

**CATCH, EFFORT AND POPULATION PARAMETERS OF *CORYPHAENA HIPPURUS*  
(Common Dolphinfish) AND *GAZZA MINUTA* (Toothpony) AT BABUYAN  
CHANNEL\***

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**ABSTRACT**

Fish Stock Assessment was conducted in twelve (12) landing centers, from April 1999 – March 2001 to evaluate the present status and future potential values of the Babuyan Channel as basis for the proper management, conservation and sustainability of its fishery resources.

National Stock Assessment Program (NSAP) standard materials and methods in data collection were utilized.

A total of 1755 fishing boats were inventoried, from this number 1607 are municipal and 148 are commercial including 15 bamboo rafts. Twenty-four kinds of fishing gears were operational in the province.

The trend of annual fish production is increasing with an aggregate volume of 1,159.6 MT. Fish production on the first year has a total of 500.6 MT and 658.95 MT on the second year.

Drift Filter Net provided the most abundant catch with 373 MT followed by Danish Seine - 290 MT, Trawl - 123 MT, Round Haul Seine – 105 MT, and Troll Line – 77 MT.

There were 83 vertebrate families identified, belonging to 187 genera and 459 species and 10 invertebrate families consisting of 19 genera and 34 species. Top producer of the vertebrates is the Carangidae family (jacks and pompanos) and Palaemonidae (spider prawns) for the invertebrates.

*Coryphaena hippurus* (dolphinfish) and *Gazza minuta* (slipmouth) were given focus. Results of the FISAT routines applied showed that these species are still below the critical range of exploitation.

Some recommendations for the management, conservation and preservation of our marine fisheries resources in the province were formulated based on the above information.

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## INTRODUCTION

Babuyan Channel is the most important fishing ground in the Cagayan Valley Region. It lies approximately between latitude  $18^{\circ} 16' 00''$  and  $11^{\circ} 35' 00''$  North and longitude  $121^{\circ} 02' 00''$  and  $121^{\circ} 14' 30''$  East. It has a coastline length of around 154 km connecting ten (10) coastal municipalities of Cagayan from Sta. Praxedes on the west to Sta. Ana on the east. It has a total area of approximately 477,550 hectares.

The Northern part of the channel extends to the islands of Fuga, Camiguin, Dalupiri, Calayan and Babuyan Group of Islands converging with the Pacific Ocean on the East and South China Sea on the West. The center of the channel, within the territorial waters of the Municipality of Aparri, is estuarine in nature where the largest and longest river in the entire archipelago, the Cagayan River, drains to this fishing ground (Figure 1).

The depth of the channel ranges from 5 fathoms to 564 fathoms deep (NAMRIA, 1966). It is shallow off the eastern coast but recedes steeply going north. Strong Pacific water currents flow westward and northward as it reaches the rim of Palau Island in Sta. Ana, Cagayan.

A total of 16,526 registered fishermen from 108 coastal barangays of the ten coastal municipalities are exploiting the fishing ground employing various types of commercial and/or municipal fishing gears. The BAS estimated an annual production of 19,166 MT in 1998 and 27,821 MT in 1999.

To date, unavailability of extensive information on the actual state of exploitation over the different fisheries resources in the channel has long been ignored.

The expansion of the National Stock Assessment Program (NSAP) in the area on March 1999 paved the way for the assessment on the present status of the fishery

resources, which include major species, exploitation level and some population parameters of major species.

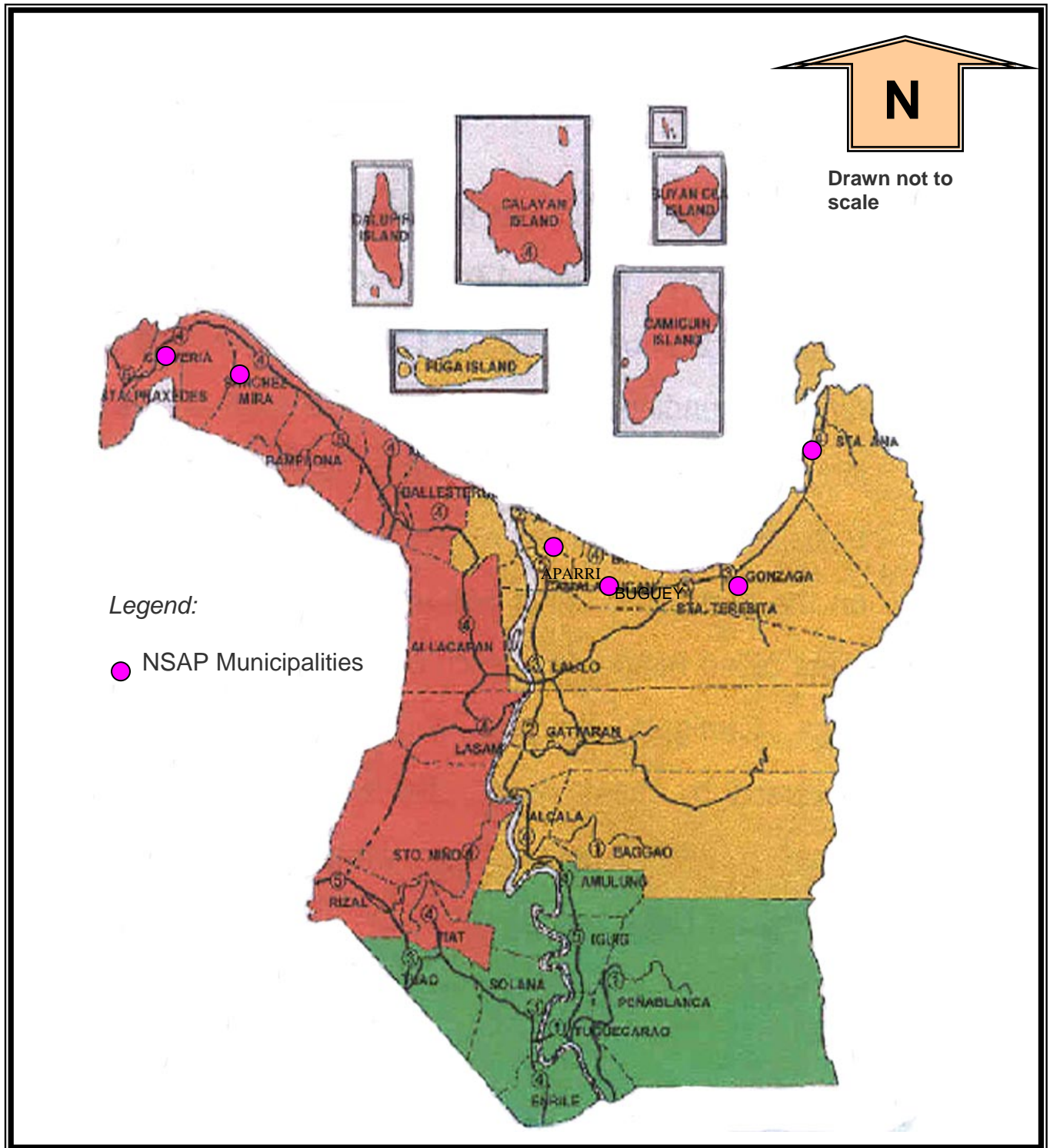


Figure 1. Map of Cagayan indicating the six coastal towns covered by the study

This paper strives to present the initial two-year results of data from April 1999 – March 2001. It primarily focused on the establishment of baseline information to provide direction for the formulation of policies and decision-making processes towards sound management and utilization of the fishing ground's resources.

The study's specific objectives are: a) update boat and gear inventory in the study area; b) determine the trend of annual fish production at Babuyan Channel during the study period; c) determine the seasonality of Catch Per Unit Effort (CPUE); d) determine the production share and seasonality of major fishing gears operating at Babuyan Channel; e) determine the most abundant families and species composition of the recorded landings; f) determine the seasonality of the most dominant fish species caught; g) provide an estimate of some of the population parameters of two major fish species.

## **MATERIALS & METHODS**

As a preliminary phase of the study, trained NSAP enumerators conducted a complete fishing boats and gears census in all of the coastal towns bordering the Babuyan Channel. With the assistance of the local barangay officials, fishermen were identified and interviewed for the needed data.

Twelve (12) major landing centers were identified and selected from six (6) coastal municipalities covered in the study. A total of twelve (12) enumerators were assigned to gather catch and effort data. Actual survey started on April 1999.

Data collection and sampling technique used was the standard NSAP method. Twelve (12) enumerators were assigned to collect data on the selected sampling sites where surveys were conducted 10-11 days monthly, depending on the actual number of days in a month with two (2) days interval during peak landing time, regardless of Saturdays, Sundays and Holidays.

The enumerators were provided with guidelines to record raw data gathered during their surveys and transferred these data to the NSAP standard data forms after they were raised.

The following are the survey forms used:

- 1) NSAP Form 1 - Monthly Report (Summary of Monthly Catch & Effort)
- 2) NSAP Form 2 - Daily Fish Landing Survey Form (Catch & Effort)
- 3) NSAP Form 2a - Weight Measurement of Samples
- 4) NSAP Form 2b - Length Measurement of Samples
- 5) NSAP Form 3 - Monthly Length Frequency Tally Sheet
- 6) NSAP Form 4 - Boat Particulars
- 7) NSAP Form 5 - Gear Particulars

All data were obtained by direct catch measurement and interview of fishermen during the landings. The fishermen were asked on the vessel and gear type used, fishing area, catch and effort exerted. Sampling of catch are done by taking fish samples randomly from the fish holds/tubs/styrofoams, sorted by species and weighed each species component to determine the total weight of each species from the catch.

Dominant species which were observed to be consistently available were measured with its total length and fork length for tuna (Scombridae) species. The length frequencies are then processed using the FAO-ICLARM Stock Assessment Tools (FiSAT) software.

Fish identifications were based on reference books such as Field Guide to Important Commercial Marine Fishes of the South China Sea by Isa, et. al. (1998) and The Marine Fishes of Northwestern Australia by Allen & Swainston (1988) and through the computer generated software, FishBase '97.

A monthly report of data and other related information were submitted to the NSAP Regional Office in Tuguegarao City for encoding, processing and analysis.

The FiSAT (FAO-ICLARM Stock Assessment Tools) software was used to estimate the von Bertalanffy Growth Function (VBGF) parameters ( $L_{\infty}$  and  $K$ ) and mortality parameters ( $Z$  and  $M$ ) for the dominant species identified (Gonzales, et. al, 1997).

The Powell-Wetherall's Plot was employed to estimate the asymptotic length ( $L_{\infty}$ ), while the method to approximate the maximum length ( $L_{\max}$ ) was made through the Extreme Value Theory. The K-scan routine of the ELEFAN 1 was also used to estimate the growth curvature parameter ( $K$ ).

Using the estimates of the growth parameters  $L_{\infty}$  and  $K$ , analysis of the seasonal recruitment pulse was performed using the Recruitment Pattern Methodology. Natural mortality ( $M$ ) was estimated using the Pauly's M-empirical equation, i. e.,

$$\log (M) = -0.0066 - 0.279 \log (L_{\infty}) + 0.6543 \log (K) + 0.4634 \log (T)$$

where  $L_{\infty}$  (in cm) and  $K$  are as estimated above, and  $T$  is the mean annual habitat temperature, taken as 28 °C in this area. The length converted catch curve was determined through the mortality estimation routine,  $Z$  from steady-state sample. From here, total mortality ( $Z$ ) was estimated and fishing mortality ( $F$ ) of the fully exploited groups was obtained by deducting  $M$  from  $Z$ . Exploitation rate ( $E$ ) was also obtained by dividing the fishing mortality ( $F$ ) with that of the total mortality ( $Z$ ).

The other routines in FiSAT used in determining the growth curve ( $K$ ) was the Output of Results in ELEFAN 1. Probability of capture analysis was also estimated at  $L_{25}$ ,  $L_{50}$  and  $L_{75}$  based on the outputs in the catch curve.

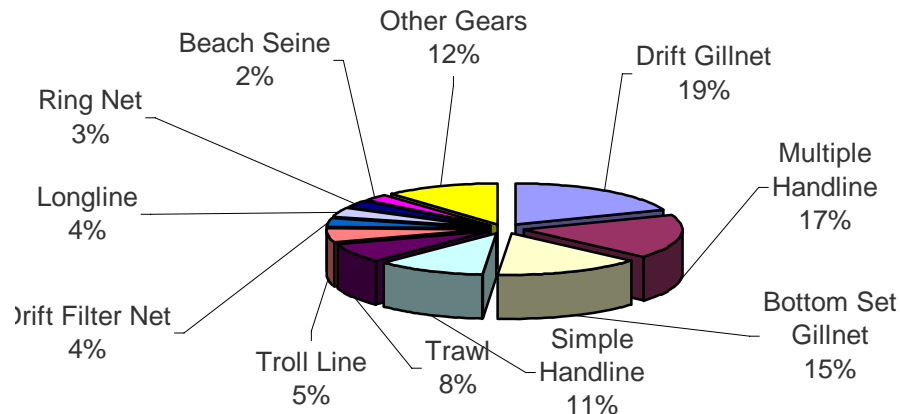
## **RESULTS AND DISCUSSIONS**

### **Survey Area**

Out of the ten (10) coastal towns identified, six (6) sampling stations with two (2) landing centers each were established based on their strategic location and intensity of fishing activities. On the east coast, Barangays San Vicente and Palauig, Sta. Ana and Barangays Batangan and Minanga Este, Gonzaga were chosen; mid-portion were Barangays Minanga and Centro, Buguey and Barangays Centro and Punta, Aparri; while on the western coast are Barangays Masisit and Namuac, Sanchez Mira and Barangays Taggat and Minanga, Claveria. These sampling sites were chosen to represent the fisheries production over the fishing ground, based on the intensity of fishing, both municipal (fishing boats 3 Gross Tons and below) and commercial fisheries (fishing boats above 3 Gross Tons).

### **Inventory of Fishing Boats and Fishing Gears**

The fishing boat and gear inventory conducted in March 23 – April 13, 1999 in all of the coastal municipalities along the Babuyan Channel, excluding Calayan showed a total of 1755 boats including 15 bamboo rafts. A total of 1607 fishing boats (92%) fall under the municipal fisheries and 148 fishing boats (8%) in commercial fisheries. According to type, 1511 (86%) are motorized and 244 (14%) are non-motorized (see Table 1).

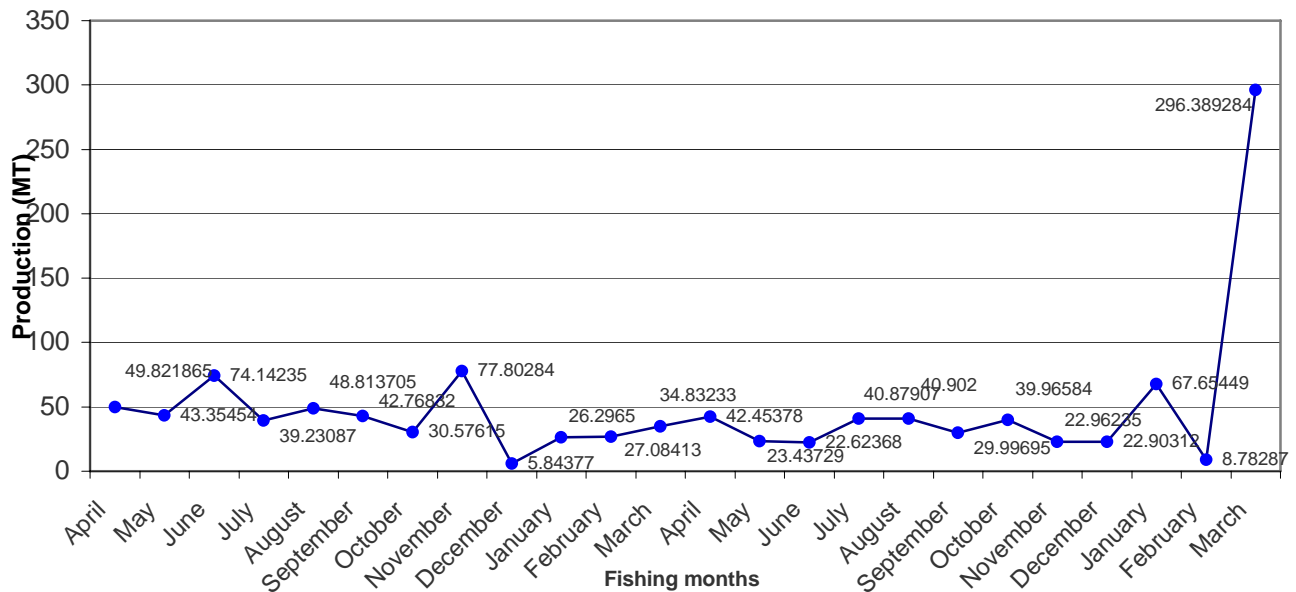


**Figure 2. Percentage Distribution of Gears at Babuyan Channel**

There were about 27 kinds of fishing gears surveyed. However, only 24 were monitored to be popularly used in Babuyan Channel from April 1999 – March 2001. From this, six (6) are commercial and eighteen (18) are municipal.

Among the most common fishing gears are drift gillnet (19% of the total number of units), multiple handline (17%), bottom set gillnet (15%), simple handline (11%) and trawl (8%) (see also Table 2).

**Annual Fish Production Trend at Babuyan Channel**



**Figure 3. Fish Production trend at Babuyan Channel (April 1999 to March 2001)**



Collected data on annual fish production show an increasing trend. Production on the first year totaled to 500.56 MT and 658.95 MT for the second year, with an aggregate volume of 1159.52 MT for the two-year period (Table 3).

Fish catch was highest during the month of March 2001 contributed mainly by Drift Filter Net and Trawl and also during November 1999 due to the presence of the *Nematopalaemon tenuipes* (Aramang). Low production was noticed in the months of December up to September 2000 (Figure 3). This was mainly due to the Northeast monsoon in the latter part of 1999 and early 2000, typhoons that hit the province, suspension on the issuance of licenses to operate Danish Seine and the vigilant enforcement of FAO 201 prohibiting active gears to operate within municipal waters by a composite team from BFAR, law enforcers in uniforms (PNP-MARICOM Group and PCG) and LGUs concerned.

**Seasonality of Catch Per Unit Effort (CPUE) at Babuyan Channel**

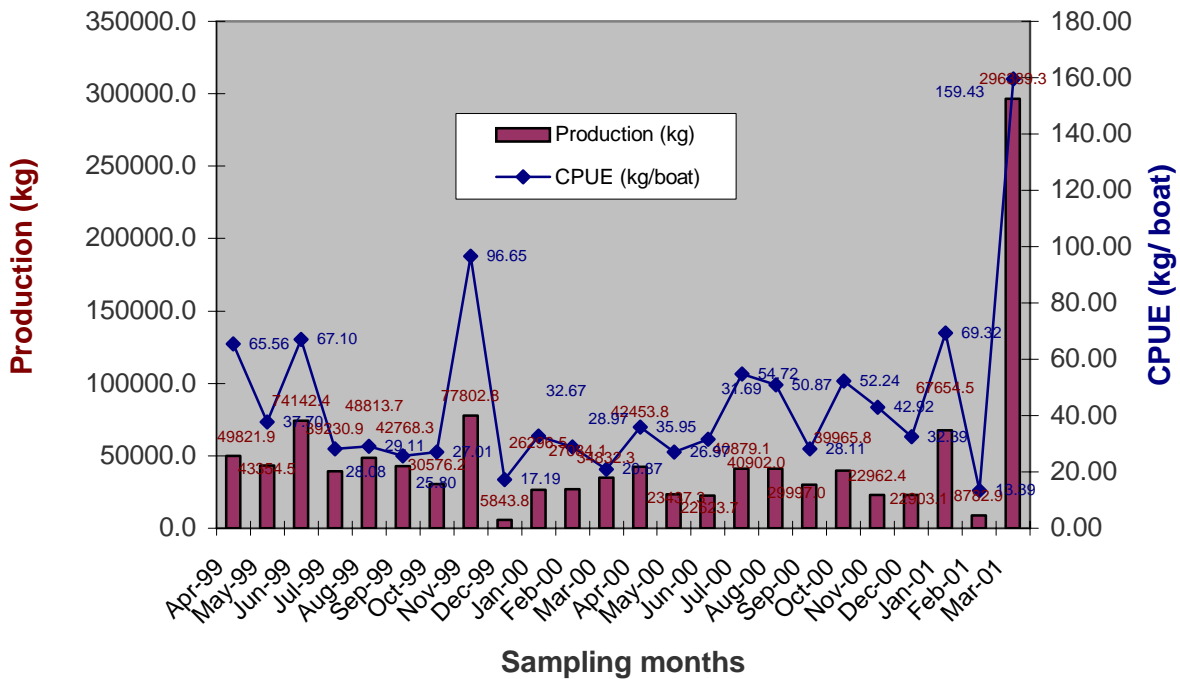


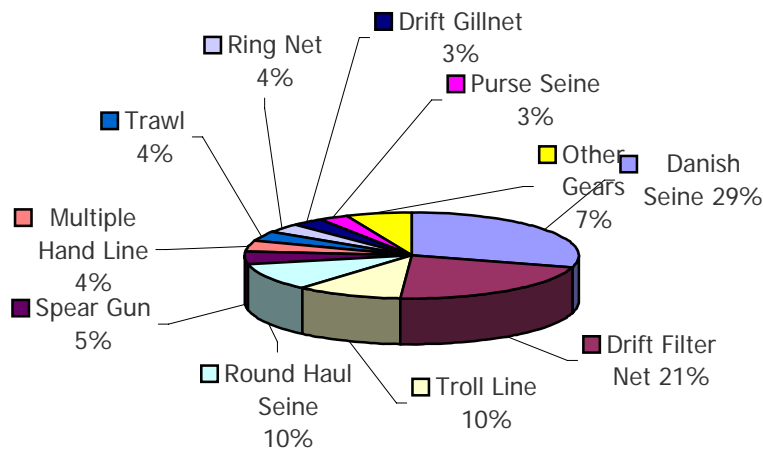
Figure 4. Seasonality of CPUE at Babuyan Channel (April 1999 to March 2001)

Determining the changes in Catch Per Unit Effort (CPUE) is the conventional method of assessing changes in exploited fish stocks. In this study, CPUE for all of the major gears observed are expressed in kg/boat.

The figure shows the fluctuating CPUE of boats landed at selected landing sites. The highest exerted effort and directly gaining the highest landed catch was on March 2001 with a CPUE of 159.43 kg/boat. This was followed by November 2000 with 96.65 kg/boat (Figure 4, see also table 4). Increased fish production during these months was due to the seasonal “aramang”.

**Catch Contribution of Major Gears**

**1) Year One**



**Figure 5. Production Share of Top Ten Fishing Gears (April 1999 to March 2000)**

The gear with the most abundant catch during the first study year (April 1999 to March 2001) was Danish seine (29.45% of the total production), followed by Drift filter net (21.55%), Troll line (10.43%), Round haul seine (10.14%) and Spear gun with 4.81% (Figure 5). Troll line had the most number of boats landed with 3342 (25% of the total boats landed), followed by Drift gillnet with 1778 (13%), Trawl with 1609 (12%), Multiple handline with

1467 (11%) and Bottom set gillnet with 1204 (9%), among which are the five fishing gears with the most number of boats landed during the first year.

## 2) Year 2

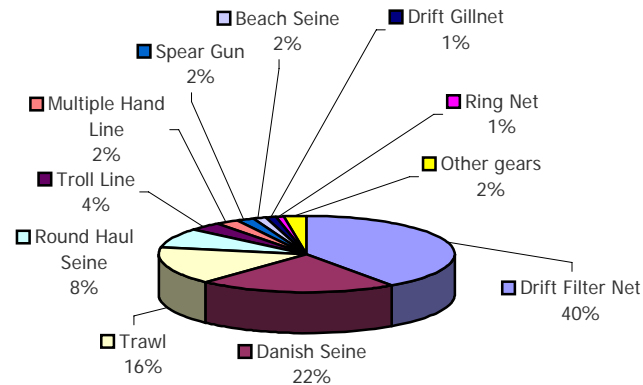


Figure 6. Production Share of Top Ten Gears (April 2000 to March 2001)

Figure 6 shows that Drift Filter Net contributed the most abundant catch with 40.25% of the total production during the second study year (April 2000 to March 2001). This was followed by Danish seine (21.64%), Trawl (15.91%), Round haul seine (8.3%) and Troll line with 3.75%. Trawl dominated the most number of boats landed with 2105 (19% of the total boats landed), followed by Troll line with 1874 (17%), Multiple handline with 1743 (16%), Drift gill net with 1364 (13%) and Sardine gillnet with 745 (7%).

## 3) Two year duration

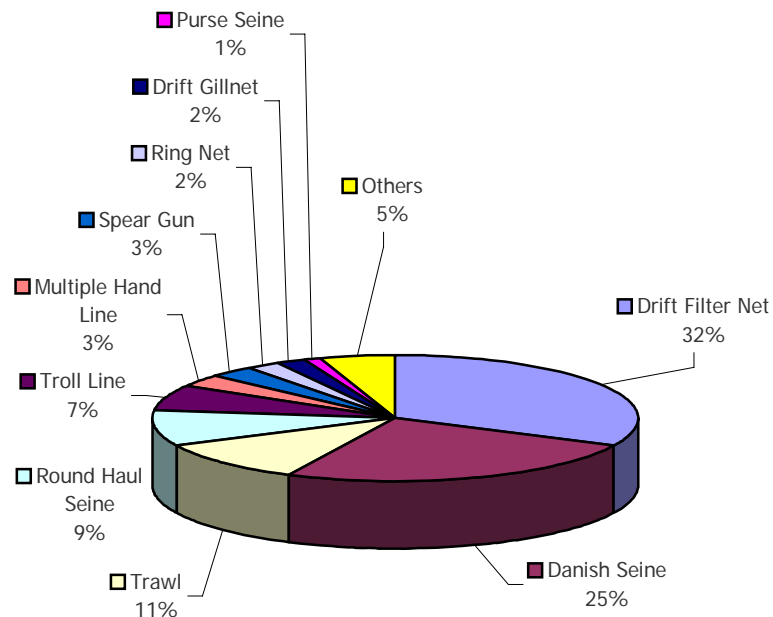


Figure 7. Catch Contribution of Major Fishing Gears Operated at Babuyan Channel (April 1999 to March 2001)

Figure 7 shows the production share of the different fishing gears operated at Babuyan Channel for the two-year period. It shows that 32% of the total production of 1159.52 MT was contributed by Drift filter net. This is followed by Danish Seine with 25%, Trawl with 11% closely trailed by Round Haul Seine with 9%, Troll line had 7%, Multiple Handline and Spear Gun with 3% each, Ring Net and Drift gill net with 2% each and 1% of the production is acquired by Purse Seine while the other gears combined had 5%.

**Seasonality of Top Two Fishing Gears**

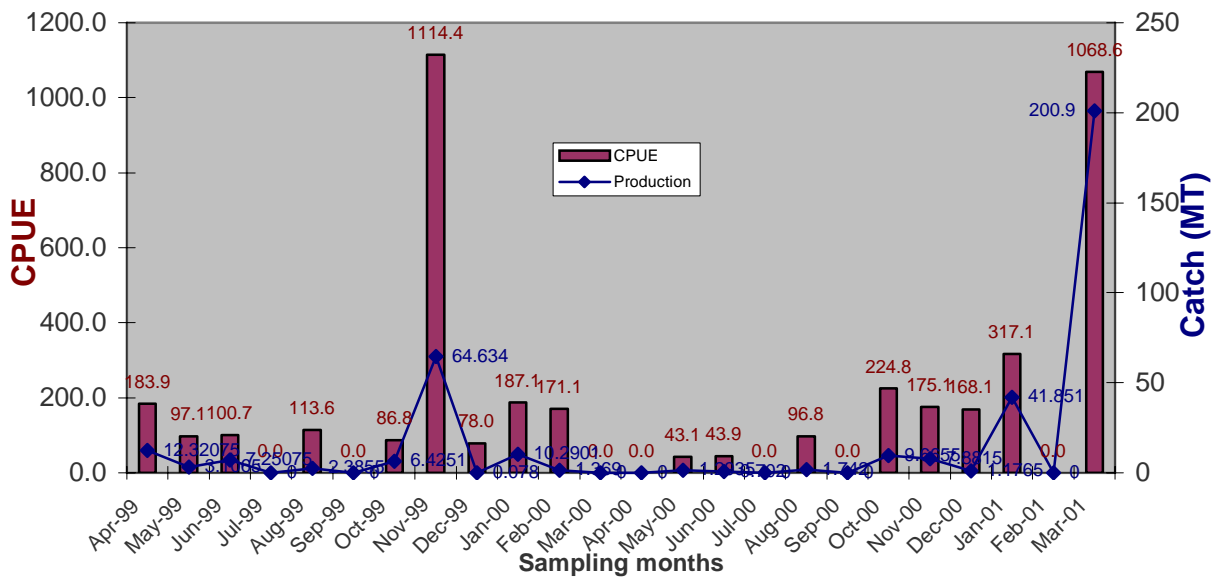
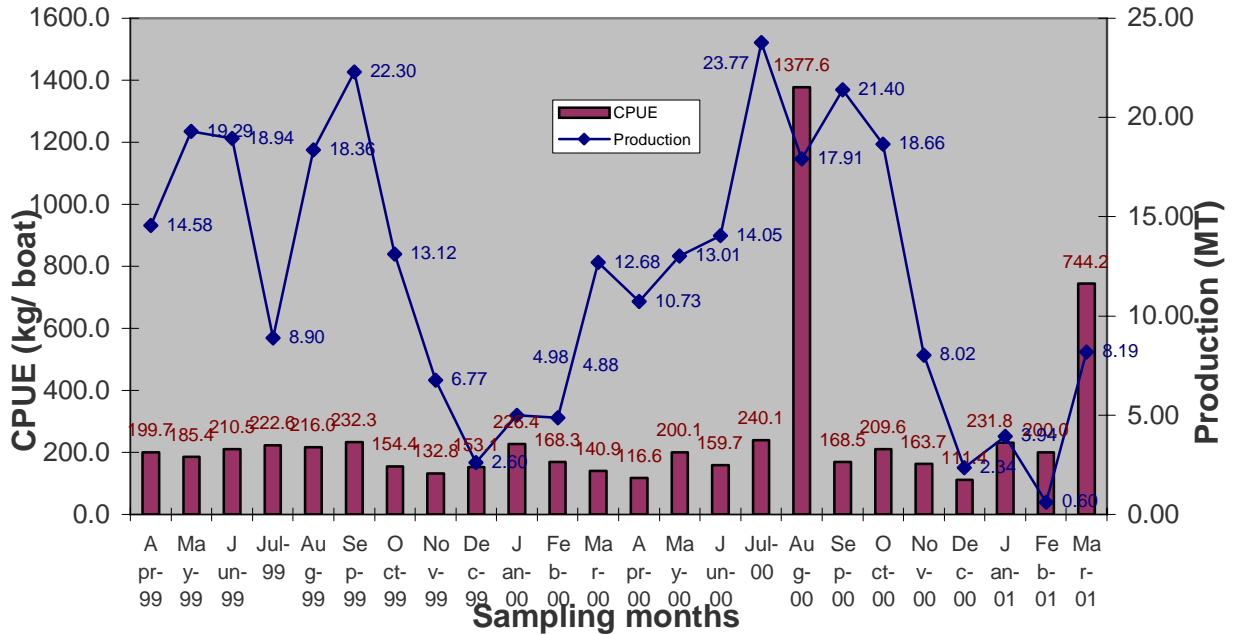


Figure 8. CPUE Seasonality of Drift Filter Net Operated at Babuyan Channel (April 1999 to March 2001)

**A) Drift Filter Net**

Drift filter net, a seasonal fishing gear which is only operated when the waters are turbid, topped all other fishing gears in terms of production. Figure 8 shows its monthly Catch Per Unit Effort (CPUE) and fluctuating monthly production. It was observed that the highest CPUE is on November 1999 with 1,114.4 kg/ boat. This was followed closely by March 2001 with a CPUE of 1,068 kg/ boat. The two mentioned months have almost similar CPUE but they differ greatly in the volume of catch (64.6 MT for November and 200.9 MT for March).

**B. Danish Seine**



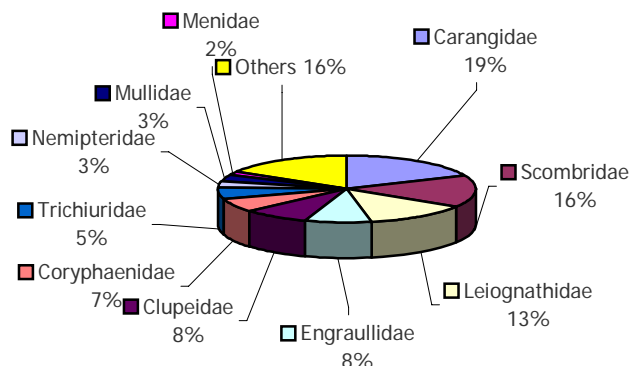
**Figure 9. CPUE Seasonality of Danish Seine Operated at Babuyan Channel (April 1999 to March 2001)**

Danish seine, a commercial fishing gear operating at Babuyan Channel is one of the top producers of fish and other aquatic products at the channel. Figure 9 shows its fluctuating trend of production and its corresponding CPUE. It further shows that the month with the highest CPUE is August 2000 with 1377.6 kg/ boat and monthly production of 17.91 MT. This was followed by March 2001 with a CPUE of 744.2 kg/boat and was able to yield 8.19 MT. The high CPUE is attributed to the reduction of boat landings as an effect of the selected operators permitted by LGU Buguey to operate within its municipal waters.

**Catch Composition of the Recorded Landings**

During the entire assessment period in the 12 established landing sites, a total of eighty three (83) families of vertebrates consisting of one hundred eighty seven (187) genera and four hundred fifty nine (459) species and ten (10) families of invertebrates composed of nineteen genera (19) and thirty four (34) species were identified. This shows that there exists a high diversity of resources along the fishing ground.

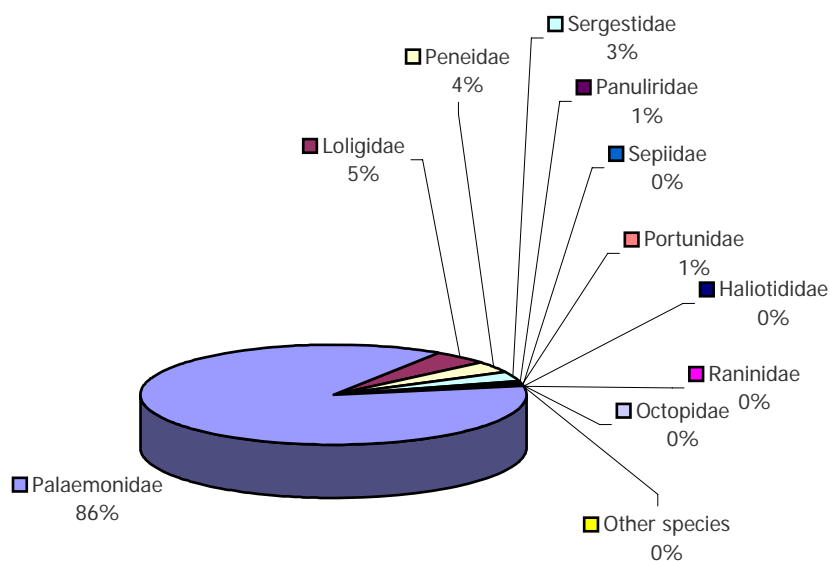
## A. Dominant Vertebrate Families



**Figure 10. Percentage Distribution of Vertebrate Families Caught Along Babuyan Channel (April 1999 to March 2001)**

The most dominant vertebrate family caught along Babuyan Channel is the Carangidae (jacks and pompanos) family with 19%, followed by Scombridae (mackerels, tunas, bonitos) with 16 %, Leiongnathidae (slipmouths and ponyfishes) with 13 %, Engraulidae (anchovies) – 8%, Clupeidae (herrings, shads, and sardines) – 8%, Coryphaenidae (dolphinfishes) – 7%, Trichiuridae (hairtails) – 5%, Nemipteridae (threadfin breems) – 3%, Mullidae (goatfishes) – 3%, Menidae (moonfish) – 2%, and all the other vertebrate families accounted for the remaining 16% of the total production of one thousand one hundred sixty (1,160) MT (Figure 10).

## B. Dominant Invertebrate Families



**Figure 11. Percentage Distribution of Invertebrate Families Caught Along Babuyan Channel (April 1999 to March 2001)**

For the invertebrates, Palaeamonidae (spider prawns) dominated the catch with a total production of 456.85 tons (86.84%), Lolididae (squids) with 24.91 tons (4.73%) and Penaeidae (shrimps) with 19.5 tons (3.71%). These three (3) families had a contribution of about 95% of the total invertebrate catch of roughly 526.06 MT. (Figure 11).

**C. Most Dominant Species**

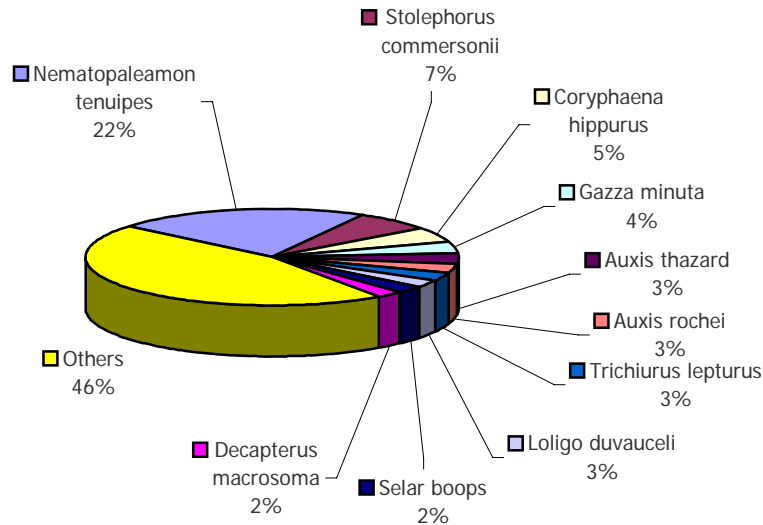


Figure 12. Top Ten Species Caught at Babuyan Channel (April 1999 to March 2000)

Among the top species caught at Babuyan Channel for the period April 1999 to March 2000 are the *Nematopalaemon tenuipes* (spider prawn) – with an aggregate volume of 110 MT (22% of the total production), *Stolephorous commersoni* (commerson’s anchovy) follows with 34 MT (7%), *Coryphaena hippurus* (dolphinfish) with 24 MT (5%) and *Gazza minuta* (toothpony) with 20 MT (4%) of the total accumulated catch for year one (Figure 12).

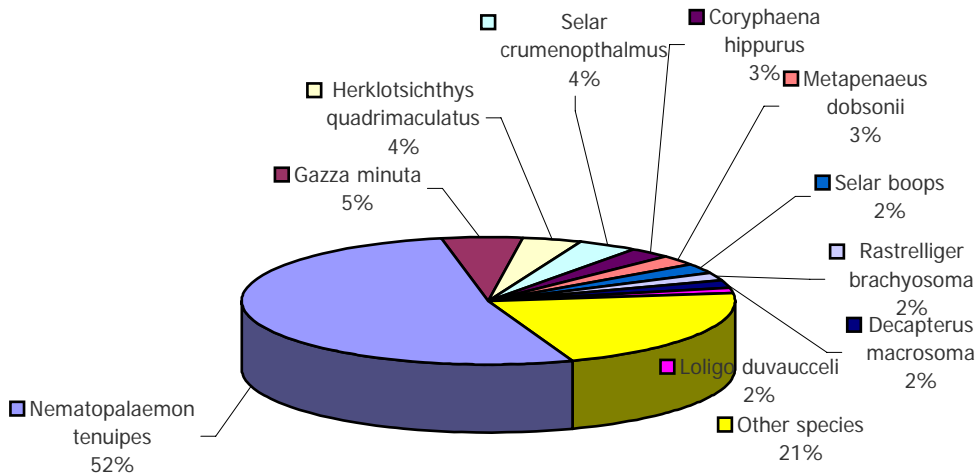


Figure 13. Top Ten Species Caught at Babuyan Channel (April 2000 to March 2001) Page 39 of 30 pages

Figure 13 shows that during the second year of the study, *Nematopalaemon tenuipes* (spider prawn) topped the production data with 347 MT (53% of the total volume), *Gazza minuta* (toothpony) - 34 MT (5%), *Herklotsichthys quadrimaculatus* (bluestripe herring) – 26 MT (4%), *Selar crumenophthalmus* (big-eye scad) - 25 MT (4%), *Coryphaena hippurus* (dolphinfish) - 18 MT (3%), and the rest of the species for the remaining 204 MT (31%).

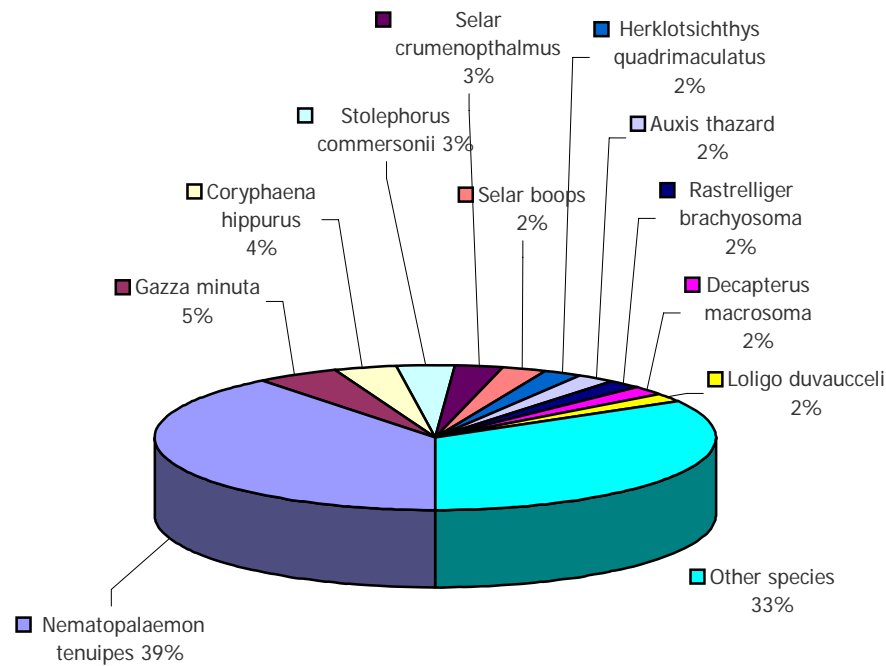
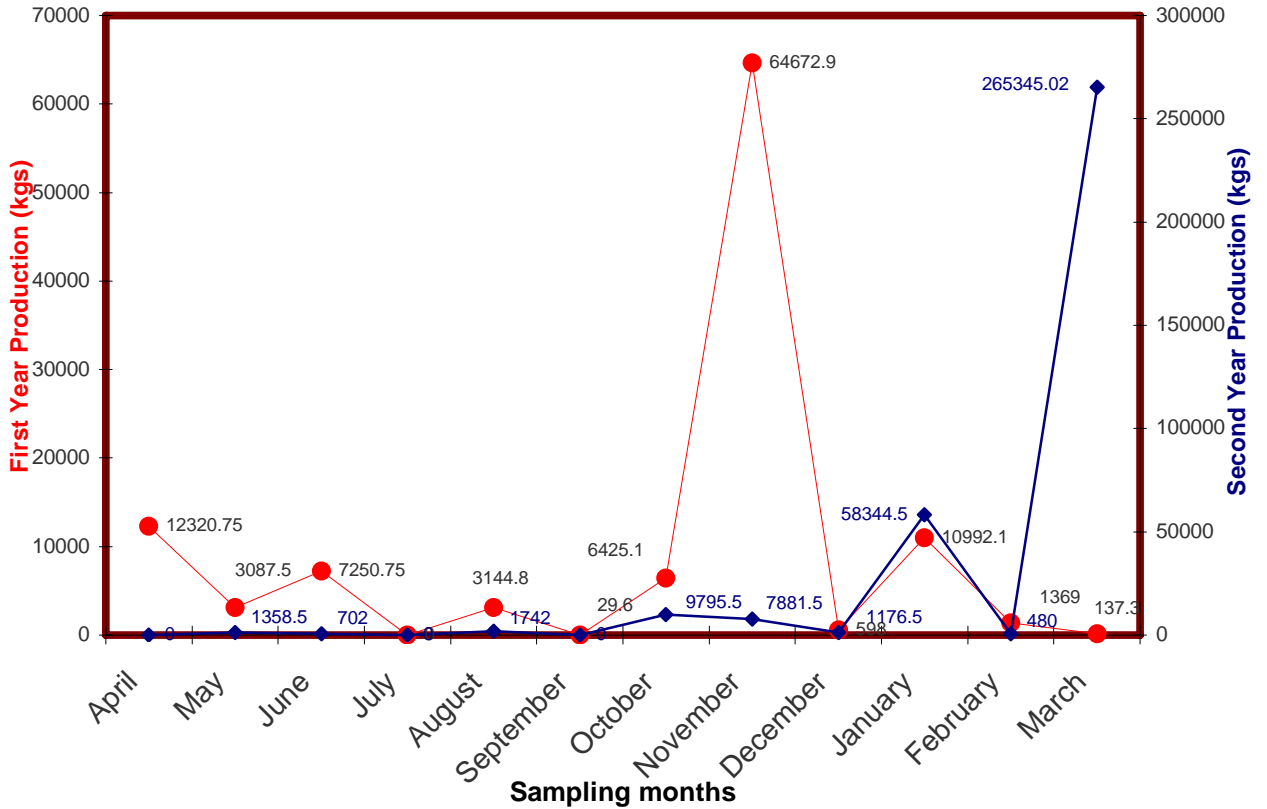


Figure 14. Major Species Caught at Babuyan Channel (April 1999 to March 2001)

During the two year study period, *Nematopalaemon tenuipes* (spider prawn) topped the production data with 39% of the total production - 457 MT, *Gazza minuta* (toothpony) with 5% - 54 MT, *Coryphaena hippurus* (dolphinfish) with 4% - 42 MT, *Stolephorous commersonii* (commerson’s anchovy) with 3% - 39 MT while *Selar crumenophthalmus* (big-eye scad) produced a catch of 32.5 MT - 3% of the aggregate production for the two-year period (Figure 14, see also Table 5).



**Seasonality of the Most Dominant Species Caught at Babuyan Channel**



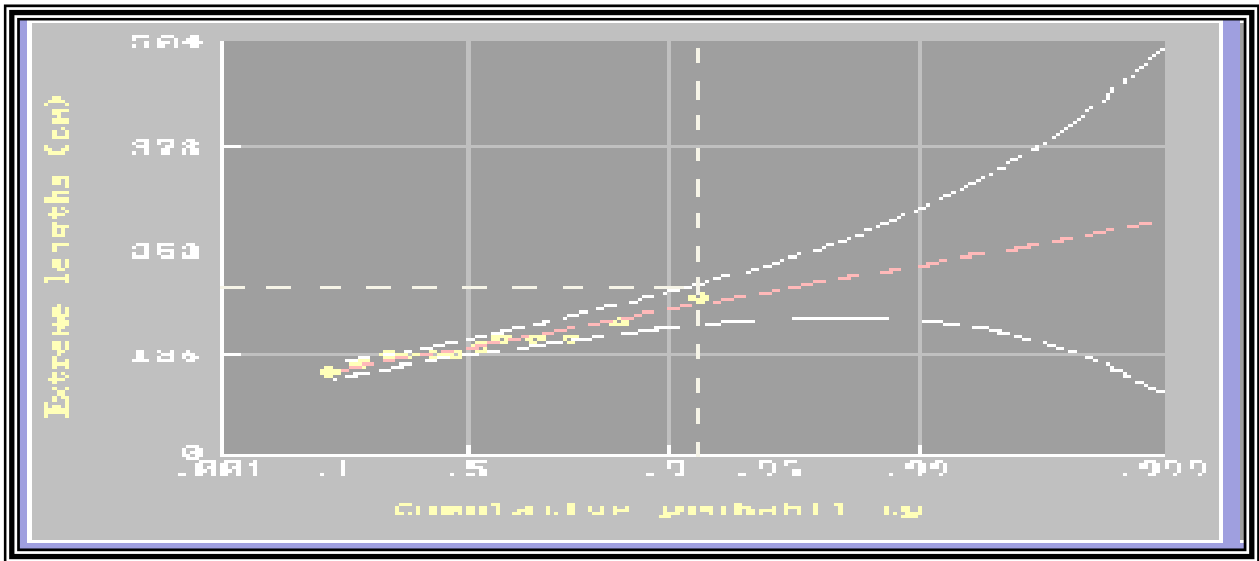
**Figure 15. Seasonality of *Nematopalaemon tenuipes* (April 1999 to March 2001)**

*Nematopalaemon tenuipes*, locally known as “*Aramang*” is one of the most dominant native fishery products in Cagayan Valley, especially at Aparri, Cagayan. This species is seasonal and is caught by Drift Filter Net particularly when the waters are turbid. Though it was found to be abundant on the months of November 1999 (64,672.9 kgs) and March 2001 (265,345.02 kgs), it had been constantly abundant on the months of January 2000 and January 2001 with 10,992.1 kgs and 58,344.5 kgs respectively (Figure 15).

The significant catch of *Aramang* is also attributed mainly to the availability of market and the controlled operation established and agreed upon by Fishermen-Operators and the LGU of Aparri, Cagayan.

**Population Parameters of *Coryphaena hippurus* (Common dolphinfish)**

*Coryphaena hippurus*, locally known as “dorado” is found in open waters but also near the coast. They form schools and inhabit surface waters where it feed on almost all forms of fish and zooplankton. Also feed on crustaceans and squids and spawn in the open sea and probably approximate to the coast when the water temperature rises. Attracting devices such as floating objects with comparable size are used to concentrate dolphinfish. They are oftentimes marketed fresh, of high value and also utilized frozen.



This species are predators and inhibits round the clock feeding (Isa *et al.*, 1998).

**Figure 16. Prediction of the maximum length of *Coryphaena hippurus* based from NSAP collected data (April 1999 to March 2000)**

Based from the analysis, it was found out that the maximum length ( $L_{max}$ ) of *Coryphaena hippurus* is 195 cm with the predicted length of 193.97 (Figure 16) which means that the possible maximum length of the sample 195 cm based from the data

gathered. It further resulted to 160- 207 cm  $L_{max}$  (at 95% confidence interval) indicating that sufficient data in terms of size ranges collected is available

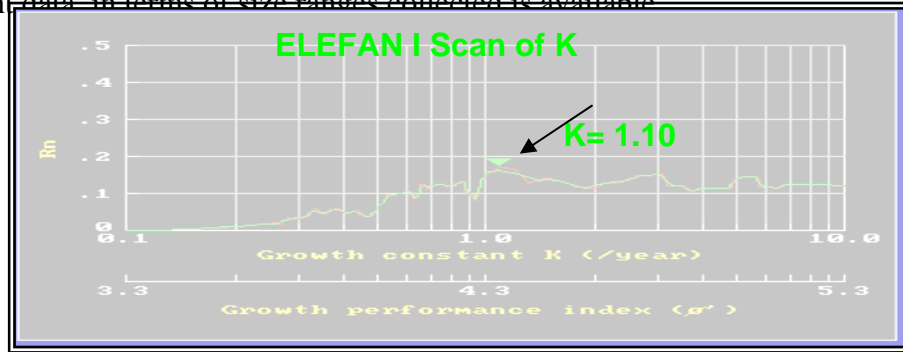


Figure 17. Scan of K values of *Coryphaena hippurus* caught at Babuyan Channel (April 1999 to March 2000)

The ELEFAN I Method was used in determining the K or the growth constant. It showed a K of 1.10 hence inhibits fast growth (Figure 17).

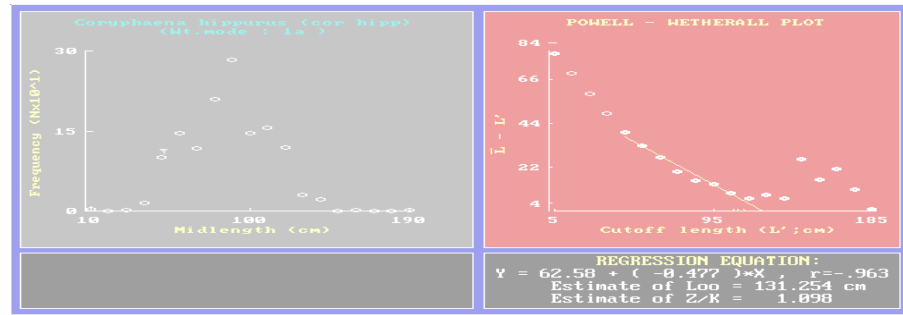


Figure 18.  $L_{\infty}$  determination using the Powell- Wetherall Plot.

Figure 18 also shows the regression equation of *Coryphaena hippurus*. It showed an estimated Length infinity ( $L_{\infty}$ ) of 144.804 cm and an estimated  $Z/K$  of 1.78.

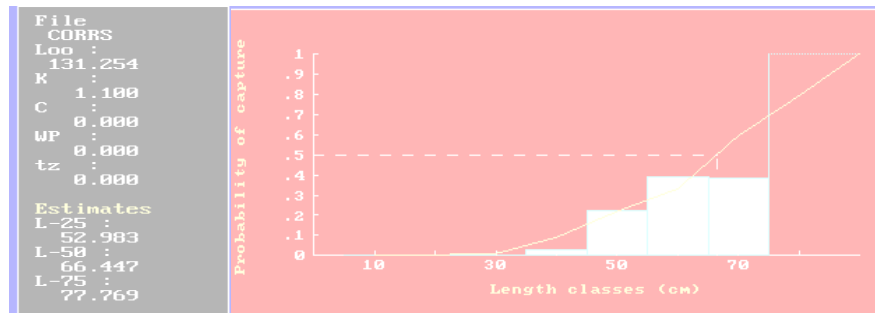


Figure 19. Probability of Capture of *Coryphaena hippurus* at Babuyan Channel (April 1999 to March 2000)

Figure 19 shows the probability of capture of the common dolphinfish being caught at Babuyan Channel from the period April 1999 to March 2001. It further shows that at

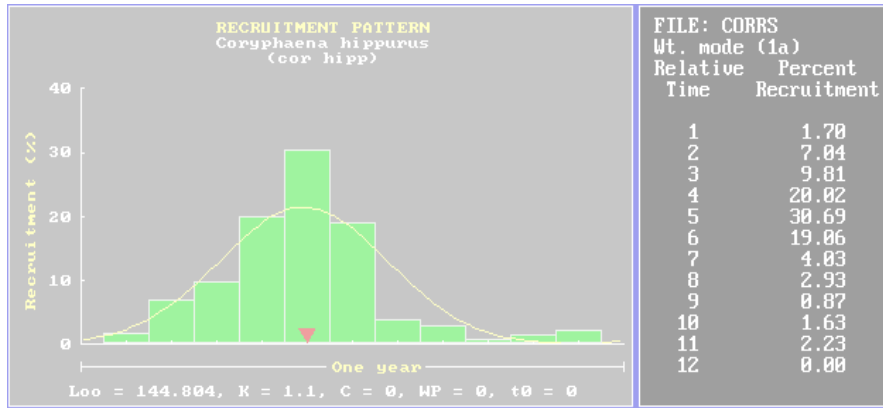
length 25 cm, the probability of capture is 52.98 percent, 66.45 percent at length 50 and

77.77

percent at

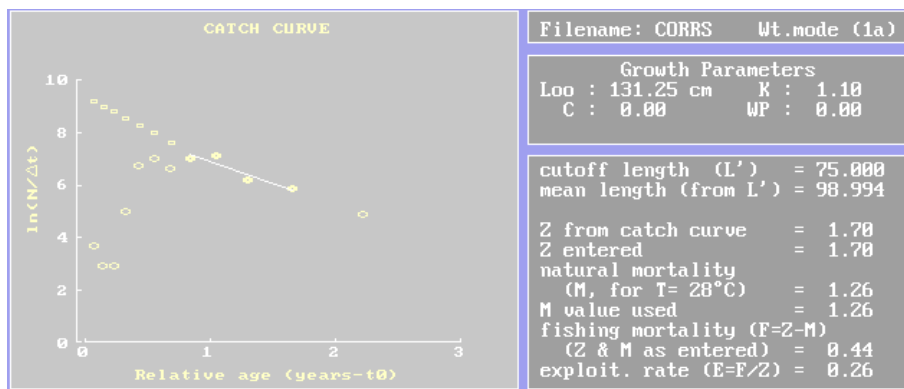
length

75(cm).



**Figure 20. Recruitment pattern of *Coryphaena hippurus* at the Babuyan Channel (April 1999 to March 2000)**

*Coryphaena hippurus* showed a single pattern of bimodal recruitment peak during the two-year study period. This shows a single stock of this species being exploited at the channel. Figure 20 also shows that most of the stocks are recruited from the fourth and at its peak on the fifth month of the study.



**Figure 21. Catch curve of *Coryphaena hippurus* at the Babuyan Channel (April 1999 to March 2000)**

Using the Length - converted catch curve method at a temperature of 28<sup>0</sup> Centigrade, *Coryphaena hippurus* showed a Total Mortality of 1.70 of which 1.26 is the Natural Mortality and the remaining .44 is the Fishing Mortality. It had an Exploitation rate of .26 which shows that the Common dolphinfish is not yet heavily

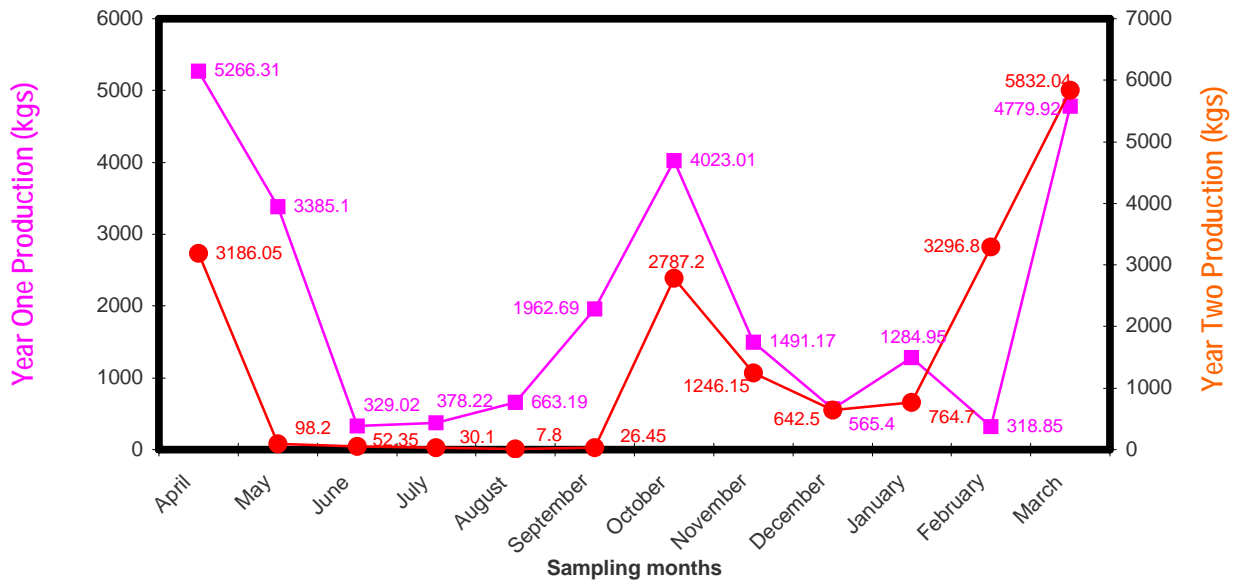


Figure 22. Seasonality of *Coryphaena hippurus* (April 1999 to March 2001)

exploited at the channel (figure 21).

*Coryphaena hippurus* is one of the top species caught at Babuyan Channel with high commercial value. It showed a constant pattern of abundance and likewise, scarcity (figure 22). It was noted to be abundant on the months of April, October (1999 and 2000) and March (2000 and 2001).

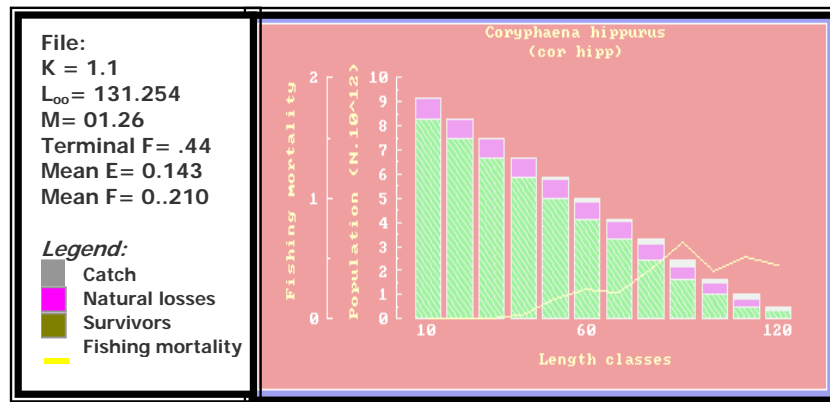
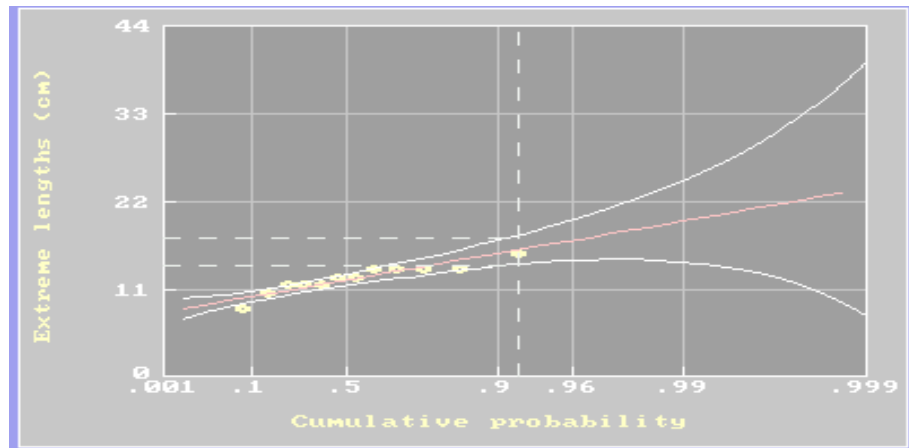


Figure 23. Virtual Population Analysis on *Coryphaena hippurus*.

The figure shows the virtual analysis on the population of *Coryphaena hippurus* being exploited at the Babuyan Channel from April 1999 to March 2000. It further states that at age 10 to 20 (age is represented by its length), a very low fishing mortality exists while its losses are due to natural mortality. Fishing mortality increases at age forty to sixty but decreases slightly at age 70. Fishing mortality again increases at age (in this case, length) 80 to 90 while it decreases at age 100 and again rises at age 110. As observed, survivors keep on decreasing as the length increases.

**Population Parameters of *Gazza minuta* (Toothpony)**

*Gazza minuta* is a demersal species which is found in coastal waters. Young ones enter estuaries. They feed on small fish, shrimps, other crustaceans, and polychaetes. They are sold fresh, dried or salted; also made into fishmeal. They possess a strongly compressed, slimy body with small scales. Their head naked, bearing bony ridges on upper surface. Mouth are small; very protractile. They have dorsal fins of about 8 or 9 spines that are somewhat elevated. All species have esophageal luminous organs. They are common in shallow coastal waters and tidal creeks and easily caught by trawls or beach seines; important artisanal food fish (Isa *et al.*, 1998).



**Figure 24. Prediction of Maximum Length ( $L_{max}$ ) of *Gazza minuta* (April 1999 to March 2000).**

Figure 24 shows the estimated maximum length ( $L_{max}$ ) of *Gazza minuta* caught at Babuyan Channel from April 1999 to March 2001. It also shows that the maximum length is 15.5 cm or a result of 13.98 - 17.49 cm (at 95% confidence interval), which indicates that sufficient data, in terms of the size ranges collected, is available.

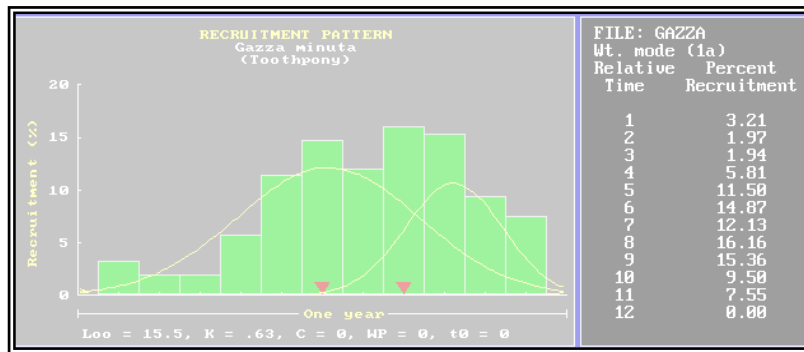


Figure 25. Recruitment pattern of *Gazza minuta* at the Babuyan Channel (April 1999 to March 2000)

Figure 25 shows two bimodal recruitment patterns which reveal that two stocks are being exploited at the Babuyan Channel. It further shows that, for the first stock, most of them are recruited during the sixth month while the second stock had its peak recruitment on the eighth sampling month.

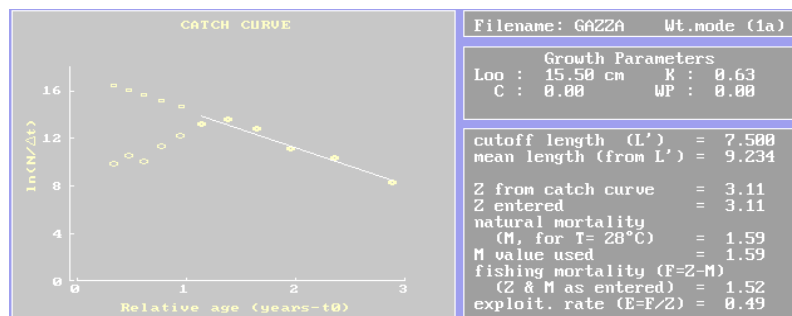
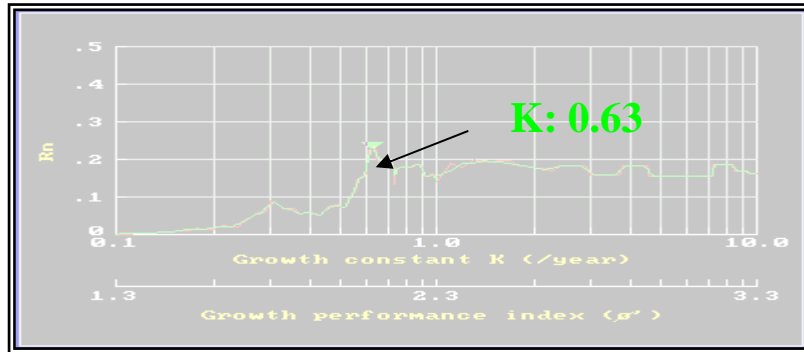
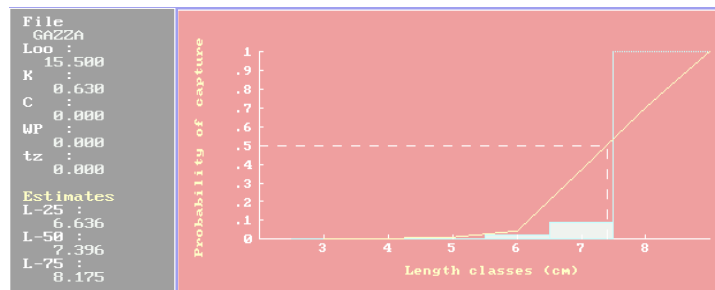


Figure 26. Catch curve of *Gazza minuta* at the Babuyan Channel (April 1999 to March 2000).

Figure 26 shows the catch curve of *Gazza minuta* being exploited at the Babuyan Channel. It showed a Total Mortality (Z) of 3.11, Natural mortality (M) of 1.59, Fishing mortality (F) of 1.52 and had an exploitation rate (E) of 0.49.



**Figure 27. Scan of Growth Constant (K) of *Gazza minuta*** The figure shows the growth constant of *Gazza minuta*, locally known as “sap-sap”. At a constant starting point it showed a Growth constant (K) of .63 and Growth performance index of 2.18 which shows that *Gazza minuta* inhibits a slow growth.



**Figure 28. Probability of Capture of *Gazza minuta* at the Babuyan Channel (April 1999 to March 2000)**

Based on the analysis using the Length- converted catch curve, the probability of *Gazza minuta* to be captured at length 25 percent is 6.64, 7.4 at 50 and 8.18 at length 75 percent. Figure 28 also shows that the increase of length is directly proportional to the probability of capture.



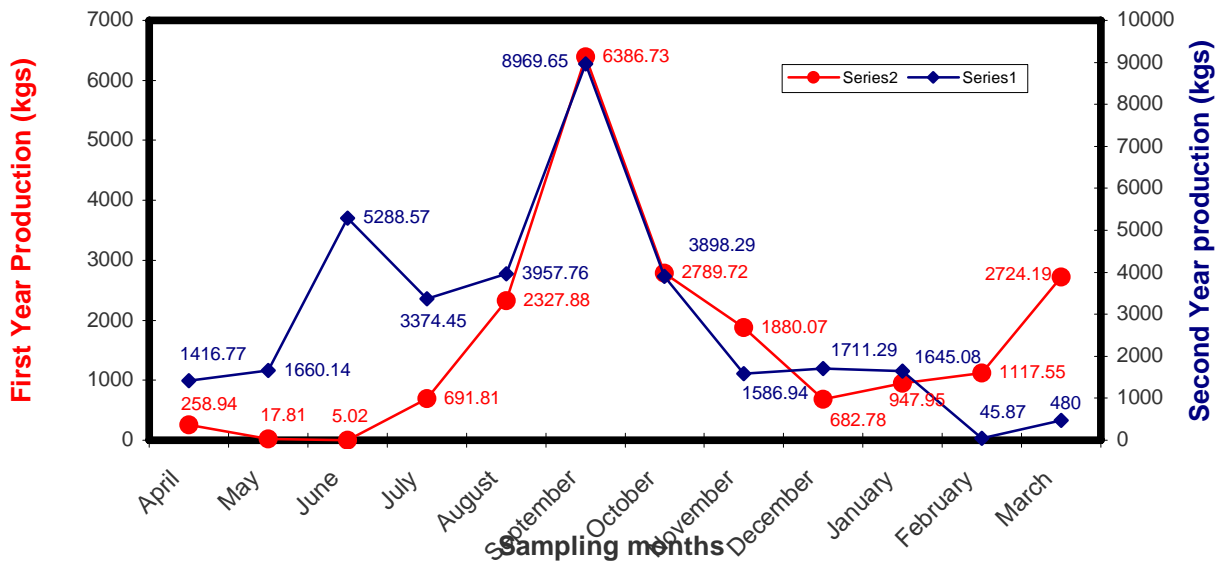


Figure 29. Seasonality of *Gazza minuta* (April 1999 to March 2001)

Figure 29 shows the seasonality of *Gazza minuta* at the Babuyan Channel. Data gathered showed the constant abundance and scarcity of the slipmouth. It was found out to be at its production peak during the month of September (2000 and 2001) and also abundant during the months of March and June 2000.

### SUMMARY

Fish Stock Assessment was conducted in twelve (12) landing centers, from April 1999 – March 2001 to evaluate the present status and future potential values of the Babuyan Channel as basis for the proper management, conservation and sustainability of its fishery resources.

A total of 1755 fishing boats were inventoried, from this number 1607 are municipal and 148 are commercial including 15 bamboo rafts. Twenty-four kinds of fishing gears are currently operational in the province.

The trend of annual fish production is increasing with an aggregate volume of 1,159.6 MT. Fish production on the first year has a total of 500.6 MT and 658.95 MT on the second year.

The month of March 2001 was the most productive month of the study period with the highest exerted fishing effort. The bulk of the production was contributed by the seasonal “aramang”.

Drift Filter Net, the most dominant gear, provided the most abundant catch with an aggregate volume of 373 MT, followed by Danish Seine - 290 MT, Trawl - 123 MT, Round Haul Seine – 105 MT, and Troll Line – 77 MT.

There were 83 vertebrate families identified, belonging to 187 genera and 459 species and 10 invertebrate families consisting of 19 genera and 34 species. These indicate the high diversity and complexity of the channel’s resources. Top producer of the vertebrates is the Carangidae family (jacks and pompanos) and Palaemonidae (spider prawns) for the invertebrates.

*Nematoplaemon tenuipes* (aramang), the most dominant species in the study area showed abundance during the months of November 1999, January 2000 and 2001, and March 2001.

*Coryphaena hippurus* (dolphinfish) and *Gazza minuta* (slipmouth) were given focus. Results of the FiSAT routines applied showed that these species are still below the critical range of exploitation.

## **RECOMMENDATIONS:**

Based from the findings and analyses stated, the following recommendations are made to ensure resource sustainability in Babuyan Channel:

1. Further studies be conducted to the two analyzed species including all major commercial species to validate and determine the necessary population parameters;
2. Biological studies be incorporated during data gathering to monitor the fecundity and spawning season of the major species which will serve as basis for the formulation and imposition of management strategies or measures;
3. Separate research on the biology of the “aramang”, the most dominant species during the study period;

4. There is a need for the updating of complete registry of fisherfolk in all fishing municipalities together with the updating of Fishing Boat and Gear Inventory for a more reliable data on efforts calculation;
5. Stricter implementation of Fisheries Administrative Orders and other fishery laws through a concerted effort between and among BFAR, PNP, MARINA, LGUs and other NGO's;
6. Full management support for the project should be made and must be continued for 5 – 10 years to accumulate a time series data, which is the minimum requirement for the analysis of the Maximum Sustainable Yield (MSY) and Total Allowable Catch (TAC), and to determine the effects of management measures to be enforced.

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