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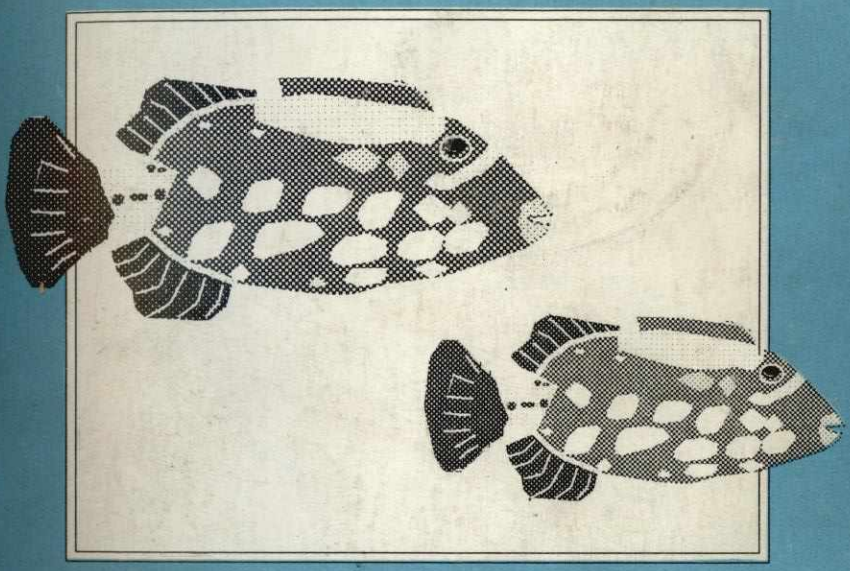

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The Marine Shrimp Resources of Luzon

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ABSTRACT

The study was made to determine the species composition and relative abundance of shrimps in Manila Bay, Tayabas Bay, Lingayen Gulf, and Sorsogon Bay. The maximum sustainable yield and maximum effort to reach MSY were calculated using the catch and effort data from the Philippine Fisheries Statistics from 1957 to 1985 and fitting the Schaefer's and Fox's models. The biomass estimation was based on monthly data obtained from bottom trawl surveys conducted in the study areas for one year. An MSY of 9366 (Schaefer) and 7527 (Fox) tons were calculated, requiring 989 and 810 trawlers fishing year round, respectively. The biomass estimates using the "swept area method" showed that densities of shrimps in Lingayen Gulf and Tayabas Bay were low among the four study areas, whereas Sorsogon Bay had the highest density, followed by Manila Bay. The dominant species of shrimps found in Manila Bay, *Metapenaeus ensis,* was not fully exploited, having an E value of 0.436; *Penaeus indicus,* the second most dominant species in Manila Bay, was slightly exploited, with an E value of 0.55; *Metapenaeus dalli* in Sorsogon Bay is also slightly exploited with an E value of 0.525.

Keywords: shrimp, Luzon, Manila Bay, composition, abundance, biomass, swept area method

INTRODUCTION

Shrimps/prawns are considered one of the most highly priced export commodities in the Philippines and a top dollar earner. Their increasing demand and high price have motivated the fishermen to exploit the shrimp resources extensively. From 1980 to 1985, shrimp export data showed a steady rise in volume and value (from 2,757 mt valued at P154 million in 1980, to 8,494 mt valued at P1.8 billion in 1985). Shrimps/prawns are exported live, frozen or chilled, or processed. The frozen or chilled shrimp ranks number one in export, followed by processed dried shrimps.

Fishermen have exploited the shrimp resources extensively. However, knowledge on the biology, distribution and abundance of shrimp resources has been based on scattered observations. Most of research work done on this subject dealt mainly on taxonomy and the culture aspect of *Penaeus monodon* Fabricius.

REVIEW OF LITERATURE

Studies on the systematics of the species include the work of Estampador (1937), Blanco and Ariola (1937), and Borja (1972). Domantay (1955) and Borja (1972) reviewed the shrimp fisheries of the Philippines. The studies on the shrimp fry grounds were reported by De Jesus and Deanon (1974). As part of the marine biological program of the Philippines under the UNTAB (Tiews, 1959), an investigation on the food and feeding habits of shrimp in Manila Bay and San Miguel Bay was undertaken by Tiews, Bravo and Ronquillo (1986). In 1969, Domantay listed the major species of prawn in the Philippines and described the methods used in catching them, along with details of the fishing gears, and some catch statistics. He reported that, among the commercially important prawns in the Philippines, *Penaeus monodon* stand foremost. *Palaemon* and *Palaemonetes* also occur in abundance, often in big schools.

Different authors have reported that there are about 55 species of shrimps, belonging to the Family Panaeidae, in the country. A review of the species composition given by different authors revealed that some names are no longer valid. They have been replaced with other names which are currently being used.

The most commercially important species supporting the Philippines' shrimp fishery belong to the genera *Penaeus, Metapenaeus* and *Acetes*. The white shrimp (*Penaeus indicus/merguiensis*) predominated the shrimp catch from 1978 to 1980, with precentage occurrence ranging from 52.96 % to 62.27% (by weight). From 1981 to 1982, *Acetes* was predominant, with occurrence ranging from 53.15% to 58.22%. From 1983 to 1984, the white shrimps again predominated the catch, with occurrence ranging from 51.15% to 56.36%. In 1985, it was again replaced

by *Acetes*, at 53.55%. The tiger shrimps which are composed mainly of *Penaeus monodon* and *P. semisulcatus* and the endeavor shrimp *Metapenaeus ensis* have negligible percentages ranging from 1.26% to 7.57%.

In 1977, Ingles conducted a study on the distribution and abundance of penaeid shrimps in the Visayan Sea. This was the first attempt to look closely at the shrimp resource of that particular fishing ground. He reported eleven species of penaeids in the Visayan Sea, five of which were dominant in the catch of bottom trawl. The dominant species, in the order of their abundance, were *Trachypenaeus fulvus, Metapeneopsis* sp., *Penaeus semisulcatus, Metapenaeus ensis* and *Parapenaeus longiceps*. He further stated that the shrimp catch represented 1.04% of the total trawl catch, or an average catch of 0.53 kg/drag. But in the commercial fishing vessels, shrimps represented between 10% to 12% of the total food fish catch. The low values obtained may be due to: (1) the type of fishing vessel used (M/V Albacore, a research vessel); (2) the exclusion of shallow areas from the study; (3) the gear used (not designed to catch shrimps); and (4) the fact that the study areas are not frequented by fishing vessels.

OBJECTIVES

The following are the objectives of this study:

1. to determine the species composition and relative abundance of shrimps in Manila Bay, Tayabas Bay, Lingayen Gulf and Sorsogon Bay;
2. to determine the seasonal distribution of different shrimp species;
3. to study some aspects of the biology of shrimps;
4. to estimate the stock density of shrimp with the use of the area swept technique; and
5. to obtain benchmark information on the shrimp resources.

METHODOLOGY

The species composition of shrimp was taken from previous work/ publications. The source of data on export, catch and fishing effort is the Fisheries Statistics of the Philippines. Based on the 1957 to 1985 catch and effort data, the MSY and FMSY were calculated by using the Schaefer's and Fox's models. The biomass estimation was based on monthly data from bottom trawl surveys conducted in the study areas for one year, using the "swept area method". Fishing vessels were utilized in the survey. The catch composition per haul, dragging time, speed of the boat and the location of fishing tracks were recorded. Carapace

lengths were measured to estimate growth and mortality by using the ELEFAN method.

RESULTS AND DISCUSSIONS

Species Composition

A listing of the different species of shrimps in specific fishing areas the Philippines is given in Table 1. The species present in the specified areas are listed in order of their importance (in terms of weight). The specific fishing areas for shrimps are presented in Figure 1.

Annual Shrimp Catch

The yearly catch of marine shrimps/prawns for a 10-year period is shown in Figure 2. There was a decrease in the total shrimp catch from 1976 to 1978. This was due apparently to the trawl ban in some areas starting mid-1976. However, the fishery picked up from 1979 to 1982, when production was highest. This could be attributed to the increased catch of vessels less than three gross tons (municipal fishing gear) brought about by the limitation of commercial trawlers (over 3 GT) to fish in areas less than seven fathoms deep and seven kilometers from the shorelines. In 1983 - 1984, a decrease in the catch was noted. However, there was an increase by almost 10 metric tons in 1985.

Figure 2 also shows the annual marine shrimp production by fishing sector. The municipal catch is greater than the commercial catch. The bigger volume of the municipal catch compared with that of the commercial catch may be due to the depth of the fishing area. The 3-GT boats fish in the shallow areas where shrimps are abundant while those more than 3-GT fish in waters beyond the seven-kilometer limit and deeper than seven fathoms.

Hall (1962) stated that penaeids are relatively more abundant in waters less than 10 fathoms than in deeper waters. Also, the type of gear used by most commercial trawl boats is designed to catch fin fishes and shrimps which are only a by-catch. The municipal fishing boats are greater in number than the commercial fishing boats, although their numbers are not recorded. Some of the former's fishing nets are modified to catch shrimp specifically.

Baby trawls contributed a high percentage in the municipal shrimp catch. They are followed by push nets, gill nets, beach seines, and fish corrals. On the other hand, the trawl and the motorized push nets contributed largely to the shrimp catch of commercial fishing boats.

Fishing effort and annual catch of commercial shrimp fishery

The annual numbers of commercial trawlers are the only available data for the fishing effort. They were used to obtain some indications of the state of the marine shrimp resources. Figure 3 shows the annual fluctuation of the total shrimp catch, the shrimp trawl catch, the number of trawlers and the shrimp catch by the other gears.

The reduction in the shrimp catch in 1973 was apparently due to the energy crises which occurred during the year. But from then on a tremendous increase was observed, up to 1975, although the number of trawlers decreased. This may have been brought about by the further development of the gear in the modification of the board and the use of new materials like polyethylene, aside from the intensive information dissemination and the technical assistance rendered by the gear technologist of the Bureau (Macatangay, pers comm.). Also, it may be due to some environmental factors which triggered the increased production or to more extensive fishing.

From 1976 to 1981, there was a sharp decline in production. This may be due to the start of the trawl ban in some areas in 1976. This was followed by a total ban throughout the country. Hence, commercial fishing boats were not able to operate in shallow areas where the shrimps are abundant.

The reported low catch of marine shrimps by trawl in the late 1940's up to the early 50's may be due to the fact that trawl fishing was then only experimental and still in its development stage. It was only in 1965 when the reported shrimp catch showed a steady rise as the technology advanced and more fishing units entered the trawl fishery.

In the reported catches, underestimation of landing is suspected because operators usually do not give the right data on the volume of the catch. This is due to fear of paying higher taxes, as they are taxed based on the value of the catch. In addition, there are numerous landing sites which make the completion of data difficult. It is also difficult to estimate the weight as several types of containers are being used.

Maximum sustainable yield

The relationship between fishing effort and its associated catch rate was used to calculate the MSY and FMSY of the shrimp resources in the Philippines.

Based on the 1957 to 1985 catch and effort data, maximum sustainable yields of 9,366 and 7,527 tons were calculated by using the Schaefer's and Fox's models, respectively, as shown in Figure 4. These yields require average efforts of 989 and 810 trawlers fishing year round.

The catch and effort data are all confined on the left-hand side of the yield curves. This suggests that the shrimp fishery is not fully exploited by the commercial trawlers, possibly because the shrimps are only a by-catch. From 1980 to 1984, the total trawl shrimp production represented a small percentage from 1.72% to 3.61% in the total shrimp production.

Density, monthly distribution and abundance

MANILA BAY - The Cavite-Parañaque portion of the bay, with an approximate area of 108 km2, was surveyed from January to December 1982. A medium trawler (commercial) was used.

Figure 5 shows that in the Cavite-Parañaque portion of Manila Bay, the peak occurred in March, with a density of 589.19 kg/km2, and a smaller peak occurred in September. Lower density of shrimp occurred in June.

The dominant species are *Metapenaeus ensis* and *Penaeus indicus/ merguiensis* (white shrimps). The peak month for *M. ensis* was March, with a density of 478.40 kg/km2, while that for white shrimps was from October to November, with a density from 100 to 112.95 kg/km2. The densities of other species are given in Table 2.

TAYABAS BAY - The northern and eastern parts, with an aggregate area of some 504 km2, were surveyed from February to December 1983.

In these areas, the shrimp season occurred from December to April, with the peak in February (37.54 kg/km2). The dominant species were *M ensis, P. semisulcatus* and *T. fulvus* (Figure 5). The peak month for *M. ensis* and *P. semisulcatus* was April, with a density of 19.01 kg/km2 and 7.49 kg/km2, respectively; and for *T. fulvus*, June, with a density of 5.73 kg/km2. The densities for the other species are given in Table 2.

LINGAYEN GULF - The eastern and southern parts were surveyed from January to December 1984, with an approximate aggregate area of 1,413 km2.

The season for shrimps was from December to June. The peak months were March, with a value of 28.29 kg/km2, and December, 23.03 kg/km2 (Figure 5). The dominant species are *P. semisulcatus, M. ensis* and *T. fulvus*. The peak month for *P. semisulcatus* was May, with a density of 11.99 kg/km2, and for *M. ensis*, June and December, with values of 6.93 kg/km2 and 6.30 kg/km2, respectively. *T. fulvus* appeared to have three peak months, March, June and November, with densities ranging from 4.39 to 4.85 kg/km2. Densities for other species are shown in Table 2c.

SORSOGON BAY - The entire bay, with an approximate area of 102 km^2, was surveyed from January to December 1985. There was a "mini trawl" fishery (in spite of the trawl ban), whose total shrimp catch was from 45% to 90%.

The peak season for shrimps occurred from August to December, with densities ranging from 796.56 to 2,128.52 kg/km^2. The peak month is December (Figure 5). The dominant species are *M. dalli*, with peak months from September to December and densities ranging from 436.57 to 1,227.49 kg/km2); *T. fulvus*, having the biggest catch from August to December, with the maximum in December; and *M. ensis,* whose season occurred from October to December, with a maximum in November at 87.06 kg/km^2 (Table 2d).

P. monodon spawners were observed to occur year round in Magallanes waters, with peak in May.

Growth, mortality and recruitment

A. *Metapenaeus dalli* - Sorsogon Bay, 1985.

From the length frequency data of 519 females, a growth curve was estimated as shown in Figure 6a. The calculated Loo and K values of 43 mm and 1.05, respectively. Figure 6b shows the length converted each curve of the shrimps having a mortality of 3.117 and fishing mortality of 3.447. The fraction of deaths caused by fishing F/Z or exploitation rate (E) is 0.525, which may indicate that the species in the area is slightly exploited. The probability of capture at 50% occurred at Lc= 17.924 (Figure 6c). The recruitment pattern shown in Figure 6d suggests one recruitment per year. The major peak is September with a minor peak observed in April. The two peaks coincide with the observed gonadal condition in April and September indicating that about 10% of the sampled individuals were already spent or have spawned.

B. *Metapenaeus ensis* - Manila Bay, 1982

The growth curve from the length frequency data of 3,728 females was estimated as shown in Figure 7a. The Loo and K values of this particular species were estimated at 54 mm and 0.59, respectively. In the length converted catch curve in Figure 7b, the calculated natural mortality was 2.05, while fishing mortality was 1.556. The exploitation rate (E) was 0.436. This suggests that this species is not fully exploited in the area. It could be noted that the natural mortality is higher than the fishing mortality, which could be attributed to the ecological disturbances like unfavorable water quality caused by oil pollution coming from shrimps, sewage from the Pasig River, the draining of fishponds with pesticides,

siltation and destruction of nursery areas caused by the reclamation project in the bay thus destroying the ecological balance. Figure 7c shows that the length at which 50% was retained by the gear (Lc) is 25.901 mm .

C. *Penaeus indicus* - Manila Bay, 1982

From the length frequency data of 1,937 females, the calculated Loo was 41.5 mm and the K value was 1.0. The natural mortality had a value of 1.94 while fishing mortality was 2.40. The exploitation rate was estimated at 0.55. This suggests that the species was slightly exploited.

Other Observations

As observed by the researchers and from data gathered through enough interviews, "mini" trawlers (16 HP) in Sorsogon Bay operate day and night within the bay. Some were apprehended, but after paying a fine, the fishermen were set free. They went back to the trawl again, as their means of livelihood is trawling.

In connection with the trawl controversy, a dialogue between government officials and fishermen of Cambulaga, Sorsogon, was arranged. We gave some suggestions on how to solve this controversy without seriously affecting the livelihood of the fishermen and the resources of the bay. We proposed the following: establishment of oyster/mussel plots along shallow areas, establishment and observance of a closed season, and limited entry.

The proposed closed season for "mini" trawl operation in Sorsogon Bay is from February to June. During these months, the catch rates are lower, compared to catch rates of other months, and the shrimps are observed to be mostly in their immature stage and of smaller sizes, making the operation of "mini" trawl during this period unprofitable.

There is also the problem of law enforcement. Dynamite fishing still occurs in the four survey areas. Commercial fishing boats operate within a seven kilometer distance from the shoreline and the seven fathoms ban in Lingayen Gulf, Tayabas Bay and Manila Bay.

The over-all study results will serve as basis for the promulgation of rules and regulations relevant to the area, which are aimed to achieve social goals like food production, employment generation, and increased income for fishermen while maintaining the stock for sustainable production. All of these will ultimately improve the living standard of our fishermen, especially the artisanal or "survival" fishermen.

CONCLUSION AND RECOMMENDATIONS

Four genera of shrimps comprise the economic basis of the shrimp fishery in the study areas. These are *Penaeus, Metapenaeus, Trachypenaeus and Acetes.*

Based on the catch and effort curves obtained by using the Schaefer's and Fox's models, results suggest that the shrimp resources are not fully exploited by the commercial trawlers. Shrimps are only their by-catch.

The municipal shrimp catch is greater than the commercial catch because municipal fishermen fish in shallow areas where shrimps abound, there are many fishing units in the area and some of their nets are designed specifically to catch shrimp (see annual shrimp catch in Figure 2).

Biomass estimation shows that Sorsogon Bay had the highest density of shrimps (2,129 kg/km2) in December; Manila Bay (589 kg/km2), in March; Tayabas Bay (37.57 kg/km2), in February; and Lingayen Gulf (28.29 kg/km2), in March. It seems that these areas are productive in shrimps during the northeast monsoon.

The exploitation rate of *Metapenaeus dalli* in Sorsogon Bay is 0.525; while in Manila Bay, the exploitation rate of *Metapenaeus ensis* and *Penaeus indicus* are 0.436 and 0.55, respectively. Results indicate that *M. dalli* and *P. indicus* are slightly exploited, while *M. ensis* is underexploited.

Shrimp, a short-lived species, is the most important resource of Sorsogon Bay. Total banning of "mini" trawl (the only gear efficient in catching shrimp) would only deprive the sustenance fishermen of their means of livelihood and lead to high natural mortality.

Based on results gathered and observations made in Sorsogon Bay, we recommend that a seasonal trawling ban, or closed season, from February to June each year be established for "mini" trawl as it is the only measure that the fishermen are willing to accept and employ.

In managing a fishery, one needs also to take account of the effect of human activities aside from fishing.

Controls on the fishery are nothing if there is destruction of mangroves and other changes in the marine environment due to pollution from fishponds using pesticides. Therefore, mangroves which serve as the nursery ground of invertebrates and fishes must be protected and pollution must be prevented to ensure an increase in the recruitment and catches of these resources.

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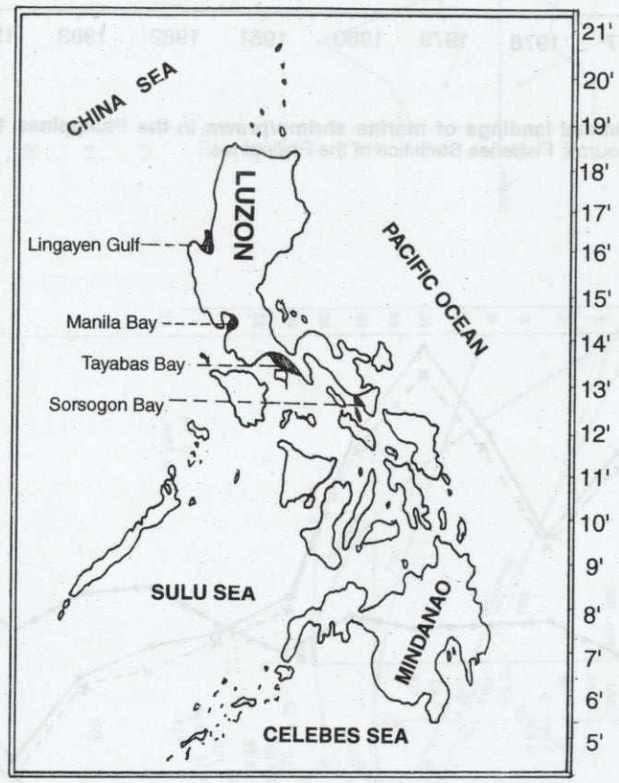


Figure 1. **Map of the Philippines showing the four fishing areas where biomass estimation from bottom Trawl survey was conducted from 1982-1985**

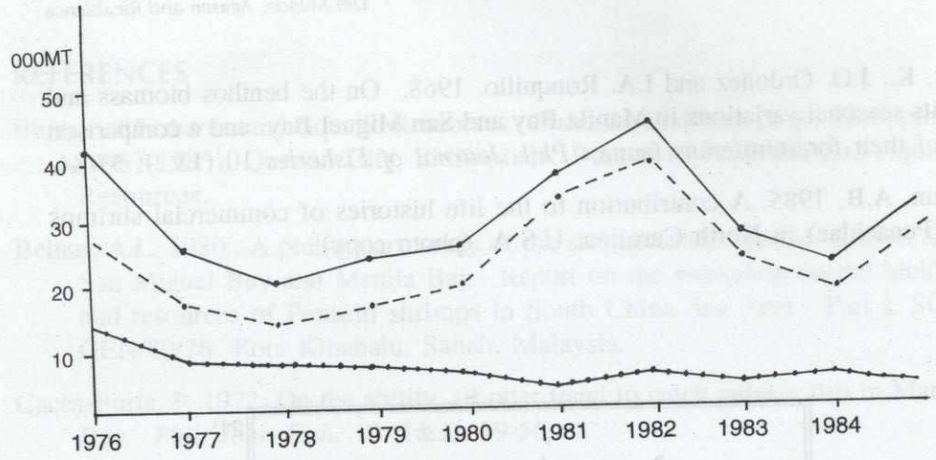


Figure 2. **Annual landings of marine shrimp/prawn in the Philippines 1976-1985.**
Source: Fisheries Statistics of the Philippines

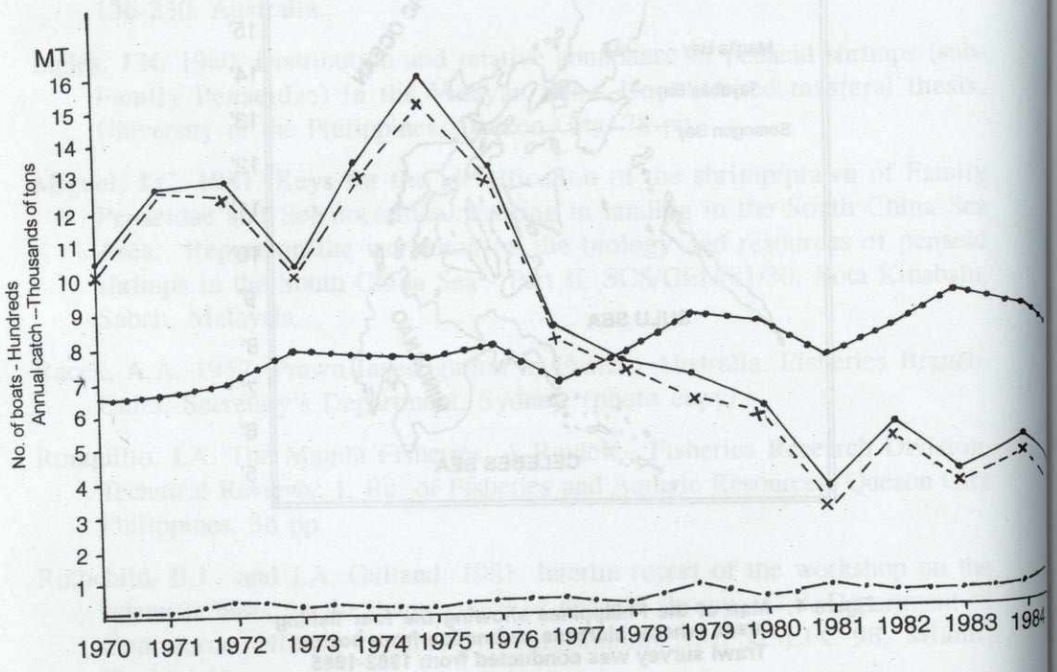


Figure 3. **Catch and effort in the commercial shrimp fishery in the Philippines. 1970-1985.**
Data source: Fisheries Statistics of the Philippines

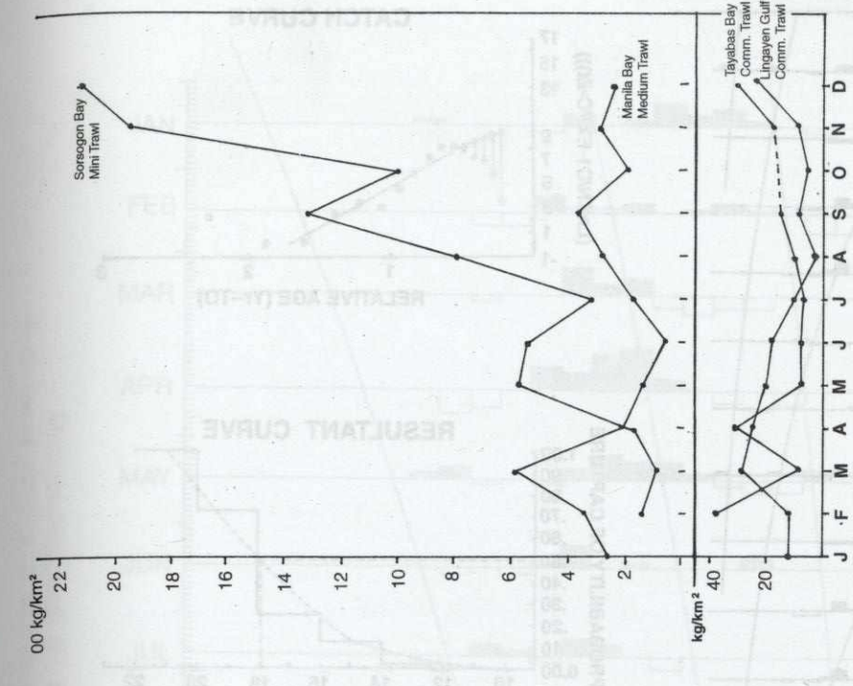


Figure 5. **Seasonal distribution and abundabce of penaeids in the 4 fishing areas.**

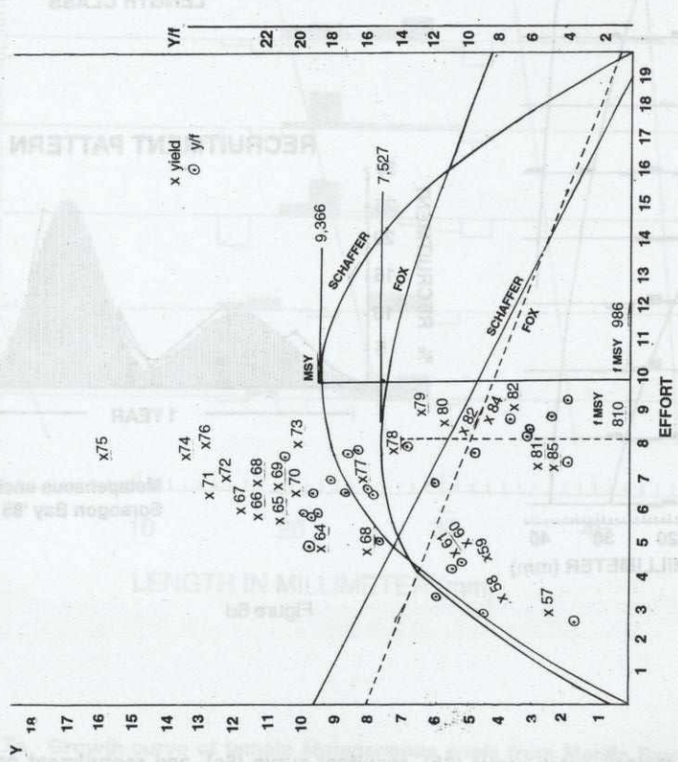


Figure 4. **The relationship of yield and effort, and catch per unit effort and effort of shrimp production in the Philippines from 1957-1985.**

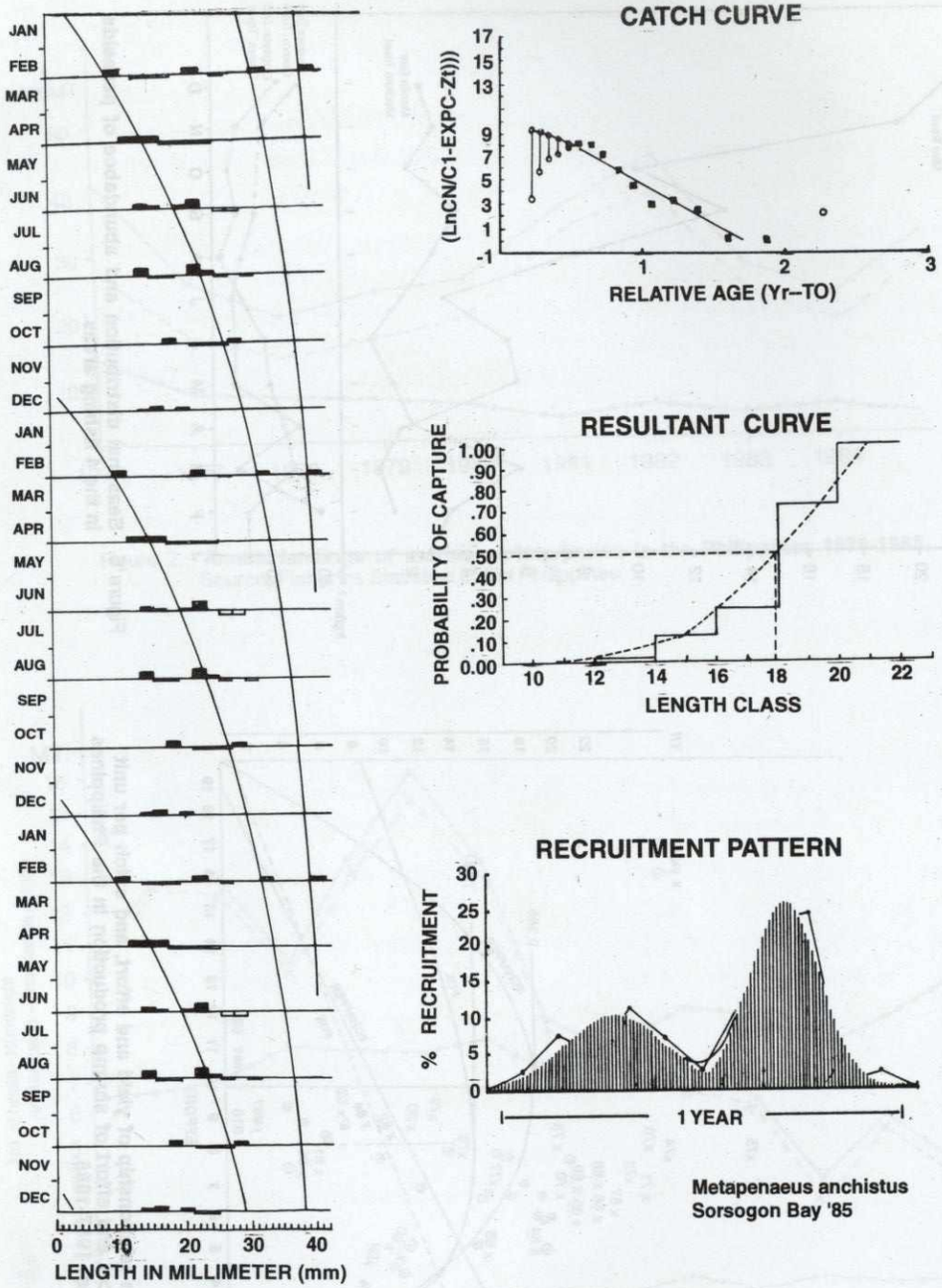
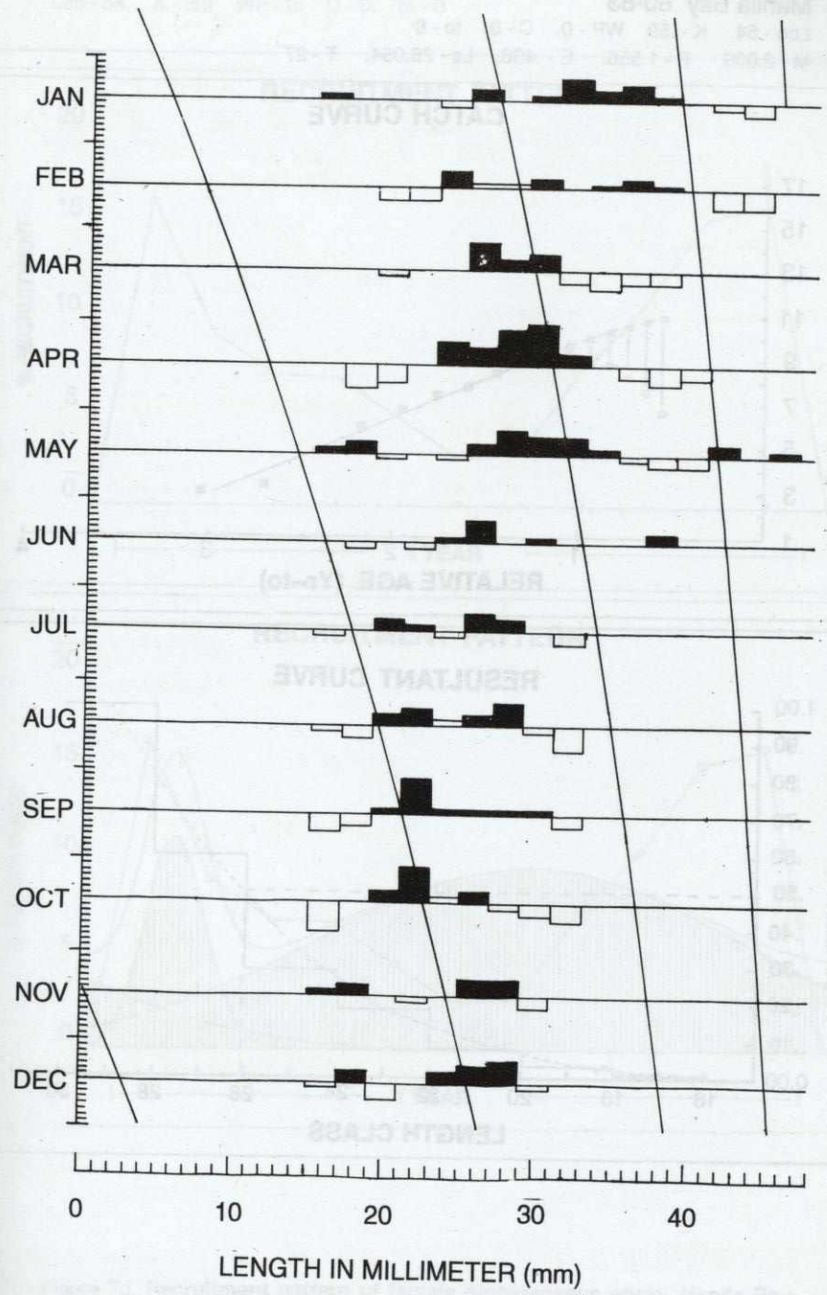


Figure 6a

Figure 6d

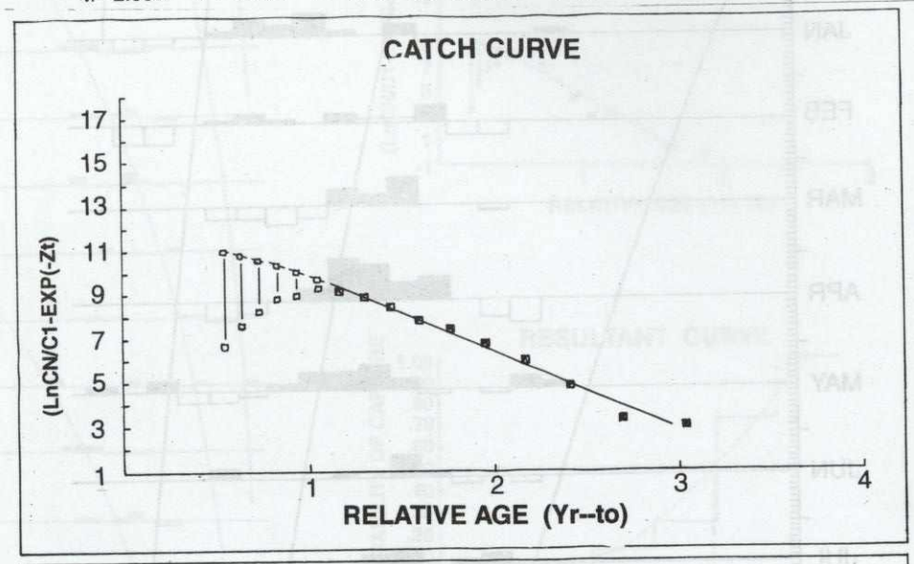
Figure 6. **Growth (6a), catch curve (6b), resultant curve (6c), and recruitment pattern (6d) of female *Metapenaeus dalli* from Sorsogon Bay.**



Metapenaeusensis (F) Manila Bay 80-83
K- .59 Loo- 54 WP- O C- O SP- 1 -39 ESP-5.609 ASP- 11.802 R-.475

Figure 7a. **Growth curve of female *Metapenaeus ensis* from Manila Bay**

Metapenaeus ensis (F)
Manila Bay 80-83
Loo - 54. K - .59 WP - 0. C - 0. to - 0
M - 2.006. F - 1.556. E - .436. Lc - 26.054. T - 27



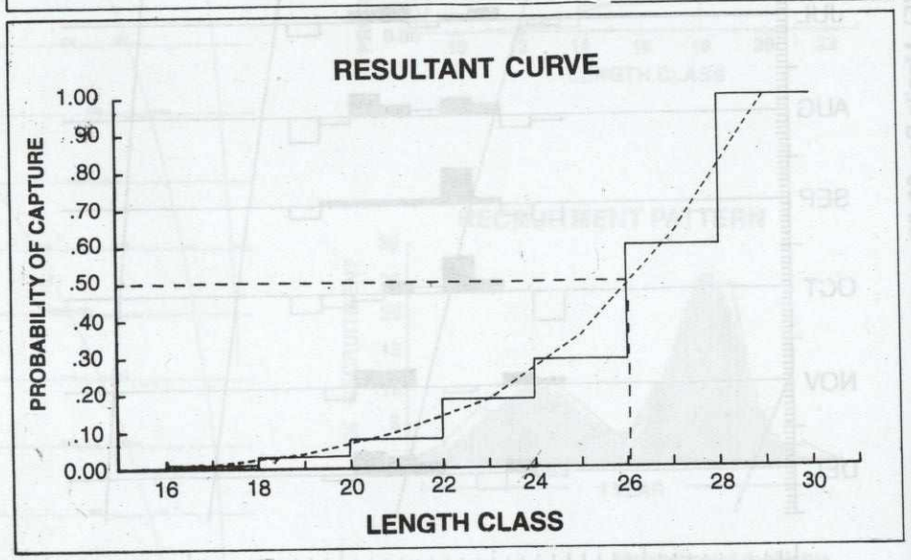
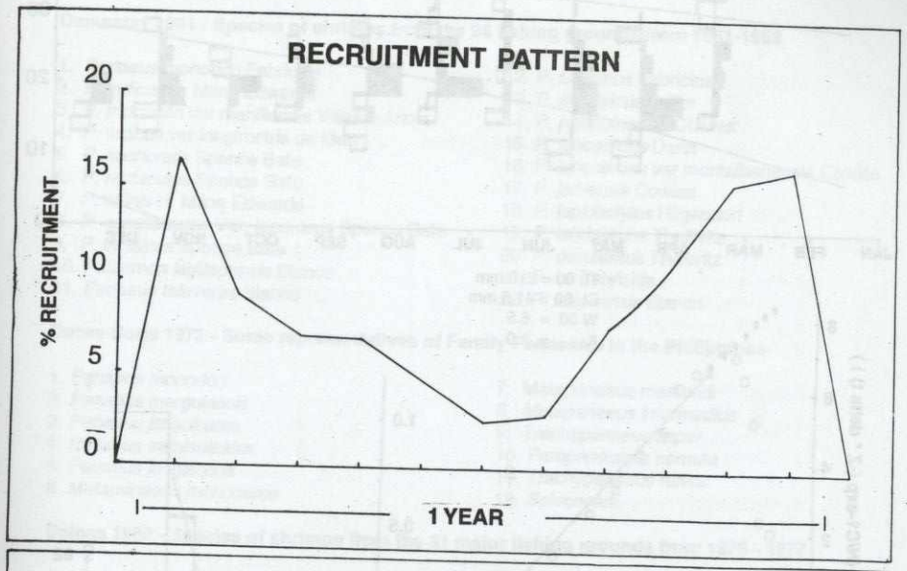


Figure 7b and 7c. **Catch curve and resultant curve of female *Metapenaeus ensis***

Metapenaeus ensis (F)
Manila Bay 80-83
Loo - 54. K - .59 WP - 0. C - 0. to - 0



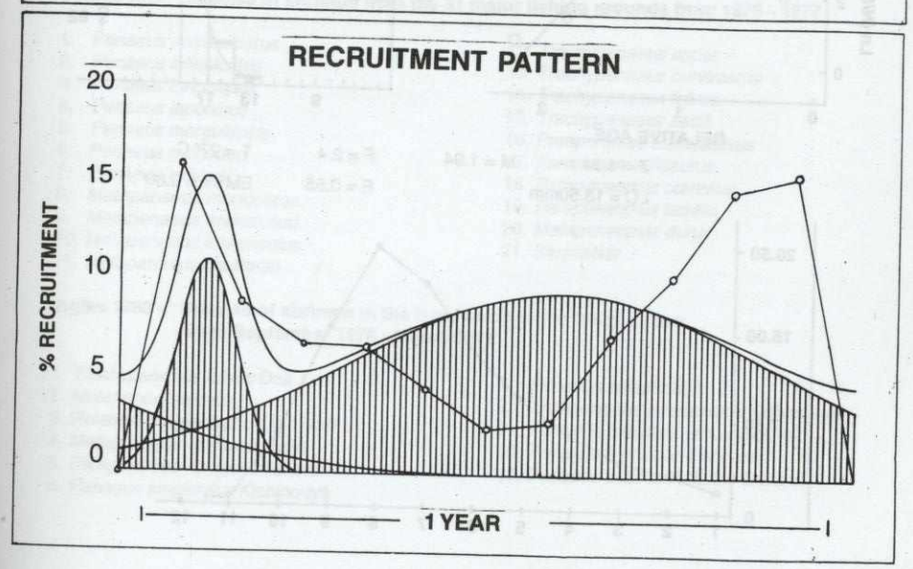


Figure 7d. **Recruitment pattern of female *Metapenaeus ensis*- Manila Bay**

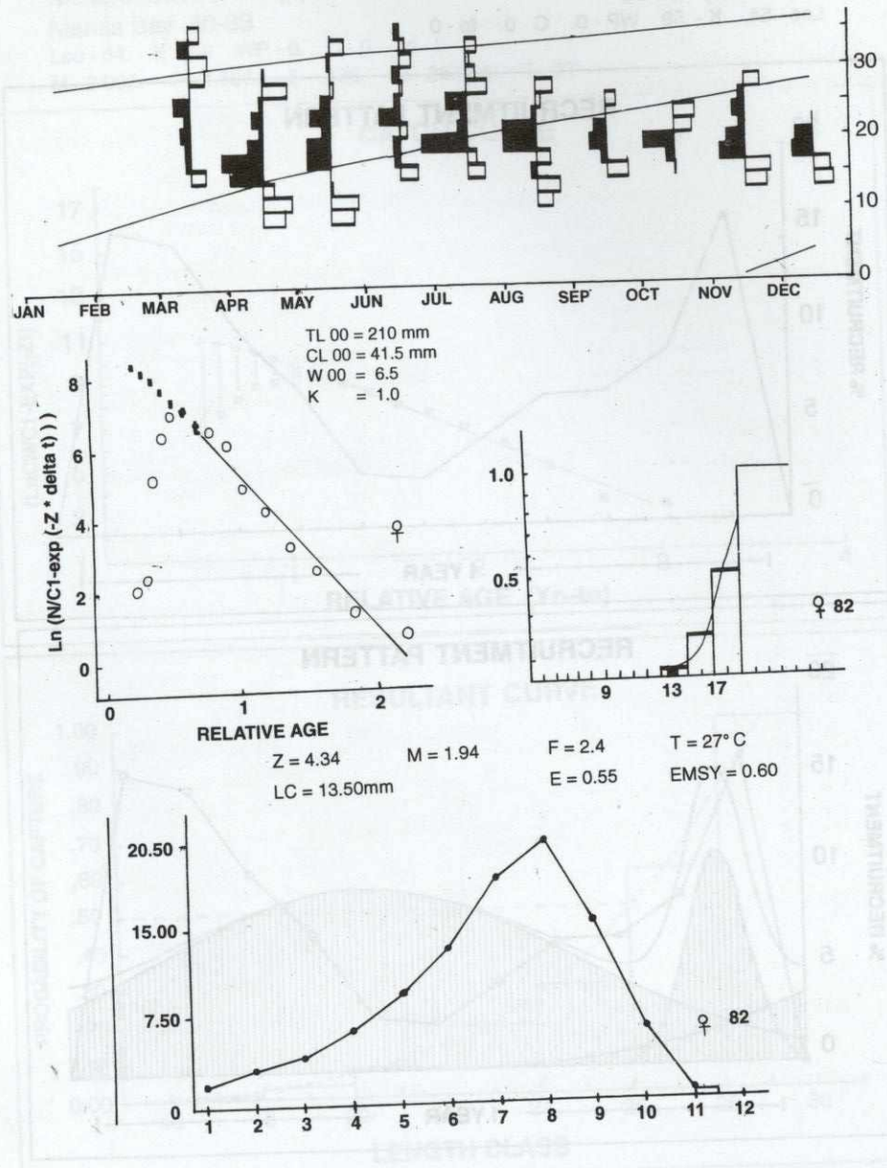


Figure 8. **Growth curve, resultant and catch curve, and recruitment pattern of *Penaeus Indicus* (white shrimp) in Manila Bay- Bataan/Bulacan area.**

Table 1. Species of Shrimps in the Philippines

Domantay 1961 - Species of shrimps from the 24 fishing grounds from 1951-1953

1. *Penaeus monodon* Fabricius
2. *P. indicus* H. Milne Edwards
3. *P. monodon* var manillensis Villalus-Ariola
4. *P. indicus* var longirostris de Man
5. *P. anchoralis* Spence Bate
6. *P. rectacutus* Spence Bate
7. *P. affinis* H. Milne Edwards
8. *P. canaliculatus* Var. japonicus Spence Bate
9. *P. incisipes* Spence Bate
10. *Palaemon lagdaoensis* Blanco
11. *Penaeus talaverae* Blanco
12. *P. Carcinus* Fabricius
13. *P. sundaicus* Heller
14. *P. philippinensis* Cowles
15. *P. lanceifrons* Dana
16. *P. lanceifrons* var montalbanensis Cowles
17. *P. jarvensis* Cowles
18. *P. lepidactylus* Hilgendorf
19. *P. latidactylus* Thallivitz
20. *P. esculentus* Thallivitz
21. *P. lar* Fabricius
22. *P. luzonensis* Blanco

Caces-Borja 1972 - Some representatives of Family *Penaeidae* in the Philippines

1. *Penaeus monodon*
2. *Penaeus merguiensis*
3. *Penaeus latisulcatus*
4. *Penaeus semisulcatus*
5. *Penaeus longistylus*
6. *Metapenaeus monoceros*
7. Metapenaeus mastersii
8. *Metapenaeus intermedius*
9. *Trachypenaeus asper*
10. *Parapeneopsis cornuta*
11. *Trachypenaeus fulvus*
12. *Solenocera*

Belnas 1980 - Species of shrimps from the 31 major fishing grounds from 1975 - 1977

1. *Penaeus semisulcatus*
2. *Penaeus latisulcatus*
3. *Penaeus longistylus*
4. *Penaeus japonicus*
5. *Penaeus merguiensis*
6. *Penaeus monodon*
7. *Penaeus indicus*
8. *Metapenaeus monoceros*
9. *Metapenaeus endeavouri*
10. *Metapenaeus intermedius*
11. *Metapenaeus mastersii*
12. *Trachypenaeus asper*
13. *Trachypenaeus curvirostris*
14. *Trachypenaeus fulvus*
15. *Trachypenaeus sedili*
16. *Parapenaeus australiensis*
17. *Parapenaeus fissurus*
18. *Parapeneopsis cornutus*
19. *Parapeneopsis tenella*
20. *Metapeneopsis durus*
21. *Sergestids*

Ingles 1980 - Species of shrimps in the trawl catch in the Visayan Sea from September 1976 - March 1977

1. *Trachypenaeus fulvus* Dall
2. *Metapenaeopsis* sp.
3. *Penaeus semisulcatus* De Haan
4. *Metapenaeus ensis* de Haan
5. *Parapenaeus longipes* Alcock
6. *Penaeus longistylus* Kishinouye
7. *Penaeus teraoi* Kubo
8. *Metapenaeus intermedius* Kishinouye
9. *Penaeus latisulcatus* Kishinouye
10. *Penaeus monodon* Fabricius
11. *Penaeus indicus* H. Milne Edwards

(Continued ...)

Table 1 continued...

Del Mundo 1982 - 1985 - Species of shrimps in order of importance by weight

A. Manila Bay January - December 1982

Manila-Paranaque-Cavite portion:

1. *Metapenaeus ensis* (De Man)
2. *Penaeus merguiensis* De Man
3. *Penaeus indicus* H. Milne Edwards
4. *Trachypenaeus fulvus* Dall
5. *Penaeus semisulcatus* De Haan
6. *Penaeus monodon* Fabricius
7. *Penaeus monodon* Fabricius
8. *Metapenaeus palmensis* (Haswell)
9. *Alpheus*

Bataan-Bulacan portion:

1. *Penaeus indicus* H. Milne Edwards
2. *Penaeus merguiensis* de Man
3. *Acetes*
4. *Metapenaeus ensis* (De Man)
5. *Penaeus monodon* Fabricius
6. *Penaeus semisulcatus* De Haan
7. *Metapenaeus mastersii* (Haswell)

B. Tayabas Bay January - December 1983

1. *Metapenaeus ensis* (De Man)
2. *Penaeus semisulcatus* de Haan
3. *Trachypenaeus fulvus* Dall
4. *Parapeneopsis tenella* (Bate)
5. *Parapeneopsis maxillipedo* Alcock
6. *Penaeus penecillatus* Alcock
7. *Penaeus latisucatus* Kishinouye
8. *Penaeus japonicus* Bate
9. *Trachypenaeus sediii* Hall
10. *Metapenaeus palmensis* (Haswell)
11. *Parapeneopsis venusta* de Man
12. *Penaeus monodon* Fabricius
13. *Penaeus indicus* H. Milne Edwards
14. *Metapenaeus mastersii* (Haswell)
15. *Metapenaeus dobsinii* (Miers)
16. *Parapeneopsis maxillipedo* Alcock
17. *Palaemon* sp.
18. *Solenocera*
19. *Acetes*
20. *Heteropenaeus longimanus* de Man
21. *Alpheus*

C. Lingayen Gulf January - December 1984

1. *Penaeus semisulcatus* de Haan
2. *Metapenaeus ensis* (De Man)
3. *Trachypenaeus fulvus* Dall
4. *...Parapeneopsis tenella* (Bate)
5. *Solenocera*
6. *Penaeus monodon* Fabricius
7. *Penaeus indicus* H. Milne Edwards
8. *Penaeus merguiensis* Kishinouye
9. *Penaeus latisucatus* Kishinouye
10. *Penaeus japonicus* Bate
11. *Parapeneopsis venusta* de Man
12. *Parapeneopsis maxillipedo* Alcock
13. *Metapenaeopsis palmensis* (Haswell)
14. *Penaeus penicillatus* Alcock
15. *Metapenaeus dobsonii* (Miers)
16. *Metapenaeus mastersii* (Haswell)
17. *Acetes*
18. *Alpheus*

D. Sorsogon Bay 1985 - 1986

1. *Metapenaeus dalli* (Racek)
2. *Trachypenaeus fulvus* Dall
3. *Metapenaeus ensis* (De Man)
4. *Penaeus merguiensis* de Man
5. *Penaeus monodon* Fabricius
6. *Penaeus semisulcatus* Kishinouye
7. *Penaeus japonicus* Bate
8. *Penaeus indicus* H. Milne Edwards
9. *Pɜnaeus semisulcatus* de Haan
10. *Metapenaeopsis palmensis* (Haswell)
11. *P. longistylus* Kishinouye
12. *Metapenaeus mastersii* (Haswell)
13. *Acetes*
14. *Alpheus*

Table 2a. **Stock densities (kg/km^2) of shrimps in the Cavite-Paranaque area of Manila Bay from January to December 1982 using the "swept area method."**

Month	Shrimp	*M. ensis*	*P. indicus/ merguiensis*	*P. semisulcatus*	*P. monodon*	*T. fulvus*	*Alpheus*
January	250.33	207.91	40.29	0.72	-	1.44	0.72
February	330.20	224.45	35.25	8.63	1.44	61.15	-
March	589.19	478.40	72.66	17.27	1.44	19.42	-
April	215.10	157.55	28.06	12.23	1.44	15.83	-
May	137.41	69.78	45.32	12.95	0.72	8.63	-
June	52.52	17.99	20.86	5.76	2.16	5.76	-
July	176.97	87.77	82.73	-	-	6.47	-
August	283.44	275.10	58.27	5.04	0.72	4.32	-
September	373.37	262.58	97.12	5.76	3.60	3.60	0.72
October	194.09	68.34	100.00	1.44	2.16	1.44	0.72
November	299.27	183.45	112.95	1.44	-	1.44	-
December	248.91	189.92	34.53	11.51	2.88	10.02	-

Table 2b. **Stock densities (kg/km^2) of shrimps in the north and eastern part of Tayabas Bay from February to December 1983 using the "swept area method".**

Month	Shrimps	*P. semisulcatus*	*M. ensis*	*T. fulvus*	*P. monodon*	*Parapeneopsis sp.*	*P. indicus/ merguiensis*	*P. latisulcatus*
January		N O	S U R V E Y					
February	37.54	7.39	6.18	1.58	0.36	22.06	-	-
March	8.36	2.70	4.58	0.54	0.27	-	-	0.27
April	30.53	7.49	19.01	1.54	1.15	1.34	-	-
May	7.54	2.51	2.87	1.80	0.36	-	-	-
June	8.15	0.60	1.81	5.73	-	-	-	-
July	7.24	1.81	1.51	3.02	0.91	-	-	-
August	10.86	-	1.21	1.81	-	-	7.24	-
September	15.68	1.51	9.36	1.21	-	-	3.62	-
October		N O	S U R V E Y					
November	17.64	0.93	9.28	1.86	3.71	-	2.17	-
December	29.70	0.93	12.69	3.09	2.17	-	10.52	-

Table 2c. **Stock densities (kg/km^2) of shrimps in the eastern and southern part of Lingayen Gulf from January to December 1984 using the "swept area method".**

Month	Shrimps	*P. semisulcatus*	*M. ensis*	*T. fulvus*	*P. tenella*	*P. monodon*	*P. indicus/ merguiensis*	*P. latisulcatus*	*Solenocera*
January	12.87	7.17	3.59	2.11	-	-	-	-	-
February	12.45	4.64	2.85	1.05	2.11	0.42	0.42	-	0.63
March	28.29	2.11	2.95	4.85	16.88	-	-	-	1.48
April	24.90	0.42	0.84	1.69	17.93	-	-	-	4.00
May	19.45	11.99	5.43	1.81	-	0.23	-	-	-
June	17.79	3.93	6.93	4.93	-	0.92	-	1.39	-
July	9.73	2.94	5.43	1.13	0.23	-	-	-	-
August	3.94	0.98	1.57	1.38	-	-	-	-	-
September	8.46	0.79	2.95	0.39	3.94	0.20	-	-	0.39
October	5.74	3.54	0.84	0.84	-	-	0.34	-	-
November	9.45	1.52	1.86	4.39	-	1.01	0.84	-	-
December	23.03	5.71	6.30	2.36	7.08	1.77	-	-	-

Table 2d. **Stock densities (kg/km^2) of shrimps in Sorsogon Bay from January to December 1985 using the "swept area method".**

Months	Shrimps	*M. dalli*	*T. fulvus*	*M. ensis*	*P. merguiensis*	*P. semisulcatus*	*P. monodon*	*P. palmensis*	*P. japonicus*	*P. latisulcatus*	*Alpheus*
January											
February	123.35	41.12	69.15	-	-	-	-	13.08	-	-	1.87
March	82.53	-	56,07	9.24		-	-	3.74	-	-	-
April	160.73	102.79	56.07	-		-	-	1.87	-	-	1.87
May	576.73	451.59	76.17	16.32		-	-	27.20	-	-	5.44
June	548.45	435.28	-	21.76		17.41	-	-	-	-	56.59
July	317.76	226.75	91.41	-		-	-	-	-	-	-
August	785.56	187.17	435.25	8.71	-	165.41	-	-	-	-	-
September	1327.60	1070.79	187.17	4.35	-	4.35	-	60.94	4.35	-	-
October	996.79	426.57	452.69	78.35	8.71	26.12	13.06	-	-	-	-
November	1954.41	1227.49	87.28	87.06	21.76	-	17.41	161.05	-	-	-
December	2128.52	1018.56	914.09	52.23	-	47.88	17.41	-	2.61	-	74.00
1986											
January	291.64	152.53	78.35	-	30.47	-	-	30.47	-	-	-
February	379.38	159.89	66.81	-	-	0.48	-	152.71	-	-	-