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PACIFIC TUNA TAGGING AND PNG TAGGING PROJECT PROGRESS REPORT AND WORKPLAN FOR 2013-2014

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Introduction

The steering committee report for the Pacific Tuna Tagging Programme (PTTP) for 2013 reports upon the tagging activities undertaken in 2012 under the banner of the PTTP, tag recoveries, and tag seeding activities. The objectives of the PTTP are specified in SC6-GN-IP-04. Funding support for the PTTP has been provided by the PNG National Fisheries Authority, New Zealand Aid Agency, the Government of the Republic of Korea, Australian Centre for International Agricultural Research, European Community 8th European Development Fund, European Community 9th European Development Fund, European Community 10th European Development Fund, the French Pacific Fund, the Government of Taiwan, Heinz Australia and the Global Environment Facility.

In 2011, SPC and the PNG National Fisheries Authority (NFA) began a three-year tag release programme in the PNG EEZ, funded by NFA. This new project, referred to here as the PNG Tagging Project (PNGTP) is considered under the umbrella of the PTTP and is reported in this annual report. The PNGTP will extend the time series of tagging in PNG since the beginning of the PTTP in mid-2006 to 7+ years. The objectives of this work are consistent with those of the PTTP; however the work will be primarily focused on providing the data resources to assess the status of tuna resources in PNG for national tuna fisheries management. The data will also contribute to the wider WCPO assessment of tuna stocks.

The overall operational structure of the PTTP is as follows (with planned work for 2013-14 shown in red):

	Time period	**Operational area**	**Tagging vessel**
Phase 1	Aug – Nov 2006	PNG	*Soltai 6*
	Feb – May 2007	PNG	*Soltai 6*
	Oct – Nov 2007	Solomon Islands	*Soltai 6*
	Feb – Mar 2008	Solomon Islands	*Soltai 6*
	Apr 2008	Solomon Islands	*Soltai 105*
Phase 2 (to date)	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)	*Aoshibi Go*
	May – Jun 2010	Central Pacific (CP4)	*Aoshibi Go*
	Oct – Nov 2010	Central Pacific (CP5)	*Pacific Sunrise*
	Oct 2011	Central Pacific (CP6)	*Pacific Sunrise*
	Nov – Dec 2011	Central Pacific (CP7)	*Aoshibi Go*
	Sep – Oct 2012	Central Pacific (CP8)	*Pacific Sunrise*
	Nov 2013	Central Pacific (CP9)	*Pacific Sunrise*
	Sep - Oct 2014	Central Pacific (CP10)	*Pacific Sunrise*
PNGTP	Apr – Jul 2011	PNG (PNGTP1)	*Soltai 105*
	Jan – Mar 2012	PNG (PNGTP2)	*Soltai 105*
	Aug 2012	PNG (TAO trial)	*FTV Pokajam*
	Apr - Jun 2013	PNG (PNGTP3)	*Soltai 101*

The report provides a review of work undertaken in 2012-13, an update of the overall programme results to date and the proposed workplan for the PTTP for 2013-2014.

Summary of PTTP Activities in 2011-2012

Since SC8, PTTP activities comprised two troll/handline cruises, CP8, in the tropical central Pacific and a trial TAO cruise in PNG, the third and last pole-and-line cruise of the PNGTP, continued implementation and refinement of tag recovery processes and tag seeding, and data preparation for use in WCPO skipjack, yellowfin and bigeye tuna stock assessments.

CP8 was a cruise of 23 days duration conducted in Sep-Oct 2012 targeting bigeye tuna aggregations associated with the TAO oceanographic moorings (Figure 1) straddling the Equator at 170ºW and 180º. The Tonga-based multipurpose vessel *Pacific Sunrise* was chartered for the cruise. A total of 6,174 tuna (6,014 bigeye, 140 yellowfin and 20 skipjack) were tagged (Table 1). All releases were made at the 2°S, equator and 2°N moorings of the 170°W. Within these releases, 18 archival tags were deployed on bigeye tuna.

Trial TAO PNG cruise: To improve the number of tagged bigeye in PNG waters it was decided during the last PNGTP debriefing meeting to undertake a trial cruise using the same fishing technique that was successfully employed in the central Pacific area. The cruise also provided the opportunity of using the new training vessel purchased by NFA and assesses its suitability for the purpose. None of the visited TAOs at the equator and 2°N on the 156°E (figure 1) was associated with a tuna school

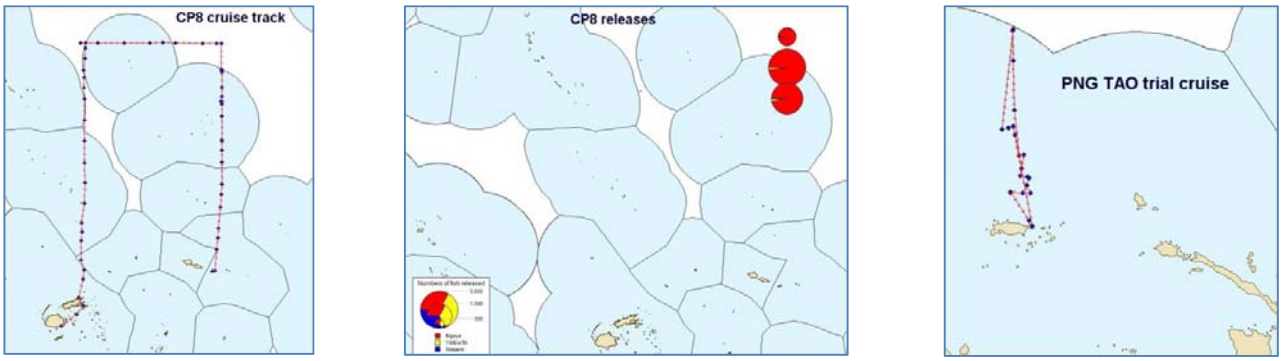


Figure 1. Cruise tracks and distribution of tag releases during CP8 & PNG-TAO-Trial cruise.

The third cruise of the **PNGTP** (PNGTP3) was conducted over two months from April to June 2013, using the chartered pole-and-line vessel, *Soltai 101*. The cruise was designed to release conventional tags across 4 areas within the PNG EEZ (Figure 2). A total of 29,920 tuna (23,396 skipjack, 5,960 yellowfin, 564 bigeye) were tagged during PNGTP3 (Table 1). The distribution of releases is shown in Figure 2. Within these releases, 31 fish (30 yellowfin and 1 bigeye) received an archival tag. Archival tagging in Solomon Sea region for yellowfin was undertaken in collaboration with CSIRO.

Table 1. CP6, CP7, PNGTP2 and total PTTP releases to date of conventional and archival tags.

Project	Tag type	Skipjack	Yellowfin	Bigeye	Total
CP8	Conventional	20 (0.3%)	140 (2.3%)	5,996 (97.4%)	**6,156**
	Archival			18	**18**
PNGTP3	Conventional	23,396 (78.3%)	5,930 (19.8%)	563 (1.9%)	**29,889**
	Archival		30	1	**31**
Total PTTP	Conventional	246,589 (62.9%)	105,520 (26.9%)	40,092 (10.2%)	**392,201**
	Archival	127	559	675	**1,361**

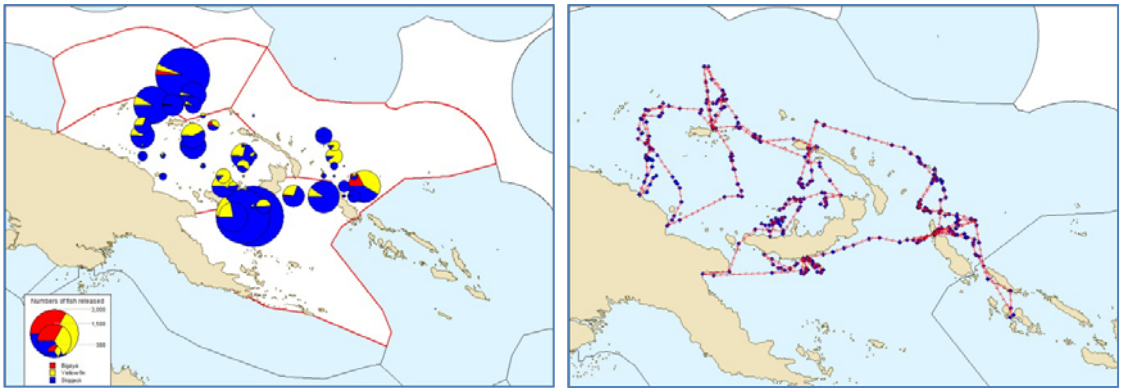


Figure 2. Left Panel. Distribution of tag releases during PNGTP3. The red lines show the delineation of the EEZ and sub regions. Right Panel. Cruise track during PNGTP3.

PNGTP3 also provided an opportunity to collect diverse samples on 483 fish (Table 2) as part of a long-term project to characterize the trophic status of the western and central Pacific pelagic ecosystem. Since the beginning of the PTTP in 2006, 5,695 stomach samples have been collected, mainly from skipjack, yellowfin, bigeye and albacore tuna (Table 3). The examination of the stomachs is an ongoing process and is conducted in the laboratory at SPC headquarters. A total of 4,466 stomach, representing 78.4% of the samples collected, have been examined and corresponding data entered in a dedicated database (see Table 3).

Table 2. Number and type of biological samples collected by area during PNGTP3.

Sp.	stomach-muscle-liver					muscle-gonads-otoliths					muscle or fin clips (DNA)				
EEZ	Area 1	Area 2	Area 3	Area 4	total	Area 1	Area 2	Area 3	Area 4	total	Area 1	Area 2	Area 3	Area 4	total
SKJ	63	48	60	50	221	4	3	12	15	34	39	18	10		67
YFT	20	24	45	38	127	4	8	6	17	35	11	21	56		88
BET		1	10	2	13	1	1	1	1	4			10		10
KAW		3	3	1	7					0					0
Nb	83	76	118	91	368	9	12	19	33	73	50	39	76	0	165

Table 3. Total number of stomach samples collected and analysed to date.

PREDATOR SPECIES		COLLECTED	ANALYSED	% ANALYSED
SKJ	SKIPJACK	2599	2026	78.0%
YFT	YELLOWFIN	2087	1591	76.2%
BET	BIGEYE	358	314	87.7%
ALB	ALBACORE	245	242	98.8%
KAW	KAWAKAWA	123	89	72.4%
RRU	RAINBOW RUNNER	112	65	58.0%
FRI	FRIGATE TUNA	95	72	75.8%
DOL	MAHI MAHI / DOLPHINFISH / DORADO	45	41	91.1%
SWO	SWORDFISH	6	6	100.0%
WAH	WAHOO	6	6	100.0%
MSD	MACKEREL SCAD / SABA	5	0	0.0%
FAL	SILKY SHARK	4	4	100.0%
BUM	BLUE MARLIN	3	3	100.0%
BRZ	POMFRETS AND OCEAN BREAMS	3	3	100.0%
CFW	POMPANO DOLPHINFISH	2	2	100.0%
YTL	AMBERJACK (LONGFIN YELLOWTAIL)	1	1	100.0%
NXI	GIANT TREVALLY	1	1	100.0%
	TOTAL	**5695**	**4466**	**78.4%**

Conventional and archival tag recoveries for the PTTP

As at 09 July 2013, a total of 63,770 tagged tuna had been recaptured and the data reported to SPC. The numbers of conventional tag recoveries by species and by main tagging cruise are given in Table 4. Tag recoveries have occurred over the duration of the project, and are expected to continue for several years. Tag attrition follows the expected declining pattern (Figure 3) with the rate of decline in skipjack tag returns indicating their shorter expected lifespan and higher natural mortality when compared to yellowfin and bigeye tuna. The recovery rates of yellowfin and bigeye tagged with archival tags and conventional tags vary depending on cruise (Table 5). Initial observations of this data suggest increased tag rejection/fish mortality with archival tagging on some cruises.

The majority of total recoveries have come from purse-seine vessels (89%), followed by pole and line and other gear types (5%), unknown (5%) and longline recoveries <1% (149 in total). Table 6 shows the number of recoveries by gear type for yellowfin and bigeye that have been at liberty for at least 1 year before recapture. After 1 year at liberty, the fish should be approximately 80cm-100cm in length and available to purse-seine and longline fleets. The disproportionately low number of tag returns is evident for longline vessels. The same trend is observed if the analyses is restricted to just the spatial domain of the purse-seine fleet (10°N to 10°S).

Table 4. Tag releases and recaptures for the PTTP to date.

Cruises	Releases				Recoveries (numbers and %)			
	SKJ	YFT	BET	Total	SKJ	YFT	BET	Total
PNG 1 Aug-Nov 2006	13,948	7,806	562	22,316	2,639 (18.9%)	1,805 (23.1%)	229 (40.7%)	4,673 (20.9%)
PNG 2 Feb-May 2007	26,493	12,845	129	39,467	2,501 (9.4%)	1,708 (13.3%)	8 (6.2%)	4,217 (10.7%)
SOL 1 Oct-Nov 2007	7,479	3,565	139	11,183	1,975 (26.4%)	783 (22%)	18 (12.9%)	2,776 (24.8%)
SOL 2 Feb-Apr 2008	15,327	14,405	414	30,146	1,761 (11.5%)	2,415 (16.8%)	62 (15%)	4,238 (14.1%)
WP1 Jun-Nov 2008	37,693	17,650	1,467	56,810	6,370 (16.9%)	2,052 (11.6%)	362 (24.7%)	8,784 (15.5%)
WP2 Mar-Jun 2009	34,207	13,919	3,145	51,271	4,603 (13.5%)	2,332 (16.8%)	481 (15.3%)	7,416 (14.5%)
WP3 Jul-Oct 2009	30,723	7,340	735	38,798	6,671 (21.7%)	1,422 (19.4%)	195 (26.5%)	8,288 (21.4%)
CP1 May-Jun 2008	57	116	1,736	1,909	4 (7%)	25 (21.6%)	570 (32.8%)	599 (31.4%)
CP2 May-Jun 2009	169	205	2,307	2,681	5 (3%)	27 (13.2%)	568 (24.6%)	600 (22.4%)
CP3 Oct-Nov 2009	66	237	4,802	5,105	2 (3%)	62 (26.2%)	1,757 (36.6%)	1,821 (35.7%)
CP4 May-Jun 2010	7	120	2284	2411	1 (14.3%)	12 (10%)	483 (21.1%)	496 (20.6%)
CP5 Nov-Dec 2010	40	228	6,091	6,359	7 (17.5%)	43 (18.9%)	1821 (29.9%)	1871 (29.4%)
PNGTP1 Apr-Jul 2011	28,736	11,574	355	40,665	5,462 (19%)	2,226 (19.2%)	56 (15.8%)	7,744 (19%)
CP6 Oct 2011	2	123	3,804	3,929	-	24 (19.5%)	831 (21.8%)	855 (21.8%)
CP7 Nov-Dec 2011	52	245	4,212	4,509	1 (1.9%)	16 (6.5%)	1,200 (28.5%)	1,217 (27%)
PNGTP2 Jan-Mar 2012	28,311	9607	2,008	39,926	5,779 (20.4%)	783 (8.2%)	382 (19%)	9,946 (17.4%)
CP8 Sep-Oct 2012	20	140	6,014	6,174	-	23 (16.4%)	1,197 (19.9%)	1,220 (19.8%)
PNGTP3 Apr-Jun 2013	23,396	5,960	564	29,920	8	1		9
TOTAL	**246,716**	**106,079**	**40,767**	**393,562**	**37,789 (15.3%)**	**15,761 (14.9%)**	**10,220 (25.1%)**	**63,770 (16.2%)**

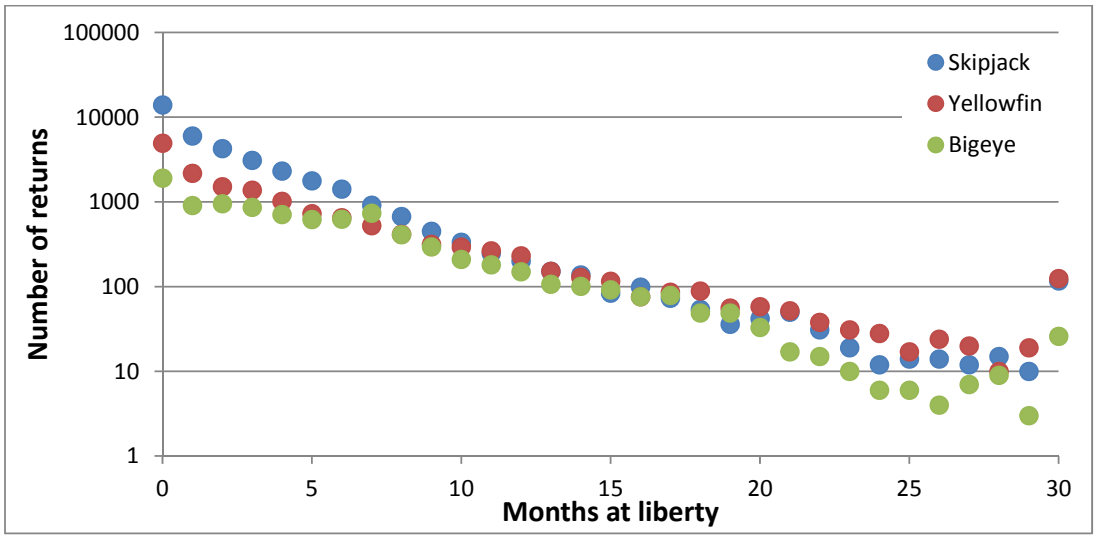


Figure 3. Tag recoveries by time at liberty for skipjack, yellowfin and bigeye tuna.

Table 5. Comparison of archival and conventional tag recoveries by species and cruise.

Cruises	ARCHIVAL Recoveries % (number tagged)				CONVENTIONAL Recoveries % (number tagged)			
	SKJ	YFT	BET	Total	SKJ	YFT	BET	Total
PNG 1 Aug-Nov 2006	100% (1)	37% (46)	44% (25)	40.3% (72)	18.9% (13,948)	23.1% (7,806)	40.7% (562)	20.9% (22,316)
PNG 2 Feb-May 2007	0% (1)	8.6% (187)	0% (23)	7.6% (211)	9.4% (26,493)	13.3% (12,845)	6.2% (129)	10.7% (39,467)
SOL 1 Oct-Nov 2007		0% (5)	0% (7)	0% (12)	26.4% (7,479)	22% (3,565)	12.9% (139)	24.8% (11,183)
SOL 2 Feb-Apr 2008		13.6% (22)	0% (1)	13% (23)	11.5% (15,327)	16.8% (14,405)	15% (414)	14.1% (30,146)
WP1 Jun-Nov 2008		0% (13)	38.9% (36)	28.6% (49)	16.9% (37,691)	11.6% (17,647)	24.7% (1,467)	15.5% (56,805)
WP2 Mar-Jun 2009	0% (39)	1.8% (56)	3.7% (81)	2.3% (176)	13.5% (34,207)	16.8% (13,919)	15.3% (3,145)	14.5% (51,271)
WP3 Jul-Oct 2009	5.4% (56)	7.7% (13)	0% (1)	5 .7% (70)	21.7% (30,722)	19.4% (7,340)	26.5% (735)	21.4% (38,797)
CP1 May-Jun 2008		40% (5)	22% (45)	24% (50)	7% (57)	21.6% (116)	32.8% (1,736)	31.4% (1,909)
CP2 May-Jun 2009		0% (9)	12.7% (79)	11.4% (88)	3% (169)	13.2% (205)	24.6% (2,307)	22.4% (2,681)
CP3 Oct-Nov 2009		10.7% (28)	20.6% (107)	18.5% (135)	3% (66)	26.2% (237)	36.6% (4,802)	35.7% (5,105)
CP4 May-Jun 2010		10% (20)	5.1% (39)	6.8% (59)	14.3% (7)	10% (120)	21.1% (2,284)	20.6% (2,411)
CP5 Nov-Dec 2010			13.8% (58)	13.8% (58)	17.5% (40)	18.9% (228)	29.9% (6.090)	29.4% (6,358)
PNGTP1 Apr-Jul 2011		10.5% (19)	0% (3)	9.1% (22)	19% (28,729)	19.2% (11,571)	15.8% (355)	19% (40,655)
CP6 Oct 2011		0% (2)	11.8% (51)	11.3% (53)	-	19.5% (123)	21.9% (3,804)	21.8% (3,929)
CP7 Nov-Dec 2011	0% (30)	0% (85)	9.8% (92)	4.3% (207)	1.9% (1)	6.5% (245)	28.5% (4,212)	27% (4,509)
PNGTP2 Jan-Mar 2012		21.1% (19)	75% (8)	37% (27)	20.4% (28,311)	8.2% (9,607)	19% (2,008)	17.4% (39,926)
CP8 Sep-Oct 2012			38.9% (18)	38.9% (18)		16.4% (140)	19.9% (6.014)	19.8% (6,174)
PNGTP3 Apr-Jun 2013		3.3% (30)	0% (1)	3.2% (31)	(23,396)	(5,960)	(564)	(29,920)
TOTAL	**3.1%** (127)	**9.3%** (559)	**16.0%** (675)	**12.0%** (1361)	**15.3%** (246,716)	**14.9%** (106,079)	**25.1%** (40,767)	**16.2%** (393,562)

Tag recoveries have been received from all vessel nationalities involved in the purse seine fishery.

In Table 7, we present the number of tags returned and reported as recaptured by different purse seine vessel nationalities, in relation to the catch of those vessels during the period of the PTTP (August 2006 – present). To aid interpretation, we also present the distribution of catch by vessel nationality in the WCPO and the distribution of tagged tuna at release (Figure 4). The pattern of recoveries is very similar to that reported to the steering committee at SC8 in 2012:

- The numbers of tags reported by Indonesia, Philippines, PNG and Solomon Islands vessels has been very high in relation to their catches.
- In the case of Indonesia, this is thought to be a combination of a large number of tag releases in Indonesian waters, the proximity of intensive fishing effort to the tag releases and good tag recovery procedures in Bitung, Sorong, Kendari, Ambon and Ternate.
- In the case of Philippines, this has been due to the proximity of tag releases in PNG to Philippines purse seiners fishing in PNG, considerable fishing effort by Philippines vessels adjacent to the large number of tag releases in Indonesia, and good tag recovery procedures in the main Philippines tuna unloading port of General Santos City.
- For PNG, large numbers of tags were recovered by the domestic purse seine fleet fishing in the Bismarck Sea, particularly in 2006 and 2007, and also by PNG purse seiners fishing more widely in the region but unloading their catch in Wewak – see PNG panel in
- Figure 4. High returns have been facilitated by excellent cooperation of the PNG-based fishing companies – Frabelle, RD Tuna and South Seas Tuna Corporation.
- Similarly in Solomon Islands, the large number of returns from Solomon Islands vessels reflects the large number of releases in Solomon Islands archipelagic waters, highly concentrated fishing effort in that area by Solomon Islands purse seiners – see Solomon Islands panel in
- Figure 4 – and very good cooperation in tag recovery by the two locally-based companies Soltai and NFD.
- Japanese purse seiners fished relatively close to the main centers of tag release, which, in combination with good tag recovery procedures in the main unloading port of Yaizu and excellent assistance by the Japan National Research Institute of Far Seas Fisheries, resulted in a moderately high number of tags per 1,000 mt of catch.
- In the case of Vanuatu, a large number of tags have been recovered by several vessels fishing in Solomon Islands archipelagic waters.
- Chinese Taipei seiners reported a moderate level of tags per 1,000 mt from fishing in an area similar to the Japanese fleet. The lower rate of reported tags per 1,000 mt of this fleet compared to the Japanese probably reflects lower tag detection or reporting rates in transshipment operations compared to direct unloading at home port.
- United States purse seiners reported a moderate level of tags per 1,000 mt despite the fact that its main area of activity was somewhat displaced to the east of the main tag release centers in PNG and Solomon islands. Most US recoveries came from fish that had been transshipped to Thailand, probably recaptured by vessels fishing closer to the main tag release sites. Very few tags have been recovered from vessels unloading in American Samoa (see following section).
- Korean vessels had a relatively low number of tags recovered, despite their fleet recording the highest overall catch since the start of the tagging programme. While the fishing activity of this fleet is largely to the east of the main tag release areas, it is similar to the areas fished by the United States and Vanuatu fleets.
- Some of the smaller fleets, such as Marshall Islands and New Zealand, reported a very low numbers of tags per 1000 mt, possibly due to their more easterly distribution of fishing effort.

Overall, most of the variability in numbers of tags returned in relation to the catch of the various fleets are potentially explainable due to the operational characteristics of these fleets.

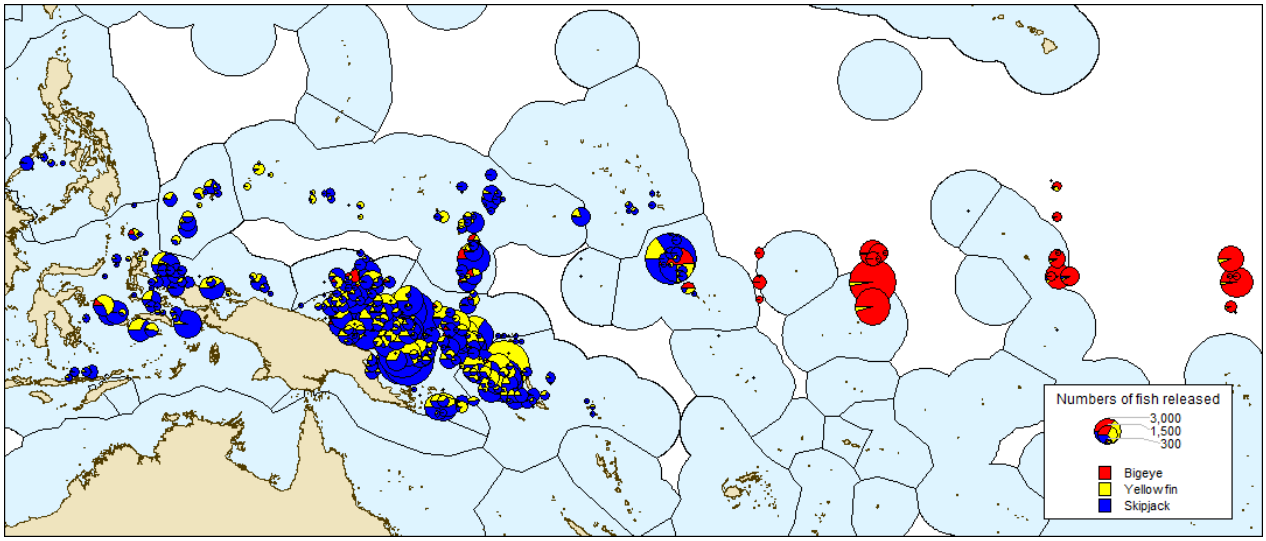
The accuracy of information returned from tags recovered on fishing vessels remains higher than that received from canneries or via transshipment (Figure 5). The information from transshipment on date and location of recovery is typically reported as unknown.

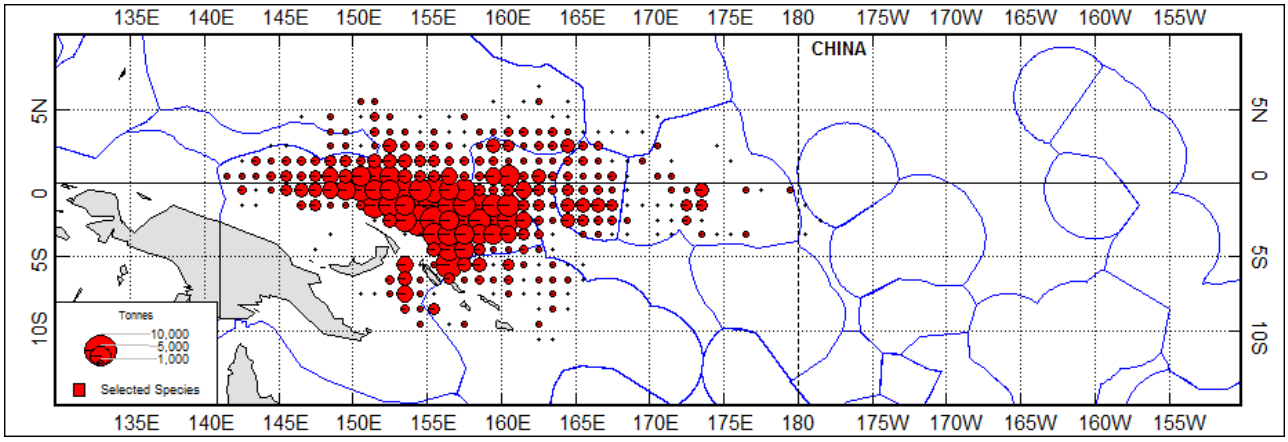
Table 6. Tag returns by gear type and by cruise for fish at liberty for at least 1 year before recovery

Cruises	Nb. Recoveries		Purse Seine		Longline		Pole & Line		Other		Unclassified	
	YFT	BET	YFT	BET	YFT	BET	YFT	BET	YFT	BET	YFT	BET
PTTP Phase 1 – Papua New Guinea	401	9	353	6	13	1	1	0	18	0	16	2
PTTP Phase 1 – Solomon Islands	271	8	260	8	2	0	0	0	1	0	8	0
PTTP Phase 2 - Central Pacific #1	0	84	0	71	0	2	0	0	0	0	0	11
PTTP Phase 2 - Central Pacific #2	4	84	3	60	0	0	0	0	0	1	1	23
PTTP Phase 2 - Central Pacific #3	1	203	0	139	0	2	0	0	0	1	1	61
PTTP Phase 2 - Central Pacific #4	1	41	1	30	0	2	0	0	0	0	0	9
PTTP Phase 2 - Central Pacific #5	6	296	5	130	0	1	0	0	0	0	1	165
PTTP Phase 2 - Central Pacific #6	1	10	1	9	0	0	0	0	0	0	0	1
PTTP Phase 2 - Central Pacific #7	0	2	0	1	0	0	0	0	0	0	0	1
PTTP Phase 2 - Western Pacific #1	147	13	127	11	1	0	2	0	13	0	4	2
PTTP Phase 2 - Western Pacific #2	245	39	223	20	8	12	0	0	2	4	12	3
PTTP Phase 2 - Western Pacific #3	151	21	141	18	1	3	0	0	6	0	3	0
PNGTP - Papua New Guinea #1	83	0	77	0	4	0	0	0	0	0	2	0
PNGTP - Papua New Guinea #2	1	0	1	0	0	0	0	0	0	0	0	0
	1312	**810**	**1192**	**503**	**29**	**23**	**3**	**0**	**40**	**6**	**48**	**278**

Table 7. Tag returns by purse-seine vessel nationality per 1,000 mt of total purse-seine catch of that nationality for the period 1 August 2006 to 31 December 2012 within the boundary of 130°E to 180°E longitude and 10°N to 15°S latitude.

Vessel Nationality	Number of tags returned	Tags returned/1,000 mt of catch
China	29	0.07
Spain	88	0.35
FSM	289	1.96
Indonesia	808	2.06
Japan	2177	1.79
Kiribati	34	0.20
Korea	382	0.23
Marshall Islands	115	0.31
New Zealand	7	0.06
Papua New Guinea	8817	6.40
Philippines	10137	11.54
Solomon Islands	5986	49.20
Chinese Taipei	1220	0.95
USA	577	0.44
Vanuatu	1572	6.38


Numbers of fish released
3,000
1,500
300
Bigeye
Yellowfin
Skipjack


CHINA
135E 140E 145E 150E 155E 160E 165E 170E 175E 180 175W 170W 165W 160W 155W
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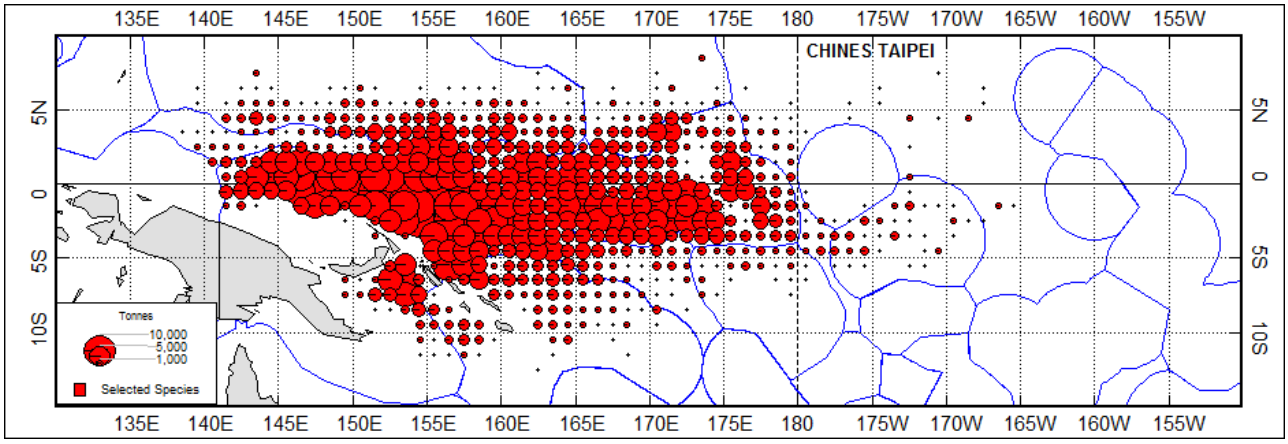
CHINES TAIPEI
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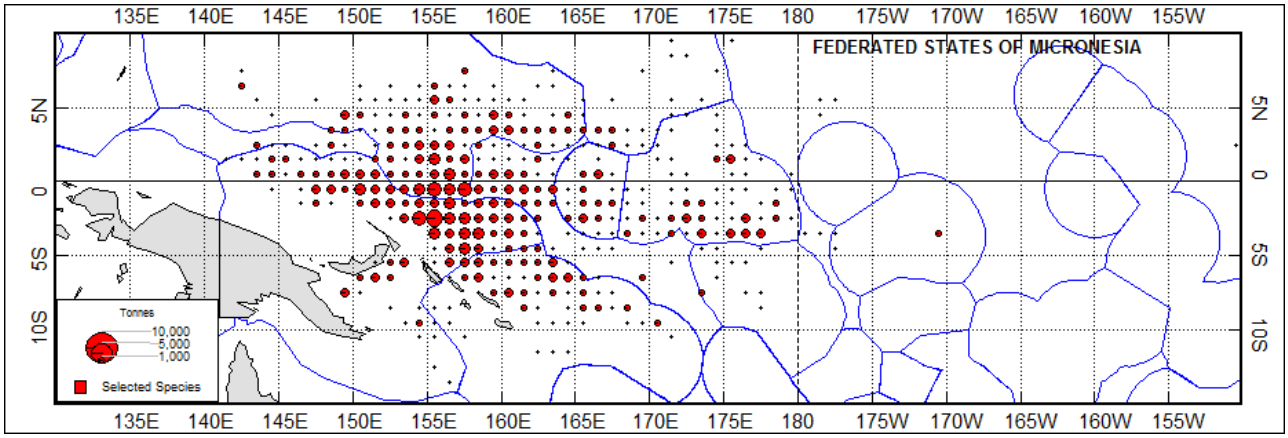
1,000
Selected Species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Tonnes
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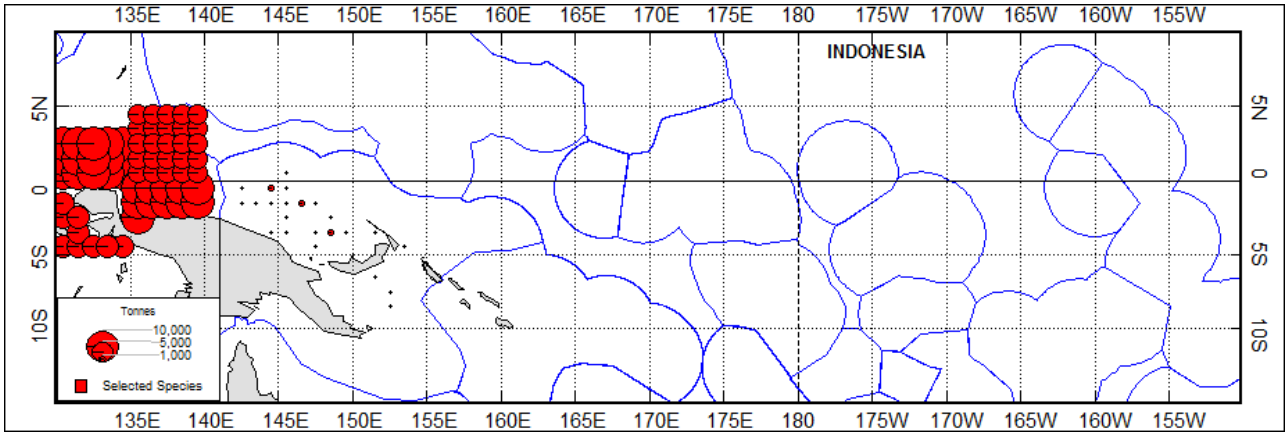
Selected Species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Tonnes
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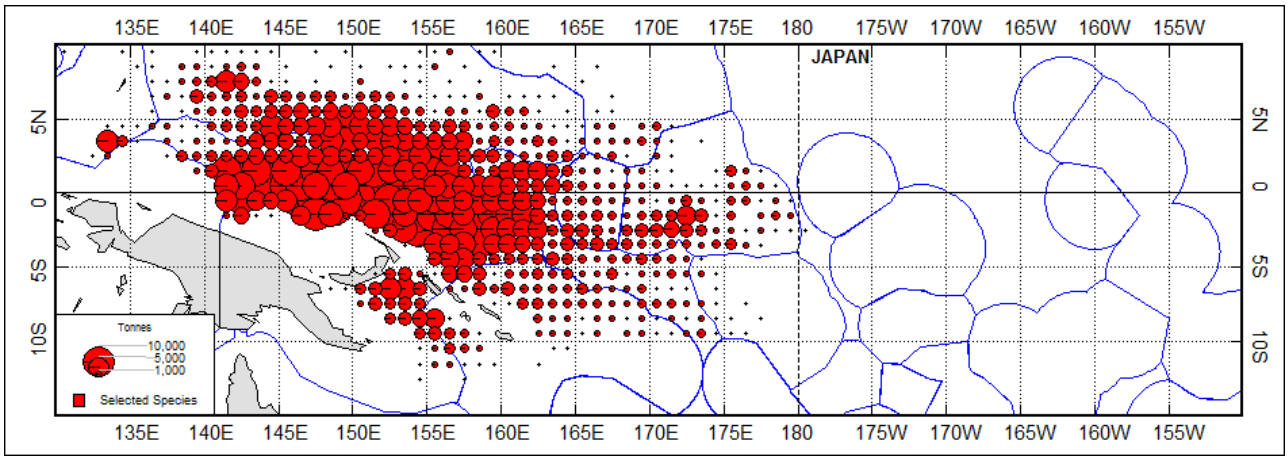
Selected Species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5N 0 5S 10S
Tonnes
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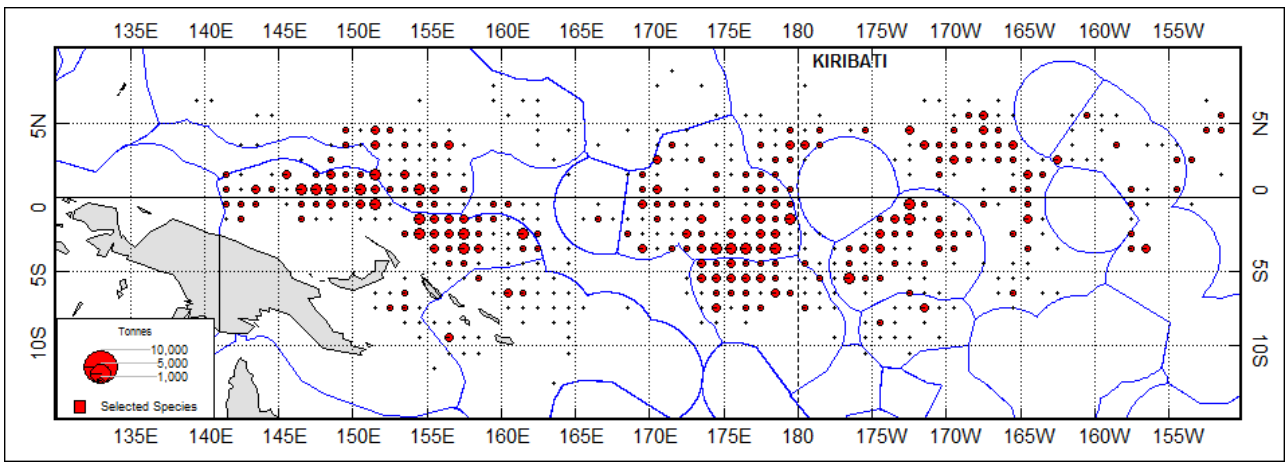
Selected Species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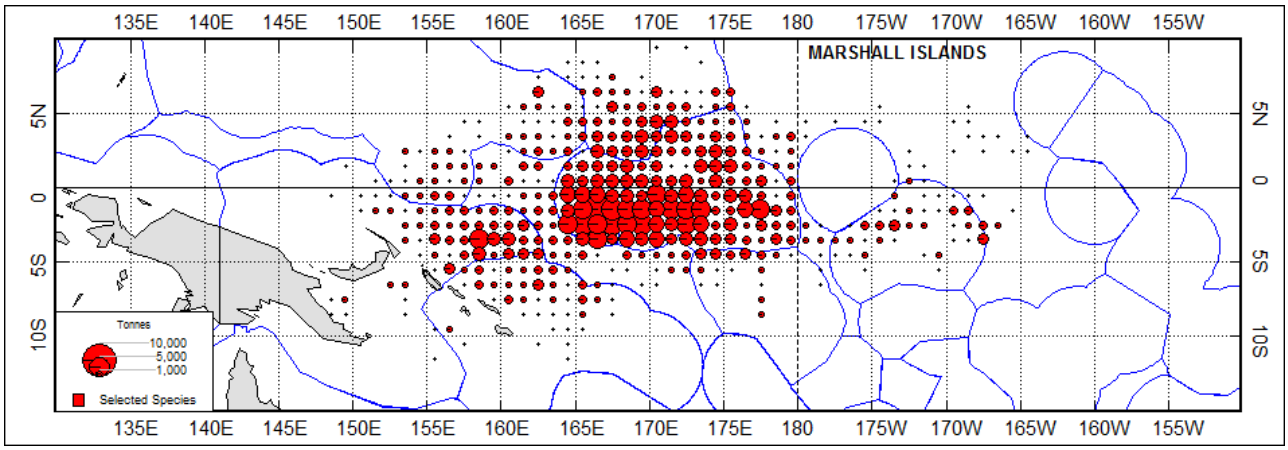
Selected Species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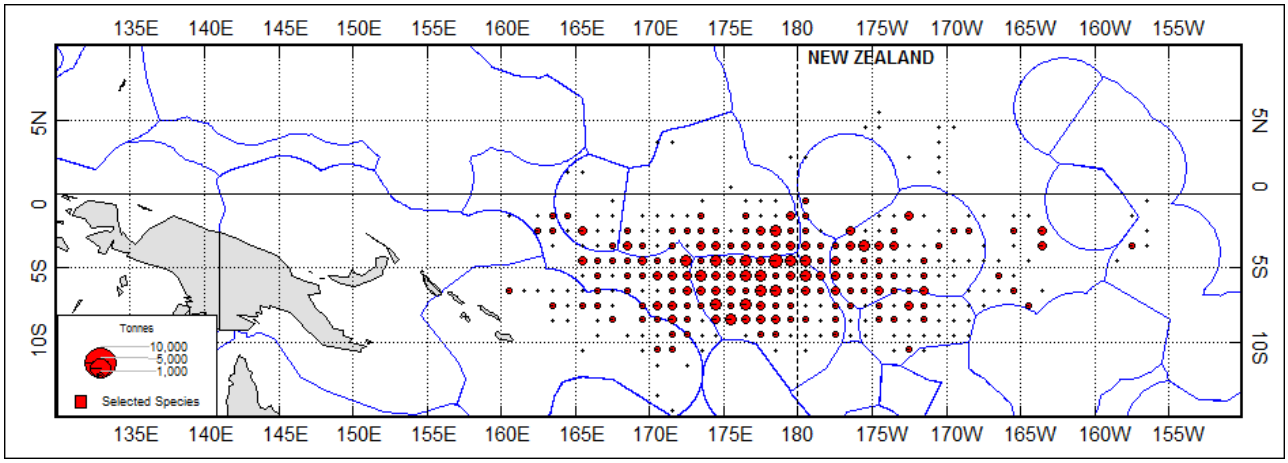
Selected Species


NEW ZEALAND
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Tonnes
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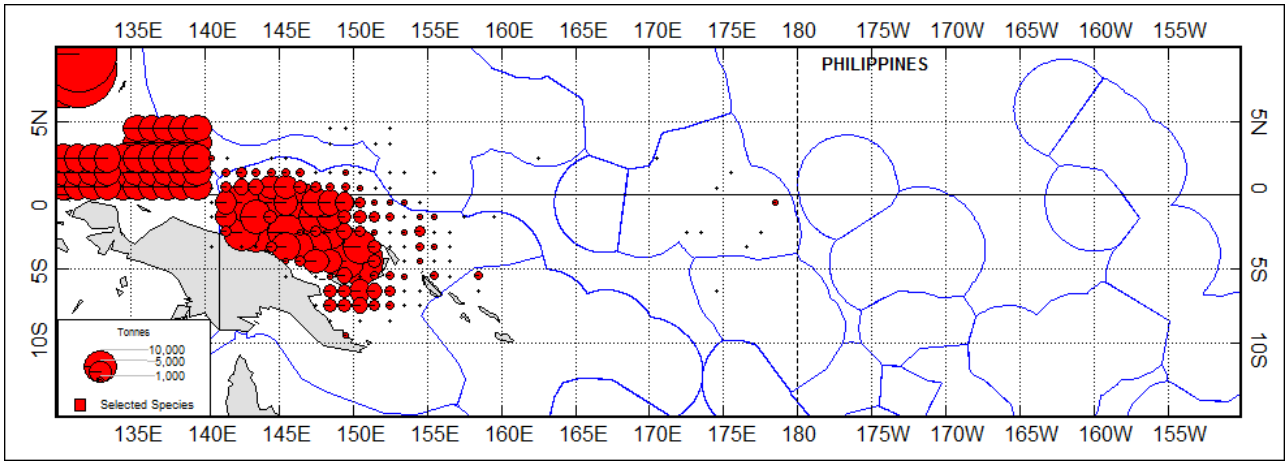
1,000
Selected Species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Tonnes
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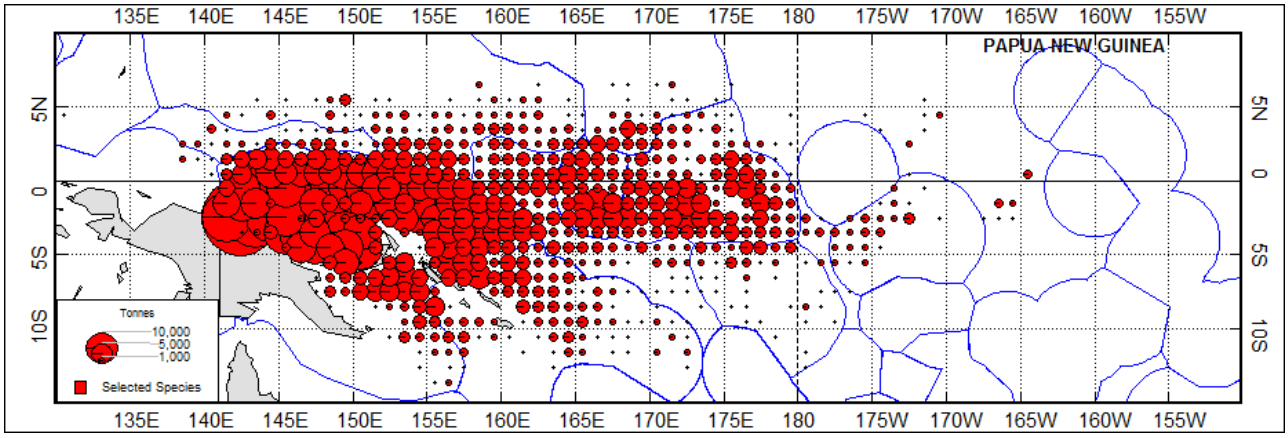
Selected Species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5N 0 5S 10S
Tonnes
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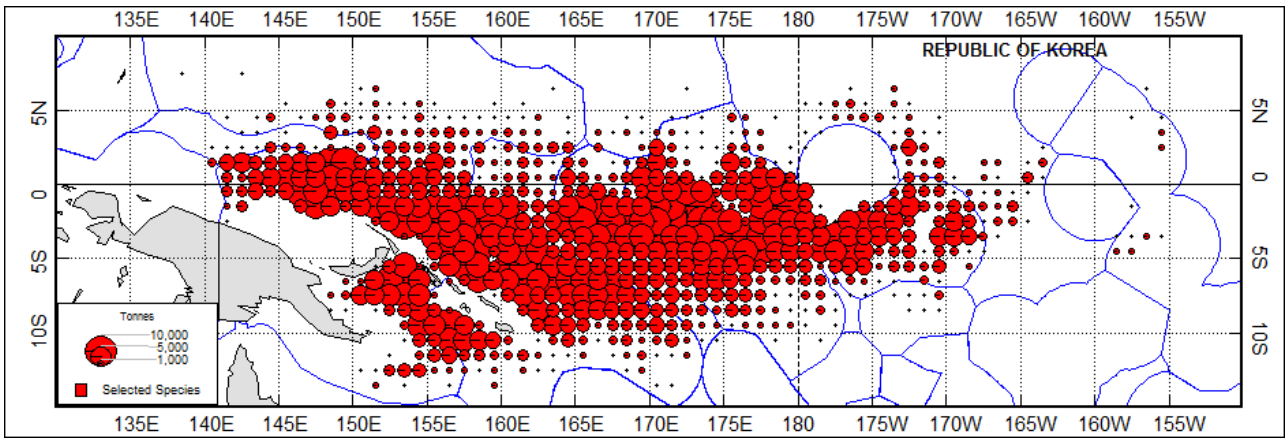
5,000
1,000
Selected Species


REPUBLIC OF KOREA
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5N 0 5S 10S
Tonnes
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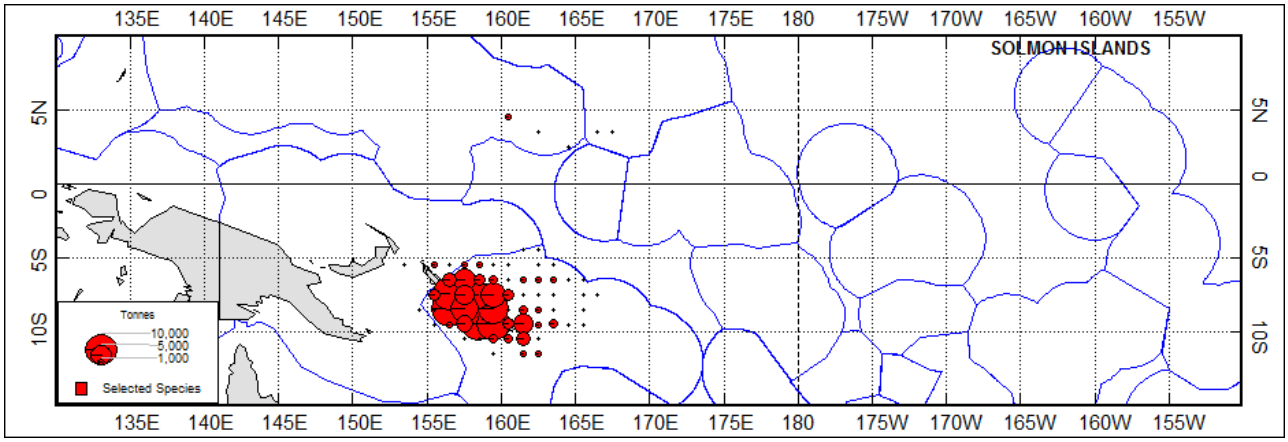
5,000
1,000
Selected Species


SOLMON ISLANDS
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Tonnes
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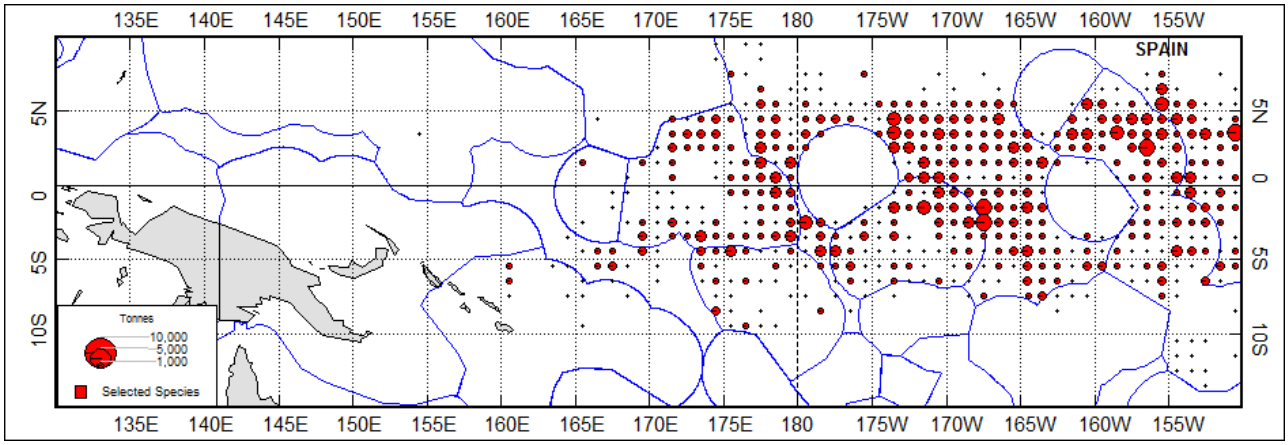
5,000
1,000
Selected Species


SPAIN
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5N 0 5S 10S
Tonnes
10,000
5,000
1,000
Selected Species

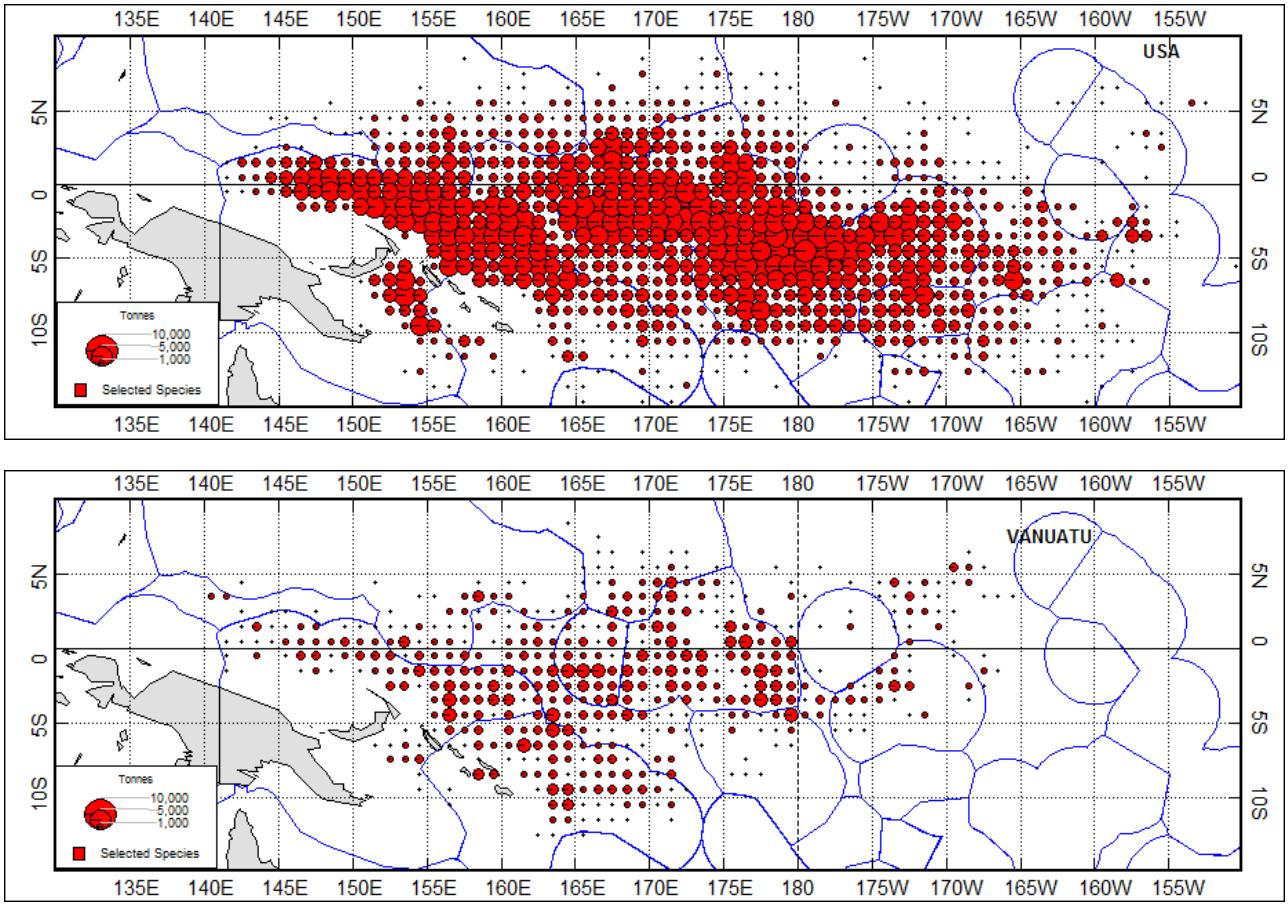
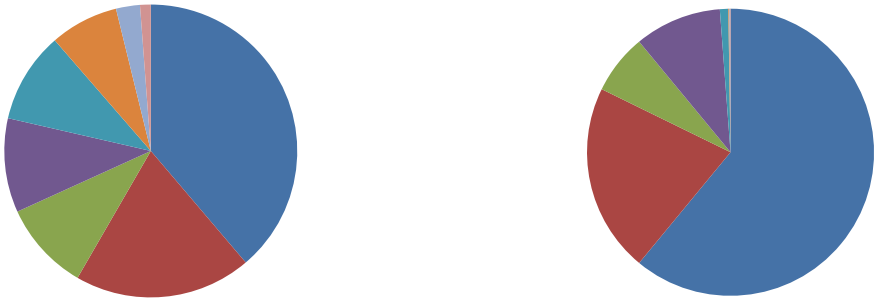


Figure 4. Top Panel. Distribution map of tag releases from 2006-2013. Lower panels. Maps showing the distribution of total catch between 1 August 2006 and 31 December 2012 for the major purse-seine fleets operating in the WCPO.

Information on Position of Capture **Information on Date of Capture**

Fishing Vessel



Transshipment

Cannery

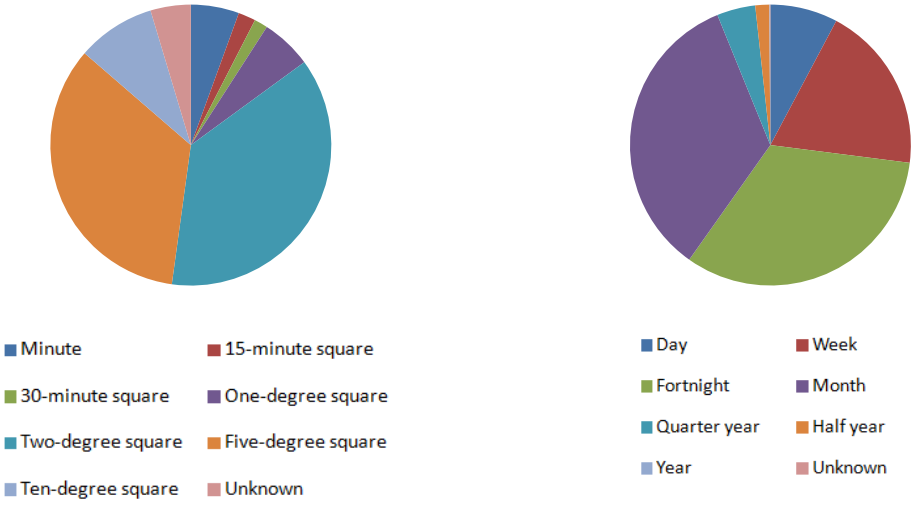


Figure 5. Location and date of tag recovery accuracy information for recoveries on fishing vessels, during transshipment and at canneries.

Tag Recovery

Full-time Tag Recovery Officers continue their duty in Wewak, Madang, Lae, Honiara, Pohnpei, Tarawa and Manta. Full-time TRO appointments have also recently been made in Philippines and Rabaul. These officers are coordinated by the central TRO at SPC. All full time TROs as well the part-time TRO in Thailand are now entering data in a specialized database that allows importation of recovery information directly into an SPC Database. This database has been improved to incorporate more data control systems and to capture information regarding transshipment if tags are reported from carriers unloading at port and Canneries. Recovery information is received at SPC on a monthly basis. The establishment of these positions has provided greater opportunity for collection of tags during unloading, transhipments

and processing in canneries with more complete and reliable capture information. Major unloading and processing facilities as well as transshipping vessels in port have been visited by TROs over the last 12 months.

Tag Seeding

From February 2007 to July 2013, 331 tag seeding kits (consisting of seeding tags, applicators, guide books and data forms) have been given to observer coordinators and TRO in PNG, Solomon Islands, Fiji, FSM, Marshall Islands, Kiribati, New Zealand and American Samoa for deployment onboard purse seine vessels by senior observers. Since 2011, kits have been modified to contain a mix of steel head and plastic barb tags to test the effect of tag type.

When a kit is not completely deployed during a trip, the kit is either kept aside or used in another kit for deployment. Table 8 details the list of kits distributed and the number of tags contained in each kit. A total of 8,484 tags have been distributed to observer coordinators.

Number of tags in a kit	Nb kits
<=10	10
12	10
13	3
15	3
17	1
18	10
20	8
23	2
24	3
25	45
30	96

Table 8: Number of kits distributed per number of tags contained

To aid in the implementation of tag seeding experiments, training is provided as part of the PIRFO Observer training courses. Tag Recovery Officers in the ports of Pohnpei, Honiara, Lae, Madang, Wewak and Tarawa continue to liaise closely with Observer coordinators, Observer debriefers and observers to implement tag seeding experiments and to recover the tag seeding logs for deployed kits. Tag seeding debriefing material are used by TROs.

Of the 331 kits distributed to observer coordinators, 200 have been given to observers for deployment, of which 178 tag seeding datasheets have been received for these observer trips. Currently, SPC is holding returned seeded tags from an additional 22 kits for which the datasheets have not yet been provided. It is worth noting that it can take 6 months or more for datasheets to be returned. Logsheets have not been returned for 2 tag seeding kits that have been deployed since January 2013.

As at 18th July 2012, there have been 4,290 reported tags that have been seeded and 1,937 of these have been returned to SPC. In addition to allowing estimation of tag reporting rates, the tag seeding data also allow the error rate in tag return information to be determined. Tables 8 and 9 detail the reporting of vessel name by location and cannery. The accurate reporting of vessel name is particularly important for validation of location and time of recapture using VMS and log book data. Vessel name was reported incorrectly for 416 tags, was absent from the recovery information for 130 tags and was correct for 1,391 tags.

Recovery location	All tag recoveries	Tag seeding recoveries (TSR)	Wrong vessel reported(TSR)	No vessel reported (TSR)	Correct vessel reported (TSR)	% correct vessel reported (TSR)
HONIARA, Solomon	568	264	20	2	242	92%
LAE,PNG	3962	96	18	3	75	78%
MADANG,PNG	1912	72	10	0	62	86%
MAJURO, Marshall	883	61	20	1	40	66%
NORO, Solomon	8116	50	20	1	29	58%
PAGO PAGO, A. Samoa	1320	399	36	20	343	86%
POHNPEI, FSM	738	26	1	0	25	96%
BANGKOK, Thailand	8971	375	140	6	229	61%
SAN DIEGO, USA	7186	95	10	71	14	15%
SHIMIZU, Japan	2769	2	1	1	0	0%
TARAWA , Kiribati	417	81	1	0	80	99%
VIDAR, PNG	6839	143	12	0	131	92%
WEWAK, PNG	5035	100	68	0	32	32%

Table 9: Vessel reported per locations of recovery

Cannery name (Thailand only)	Tag seeding recoveries	Wrong vessel reported	No vessel reported	Correct vessel reported	% correct vessel reported
Asian Alliance International	11	0	1	10	91%
CHOTIWAT	10	1	0	9	90%
EKSAKHON COLD STORAGE CO., LTD	24	4	0	20	83%
ISA VALUE	6	4	0	2	33%
PATAYA FOOD INDUSTRIES LTD.	65	48	0	17	26%
R.S. Cannery Co., Ltd.	23	6	0	17	74%
SEAPAC	8	2	0	6	75%
Songkla Canning PLC.	53	26	0	27	51%
SOUTHEAST ASIAN PACKAGING	22	3	0	19	86%
Thai Union Manufacturing Co.,	25	3	0	22	88%
TROPICAL	5	1	0	4	80%
Unicord Public Co., Ltd.	43	14	1	28	65%

Table 10: Vessel reported per cannery (Thailand)

Analyses of Movement

Movement trends observed from both conventional and archival tags are consistent with expectations for highly migratory species with larger movements positively related to time at liberty (Figure 6). Vertical movements are reported in WCPFC-SC9-2013/RP-PTTP-03.

The steering committee is directed to the following documents which detail the analyses of movement and mixing undertaken since SC8; WCPFC-SC9-2013/SA-IP-06 and WCPFC-SC9-2013/SA-IP-11.

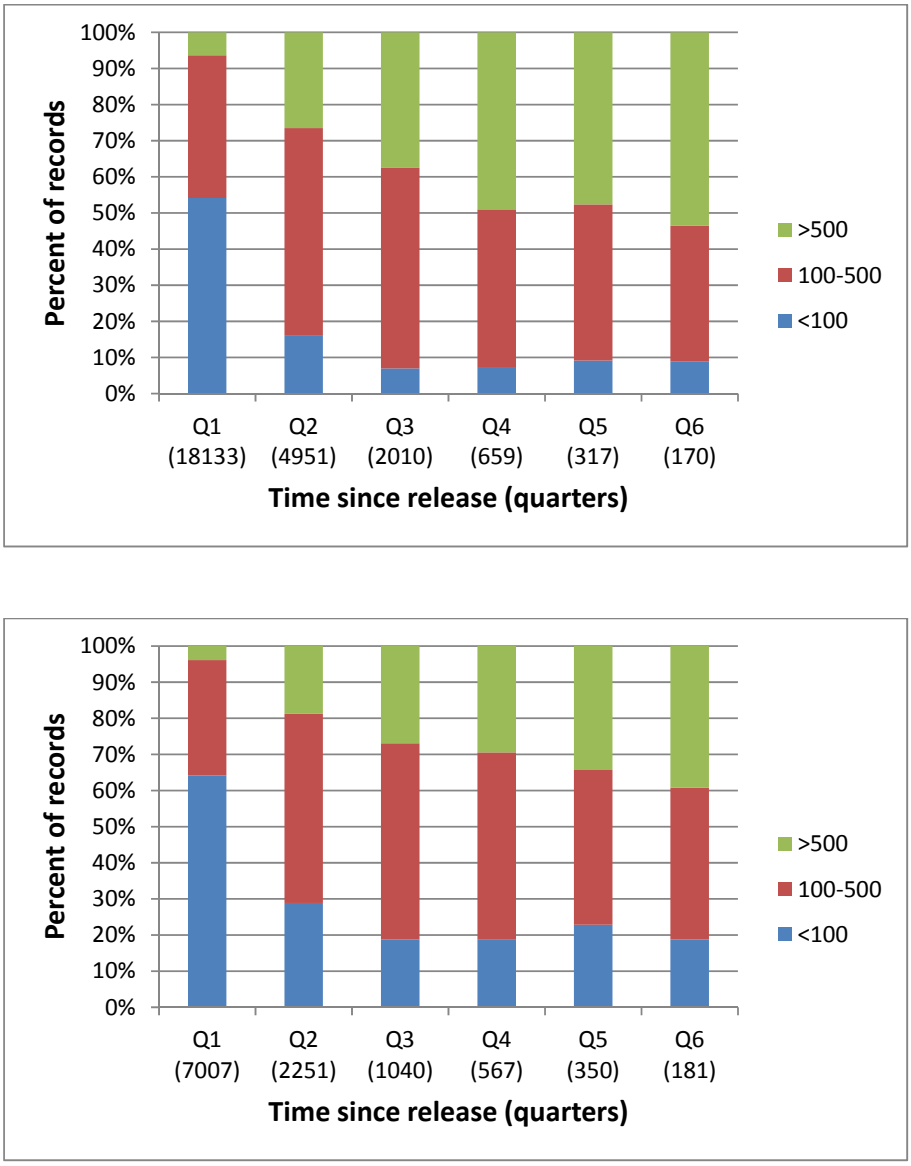


Figure 6. Reported recoveries within 100 nm, 100-500 nm and >500 nm in the first 6 quarters (18 months) since release for skipjack (upper graph) and yellowfin (lower graph). The sample size for each quarter is provided in the parentheses below the quarter label on the x-axis.

A number of analyses are being undertaken to use the PTTP tagging data to estimate movement and mortality rates. This includes the relatively coarse resolution (Multifan-CL), and relatively high resolution models (SEAPODYM, TAGEST). The steering committee is directed to WCPFC-SC9-2013/EB-WP-03.

Stock Assessment Data Preparation

Verification of the large number of recoveries received (~ 65,729), mostly with good data, but all in need of corroboration from logsheets and VMS matching is an ongoing task. Approximately 45,148 recovery records have been verified with VMS. Verification of the remaining tags is expected to be completed in 2013. Table 11 documents the number verified and data quality associated with the tags by source.

Table 11. Tag recoveries by source and validation.

Source	Recov.	% Valid	% VMS	% Logsheet	% Archival	% Buffer	% Other	% None	% No vessel name	% Vessel but no date	% Vessel but no position	% No length
American Samoa	1737	95.8	93.87	0.24	0.12	0	0.42	5.35	3.68	0.23	23.03	23.66
China	15	80	8.33	0	0	0	0	91.67	80	0	6.67	80
Fishing vessel	531	92.47	81.47	2.04	0	0	16.09	0.41	1.88	0.19	2.82	3.39
FSM	533	72.8	99.23	0.52	0	0	0.26	0	2.63	0	9.76	30.96
FSM (SPC)	90	81.11	91.78	2.74	1.37	0	1.37	2.74	1.11	0	11.11	2.22
IATTC	7615	22.38	37.03	5.87	1.53	0	10.27	45.31	24.79	7	12.04	76.32
Indonesia	5983	83.39	0.12	0	0	96.27	3.19	0.42	2.06	0	5.01	5.58
IOTC	10	30	33.33	0	0	0	0	66.67	50	0	50	20
Japan	2772	83.37	92.21	3.89	0	0	0.69	3.2	3.07	3.68	20.24	3.86
Kiribati (Kiritimati)	121	85.95	91.35	0	2.88	0	0	5.77	5.79	1.65	23.97	13.22
Kiribati (Tarawa)	578	25.78	45.64	0.67	1.34	0	3.36	48.99	35.12	6.57	11.25	8.48
Korea	610	68.69	16.47	1.43	0.24	0	0.48	81.38	82.3	0	4.1	9.84
Marshall Islands	780	93.33	85.99	11.68	0.27	0	0.55	1.51	1.67	0.51	10.51	26.79
Nauru	2	100	0	0	0	0	0	100	50	0	50	50
Other	163	65.03	67.92	2.83	1.89	0	6.6	20.75	19.02	3.07	17.18	25.77
Philippines (direct)	6958	50.83	63.61	7.46	0.06	0	7.1	21.77	12.65	2.63	31.62	71.56
Philippines (Frabelle)	182	78.02	97.18	0.7	2.11	0	0	0	7.14	0	0	5.49
Philippines (NFRDI)	175	45.14	65.82	5.06	0	0	17.72	11.39	10.29	0	10.29	13.71
PNG (Dologen ltd)	1	0	0	0	0	0	0	0	0	0	0	0
PNG (Fairwell Fishery)	18	44.44	87.5	0	0	0	0	12.5	5.56	5.56	44.44	38.89
PNG (Frabelle)	4882	55.69	76.76	21.22	0.11	0	0.15	1.77	1.13	1.74	2.68	8.11
PNG (Korean Overseas Association)	1	0	0	0	0	0	0	0	0	0	0	0
PNG (Luminar Fishing)	10	20	100	0	0	0	0	0	0	0	0	0
PNG (NFA)	450	76.22	79.3	8.45	0.58	0	1.46	10.2	19.33	0.44	13.33	25.11
PNG (other)	920	56.63	58.35	1.15	0	0	0.58	39.92	6.52	0.98	12.28	10.87
PNG (Pacific Blue Sea Fishing)	175	41.71	69.86	30.14	0	0	0	0	0	0	1.14	0

PNG (RBL Fishing)	456	78.51	91.34	7.26	0	0	0	1.4	0	3.29	3.95	4.61
PNG (RD)	8402	94.79	77.2	20.42	0.04	0	0.08	2.27	0.49	0	1.74	3.27
PNG (RR Fishing)	25	32	100	0	0	0	0	0	0	4	4	0
PNG (Sepik Coastal Agencie)	10	20	50	0	0	0	0	50	10	0	0	10
PNG (SST)	1367	54.21	76.11	15.65	0	0	2.56	5.67	4.39	0.22	59.4	35.04
PNG (TPJ Fishing)	1185	44.56	98.48	0.38	0	0	1.14	0	0	0	2.87	1.1
PNG (TSP Marine)	257	76.65	98.98	0.51	0	0	0	0.51	0	0	10.51	0.39
SB (Global Investment)	1049	91.9	83.61	13.9	0	0	0	2.49	8.67	0	0.95	56.05
SB (Korean Deep Sea Association)	129	85.27	77.27	22.73	0	0	0	0	0.78	9.3	9.3	3.1
SB (MFMR)	273	71.79	90.82	5.1	3.06	0	0	1.02	15.75	0	14.65	10.26
SB (NFD)	3848	90.64	61.47	38.45	0.03	0	0	0.06	0.21	0.08	3.77	2.21
SB (other)	156	30.13	80.85	4.26	0	0	2.13	12.77	12.18	1.92	10.26	24.36
SB (Soltai)	3070	86.19	86.32	11.87	0	0	0.42	1.4	7.13	0.16	1.53	2.7
SB (Taiwan Deep Sea Association)	549	98.54	98.89	1.11	0	0	0	0	0	0	0.18	0.18
SB (Western Solomon ventures limited)	7	100	100	0	0	0	0	0	0	0	0	0
Tagging vessel	217	18.89	7.32	0	0	0	90.24	2.44	0.46	0	10.14	1.38
Taiwan	65	95.38	95.16	0	0	0	0	4.84	0	0	24.62	0
Thailand	9345	71.42	93.77	3.61	0.06	0	0.06	2.5	1.07	0	95.27	1.23
Vanuatu	7	100	100	0	0	0	0	0	0	0	0	0

ALBACORE TAGGING

A description of albacore tagging activities was outlined previously in SC6 GN IP-06 and SC5 GN IP-16. As of the 18th July 2013, there have been 10 conventional tag returns since the beginning of 2012. Tag recovery details are specified in Table 12. Two of the recoveries were recaptured in New Zealand waters, close to where they were tagged and released. Other tags have been recovered all over the Western Pacific Ocean with one tag in Solomon Islands waters, 1 in Vanuatu, 2 in Fiji, 1 in international waters South of Tonga and 1 in Australian waters.

Table 12. Recovery information for the 10 albacore tags reported to SPC

Release date	Lat	Lon	FL (cm)	OTC	Catch date	Found date	Lat	Lon	FL (cm)	Growth	Days at liberty
17-Feb-09	4207.850S	17047.150E	59	N	06-Feb-13	06-Feb-13					1450
03-Mar-09	4129.030S	17053.600E	59	N	19-May-12	19-May-12	1317.292S	17654.170E	66	7	1173
04-Mar-09	4131.640S	17059.560E	61	N		01-Nov-12					
06-Mar-09	4220.360S	17103.440E	60	Y	15-Jan-12	22-May-12			89	29	1045
15-Mar-09	4204.960S	17048.460E	51	Y	23-Mar-12	23-Mar-12	4356.338S	16837.108E	82	31	1104
16-Mar-09	4206.060S	17048.940E	60	Y		18-Oct-12					
16-Mar-09	4210.460S	17048.330E	55	Y	15-Jul-12	08-Oct-12	2700.000S	17200.000W	53		1217
16-Mar-09	4222.030S	17042.790E	60	N	29-Mar-12	29-Mar-12	4217.000S	17000.000E			1109
17-Mar-09	4237.750S	17022.860E	60	Y	26-Aug-12	26-Aug-12	1736.944S	17626.470E	88	28	1258
18-Mar-09	4232.570S	17043.710E	63	Y	15-Mar-13	15-Mar-13	1553.000S	15747.000E	90	27	1458
18-Mar-09	4232.570S	17043.710E	62	N	16-Dec-12	16-Dec-12			100	38	1369

PTTP 2012-2013 work plan

The 2012-2013 work plan of the PTTP is characterised by a change in emphasis from tag deployment to data analyses and continued tag recovery. Tag deployment will continue in the central Pacific region to continue to bolster the number of bigeye tagged in the core area of this species. The implementation of the work plan is feasible due to the financial and operational support provided by the PNG National Fisheries Authority, New Zealand Aid Agency, and the Government of the Republic of Korea. A proposal for more extensive tagging of bigeye in its core areas is attached as Appendix 1.

	Task	2013	2014
TAGGING			
1.	**CP9** *Background*: 4 week cruise focusing upon the NOAA TAO Oceanographic Buoys along the 170°W meridian (waters of Kiribati, Phoenix Islands and High Seas) and along the 180°W meridian (High Seas, waters of Kiribati, Gilbert Islands and Tuvalu). This is the ninth Central Pacific cruise designed to improve overall spatial coverage of PTTP tag releases in areas difficult to access between the Date line and French Polynesia. The cruise will charter the *FV Pacific Sunrise*, a multi-purpose pelagic handline/longline vessel which is based in Nuku'alofa, Kingdom of Tonga. *Target*: BET 1,000 conventional tags; BET & YFT 20 Archival Tags		
TAG RECOVERY			
1.	Continue tag recovery in PNG, Philippines, Thailand, Indonesia, key Pacific Island locations and in Ecuador		
TAG SEEDING			
1.	Prioritize continued tag seeding in order to improve understanding of the processes involved in tag reporting		
2.	Support locally based tag seeding co-ordinators		
3.	Undertake Observer training in tag seeding		
DATA MANAGEMENT			
1.	PTTP data verification with VMS and Logbook		
2.	Revision of PTTP web access		
3.	Updating of country specific PTTP web pages		
DATA ANALYSES			
1.	**Tag reporting and seeding** *Purpose*: Critical for any estimation of fishing mortality as it is a direct scalar for fishing mortality. *Tasks:* (1) Determine detection rate of double tags (test for impact on tag seeding returns); (2) Undertake an external analysis of seeding data to identify what influences recovery rate (vessel, flag/fleet, unloading locations).		
2.	**Incorporate tagging data into SEAPODYM** *Purpose*: To integrate tagging data into the likelihood of SEAPODYM which will provide direct information on diffusion allowing improved estimation of movement in this model. *Tasks:* (1) Incorporate as many years of tagging data as the available physical forcing allows and generate optimisations for skipjack, bigeye and yellowfin.		
3.	**Movement (horizontal)** *Purpose*: Define regional structure of stock assessment models and provide estimation of mixing rates. *Tasks*: (1) Estimate movement from conventional tags and test for spatial variability in movement (use multiple models & compare ADR estimates); (2.) Estimate horizontal movement from archival tags; (3) Compare movement rate estimates among species & fish size from both archival and conventional tags, using AD models and simple approaches such as maximum displacement; (4) Use SEAPODYM to identify sub-regional differences in diffusion rates and the influence of environmental correlates on oceanographic cycles of advection and diffusion. (5) Determine the most suitable spatial structures for MFCL that maximize the information derived from the tagging data.		

4.	**Fishing and natural mortality** *Purpose*: Provide external validation to estimates from within MFCL and identify fishing mortality changes in response to expansion of the WCPO fisheries. *Tasks*: (1) Use SEAPODYM to identify sub-regional differences in fishing mortalities and depletion.	[redacted]
5.	**Country Specific Analyses** *Purpose*: Provide analyses to assist WCPFC members with development of national tuna management policies. *Tasks*: (1) Use SEAPODYM to provide relevant national/sub regional level information with priority to requests from PTTP participating countries.	[redacted]

Appendix 1. Pacific Wide bigeye tagging brief

LONG-TERM TAGGING OF BIGEYE TUNA IN THE EQUATORIAL PACIFIC OCEAN IN SUPPORT OF STOCK ASSESSMENT AND MANAGEMENT

A Proposal by the Secretariat of the Pacific Community and the Inter-American Tropical Tuna Commission

Bigeye tuna are captured throughout the equatorial Pacific by purse seine and longline. They are targeted by longliners in this region, but are of lesser importance to the purse seine fishery, which generally targets skipjack and yellowfin tuna. However, purse seine catches throughout the equatorial Pacific have increased greatly since the early 1990s, when the use of drifting fish aggregation devices became widespread. Stock assessments for both the western and central Pacific (WCPO, west of 150°W) and eastern Pacific (EPO, east of 150°W) indicate that bigeye tuna spawning biomass has been reduced to around 20% of unfished levels, and that management actions are required to avoid further depletion. Currently, fisheries in the WCPO are managed by the Western and Central Pacific Fisheries Commission (WCPFC), while those in the EPO are managed by the Inter-American Tropical Tuna Commission (IATTC). Stock assessments are routinely conducted by the Secretariat of the Pacific Community (SPC) (the WCPFC's scientific services provider) and the IATTC for these regions separately. However, recent bigeye tuna tagging in the central Pacific indicates that substantial mixing of bigeye between the two regions occurs, and it is widely agreed that the regional assessments should be complemented by a Pacific-wide approach.
The current assessments of bigeye tuna in the Pacific are subject to considerable uncertainty. The causes of this uncertainty include:

- The data typically available for stock assessment – catch, effort, catch-per-unit-effort and size data – are generally uninformative regarding absolute levels of stock biomass, and consequently fishing mortality.
- To date, simplistic assumptions regarding stock structure (essentially, separate populations in the WCPO and EPO) have been required in stock assessments. It is well known that this assumption is false and that some level of mixing occurs. It is not clear to what extent the levels of mixing observed from recent bigeye tuna tagging might bias stock assessment results.
- The rate of natural mortality, a key parameter in stock assessments, is difficult to estimate and is assumed in WCPO and EPO bigeye assessments. Furthermore, there is a lack of solid information on how natural mortality might vary with fish size or age.
- Bigeye tuna growth rates, which are influential parameters in the stock assessments, are not well known. In particular, the sizes of the oldest age classes of fish in the population are difficult to estimate and are often assumed in assessments.

To address these sources of uncertainty, it is proposed to undertake systematic annual bigeye tuna tagging surveys across the equatorial Pacific, utilizing the now-proven technique of capturing and tagging bigeye tuna (and to a lesser extent yellowfin and skipjack tuna) from aggregations associated with the equatorial Tropical Atmosphere Ocean (TAO) array of oceanographic moorings (Figure 1).

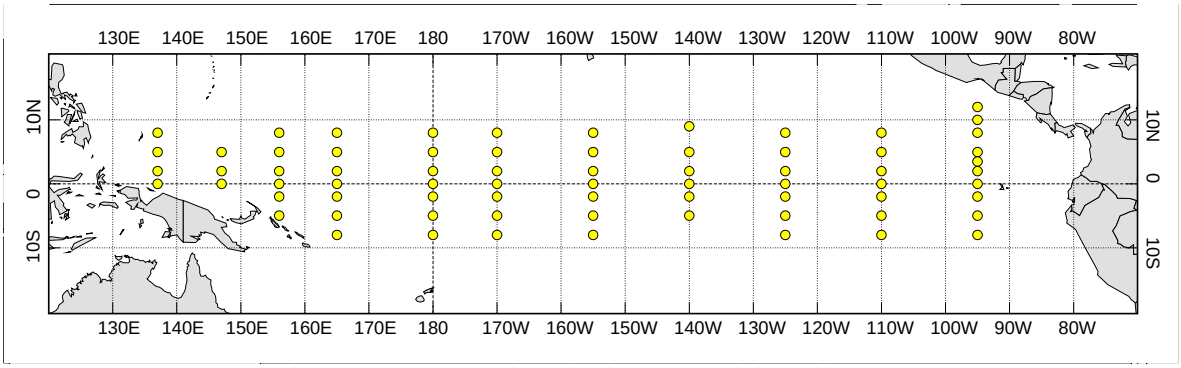


Figure 6. TAO moorings in the equatorial Pacific.

It is proposed that 4-5 tagging cruises per year be undertaken using fishing vessels equipped for bigeye tuna dangler/short troll-line fishing. Each cruise would conduct tagging operations on 2-3 lines of TAO moorings. The operational objective would be to tag and release approximately 20,000 bigeye tuna per year with plastic dart tags (PDTs) and 400 bigeye tuna per year with electronic archival tags (ATs). Tag releases would be distributed as evenly as possible over most if not all of the lines of TAO moorings shown in Figure 1.
If sustained over a number of years, the tagging operation would generate a wealth of new data that would specifically address the uncertainties noted above:

- Tag recapture data, with appropriate measures taken to ensure and confirm a high reporting rate of recaptured tags, provides direct, time-series information for stock assessments on the rates of exploitation and by inference, absolute stock size. Used in this way, the tagging data would be similar to fishery-independent survey data that are frequently used to enhance assessments for groundfish and small pelagics.
- Data on bigeye tuna movement collected during the recent central Pacific tagging work conducted collaboratively by SPC and IATTC would be significantly enhanced by the recaptures of PDTs and ATs. These data would allow more realistic assumptions regarding Pacific-wide stock structure of bigeye to be employed in assessments. Data on movement, particularly the detailed tracks of individuals tagged with ATs, would also allow more detailed assessments of the efficacy of existing and proposed spatial management measures.
- Tagging data are acknowledged as probably the only means of estimating the natural mortality rates of tunas. A time series of tagging data would allow estimation of age-specific natural mortality to be integrated into the assessment models.
- Tagging data also provide information on the growth of tunas through observations on the lengths at release and recapture of the tagged fish. As longer-term recaptures occur, critical observations of the size of older bigeye tuna will occur and allow this source of uncertainty to be reduced.

Proposed Budget

The annual budget proposed to undertake this work is summarized below.

Table 7. Proposed annual budget by major cost items.

Budget Category	USD
Vessel charter	610,000
Tags and related equipment	340,000
Tag recovery	390,000
Travel	50,000
Administrative costs	100,000
TOTAL	**1,490,000**