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Trends in the south Pacific albacore longline and troll fisheries

WCPFC-SC10-2014/SA-WP-07 Rev 1*

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*Rev 1: Updated transhipment tables for 2013/2014, including the addition of Solomon Islands data for April 2012.

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Abstract

The paper presents a compendium of fishery indicators for south Pacific albacore tuna, the only principal target tuna species not subject to a full stock assessment in 2014. Documented indicators include: total catch; catch by gear, longline effort and nominal longline CPUE trends, along with their spatial patterns; catch size composition; and trends in average fish weight. Commentary provided includes comparisons of 2013 values to 2012 and to the average over 2008-12. The information requested for south Pacific albacore as provided within previous papers to meetings of the Commission (e.g. WCPFC-SC9-2013/GN-IP-04) is also presented. Time series are extended using available longline and troll catch estimate data. Information provided includes data loaded into databases as of 10th July 2014. Note that catch levels and their distribution amongst areas may change as more data become available.

Transshipment data are available over the period from the inception of transshipment reporting (July 2010) to date. Data presented represent high seas transshipments only; they do not include in port or in zone transshipments. Monthly reported transshipment levels fluctuate notably, and may reflect logistical/operational factors rather than fishing activity. There is a notable peak in transshipment activity in November 2013 (2,047 mt) of which just over 50% was ascribed to Chinese activity (1,049 mt). Three of the four highest monthly transshipment totals are found between September 2013 and January 2014, each over 1,900 mt. It should be noted that transshipment levels are unlikely to be fully reported for the most recent months.

Due to the complex interactions between the major species-specific fisheries, it is difficult to correctly interpret the stock status-related implications from the trends in any indicators in isolation of other data sets and a population dynamics model. Therefore we also summarise the stock status from the most recent assessment (2012) and include an analysis of the potential stock consequences of recent fishing patterns on the south Pacific albacore stock relative to the agreed biomass limit reference point, using stochastic stock projections and incorporating the recommendations on inclusion of uncertainty from WCPFC-SC9. Based upon the 2012 stock assessment, and the level of uncertainty included within the projection analysis, there is more than a 30% chance that the south Pacific albacore stock will fall below the Limit Reference Point by 2030 under recent fishing effort levels. Decreases in vulnerable biomass (a CPUE proxy) of up to 19% in longline fisheries are estimated.

Introduction

The Scientific Committee's Work Programme for 2008-2010, developed at its 3rd session, includes Project 24: *development and reporting of stock indicators for those key species not formally assessed*. Reporting of stock indicators was first undertaken at SC4 in 2008 with the paper of Hampton and Williams (2008), and a compendium of fishery indicators was reported in Harley et al. (2012) and Harley and Williams (2013) for the principal target tuna species - skipjack, yellowfin, bigeye and south Pacific albacore tuna – and south Pacific swordfish. This paper represents the fourth compendium of fishery indicators. It concentrates on the south Pacific albacore stock as the only principal target tuna species not assessed this year.

At TCC7, some members requested a paper on south Pacific albacore be prepared by the Western and Central Pacific Fisheries Commission (WCPFC) Secretariat. That request indicated the paper should contain all available catch and transshipment data available, and should highlight trends. The paper was first prepared by the Secretariat for WCPFC8 in March 2012. It has since been updated frequently (e.g. WCPFC10-2013-IP02), taking into consideration further requests from members.

The current paper combines both sets of information for south Pacific albacore. It presents trends within the fishery in terms of catch, effort and Catch per Unit Effort (CPUE) both spatially and temporally. Available information on transshipment patterns are presented, consistent with WCPFC10-2013-IP02. Following the request for further information to assist in the interpretation of the key observations, and noting that it is difficult to correctly interpret the stock status-related implications of trends in any indicators in isolation of other data sets and a population dynamics model, the potential consequences of recent fishing levels for future south Pacific albacore stock status are evaluated using stochastic projections.

The analyses presented are based on data available to SPC as of 10th July 2014. The overall catch and its distribution amongst spatial areas may change as more data become available. Catches and Vessel Monitoring System (VMS) effort in archipelagic waters have been excluded from analyses for the southern WCPFC Convention Area (WCP-CA) specifically. Please note that the figures may include or exclude specific fleets that are included in summaries made for other purposes (e.g. CMM tables) and therefore the reported values (catch, effort, CPUE, etc) may not be identical to those presented in other documents. Additional information by latitudinal zone, requested at WCPFC9, are posted as excel files annexed to this paper (SA-WP-08a and SA-WP-08b). These data are for south of the equator. The information on vessel numbers excludes archipelagic waters (SA-WP-08a).

Patterns of longline and troll fishing

Two groups of fleets exploit south Pacific albacore, i.e. longliners and troll fisheries. In this section we examine trends in their catch, effort and catch rate (CPUE). Catch and effort information come primarily from logsheet returns, or for the high seas from the provision of aggregate catch from distant water fishing nations.

Catch

Annual catch estimates for albacore in the south Pacific (south of the equator) as a whole peaked in 2010 at just under 89,000 mt. 2013 was the fourth highest catch on record, 3% lower than the catch in 2012, but 9% higher than the average over 2008-2012 (Figure 1). Catch by longliners represented 96% of the catch weight in 2013 at 81,198 mt. The 2013 longline catch was 4% lower than in 2012, and 9% higher than the 2008-12 average. Other catch (3,500 mt; the majority (3,226 mt) being by troll vessels) increased 8% on 2012, and were up 17% on 2008-12.

A similar pattern is seen for annual catch estimates within the southern part of the WCP-CA[1] specifically (excluding archipelagic waters; Tables 1 and 2). Other tables presenting annual longline catch estimates by vessel flag and EEZ/flag in the southern WCP-CA are presented in Appendix 1. The 2013 longline catch of south Pacific albacore within the Convention Area is currently estimated to be 68,415 mt, 4% down on the catch in 2012, but up 4% from the average over 2008-2012. High seas longline catch estimates represent 43% of the total catch, and has ranged from 29-48% of the total over the last 10 years. By flag, China and Chinese Taipei have the highest catch estimates of south Pacific albacore in 2013 (23,842 mt and 13,248 mt respectively, the combined total representing 54% of the total catch; Table A1.1). The majority of the catch by those flags (57% of their combined total) was taken on the high seas (Table A1.2).

Three flag states have reported troll catches during the period 2000 to 2013 within the WCP-CA, namely the Cook Islands, USA and New Zealand (Table A1.3). Troll activity has been reported only in the New Zealand EEZ and on the high seas (Table 2), totalling 3,226 mt in 2013, a 10% increase over 2012 and a 16% increase over the average 2008-2012. Catch estimates for 2013 were 390 mt for the high seas and 2,836 mt for the New Zealand EEZ.

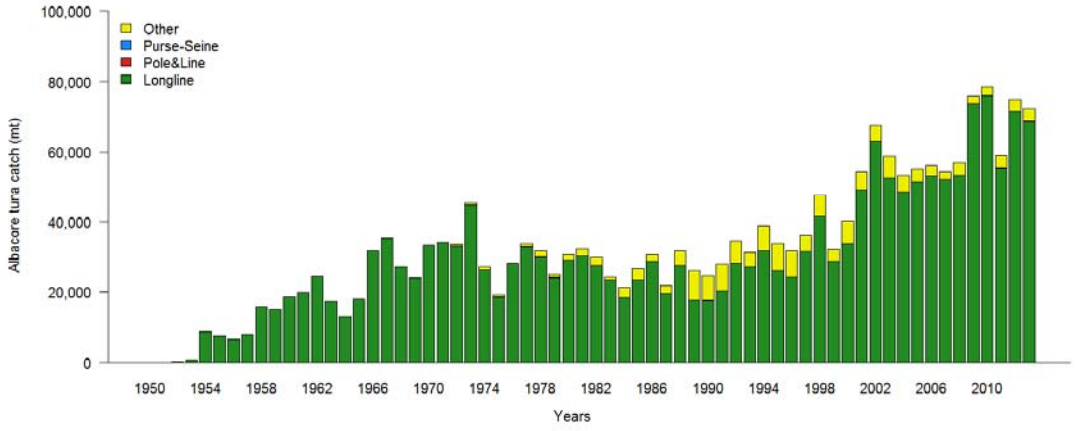

Figure 1. Catch of south Pacific albacore by gear (all the south Pacific, south of the equator, including archipelagic waters). 'Other' catches are primarily from troll gears in recent years.

[1] Note that these annual catch estimate-based tables approximate the southern area of the WCP-CA as far as possible, given that some EEZs and high seas area span the equator.

The spatial pattern of south Pacific albacore catches over the long-term (1950-2013) and the last 5 years (2009-2013) is shown in Figure 2. In recent years, catches have been concentrated in the 10-20°S latitudinal band, with catches in the high seas south of 25°S and east of the French Polynesian EEZ remaining notable.

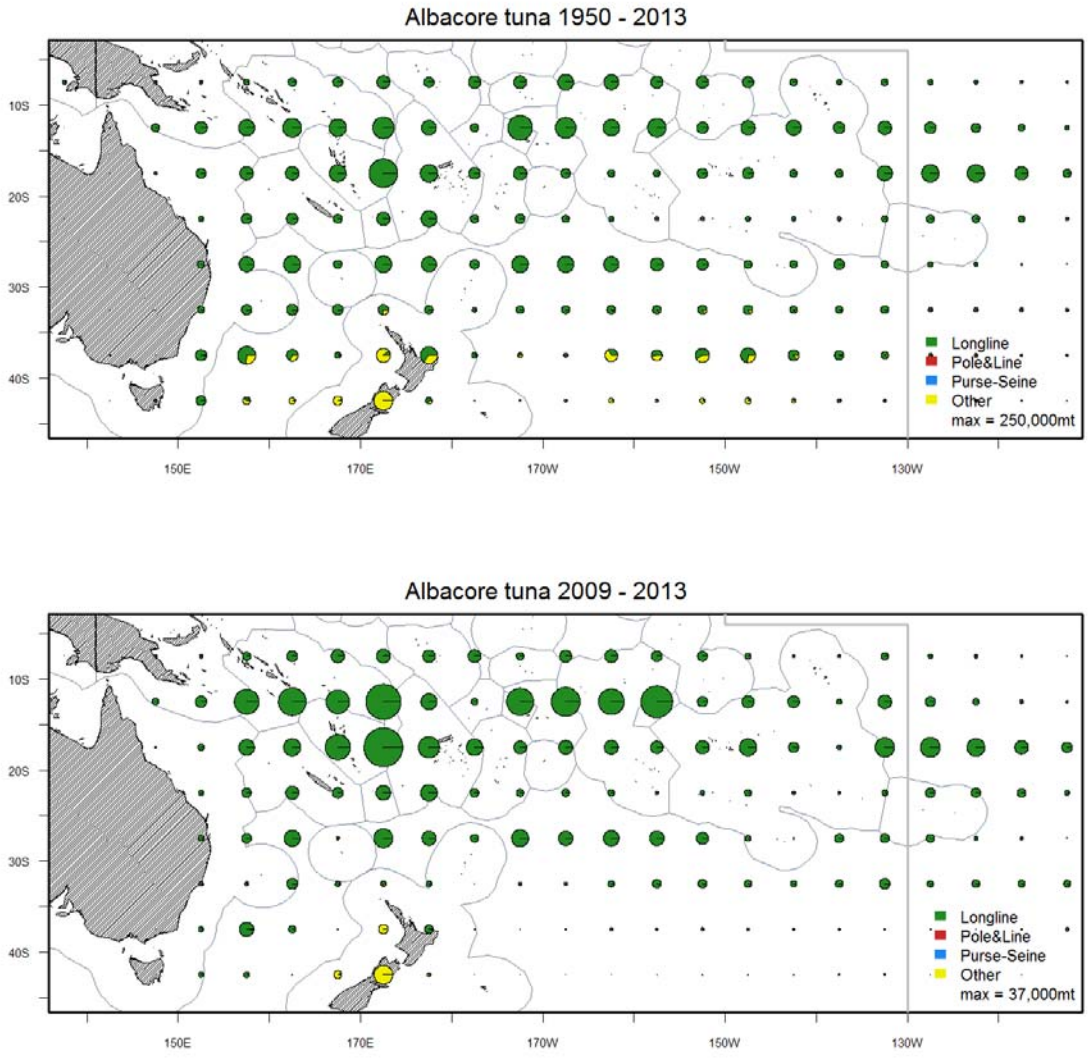

Figure 2. Albacore tuna catch distribution by gear type and 5x5 degree region in the south Pacific ocean for the period 1950-2013 (top) and 2009-2013 (bottom). Circle size represents catch volume with maximum circle size presented in the legends.

Table 1. Annual southern WCP-CA albacore longline catch estimates by EEZ and High Seas, 2000–2013.
Notes: Available operational and aggregate logsheet data raised to annual catch estimates. "EEZ" are approximate 200-mile boundaries; "High seas" is the high seas in the WCPFC Convention Area, south of the equator. Allocation of flag catch to EEZ is approximate due to the lack of operational logsheet data in some cases.

EEZ/High Seas	ANNUAL SOUTH PACIFIC ALBACORE LONGLINE CATCH ESTIMATES BY EEZ AND HIGH SEAS													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
American Samoa	626	3217	5353	3212	2019	2880	4078	4667	2963	3299	3125	2224	2606	1859
Australia	359	554	505	391	587	622	2526	1867	1256	1471	706	627	529	524
Cook Islands		9	1112	1854	2172	2282	1986	3670	2492	5413	5680	5525	10284	6077
Fiji	4524	7294	6239	4077	6161	5654	5797	3721	4552	5601	3769	5171	5053	4050
High Seas	12784	22178	28046	25646	23928	22618	18165	15189	20763	27855	23875	17086	24799	29096
Jarvis (USA)				53									0	
Kiribati	268	742	758	644	833	241	303	686	254	741	1034	561	1181	428
Non-attributed non-high seas area	4	4	1	19	11	12	4	5	2	24	6	5	7	
New Caledonia	885	1015	1160	1087	1367	1579	1348	1312	1484	1611	1923	1732	1700	1712
Niue			34			55	259	216	337	238	219			401
New Zealand	1334	2593	2522	2936	1246	602	496	277	382	422	460	418	266	302
French Polynesia	3463	4261	4555	3813	2210	2255	2849	3924	3064	3560	3482	3223	3590	3493
Papua New Guinea	105	72	82	645	1530	2182	1789	1920	509	865	806	720	1047	457
Solomon Islands	339	170	1074	932	2231	3001	6954	4922	8433	11619	20918	9859	11416	8751
Tokelau									121			90	130	
Tonga	858	1074	845	318	197	256	405	354	220	124	57	36	803	2104
Tuvalu	224	117	186	53	239	300	8	317	159	313	198	513	1091	1467
Vanuatu	2516	2759	2629	2812	3700	6957	8321	5717	6430	6174	5313	7408	4762	6054
Wallis and Futuna						34						3		
Western Samoa	4067	4820	4205	2253	1233	1263	2113	3113	2342	2816	2529	1415	2037	1640
Total	32356	50879	59306	50745	49664	52793	57401	51877	55763	72146	74100	56616	71301	68415

Table 2. Annual south Pacific albacore troll catch estimates by EEZ, 2000–2013.
Notes: Available operational and aggregate logsheet data raised to annual catch estimates. "EEZ" are approximate 200-mile boundaries (excluding archipelagic waters); "High seas" is the high seas in the WCPFC Convention Area, south of the equator.

EEZ/High Seas	ANNUAL SOUTH PACIFIC ALBACORE TROLL CATCH ESTIMATES BY EEZ AND HIGH SEAS													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
High Seas	2768	2309	1503	2262	1336	665	708	325	151	237	307	471	235	390
New Zealand	3336	2736	3012	3721	3212	2855	2043	1736	3352	1794	1832	2787	2727	2836
Total	6104	5045	4515	5983	4548	3520	2751	2061	3503	2031	2139	3258	2962	3226

Effort

It is challenging to identify the specific species being targeted by longline vessels, particularly within the aggregate data received from particular fleets fishing on the high seas. To more directly relate the patterns seen in effort to the declared catches (described above from the area south of the equator), therefore, we have evaluated fishing effort south of 10°S to approximate south Pacific albacore targeting (noting that this will include effort targeting swordfish) and to attempt to exclude the 'tropical' longline fishery effort.

Raised logsheet (and aggregated) data for the southern WCP-CA (south of 10°S) were available up to 2013 (Figure 3). The number of deployed hooks in 2013 within the WCP-CA south of 10°S was 13% lower than in 2012, but up 3% on the average over the last five years.

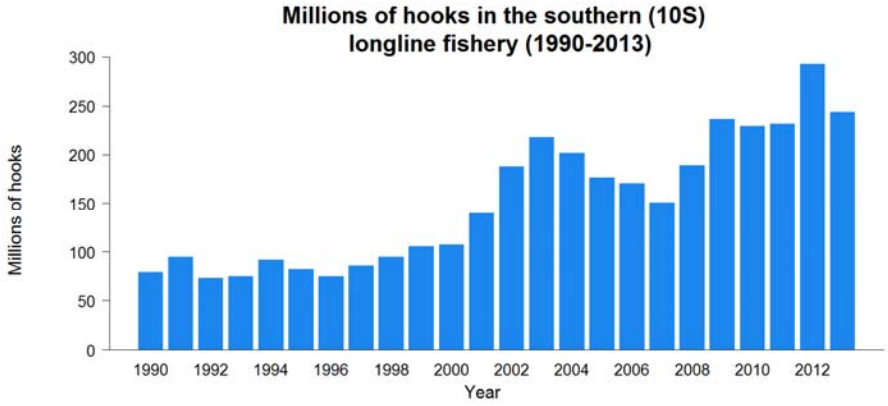

Figure 3. Temporal trends in effort (millions of hooks) in the southern longline fishery (WCP-CA south of 10°S; excluding effort in archipelagic waters).

Effort data from VMS provides the most 'up to date' information available, given that logsheet effort for recent years may be incomplete, increasing uncertainty in raised logsheet effort data. VMS data analysed represents days at sea and includes fishing and transit activity, but excludes data close to port. As for the aggregate longline data, it does not allow information on the species targeted by vessels during fishing to be assessed. In turn, some trends over time may be influenced by increased coverage of VMS across longline vessels in the south Pacific, while data for certain EEZs may be incomplete or non-existent. A list of notes on the VMS data and a table of effort by high seas area are provided in Appendix 2. To overcome the issue of the absence of VMS data for some EEZs, data were augmented with logsheet information in these locations.

Effort south of 10°S grouped by EEZ and high seas suggests that effort (VMS days at sea, augmented by logsheet days) within both EEZs and high seas has increased over the period 2009-2013; total effort increased by 9% from 2012 to 2013. The rate of increase has been greater in the high seas zone, with over 27% of the VMS days occurring within the high seas in 2013 (Table 3). Between 50% and 65% of the international waters VMS effort has been within the regions east of the Line Islands and French Polynesia, and the region north and northeast of New Zealand (Figure 4, Table A2.1).

Table 3. Total VMS days at sea (augmented by logsheet information) by year and geographic area in the WCP-CA south of 10°S (excluding effort in archipelagic waters).

	2009	2010	2011	2012	2013
EEZs	60,996	73,600	75,764	81,523	83,437
International waters (IW)	12,750	20,920	23,763	24,021	31,713
Total	73,746	94,520	99,527	105,544	115,150
% EEZs	82.7	77.9	76.1	77.2	72.5
% High Seas	17.3	22.1	23.9	22.8	27.5

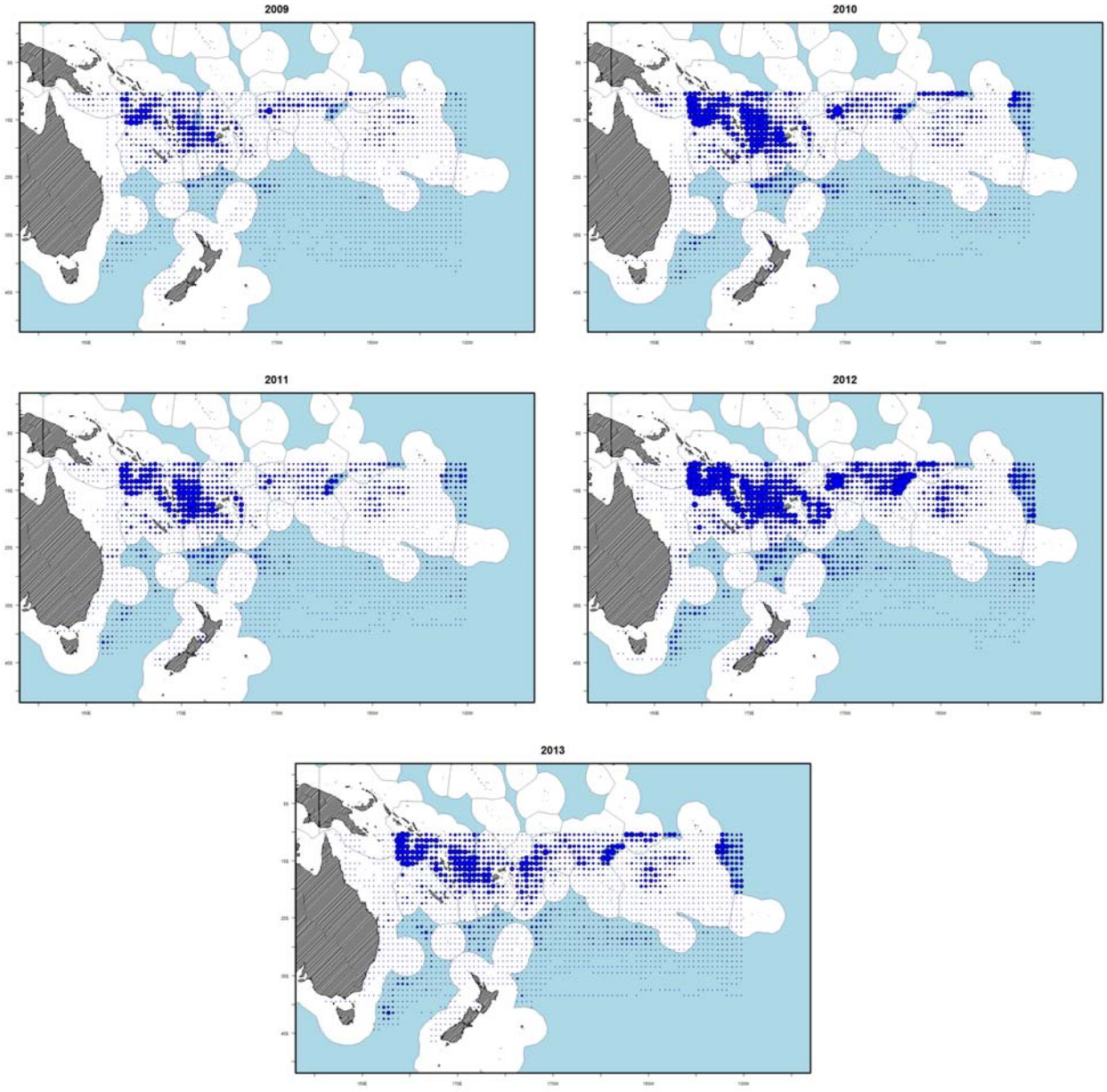

Figure 4. Longline VMS days at sea (augmented by logsheets) within the southern WCP-CA at 1°x1° (excluding archipelagic waters), south of 10°S. Maximum circle size = 1,354 days.

Catch per unit effort

Figure 5 presents nominal longline south Pacific albacore CPUE series from key distant water fleets:

- Japanese longline CPUE in 2013 (1.147 fish per 100 hooks) was a 3% increase on 2012 and a 32% increase on 2008-12;
- Korean longline CPUE in 2013 (0.157 fish per 100 hooks) was a 33% decrease on 2012 and a 34% decrease on 2008-12;
- Chinese longline CPUE in 2013 (1.095 fish per 100 hooks) was an 11% increase on 2012 and a 1% increase on 2008-12;
- Chinese Taipei longline CPUE in 2013 (1.317 fish per 100 hooks) was a 93% increase on 2012 and a 38% increase on 2008-12.

Examining longer term trends, the nominal CPUE for the Korean fleet has declined by 43% from the 1991-2000 average, while that for the Chinese Taipei fleet has declined by 40%. In contrast, that for the Japanese fleet has increased by 18%.

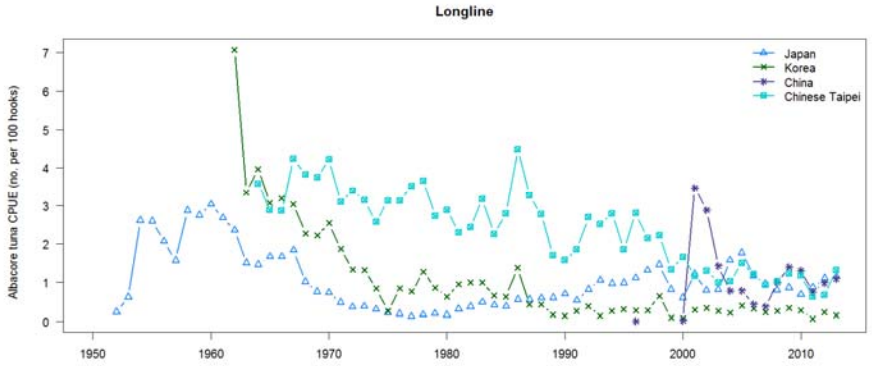

Figure 5. Trends in the nominal CPUE (number of fish per 100 hooks) over time for key distant water fleets in the south Pacific Ocean.

The relative spatial pattern of catch and effort, and hence CPUE, is presented in Figure 6. Relative high south Pacific albacore CPUE regions (where the '+' is larger than the circle) are consistent with the regions of comparatively large catches seen in Figure 2.

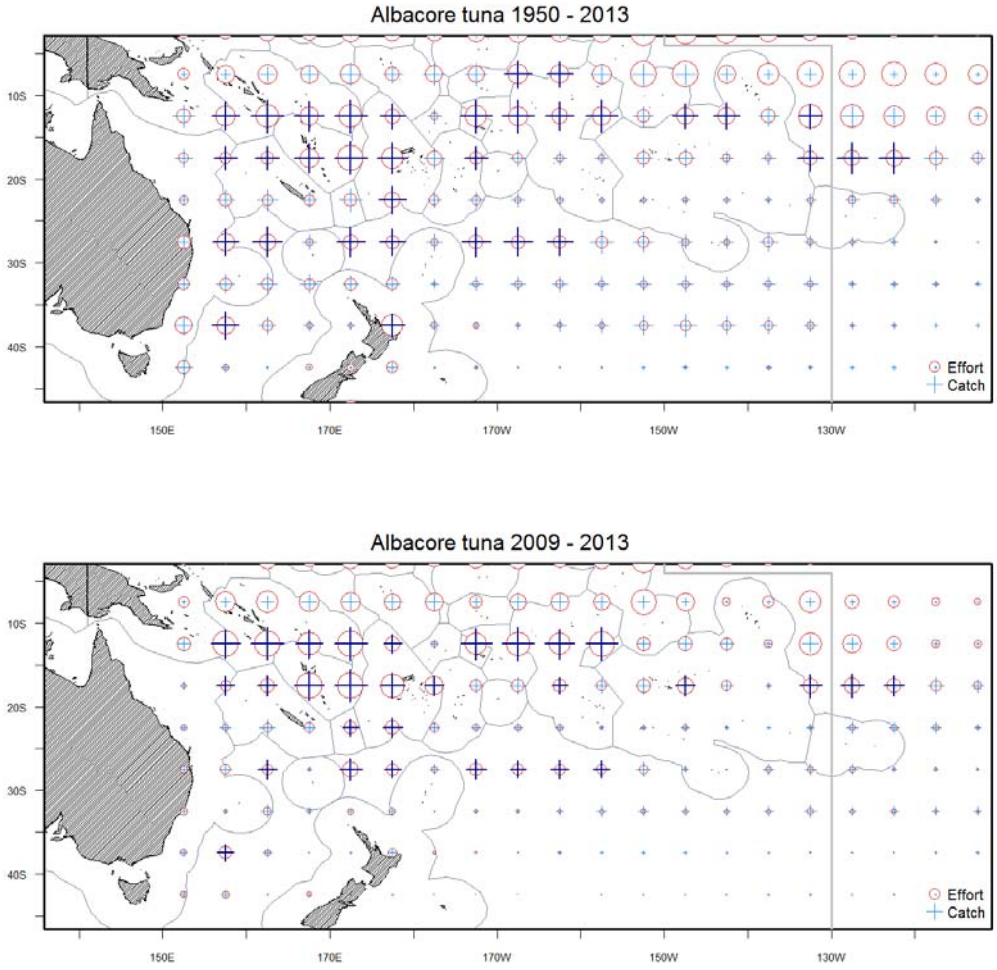

Figure 6. Albacore tuna longline catch (+) and effort (circles) distribution for the period 1950-2013 (top) and 2009-2013 (bottom). The top 15% of 5x5 degree squares for catch have bolded '+'. The relative size of the + and circle give an indication of the CPUE for the square. Where the + is larger than the circle, CPUE is high.

Catch size structure

Length distributions of south Pacific albacore for 2008-2013 are presented in Figure 7 in terms of numbers-at-length and weight-at-length. The more southerly troll fleet primarily catches smaller individuals, while the longline fleet catches larger (generally mature) individuals. The size distribution in catches of the latter gear is relatively consistent over time, and shows limited modal structure.

Figure 8 presents the mean catch weight of south Pacific albacore by gear (longline and primarily troll), and overall for 2007-2013. The mean weight by gear has remained relatively constant with little trend over time, although some increase in the weight of individual fish within the troll fishery is seen in the last two years. The mean weight of individual fish taken across both gears in 2013 (14.13kg) was a 1% decrease on 2012 but equal to that seen over the

period 2008-2012. Note that for south Pacific albacore this is heavily influenced by the numbers of fish and wider size range caught in the longline fishery (Figure 7). The mean weight of longline caught fish (15.15kg) was a 1% decrease on 2012 and 2008-12. The mean weight of troll caught fish (5.12kg) was a 12% increase on 2012 and a 15% increase on 2008-12. Catch levels in the troll fishery are influenced by the state of the Southern Oscillation Index (Kendrick and Bentley, 2010). If this also affects the troll catch structure, it will reduce the usefulness of mean size or weight from this gear as a stock status indicator for south Pacific albacore.

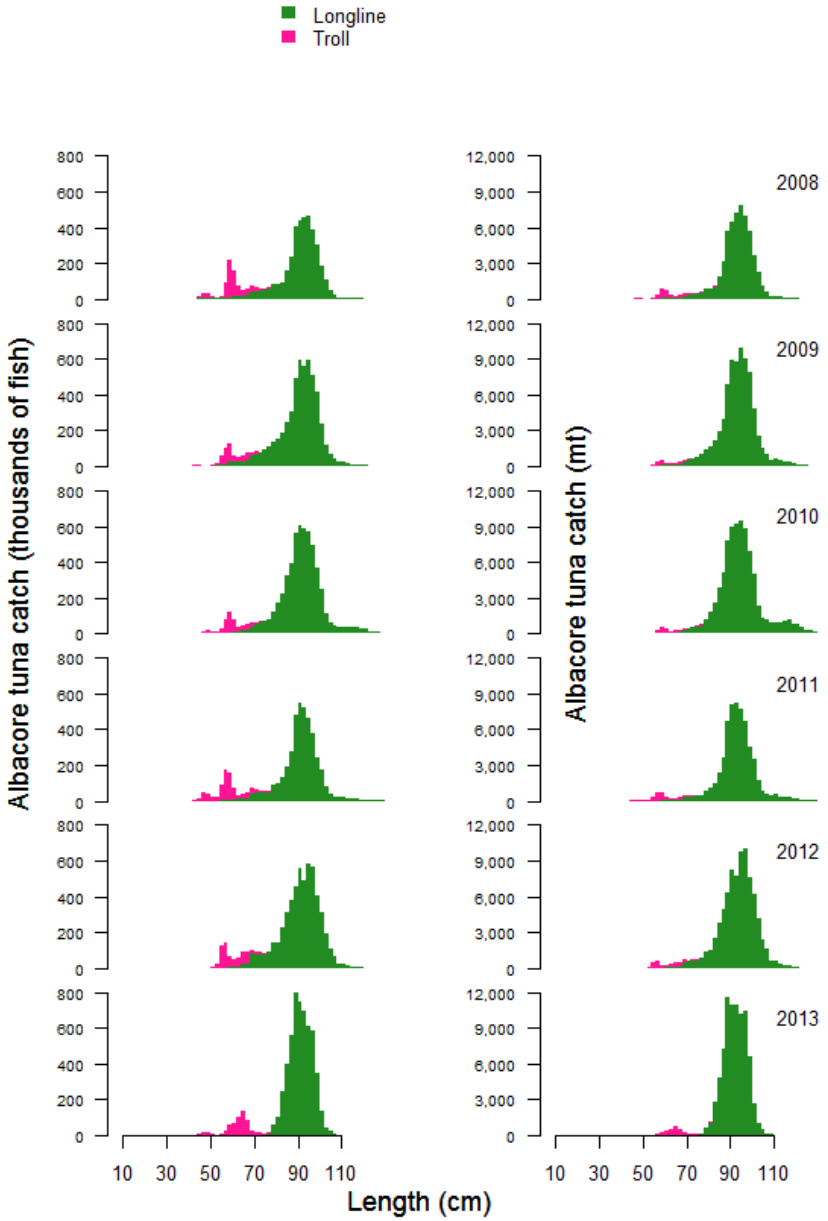

Figure 7. Catch-at-size of albacore tuna in the south Pacific Ocean by gear type and year. Catch is provided in thousands of fish (left) and metric tons (right).

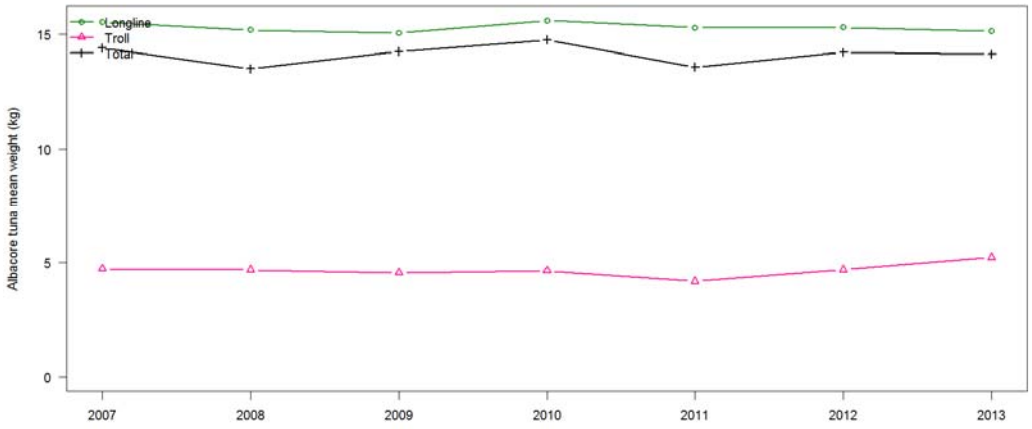

Figure 8. Mean weight of individual albacore tuna in the south Pacific Ocean taken by gear and year. The 'total' line represents the overall catch-at-size.

Transshipment information

High seas transshipment data are available from July 2010 to July 2014 (Figure 9); no in port or in zone transshipment data are presented. Fluctuations in reported transshipments may reflect logistical/operational factors rather than fishing activity. It is noted that historically south Pacific albacore would have been offloaded directly to canneries (e.g. Pago Pago, American Samoa, or Levuka, Fiji) rather than being transshipped on the high seas. There is a notable peak in transshipment activity in November 2013 (2,047 mt) of which just over 50% may be ascribed to Chinese activity (1,049 mt). Total reported transshipments on the high seas declined in 2012 (Table 4), despite relatively high transshipment levels in July of that year. Further transshipment information by flag and month is presented in Appendix 3. It should be noted that transshipment levels are unlikely to be fully reported for the most recent months. Transshipment data for 2010 and 2011 should also be considered preliminary and subject to change.

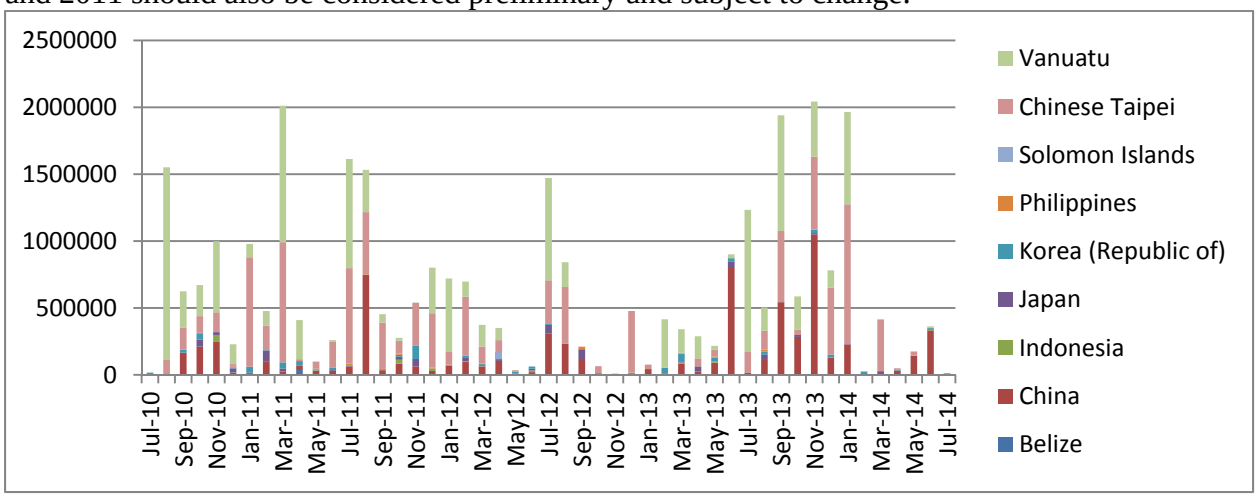

Figure 9. Reported transshipment (kg) by flag and month (July 2010 to July 2014). Source: WCPFC Transshipment Events Database (11 July 2014).

Table 4. Annual total and monthly average transshipment in mt (July 2010 to July 2014).

Year	Annual total	Monthly average
2010*	4,091	682
2011	9,454	788
2012	5,311	443
2013	9,321	777
2014**	3,006	429

* 01 July to 31 December data only.
** 01 January to 7 July data only.

Albacore stock status

The last assessment for South Pacific albacore was performed in 2012 (Hoyle et al., 2012) and estimated the stock status averaged over the period July 2007 - June 2010 ('current'), relative to MSY reference points. SC8 provided advice to the Commission using the median values calculated from the structural uncertainty grid. Resulting estimates are presented in Table 5, and the kobe plot is presented in Figure 10.

Table 5: Estimates of reference points from the last (2012) south Pacific albacore tuna stock assessments (WCPFC and IATTC RFMO regions).

Management Quantity	2012 Assessment
Most Recent Catch	78,664 mt
MSY	99,085 mt
$Y_{Fcurrent}$	66,255
$Y_{Fcurrent}/MSY$	0.70
$SB_{current}/SB_{current,\ F=0}$	0.63
$F_{current}/F_{MSY}$	0.21
$B_{current}/B_{MSY}$	1.62
$SB_{current}/SB_{MSY}$	2.56

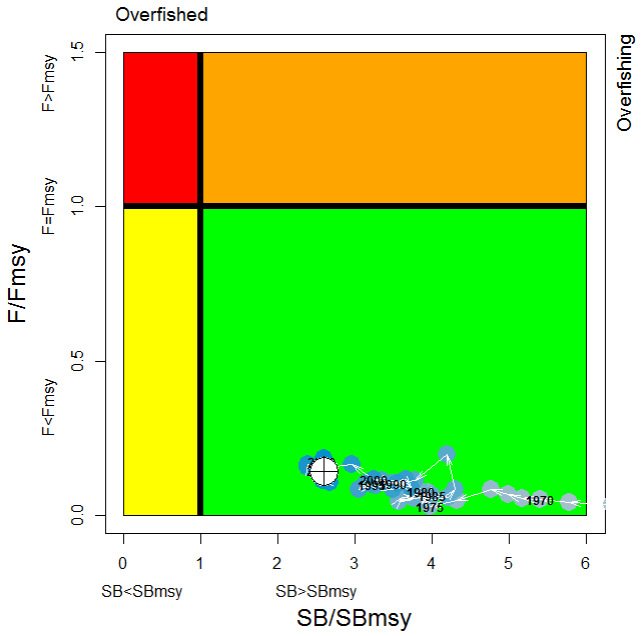

Figure 10: Temporal trend in annual stock status, relative to SB_{MSY} (x-axis) and F_{MSY} (y-axis) reference points, for the model period (starting in 1960). The colour of the points is graduated from grey (1960) to blue (2009) and white cross (2010), and points are labelled at five-year intervals. The last year of the model (2011) is excluded because it is highly uncertain.

As noted in previous Indicators papers (e.g. Harley and Williams, 2013), it is difficult to correctly interpret the stock status-related implications of trends in any indicators in isolation of other data sets and a population dynamics model.

To examine the potential consequences of recent fishing levels relative to the agreed biomass limit reference point for south Pacific albacore ($20\%SB_{2001\text{-}2010,\ F=0}$), stochastic 20-year effort-based projections were performed under different assumptions of population dynamics (defined by eighteen alternative stock assessment runs from the 2012 Multifan-CL stock assessment, capturing uncertainty in stock recruitment steepness, natural mortality and growth; see WCPFC-SC10/MI-WP-01 for further information), and future conditions (variability in future recruitment around the stock-recruitment relationship), consistent with the recommendations on inclusion of uncertainty within projections from WCPFC-SC9 and in Berger et al. (2013).

Future southern longline fisheries effort was modelled at levels equal to those seen in 2010 and 2012, representing the lowest and highest effort over the last five years, respectively. Longline effort scalars were applied to fleets operating in the south Pacific WCP-CA only; fleets operating in the eastern south Pacific remained at 2010 levels. Potential future adult (spawning) biomass levels relative to unfished levels were examined, and the probability that the south Pacific albacore stock may fall below the biomass Limit Reference Point was calculated (Figure 11, Table 6).

2010 effort levels 2012 effort levels

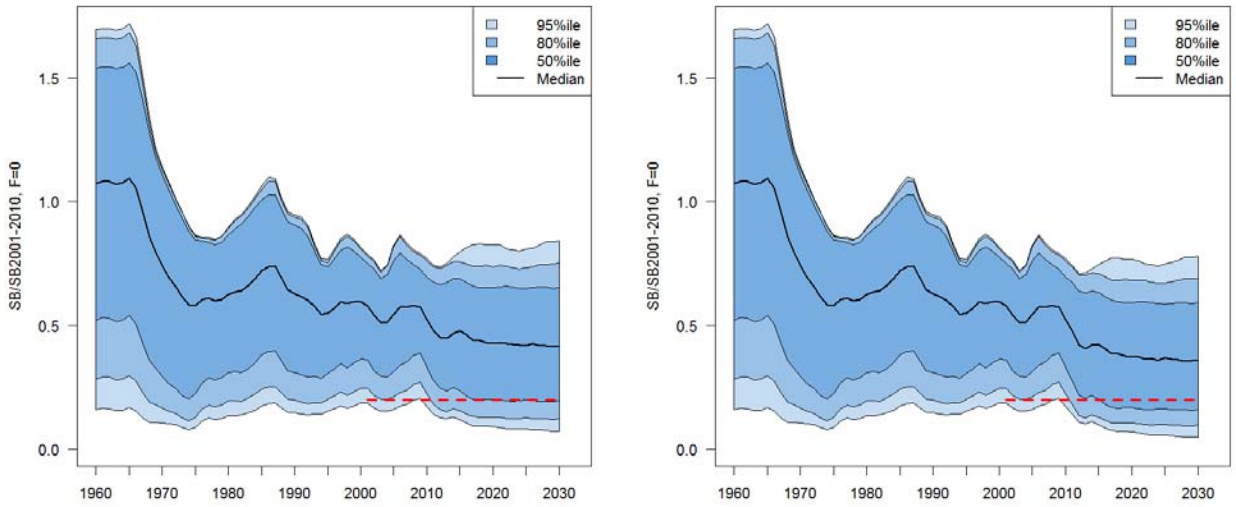

Figure 11. Stochastic projections of future south Pacific albacore adult stock status under 2010 or 2012 effort levels relative to the biomass Limit Reference Point (20% $SB_{F=0,\ 2001\text{-}2010}$, indicated by horizontal dashed red line). Note: uncertainty from 1960 up to 2010 inclusive represents structural uncertainty only (across the 18 assessment model runs); uncertainty after 2010 represents both structural uncertainty and stochastic recruitment (3600 simulation runs).

Based upon the level of uncertainty in future conditions examined here (a subset of 18 stock assessment model runs used) there is a notable risk of recent fishing effort levels reducing the adult biomass of south Pacific albacore below the Limit Reference Point within the coming years, with the stock having a 30% chance or greater (i.e. a 1 in 3 chance) of being below the Limit Reference Point by 2030 (Table 6).

Table 6. Probability that south Pacific albacore adult (spawning) biomass in 2030 falls below the Limit Reference Point ($20\%SB_{2001\text{-}2010,\ F=0}$)

Future effort level in WCPO fisheries	$P(SB_{2030} < 20\%SB_{2001\text{-}2010,F=0})$
2010 level	0.30
2012 level	0.35

Projection outputs provide information on the biomass of south Pacific albacore available to specific fleets (the 'vulnerable biomass'), taking into account the regional biomass at a given time and estimated selectivity of that fleet. The relative change in vulnerable biomass can be taken as a proxy for the potential change in catch rates (CPUE). Examining the 2030 vulnerable biomass for different fleets within the assessment model relative to 2010 levels (Table 7), an on-average 5-9% and 7-19% reduction in troll and longline gear CPUE was estimated dependent upon the level of future effort. The decline for some individual longline fleets was notably greater than those 'average' levels.

Table 7. Estimated reduction in the vulnerable biomass available to different fleets within the south Pacific albacore stock assessment by 2030 relative to that in 2010 under alternative future conditions.

Fleet	% reduction in 2030 vulnerable biomass available to fleets	
	2010 level	2012 level
JP	-7	-15
KR	-7	-19
CT	-7	-19
AU	-7	-16
NC	-10	-28
FJ	-9	-23
OT	-8	-21
AS	-8	-22
TO	-10	-27
PF	-13	-32
NZ	-5	-10
Troll	**-5**	**-9**
Longline combined	**-7**	**-19**

Please note that analyses related to the bio-economics of the southern longline fishery and potential MEY reference points, are presented in WCPFC-SC10-2014/MI-WP-04.

References

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Appendix 1. Summaries of south Pacific albacore longline and troll catch, by flag/geographic region.

Table A1.1. Annual southern WCP-CA albacore longline catch estimates by Vessel Nation, 2000–2013.
Notes: Available operational and aggregate logsheet data raised to annual catch estimates (ACE). Differences in annual totals between this table and Table 1 result from rounding errors. Southern WCP-CA approximated - some EEZ and high seas areas span the equator.

Flag	ANNUAL SOUTH PACIFIC ALBACORE LONGLINE CATCH ESTIMATES BY FLAG													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australia	381	591	553	490	667	743	2591	1925	1277	1523	745	653	572	572
Belize	191	4050	1472	885	353	7	0	164	7	26	10	105	32	
Cook Islands		2	490	1358	1869	2371	2223	2644	2224	1551	2423	2182	2614	1310
China	2030	2495	2704	6002	5828	4026	7115	5424	15059	20100	12950	11868	24538	23842
Spain					2	2	0	0	33	35	6	3	2	2
Fiji	5363	7230	7279	6337	10938	11104	11474	6981	9262	12096	8744	9942	9478	8678
Federated States of Micronesia	0	0		0	0	0	0	0	0	0	1	1	168	669
Japan	2254	3358	2637	3146	4004	4652	3223	2806	2384	2812	2461	2136	2046	1450
Kiribati	0	0		0	0						66	236	356	180
Korea	591	1728	2850	1394	743	2167	786	1035	1135	1141	907	443	856	643
New Caledonia	895	1020	1165	1111	1468	1590	1358	1324	1506	1649	1939	1736	1715	1714
Niue						55	213	216	337	154	97			
New Zealand	1344	2614	2545	2971	1248	602	496	357	382	422	460	418	266	302
French Polynesia	3473	4261	4557	3846	2218	2426	2918	3957	3068	3560	3483	3225	3594	3512
Papua New Guinea	105	72	82	645	1530	2182	1740	1556	438	807	791	245	693	232
Portugal												4	1	67
Solomon Islands	224	54	121	95	207	0					9391	1245		
Tonga	862	1268	1189	611	182	283	414	390	220	124	57	34	20	13
Tuvalu												184	435	92
Chinese Taipei	9502	12800	16057	12187	8313	8616	8590	8592	7577	11473	13762	13103	11750	13248
United States	1075	3861	6105	4234	2623	3058	4146	5298	3687	3937	4079	2750	3344	2182

of America														
Vanuatu		655	5275	3180	6237	7648	8001	6091	4825	7920	9198	4685	6783	8062
Wallis and Futuna												3		
Western Samoa	4067	4820	4223	2253	1233	1263	2113	3113	2342	2816	2529	1415	2038	1642
Total	32357	50879	59304	50745	49663	52795	57401	51873	55763	72146	74099	56616	71301	68412

Table A1.2. Annual south Pacific albacore longline catch estimates by EEZ and Vessel Nation, 2000–2013.
Notes: Available operational and aggregate logsheet data raised to annual catch estimates. "EEZ" are approximate 200-mile boundaries; "High seas" is the high seas in the WCPFC Convention Area, south of the equator. Allocation of flag catch to EEZ may be approximate due to the lack of operational logsheet data in some cases.

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
American Samoa	US	626	3217	5353	3212	2019	2880	4078	4667	2963	3299	3125	2224	2606	1859
Australia	AU	359	554	505	391	587	622	2526	1867	1256	1471	706	627	529	524
Cook Islands	BZ				70										
	CK		2	490	1344	1866	2266	1986	2380	1918	1363	2207	2178	2583	1186
	CN												217	2970	2116
	FJ											105	394	361	45
	FM													148	655
	KI												215	270	154
	PF				14										
	CT			6	0	0		0	986	205	1785	782	347	370	
	US		7	598	411	297	16		304	370	476	665	335	332	144
	VU				15	9					1789	1922	1839	3251	1778
	WS			18											
Fiji	CK						15								
	CN			77	63	150	151	39	78	149	376	108	1088	769	619
	FJ	4278	6578	5527	3806	5939	5486	5752	3554	4390	5216	3649	3943	4258	3356
	KR		0									11	69		38
	NZ								80						
	CT	246	529	331	90	39	2	1	9	11	8	0	32	0	8
	US		187	304	119	33	1	6		2		1	39	26	28
	VU						15								

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
High Seas	AU	22	37	48	99	80	121	65	58	21	52	39	26	43	48
	BZ	31	2800	1472	805	2	7	0	19	0	2				
	CK			0	14	3	6	81	158	180	30	61	4	23	19
	CN	2029	2413	2494	5588	5290	2488	5126	4387	12402	15031	9642	6260	15997	14154
	ES					2	2	0	0	33	35	6	3	2	2
	FJ	363	221	710	1291	2189	2263	2093	1045	1342	2130	1591	2195	1797	1803
	FM	0	0		0	0	0	0	0	0	0	1	1	19	15
	JP	2069	3170	2466	2910	3978	4531	1938	1764	1404	1580	948	1673	1156	1217
	KR	284	1070	1837	1095	444	1787	308	452	419	580	531	246	456	514
	NC	8	1	4	23	94	10	8	12	22	38	16	4	14	2
	NU							2							
	NZ	10	21	23	35	2	0	0	0	0	0	0	0		0
	PF	36		2	20	8	138	69	33	4		1	2	4	19
	PT												4	1	67
	TO	4	194	344	293	3	27	9	36						0
	CT	7479	11339	14433	11355	6723	5337	3214	2557	1437	3035	4163	5001	2899	7088
	US	449	636	154	557	308	162	68	328	266	163	289	192	405	179
	VU		276	4058	1563	4803	5740	5183	4339	3233	5179	6586	1476	1981	3966
	WS													1	2
Jarvis	US				53									0	
Kiribati	BZ					351								32	
	CN	1	82		48	9	0	0	0	1	101	177	208	291	141
	FJ												16	40	20
	JP	42	83	44	40	27	11	2			10	1	13	34	2
	KI	0	0		0	0						66	21	41	1
	KR	224	576	692	262	234	134	131	186	124	144	248	97	280	68
	CT	1	0	22	64	116	28	14	265	48	70	32	154	388	180
	US	0	1												
	VU				230	96	69	156	236	82	418	511	51	74	16
New Caledonia	NC	885	1015	1160	1087	1367	1579	1348	1312	1484	1611	1923	1732	1700	1712

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Niue	CK							47			84	122			92
	FJ														310
	NU						55	211	216	337	154	97			
	CT			34			0								
Non-attributed non-high seas area	FJ	2			17	4	10	2	3	2	10	6	5	6	
	NC	2	4	1	1	7	0	2						1	
	VU				1		2	0	3	0	14		0		
New Zealand	NZ	1334	2593	2522	2936	1246	602	496	277	382	422	460	418	266	302
French Polynesia	KR	27	0												
	PF	3437	4261	4555	3813	2210	2255	2849	3924	3064	3560	3482	3223	3590	3493
Papua New Guinea	PG	105	72	82	645	1530	2182	1740	1556	438	807	791	245	693	232
	CT							49	363	71	58	15	476	354	224
Solomon Islands	BZ				10	0			145	7	24	10	105		
	CK							45		12	16			5	13
	CN			17	102	157	426	866	310	1315	2378	1303	968	1682	2629
	FJ	10	2	160	60	368	232	680	576	1275	2719	1431	1198	1478	1806
	JP	103	69	126	193		110	1276	1042	980	1223	1469	450	855	232
	KI														25
	KR		0	76	16	24	83	319	226	463	299	34	27	108	22
	SB	224	54	121	95	207	0					9391	1245		
	CT	2	44	266	150	718	1638	2713	2217	3807	4640	7183	5356	6274	3156
	VU			307	306	757	513	1055	407	574	320	98	511	1013	868
Tokelau	CK									33					
	FJ												73	102	
	KI													28	
	CT												17		
	US									88					
Tonga	CN													11	100
	FJ					18								27	114
	TO	858	1074	845	318	179	256	405	354	220	124	57	34	20	13
	CT												2	745	1877

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Tuvalu	CK								52	20	54	23		3	
	CN												90	0	
	FJ				31	194	123	1	2	15	124	28	202	573	208
	JP	41	36	2	3	0		0				43		0	
	KI													17	
	KR	55	82	184	18	41	162	6	171	123	119	83	4	13	0
	TV												184	435	92
	CT	128	0		0	4	15	0		1		13	8	0	85
	US													1	
	VU							0	91		16	8	24	50	1082
Vanuatu	BZ	160	1251												
	CK						84	63	54	62	3	11			
	CN			115	202	223	962	1084	649	1192	2214	1721	3038	2817	4083
	FJ	709	428	883	1132	2226	2991	2946	1802	2239	1897	1935	1916	836	1018
	JP							7							
	KR			62	4			21		7					
	CT	1647	888	964	528	713	1597	2599	2195	1997	1877	1574	1710	721	629
	VU		192	605	946	537	1323	1601	1016	933	183	73	744	388	325
Wallis et Futuna	PF						34								
	WF												3		
Western Samoa	WS	4067	4820	4205	2253	1233	1263	2113	3113	2342	2816	2529	1415	2037	1640

Table A1.3. Annual south Pacific albacore troll catch estimates by flag, 2000–2013.

Flag	ANNUAL SOUTH PACIFIC ALBACORE TROLL CATCH ESTIMATES BY FLAG													
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CK	335	202	166	688	376	89	121	53						
NZ	3336	2736	3012	3721	3212	2855	2043	1736	3352	1794	1832	2787	2727	2836
US	2433	2107	1337	1574	960	576	587	272	151	237	307	471	235	390
TOTAL	6104	5045	4515	5983	4548	3520	2751	2061	3503	2031	2139	3258	2962	3226

Appendix 2: Notes on the time series of longline VMS information in the South Pacific

The analysis summarises the longline VMS information available to SPC through the FFA and WCPFC over the period 2009-2013, by geographic region of the South Pacific. Effort in that database corresponds to days at sea (i.e. includes fishing and transiting). Please note:

- This analysis uses annual VMS data available up to and including December 2012;
- Effort represents total longline effort, not just that targeted at South Pacific albacore;
- VMS effort presented for EEZs includes that in archipelagic waters;
- Effort data for some countries (e.g. those with domestic longliners not on FFA VMS) will not be included within EEZ patterns;
- Effort for some countries (e.g. New Caledonia; French Polynesia) may be incomplete;
- Some trends may result from improved VMS coverage of vessels over time;
- EEZ effort excludes the Indonesian EEZ.

Table A2.1. Total VMS days at sea by year in International Waters, south of 10°S (see Figure A1).

International waters code	2009	2010	2011	2012	2013
I2	206	175	194	251	297
I5	1592	5109	4876	5284	10727
I7	7974	10992	12662	10811	13256
I8	1821	2856	3422	2383	2964
I9	1158	1787	2610	5291	4469
Total	12750	20920	23763	24021	31713

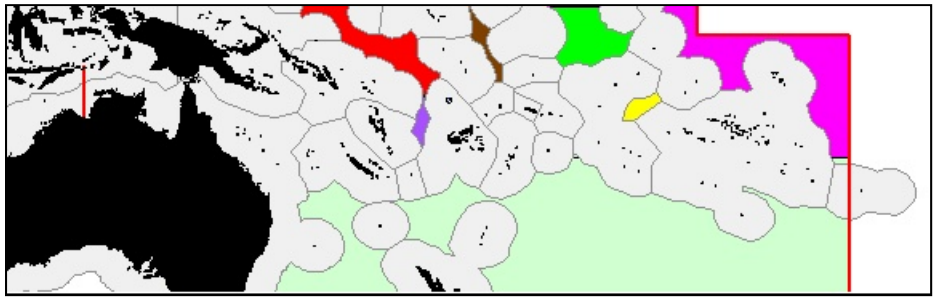

Figure A1. Map of International Waters in the southerly WCPFC-CA

Key:

Code	Area	Colour
H4	International waters between Tuvalu, Phoenix and Tokelau	Brown
H5	International waters between Phoenix and Line groups	Bright green
I2	Doughnut hole between FSM, Solomon Islands, Kiribati, RMI, Nauru and Tuvalu	Red
I5	International waters between Phoenix and Line groups and east of Line group	Pink
I7	High seas area to the east of Australia and New Zealand	Light green
I8	High seas pocket between Fiji and Vanuatu	Purple
I9	High seas pocket between the Cook Islands and French Polynesia	Yellow

Appendix 3. High Seas transshipment data for south Pacific albacore.

Table A3.1. High Seas transshipment data for SPA, by flag, year and month from July 2010

Notes:

1. The requirement to report (within 15 days of transshipment) high seas transshipment commenced in July 2010.
2. The data refer to high seas transshipments, but a proportion of the catches will likely have been caught within EEZs.
3. Weights are in kg.

Flag	2010					
	Jul	Aug	Sep	Oct	Nov	Dec
Belize					2,837	
China			166,000	210,668	247,192	17,091
Indonesia					44,170	869
Japan		900		53,543	24,937	30,000
Korea (Republic of)	16,984		22,303	41,890		6,389
Philippines				7,500		4,848
Chinese Taipei		115,000	165,552	125,298	147,809	20,582
Vanuatu		1,435,000	270,600	232,293	532,130	148,835
Total	16,984	1,550,900	624,455	671,192	999,075	228,614

Flag	2011											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	2,015			36,000			710					
China	5,073	101,989	24,854	31,588	31,987	29,524	61,905	748,608	34,656	82,198	63,458	28,013
Indonesia				794	8,277				8,322	29,668		7,220
Japan	10,850	79,731	22,475			5,777	822			23,160	54,303	4,687
Korea (Republic of)	42,584	3,017	45,988	33,941	5,622	16,595	3,678		1,225	13,768	98,599	6,360
Philippines				400		500	17,303	2,284		10,346		6,723
Chinese Taipei	818,356	182,858	898,650	14,806	52,060	193,654	712,740	465,695	346,645	94,959	320,851	406,940
Vanuatu	100,000	110,000	1,020,165	290,970	2,447	13,700	816,794	315,938	62,000	22,061	2,983	341,175
Total	978,878	477,595	2,012,132	408,499	100,393	259,750	1,613,952	1,532,525	452,848	276,160	540,194	801,118

Flag	2012											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize							841					
China	67701	95807	61927	103977	8055	20149	305884	231568	118390	11224		11276
Indonesia	1894	4820	1900			11505						4656
Japan		31016	1774	12999	1575	13449	66858	2597	72544		3281	
Korea (Republic of)	3777	13163	14234	5454	12710	16829	6312				4920	
Philippines	1500		4684						19278			
Solomon Islands				45500								
Chinese Taipei	100420	438492	127178	91510	12089		326644	422285		52845		461336
Vanuatu	544933	114067	161242	90280	1657		764900	185000				
Total	**720225**	**697365**	**372939**	**349720**	**36086**	**61932**	**1471439**	**841450**	**210212**	**64069**	**8201**	**477268**

Flag	2013											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
China	42364	7376	84850	24498	90383	805828		110513	542675	282996	1048906	127757
Indonesia			6891	286	5800							2403
Japan			9481	38422	3100	39089	13602	42460	147	14639	10539	2765
Korea (Republic of)		45342	53797		29523	26676		20268			24377	18848
Philippines			4959		7982			15527			2798	
Chinese Taipei	33541		5000	59423	50711		157174	140100	532164	39331	543864	498889
Vanuatu		361951	175489	165000	28228	28496	1062757	174754	864995	249017	412360	130000
Total	**75905**	**414669**	**340467**	**287629**	**215727**	**900089**	**1233533**	**503622**	**1939981**	**585983**	**2042844**	**780662**

Flag	2014						
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**
China	225302	875	26	31578	140373	331788	5758
Indonesia	70					3728	
Japan	3626		27308		2000	200	3200
Korea (Republic of)		22285		8844	1241	13958	3343
Philippines		1162					
Chinese Taipei	1045849	636	386115	8688	31399	529	
Vanuatu	691021		2620			12639	
Total	**1965868**	**24958**	**416069**	**49110**	**175013**	**362842**	**12301**