SCTB16 Working Paper

SWG–4

OBSERVER COVERAGE RATES AND THE ACCURACY AND RELIABILITY OF ESTIMATES OF CPUE FOR OFFSHORE LONGLINE FLEETS TARGETING SOUTH PACIFIC ALBACORE

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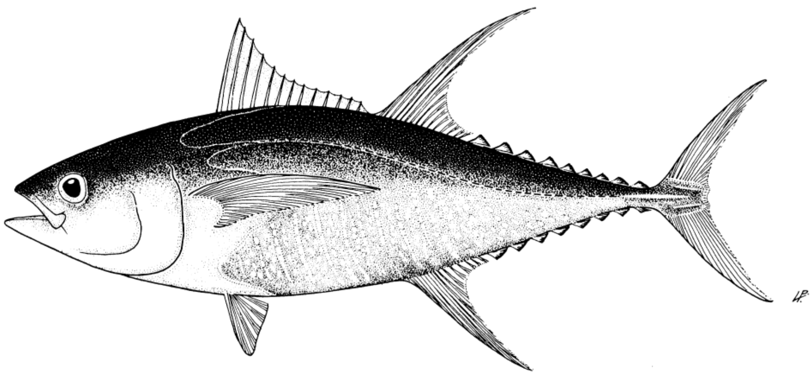

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INTRODUCTION

A meeting of the Statistics Working Group of the Standing Committee on Tuna and Billfish was held on 18 July 2002, at the Imin Conference Center at the University of Hawaii, to discuss the establishment of standards for the design of national and regional observer programs for tuna fisheries of the Western and Central Pacific Ocean (Anon 2002). It was noted that "target coverage rates for observer programmes represent a compromise between research objectives, compliance objectives and considerations of cost. Target coverage rates for research purposes should be determined from the relationship between coverage and the accuracy and reliability (i.e. bias and variance) of measures determined from observer data (e.g. estimates of annual catches, length frequencies by time-area strata, etc.). Ideally, an appropriate observer coverage rate should be determined for each fleet. However, it was recognised that while the observer data currently available for some fleets may be sufficient to determine the relationship between coverage and the accuracy and reliability of measures, the lack of observer data for most fleets implies that generalised target coverage rates should be developed for the major gear types. These generalised target coverage rates could then be used in new or expanding observer programs, until sufficient data are available to determine a coverage rate specific to the particular fleet."

The present study examines the relationship between the coverage rate for observer programmes and the accuracy and reliability of estimates of catch per unit of effort (CPUE) for eight species caught by seven longline fleets targeting South Pacific albacore in tropical and sub-tropical waters. CPUE was examined since estimates of CPUE are used in conjunction with estimates of fishing effort to estimate catches. For the purposes here, it is assumed that fishing effort is known with precision, such that the accuracy and reliability of CPUE is equivalent to the accuracy and reliability of the estimates of catches.

The longline fleets examined include those of American Samoa, Cook Islands, Fiji Islands, French Polynesia, New Caledonia, Samoa and Tonga. These fleets have operated across the WCPO, between 5°S and 30°S (Figure 1), and catch primarily albacore (*Thunnus alalunga*). While yellowfin (*Thunnus albacares*) and bigeye (*Thunnus obesus*) are also important components of the catch, these seven fleets are considered distinct from (a) the offshore longline fleets that target yellowfin and bigeye in tropical waters (e.g. China, Federated States of Micronesia and Taiwan), (b) the distant-water longline fleets that target primarily yellowfin and bigeye throughout the WCPO (e.g. Japan and Korea), (c) the distant-water longline fleet that targets primarily albacore in temperate waters (i.e. Taiwan), and (d) other offshore longline fleets operating in sub-tropical and temperate waters (e.g. Australia, Japan, New Zealand and Hawaii, United States).

The observer data held by the SPC Oceanic Fisheries Programme (OFP) are insufficient to examine each of the seven fleets individually, but it was considered that they may be sufficient to develop generalised target coverage rates for the offshore albacore fleets as a group.

SOURCE OF DATA

The observer data held by the OFP were either collected by SPC observers or provided by the national observer programmes of SPC member countries and territories. At the time of writing, the observer data for the seven offshore albacore longline fleets covered 53 vessels, 68 trips, 496 days fished, 499 sets and 879,723 hooks (Tables 1 and 2). The observer data were collected from 1992 to 2002, but they are unequally distributed among years; 90.1 percent of the data cover 1995–1999 and 2002, while the remaining 9.9 percent cover 1992–1994 and 2000–2001. The data are also unequally distributed among fleets; 94.4 percent of the data cover Fiji, French Polynesia, New Caledonia and Tonga, while 5.6 percent cover American Samoa, Cook Islands and Samoa.

Table 3 presents summaries of the data for all 77 species and species groups reported by observers, sorted by the pooled CPUE for all fleets and all years combined (i.e. the number of fish observed, summed over all sets, divided by the number of hooks observed, summed over all sets). The pooled CPUE ranges widely, from 1.4053 fish per 100 hooks for albacore, the primary target species, to 0.0001 fish per 100 hooks for 13 species for which only one fish was observed. Eight species were chosen for the analysis based on their CPUE; the species and pooled CPUE are given below:

COMMON NAME	SCIENTIFIC NAME	POOLED CPUE
Albacore	*Thunnus alalalunga*	1.4053
Blue shark	*Prionace glauca*	0.1375
Mahi mahi	*Coryphaena hippurus*	0.1257
Wahoo	*Acanthocybium solandri*	0.0881
Opah	*Lampris guttatus*	0.0590
Silky shark	*Carcharhinus falciformis*	0.0263
Black marlin	*Makaira indica*	0.0122
Hammerhead sharks	*Sphyrna spp.*	0.0010

The eight species therefore represent a range of common to less common to uncommon species. It is expected that the relationship between the coverage rate and the accuracy and reliability of estimates of CPUE will vary among species depending on the value of the CPUE.

METHOD

The observer data covering all 499 sets were considered to be the 'universe' from which samples would be drawn in order to determine the relationship between the coverage rate and the accuracy and reliability of estimates of CPUE. This approach assumes that the variation in CPUE among the 499 observed sets is representative of the real world.

Unstratified sampling

Monte Carlo studies for each species were conducted in which CPUE was estimated based on random sub-sampling of the universe of 499 observed sets at a given coverage rate. The coverage rates ranged from 2 percent to 100 percent in 2 percent intervals. For each coverage rate, 300 random samples were drawn.

For each sample, the pooled CPUE (i.e. the sum of the number of fish divided by the sum of the number of hooks, for all sets in the sample) and mean CPUE (i.e. the average of CPUE for all sets in the sample) were estimated.

The results for each coverage rate were summarised by calculating the mean and standard deviation of (a) the pooled CPUE and (b) the mean CPUE, estimated from each of the 300 samples. Since the 'true' CPUE, i.e. the pooled CPUE from the universe of 499 observed sets, was known, the bias of the pooled CPUE and mean CPUE could be determined.

Stratified sampling

The Monte Carlo studies were conducted for both unstratified and stratified sampling. For unstratified sampling, the random samples were drawn from the universe of 499 observed sets without regard to the distribution of samples among fleets and years. For stratified sampling, the samples were distributed among fleets and years in the same relative proportions as in the universe of 499 observed sets; that is, the coverage rate was applied equally to each combination of fleet and year.

For stratified sampling, the pooled CPUE and the mean CPUE were first estimated for each fleet-year stratum. The pooled CPUE and mean CPUE for the sample were then estimated by taking weighted averages of the pooled CPUE and mean CPUE for each strata. The weights were equal to the ‘true’ ratio of the number of hooks in the strata to the total number of hooks, i.e. the ratio determined from the universe of 499 observed sets.

RESULTS

Figures 2–9 present the results of unstratified sampling for each species, while Figures 10–17 present the results of stratified sampling. The bias of the pooled and mean CPUE is shown as a percentage of the ‘true’ CPUE. The standard deviation of the pooled and mean CPUE is shown as a percentage of the mean (i.e. coefficient of variation). The following points are of interest:

- The mean CPUE is biased, whereas the pooled CPUE is unbiased. The sign (positive or negative) and the magnitude of the bias in mean CPUE varies among species.
- The coefficients of variation of the mean CPUE and the pooled CPUE are almost identical.
- The value of the coefficients of variation depend strongly on the level of CPUE, with smaller coefficients of variation for higher levels of CPUE.
- Stratified sampling reduces the coefficients of variation by small to moderate amounts.
- The shape of the relationship between the coefficients of variation and the coverage rate is similar among species, with a steep decline in the coefficients of variation from 2 percent coverage to about 20–30 percent coverage, followed by a gradual decline to a coefficient of variation of zero at 100 percent coverage.

DISCUSSION

Bias of mean CPUE

The fact that the pooled mean is unbiased can be explained by noting that when the coverage rate is 100 percent, the pooled mean is the true CPUE; that is, with full coverage, the pooled CPUE multiplied by total fishing effort (assuming it is known exactly) gives the total catch. This is not the case for the mean CPUE; even with full coverage, the mean CPUE multiplied by total fishing effort does not give the total catch.

The fact that the mean CPUE is biased, while the pooled CPUE is unbiased, can be explained by noting that the mean CPUE is an unweighted average of the CPUE for each set, while the pooled CPUE is equivalent to a weighted average. It can be shown that the weights, for each set, in the pooled CPUE, are equal to the ratio of the number of hooks for each set to the sum of hooks for all sets in the sample. (The mean CPUE can also be considered as a weighted average, with each of the 'weights' equal to the ratio of the average number of hooks in the sample to the sum of hooks in the sample.) The pooled mean will therefore differ from the mean CPUE if the distribution of the number of hooks per set depends on CPUE. If more hooks are set when CPUE is higher, then the mean CPUE will place less weight on high CPUE than the pooled CPUE and, as a result, the mean CPUE will show a negative bias relative to the pooled CPUE.

For target species, the bias in mean CPUE will be negative, since more hooks are set when CPUE is higher. In the present study, the average number of hooks per set for sets for which the CPUE for the target species, albacore, is greater than the mean is 1,875, while the average number of hooks per set for sets for which the CPUE is lower than the mean is 1,699.

In fisheries where there is avoidance of certain non-target species, such that fishing effort per operation is greater when CPUE for those species is lower, then mean CPUE for those species will be positively biased (e.g. Hay et al. 1999). For most non-target species, however, the relationship between the number of hooks set and the level of CPUE is largely a matter of chance; therefore, the bias may be positive or negative.

Coefficients of variation of pooled CPUE and mean CPUE

That the coefficients of variation of the pooled CPUE and the mean CPUE are almost identical is to be expected, since the variation in both depends equally on the variation of CPUE in the samples.

Dependence of coefficient of variation on CPUE

It can be seen in Figures 2–17 that the reliability of estimates of CPUE depend strongly on the level of CPUE. The following table gives the coverage rate (percent) required for a coefficient of variation of the estimate of the pooled CPUE of 10 percent, for both stratified and unstratified sampling:

COMMON NAME	COVERAGE RATE	
	UNSTRAT	STRAT
Albacore	18	12
Blue shark	24	18
Mahi mahi	32	28
Wahoo	38	28
Opah	42	36
Silky shark	64	56
Black marlin	84	84
Hammerhead sharks	92	92

For unstratified sampling, the required coverage rate increases from 18 percent for albacore to 92 percent for hammerhead sharks. For stratified sampling, the required coverage rate increases from 12 percent to 92 percent. If a coefficient of variation of 10 percent (which is approximately equivalent to a 95% confidence interval of plus or minus 20 percent) is an acceptable level of reliability for estimates of CPUE and, hence, catches (assuming fishing effort is known without error), then, for the target species, a moderate level of coverage is required, while for uncommon species, a high level of coverage is required. For the species in Table 3 that are even less common than hammerhead sharks, it is expected that almost full coverage will be required.

Stratified versus unstratified sampling

The unstratified sampling conducted in this study is equivalent to allocating sampling effort across the region and through time, without regard to the coverage rates for individual fleets and years. This is more or less how the opportunistic sampling of these fleets has so far actually occurred. When sampling is stratified by fleet and year, the coverage rate is applied to each fleet-year stratum.

Figures 2-17, and the table above, indicate that small to moderate improvements in the coefficients of variation of estimates of CPUE are achieved by stratifying for all species except the two most uncommon. The improvements are to be expected, since there is clearly variation in CPUE among fleets and years (Figures 18 and 19). On the other hand, the improvements are not large, which suggests that the variation within strata is more important than the variation among strata. This was confirmed in an analysis of variance of CPUE in the universe of 499 observed sets. While fleet and year are highly significant predictors of CPUE, they explain only 31.6 percent of the variation in CPUE.

Figures 2-17 also indicate that the magnitude of the bias in mean CPUE is reduced by stratifying. It is not obvious why this should occur, although it is related to the fact that when taking a weighted average of mean CPUE for each strata, the weights applied to each set in determining the estimate of mean CPUE for the sample are no longer equal.

Rate of decline of coefficient of variation

Figures 2–17 show that increases in the coverage rate beyond 20–30 percent result in smaller incremental improvements in the coefficient of variation of estimates of CPUE. If financial or other constraints limit the level of observer coverage, then the fact that the reliability of estimates of CPUE improves less rapidly with increasing coverage, once coverage rates of 20–30 percent are achieved, will be an important consideration in setting the coverage rate.

CONCLUSION

The results presented in Figures 2–17 and discussed above are based on 499 observed sets. While this is not a small amount of data, neither is it large. The results should therefore be considered as indicative of the relationship between observer coverage rates and the accuracy and reliability of estimates of CPUE for offshore longline fleets targeting South Pacific albacore in tropical and sub-tropical waters. The analysis should be updated as more data are collected.

It would be useful to conduct ‘experimental’ observer programmes with high levels of coverage to collect data for this type of analysis. Ideally, each of the seven fleets should be covered in order to examine the variation among fleets, and two or more years should be covered in order to examine inter-annual variation. However, even if such experiments are not conducted, additional data will still accumulate with time and it should be possible to refine the analysis.

The results presented above concern only estimates of CPUE, whereas observer programmes are conducted to also collect other kinds of research data. In particular, a similar analysis could be conducted on the accuracy and reliability of length data collected by observers. The coverage rates that are set for observer programmes should take into account the multiple research objectives and, in particular, the relationships between the coverage rate and the accuracy and reliability of the various estimates of interest, in addition to compliance objectives and considerations of cost.

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Hay, D.E., R. Harbo, J. Boutillier, E. Wylie, L. Convey & P.B. McCarter. 1999. Assessment of bycatch in the 1997 and 1998 shrimp trawl fisheries in British Columbia, with emphasis on eulachons. Canadian Stock Assessment Secretariat Research Document 99/179. Biological Sciences Branch, Fisheries and Oceans Canada, Nanaimo, British Columbia, Canada. 44 pp.

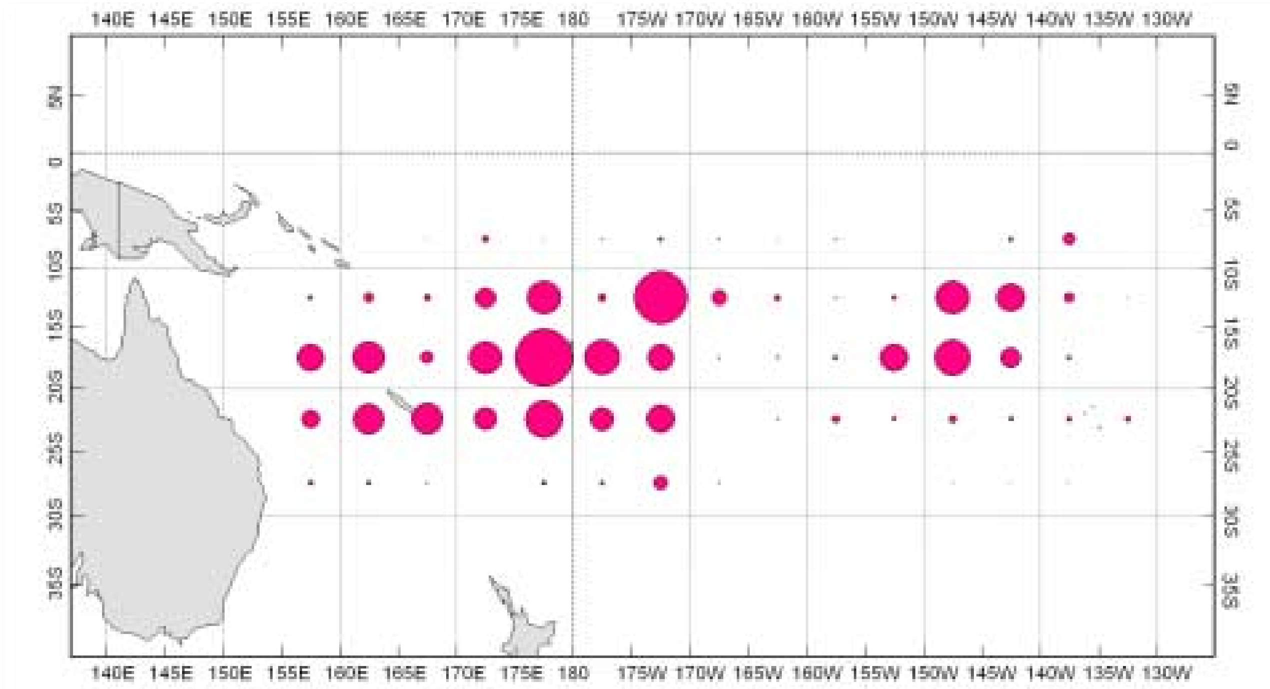

Figure 1. Distribution of the catch by offshore longline fleets targeting South Pacific albacore in tropical and sub-tropical waters, 1982–2003

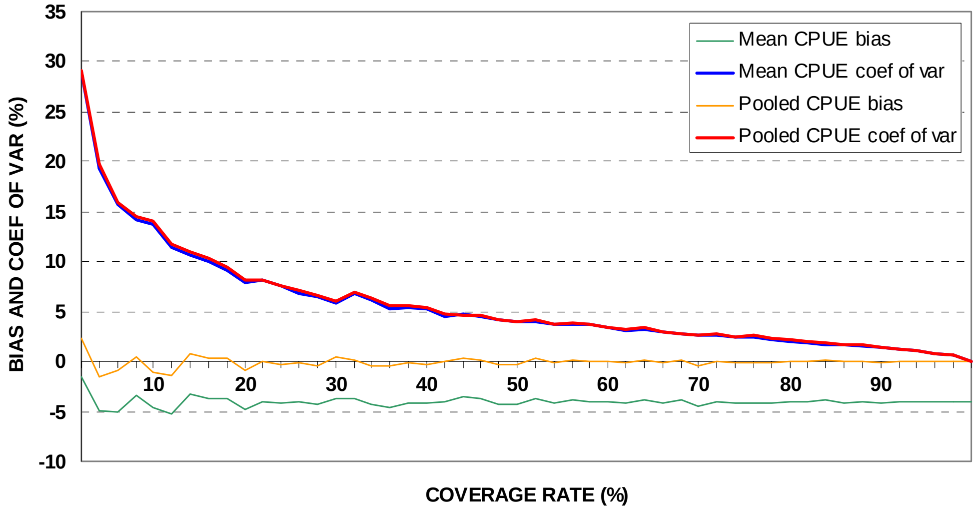

Figure 2. Monte Carlo results for albacore, unstratified sampling

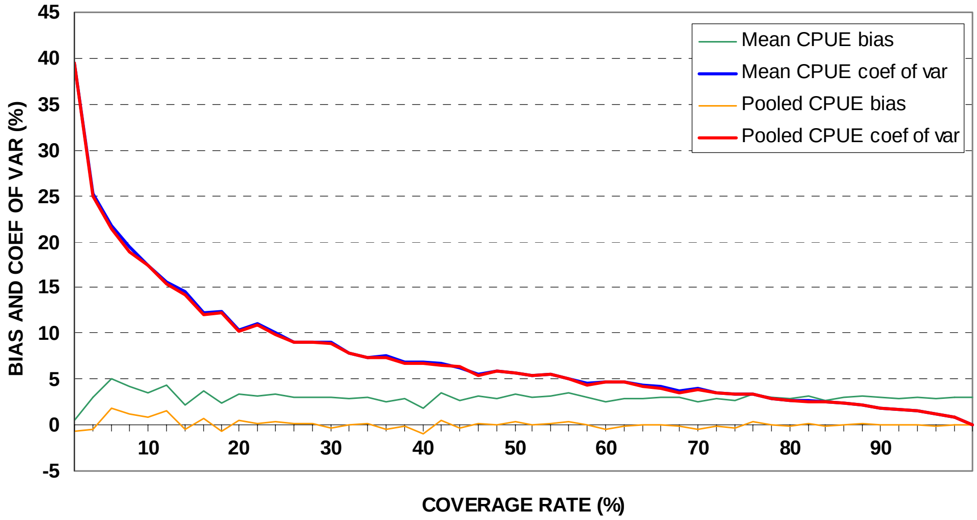

Figure 3. Monte Carlo results for blue shark, unstratified sampling

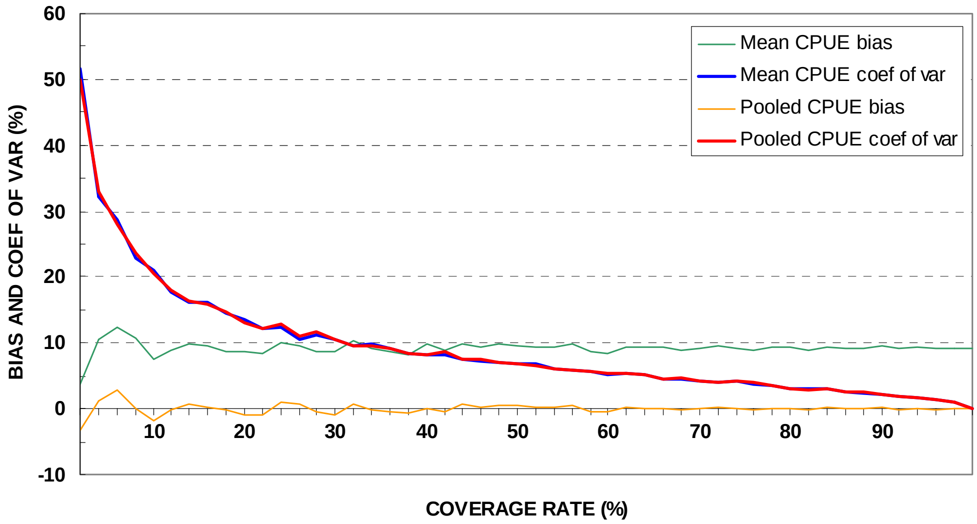

Figure 4. Monte Carlo results for mahi mahi, unstratified sampling

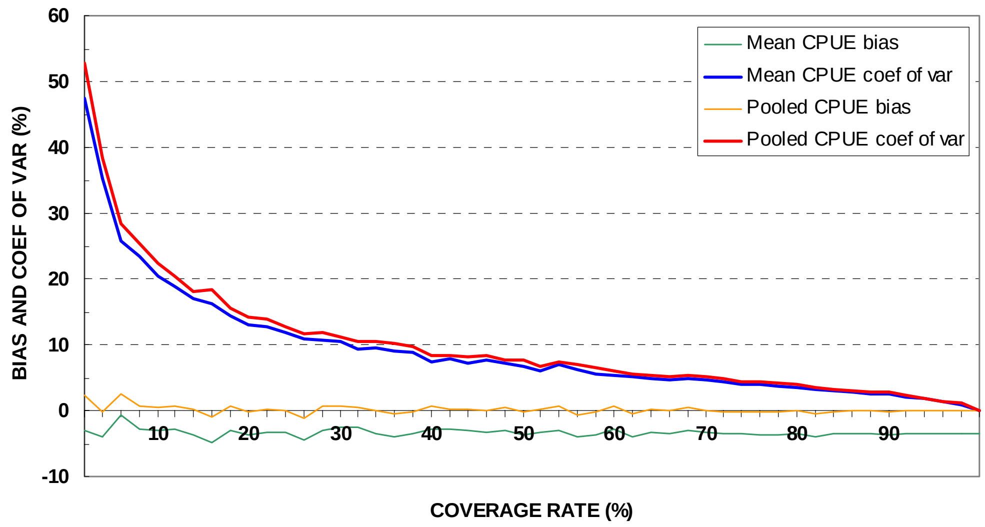

Figure 5. Monte Carlo results for wahoo, unstratified sampling

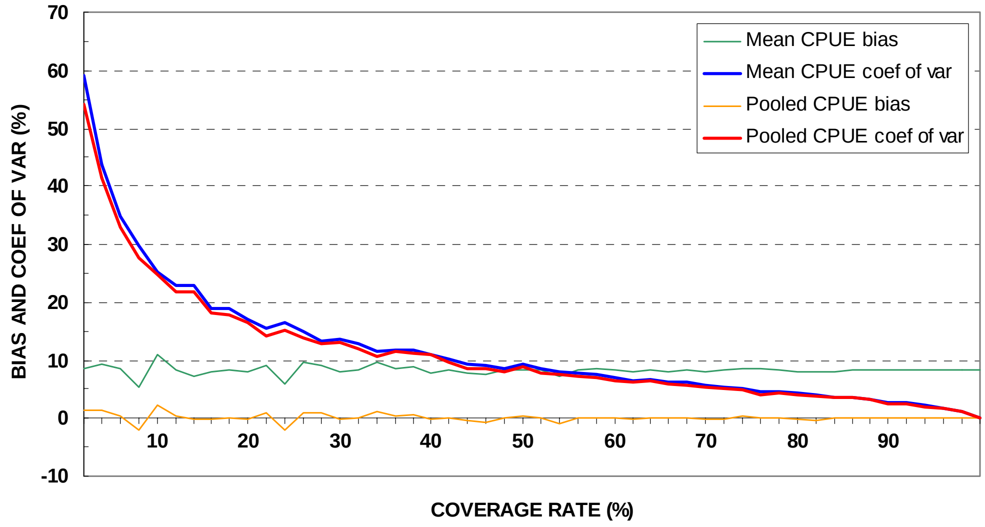

Figure 6. Monte Carlo results for opah, unstratified sampling

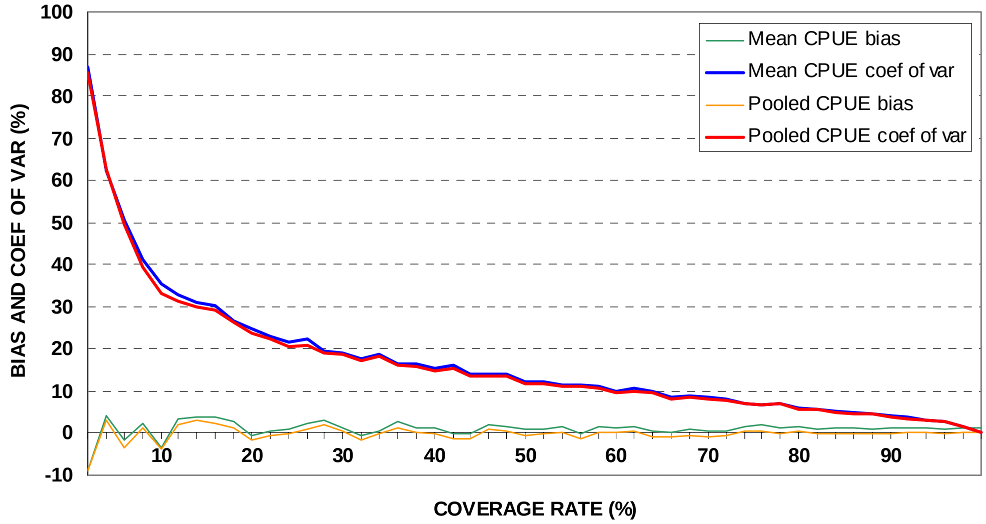

Figure 7. Monte Carlo results for silky shark, unstratified sampling

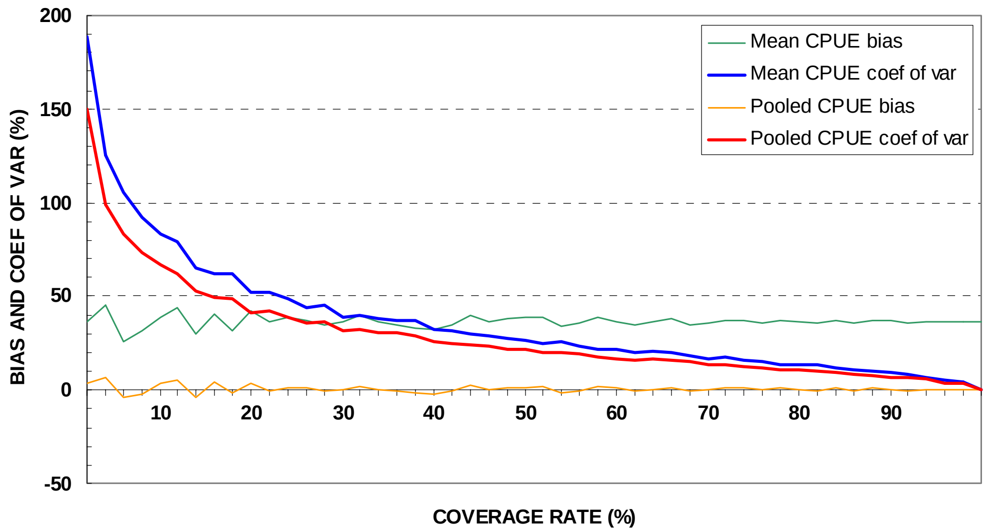

Figure 8. Monte Carlo results for black marlin, unstratified sampling

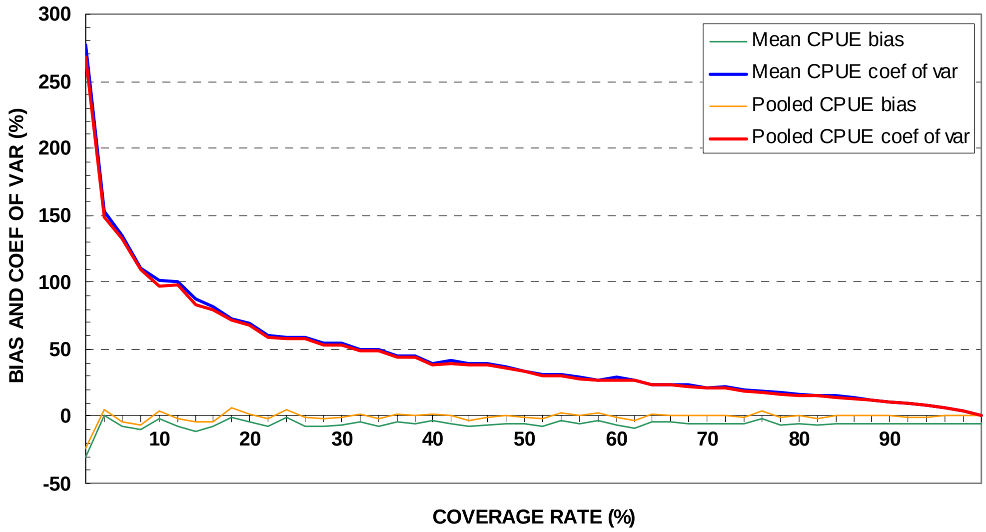

Figure 9. Monte Carlo results for hammerhead sharks, unstratified sampling

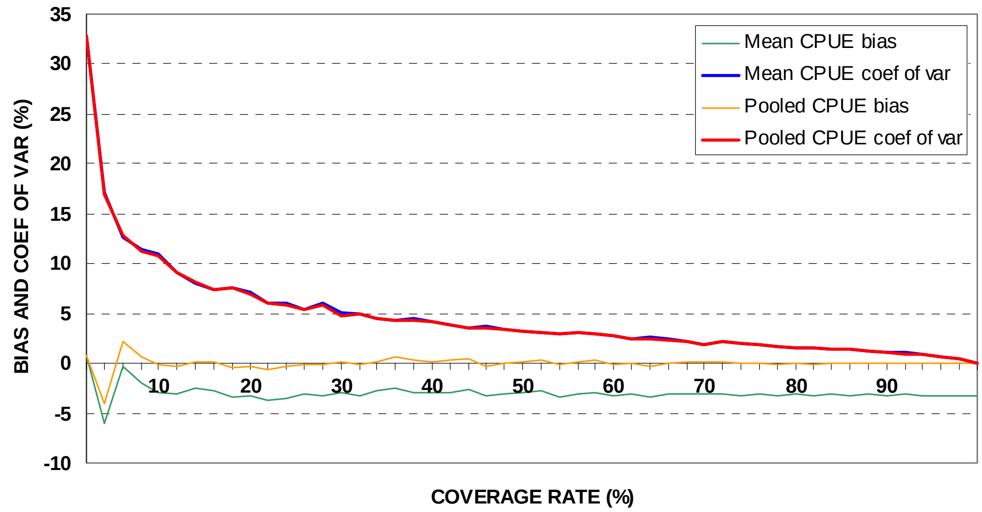

Figure 10. Monte Carlo results for albacore, stratified sampling

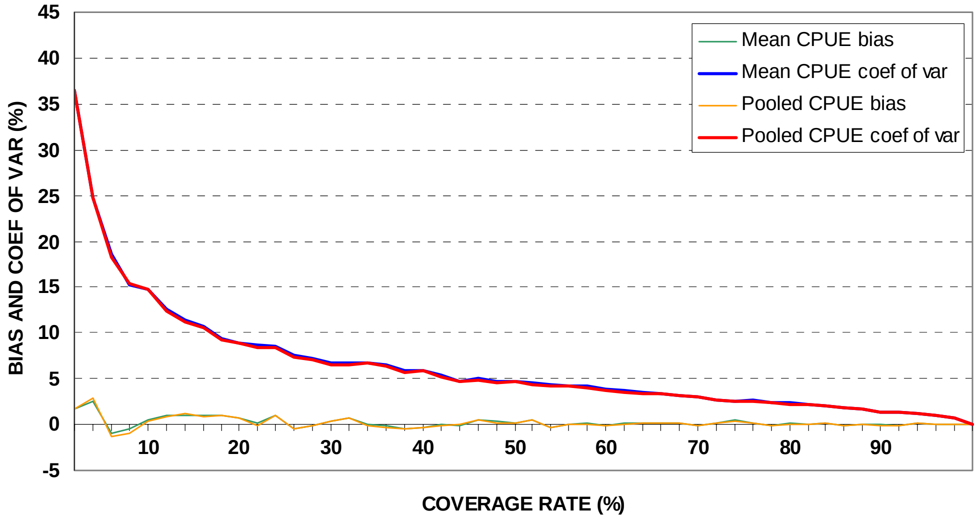

Figure 11. Monte Carlo results for blue shark, stratified sampling

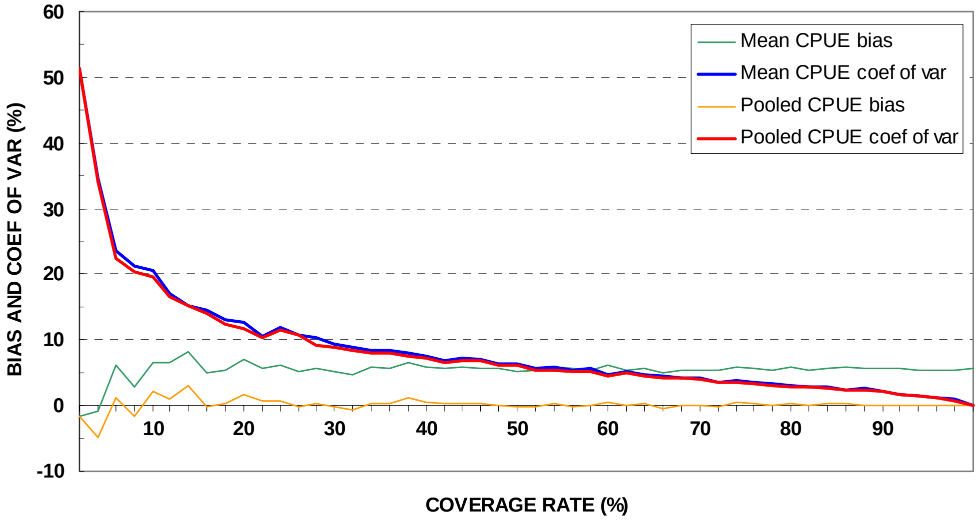

Figure 12. Monte Carlo results for mahi mahi, stratified sampling

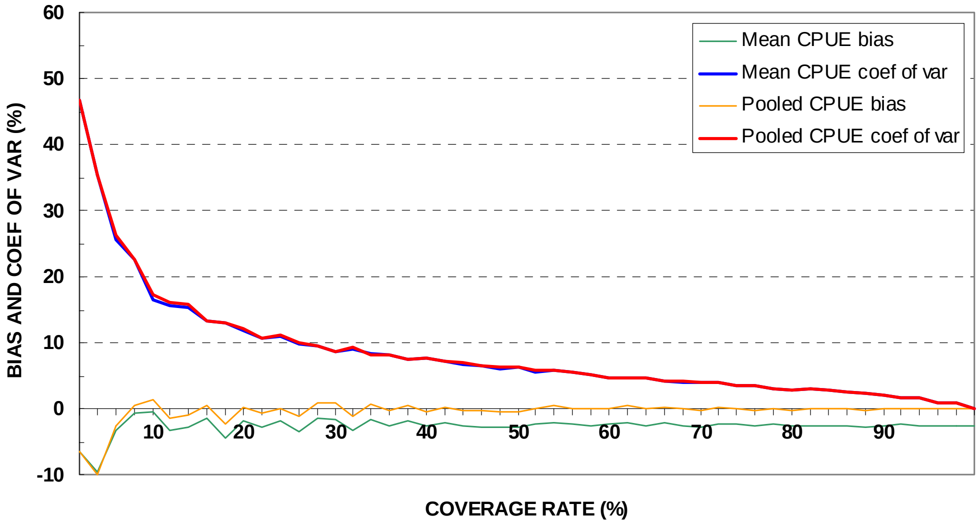

Figure 13. Monte Carlo results for wahoo, stratified sampling

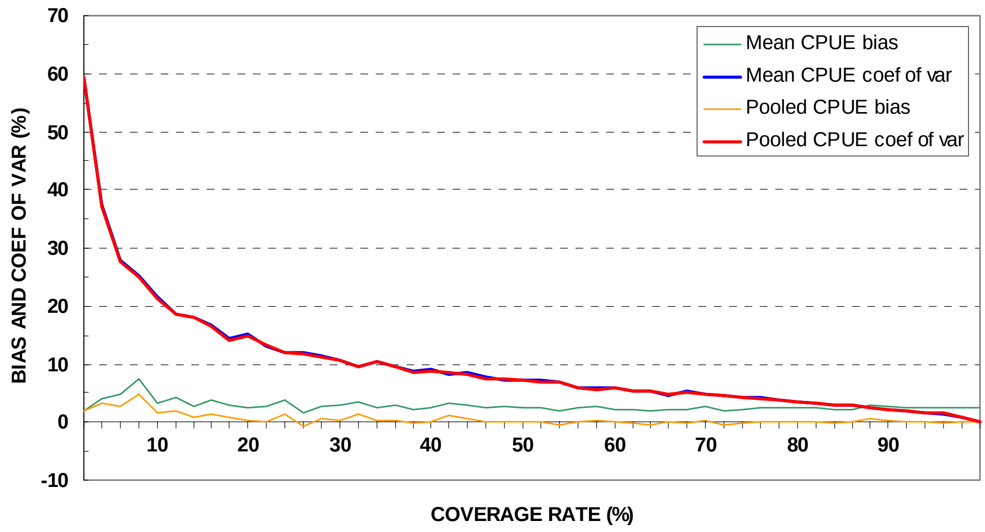

Figure 14. Monte Carlo results for opah, stratified sampling

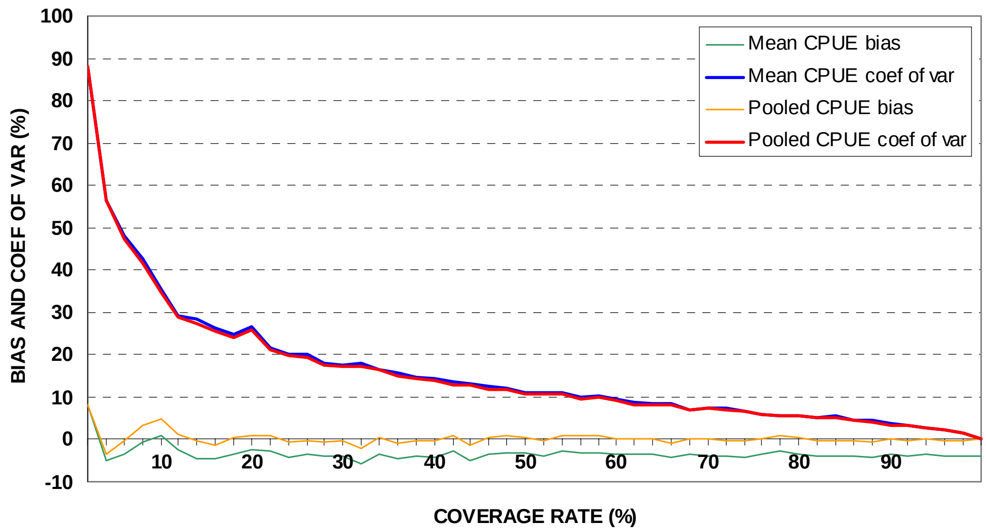

Figure 15. Monte Carlo results for silky shark, stratified sampling

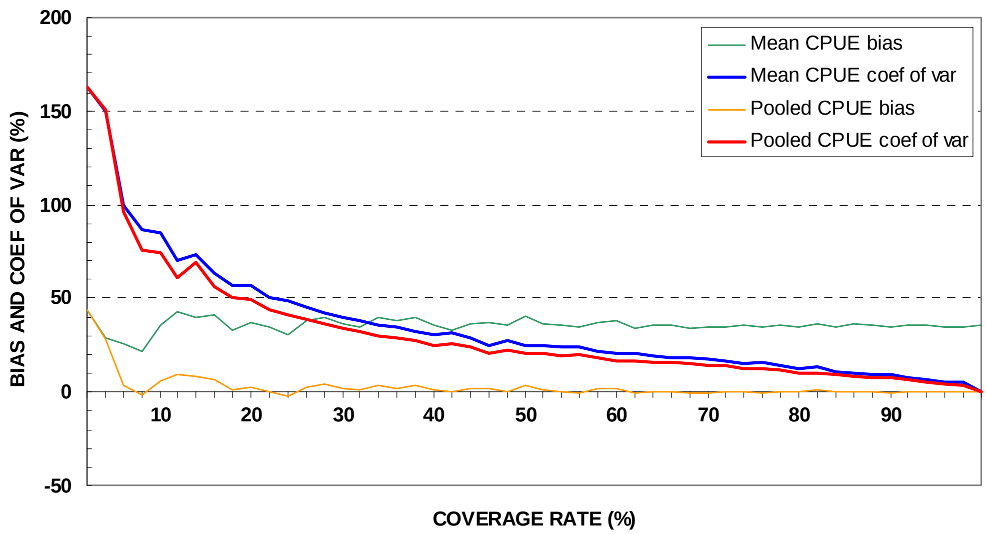

Figure 16. Monte Carlo results for black marlin, stratified sampling

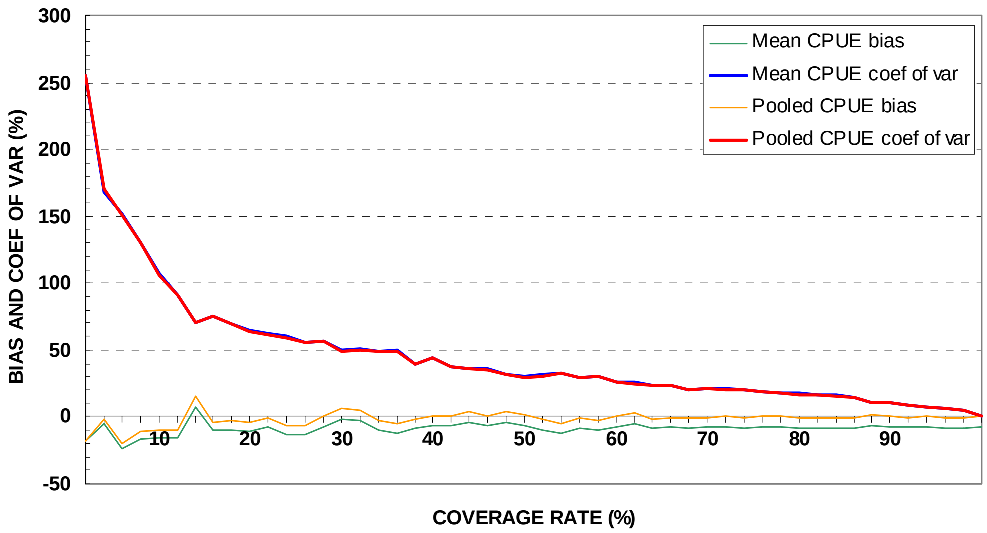

Figure 17. Monte Carlo results for hammerhead sharks, stratified sampling

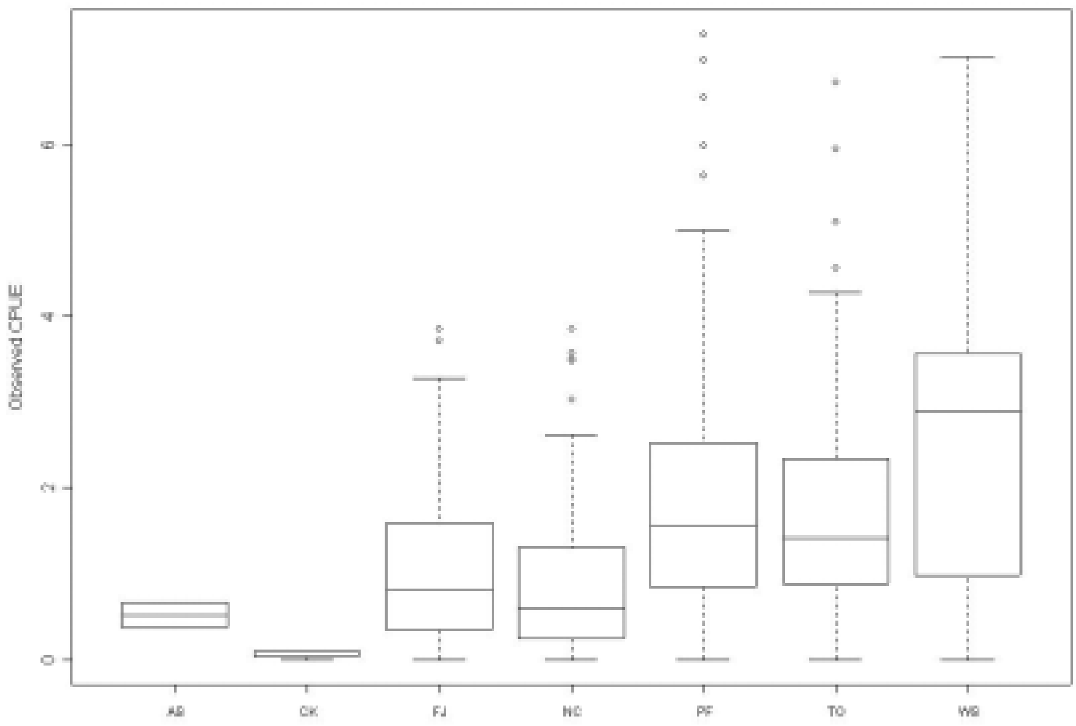

Figure 18. Distribution of CPUE (number of fish per 100 hooks) among fleets.
Boxplots show the median, the interquartile range, the minimum and maximum within 1.5 * IQR, and outliers.
Key: AS = American Samoa, CK = Cook islands, FJ = Fiji Islands, NC = New Caledonia,
PF = French Polynesia, TO = Tonga, WS = Samoa

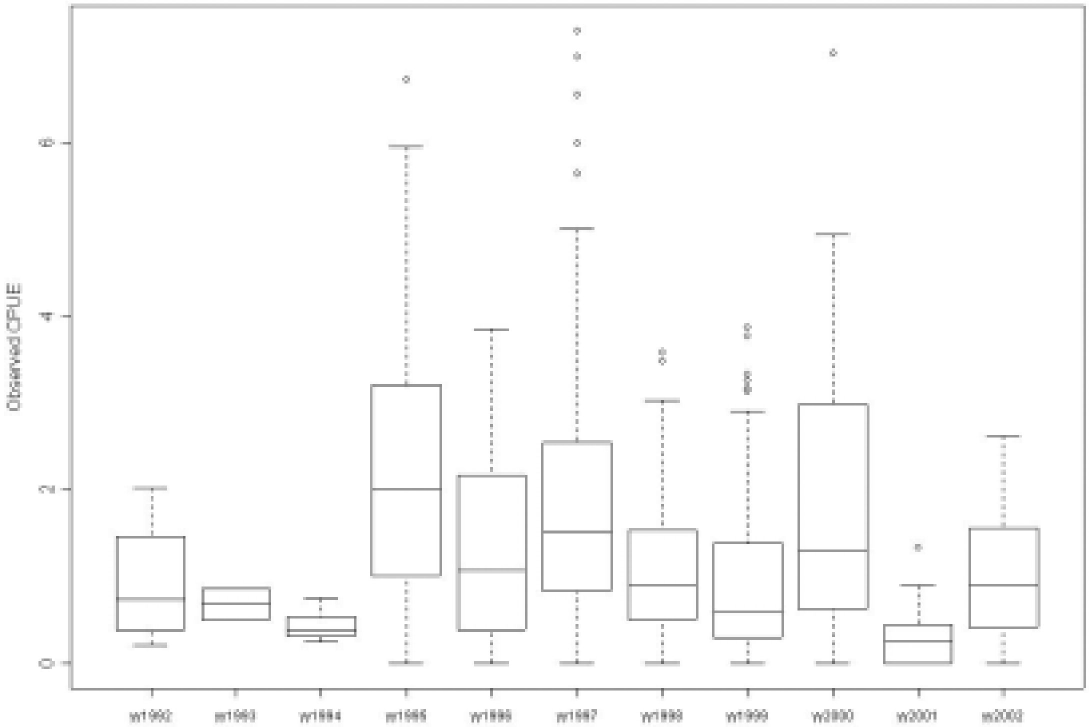

Figure 19. Distribution of CPUE (number of fish per 100 hooks) among years

Table 1. Distribution of observer data held by the OFP covering offshore longline fleets targeting South Pacific albacore in tropical and sub-tropical waters, by year

YEAR	VESSELS	TRIPS	DAYS	SETS	HOOKS		DAYS PER TRIP	HOOKS PER SET
					NO.	%		
1992	1	1	4	4	5,757	0.7	4.0	1,439
1993	1	1	2	2	2,800	0.3	2.0	1,400
1994	1	1	6	6	7,387	0.8	6.0	1,231
1995	5	6	53	55	79,896	9.1	8.8	1,453
1996	8	11	71	72	101,652	11.6	6.5	1,412
1997	9	10	89	89	195,342	22.2	8.9	2,195
1998	10	10	78	78	135,072	15.4	7.8	1,732
1999	9	10	74	74	138,478	15.7	7.4	1,871
2000	5	5	25	25	35,744	4.1	5.0	1,430
2001	2	3	20	20	35,070	4.0	6.7	1,754
2002	9	10	74	74	142,525	16.2	7.4	1,926
TOTAL	53	68	496	499	879,723	100.0	7.3	1,763

Table 2. Distribution of observer data held by the OFP covering offshore longline fleets targeting South Pacific albacore in tropical and sub-tropical waters, by fleet

FLEET	VESSELS	TRIPS	DAYS	SETS	HOOKS		DAYS PER TRIP	HOOKS PER SET
					NO.	%		
American Samoa	2	2	2	2	570	0.1	1.0	285
Cook Islands	2	2	7	7	7,530	0.9	3.5	1,076
Fiji Islands	11	12	102	104	200,425	22.8	8.5	1,927
French Polynesia	12	13	103	103	222,970	25.3	7.9	2,165
New Caledonia	12	23	168	169	273,797	31.1	7.3	1,620
Samoa	7	7	19	19	19,259	2.2	2.7	1,014
Tonga	7	9	95	95	155,172	17.6	10.6	1,633
TOTAL	53	68	496	499	879,723	100.0	7.3	1,763

Table 3. Pooled CPUE (number of fish per 100 hooks), mean CPUE (number of fish per 100 hooks), bias of mean CPUE (percentage of pooled CPUE), standard deviation of CPUE (number of fish per 100 hooks and percentage of mean CPUE), number of positive sets, and total number of fish caught

SPECIES	POOLED CPUE	MEAN CPUE	BIAS %	STD DEV	STD DEV %	POS SETS	NO CAUGHT
ALBACORE	1.4053	1.3492	-4.0	1.2659	93.8	469	12,363
YELLOWFIN	0.4457	0.4642	4.1	0.9313	200.6	402	3,921
BIGEYE	0.2172	0.2165	-0.3	0.2867	132.4	346	1,911
BLUE SHARK	0.1375	0.1417	3.0	0.1774	125.2	354	1,210
MAHI MAHI / DOLPHINFISH / DORADO	0.1257	0.1373	9.3	0.2062	150.1	286	1,106
SKIPJACK	0.0950	0.0898	-5.5	0.2618	291.5	200	836
LONGSNOUTED LANCETFISH	0.0928	0.0981	5.7	0.2525	257.4	120	816
WAHOO	0.0881	0.0851	-3.5	0.1287	151.3	284	775
ESCOLAR	0.0780	0.1019	30.6	0.2959	290.5	165	686
MOONFISH / OPAH	0.0590	0.0639	8.2	0.1229	192.5	217	519
LANCETFISHES	0.0566	0.0617	9.0	0.1631	264.4	113	498
OCEANIC WHITE-TIP SHARK	0.0447	0.0449	0.5	0.0768	171.0	205	393
STRIPED MARLIN	0.0418	0.0460	10.0	0.0868	188.7	183	368
SHORT-BILLED SPEARFISH	0.0413	0.0424	2.6	0.1079	254.6	157	363
GREAT BARRACUDA	0.0407	0.0386	-5.2	0.1042	270.2	153	358
OILFISH	0.0343	0.0346	1.0	0.0881	254.3	120	302
BARRACUDAS (UNIDENTIFIED)	0.0284	0.0330	16.3	0.1019	308.5	90	250
SILKY SHARK	0.0263	0.0266	1.0	0.0748	281.5	109	231
SWORDFISH	0.0236	0.0267	13.3	0.0891	333.1	131	208
BLUE MARLIN	0.0235	0.0248	5.5	0.0599	241.5	136	207
SHORT FINNED MAKO SHARK	0.0216	0.0231	7.1	0.0543	234.7	132	190
SNAKE MACKEREL	0.0215	0.0178	-17.4	0.0522	293.9	84	189
UNSPECIFIED	0.0178	0.0206	15.6	0.0945	459.3	67	157
SHARKS (UNIDENTIFIED)	0.0157	0.0200	27.5	0.0633	316.3	81	138
PELAGIC STING-RAY	0.0149	0.0148	-0.9	0.0375	254.0	94	131
SAILFISH (INDO-PACIFIC)	0.0136	0.0139	2.3	0.0364	261.5	87	120
SICKLE POMFRET	0.0125	0.0114	-8.6	0.0392	343.2	62	110
BLACK MARLIN	0.0122	0.0166	35.8	0.1010	609.8	54	107
SNAKE MACKERELS AND ESCOLARS	0.0089	0.0114	28.3	0.0688	602.5	37	78
OTHER FISH	0.0057	0.0049	-14.9	0.0353	727.8	14	50
POMFRETS AND OCEAN BREAMS	0.0049	0.0059	20.0	0.0386	656.5	26	43
MAKO SHARKS	0.0049	0.0072	46.8	0.0359	499.0	25	43
TUNA (UNIDENTIFIED)	0.0049	0.0057	17.2	0.0347	604.2	24	43
BIGEYE THRESHER SHARK	0.0033	0.0031	-7.2	0.0156	509.1	22	29
BIG-SCALED POMFRET	0.0032	0.0032	1.2	0.0206	635.8	19	28
GEMFISH (SOUTHERN OR SILVER KINGFISH)	0.0031	0.0030	-2.6	0.0303	1,004.0	13	27
ATLANTIC POMFRET / RAY'S BREAM	0.0031	0.0027	-13.1	0.0228	846.0	11	27
GREY REEF SHARK	0.0028	0.0026	-7.9	0.0256	992.6	9	25
LONG FINNED MAKO SHARK	0.0027	0.0024	-12.6	0.0129	546.4	20	24
THRESHER SHARKS	0.0027	0.0033	21.9	0.0165	501.4	22	24
BLACK MACKEREL	0.0024	0.0025	2.2	0.0184	750.1	11	21
RAINBOW RUNNER	0.0022	0.0018	-17.9	0.0135	747.5	12	19
OCEAN SUNFISH	0.0019	0.0017	-9.2	0.0112	649.3	13	17
SCABBARD FISH, FROSTFISH	0.0017	0.0012	-30.9	0.0077	655.9	13	15
TIGER SHARK	0.0015	0.0014	-5.0	0.0100	701.8	11	13
MARLINS, SAILFISHES, SPEARFISHES (UNIDENTIFIED)	0.0010	0.0013	26.5	0.0095	751.0	9	9
HAMMERHEAD SHARKS	0.0010	0.0010	-3.4	0.0073	755.7	9	9
CRESTFISH/UNICORNFISH	0.0009	0.0008	-9.8	0.0071	874.4	7	8
RAYS, SKATES AND MANTAS	0.0007	0.0006	-16.1	0.0054	919.9	6	6
DEALFISH (DESMODEMA POLYSTICTUM)	0.0007	0.0009	21.4	0.0089	1,047.1	5	6
SOAPFISH	0.0007	0.0005	-31.0	0.0045	931.7	6	6

Table 3 (continued)

SPECIES	POOLED CPUE	MEAN CPUE	BIAS %	STD DEV	STD DEV %	POS SETS	NO CAUGHT
BARRACOUTA (SNOEK)	0.0006	0.0012	101.7	0.0145	1,198.3	4	5
FILEFISH (SCRIBBLED LEATHERJACKET)	0.0005	0.0009	76.4	0.0145	1,644.0	2	4
SILVER-TIP SHARK	0.0005	0.0004	-18.6	0.0055	1,351.4	3	4
PELAGIC THRESHER SHARK	0.0005	0.0004	-10.2	0.0051	1,135.9	4	4
SANDBAR SHARK	0.0003	0.0003	15.7	0.0045	1,296.8	3	3
THRESHER SHARK (VULPINAS)	0.0002	0.0002	6.0	0.0034	1,603.8	2	2
BLACKFIN BARRACUDA	0.0002	0.0002	0.0	0.0032	1,600.0	2	2
SOUTHERN RAYS BREAM	0.0002	0.0002	-9.0	0.0041	2,252.7	1	2
BLACKTIP SHARK	0.0002	0.0002	12.0	0.0035	1,562.5	2	2
KAWAKAWA	0.0002	0.0002	4.0	0.0033	1,586.5	2	2
SEAL SHARK / BLACK SHARK	0.0002	0.0002	3.0	0.0046	2,233.0	1	2
TREVALLIES (UNIDENTIFIED - JACKS)	0.0002	0.0004	79.5	0.0080	2,228.4	1	2
DEALFISHES	0.0002	0.0002	5.0	0.0034	1,619.0	2	2
RIBBONFISH	0.0001	0.0002	90.0	0.0042	2,210.5	1	1
FILEFISH (UNICORN LEATHERJACKET)	0.0001	0.0001	4.0	0.0023	2,211.5	1	1
SHORTSNOUTED LANCETFISH	0.0001	0.0001	12.0	0.0025	2,232.1	1	1
PORCUPINE FISH	0.0001	0.0001	0.0	0.0022	2,200.0	1	1
DOLPHINS / PORPOISES (UNIDENTIFIED)	0.0001	0.0003	167.0	0.0059	2,209.7	1	1
PUFFER FISH (G. SCELERATUS)	0.0001	0.0001	0.0	0.0022	2,200.0	1	1
GALAPAGOS SHARK	0.0001	0.0001	14.0	0.0025	2,193.0	1	1
MANTA RAYS (UNIDENTIFIED)	0.0001	0.0001	-8.0	0.0021	2,282.6	1	1
MARLIN	0.0001	0.0002	54.0	0.0034	2,207.8	1	1
MACKEREL (UNIDENTIFIED)	0.0001	0.0001	38.0	0.0031	2,246.4	1	1
CROCODILE SHARK	0.0001	0.0001	2.0	0.0023	2,254.9	1	1
PUFFERS (FAMILY)	0.0001	0.0001	32.0	0.0030	2,272.7	1	1
MORID COD (RIBALDO)	0.0001	0.0001	24.0	0.0028	2,258.1	1	1