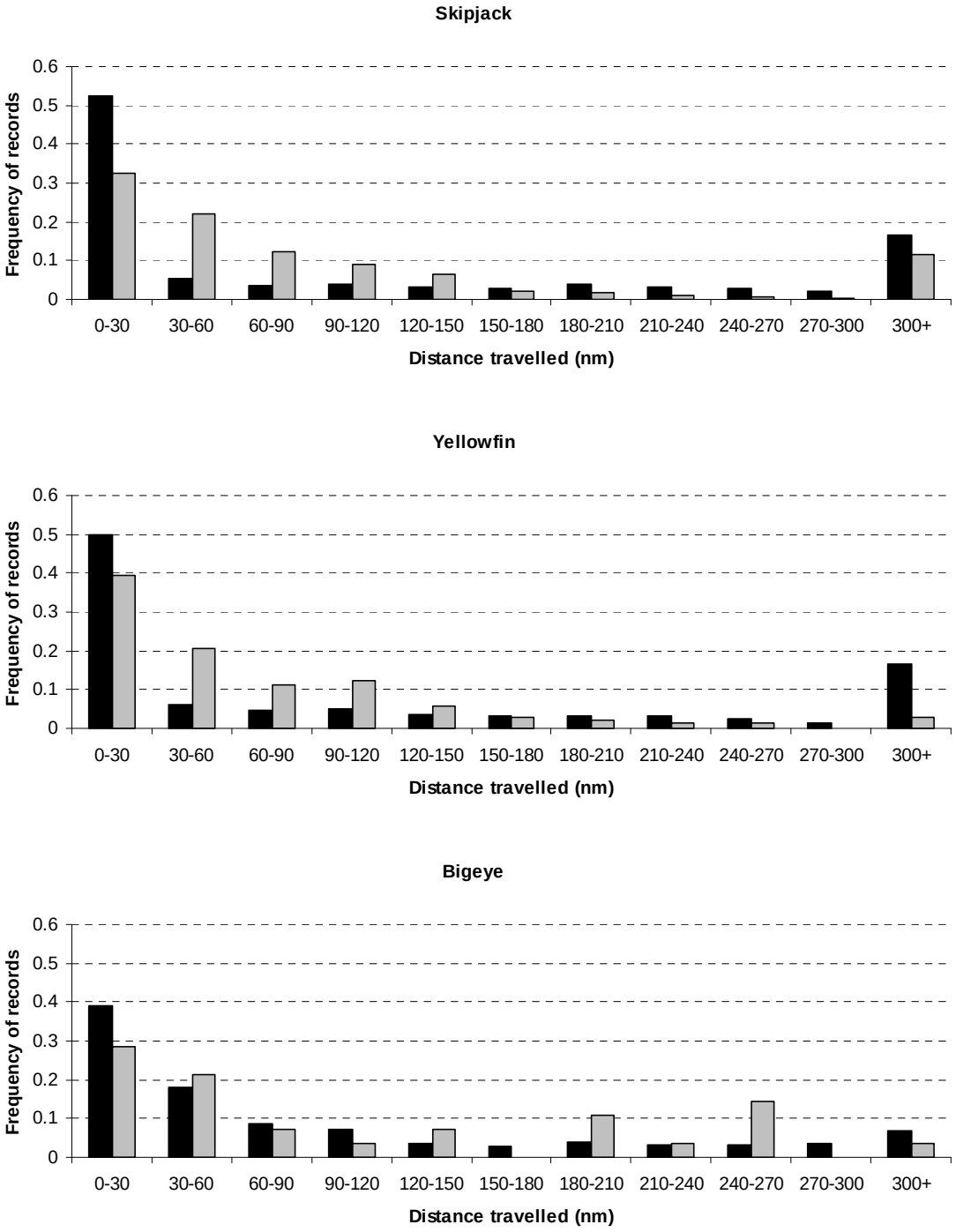

Figure 13 Frequency of distance between release and capture location for conventionally tagged skipjack, yellowfin and bigeye (Black bars= PNG releases and grey bars = Solomon Islands releases).

The tag recoveries by size class shows a general trend of higher tag recovery rates for larger size classes and lower tag recovery rates for smaller size classes (Table 6). Hampton (2000) demonstrated important size specific natural mortality for skipjack, yellowfin and bigeye tuna in the western and central Pacific Ocean. For skipjack, yellowfin, and bigeye in the western tropical Pacific Ocean, natural mortality for the smallest size-class was an order of magnitude higher than those for midsized fish (Hampton 2000). The transition from high to low natural mortality was around 40 cm FL. Consequently, we would expect a lower tag recovery rate in these fish that are experiencing higher natural mortality.

The recovery rates between the 11 cm (Z tags) and 13 cm (P tags) dart tags appears consistent by size class for yellowfin in both PNG and SI. Some discrepancy is apparent in the recoveries for skipjack, with the recovery rate of "Z" tags from fish tagged in PNG considerably lower than that observed in the "P" tags for fish of approximately the same size. Examination of the release histories of the "Z" tags in PNG indicates no unusual trends in the release data by school association but clearly demonstrates that the majority of tags were released during a single cruise leg (PNG-07-04;Table 7). The recapture rates from cruise legs where sample size is greater than 500 are mixed with PNG-06-05, PNG-06-06, PNG-07-02 and PNG-07-03 lower than average (Table 7). All four cruise legs occurred in areas where anchored FAD density is lower than average for the Bismarck Sea. This may partially explain the trend observed. A shedding experiment is planned for Phase 2 where a number of larger fish will be tagged with the 11 cm tags as well as the smaller fish to assess whether this anomaly may be a shedding issue associated with the tags. The sample size for bigeye is insufficient to draw any observations on recovery rate by size or tag type.

Table 6. The recovery rate (%) by fish length, tag size, region and species

	Length (cm)											
Tag Size	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65- 9**	**70- 4**	**75-79**	**80-84**
Skipjack												
PNG 11 cm	1.3	2.9	5.1	6.7	8.5	42.9						
PNG 13 cm			10.9	12.6	14.9	20.3	16.1	15.8	18.3	26.9		
SI 11 cm	5.9	4.3	4.7	11	26.7							
SI 13 cm			4	8.9	24.3	13.2	11.7	6.7				
Yellowfin												
PNG 11 cm	6.4	6.3	10.8	13.1	18.2							
PNG 13 cm			13.7	14.6	18.9	18	19.3	16.1	8.8	9.9	19	
SI 11 cm	6.5	6.1	8.7	7.8								
SI 13 cm			6.7	6.6	19.3	24.5	12.3	7.2	3.6			20
Bigeye												
PNG 11 cm			12.5									
PNG 13 cm				19.7	22.7	36.2	45.2	47.7	34.5	40		
SI 11 cm		5.4	5.6									
SI 13 cm			7.6	6.7		50.0						

Table 7. "Z" (11 cm) dart tag releases by cruise leg and school and recapture.

Cruise	Released	Recaptured	% Recovery	Proportion of Sample			
				Anch. FAD	Free school	Log	Other
PNG-06-01	0						
PNG-06-02	206	34	16.5	78.6		21.4	
PNG-06-03	630	63	10.0	97.9		2.1	
PNG-06-04	34	3	8.8	100.0			
PNG-06-05	713	14	2.0	86.0		13.6	0.4
PNG-06-06	1213	19	1.6	67.2	24.9	7.9	
PNG-06-07	0						
PNG-07-01	662	23	3.5	90.6	5.4	3.9	
PNG-07-02	1138	21	1.8	90.9	1.4	5.2	2.5
PNG-07-03	1405	40	2.8	90.0	1.6	2.1	6.3
PNG-07-04	3788	204	5.4	83.7	0.1	3.4	12.9
PNG-07-05	248	30	12.1	64.1	35.1		0.8
PNG-07-06	217	1	0.5	80.2	0.5	19.4	

DATA QUALITY

Common problems associated with the tag recovery data include misidentification of species, poor length measurements and no position of recapture (Table 8). Overall 4829 records had at least 1 missing value.

Table 8. Number of tag return records with missing information by source.

Source	No length data	Length Shrinkage	Data absent: No recorded position	Data absent: No vessel flag	Data absent: No vessel name	Data absent: No species ID
American Samoa	13	1	13	10	8	
China				1	1	
FSM						
IATTC	116	4	134	97	37	
Indonesia		10	38	1		15
IOTC		1	4	2	36	10
Japan	18	10	69	-	11	
Korea	9	45	70	44	45	8
Marshall Islands	1					10
Philippines (Direct)	267	17	287	13	52	
Philippines (Frabelle)	9	34		5		57
PNG (Frabelle)	83	152	2	3	2	6
PNG (NFA)	70	3	55	55	55	107
PNG (RD)	63	1210	32	54	1	11
PNG (SSTC)	5	26	74	15	4	517
PNG (Other)	4		10	8	9	20
Solomon Islands (NMFMR)	5	13	26	13		3
Solomon Islands (Soltai)	22	15	65	4	10	12
Solomon Islands (Global Investment)	579	69	100	90	91	16
Solomon Islands (NFD)	64	243	58	1	8	54
Solomon Islands (Other)	5	10	7	6	7	159
Tagging Vessel	1	2				1
Thailand	12	116	742	34	4	1
Other	1	1		1	2	42

Position data

1 786 tag recoveries did not have any position-of-tag-recapture data associated with the tag recovery data.

Length at recapture

1 347 recoveries had no length measurements associated with tag recapture and a large number of length-at-tag-recovery measurements being lower than length-at-tag-release measurements. It is unclear whether this is an indication of poor attention to detail when measuring the recaptured fish or whether measurement of frozen fish may be responsible for the observed shrinkage.

Species Identification

1, 072 recoveries had species identification associated with tag recapture being different from species identification at tag release. There was no species information provided for 3 records. Miss-identification records were as follows:

5 records report bigeye recapture when the release record was skipjack;
457 records report skipjack on recapture when the release record was yellowfin;
44 records report bigeye recapture when the release record was yellowfin;
29 records report skipjack on recapture when the release record was bigeye;
113 records report yellowfin on recapture when the release record was bigeye; and
421 records report yellowfin on recapture when the release record was skipjack.

Identification issues commonly occur between small bigeye and yellowfin, however the miss-match between skipjack and bigeye and yellowfin and skipjack suggest that the data was more than likely fabricated.

Data by Source and Flag

Recovery rates from Thailand and American Samoa are considerably lower than expected (Table 4) given the volume of fish processed in these locations.

Data by gear

Few recoveries have been made by longline vessels (<1%; Table 9). Longline fleets are the only fleets that can potentially provide information on older age classes of bigeye tuna. Because of the careful individual handling received by longline-caught fish, it is unlikely that any tags would escape detection by longline crews. It is therefore suspected that some longline fleets either have had a deliberate policy of non-reporting of tag recaptures, or that for some reason longline crews have been unaware of the tagging programmes and did not know what to do with recaptured tags. Hampton and Williams (2005) also observed a similar situation with tag recoveries from longline gear during the RTTP. Biological studies may shed some light on this issue by indicating other differences between surface and subsurface caught tuna. Tag seeding experiments undertaken in conjunction with the RTTP identified low rates of tag reporting for Korean and Taiwanese purse seiners in particular (Hampton and Williams 2005). The tag seeding plan for the PTTP is outlined in the companion document Hampton et al 2008 (SC4-GN-IP-4). For comparison Table 10 shows the tag recoveries by vessel flag and gear type for the RTTP. Systematic visits by project staff or local fisheries officers to vessels while in port is also planned to assist in raising awareness of the project and improving the tag-reporting rate.

Table 9. PTTP Tag recoveries by gear type (note. Only includes recoveries where gear type has been confirmed).

Gear Type	Number of tag recaptures
Purse Seine	10274
Pole and Line	142
Trolling	78
Handline	24
Longline	8

Table 10. RTTP tag recoveries by gear type

Gear Type	Number of recaptures
Purse Seine	13841
Pole and Line	3032
Longline	316
Other	1174
Total	18363

TAG RECOVERY PLAN 2008-2009

Priority activities and actions for 2008 – 2009 for tag recovery are described below

DATA QUALITY

Three activities are planned to remove and minimise missing and/or low resolution data (Table 11).

Table 11. Planned activities to improve data quality in 2008-2009.

Activity	Action
Analysis of current data to identify missing data, low resolution data, and sources and vessels with lower than expected recovery rates	Appoint a database analyst with responsibilities for data quality control. Analyst to undertake regular examination of return data to identify missing and low resolution data and sources/areas/fisheries/vessels with low recovery rates. Analyst to assist recovery officers with sourcing information to remove missing/low resolution information.
Increased provision of information to fishing industry to improve awareness of PTTP, quality of data and rewards for tag returns	Develop and distribute PTTP tag recovery manuals that details the process for returning the tag, receiving the reward and providing all necessary meta data PTTP recovery officer to visit locations where recovery rates are low. Implement publicity campaign, including: information sheets; posters; and popular media.

Implement activities to encourage the rapid return of tags.	Tag lotteries to be implemented in 2008 and 2009 to encourage the return of tags. Publicity campaign to be implemented to emphasis the rewards for tag returns.

PTTP PHASE 2 CRUISES

The cruises planned for Phase 2 of the PTTP expand the tagging into the EEZ's of countries in the equatorial pacific west of 180 degrees longitude. To ensure that processes are in place to facilitate tag recovery a 'Product-Flow" analysis will be undertaken for each EEZ to determine the priority sources and flags. If new sources are identified, new RO's will be established in these locations. Publicity will be provided to each of these EEZ's during and after visitation by the tagging vessel.

TAG RECOVERY RATES

Three approaches will be implemented to estimate recovery rate in 2008 and 2009 (Table 12).

Table 12. Planned tag recovery rate activities for 2008-2009.

Activity	Action
HIGH REWARD When both standard and high-reward tags are used, the tag reporting rate can be estimated if the reward level is high enough to produce a 100% reporting rate for high-reward tags. The high-reward approach (Pollock et al. 2001), involves a sample of tags having such a high monetary reward that they can be assumed to have a reporting rate of 100%. The ratio of normal to high-reward tag-return rates by a particular fishery is then an estimate of the reporting rate of normal tags. Archival tags, with a reward of USD 250, could be suitable as a high-reward tag in the PTTP. This approach may provide information on tag reporting rate for the purse seine fishery where most returns are expected to occur. It is unlikely, however, to provide sufficient numbers of returns in the longline or other fisheries to estimate reporting rates.	Undertake analysis using Phase 1 information.
CATCH MONITORING The logic of this method is comparable to the high-reward method. In this approach, a known proportion of the catch is monitored by observers, and it is assumed that 100% of tagged fish in the monitored catch are reported. Boats without observers provide the standard scenario where recovery of tags depends on fishers' cooperation. If the relative catch between these components is known or estimable, the expected ratio of tagged fish caught by the observer component to tagged fish caught by the non-observer component can be assumed to be equal to the expected ratio of total catch by each component. This approach may be suitable for longline if observer	Coordinate with longline observer programs in PNG and/or Solomon Islands to trial in 2009.

coverage was sufficiently high. Method is not suitable for purse-seine as there is little opportunity for observers to sample entire catch. Fish tagged in PNG and Solomon Islands are expected to reach appropriate size to enter the longline fishery in 2009.	
TAG SHEDDING Tag shedding is categorised into two types, Type-I events occur immediately after tagging, usually as a result of sub-optimal placement of tags in the fish. Effectively, it reduces the number of tags initially put out to sea. Type-II shedding is the loss of a tag over a period of time after the fish has been tagged and released back into the sea. For long-lived species, it may not occur at a constant rate because some tags are likely to have been applied more effectively than others, and some may become firmly embedded (with growth of muscle tissues), such that they are very unlikely to be detached from the fish. Decoupling these two shedding types however is extremely difficult and reliant upon often unrealistic assumptions. Decoupling methods require the placement of 2 tags in the fish and Type-II shedding estimated by modelling the number of single sheds observed in the recapture data. This however assumes that at least one tag was not placed sub-optimally. This assumption is often hard to satisfy as sub-optimal placement is generally the result of the fish moving during the tagging procedure or placement by inexperienced taggers. If fish is moving or tagging is undertaken by an inexperienced technician, then it is likely that both tags will be placed sub-optimally. The method also assumes that individual rejection of tags are independent (ie. if a fish rejects one tag it is no more likely to reject a second tag). There is no biological foundation for this later assumption. Tag shedding experiments have not been implemented in the PTTP to date as we have not yet developed methods that overcome these unrealistic assumptions.	No action planned for 2008 and 2009
TAG SEEDING We plan for tag seeding to be undertaken by regional and national observers on purse seine vessels operating throughout the WCPO. The analysis of seeded-tag-return rates will be stratified by processing location, which is known to be a major source of variation in reporting rates, and by time. Tag seeding has already commenced in support of Phase 1. Tag seeding for Phase 1 has been carried out opportunistically by experienced observers who were briefed in detail on the tag placement and the need for not alerting the crew to the seeding experiment. If possible, the observers were requested to spread the seeding out over the duration of a trip. The number of observers trained in seeding procedures is currently low and identification of suitable observers and	Observer training in 2008. 32 seeding kits deployed in 2008. 100 seeding kits deployed in 2009.

training them is the current priority. Once trained, we are planning on paying observers USD50 for the first deployment of their first kit. If the observer deploys the kit correctly and returns all the required release data to SPC, the observer will be paid USD100 for each subsequent kit they deploy correctly. A seeding kit comprises 25 tags, with the instructions for 15 fish to receive a single tag per fish and 5 to receive two tags (to assess potential Type-II shedding of seeded tags). A minimum target of 100 kits per year has been set for the PTTP.

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ANNEX 1 Tag recovery officers

Tag Recovery Officer	Country
Suwimon Keerativiriyapor	Thailand
Praulai Nootmorn	Thailand
Vincente Rivera	Papua New Guinea
Rosalina lagada	Papua New Guinea
Maireen Sarita	Papua New Guinea
Thomas usu	Papua New Guinea
Luanah Koren	Papua New Guinea
Philip Lens	Papua New Guinea
Pavara Silas Tozo	Solomon Islands
Hudson Wakio	Solomon Islands
Ambrose Orianihaa	Solomon Islands
Berry Muller	Marshall Islands
Manasseh Avicks	Marshall Islands
Gordon Yamasaki	American Samoa
Noel Barut	Philippines
Elaine Garvilles	Philippines
Glenville Castrance	Philippines
Takayuki Masumoto	Japan
Hiroaki Okamoto	Japan
Koji Uosaki	Japan
Hwang Seon Jae	Korea
Dae Yeon Moon	Korea
Teresa Athayde	Seychelles
Julien Millon	Seychelles
Akete Taanga	Kiribati
Michael Tekanene	Kiribati
Steven Retalmai	Federated States of Micronesia
Manuel Duenas	Guam
Kurt Schaeffer	IATTC

ANNEX 2

PACIFIC TUNA TAGGING PROJECT

Secretariat of the Pacific Community

Oceanic Fisheries Programme
Secretariat of the Pacific Community,
B.P D5, Noumea Cedex, 98848, New Caledonia
Contact: Brian Kumasi Email: briank@spc.int

Industry cooperation in the recovery of tag recovery data is crucial to the success of the pacific tuna tagging project

Conventional and archival tagging projects rely on recaptures by the fishery to provide information. Attention to tag recovery procedures is therefore a high priority for any large-scale tagging programme, such as the Pacific Tuna Tagging Project (PTTP).

The implementation of measures to maximise the return of recaptured tags is crucial to the success of the PTTP in general.

The success of these tag recovery procedures is highly dependent on the cooperation of the commercial fishing industry, throughout the range of the fishery and across all gear types.

A number of steps have been taken to ensure high reporting of recaptured tags and the full cooperation of industry and artisanal fishers throughout the very large region where tagged fish might be recovered, i.e. where fish are landed or processed.

Recovery procedures have been established in major tuna landing ports throughout the region and elsewhere, e.g. Thailand, utilising, for the most part, established catch monitoring programmes. In most cases, these arrangements are already in place.

Tag recovery procedures, including wide publicity, attractive rewards, lotteries, in-country tag-recovery officers and tag seeding experiments, are being conducted to achieve (and verify) high rates of tag reporting. Tag releases and returns are processed and stored in an established database and tag return data is cross-checked against other data sources (logsheet, vessel monitoring systems) to verify reported data and estimate missing data. Established and new methods will be used to analyse the data.

Tag-recovery arrangements

Industry briefing, publicity, tag-reward payment and data collection will be overseen by individuals identified in each location. A preliminary product-flow analysis provides important information regarding the allocation of tag-recovery effort. For the WCPO tuna fishery, Thailand emerges as a particularly important product destination and a likely major tag-recovery location. As part of the PNG Phase 1 tagging, tag-recovery arrangements have been established in Thailand, Philippines, Indonesia, Korea and Japan, and at unloading/transshipment locations in the Pacific. Arrangements are put in place to obtain accurate length and weight measurements of recaptured tuna through the provision of calipers and possibly weighing scales.

Publicity

A publicity campaign was launched throughout the region to publicise the project. It will include tagging posters in various languages distributed to landing ports and processing facilities, announcements in local news media, and personal contact between project staff and the fishing industry and local communities. A website has been also be set up to disseminate information about the project, and provide a means of collecting tag-recovery data.[see http://www.spc.int/tagging/]

Tag rewards

Rewards are paid to tag finders for the return of tags. For conventional tags, a reward of USD 10 per tag return is paid. For archival tags, a reward of USD 250 for each tag return is paid. For acoustic transmitting tags, a reward of USD 50 for each tag return is paid. These differential rewards reflect the value of the hardware and/or of the data accompanying the tag. Assuming that there is complete reporting of the higher value tags, any significant differences in return rates between conventional and electronic tags might be attributable to non-reporting (of conventional tags). This information will be important for subsequent modeling of the tag-return data.

Regular (annual or biannual) lotteries with attractive cash prizes will also be held in key locations throughout the region.

Tag-reporting rates

The above procedures are all designed to maximise the reporting rate of recaptured tags. However, in any large-scale tagging programme such as this, the reporting rate will never be 100%. Therefore, the reporting rates for the different components of the fishery must be maximised through attractive rewards, publicity, etc., to obtain unbiased estimates of parameters such as fishing mortality.

Tag recovery procedure

1. Record the species of the recaptured tuna
2. Record the tag number
3. Record the fork length of the recaptured tuna
4. Record the location/position of recapture.
5. Send tag and recovery information to SPC.