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**DATA SUMMARY PERTAINING TO THE CATCH OF SWORDFISH
BY LONGLINE FLEETS
OPERATING IN THE SOUTHERN WCPO**

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Robert Campbell¹

¹ CSIRO Marine and Atmospheric Research, Hobart, Australia

Data summary pertaining to the catch of swordfish by longline fleets operating in the southern WCPO.

Robert Campbell

CSIRO Marine and Atmospheric Research, Australia

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1. Introduction

This document provides a summary of the data available for undertaking the 2008 stock assessment for swordfish in the southern Western Central Pacific Ocean (WCPO). This region is defined as the area bounded to the north by the equator and to the east by the eastern boundary of the WCPFC Area (130°W or 230°E). The southern boundary was placed at 50°S and the western boundary at 140°E. In particular, the data pertains to the catch of swordfish taken by longline fleets operating in this region between 1952 and 2007. A summary of the main data sets is provided in the next section while the remainder of the document consists of a number of summary Figures and Tables.

2. Available Data

The following data sets are available for the 2008 swordfish assessment:

1. Catch and Effort

- Data held at SPC, Noumea on longline effort and associated catch of swordfish for all fleets operating in the southern WCPO.
- Logbook data held by the Australian Fisheries Management Authority relating to the Australian domestic longline fleet operating in the Eastern Tuna and Billfish Fishery off eastern Australia.
- Logbook data held by the Ministry of Fisheries, NZ relating to the New Zealand domestic longline fleet operating around New Zealand.

2. Commercial Size Data

- Length (lower jaw to caudal fork) data held at SPC, Noumea pertaining to individual swordfish sampled from longline fleets operating across the southern WCPO.
- Processor measured and recorded dressed weights (trunked) pertaining to swordfish landed at various ports within the Australian Eastern Tuna and Billfish Fishery operating off eastern Australia.
- Port sampling lengths (lower jaw to caudal fork) pertaining to swordfish landed within the domestic New Zealand longline fishery.
- Dressed weight and length (orbital-eye to caudal fork) data held at NRIFSF, Japan pertaining to individual swordfish sampled from longline fleets operating across the southern WCPO.
- Length (lower jaw to caudal fork) provided by Spain pertaining to individual swordfish sampled from longline fleets operating across the Pacific Ocean.

3. Observer Data

- Data collected by AFMA observers on Japanese longline vessels operating off eastern Australian between 1980 and 1997.
- Data collected by AFMA observers on Australian longline vessels operating off eastern Australian between 2001 and 2007.
- Data collected by NZ observers on Japanese longline vessels operating within the New Zealand EEZ.

4. Tagging Data

- Data pertaining to the tagging of swordfish in the Tasman and Coral Seas using Pop-Up Satellite Tags undertaken by Australian and New Zealand scientists in recent years.

3. Catch and Effort Data

Listing of the longline fleets operating in the southern WCPO for which catch and effort data is available is provided in Table 1. The following summary statistics are also provided:

- (a) Fleet Type used to categorise fleet, - Distant Water Fishing Nation (DFWN), Pacific Island Nation (PIN) and Other (OTH). Australian and New Zealand fleets were retained as separate fleets.
- (b) The first and last years for which data was available,
- (c) The spatial extent of the data as defined by the number of 5x5-degree squares of latitude and longitude fished,
- (d) Total effort over all years (Hundreds of Hooks), and
- (e) Total Catch over all years in i) number of fish caught and ii) tonnes, estimated whole weight

The stock assessment model used to undertake the stock assessment is spatially disaggregated with the southern WCPO divided in the four main Areas shown in Figure 1. These four Areas are defined as follows:

- Area 1: 140-165°E, 0-50°S
- Area 2: 165-185°E, 0-50°S
- Area 3: 185-205°E, 0-50°S
- Area 4: 205-230°E, 0-50°S

Each Area was further stratified into a Northern (0-20°S), Central (20-40°S) and Southern (40-50°S) regions giving a total of 12 zones across the southern WCPO. Each of these zones is shown in Figure 1.

In the following data summaries the Southwest Pacific is defined as the combination of Areas 1 and 2 (i.e. between longitudes 140-185°E).

Furthermore, for some data summaries a single Distant Water Fishing Nation (DWFN) fleet and a single Pacific Island Nation (PIN) fleet are defined and consist of the combination of the corresponding data from all fleets having Fleet-Type equal to DWFN and PIN respectively in Table 2.

The following data summaries are provided in Table 3 and Figures 2-10:

- Table 3a. Annual total catch (tonnes) of swordfish taken by all longline fleets operating in each of the four assessment areas of the southern WCPO.
- Table 3b. Annual total catch (numbers) of swordfish taken by all longline fleets operating in each of the four assessment areas of the southern WCPO.
- Figure 2. Annual catch, (a) tonnes, (b) numbers, of swordfish taken by longline fleets operating in each of the four assessment areas of the southern WCPO.
- Figure 3a. Annual longline effort (hundred of hooks) for the major longline fleets within the four assessment regions of the southern WCPO.
- Figure 3b. Annual longline swordfish catch (number of fish) for the major longline fleets within the four assessment regions of the southern WCPO.
- Figure 4a. Annual longline effort (hundred of hooks) for the major longline fleets within the southern WCPO and south west Pacific.
- Figure 4b. Annual longline swordfish catch (number of fish) for the major longline fleets within the southern WCPO and south west Pacific.
- Figure 5a. Annual longline effort (hundred of hooks) for the main Pacific Island Nation longline fleets in the four assessment regions of the southern WCPO.
- Figure 5b. Annual longline swordfish catch (number of fish) for the main Pacific Island Nation longline fleets in the four assessment regions of the southern WCPO.
- Figure 6a. Annual effort (hundred of hooks) for the main Pacific Island Nation longline fleets within the southern WCPO and SW Pacific.
- Figure 6a. Annual swordfish catch (number of fish) for the main Pacific Island Nation longline fleets within the southern WCPO and SW Pacific.
- Figure 7. Proportion of (a) effort and (b) catch of swordfish taken by each fleet within each of the 12 zones used in the 2008 assessment.
- Figure 8. Annual nominal swordfish CPUE (number of fish per 10,000 hooks), by area, for the major longline fleets operating in the south WCPO.
- Figure 9. Annual nominal swordfish CPUE (number of fish per 10,000 hooks), by area, for the main Pacific Island Nation fleets operating in the south WCPO.
- Figure 10a. Annual nominal swordfish CPUE (number of fish per 10,000 hooks) for the major longline fleets in the south WCPO and the SW Pacific.
- Figure 10b. Annual nominal swordfish CPUE (number of fish per 10,000 hooks) for the main Pacific Island Nation longline fleets in the south WCPO and the SW Pacific.

4. Size Data

The listing of size data available (cf. Section 2) indicates that both dressed weight and length data was available. However, as the majority of the data was Lower-jaw to caudal-fork (LJFL) length data it was decided to use this size measurement as the standard. The Australian weight data and Japanese Orbital-eye to caudal-fork (OFL) data were converted to LJFL using the following conversion routines:

a) Weight to Length:

Measurements collected at sea of length (LJFL) and processed weight available from the New Zealand MFish observer programme (n = 3,128) were used to derive the following relationship.

$$\text{LJFL} = 56.544 * (\text{DWT}^{0.2865})$$

b) OFL to LFL:

Measurements collected at sea of both OFL and LJFL lengths available from the Australian AFMA observer programme on Japanese vessels (n = 2,215) were used to derive the following relationship.

$$\text{OFL} = 1.0753 * (\text{LJFL} + 6.898)$$

A summary of the number of swordfish size samples by fleet is given in Table 3. A large majority of the data pertains to the processor measured weight data collected from the Australian longline fleet. The most spatially extensive data pertains to the two sets of data collected from the Japanese longline fleet (13,298 fish in total) with samples across all four assessment areas. The third largest set of data pertains to the data collected from the Spain longline operations in the Pacific during 2004.

The following data summaries are provided in Figures 11a-d:

- Figure 11a. Histograms of lower-jaw to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 1.
- Figure 11b. Histograms of lower-jaw to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 2.
- Figure 11c. Histograms of lower-jaw to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 3.
- Figure 11d. Histograms of lower-jaw to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 4.

5. Spatial Distributions

The following maps displaying the following spatial distributions:

- Map 1a. Spatial distribution of the total catch of swordfish (number of fish) taken by longline vessels in the southern WCPO between 2000 and 2006.
- Map 1b. Spatial distribution of the total catch of swordfish (number of fish) taken by DWFN fleets in the southern WCPO between 2000 and 2006.
- Map 1c. Spatial distribution of the total catch of swordfish (number of fish) taken by PIN fleets in the southern WCPO between 2000 and 2006.

- Map 2a. Distribution of Australian swordfish catch: 2000-06.
 - Map 2b. Distribution of New Zealand swordfish catch: 2000-06.
 - Map 2c. Distribution of Japanese swordfish catch: 2000-06.
 - Map 2d. Distribution of Taiwanese swordfish catch: 2000-06.
 - Map 2e. Distribution of Korean swordfish catch: 2000-06.
 - Map 2f. Distribution of Chinese swordfish catch: 2000-06.
 - Map 2g. Distribution of Spanish swordfish catch: 2000-06.
 - Map 2h. Distribution of Fijian swordfish catch: 2000-06.
- Map 3. Spatial distribution of Japanese nominal swordfish CPUE, by quarter, within the southern WCPO aggregated over the years 1971-2005. (Note, the same scale is used in each quarter and the size of the dots is scaled to represent the average CPUE within each level indicated in the legend for that quarter).

6. Observer data

A summary of this data will be provided in a separate working paper.

Table 1. Listing of the longline fleets operating in the southern WCPO for which catch and effort data are available. The following summary statistics are also provided: (a) Fleet Type used to categorise fleet, (b) The first and last years for which data was available, (c) The spatial extent of the data as defined by the number of 5x5-degree squares of latitude and longitude, (d) Total effort over all years (Hundreds of Hooks), and (e) Total Catch over all years in i) number of fish caught and ii) tonnes, estimated whole weight.

Nation	Abbrev. Flag	Fleet Type	Data Years		Spatial Extent	Effort		Catch	
			First	Last		Hhooks	Number	Tonnes	
Japan	JP	DWFN	1952	2006	166	29,479,144	1,134,717	77,091	
Australia	AU	AU	1985	2007	34	1,279,098	346,953	18,692	
Korea	KR	DWFN	1962	2006	151	25,793,328	375,143	16,384	
Taiwan	TW	DWFN	1964	2006	146	15,861,012	180,979	11,552	
New Zealand	NZ	NZ	1989	2007*	32	1,137,305	128,742	6,653	
Spain	ES	DWFN	2004	2006	41	51,280	70,943	5,034	
China	CN	DWFN	1996	2006	95	1,279,637	32,379	1,311	
Fiji	FJ	PIN	1989	2006	38	3,221,827	25,458	1,222	
French Polynesia	PF	PIN	1992	2006	39	1,652,488	16,555	965	
Cook Islands	CK	PIN	1994	2006	41	299,627	10,809	587	
Vanuatu	VU	DWFN	1996	2007	119	732,683	8,015	385	
Tonga	TO	PIN	1982	2006	28	445,592	6,298	294	
New Caledonia	NC	PIN	1983	2006	24	691,675	5,331	290	
American Samoa	AS	PIN	1996	2006	27	705,029	2,147	255	
Papua NewGuinea	PG	PIN	1993	2006	19	533,055	5,281	236	
Western Samoa	WS	PIN	1993	2006	4	637,193	3,121	202	
Vanuatu	VU	PIN	1995	2007	92	313,159	2,250	111	
Solomon Lslands	SB	PIN	1981	2005	14	381,116	1,418	72	
United States	US	DWFN	1997	2004	7	11,935	104	6	
Philippines	PH	OTH	2002	2003	4	1,818	99	5	
Indonesia	ID	OTH	2004	2005	13	8,906	64	3	
Nuie	NU	PIN	2005	2006	6	7,665	48	3	
Kiribati	KI	PIN	2003	2003	5	1,985	31	1	
Tuvulu	TV	PIN	2005	2005	2	65	1	0	
Fed. States Micronesia	FM	PIN	1995	1998	2	565	5	0	

* Third quarter of 2007 only

Table 2. Listing of the longline fleets operating in the southern WCPO for which size sampling data for swordfish are available. The following summary statistics are also provided: (a) Fleet Type used to categorise fleet, (b) Source of the data, (c) Data type (DWT=dressed weight, OFL=Orbital-fork length, LJL=Lower jaw-fork length) (d) The first and last years for which data was available, (e) The spatial extent of the data as defined by the number of 5x5-degree squares of latitude and longitude, (f) Total number of individual swordfish sampled.

Nation	Abbrev. Flag	Fleet Type	Data Source	Size Type	Data Years		Spatial Extent	Number Fish
					First	Last		
Australia *	AU		AFMA	DWT	1997	2007	32	244775
Spain	SP	DW	Spain	LJL	2004	2004	24	9548
Japan **	JP	DW	NRIFSF	OFL	1971	2002		8607
Japan	JP	DW	SPC	LJL	1987	2004	44	5291
Fiji	FJ	PN	SPC	LJL	1994	2006	24	1600
Papua New Guinea	PG	PN	SPC	LJL	1996	2006	11	1397
New Zealand	NZ		SPC	LJL	1992	2005	16	1387
Tonga	TO	PN	SPC	LJL	1995	2006	8	1235
New Caledonia	NC	PN	SPC	LJL	1993	2006	8	798
Taiwan	TW	DW	SPC	LJL	1997	2006	19	703
Cook Island	CK	PN	SPC	LJL	1995	2005	8	432
Solomon Island	SB	PN	SPC	LJL	1996	2004	7	258
French Polynesia	PF	PN	SPC	LJL	1996	2006	13	253
Korea	KR	DW	SPC	LJL	1992	2006	16	231
Western Samoa	WS	PN	SPC	LJL	1998	2005	4	206
Vanuatu	VU	PN	SPC	LJL	2003	2005	14	158
Philippines	PH	OT	SPC	LJL	2003	2003	2	116
China	CN	DW	SPC	LJL	1996	2005	11	33
United States	US	OT	SPC	LJL	2004	2004	1	11
American Samoa	AS	PN	SPC	LJL	2002	2004	4	7
Marshall Islands	MH	PN	SPC	LJL	1993	1993	1	3
Fed. State Micronesia	FM	PN	SPC	LJL	2002	2002	1	1

* Truncated weights, ** Data aggregated by 10x20-degrees of latitude and longitude

Figure 1. Map of the southern Western Central Pacific Ocean indicating the Areas and Zones used to stratify the catch and effort data.

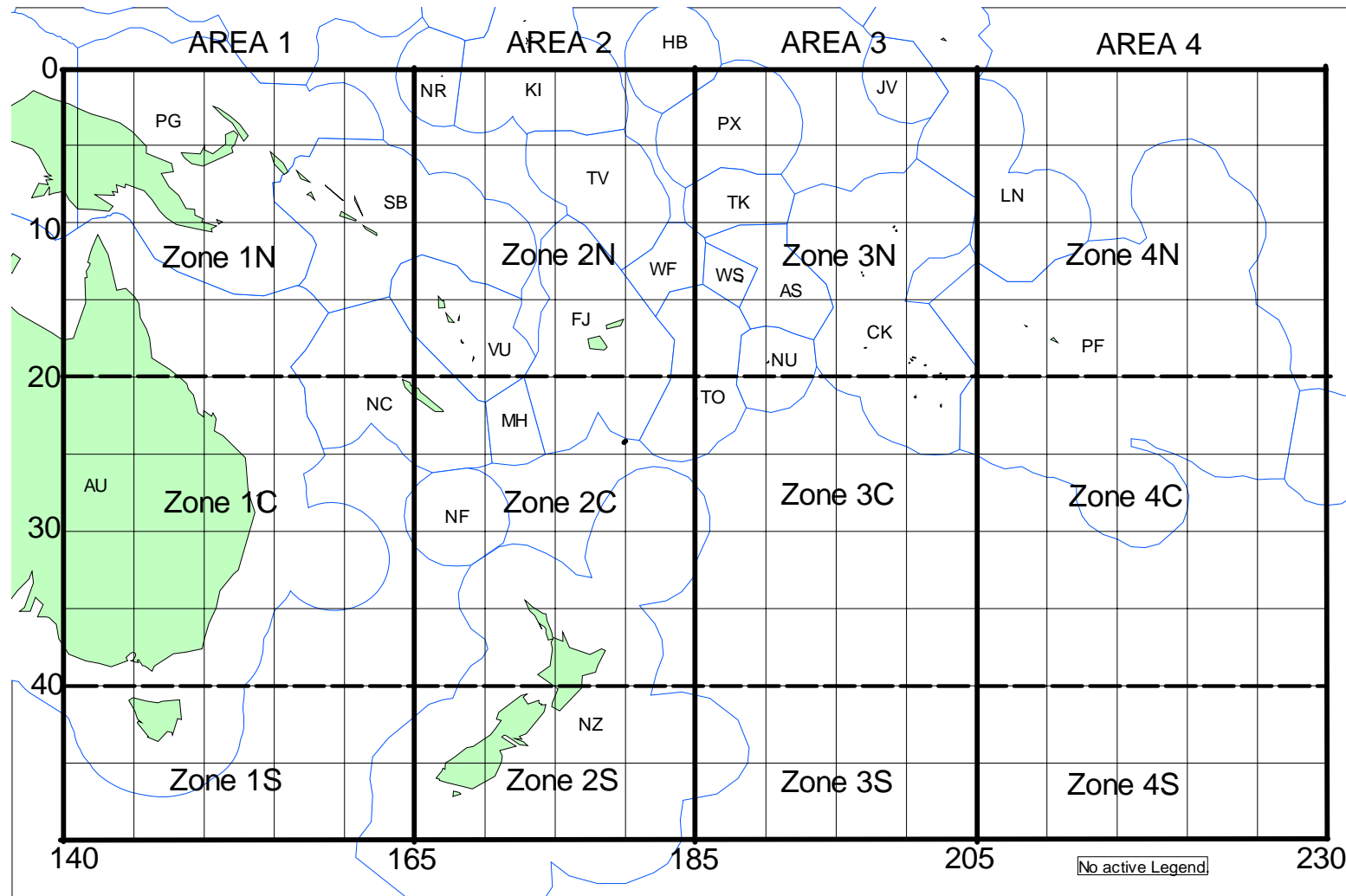


Table 3a. Annual total catch (tonnes) of swordfish taken by all longline fleets operating in each of the four assessment areas of the southern WCPO.

YEAR	AREA_1	AREA_2	AREA_3	AREA_4	TOTAL
1952	17	0	0	0	17
1953	41	1	1	0	42
1954	185	59	4	0	248
1955	93	177	84	1	355
1956	62	159	50	3	274
1957	104	86	19	20	230
1958	200	119	70	22	412
1959	130	218	102	10	461
1960	117	169	19	16	321
1961	184	282	41	96	604
1962	354	63	29	164	611
1963	394	163	68	253	879
1964	244	64	24	102	433
1965	703	60	62	185	1010
1966	678	244	81	84	1087
1967	452	263	76	122	913
1968	964	187	50	127	1328
1969	607	335	36	89	1067
1970	655	178	25	125	983
1971	1042	496	31	210	1780
1972	1033	492	22	96	1644
1973	992	206	25	79	1302
1974	1163	260	13	242	1678
1975	580	213	113	243	1150
1976	999	415	195	408	2017
1977	246	215	46	264	771
1978	497	78	58	330	964
1979	723	390	119	309	1542
1980	1757	737	160	628	3282
1981	2199	1138	190	996	4523
1982	2234	1231	135	399	3998
1983	1472	722	82	223	2498
1984	1511	606	153	267	2537
1985	1922	573	160	545	3200
1986	1654	1070	85	762	3572
1987	1717	1032	104	506	3359
1988	2419	1422	118	1020	4980
1989	1564	506	149	831	3050
1990	1259	638	134	1068	3099
1991	1274	488	78	790	2630
1992	1762	509	163	728	3162
1993	1286	291	148	944	2669
1994	1447	533	238	1081	3300
1995	1177	460	102	656	2395
1996	2047	522	107	949	3625
1997	3112	590	161	784	4647
1998	2629	980	309	935	4853
1999	2594	991	363	1074	5022
2000	2310	1168	503	1570	5550
2001	2206	1511	355	2429	6501
2002	2335	1615	1112	1485	6546
2003	2033	1380	1126	2971	7511
2004	1856	1443	1492	2320	7110
2005	1555	1143	1448	1590	5736
2006	910	1144	2013	2188	6255
2007	1089	830	2013	2188	6120

Table 3b. Annual total catch (numbers) of swordfish taken by all longline fleets operating in each of the four assessment areas of the southern WCPO.

YEAR	AREA_1	AREA_2	AREA_3	AREA_4	TOTAL
1952	350	6	0	0	356
1953	856	18	12	0	886
1954	3902	1251	95	0	5248
1955	1956	3746	1771	30	7503
1956	1300	3359	1059	68	5786
1957	2205	1825	395	424	4849
1958	4223	2523	1488	458	8692
1959	2744	4610	2161	219	9734
1960	2470	3560	405	340	6775
1961	3889	5963	875	2035	12762
1962	7474	1329	623	3472	12898
1963	8311	3452	1446	5352	18561
1964	5149	1357	499	2144	9149
1965	14845	1269	1303	3911	21328
1966	14309	5163	1707	1772	22951
1967	9555	5548	1695	2579	19377
1968	20238	3927	990	2599	27754
1969	12878	7052	751	1851	22532
1970	13708	3768	543	2643	20662
1971	21924	10441	649	4400	37414
1972	21597	10294	458	1896	34245
1973	20868	4293	442	1578	27181
1974	24536	5447	334	4853	35170
1975	12136	4363	2210	5066	23775
1976	21105	8383	3013	7827	40328
1977	5253	4344	809	5319	15725
1978	10499	1589	1172	5651	18911
1979	15129	8186	2460	6487	32262
1980	18531	8249	2441	7782	37003
1981	21506	11792	3110	11345	47753
1982	22212	13150	2102	4648	42112
1983	14713	7635	1473	2802	26623
1984	17146	7055	3161	3913	31275
1985	21823	7264	3199	8536	40822
1986	17440	11771	1593	11466	42270
1987	17066	10990	2345	8072	38473
1988	23901	14799	2809	14501	56010
1989	21616	7679	3530	13066	45891
1990	18082	9509	3569	18699	49859
1991	18254	6842	2167	14668	41931
1992	23436	7430	3795	13446	48107
1993	18429	4707	4355	16825	44316
1994	22742	8906	6910	22662	61220
1995	16834	7820	2425	12618	39697
1996	27959	7980	2910	19548	58397
1997	48490	8682	4083	14337	75592
1998	46091	15200	6640	16084	84015
1999	49924	16220	8276	22414	96834
2000	44587	19828	11418	32647	108480
2001	38404	31386	8289	47734	125813
2002	41995	32055	18520	26094	118664
2003	33807	26112	20572	56403	136894
2004	30221	25759	23753	37351	117084
2005	28070	20285	21801	28163	98319
2006	21169	24179	30150	37649	113147
2007	24868	17315	30150	37649	109982

Figure 2. Annual catch, (a) tonnes, (b) numbers, of swordfish taken by longline fleets operating in each of the four assessment areas of the southern WCPO

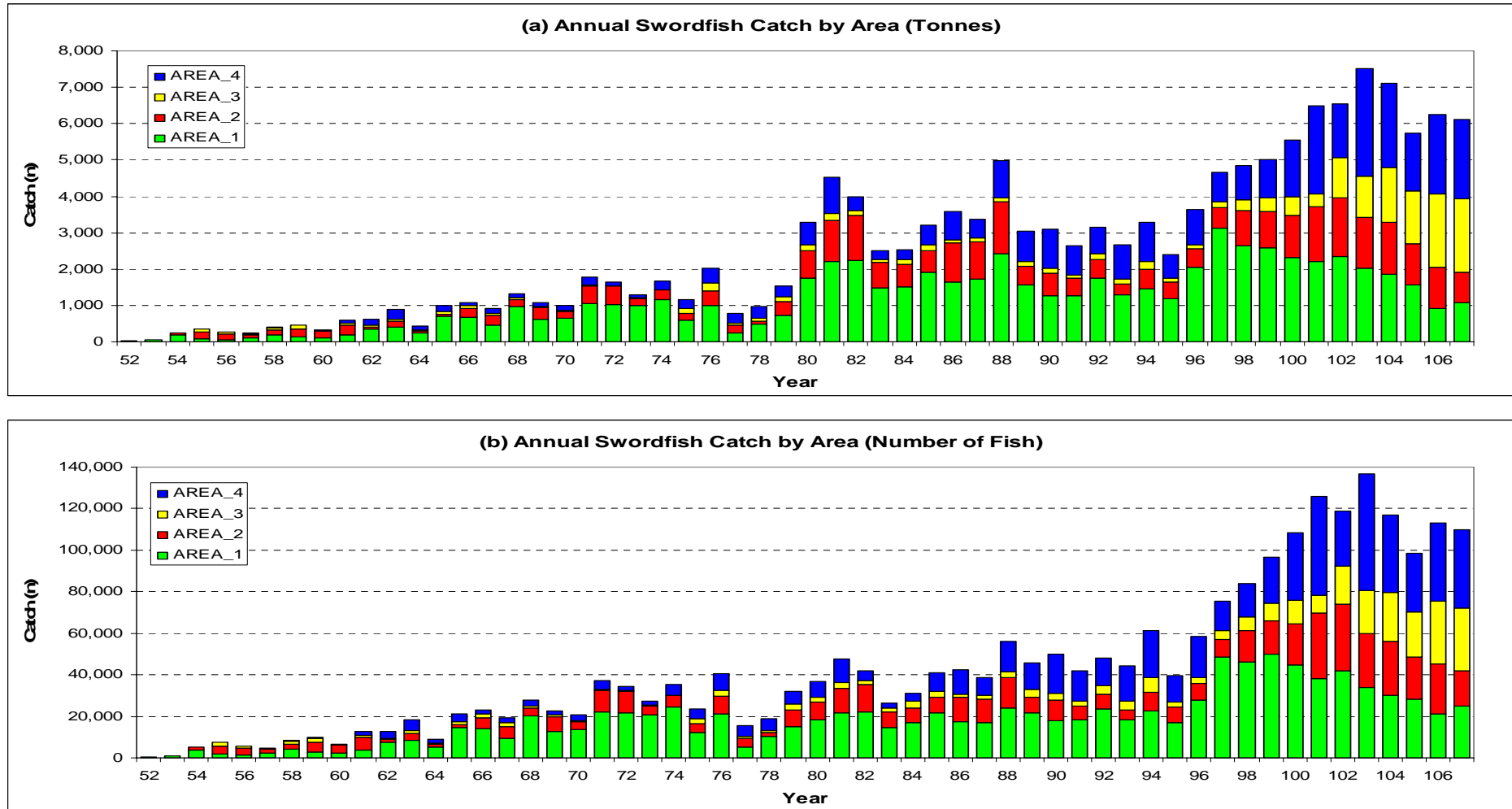


Figure 3a Annual longline effort (hundred of hooks) for the major longline fleets within the four assessment regions of the southern WCPO.

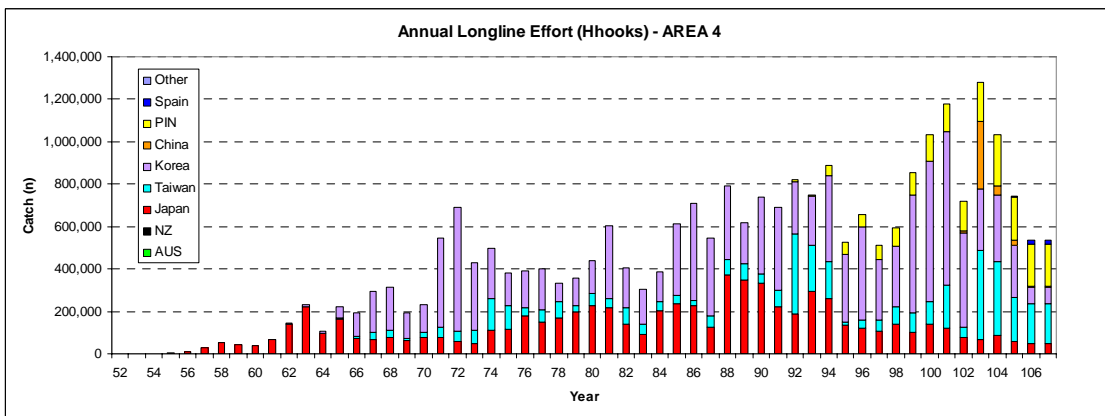
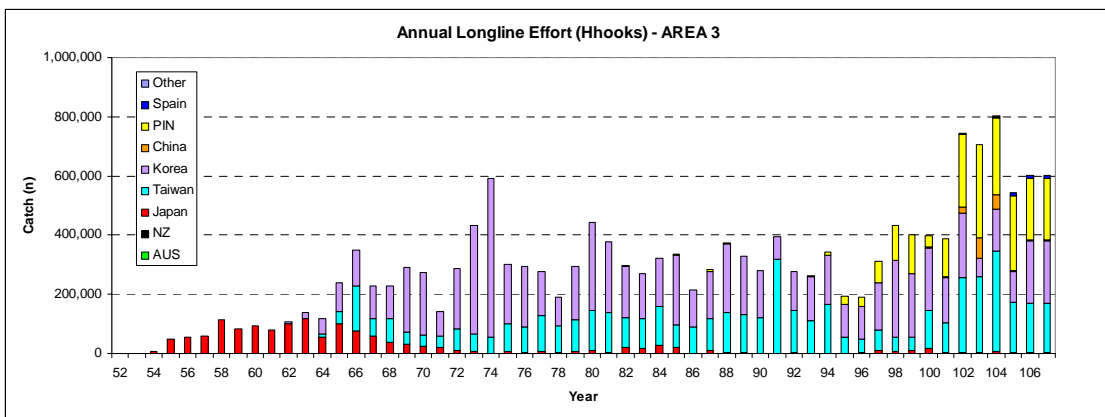
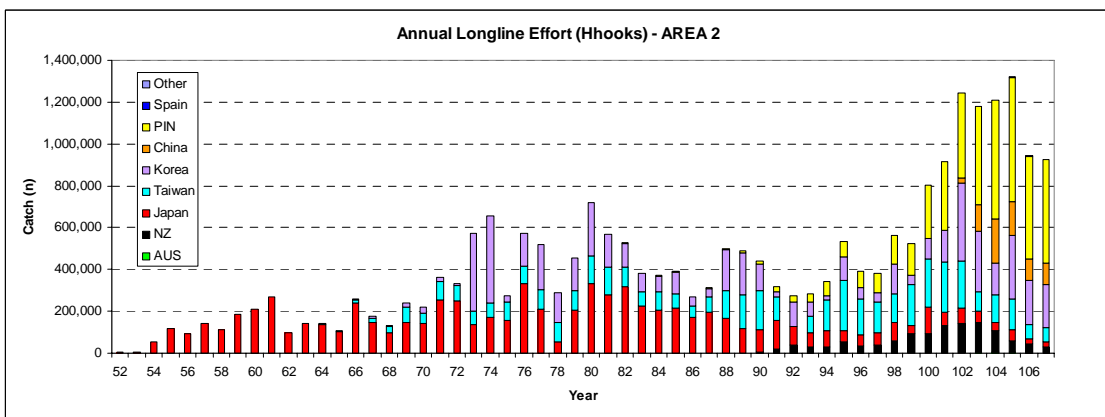
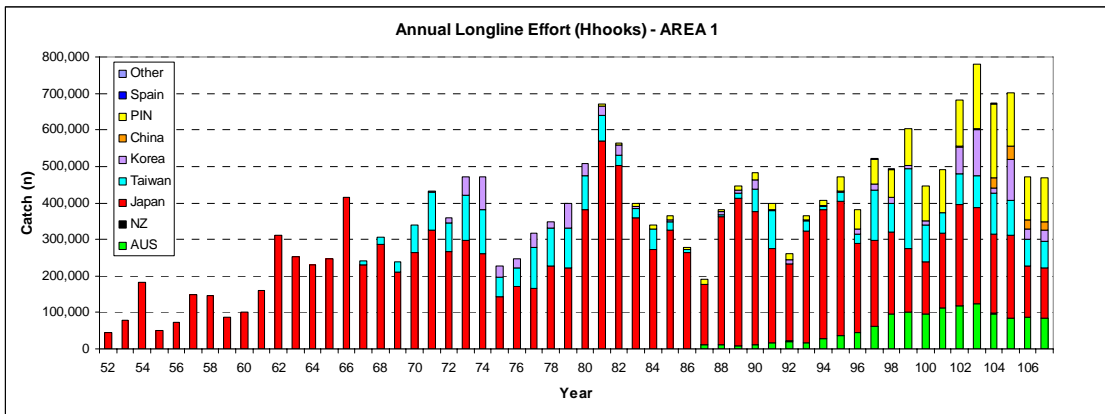


Figure 3b Annual longline swordfish catch (number of fish) for the major longline fleets within the four assessment regions of the southern WCPO.

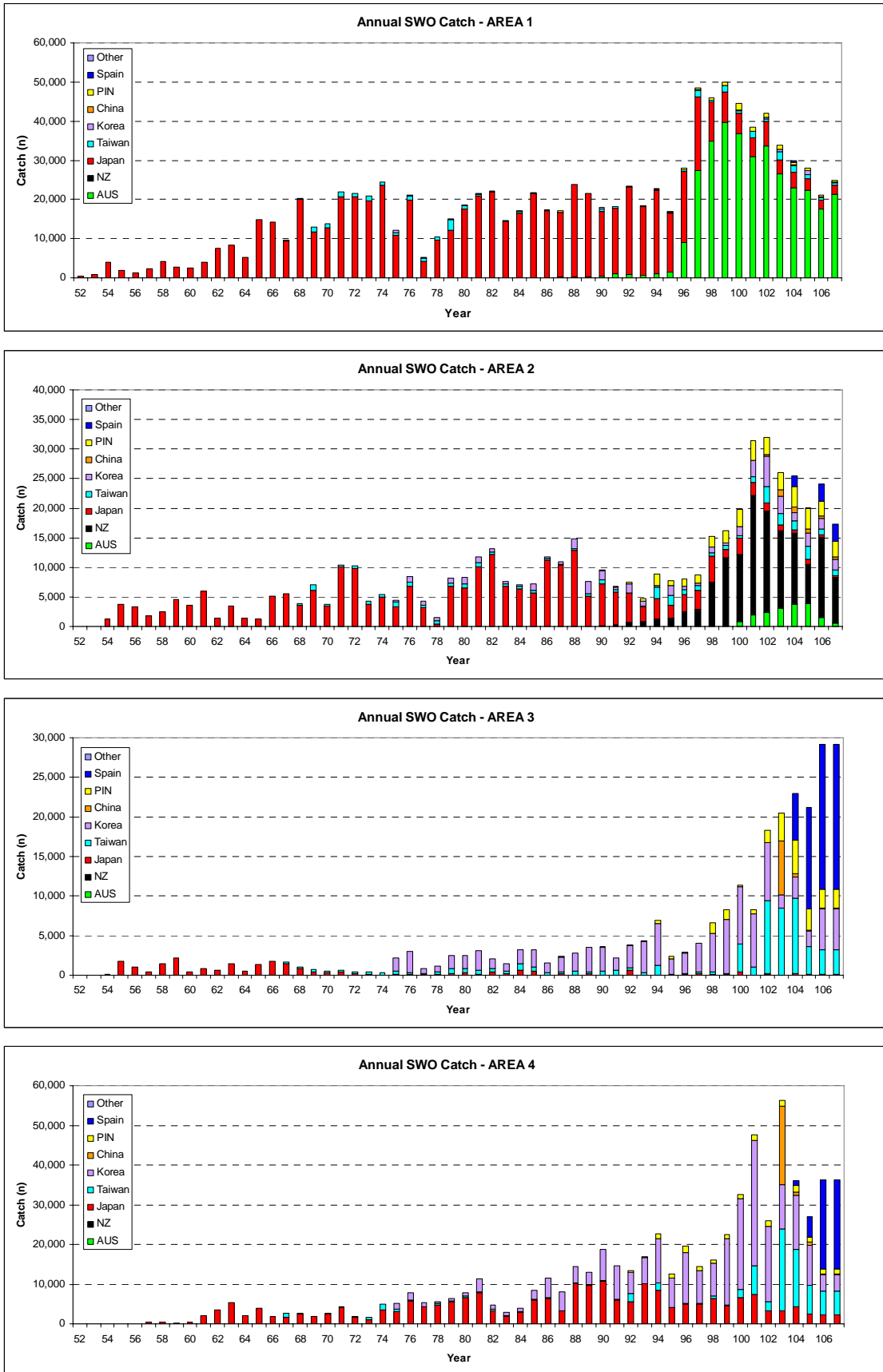


Figure 4a. Annual longline effort (hundred of hooks) for the major longline fleets within the southern WCPO and south west Pacific.

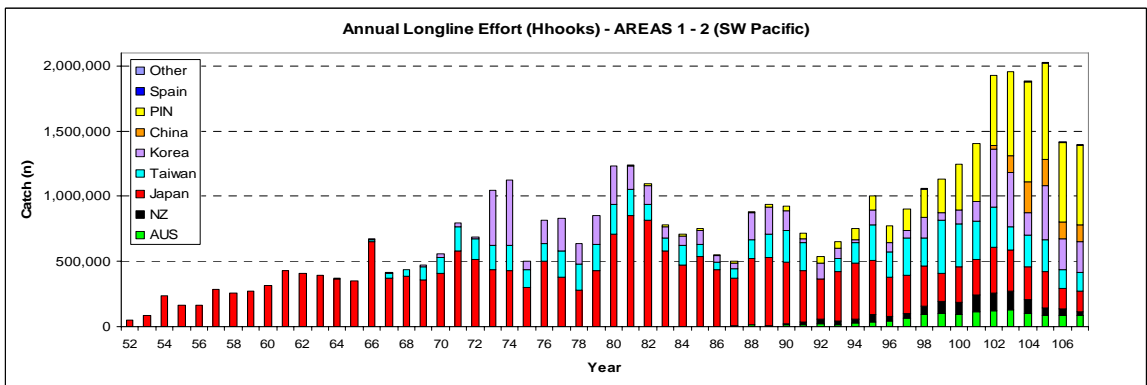
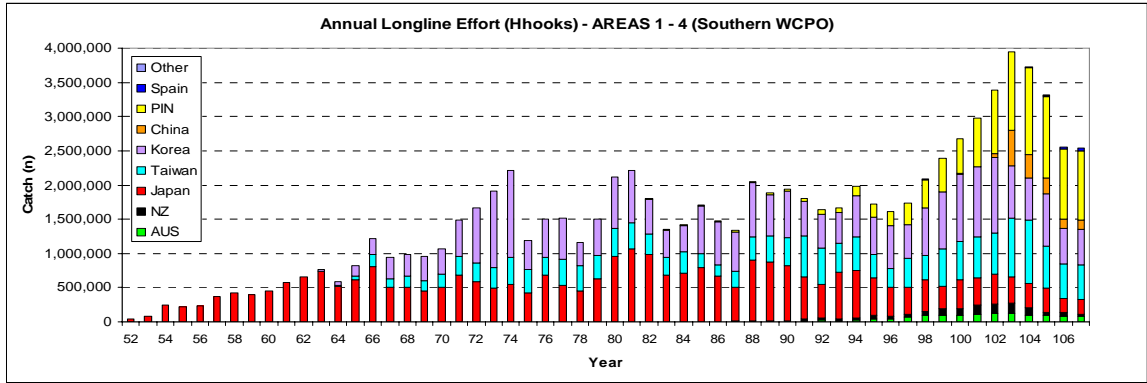


Figure 4b. Annual longline swordfish catch (number of fish) for the major longline fleets within the southern WCPO and south west Pacific.

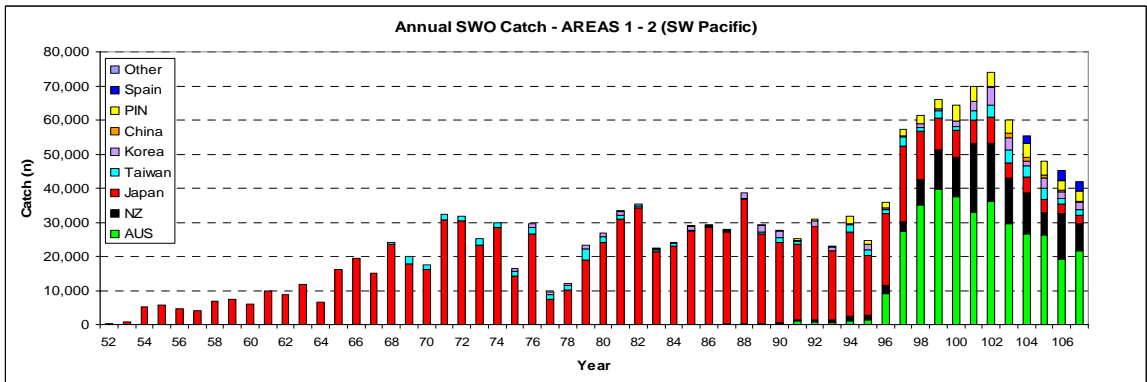
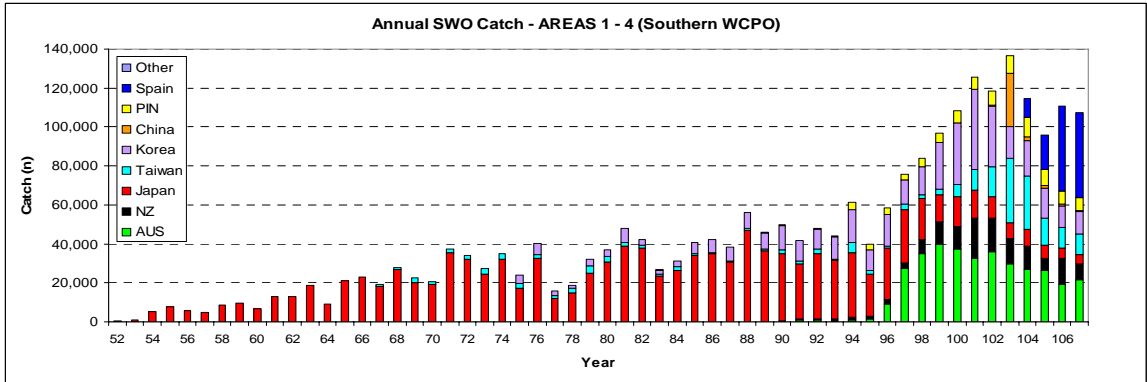


Figure 5a. Annual longline effort (hundred of hooks) for the main Pacific Island Nation longline fleets in the four assessment regions of the southern WCPO.

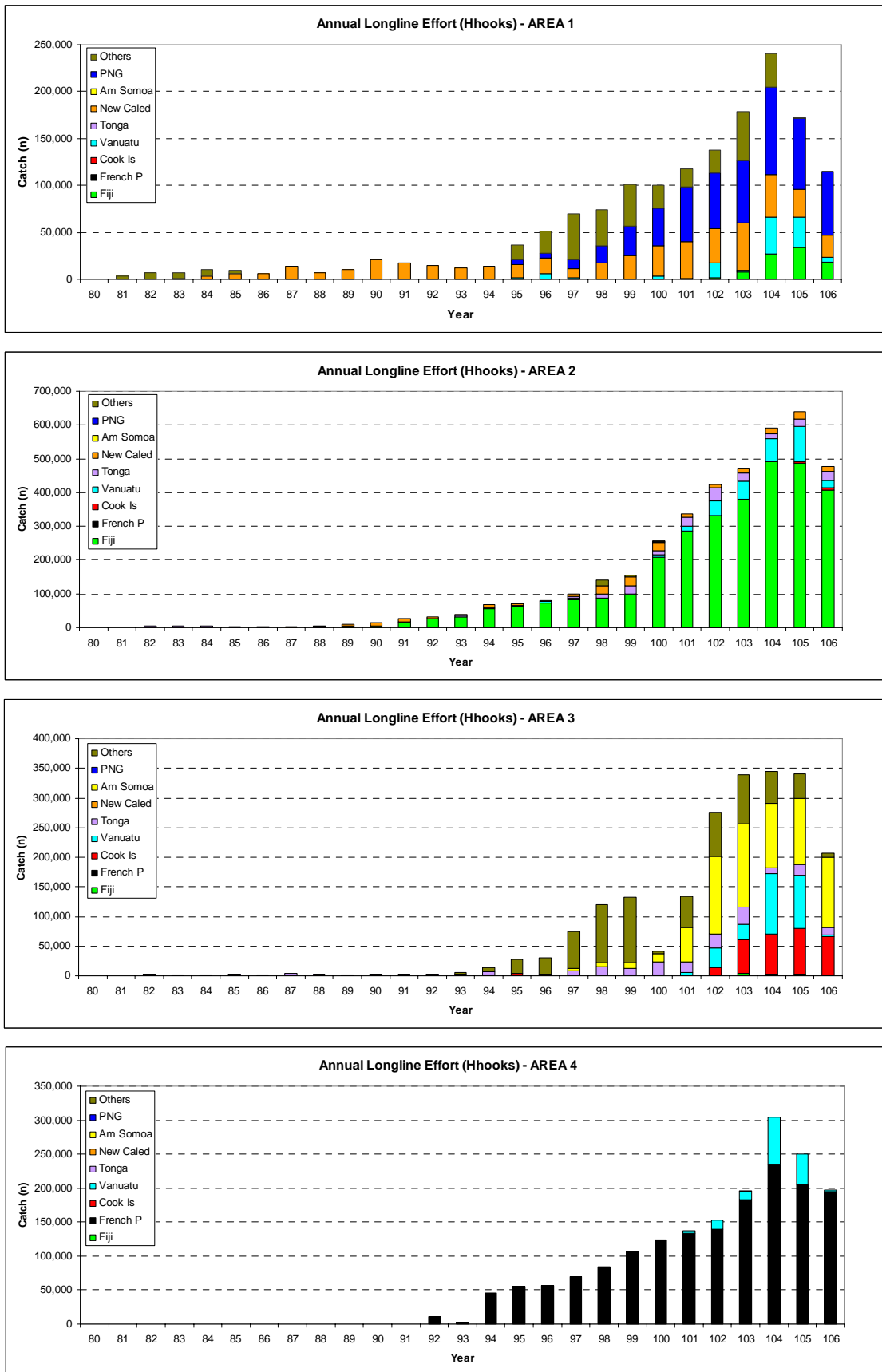


Figure 5b. Annual longline swordfish catch (number of fish) for the main Pacific Island Nation longline fleets in the four assessment regions of the south WCPO.

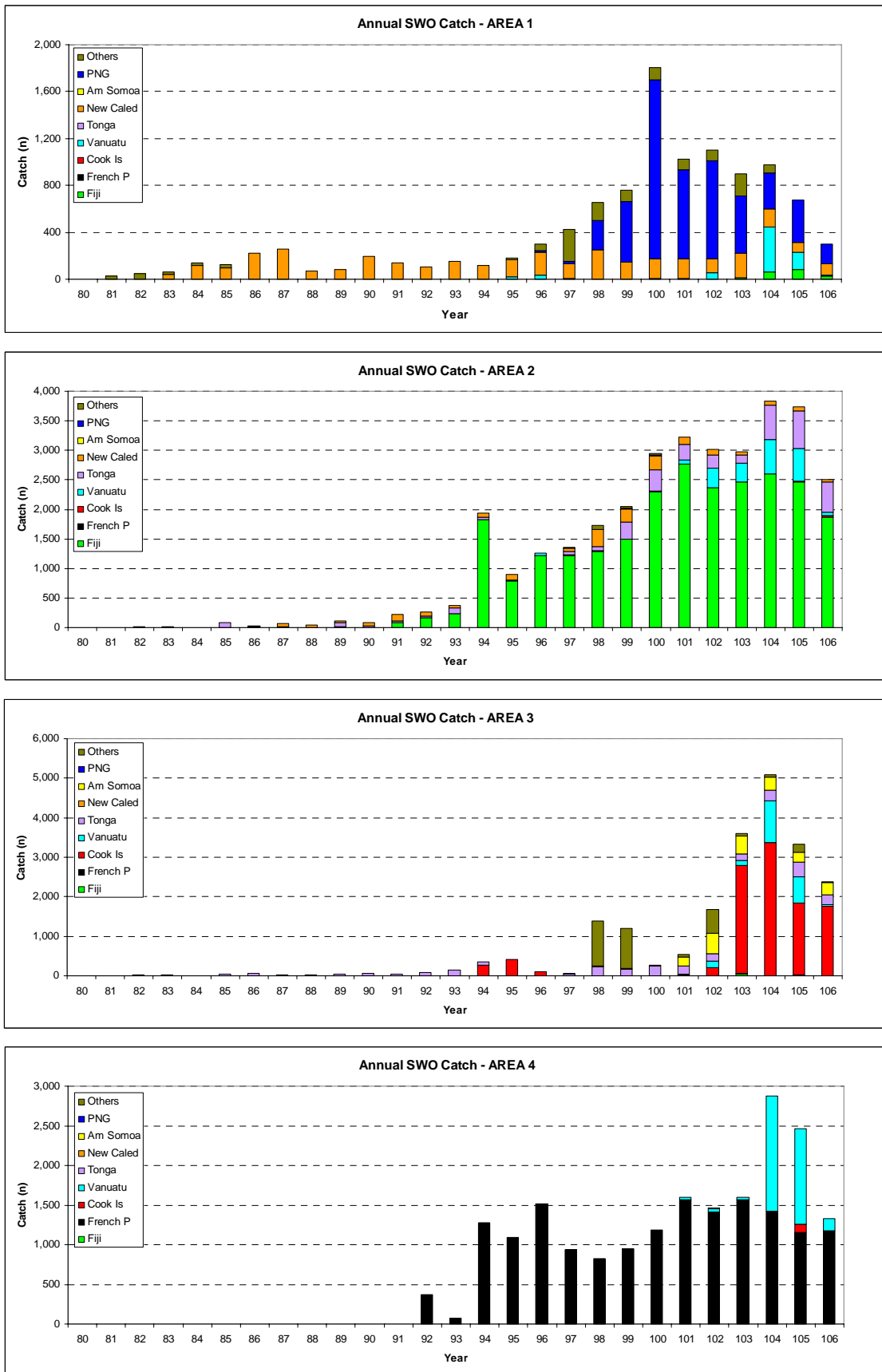


Figure 6a. Annual effort (hundred of hooks) for the main Pacific Island Nation longline fleets within the southern WCPO and SW Pacific.

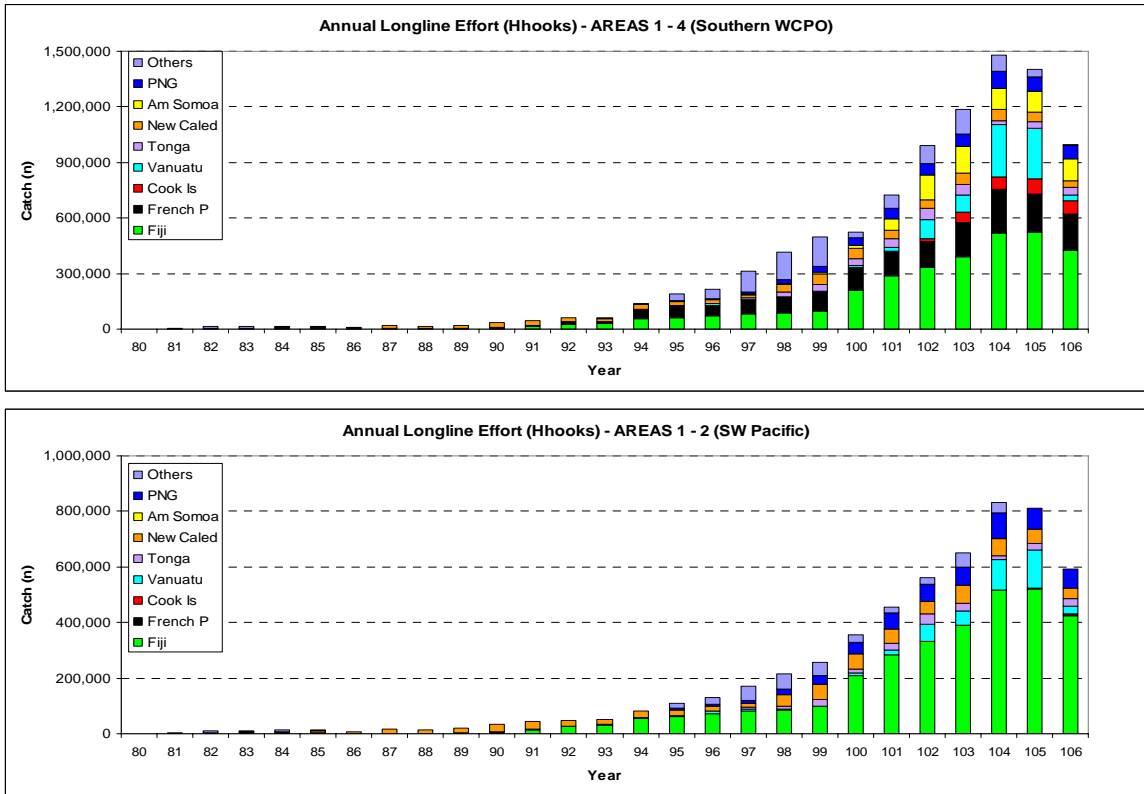


Figure 6a. Annual swordfish catch (number of fish) for the main Pacific Island Nation longline fleets within the southern WCPO and SW Pacific.

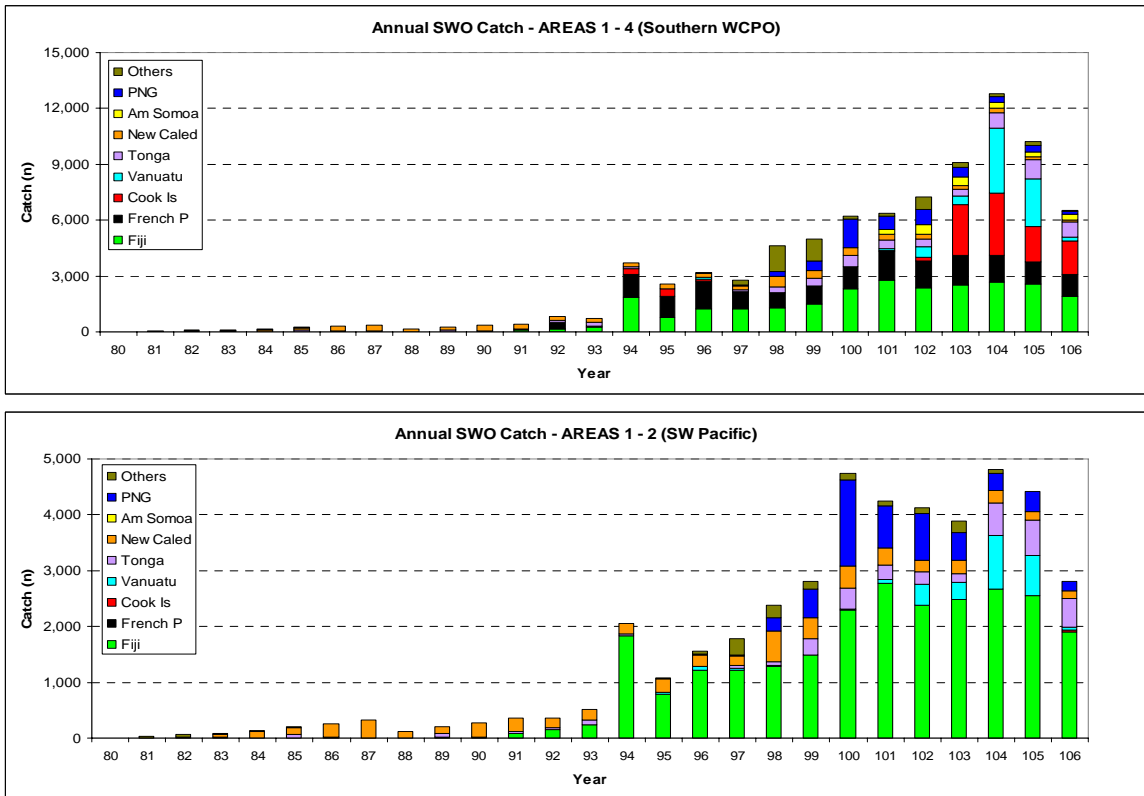


Figure 7. Proportion of (a) effort and (b) catch of swordfish taken by each fleet within each of the 12 zones used in the 2008 assessment.

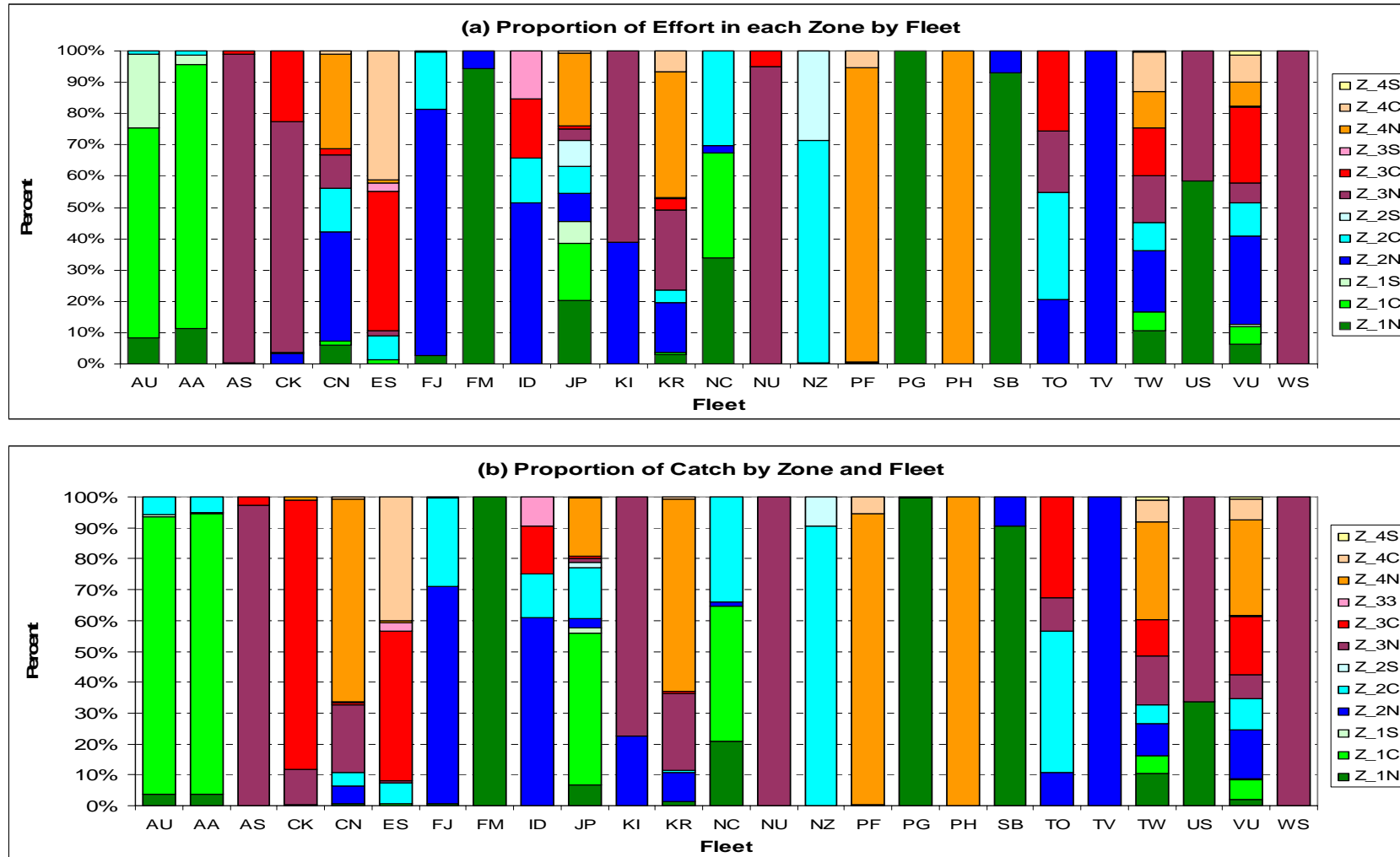


Figure 8. Annual nominal swordfish CPUE (number of fish per 10,000 hooks), by area, for the major longline fleets operating in the south WCPO. (Note: Fleets with CPUE referenced by the right-hand scale are annotated with the letter R.)

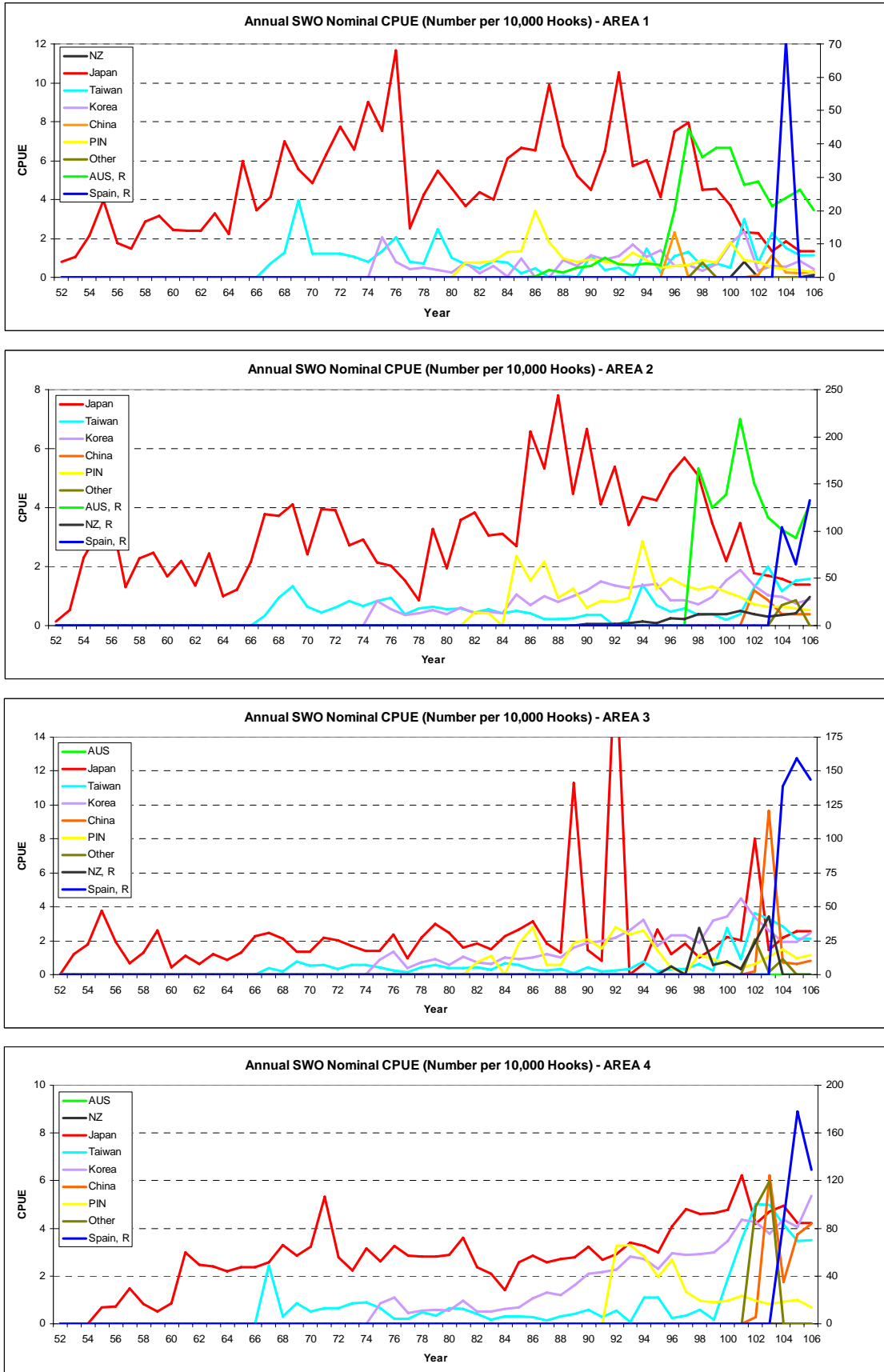


Figure 9. Annual nominal swordfish CPUE (number of fish per 10,000 hooks), by area, for the main Pacific Island Nation fleets operating in the south WCPO. (NB: Fleets with CPUE referenced by the right-hand scale are annotated with the letter R.)

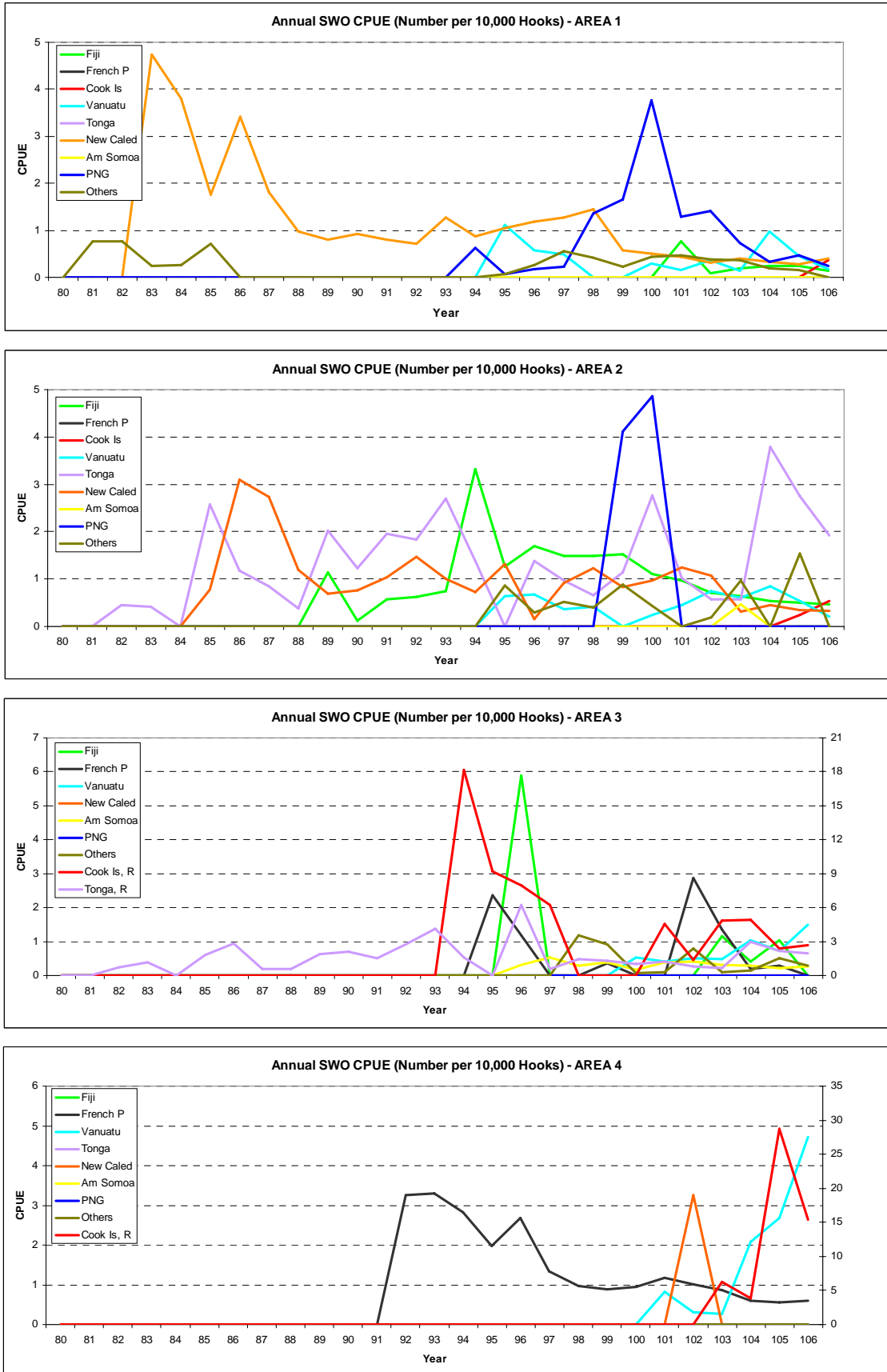


Figure 10a. Annual nominal swordfish CPUE (number of fish per 10,000 hooks) for the major longline fleets in the south WCPO and the SW Pacific. (Note: Fleets with CPUE referenced by the right-hand scale are annotated with the letter R.)

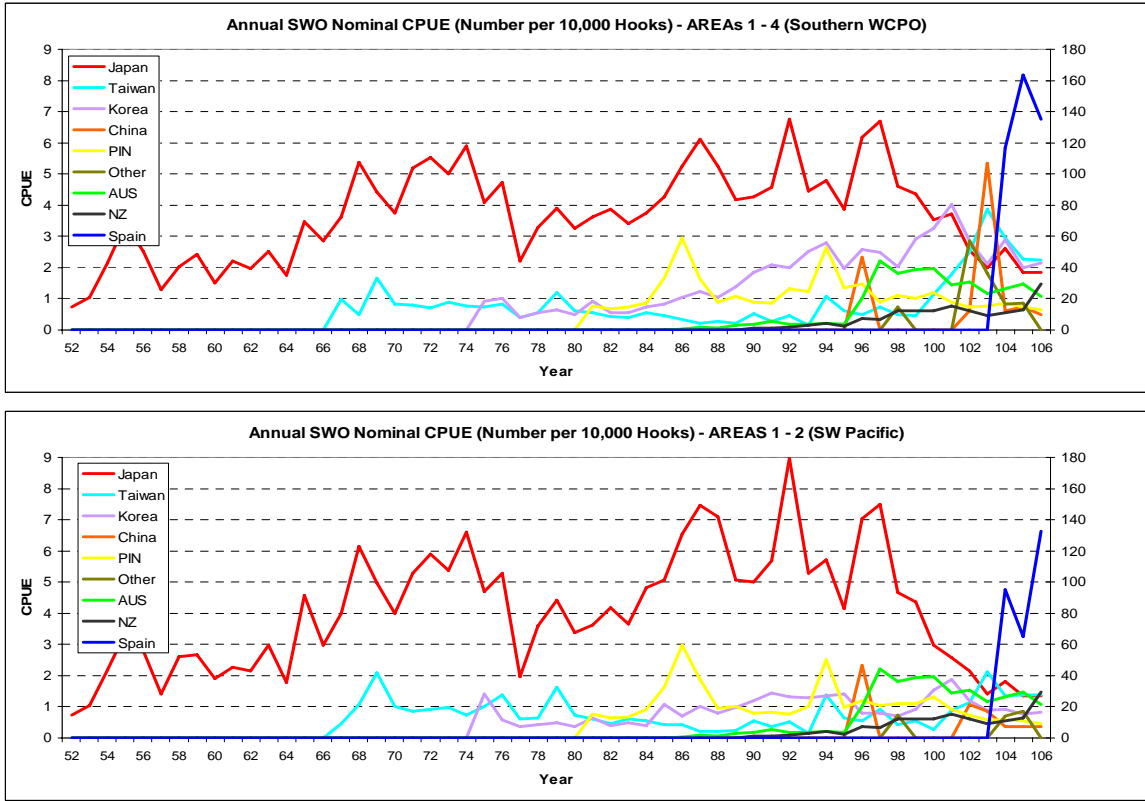


Figure 10b. Annual nominal swordfish CPUE (number of fish per 10,000 hooks) for the main Pacific Island Nation longline fleets in the south WCPO and the SW Pacific.

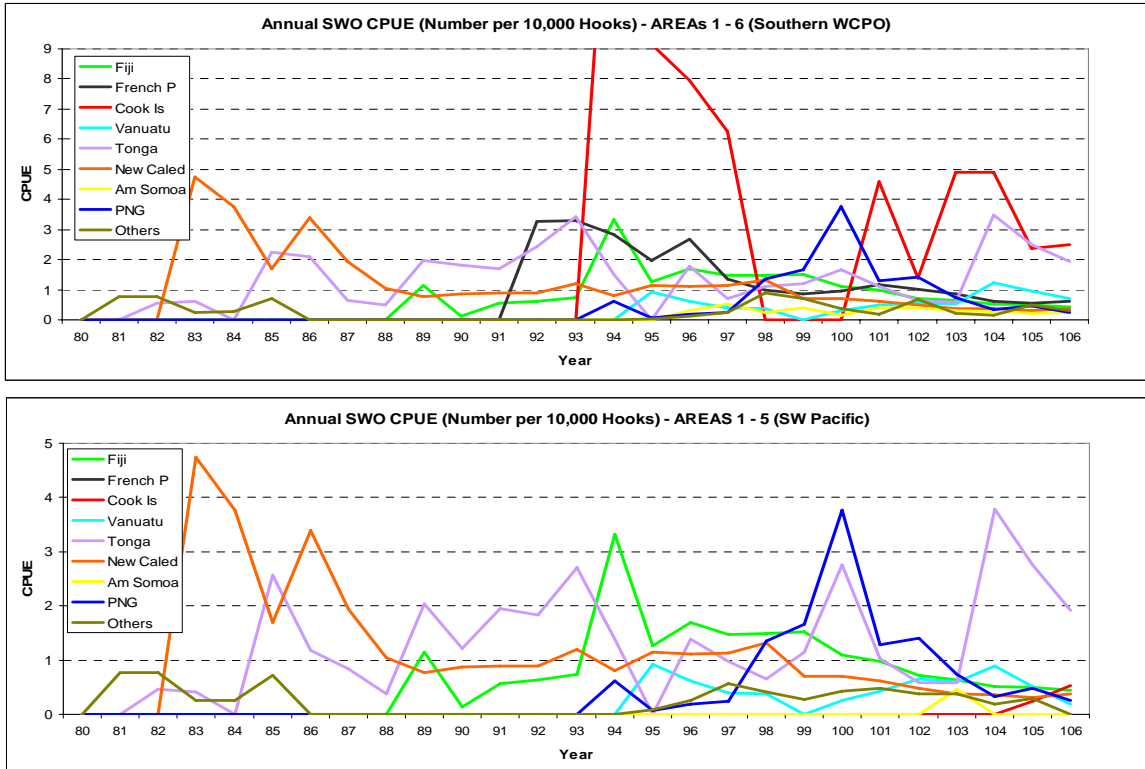


Figure 11a. Histograms of lower-jam to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 1.

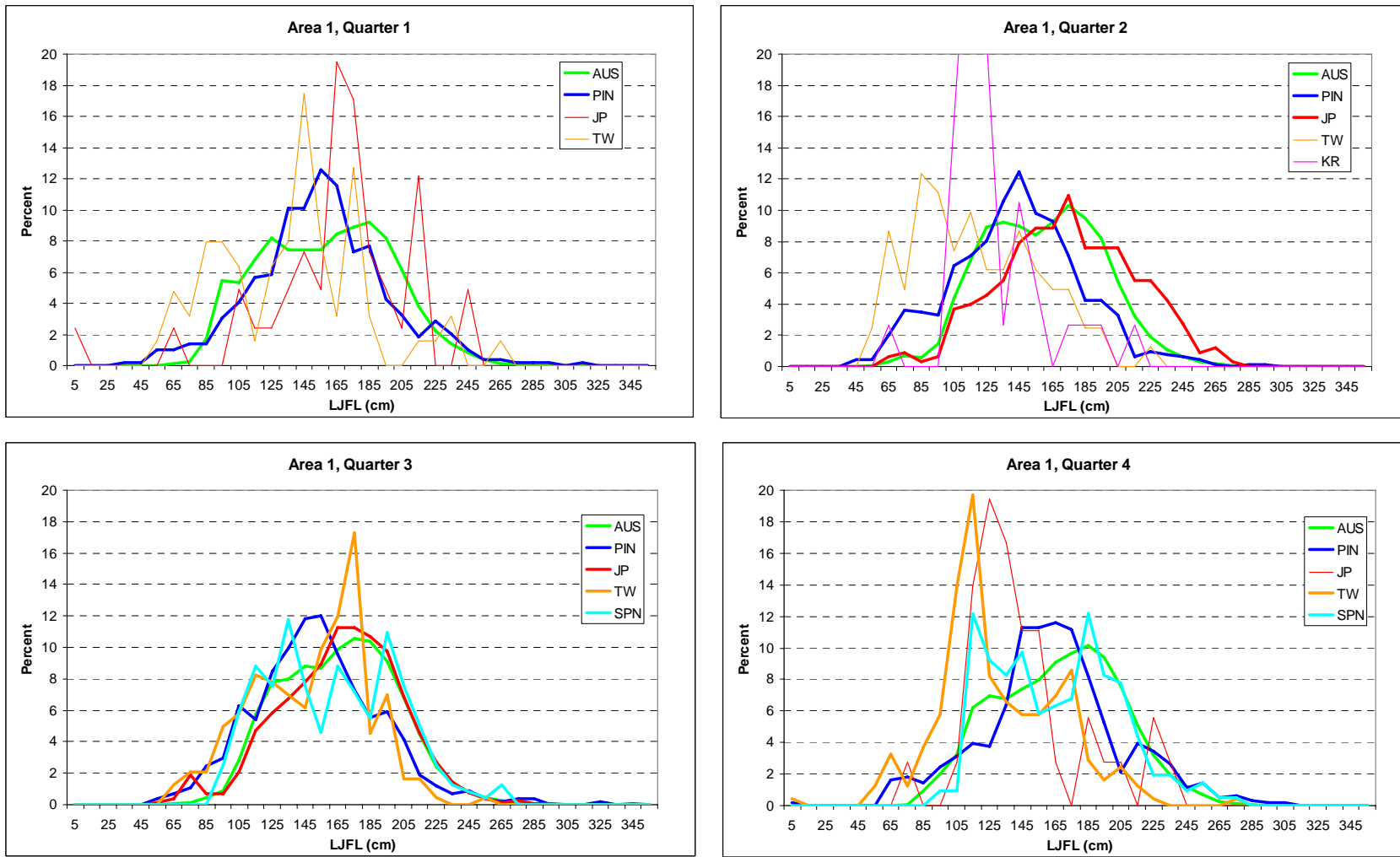


Figure 11b. Histograms of lower-jam to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 2.

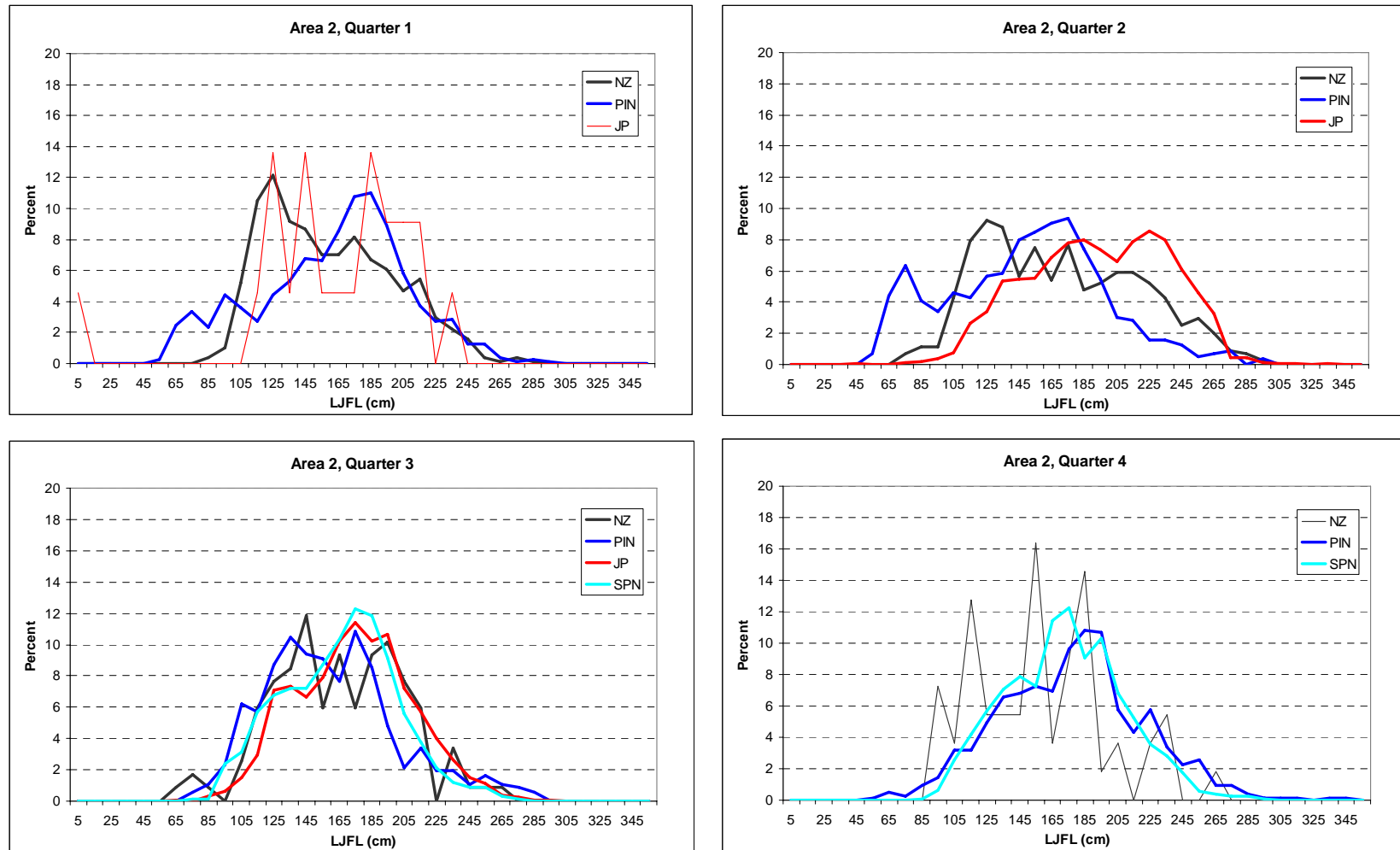


Figure 11c. Histograms of lower-jam to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 3.

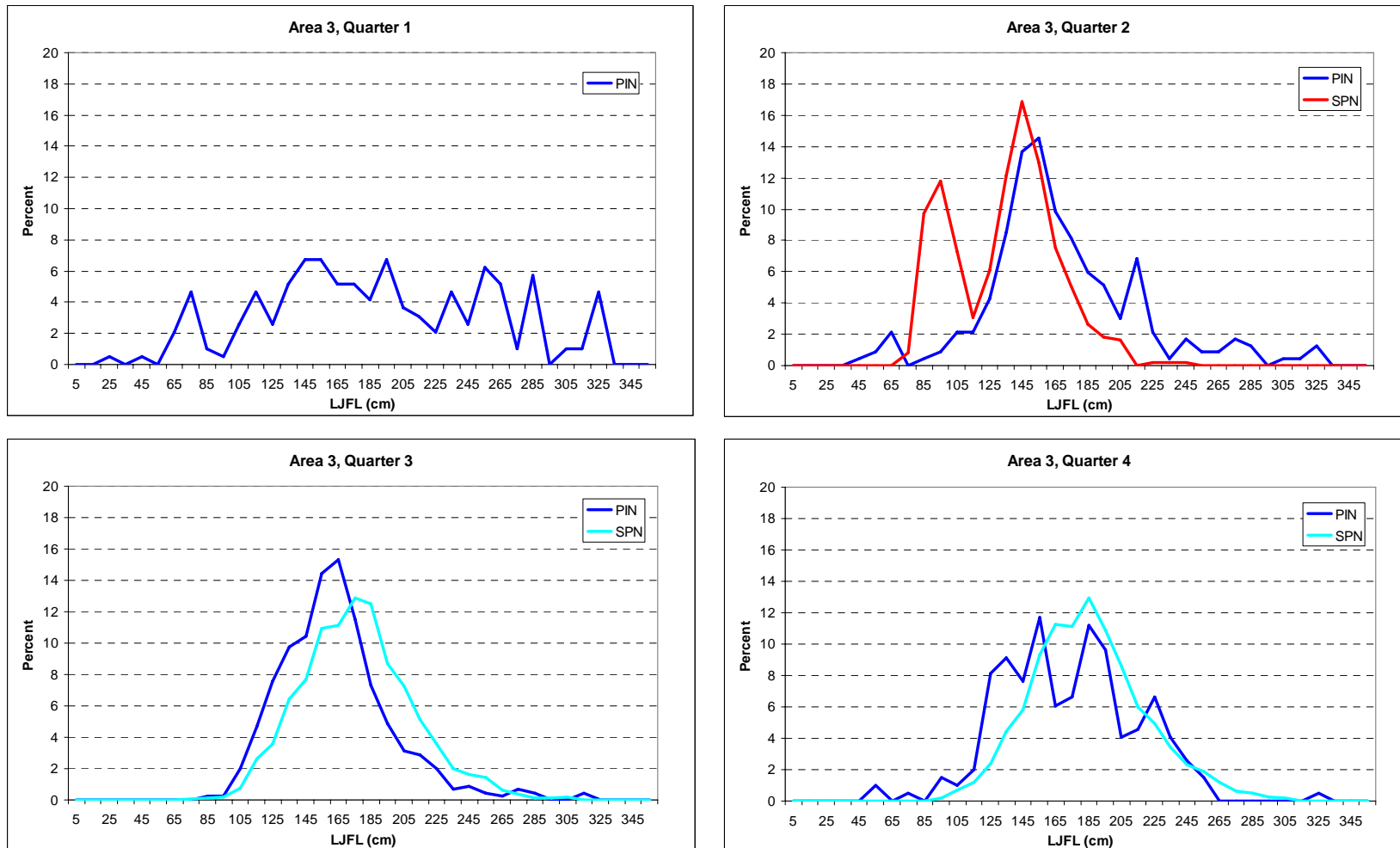
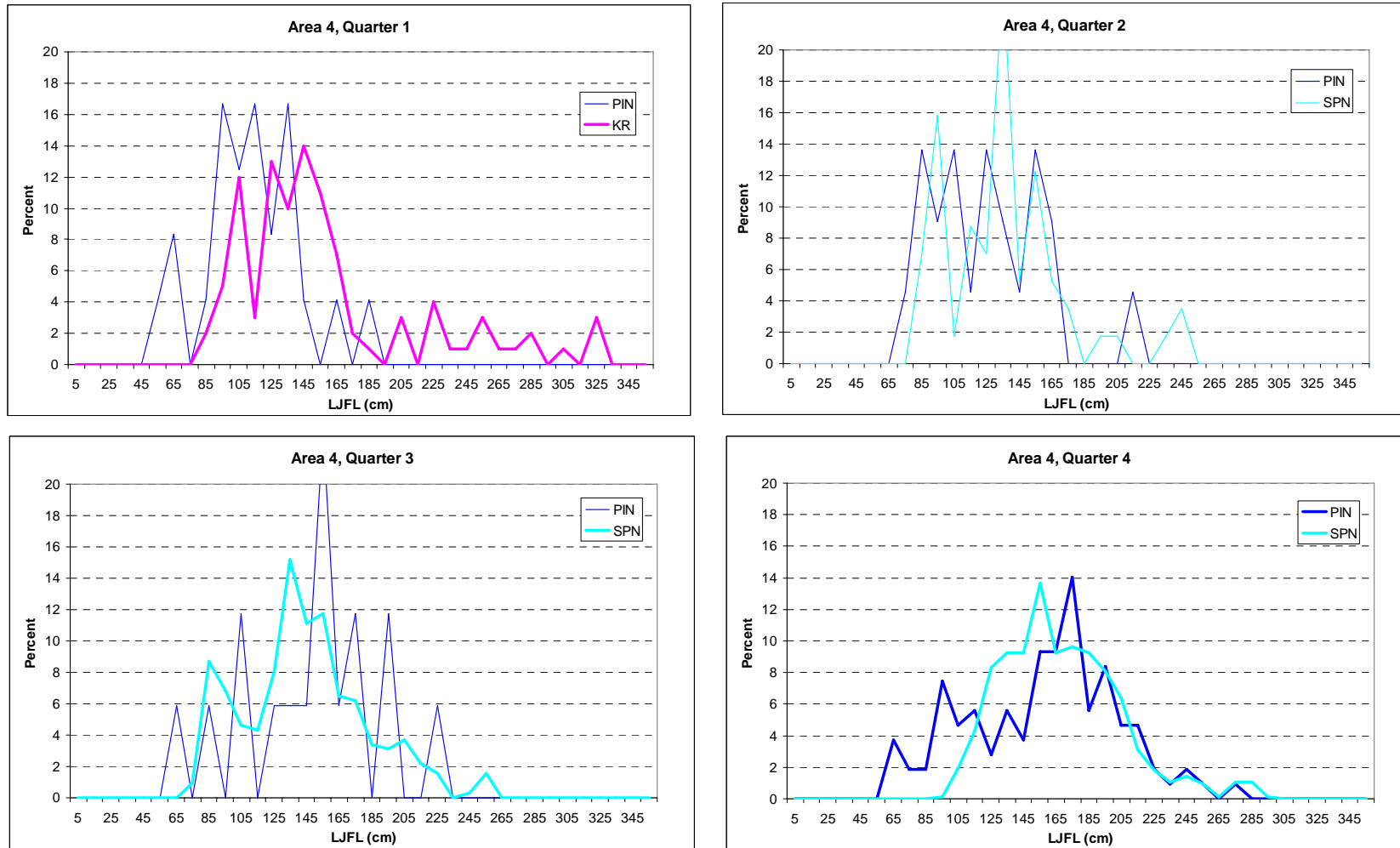
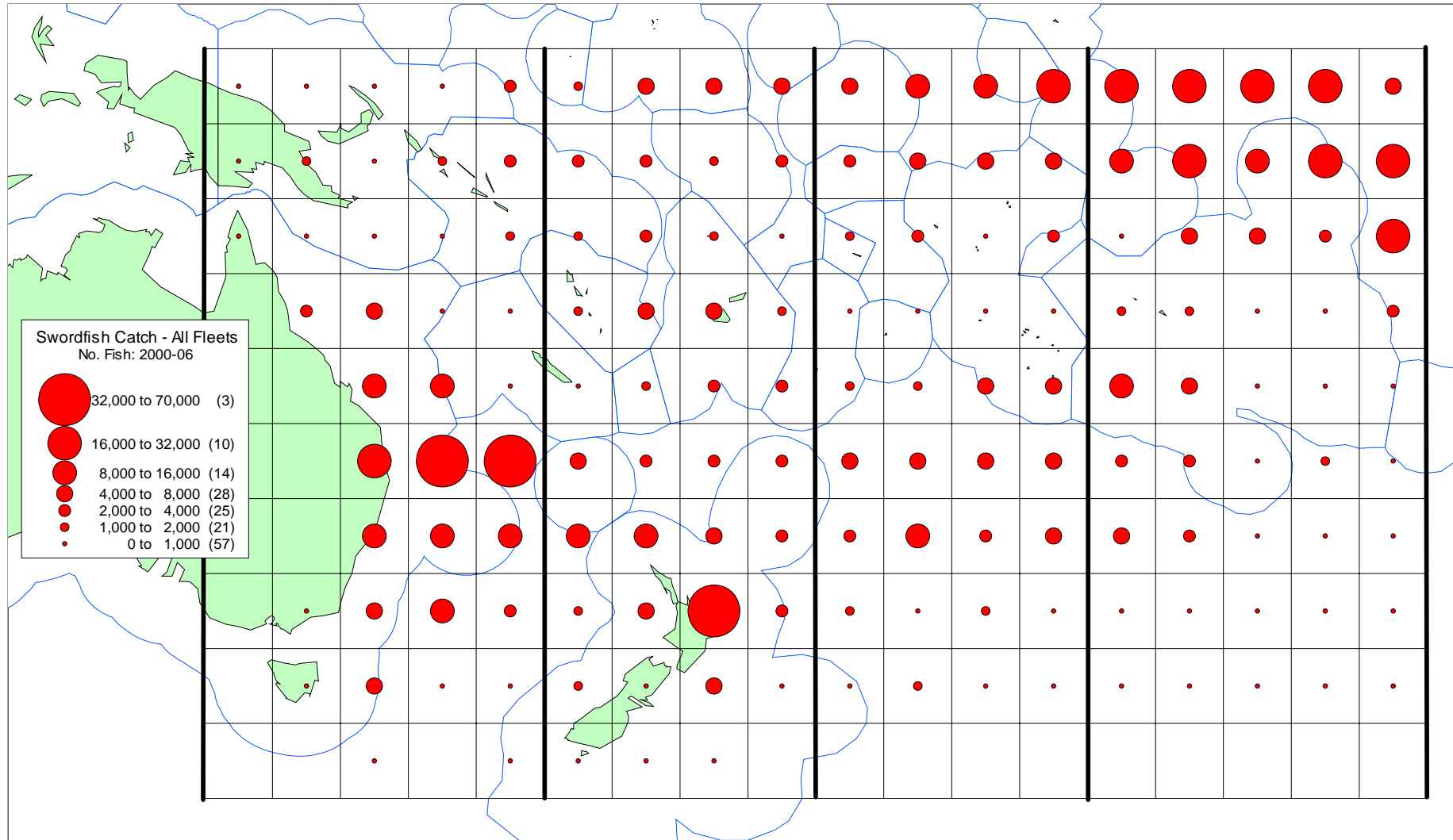


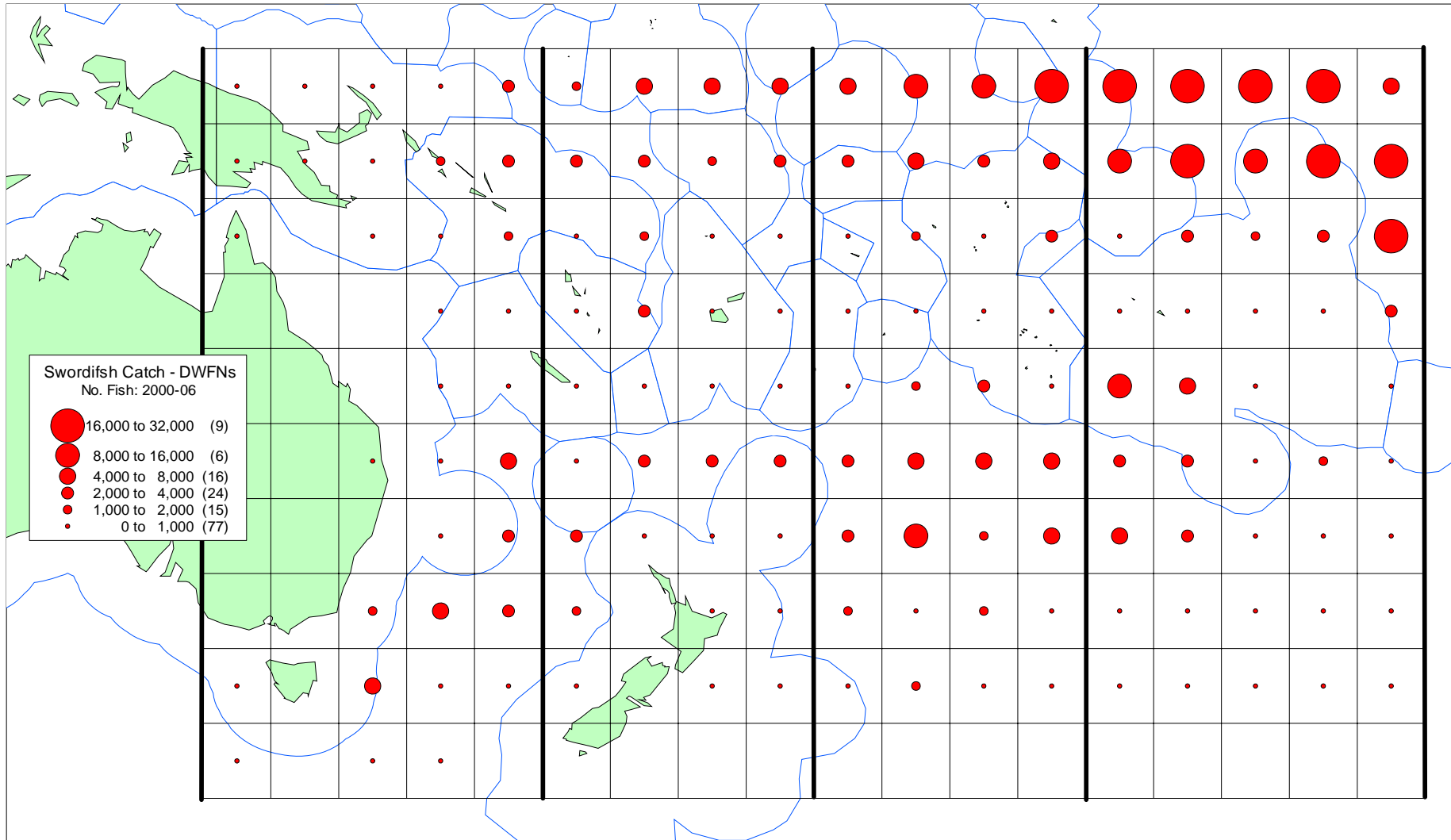
Figure 11d. Histograms of lower-jam to caudal length measurements, by quarter, for swordfish caught by various fleets operating in assessment Areas 4.



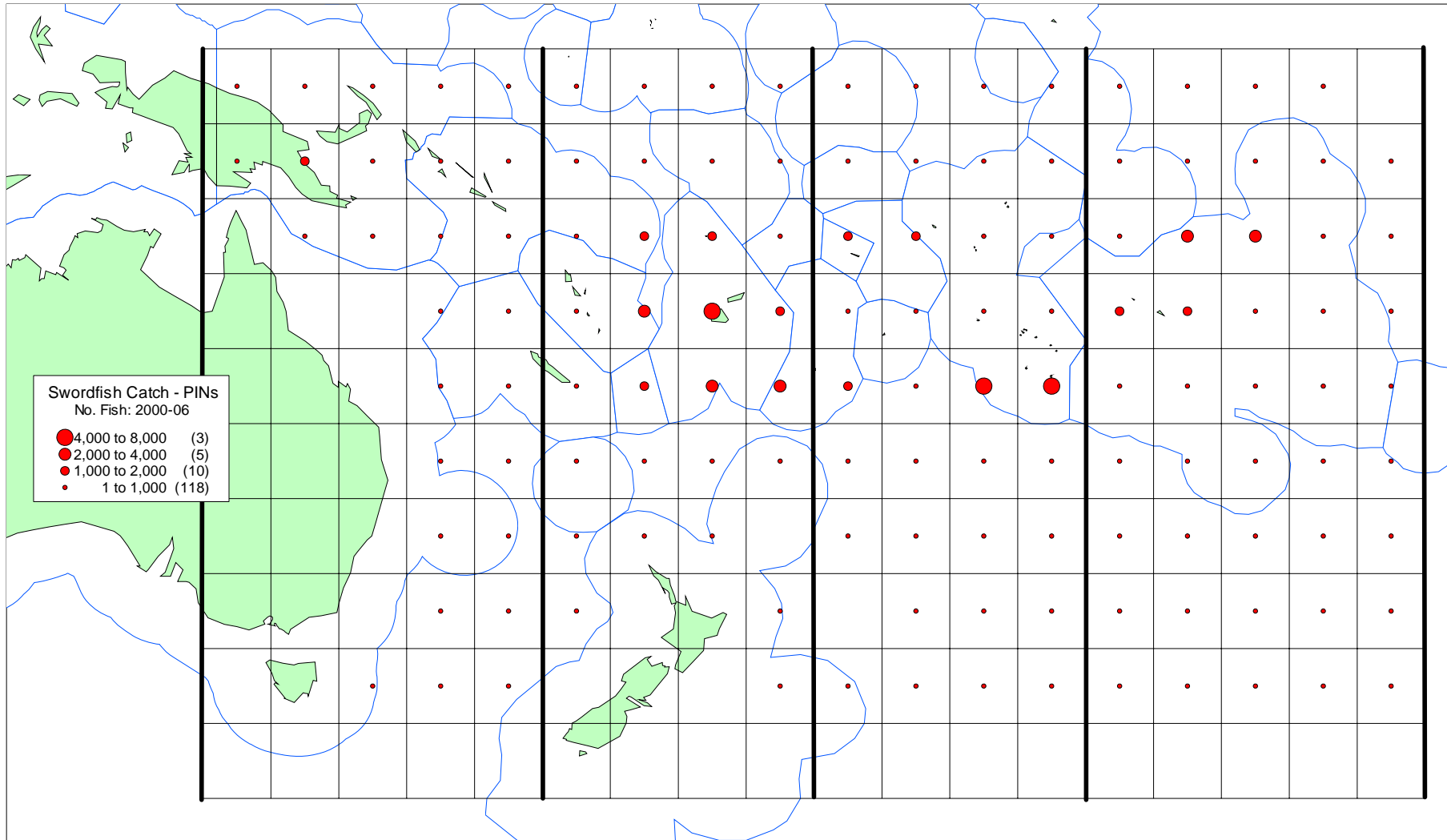
Map 1a. Spatial distribution of the total catch of swordfish (number of fish) taken by longline fleets in the southern WCPO: 2000 and 2006.



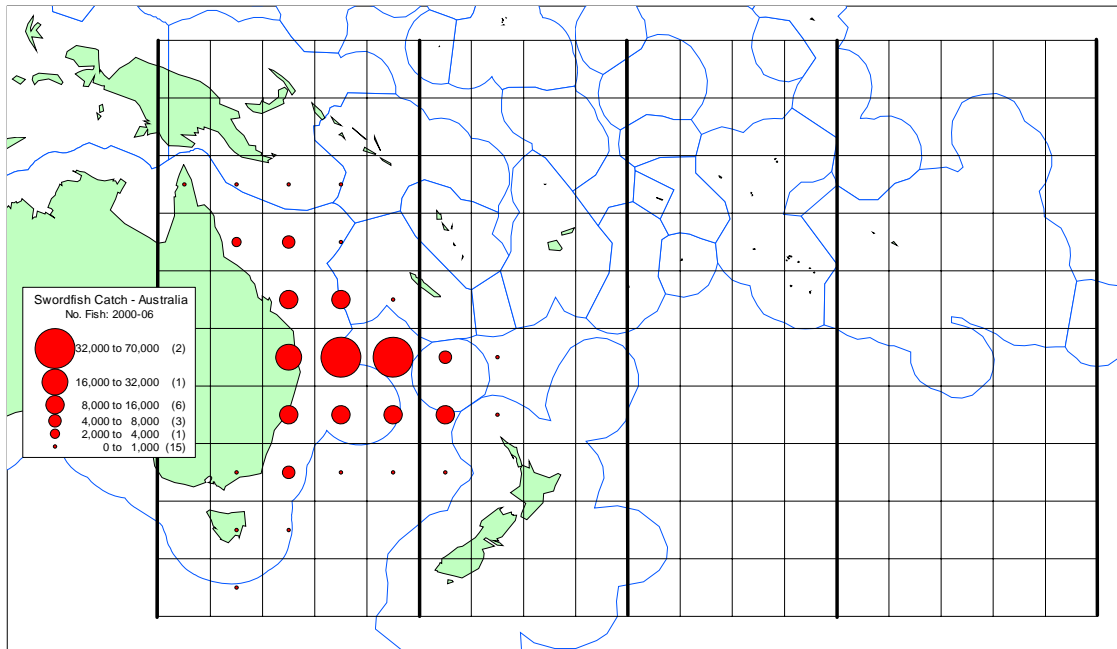
Map 1b. Spatial distribution of the total catch of swordfish (number of fish) taken by DFWN fleets in the southern WCPO: 2000 and 2006.



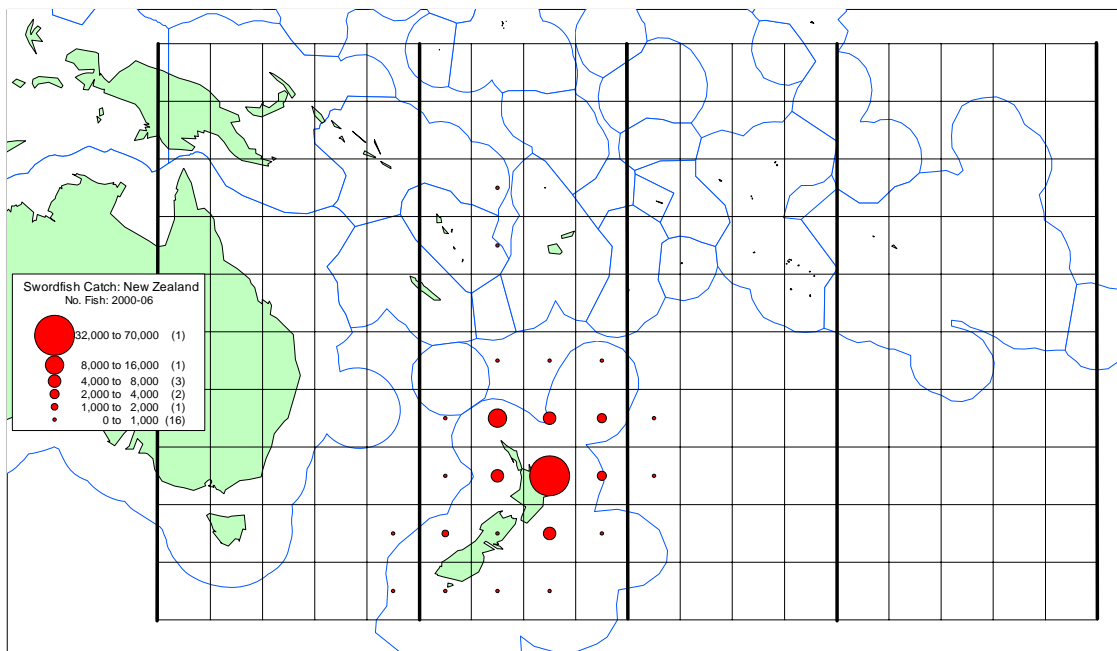
Map 1c. Spatial distribution of the total catch of swordfish (number of fish) taken by PIN fleets in the southern WCPO: 2000 and 2006.



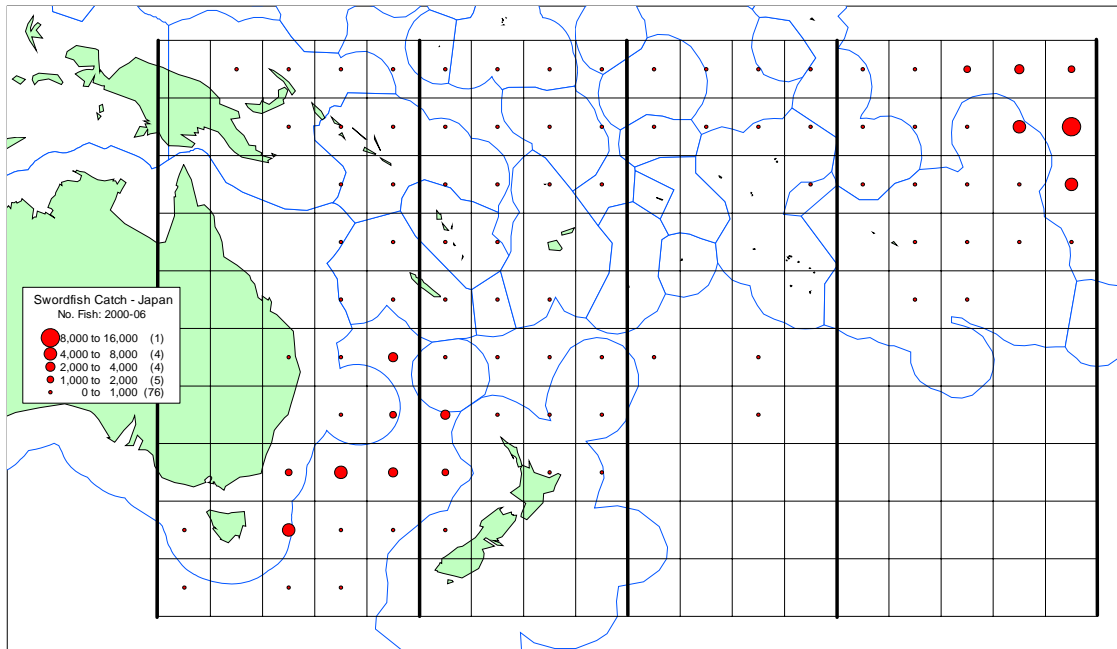
Map 2a. Distribution of Australian swordfish catch: 2000-06.



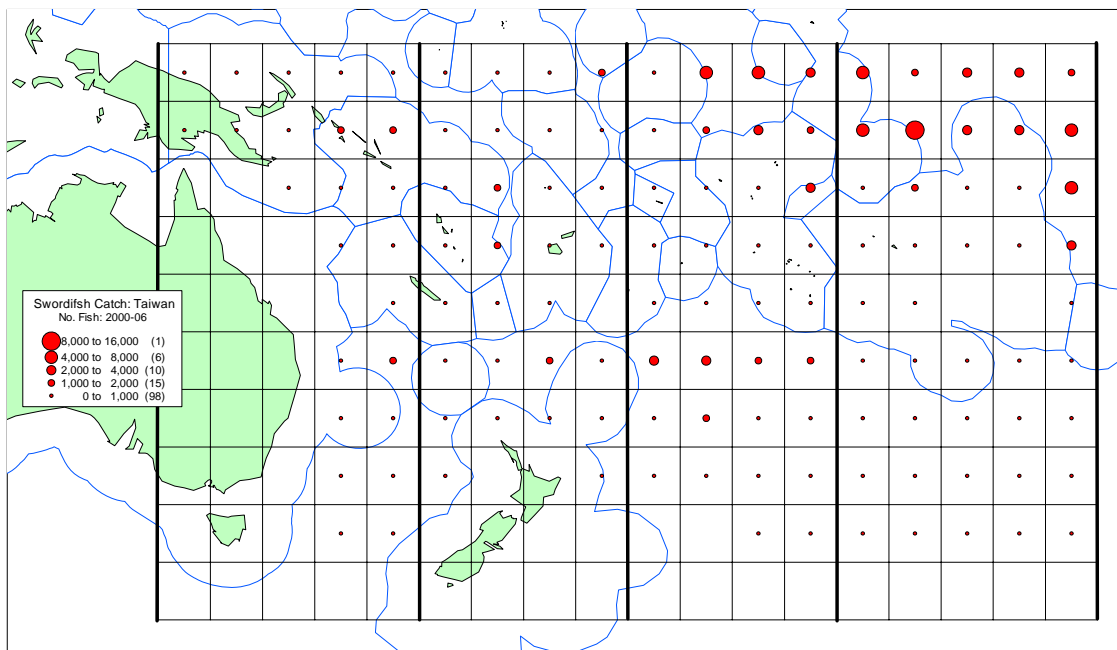
Map 2b. Distribution of New Zealand swordfish catch: 2000-06.



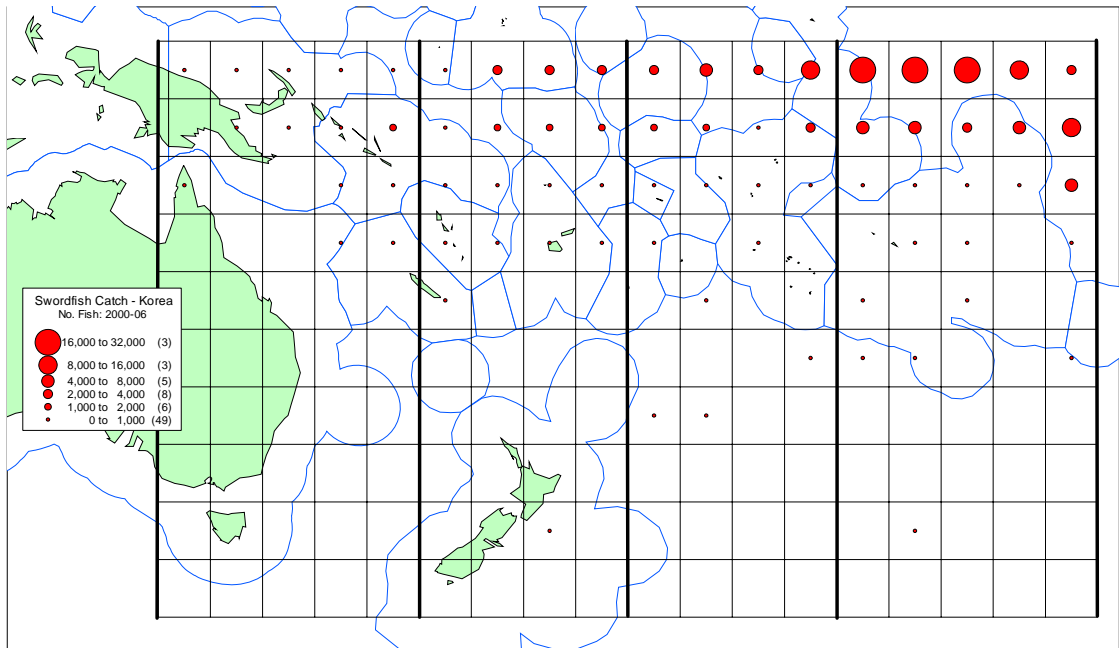
Map 2c. Distribution of Japanese swordfish catch: 2000-06.



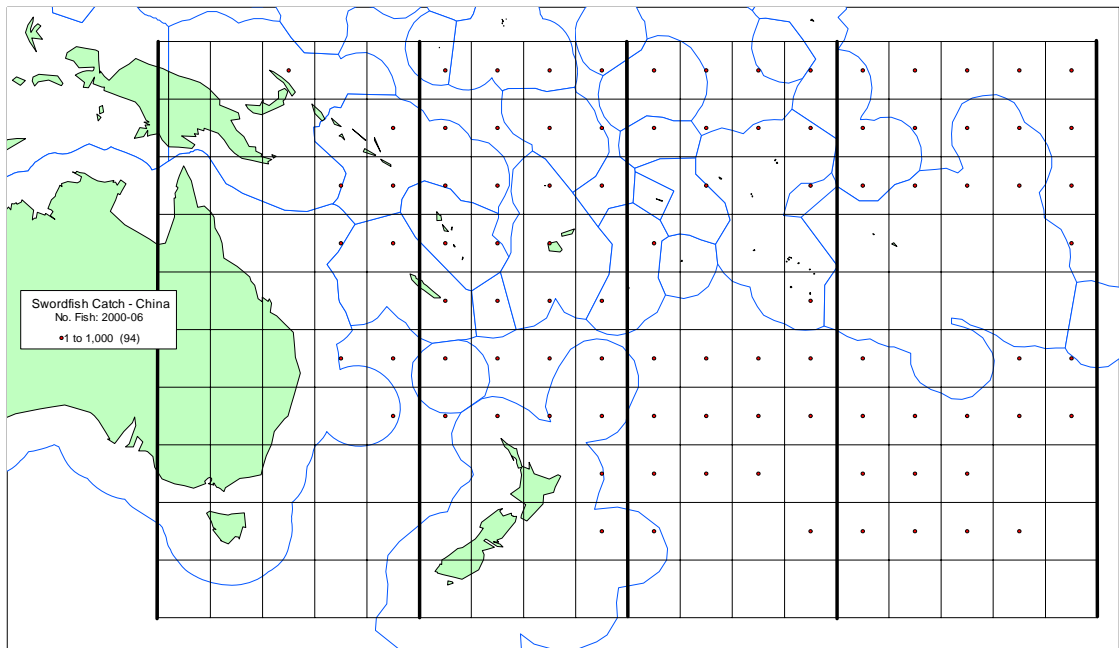
Map 2d. Distribution of Taiwanese swordfish catch: 2000-06.



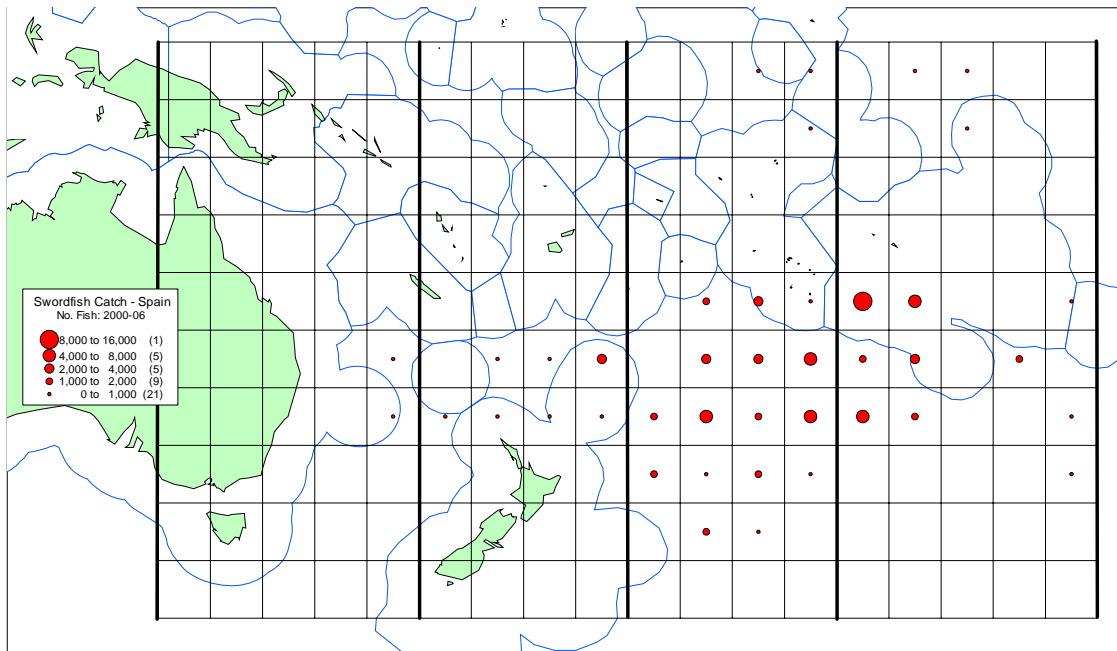
Map 2e. Distribution of Korean swordfish catch: 2000-06.



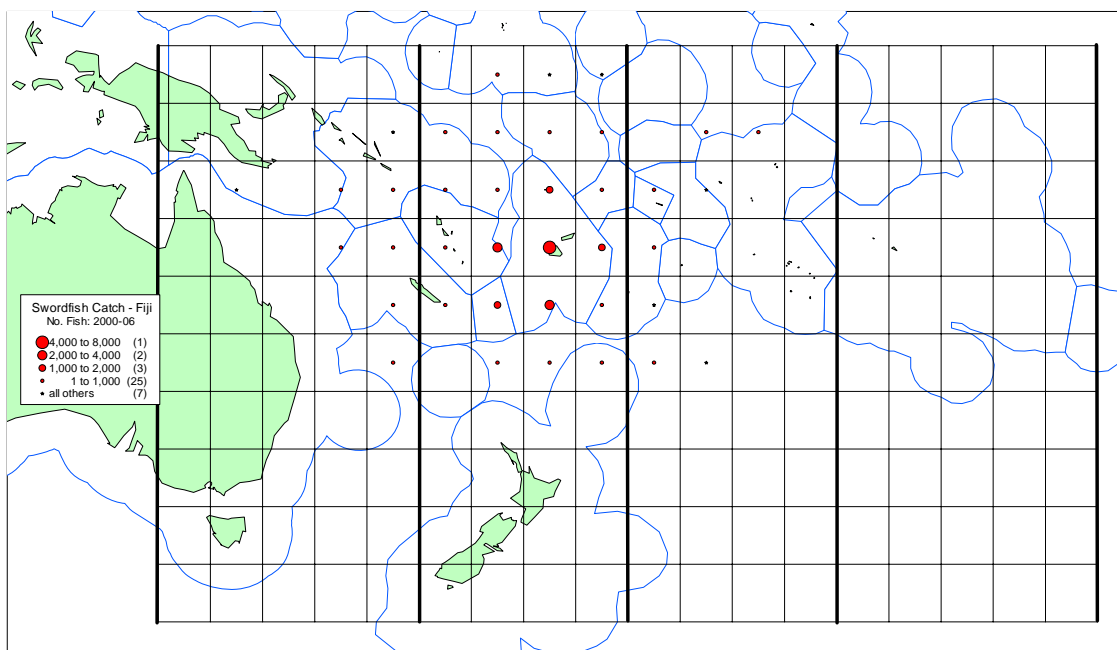
Map 2f. Distribution of Chinese swordfish catch: 2000-06.



Map 2g. Distribution of Spain swordfish catch: 2000-06.



Map 2h. Distribution of Fijian swordfish catch: 2000-06.



Map 3. Spatial distribution of Japanese nominal swordfish CPUE, by quarter, aggregated over the years 1971-2005.

