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Assessment on fishery resources in Kottaipattinam coast, Palk Bay, Southeast coast of India.

Evaluación de los recursos pesqueros en la costa de Kottaipattinam, Palk Bay, costa sureste de India.

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ABSTRACT

The present study dealt with fishery resources in Kottaipattinam coast. The study was carried out for the period of one year from (April 2019 - March 2020) to assess the diversity and seasonal changes. 58 species belongs to 19 order were recorded in the present study. Among, nineteen species were collected from the order perciforms which showed highest species composition. Eight species were collected in the order Carangiforms noticed to be second dominant order for species composition. Other orders showed least representations. Fifty three species were landed during post monsoon season followed by pre monsoon (50 Nos) and monsoon and summer seasons represented by equal numbers as 48. It was clearly found that the life history of many fishes in Palk bay are adapted to the seasonal changes. Hence it would be useful to design the capture strategies especially in Palk bay for sustainable resource utilization.

Keywords: Fisheries, Kottaipattinam coast, Carangiforms, monsoon

RESUMEN

El presente estudio se ocupó de los recursos pesqueros en la costa de Kottaipattinam. El estudio se llevó a cabo durante el período de un año (abril de 2019 - marzo de 2020) para evaluar la diversidad y los cambios estacionales. En el presente estudio se registraron 58 especies pertenecientes al orden 19. Entre, se recolectaron diecinueve especies del orden perciformes que mostraron la mayor composición de especies. Se recolectaron ocho especies en el orden Carangiformes notado como el segundo orden dominante para la composición de especies. Otras órdenes mostraron menos representaciones. Se desembarcaron 53 especies durante la temporada posterior al monzón, seguida de la premonzónica (50 Nos) y las temporadas de monzón y verano representadas en números

iguales a 48. Se encontró claramente que la historia de vida de muchos peces en la bahía de Palk está adaptada a los cambios estacionales. Por lo tanto, sería útil diseñar estrategias de captura, especialmente en la bahía de Palk, para la utilización sostenible de los recursos.

Palabras clave: pesquerías, Costa de Kottaipattinam, Carangiformes, monson

INTRODUCTION

Marine fishery resource is a self-renewable living natural resource. This resources need to be managed and utilized in an optimum level is a prerequisite task (Bavinck et al 2005; FAO, 2006). Fishes has always been a primary source of food for coastal people which mainly extracted from coastal seas (Vivekanandan, et al., 1991). Coastal seas are dynamic environment which have rich community of fauna and flora, dependent each other, working together, vital to our planet and humanity. Coastal seas are commonly defined as the areas from the shoreline to the outer edge of the continental shelf. They connect the continents to the open ocean and serve as a link for transporting organic and inorganic, natural and anthropogenic material from land to sea. Coastal seas account for 7% of our ocean yet they are responsible for 95% of world marine productivity. Most of the coastal seas act as effective fishing grounds which supply fishery resources constantly to the human consumption. Coastal habitats such as estuaries, coastal wetlands, seagrass meadows, coral reefs, mangrove forests, and upwelling areas are act as feeding and breeding grounds which are unique ecosystems vital for faunal survival and human existence. India is rich in coastal resources and the annual harvestable fishery product increased as millions of tones day by day (Stevens *et al*, 2000; Varadharajan *et al* 2009).Exploitation of fishery resources over the years has gradually progressed from under exploitation to overexploitation in different parts of the coastal ecosystem (Savad. and Raghavan, 2001; Vivekanandan, 2003). Therefore, coastal resources are need to be assessed periodically to know the present status and exploitation limit. Hence, the present study was carried out in Palk Bay, India to know the present status of fishery resources which would useful to assess the habitat utilization by various organisms, migration and to design the management strategies for carrying capacity of Palk bay coastal seas ecosystem.

MATERIALS AND METHODS

Study area : Palk bay has a coastline of around 250 kilometres along the south-east coast of India, stretching from Kodiakarai (Point Calimere) to Dhanuskodi. The width of the Palk bay ranges from 64 to 137 km. It is a very shallow, flat basin with a maximum depth of 15 m and an average depth of 9 m. This shallowness allows light penetration to the bottom sediments and promote the extensive growth of seagrasses and seaweeds. Entire Palk bay found to have seagrass beds which giving scope for extensive productivity that in turn allows a wide variety of animals to shelter, breed and flourish. Hence, Study area support a wide diversity of marine resources, as well as a large number of livelihoods. The detailed information on study area explained in the figure 1.

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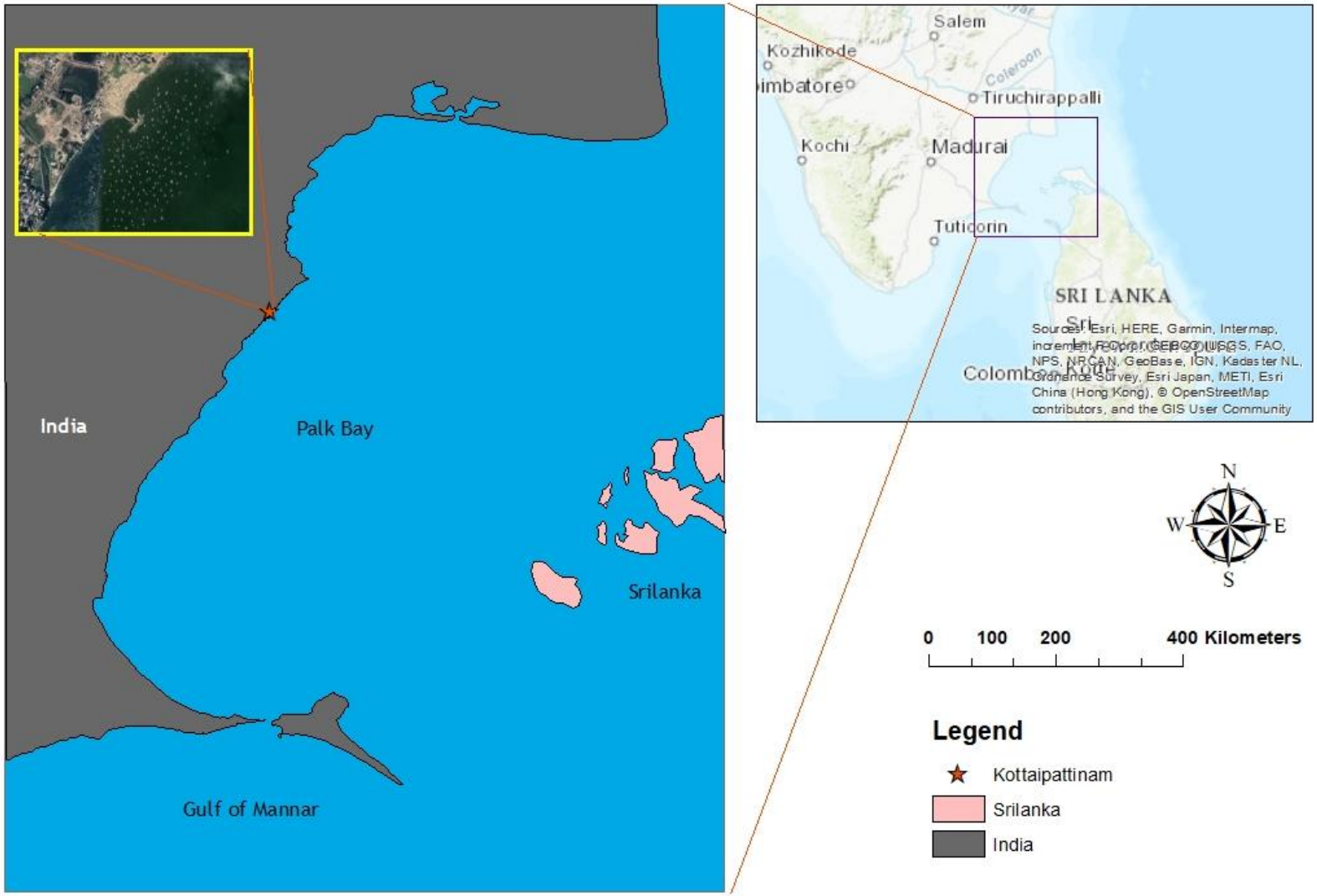
Fig.1 Study area - Kottaipattinam Landing Center



Sample Collection and assessment: The present study was carried out to assess the diversity of fishes in Kottaipattinam coast for the period of one year from March 2019 to February 2020. Fishes were collected from the landing center with the help of fishermen using different types of nets *viz*., gill net, and drawl net. Collected fish samples were preserved in the 10%formaldehyde solution in a plastic containers and brought to the laboratory for further analysis. Fishes were identified the morphological characters using a FAO sheets and standard references (Fischer, and Bianchi, 1984; Nelson, 1994, Ramaiyan, and Sivakumar, 1991) and Fish base. Qualitative and quantitative assessment were made in all seasons. The methodology for the present study is carried out as followed by Varadharajan and Soundarapandian (2009).

Data analysis: The species diversity (Shannon and Weiner, 1963); richness (Margalef, 1957); evenness index (Pielou's, 1966) were calculated using PRIMER v6 (Clarke and Gorley, 2006). The species diversity of fishery resources was calculated by using Shannon Weiner diversity index (H') (Shannon and Wiener, 1963)

$$H' = \Sigma^{S}i=1 \ (Ni/ N) \ln (Ni/N)$$

Where,

H' – the species diversity in bits per individual

S – the total number of species in the sample

N – the total number of individuals in the sample and

Ni – the number of individual in the ith species. (I = 1 to S)

Species richness (SR) was calculated using Simpson (D) formula, (Margalef, 1957)

$$D = S – 1 / \ln (C)$$

Where,

C – Σ pi 2

pi – ni /N

ni – Number of individuals of i1, i2 etc. and

N - Total number of individuals

S – Number of species

Species evenness index (J') (equitability) was calculated using the formula of Pielou, (1966)

$$J' = H' / \log (s)$$

Where,

H' – species diversity in bits per individual

S – Number of species

Multivariate statistical analysis: Principal Component analysis (PCA) provides an integrated description of species-seasons relationships. It was performed to evaluate possible correlations between fishery resources,

stations and seasons. It was performed using the multivariate statistical software PAST4 (v.4.11) Legendre & Legendre (1998). Multivariate tool such as Bray–Curtis similarity after suitable transformation of sample abundance data, classification (hierarchical agglomerative clustering using group-average linking), and ordination (multidimensional scaling, MDS) were used to assess the relationship of species and this analysis was calculated using of computer software of PRIMER (Plymouth Routines in Multivariate Ecological Research ver. 5.2).

RESULTS AND DISCUSSION

Kottaipattinam study area is the prominent landing center at Palk bay. A total of 58 species belongs to 19 order were recorded in the present study. Among, nineteen species were collected from the order perciforms which showed highest species composition. Eight species were collected in the order Carangiforms noticed to be second dominant order for species composition. Other orders showed least representations during the entire study. The details of species composition were showed at table 1. Fifty three species were landed during post monsoon season followed by pre monsoon (50 Nos) and monsoon and summer seasons represented by equal numbers as 48. Vintothkumar *et al* (2020) documented similar species composition at Palk bay.

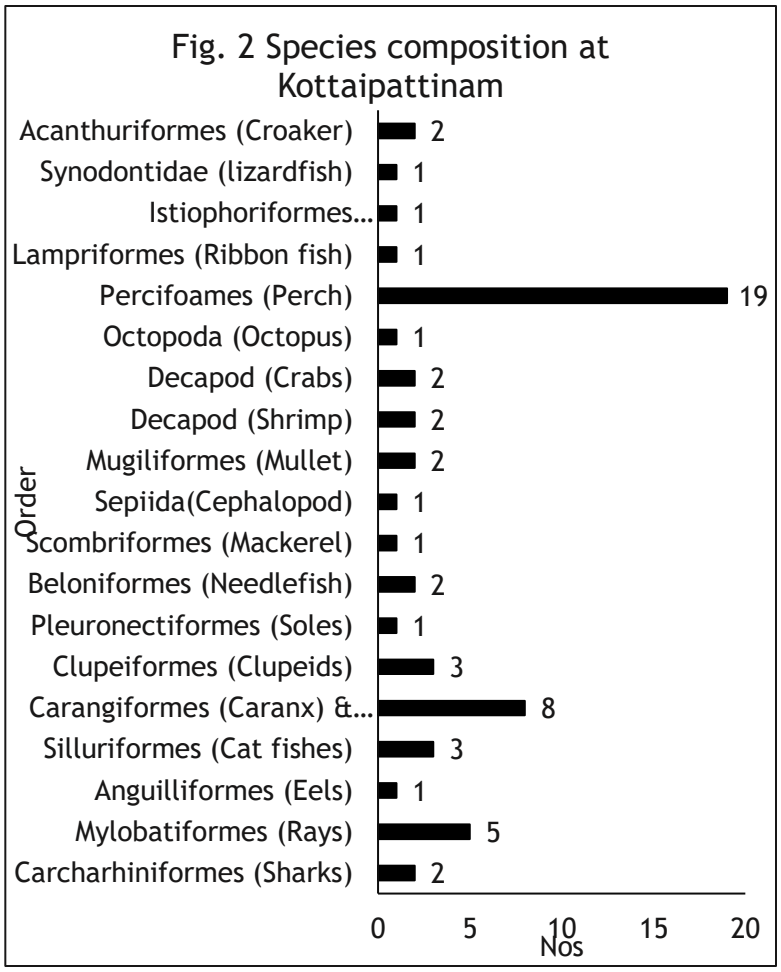


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Table1. Species composition at different seasons

S.no	Order	species	Summer	Pre- monsoon	Monsoon	Post monsoon
1	Carcharhiniformes (Shark)	*Cyiloscyilium indicum*	+	+	+	+
2		*Scoliodon* sp	+	-	-	+
3	Mylobatiformes (Rays)	*Dasyatis bleekeri*	+	-	+	+
4		*Himantura undulata*	-	+	-	+
5		*Himantura imbricata*	+	+	-	-
6		*Gymnura fasciolaris*	+	+	-	-
7		*Aetobatus flagellum*	+	+	+	+
8	Anguilliformes (Eels)	*Anguilla bicolor*	+	+	+	+
9	Silluriformes (Catfishes)	*Arius maculatus*	+	+	+	+
10		*Arius dussumeri*	+	+	+	+
11		*Soldier militaris*	+	+	+	+
12	Carangiformes (Caranx&	*Alepes djedaba*	+	+	+	+
13	Pomfret)	*Caranx heberi*	-	+	+	+
14		*Caranx ignobilis*	+	+	+	+
15		*Atule mate*	+	+	+	+
16		*Parastromatis niger*	+	-	-	+
17		*Pampus argenteus*	-	+	+	+
18		*Pampus chinensis*	-	+	+	+
19		*Scomberiodes commersonnians*	+	+	+	+
20	Clupeiformes (Clupeids)	*Sardinella gibbosa*	+	+	-	+
21		*Sardinella longiceps*	+	+	+	+
22		*Chirocentrus dorab*	+	-	+	-
23	Pleuronectiformes (Soles)	*Cynoglossus arel*	-	+	+	-
24	Beloniformes (Needlefish)	*Hemiramphus far*	+	+	+	+
25		*Hemiramphus limbatus*	+	+	+	+
26	Scombriformes (Mackerel)	*Rastrilliger kanagurta*	+	+	+	+
27	Sepiida (Cephalopoda)	*Sepia* sp	+	-	+	+
28	Mugiliformes (Mullet)	*Mugil cephalus*	+	+	+	+
29		*Mugil waigiensis*	+	+	+	+
30	Decapoda (shrimp)	*Panaeus indicus*	-	+	+	+
31		*Panaeus monodon*	+	-	+	+

32	Decapoda (Crab)	*Portunus pelagicus*	+	+	+	+
33		*Scylla serrata*	+	+	+	-
34	Octopoda (Octopus)	*Octopus* sp	+	-	+	+
35	Perciformes (perches)	*Etroplus suratensis*	-	-	+	+
36		*Stolephorous indicus*	-	+	-	+
37		*Gerres Oyena*	+	+	+	+
38		*Psammaperca waigiensis*	+	+	+	+
39		*Lethrinus lentjan*	+	+	+	+
40		*Leiognathus daura*	+	+	+	+
41		*Leiognathus equula*	+	+	+	+
42		*Secutor insidiator*	+	+	+	+
43		*Gazza minuta*	+	+	+	+
44		*karalla dussumieri*	+	+	+	+
45		*Upeneus tragula*	+	+	+	+
46		*Upeneus sundaicus*	+	+	-	+
47		*Chanos chanos*	+	+	+	+
48		*Siganus canaliculatus*	+	+	+	+
49		*Siganus javus*	+	+	-	+
50		*Sillago sihama*	+	+	+	+
51		*Teraon jarbua*	-	+	-	+
52		*Terapon puta*	+	+	+	+
53		*Epinephalus malabaricus*	-	+	+	+
54	Lambriformes (Ribbon fish)	*Lepturocanthus savala*	+	+	+	+
55	Istiphoriformes (Barracuda)	*Sphyraena barracuda*	+	+	+	+
56	Aulopiformes (Lizard fish)	*Saurida tumbil*	+	+	+	+
57	Acanthuriformes (Croaker)	*Panna microdon*	+	+	+	+
58		*Dendrophysa russeli*	+	+	+	+

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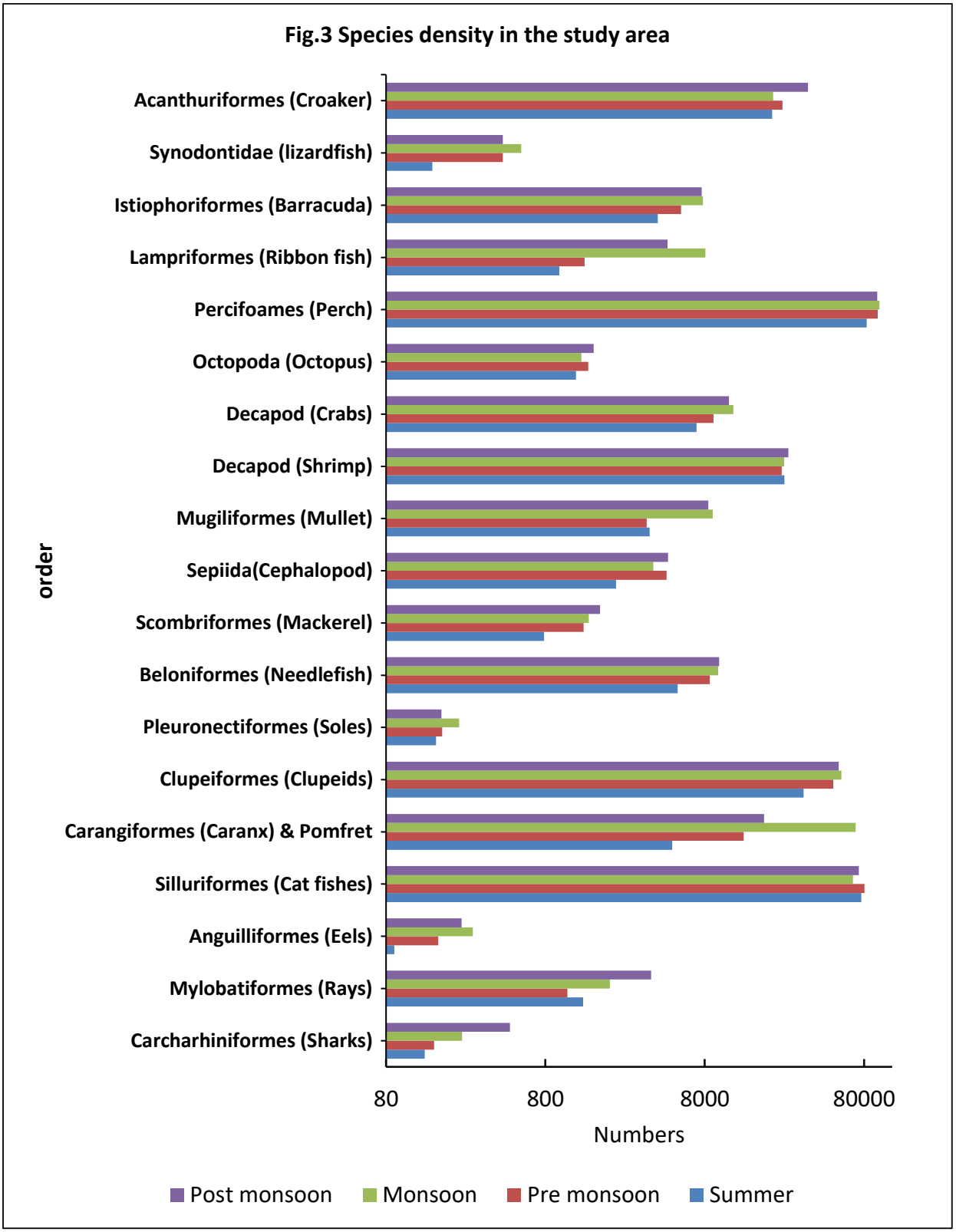

The Lakshadweep islands reported to have a total of 603 species of fishes (Jones and Kumaran, 1980; Talwar, and Kacker, 1984) and 1000 species are documented in the Andaman and Nicobar Islands and 358 in the Gulf of Mannar Biosphere Reserve (Varadharajan *et al* 2012). Kumaraguru *et al* (2008) enumerated that there are 580 species of fishes distributed in the entire Palk bay. But, landing centers such as Visakhapatnam, Pichavaram mangroves, Parangipettai reported as 50, 197 and 62 numbers (Ramaiyan., 997). Though the specific geographic area accounted to have larger numbers of species, landing center in the same location noticed to be less. Such observation found in Kottaipattinam which represented 10 % of the total resources of fishes at Palk bay due to seagrass beds and its productivity.

The population density of fishes varied from 90 to 99876 nos. Lower population noticed in the order anguilliformes (Eels) (90) during summer and higher population observed at Perciformes (Perch) (99876) during monsoon. Population density of fishes presented in the figure 3. Carcharhiniformes (Sharks), mylobatiformes (Rays), beloniformes (Needlefish), scombriformes (Mackerel), sepiida(Cephalopod), decapod (Shrimp), octopoda (Octopus) and acanthuriformes (Croaker) were abundant during post monsoon season (Jayaprakash, 2003). Anguilliformes (Eels), Carangiformes (Caranx) & Pomfret, Clupeiformes (Clupeids), Pleuronectiformes (Soles), Mugiliformes (Mullet) Decapod (Crabs), Perciformes (Perch), Lampriformes (Ribbon fish), Istiophoriformes (Barracuda), Synodontidae (lizardfish) were dominant during monsoon season (Vijayan., 2002, Antony Raja, 1964). Silluriformes (Cat fishes) alone dominant during pre-monsoon season (Santhanam and Perumal 2003). It was supported by principal component analysis stated that monsoon season greatly influence Carangiformes, Clupeiformes and Perciformes as they are found to be dominant groups influence fishery potential in the study area (Fig. 4). Hence, they are grouped in single axis. Meanwhile, post monsoon season influence other fishes might be treated as second dominate group. Silluriformes alone influenced by pre monsoon season. Same pattern of fish distribution according to seasons also elucidated at nonmetric multidimensional scaling (Fig. 5). Croaker and shrimps are influenced by post monsoon season, their population strength predominantly support to the resource stock in Palk bay, especially at kottaipattinam coastal area. It was clearly found that the life history of many fishes in Palk bay are adapted to the seasonal changes. Hence it would be useful to design the capture strategies especially in Palk bay for sustainable resource utilization (Balasubramanian, 2000; Karuppasamy and Perumal 2000).

The diversity indices was higher at Post monsoon followed monsoon, pre monsoon and summer (Table.2). Likewise, species evenness was higher at monsoon and post monsoon and lower at pre monsoon and summer. Species richness was high at summer and followed by pre monsoon, post monsoon and monsoon. The present study reveals that monsoon and post monsoon seasons are highly significant for capture fisheries.

As conclusion, the present study dealt fishery resources at Kottaipattinam coast. Kottaipattinam represented nearly 10% of total resources of the Palk bay. The species composition and population of the fishes are

greatly influenced by seasonal climatic conditions. Monsoon season influences many fishes for their dominance and proliferation followed by post monsoon season and pre monsoon season. Carangiformes, Clupeiformes and Perciformes found to be abundant and monsoon season would be play a vital role for its proliferation. Therefore, some conservation planning and capture related strategies are vital during monsoon and post monsoon seasons for sustainable exploitation and stock maintenance.

Table 2. Diversity indices in different seasons

	Summer	Pre monsoon	Monsoon	Post monsoon
DIVERSITY	1.906	1.995	2.136	2.148
EVENNESS	0.65	0.68	0.73	0.73
RICHNESS	1.44	1.42	1.4	1.41

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Fig.4 Principal Component analysis of species with seasons

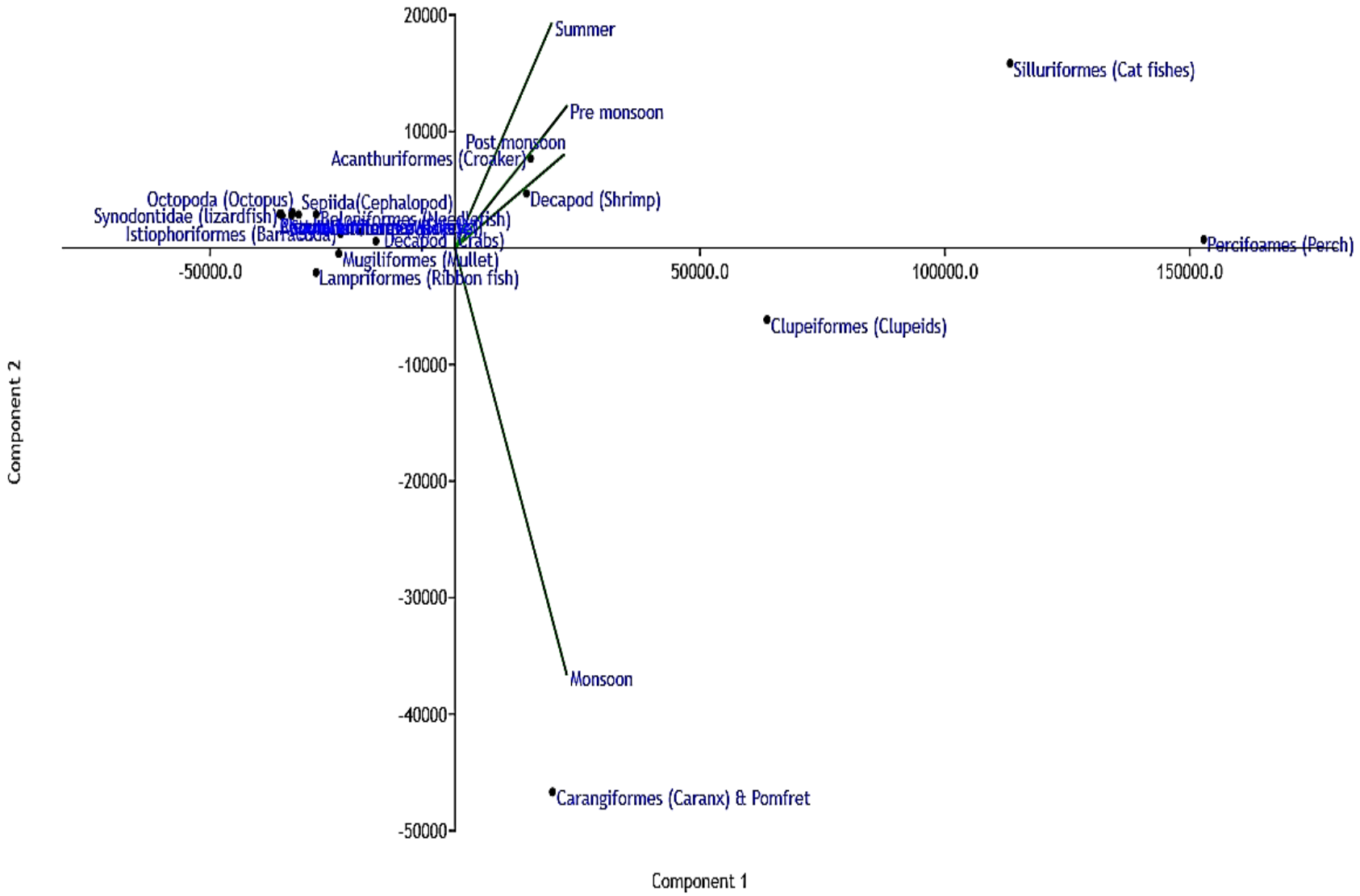

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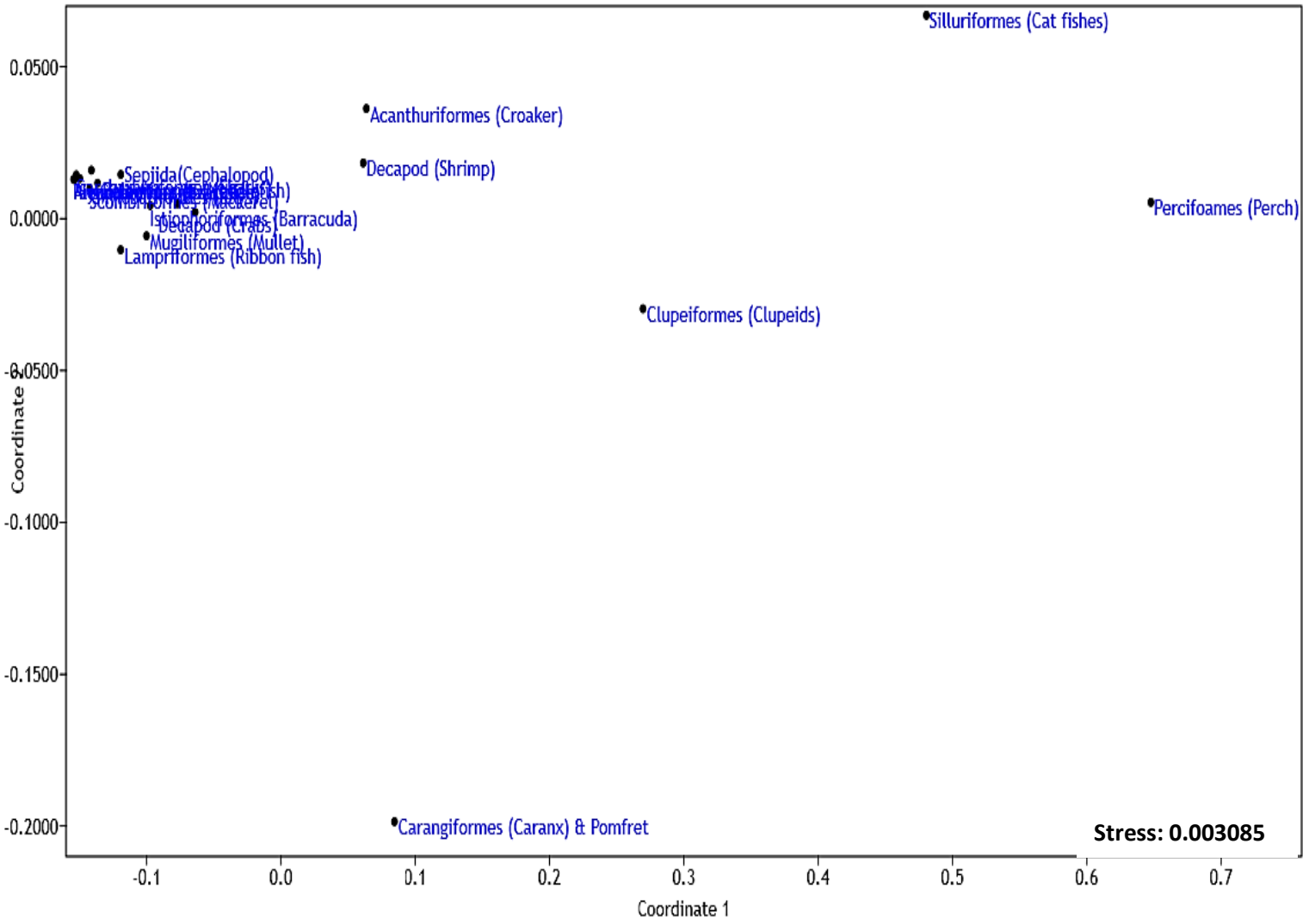
Fig.5 nMDS of order-level data at season wise. Non-metric multidimensional scaling ordination of average daily estimated weights of each of the order-level taxonomic categories at each of the seasons



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