

**CHAPTER 4****4. Materials And Methods****4.1 Fishing Gear : Bagnet**

The bagnet is a passive gear, which is left in position for some time and does not require movement to capture fish and prawns (Fig. 3). The bagnet samples adequately fishes and prawns in the water column. Large numbers of juvenile fishes were captured using the bagnet. This is related to the small mesh sizes of the bagnets. The bagnet has a sagging bag at its cod end. This bag prevents the catch from spilling out. The opening of the bagnet faces the creek mouth. All the specimens will be captured in the bag at the cod end when the water has receded.

The three creeks were sampled using two bagnets with similar mesh sizes. Site I was sampled with a bagnet with a stretched mesh size 1.4 cm with dimensions 24 m width by 15 m length by 5 m depth. Sites II and III were sampled with bagnet with dimensions 24 m width by 80 m length by 5 m depth with a stretched mesh size of 1.4 cm.

**4.2 Field Methods**

Sampling at Site I was done from September 1992 until

September 1993. Site II was only sampled 3 times, i.e on 2 and 29 September and 28 October in 1992. Sampling at Site III was carried out monthly from November 1992 until September 1993. Tide levels on days of sampling were noted.

Bagnets were set during low tide hours. The bottom of the bagnet was anchored into the soft substratum of the creek with wood pegs. The creek's banks are quite high (almost 2 m in height). The lateral strings of the bagnet were anchored to trees on the creek banks (Fig. 3). The top of the sagging bag was tied with a float to lift it up in the water. The bagnet was set to face the outflow current from the creek. At maximum height of high tide, when the water was about to recede, the topline of the net was raised and tied securely to mangrove trees on the banks of the creek. All the specimens in the bagnet were collected when the water had completely receded.

#### **4.3 Treatment Of Catches**

Samples were then immediately packed into an icebox in the field before being stored in a deep freeze in the laboratory. Besides fish and prawns, mangrove detritus were also found inside the bagnet. The detritus were packed into plastic bags for determination of its wet weight in the laboratory.

Normally the entire sample was taken for analysis. Sub-samples were only taken when the number of specimens were too large. The area of the mangrove floor inundated during high tide was determined by multiplying the creek's length with its average width. All the measurements were done using a meter tape.

#### **4.4 Abundance**

Samples were divided into fish and prawns. Fish specimens were identified with the aid of the following references: Fischer and Whitehead (1971), Munro (1955), Scott (1959) and Weber (1911-1963) . Whereas prawns specimens were identified using the keys from Lovett (1981).

All the specimens were identified to genera and species. The wet weight, standard length, total length, body depth, sex and maturity stages of each captured fish was recorded. Wet weight was measured after the excess water was removed by blotting with filter paper. An analytical balance (model EK - 1200A) was used for measuring the weights to the nearest one tenth of the gram.

Total length of fish was taken from the pre - maxilla to the end of the caudal fin. Standard length was measured

from pre - maxilla to the beginning of caudal fin. Measurement for the body depth was taken at the middle of dorsal fish body. Total lengths, standard lengths and body depths were measured to the nearest one tenth of the centimeter by using a calliper. From the data obtained, the abundance is calculated in terms of:

- (1) total wet weight,
- (2) total wet weight over the inundated area ( $\text{g}/\text{m}^2$ ) and
- (3) number of specimens and species at each site.

#### **4.5 The Total Wet Weight Of Catches In Bagnet Against Tidal Heights**

Sampling was carried out at various high tide levels. Total catch in term of wet weight (g) was compared to the tide level. This is to test the hypothesis that a higher biomass of fish and prawns ingress into creeks during maximum high tides than tides of lower heights. The regression between wet weights against tide levels was calculated for samples at Sites I and III (Site II had only three samples).

#### **4.6 Estimation Of Species Diversity And Similarity**

A number of ecological indices were used to describe

the structure of the community and also to enable comparisons to be made between the study sites. These were Margalef's index ( $D$ ) for species richness (Margalef, 1968), Shannon - Wiener's index ( $H'$ ) of heterogeneity or diversity (Shannon and Weaver, 1963), Pielou's index ( $J'$ ) for evenness (Pielou, 1969) and Schoener's index ( $D$ ) for evenness between sites (Schoener, 1968).

The species richness element of diversity was expressed by,

$$D = (S-1)/\log N$$

where  $S$  is the number of species and  $N$  is total number of individuals.

Species diversity was calculated using Shannon-Wiener's index ( $H'$ ),

$$H' = -\sum_{i=1}^s p_i \log p_i$$

where  $s$  is the number of species, and  $p_i$  is the proportion of the total number of individuals consisting of the  $i$ th species.

The evenness component of diversity was calculated using Pielou's index,

$$J' = H' / H' \text{ maximum.}$$

The maximum value of  $H'$  is  $\log s$ , where  $s$  is the number of

species.

For the analysis of species similarity between sites, the results was tested using Schoener's index,

$$D = 1 - \frac{1}{2} \sum_{i=1}^s |P_{in} - P_{jn}|$$

where  $s$  is the number of species,  $P_{in}$  and  $P_{jn}$  are the proportion of species from the total number of individuals at site  $i$  and  $j$ .

#### 4.7 Population Structure

Samples of fish were taken for further analysis. The fish specimens were then dissected. Sex and stages of maturity were determined following the maturity key of Kesteven (1960). The key is based on the microscope examination of the testes or ovary. There are seven stages of maturity for the female. Stage 1 is immature virgin, stage II is developing virgin, stage III is maturing, stage IV is matured, stage V is gravid, stage VI is spawning and stage VII is spent. For males, there are six stages. The first five stages are same as in female whereas stage VI is the spent stage.

Analysis of prawn samples were also taken. Each specimen was weighed wet after blotting the excess water using filter paper. This measurement was taken using an analytical balance (model EK - 1200A) and read to the nearest one tenth of gram. Carapace length, sex and maturity stage was then recorded. Carapace length was taken from the tip of the rostrum to the posterior end of the <sup>carapace</sup> on the dorsal site of the prawns. The measurement was taken with a calliper to the nearest one tenth of centimeter.

Sex and maturity stages were determined based on the colour and size of the ovary or the development of the petasma and terminal ampoule/spermatophore

There are four stages for male and female namely as; stage I for immature, stage II for maturing, stage III for mature and stage IV for spent (see Appendix 1)

The sex-ratios and percentages of males and females for fish and prawns species were determined. The sex-ratio of each sample was calculated using the total number of the male and female species examined.

#### **4.8 Length Frequency Distribution**

The standard length of fish specimens were classified into length-classes at 0.15 cm intervals. For prawn

specimens the carapace length at 0.15 cm intervals were used. The frequency of size classes for both fish and prawns species were converted into percentages. On the basis of each length-class data, the length-frequency histograms were drawn. This data will show the major size classes and the dominant size groups for each site. This chart will also show if there are any differences between the sites in terms of the size of individuals in the population.

#### 4.9 Food and feeding ecology

##### 4.9.1 Composition of the diet of fish

About fifteen to thirty specimens of the dominant fish species were examined for their gut contents. Dominant species is classified as species that can be found in every sample. Specimens were dissected and the gut taken out and preserved in 10% alcohol. The standard length of the specimens were recorded to relate them with the stomach size and the food contents. The purpose of the study is to quantify the composition of the diet of fish.

The stomachs were arbitrarily classified according to their fullness, as follow : 5 - fully gorged with food; 4 - full but not gorged; 3 - half full; 2 - containing a small but significant food matter; 0 - empty but possibly

containing bits of debris. Specimens with full stomachs were considered to have been actively feeding while for half full, quarter-full and empty stomachs denoted reduced feeding activity.

The entire stomach contents were emptied onto a microscope slide for the small digested food components.

Bulky food components were filled into a graduated cylinder, and analyzed for their volumetric composition by *water displacement*.

The volumetric methods are the best to assess the various food items quantitatively (Natarajan and Jhingran, 1961). This method employs the principle of water displacement i.e the volume of water displaced is equal to the volume of food items. The water adhering to the surfaces and trapped in the interstices of the food items must first be effectively removed using filter paper (Hellowell and Abel, 1971 and Hyslop, 1980). Animals of small volume were measured in a graduated capillary tube (Jude, 1971). The total volume of a food category is given as a percentage of the total volume of all examined stomach.

Very small items are also prevalent in stomachs. Each particulate food item was estimated under a monocular microscope under a magnification of 100X. An eye-piece

mounted grid 10 X 10 mm was used for estimation of abundance to overcome bias by the observer's eye (McHugh, 1940; Pillay, 1953). Area estimates are approximately proportional to volume since height differences between fine food items are small. All the food items were identified to the generic level wherever possible using the keys from Arvin (1977), Barnes (1974) and Lokman (1990).

The occurrence of each food item was also examined as a percentage. This method was estimated by dividing the number of stomachs containing a particular food item by the total number of stomachs examined and multiplied by 100.