SPC/Fisheries 20/WP 4
June 6, 1988

ORIGINAL: ENGLISH

# SOUTH PACIFIC COMMISSION

## TWENTIETH REGIONAL TECHNICAL MEETING ON FISHERIES
(Noumea, New Caledonia, 1 - 5 August, 1988)

## A STUDY OF SOLOMON ISLANDS TUNA LENGTH-FREQUENCY DATA
(Paper Prepared by the Secretariat)

762/88

## Background

1. The Solomon Islands have a domestic tuna fleet made up of 35 pole-and-line boats ranging between 60 - 120 grt, one group seiner, and a new single purse seiner that began fishing in 1988 and one foreign 500 grt single purse seiner operating under charter. Annual catch and effort by gear type since 1980 are given in Table 1. Another new purse seine vessel is scheduled to start fishing before the end of 1988. The Solomon Islands Ministry of Natural Resources, Fisheries Division Research and Management Section (FDRMS) closely monitors tuna fishing within their 200-mile economic zone and processes a wide variety of information to advise on the continued development of the local fishing industry. Part of FDRMS's monitoring programme involves the collection of tuna length-frequency data from domestic commercial catches.

2. FDRMS have been providing the length-frequency data to the South Pacific Commission Tuna and Billfish Assessment Programme (TBAP) since 1981. This database is now a potentially useful tool for:

i) assessing the current status of tuna stocks available to the Solomon Island surface fisheries; and
ii) investigating existing and potential interaction between the pole-and-line and purse seine fisheries.

These questions are key fisheries management issues facing the Solomon Islands Government and as such are priority activities of the TBAP.

3. This paper summarizes the length-frequency data available and presents some preliminary descriptive analyses of these data. Analyses performed include :

i) overall trends in size composition of the combined surface fisheries by species to assess the biological impact of increased fishing pressure;
ii) trends and characteristics of size composition of catches by both purse seine and pole-and-line gear and by species;
iii) differences in size composition of catches made around fish aggregation devices (FADs) and catches from open-water schools by species.

An indication of the additional data required to specifically address the important management questions outlined above is also given.

**TABLE 1. Summary of surface fishery catch and effort for tunas in waters of Solomon Islands, 1980-1986.** *(Source : Solomon Island Fisheries Department Annual Report 1986).*

| | Pole & Line | | | Purse Seine | | |
|---|---|---|---|---|---|---|
| Year | Catch (tonnes) | Effort (days) | C/E | Catch (tonnes) | Effort (days) | C/E |
| 1980 | 21,900 | 4,993 | 4.4 | - | - | - |
| 1981 | 22,600 | 5,259 | 4.3 | 2,400 | 121 | 20.2 |
| 1982 | 17,300 | 4,858 | 3.6 | 4,500 | 209 | 21.4 |
| 1983 | 29,300 | 6,185 | 4.7 | 6,900 | 228 | 30.1 |
| 1984 | 30,600 | 6,397 | 4.8 | 5,400 | 166 | 32.8 |
| 1985 | 25,000 | 6,966 | 3.6 | 5,700 | 166 | 32.8 |
| 1986 | 38,600 | 7,663 | 5.0 | 5,900 | 177 | 33.6 |

**The data**

4. Length measurements were carried out as part of the FDRMS observer programme and were undertaken either during unloading operations or while at sea. All measurements were recorded to the least nearest centimetre. Sampling fish has been carried out by 17 different FDRMS staff since mid-1981. The samples were taken from 28 pole-and-line boats and 2 different purse seine vessels (or one of their carrier vessels). The annual figures for numbers of fish sampled are summarized in Table 1. A sample length-frequency data sheet is given in Appendix I.

**TABLE 2. Numbers of tuna measured by gear type, species and year for Solomon Islands**

| | Purse Seine | | Pole & Line | | Total | |
|---|---|---|---|---|---|---|
| Year | SKJ | YFT | SKJ | YFT | SKJ | YFT |
| 81 | 4,819 | 2,870 | 0 | 0 | 4,819 | 2,870 |
| 82 | 2,706 | 1,622 | 0 | 0 | 2,706 | 1,622 |
| 83 | 4,522 | 1,868 | 0 | 0 | 4,522 | 1,868 |
| 84 | 3,581 | 215 | 680 | 0 | 4,261 | 215 |
| 85 | 3,851 | 1,544 | 7,026 | 1,307 | 10,877 | 2,851 |
| 86 | 4,132 | 2,333 | 9,349 | 1,019 | 13,481 | 3,352 |
| 87 | 3,336 | 2,286 | 1,181 | 306 | 4,517 | 2,592 |
| Total | 26,947 | 12,738 | 18,236 | 2,632 | 45,183 | 15,370 |

5. The SPC has processed 60,553 fish measurements (45,183 skipjack and 15,370 yellowfin). The concentration of sampling effort over time is variable with over 5,000 fish measured in some quarters of the year, while in others, none or less than 500 fish were measured (Figure 1).

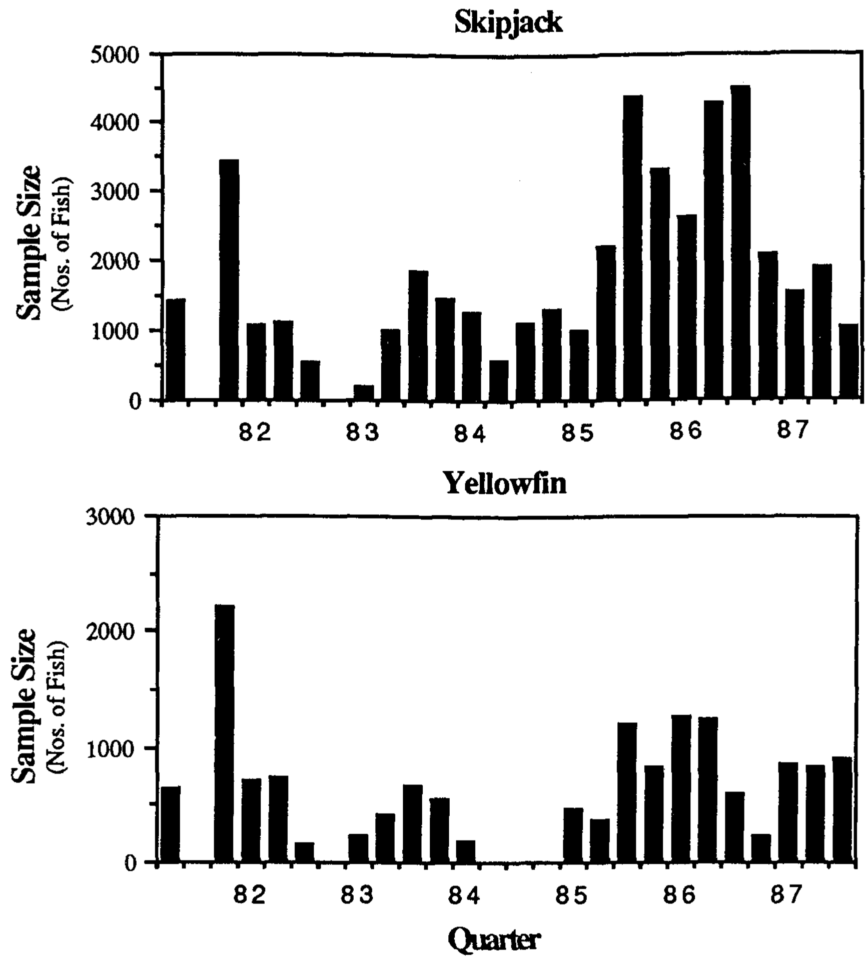



**FIGURE 1. Distribution of length-frequency sampling effort by species and quarter.**

6. In this report, details of sampling methods are not presented; it is assumed that the length measurements are free from biases associated with the sampling method and that they are representative of the catch within year-quarters. It was also assumed that no juvenile bigeye tuna (*Thunnus obesus*) were mis-identified as yellowfin (*Thunnus albacares).*

## Methods

7. As detailed catch and effort data required for the application of comprehensive age (size) structured models are not yet available for the combined surface fisheries by species, only descriptive analyses of the length-frequency data can be presented at this stage.

### *Size composition of surface fishery catches*

8. Samples were aggregated by quarter and species regardless of gear type and smoothed by a running average of three one-cm length intervals. Mean lengths by quarter and species were also calculated.

### *Testing for differences between length-frequency distributions*

9. Length-frequency distributions were contrasted in order to detect the degree of commonality of fish being exploited by the two gear types; similar contrasts were made for FAD and non-FAD purse seine sets. The data were selected only from quarters where samples of a particular species were drawn from both gear types (or set types). The distributions were then compared using a Kolmogrov-Smirnov non-parametric statistical test for analysing frequency data (Wetherall and Yong 1988, Sokal and Rolf 1981). This test provides an indication as to whether, based on the level of sampling, a significant difference between two length-frequency distributions exists.

## Results

### *Size composition of the surface fishery*

10. Quarterly mean lengths range from 47.5 to 64.6 cm for yellowfin and 49.1 to 54.8 cm for skipjack (Figure 2). No seasonal patterns emerge, however, the mean lengths vary considerably between quarters. There is no indication, based simply on the average size over time, that fishery induced changes to the tuna population are occurring. Appendix II lists the quarterly mean lengths and sample sizes that were available for skipjack and yellowfin.

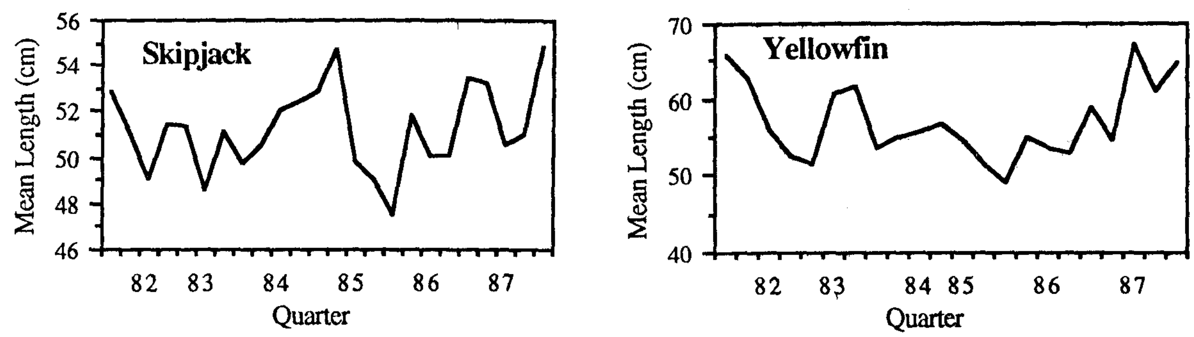



**FIGURE 2. Quarterly mean lengths for skipjack and yellowfin sampled from surface fisheries. Quarters appear unevenly distributed due to missing values.**

11. Smoothed percent length-frequency distributions for skipjack samples aggregated by quarters for both surface gears combined are shown in Figure 3. Most quarters show unimodal distributions centred around 50 cm. In several quarters, modes between 35-40 cm appear, presumably indicating new recruits to the fishery. During other periods, modes around 60 cm appear .

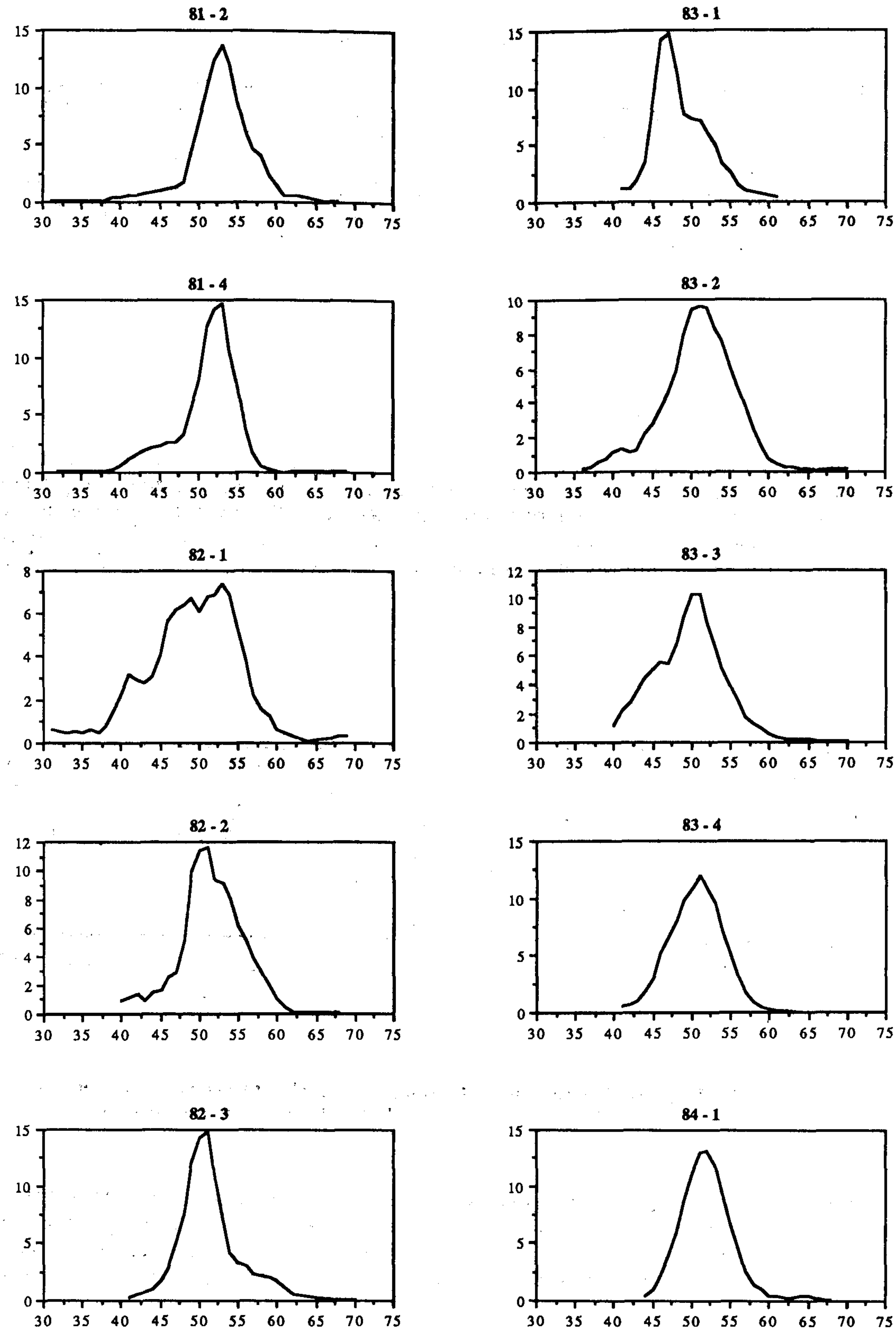



**FIGURE 3. Length-frequency distributions (percent) for skipjack samples within quarters for both surface gears, second quarter 1981 - third quarter 1987 (note: no samples taken in third quarter 1981 or in fourth quarter 1982). The data are smoothed over 3 frequency intervals.**

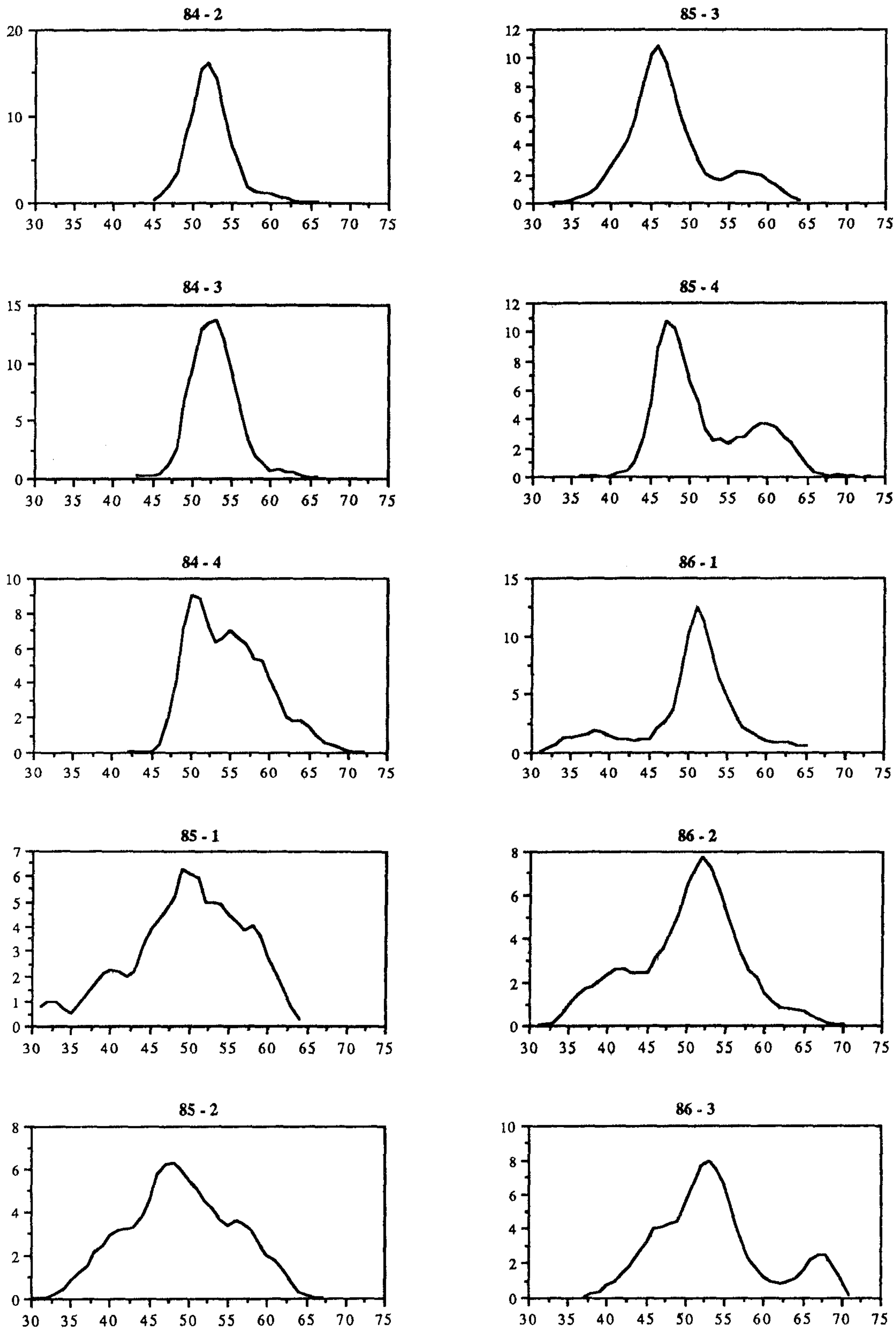



FIGURE 3. Cont'd

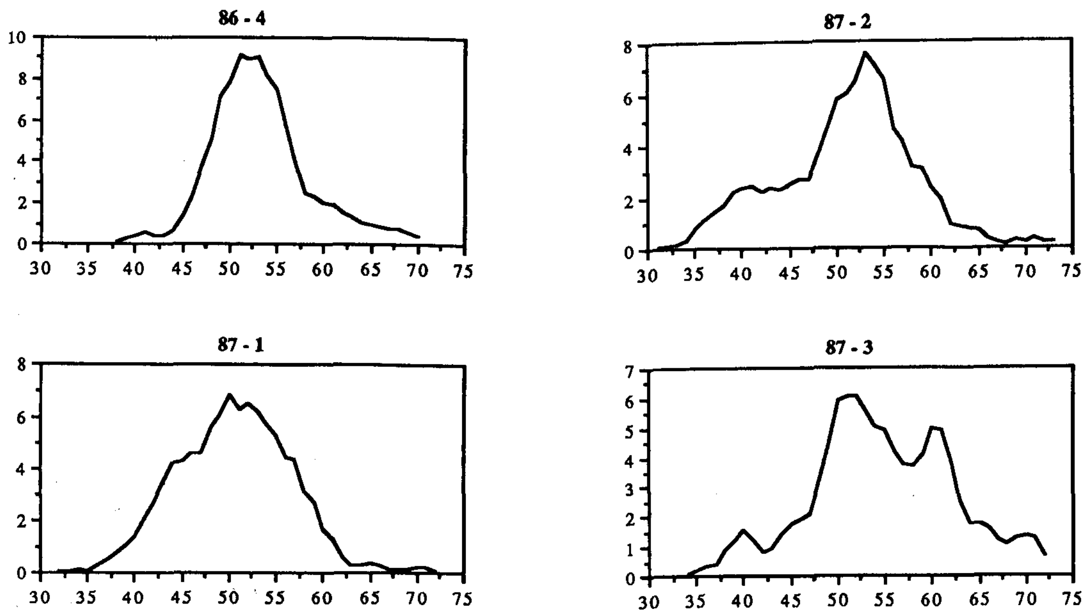



**FIGURE 3. Cont'd**

12. Smoothed percent length-frequency distributions for yellowfin samples aggregated quarters for both surface gears combined are shown in Figure 4. The yellowfin size distributions are frequently polymodal, with a size range that is broader than that for skipjack. Small modes between 35-40 cm appear often in the distributions, which indicates that a proportion of the yellowfin stock is recruited directly to commercial tuna fisheries within Solomon Islands waters.

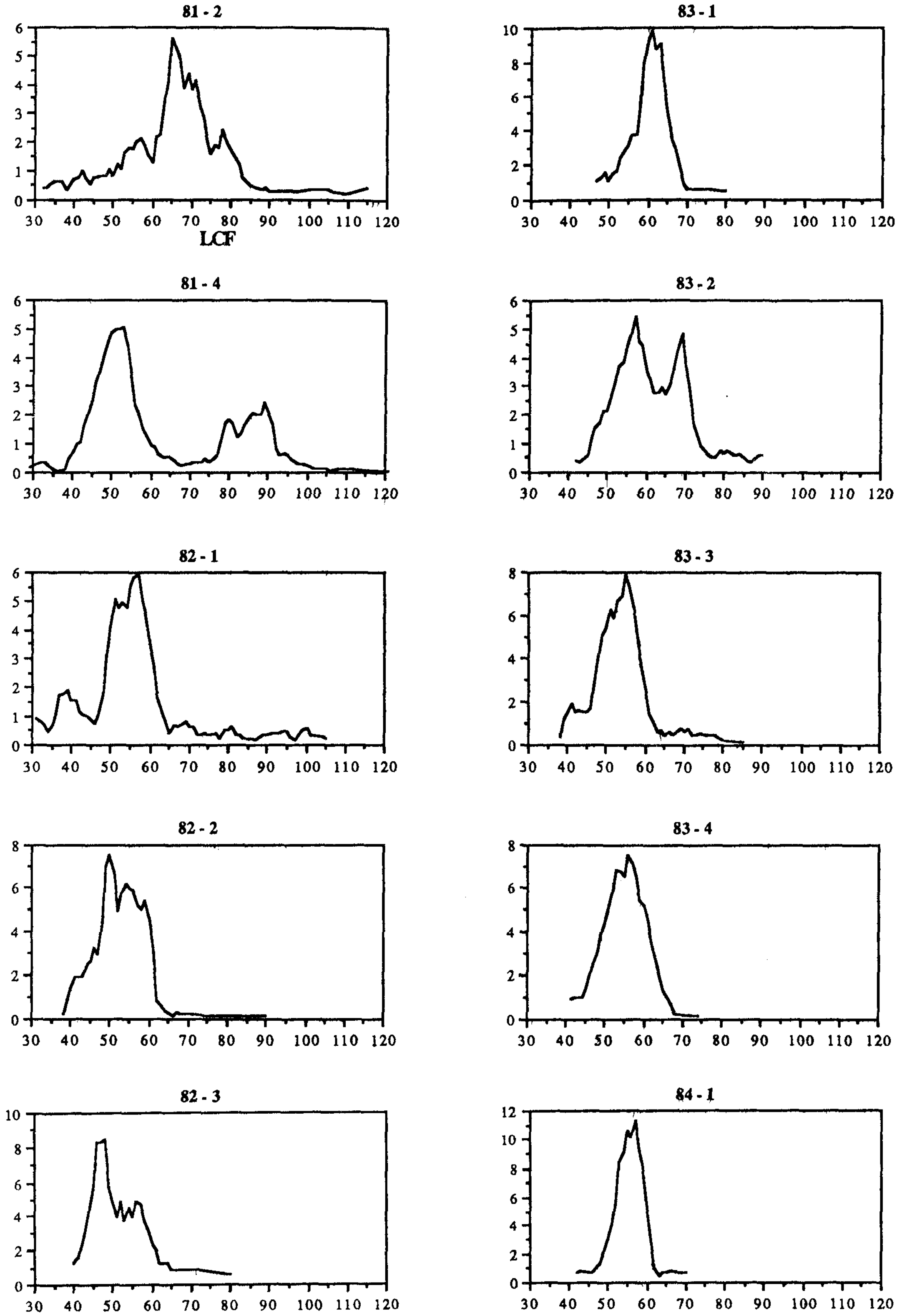



**FIGURE 4. Length-frequency distributions (percent) for yellowfin samples within quarters for both surface gears, second quarter 1981 - third quarter 1987 (note: no samples taken in third quarter 1981 or in fourth quarter 1982). The data are smoothed over 3 frequency intervals.**

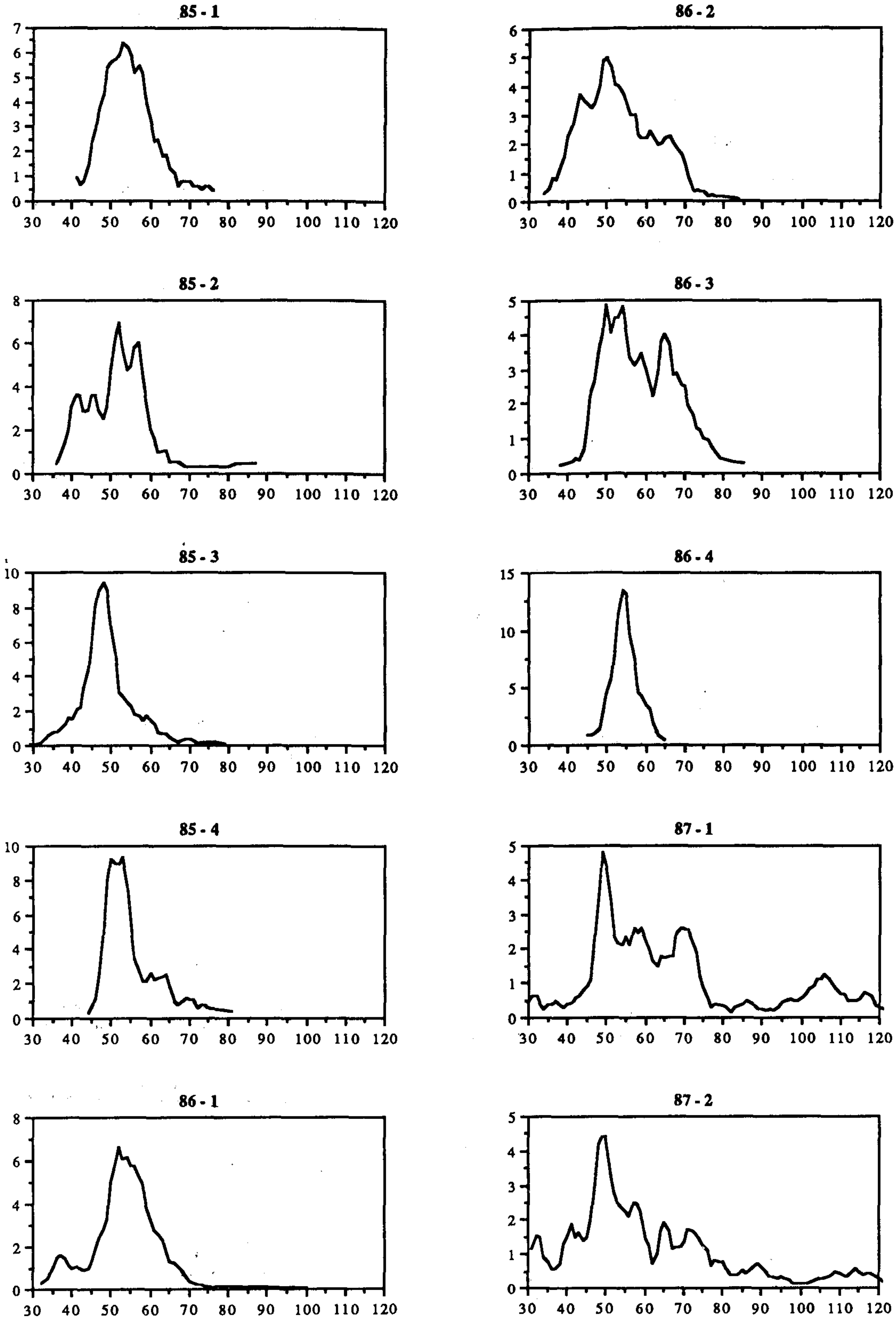



**FIGURE 4. Cont'd**

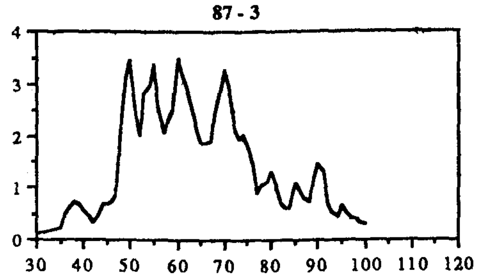



**FIGURE 4. Cont'd**

*Size composition of pole-and-line and purse seine catches*

13. Where two or more fisheries operate in the same general areas and at the same time, the respective size compositions of the catches from each fishery may be used to assess the potential for interaction. In the Solomon Islands, purse seine and pole-and-line vessels operate relatively close to one another and the effect of one fishery on the other requires close monitoring. If the catch length frequencies of the fisheries are different, further analysis (using total catch and effort data) may reveal relative advantages of one fishing gear over another based on the life history characteristics of the species.

14. In addition to differences in size composition, long-term trends in the average size of fish caught may provide evidence for direct interaction between gear types. For example, consider two fisheries exploiting a common stock with fishery **A** catching smaller fish on average than fishery **B**. If the catch of fishery **A** was increased, it would tend to remove smaller than average fish that were vulnerable to fishery **B**, thus increasing the average size of fish caught in fishery **B**. Conversely, if the catch of fisher **B** increased, larger than average fish vulnerable to fishery **A** would be selectively removed, thus decreasing the average size of fish caught in that fishery. Strong correlation between catch magnitude of one fishery and average fish size in the other would therefore indicate a strong interaction between the fisheries. Again, analyses of this type require detailed catch data not presently available to the TBAP.

15. Figure 5 shows the mean length and one standard deviation for yellowfin and skipjack caught by pole-and-line and purse seine vessels. The purse seine caught fish are generally larger and, not surprisingly, yellowfin tuna show the greatest amount of variability in length.

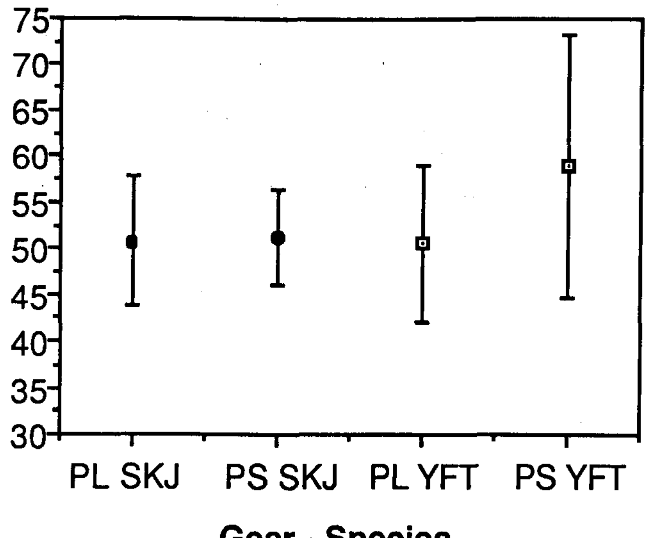



**FIGURE 5. Mean size and standard deviations of skipjack and yellowfin tuna from purse seine and pole-and-line fishing.**

16. The length distributions of purse seine and pole-and-line catches of both species aggregated across quarters were different at >99.9% significance level. The purse seine caught yellowfin distribution is more skewed toward larger tuna than pole-and-line yellowfin and extends over a greater range (Figure 6). The pole-and-line caught skipjack distribution has a wider distribution of sizes than skipjack from purse seine catches however the average sizes are very similar.

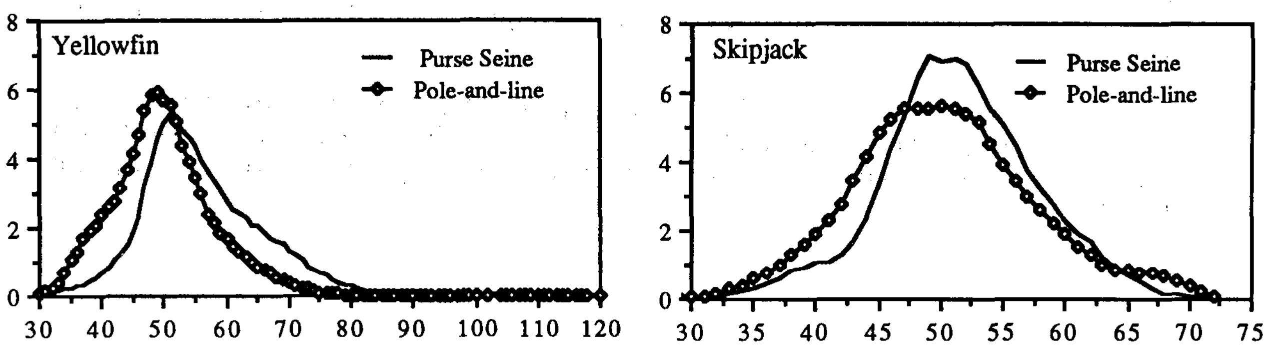
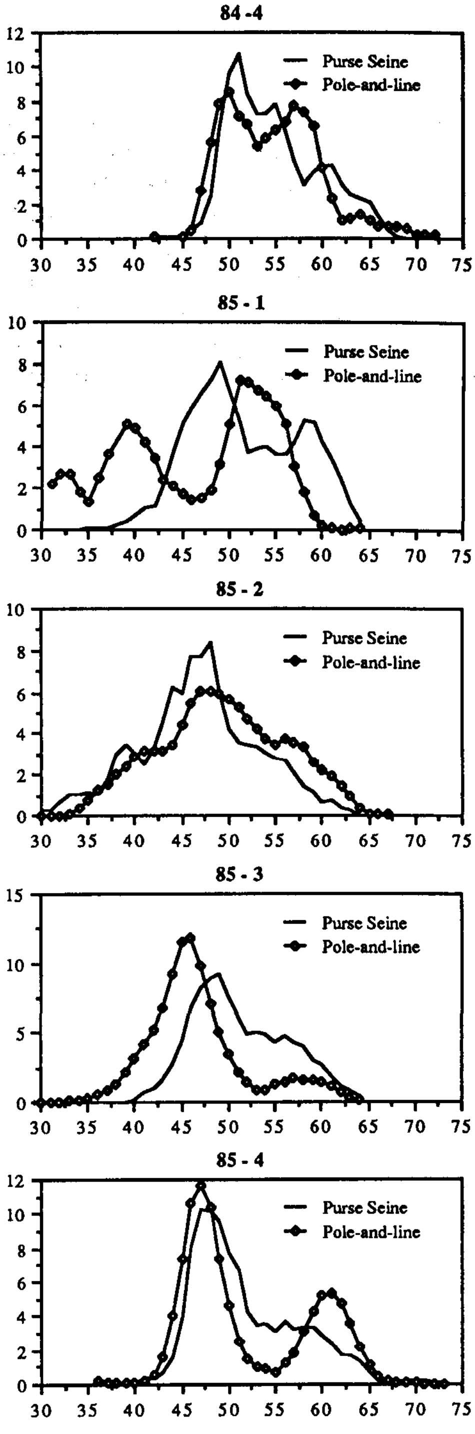



**FIGURE 6. Combined size composition of purse seine and pole-and-line catches for yellowfin and skipjack. The data were selected only from quarters where samples were drawn from both gear types in order to reduce the effect of temporal trends.**

17. Size distributions compared on a quarter by quarter basis were consistent with results from the overall comparison. For skipjack, 10 quarters were suitable for examination. Of these, 7 were significantly different at > 99% level, 1 at 95% level and 2 quarters showed no significant differences in length-frequency distributions between the two gears (Figure 7). All significant differences had greater mean lengths from the purse seine fishery except in the fourth quarter of 1985 where a mode centred around 61 cm appears in the pole-and-line fishery. For yellowfin, 8 quarters were suitable for examination. Of these, 2 were significantly different at > 99% level, 1 at 95% level and 5 quarters showed no significant differences in length-frequency distributions between the two gears (Figure 8). All significant differences (and non-significant differences) had greater mean lengths from the purse seine fishery.




| | | |
|---|---|---|
| Quarter | : 844 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 624 | 677 |
| Mean | 54.81 | 54.69 |
| D - Statistic = 0.241517 *** | | |

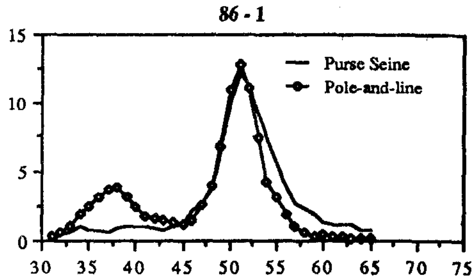
| | | |
|---|---|---|
| Quarter | : 851 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 626 | 372 |
| Mean | 51.73 | 46.53 |
| D - Statistic = 0.22268 *** | | |

| | | |
|---|---|---|
| Quarter | : 852 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 250 | 1954 |
| Mean | 46.74 | 49.26 |
| D - Statistic = 0.07478 NS | | |

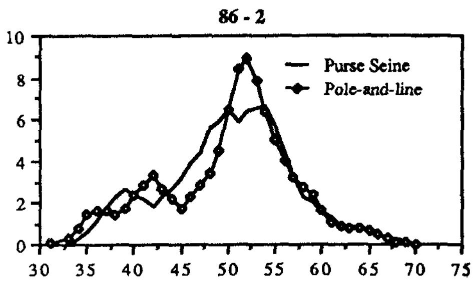
| | | |
|---|---|---|
| Quarter | : 853 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 837 | 3531 |
| Mean | 51.25 | 46.67 |
| D - Statistic = 0.123298 *** | | |

| | | |
|---|---|---|
| Quarter | : 854 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 2136 | 1168 |
| Mean | 51.79 | 51.82 |
| D - Statistic = 0.088335 *** | | |

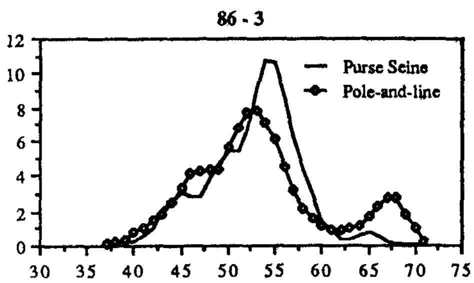
**FIGURE 7. Quarterly smoothed length-frequency distributions for skipjack sampled from pole-and-line and purse seine fishing gear. Horizontal axis is fork length in centimetres, vertical axis is percent frequency. Significance values are the Kolmogrov-Smirnov D-statistic. The quarters are represented by YYQ where YY is the year and Q is the quarter for that year.**



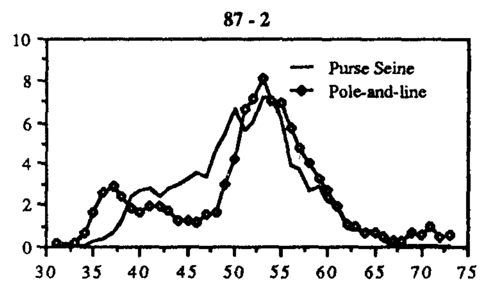

| | | |
|---|---|---|
| Quarter | : 861 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 1737 | 884 |
| Mean | 51.29 | 47.56 |
| D - Statistic = | 0.056687 * | |



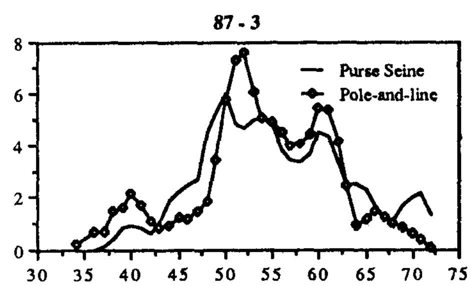

| | | |
|---|---|---|
| Quarter | : 862 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 1972 | 2307 |
| Mean | 50.12 | 50.07 |
| D - Statistic = | 0.123377 NS | |




| | | |
|---|---|---|
| Quarter | : 863 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 422 | 4086 |
| Mean | 52.73 | 53.46 |
| D - Statistic = | 0.067099 NS | |



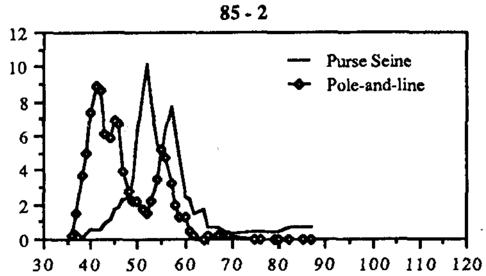

| | | |
|---|---|---|
| Quarter | : 872 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 1193 | 676 |
| Mean | 50.70 | 51.64 |
| D - Statistic = | 0.048658 NS | |



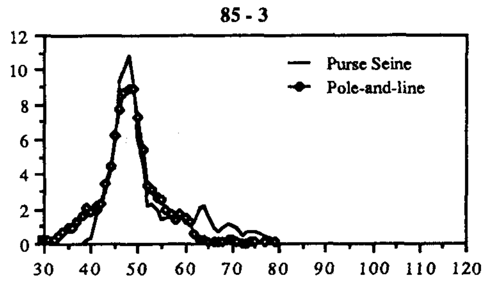

| | | |
|---|---|---|
| Quarter | : 873 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 547 | 504 |
| Mean | 55.49 | 54.04 |
| D - Statistic = | 0.113679 ** | |

NS - Not significant
* - Significant at > 95% level
** - Significant at > 99% level
*** - Significant at > 99.9% level

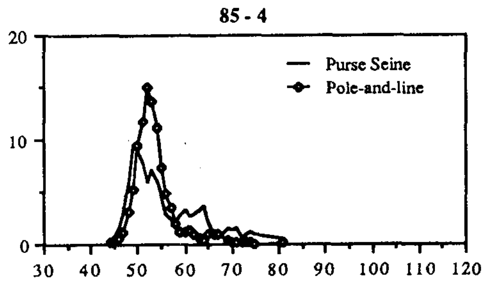
**FIGURE 7. Cont'd**



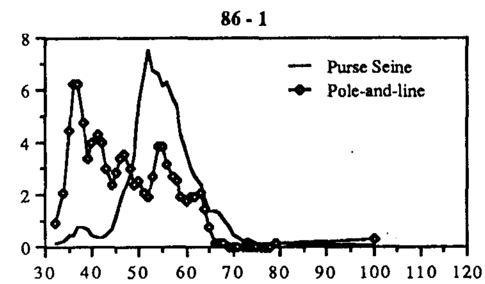

| | | |
|---|---|---|
| Quarter | : 852 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 230 | 135 |
| Mean | 54.53 | 46.58 |
| D - Statistic = | 0.111111 NS | |



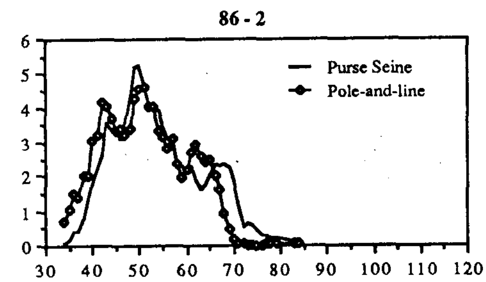

| | | |
|---|---|---|
| Quarter | : 853 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 289 | 903 |
| Mean | 51.77 | 48.21 |
| D - Statistic = | 0.08393 NS | |




| | | |
|---|---|---|
| Quarter | : 854 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 551 | 269 |
| Mean | 55.59 | 53.90 |
| D - Statistic = | 0.15135 *** | |

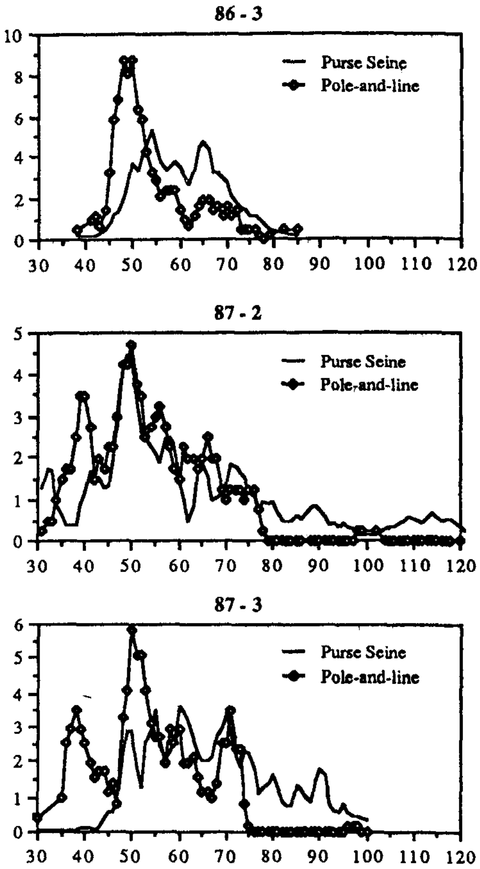



| | | |
|---|---|---|
| Quarter | : 861 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 1067 | 209 |
| Mean | 54.79 | 47.29 |
| D - Statistic = | 0.118088 * | |




| | | |
|---|---|---|
| Quarter | : 862 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 816 | 440 |
| Mean | 54.00 | 51.12 |
| D - Statistic = | 0.066689 NS | |

**FIGURE 8. Quarterly smoothed length-frequency distributions for yellowfin sampled from pole-and-line and purse seine fishing gear. Horizontal axis is fork length in centimetres, vertical axis is percent frequency. Significance values are the Kolmogrov-Smirnov D-statistic. The quarters are represented by YYQ where YY is the year and Q is the quarter for that year.**




| | | |
|---|---|---|
| Quarter | : 863 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 450 | 141 |
| Mean | 60.20 | 54.01 |
| D - Statistic = | 0.067896 NS | |

| | | |
|---|---|---|
| Quarter | : 872 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 708 | 134 |
| Mean | 62.51 | 53.28 |
| D - Statistic = | 0.081373 NS | |

| | | |
|---|---|---|
| Quarter | : 873 | |
| Gear | Purse Seine | Pole-and-line |
| Sample Size | 719 | 171 |
| Mean | 67.18 | 53.80 |
| D - Statistic = | 0.152697 ** | |

NS - Not significant
* - Significant at > 95% level
** - Significant at > 99% level
*** - Significant at > 99.9% level

**FIGURE 8. Cont'd**

18. Another indication of the two surface gears fishing a common stock would be a strong positive correlation between average sizes of fish caught in the two fisheries, i.e. if the average size of pole-and-line caught fish increased in a particular quarter, we might expect the average size of purse seine caught fish to increase also. Such appears to be the case as quarterly mean lengths from both fisheries are positively correlated (90% significance level) for skipjack and yellowfin (Figures 9 & 10). This implies that when purse seine catches are made up of larger fish, so too are pole-and-line catches.

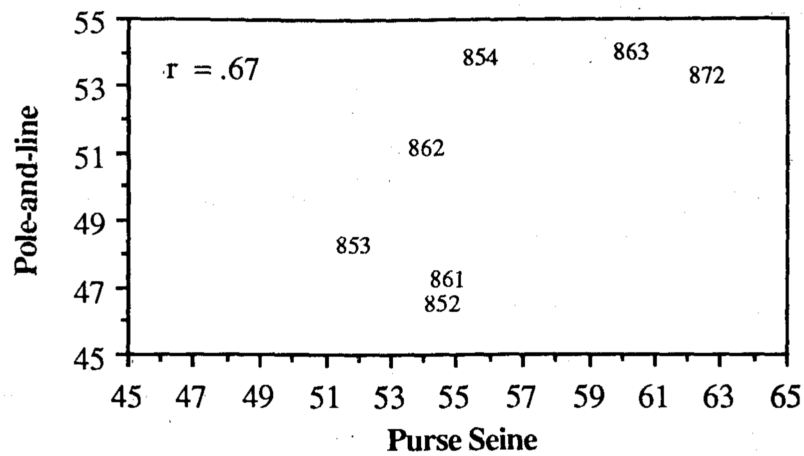



**FIGURE 9. Quarterly mean lengths of yellowfin samples from the pole-and-line fishery (vertical axis) versus those from the purse seine fishery (horizontal axis). The data points are given as the year and quarter (YYQ).**

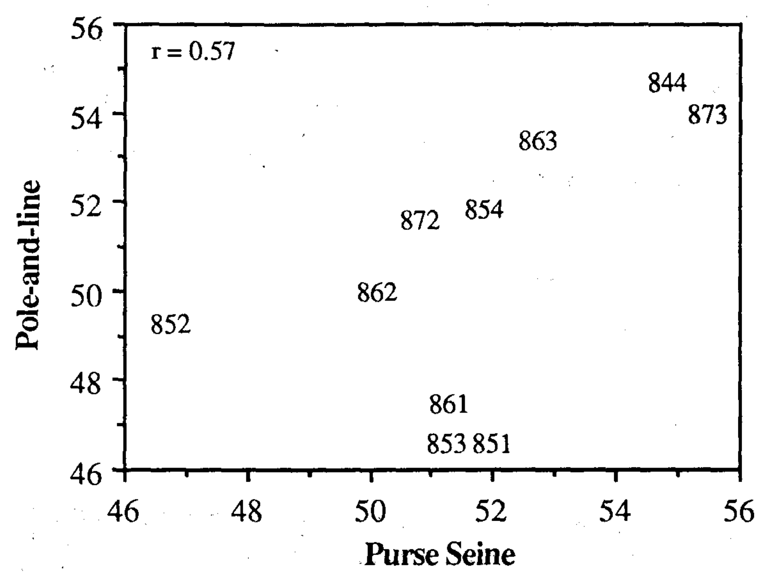
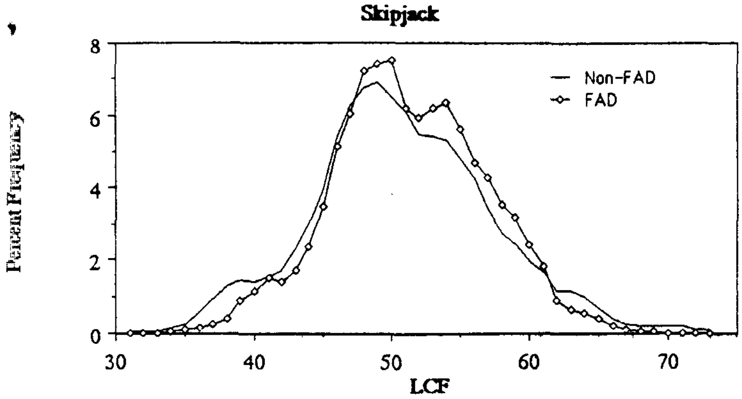



**FIGURE 10. Quarterly mean lengths of skipjack samples from the pole-and-line fishery (vertical axis) versus those from the purse seine fishery (horizontal axis). The data points are given as the year and quarter (YYQ).**

*Size composition associated with FAD and non-FAD sets*

19. Tuna fisheries development in Pacific Island countries has nearly always involved a programme of FAD deployment. There are a variety of advantages to using FADs and their popularity in countries continues to increase. The Solomon Islands has one of the most active FAD programmes operating in conjunction with purse seine operations. Information on whether or not a purse seine set on an FAD was sometimes recorded on the length-frequency data sheets. Only purse seiners recorded sets on FADs so pole-and-line data are not included in this section.

20. Again data were selected for quarters where samples were drawn from both non-FAD sets and FAD sets to avoid influences of changes over time. In all, 1,313 yellowfin and 3,398 skipjack length measurements were available from sets associated with a FAD and 1,807 yellowfin and 4,697 skipjack were sampled from non-FAD sets within the same quarter. Yellowfin from non-FAD sets averaged 61.9 cm and were significantly different at > 99.9% level from FAD associated sets, which yielded an average length of 58.1 cm (Figure 11). Skipjack from non-FAD sets were slightly but significantly (95% level) smaller than FAD associated sets with mean lengths of 50.8 and 51.3 cm, respectively.



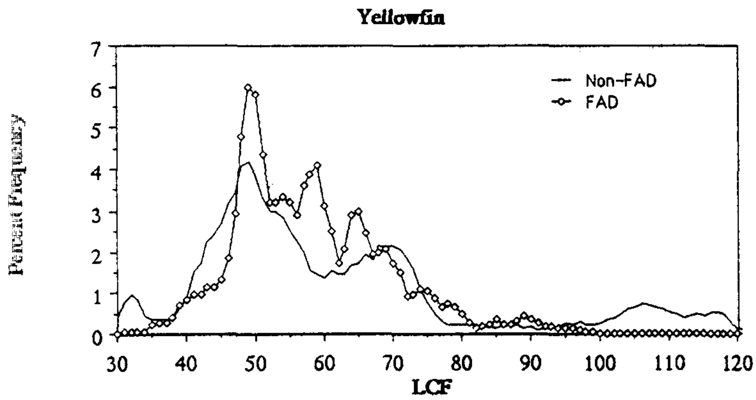




**FIGURE 11. Smoothed length-frequency distributions for yellowfin and skipjack sampled from purse seine associated with FADs and those that were not associated with FADs. Horizontal axis is fork length in centimetres, vertical axis is percent frequency.**

**Discussion and Summary**

21. The mean lengths of tuna from the Solomon Islands surface fisheries are variable between quarters but do not show any upward or downward trend. In general, when a developing fishery approaches its full potential a decline in the average fish size may appear. Such trends (or lack thereof) in this case must be interpreted with caution because pole-and-line vessels are limited in the size range of fish they are able to catch. Also for purse seiners, concentrating on different school types or modifying techniques may change the vulnerability of certain size groups of fish to that gear and may influence the average size of fish caught more than biological responses to fishing.

22. Based on yield-per-recruit analyses of skipjack in the Eastern Pacific, the resource is best utilized if catches start on fish at small sizes (~35cm) (Anon. 1984). For Eastern Pacific yellowfin, length-based analyses indicate that the best yield-per-recruit occurs when the average size of the catch is much greater than that of either surface fishery presented here. However, the Solomon Islands tuna fishery is much more confined geographically, therefore migration away from the fishery is likely to be a much more significant factor than in the Eastern Pacific. This would tend to favour catching smaller yellowfin in the Solomon Islands fishery than in the Eastern Pacific. Pole-and-line vessels generally catch relatively fewer yellowfin than purse seiners and thus probably do not contribute significantly to the fishing mortality inflicted on yellowfin. As purse seining continues to develop, however, there will be an increasing need to monitor potential interaction with the longline fisheries that rely heavily on catches of large yellowfin.

23. The average size of yellowfin and skipjack caught by purse seiners is larger than those caught by pole-and-line vessels. On a quarterly basis where samples from purse seine and pole-and-line catches are available the average size of fish caught by the two gear types was positively correlated for both yellowfin and skipjack. This indicates that the two gear types are catching fish from the same general stock and that the catch of larger (or smaller) fish from one fishery does not seem to affect the size composition of the other. This is not surprising given that early estimates of potential fishery expansion made by the SPC Skipjack Survey and Assessment Programme were nearly twice the current catch levels (Kearney 1982). This would indicate that the stocks are only moderately harvested.

24. Skipjack sampled from FAD associated purse seine sets appear to be slightly larger on average than skipjack sampled from non-FAD purse seine sets; the distributions were significantly different at the 95% level. For yellowfin, samples from non-FAD sets indicate a wider variety of sizes than those from FAD sets and the distributions were significantly different (> 99.9% level). Data on the species composition of the total catch from the different types of purse seine sets (e.g. log and schoolfish set types) were not available for a more thorough treatment of this aspect of the length-frequency data.

25. The TBAP has implemented a length-frequency data-base of this data on micro computers. Currently, the TBAP and FDRMS are developing a programme to link catch data and effort data not presently available to the TBAP with the length-frequency data-base. Access to such data would enable estimation of the size distribution of the total catch which could then be input to age or size-structured models. The use of such models would allow a more quantitative description of interaction between gear types and a more thorough assessment of tuna stocks in the Solomon Islands. The future of this project will become increasingly important with further development of tuna fisheries in the Solomon Islands. The current programme will also benefit with the addition of length frequency information soon to be available from other sources in the region (e.g. the US multi lateral treaty).

**Literature Cited**

Anon. 1984. Annual Report of the Inter-American Tropical Tuna Commission. ISSN 0074-1000. La Jolla, California. 272p.

Anon. 1986. Annual report. Solomon Islands Government Ministry of Natural Resources, Fisheries Department. Honiara, Solomon Islands. 59p.

Kearney, R. E. 1983. Assessment of the skipjack and baitfish resources in the central and western tropical Pacific ocean: a summary of the skipjack survey and assessment programme. South Pacific Commission. Noumea New Caledonia. 37p.

Sokal, R. R. and F.J. Rohlf. 1981. Biometry (2nd. Edition), W. H. Freeman and Company, San Francisco, 859p.

Wetherall, J. A. and M.Y.Y. Yong. 1987. Sample size requirements for detecting time-area variations in the length composition of tuna purse seine catches. *NOAA Technical Memorandum NMFS -Draft-* . Southwest Fisheries Centre Honolulu Laboratory, National Marine Fisheries Service, NOAA.21p.

**APPENDIX I. A sample length-frequency data form used by FDRMS staff.**

FISHERIES DIVISION
TUNA LENGTH COLLECTION

Date ..........................................

Name of Ship ..........................................

Fishing Area ..........................................

Recorder ..........................................

| Number | Length (cms.) | Number | Length (cms.) | Number | Length (cms.) | Number | Length (cms.) |
|---|---|---|---|---|---|---|---|
| 1 | | 26 | | 51 | | 76 | |
| 2 | | 27 | | 52 | | 77 | |
| 3 | | 28 | | 53 | | 78 | |
| 4 | | 29 | | 54 | | 79 | |
| 5 | | 30 | | 55 | | 80 | |
| 6 | | 31 | | 56 | | 81 | |
| 7 | | 32 | | 57 | | 82 | |
| 8 | | 33 | | 58 | | 83 | |
| 9 | | 34 | | 59 | | 84 | |
| 10 | | 35 | | 60 | | 85 | |
| 11 | | 36 | | 61 | | 86 | |
| 12 | | 37 | | 62 | | 87 | |
| 13 | | 38 | | 63 | | 88 | |
| 14 | | 39 | | 64 | | 89 | |
| 15 | | 40 | | 65 | | 90 | |
| 16 | | 41 | | 66 | | 91 | |
| 17 | | 42 | | 67 | | 92 | |
| 18 | | 43 | | 68 | | 93 | |
| 19 | | 44 | | 69 | | 94 | |
| 20 | | 45 | | 70 | | 95 | |
| 21 | | 46 | | 71 | | 96 | |
| 22 | | 47 | | 72 | | 97 | |
| 23 | | 48 | | 73 | | 98 | |
| 24 | | 49 | | 74 | | 99 | |
| 25 | | 50 | | 75 | | 100 | |

**APPENDIX II. Quarterly mean lengths and numbers of fish measured (n) by species, 1981 - 1988.**

| | Skipjack | | | Yellowfin | |
|---|---|---|---|---|---|
| Qtr. | n | mean | Qtr. | n | mean |
| 812 | 1412 | 52.82 | 812 | 646 | 65.89 |
| 813 | 0 | - | 813 | 0 | - |
| 814 | 3404 | 51.13 | 814 | 2224 | 62.57 |
| 821 | 1079 | 49.01 | 821 | 721 | 56.03 |
| 822 | 1104 | 51.49 | 822 | 739 | 52.42 |
| 823 | 523 | 51.30 | 823 | 162 | 51.36 |
| 824 | 0 | - | 824 | 0 | - |
| 831 | 208 | 48.52 | 831 | 221 | 60.48 |
| 832 | 999 | 51.10 | 832 | 405 | 61.60 |
| 833 | 1854 | 49.71 | 833 | 679 | 53.62 |
| 834 | 1458 | 50.53 | 834 | 563 | 54.94 |
| 841 | 1276 | 52.01 | 841 | 194 | 55.68 |
| 842 | 561 | 52.35 | 842 | 1 | 68.00 |
| 843 | 1120 | 52.85 | 843 | 11 | 56.73 |
| 844 | 1301 | 54.75 | 844 | 9 | 58.11 |
| 851 | 998 | 49.79 | 851 | 473 | 54.69 |
| 852 | 2204 | 48.98 | 852 | 365 | 51.59 |
| 853 | 4368 | 47.55 | 853 | 1192 | 49.08 |
| 854 | 3304 | 51.80 | 854 | 820 | 55.04 |
| 861 | 2621 | 50.03 | 861 | 1276 | 53.56 |
| 862 | 4279 | 50.09 | 862 | 1256 | 52.99 |
| 863 | 4508 | 53.39 | 863 | 591 | 58.72 |
| 864 | 2069 | 53.26 | 864 | 228 | 54.55 |
| 871 | 1535 | 50.53 | 871 | 857 | 67.37 |
| 872 | 1869 | 51.04 | 872 | 842 | 61.04 |
| 873 | 1051 | 54.79 | 873 | 890 | 64.61 |

SPC/Fisheries 20/WP.4
24 June 1988

ORIGINAL: ENGLISH

SOUTH PACIFIC COMMISSION

TWENTIETH REGIONAL TECHNICAL MEETING ON FISHERIES
(Noumea, New Caledonia, 1 - 5 August 1988)

# A STUDY OF SOLOMON ISLANDS TUNA LENGTH-FREQUENCY DATA

(Paper Prepared by the Secretariat)

## ERRATA

| | | |
|---|---|---|
| Page 3, para. 4, 6th line | ____ | "Table 1" should read "Table 2" |
| Page 8, para. 12, 1st line | ____ | "aggregated quarters" should read "aggregated by quarters" |