Journal of Research in Biology

FicusPublishers

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Original Research paper

An International Online Open Access Publication group

Impact of elevation, latitude and longitude on fish diversity in Godavari River

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ABSTRACT:

India is very rich in biodiversity, India supports about 10% of the world's biological diversity, with just 2% of world land area. Therefore India is the seventh richest biodiversity in the world. The India has Himalaya Mountain, Eastern Ghat, Western Ghats Indo-gangetic plain, Deccan plateau, desert, coasts are all present in it. In India many type of river also present, one of the river Godavari River is the second largest river in India. Fish biodiversity studies were undertaken during January-2008 to Decemeber-2008 to census and commercially important fishes in the Godavari River. The present paper deals with the variety and abundance of fresh water fishes in Godavari River with reference to the elevation, latitude and longitude. Two sampling points were selected with different elevation latitude and longitude. The Results of the present investigation reveal the occurrence of 53 fish species belonging to 9 orders, 21 families and 37 genera.

Among the collected species two sampling site species composition were so different. Species composition in Gangapur dam is lower than the Rajahmundry dam. In species composition order Cypriniformes was most dominant to both sampling site.

Keywords:
Elevation, latitude and longitude Fish biodiversity, Percent wise compositions, Godavari River.

Web Address:
http://jresearchbiology.com/Documents/RA0075.pdf.

Article Citation:
Sandeep R. Rathod
Impact of elevation, latitude and longitude on fish diversity in Godavari River
Journal of research in Biology (2011) 4: 269-275

Dates:
Received: 07 Aug 2011 /**Accepted:** 11 Aug 2011 /**Published:** 16 Aug 2011

INTRODUCTION

Fishes form one of the most important groups of vertebrates, influencing there life in various ways, Such as economically and nutritionally it very important. Fishes provide several by-products to us. Fishes have formed an important item of human diet from time immemorial and are primarily caught for this purpose. A large amount of phosphorous and other elements are also present in it.

Biodiversity is the degree of variation of life forms within a given ecosystem, biodiversity is essential for stabilization of ecosystem protection of overall environmental quality for understanding intrinsic worth of all species on the earth (Ehrlich *et al.,* 1991).The rapid environment change on earth therefore has its impact on the biodiversity, that's why the united nation declares the year 2010 as the international year of biodiversity. India consists of six drainage system. These are Indus river system, upland cold water bodies, Gangetic river system, Bramhaputra river system, east flowing river system, and west flowing system. (Pandey *et al*, 2007). In this river ecosystem fishes play a very important role to maintain ecosystem. Fish biodiversity of river essentially represents the fish faunal diversity and their abundance. River conserves a rich variety of fish species which support to the commercial fisheries.

The Godavari River originates in the Western Ghats near Tribmkeshwar in Nishik district of Maharashtra. It flows in the east across the Deccan plateau through the Maharashtra and end Bay of Bengal at Yanum, Andhra Pradesh. It lengths about 1465 km. It is the second largest river in India. On this river many major irrigation projects were constructed. We have selected two major dams on Godavari River such as Gangapur dam and Rajahmundry dam for our analysis. Present investigation was undertaken to study the fish diversity of Godavari River.

Indian region fishes are about 2500 species, freshwater fishes 930 species and remaining 1570 are marine(K.C Jayaram 1999). Present freshwater fishes are recorded 801 (Fish base 2004).

The ancient Indians classified fish, based on the shape size and their knowledge from keen observation are remarkable as seen from Kautilya's Arthashasthra (Ca300 B.C.), King Someswara's Manasallosa (1127A.D.) In the field of ichthyology there is a valuable contribution by many workers, (Hamilton Buchanan, 1822; McClelland,1839; Sykes 1839; T.C. Jerdon 1849; Day 1878; Talwar and Jhingran, 1991; K.C. Jayaram**,** 1999; Sakhare and Joshi, 2002; Dutta *et al.,* 2003; Sakhare and Joshi, 2004; Yadav, 2005; Battul *et al.,* 2007; Ashashree *et al.,* 2008.)

Some of them are on the specific ponds, lakes and the water laying areas fish biodiversity. No more documentation and fishes were recorded from the major Indian River ecosystem. We have studied on the Contribution and composition of fishes in Godavari River with reference to its elevation, longitude and latitude.

MATERIAL AND METHODS

Fishes were collected from Godavari River; Gangapur Dam Dist. Nashik (M.S) and Rajahmundry Dam Dist. Rajahmundry (A.P) India. We have sampled in three seasons (Monsoon, winter and summer), Sampling was done with the help of local fishermen using different type of nets namely gill nets, cast nets, dragnets, jhel net(Arial net) and tradition net. In rainy session the gill net varies in mesh sizes. After collection specimen photographs were taken immediately with the help of digital camera.

Fishes were brought to laboratory and preserved in 10% formalin. Small fishes specimens were directly preserve in 10% solution and big specimens were injected with 10% formalin in the abdomen of the fish. Keep these specimens in separate jars according to the size of species.

The Meristic and morphometric characters were measured and identified up to the species level, with the help of standard keys and books (Day, 1978; Jayaram**,** 1999 and Talwar and Jhingran 1991).

Study area:

Site 1: The Gangapur dam is located near Gangawadi village and it is 10 km from the Nashik city. This earthen dam was constructed in 1954. Total length of dam is 3810 m., and maximum height is 36.56 m. From origin of Godavari river distance is 28 kms. Distance between Gangapur dam to Rajmuhandri dam is 1352kms. (Longitude: $74^0$07'E, Latitude: $20^0$00'N and Elevation above sea level: 1992ft.).

Site 2: Rajahmundri dam is also known as Dowleshwaram Dam. It's just 10 km from the rajahmundri city. It was built by Sir Alfred cotton and constructed 1848-52. (Longitude: $81^0$45'E, Latitude: $17^0$01'N and Elevation above sea level: 74ft.)

RESULT AND DISCUSSIONS

During the study period different fish varieties can be observed in the Godavari River, India. Fishes belonging to nine orders and twenty one families were collected during the study period. Many collected fishes were having economic, medicinal and cultural, ornamental importance and sold after collection in the local fish market. In the present fish biodiversity study 53 species of 37 different genera 21 families and 9 orders were recorded from the Godavari River during January 2008- December 2009. The members of Order Cypriniformes were dominated with 40 species followed by Perciformes with 7 species, Siluriformes with 6 species, Beloniformes with five species each, Osteoglossiformes with 2 species and Synbranchiformes with 1 species.

In Gangapur Dam there found five orders representing by 26 fish species, order Cypriniformes was dominant group with 14 species in the assemblage composition in which ***Puntius ticto, Salmostoma navacula*****,** were found most abundant. ***Catla catla, Cyprinus carpio carpio Garra mullya*** were found abundant form. ***Puntius fraseri***, ***Rasbora Daniconias***, ***Thynicthys sandkhol, Osteobrama vigorsii, Nemachilus Moreh, Nemachilus botia*** were found less abundant. ***Chela laubuca, Puntius dorsalis, Puntius filamentosus,*** were found rare abundant. Followed by order Perciformes were six species in the assemblage composition in which ***Chanda nama*** was found most abundant form. ***Glossogobius giuris giuris*** were found abundant form. ***Channa marulius, channa punctatus, Channa oriantalis, and Parambassis ranga*** were found less abundant. Followed by order Siluriformes were four species in the assemblage composition in which ***Aorichthys aor*** were found abundant form. ***Mystus cavasius*** were found less abundant. ***Wallago attu, Heteropneustes fossilis*** were found rare abundant. Followed by order Synbranchiformes were one species in the assemblage composition in which ***Macrognathus pancalus*** were found abundant. Followed by order Osteoglossiformes were one species in the assemblage composition in which ***Notopterus notopterus*** were found abundant. (**Table 1**).

Table 1: - The fish biodiversity of Godavari River in Gangapur dam during January 2008 – December 2008.

	Family	Species	Native/Introduce	Species abundance
1	Notopteridae	Notopterus notopterus	Native	++
2	Cyprinidae	*Puntius ticto*	Native	+++
3	Cyprinidae	*Puntius fraseri*	Native	+
4	Cyprinidae	*Puntius filamentosus*	Native	-
5	Cyprinidae	*Puntius dorsalis*	Native	-
6	Cyprinidae	*Salmostoma navacula*	Native	+++
7	Cyprinidae	*Chela laubuca*	Native	-
8	Cyprinidae	*Rasbora Daniconias*	Native	+
9	Cyprinidae	*Thynicthys sandkhol*	Native	+
10	Cyprinidae	*Osteobrama vigorsii*	Native	+
11	Cyprinidae	*Catla catla*	Native	++
12	Cyprinidae	*Cyprinus carpio carpio*	Introduced	++
13	Cyprinidae	*Garra mullya*	Native	++
14	Balitoridae	*Nemachilus Moreh*	Native	+
15	Balitoridae	*Nemachilus botia*	Native	+
16	Chanidiae	*Chanda nama*	Native	+++
17	Chanidiae	*Parambassis ranga*	Native	+
18	Gobiidae	*Glossogobius giuris giuris*	Native	++
19	Channidae	*Channa marulius*	Native	+
20	Channidae	*channa punctatus*	Native	+
21	Channidae	*Channa oriantalis*	Native	+
22	Bagiridae	*Aoirichthys aor*	Native	++
23	Bagiridae	*Aoirichthys cavasius*	Native	+
24	Siluridae	*Wallago attu*	Native	-
25	Heteropneustidae	*Heteropneustes fossilis*	Native	-
26	Mastacembelidae	*Macrognathus pancalus*	Native	++

Table 2: - The fish biodiversity of Godavari River in Rajahmundri dam during January 2008 – December 2008.

Sr. no	Family	Species	Native/Introduce	Species abundance
1	Notopteridae	Notopterus notopterus	Native	+
2	Notopteridae	*Notopterus chitala*	Native	+
3	Anguillidae	*Angulla bengulensis bengalenss*	Native	-
4	Clupeidae	*Hilsa ilisha*	Native	+
5	Cyprinidae	*Salmostoma navacula*	Native	++
6	Cyprinidae	*Cyprinus carpio carpio*	Native	++
7	Cyprinidae	*Osteobrama vigorsii*	Native	+++
8	Cyprinidae	*osteobrama dayi*	Native	-
9	Cyprinidae	*Thynnichthys sandkhol*	Native	+
10	Cyprinidae	*Cirrhinus mirgala*	Native	+
11	Cyprinidae	*Cirrhinus reba*	Native	+
12	Cyprinidae	*Puntius Vittatus*	Native	-
13	Cyprinidae	*Puntius ticto*	Native	+
14	Cyprinidae	*Puntius fraseri*	Native	+
15	Cyprinidae	*Puntius filamentosus*	Native	-
16	Cyprinidae	*Catla catla*	Native	++
17	Cyprinidae	*Labeo rohita*	Native	+
18	Cyprinidae	*Labeo calbasu*	Native	++
19	Cyprinidae	*Labeo arzia*	Native	++
20	Cobitidae	*Lepidocephalus guntea*	Native	++
21	Heteropneustidae	*Heteropneustes fossilis*	Native	-
22	Bagiridae	Mystus seenghala	Native	+
23	Bagiridae	Mystus bleekeri	Native	++
24	Bagiridae	*Mystus cavasius*	Native	++
25	Bagiridae	*Aorichthys aor*	Native	+
26	Bagiridae	*Rita rita*	Native	+
27	Siluridae	*Wallago attu*	Native	++
28	Siluridae	*Ompak bimaculatus*	Native	+++
29	Pangasiidae	*Pangasius pangasius*	Native	+
30	Sisoridae	*Bagarius bagarius*	Native	++
31	Schilbeidae	*Silonia children*	Native	+
32	*Nandidae*	nandus nandus	Native	-
33	Gobiidae	*Glossogobius giuris giuris*	Native	++
34	Chanidiae	*Chanda nama*	Native	++
35	Chanidiae	*Parambassis ranga*	Native	++
36	Channidae	*Channa marulius*	Native	++
37	Channidae	*channa striatus*	Native	++
38	Channidae	*channa punctatus*	Native	++
39	Channidae	*channa orentalis*	Native	++
40	Cichlidae	*Etroplus suratensis*	Native	+
41	Cichlidae	*Oreochromis mossambica*	introduced	+
42	*Anabantidae*	*Anabus testudineus*	Native	-
43	Mastacembelidae	*Mastacembelus armatus*	Native	+
44	Mastacembelidae	*Macrognathus pancalus*	Native	+++
45	Mastacembelidae	Macrognathus aculeateda	Native	+
46	Beonidae	*Xanthodon cansula*	Native	++
47	Mugilidae	*Rhinomugil corsula*	Native	+

In Rajahmundry Dam there found nine orders representing by 47 fish species, order Cypriniformes was dominant group with 16 species in the assemblage composition in which ***Osteobrama vigorsii*** were found most abundant. ***Lepidocephalus guntea, Labeo arzia, Labeo calbasu, Catla catla, Cyprinus carpio carpio and Salmostoma navacula*** were found abundant form. ***Thynnichthys sandkhol, Cirrhinus mirgala, Cirrhinus reba, Puntius ticto, Puntius fraseri and Labeo rohita*** were found less abundant. ***Puntius filamentosus, Puntius Vittatus, osteobrama dayi*** were found rare abundant. Followed by order Perciformes were 10 species in the assemblage composition in which ***Glossogobius giuris giuris, Chanda nama, Parambassis ranga, Channa marulius, channa striatus, channa punctatus, channa orentalis*** was found abundant. ***Etroplus suratensis, Oreochromis mossambica*** were found less abundant. ***Anabus testudineus*** was found to be rare abundant. Next order Siluriformes were 12 species in the assemblage composition in which ***Ompak bimaculatus*** were found most abundant form. **Mystus bleekeri,** ***Mystus cavasius, Wallago attu, Bagarius bagarius*** were found abundant. **Mystus seenghala** ***Aorichthys aor, Rita rita, Pangasius pangasius, Silonia children*** were found less abundant. **Nandus nandus,** ***Heteropneustes fossilis*** were found rare abundant. Followed by order Synbranchiformes were three species in the assemblage composition in which ***Macrognathus pancalus*** were found most abundant. ***Mastacembelus armatus*** **Macrognathus aculeateda** were found less abundant. Followed by order Osteoglossiformes were two species in the assemblage composition in which ***Notopterus notopterus Notopterus chitala*** found less abundant. Followed by order Anguilliformes were one species in the assemblage composition in which ***Angulla bengulensis bengalenss*** were found rare abundant. Followed by order Clupeiformes were one species in the assemblage composition in which ***Hilsa ilisha*** were found rare abundant. Followed by order Beloniformes were one species in the assemblage composition in which ***Xanthodon cansula*** were found abundant. Next order Salmoniformes were one species in the assemblage composition in which ***Rhinomugil corsula*** were found less abundant. (**Table 2**)

26 species were recorded and identified on the Gangapur Dam. Among the order Cypriniformes were most dominant constituting 55 % followed by order Perciformes were constituting 22%, Siluriformes constituting 12 %, Osteoglossiformes constituting 8 %, and Synbranchiformes constituting 3 % of the total fish species. (**Fig.1**)

47 species were recorded and identified on the Rajahmundry Dam. Among the order Cypriniformes were most dominant constituting 43 % followed by order Siluriformes constituting 33 %, Clupeiformes were constituting 7%, Perciformes was constituting 6%, Beloniformes constituting 4 %, Synbranchiformes constituting 3 %, Anguilliformes constituting 2%, Osteoglossiformes constituting 1 %, and Salmoniformes constituting 1 % of the total fish species. (Fig.2)

When sampling throughout the year, we observed that so many different fish species were being caught in monsoon compared to winter and summer seasons. Local Fisherman also undergoes intensive fishing in monsoon seasons as compare to other seasons.

Mahapatra (2003) recorded abundance of catfishes in Hirakund reservoir. Total of 43 species were present in which 18 were commercially important. Sakhare and Joshi (2003) reported 34 species of fishes in reservoirs of Parbhani Dist. of Maharashtra (India). Pisca *et al*., (2000) reported a genera fish belonging to four orders and 28 species from Ibrahimbagh reservoir of Hyderabad. Sugunan and Yadava, (1992) mentioned 40 fish species from Hirakhud reservoir of Orissa forming the commercial fishery.

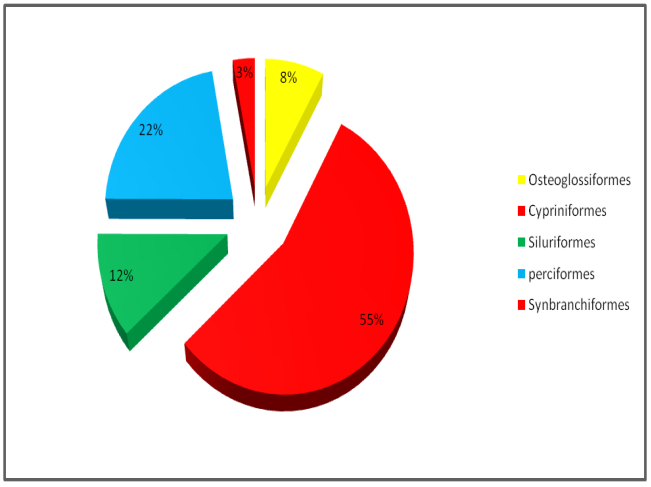

Fig.1. Pie chart image showing Family wise fish composition, Gangapur Dam (Godavari River) Dist. Nashik(M.S), India.

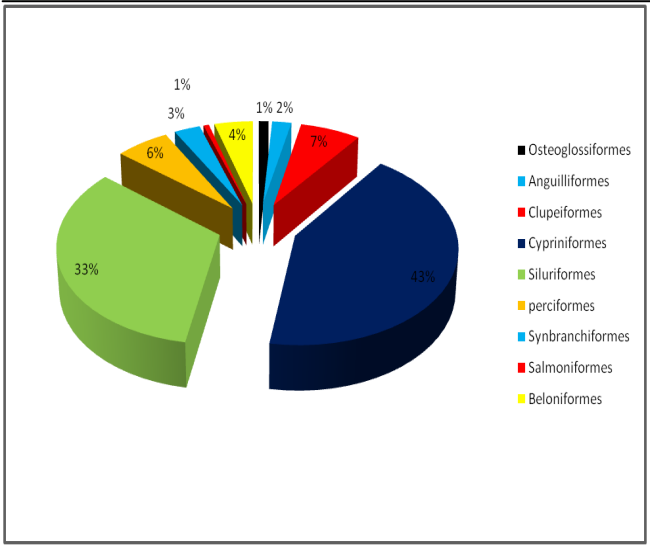

Fig.2. Pie chart image showing Family wise fish composition, Rajahmundri dam (Godavari River) Dist. Rajahmundri (A.P), India.

Species diversity is also depending on the altitudes because when the altitude increases the species richness decreases thus in low latitudes the species richness increases. The gradient of species richness is asymmetrical about the equator. The latitudinal gradients of species richness may be resulted from the energy available to the ecosystems. At lower latitudes, there are higher amounts of energy available because of more solar radiation, more resources (for example, minerals and water); as a result, even higher levels of species richness can be allowed at lower latitudes. However, there have been relevant studies showing that species richness and primary productivity are actually negatively correlated (www.physorg.com). Studies on altitudinal gradients in flowering plants (Schroeter, 1908; Braun-Blanquet, 1932; Raunkiaer, 1934) showed that there is a sharp decrease in the total number with altitude, at least beginning with the subalpine level. Between 2001 and 2200 meters in the Polish tatra, there are almost 200 species whereas above 2400 there are only 46 species. Similar gradings in Switzerland show how the number of species gradually dwindles so that above 3900 meters there are no more than six. In the canton of glarus, at less than 3250 meters, there are none at all. Similar records were made in the Vale d'Aosta in Italy and also at various other places (Braun-Blanquet, 1932).

In Herbaceous Plants, it depends clearly on ecological interpretation, and indicate the distribution and abundance pattern of this species in grassland were correlated with the topographic feature as well as sheep impact and elevation gradient. Species distribution and abundance pattern varying from high elevation areas with low vegetation cover to low elevation areas with higher vegetation cover.(R.C. Klinger *et.al*).

In present study the Gangapur Dam (Longitude: $74^0$07'E, Latitude: $20^0$00'N and Elevation above sea level: 1992ft.) elevation is high were less species richness of about 26 species belonging 10 family included in 5 orders were recorded. In Rajahmundry Dam (Longitude: $81^0$45'E, Latitude: $17^0$01'N and Elevation above sea level: 74ft.) elevation is low and species richness is more it is about 47 species of 20 families included in 9 orders. On concluding result Gangapur Dam located at an elevation of about 1992 ft. and species records were found to be26 species and the Rajahmundry Dam located at an elevation of about 74 ft. and species records were found to be 47 species. Altitude as well as latitude is one of the factors which most strongly influence the distribution of species.

ACKNOWLEDGMENTS

The authors are grateful to the Head, Dept of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004 (M.S) India, and Aquaculture research laboratory, Department of Zoology Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004 (Maharashtra) India for providing laboratory and library Facilities during the course of study.

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