PACIFIC TUNA TAGGING PROGRAMME

REPORT OF ACTIVITIES FOR 2008

Australian Government
Australian Centre for International Agricultural Research

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1. Introduction

The Pacific Tuna Tagging Programme (PTTP) is a joint research project being implemented by the Oceanic Fisheries Programme (OFP) of the Secretariat of the Pacific Community (SPC), the PNG National Fisheries Authority (NFA) and the members and participating non-members of the Western and Central Pacific Fisheries Commission. The goal of the PTTP is to improve stock assessment and management of skipjack, yellowfin and bigeye tuna in the Pacific Ocean. The specific objectives are:

1. *To obtain data that will contribute to, and reduce uncertainty in, WCPO tuna stock assessments.*

Conventional tagging data are an important component of tuna stock assessments, providing quasi-fishery-independent information on various biological and fishery processes, such as exploitation rates, natural mortality, movements and growth rates, and their spatial and temporal variability.

2. *To obtain information on the rates of movement and mixing of tuna in the equatorial WCPO, between this region and other adjacent regions of the Pacific basin, and the impact of FADs on movement at all spatial scales.*

This information is important for understanding the relationship of tuna stocks in the tropical WCPO with those in the sub-tropical WCPO and the EPO. Movement rates are particularly important for assessing the potential for interaction between fisheries operating in different areas. The comparison of tagged fish movements from areas of high FAD density with tagged fish movements from the same areas in the early 1990s (before extensive FAD deployment) will provide important new information on the meso-to large-scale effects on tuna movement of high-density FAD arrays. This will allow various hypotheses regarding the impact of FADs on the movements of small tuna, e.g. the "ecological trap" hypothesis (Marsac et al 2000), to be tested. The movement data will also provide critical information on appropriate spatial structuring of stock assessment models.

3. *To obtain information on species-specific vertical habitat utilisation by tunas in the tropical WCPO, and the impacts of FADs on vertical behaviour.*

Vertical habitat utilisation plays a large role in determining vulnerability to all major gear types operating in the fishery. This objective seeks to characterise the effect of FADs (anchored and drifting) and other possible impactors (e.g., seamounts) on tropical tuna vertical behaviour and habitat utilisation This information will allow better estimation of abundance indices and standardised effort for the main fisheries and possibly contribute directly to the design of management measures for FAD fishing.

4. *To obtain information on local exploitation rates and productivity of tuna in various parts of the WCPO.*

Knowledge of local exploitation rates, productivity and movements is important for understanding the impact of fishing at more local scales. In particular, it allows estimation of the extent to which current catch levels may reduce the standing stock of tuna and the catch-per-unit-effort of the fisheries, a phenomenon commonly known as "local depletion".

These objectives are being pursued through a tagging programme and associated data collection activities in the WCPO. Funding support for the project has been generously provided by the PNG National Fisheries Authority, New Zealand Agency for International Development, Australian Centre for International Agricultural Research, European Community 8th European Development Fund (through the PROCFish Project), European Community 9th European Development Fund (through the SciFish Project), the French

Pacific Fund, the Government of Taiwan and the Global Environment Facility (through the Pacific Oceanic Fisheries Management Project).

The PTTP is a multi-phase programme that commenced in mid-2006. It has the following operational structure:

	Time period	**Operational area**	**Tagging vessel**
Phase 1	Aug – Nov 2006	Papua New Guinea	*Soltai 6*
	Feb – May 2007	Papua New Guinea	*Soltai 6*
	Oct – Nov 2007	Solomon Islands	*Soltai 6*
	Feb – Mar 2008	Solomon Islands	*Soltai 6*
	Apr 2008	Solomon Islands	*Soltai 105*
Phase 2	May – Jun 2008	Central Pacific (CP1)	*Double D*
	Jun – Nov 2008	Western Pacific (WP1)	*Soltai 105*
	Mar – Jun 2009	Western Pacific (WP2)	*Soltai 105*
	May – Jun 2009	Central Pacific (CP2)	*Double D*
	Jul – Oct 2009	Western Pacific (WP3)	*Soltai 105*
	Oct – Nov 2009	Central Pacific (CP3)	*Double D*

Phase 1 focused very successfully upon the waters of Papua New Guinea and the Solomon Islands with their large domestic fisheries and significant contribution to overall regional catches. Phase 2, approved in August 2007 and now partially funded, aimed to considerably extend the operational area of the PTTP, as well as broadening the scope and operations of the project. The first pole-and-line vessel tagging cruise of Phase 2 activity (WP1) extended tagging activity to areas west of 160°E and north of the Equator (FSM and Palau), to the far west of the WCPO (Philippines and Indonesia), to the northern part of the PNG EEZ and waters east of Bougainville Island. During 2009, a second WP cruise (WP2) will extend the coverage eastwards to 180°, then a final cruise (WP 3) will endeavour to fill any gaps in the coverage of the primary fishing area west of 165°E.

As a additional component of Phase 2, a different strategy has been adopted for the Central Pacific (140°W – 155°W) where pole-and-line operations are difficult, with a multipurpose handline vessel based in Hawai'i being used to tag and release primarily bigeye tuna in this area. The first one-month cruise (CP1) took place concurrently with WP1 and two more cruises are planned for 2009 in collaboration with the Inter-American Tropical Tuna Commission (IATTC).

This report provides a review of 2008 Phase 2 activities, and a brief update of Phase 1 tag recoveries.

2. General methods

2.1 Conventional tagging methods and equipment

The PTTP has adopted tagging methods and equipment that have been tried and tested in previous SPC projects, notably the Regional Tuna Tagging Project in the early 1990s. Conventional tagging is carried out primarily from three or four tagging stations – on the starboard and port sides at the bow, and on each side of the stern, if personnel numbers allow. Specially designed tagging cradles consisting of a vinyl cover attached to a metal frame are used to restrain the fish during the tagging procedure.

Fish are captured using pole-and-line gear, and tagged with a single conventional tuna tag near the posterior insertion of the second dorsal fin, securely anchoring the tag head in the pterygiophores. Tags are inserted using stainless steel applicators. The tags are 11 cm (Y11) or 13 cm (Y13) Hallprint™ dart tags. The Y11 tags are generally applied to tuna <38 cm and the Y13 tags to larger tuna. All tuna are measured prior to release using a scale drawn on the cradle. The tagging operation typically lasts less than 15 seconds from fish capture to release, with information on each fish (species, fork length, fish condition and tagging quality) recorded on voice recorders.

2.2 Electronic tagging methods and equipment

Two additional collapsible tagging cradles designed for archival/sonic tagging were also available (see Figure 1) These cradles greatly increased the possibilities of deploying archival and sonic tags during standard pole-and-line fishing operations but also increased the numbers of conventional tag releases during fast biting schools.

2.2.1 Archival tagging

Fish were captured for archival tagging during pole-and-line operations during the day, and also at night by using hand lines or rod-and-reel techniques when tied up to a FAD. Smaller bigeye and yellowfin (< 70 cm FL) were prioritized for tagging during pole-and-line fishing as fish condition was not compromised by the fishing technique. Larger-sized fish (> 70 cm FL) were generally caught with rod-and-reel or hand line at night and lifted from the water using a purpose-built sling, to minimize injury or stress.

Two different size classes of archival tag were used: (1) the larger LTD-2310 (Lotek Wireless, Newmarket, Canada) and the Mk9 (Wildlife Computers, Redmond, USA) which were surgically implanted into fish 60 cm and larger; and (2) the smaller LTD-2410 and LTD-1110 (Lotek Wireless, Newmarket, Canada) which were implanted into fish 40 cm and larger. Depth, fish and sea water temperatures and ambient light were recorded each minute for LTD-2310 and Mk9. The LTD-2410 has limited memory capacity (128 Kb) and to extend the period of sequential records of all data, the tag was programmed to record every 5 minutes. The LTD-1110 model also has limited memory and only records depth and internal temperature. The sampling interval for this tag is pre-programmed by the manufacturer. The sampling interval also varies with the duration of tag deployment (7 and 3 minute intervals were observed).

2.2.2 Sonic tagging

Sonic tagging of tuna associated with FADs monitored with an acoustic receiver to record the presence and depth of tagged tuna was undertaken during Phase 1 of the PTTP in PNG. This work is described in Leroy et al. (2007). No further sonic tagging has been undertaken.

2.2.3 Surgery procedures

Tuna selected for archival were placed in a smooth vinyl tagging cradle or left in the vinyl landing sling if greater than 10 kg. The eyes were immediately covered with a wet artificial chamois cloth, a sea water hose inserted in its mouth to gently irrigate the gills, and the hook removed. If fish condition was judged suitable, an electronic tag(s) was surgically implanted. Implantation involved the insertion of the Betadine-rinsed tag into the body cavity through a small incision (3cm) made with a knife-blade, which for yellowfin and bigeye tuna was closed using a dissolvable suture after insertion. Each fish was also marked with a conventional dart tag placed below the second dorsal fin. Orange colored dart tags were used to mark fish receiving an archival (or archival plus sonic tag). Green colored tags were used for sonic tag releases. Fish were measured to the nearest cm (FL) before being released. The time of

release with school and location data were recorded and stored on an Access database. The tagging operation lasted between 50 seconds and 2 minutes. Identical methods were used for the implantation of archival and sonic tags with one exception Skipjack receiving an internal sonic tag were closed using three stainless steel staples delivered by a 3M 35W surgical staple gun.

2.3 Recovery procedures

Considerable efforts have been made to publicize the project and establish tag recovery procedures in the main locations where recoveries are likely to occur, both within PNG and beyond. Tagging posters, providing information to finders on what information to collect, where to send the tags and information, and the rewards that will be paid, have been produced in 13 languages. Posters have been sent to industry and Government contacts throughout the Pacific and East Asian regions, and other media eg radio, TV, newspapers have been used to publicize the project where possible. Tag Recovery Officers have been appointed in key locations, including PNG ports, other Pacific Island landing sites, Philippines, Thailand, Japan and Korea, to publicize the programme, collect tags, pay rewards, and arrange for the tags and recovery data to be sent to SPC.

The rewards being for the return of tags and recovery data are:

Conventional tags USD10 or a project shirt or cap
Archival tags USD 250
Sonic tags USD 50

2.4 Biological sampling

Biological sampling has been conducted as a part of the tagging cruises to obtain information on the trophic status of tunas in different types of school association and ultimately provide information for ecosystem modelling. A sampling design was developed and design stratification included species, school association type, area and time of day. The sampling strategy was to sample 15 individuals from 2 schools within each stratum. For each individual, species, length and sex were recorded, stomach contents collected and muscle and liver samples taken.

In addition to stomach/muscle/liver sampling, measurements using a Fatmeter were undertaken. The Fatmeter is a non-destructive, non-invasive method that can be used on live fish. This electronic device measures the lipid content of the fish. The lipid content of fish is related to the water content of the sample; by measuring the water content using a micro strip sensor the amount of lipids can be inferred by conversion with the appropriate calibration (required for each species). Calibration for yellowfin was built in to the device but muscle samples have been collected for checking the calibration in the lab. More muscle samples were collected for skipjack to establish a proper calibration for this species.

3. Summary of Phase 2 Results

Phase 2 activities in 2008 comprised two cruises, WP1 in the tropical western Pacific and CP1 in the tropical central Pacific. During WP1, which consisted of six cruise legs spanning a continuous five month period from late June to late November 2008, 56,680 tuna were tagged and released over a wide area of the western tropical Pacific. More than 60% of the releases were made on the last two cruise legs, in Indonesia and Papua New Guinea.

The first two cruise legs of WP1 were spent in FSM waters, where good numbers of releases were achieved in southernmost portion of the EEZ, as well as intermittently along the chain

of islands at 5° – 8°N where bait could be obtained in some locations. The third short cruise leg saw good numbers of fish released in the small Palau EEZ. The fourth cruise leg started with further releases in Palau, en route to the Philippines, where subsequent fishing was less successful, due to the scarcity of both tuna and bait as well as restricted access to some potentially productive areas for security reasons. The fifth cruise leg, in eastern Indonesian waters, saw high numbers of fish released in Sulawesi, Maluku and Papua Provinces. The final cruise leg targeted the northern part of the PNG EEZ where few fish had been tagged during Phase 1, and provided additional releases in eastern PNG waters on the return to Solomon Islands for the end of the cruise. Figure 1 shows the cruise track followed during WP1.

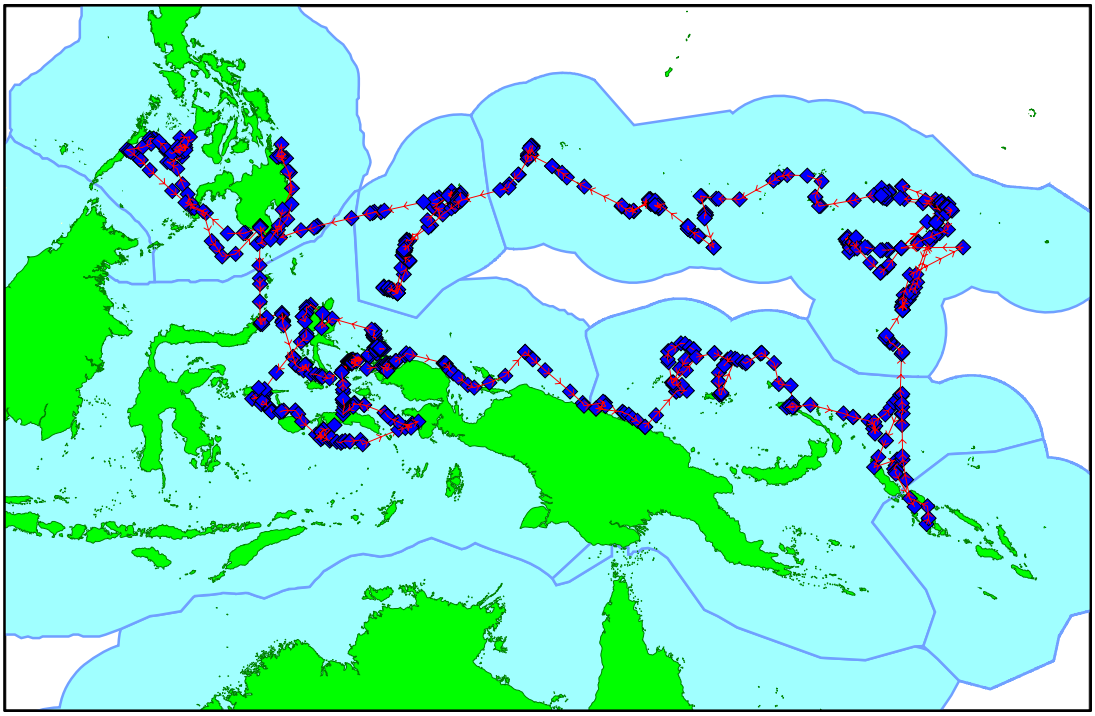


Figure 1. Cruise track of Soltai 105 during WP1 (red line), with tagged school positions shown (blue diamonds).

The central Pacific tagging cruise CP1 was conducted in May-June 2008 using a chartered Hawaii-based handline vessel *Double D*. This work successfully targeted bigeye tuna aggregations associated with the TAO oceanographic moorings at 155°W in and adjacent to the Line Islands of Kiribati (Figure 2).

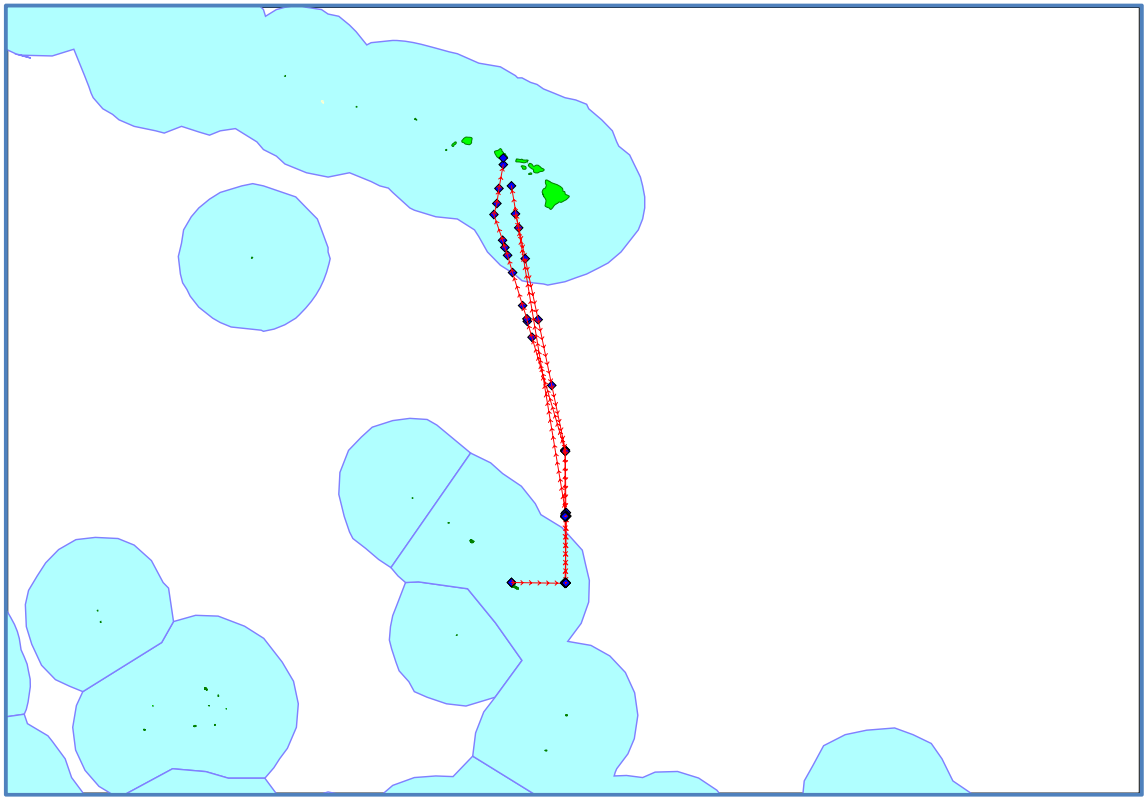


Figure 2. Cruise track of *Double D* during CP1.

3.1 Conventional tag releases during Phase 2

3.1.1 Release numbers

A total of 56,680 conventional tags was released during WP1 – 37,595 skipjack (66.4%), 17,619 yellowfin (31.1%) and 1,466 bigeye (2.6%). The species composition of the releases was close to the desired 60:30 proportion for skipjack and yellowfin. Bigeye numbers however continued to be less than the 10% target, as was the case during Phase 1 operations, with a low percentage of the species in pole-and-line catches and fewer than expected taken by night fishing around FADs and logs. 20,143 of the conventional tag releases (35.5%) were the smaller Y11 tags, usually deployed on fish of 38 cm FL or less, and the balance the larger Y13 tags (36,537). A high 45.7% of the Y11 tags deployed were yellowfin, whereas only 22.7% of the Y13 tags were of that species.

A total of 1,909 tuna were tagged during the CP1 cruise, with the majority (1,736) being bigeye (Itano 2008). Smaller numbers of yellowfn (116) and skipjack tuna (57) were also tagged. All releases were made at three TAO moorings - 8°N, 155°W , 5°N, 155°W and 2°N, 155°W. Most of the releases occurred at the 5°N and 2°N moorings. The high proportion of bigeye tuna tagged was gratifying.

3.1.2 Spatial distribution of releases

Figure 3 shows the distribution of releases by species and Table 1 the number of releases by EEZ during WP1. A broad distribution of releases across the area between 165°E westwards to 118°E, and between 10°N and 10°S was achieved, in accordance with the project strategy. A significant gap in the spatial coverage remains in equatorial waters, much

of which is the high seas corridor between FSM and PNG. No releases were made in these high seas areas during WP1, but it hoped to better cover this area during WP3 (see earlier).

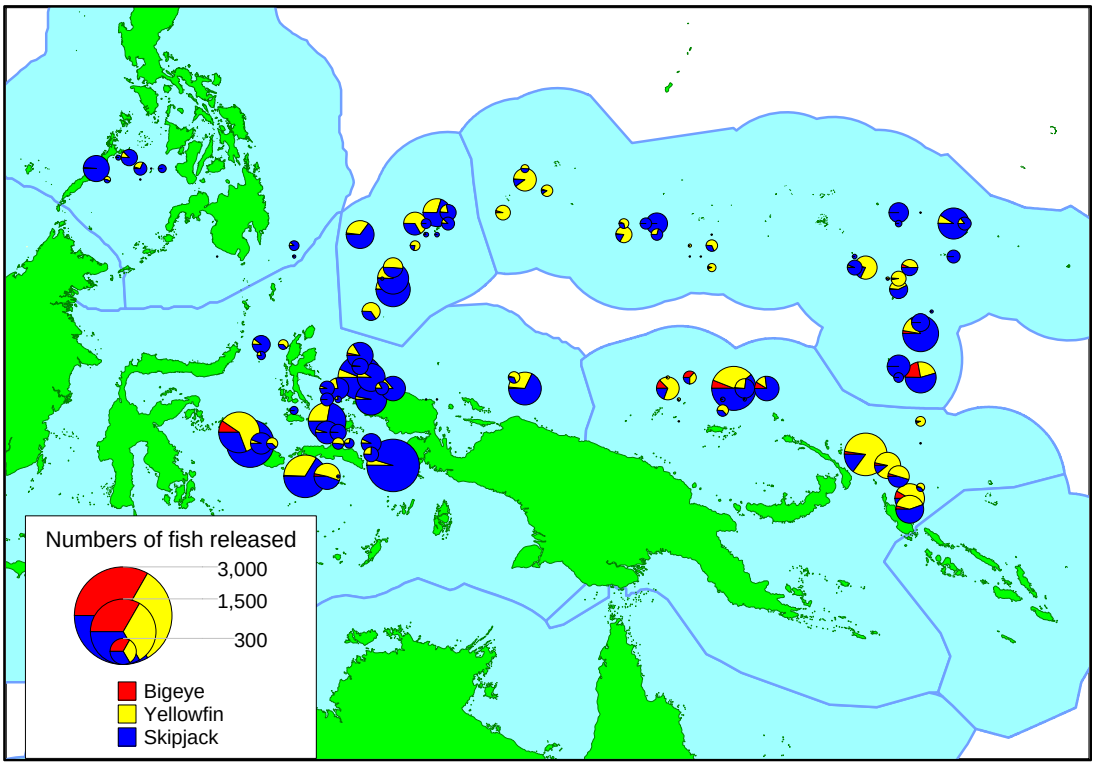


Figure 3. Number of releases during WP1, by species.

Table 1. Number of releases by EEZ during WP1, compared with the operational targets.

EEZ	Skipjack	Yellowfin	Bigeye	Total	Nominal target	
FSM	7,574	3,723	428	11,725	10,600	(+ 900)
Palau	4,540	2,702	45	7,287	2,900	(+ 5,400)
Philippines	1,702	198	14	1,914	4,200	(-2,300)
Indonesia	19,576	5,267	354	25,197	8,600	(+16,600)
PNG*	4,203	5,279	625	10,550	4,700	(+ 5,800)
TOTAL	**37,595**	**17,619**	**1,466**	**56,680**	**29,000**	**(+27,700)**

*** includes 3 yellowfin and 4 skipjack tagged in PNG waters, en route FSM at the outset of Phase 2**

Table 1 also compares actual release numbers with those proposed in the approved operational plans for 2008-2011. In all cases except Philippines, the number of releases greatly exceeded the target number, with the overall number nearly twice the nominal target of 29,000 releases for the 5 EEZs involved.

Figure 4 shows the spatial distribution of releases by species for CP1. As noted, the majority of releases occurred at the TAO moorings at 5°N and 5°N.

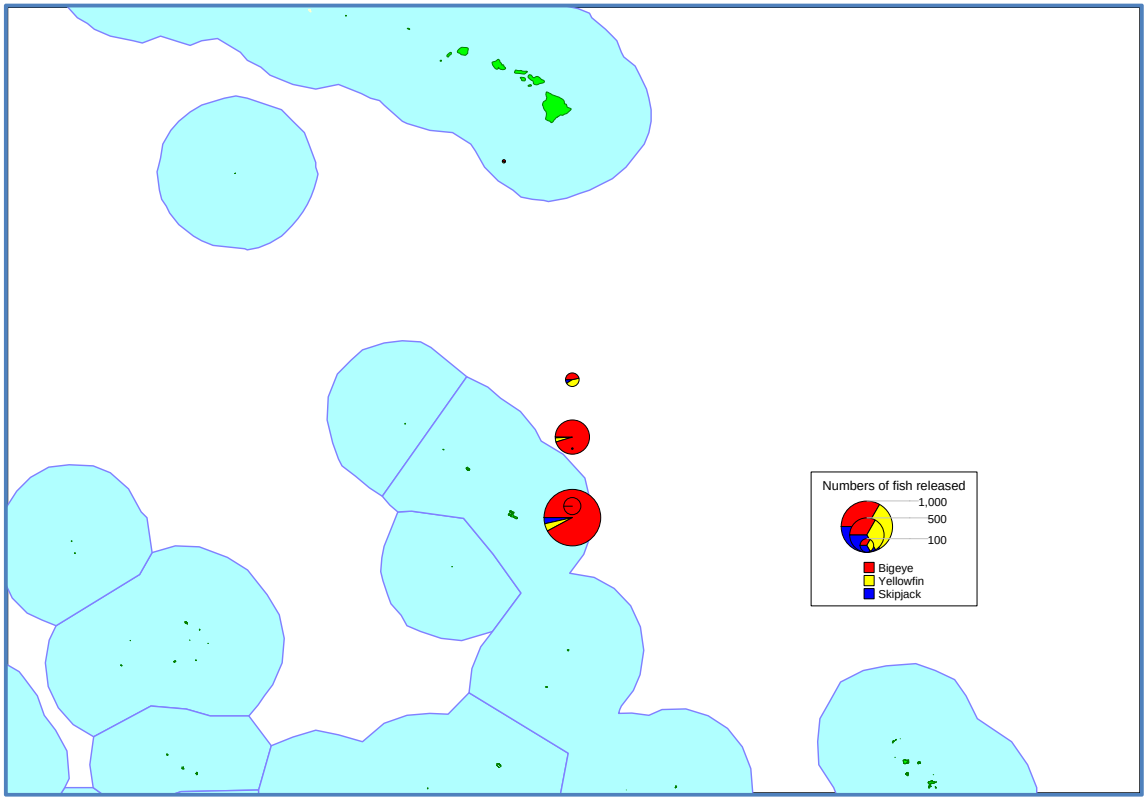


Figure 4. Number of releases during CP1, by species.

3.1.3 Releases by school association

Over half the total number of releases were made from schools associated with anchored FADs (Table 2).This category includes releases made adjacent to the array of oceanographic buoys (TAO and TRITON buoys) anchored in the WCPO, which proved quite effective in aggregating tunas, especially in equatorial areas. Significant numbers of releases were made on schools associated with drifting FAD and logs, with 78% of the total releases made in association with floating objects, and just 18% from unassociated schools. Small numbers of releases were made on a variety of other associations, including marine mammals and whale sharks, but these accounted for less than 4% of all releases.

Nearly all the bigeye releases (98%) were associated with floating objects, whereas 23% and 9% of skipjack and yellowfin releases, respectively, were from unassociated schools.

Table 2. Number of releases by species, by school association, during WP1.

Association	Skipjack	Yellowfin	Bigeye	Total	% of total
Unassociated	8,527	1,664	28	10,219	18.0
Log	2,532	1,977	82	4,591	8.1
Anchored FAD	22,079	8,136	1,130	31,345	55.3
Drifting FAD	2,952	5,145	219	8,316	14.7
Marine mammal/fish	838	18	-	856	1.5
Current line	279	357	6	642	1.1
Seamount	55	48	-	103	0.2
Island or reef	105	271	1	377	0.6
Other	228	3	-	231	0.4
TOTAL	37,595	17,619	1,466	56,680	

The proportion of releases by cruise on anchored FADs was highest in Indonesia (83.2% of releases) and PNG (61.7%), whereas the proportion of unassociated school releases was highest in FSM (44%) and Palau (44%). Drifting FAD releases made smaller but significant contributions to release numbers in FSM, Palau and Philippines, and log schools to releases in Philippines and FSM.

Figure 5 shows the distribution of releases by species and association during WP1. Note that releases on drifting FADs are included in the association categories with “Other” and do not appear in the figure. Many of the releases in eastern PNG (cruise leg 6) and FSM were in association with drifting FADs. Note again that the great majority of bigeye releases were FAD-associated in equatorial areas.

In CP1, all releases were made on anchored FADs (TAO moorings).

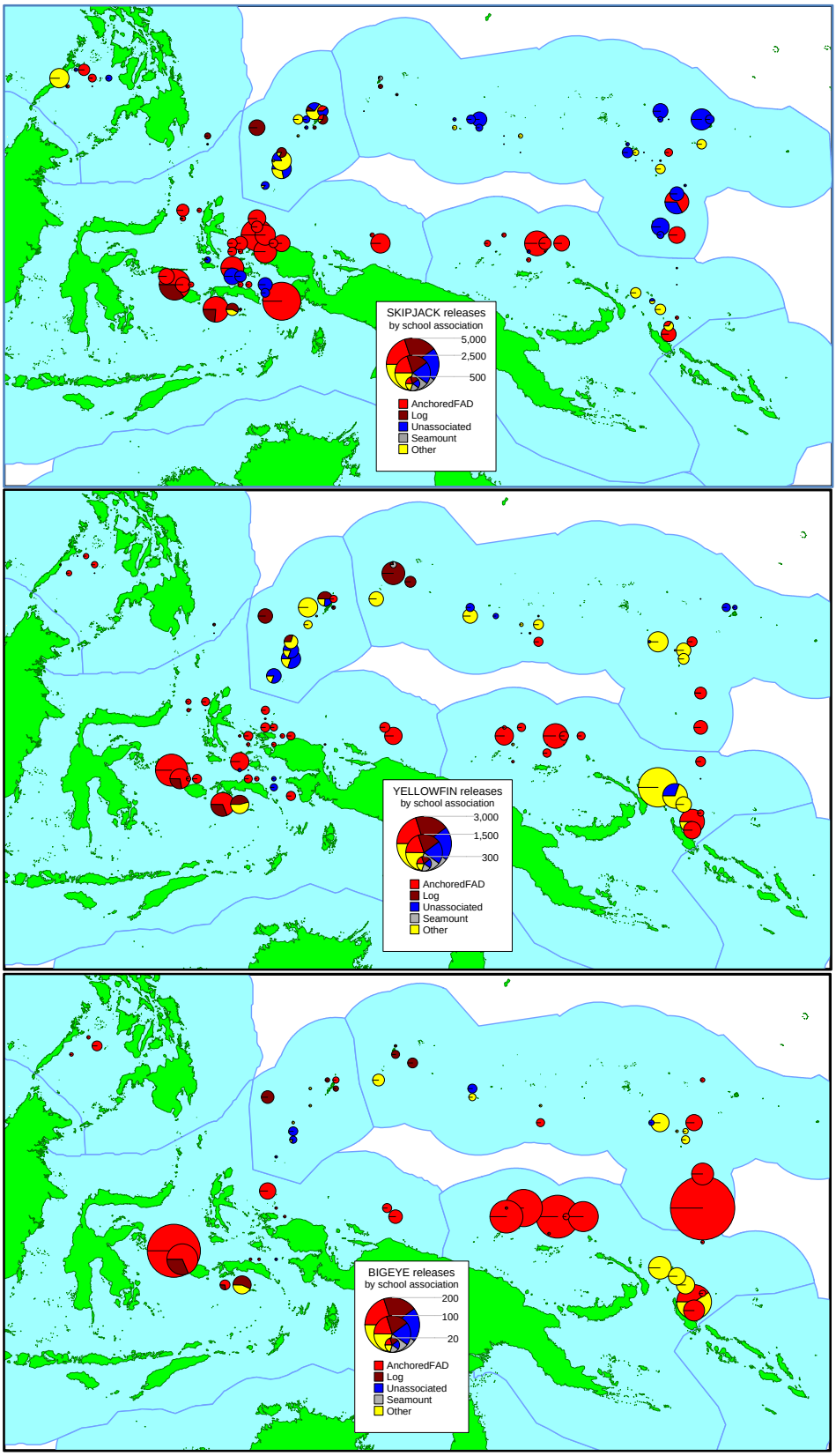


Figure 5. Distribution of releases by association for each species during WP1.

3.1.4 Size distribution of releases

Figure 6, Figure 7 and Figure 8 show the overall size distribution of releases of skipjack, yellowfin and bigeye, respectively, tagged during WP1. The majority of skipjack were larger than 38cm (72% Y13 tags) whereas over half the yellowfin released (53%) were smaller fish with Y11 tags. Both skipjack and yellowfin distributions show a long tail but with very few fish larger than 70 cm. The bigeye releases contained the highest proportion of fish larger than 50 cm FL.

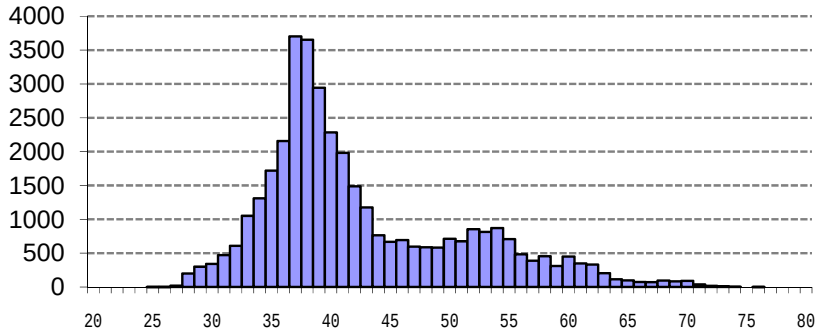


Figure 6. Size distribution of skipjack released during WP1 (n = 37,562).

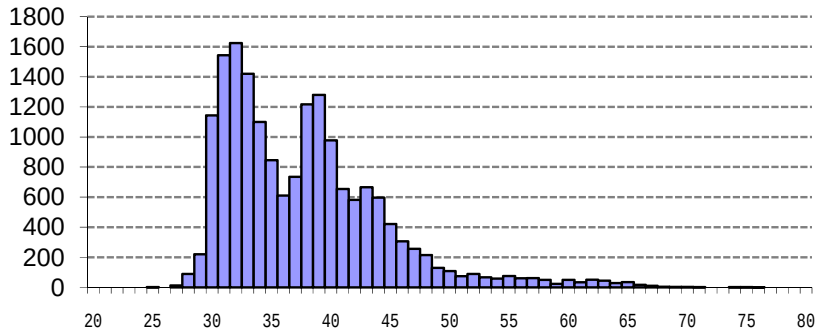


Figure 7. Size distribution of yellowfin released during WP1 (n = 17,602).

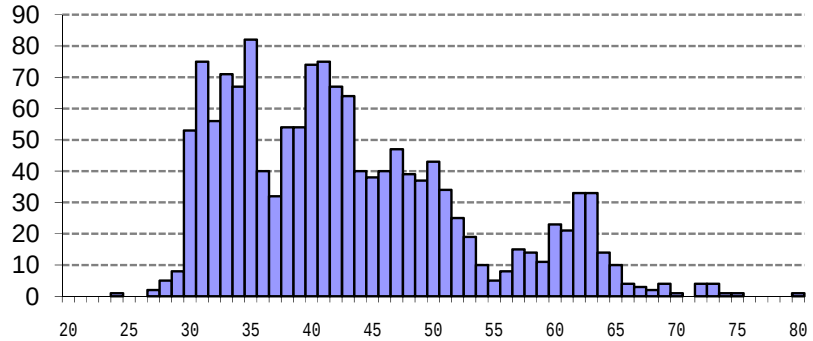
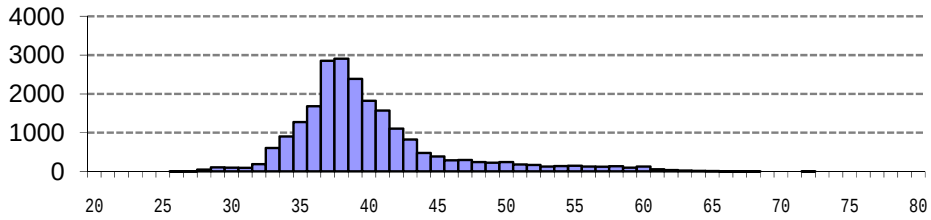


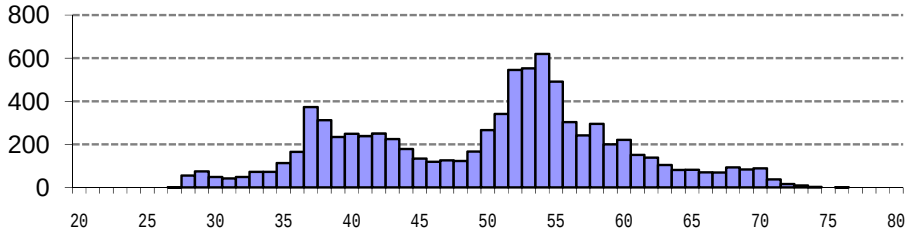
Figure 8. Size distribution of bigeye released during WP1 (n = 1,464).

Comparison of length frequency distributions from anchored FAD and free schools for skipjack and yellowfin (Figure 9) reveals a much higher proportion of larger fish (> 50cm) from unassociated schools in both cases, an effect more pronounced for skipjack. Although not shown here, the same effect applies for drifting FAD and log schools, i.e. smaller fish than on unassociated schools.

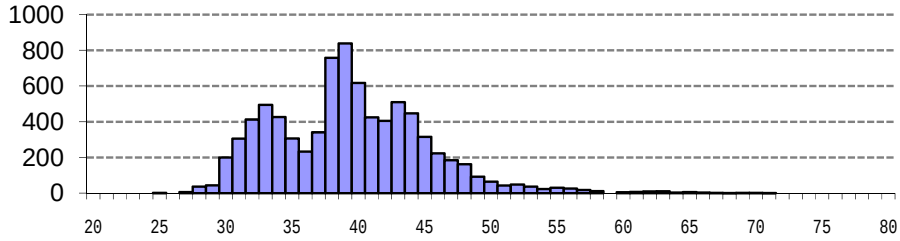
Skipjack
(a) Anchored FADs (n = 22,056)



Skipjack
(b) Free schools (n = 8,521)



Yellowfin
(a) Anchored FADs (n = 8,130)



Yellowfin
(b) Free schools (n = 1,663)

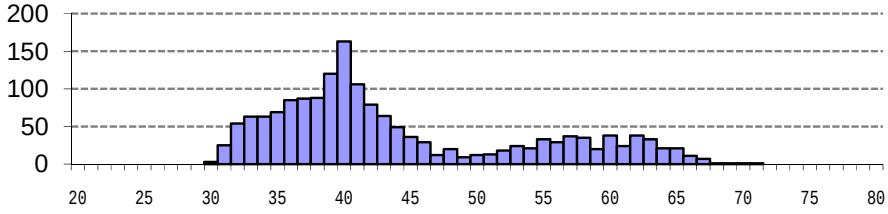


Figure 9. Comparison of length frequency distributions for skipjack and yellowfin releases from anchored FAD and free school associations during WP1.

The size distribution of releases for CP1 indicates somewhat larger sizes on average compared to WP1, with bigeye tuna in particular having a mean size at release of around 60 cm (Figure 10).

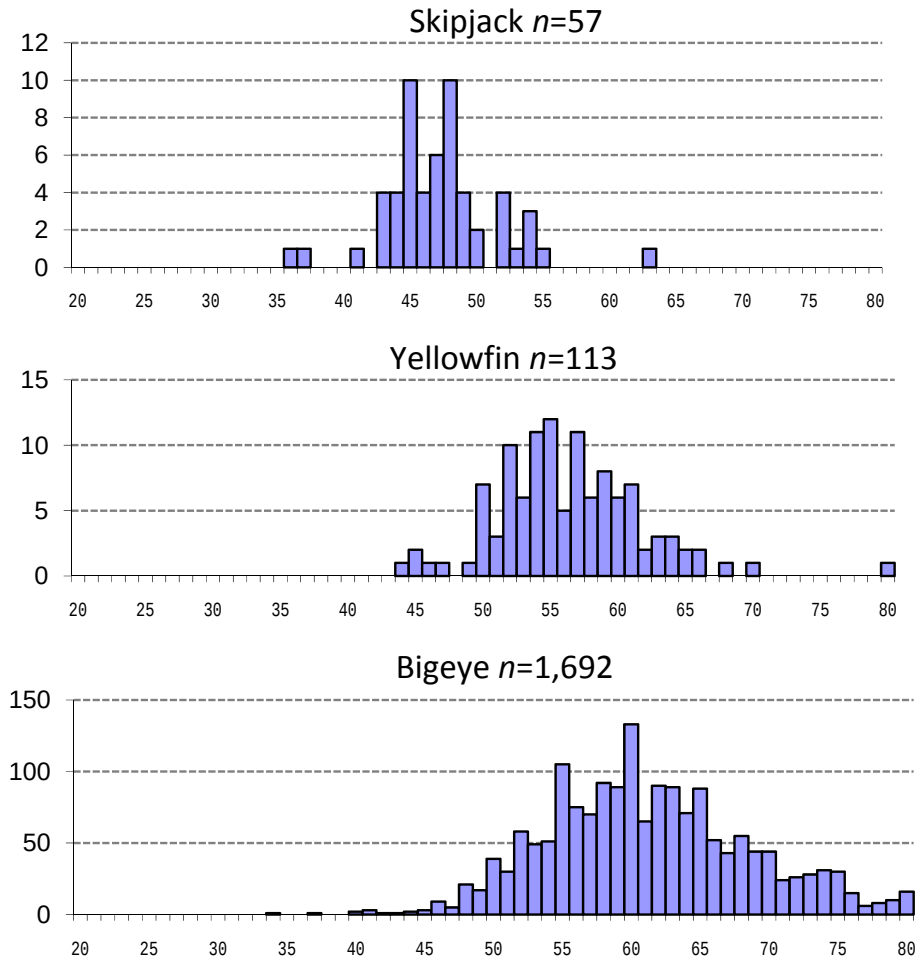


Figure 10. Size distribution of releases during CP1.

3.2 Archival tagging during Phase 2

During WP1, a total of 49 archival tags were deployed comprising 13 yellowfin and 36 bigeye. The table below display school association of archival tagged fish.

Archival WP1	Anchored Fad	Drifting Fad	Free school	Seamount	Whale	Total
Bigeye	35		1			36
Yellowfin	1	5	6	1	1	13

The manufacture of the small LTD 2410 Lotek tag used during Phase 1 has been discontinued due to the many malfunctions encountered with this model. A new tag, the LAT2510 has been engineered but was not fully tested at the beginning of WP1 and only 24 of this model were available at this stage and all have been deployed on bigeye tuna. Twenty-five Mk9 tags from Wildlife Computers (WLC) were deployed on larger fish. Yellowfin and especially bigeye tuna around or above 60 cm FL were seen mainly during cruise leg 1

(on TAO buoys along the 156° E) and cruise 6 leg 6 in the north of the PNG EEZ. Figure 11 shows the sizes archival tagged fish.

WLC discovered a malfunction in the Mk9 temperature sensor in the middle of WP1 which required the return of all non-deployed tags for repair. This prevented any archival tag deployment during 1.5 months of WP1.

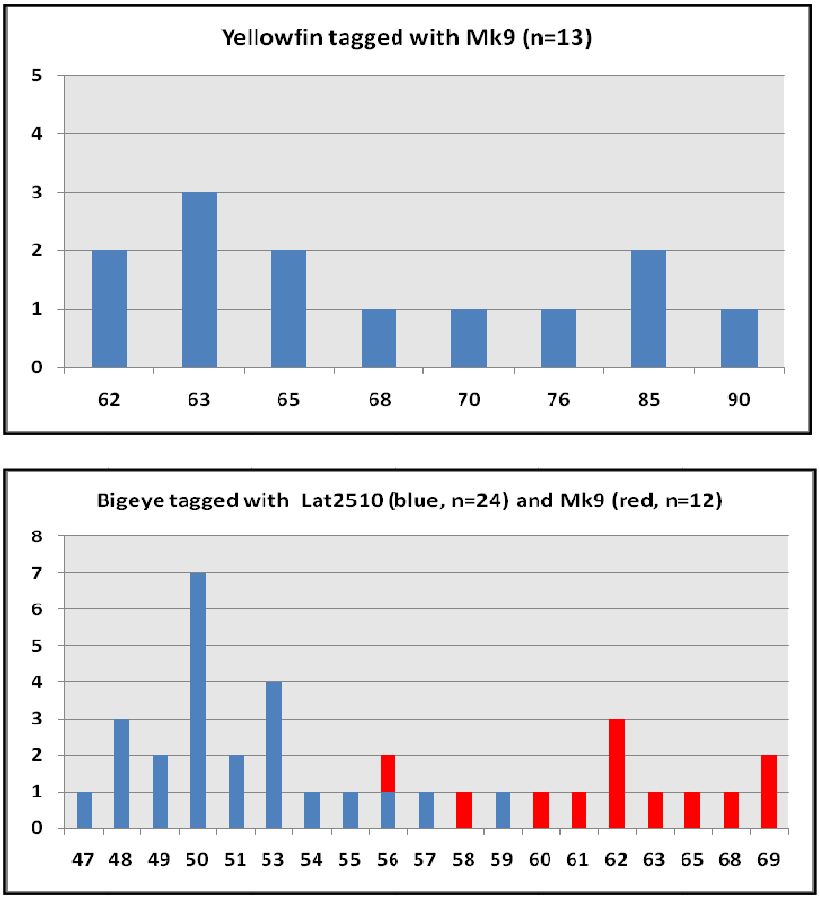


Figure 11. Length frequency of yellowfin and bigeye tuna tagged with archival tags during WP1.

During CP1, 50 Mk9 archival tags were deployed on 45 bigeye and 5 yellowfin tuna. All deployments were on fish associated with the TAO moorings and one yellowfin deployment on a NOAA weather buoy south of Hawaii.

4. Tag recoveries

4.1 Phase 2 recoveries

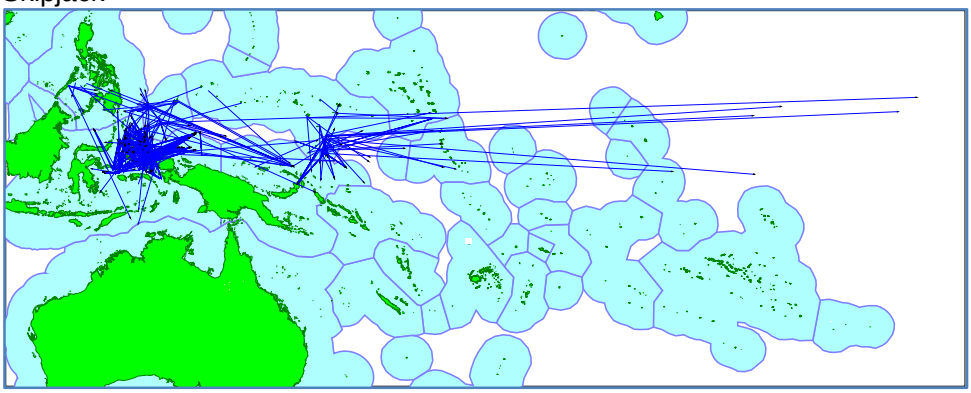
4.1.1 WP1 recoveries

As at 31 December 2008, 3,266 recoveries had been received from the WP1 releases (5.8%), with many more known to be on the way. The current skipjack recovery rate, at 7.3% is considerably higher than that of yellowfin (2.6%) and bigeye (5.6%) at this stage.
The recapture rate for larger Y13 tags is higher than that of the Y11 tags (8.3% vs 4.6%), as expected from Phase 1 results.

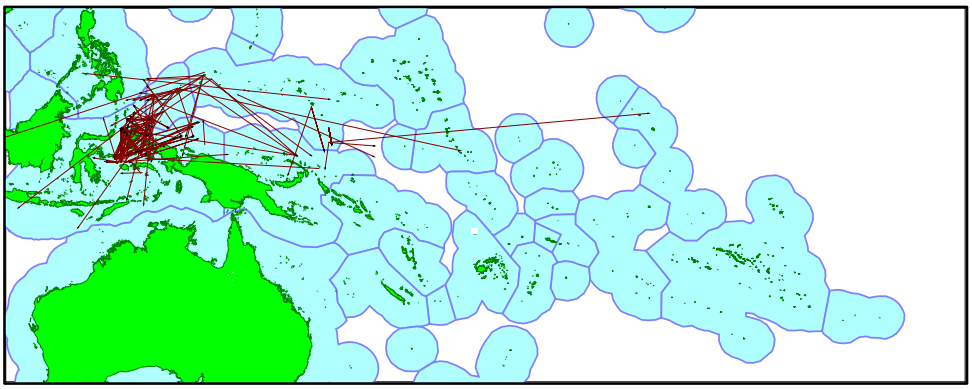
The recovery rate from cruise leg 1 (FSM) releases, mostly adjacent to an area of generally high purse seine effort, is already over 10%, whilst over 2,200 recoveries (8.9%) have already been notified from the large number of Indonesian releases in October. On the other hand, no recoveries from the PNG releases in November have been received at SPC (although many are known to be currently in transit from Philippines and PNG) and the recovery rate from cruise legs 2, 3 and 4 is still relatively low (< 4%). No recoveries from the 49 archival tag releases have yet been received, although there have been reports that several have been returned to tag recovery officers in Philippines and PNG.

Although most WP1 recaptures to date have been local, some extensive individual movements have been recorded (Figure 12). There also appears to have been limited movement into the Indian Ocean for both skipjack and yellowfin.

Skipjack



Yellowfin



Bigeye

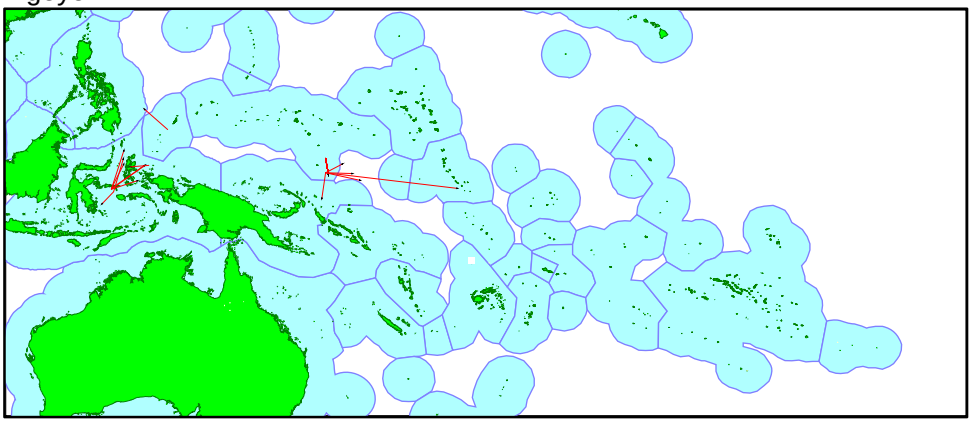


Figure 12. Displacements greater than 100nm for recoveries of skipjack, yellowfin and bigeye.

4.1.2 CP1 recoveries

324 recoveries (17%), including 7 archival tags, have been received from the CP1 releases in waters south of Hawaii, where 1,736 bigeye, 116 yellowfin, and 57 skipjack were tagged. The interim bigeye recovery rate is 17.3%, slightly higher than the much smaller number of yellowfin (16.4%) at this time. All of these returns have been from eastern Pacific based purse seiners, with most of the recoveries being sourced from canneries in Latin America.

Figure 13 below shows some initial displacements greater than 100 nm for bigeye tagged during CP1, with significant longitudinal dispersal already apparent.

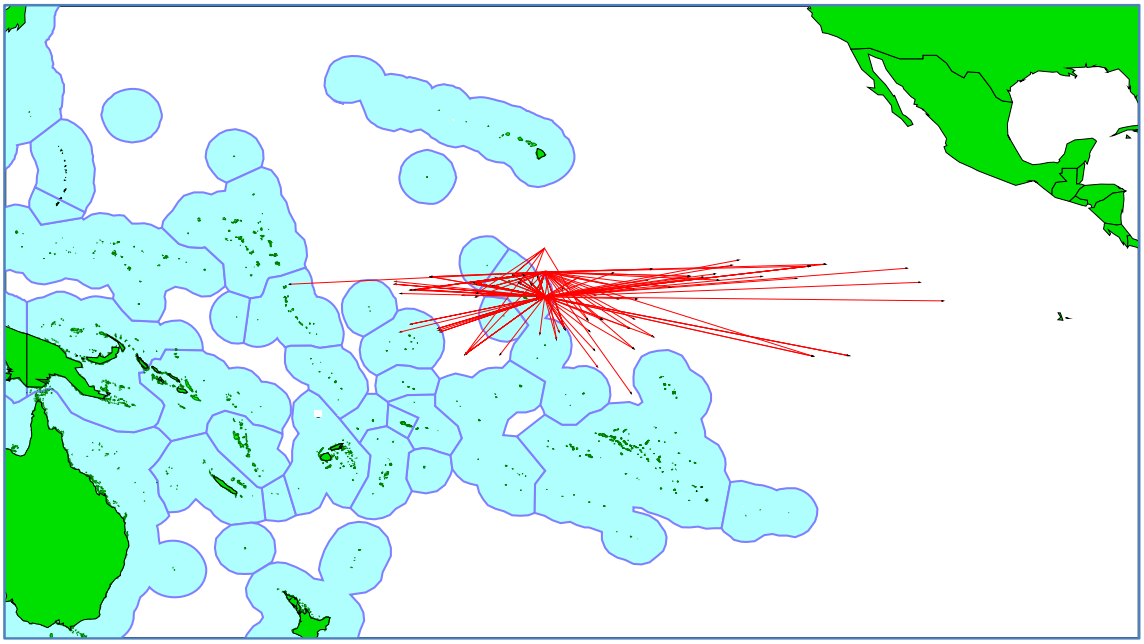


Figure 13. Displacements greater than 100nm for bigeye tuna released during CP1.

4.2 Phase 1 recoveries – an update

Tag recoveries continue to be received from Phase 1 releases in PNG and the Solomon Islands in good numbers, although few are now being received from the 2006 releases in PNG.

Table 3 below lists the recovery rates as at the end of 2008 for the five release sets during Phase 1 activity in those two countries, with an overall rate of 13.5%. Recovery rates are now over 20% for the first cruises in both PNG and Solomons, where most releases were in central areas with high fishing effort and large numbers of anchored FADs. The recovery rate for the subsequent cruises, with a higher proportion of releases in peripheral, although lower, continues to increase and will likely exceed 12%.

Yellowfin recovery rates exceed those of skipjack in most release sets, and continue to increase with the recovery of larger fish, whereas few recoveries of shorter-lived skipjack are now being received from the early (2006) release sets.

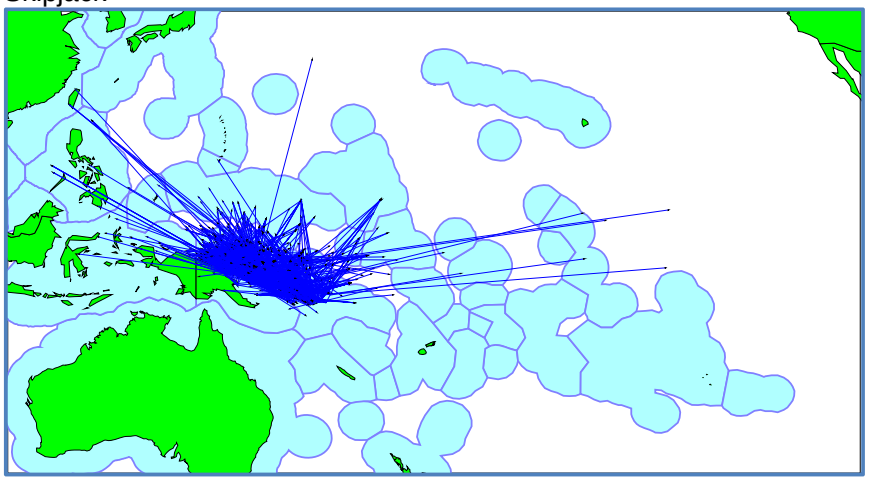
Table 3. Fractional recovery rates, by species, for Phase 1 releases on five cruises in PNG and Solomon Islands.

	Releases				Recoveries (numbers and %)			
	SKJ	**YFT**	**BET**	**Total**	**SKJ**	**YFT**	**BET**	**Total**
PNG 1 Aug-Nov 2006	13,948	7,806	562	22,316	2,610 (18.7)	1,746 (22.4)	226 (40.2)	4,582 (20.5)
PNG 2 Feb-May 2007	26,493	12,845	129	39,467	2,350 (8.9)	1,489 (11.6)	6 (4.7)	3,845 (9.7)
SOLS 1 Oct-Nov 2007	7,479	3,565	139	11,183	1,857 (24.8)	720 (20.2)	12 (8.6)	2,589 (23.2)
SOLS 2 Feb-Mar 2008	6,207	10,448	388	17,043	523 (8.4)	1,045 (10.0)	34 (8.8)	1,602 (9.4)
SOLS 3 Apr 2008	9,115	3,956	26	13,097	693 (7.6)	563 (14.2)	6 (23.1)	1,262 (9.6)
TOTAL	**63,242**	**38,620**	**1,244**	**103,106**	**8,033 (12.7)**	**5,563 (14.4)**	**284 (22.8)**	**13,880 (13.5)**

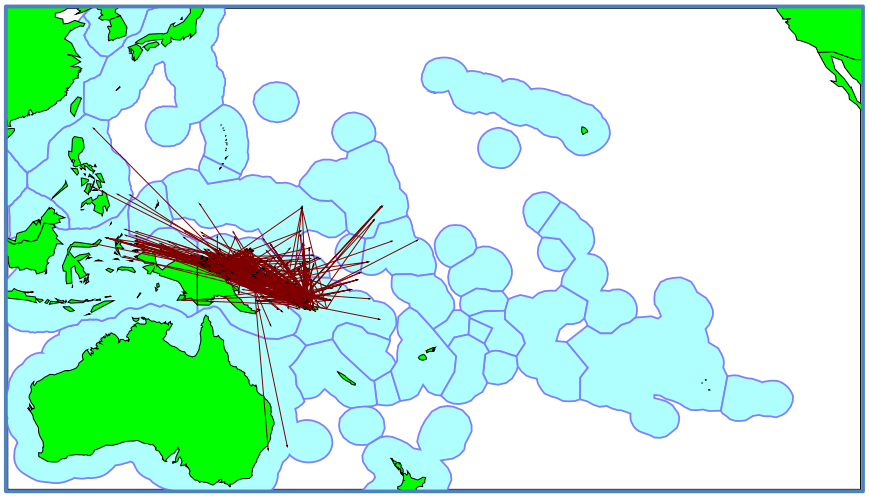
Size at release appears to have a significant effect on subsequent recovery rate, at least for skipjack and yellowfin, with recovery rates lower for fish less than 40 cm FL, increasing to a peak at 50-55 cm before declining to some degree for larger fish. The relative impacts of natural mortality by size, size selection by purse seine gear and size-related tagging mortality have yet to be determined. It is also possible that there may be tag type effects, with greater slippage or loss of the smaller less robust Y11 tags. Work has been initiated to investigate this possibility.

Summaries of the frequency of time at liberty for the three species and the displacement between release and recapture locations has changed little since the previous report, with greater numbers of fish at liberty for more than 420 days and an increase in the frequency of displacements greater than 300 nm. Figure 14 shows longer-distance displacements (>300 nm) for skipjack, yellowfin and bigeye recoveries from Phase 1 releases.

Skipjack



Yellowfin



Bigeye

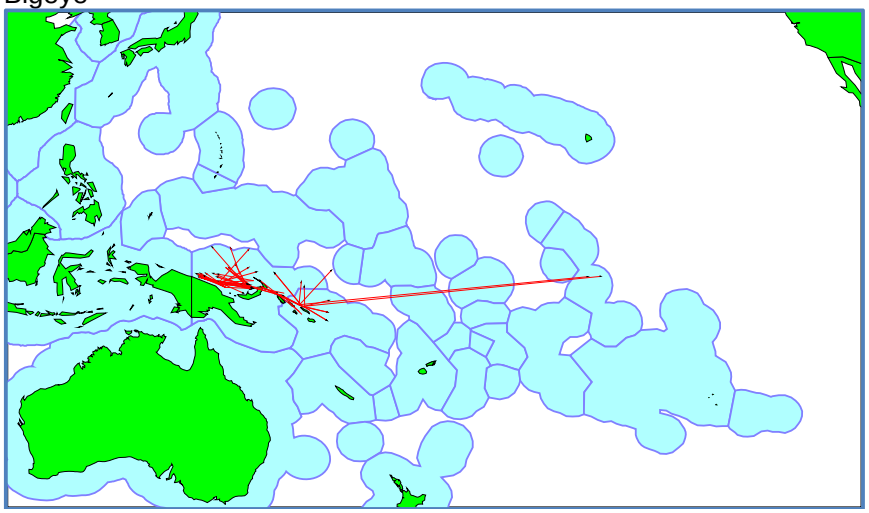


Figure 14. Displacements > 200 nm of recoveries of skipjack, yellowfin and bigeye from Phase 1 releases.

Much work now needs to be done with verification of the large number of recoveries received (~ 14,200), mostly with good data, but all in need of corroboration from logsheet and VMS matching etc. Work will begin with the 2006 PNG releases in primarily in the Bismarck Sea and in association with anchored FADs, which are expected to provide a wealth of useful information on the dynamics of FAD associations, levels of exploitation and local movement.

5. Conclusion

WP1 has succeeded in considerably expanding the PTTP coverage of the WCPO, with significant numbers of releases of conventional tags north of the equator (FSM, Palau) and in the far west of the WCPO (Indonesia, Philippines), in spite of sometimes difficult conditions prevailing. The large number of recoveries already received suggests that mechanisms to receive and return recaptured tags are working well, and that good results can be expected in the longer term, in fulfilment of project objectives. With the number of PTTP releases now over 160,000, the project is running well in advance of nominal target numbers, although bigeye numbers are still lower than hoped, and large areas of the WCPO remain to covered in succeeding WP cruises (WP2 and WP3 in 2009).

The number of archival tags released was relatively small (49), with tagging suspended for a long period whilst data reliability issues with some tag types were resolved. It is hoped this activity will resume at a higher level during 2009.

The complementary CP cruises in the Central Pacific have commenced, with the first cruise successfully completed in June 2008, and a recovery rate of over 17% already achieved.

Recoveries from Phase 1 releases continue to be received, with an overall return rate of 13.5%. Verification and analyses of these data are expected to commence in the near future.

6. References

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