

## **ABUNDANCE, DISTRIBUTION AND SPECIES DIVERSITY OF INVERTEBRATES COLLECTED BY COMMERCIAL TRAWLER FROM NEAR SHORE COASTAL AREAS OF KARACHI, PAKISTAN (NORTHERN ARABIAN SEA)**

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### **ABSTRACT**

The abundance and distribution of benthic macro fauna in near shore waters off Karachi was studied. The marine benthic fauna was collected every month for a period of one year from otter trawl catches of "Hella" fishing trips undertaken by Karachi based commercial shrimp trawlers fishing in the depth of about 12 meters. A total of 76 species of invertebrates belonging to 38 families were studied. The distribution and abundance varied with seasons and maximum number of invertebrate species was found during the monsoon season with increasing salinity and falling temperature the number of invertebrate species in the study area, seemed to decrease. The diversity of invertebrate species collected was studied using the diversity indices and the seasonal variation was also observed.

**Key-words:** Diversity, abundance, distribution, macrofauna, coastal line, Karachi, Pakistan.

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### **INTRODUCTION**

Commercial trawlers along the cost of Karachi are conducting a lot of bottom trawling. One of the supports of the regional economy and fulfill the needs of protein source of the country. Little information is available in the literature on the bottom dwelling macro-faunas of the coast of Pakistan. There is thus a grate gap in our knowledge about our own marine fauna. The main reason for this paucity of information lies in the fact that scientific bottom trawling studies have not been frequently made, and in the occasional cases where undertaken, not much attention has been given to non-commercial or economically unimportant marine organisms. Hence sub tidal fauna remains little studied. Compared to the sub tidal and benthic marine studies, investigation of the intertidal fauna, flora and their biology are many in number. For instance, Ahmed (1980) dealt with the breeding and recruitment of marine animals of the coast of Pakistan bordering the Arabian Sea. Ataur-Rahim, (1986) publish a bibliography of scientific research in the northern Arabian Sea. Ahmed (1987) dealt with the marine fisheries resources of Indus delta (Northern Arabian Sea). There are several other noteworthy papers or reprints, as for instance those of Anonymous (1972) on the marine fauna supplements, Chhapgar (1957) On the Marine Crabs (Decapoda: Brachyura).

An extremely limited number of direct studies of the abundance and distribution of marine animals of our waters have been made so far. Studies about shrimps, finfishes and other animals are available in Zupanovic (1971) and Niazi (1996). In another study marine fisheries of the Indian Ocean are summarized briefly by Bakus (1986). Studies of Sharp (1986) reflect the

Arabian Sea fisheries and their production. According to Food and Agriculture Organization (FAO) estimates the northwestern part of the Indian Ocean Arabian Sea in which Pakistan is situated, is believed to contain one of the largest potential resources of marine fishes. In addition, crabs, molluscs, and other marine animals are caught during trawling operation Abdul Majid (1986).

The otter trawl surveys are frequently used to assess fish and macro invertebrate communities Stokesbury et al. (1999). The North Carolina Division of Marine Fisheries (NCDMF) used the otter trawl surveys to examine species composition, size composition, and abundance of juvenile fish and invertebrates to calculate indices of year class strength Stokesbury et al. (1999).

This paper dealt with the otter trawl survey in which abundance, distribution and species diversity of the marine invertebrates are studied. For this purpose the benthic fauna was collected every month for one year. A total of 76 species of invertebrates belonging to 38 families were collected.

### **MATERIAL AND METHODS**

Otter trawl survey was conducted along the near shore waters off Karachi which lasted for one year. Otter trawl operated from a commercial trawler AL-AHMEDI. The trawler undertaken one trip per month along the near shore

waters off Karachi made a total of 36 hauls during the year. The trawling operations were generally a daylong and are locally known by the name of “Hella” fishery. Random sample from the total catch of the trawl was separated on every trip for subsequent study in laboratory. Identifications of invertebrates were made to species or generic level with the help of Anonymous (1972), Bianchi (1985), Chhapgar (1957) and Tirmizi and Kazmi (1988). During the monthly observations temperature was measured by the thermometer and salinity by refractometer.

## RESULT AND DISCUSSION

### *Hydrographic conditions*

#### **Salinity:**

Salinity in the near shore waters off Karachi ranged from 35 to 38 ppt (parts per thousand). The month-wise highest and lowest salinity profile is shown in Figure 1.

#### **Temperature:**

Seawater temperature ranged from 23-32 °C with the highest temperature occurring in June and the lowest in December, as shown in Figure 2.

### *Seasonal Variation of invertebrates*

On the fishing grounds off Karachi invertebrate fauna was found abundant in trawl operations. A total of 76 species of invertebrates belonging to 38 families were collected (Figure 3). The largest number of animals was collected in November, (Figure 4) followed by February and March. Compared to the intertidal fauna as shown in Ahmed and Hameed (1999) the largest number of animals were collected in January, followed by February and December. In (Table 1) the month-wise occurrence of three most abundant invertebrate species in the study area were shown among these *Oratosquilla nepa*, *Charybdis callianassa* and *Bulla ampulla* were found to be more numerous than other species in the area. Monthly distribution of invertebrate species shown in (Figure 3)

### *Diversity indices*

The Shannon and Wiener diversity index (Shannon and Wiener 1949) was used for the evaluation of species diversity in each collection of the months (Table 2). Diversity index is a mathematical measure of species diversity in a community and was calculated by using the Shannon Wiener diversity Index ( $H'$ ) and equitability or evenness ( $J$ ) was also calculated. The following formulas were used for the calculations:

$$H = -\sum_{(1-i)} (P_i) (\log_{10} P_i)$$

$$J = H / H_{\max}$$

Where  $P_i$  = Relative percentage of species.

$S$  = Number of species.

$H_{\max}$  = Maximum number of species and is equal to  $\log_{10} S$

### *Statistical analysis*

Diversity indices provide more information about community composition than simply species richness (i.e., the number of species present). It also provides important information about rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure. Diversity commonly depends on the number of species and individuals in the community at a given time and has been mathematically well documented. Table 3 shows the highest species diversity was recorded in June (1.27) and July (1.25) while lowest in February (0.72) however, the maximum Equitability of organisms was calculated in December (1.11) and minimum (0.30) in February (Table 2). Nearly same pattern was observed in Ahmed and Hameed (1999) in coastal collection.

According to (Figure 5 & 6). In northeast monsoon season lowest density was observed and higher density in pre monsoon and southwest monsoon seasons (Figure 7) while in post monsoon season again low density occurred. This pattern shows the diversity of invertebrates high in warmer seasons and low in colder seasons.

Table .1 The month-wise occurrence of three most abundant invertebrate species.

MONTHS	I	II	III
DECEMBER	<i>Thenus orientalis</i>	<i>Sepiella inermis</i>	<i>Calappa lophos</i>
JANUARY	<i>Thenus orientalis</i>	<i>Charybdis callianassa</i>	<i>Calappa lophos</i>
FEBRUARY	<i>Charybdis callianassa</i>	<i>Thenus orientalis</i>	<i>Portunus hastatoides</i>
MARCH	<i>Bulla ampulla</i>	<i>Portunus hastatoides</i>	<i>Stomopneustes variolaris</i>
APRIL	<i>Oratosquilla nepa</i>	<i>Portunus hastatoides</i>	<i>Charybdis callianassa</i>
MAY	<i>Portunus sanguinolentus</i>	<i>Oratosquilla interrupta</i>	<i>Loligo duvauceli</i>
JUNE	<i>Sepiella inermis</i>	<i>Portunus pelagieus</i>	<i>Matuta planipes</i>
JULY	Jellyfish	<i>Loligo duvauceli</i>	<i>Dorippe astuta</i>
AUGUST	<i>Scylla serrata</i>	<i>Renilla reniformis</i>	<i>Babylonia spirata</i>
SEPTEMBER	<i>Portunus sanguinolentus</i>	<i>Natica didyma</i>	<i>Scylla serrata</i>
OCTOBER	<i>Portunus sanguinolentus</i>	<i>Cavernularia obesa</i>	<i>Portunus hastatoides</i>
NOVEMBER	<i>Oratosquilla nepa</i>	<i>Philyra scabriuscula</i>	<i>Oratosquilla hesperia</i>

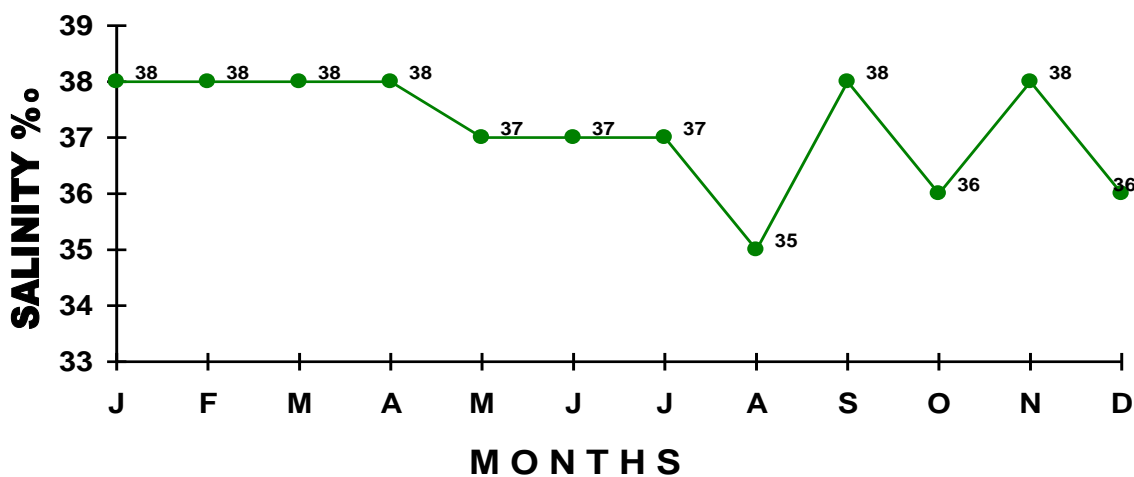


Fig. 1. Seasonal Variations of slinity in near shore waters of Karachi, Pakistan.

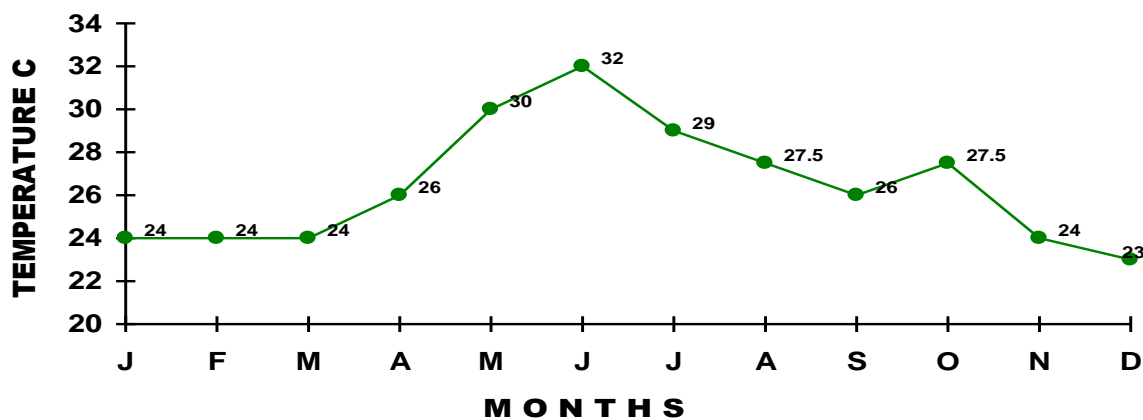


Fig. 2. Seasonal Variations of sea water temperature in near shore waters of Karachi.

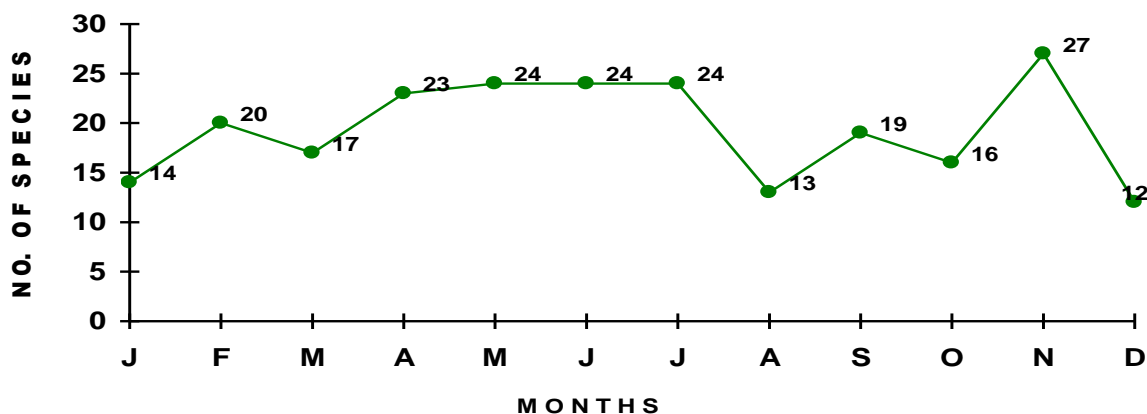


Fig. 3. Seasonal Variations of invertebrate species in near shore waters of Karachi.

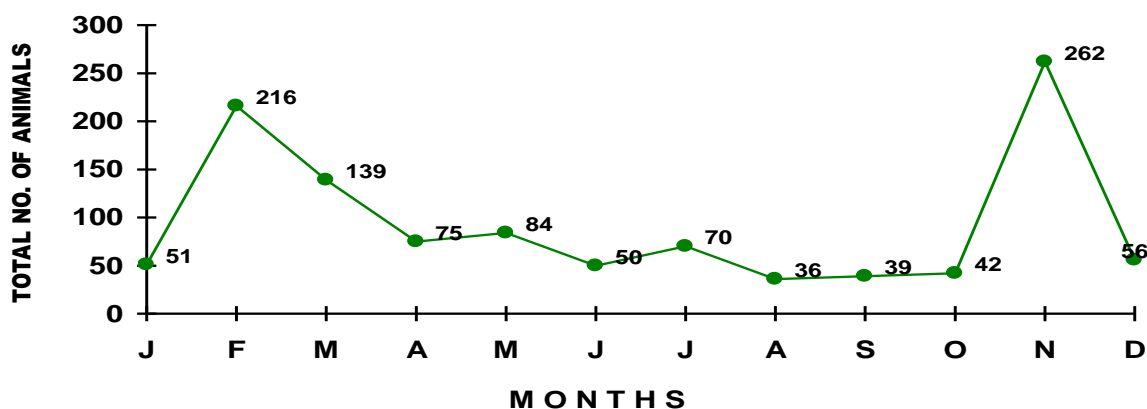


Fig. 4. Seasonal Variations in the total number of animals in near shore waters of Karachi.

The study showed that the bottom fauna in near shore waters off Karachi was dominated by Crustaceans mostly crab fauna then Molluscs fauna.

Several other interesting species showed up in the collection made at otter trawl. These were specimens of the Flathead locust lobster *Thenus orientalis* (Fam: Scyllaridae) these lobsters found abundant in our waters and Bubble Shell *Bulla ampulla* (Fam: Bullidae) has been reported and found abundant when otter trawl hauled up.

The frequent use of the otter trawl threatening the existence of the animal diversity of the study area. If the control on mesh size is not regulate it should threat the entire biota of the bottom.

The study provides valuable information about the occurrence and abundance of marine fauna. It should be continued furthers. The results of the present study provide baseline data for acquiring a better understanding of the macro-benthic life of the near shore waters off Karachi.

Table 2. Monthly fluctuations in Diversity ( $H'$ ) and equitability ( $J$ ) of invertebrate species from near shore waters of Karachi.

<b>MONTHS</b>	<b>DIVERSITY (<math>H'</math>)</b>	<b>EQUITABILITY (<math>J</math>)</b>
December	1.20	1.11
January	0.93	0.81
February	0.72	0.30
March	0.79	0.36
April	1.03	0.55
May	1.21	0.62
June	1.27	0.75
July	1.25	0.68
August	1.00	0.64
September	1.18	0.74
October	1.06	0.65
November	0.82	0.34

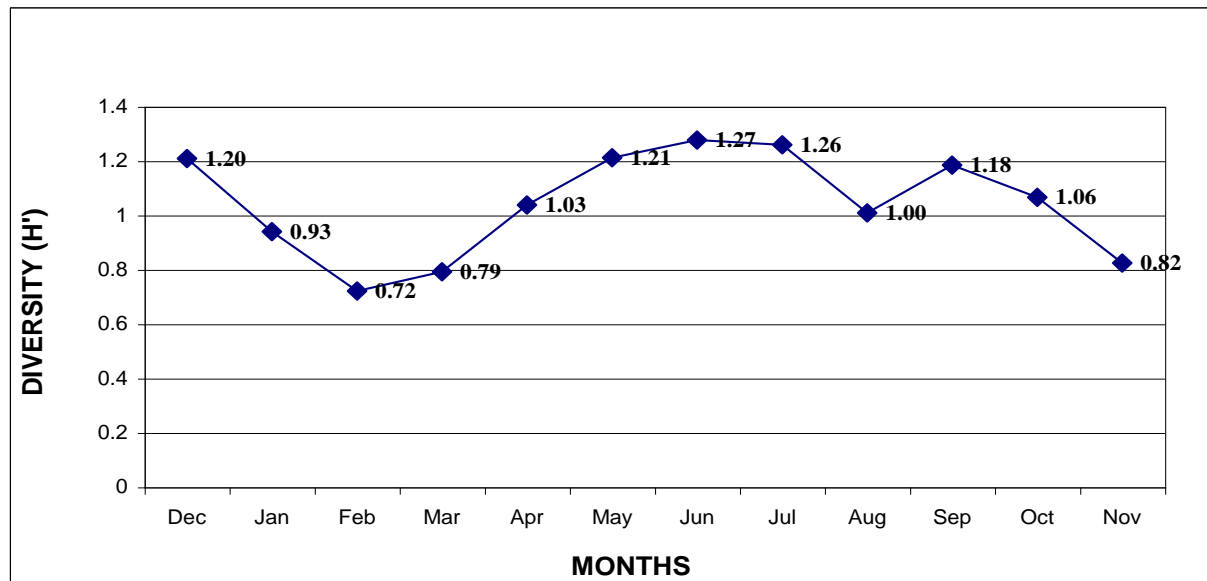


Fig. 5. Monthly Diversity index ( $H'$ ) of Invertebrates from near shore waters of Karachi, (Northern Arabian Sea). Pakistan.

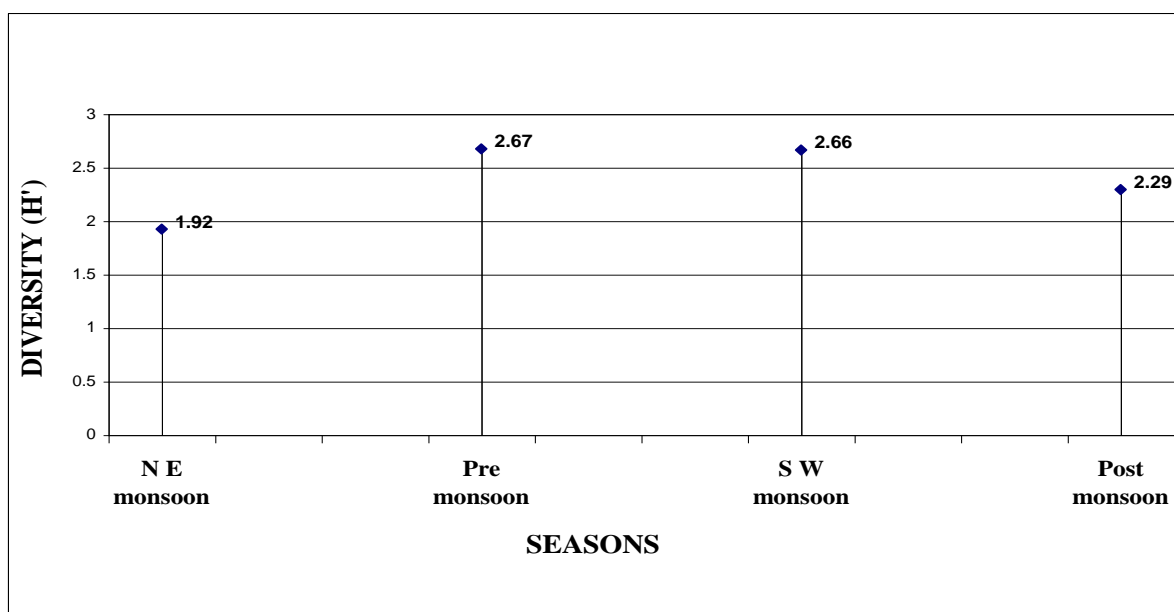


Fig. 6. Mean Seasonal Diversity index ( $H'$ ) of invertebrates from near shore Karachi, (Northern Arabian Sea). Pakistan.

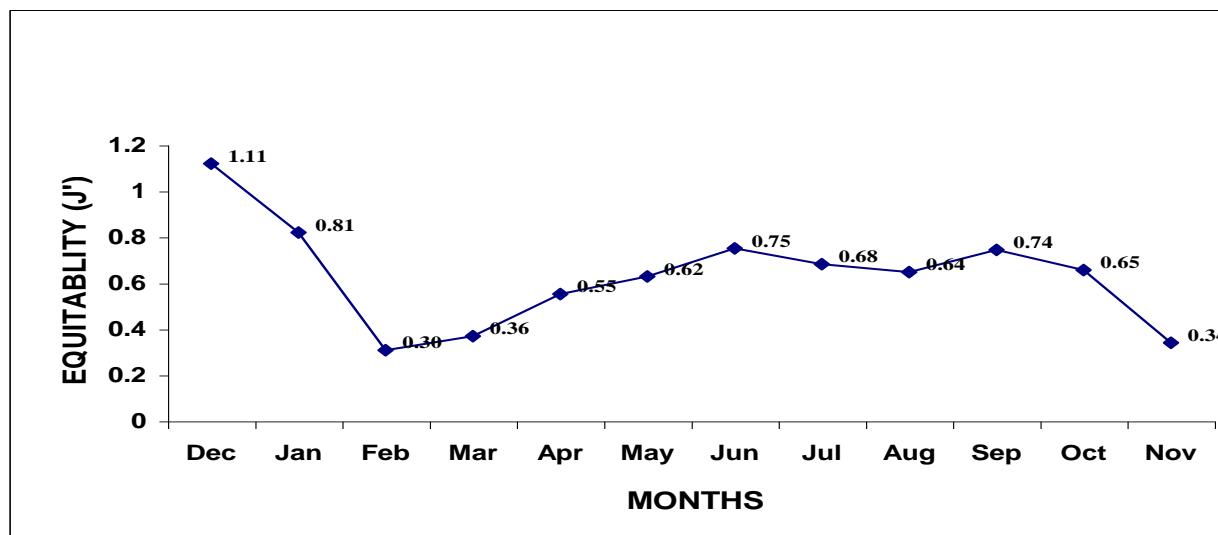


Fig. 7. Monthly Equitability ( $J'$ ) of Invertebrates from near shore waters of Karachi, (Northern Arabian Sea). Pakistan.

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