

Impact of shrimp aquaculture on the finfish diversity along the estuary of River Kali, West coast of India

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Abstract: The present study was carried out to determine the impact of shrimp aquaculture on the finfish diversity along the estuary of river Kali, West Coast of India from January 2016 to January 2017(13 months). The estuary was divided into three zones, zone 1&3 were near the shrimp farm area and zone 2 in the middle of the estuary, zone 2 was not directly affected by the shrimp farm activities. Totally 51 species of finfish were recorded from the estuary, zone 2 being the highest 51 species of finfish recorded, zone 1&3 with 37 and 40 nos. This study showed that the water released from pond has direct impact on the finfish diversity.

Introduction:

Estuaries means mixing of freshwater and saline water near the bar mouth of the river. The water is generally highly saline; this is why estuary supports a rich biodiversity of flora and fauna. Karnataka coast line extends over a length of 320 km with numerous mouths, lagoons, bays, creeks and long beaches. Fourteen rivers drain their waters in to the sea along the coast of Karnataka. The important estuaries include Nethvathi-Gurupur, Shambavi,Gangoli,Shravathi, Aghnashini, Gangavali and Kali (Purshottama et al., 2014). It is well known that the estuaries and brackish water impoundments from the nursery grounds for several economically important species of finfish and shellfish(Wickens, 1976,Achuthankutty and Nair, 1980; Achuthankutty, 1987, Gunaga et al 1989, Sambandam, 1994; Mohan et al., 1995; De and Sinha 1997). Kali estuary which is located on the northern Karnataka west coast of India is known for its richness in flora and fauna. During the past few decades human interference in estuary is affecting the organisms present in water body, lots of Dams have came up on the upstream of the river which breaks down the flow of nutrient in to the estuary. Since no big industries establishment has not come up on the river bank, but aquaculture which is practicing semi intensive way has dotted the estuary from early 90s.To study if there is any impact of aquaculture activity on the fish diversity in the Kali estuary is presents this study will give a compressive report on the affect.

Material & Methods -

Kali Estuary is situated in Uttar Kannada district in Karwar ($14^{\circ}.48'N$ and $74^{\circ}.07'E$). A study was undertaken for the period of 13 months(January2016 – January2017) to study the biodiversity of finishes in the Kali estuary with relation to impact of aquaculture on these species.

The estuary was divided into three zones, zone 1(Which is near the shrimp aquaculture farms situated at Kanasgiri and Bandarwada) zone3 (which is situated along to the shrimp aquaculture pond at Sunker backwaters), zone 2 (which is situated in the middle to the estuary, not that much affected by shrimp aquaculture), (Fig1).Cast net and drag net were used to collect fin fishes in concurrence with fishermen to keep an account and record the availability of tides. Collected fishes were preserved in 5% formaldehyde for identification by using StandardKeys (Jayaram et al 1984, Day. 1989 and Talwar.1991) and fish base website (www.fishbase.org) was used for identification.

“Fig.1”. Kali estuary divided into three zones for study of finfish diversity.



Result and discussion:-

Three zones were demarked in the aquaculture area, so two zones 1&3 were located on the right banks of the river where pond water is released directly into the river and zone 2 in the middle of the estuary which is not affected because it is located far away from aquaculture sites. In the present study, around 51 fin fishes were recorded belong to 24 families in all the zones. All the 51 fin fishes were present in zone 2 which is in middle of the estuary, indirectly affected by anthropogenic activities especially by aquaculture. In zone 1, 37 species belonging to 22 families were observed and in zone 3, 40 species of fin fishes belonging to 22 families were recorded in the study period (Tab 1 and Fig 2). Low number of fishes in zone 1 and 3 could be due to impact of aquaculture in this area. Fin fishes generally avoid polluted waters.

No study on the impact of aquaculture on the finfish diversity along the Karnataka estuary has been carried out during recent years. But there are studies on the diversity of fin fishes along the Karnataka estuary. Archana (2003) has studied on the finfish seed resources of Kali estuary and reported presence of 46 seeds of fin fish. Roopa et al, 2011 has studied on the fin fish diversity in river Kali and reported presence of 37 fin fishes in the estuarine area, A comprehensive study by Ramchandra et al., 2013 on the fin fishes of estuaries along Uttar Kannada coast was done and he reported 61 fin fishes belonging to 50 genera from Kali estuary 55 species of 48 genera from Gangavali estuary and 80 species of 64 genera from Agnashini estuary. When compared to earlier workers on their on fin fishes of Kali estuary.

The present study shows elevated species richness in river kali, but when the data is seen zone wise, zone 1 and 3 which are near the aquaculture ponds shows comparatively lower no of species, this can directly be attributed to release of pond water in the open waters of the river. Due to the introduction of *L.vannamei* the aquaculture is gaining high momentum without proper management. There are detailed study carried out around the world on the impact of aquaculture on the wild fish stocks (Dempster et al 2004, 2006 Machias et al 2004). Another issue that has been taken in account is the transmission of diseases from the cultured species to the wild stock (Dempster et al 2002). A further analysis using PRIMER software was carried to see the various diversity. The results of various diversity indices are calculated and given in Table 2. Zone 2 showed high no of Shannon Weaver indices with 3.93 followed by, 3.68 in zone 3 and 3.61 in zone 1. The dendrogram revealed clearly the separate grouping of zone 1&3 and this was linked with zone 2 i.e., there is similarity of species in zone 1 and 3 (fig 3).

In conclusion of the study we can understand that river Kali estuary is still very rich in finfish diversity when compared to other estuaries. A proper management and practice, especially educating the farmers on the impact of aquaculture on the resources of river has to be given. The current study gives a clear picture that pond water has been putting strain on the finishes as the fishes move out into the open waters. This will have an impact on the breeding of the fishes as fishes generally prefer mangrove areas in the estuary.

Table 1: Finfish recorded along Kali estuary in different zones

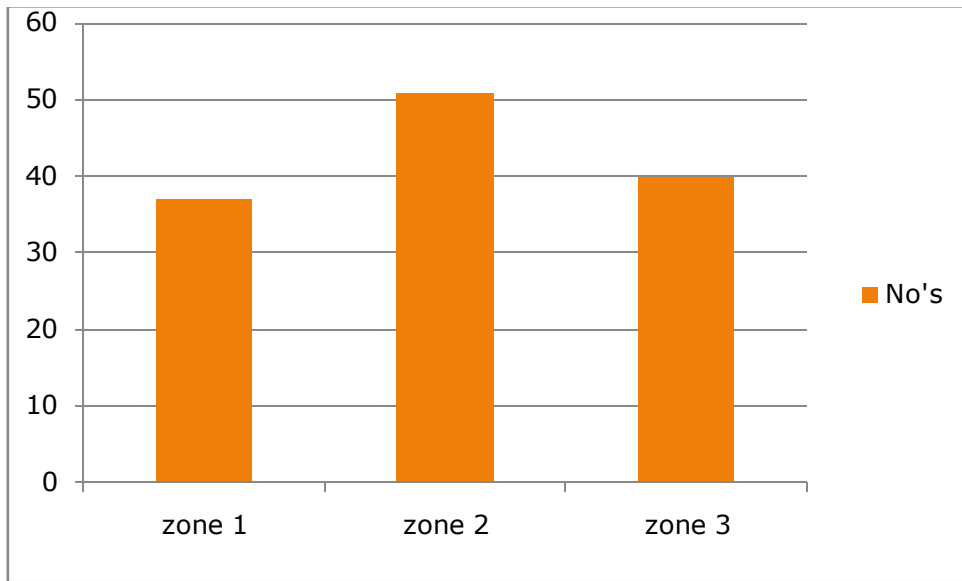
Family	Species	zone 1	zone 2	zone 3
<i>Ambassidae</i>	<i>Ambassis natalensis</i>	+	+	+
<i>Apogonidae</i>	<i>Apogon frangilis</i>	+	+	+
<i>Apogonidae</i>	<i>Apogon kiensis</i>	+	+	
<i>Arridae</i>	<i>Arius jella</i>		+	
<i>Arridae</i>	<i>Arius subrostratus</i>		+	+
<i>Carangidae</i>	<i>Alectis indicus</i>		+	+
<i>Carangidae</i>	<i>Caranx ignobilis</i>	+	+	+
<i>Carangidae</i>	<i>Megalapsis cordyla</i>	+	+	+
<i>Centropomidae</i>	<i>Lates calcarifer</i>	+	+	+
<i>Cichlidae</i>	<i>Etroplus suratensis</i>		+	+
<i>Cichlidae</i>	<i>Etroplus canarensis</i>	+	+	+
<i>Cichlidae</i>	<i>Etroplus maculates</i>	+	+	+
<i>Clupeidae</i>	<i>Anodontostoma chacunda</i>	+	+	+
<i>Cichlidae</i>	<i>Escualosa thoracata</i>	+	+	+
<i>Cichlidae</i>	<i>Hilsa kelee</i>		+	+
<i>Cichlidae</i>	<i>Illisha megaloptera</i>	+	+	+

<i>Cichlidae</i>	<i>Nematalosa nasus</i>	+	+	
<i>Cynoglossidae</i>	<i>Cynoglossus arel</i>	+	+	+
<i>Cynoglossidae</i>	<i>Cynoglossus macrostomus</i>		+	+
<i>Cynoglossidae</i>	<i>Cynoglossus puncticeps</i>		+	+
<i>Engraulidae</i>	<i>Coilia dussumieri</i>	+	+	
<i>Cynoglossidae</i>	<i>Encrasicholina devisi</i>	+	+	
<i>Cynoglossidae</i>	<i>Encrasicholina punctifer</i>		+	+
<i>Cynoglossidae</i>	<i>Stolephorus indicus</i>		+	+
<i>Cynoglossidae</i>	<i>Stolephorus insularis</i>	+	+	
<i>Cynoglossidae</i>	<i>Thryssa dussumieri</i>		+	+
<i>Cynoglossidae</i>	<i>Thryssa mystax</i>		+	
<i>Cynoglossidae</i>	<i>Thryssa malabarica</i>	+	+	
<i>Gerreidae</i>	<i>Gerres filamentosus</i>	+	+	+
<i>Gerreidae</i>	<i>Gerres limbatus</i>		+	+
<i>Haemulidae</i>	<i>Pomadysus maculatus</i>	+	+	+
<i>Hemiramhidae</i>	<i>Hemiraphus archipelagicus</i>	+	+	+
<i>Hemiramhidae</i>	<i>Hyporhamphus limbatus</i>	+	+	+
<i>Leiognathidae</i>	<i>Leiognathus bindus</i>		+	+
<i>Leiognathidae</i>	<i>Leiognathus equulus</i>	+	+	+
<i>Leiognathidae</i>	<i>Leiognathus splendens</i>	+	+	
<i>Leiognathidae</i>	<i>Leiognathus lineolatus</i>	+	+	+
<i>Leiognathidae</i>	<i>Gazza minuta</i>	+	+	+
<i>Leiognathidae</i>	<i>Secutor insidiator</i>	+	+	+
<i>Megalopidae</i>	<i>Megalopas cyprinoides</i>	+	+	+
<i>Menidae</i>	<i>Mene maculate</i>	+	+	
<i>Monodactylidae</i>	<i>Monodactylus argenteus</i>	+	+	
<i>Mugilidae</i>	<i>Liza parsia</i>	+	+	+
<i>Mugilidae</i>	<i>Mugil cephalus</i>	+	+	+
<i>Platycephalidae</i>	<i>Grammoplites scaber</i>	+	+	+
<i>Plotosidae</i>	<i>Polydactylus sextarius</i>	+	+	+
<i>Sillaginidae</i>	<i>Sillago sihama</i>	+	+	+
<i>Terapontidae</i>	<i>Terapon theraps</i>	+	+	+
<i>Terapontidae</i>	<i>Terapon puta</i>	+	+	+
<i>Triacanthidae</i>	<i>Triacanthus biaculeatus</i>	+	+	+
<i>Tetraodontidae</i>	<i>Lagocephalus inermis</i>		+	+

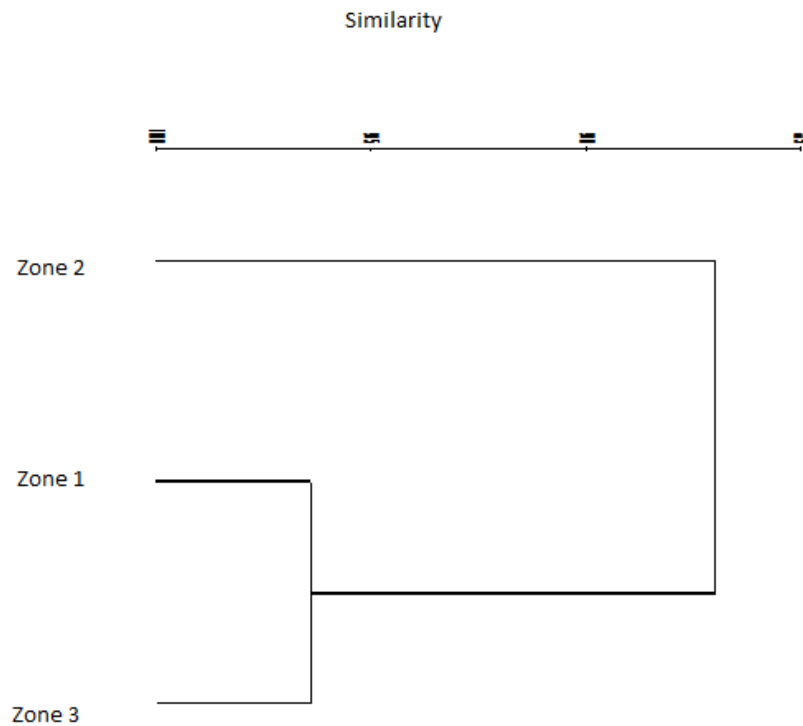
Table 2: Variation in species abundance of fin fishes at different zones

S	N	d	H'(log)	1-Lamb
37.00	37.00	9.97	3.61	1.00
51.00	51.00	12.72	3.93	1.00
40.00	40.00	10.57	3.69	1.00

“Fig 2”: Zone wise fin fish diversity in River Kali estuary



“Fig. 3”: Variation in species abundance and similarity index for finfish diversity



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