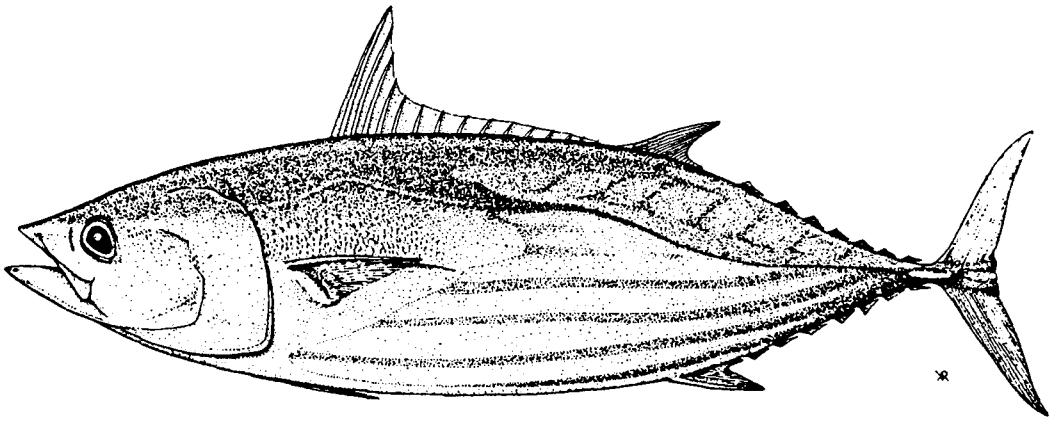
SPC PORT SAMPLING WORKSHOP

17-21 January 1994
Chuuk
Federated States of Micronesia

WORKING PAPER 1

STATUS OF LONGLINE PORT SAMPLING PROGRAMMES SUPPORTED BY THE SOUTH PACIFIC COMMISSION



Tuna and Billfish Assessment Programme
South Pacific Commission
Noumea, New Caledonia

June 1993

samplers to collect catch and effort logbooks and to sample 100 albacore per trip, from trollers and foreign longliners. EVAAM, under biologist Stephen Yen, provided logistic support, administered the funds, and trained and supervised the port samplers. Additional funds were provided by SPC to continue sampling during 1992.

Status

Port sampling in Papeete has proceeded smoothly. Complete responsibility for funding of sampling during 1993 was met by EVAAM.

MARSHALL ISLANDS (MAJURO)

Longline transshipment has occurred on Majuro since December 1990. Approximately six Taiwanese longliners transshipped in Majuro in 1991, unloading fish destined for the Japanese and Hawaiian markets. Taiwanese vessels ceased transshipping in Majuro in June 1992. Four other vessels owned or managed by local interests have operated since 1991. In late 1992, four American - Marshall Islands joint-venture vessels began fishing out of Majuro, managed by MMAGG and the Marshall Islands Development Agency (MIDA).

Transshipment in Majuro is conducted by MMAGG Inc., a joint-venture between MMG, Hawaii, and MIDA. In January 1993, transshipment took place twice a week, on Friday and Monday evenings, prior to Air Marshall Islands flights to Honolulu on Saturday and Tuesday mornings. Up to five vessels transshipped during a day, with each vessel unloading for about two hours.

Port sampling was initiated in February 1992 by the SPC Assistant Fisheies Statistician (Peter Williams), who trained the Marshall Islands Marine Resources Authority (MIMRA) port sampling officer, Virgil Alfred. Sampling proceeded regularly until January 1993, when MMAGG began transshipping at midnight, rather than in late afternoon. Sampling ceased for a month, until arrangements could be made to replace Alfred, who was not available for late night work. Sampling recommenced in February 1993, with Xavier Myazoe, MIMRA statistican, acting as the head port sampler, and has proceeded regularly since then.

Originally, sampling was conducted on palets onto which the fish were hoisted by a dockside crane, before being taken by a forklift over to the packing area. Since January 1993, sampling has been done at tables in the packing area, rather than on the palets, in order to allow recording of the weights measured on the scale at the packing area, as well as lengths. One problem, however, is that after the length measurement is taken, but prior to weighing, the heads and tails are usually removed, so the fish weights taken in Majuro are not directly comparable with weights recorded at other ports. The samplers have been instructed to write on the form that the weights were headed and tailed, and to note on the form if any fish were measured with heads and/or tails.

Another potential problem concerns the units of weight measurements. Fish bound for Hawaii are measured in pounds, while fish bound for Japan are measured in kilogrammes. Fish unloaded from a single trip are often sent to both destinations. The sampler has been instructed to note the units of each measurement for each fish.

All fish unloaded for a trip are measured, including the rejected tuna and swordfish. Coverage of trips was moderate to high, until January 1993, when sampling temporarily ceased. Sampling recommenced in February 1993.

MIMRA has been consistent in forwarding the port sampling sheets to SPC, where they are processed. MIMRA has also sent transshipment summary forms, detailing the amount unloaded, by species, for each trip, which is obtained from MMAGG.

Status

With the exception of January 1993, when sampling was interrupted, longline port sampling in Majuro has proceeded regularly since implementation in February 1992. The port sampling data are forwarded to SPC on a regular basis, together with information summarising all transshipments.

NEW CALEDONIA (NOUMEA)

Sampling of albacore catches landed in Noumea by the Caledonie Toho fleet of longliners began in May 1990, with the objective of collecting length data, gonads and hard parts for biological studies. SPC staff conducted sampling on a weekly basis, meeting vessels entering port to transship yellowfin and bigeye destined for Japan. About 100 albacore were sampled from each unloading. During 1992, yellowfin and bigeye were also sampled. Sampling operations were taken over by the Service Territorial de la Marine Marchande et des Pêches Maritimes, New Caledonia, under the supervision of Régis Etaix-Bonnin, in January 1993. Throughout the port sampling programme, collection of catch and effort logbooks, which are used to identify the time-area fished, has been incomplete.

Status

Port sampling has been carried out on a regular basis since implementation in 1990. However, the lack of catch and effort logbooks for 78 per cent of trips has resulted in problems determining the time-area fished, thereby reducing the usefulness of the length data collected.

PALAU (KOROR)

Taiwanese longliners began transshipping at Koror in 1987. During 1992, Japanese longliners began transshipping. Most vessels are 25—49 gross tonnes. The vessels are managed by two companies, Palau International Traders Incorporated (PITI) and Palau Marine Industries Corporation (PMIC). A third company, Palau Freight and Forwarding Service (PFFS), has been involved in transshipment activity in the past, but has not been active since at least 1991. During 1991, PITI managed 40 Taiwanese and 28 mainland Chinese vessels, while PMIC managed 30 Taiwanese and 3 mainland Chinese vessels.

Yellowfin and bigeye make up 95 per cent of the fish sent by air freight to Japan. During 1990, approximately 2,186 mt were sent to Japan; during 1991, 2,781 mt were transshipped. It has been estimated that the amount of other species unloaded, including blue marlin, black marlin, swordfish, mahi mahi and sharks, is on the order of 25—30 per cent of the amount transshipped to Japan.

Catch rates are low from December through March, 15-20 fish per trip for Taiwanese vessels, compared to 70 fish per trip during the rest of the year. Therefore most Taiwanese vessels stop fishing during late January — early March and return to Taiwan. Japanese vessels operate year round and, when fishing is good, usually transship 100—200 fish.

Sampling was implemented during June—July 1991 by a consultant (Kevin Williams) recruited by SPC and funded by the United Nations Development Programme (UNDP). An employee of the Marine Resources Division (MRD), Masubed Tkel, was trained and began sampling at the two dock areas, one used by PITI and the other by PMIC. From 1 September 1991 to 30 September 1992, Tkel's salary was funded by SPC.

In August 1991, a data processing system for the length samples was implemented at MRD by the SPC Programmer/Research Officer (Russell Price).

Sampling proceeded regularly until July 1992, when MRD assigned Tkel to other activities. No sampling occurred during August 1992 — January 1993. Sampling activities recommenced in February 1993, shortly after Tkel was transferred to the Palau Maritime Authority (PMA).

PMA has been responsible for management of tuna fisheries, including the collection and processing of cargo manifests, catch and effort logsheets, and packing lists. Processing of the transshipment data, however, has suffered from delays. During early 1993, an attempt was made to clear the substantial backlog of data processing.

Forwarding of the port sampling data to SPC has not been successful. The only data received at SPC to date was hand-carried by Price after his visit in August 1991. The situation was discussed with Tkel, however, in January 1993, and is expected to improve.

During transshipment, fish are hoisted by the tail with a winch from the hold to a ramp; then hauled up the ramp with a gaff; then dragged two metres over the smooth concrete of the dock to where they are sponged down and rinsed; then placed on a metal table a few centimetres off the ground where they are graded; then dragged a metre to the scale sitting on the ground where they are weighed; then lifted by hand to the waist-high metal table, where Tkel measures with his calipers; then slid into the plastic-lined boxes with dry ice. As at PITI, the rejects are put to the side after grading and are not weighed. Tkel has been instructed to measure the rejects as well as the air-freighted fish.

Unlike other ports, where all fish unloaded are measured, the sampling protocol for Taiwanese vessels in Koror is to measure 50 tuna in sequence from whenever measuring begins, or until the vessel ceases unloading. In January 1993, the sampling protocol for Japanese vessels, which unload 100—200 fish per trip, compared to 50—100 fish for Taiwanese vessels, was modified such that 100 fish are measured. The sampling protocol was also modified in January 1993 to include rejects in the 50 or 100 fish sampled. Previously, no rejects had been sampled. The rejected fish appear to be larger on-average than other fish.

Status

During the initial phase of longline port sampling in Koror, July 1991 — July 1992, rejects were not measured, which may have resulted in biased samples. The sample size for Japanese vessels was the same as for Taiwanese vessels, even though the Japanese regularly unload more fish than

the Taiwanese. Both problems, i.e., rejects and the sample size for Japanese vessels, were addressed in January 1993.

The lack of sampling during the latter half of 1992 represents a serious gap in the time series. While it would have been useful to compare length frequencies from Koror to other ports, on a quarterly basis throughout 1992, this is no longer possible.

The lack of full information on the number of unloadings and the total amount unloaded, from sources other than port sampling, such as cargo manifests and packing lists, due to delays in data processing at PMA, makes a detailed analysis of coverage impossible. Full information on the total amounts transshipped, by vessel nationality, will be essential for raising the length frequency samples to represent the total catch of fish transshipped in Koror.

COVERAGE OF CATCHES BY PORT SAMPLING

Table 1 presents a summary of the number of fish sampled by port of unloading. The sampling effort varied considerably among ports during 1992, from 564 fish sampled in Koror to 26,182 fish sampled in Yap. A total of 68,723 fish was sampled during 1992.

In order to establish the coverage of unloadings by the port sampling programmes, Table 2 gives summary of unloadings by port, fleet, year and month, for Majuro, Pohnpei and Yap. Unfortunately, unloading data for other ports are currently unavailable. The unloading statistics have been compiled from various sources, including packing lists, cargo manifests and other records provided by vessel agents. According to the data available, 226 mt were transshipped from Majuro during 1992, 774 mt from Pohnpei, and 1,340 mt from Yap.

It would appear that the estimate of unloadings for Yap during 1992, 1,400 mt, which was determined from data compiled by the Micronesian Maritime Authority (MMA), is under-estimated, since the vessel agent on Yap has indicated that a total of 2,100 mt were transshipped from Yap during 1992. Unloading data for Majuro and Pohnpei have not, as yet, been verified against totals provided by the vessel agents.

Table 3 compares the number of vessels, trips and the total amount transshipped determined from port sampling data to those determined from the available unloading data. In Majuro and Pohnpei, coverage in terms of the amount of fish unloaded appears to be moderate to high, 59—86 per cent in Majuro and 59—74 per cent in Pohnpei. In Yap, the MMA unloading data indicates that coverage is high, 86 per cent for Taiwanese vessels in 1992, although, given the Ting Hong figure of 2,100 mt transshipped during 1992, the actual coverage is probably much less.

STRATIFICATION OF LONGLINE LENGTH FREQUENCY SAMPLES BY AREA

For purse seiners, the catch location of the fish sampled can often be identified to the nearest minute of longitude and latitude. Samples are taken from the wells where the fish are stored after capture. Usually the catches from only one or a few sets are stored in the same well. The location of the set and the well in which the catch was stored are recorded together on the logsheet, thus enabling identification of the position at which the fish sampled in the well were caught.

In contrast, for longliners, it is not possible to identify the catch location of the fish sampled with such precision. While the set positions are recorded on logsheets, the fish from each set are stored together, making it impossible to identify the set from which the fish were caught. For longliners, the best that can be accomplished is to identify the area fished during the trip. Provision for recording the area fished is made on the sampling forms. However, this information is often not available to the port samplers. In cases for which the area fished has not been recorded on the sampling form, the logsheet data must be cross-referenced to identify the area fished.

Unfortunately, logsheets are not always available. Table 4 shows the proportion of trips sampled for which logsheet data are available (P5) varies among ports. No logsheet data are currently available for vessels unloading in Koror during 1992. Only 25—33 per cent of trips sampled are covered by logsheets for vessels based in Majuro. Logsheets are available for most trips sampled in Yap and Pohnpei.

Even when logsheets are available, however, quite often the catch can still not be allocated to a single area strata (even as large as 10° x 20°) due to the large area fished during some trips (Table 4, T10, P10).

The importance of the problem in identifying the catch position of fish sampled will depend in part on the amount of overlap in the areas fished from the different ports. If overlap occurs, it would be necessary to somehow isolate samples from the area of overlap in order to compare and possibly aggregate length frequencies taken from the different ports. Figures 1—6 present the distribution of yellowfin and bigeye catches during 1992, determined from daily catch and effort logsheets, for each of the major fleets based in Majuro, Pohnpei and Yap. It is noteworthy that the distributions of the catch of both yellowfin and bigeye exhibit little overlap among ports. Unfortunately, logsheet data for 1992 for vessels based in Koror are unavailable at present; these data may possibly show some overlap with vessels based in Yap.

Whereas the areas fished from each port appear not to overlap, the areas fished for each of the fleets based in the same port appear to be identical, except for Pohnpei. The Japanese and Taiwanese vessels based in Pohnpei fished in generally the same area during 1992. However, the Korean fleet fished well apart from the Japanese and Taiwanese fleets, further to the north and to the south.

VARIATION IN LENGTH FREQUENCIES

Visual inspection of the length frequencies presented in Figures 1—6 indicates that the length frequencies can differ among areas fished and among fleets fishing the same area.

Length frequencies of yellowfin and bigeye landed in 1992 show smaller fish in Majuro than in Yap. For Taiwanese vessels, the mean length of yellowfin landed in Majuro is 115.5 cm compared to 127.9 cm for yellowfin landed in Yap, while the mean length of bigeye landed in Majuro is 126.3 cm compared to 135.9 cm for bigeye landed in Yap.

Length frequencies of fish landed in Pohnpei during 1992 by Japanese and Korean vessels are similar, with similar mean lengths, although the two fleets fished in different areas. Length frequencies for fish landed by the Taiwanese based in Pohnpei, however, are different from those for fish landed by the Japanese and Koreans, with the Taiwanese landing larger fish on average.

Bearing in mind that the Taiwanese and Japanese based in Pohnpei fished in similar areas during 1992, but that the length frequencies are different, either the two fleets are selectively catching different sized fish, or the two fleets are catching similar sized fish but selectively discarding.

Of special interest is the relatively large number of small (80—95 cm) fish, particularly yellowfin, landed by American vessels in Majuro. The number of similar sized fish landed by the other fleets, regardless of port, is negligible, even though sample sizes in Pohnpei and Yap are large.

FUTURE DIRECTIONS

The sampling programmes have in general operated smoothly during 1992, with the exception of Koror, where sampling was interrupted during the second half of the year. Sampling has since recommenced in Koror, and it is expected that sampling will continue to proceed smoothly in the other ports during 1993.

The longline sampling form currently used in Mirconesia has recently been revised to account for different methods of length measurement, different units of weight measurement, and other items (attached). The revised form should be introduced to other ports in order to standardise data collection and processing. Correct usage of the revised form should be verified in each port.

Compilation and verification of statistics on the amounts unloaded per trip are necessary to estimate the coverage of the port sampling programmes and to raise the sampled length frequencies to the total catch. Unloadings data should be obtained for Levuka, Lami, Koror, Noumea and Papeete, while data available for Pohnpei, Majuro and Yap, which are compiled from various sources, should be verified against totals provided by the vessel agents.

The inclusion of rejected fish in unloading data should be verified. A longline unloading summary form, which has recently been introduced in several ports, has been modified to include rejected fish explicitly (attached). Correct usage of the revised form should be verified in each port.

Efforts should be made to obtain logsheet data for Koror and to examine logsheet data for vessels unloading in Levuka, Lami, Noumea and Papeete, in order to establish the areas covered by the respective sampling programmes. Further examination of logsheet data for all ports should take into account time strata (month or quarter) to determine differences in areas fished by fleets based at the same ports.

Visual inspection of length frequencies reveals differences between areas fished and fleets fishing similar areas. Further quantitative analyses should be undertaken to explore variation in length frequencies, taking into account area fished and fleet, and also other factors not examined above, such as year, quarter and fishing vessel. The data should be examined to establish the most efficient sampling protocols, in terms of the number of fish sampled per trip and the number of vessels sampled per fleet and port. The analysis should also take into account all ports, including those not examined above, such as Levuka, Lami, Koror, Noumea and Papeete.

Differences in mean lengths between fish transshipped and fish discarded at dockside have not been addressed above. An analysis of mean lengths of rejects should be conducted for each port, in order to determine the importance of sampling rejected fish.

The possibly that fleets are selectively discarding at sea may present a problem in interpreting the length frequency data. Longline observer programmes have indicated that selective discarding occurs. Taiwanese longliners based in Pohnpei are known to discard almost all fish under 90 cm. Discussions with American skippers in Majuro have shown that they keep almost all fish caught, rather than discard on the basis of size, which would explain the large number of small fish landed by American vessels, compared to other fleets. The extent of selective discarding should be determined by comparison with information collected by observers. Where selective discarding is known to occur, the range of sizes over which sampling is unbiased should be determined.

After unloading data have been compiled and verified, the length frequency data should be raised to reflect total catches for appropriate time-area strata. The results should be reported at future meetings of the Standing Committee on Tuna and Billfish, through TBAP publications and to the port samplers.

A workshop for port samplers during 1993 should be considered. The objectives of the workshop could include:

- instruction and standardisation of sampling techniques and compilation of unloading data;
- comparison of experiences in sampling and data compilation;
- providing the context for the work of port samplers through discussion of the results and their use in stock assessment.

It is envisaged that such a workshop would increase the motivation of the port samplers, and thereby increase the quality and coverage of the data collected.

Table 1. Summary of longline port sampling data

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	NUMBER OF FISH SAMPLED					
						ALB	BET	YFT	BIL	OTH	TOTAL
FIJI	FJ	1991	OCT	1	1	62	–	–	–	–	62
			DEC	1	1	100	–	–	–	–	100
			TOT	2	2	162	–	–	–	–	162
		1992	FEB	8	15	604	332	466	–	–	1,402
			MAR	8	21	594	470	745	–	–	1,809
			APR	8	23	688	517	694	–	–	1,899
			MAY	8	21	1,059	957	337	–	–	2,353
			JUN	5	13	674	568	258	–	–	1,500
			JUL	8	17	968	547	166	–	–	1,681
			OCT	1	1	179	–	–	–	–	179
			TOT	8	111	4,766	3,391	2,666	–	–	10,823
	KR	1991	SEP	1	1	93	–	–	–	–	93
		1992	FEB	1	1	200	–	–	–	–	200
			AUG	4	4	629	–	–	–	–	629
			SEP	3	3	515	–	–	–	–	515
			OCT	1	1	200	–	–	–	–	200
			NOV	1	1	176	–	–	–	–	176
			TOT	10	10	1,720	–	–	–	–	1,720
	TO	1990	MAR	1	1	31	–	–	–	–	31
	TW	1989	DEC	7	7	277	–	–	–	–	277
		1990	JAN	4	4	186	–	–	–	–	186
			FEB	3	3	91	–	–	–	–	91
			MAR	1	1	91	–	–	–	–	91
			TOT	8	8	368	–	–	–	–	368
		1991	JUL	1	1	116	–	–	–	–	116
			AUG	1	1	100	–	–	–	–	100
			SEP	5	8	938	–	–	–	50	988
			OCT	1	1	136	–	–	–	–	136
			NOV	2	2	400	–	–	–	–	400
			TOT	9	13	1,690	–	–	–	50	1,740
		1992	JAN	4	4	800	–	–	–	–	800
			FEB	2	2	350	–	–	–	–	350
			MAR	5	5	919	–	18	–	–	937
			APR	3	3	600	–	–	–	–	600
			JUN	1	1	200	–	–	–	–	200
			JUL	4	4	793	–	–	–	–	793
			AUG	5	5	1,060	–	21	–	–	1,081
			SEP	1	1	200	–	–	–	–	200
			TOT	17	25	4,922	–	39	–	–	4,961
	ALL	1989		7	7	277	–	–	–	–	277
		1990		9	9	399	–	–	–	–	399
		1991		12	16	1,945	–	–	–	50	1,995
		1992		35	146	11,408	3,391	2,705	–	–	17,504

Table 1 (continued)

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	NUMBER OF FISH SAMPLED ALB	BET	YFT	BIL	OTH	TOTAL
KOROR	CH	1991	NOV	1	1	–	18	32	–	–	50
			DEC	1	1	–	32	7	–	–	39
			TOT	2	2	–	50	39	–	–	89
		1992	JAN	1	1	–	19	10	–	–	29
			FEB	1	1	–	7	6	–	–	13
			MAR	2	2	–	42	3	–	–	45
			TOT	3	4	–	68	19	–	–	87
	JP	1992	JAN	1	2	–	25	40	–	–	65
			FEB	1	1	–	20	13	–	–	33
			MAR	1	1	–	153	–	–	–	153
			TOT	3	4	–	198	53	–	–	251
	TW	1991	JUL	2	2	–	41	59	–	–	100
			SEP	8	8	–	157	205	–	–	362
			OCT	3	3	–	44	81	–	–	125
			DEC	2	2	–	30	41	–	–	71
			TOT	14	15	–	272	386	–	–	658
		1992	JAN	2	2	–	153	18	–	–	171
			FEB	1	1	–	20	8	–	–	28
			MAR	2	2	–	19	8	–	–	27
			TOT	4	5	–	192	34	–	–	226
	ALL	1991		16	17	–	322	425	–	–	747
		1992		10	13	–	458	106	–	–	564
MAJURO	MI	1992	JUL	1	1	-	-	18	6	-	24
			AUG	1	1	-	49	11	-	-	60
			SEP	1	1	-	33	19	-	-	52
			OCT	1	1	–	10	11	–	–	21
			NOV	2	3	–	40	47	–	–	87
			TOT	2	6	–	132	106	6	–	244
	TW	1992	FEB	1	1	–	44	6	–	–	50
			MAR	2	3	–	179	46	–	–	225
			APR	2	4	–	186	63	–	–	249
			MAY	1	1	–	82	6	–	–	88
			JUN	1	3	–	70	143	–	–	213
			TOT	2	10	–	561	264	–	–	825
	US	1992	FEB	1	1	–	40	10	–	–	50
			MAR	2	3	–	276	62	–	–	338
			APR	2	2	–	114	36	–	–	150
			MAY	2	4	–	319	587	1	–	907
			JUN	1	2	–	54	456	7	–	517
			JUL	1	1	–	49	81	–	–	130
			AUG	1	3	–	65	229	–	–	294
			SEP	1	1	–	17	31	2	–	50
			OCT	2	4	–	73	182	12	–	267
			NOV	2	4	–	187	455	50	–	692
			DEC	4	4	–	72	163	–	–	235
			TOT	5	21	–	1,266	2,292	72	–	3,630
		1993	JAN	1	1	–	35	15	–	–	50
			FEB	2	3	–	117	103	–	–	220
			MAR	2	3	–	83	37	–	–	120
			APR	1	1	–	14	17	14	–	45
			TOT	4	8	–	249	172	14	–	435

Table 1 (continued)

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	NUMBER OF FISH SAMPLED ALB	BET	YFT	BIL	OTH	TOTAL
	ALL	1992		9	37	–	1,959	2,662	78	–	4,699
		1993		4	8	–	249	172	14	–	435
NOUMEA	NC	1990	MAY	1	3	143	–	–	–	–	143
			JUN	2	5	277	–	–	–	–	277
			JUL	2	6	354	–	–	–	–	354
			AUG	1	2	216	–	–	–	–	216
			SEP	2	5	391	–	–	–	–	391
			OCT	2	7	506	–	–	–	–	506
			NOV	3	5	236	–	–	–	–	236
			DEC	2	3	200	–	–	–	–	200
			TOT	3	36	2,323	–	–	–	–	2,323
		1991	JAN	2	4	217	–	–	–	–	217
			FEB	3	4	327	–	–	–	–	327
			MAR	2	3	174	–	–	–	–	174
			APR	3	10	382	–	–	–	–	382
			MAY	3	5	291	–	–	–	–	291
			JUN	2	3	167	–	–	–	–	167
			JUL	2	6	540	–	–	–	–	540
			AUG	2	4	403	–	–	–	–	403
			SEP	2	5	363	–	–	–	–	363
			OCT	2	6	365	–	–	–	–	365
			NOV	2	3	201	–	–	–	–	201
			TOT	4	53	3,430	–	–	–	–	3,430
		1992	JAN	1	2	203	–	–	–	–	203
			FEB	2	3	92	4	182	–	–	278
			MAY	2	2	211	22	34	–	–	267
			JUN	2	6	291	36	43	–	–	370
			JUL	2	4	130	9	14	–	–	153
			AUG	2	4	305	1	29	–	–	335
			SEP	3	6	318	2	50	–	–	370
			OCT	2	5	284	9	52	–	–	345
			NOV	2	8	346	17	109	–	–	472
			TOT	3	40	2,180	100	513	–	–	2,793
	ALL	1990		3	36	2,323	–	–	–	–	2,323
		1991		4	53	3,430	–	–	–	–	3,430
		1992		3	40	2,180	100	513	–	–	2,793
PAPEETE	PF	1992	MAR	8	16	77	25	389	–	–	491
			APR	7	8	63	40	193	–	–	296
			JUL	8	12	252	22	27	–	–	301
			AUG	6	10	166	44	9	–	–	219
			SEP	8	14	190	42	11	–	–	243
			OCT	2	2	123	5	47	–	–	175
			NOV	5	9	78	12	6	–	–	96
	ALL	1992		16	71	949	190	682	–	–	1,821

Table 1 (continued)

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	NUMBER OF FISH SAMPLED ALB	BET	YFT	BIL	OTH	TOTAL
POHNPEI	FM	1991	AUG	1	1	–	2	20	–	–	22
			SEP	1	1	–	2	3	–	–	5
			OCT	1	1	–	–	12	–	–	12
			NOV	1	2	–	3	45	–	–	48
			DEC	1	2	–	2	4	–	–	6
			TOT	1	7	–	9	84	–	–	93
		1992	MAR	1	1	–	1	–	–	–	1
	JP	1991	MAY	1	1	–	71	29	–	–	100
			SEP	2	2	–	54	121	5	–	180
			OCT	2	2	–	37	133	–	–	170
			NOV	2	4	–	53	262	3	–	318
			DEC	2	2	–	144	379	9	–	532
			TOT	3	11	–	359	924	17	–	1,300
		1992	MAR	1	1	–	36	15	–	–	51
			APR	2	2	–	99	15	–	–	114
			MAY	1	1	–	13	119	–	–	132
			JUL	2	3	–	186	131	–	–	317
			AUG	2	2	–	155	139	1	–	295
			NOV	3	3	–	227	540	26	–	793
			TOT	5	8	–	716	959	27	–	1,702
	KR	1992	APR	2	2	–	943	241	4	–	1,188
			MAY	5	7	–	987	408	18	–	1,413
			JUN	5	9	–	1,097	510	10	–	1,617
			JUL	5	10	–	877	256	16	–	1,149
			AUG	1	1	–	182	93	9	–	284
			OCT	4	4	–	762	217	24	2	1,005
			NOV	3	3	–	633	308	39	7	987
			DEC	4	4	–	599	196	32	1	828
			TOT	7	32	–	6,080	2,229	152	10	8,471
	TW	1991	MAY	2	2	–	43	65	16	–	124
			AUG	1	1	–	18	42	–	–	60
			SEP	1	1	–	29	44	–	–	73
			OCT	3	4	–	76	129	–	–	205
			NOV	1	2	–	25	31	–	–	56
			DEC	5	8	–	312	232	–	–	544
			TOT	8	17	–	503	543	16	–	1,062
		1992	JAN	3	4	–	221	196	4	–	421
			FEB	4	4	–	142	22	–	–	164
			MAR	3	3	–	75	87	–	–	162
			APR	7	13	–	278	326	26	–	630
			MAY	5	8	–	195	209	10	–	414
			JUN	6	8	–	240	346	4	–	590
			JUL	6	9	–	203	344	6	–	553
			AUG	3	3	–	52	80	2	–	134
			SEP	4	9	–	338	391	135	308	1,172
			OCT	3	4	–	155	162	17	–	334
			NOV	4	5	–	162	156	2	–	320
			DEC	2	2	–	76	14	2	–	92
			TOT	12	65	–	2,137	2,333	208	308	4,986
		1993	JAN	2	2	–	58	64	5	–	127
	ALL	1991		12	35	–	871	1,551	33	–	2,455
		1992		25	106	–	8,934	5,521	387	318	15,160
		1993		2	2	–	58	64	5	–	127

Table 1 (continued)

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	NUMBER OF FISH SAMPLED					
						ALB	BET	YFT	BIL	OTH	TOTAL
YAP	CH	1992	JUN	4	8	–	283	183	93	16	575
			JUL	7	9	–	252	394	20	3	669
			AUG	11	17	–	418	539	91	27	1,075
			SEP	11	22	–	621	850	36	9	1,516
			OCT	12	26	–	640	867	149	35	1,691
			NOV	9	9	–	128	207	48	17	400
			TOT	13	91	–	2,342	3,040	437	107	5,926
	FM	1992	APR	2	2	–	5	2	9	1	17
			JUL	2	2	–	29	25	–	–	54
			AUG	2	4	–	54	30	11	1	96
			SEP	3	3	–	21	51	4	–	76
			OCT	2	2	–	14	49	–	–	63
			NOV	3	3	–	83	101	4	2	190
			TOT	4	13	–	206	258	28	4	496
	TW	1992	JAN	5	5	–	313	132	1	–	446
			FEB	9	11	–	679	283	23	–	985
			MAR	6	6	–	392	159	–	–	551
			APR	8	13	–	918	870	–	–	1,788
			MAY	5	7	–	355	369	28	1	753
			JUN	9	16	–	752	602	44	7	1,405
			JUL	19	21	–	1,069	1,643	28	15	2,755
			AUG	22	36	–	1,429	1,687	86	13	3,215
			SEP	25	33	–	1,408	1,285	3	9	2,705
			OCT	21	32	–	1,308	1,583	7	–	2,898
			NOV	20	23	–	1,273	962	24	–	2,259
			TOT	57	199	–	9,896	9,575	244	45	19,760
	ALL	1992		74	303	–	12,444	12,873	709	156	26,182

Table 2. Summary of unloading data

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	TRANSHIPMENTS (MT) ALB	BET	YFT	BIL	OTH	TOTAL
MAJURO	MI	1992	JUL	1	1	–	–	4.836	–	–	4.836
			AUG	1	1	–	1.516	.414	–	–	1.931
			SEP	1	2	–	1.865	1.448	–	–	3.313
			OCT	1	1	–	.395	.283	–	–	.678
			NOV	2	2	–	.897	.515	–	–	1.412
			DEC	3	3	–	.434	1.213	–	–	1.647
			TOT	4	10	–	5.107	8.710	–	–	13.817
	TW	1992	JAN	7	10	–	7.072	6.291	1.135	.354	14.852
			FEB	1	1	–	2.931	.310	–	–	3.240
			MAR	2	3	–	9.009	7.593	–	–	16.603
			APR	2	3	–	8.461	1.693	.070	–	10.224
			MAY	2	2	–	4.983	1.617	–	–	6.600
			JUN	1	3	–	4.116	3.545	–	–	7.661
			TOT	9	22	–	36.572	21.049	1.205	.354	59.180
	US	1992	JAN	2	3	–	2.251	2.716	.534	.110	5.610
			FEB	2	2	–	5.153	2.857	.081	.160	8.250
			MAR	2	4	–	14.872	2.516	.127	.168	17.683
			APR	2	3	–	4.964	1.222	.083	.095	6.364
			MAY	2	5	–	13.885	12.404	–	–	26.289
			JUN	2	3	–	3.167	9.888	–	–	13.055
			JUL	1	1	–	.741	2.950	–	–	3.691
			AUG	1	3	–	3.680	9.510	–	–	13.190
			SEP	1	2	–	2.219	2.708	.164	–	5.091
			OCT	2	4	–	4.390	7.133	.200	–	11.722
			NOV	6	8	–	8.520	12.551	.064	–	21.135
			DEC	5	8	–	8.597	12.889	.087	–	21.573
			TOT	6	46	–	72.437	79.343	1.339	.533	153.652
	ALL	1992		19	78	–	114.117	109.102	2.544	.887	226.649
POHNPEI	JP	1991	FEB	2	2	–	2.508	2.548	.156	–	5.212
			MAR	3	5	–	13.383	10.628	.531	–	24.542
			APR	5	8	–	17.381	13.094	1.986	–	32.461
			MAY	4	5	–	14.404	7.143	1.135	.028	22.710
			JUN	2	4	–	6.531	6.398	.353	–	13.282
			JUL	2	4	–	11.810	7.823	.460	.048	20.141
			AUG	2	4	–	5.583	4.302	.346	–	10.231
			SEP	3	4	–	7.479	10.265	.548	–	18.292
			OCT	3	5	–	5.771	7.602	.409	–	13.782
			NOV	2	4	–	3.424	8.956	.252	.018	12.650
			DEC	2	2	–	2.211	4.418	.339	–	6.968
			TOT	6	45	–	90.485	83.177	6.515	.094	180.271
		1992	APR	1	1	–	4.125	–	–	–	4.125
			JUN	1	1	–	7.412	1.477	–	–	8.889
			AUG	2	3	–	7.595	5.675	–	–	13.270
			SEP	2	3	–	7.357	5.953	.080	–	13.390
			NOV	3	3	–	6.025	4.956	.095	–	11.076
			DEC	1	3	–	5.266	2.655	–	–	7.921
			TOT	4	14	–	37.780	20.716	.175	–	58.671
		1993	JAN	1	2	–	6.958	4.403	–	–	11.361
			FEB	3	6	–	17.084	6.270	–	–	23.354
			MAR	2	2	–	1.524	1.152	.724	–	3.400
			TOT	3	9	–	25.566	11.825	.724	–	38.115

Table 2 (continued)

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	TRANSHIPMENTS (MT) ALB	BET	YFT	BIL	OTH	TOTAL
	KR	1992	APR	1	1	–	15.138	–	–	–	15.138
			MAY	6	10	–	60.232	10.361	.895	–	71.488
			JUN	6	10	–	76.024	17.098	.506	–	93.628
			JUL	6	11	–	56.515	10.977	.406	–	67.898
			AUG	5	6	–	75.922	8.715	1.333	–	85.970
			OCT	5	5	–	31.131	4.760	–	–	35.891
			NOV	6	6	–	26.074	5.287	–	–	31.361
			DEC	5	8	–	42.969	5.855	.999	–	49.823
			TOT	7	57	–	384.005	63.053	4.139	–	451.197
POHNPEI	KR	1993	JAN	5	5	–	23.406	3.633	.485	–	27.524
			FEB	3	3	–	6.534	1.561	.245	–	8.340
			TOT	6	8	–	29.940	5.194	.730	–	35.864
	TW	1991	APR	2	4	–	6.310	1.036	1.749	–	9.095
			MAY	4	7	–	8.343	6.565	1.515	–	16.423
			JUN	2	5	–	7.662	5.308	.524	.040	13.534
			JUL	3	6	–	8.128	9.550	.344	.025	18.047
			AUG	3	5	–	8.921	7.987	–	–	16.908
			SEP	3	5	–	6.317	8.539	.076	–	14.932
			OCT	1	4	–	5.208	6.182	.156	–	11.546
			NOV	2	2	–	1.945	2.371	–	–	4.316
			DEC	4	7	–	15.768	8.871	1.198	–	25.837
			TOT	8	44	–	68.602	56.409	5.562	.065	130.638
		1992	JAN	4	7	–	9.312	4.608	.952	–	14.872
			FEB	7	9	–	21.629	4.060	1.100	–	26.789
			MAR	3	4	–	2.936	1.392	.163	–	4.491
			APR	6	9	–	13.712	6.729	1.835	–	22.276
			MAY	4	7	–	10.681	7.867	4.758	–	23.306
			JUN	4	7	–	10.841	6.160	2.005	–	19.006
			JUL	4	10	–	11.531	15.214	1.252	–	27.997
			AUG	4	7	–	12.992	12.064	1.520	.072	26.648
			SEP	4	9	–	17.244	13.986	.656	–	31.886
			OCT	5	8	–	14.797	10.045	1.718	–	26.560
			NOV	4	6	–	13.346	6.781	.356	–	20.483
			DEC	6	9	–	13.136	5.799	.479	–	19.414
			TOT	14	90	–	152.157	94.705	16.794	.072	263.728
		1993	JAN	5	7	–	11.129	7.945	.180	–	19.254
			FEB	8	17	–	45.342	20.852	.931	–	67.125
			MAR	9	12	–	27.552	5.028	2.610	–	35.190
			APR	9	17	–	33.707	10.171	2.416	–	46.294
			MAY	5	5	–	10.091	2.138	1.451	–	13.680
			TOT	12	58	–	127.821	46.134	7.588	–	181.543
	ALL	1991		14	89	–	159.087	139.586	12.077	.159	310.909
		1992		25	161	–	573.942	178.474	21.108	.072	773.596
		1993		21	75	–	183.327	63.153	9.042	–	255.522
YAP	CH	1992	FEB	1	1	–	–	.098	–	–	.098
			JUN	4	8	–	14.320	6.018	–	.036	20.374
			JUL	13	24	–	36.492	30.988	–	–	67.480
			AUG	11	20	–	29.564	24.846	.245	–	54.655
			SEP	12	24	–	37.137	31.755	.238	.024	69.154
			OCT	12	21	–	38.825	31.201	.428	–	70.454
			NOV	10	12	–	10.002	7.479	–	–	17.481
			TOT	13	110	–	166.340	132.385	.911	.060	299.696

Table 2 (continued)

PORT	FLAG	YEAR	MON	VESSELS	TRIPS	TRANSHIPMENTS (MT) ALB	BET	YFT	BIL	OTH	TOTAL
	FM	1992	APR	2	2	–	.160	.029	.050	–	.239
			MAY	2	2	–	1.223	.481	–	–	1.704
			JUN	2	2	–	.628	.455	–	–	1.083
			JUL	2	2	–	3.587	1.539	–	–	5.126
			AUG	3	5	–	3.226	2.943	–	–	6.169
			SEP	4	4	–	2.317	1.903	.295	–	4.515
			OCT	2	2	–	.709	.540	–	–	1.249
			NOV	3	3	–	3.909	3.187	.095	–	7.191
			TOT	4	22	–	15.759	11.077	.440	–	27.276
YAP	JP	1992	FEB	1	1	–	1.139	.421	–	–	1.560
			MAR	1	1	–	.430	3.078	–	–	3.508
			APR	1	2	–	.646	7.439	–	–	8.085
			MAY	1	2	–	3.548	1.054	–	–	4.602
			JUN	1	2	–	.090	.152	.166	–	.408
			AUG	1	2	–	.082	.224	.034	–	.340
			SEP	1	1	–	.073	.037	.346	–	.456
			OCT	1	3	–	.124	2.527	.523	–	3.174
			TOT	3	14	–	6.132	14.932	1.069	–	22.133
	KR	1992	MAR	1	1	–	2.398	.240	–	–	2.638
			APR	1	1	–	2.091	2.242	–	–	4.333
			TOT	2	2	–	4.489	2.482	–	–	6.971
	TW	1992	JAN	5	5	–	13.225	4.111	.106	–	17.442
			FEB	8	8	–	14.682	3.203	.212	–	18.097
			MAR	7	8	–	12.942	.560	–	–	13.502
			APR	13	18	–	45.182	24.472	–	.092	69.746
			MAY	5	7	–	19.919	9.574	.110	.043	29.646
			JUN	10	18	–	53.615	22.102	–	.095	75.812
			JUL	24	37	–	86.718	84.630	.217	–	171.565
			AUG	22	38	–	104.919	81.823	1.015	–	187.757
			SEP	22	35	–	95.470	73.010	.768	–	169.248
			OCT	21	34	–	78.302	66.234	.379	–	144.915
			NOV	24	30	–	93.234	36.667	.251	–	130.152
			DEC	3	3	–	12.985	2.904	–	–	15.889
			TOT	71	240	–	631.193	409.290	3.058	.230	1042.771
		1993	JAN	5	5	–	9.261	13.458	–	–	22.719
			DEC	3	3	–	13.117	5.712	.160	–	18.989
			TOT	8	8	–	22.378	19.170	.160	–	41.708
	ALL	1992		93	388	–	823.913	570.166	5.478	.290	1399.847
		1993		8	8	–	22.378	19.170	.160	–	41.708

Table 3. Coverage of longline port sampling data compared to unloading data

PORT	FLAG	YEAR	Transhipments VESSELS	Transhipments TRIPS	Transhipments TOTAL	Port Sampling VESSELS	Port Sampling TRIPS	Port Sampling TOTAL	Coverage % VESSELS	Coverage % TRIPS	Coverage % TOTAL
MAJURO	MI	1992	4	10	13.817	2	6	9.909	50	60	72
	TW	1992	9	22	59.180	2	10	34.788	22	45	59
	US	1992	6	46	153.652	5	21	131.813	83	46	86
	US	1993	–	–	–	4	8	18.147	–	–	–
POHNPEI	FM	1991	–	–	–	1	7	2.847	–	–	–
	FM	1992	–	–	–	1	1	.068	–	–	–
	JP	1991	6	45	180.271	3	11	39.003	50	24	22
	JP	1992	4	14	58.671	5	8	41.544	125	57	71
	JP	1993	3	9	38.115	–	–	–	–	–	–
	KR	1992	7	57	451.197	7	32	267.532	100	56	59
	KR	1993	6	8	35.864	–	–	–	–	–	–
	TW	1991	8	44	130.638	8	16	41.579	100	36	32
	TW	1992	14	90	263.728	12	65	194.841	86	72	74
	TW	1993	12	58	181.543	2	2	5.319	17	3	3
	TW	1999	2	2	1.749	–	–	–	–	–	–
YAP	CH	1992	13	110	299.696	13	91	259.414	100	83	87
	FM	1992	4	22	27.276	4	13	18.365	100	59	67
	JP	1992	3	14	22.133	–	–	–	–	–	–
	KR	1992	2	2	6.971	–	–	–	–	–	–
	TW	1992	71	240	1,043.771	57	199	894.335	80	83	86
	TW	1993	8	8	41.708	–	–	–	–	–	–

Table 4. Coverage of port sampling data compared to catch logsheet data

LEGEND

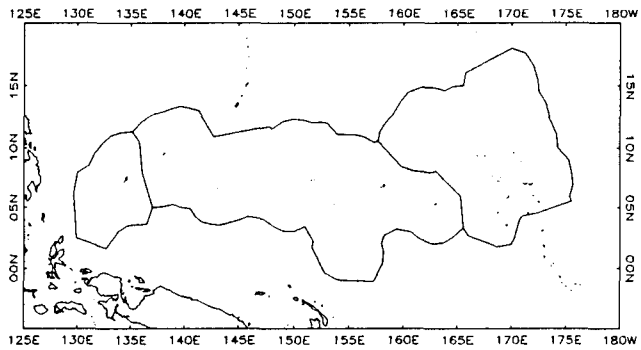
T1 - No. trips where transhipment data collected
T2 - No. transhipments where logsheets available
T3 - No. trips where samples were taken
T4 - No. trips sampled where positions are available
T5 - No. trips sampled where logsheets are available
T6 - No. trips where Fishing occured in 5x5 square (fixed)
T7 - No. trips where Fishing occured in 5x10 square (fixed)
T8 - No. trips where Fishing occured in 10x10 square (fixed)
T9 - No. trips where Fishing occured in 5x20 square (fixed)
T10 - No. trips where Fishing occured in 10x20 square (fixed)
T11 - No. trips where Fishing occured in 5x5 square (variable)
T12 - No. trips where Fishing occured in 5x10 square (variable)

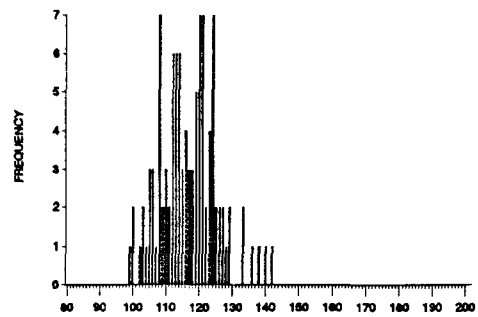
P2 - No. transhipments where logsheets available (% of T1)
P5 - No. trips sampled where logsheets are available (% of T4)
P6 - No. trips where Fishing occured in 5x5 square (fixed; % of T4)
P7 - No. trips where Fishing occured in 5x10 square (fixed; % of T4)
P8 - No. trips where Fishing occured in 10x10 square (fixed; % of T4)
P9 - No. trips where Fishing occured in 5x20 square (fixed; % of T4)
P10 - No. trips where Fishing occured in 10x20 square (fixed; % of T4)
P11 - No. trips where Fishing occured in 5x5 square (variable; % of T4)
P12 - No. trips where Fishing occured in 5x10 square (variable; % of T4)

PORT	FL	YEAR	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12
KOROR	CH	1991	0	0	2	2	1	1	1	1	1	2	2	2
		1992	0	0	4	2	0	0	0	0	0	2	2	2
	JP	1992	0	0	4	3	0	0	0	0	0	3	3	3
	TW	1991	0	0	15	11	5	3	3	3	3	9	9	9
		1992	0	0	5	4	0	0	0	0	0	4	4	4
MAJURO	MI	1992	10	1	6	4	1	0	0	0	0	4	4	4
	TW	1992	21	6	10	9	3	1	1	2	1	9	9	9
	US	1992	41	6	21	16	4	0	0	0	0	13	14	15
		1993	0	0	8	8	0	0	0	0	0	8	6	6
POHNPEI	FM	1991	0	0	7	6	2	2	2	2	2	5	6	6
		1992	0	0	1	0	0	0	0	0	0	0	0	0
	JP	1991	46	37	11	11	11	6	9	9	11	11	11	11
		1992	14	5	8	5	5	2	2	2	3	4	4	4
	KR	1992	55	35	32	26	26	0	2	2	2	2	24	26
	TW	1991	39	32	17	10	11	1	1	1	8	8	10	10
		1992	89	58	65	56	56	31	31	31	36	36	53	56
		1993	58	0	2	0	0	0	0	0	0	0	0	0
YAP	CH	1992	107	100	91	91	91	57	58	58	71	71	91	91
	FM	1992	22	15	13	10	10	2	2	2	5	5	8	9
	TW	1992	234	154	199	176	174	54	58	58	70	75	160	169

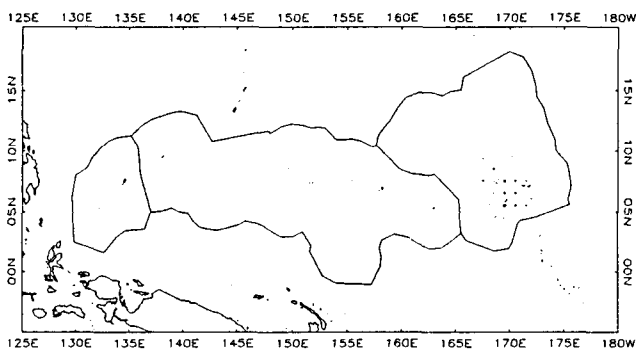
PORT	FL	YEAR	T1	P2	T3	T4	P5	P6	P7	P8	P9	P10	P11	P12
KOROR	CH	1991	0	0	2	2	50	50	50	50	50	100	100	100
		1992	0	0	4	2	0	0	0	0	0	100	100	100
	JP	1992	0	0	4	3	0	0	0	0	0	100	100	100
	TW	1991	0	0	15	11	45	27	27	27	27	82	82	82
		1992	0	0	5	4	0	0	0	0	0	100	100	100
MAJURO	MI	1992	10	10	6	4	25	0	0	0	0	100	100	100
	TW	1992	21	29	10	9	33	11	11	22	11	100	100	100
	US	1992	41	15	21	16	25	0	0	0	0	81	88	94
		1993	0	0	8	8	0	0	0	0	0	100	75	75
POHNPEI	FM	1991	0	0	7	6	33	33	33	33	33	83	100	100
		1992	0	0	1	0	0	0	0	0	0	0	0	0
	JP	1991	46	80	11	11	100	55	82	82	100	100	100	100
		1992	14	36	8	5	100	40	40	40	60	80	80	80
	KR	1992	55	64	32	26	100	0	8	8	8	8	92	100
	TW	1991	39	82	17	10	110	10	10	10	80	80	100	100
		1992	89	65	65	56	100	55	55	55	64	64	95	100
		1993	58	0	2	0	0	0	0	0	0	0	0	0
YAP	CH	1992	107	93	91	91	100	63	64	64	78	78	100	100
	FM	1992	22	68	13	10	100	20	20	20	50	50	80	90
	TW	1992	234	66	199	176	99	31	33	33	40	43	91	96

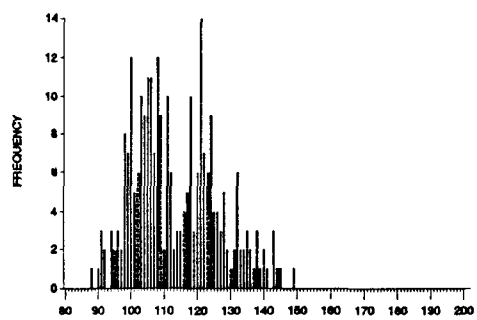
Figure 1. Distribution of yellowfin catch during 1992 and yellowfin length (cm) frequencies for vessels unloading in Majuro



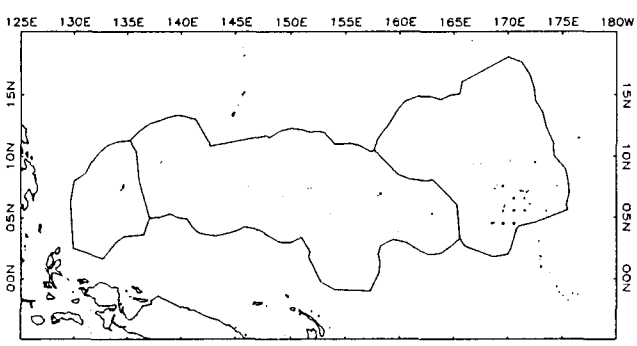


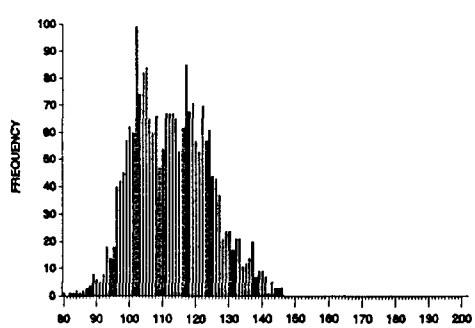
Marshallese fleet





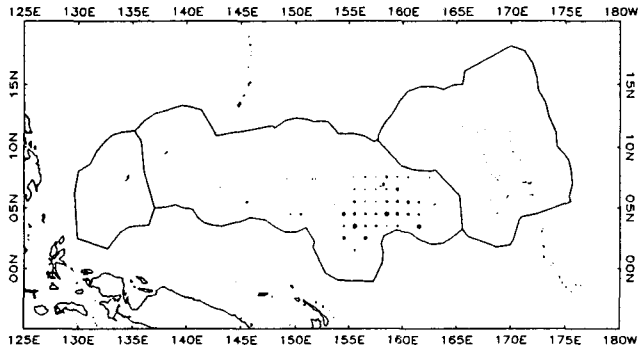
Taiwanese fleet

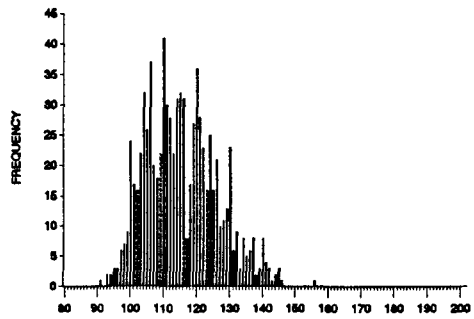




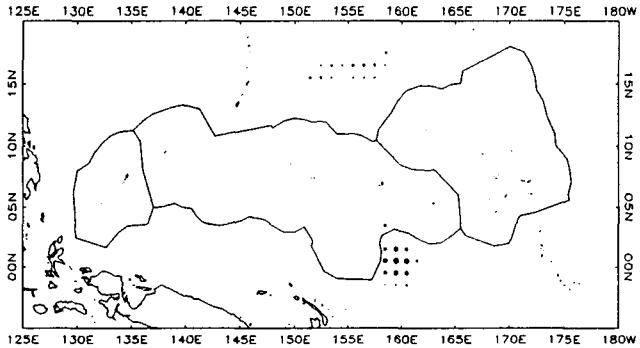
American fleet

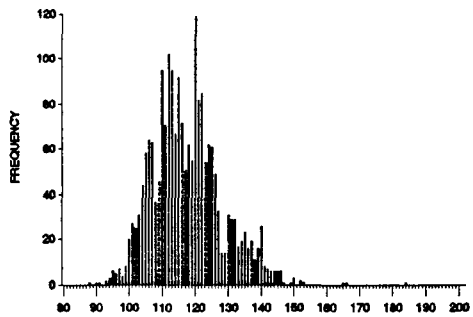
Figure 2. Distribution of yellowfin catch during 1992 and yellowfin length (cm) frequencies for vessels unloading in Pohnpei



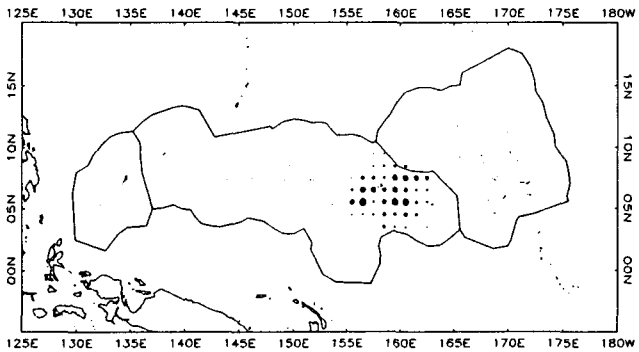


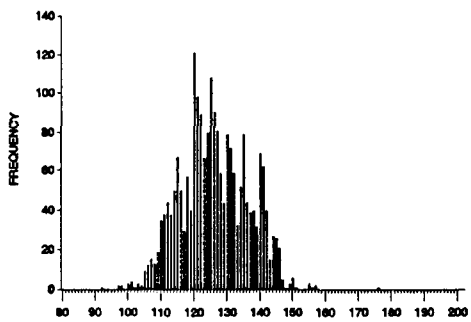
Japanese fleet





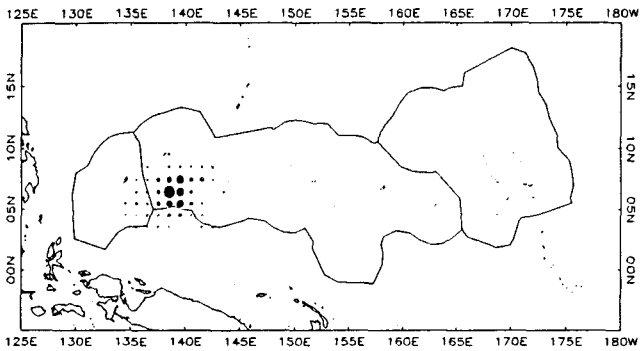
Korean fleet

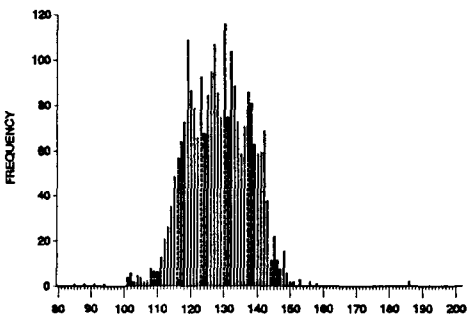




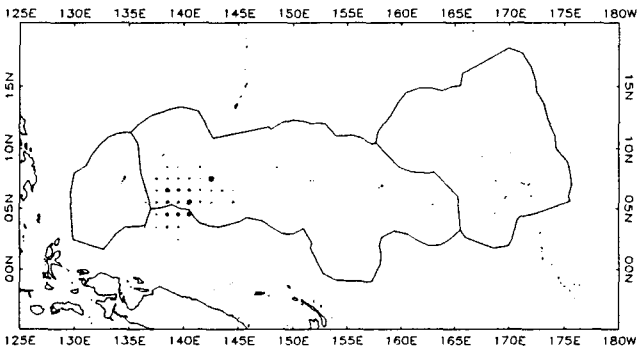
Taiwanese fleet

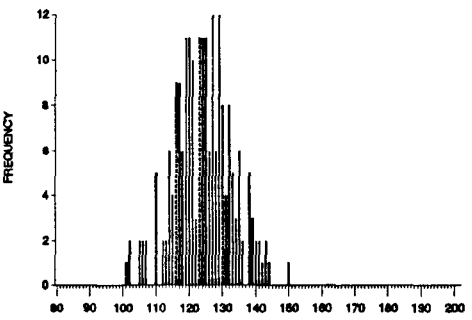
Figure 3. Distribution of yellowfin catch during 1992 and yellowfin length (cm) frequencies for vessels unloading in Yap



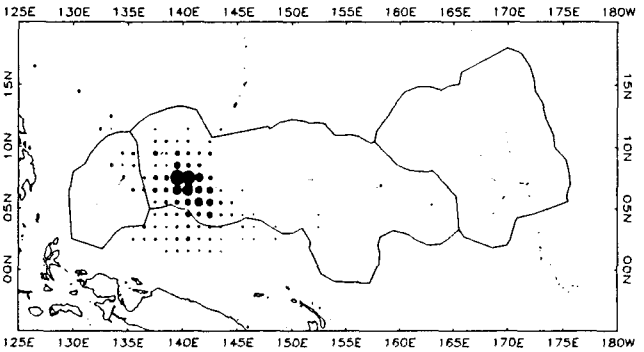


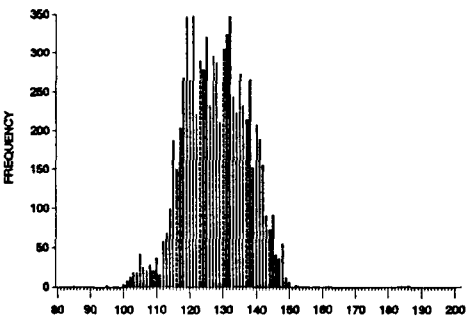
Mainland Chinese fleet





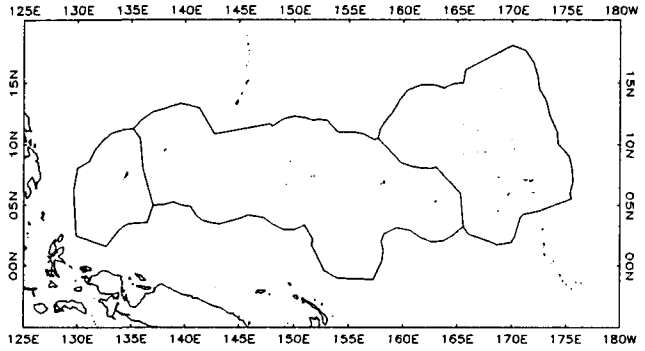
Micronesian fleet

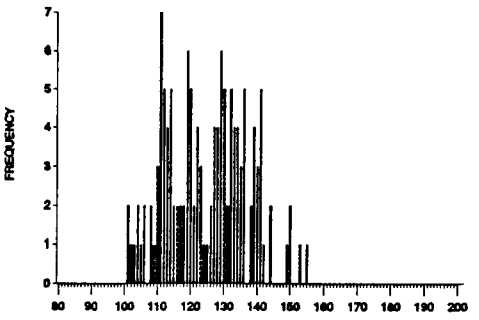




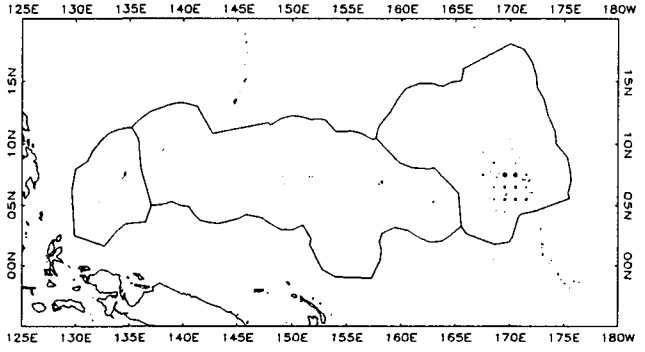
Taiwanese fleet

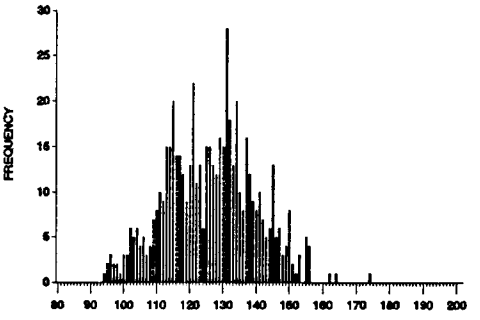
Figure 4. Distribution of bigeye catch during 1992 and bigeye length (cm) frequencies for vessels unloading in Majuro



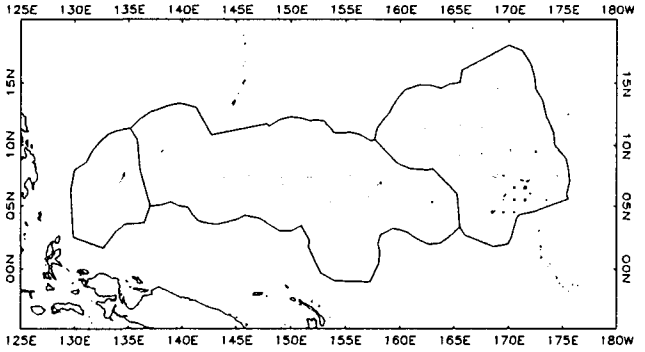


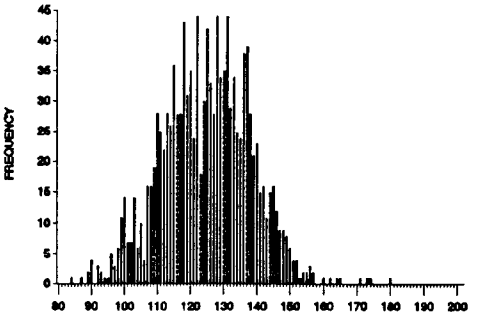
Marshallese fleet





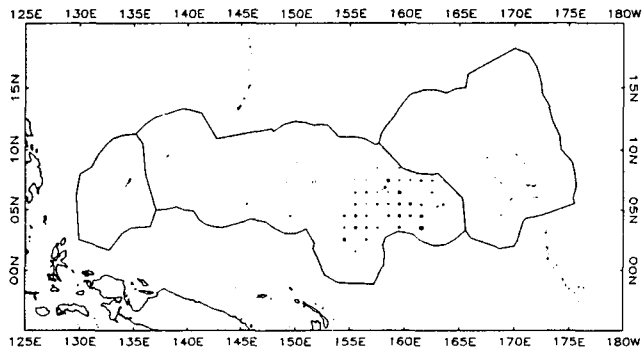
Taiwanese fleet

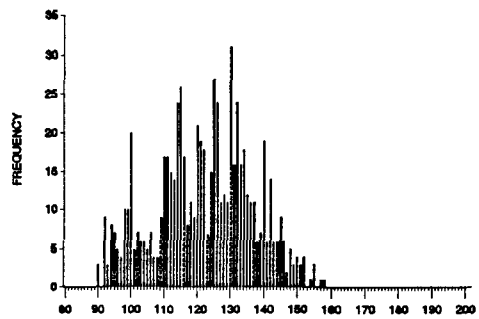




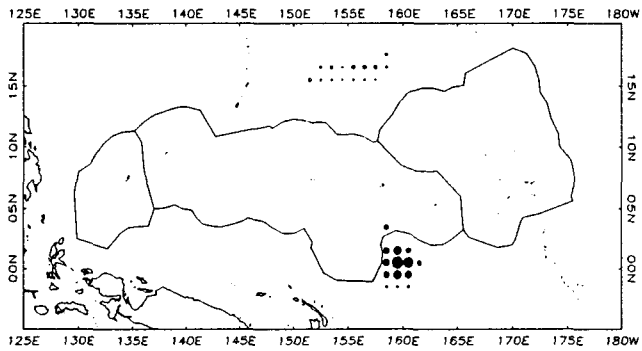
American fleet

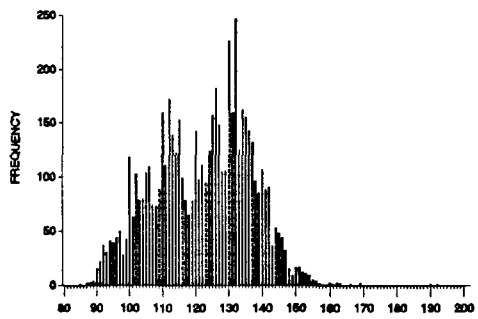
Figure 5. Distribution of bigeye catch during 1992 and bigeye length (cm) frequencies for vessels unloading in Pohnpei



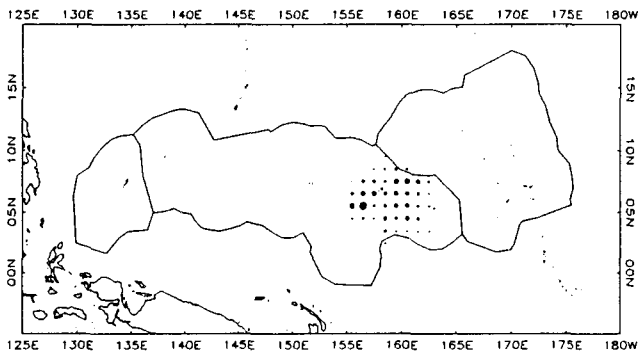


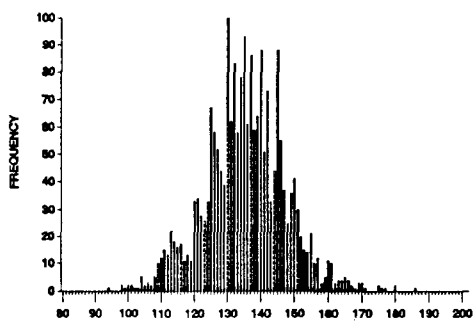
Japanese fleet





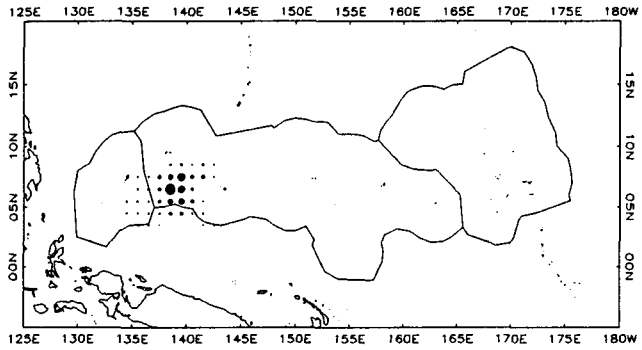
Korean fleet

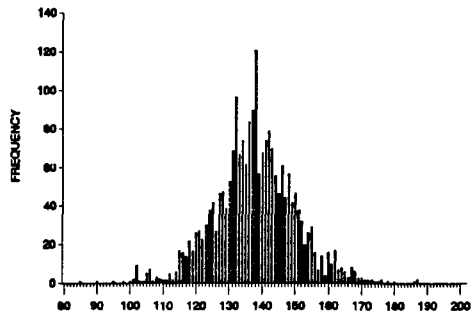




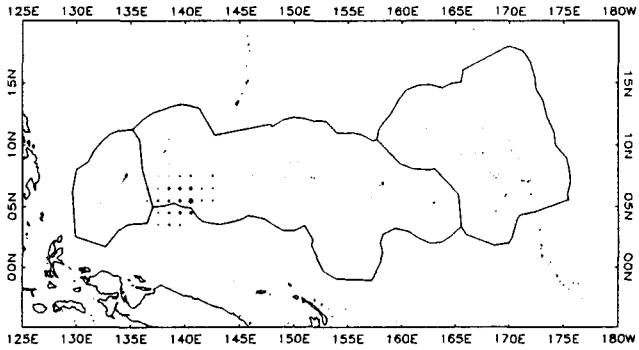
Taiwanese fleet

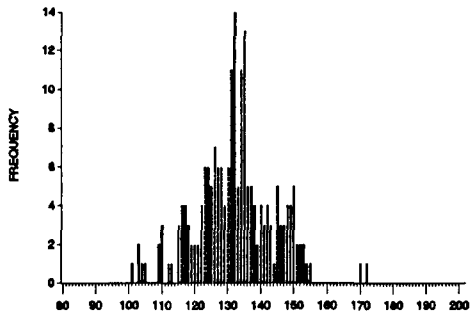
Figure 6. Distribution of bigeye catch during 1992 and bigeye length (cm) frequencies for vessels unloading in Yap



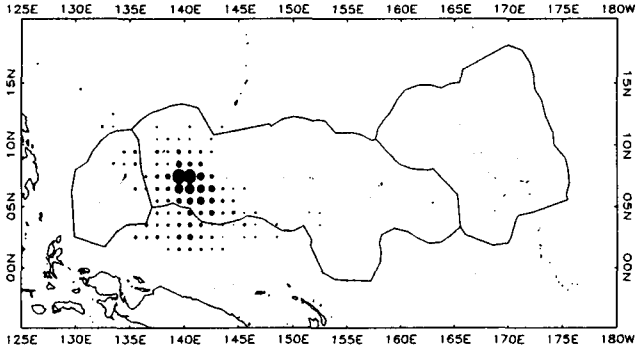


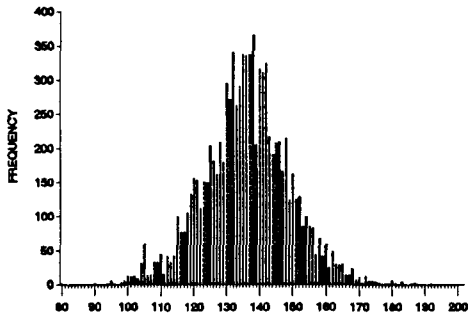
Mainland Chinese fleet





Micronesian fleet





Taiwanese fleet