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**Trends in the South Pacific albacore longline and troll fisheries**

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## Executive summary

This paper presents a compendium of fishery indicators for South Pacific albacore tuna, as requested at previous Western and Central Pacific Fisheries Commission (WCPFC) meetings. These indicators include: total catch; catch by gear; and longline effort and nominal troll and longline CPUE trends, along with their spatial patterns. Commentary provided includes comparisons of 2021 values to 2020 and to the average over 2016-2020. Information provided includes data loaded into databases as of 12 July 2022. Note that catch levels and their distribution among areas may change as more data become available. This paper complements the information provided by Hare, Pilling, and Williams (2022) who summarise the latest trends for the main target species for the fisheries occurring in the WCPFC convention area (WCPFC-CA).

The most recent estimates of stock status (from the 2021 stock assessment for the entire south Pacific, Castillo-Jordan et al. 2021) are included, along with stochastic projections from the full structural uncertainty grid, to provide an indication of future stock status under status quo conditions. Furthermore, transshipment data are available over the period from the inception of transshipment reporting (July 2010) to July 2022. Data presented represent high seas transshipments only; they do not include in-port or in-zone transshipments.

## Introduction

At the 7<sup>th</sup> Technical and Compliance Committee meeting (TCC), members requested the preparation of a paper on South Pacific albacore. That request indicated the paper should contain all available data on catches and transshipments, and should highlight trends. The paper was first prepared by the scientific services provider and the WCPFC Secretariat for WCPFC8 in March 2012. It has since been updated frequently, taking into consideration further requests from members.

This paper presents trends in catch, effort and catch per unit effort (CPUE), both spatially and temporally for the South Pacific albacore (SPA) fishery. Depending on the context, summaries are computed for the South Pacific (all waters south of the equator), for the albacore target longline fishery region (Pacific waters south of 10°S), and also for Exclusive Economic Zones (EEZs) and High Seas regions (HS) within the WCPFC-Convention Area (WCPFC-CA). In addition, information on transshipment patterns is presented, as requested in previous reports (WCPFC and SPC-OFP 2013).

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 population dynamics models, 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 12 July 2022. The overall catch, and its distribution among spatial areas, may change as more data becomes available. This is particularly the case for the eastern Pacific Ocean (EPO), where catch estimates appear to be incomplete for 2021, and possibly 2020. These will be revised with further data previsions. 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. The stock status information is derived from the most recent stock assessment of south Pacific albacore presented in 2021 (Castillo-Jordan et al. 2021).

## Patterns of longline and troll fishing

The longline and troll fleets are the two main groups of commercial vessels exploiting South Pacific albacore. In this section we examine trends in their catch, effort and CPUE. Catch and effort information come primarily from logsheet returns or, particularly 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 at 94,504 mt (all gears) in 2017 (Figure 1). Catch by longliners represented 91% of the catch weight in 2021 at 47,377 mt. The 2021 longline catch was a 29% decrease from 2020. Provisional troll catch (4,037 mt) was a 14% decrease from 2020. Very small amounts of catch by ‘other’ gears also occurred. The annual contribution of the EPO catch south of the equator has ranged from 6–23% of the total catch over the past 10 years. The provisional estimate for the 2019 EPO share is 6% of the total catch, but it is likely the EPO data are still incomplete.

In comparison, the 2021 total albacore catch within the southern part of the WCPFC-CA<sup>2</sup> (Table 1) was 46,375 mt and the longline catch was 42,307 mt. The 2021 longline catch in the southern WCPFC-CA was a 25% decrease from 2020. High seas longline catch estimates represent 52% of the 2021 total, and have ranged from 29–52% of the total since 2010. By flag (or attributed nationality based on charter agreements), China and Fiji had the highest catch estimates of South Pacific albacore in 2021 (15,974 mt and 6,250 mt respectively), representing 53% of the total longline catch (Table 5), with much of China’s catch taken on the high seas (Table 6).

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<sup>2</sup>Note that these annual catch estimate-based tables approximate the southern area of the WCPFC-CA as far as possible, given that some EEZs and high seas areas span the equator.

Four flag states reported troll catch within the WCPFC-CA during the period 2000 to 2021, namely Canada, the Cook Islands, USA and New Zealand (Table 7) with catch totaling 4,068 mt in 2021. Troll activity in 2021 was exclusively in the New Zealand EEZ and on the high seas (Table 2). Catch estimates for 2021 were 685 mt for the high seas and 3,383 mt for the New Zealand EEZ. The total troll catch within the WCPFC-CA in 2021 was a 14% decrease from the 2020 catch.

The spatial pattern of South Pacific albacore catch over the long-term (1950–2015), the last 5 years excluding the most recent year (2016–2020), and 2021 alone, are shown in Figure 2. In recent years, catch has been concentrated in EEZ's and several high seas zones in the 10-20°S latitudinal band. Note that, while 2021 estimates remain provisional, the geographic distribution of catch is generally consistent with that observed in recent years, with the exception of the scarcity of fishing in the EPO.

## Effort

It is challenging to identify the specific species being targeted by longline vessels, particularly within the aggregate data received from some fleets fishing on the high seas. To compare estimates of effort to the declared South Pacific albacore catch, we have considered fishing effort south of 10°S to approximate South Pacific albacore targeting (noting that this will include longline effort targeting swordfish, southern bluefin, and in some cases tropical tunas), in an effort to exclude most of the tropical longline fishery effort.

Raised effort data for the southern WCPFC-CA south of 10°S were available up to 2021 (Figure 3). The longline effort in this region was estimated at 254 million hooks in 2021, although we note there is considerable uncertainty in effort estimates for this most recent year. The number of deployed hooks in 2021 within the WCPFC-CA south of 10°S was a 18% decrease from in 2020, and a 24% decrease from the peak of 334 million hooks fished in 2010.

Effort data from VMS provides more 'up to date' information than raised logsheet data, given that logsheet effort for recent years may be incomplete, and the uncertainty in raised annual logsheet effort estimates for 2021 is high. The VMS data reported are restricted to the WCPFC-CA waters south of 10°S, in an effort to again remove fishing targeting tropical tunas. The VMS data represents fishing days which are identified using a fishing activity classification algorithm that accounts for speed and changes in bearing of the vessel. It must be noted that a new algorithm has been adopted since the 2019 report and this has been applied to all available VMS data, which means that estimates are comparable among years, but not with previous reports.

VMS data does not explicitly indicate the species targeted by vessels during fishing. In addition, 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 not available. A list of notes on the VMS data and a table of effort by high seas area are provided in Appendix 1. To overcome the absence of VMS data for some EEZs, data were augmented with logsheet information in these locations (New Caledonia and French Polynesia).

Effort south of 10°S (VMS fishing days, augmented by logsheet days) both within EEZs and on the high seas generally increased through to 2013, then declined to a lower average level before rebounding in 2019 and 2020. Around 28% of the VMS days occurred within the high seas in 2021 (Table 3). Overall effort has increased in the EEZs and had been decreasing on the high seas until a sharp upturn in 2019 (Table 3). Of the VMS days fished within the international waters in 2021, the most important high seas areas were Region I5, which is east of the Line Islands and French Polynesia, and Region I7, which is the region north and northeast of New Zealand (Table 9; Figure 12).

## Catch per unit effort

Figure 5 presents nominal South Pacific albacore CPUE series by key longline fleets south of 10° south. Note, the values presented in Hare, Pilling, and Williams (2022) are south of the equator, and are measured in numbers, rather than weights of fish, and will therefore differ from those presented here. Some key changes in CPUE in the recent periods were:

- Japanese longline CPUE in 2021 (14.8 kg per 100 hooks) was a 14% decrease on 2020, the 2016-2020 average was 13.6 kg per 100 hooks;
- Fiji longline CPUE in 2021 (18.5 kg per 100 hooks) was a 19% increase on 2020, the 2016-2020 average was 17.4 kg per 100 hooks;
- Chinese longline CPUE in 2021 (12.9kg per 100 hooks) was a 22% decrease on 2020, the 2016-2020 average was 24 kg per 100 hooks;
- Chinese Taipei longline CPUE in 2021 (17.4 kg per 100 hooks) was a 22% decrease on 2020, the 2016-2020 average was 25.5 kg per 100 hooks.

Examining longer-term trends, the average nominal CPUE for the Fiji fleet was 23.7 kg per 100 hooks between 1991 and 2000, while that for the Chinese Taipei fleet was 34.9 kg per 100 hooks. In contrast, the Japanese fleet averaged 18 kg per 100 hooks over that time.

The relative spatial pattern of CPUE is presented in Figure 6 for two time periods. Over the period 2000–2018, catch rates were relatively high across much of the southern WCPFC-CA, in particular within high seas areas. Catch rates in the most recent three year period (2019–2021) are generally lower across the region. It is notable that increases in effort within particular  $5^{\circ} \times 5^{\circ}$  squares are generally matched by declines in CPUE. The CPUE in the high seas east of New Zealand was high in the most recent years.

Figure 7 presents nominal South Pacific albacore CPUE series for two troll fleets. The CPUE of the US fleet was highly variable with a general decline over the period 1987 to 2006, with catch rates in the most recent years of activity being comparable to that in the mid-2000s, with the exception of 2019-20 where CPUE was very high. 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 July 2022, but no in-port or in-zone transshipment data are presented. Fluctuations in reported transshipments may reflect logistical or operational factors, rather than fishing activity. It is noted that South Pacific albacore would have historically 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 around September of each year (Figure 8). Vanuatu has had the highest transshipment volumes in the past, as averaged over the entire period. The highest peak in the time series was in October 2017 ( $\sim 4,000$  mt) (Figure 8), of which, about 2,500 mt was attributable to China and 1,000 mt to Vanuatu (Table A3-8). 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 18 months. Transshipment data for 2021 to 2022 should, therefore, be considered preliminary and subject to change.

## Albacore stock status

A South Pacific albacore stock assessment was completed in 2021 (Castillo-Jordan et al. 2021), and used data up until the end of 2019. The Scientific Committee meeting in 2021 (SC17) provided advice to the Commission based upon the structural uncertainty grid that was used to characterize uncertainty in the assessment. This included different levels of the recruitment distribution, stock recruitment relationship steepness, the weighting of the input length data, movement estimates (one level was downweighted for this axis) and an axis for growth/natural mortality combinations. Stock status for this uncertainty grid is shown on the Majuro plot in Figure 9.

Across the 72 stock assessment models used within the analysis, the median stock status in recent years (2016–2019) was  $SB_{recent}/SB_{F=0} = 0.52$  (10-90% quantiles = 0.41–0.57), which is below the interim target reference point ( $SB_{recent}/SB_{F=0} = 0.56$ ) established by the WCPFC in 2018 (WCPFC 2018).

The most recent status quo projections of this stock used catches up to and including 2019. Future catches for the southern longline and troll fisheries were assumed to continue into the future at levels equal to those taken in 2019 (based on the information available to SPC at the time of the projection work). If 2019 catch levels continue into the future, the stock is predicted to continue to decline on average towards the biomass Limit Reference Point ( $SB_{recent}/SB_{F=0} = 0.2$ ) with some risk of falling below it, before starting to recover (Figure 10).

## References

- Castillo-Jordan, C., H. Xu, J. Hampton, N. Ducharme-Barth, and P. Hamer. 2021. "Stock Assessment of South Pacific Albacore." WCPFC-SC17-2021/ST-WP-02. Electronic meeting, 11–19 August 2021.
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## Tables

Table 1: Annual southern WCPFC-CA albacore longline catch estimates (excluding archipelagic waters) by EEZ and High Seas, since 2010. Note: 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	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
American Samoa	2,838	1,784	2,416	1,769	1,377	1,760	1,511	1,511	1,552	1,062	545	715
Australia	745	652	702	757	728	945	910	830	751	796	1,158	1,072
Cook Islands	4,911	5,559	10,627	5,985	4,483	4,556	4,757	3,310	4,715	5,314	3,720	2,191
Fiji	5,771	4,165	4,287	3,642	3,916	5,643	4,784	5,871	5,466	5,140	3,913	4,258
High seas	40,349	22,910	29,765	29,707	19,984	23,045	16,818	35,803	27,407	31,376	28,357	21,841
Jarvis (USA)	0	0	0	0	0	0	0	0	0	0	0	0
Kiribati	1,290	550	1,218	819	1,258	2,578	4,752	426	72	1,165	2,699	340
Matthew and Hunter	15	6	9	0	0	2	1	2	1	2	2	32
New Caledonia	1,932	1,734	1,711	1,713	1,628	1,578	1,745	1,719	1,742	2,009	1,896	1,742
Niue	196	0	0	362	208	196	88	14	364	386	163	19
New Zealand	460	418	266	302	311	223	233	181	239	117	202	102
French Polynesia	3,482	3,224	3,591	3,495	3,744	3,418	3,276	2,148	3,058	3,439	2,812	2,689
PNG	795	294	801	237	310	459	1,185	1,613	1,451	757	755	529
Solomon Islands	6,021	6,424	8,172	9,074	13,111	6,887	3,748	5,553	7,022	4,498	2,507	2,452
Tokelau	0	108	250	0	7	1,867	2,447	1,662	632	1,970	1,220	461
Tonga	57	36	760	1,471	264	710	1,105	613	655	1,115	705	691
Tuvalu	675	467	930	1,491	475	406	1,501	1,426	944	1,448	554	245
Vanuatu	4,790	6,077	4,281	6,819	6,604	5,419	7,513	7,972	5,602	3,195	4,230	2,514
Wallis and Futuna	0	3	0	0	0	0	0	0	0	0	0	0
Samoa	2,529	1,415	2,038	1,642	800	840	823	1,638	1,364	1,442	849	414
Total	76,856	55,826	71,824	69,285	59,208	60,532	57,197	72,292	63,037	65,231	56,287	42,307
EEZ percent	48	59	59	57	66	62	71	50	57	52	50	48
HS percent	52	41	41	43	34	38	29	50	43	48	50	52

Table 2: Annual southern WCPFC-CA albacore troll catch estimates by EEZ and High Seas, Since 2010. Note: 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	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
High seas	307	472	235	390	466	189	166	855	442	874	1,926	685
New Zealand	1,832	2,787	2,727	2,836	1,937	2,425	1,969	1,959	2,272	1,907	2,825	3,383
Total	2,139	3,259	2,962	3,226	2,403	2,614	2,135	2,814	2,714	2,781	4,751	4,068
EEZ percent	86	86	92	88	81	93	92	70	84	69	59	83
HS percent	14	14	8	12	19	7	8	30	16	31	41	17

Table 3: Total VMS fishing days (augmented by logsheets for New Caledonia and French Polynesia) by year and geographic area in the WCPFC-CA south of 10°S.

EEZ	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EEZ	71,784	74,723	77,059	79,223	66,202	66,998	72,936	73,043	74,295	77,650	78,423	72,956
High seas	20,680	23,052	23,153	31,188	27,151	22,719	19,448	23,831	25,522	27,709	32,036	27,783
Total	92,464	97,775	100,212	110,411	93,353	89,717	92,384	96,875	99,818	105,359	110,459	100,739
EEZ percent	78	76	77	72	71	75	79	75	74	74	71	72
HS percent	22	24	23	28	29	25	21	25	26	26	29	28



Table 4: Annual total and monthly average transshipment of albacore in the high seas of the WCPFC-CA in metric tonnes. Note that values for 2020 and 2021 are incomplete, with data only available up to July in 2021.

Year	Annual total	Monthly average
2010	4,085	681
2011	9,367	781
2012	5,487	457
2013	9,321	777
2014	9,586	799
2015	9,943	829
2016	18,590	1,549
2017	18,193	1,516
2018	23,432	1,953
2019	22,234	1,853
2020	18,960	1,580
2021	13,099	1,092
2022	6,271	896

Table 5: Annual southern WCPFC-CA albacore longline catch estimates by Vessel Nation, 2010 - 2021. Note: 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 WCPFC-CA is approximated - some EEZ and high seas areas span the equator.

Flag	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Australia	745	653	709	773	737	949	916	831	752	798	1,163	1,073
Belize	5	52	18	7	0	0	0	0	0	0	0	0
Cook Islands	2,423	2,182	2,757	1,354	1,186	1,167	1,352	2,562	3,083	2,277	1,194	767
China	12,926	11,846	24,523	23,789	14,471	14,494	16,123	29,154	21,130	22,643	20,602	15,974
Spain (EC)	13	6	3	3	2	1	2	2	2	2	4	4
Fiji	8,603	9,947	9,369	8,708	7,016	7,016	7,274	9,763	8,854	8,343	6,405	6,250
FSM	1	1	156	634	366	1,224	1,966	250	1,461	2,098	431	745
Japan	2,635	2,057	2,048	1,752	1,151	901	1,578	1,755	1,162	1,132	1,002	893
Kiribati	66	200	349	40	7	357	509	653	340	1,123	1,854	1,025
Republic of Korea	1,027	488	892	767	691	1,013	1,387	1,134	1,064	1,693	571	359
Marshall Islands	0	0	0	0	0	0	0	0	0	0	0	0
New Caledonia	1,939	1,736	1,715	1,714	1,630	1,583	1,747	1,734	1,752	2,011	1,897	1,774
Niue	97	0	0	0	0	0	0	0	0	0	0	0
New Zealand	460	418	266	302	311	223	233	181	239	117	202	102
French Polynesia	3,483	3,225	3,594	3,512	3,744	3,418	3,277	2,148	3,058	3,439	2,812	2,689
PNG	791	245	693	235	308	336	48	627	92	39	18	0
Portugal (EC)	0	4	1	67	1	0	0	0	0	0	0	0
Solomon Islands	7,716	899	0	0	14,236	11,249	1,703	0	1,918	2,538	1,682	1,778
Tonga	57	34	20	13	25	29	42	26	23	29	13	10
Tuvalu	0	184	432	169	78	97	52	175	121	64	117	57
Chinese Taipei	16,440	12,949	11,595	13,387	7,367	7,954	11,803	12,532	9,182	8,704	10,608	3,808
USA	4,082	2,555	3,461	2,213	1,543	1,961	1,655	1,539	1,567	1,090	575	767
Vanuatu	10,817	4,726	7,185	8,202	3,540	5,722	4,582	4,855	5,554	4,482	3,724	3,689
Wallis and Futuna	0	3	0	0	0	0	0	0	0	0	0	0
Samoa	2,529	1,415	2,038	1,642	800	840	947	2,374	1,684	2,610	1,413	542

Table 6: Annual southern WCPFC-CA albacore longline catch estimates by Vessel Nation in each EEZ, 2010 - 2021. Note: 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 WCPFC-CA is approximated - some EEZ and high seas areas span the equator.

EEZ	Flag	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Am. Samoa	US	2,416	1,769	1,377	1,760	1,511	1,511	1,552	1,062	545	715
Australia	AU	702	757	728	945	910	830	751	796	1,158	1,072
	JP	0	0	0	0	1	0	0	0	0	0
Cook Islands	CK	2,726	1,223	1,073	1,040	1,267	2,370	2,299	1,196	360	295
	CN	2,970	2,223	3,186	2,238	1,542	687	940	2,612	2,887	1,149
	FJ	329	80	0	0	0	0	0	0	0	0
	FM	134	573	174	1,198	1,945	248	1,437	1,491	407	736
	KI	244	29	0	0	0	0	0	5	41	0
	KR	0	0	0	1	0	0	0	0	0	0
	TW	311	0	0	0	0	6	38	10	25	10
	US	650	267	40	75	0	0	0	0	0	0
	VU	3,263	1,590	10	4	3	0	0	0	0	1
Fiji	CN	433	305	201	324	643	214	20	10	4	5
	FJ	3,852	3,253	3,715	5,312	4,139	5,656	5,443	5,130	3,907	4,251
	KR	0	38	0	0	2	0	0	0	2	0
	TV	0	0	0	0	0	0	0	0	0	0
	TW	0	3	1	0	0	0	2	0	0	0
	VU	1	43	0	5	0	1	0	0	0	1
High seas	AU	7	16	9	4	6	1	1	2	5	1
	BZ	14	7	0	0	0	0	0	0	0	0
	CK	23	28	0	1	6	110	270	165	320	216
	CN	16,262	12,949	5,880	8,098	3,121	18,481	11,138	15,430	10,141	11,670
	ES	3	3	2	1	2	2	2	2	4	4
	FJ	2,468	1,891	1,791	1,039	1,085	1,466	1,512	1,011	1,411	923
	FM	21	61	192	25	20	2	24	606	24	9
	JP	1,091	1,181	1,089	689	579	663	364	464	873	603
	KI	16	3	1	162	13	240	283	147	452	695
	KR	427	425	163	272	464	639	499	1,186	559	353
	MH	0	0	0	0	0	0	0	0	0	0
	NC	3	1	2	4	2	14	10	0	0	0
	NZ	0	0	0	0	0	0	0	0	0	0
	PF	3	17	0	0	1	0	0	0	0	0
	PG	0	0	0	0	33	139	0	0	0	0
	PT	1	67	1	0	0	0	0	0	0	0
	SB	0	0	970	1,644	144	0	17	46	799	0
	TO	0	0	1	0	0	1	0	0	0	0
	TV	15	10	1	1	1	52	15	4	112	57
	TW	6,517	8,883	6,592	7,077	8,593	9,861	8,192	8,161	10,202	3,664
US	395	177	125	126	144	28	15	28	31	52	
VU	2,498	3,987	3,165	3,902	2,597	4,072	4,958	4,105	3,419	3,594	
WS	0	0	0	0	5	34	107	20	5	0	
Jarvis (USA)	US	0	0	0	0	0	0	0	0	0	0
Kiribati	BZ	5	0	0	0	0	0	0	0	0	0
	CN	293	216	308	1,330	3,024	170	4	80	1,322	0
	FJ	41	29	176	139	143	4	0	50	0	0
	FM	0	0	0	0	1	1	0	0	0	0
	JP	45	8	6	0	0	0	0	0	0	0
	KI	46	3	1	54	406	207	57	971	1,361	326
	KR	335	187	351	612	416	11	9	38	6	3
	TV	48	0	0	0	0	0	0	0	0	0
	TW	328	351	263	237	668	33	3	25	9	11
VU	78	26	152	205	95	0	0	1	0	0	

Mthw-Hunter	FJ	9	0	0	1	1	0	1	0	0	0
	NC	1	0	0	1	0	1	0	2	1	32
	VU	0	0	0	0	0	1	0	0	0	0
New Caledonia	NC	1,711	1,713	1,628	1,578	1,745	1,719	1,742	2,009	1,896	1,742
Niue	CK	0	85	33	0	0	0	362	386	163	19
	FJ	0	277	157	193	88	14	0	0	0	0
	NU	0	0	0	0	0	0	0	0	0	0
	TW	0	0	18	3	0	0	2	0	0	0
New Zealand	NZ	266	302	311	223	233	181	239	117	202	102
F. Polynesia	PF	3,591	3,495	3,744	3,418	3,276	2,148	3,058	3,439	2,812	2,689
PNG	CN	0	1	3	0	101	0	559	20	603	239
	JP	0	0	0	105	998	1,091	796	669	129	290
	PG	693	235	308	336	14	488	92	39	18	0
	TW	108	2	0	19	72	33	4	29	5	1
Solomon Is.	CK	5	18	79	0	0	0	0	0	0	0
	CN	1,737	2,903	239	0	1,511	3,321	3,875	1,753	1,618	667
	FJ	1,305	1,783	130	0	563	163	558	213	1	0
	JP	855	563	55	106	0	0	1	0	0	0
	KI	0	5	0	0	0	1	0	0	0	3
	KR	111	96	57	34	2	39	11	16	2	3
	SB	0	0	12,136	6,747	530	0	1,901	2,492	883	1,778
	TV	0	0	0	0	0	0	0	0	0	0
	TW	3,239	2,424	278	0	1,142	1,911	452	1	2	0
VU	919	1,282	136	0	0	119	223	23	0	0	
Tokelau	CK	0	0	0	125	78	82	152	531	351	237
	CN	0	0	0	0	5	57	6	0	3	1
	FJ	89	0	1	1	0	0	0	0	0	0
	KI	26	0	5	140	91	204	0	0	0	1
	TV	134	0	0	0	0	0	0	0	0	0
	TW	0	0	0	0	267	108	0	0	3	1
	VU	0	0	0	1,601	1,886	510	262	291	305	93
	WS	0	0	0	0	119	702	212	1,147	559	128
Tonga	CN	12	155	107	61	1	7	13	0	0	0
	FJ	29	123	1	2	1	0	131	608	329	560
	TO	20	13	24	29	42	25	23	29	13	10
	TW	700	1,179	133	618	1,061	581	489	478	363	121
Tuvalu	CK	3	0	0	0	0	0	0	0	0	0
	CN	0	3	129	148	271	475	153	78	271	229
	FJ	548	192	149	64	675	383	140	804	278	15
	JP	57	0	0	0	0	0	0	0	0	0
	KI	17	0	0	0	0	0	0	0	0	0
	KR	19	21	120	94	504	445	545	453	1	1
	TV	234	159	77	95	51	123	106	60	5	0
	TW	0	87	0	0	0	0	0	0	0	0
	US	1	0	0	0	0	0	0	0	0	0
VU	51	1,029	0	5	0	0	0	53	0	0	
Vanuatu	CK	0	0	0	0	0	0	0	0	0	0
	CN	2,817	5,034	4,419	2,295	5,904	5,743	4,423	2,660	3,752	2,014
	FJ	698	1,080	896	265	580	2,077	1,070	527	479	500
	SB	0	0	1,130	2,858	1,029	0	0	0	0	0
	TW	392	459	83	1	0	0	0	0	0	0
VU	374	246	77	0	0	152	110	8	0	0	
Wal-Futuna	WF	0	0	0	0	0	0	0	0	0	0
Samoa	WS	2,038	1,642	800	840	823	1,638	1,364	1,442	849	414

Table 7: Annual south Pacific albacore troll catch estimates in the southern WCPFC-CA, by flag, 2000–2021.

Year	Canada	Cook Islands	New Zealand	USA	Total
2000	351	335	3,336	2,433	6,455
2001	206	202	2,736	2,107	5,253
2002	144	166	3,012	1,337	4,661
2003	0	688	3,721	1,574	5,984
2004	63	376	3,212	960	4,614
2005	72	89	2,855	576	3,592
2006	135	121	2,043	587	2,886
2007	27	53	1,736	272	2,088
2008	0	0	3,352	151	3,503
2009	0	0	1,794	237	2,031
2010	0	0	1,832	307	2,139
2011	1	0	2,787	471	3,259
2012	0	0	2,727	235	2,962
2013	0	0	2,836	390	3,226
2014	0	21	1,937	445	2,403
2015	0	21	2,425	168	2,614
2016	0	21	1,969	145	2,135
2017	55	0	1,959	800	2,814
2018	0	1	2,272	441	2,714
2019	0	0	1,907	874	2,781
2020	0	0	2,825	1,926	4,751
2021	31	0	3,383	654	4,068

# Figures

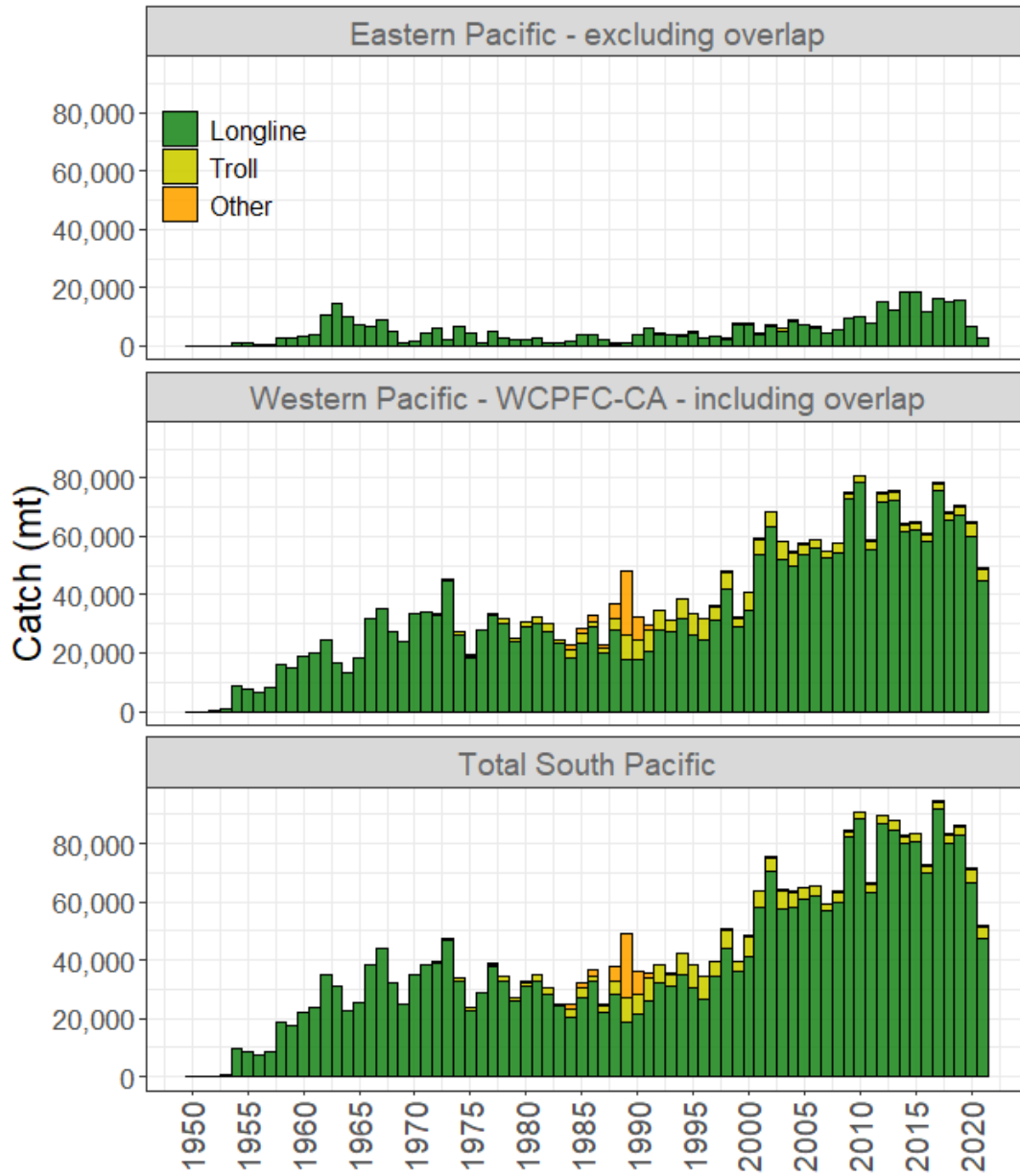


Figure 1: South Pacific albacore catch by gear (all Pacific Ocean waters south of the equator, including archipelagic waters).

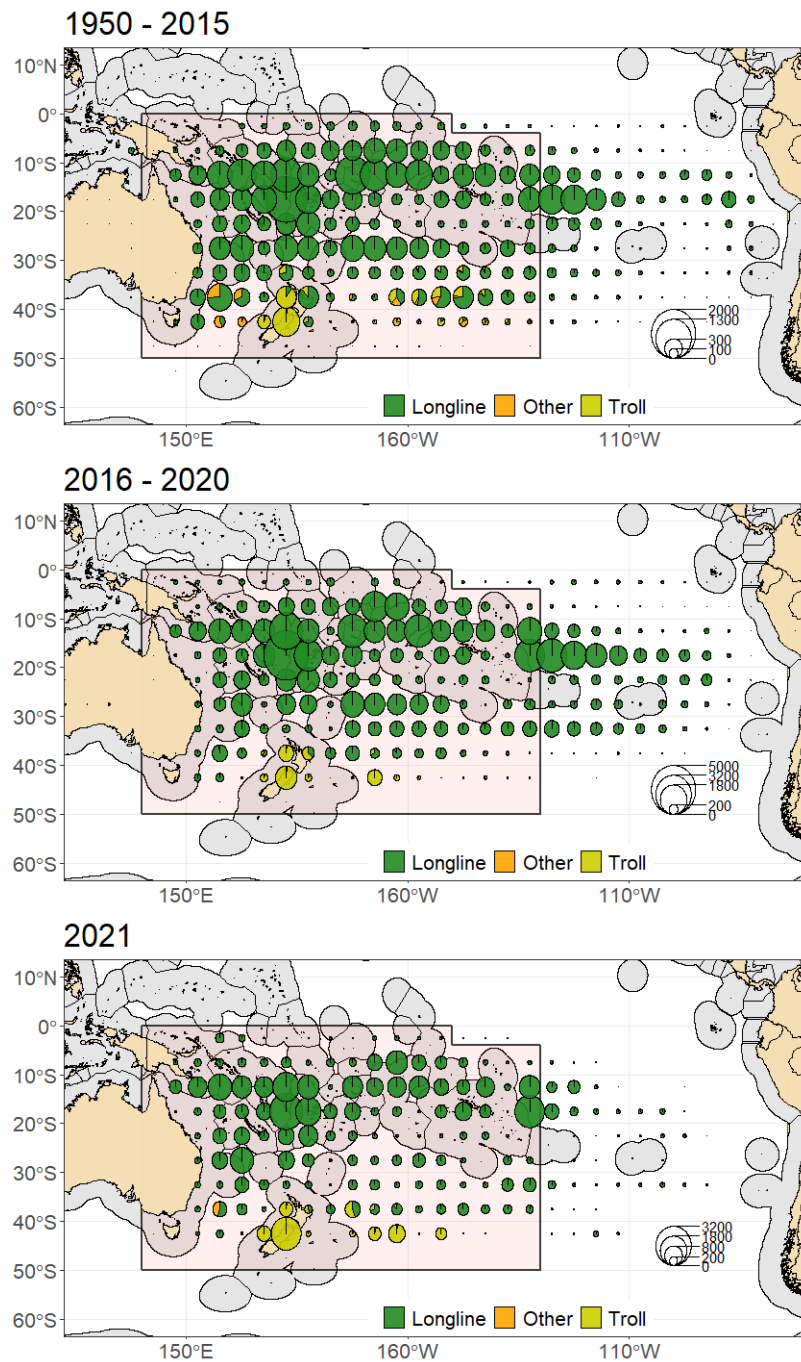


Figure 2: Albacore tuna catch distribution by gear type and  $5^{\circ} \times 5^{\circ}$  degree region in the South Pacific Ocean for the period 1950-2015 (top), 2016 -2020 (middle) and 2021 (bottom). Circle size represents total catch volume with maximum circle size presented in the legends.

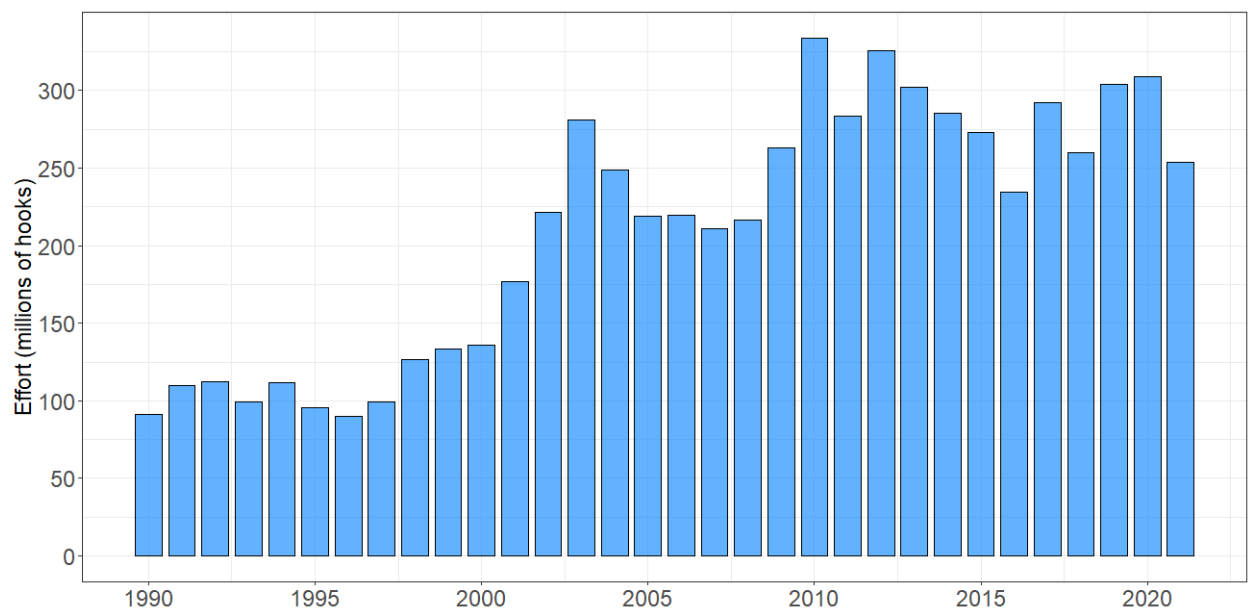


Figure 3: Temporal trends in effort (millions of hooks) in the southern longline fishery (WCPFC-CA south of 10°S).



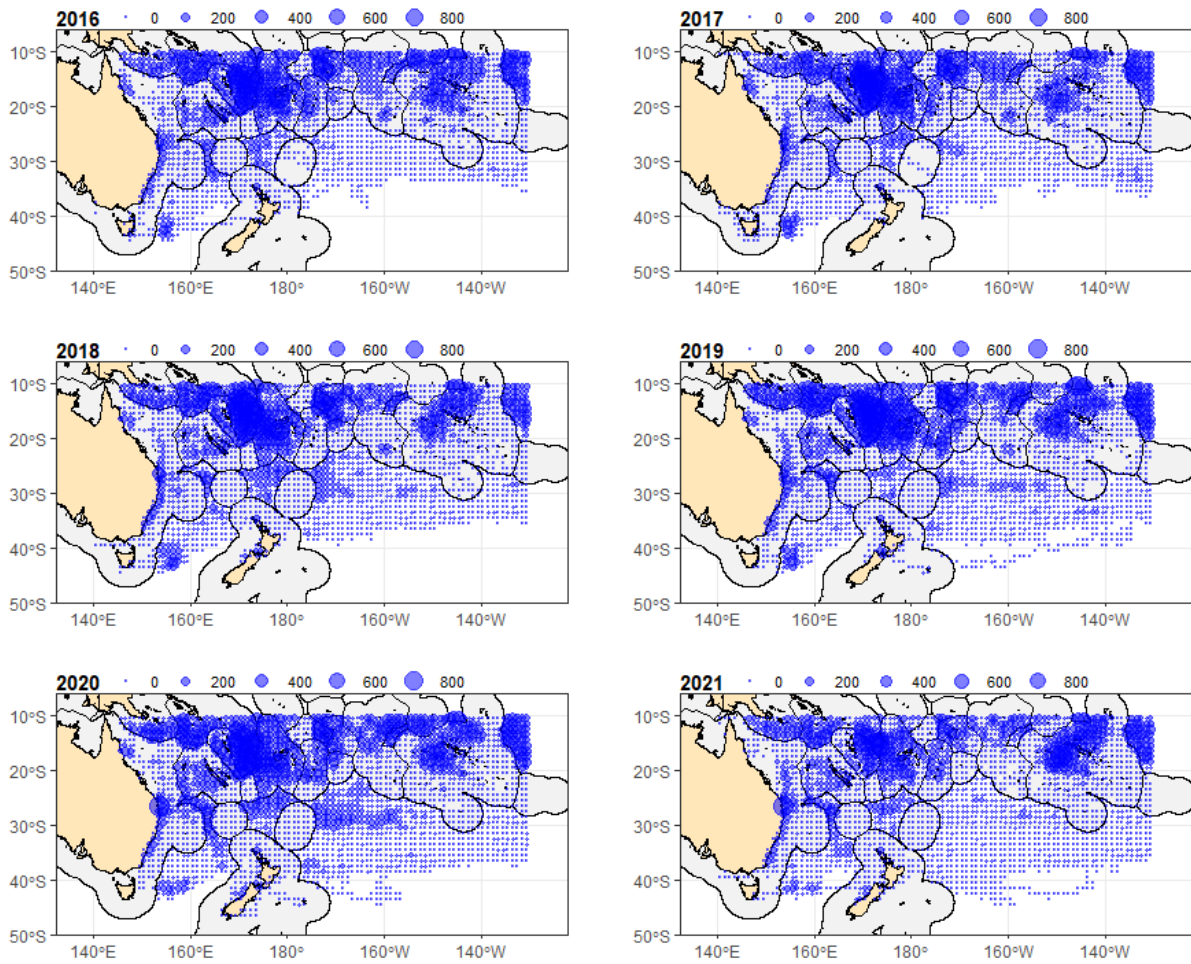


Figure 4: Longline VMS fishing days (augmented by logsheets for New Caledonia and French Polynesia) within the southern WCPFC-CA south of 10°S at the 1°×1° scale.

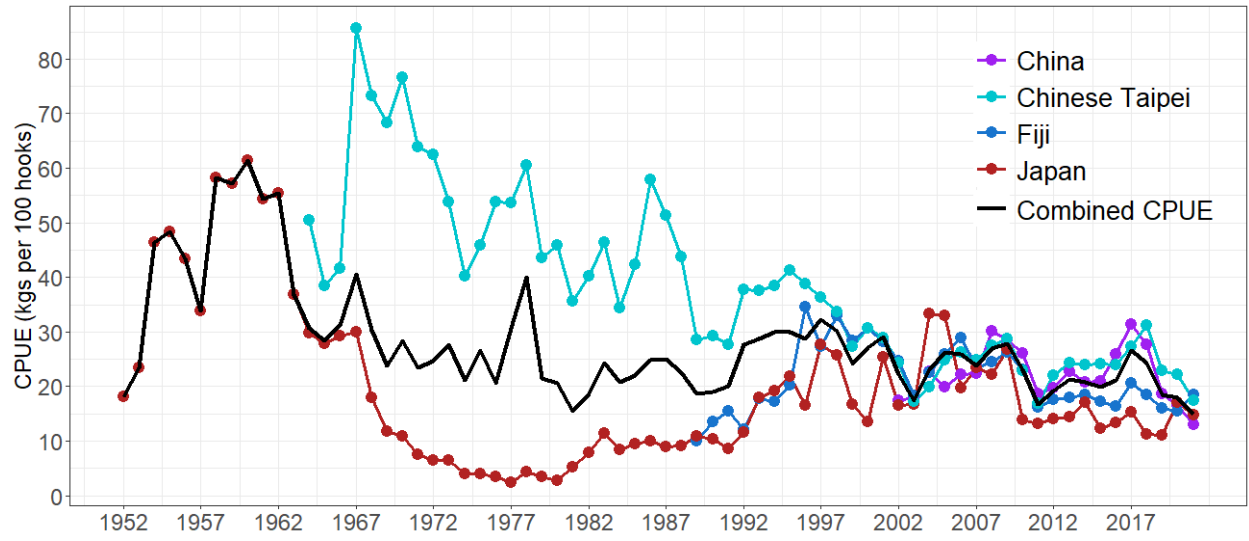


Figure 5: Trends in the nominal CPUE (kg per 100 hooks) over time for key fleets in the southern WCPFC-CA south of 10°S. The black line is the combined CPUE over each of the fleets shown.

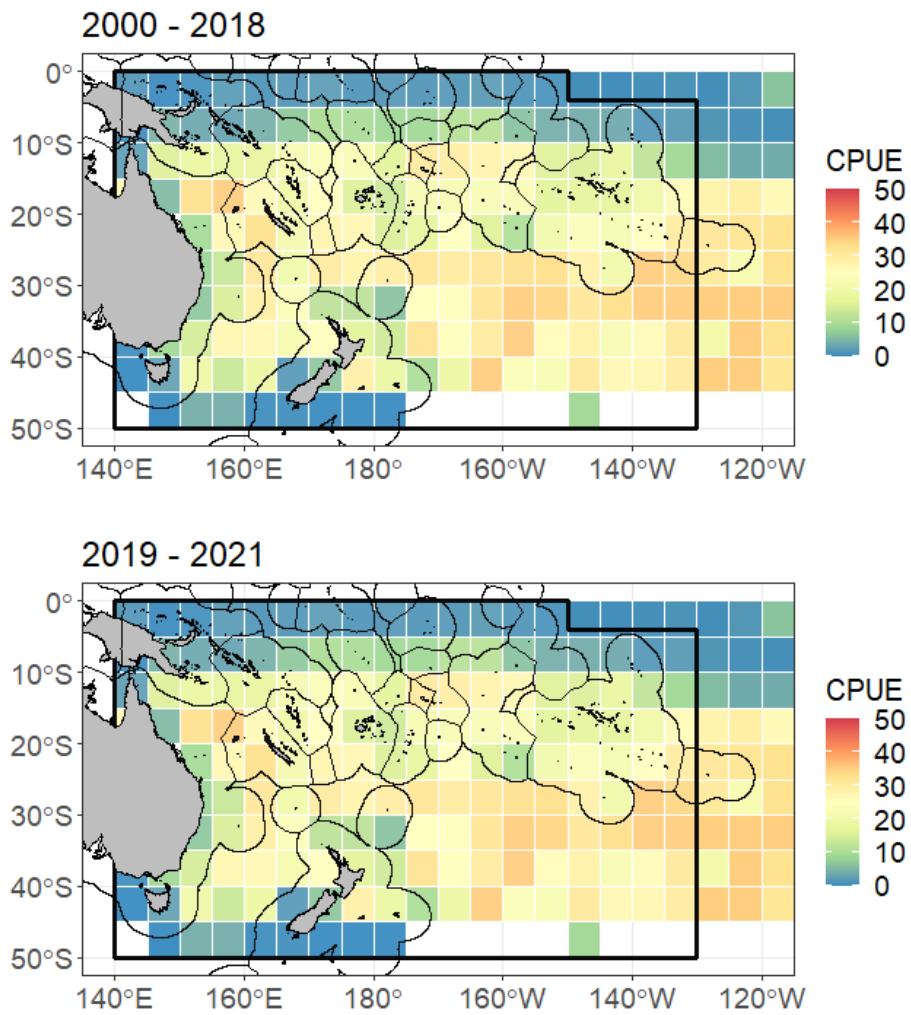


Figure 6: Albacore tuna longline CPUE distribution for the period 2000–2018 (top), and 2019–2021 (bottom). CPUE (kg/100 hooks) for a given  $5^\circ \times 5^\circ$  square is indicated by the colour of the tile.

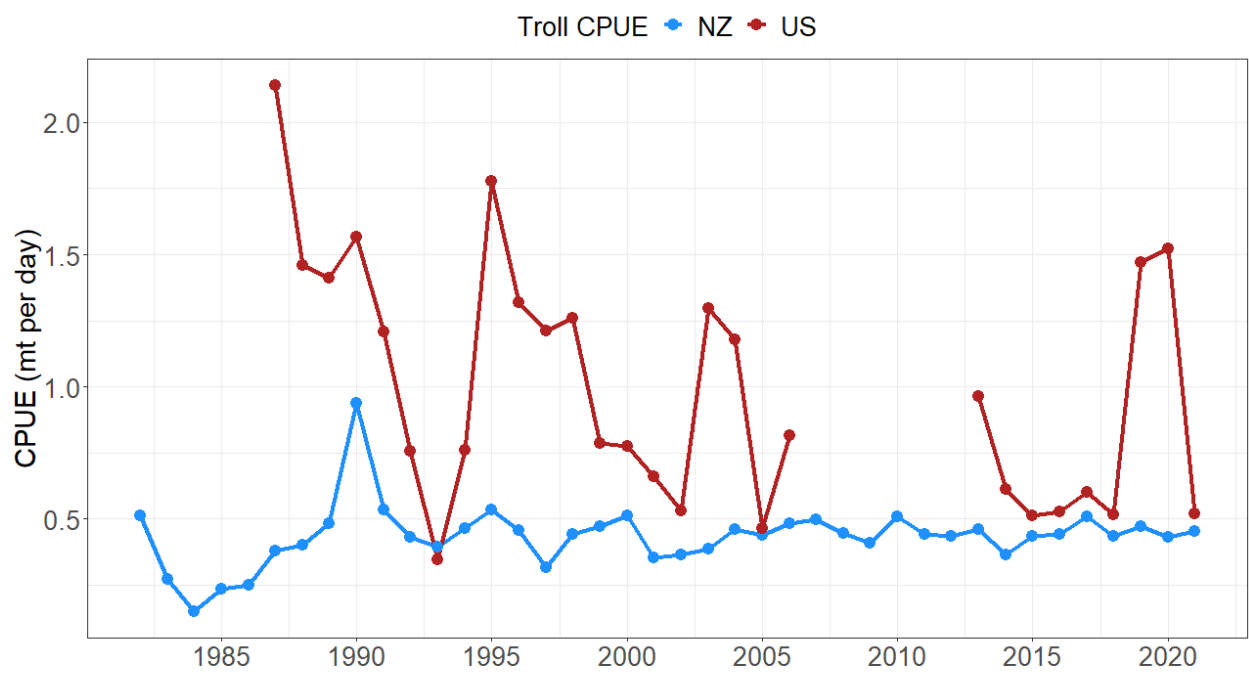


Figure 7: Trends in troll CPUE (albacore mt/day) over time in the WCPFC-CA south of 10°S for two troll fleets.

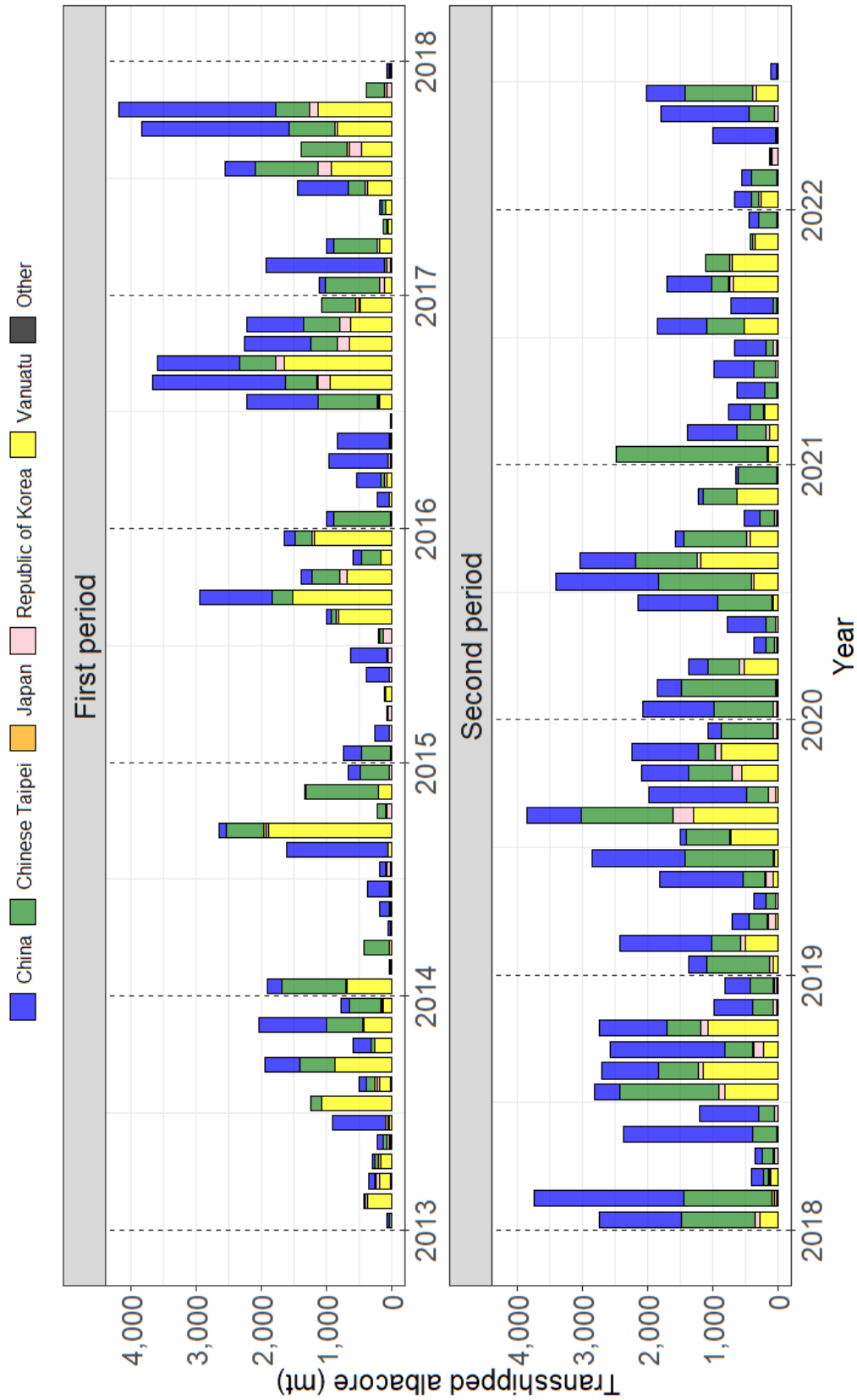


Figure 8: Reported transshipment (mt) by flag and month for 2013 to 2017 (top) and 2018 to 2022 (bottom). Source: WCPFC Transshipment Events Database (12 July 2022).

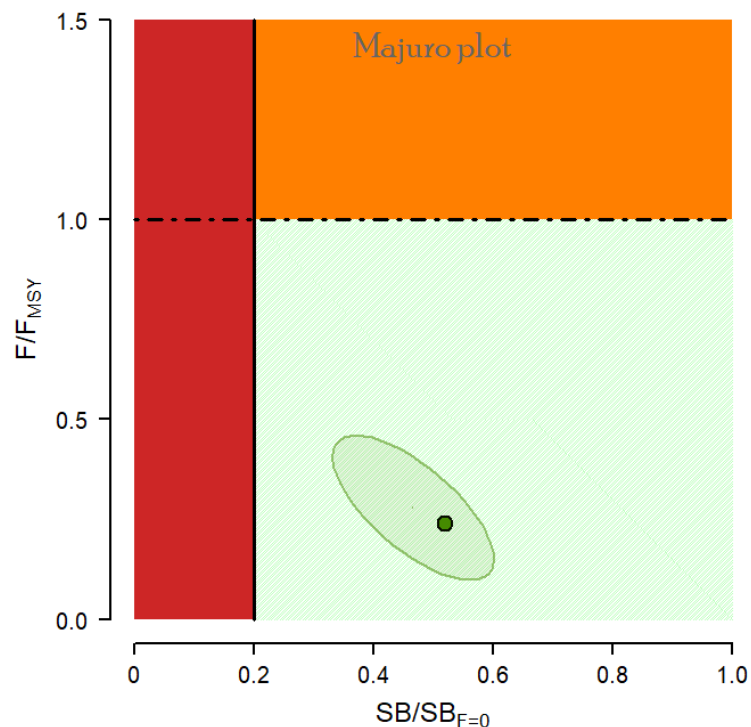


Figure 9: SPA stock status, as measured by  $SB_{recent}/SB_{F=0}$ , and  $F/F_{MSY}$ , shown on a Majuro plot. The green point is the median stock status for the ‘recent’ period and the ellipse indicates the range of uncertainty in stock status from other runs in the structural uncertainty grid.

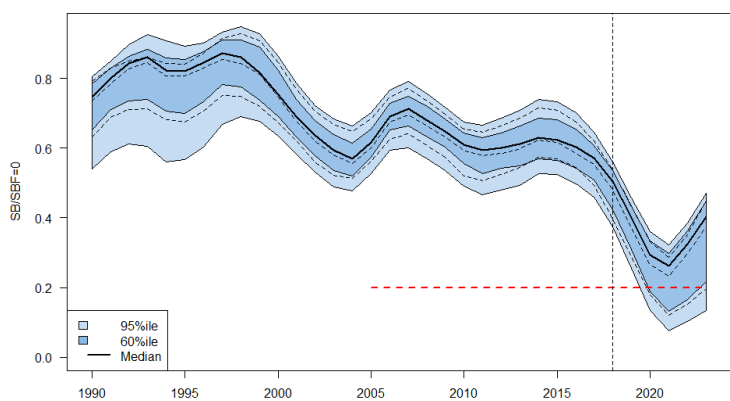


Figure 10: Stochastic projections of adult stock status under 2019 longline and troll catch levels. The dashed red indicates the limit reference point (20%  $SB_{F=0}$ ). Uncertainty after 2019 represents both structural uncertainty and stochastic recruitment (7200 simulation runs).

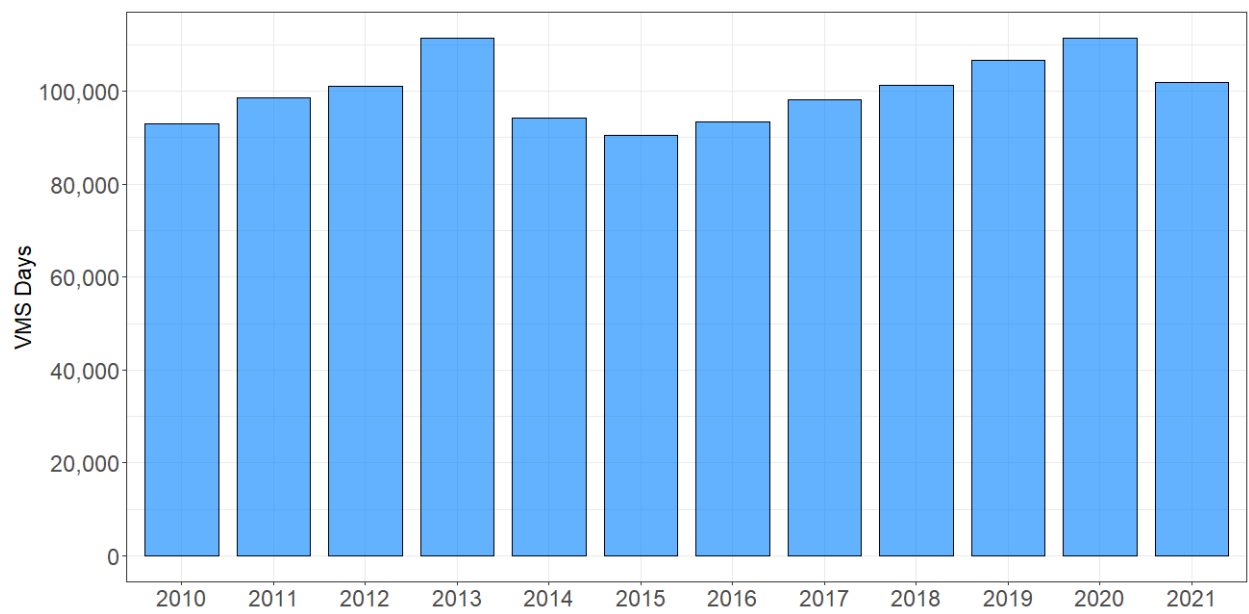


Figure 11: Longline VMS fishing days (augmented by logsheets for New Caledonia and French Polynesia) within the southern WCP-CA at  $1^{\circ} \times 1^{\circ}$ , south of  $10^{\circ}\text{S}$ .

## **Appendix 1: Notes on the time series of longline VMS information in the South Pacific**

This analysis summarises the longline VMS information available to SPC through the FFA and WCPFC over the period 2010-2021, by geographic region of the southern WCPFC-CA. Effort in that database corresponds to fishing days. Please note:

- This analysis uses annual VMS data available up to and including 12 July 2022;
- 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 the FFA VMS system) will not be included within EEZ patterns;
- Effort for some countries (e.g. New Caledonia; French Polynesia) may be incomplete and so data were augmented with logsheets for those two countries;
- Some trends may result from improved VMS coverage of vessels over time;
- EEZ effort excludes the Indonesian EEZ.



Table 8: Total VMS fishing days (augmented by logsheets for New Caledonia and French Polynesia) by year for all EEZs and the High Seas (HS), south of 10°S (Figure 12)

EEZ	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
American Samoa	1,648	1,287	1,746	1,661	1,187	937	1,345	2,378	3,185	2,498	2,166	1,733
Australia	774	1,500	1,274	1,227	1,463	3,448	3,480	4,247	3,883	4,040	4,560	5,567
Cook Islands	4,358	5,452	9,287	7,489	5,337	3,828	4,884	5,267	4,084	4,629	5,561	4,254
Fiji	13,518	15,948	17,555	14,262	13,162	13,940	12,668	13,305	14,199	14,412	12,585	11,163
High seas	20,680	23,052	23,153	31,188	27,151	22,719	19,448	23,831	25,522	27,709	32,036	27,783
Kiribati	2,391	1,879	2,294	3,564	1,312	1,645	4,040	493	34	1,009	3,126	950
Matthew and Hunter	81	106	65	53	92	87	68	54	63	59	111	102
New Caledonia	3,401	3,105	3,182	2,899	2,647	2,586	2,777	2,730	2,800	2,672	3,398	3,356
Nine	241	25	51	454	387	335	587	420	834	894	978	67
New Zealand	278	503	560	233	228	344	293	257	541	831	988	795
French Polynesia	6,178	6,694	7,346	9,517	9,712	10,302	10,204	9,557	10,287	11,074	11,441	21,768
PNG	1,590	757	453	180	52	249	2,156	2,380	3,054	3,827	3,180	3,098
Solomon Islands	21,353	17,907	15,383	19,341	17,729	14,412	10,259	8,510	14,149	12,458	10,632	9,118
Tokelau	20	54	37	57	96	1,162	1,512	1,058	458	839	734	604
Tonga	131	321	1,944	4,895	1,187	1,738	2,302	1,970	960	2,933	2,398	2,276
Tuvalu	768	974	634	261	297	302	1,043	1,216	301	508	667	382
Vanuatu	14,967	17,998	14,802	12,389	10,903	9,874	12,010	15,648	11,134	11,842	12,730	5,506
Wallis and Futuna	60	139	225	243	277	300	303	183	156	197	170	140
Samoa	26	76	221	497	134	1,508	3,005	3,372	4,175	2,929	2,999	2,077
Total	92,464	97,775	100,212	110,411	93,353	89,717	92,384	96,875	99,818	105,359	110,459	100,739
EEZ percent	78	76	77	72	71	75	79	75	74	74	71	72
HS percent	22	24	23	28	29	25	21	25	26	26	29	28

Table 9: Total VMS fishing days by year in International Waters, south of 10°S (Figure 12).

EEZ	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I2	172	195	248	303	262	380	593	555	574	215	364	210
I5	5,504	4,536	5,055	10,474	7,864	6,377	7,349	8,066	5,721	9,689	8,740	8,726
I7	10,504	12,388	10,334	13,053	13,136	11,207	7,062	9,217	13,306	12,326	17,672	13,198
I8	2,740	3,325	2,295	2,880	2,711	3,062	3,409	4,844	4,623	3,863	3,356	4,754
I9	1,760	2,608	5,221	4,478	3,178	1,693	1,036	1,150	1,298	1,617	1,905	894
Total	20,680	23,052	23,153	31,188	27,151	22,719	19,448	23,831	25,522	27,709	32,036	27,783

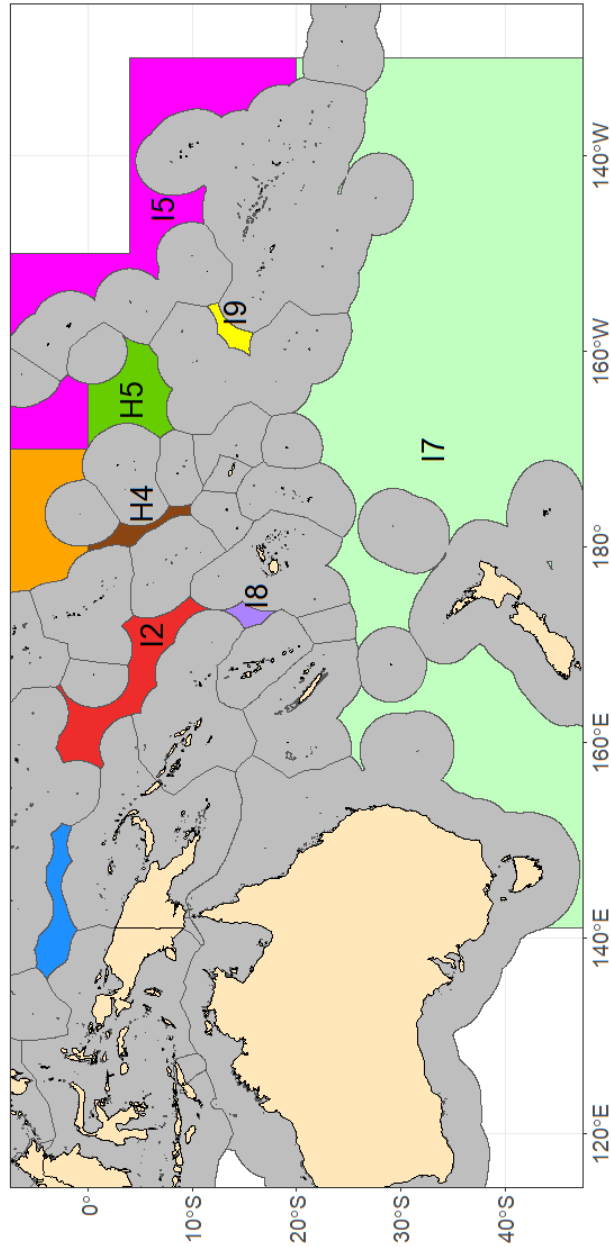


Figure 12: Map of International Waters in the southern WCPFC-C.A.

## Appendix 2: High Seas transshipment data for albacore based on CMM 2009-06 reporting

The tables below show high seas transshipment data for albacore, by flag, year and month from July 2010–July 2022.

Notes:

1. Responsible CCM is the country responsible for reporting for the fishing vessel
2. The requirement to report (within 15 days of transshipment) high seas transshipment activities commenced in July 2010.
3. The data refer to high seas transshipments inside and outside the WCPFC Convention Area, and it should be noted that a proportion of the catch will likely have been caught within EEZs in the Convention Area and the IATTC Convention area.
4. Weights are in metric tonnes.

Table A3-1: Table of albacore transshipments - 2010.

Responsible CCM	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	3	0
China	0	0	166	211	247	17
Chinese Taipei	0	115	166	125	148	21
Indonesia	0	0	0	0	41	1
Japan	0	1	0	54	35	30
Republic of Korea	17	0	22	38	0	6
Philippines	0	0	0	8	0	5
Vanuatu	0	1,435	271	232	522	149
Total	17	1,551	625	668	996	229

Table A3-2: Table of albacore transshipments - 2011.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	2	0	0	36	0	0	1	0	0	0	0	0
China	5	102	24	32	32	30	62	749	35	82	63	28
Chinese Taipei	818	183	871	15	52	194	707	466	347	95	321	407
Indonesia	0	0	0	1	8	0	0	0	8	30	0	7
Japan	11	80	0	0	2	2	1	3	0	32	57	5
Republic of Korea	43	3	46	34	6	16	4	0	1	6	80	6
Philippines	0	0	0	0	0	0	17	2	0	10	0	7
Vanuatu	100	110	1,020	291	1	14	817	313	62	13	0	341
Total	979	478	1,961	409	101	256	1,609	1,533	453	268	521	801

Table A3-3: Table of albacore transshipments - 2012.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	1	0	0	0	0	0
China	68	96	62	149	8	20	306	217	118	7	0	11
Chinese Taipei	87	438	127	92	12	0	327	406	0	18	0	457
Indonesia	2	5	2	0	0	12	0	0	0	0	0	5
Japan	0	31	2	13	2	13	67	3	73	0	3	0
Republic of Korea	4	13	14	5	13	17	6	0	0	0	5	0
Philippines	2	0	5	0	0	0	0	0	19	0	0	0
Vanuatu	545	108	161	90	2	0	765	185	0	165	105	0
Total	708	691	373	349	37	62	1,472	811	210	190	113	473

Table A3-4: Table of albacore transshipments - 2013.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	42	7	85	24	90	806	0	111	543	283	1,049	128
Chinese Taipei	34	0	5	59	51	0	157	140	532	39	544	499
Indonesia	0	0	7	0	6	0	0	0	0	0	0	2
Japan	0	0	9	38	3	39	14	42	0	15	11	3
Republic of Korea	0	45	54	0	30	27	0	20	0	0	24	19
Philippines	0	0	5	0	8	0	0	16	0	0	3	0
Vanuatu	0	362	175	165	28	28	1,063	175	865	249	412	130
Total	76	414	340	286	216	900	1,234	504	1,940	586	2,043	781

Table A3-5: Table of albacore transshipments - 2014.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	225	1	0	32	139	332	103	1,551	116	7	16	171
Chinese Taipei	986	1	386	9	31	1	0	0	576	130	1,110	449
Indonesia	0	0	0	0	0	4	0	0	0	0	0	0
Japan	4	0	27	0	2	0	21	0	24	8	0	0
Republic of Korea	0	22	0	9	3	14	47	6	38	74	0	38
Philippines	0	1	0	0	0	0	0	0	0	0	0	0
Vanuatu	691	0	3	0	0	13	18	49	1,896	1	206	0
Total	1,906	25	416	50	175	364	189	1,606	2,650	220	1,332	658

Table A3-6: Table of albacore transshipments - 2015.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	273	216	4	0	351	558	6	71	1,102	181	122	169
Chinese Taipei	449	8	13	19	0	6	62	81	330	419	294	275
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	2	5	6	2	0	0	1	1	0	6	7	0
Republic of Korea	2	22	43	4	26	50	128	26	0	101	4	22
Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	9	5	0	91	4	5	0	817	1,508	687	161	1,190
Total	735	256	66	116	381	619	197	996	2,940	1,394	588	1,656

Table A3-7: Table of albacore transshipments - 2016.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	115	187	386	898	783	0	1,099	2,046	1,258	1,028	869	0
Chinese Taipei	874	0	47	6	18	0	902	485	556	400	562	521
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	3	0	0	0	0	2	14	12	5	0	10	47
Republic of Korea	3	4	37	29	20	7	27	188	118	188	152	29
Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	10	28	72	20	0	3	182	937	1,654	642	635	470
Total	1,005	219	542	953	821	12	2,224	3,668	3,591	2,258	2,228	1,067

Table A3-8: Table of albacore transshipments - 2017.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	91	1,822	109	1	29	772	454	2	2,253	2,404	10	39
Chinese Taipei	841	40	665	50	60	264	972	709	708	526	265	6
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	0	0	0	1	0	0	0	34	0	5	43	14
Republic of Korea	72	56	49	18	8	28	193	189	34	130	66	0
Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	101	13	179	58	80	371	932	461	837	1,122	3	5
Total	1,105	1,931	1,002	128	177	1,435	2,551	1,395	3,832	4,187	387	64

Table A3-9: Table of albacore transshipments - 2018.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	1,252	2,304	185	118	1,978	907	390	886	1,768	1,043	591	389
Chinese Taipei	1,146	1,365	72	161	367	244	1,530	612	429	515	322	363
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	1	30	19	8	0	2	0	0	9	0	0	9
Republic of Korea	68	45	24	56	15	48	87	74	154	107	56	40
Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	271	5	107	1	0	1	814	1,137	212	1,074	12	12
Total	2,738	3,749	407	344	2,360	1,202	2,821	2,709	2,572	2,739	981	813

Table A3-10: Table of albacore transshipments - 2019.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	285	1,419	253	198	1,279	1,427	95	824	1,497	724	1,016	213
Chinese Taipei	961	433	272	140	333	1,346	666	1,407	332	658	249	787
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	0	0	31	0	18	0	0	0	0	0	0	0
Republic of Korea	49	81	110	29	114	15	18	324	121	149	94	53
Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	72	494	27	2	74	58	716	1,293	30	558	871	18
Total	1,367	2,427	693	369	1,818	2,846	1,495	3,848	1,980	2,089	2,230	1,071

Table A3-11: Table of albacore transshipments - 2020.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	1,092	373	309	194	602	1,229	1,577	853	131	235	90	35
Chinese Taipei	911	1,454	475	123	138	836	1,423	941	957	228	503	583
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	0	0	0	0
Republic of Korea	47	21	76	38	33	29	48	56	57	28	3	12
Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	12	8	511	18	1	60	357	1,181	418	19	629	8
Total	2,062	1,856	1,371	373	774	2,154	3,405	3,031	1,563	510	1,225	638

Table A3-12: Table of albacore transshipments - 2021.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Belize	0	0	0	0	0	0	0	0	0	0	0	0
China	17	752	338	424	612	471	760	632	682	0	8	138
Chinese Taipei	2,313	439	192	194	343	113	576	69	265	367	37	286
Indonesia	0	0	0	0	0	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0	0	5	0	0	0
Republic of Korea	18	72	33	7	27	66	5	6	68	40	28	6

Philippines	0	0	0	0	0	0	0	0	0	0	0	0
Vanuatu	140	115	191	0	0	6	512	3	675	696	353	1
Total	2,488	1,378	754	625	982	656	1,853	710	1,695	1,103	426	431

Table A3-13: Table of albacore transshipments - 2022.

Responsible CCM	Jan	Feb	Mar	Apr	May	Jun	Jul
Belize	0	0	0	0	0	0	0
China	257	142	16	966	1,356	603	95
Chinese Taipei	127	394	22	0	392	1,028	2
Indonesia	0	0	0	0	0	0	0
Japan	0	0	0	0	0	0	0
Republic of Korea	35	16	82	30	47	65	12
Philippines	0	0	0	0	0	0	0
Vanuatu	248	0	0	7	0	327	0
Total	667	552	120	1,003	1,795	2,023	109