

# Studies on the Biodiversity and Stock Assessment of Selected Portunus Species of Thoothukudi Southeast Coastal, Tamil Nadu

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## Abstract:

A detailed investigation was undertaken to study the biodiversity and stock assessment of selected Portunus species of Thoothukudi coast. Specimens for the present investigation were collected four times in a month from the gill net and trawl net catches of two landing centers thoothukudi fishing harbor and threshpuram fish landing center of Thoothukudi. The study was carried out for six months from August 2018 to January 2019. P.Pelagicus and P.Sanguinolentus showed year round occurrence at Thoothukudi coast.

**Keywords:** Biodiversity, Stock Assessment, Portunus species, Indices.

## INTRODUCTION

Crabs coming under the class Crustacea of the phylum Arthropoda are characterized by the presence of jointed appendages and periodical molting of exoskeleton. Crabs have ten thoracic appendages and are classified into two major groups, namely Brachyuran crabs and Anomuran crabs. Marine brachyuran crabs are one of the valuable seafood items of great demand both in the domestic market and the export industry of India. Among the marine crustaceans found along the Indian coast, crab ranks third after shrimp and lobster for their esteemed seafood delicacy and also the value of fishery they support, (Saved and Reghavan, 2001). Crabs were not only valuable food items, but also have good nutritional and medicinal value. The crab meat contains rich amounts of protein, vitamin A and D, minerals, glycogen and essential amino acids. The crab meat also has medicinal properties to cure asthma and chronic fevers (Raja, 1981). About 990 species of brachyuran crabs have been observed in the littoral and deep sea regions all along the Indian coast (Kathirvel, 2008). Out of 990 species recorded from Indian waters, 32 species attain large sizes and are edible. Twelve edible species come under three families such as Calippidae, Portunidae and Grapsidae. The edible species are Portunus pelagicus, P sanguinolentus,

*Charybdis feriatus*, *C. lucifera*, *C. annulata*, *C. natator*, *Scylla tranquebarica*, *S. serrata*, *Matuta lunaris*, *Sesarma retragonum* and *varuna litterata*. Of these, Portunidae includes the commercially important marine species such as *P. sanguinolentus*, *P. pelagicus*, *C. feritatus*, *C. annulata*, *C. natator*, *S. tranquebarica* and *S. serrata*. The swimming spotted crab *P. sanguinolentus* is widely distributed in ocean waters from East Africa through the Indo-Pacific region, to the Hawaiian island (Stephenson and Campbell, 1959), the reticulate crab *P. pelagicus* is distributed along the Indo-Pacific waters and forms a good fishery along the coasts of Karnataka, Kerala and Tamil Nadu.

### **Review of Literature:**

Stock assessment studies are much important to estimate the standing stock biomass of the fishes; it also helps in understanding the status of exploitation of any particular fishes. However, information available on the stock of portunid species in Indian waters is very scanty. The review of research work on the portunid species are detailed below.

### **Distribution**

The blue swimming crab, *P. pelagicus* which enjoys a wide distribution in the Indo-Pacific waters, forms a good fishery along the coasts of Karnataka, Kerala and Tamilnadu. *P. sanguinolentus* is widely distributed in ocean waters from East Africa, through the Indo-Pacific region to the Hawaiian Islands. *P. pelagicus* is found sheltered near the shore and estuaries throughout the Indo- West Pacific waters. *P. pelagicus* lives in a wide range of inshore and continental shelf areas, including sandy, muddy, algal and sea grass habitats from the intertidal zone to at least 50 m depth. Potter et al., (1983) stated that the *P. pelagicus* distribution extends from the southern Mediterranean Sea, the east coast of Africa and across the Indian Ocean to Japan and the Western Pacific ocean. The *P. sanguinolentus* are distributed throughout the Indo-West Pacific region and typically inhabit sandy oceanic habitats. Kailola et al. (1993) observed that the *P. pelagicus* is distributed throughout the coastal margins of the tropical regions of the Western Indian Ocean and the Eastern Pacific. In Indian waters, about 990 species of brachyuran crabs occurring in the littoral and deep sea regions were reported. Ganesh, K. and Geetha, B. et.al (2017) sharks have typically been exploited as a by-catch of commercial fisheries targeting more valuable bony fishes.

### **Biology of portunid crabs**

The biology of portunid crabs was investigated by many Indian researchers. In world waters, Potter et al. (1983) studied the biology of *P. pelagicus* in Australian estuary. *P. sanguinolentus* in subtropical Queensland waters and the morphometric growth and fisheries biology of the *C. natator* in Australia. Biology and exploitation of *P. pelagicus* in Western Australia was studied by Kangas (2000).

## Fishery

In India, fishery of portunid crabs were investigated by various researchers reported that more than 600 species of crabs were known to occur in Indian waters, of which only eight species formed regular fishery along the entire stretch of peninsular India. Ranjiga Anjali, A. Ganesh, K. et.al (2018) marine fishery resource of increasing importance and many species are exploited as by-catch by trawlers from throughout the Indian coast. Nazerath Nisha, Ganesh, K. et.al (2018) the ever increasing demand for marine aquarium fishes in every year.

## Stock assessment

Studies on the stock assessment of portunid species are very scanty. Assessed the stock of portunid crabs along the Karnataka coast. The standing stock was estimated to be 308 tonnes for *P. sanguinolentus* (154 t each for males and females) Ganesh, K. Geetha, B. et.al (2018) gastropoda in thoothukudi coastal area are 85 ton per year and 161 t for *P. pelagicus* (70 t and 91 t for males and female respectively). The annual average stocks were 1,272 t for *P. sanguinolentus* (658 t for males, 614 t to for females) and 834 t for *P. pelagicus* (894 t for males and 440 t for females). The maximum sustainable yield (MSY) estimated for *P. sanguinolentus* was 776t (403 t for males and 373 t for females) and for *P. pelagicus* 567 t (275 t for males and 292 t for females. Defeo et al.

## MATERIALS AND METHODS

The stock assessment study was carried out for a period of six months (August 2018 to January 2019) at Thoothukudi coast of Gulf of Mannar. Six portunid species available in this coast are *Charybdis feriata* (Linnaeus, 1758), *Charybdis natator* (Herbst, 1789), *Charybdis hellari* (H. Milne Edwards, 1867), *Portunus pelagicus* (Linnaeus, 1766). *Portunus sanguinolentus* (Herbst, 1783) and *Scylla serrata* (Forsk., 1755). Among the six portunid species, *P. pelagicus* and *P. sanguinolentus* were selected for the stock assessment study as these two species are dominant in the catch and are available throughout the year by bottom set gill net (crab net) and trawl net operated at Thoothukudi fishing harbor and Threshpuram fish landing center.

## Species richness (*d*)

Species richness is a measure of the total number of the species present, making some allowances for the number of individuals. Species richness for each station was calculated following Margalef index (*d*) using the formula,

$$d = (S-1) / \log_e N$$

Where, *S* is the total number of species in each sample i.e. species with non-zero counts and *N*, the total number of individuals in each sample.

### Species evenness ( $j'$ )

This is measure of equitability and a measure of how evenly the individuals are distributed among the species. Evenness was calculated for each station following Pielou's evenness ( $j'$ ) using the formula,

$$J' = H' / \log_2 S \quad \text{or} \quad H' / \ln_2 S$$

Where,  $H'$  is the diversity in bits of information per individual and  $S$ , the total number of species.

### Simpson's diversity index (D)

Simpson's index (D) is a measure of diversity, which takes into account both species richness, and an evenness of abundance among the species present. In essence it measures the probability that two individuals randomly selected from an area will belong to the same species. The formula for calculating D is presented as:

$$D = \frac{\sum n_i (n_i - 1)}{N (N - 1)}$$

Where  $n_i$  is the total number of organisms of each individual species,  $N$  is the total number of organisms of all species. The value D ranges from 0 to 1.

### Shannon Index (H)

The Shannon index is an information statistic index, which means it assumes all species are represented in a sample and that they are randomly sampled.

$$H = \sum_{i=1}^s P_i \ln P_i$$

Where  $P$  is the proportion ( $n/N$ ) of individuals of one particular species found ( $n$ ) divided by the total number of individuals found ( $N$ ),  $\ln$  is the natural log,  $\sum$  is the sum of the calculations, and  $s$  is the number of species.

## RESULTS

An intensive study was made during six months period (August 2018 to January 2019) to assess the stock of selected portunid crabs, *P. pelagicus* and *P. sanguinolentus* along the Thoothukudi coast. Six species of portunid species were recorded in this coast area.

### Distribution

The present study on *P. pelagicus* and *P. sanguinolentus* revealed that this species were available throughout the year at Thoothukudi coast (Plate-I). In this coast, vallam and mechanized boats were used for exploiting *P. pelagicus* and *P. sanguinolentus*. The carapace width and length composition, the length frequency data and catch and effort details were collected from the mechanized trawlers and gill nets operated by vallams. In general, *P. pelagicus* and *P. sanguinolentus* were available in shallow waters.

## Plate - I

*Portunus Armatus**Portunus Trituberculatus**Portunus Sayi**Portunus Pelagicus**Portunus Haanii**Portunus Sanguinolentus***Margalef Species richness (  $d$  )**

The Spatial variations in Margalef Species richness ( $d$ ) was calculated to be ranges of 0.7791 – 1.378 for Thoothukudi. The index was in the ranges of 0.8285 – 1.418 for Threshpuram.

**Pielou's evenness index (  $J'$  )**

The Spatial variations in Pielou's evenness index ( $J'$ ) was estimated to be ranges of 0.9912 – 0.9997 for Thoothukudi. The index was in the ranges of 0.9681 – 0.9904 for Threshpuram.

**Shannon –Wiener diversity index (  $H'$  )**

The Shannon – Wiener diversity index ( $H'$  ( $\log_2$ )) was calculated to be ranges of 1.094 – 1.386 for Thoothukudi. The index was in the ranges of 0.691 – 1.594 for Threshpuram.

**Simpson's diversity index (  $D$  )**

The Spatial variations in Simpson's diversity index ( $D$ ) was calculated to be ranges of 0.7186 – 0.8117 for Thoothukudi. The index was in the ranges of 0.7105 – 0.9051 for Threshpuram.

**Discussion:**

Portunus pelagicus and P.sanguinolentus form a good fishery at Thoothukudi coast and contribute 85% to the total portunid fishery and the major catches of these species are mainly by gill net. Smaller sized specimens of male P.pelagicus were represented considerably in the month of September and October, while smaller sized females were represented in the month of August. Both the sexes of P.sanguinolentus were collected appreciably in large numbers in the month of November and December.

Mature specimens of male and female *P.pelagicus* and *P.sanguinolentus* dominated the fishery round the year.

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