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TRENDS IN THE SOUTH PACIFIC ALBACORE LONGLINE AND TROLL FISHERIES

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Trends in the south Pacific albacore longline and troll fisheries

Abstract

This paper presents a compendium of fishery indicators for south Pacific albacore tuna, as requested at previous WCPFC-related meetings. Documented indicators include: total catch; catch by gear; and longline effort and nominal longline CPUE trends, along with their spatial patterns. Commentary provided includes comparisons of 2015 values to 2014 and to the average over 2010-14. Information provided includes data loaded into databases as of 2nd July 2016, with minor updates to 2015 EEZ-level catch information. 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 May 2016. 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 September 2014 (2,649 mt) of which just over 70% was reported by Vanuatu (1,896 mt), and the highest peak in the time series in September 2015 (2,941 mt), almost 90% of which was by China (1,102 mt) and Vanuatu (1,509 mt) fleets. 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 from other data sets and a population dynamics model. Therefore we summarise the stock status from the most recent assessment (2015) and update 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 assuming 2014 status quo effort. This analysis uses stochastic stock projections and incorporates the recommendations on inclusion of uncertainty from WCPFC-SC9. Based upon the 2015 stock assessment, and the level of uncertainty included within the projection analysis, the outcomes are unchanged from that seen under the assumption that 2013 conditions continue into the future: there is a 20% chance that the south Pacific albacore stock will fall below the Limit Reference Point by 2033 under 2014 fishing effort levels. Overall decreases in vulnerable biomass (a CPUE proxy) of 14% in longline fisheries are estimated over that period.

Introduction

At the 7th Technical and Compliance Committee, 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, taking into consideration further requests from members.

The current paper presents trends within the south Pacific albacore fishery in terms of catch, effort and Catch per Unit Effort (CPUE) both spatially and temporally. Available information on transshipment patterns is presented, consistent with WCPFC10-2013-IP02. Following the request for further information to assist in the interpretation of 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 2nd July 2016, and minor updates to 2015 EEZ catch levels have subsequently been made to Table 1. 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 (this represents approximately 2% of the effort). 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, have been posted as Microsoft Excel files annexed to the original SC12 paper (see SC12-SA-WP-06a and SC12-SA-WP-06b). These data are for south of the equator. The information on vessel numbers excludes archipelagic waters.

Patterns of longline and troll fishing

Two groups of fleets exploit south Pacific albacore, i.e. longliners and troll vessels. 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 data from distant water fishing nations.

Catch

Annual catch estimates for albacore in the south Pacific (south of the equator) as a whole peaked in 2012 at just under 88,000 mt (all gears). 2015 catches (at just under 69,000 mt) were the sixth highest on record (Figure 1). Catch by longliners represented 96% of the catch weight in 2015 at 65,744 mt. The 2015 longline catch was 17% lower than both 2014 and the 2010-14 average. Provisional other catch (approximately 2,850 mt; the majority (2,576 mt) being by troll vessels) was 14% higher than 2014, and 6% lower than the 2010-14 average.

By comparison, the 2015 south Pacific albacore longline catch within the southern part of the WCP-CA[2] specifically (excluding archipelagic waters; Table 1) of 56,893 mt was lower than preceding years (5% down from the catch in 2014 and 14% lower than the average over 2010-2014), and was comparable to the 2011 catch. High seas longline catch estimates represent 38% of the total, and have ranged from 25-41% of the total over the last 10 years. By flag (or attributed nationality based on charter agreements), China and Solomon Islands had the highest catch estimates of south Pacific albacore in 2015 (14,926 mt and 10,742 mt respectively, the combined total representing 45% of the total catch; Table A1.1). 33% of those catches were taken on the high seas (Table A1.2).

[2] 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.

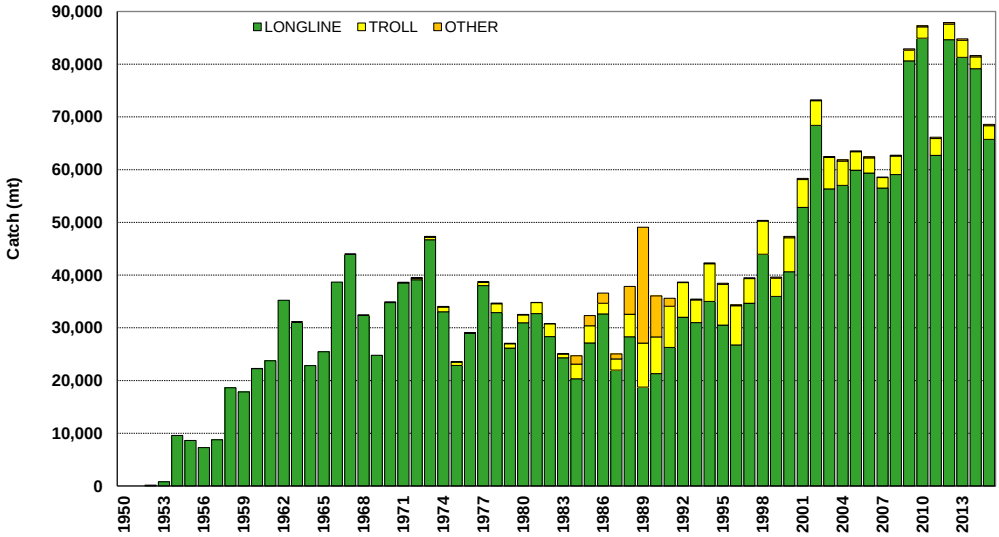

Figure 1. South Pacific albacore catch by gear (total south Pacific, including archipelagic waters).

Four flag states reported troll catches during the period 2000 to 2015 within the WCP-CA, namely Canada, 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 2,597 mt in 2015, a 17% increase over 2014 but a 6% decrease over the 2010-2014 average. Catch estimates for 2015 were 172 mt for the high seas and 2,425 mt for the New Zealand EEZ.

The spatial pattern of south Pacific albacore catches over the long-term (1950-2015), the last 5 years (2011-2015) and 2015 alone, are shown in Figure 2. In recent years, catches have been concentrated in the 10-20°S latitudinal band. Note that while 2015 estimates remain uncertain, the geographic distribution of catches is generally consistent with that seen in recent years.

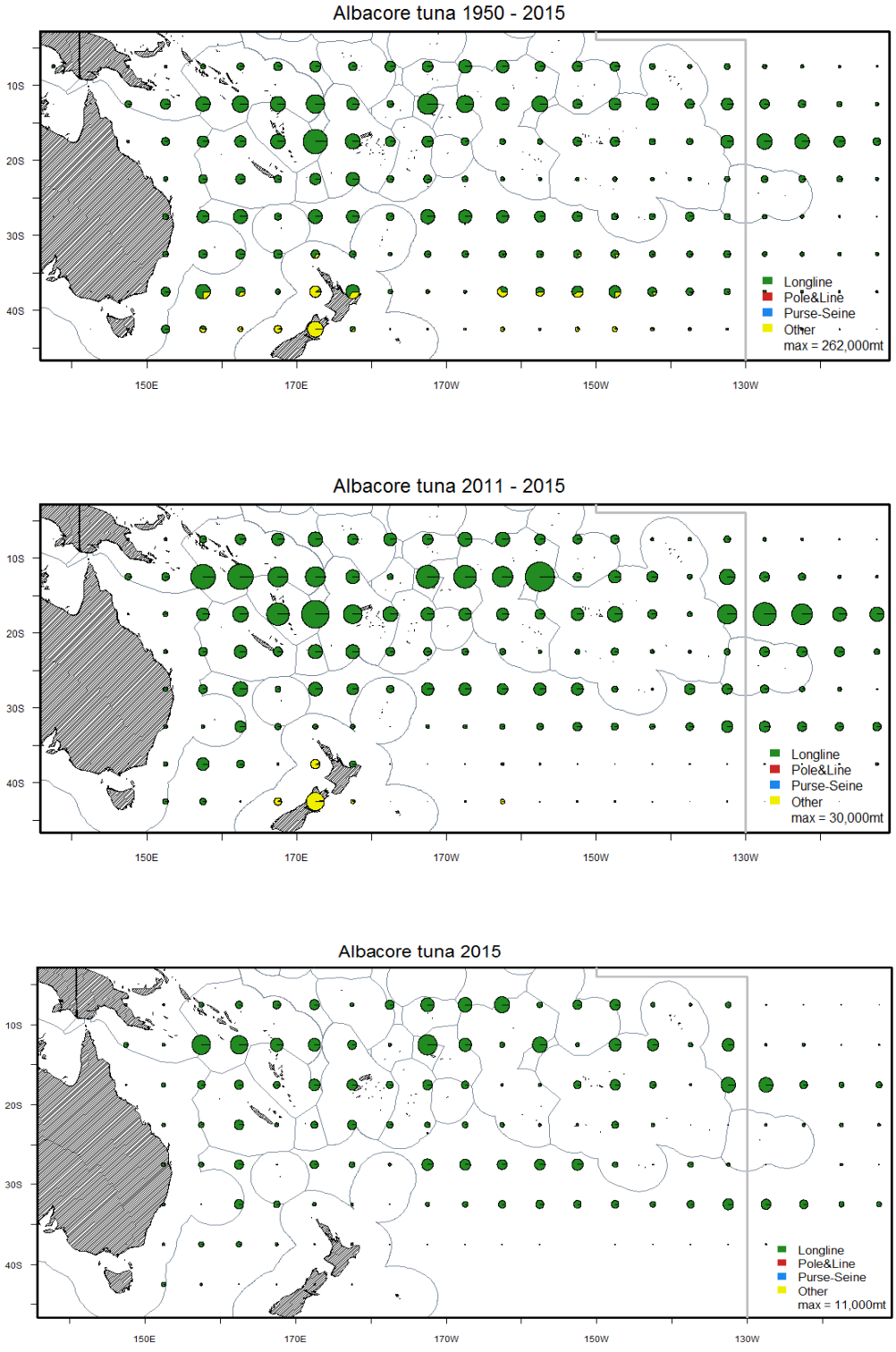

Figure 2. Albacore tuna catch distribution by gear type and 5x5 degree region in the south Pacific ocean for the period 1950-2015 (top), 2011-2015 (middle) and 2015 (bottom). Circle size represents catch volume with maximum circle size presented in the legends.

Table 1. Annual southern WCP-CA albacore longline catch estimates by EEZ and High Seas, 2000–2015.

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; these estimates are based on available logsheets which in most cases do not represent 100% coverage, and when coverage is not high are potentially biased spatially. This will affect the estimation in the allocation of catch to EEZ and high seas areas.

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	2014	2015
American Samoa	626	3217	5353	3212	2019	2880	4078	4667	2963	3299	3065	2224	2414	1760	1277	1601
Australia	359	554	505	391	587	619	2526	1867	1256	1471	706	627	529	592	515	742
Cook Islands		9	1112	1847	2172	2282	1954	3482	2491	5385	5973	5862	10727	6283	4805	2924
Fiji	4382	7417	6327	4045	5986	5617	5620	3659	4533	5627	5810	4068	4221	3946	3270	2238
High Seas	12650	21997	27874	25445	23565	21127	15421	12964	20681	27551	29721	17703	25471	22090	16502	21740
Jarvis (USA)				53									0		0	
Kiribati	271	729	775	712	839	238	300	677	386	1220	1219	597	1329	923	1552	1952
Non-attributed non-high seas area	4	4	1	19	12	11	6	6	2	26	14	7	10			5
New Caledonia	885	1015	1160	1087	1367	1579	1348	1312	1484	1611	1923	1732	1700	1712	1624	1570
Niue			34			55	258	216	337	239	191			374	323	206
New Zealand	1334	2593	2522	2936	1246	602	496	277	382	422	460	418	266	302	311	223
French Polynesia	3464	4261	4555	3819	2210	2259	2846	3924	3060	3560	3482	3223	3591	3495	3743	3367
Papua New Guinea	105	72	82	645	1529	2181	1790	1919	508	865	795	304	803	240	308	356
Solomon Islands	317	170	1092	958	2460	3943	8551	6790	8413	11577	10786	9849	10656	13139	17359	12319
Tokelau									121			106	252	0	7	2313
Tonga	858	1074	845	318	196	256	405	354	220	124	57	38	1582	3242	1068	711
Tuvalu	224	104	186	52	234	276	10	476	159	320	680	458	912	1457	342	261
Vanuatu	2966	2882	2714	2964	4081	8344	10425	6988	6450	6189	5323	8037	4769	8329	6172	3514
Wallis and Futuna						33						3				
Samoa	4067	4820	4205	2253	1233	1263	2113	3113	2342	2816	2529	1415	2037	1640	801	851
Total	32512	50918	59342	50756	49736	53565	58147	52691	55788	72302	72734	56671	71269	69524	59979	56893
% EEZ	0.61	0.57	0.53	0.50	0.53	0.61	0.73	0.75	0.63	0.62	0.59	0.69	0.64	0.68	0.72	0.68
% High Seas	0.39	0.43	0.47	0.50	0.47	0.39	0.27	0.25	0.37	0.38	0.41	0.31	0.36	0.32	0.28	0.38

Table 2. Annual south Pacific albacore troll catch estimates by EEZ, 2000–2015.

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	2014	2015
High Seas	3119	2515	1647	2262	1399	737	843	352	151	237	307	472	235	390	284	172
New Zealand	3336	2736	3012	3721	3212	2855	2043	1736	3352	1794	1832	2787	2727	2836	1937	2425
Total	6455	5251	4659	5983	4611	3592	2886	2088	3503	2031	2139	3259	2962	3226	2221	2597

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 south Pacific albacore catches, we have evaluated fishing effort south of 10°S to approximate south Pacific albacore targeting (noting that this will include longline effort targeting swordfish) and to attempt to exclude 'tropical' longline fishery effort.

Raised effort data for the southern WCP-CA south of 10°S (excluding archipelagic waters) were available up to 2015 (Figure 3). We note there is considerable uncertainty in 2015 effort estimates. The number of deployed hooks in 2015 within the WCP-CA south of 10°S was 15% lower than in 2014, 19% lower than the average over the last five years and the lowest since 2008. Overall longline effort, at 242 million hooks, was the ninth highest on record. Using 2014 (the fourth highest on record) for which information is thought more complete, that year was 3% lower than both 2013 and the 2009-2013 average.

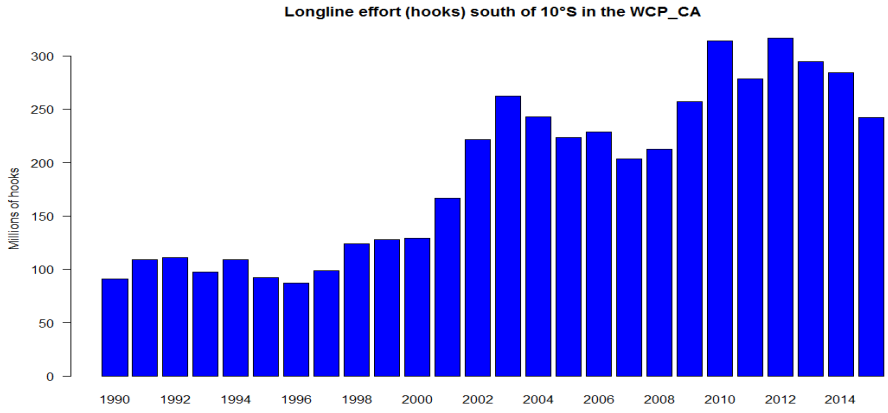

Figure 3. Temporal trends in effort (millions of hooks) in the southern longline fishery (WCP-CA south of 10°S; excluding effort in archipelagic waters).

Effort data from VMS provides the most 'up to date' information available, given that logsheet effort for recent years may be incomplete, and hence the uncertainty in raised annual logsheet effort estimates is increased. 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 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 effort (VMS days at sea, augmented by logsheet days) within both EEZs and high seas has generally increased across the period 2010-2015, although overall effort in 2014 and 2015 was the lowest since 2010. Total effort increased by 2% from 2014 to 2015. Larger effort changes have been seen within EEZs compared to high seas. The proportion of overall effort has generally increased in the high seas over time, with around 29% of the VMS days occurring within the high seas in 2015 (Table 3). Between 67% and 81% 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).

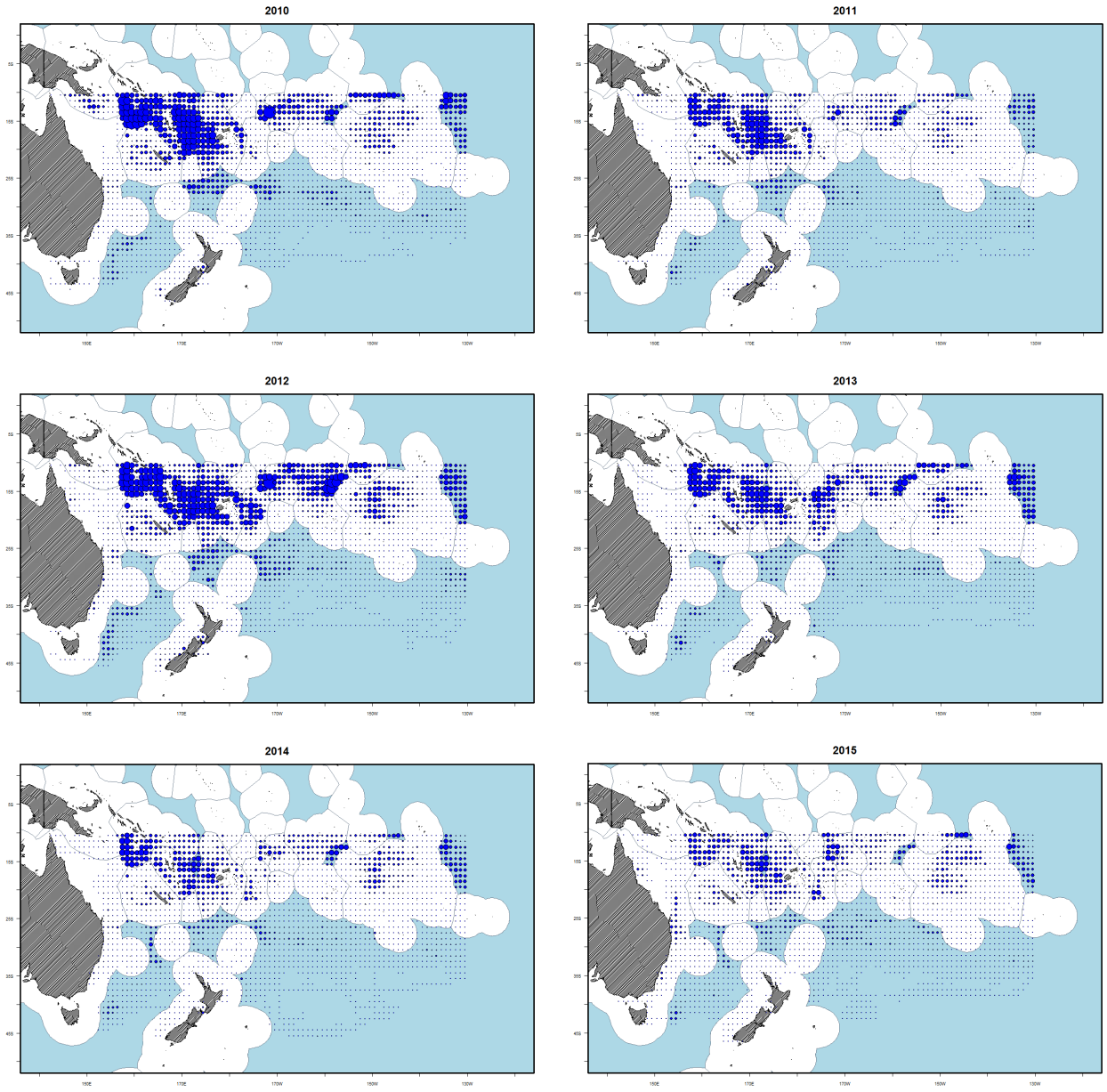

Figure 4. Longline VMS days at sea (augmented by logsheets) within the southern WCP-CA at 1°x1° (excluding archipelagic waters), south of 10°S. Maximum circle size = 1,383 days.

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).

	2010	2011	2012	2013	2014	2015
EEZs	74,825	76,419	82,180	85,434	68,734	70,415
International waters (IW)	21,362	23,796	24,021	32,463	28,122	28,392
Total	96,187	100,216	106,201	117,897	96,856	98,807
% EEZs	77.8	76.3	77.4	72.5	71.0	71.3
% High Seas	22.2	23.7	22.6	27.5	29.0	28.7

Catch per unit effort

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

- Japanese longline CPUE in 2015 (1.18 fish per 100 hooks) was a 22% decrease on 2014, but a 10% increase on 2010-14 average;
- Korean longline CPUE in 2015 (0.15 fish per 100 hooks) was a 50% increase on 2014 but a 13% decrease on 2010-14 average;
- Chinese longline CPUE in 2015 (0.95 fish per 100 hooks) was a 1% decrease on 2014 and a 7% decrease on 2010-14 average;
- Chinese Taipei longline CPUE in 2015 (1.09 fish per 100 hooks) was a 9% decrease on 2014 and a 7% increase on 2010-14 average.

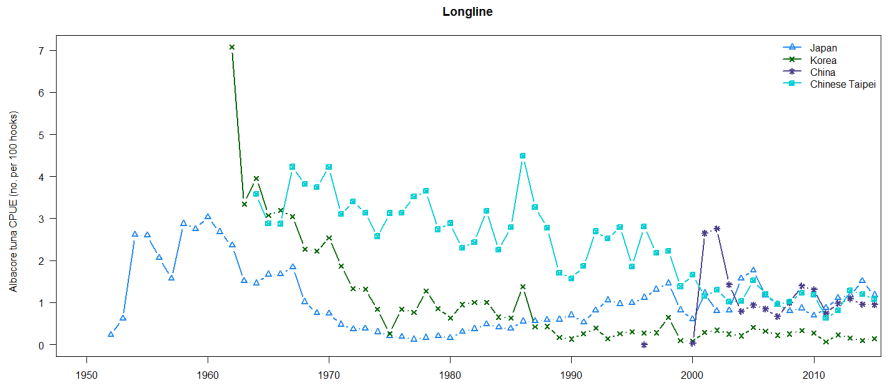

Figure 5. Trends in the nominal CPUE (number of fish per 100 hooks) over time for key distant water fleets in the south Pacific Ocean.

Examining longer term trends, the nominal CPUE for the Korean fleet has declined by 47% from the 1991-2000 average, while that for the Chinese Taipei fleet has declined by 50%. In contrast, that for the Japanese fleet has increased by 21% (from a low baseline level).

The relative spatial pattern of CPUE is presented in Figure 6 for two time periods, and for 2015. In the period 1986-2000, catch rates were relatively high across much of the southern WCP-CA, in particular within high seas areas and the EEZs of New Caledonia, Vanuatu and Tonga. Catch rates in the recent

period (2001-2015) are generally lower across the region, with northern Tonga, American Samoa and the Cook Islands latitudinal band of 15°S, as well as some high seas areas, showing relatively high catch rates for that period. It is notable that increases in effort within particular 5°x5° squares are generally matched by declines in CPUE.

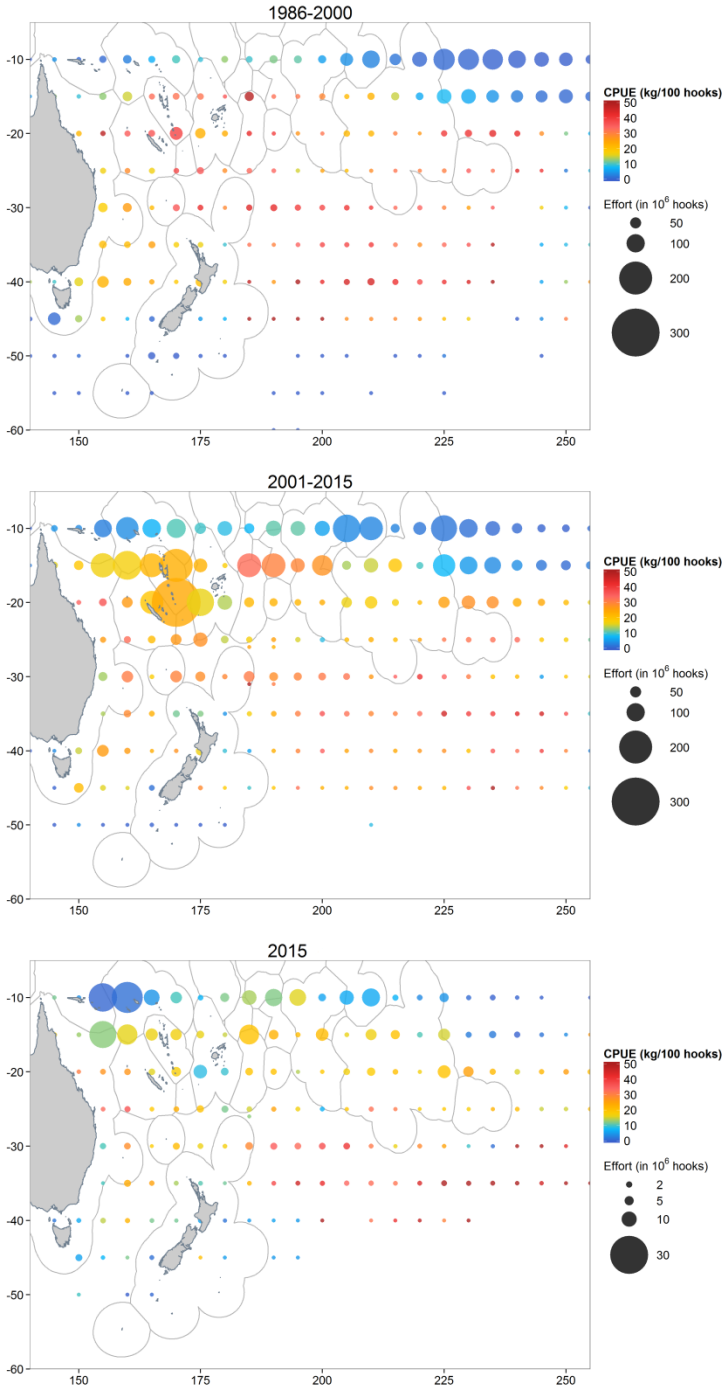

Figure 6. Albacore tuna longline CPUE distribution for the period 1986-2000 (top), 2001-2015 (middle) and 2015 (bottom). CPUE (kg/100 hooks) for a given 5°x5° square is indicated by the colour of the circle, while the relative size of the circle give an indication of the underlying effort over the period (millions of hooks). Note the change in scales for the 2015 plot.

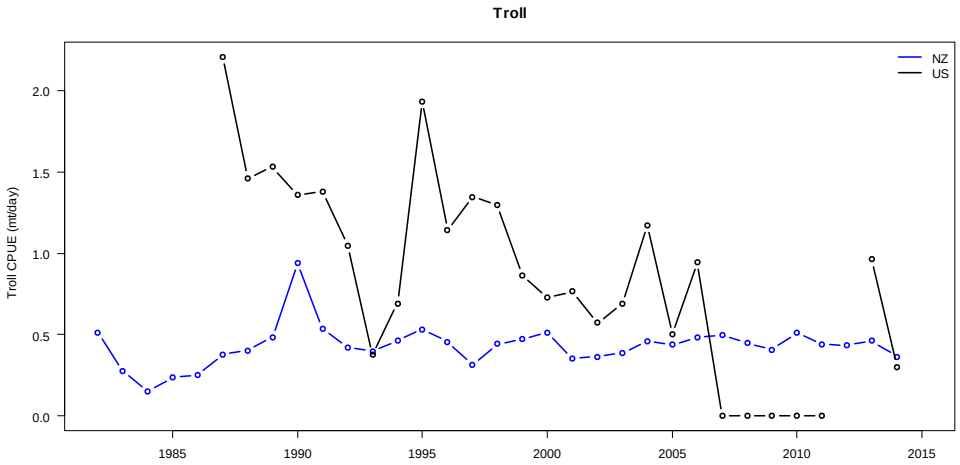

Figure 7. Trends in troll CPUE (albacore mt/day) over time for two troll fleets.

Figure 7 presents nominal south Pacific albacore CPUE series for two troll fleets. The CPUE of the US fleet generally declined over the period 1987 to 2006, with catch rates in the most recent years of activity being comparable to that in the mid-2000s. By comparison, the nominal CPUE of the New Zealand fleet has generally been lower, but relatively stable.

Transshipment information

High seas transshipment data are available from July 2010 to May 2016 (Figure 8); 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 September 2014 (2,649 mt) of which just over 70% was reported by Vanuatu (1,896 mt), and the highest peak in the time series in September 2015 (2,941 mt), almost 90% of which was by China (1,102 mt) and Vanuatu (1,509 mt). 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.

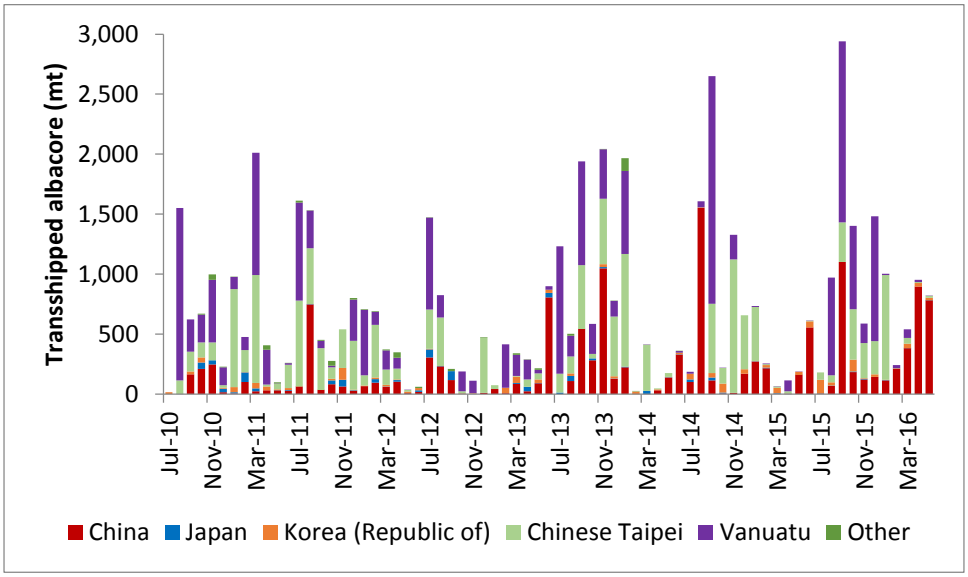

Figure 8. Reported transshipment (mt) by flag and month (July 2010 to May 2016). Source: WCPFC Transshipment Events Database (29 June 2016). 'Other' includes Belize, Indonesia, Philippines and Solomon Islands.

Table 4. Annual total and monthly average transshipment in mt (July 2010 to May 2016).

Year	Annual total	Monthly average
2010*	4,091	682
2011	9,454	788
2012	5,502	458
2013	9,321	777
2014	9,643	804
2015	9,544	795
2016**	3,563	713

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

Albacore stock status

The last assessment for South Pacific albacore was performed in 2015 (Harley et al., 2015) and estimated the stock status averaged over the period 2009-2012 ('current') and 2013 ('latest'), relative to agreed reference points. This assessment contained significant improvements to the previous (2012) assessment including: improvements to the MULTIFAN-CL modelling framework, a regional disaggregated spatial structure, access to operational data for construction of CPUE indices and regional weights, age-length data to improve growth estimation, and additional tagging data. Further, the regional structure of the model was changed to cover the southern Convention area only, and therefore was better aligned with the other tuna assessments. Natural mortality was set at 0.3 in the reference case for consistency with the value used in assessments performed in other RFMOs.

SC11 provided advice to the Commission based upon the 'reference case' assessment model, and characterised uncertainty based upon 18 model runs describing dynamics under different levels of

natural mortality, stock recruitment relationship steepness, and weighting of the input length data. Estimates are presented in Table 5, and the Majuro plot in Figure 9.

Table 5. Estimates of reference points and stock status from the last (2015) south Pacific albacore tuna stock assessment (southern WCPFC region only), based upon the single reference case run, and the 18 runs used to capture uncertainty (5th percentile, median and 95th percentile).

Management Quantity	2015 reference case	5%	Grid Median	95%
MSY (mt)	76,800	62,260	84,980	129,814
$SB_{latest}/SB_{F=0}$	0.40	0.30	0.44	0.60
$F_{current}/F_{MSY}$	0.39	0.13	0.34	0.62
SB_{latest}/SB_{MSY}	2.86	1.74	3.20	7.03
SB_{MSY}	57,430	35,762	59,180	90,778
$SB_{F=0}$	408,361	392,358	442,163	486,146

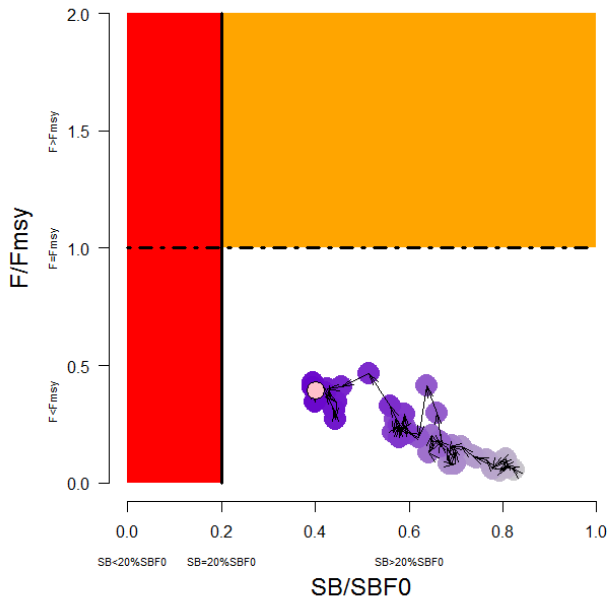

Figure 9. Temporal trend for the reference case model in stock status relative to $SB_{F=0}$ (x-axis) and F_{MSY} (y-axis). The red zone represents spawning potential levels lower than the agreed LRP which is marked with the solid black line ($0.2SB_{F=0}$). The orange region is for fishing mortality greater than F_{MSY} ($F=F_{MSY}$; marked with the black dashed line). The pink circle is $SB_{2013}/SB_{F=0}$ (where $SB_{F=0}$ was the average over the period 2003-2012).

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 ($20\%SB_{2003\text{-}2012,\ F=0}$), stochastic 20-year effort-based projections were performed under different assumptions of population dynamics (defined by nine stock assessment

runs from the 2015 Multifan-CL stock assessment, a subset of those selected by SC11 to present key uncertainties within SC11 advice and capturing uncertainty in stock recruitment steepness and natural mortality), 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).

There had been some small reductions in southern longline effort in 2014 compared to 2013 (Figure 3), but 2015 effort levels are currently considered uncertain. We therefore update the status quo projection analysis presented in SPC-OFP and WCPFC Secretariat (2015), assuming future southern longline and troll fishery effort would continue into the future at levels equal to those seen in 2014 (based on the information available to SPC as at 2nd June 2016). 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 10).

Across the nine stock assessment models used within the analysis, the average stock status in 2013 (the last year of the assessment) was $SB/SB_{F=0}$ = 0.41. If 2014 fishing effort levels continue into the future, however, the stock is predicted to continue to decline on average, falling to $SB/SB_{F=0}$ = 0.32 in 2033, identical to the level seen under 2013 effort conditions. The risk of falling below the LRP was reduced very slightly to 19% (approximately a 1 in 5 chance). Furthermore, the CPUE was still estimated to decline by 14% from 2013 levels. While effort overall has shown a small decline between 2013 and 2014 therefore, the amount of that decline, combined with changes in the distribution of effort across the fleets within the south Pacific albacore assessment, resulted in little overall change in the status quo projection results.

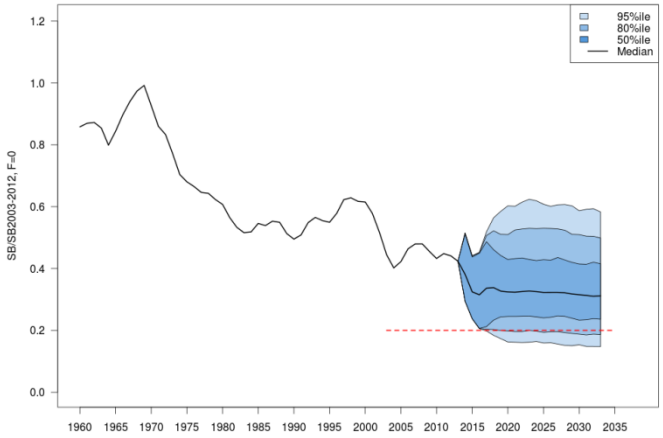

Figure 10. Stochastic projections of adult stock status under 2014 longline and troll effort levels. The limit reference point (20% $SB_{F=0}$) is indicated by horizontal dashed red line. Note: from 1960 up to 2013 inclusive the line represents the median across the 9 assessment model runs (structural uncertainty only); uncertainty after 2013 represents both structural uncertainty and stochastic recruitment (1800 simulation runs).

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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, 2000–2014.

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 (or nationality attributed by charter arrangements)	ANNUAL SOUTH PACIFIC ALBACORE LONGLINE CATCH ESTIMATES BY FLAG															
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Australia	381	591	553	490	667	743	2591	1925	1277	1523	745	653	572	647	579	773
Belize	191	4050	1467	885	353	7	0	164	7	26	10	105	32			
Cook Islands		2	490	1358	1869	2371	2223	2644	2224	1551	2423	2182	2757	1354	1276	1167
China	2030	2495	2704	6002	5828	4026	7104	5415	15046	20079	12896	11842	24516	23763	14460	14926
EU (Spain)					2	2	0	0	33	35	6	3	2	2	1	0
Fiji	5429	7269	7298	6318	10917	11065	11454	6942	9265	12100	8633	9964	9382	8684	7104	7468
Federated States of Micronesia	0	0		0	0	0	0	0	0	0	1	1	168	649	328	69
Japan	2240	3337	2645	3145	4005	4651	3328	3082	2371	2824	2637	2168	2085	1818	1403	217
Kiribati	0	0		0	0						66	289	349	40	7	358
Korea	591	1729	2854	1394	746	2167	798	1082	1143	1208	1045	488	898	769	689	692
New Caledonia	895	1020	1165	1111	1468	1590	1358	1324	1506	1649	1939	1736	1715	1714	1630	1583
Niue						55	213	216	337	154	97					
New Zealand	1344	2614	2545	2971	1248	602	496	357	382	422	460	418	266	302	311	223
French Polynesia	3473	4261	4557	3846	2218	2426	2918	3957	3068	3560	3483	3225	3594	3512	3744	3367
Papua New Guinea	105	72	82	645	1529	2181	1741	1556	437	807	791	245	693	235	308	338
EU (Portugal)												4	1	67	1	0
Solomon Islands	224	54	121	95	207	0					7705	893	0	0	14233	10742
Tonga	862	1268	1189	611	182	283	414	390	220	124	57	34	20	13	25	29
Tuvalu												184	432	92	78	102
Chinese Taipei	9598	12821	16065	12240	8424	9256	9124	8973	7601	11551	13051	13334	11737	13495	7087	7892
United States of America	1083	3860	6106	4234	2622	3062	4150	5299	3687	3938	4086	2756	3348	2186	1557	1796
Vanuatu		655	5276	3160	6218	7816	8124	6250	4840	7932	10074	4730	6666	8542	4356	4298
Wallis and Futuna												3				
Samoa	4067	4820	4223	2253	1233	1263	2113	3113	2342	2816	2529	1415	2038	1642	802	851
Total	32513	50918	59340	50758	49736	53566	58149	52689	55786	72299	72734	56672	71271	69526	59979	56891

Table A1.2. Annual south Pacific albacore longline catch estimates by EEZ and Vessel Nation, 2000–2014.

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	2014	2015
American Samoa	US	626	3217	5353	3212	2019	2880	4078	4667	2963	3299	3065	2224	2414	1760	1277	1601
Australia	AU	359	554	505	391	587	619	2526	1867	1256	1471	706	627	529	592	515	742
Cook Islands	BZ				70												
	CK		2	490	1344	1866	2266	1954	2327	1918	1362	2230	2178	2729	1207	1147	977
	CN												148	2970	2223	3192	1843
	FJ											133	385	325	79	0	1
	FM													154	636	307	33
	KI											30	257	244	29	0	
	PF																1
	CT				8	0											
	US			6	0	0		0	851	204	1775	1337	449	679	0		0
	VU		7	598	411	297	16		304	370	476	729	335	539	249	152	68
	WS				15	10					1772	1514	2110	3087	1860	7	3
Fiji	CK						15										
	CN			77	82	212	353	288	215	138	376	411	298	430	303	203	145
	FJ	4118	6557	5527	3707	5698	5242	5324	3353	4382	5243	5382	3659	3790	3243	3061	2085
	KR		0									11	69		38		
	NZ								80								
	CT	264	672	419	138	54	5	3	10	11	8	6	12	0	6	6	4
	VU		187	304	118	22	1	5	0	2		1	31	1	356		4

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
High Seas	AU	22	37	48	99	80	124	65	58	21	52	39	26	43	55	64	31
	BZ	31	2800	1467	805	2	7	0	19	0	2						
	CK			0	14	3	6	84	168	180	30	56	4	21	25	2	1
	CN	2028	2413	2464	5544	5170	2032	3222	2912	12406	14945	10746	7632	16218	12037	5042	7701
	ES					2	2	0	0	33	35	6	3	2	2	1	0
	FJ	362	213	715	1337	2135	2198	2141	1071	1340	2120	1299	2501	2523	1854	1735	3592
	FM	0	0		0	0	0	0	0	0	0	1	1	13	13	22	36
	JP	2072	3176	2463	2905	3978	4530	1882	1654	1382	1563	906	1643	1128	1247	1339	217
	KI				0							36	0	17	3	1	10
	KR	284	1069	1834	1095	441	1786	300	407	410	520	404	226	421	424	149	141
	NC	8	1	4	23	94	10	8	12	22	38	16	4	14	2	6	12
	NU							2									
	NZ	10	21	23	35	2	0	0	0	0	0	0	0		0	0	
	PF	36		2	19	8	134	72	33	8	0	1	2	3	17	1	
	PT												4	1	67	1	0
	SB	3	0		1	1						2851	108	0	0	2267	820
	TO	4	194	344	293	3	27	9	36						0	1	
	TV												13	16	7	1	1
	CT	7335	11162	14301	11138	6521	4493	2549	2184	1398	2932	5302	3630	2472	3380	3332	3178
	US	457	636	156	558	307	166	72	329	267	163	292	197	394	177	128	127
	VU		276	4053	1580	4819	5612	5017	4081	3214	5149	7765	1710	2184	2780	2411	2190
	WS													1	2	0	
Jarvis	US				53									0		0	
Kiribati	BZ					351								32			
	CN	2	82		48	9	0	0	0	1	157	398	208	292	223	308	851
	FJ												16	41	29	145	113
	JP	43	70	53	40	27	11	2		9	38	19	13	45	8	9	
	KI	0	0		0	0							32	46	3	1	
	KR	225	578	699	262	240	135	134	190	140	262	376	99	348	188	349	482
	TV												3	48			
	CT	1	0	22	129	116	28	14	267	110	292	50	153	403	428	583	380
	US	0	0														
	VU				233	97	65	150	219	126	471	376	73	75	43	158	125
New Caledonia	NC	885	1015	1160	1087	1367	1579	1348	1312	1484	1611	1923	1732	1700	1712	1624	1570

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Niue	CK							46			85	94			101	45	
	FJ														272	260	203
	NU						55	211	216	337	154	97					
	CT			34			0									18	3
Non-attributed non-high seas area	FJ	2			17	5	9	4	4	2	12	13	7	8			4
	NC	2	4	1	1	7	0	2						1			1
	VU				1		2	0	2	0	14	1	0				
New Zealand	NZ	1334	2593	2522	2936	1246	602	496	277	382	422	460	418	266	302	311	223
French Polynesia	KR	27	0														
	PF	3437	4261	4555	3819	2210	2259	2846	3924	3060	3560	3482	3223	3591	3495	3743	3367
Papua New Guinea	PG	105	72	82	645	1529	2181	1741	1556	437	807	791	245	693	235	308	338
	CT							49	363	71	58	4	59	110	6	0	18
Solomon Islands	BZ				10	0			145	7	24	10	105				
	CK							66		12	16			5	21	82	
	CN			17	102	164	439	1441	975	1315	2379	465	1046	1741	3059	1079	951
	FJ	9	2	171	58	437	284	787	611	1273	2699	446	1250	1334	1773	779	1237
	JP	85	69	128	196		110	1437	1428	980	1223	1471	506	855	563	55	
	KI														5		
	KR		0	76	16	24	83	337	313	463	299	40	43	111	96	57	11
	SB	221	54	121	94	206	0					4854	785	0	0	11966	9922
	TV												12				
	CT	2	44	272	170	892	2401	3325	2631	3793	4619	3432	5912	5710	5531	1621	0
	VU			307	311	736	626	1159	687	571	318	69	190	901	2092	1720	197
Tokelau	CK									33							189
	FJ												73	92		2	
	KI													26	0	5	348
	TV												17	134			
	CT												16				
	US									88							
	VU															0	1776
Tonga	CN													11	194	106	58
	FJ					17								29	121	0	3
	TO	858	1074	845	318	179	256	405	354	220	124	57	34	20	13	24	29
	CT												4	1523	2914	938	4305

EEZ/high seas	Flag	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Tuvalu	CK								72	20	54	33		3			
	CN								1			0	77	0			
	FJ				30	189	99	1	147	15	123	174	157	533	187	126	99
	JP	41	22	2	3	0		0				241	5	57			
	KI													17		0	
	KR	55	82	184	18	41	162	6	171	123	127	215	51	19	22	135	57
	TV												140	234	85	77	101
	CT	128	0		0	4	15	0		1		12	5	0	88	4	1
	US													1			
	VU							2	85		16	5	22	49	1075	0	3
Vanuatu	BZ	160	1251														
	CK						84	73	78	62	3	10					
	CN			146	226	273	1202	2153	1313	1187	2222	876	2433	2854	5724	4530	3378
	FJ	937	497	885	1169	2436	3233	3198	1757	2254	1904	1186	1916	708	1125	996	133
	JP							7									
	KR			62	4			21		7							
	CT	1869	943	1010	665	837	2315	3183	2667	2013	1868	2909	3094	839	1143	587	4
	VU		192	612	901	535	1509	1790	1175	928	192	343	594	368	336	59	
Wallis et Futuna	PF						33										
	WF												3				
Western Samoa	WS	4067	4820	4205	2253	1233	1263	2113	3113	2342	2816	2529	1415	2037	1640	801	851

Table A1.3. Annual south Pacific albacore troll catch estimates by flag, 2000–2015.

Flag	ANNUAL SOUTH PACIFIC ALBACORE TROLL CATCH ESTIMATES BY FLAG															
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CA	351	206	144		63	72	135	27				1				
CK	335	202	166	688	376	89	121	53							21	21
NZ	3336	2736	3012	3721	3212	2855	2043	1736	3352	1794	1832	2787	2727	2836	1937	2425
US	2433	2107	1337	1574	960	576	587	272	151	237	307	471	235	390	263	151
TOTAL	6455	5251	4659	5983	4611	3592	2886	2088	3503	2031	2139	3259	2962	3226	2221	2597

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 2010-2015, by geographic region of the southern WCPFC-CA. 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 2015;
- 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 (Figure A1).

International waters code	2010	2011	2012	2013	2014	2015
I2	175	196	251	306	264	369
I5	5,878	4,898	5,284	11,049	8,437	7,992
I7	10,668	12,665	10,811	13,659	13,458	15,074
I8	2,856	3,425	2,383	2,968	2,774	3,060
I9	1,785	2,612	5,291	4,482	3,188	1,896
Total	21,362	23,796	24,021	32,463	28,122	28,392

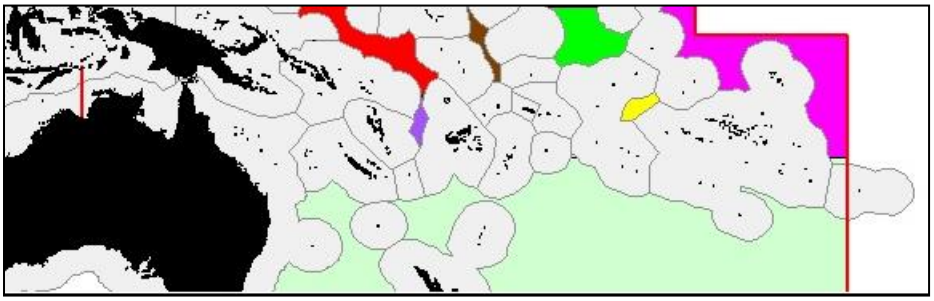

Figure A1. Map of International Waters in the southerly WCPFC-CA

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 albacore based on CMM 2009-06 reporting.

Table A3.1. High Seas transshipment data for albacore, by flag, year and month from July 2010 – June 2016
Notes:

1. The requirement to report (within 15 days of transshipment) high seas transshipment activities commenced in July 2010.
2. The data refer to high seas transshipments inside and outside the WCPFC Convention Area, and it should be noted that a proportion of the catches will likely have been caught within EEZs in the Convention Area and the IATTC Convention area.
3. Weights are in kg.

2010

CCM responsible for reporting for the Fishing Vessel	Jul	Aug	Sept	Oct	Nov	Dec
Belize					2,837	
China			166,000	210,668	247,192	17,091
Indonesia					44,170	869
Japan		900		53,543	35,437	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	521,630	148,835
Total	16,984	1,550,900	624,455	671,192	999,075	228,614

2011

CCM responsible for reporting for the Fishing Vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	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		1,850	5,777	822	2,900		32,364	57,286	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	597	13,700	816,794	313,038	62,000	12,857		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

2012

CCM responsible for reporting for the Fishing Vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Belize							841					
China	67,701	95,807	61,927	103,977	8,055	20,149	305,884	231,568	118,390	6,507		11,276
Indonesia	1,894	4,820	1,900			11,505						4,656
Japan		31,016	1,774	12,999	1,575	13,449	66,858	2,597	72,544		3,281	
Korea (Republic of)	3,777	13,163	14,234	5,454	12,710	16,829	6,312				4,920	
Philippines	1,500		4,684						19,278			
Solomon Islands				45,500								
Chinese Taipei	87,183	438,492	127,178	91,510	12,089		326,644	406,037		18,305		457,106
Vanuatu	544,933	108,000	161,242	90,280	1,657		764,900	185,000		165,000	105,000	
Total	706,988	691,298	372,939	349,720	36,086	61,932	1,471,439	825,202	210,212	189,812	113,201	473,038

2013

CCM responsible for reporting for the Fishing Vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
China	42,364	7,376	84,590	24,498	90,383	805,828		110,513	542,675	282,996	1,048,906	127,757
Indonesia			6,891	286	5,800							2,403
Japan			9,481	38,422	3,100	39,089	13,602	42,460	147	14,639	10,539	2,765
Korea (Republic of)		45,342	53,797		29,523	26,676		20,268			24,377	18,848
Philippines			4,959		7,982			15,527			2,798	
Chinese Taipei	33,541		5,000	59,423	50,711		157,174	140,100	532,164	39,331	543,864	498,889
Vanuatu		361,951	175,489	165,000	28,228	28,496	1,062,757	174,754	864,995	249,017	412,360	130,000
Total	75,905	414,669	340,207	287,629	215,727	900,089	1,233,533	503,622	1,939,981	585,983	2,042,844	780,662

2014

CCM responsible for reporting for the Fishing Vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
China	224,998	875	26	31,578	138,573	331,788	102,822	1,551,373	115,965	6,825	12,505	171,219
Indonesia	940,429	636	386,115	8,688	31,399	529			576,390	129,558	1,109,509	449,172
Japan						3,728						
Korea (Republic of)	3,626		27,308		2,000	200	20,533		23,693	8,005		
Philippines		22,285		8,844	3,393	13,958	46,724	6,004	37,687	74,214		37,621
Solomon Islands		1,162										
Chinese Taipei	105,420											
Vanuatu	691,021		2,620			12,639	17,935	49,549	1,895,708	578	205,667	
Total	1,965,494	24,958	416,069	49,110	175,365	362,842	188,014	1,606,926	2,649,443	219,180	1,327,681	658,012

2015

CCM responsible for reporting for the Fishing Vessel	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
China	273,169	215,527	3,889	16	160,944	557,865	5,512	70,724	1,102,161	182,897	122,120	144,406
Chinese Taipei	449,399	7,915	12,663	17,320		3,572	61,526	59,938	329,500	419,241	294,284	274,693
Japan	1,515	5,101	5,645	2,221	119		647	1,466		5,587	6,566	
Korea (Republic of)	2,444	22,212	43,063	3,759	25,975	50,251	113,491	26,143		100,741	4,395	21,934
Vanuatu	9,294	5,049	409	90,697	2,505	4,601		812,870	1,509,490	693,072	160,944	1,042,590
Total	735,821	255,804	65,669	114,013	189,543	616,289	181,176	971,141	2,941,151	1,401,538	588,309	1,483,623

2016

CCM responsible for reporting for the Fishing Vessel	Jan	Feb	Mar	Apr	May
China	115,400	211,774	383,130	898,315	783,017
Chinese Taipei	873,578	407	47,290	6,081	17,946
Japan	2,560		331		134
Korea (Republic of)	2,026	3,631	37,070	29,140	20,184
Vanuatu	9,871	28,238	71,941	20,172	352
Total	1,003,435	244,050	539,762	953,708	821,633