STOCK ASSESSMENT OF TUNA FISHES IN MAJOR TUNA FISHING GROUNDS OF ILOCOS SUR

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ABSTRACT

This study attempted to find out the seasonal and spatial distributions of two tuna species, Thunnus albacares (yellowfin) and Katsuwonus pelamis (skipjack or bluefin) in the Province of Ilocos Sur, focusing its investigation on three variables: a) number of fishes caught per fishing effort, b) total weight ot fishes caught per fishing effort and c) price per kilo. Three collecting stations were selected based on the reports of the fishing municipalities: Station 1 - Puro, Magsingal; Station 2 - Villamar, Caoayan and San Pedro, Vigan, and Station 3 - NaNvo, Santa Maria.

Results showed that there are no differences in the seasonal distribution of tuna fishes in Ilocos Sur. Tuna fishes abound throughout the province the whole year round. There are, however, significant differences in the spatial distribution of tuna fishes. More and heavier fishes are caught in Station 1 that Stations 2 and 3. Prices are also cheaper in Station 1 than Stations 2 and 3. Recommendations are given by the researcher for the proper management of the resource.

INTRODUCTION

Fisheries constitute an important segment of the general economy. Fish production contributes a little less than ten percent to the gross national product and provides livelihood for five percent of the total labor force (Pagdilao, 1990). Fish is a staple food in the Filipino diet, second only to rice in importance and it comprises about fifty-four percent (54%) of the total protein intake of the population. It is the cheapest and largest single source of animal protein (Aprieto, 1981).

The marine fishery resources comprise the biggest fishery sector and contribute nearly ninety percent (90%) of the total fish production. These consist of a tropical multispccics fauna with the tuna fishes accounting for more than forty percent (40%).

In the Province of Ilocos Sur, fishing is considered as one of the major sources of livelihood of the people. Of the thirty-four (34) municipalities in the province, eighteen (18) are located along the coast. Scvcnty-seven percent (77%) of the total population live in the coastal towns with sixty-five percent (65%) engaged in agriculture and fishery industries (NCO,1980).

Most of the fishermen in the Province of Ilocos Sur are engaged in tuna-fishing. Of the several species, two are commonly caught by them, Thunnus albacares (yellowfin) and Katsuonus pelamis (skipjack or bluefin). The fishermen, however, complain about the low prices of their catches. Although at certain trips, the fishermen are encouraged of their catches, it is more often that the yield is not sufficient to pay the cost of operations.

The fishermen's complaint about low prices, however, run contrary to the complaint of the fish consumers. Fish consumers complain against the high prices of the tuna fish in local markets. The average cost of per kilo tuna in the local markets is from sixty to Seventy pesos (P 60.00 to P 70.00).

Proper management of the fishery resource is therefore needed. A sound manage-

ment and development of our fishery requires proper resource information that could be borne out of the findings of the study. Planners, and decision-makers, both in the public and private sectors, would do better if proper resource infonnation is available. This would enable the BFAR to provide better guidance to the fishermen in order to improve the latter's fishing efforts, to help them gain for their catches, and eventually, to help them stabilize their income. In effect, a proper resource information would help stabilize the price of tuna fish that would be advantageous both to the fishermen and fish consumers.

It is deemed that the results of the study would serve as information guide to agencies like BFAR in the fonnulation of tuna fishing guidelines, including price standardization and postharvcst handling operations.

The study is considered the first investigation conducted on the tuna fishery resource in the Province of Ilocos Sur.

OBJECTIVES OF THE STUDY

The study attempted to find out the status of tuna fishery in major tuna fishing grounds of Ilocos Sur. It focused its investigations on:

I. The seasonal distribution of tuna fishes in the Province of Ilocos Sur in tenns of: (a) number of fishes caught per fishing effort; (b) total weight of fishes caught per fishing effort; and (c) price per kilo.

2. The spatial distribution of tuna fishes in Ilocos Sur in terms of: (a) number of fishes caught per fishing effort; (b) total weight of fishes caught per fishing effort; and (c) price per kilo.

3. The study also sought to determine differences in the seasonal and spatial distribution of tuna fishes in Ilocos Sur in terms of the aforementioned criteria.

SCOPE AND DELIMITATION

This study was conducted in three collecting stations of the province: Station I Puro, Magsingal, Ilocos Sur; Station II - San Pedro, Vigan and Villamar, Caoayan, Ilocos Sur; Station III - Nalvo, Sta. Maria, Ilocos Sur. Ten fishermen from each station were taken as respondents. Only the two most commonly caught tuna species were considered: Thunnus albacares (yellowfin) and Katsuwonus pelamis (skipjack or bluefin). This study was conducted for a period of one year, August, 1991 to July, 1992. No data, however, were collected in July, 1992 because of strong winds and typhoons.

REVIEW OF RELATED LITERATURE

Towards a sound management and development of our marine fishery resources, proper resource information is necessary. At present, there is an urgent need for a comprehensive fishery resource assessment (Aprieto, 1980).

The fish stocks are not visible in the usual sense of the word and their assessments are made by indirect means usually with mathematical models. Converting data into information involves a translation and interpretation step that requires human intervention. In this stage of management, stock assessment necessary to provide an understanding of what has been happening in the fishery in the past, information on its present status, and predictions on what is likely to happen in the future under different situations (Aprieto, 1981).

In the Philippines, The Tuna Fishery Development Project of the Southeast Asia Fishery Development center (SEAFDEC) reported in 1982 that researches on stock assessment of fishery resource had been undertaken solely by the private sector. This was the result of the Marine Regionalization Project in the Southeast Asian Seas Areas. Data for the Philippines had been taken from the re-

gional centers. In Region I, data was collected from Lingayen gulf, and it showed that 2,352 metric tons (MT) of tuna was produced in 1978 and 4042 MT in 1980.

About 800,000 fishermen, 5 percent (5%) of the total employment work in the fishing industry. The industry also provides jobs for those engaged in fish trading and processing, operating fish ports and markets, ice plants and cold storage facilities and for those in support industries, such as rope-and-net-making, gear manufacture, and boat building and repair (Pagdilao, 1990).

In recent years, the weight of the aggregate catch of tuna has increased significantly. They become the most valuable fish export in terms of volume, as well as an important fish food in tenns of local consumption. In 1980, the Fisheries Statistics of the Philippines published that 41,462 MT of yellowfin and bluefin were exported at value nearly P 429 million US $58.5 million) or 50% of the total value of fishery exports. These data made were based from commercial catch data since there are no records of provincial and municipal productions.

Municipal tuna fishing operations exist in 6000 fishing villages of the country, mostly situated along the coastal areas of some 1,400 municipalities. These fishing activities are generally confined within the foreshore waters of the municipalities. Statistics on the municipal fishery are limited. The Bureau of Fisheries and Aquatic Resources (BFAR) has assembled data on the number of fishennen and bancas per region involved in catching tunas. In Region I, the source of data was only in Lingayen gulf and not representative of the whole region.

Aprieto (1980) described the distinctive feature of the Philippine Marine Fisheries Management as there is very little of it. Management concentrates on the enforcement of fishery laws, rules and regulations (mainly prohibitions against fishing with explosives and electricity, the closing of fishing areas, and the banning of certain gears), without appropriate and biological research and without providing alternative sources of income in the affected communities.

Available statistics of the tuna fish production are inadequate. Information of the biology and population structure of Philippine tunas is scanty. However, it is emphasized that an accurate assessment of the tuna fishery situation is important for the development and management of the fisheries (White, 1982).

All these readings support the importance of a fishery stock assessment activity.

HYPOTHESIS

The researcher hypothesized at .05 level of significance that:

I. There are no differences in the seasonal distribution of tuna in Ilocos Sur based on the following criteria: (a) number of fishes caught **per** fishing effort; (b) total weight of fishes caught per fishing effort; (c) price per kilo.

2. There are no differences in the spatial distribution of tuna in llocos Sur based on the following criteria: (a) number of fishes caught per fishing effort; (b) total weight of fishes caught per fishing effort; (c) price **per** kilo.

METHODOLOGY

Research Design. This study made use of the descriptive method of research, particularly the survey method. Actual interview, counting and weighing of samples were done by the data collectors.

Study Areas. Three collecting stations were selected from the fishing municipalities of the province. To have a data representative of the whole province, the northern, central, and southern municipalities were considered. The collecting stations chosen were: Puro, Magsingal - representing the northern municipalities: Villamar, Caoayan and San Pedro, Vigan - representing the central municipalities: and Nalvo, Santa Maria - representying the southern municipalities (Appendix A). In selecting the representative barangays, the number one fishing barangay of the municipality was considered based on the record of the municipalities.

Techniques/Tools of Investigation Used. Two data collectors were assigned each in Station I (Magsingal) and Station III (Santa Maria) while three were assigned in Station II (Vigan-Caoayan). Ten fishermen from each collecting station served as respondents, the selection of which was based on their regularity in fishing (Appendix B). The data collectors collected the needed data three times a week (Mondays, Wednesdays, Saturdays) for a period of one year (August 1991 to July 1992).

Statistical Treatment of Data. To determine the average catch per fishing effort, average weight, and average price per kilo of tuna fishes, simple mean was used. To find out if significant differences occurred on the seasonal and spatial distribution of tuna fishes, two-way analysis of variance (2-Way ANOVA) and Duncan's Multiple Range Test (DMRT) were used.

RESULTS

This section deals with the presentation, analysis and interpretation of the data gathered in this study. The data are presented in tabular and textual form.

Problem 1. What is the seasonal distribution of tuna fishes in Ilocos Sur in terms of: (a) number of fishes caught per fishing effort; (b) total weight of fishes caught per fishing effort; (c) price per kilo

The following table shows the average number of fishes caught per fishing effort, total weight of fishes caught per fishing effort, and price per kilo of tuna fishes from August 1991 to July 1992.

***Table** 1. **Seasonal** Distribution **of** Tuna Flhes In **Ilocos** Sur (August 1991-July 1992)*

		Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
NUMBER	I	12	20	24	39	33	29	23	20	16	13	12
	II	10	12	10	7	5	6	8	10	8	6	8
	III	10	10	8	9	6	4	7	12	12	10	**8**
	Mean	10.67	14.00	14.00	18.33	14.67	13.00	12.67	14.00	12.00	9.67	9.33
WEIGHT (kilos)	I	14.50	14.06	16.80	26.95	22.75	20.00	22.30	23.00	21.00	15.2	13.3
	II	5.4	7	5.25	4.2	4.1	4.5	8.2	9.2	10.5	7.2	9.2
	III	5.6	6.3	5.35	5.8	5.5	3.95	7.2	6	17	12.5	12
	Mean	**8.5**	9.12	9.13	12.3	10.78	9.48	12.56	12.73	16.16	11.6	11.5
PRICE (Pesos)	I	32	**28.5**	*27.5*	31.0	25.00	20	25	27	30	32	32
	II	34.5	25.5	33.5	34.5	36.5	34	37	37	33	36	38
	III	33	37.5	37.5	33.5	42.5	36.5	40	35	35	35	35
	Mean	33,16	**33.8**	32.8	33	34.6	30.16	34	33	32.6	34.3	35

Table 1 is shown graphically in the following figures:

FIGURE 1a

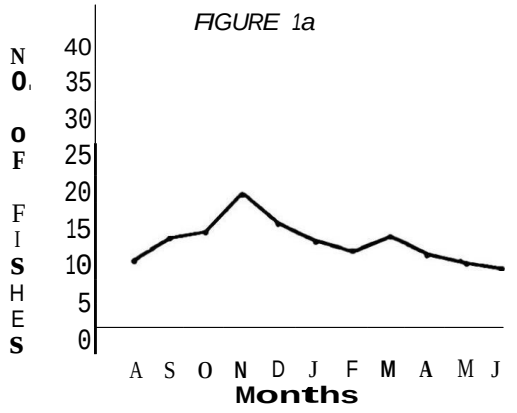


FIGURE 1b

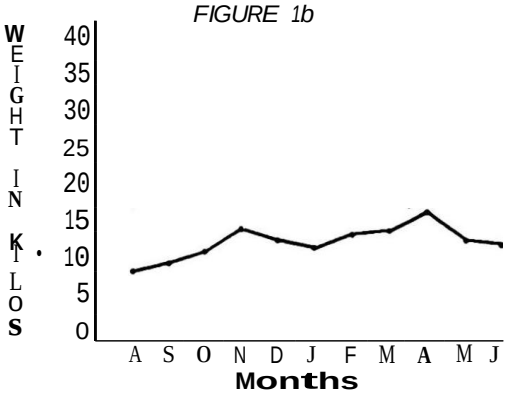
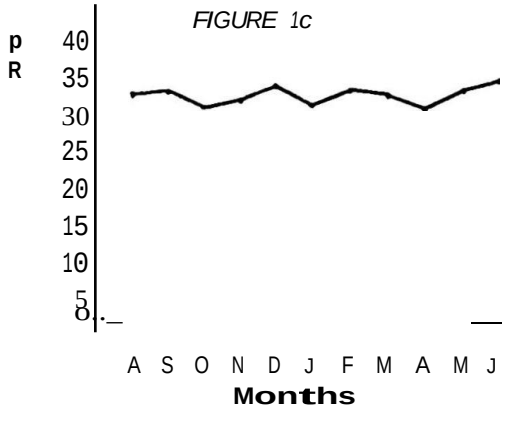


FIGURE 1c



Based on Table 1 and Figure 1a, the month of November yielded the highest average number of catch with a mean of 18.33. This was followed by the month of December with a mean of 14. The month of June yielded the least nwnber of catch while the month of July yielded no catch. Months which reported high catches were characterized by fine weather while months which reported poor catch or no fishing efforts were characterized by strong water movement triggered by strong winds and typhoons.

On the total weight of fish catch, Table 1 and Figure 1b shows that the fishermen had the best catch in April with a mean weight of 16.16 kilos followed by the month of March with a mean weight of 12.73 kilos. It was during the month of August when the fishermen had the lowest average weight of catch with a mean of 8.5 kilos. This was followed by the months of September and October with means of 9.12 and 9.13 kilos respectively. These data support the fact that juvenile fishes are, caught from August to November (hence, lower in weight), while larger fishes are caught from December to June (hence, heavier).

On the average price per kilo, Table 1 and Figure 1e shows that tuna fish was most expensive during the month. of June with a mean price of P 35.00 per kilo. The reseacher observed that this was the month when the fishermen obtained the least number of catch. Hence, the "Law of Supply and Demand" prevailed. The table and figure also show that tuna fish was cheapest in January (with a mean price of P 30.16 per kilo), the month when the researcher observed many by-catches.

Problem 2. What is the spatial distribution of tuna fishes in Ilocos Sur in terms of: (a) number of fishes caught per fishing effort? (b) total weight of fishes caught per fishing effort? (c) price per kilo?

The following table shows the average number, average weight, and average price per kilo of the tuna fishes caught in the differen. collecting stations of the province.

Table 2. Spatlal Distributlon ot Tuna Fishes** In **Ilocos Sur** From **August 1991 to July 1992

Station / Month	NUMBER I	II	III	WEIGHT (IN KILOS) I	II	Ill	PRICE (IN PESOS) I	II	Ill
August	12	10	10	14.5	5.4	5.6	32	34.5	33
September •	20	12	10	14.06	7	6.3	28.5	35.5	37.5
October	24	10	**8**	16.8	5.25	5.35	27.5	33.5	37.5
November	39	7	9	26.95	4.2	5.8	31	34.5	33.5
December	33	5	6	22.75	4.1	5.5	25	36.5	42.5
January	29	6	**4**	20	**4.5**	3.95	20	34	36.5
February	23	**8**	7	22.3	8.2	7.2	25	37	40
March	20	10	12	23	9.2	6	27	37	35
April	16	**8**	12	21	10.5	17	30	33	35
May	13	6	10	15.2	7.2	12.5	32	36	35
June	12	8	**8**	13.3	9.2	12	32	38	35
Mean	21.9	**8.18**	8.72	19.0	6.79	7.9	28.18	35.4	36.4

Table 2 is also shown in the following figures:

FIGURE 2a

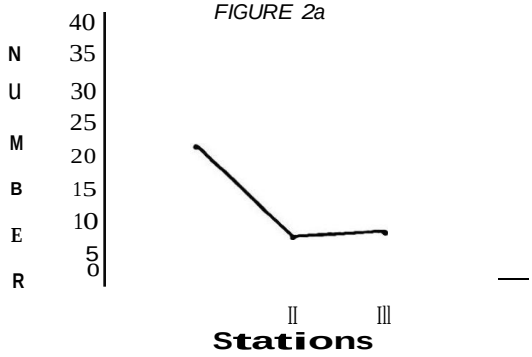


FIGURE 2b

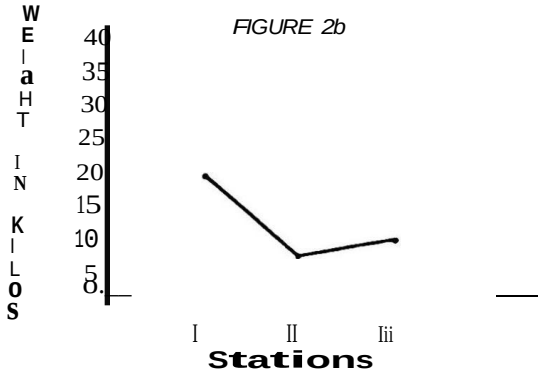
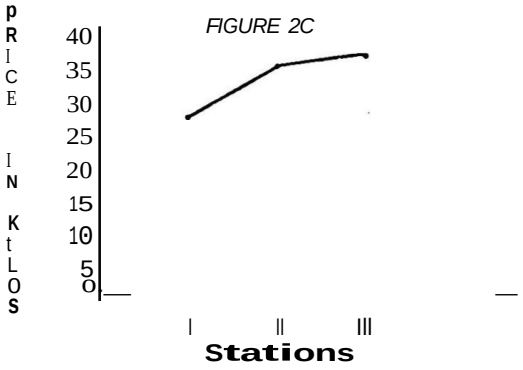


FIGURE 2C



Based on Table II and Figures 2a,2t and 2c, the number, weight and price per of tuna fishes caught by the fishermen in threecollecting stations varied. As to number of fish catch, station 1 shows the higt est with a mean of 21.9, followed by statio 3 with a mean of 8.72, and station 2 with mean of 8.18 (Fig. 2a). As to the weight fish catch, station I shows the heaviest with mean of 7.9 kilos, and station 2 with a mea; of *6.79* kilos (Fgure 2b). These records sho. that more fishes are caught in station I this could be due to more spawning and feeding area found in the offshores of station than stations 2 and 3.

As to the price per kilo, Station 1 showed the cheapest average price of P 28.18 per kilo, followed by Station 2 with a mean price of P 35.40 per kilo. Prices were highest in Station 3 with a mean of P 36.40 per kilo Figure 2c). The differences in prices between Station 1 and Station 2 and 3 is attributed to the economic law of supply. Another factor is the geographical location of the collecting stations. Station 1 is geographically more distant to the market place than stations 2 and 3. Station 3 seems to be the most accessible among the three stations, hence, offering the highest price.

Problem 3a. Are there differences in the seasonal and spatial distribution of tuna fishes in Ilocos Sur in terms of the number of fishes caught per fishing effort?

To answer problem 3a, the data was subjected to two-way analysis of variance, results of which are shown in table 3.

Table 3. Two-Way Anova Table for Average Number of Fishes Caught Per Fishing Ettort (Seasonal and Spatial)

Source of Variation	Sum of Squares	DI	Mean Squares	Computed f	Tabular f
Row means	195.88	10	19.588	0.56	2.35
Column means	1329.15	2	664.575	19.05*	3.49
Error	698.85	20	34.9429		
Total	2223.88	32			

• Significant

Table 3 shows that there are no differences in the seasonal distribution of tuna fishes in llocos Sur as shown by the computed f-value of 0.56 which is lower than the tabular f-value of 2.35. Hence, hypothesis la is accepted. Therefore, the researcher concludes that there are no significant differences in the seasonal distribution of tuna fishes in Ilocos Sur based on the number of fishes caught per fishing effort.

However, the above table shows a significant difference in the spatial distribution of tuna fishes in Ilocos Sur as shown by the computed f-value of *19.05* which is much higher than the tabula value of 3.49. Hence, hypothesis 2a is rejected. Therefore, the researcher concludes that there are significant differences in the spatial distribution of tuna fishes in Ilocos Sur in terms of the number of fishes caught per fishing effort.

To find out which of the stations are significantly different in terms of number of fishes caught per fishing effort, the data was further subjected to Duncan's Multiple Range Test (DMRT). The results are shown below.

Table 3a. DMRT Analysis tor'Average Number of Fishes (Spatal)

Comparisons	Mean Difference	Critical Value	Decision
1 vs 2	13.73	10.56	significant
1 vs 3	13.18	10.56	significant
2 vs 3	.55	10.06	not significant

Table 3a shows that station 1 and station 2 are significantly different as shown by their mean difference of '13.73 which is higher than the critical value of 10.56. Likewise, station 1 and 3 are also significantly different as shown by their mean difference of 13.18 which is also higher than the critical value of 10.56. On the other hand, station 2 and station 3 are not significantly different as shown by their mean difference of 0.55 which is very much lower than the critical value of 10.06. The researcher concludes therefore, that more fishes are caught in station 1 than stations 2 and 3. Further, there are no differences in the number of catches between station 2 and station 3.

Problem 3b. Are there no differences in the seasonal and spatial distribution of tuna fishes in Ilocos Sur in terms of total weight of fishes caught per fishing effort?

To answer Problem 3b, two-way ANOVA was employed as shown by the following table:

Table 4. Two-way Anova for Total Weight of Fishes Caught Per Fishing Effort (Seasonal and Spatial)

Source of Variation	Sum of Squares	DI	Mean Squares	Computed f	Tabular f
Row Means	148.11	10	14.811	1.08	2.35
Column Means	1013.80	2	506.90	37.07*	3.49
Error	273,45	20	13.6725		
Total	1435.36	32			

• Significant

The above table shows that there are no significant differences in the seasonal distribution of tuna fishes in Ilocos Sur based on the total weight of fishes caught per fishing effort as supported by the computed f-value of 1.08 which is less than the tabular value of 2.35. Therefore, hypothesis 1b is accepted. The researcher concludes that no significant seasonal variations occured on the total weight of fishes caught per fishing effort from August, 1991 to July, 1992.

Table 4 also shows that there are no significant differences in the spatial distribution of tuna fishes in Ilocos Sur based on the total weight of fishes caught per fishing effort. This is supported by the computed f-value of 37.07 which is very much higher than the tabular f-value of 3.49. Hypothesis 2b is therefore rejected and the researcher concludes that there are significant spatial variations on the total weight of fishes caught per fishing effort in Ilocos Sur from August, 1991 to July, 1992.

To find out which of the stations are significantly different in terms of total weight of fishes caught, DMRT was used as shown in table 4a.

Table 4a. DMRT Analysle for Total Welght ot Fishes (Spatial)

Comparisons	Mean Diff.	Critical Value	Decision
1vs2	12.28	6.60	significant
1vs 3	11.15	6.60	significant
2vs 3	1.13	6.28	not significant

Based on Table 4a, station I and station 2 are significantly different in terms of total weight of tuna catches as shown by their mean difference of 12.28 which is higher than critical value of 6.60. Likewise station l, Station III are also significantly different shown by their mean difference of 11.15 which is higher than the critical value of 6.60. the other hand, Stations 11 and Ill do differ significantly as shown by their mean difference of 1.13 which is lower than critical value of 6.28. The researcher concludes therefore that catches are heavier in Station than Stations 11 and Ill.

Problem 3c. Are there differences the seasonal and spatial distribution of tuna fishes in Ilocos Sur in terms of the average price per kilo?

To answer Problem 3c, 2-Way ANOV was again employed. . Results are shown the table below.

Table 5. Two-Way ANOVA for Average Price Per Kllo (Seasonal and Spatial)

Source of Variation	Sum of Squares	DI	Mean Squares	Computed f	Tabular
Row Means	54.50	10	5.45	.55	2.35
Column Means	443.38	**2**	221.69	22.57	**3.49**
Error	196.45	20	9.8225		
Total	694.33				

• Significant

The above table shows that there are significant differences in the seasonal distribu.

tion of tuna fishes in Ilocos Sur based on the average price per kilo as supported by the computed f-value of 0.55 which is less than the tabular value of 2.35. Therefore, hypothesis Ie is accepted. The researcher concludes that no significant price variations occurred from August, 1991 to July, 1992.

The same table shows a significant difference in the spatial distribution of tuna fishes based on the average price per kilo. This is supported by the computed f-value of 22.59 which is very much higher than the tabular f-value of 3.49. Hypothesis 2c is therefore rejected and it is concluded that there are significant spatial variations on the prices of tuna fishes in the different stations of the province.

To find out which of the stations are significantly different in terms of prices of tuna, DMRT was also employed. The results are shown in the following table.

Table 5a. DMRT Analysis tor Price Per Kilo (Spatial)

Comparisons	Mean Diff.	Critical Value	Decision
1 vs 2	7.23	5.61	significant
2vs 3	8.23	5.61	significant
2 vs 3	1.00	5.34	not significant

The above table shows that Stations I and II are significantly different in terms of price per kilo of tuna as shown by their mean difference of 7.23 which is higher than the critical value of 5.61. Stations I and III are also significantly different as shown by their mean difference of 8.23 which is also higher than the critical value of 5.61. Stations II and Ill do not show any significant difference as shown by their mean difference of 1.0 which is much lower than the critical value of 5.34. The researcher concludes therefore that prices of tuna in Station I vary significantly with prices in Stations ll and III. Prices are lower in Station 1.

Station I, therefore, stands out of the other two Stations in terms of more & bigger catches and lower prices. The researcher concludes that prices are lower because the supply is greater. Another factor attributable to this is the inaccessibility of Station I to the local markets. There is no market for fishes in Station I. The researcher also concludes that there are more and bigger catches in Station I probably because more sparing and rearing areas are found in the offshores of Station I. Although tuna fishes are migratory in nature, they settle most in areas with spawning and rearing areas.

Figure 3 shows a five-year projection of the weight of tuna caught per fishing effort and the price per kilo of the resource, considering the same environmental conditions. As observed from the figure, an arithmetical increase in the catches of the fishermen will likely to occur. No decrease in catch is expected in as much as no overfishing will take place in the area. Based on a report made by the Philippine Council for Aquatic & Marine Research and Development (PCAMRD) of the Department of Science and Technology (DOST) the Philippines sits within the Food & Agriculture Organization ,(FAO) Statistical Area 2l, where half of the world's skipjack and one-third of yellowfin catches are taken. Tuna stocks in this area are still underfished PCAMRD, 1990).

There will be an exponential increase in the prices of tuna in the next five years. This will be brought about by the increase in the cost of operations. There will be a big gap between the in-shore price and the local market price, This will be due to the presence of middlemen and poor postharvest handling operations.

The **Future** ***of*** *the* ***Fleh Resources***

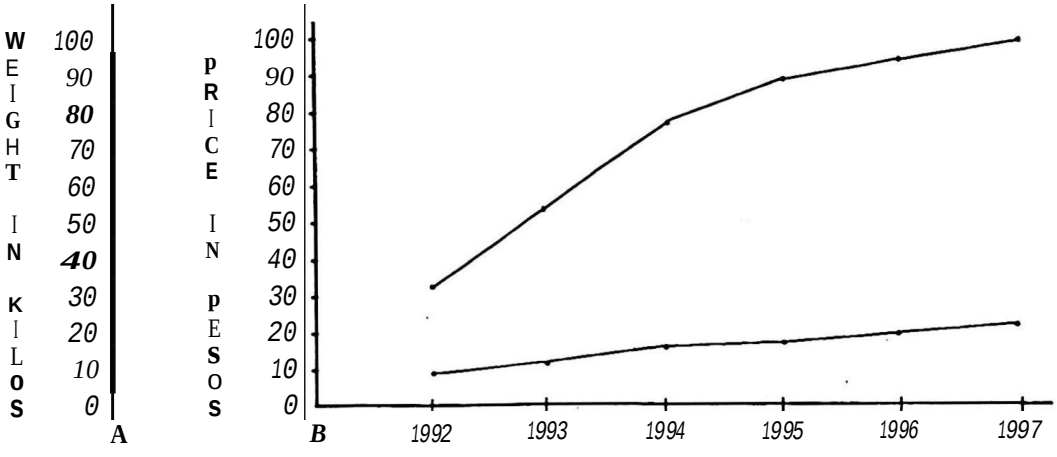


FIGURE 3
Five-Year Production of Weight-Price Relationship of Tuna Caught Per Fishing Effort in the Province of Ilocos Sur.

FINDINGS

1. Data on seasonal distribution revealed that:

a) There existed a monthly variation in the average number of fishes caught per fishing effort from August 1991 to July 1992. Arithmetic differences showed that the month of November yielded the highest average number of fish catch with a mean of 18.33 while the month of June yielded the least with a mean of 9.33. Analysis of variance (ANOVA), however, showed that there arc no significant differences in average monthly catches as shown by the computed f-value of 0.56 which is lower than the tabular f-value of *2.35.*

b) There also existed a monthly variation in the average weight of tuna fishes caught per .fishing effort from August 1991 to July 1992. Ari▾unetic differences showed that he month of yil yielded the heaviest catch with a mean of 16.16 kilos, while the month of August yielded the lowest catch with a mean of 8.5 kilos. Analysis of variance (ANOVA), showed that there are no significant differences in the average monthly weights of catches as shown by the computed f-value of 1.08 which is lower than the tabular f-value of 2.35.

c) The monthly average price per kilo of tuna fishes caught from August 1991 to July 1992 varied arithmetically. Prices were highest during the month of June with a mean of **F** 35.00 and lowest in January with a mean of **P** 30.16 per kilo. Prices were highest when catches were lowest and prices were lowest when plenty of tuna by-catches were observed. Analysis of variance (ANOVA), however, showed that there are no significant differences in the average monthly price per kilo of tuna fishes as shown by the computed f-value of 0.55 which is lower than the tabular f-value of 2.35.

2. Data on spatial distribution of tuna fishes in Ilocos Sur revealed that:

a) Station I (Puro, Magsingal) recorded the highest average number of catch with a mean of 21.9, followed by station III (Nalvo, Santa Maria) with a mean of 8.72 and Station II (San Pedro, Vigan and Villamar, Caoayan) with a mean of 8.18. Significant differences occurred among the three collecting stations as revealed by the computed f-value of 19.02 which is higher than the tabular f-value of 3.49. DMRT results showed that tStation I and Station III are also significantly different; Station I and Station III are significantly different; while Stations II and III are not significantly different. More catches were recorded in Puro, Magsingal than in San Pedro, Vigan and Villamar, Caoayan and Nalvo, Santa Maria.

b. Station I (Puro, Magsingal) recorded the highest average weight of catch with a mean of 19 kilos, followed by Station III (Nalvo, Santa Maria) with a mean of 7.9 kilos and Station II (San Pedro, Vigan and Villamar, Caoayan) with a mean of 6.79 kilos. Significant differences occured among the three stations as evidenced by the ANOVA computed f-value of 37.07 which is higher than the tabular f-value of 3.49. DMRT results showed that Stations I and II are significantly different; while Stations II and III are not significantly different. Heavier catches were recorded in Station I than Stations II and III.

c. The average price per kilo of tuna was lowest in Station I (Puro, Magsingal) with a mean of P 28.18 per kilo, followed by Station II (San Pedro, Vigan and Villamar, Caoayan) with a mean of P 35.40 per kilo. Prices were highest in Station III (Nalvo, Santa Maria) with a mean of P 36.40 per kilo. Significant differences occurred in the prices of tuna among the three stations based on the computed f-value of P 22.59 which is higher than the tabular f-value of 3.49. DMRT results showed significant differences between Station I and II and between Station II and III. No significant difference occurred between Station II and III. Prices were lower in Puro, Magsingal than in San Pedro, Vigan and Villamar, Caoayan and Nalvo, Santa Maria.

CONCLUSIONS

Based on the above findings, the following conclusions are drawn:

1. There are no seasonal differences in the distribution of tuna fishes in Ilocos Sur in terms of: (a) number of catches per fishing effort; (b) total weight of catches per fishing effort (c) price per kilo of catches per fishing effort

2. There are spatial differences in the distribution of tuna fishes in Ilocos Sug: (a) More fishes are caught in Puro, Magsingal than San Pedro, Vigan; Villamar, Caoayan and Nalvo, Santa Maria. (b) Heavier catches are made in Puro, Magsingal than San Pedro, Vigan; Villamar, Caoayan and Nalvo, Santa Maria. (c) Tuna fishes are cheaper in Magsingal, Ilocos Sur than in Vigan, Caoayan and Santa Maria, Ilcos Sur.

RECOMMENDATIONS

Based on the conclusions, the researcher presents the following recommendations:

1. Results of this study show that tuna fishes abound throughout the province the whole year round. This result is supported by the report of the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) of tbe DOST that tuna stocks are still nderfished. Fishermen are therefore, encouraged to get involved in tuna fishing, furthermore; to use the different tuna fishing gears like hook and line, purse seine, and the local fish aggregating device commonly known as "payao."

2. To alleviate the income of the tuna fishermen at the same time considering the welfare of the fish consumers, the government should do its role in the proper management of the resource. (a) It should impose price standardization programs. (b) Postharvest handling and transporting operations should be improved by the establishment of cold storage centers and fish ports. These cold storage centers and fish ports should be established in the stations most accessible to the local markets. Fish processing zones should likewise be established where tuna fishes could be canned or smoked for local use or for exports. (c) Cooperative marketing should be initiated to prevent existence of middlemen responsible for high prices of tuna in the local markets. (d) Tuna fishing municipalities should come up with the development of the fish aggregating device "payao" to ensure maximum yield. (e) The government should establish linkages with non-government organizations and other agencies for the proper management of the resource.

3. Other studies on tuna should be conducted like number of fishermen and bancas in the province, type of fishing gears used and tuna by catches.

4. Other fishing resources of the province should also be assessed.

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APPENDIX B

LIST OF FISHERMEN WHO SERVED AS RESPONDENTS

Station I (Puro, Magsingal)	**Station II** (San Pedro, Vigan and Villamar, Caoayan)
1. ANGELITO PAGAY	1. CANOTO ABINOJA
2. ERNESTO PAGAY	2. EULOGIO AMANONCE
3. ORLANDO PAGAY	3. CARLITO DE LA CRUZ
4. NESTOR PAGUD	4. CESAR PINTO
5. VIRGILIO PAZ	5. VALENTIN ROSARIO
6. FERNANDO SUSA	6. PROCESO BARRIENTOS
7. FRANCISCO TABISULA	7. ERWIN LLANES
8. HYME TAGAY	8. FERNANDO LLANES
9. ERNESTO TINDOC	9. RAYMUNDO LLANES
10. DOMINADOR TORRICER	10. DOMINGO QUITON

Station m
(Nalvo, Santa Maria, Il&cos Sur)

1. VENERANDO ANTOLIN	6. CESAR REYES
2. ROMEO AYSON	7. LORENZO RIVAD
3. FERNANDO DURO	8. ROBERT RIVERO
4. GASPAR DURO	9. WILFREDO RIVERO
5. OLEGARIO DURO	10. ALEJANDRO TUGADE

APPENDIX *C*

LIST OF DATA COLLECTORS

Station I

1. Robclyn Tindoc
2. Melinda Corpuz

Station: II

1. Wilfredo Corpuz
2. Clemente Rabena
3. Martin Ruizan, Jr.

Station II

1. Nora Beltran
2. Catherine Calibuso