

Taxonomic study and Identification key to the Species of the shrimps, particularly the Family Penaeidae in Kakkaiithivu coastal waters, Jaffna, Sri Lanka

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Abstract- Taxonomic study of Penaeid shrimps in Kakkaiithivu coastal waters, Jaffna, Sri Lanka were studied in specimens of shrimp collected from Kakkaiithivu coastal waters from January 2011 through December 2012. Identification of species was based on the morphological characters of rostrum (dorsal and ventral teeth), carapace (longitudinal or transverse sutures in the carapace), branchiae, antennule, antenna, third maxilliped, fifth pereopods, pleopods, abdomen, sub apical spines on telson, petasma, thelycum and the colored pattern of the whole body based on standard keys and diagnoses available from the current literature.

A total of 7 species from 2 genera (*Penaeus* and *Metapenaeus*) and 1 family of Penaeidae were identified in Kakkaiithivu coastal waters. These are *Metapenaeus dobsoni* (Miers, 1878), *Metapenaeus monoceros* (Fabricus, 1798), *Penaeus indicus* (H.Milne Edwards, 1837), *Penaeus japonicus* (Bate, 1888), *Penaeus latisulcatus* (Kishinouye, 1896), *Penaeus monodon* (Fabricus, 1798) and *Penaeus semisulcatus* (De Haan, 1884). Modified Key to identify shrimp species from Kakkaiithivu Coastal waters, Jaffna, Sri Lanka was prepared after morphometric analysis. Additional research is needed to more clearly define the distribution of shrimp species in Kakkaiithivu coastal waters, Jaffna, Sri Lanka.

Index Terms- Species, Penaeidae, Shrimps, Coastal waters

I. INTRODUCTION

Shrimps are a charming group of animals classified under class crustaceans. They are widely distributed in the Indian Ocean and surrounding areas from the shore to the greatest depth. The species present especially around Sri Lanka, India and Malaysia are the most valuable. Penaeid shrimps are important resources for worldwide fisheries and aquaculture. They supply the increasing population with animal proteins and provide significant earnings of foreign exchange for developing countries (Jayawickrema, 2010).

Penaeid shrimps are widely distributed in the tropical and sub tropical areas of the world. They are particularly abundant in South East Asia. Penaeid shrimps differ in a variety of morphological characters that are expression of genetic differences among them. Morphological studies within and among species of Penaeid shrimps in nature is useful for fishery management. Conservation of biodiversity depends on the identification and maintenance of the taxonomic records of its biotic components (Mevlut *et al.*, 2006).

General characteristics of shrimps

Shrimps constitute a large group of crustaceans varying in size from microscopic to about 35 cm long. The body of the shrimps is almost always laterally compressed, the rostrum usually compressed and toothed and the abdomen long, longer than the carapace or head. The antennules and antennae are generally large and plate-like. The pereopods or legs are usually slender, but in some a single leg or pair of legs may be stout and some pereopods end in pincers or chelae. The pleopods or abdominal appendages used for swimming are well developed and except in a few species, are present on all five anterior abdominal segments (De Bruin *et al.*, 1994).

Taxonomy of shrimps

Most of the commercial shrimp species belong to the 5 penaeidean families Solenoceridae, Aristeidae, Penaeidae, Sicyoniidae and Sergestidae and 3 caridean families, Pandalidae, Crangonidae and Palaemonidae (Soundarapandian and Rajendran, 2012). The Palaemonidae includes two subfamilies, namely Palaemoninae and Pontoniinae. The prawns belonging to the Palaemoninae inhabit inland water bodies. Shrimps inhabit in the brackish and marine water bodies (Carpenter and Niem, 1998).

Scientific Classification

Kingdom –Animalia
Phylum- Arthropoda
Class - Crustacea
Sub class- Malacostraca
Superorder - Euarida

Order- Decapoda

Superfamily - Sergestoidea , Penaeoidea, Stenopodidea , and Caridea

Superfamily Penaeoidea -Family Solenoceridae, Family Aristeidae, Family Penaeidae Family Sicyoniidae, Family Sergestidae

Despite their high commercial value, there is little information available on description and the taxonomic relationship of the shrimp species.

Therefore, this study is made a first attempt to provide a detailed systematic account of shrimps of Kakkaitivu coastal waters, Jaffna, Sri Lanka. The aim of this study was to establish the composition of shrimps with identification key to shrimps in Kakkaitivu coastal waters, Jaffna, Sri Lanka and to contribute further knowledge of shrimps in Sri Lanka. Also, pattern of taxonomic characters and morphological variation of the shrimps in Kakkaitivu Coastal waters were investigated.

II. MATERIALS AND METHODS

Study area

The Jaffna Peninsula is located at the northern most region of the Island of Sri Lanka. It has an area of about 1 025.6 km². Jaffna district has a coastal belt of 292.2 km by length and a continental shelf area of 3 360 square miles. Similar to most other lagoons and estuaries in Sri Lanka, Jaffna estuary also supports profitable shellfish and finfish fisheries. It lies between approximate 79° 52' E – 80° 38' E longitudes and 9° 26' N – 9° 46' N latitudes. It has an area of about 412 km² and the depth does not exceed 4m (Chitravadivelu and Arudpragasam, 1983; Sachithanathan and Perera, 1970).

Kakkaitivu Coastal Area which is part of the Jaffna estuary was selected for this study. Site length of Kakkaitivu Coastal area is 1.2 km. Shrimp species found in this area is significant and it is a major fish landing centre in Jaffna district within Sandillipay Fisheries Inspector Division (Fig 1: Plate 1).



Plate 1: Landing centre at Kakkaitivu



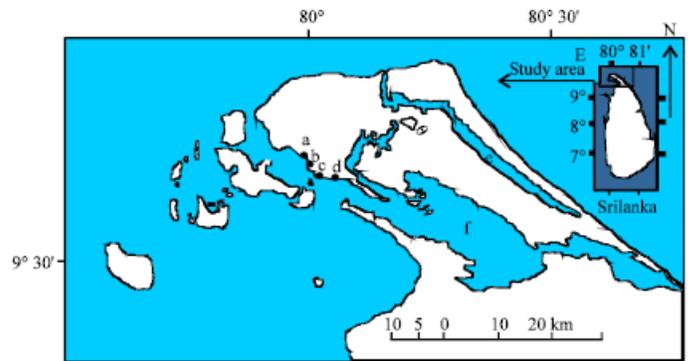


Fig 1: Location of the Jaffna estuary

(a) **Kakkaiithivu**, (b) Navanthurai, (c) Kurunagar, (d) Pasaioor (e) Thondaimannar lagoon and (f) Jaffna estuary.

Sampling

Random samples of shrimp were collected weekly from the commercial catches between January, 2011 till December, 2012. The observations were made between 6.30 a.m to 10.00 a.m weekly.

Randomly collected specimens were placed in polythene bags. All collected shrimps were brought to the laboratory in an ice box and analyzed.

Sample identification

Shrimps were examined using hand lenses and under a binocular stereo microscope. Identification of shrimp was done up to the species level at the laboratory by observing the morphological characteristics. Photographs of all shrimps were taken at the laboratory. Identification was confirmed with the help of widely used references (De Bruin *et al.*, 1994; Carpenter and Niem, 1998).

III. RESULTS AND DISCUSSION

In the present study, seven species were identified from the Kakkaiithivu Coastal waters, Jaffna, Sri Lanka. These are *Metapenaeus dobsoni* (Miers, 1878), *Metapenaeus monoceros* (Fabricus, 1798), *Penaeus indicus* (H.Milne Edwards, 1837), *Penaeus japonicus* (Bate, 1888), *Penaeus latisulcatus* (Kishinouye, 1896), *Penaeus monodon* (Fabricus, 1798) and *Penaeus semisulcatus* (De Haan, 1884).

Identification of shrimp species in the catch

Shrimps were identified based on the morphological characteristics. Number of rostral teeth, subapical spines on telson and exopod on fifth pereopod were considered as major morphological characteristics to identify the shrimp species. They are classified under one family Penaeidae. Synonyms of shrimps presented in Table 1.

Table 1: Synonyms of shrimps at Kakkaiithivu Coastal waters, Jaffna, Sri Lanka collected during January 2011 to December 2012 (De Bruin *et al.*, 1994)

Species	Synonyms
<i>Penaeus indicus</i> (H.Milne-Edwards, 1837)	<i>Fenneropenaeus indicus</i> H. Milne Edwards,1837 <i>Palaemon longicornis</i> Olivier, 1811, <i>Penaeus indicus longirostris</i> De Man, 1892
<i>Penaeus monodon</i> (Fabricus,1798)	<i>Penaeus coeruleus</i> Stebbing, 1905 <i>Penaeus durbani</i> Stebbing, 1917 <i>Penaeus semisulcatus exsulcatus</i> Hilgendorf, 1879
<i>Penaeus latisulcatus</i> (Kishinouye,1896)	<i>Melicertus latisulcatus</i> (Kishinouye, 1896)

<i>Penaeus semisulcatus</i> (De Haan,1884)	<i>Penaeus ashiaka</i> Kishinouye, 1900 <i>Penaeus semisulcatus paucidentatus</i> Parisi,1919
<i>Penaeus japonicus</i> (Bate, 1888)	<i>Marsupenaeus japonicus</i> (Spence Bate, 1888) <i>Penaeus canaliculatus japonicus</i> Spence Bate, 1888 <i>Penaeus pulchricaudatus</i> Stebbing, 1914
<i>Metapenaeus monoceros</i> (Fabricius, 1798)	<i>Metapenaeus cognatus</i> Nobili,1904 <i>Metapenaeus deschampsi</i> Nobili,1903 <i>Penaeus monoceros</i> Fabricius, 1798 <i>Penaeopsis monoceros</i> Fabricius, 1798
<i>Metapenaeus dobsoni</i> (Miers,1878)	<i>Penaeopsis dobsoni</i> (Miers, 1878) <i>Penaeus dobsoni</i> Miers, 1878

***Penaeus indicus* (H.Milne-Edwards, 1837)**

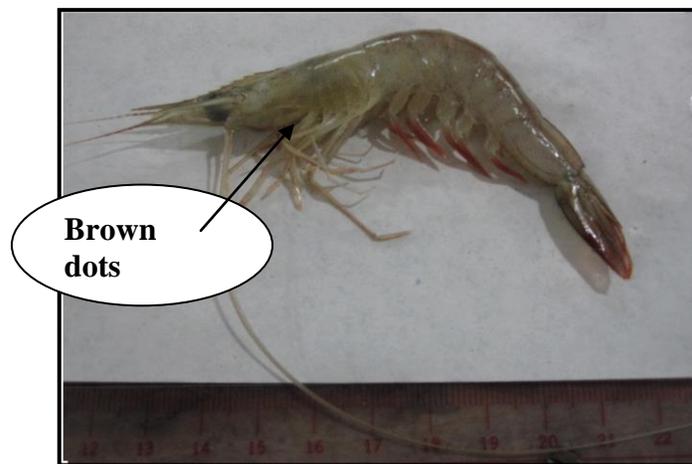


Plate 2: *Penaeus indicus*

Common name : White Shrimp

Colour : White body covered with numerous minute dark brown dots

Descriptive remarks: The rostrum is well developed and toothed dorsally (7-9) and ventrally (4-6). Carapace is without longitudinal sutures. There are no fixed subapical spines on telson. There are fifth pereiopods with exopod.

***Penaeus japonicus* (Bate, 1888)**



Plate 3: *Penaeus japonicus*

Common name : [Kuruma prawn](#)

Colour : Colour lightly tanned to greenish brown, striped in clear dark brown. Blue edge at tail fan. Yellow legs.

Descriptive remarks : The rostrum is well developed and toothed dorsally (10) and ventrally (1). Carapace is without longitudinal sutures. Exopod present on fifth pereopods. Two bands present in carapace. Last band is not reaching to ventral margin.

Penaeus latisulcatus (Kishinouye,1896)

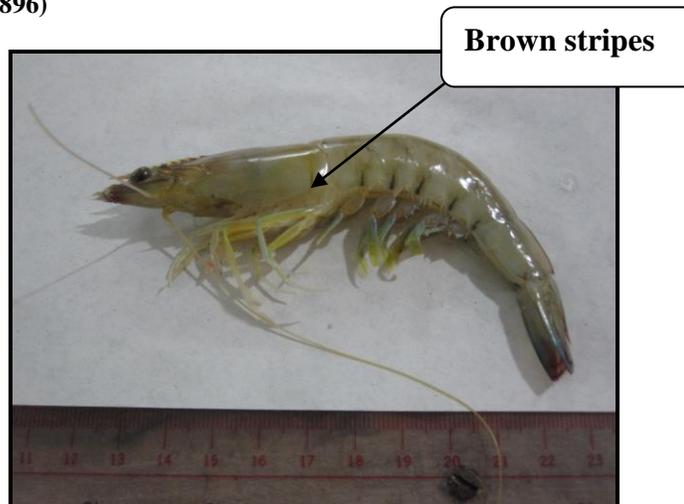


Plate 4: *Penaeus latisulcatus*

Common name : Western King shrimp

Colour : Pale brown body. Short brown stripes present in abdomen with yellow pleopods

Descriptive remarks: The rostrum is well developed and toothed dorsally (9-12) and ventrally (1). Carapace is without longitudinal sutures. Exopod present on fifth pereopods. Telson armed with 3 pairs of small movable spines.

Penaeus monodon (Fabricus,1798)

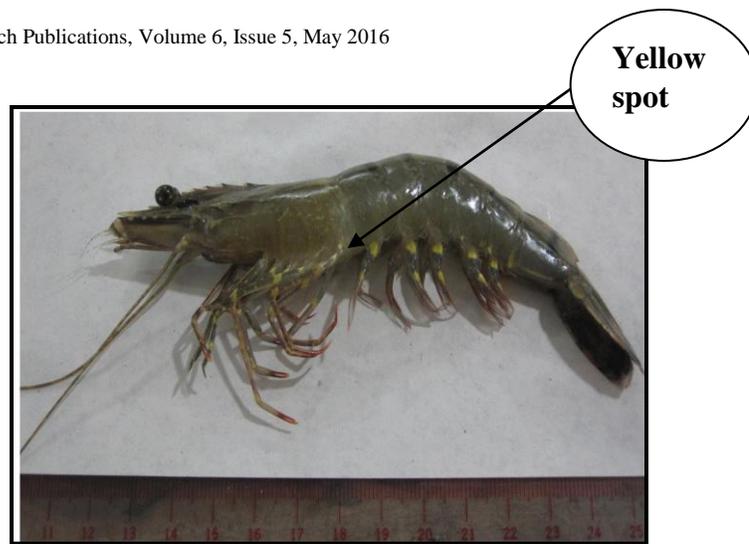


Plate 5: *Penaeus monodon*

Common name : Giant tiger shrimp

Colour : Greenish grey body with dark brown bars present and yellow spot on pleopods. Antenna is uniform pink –brown

Descriptive remarks : The rostrum is well developed and toothed dorsally (7-8) and ventrally (3-4). The most distinct features for identification of this species are fifth pereiopods without exopod, carapace without longitudinal sutures and unarmed telson.

***Penaeus semisulcatus* (De Haan, 1884)**

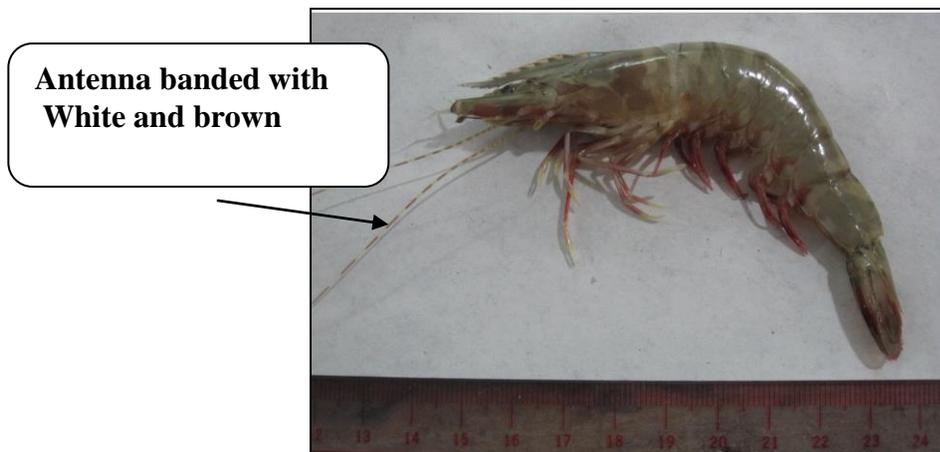


Plate 6: *Penaeus semisulcatus*

Common name : Green tiger prawn or flower shrimp

Colour : Antenna banded white and brown. Reddish brown to pale brown body with brownish grey dorsal transverse bands present

Descriptive remarks: The rostrum is well developed and toothed dorsally (5-8) and ventrally (2-4). Antenna banded white and brown. Carapace is without longitudinal sutures. Telson unarmed. Exopod present on fifth pereiopods.

***Metapenaeus monoceros* (Fabricus,1798)**

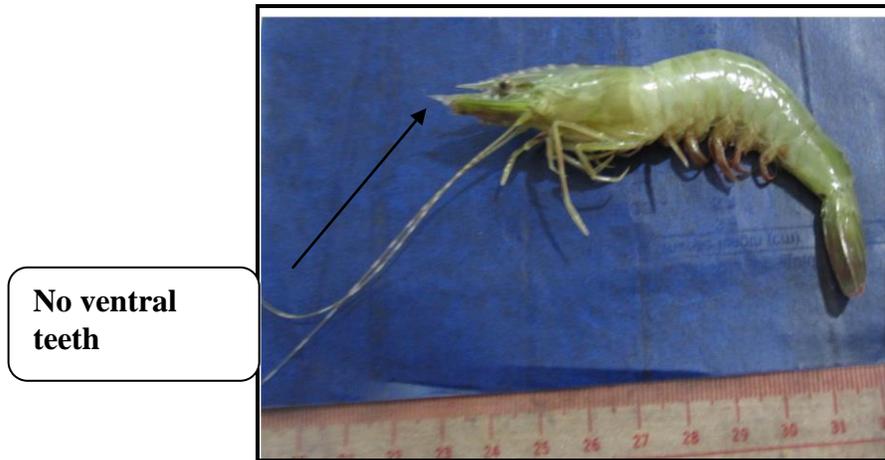


Plate 7: *Metapenaeus monoceros*

Common name : Speckled shrimp

Colour : Greenish grey body

Descriptive remarks : The rostrum is well developed and toothed dorsally (9-12) and no ventral teeth. Carapace is without longitudinal or transverse sutures. Telson armed only with spicules. Fifth pereopods have no exopod. Branchiocardiac ridge reaches the posterior extension of hepatic spine.

***Metapenaeus dobsoni* (Miers,1878)**

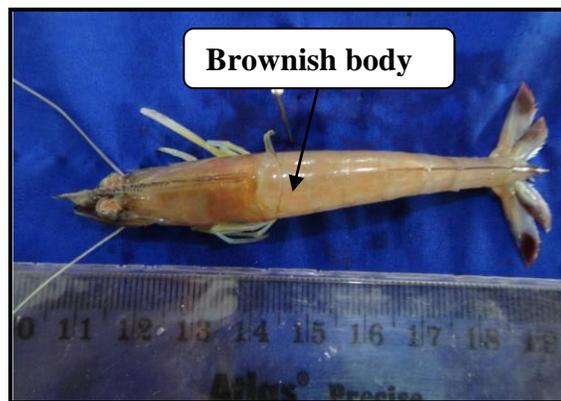


Plate 8: *Metapenaeus dobsoni*

Common name : Kadal shrimp.

Colour : Pale yellow to brownish body

Descriptive remarks : The rostrum is well developed and toothed dorsally (7-9) and no ventral teeth. Carapace is without longitudinal or transverse sutures. Telson armed only with spicules. Fifth pereopods have no exopod.

Modified Key to identify shrimp species from Kakkaitivu Coastal waters, Jaffna, Sri Lanka was prepared after morphometric analysis.

IV. MODIFIED KEY TO IDENTIFY SHRIMP SPECIES FROM KAKKAITHIVU COASTAL WATERS, JAFFNA, SRI LANKA

Rostrum with teeth on both dorsal and ventral edges**Genus *Penaeus***.

Rostrum with teeth on its dorsal side only.....**Genus *Metapenaeus***

Key for differentiation of penaeid shrimps to species level

Genus..... .. *Penaeus*

1. Rostrum with 1-3 teeth on ventral edges.....2

Rostrum with more than 3 teeth on ventral edges.....5

2. Telson unarmed3
Telson armed with 3 pairs of small movable spines.4
3. Rostrum with a distinct double curve eight dorsal teeth and only three ventral teeth; hepaticcarina horizontally straight; 5th walking legs without exopodites; abdomen transverselybanded with black and white rest of the body brown.....*Penaeus monodon*
- Hepatic carina oblique antero - ventrally, 5th walking leg with small exopodite; dark green to dark brown cross bands on the abdomen, leg with yellow and reddish bands*Penaeus semisulcatus*
4. Body with yellow and brown bands.....*Penaeus japonicus*
Body without coloured cross bands.....*Penaeus latisulcatus*
5. Rostrum with high blade, rostral crest triangular in shape; rostrum with eight to ten dorsal and more than three usually four ventral teeth*Penaeus indicus*.

Genus ----- -- *Metapenaeus*

1. Rostrum nearly reaches or slightly beyond the tip of antennular peduncle: eight to twelve dorsal teeth; post rostral crest absent2 (i)
Rostrum just surpasses the eyes; sometimes fall slightly short of them; with seven to nine dorsal teeth2 (ii)
2. (i) The last pair of walking legs usually reach a little beyond the middle of antennal Scale; rostrum with nine to twelve dorsal teeth*Metapenaeus monoceros*
(ii) The last pair of walking legs falls considerably short of the middle of antennal scale; often in female, these legs are reduced to stumps. Rostrum with a well defined double curve and crest and seven to nine dorsal teeth.....*Metapenaeus dobsoni*

Jayawickrema (2010) reported that in the Indo Pacific region, 33 species of shrimps have been recorded from Pakistan, India and Sri Lanka. Out of these, 32 species have been recorded from Sri Lanka.

De Croos and Palsson (2013) reported the presence of 13 shrimp species at west coast of Sri Lanka. *Metapenaeus dobsoni*, *Fenneropenaeus indicus*, *Penaeus semisulcatus* and *Parapenaeopsis coromandelica* dominated the shrimp catches in this area.

Fourteen species of shrimp were indentified in the catch from Negombo Lagoon, six of which are major contributors to the catches. *P. indicus* and *P. semisulcatus* were the most important in the trammel net and cast net catches. The other important species caught in the lagoon was *M. elegans*. The major species in the trawl catches were *M. dobsoni* and *P. coromandelica* (Sanders *et al.*, 2000)

Five species shrimps were recorded in Batticaloa lagoon. *Penaeus monodon* and *Penaeus indicus* are common. *Penaeus semisulcatus*, *Metapenaeus monoceros* and *Metapenaeus dobsoni* are quite abundant (Harris and Vinobaba, 2013).

Five species, *Penaeus indicus*, *P.monodon*, *P.latisulcatus*, *P.semisulcatus* and *Metapenaeus monoceros* were recorded by Chitravadivelu and Arudpragasam (1983) from Jaffna lagoon.

V. CONCLUSION

During the present study, seven species *Penaeus indicus*, *P. monodon*, *P. latisulcatus*, *P. semisulcatus*, *P. japonicus*, *Metapenaeus monoceros* and *Metapenaeus dobsoni* were records in Kakkaiithivu Coastal waters in Jaffna district and their identifying characters were very closely similar with the descriptions given by De Bruin *et al.* (1994), Carpenter and Niem (1998).

Among them, the occurrence of *P. japonicus* and *Metapenaeus dobsoni* were recorded for the first time in Kakkaiithivu Coastal waters, Jaffna, Sri Lanka.

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REFERENCES

- [1] Carpenter, K.E. and Niem, V.H. (1998). FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Cephalopods, crustaceans, holothurians and sharks. Rome, FAO. Volume 2. pp 687-1396.
- [2] Chitravadivelu, K and Arudpragasam, K.D (1983). Studies on the prawn fishery in the Jaffna lagoon.Proceeding of Sri lanka Association for Advancement of Science.39(1) 47

- [3] De Bruin, G.H.P., Russell, B. and Bogusch, A.(1994). The Marine Fishery Resources of Sri Lanka, FAO species Identification guide for fishery purposes. FAO, Rome.
- [4] De Croos, M. D. S. T. and Palsson, S.(2013). Present status of the multi-gear shrimp fishery off the west coast of Sri Lanka: gear-based species diversity and selectivity .Journal of Applied Ichthyology J. Appl. Ichthyol. 29: 93-107
- [5] Harris, M. and Vinobaba, P.(2013). Assessment the present status of Batticaloa lagoon, Sri Lanka by means of water quality, fish diversity indices and pollution indicating planktons. Biodiversity and Endangered species. 1: 1-6.
- [6] Jayawickrama, S.J.C. (2010). Towards sustainable utilization of Penaeid prawn resources in Sri Lankan waters.Vidura.13:17-19.
- [7] Sachithanathan, K. and. Perera, W.K.T (1970). Topography and Substratum of the Jaffna lagoon. Bulletin of the Fisheries research station Ceylon.21:75-85.
- [8] Sanders,M., Jayawardena, A. and Ediriweera, S. (2000). Preliminary Assessment for the shrimp fisheries of the Negombo Lagoon. Sri lanka .FAO Fisheries Circular No. 958: 5-45.
- [9] Soundarapandian,P. and Rajendran, N.(2012). Prawns and Shrimps. UNU- INWCH International Training Course: Mangrove Biodiversity and Ecosystem proceeding: 427-435

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