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AN ASSESSMENT OF INDEPENDENT FISHERY TUNA DATA COLLECTED FROM TUNA LANDINGS FROM PURSE SEINE VESSELS IN MADANG FOR THE YEAR 1999 AND 2005

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Abstract

An assessment of independent fishery tuna data was done to undermine the catch composition from the sampling, the size distribution and likely trend by species and to have a comparison between years (1999 and 2005). Using stratified random selections, fork length measurements from landings of tuna was done in Madang of purse seine vessels however for 9 months (January to September) in 1999 and 3 months (November to January) in 2005. The catch composition calculated indicated that skipjack had the highest followed by yellowfin and bigeye the least however between the years the composition varied. The size distribution and trend by tuna species clearly indicated that each species has its own distinct distribution and trend however there was no significant difference of mean lengths by species by years. In future, it would be best to have established an ongoing sampling regime so as to collect and collate up to date as well as on going data enhancing the opportunity to understand better. The primarily implication of the results is the clear need for future long term sampling arrangements and cross checking of data collected (observer, port sampling and independent data) so as to carefully verify data which would form an important data base for stock assessment and management of tunas in PNG and to a certain extent the western and central Pacific Ocean.

Introduction

Industrial scale fisheries for tuna and associated species have operated since the 1950s, and in certain years, around 10% of the global catch of the main market species of tuna has been taken within the PNG economic exclusive zone (EEZ). The tuna fishery is the largest of Papua New Guinea's fisheries and represents a balance of both domestic industry development and foreign Distant Water Fishing Nations (DWFN) access arrangements. Currently, domestic longline vessels and purse seine vessels - domestic, locally-based foreign and foreign access - operate under various arrangements.

There has been on-going data collection from fisheries independent and dependent data for sometime now and over the years the tuna fishery as a whole has been subject to policy management to address issues over the level of fishing effort and the biological sustainability of stocks. As such, a number of measurement regimes have been set in place to help regulate the fishery. To ensure that the management regimes are adhered to the National Fisheries Authority (NFA) as one of its function ensures that there is compliance. As one means in ensuring compliance, there is on-going data collection, both from fishery independent and dependent data. To date NFA has collected independent and dependent fishery data and has developed databases for these data. This paper presents an assessment done on fishery independent data (measured forked lengths of tuna) collected from landings of purse seine catch which includes a comparison for two years (1999 and 2005) to see whether the lengths were significantly different.

Method

In 1999, measurements of fork lengths of tuna species landed in Madang were recorded for January - September. In addition to taking measurements (fork length, cm) of the tuna species, the vessel the tuna came from, the net, the well position and the date of sampling was also recorded. In 2005, NFA carried out a similar exercise where measurements (fork length, cm) were taken of tuna species landed in Madang for November - January and in addition to the variables stated previously, the net layer the sampling was coming from was also accounted for. The data used for this paper was obtained from electronic records stored in constructed database.

Data Analysis

The data obtained from the sampling was entered into a database in access and excel software. The access and excel software comprised of variables such as the date, place of sampling, name of vessel, well position, well layer, net number, tuna species, length (fork length, cm) and the proportional weight.

The data was analyzed using Microsoft Excel software. The analysis concentrated on total catch by species and year, seasonal trend by species for each month in 1999, the fork lengths recorded were used to determine size composition of tuna caught for each year and the mean length by species for each year was calculated and tested to see if there were any significant difference.

Results

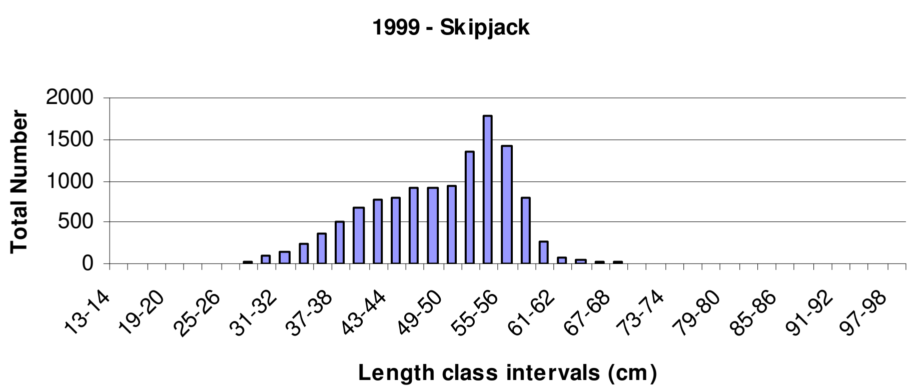
Total tuna sampled by species and year

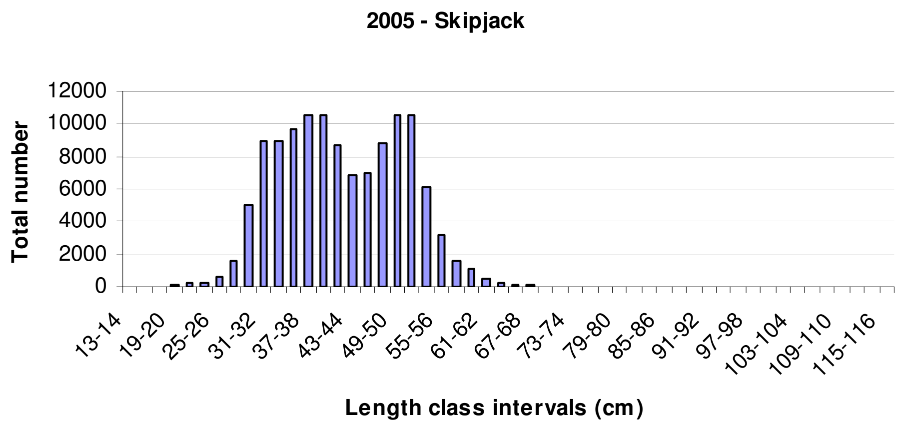
A total of 215, 805 tuna were sampled both in 1999 and 2005 (26 157 in 1999 and 189, 648 in 2005). Of these sampled 23, 486 were yellowfin (11 744 in 1999 and 65 535 in 2005), 134, 115 were skipjack (12 081 in 1999 and 122, 034 in 2005) and 4, 411 were bigeye (2, 332 in 1999 and 2, 079 in 2005).

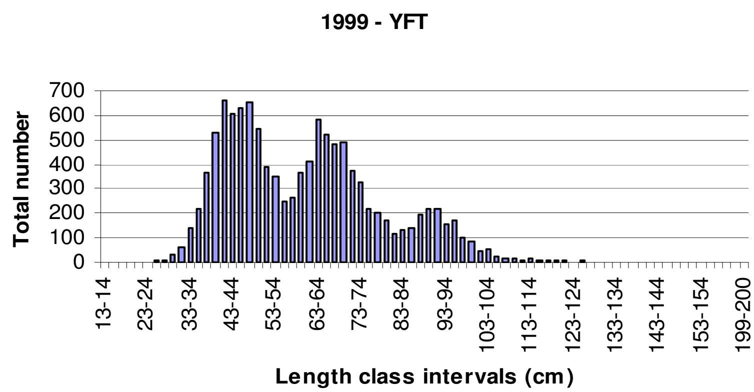
In 1999 the tuna species composition sampled were 46.1 % skipjack, 44.9% yellowfin and 9% bigeye. In 2005 64% were skipjack, 35% yellowfin and 1% bigeye. There is decrease in composition sampled of yellowfin and bigeye in 2005.

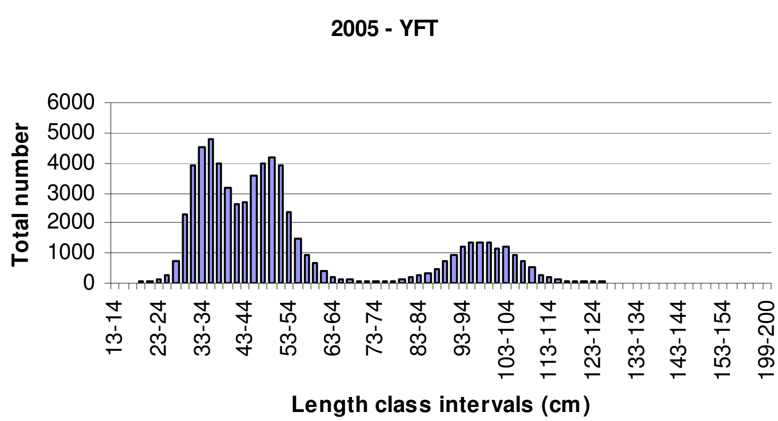
Size (length) distribution

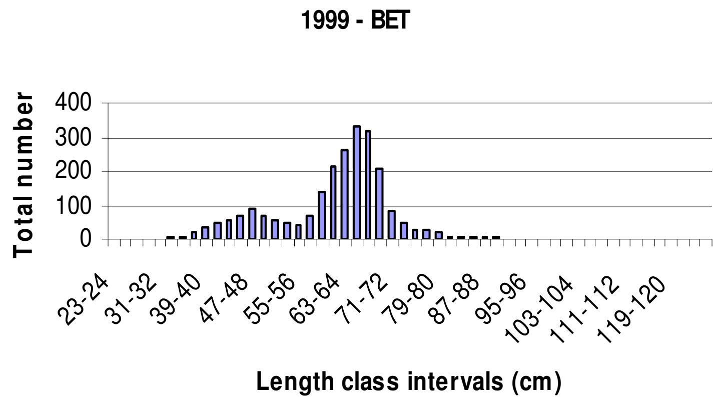
The length distribution by the total number sampled for each tuna species are shown in Figure 1. The fork lengths (FL) ranged from 23 cm – 108 cm for bigeye, 13 cm – 200 cm for yellow fin and 13 cm – 116 for skipjack. The modal class for bigeye in 1999 was 65 – 66 cm and in 2005 was 95 – 96 cm, yellowfin in 1999 was 41 – 42 cm and in 2005 was 35 – 36 cm and skipjack had a modal class of 55 – 56 cm in 1999 and 39 – 40 cm, 41- 42 cm and 51 – 52 cm in 2005. The size distribution of skipjack varied between the two years (1999 and 2005) however yellowfin and bigeye's size distribution were similar for the two years.




2005 - Skipjack
Total number
12000
10000
8000
6000
4000
2000
0
13-14
19-20
25-26
31-32
37-38
43-44
49-50
55-56
61-62
67-68
73-74
79-80
85-86
91-92
97-98
103-104
109-110
115-116
Length class intervals (cm)


1999 - YFT
Total number
700
600
500
400
300
200
100
0
13-14
23-24
33-34
43-44
53-54
63-64
73-74
83-84
93-94
103-104
113-114
123-124
133-134
143-144
153-154
199-200
Length class intervals (cm)


2005 - YFT
Total number
6000
5000
4000
3000
2000
1000
0
13-14
23-24
33-34
43-44
53-54
63-64
73-74
83-84
93-94
103-104
113-114
123-124
133-134
143-144
153-154
199-200
Length class intervals (cm)



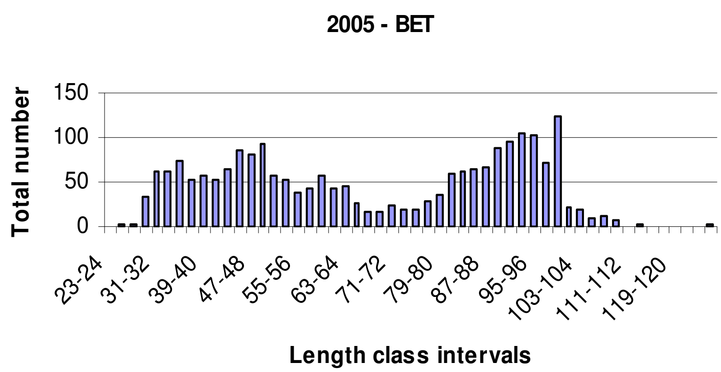
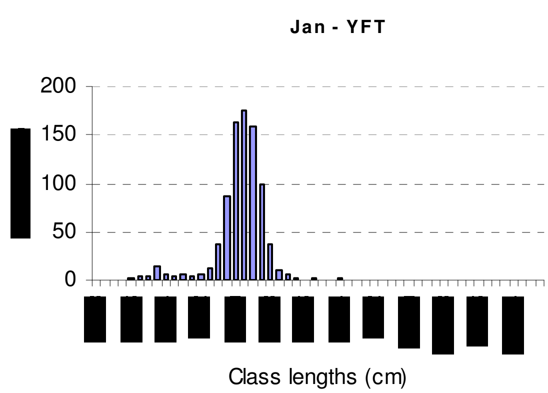


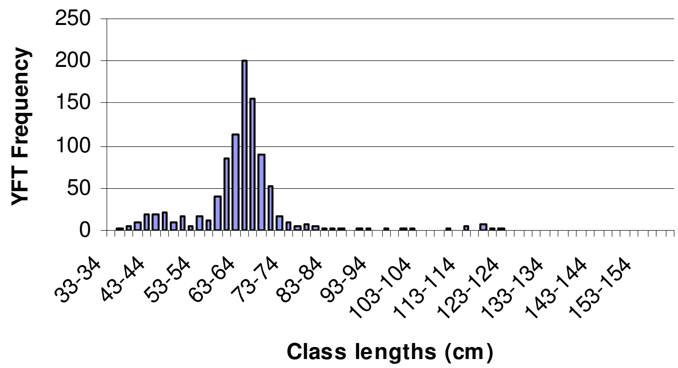
Figure 1. 1999 and 2005 class lengths (sizes) of tuna species sampled.

Monthly trends of tuna sampled

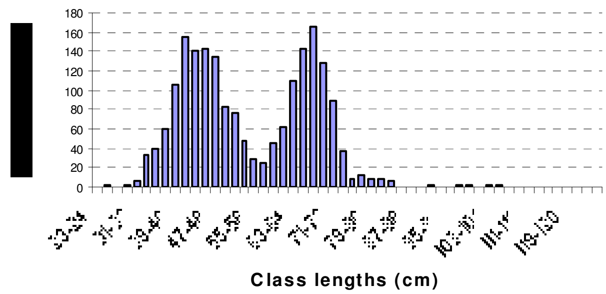
Figure 3 shows the monthly trend for the tuna species sampled in 1999. There is variability of the sizes caught between months for yellowfin and bigeye where as skipjack appears to have similar trends between months.



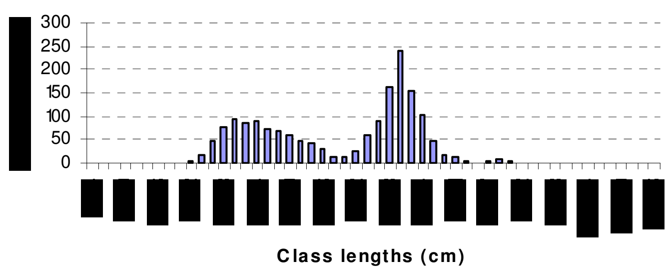
Feb - YFT



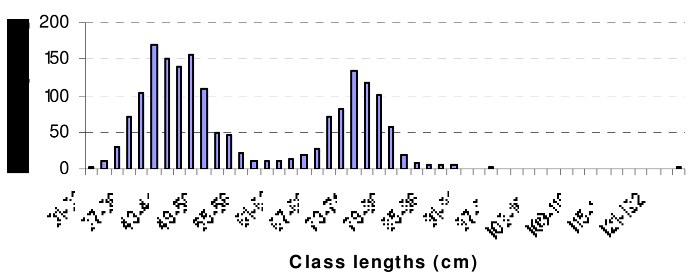
Mar - YFT



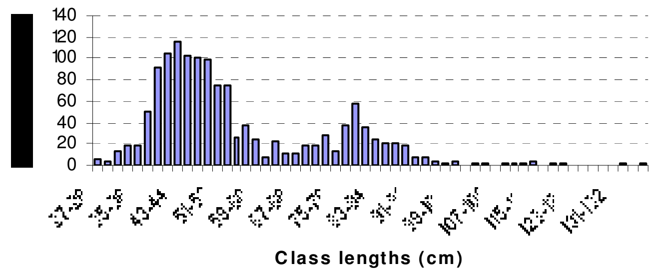
Apr - YFT



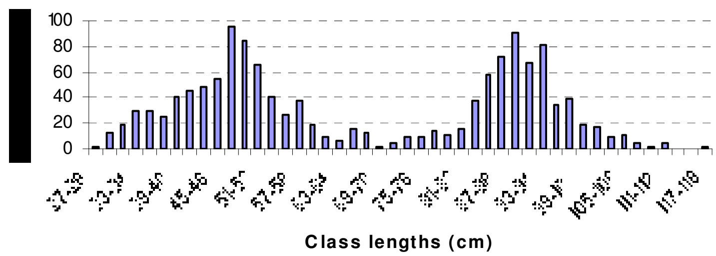
May - YFT



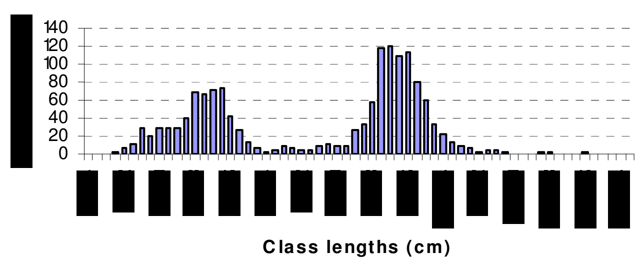
Jun - YFT



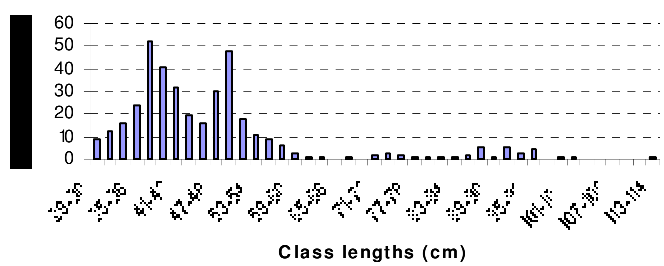
Jul - YFT

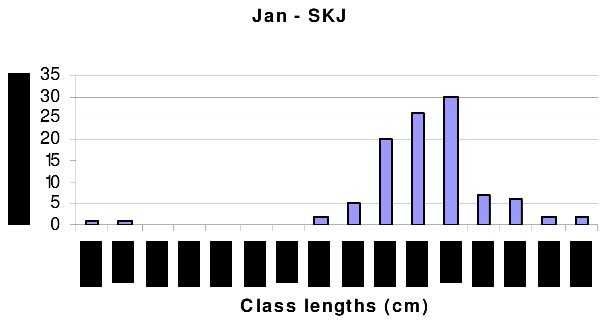


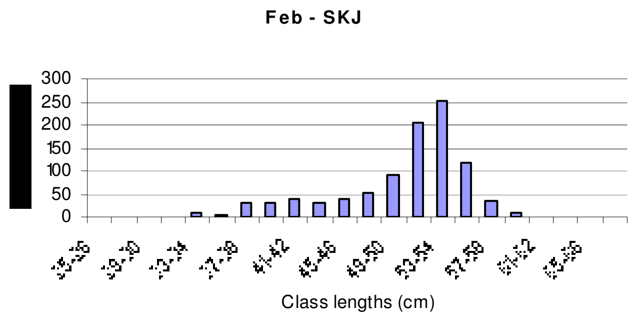
Aug - YFT

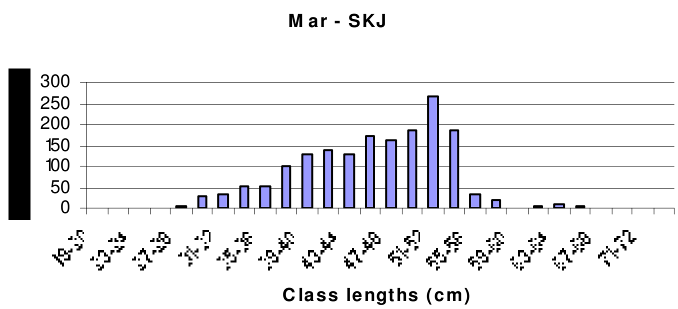


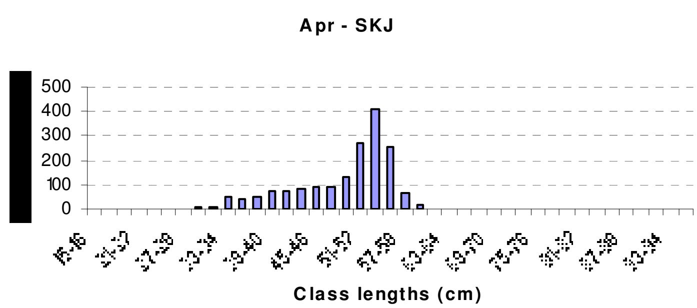
Sept - YFT

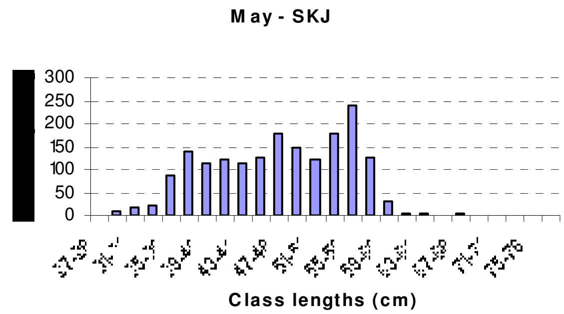


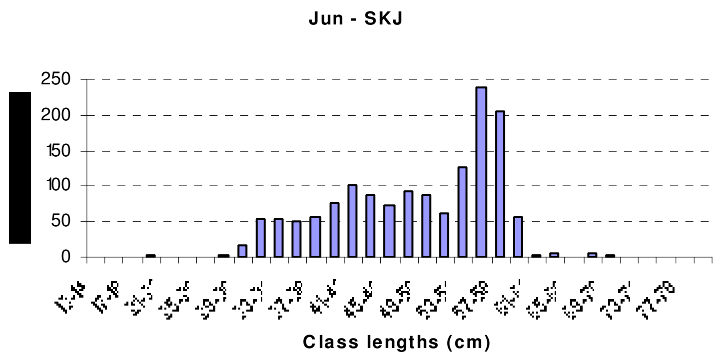

Jan - SKJ
35
30
25
20
15
10
5
0
Class lengths (cm)

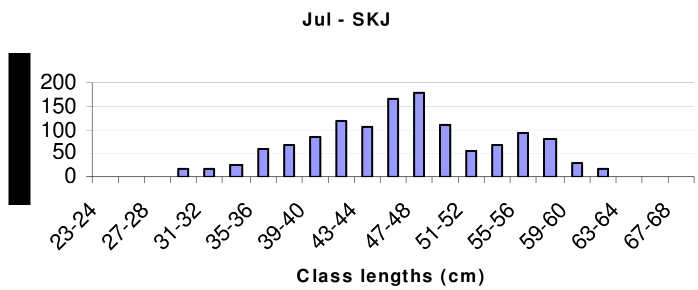

Feb - SKJ
300
250
200
150
100
50
0
Class lengths (cm)

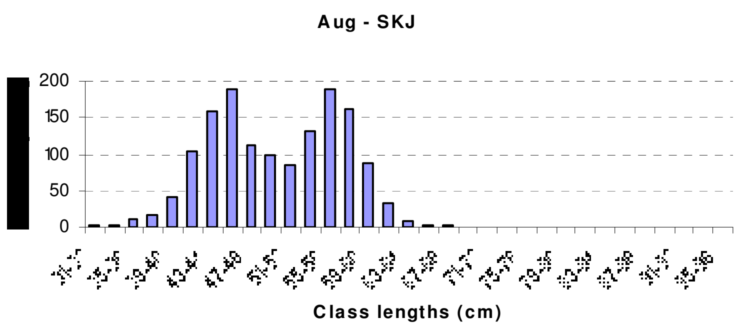

Mar - SKJ
300
250
200
150
100
50
0
Class lengths (cm)

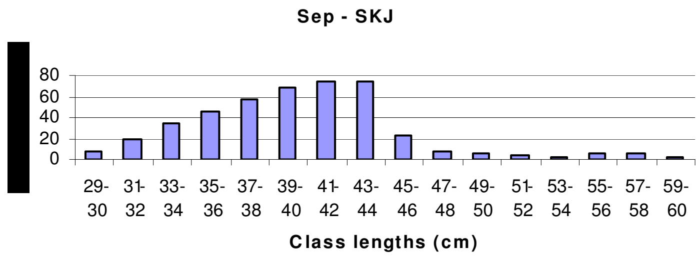

Apr - SKJ
500
400
300
200
100
0
Class lengths (cm)

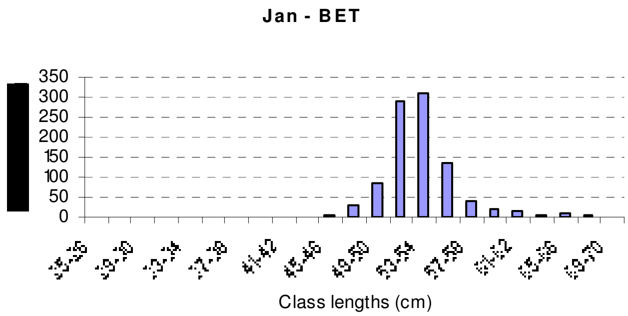

May - SKJ
300
250
200
150
100
50
0
Class lengths (cm)

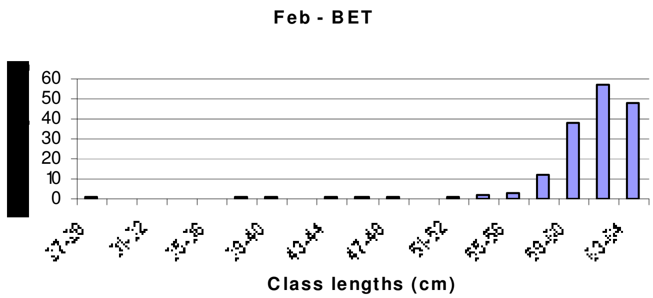

Jun - SKJ
250
200
150
100
50
0
Class lengths (cm)

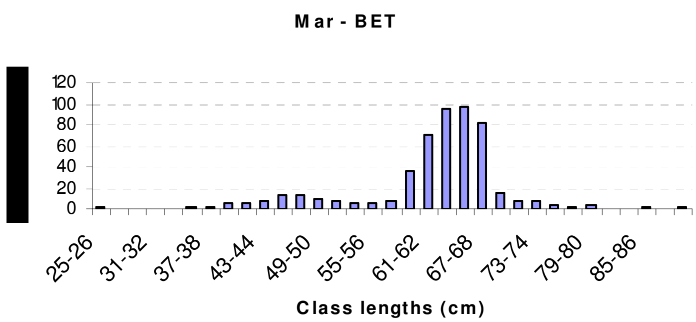

Jul - SKJ
200
150
100
50
0
23-24
27-28
31-32
35-36
39-40
43-44
47-48
51-52
55-56
59-60
63-64
67-68
Class lengths (cm)

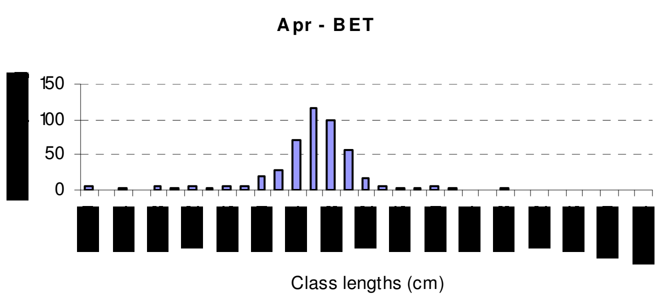

Aug - SKJ
200
150
100
50
0
Class lengths (cm)


Sep - SKJ
80
60
40
20
0
29-30
31-32
33-34
35-36
37-38
39-40
41-42
43-44
45-46
47-48
49-50
51-52
53-54
55-56
57-58
59-60
Class lengths (cm)


Jan - BET
350
300
250
200
150
100
50
0
Class lengths (cm)


Feb - BET
60
50
40
30
20
10
0
Class lengths (cm)


Mar - BET
120
100
80
60
40
20
0
25-26
31-32
37-38
43-44
49-50
55-56
61-62
67-68
73-74
79-80
85-86
Class lengths (cm)


Apr - BET
150
100
50
0
Class lengths (cm)

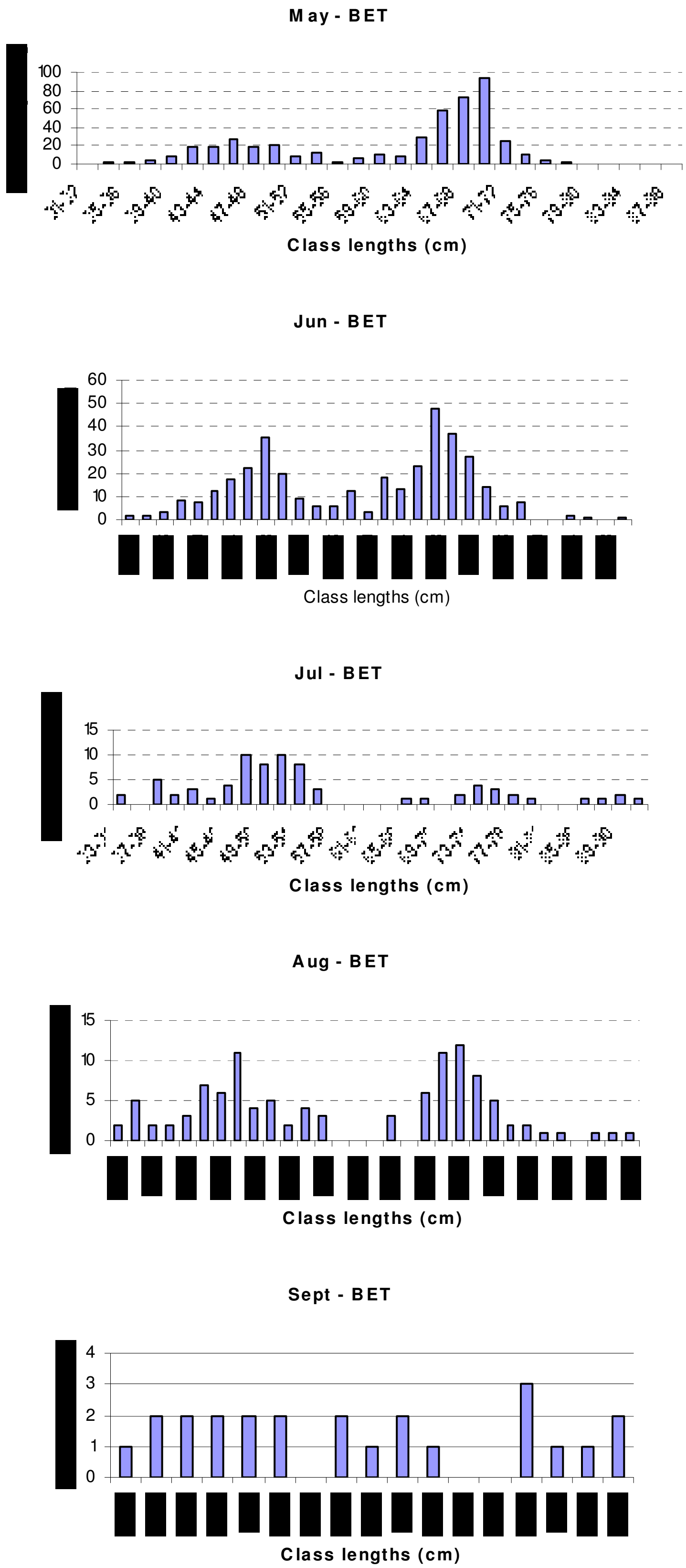


Figure 2. Monthly trend of tuna species sampled in 1999.

Mean length of tuna species compared between years

The means of each tuna species were calculated and tested to see if they were any significant difference between the average lengths of each species. Figure 3 shows the interannual difference by mean of each tuna species by the two years. Skipjack and yellowfin average lengths for the two years have been decreasing (12.2 % decrease in skipjack and 0.7% decrease in yellowfin) where as there is an increase for bigeye (5% increase).

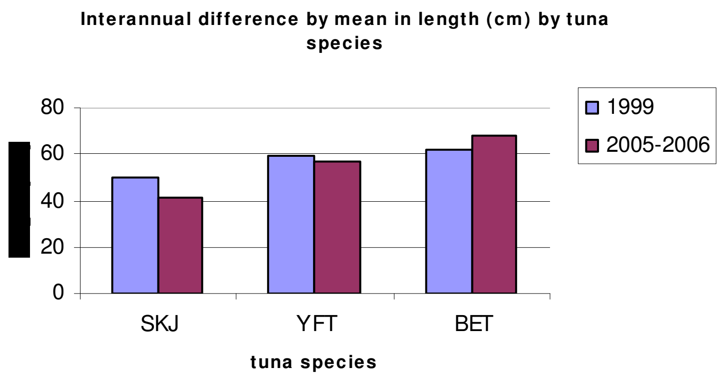


Figure 3. Inter annual differences in mean length (cm) for *skipjack*, *yellowfin* and *bigeye*.

There was no significant difference between mean lengths of skipjack, yellowfin and bigeye for the two years.

Discussion

Total tuna sampled by species and year

There were three tuna species sampled in both 1999 and 2005 (skipjack, yellowfin and bigeye). The percentage of each tuna species was calculated. Yellowfin and bigeye's percentage composition decreased where as skipjack's increased between 1999 and 2005. (Skipjack 46.1% in 1999 to 64% in 2005, Yellowfin 44.9% to 35% in 2005 and Bigeye 9% in 1999 and 1% in 2005).

Past studies have shown that catch composition from purse seiners have skipjack with the highest percentage followed by yellowfin and bigeye with the least percentage. In addition, the tuna purse seine fishery is known mainly to be a skipjack fishery although other tuna species are caught. These statements can only be seen in the catch composition results of 2005.

The decrease in composition of both yellowfin and bigeye could be due to the fact that sampling in 2005 were carried out in 3 months (November to January) compared to 1999 which had samples collected for 9 months (January to September) and therefore 2005 percentage composition of yellowfin and bigeye could have resulted differently if there was 9 months sampling in 2005. The decrease in catch composition of yellowfin and bigeye cannot be conclusive at this point in time for this report as it would be better to have more sampling done in this line of study to actually verify if this is true over the same period and the result would be far better and accurate. Percentage composition of skipjack on the other hand has increased and this could appear to be that skipjack catch quantities are increasing.

Doulman and Wright (1983) did state that *purse-seining* targeted species were skipjack and yellowfin and this appears to be shown in the results that there is more skipjack and yellowfin caught than bigeye. A total of 134, 115 skipjack (12 081 in 1999 and 122, 034 in 2005), 23, 486 yellowfin (11 7444 in 1999 and 65 535 in 2005) and 4, 411 bigeye (2, 332 in 1999 and 2, 079 in 2005).

Size distribution and monthly trends

The size distribution and monthly trends of tuna species sampled were distinct to each species. The fork lengths (FL) ranged from 23 cm – 108 cm for bigeye, 13 cm – 200 cm for yellow fin and 13 cm – 116 for skipjack. The sampling quantity showed that most the tuna caught for all three species were relatively small. The size distribution of the catch could appear to be dependent upon the set types. This can be conclusive if more work (collection of data) is done in the fishery noting the association with different sets.

In addition, skipjack's size distribution varied between years where else yellowfin and bigeyes were similar. It may be that skipjack's growth rate is dependent on other factors such as high fishing pressure especially on FADs, resulting in variation in distribution between years or it may be that there is a need for the same sampling timeframe to clearly show the size distribution and trends for skipjack. Hampton (1993) did mention that skipjack had some variability with distribution.

Other influencing factors that may have contributed to this outcome could be as described by the South Pacific Commission (1993) which is the influence of oceanographic conditions and that tuna distributions and habitats are determined by their physiological requirements, in turn dependent especially on levels of dissolved oxygen, water temperature, and salinity and forage organisms.

Past studies have shown that the size distribution of each tuna species is distinct to each species and that they can be highly variable. To have a clear picture of the trend of distribution of each species in PNG, an on going sampling program must be established and maintained so that collection of data is timely as well as on going which would result in a better basis to build on as well as get results from.

Progress made in research and data collection

Further work is needed to have current information as well as to address questions of stock structure, migration, spawning, sex ratios, growth parameters, recruitment and maximum yield in terms of gear and species in PNG. In addition, the comparison of observer data to port sampling data and independent data must be done to give better results show as well as indicate for any discrepancies with data collected. The results will form an important data base for stock assessment and management of tunas in PNG and to a certain extent the western and central Pacific Ocean.

Acknowledgements

I wish to thank Mr. Thomas Usu for cross-checking the 2005 entered sampling data and collating it before it could be used and also to my colleagues, Mr. A. Mobiha and Mr. L. Kumoru for useful comments on the earlier draft of the paper.

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