Fishes of the Towkak River: With special emphasis on the habitat requirements

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Abstract:

Fishes occur wherever water of reasonable integrity exists, from deep sea depths exceeding 8,000 m to mountain lakes above 5,000 m altitude. The biodiversity, of the Towkak River shows an interesting trend in regards to habitat requirements. The Geomorphology of the river basin and different habitat requirements parameters also reveals that the distribution of the fishes along the river course. The study results total of 96 species of fishes under, 57 genera belonging to 24 families and 10 orders. The Habitat Suitability Index (HIS), also results that, water quality of the Towkak River have optimum carrying species capacity At the same time, the increased population and environmental degradation have caused damage to this biodiversity. This damage could be severe and may result in loss of genetic diversity, populations and eventually to the extinction of species.

Key words: Biodiversity, Fishes, Geomorphology, Habitat requirements, Towkak River,

Introduction:

Fishes occur wherever water of reasonable integrity exists, from deep sea depths exceeding 8,000 m to mountain lakes above 5,000 m altitude. (Stiassny, 1999). About 58% of all fishes are marine and 41% live in freshwater, with the remaining 1% designated as diadromous, moving regularly between the ocean and freshwater systems Approximately 97.5% of Earth's water is oceanic salt water, leaving only 2.5% as fresh. However, 99.7% of the freshwater is frozen in polar ice caps and glaciers, stored as groundwater, or locked up as soil moisture or permafrost (Stiassny, 1999). Only about 0.009% of the water on Earth is available as habitat for the more than 10,250 freshwater fish species (Kar, 2007).

Water is valuable natural resources that essential to human survive and the ecosystems health. Water are comprises of coastal water bodies and fresh water bodies (lakes, river and groundwater). Since the past few decades, the increasing of anthropogenic activities especially in industrial area has effects to water bodies. (Kar, 2007, 2010, 2012, 2013)

India is one of the Mega biodiversity countries in the World and occupies 9th position in terms of fresh water mega biodiversity (Mittermeier and Mittermeier, 1997). Concomitantly, North-Eastern region of India has been identified as a 'Hotspot' of Biodiversity by the World Conservation Monitoring Centre (WCMC, 1998). This rich diversity of the region could be assigned to certain reasons, notably, the geomorphology and the tectonics of this zone. (Dutta *et al* 2013).

The valuable data can be obtained to provide a basis comparison of river's system at different seasons and different years. The monitoring and assessment may be useful for research and policy making purposes. *In situ* measurements and collection of water samples for subsequent laboratory analyses are currently used to evaluate water quality. These measurements are accurate for a point in time and space but do not give either the spatial or temporal view of water quality in wide space. Thus, the technologies such as remote sensing and GIS are very useful as a tool in evaluating and monitoring water quality.

Structural characteristics of the lotic environment are closely associated with the occurrence of the fish species. The importance of the habitat and the relationship between fish and the habitat are major concerns of the fishery biologist, as the habitat features like depth, flow, substrate type etc are generally considered as major determinants in distribution and abundances of fishes from earlier times (Shelford, 1911).

Methods and Methodology:

The present study will be to compile a description of the fish diversity, and its suitable habitat, to assess the potential sites for the fish habitat restoration and conservation. Fish diversity and inventorization were be done following standard literature of Jayaram (1999) and Talwar & Jhingran (1991). The habitat inventory parameters would be studied after Armontrout (1990, 1992); NBFGR Manual (2000); Kar (2007). The geographic locations of the study points would be recorded with the help of German made Garmin GPS-60 having software interface. GIS works would be done following standard procedure and with the help of satellite imageries, Survey of India toposheets and aided by standard GIS (ArcGIS9.1, ERDAS 9.2 and QGIS 2.0.1)

About The Study Area:

The Towkak river is situated in the district of Sivasagar in Assam and in Tizit and Mon district in North Nagaland.The Geographical location of the Towkak river is in between $27^0 02.710^/$ N to $26^0 52.510^/$ N and $094^0 57.279^/$ E to $095^0 06.034^/$E. The river is a tributary of the Dichang river of Brahmaputra drainage system. The origin of the river is hilly and reach type is mainly pool and riffle to braided type as it occurs from the different hills of the Nagaland state. It is named as Tigit river in its upper course of origin, as it enter into the Sivasagar district of Assam it named changed into Towkak river. In the course of the river it meets with a another small river (Tiok) and finally with Tiok river it reach the Dichang river of Brahmaputra drainage system at Borahi, near Sonari of Sivasagar District. River Tiok and Naga nadi are main two sub-tributaries of the river.The bed rocks, boulders, cobbles and gravels from the main components of the river substratum on the upper part of the river, which provides suitable feeding and breeding habitat for the up streams fishes. The muddy and sandy substratum at the lower part of the river have a rich diversity of phytoplankton and zooplankton, also provides sufficient nutrition's for the fishes.

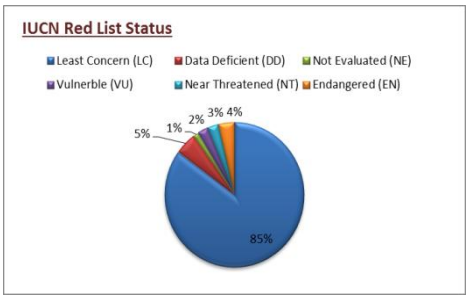
Fishes of the Towkak River:

A total of 96 species of fishes, under, 57 genera belonging to 24 families and 10 orders.

Where, Cyprinidae family having highest number of 41 fish species with 24 genera belonging to Cypriniformes order which are occurred in the Towkak River. Channidae and Bagridae family have 8 and 7 number fish species each respectively, having 2 and 4 genus each belonging from perciformes and siluriformes order. The fishes of other family like Belonidae, Ambassidae, Anabantidae, Chacidae, Heteropneustidae, Synbranchidae, Labroidei, Tetraodontidae were found to be very less in their occurrence.

It was also noticed few exotic species found in the river, in which Common carp (Cyprinus carpio), Grass carp (Ctenopharyngodon idella), Silver carp (Hypopthalmichthys molitrix), Big head carp (Hypopthalmichthys nobilis), Thailand magur (Clarius garripinius), Japani Kawai (Oreochromis mossambica) etc., are common throughout the river.

Conservation Status of the Fishes:



According to the IUCN red list, the studied fish species were categorized into six groups, *viz*., Least Concern, Data Deficient, Not Evaluated, Venerable, Near Threatened, and Endangered.

The above diagram shows, there are 85% of fishes are Least Concern, whereas 1% of the total fishes are not evaluated.

No of Fish Species with Respect to their Occurrence (categorized after IUCN red list assessment)

Occurrence	No of Fish Species
Critically Found (+)	9
Rare (++)	36
Widely Distributed (+++)	51

No of Fish Species With Respect to their Feeding Habitat

Feeding Habitat	No of Fish Species
Herbivorous	44
Carnivorous	29
Omnivorous	23

Linear Correlation table between total Number of Fishes and Plankton in Three different Seasons

Sl No	Fish Species	Pre-monsoon	Monsoon	Post-monsoon
Fish Species	0	0.5608	0.5231	0.43677
Pre-monsoon	-0.12493	0	5.4716	1.1793
Monsoon	-0.13705	0.99548	0	1.0006
Post-monsoon	-0.16651	0.96771	0.96067	0

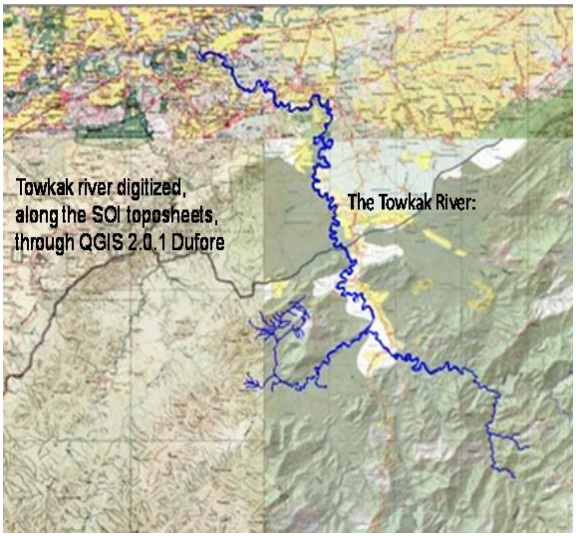
The above correlation table between Fish Species and Plankton in three different seasons results,

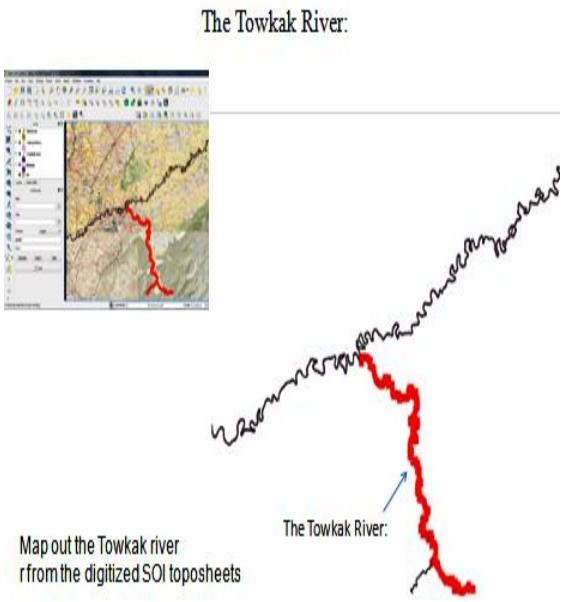
There is a positive correlation between number of plankton in each season and with fish number, indicates number of fishes increase with the increasing number of plankton in each seasons.

While there also negative correlation occurs between number of fishes with plankton, indicates number of plankton in each season decreases with the increasing number of fishes

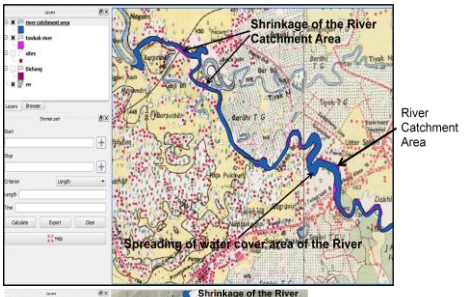
Characteristic features of the soil types and river basin

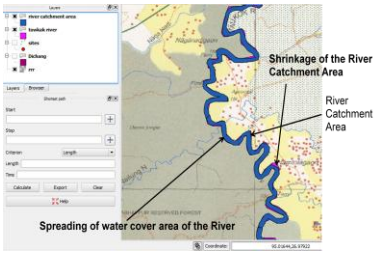
The bed rocks, boulders, cobbles and gravels form the main components of the river substratum in the upstream portion of the river, which provide suitable feeding and breeding grounds for the up streams aquatic life. The muddy and sandy substratum at the lower part of the river comprises a rich diversity of phytoplankton and zooplankton. They also provide sufficient nutrition for the fishes and also for the other aquatic organisms. The flood in the lower and middle part of the river also plays an important role in the production of fishes which are found to be increased during the rainy season (June to August of each year). The soil type of river basin is alluvial throughout the year with high percentage of sand and silt, but the other nutrients like NPK are found to be on the lower side. The soil samples from the three regions of the river mainly, upper, lower and middle course of the river, collected for analysis, and found that the river soil contains 70% to 80% of sand, followed by 15% to 20% of silt and 10% to 15% of clay.

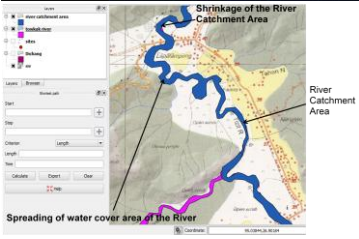




Intrusion of the water spread area into the river water area at different portion:







Typical GIS output table including surveyed Species data (temporal and biological measurements) as well as derived habitat environmental.

Sl No	Sites	LAT-LON		X-Y		Height (Meters)	Species Index	Temporal	Habitat Descriptions					
									BS	WV (M/Sec)	Microhabitat	Substratum type	ST	RV
1	Dumukhiya	27002	94057	644063.2	2986654	532	2.15	July2011-june 2014	+	L	Fall,	Fines	Clayey	P
2	Borahi	27002	94058	652244.7	2982154	458	2.11	July2011-june 2014	+	L	Fall,	Fines	Clayey	P
3	Dumahi	27002	94058	660428.1	2985804	399	2.45	July2011-june 2014	+	L	Fall,	Fines	Clayey	P
4	Sonari	27001	95000	666305.1	2983150	195	3.2	July2011-june 2014	+	L	Fall,	Fines	Clayey and Gravelly	P
5	Santipur	27000	95000	670876	2980766	125	1.56	July2011-june 2014	+	L	Fall,	Fines	Clayey and Gravelly	P
6	Thukubill	27001	95001	673986.9	2977728	50	2.4	July2011-june 2014	+	M	Fall,	Boulder	Silty, Clayey	P
7	Sildubi	27001	95001	677212.8	2973153	21	2.14	July2011-june 2014	+	M	Fall Cascade	Fines	Clayey	P
8	Bordubi	27001	95002	672849.5	2970846	20	1.76	July2011-june 2014	+	M	Fall Cascade	Fines	Sandy and Clayey	P
9	Toop	27001	95002	678902	2968501	24	1.8	July2011-june 2014	+	M	Fall Cascade	Cobble-gravel	Sandy and Clayey	P
10	Joboka	27000	95002	679247.2	2966271	17	3.1	July2011-june 2014	+	M	Fall Cascade	Cobble-gravel	NR	P
11	Jobokahabi	27000	95002	678325	2965156	46	2.1	July2011-june 2014	+	M	Fall	Cobble-gravel	Sandy	P
12	Gutighat	27000	95002	680130.4	2964733	72	1.4	July2011-june 2014	+	M	Fall Cascade	Cobble-gravel	Sandy	P
13	Silghat	27000	95001	680245.2	2962695	116	2.3	July2011-june 2014	+	M	Fall Cascade	Boulder	Silty	P
14	Naganadi	26059	95001	678362.7	2962081	145	2.23	July2011-june 2014	+	M	Runseed	Fines	Sandy, Silty	P
15	Namtola	26057	95002	677093.2	2954315	417	2.76	July2011-june 2014	+	H	Runseed	Cobble-gravel	Sandy, Silty	P
16	Lapha	26056	95003	677284.7	2951701	568	3.42	July2011-june 2014	-	H	Runseed	Boulder	Sandy, Silty	A
17	Tizit	26054	95003	677092.2	2949779	730	3.12	July2011-june 2014	-	H	Riffle-pool	Bed rock	Silty	P
18	Dumahi	26053	95003	678013.6	2947587	881	3.36	July2011-june 2014	-	H	Riffle-pool	Bed rock	Silty	P

19	Camp	26053	95004	678052	2947549	966	2.8	July2011-june 2014	-	H	Riffle-pool	Bed rock	Silty	P
20	Sangcha	26052	95006	677859.9	2947280	1070	3.1	July2011-june 2014	-	H	Riffle-pool	Bed rock	Silty	P

(*LAT-LON (decimal degrees) and X-Y (meters): coordinates
WV: Water Velocity; ST: Soil Type; BS: Bank Stability: RP: Riparian Vegetation).

The above derived habitat environmental table results, Stable Bank stability in all most all regions of the river, but the river-bank in the upstream portion is not stable, the instability of the river bank is due to the tremendous collection of bed rocks, boulders etc., from that region. The water velocity continuously decreasing from upstream to downstream. Microhabitat are mainly Fall, Cascade in the lower and middle parts of the river, while the upper middle and upper parts are Run-seed and Riffle-pool type. The substratum constitute Fines, Cobble-gravel and Boulders all most in all parts of the river, but the upper part of the river mainly consists of Bed rock. Soil type constitute of Clayey and Gravelly at the lower parts of the river, Clayey and Sandy at the middle parts, and the upper parts mainly Sandy and Silts. Rippian Vegetation present in every sites along the river, except Lapha in nagaland.

Habitat Suitability Index

A Habitat Suitability Index (HIS) is a numerical index that represents the capacity of a given habitat to support a selected species.

HSI of water quality for Towkak River
HSI=sqtroot(21.29*20.56*6.7*19.87*8.4*5*6.78*2.33*49.1*0.21)/9
= 0.92

The results indicates water quality of the Towkak have optimum carrying species capacity

HSI of fish diversity for Towkak River
HSI=nth sqrroot of no of all fish species/20
= 0.38

The results revels possible diversity for the fish species in the Towkak River

DISCUSSION

A brief study of biotic and abiotic parameters of the river Towkak subjected to wide variation of biodiversity in within the river. As, the river originated from the various hills of the southern Nagaland towards the plain regions, the geomorphology of the river basin is little unstable. The frequent changes of the river courses, especially in the upper and middle reaches, have a great bearing on the faunal compositions of the river. Two most important factor sedimentation and siltation also plays a vital role in the production of fishes. The importance of the study concerns about the habitat features like position, stream order, depth (bankful depth, channel depth, wetted depth)., width, (bankful width, channel width, wetted width)., flow, substrate type, microhabitat, riparian vegetation, valley segments, cover type, sings of erosion., etc., are subjected to distribution of the fishes within the river itself. The potential habitat parameters for the fishes of the Towkak River in Assam and Nagaland were estimated by using various habitat potential parameters give clear reasons to justify the availability of fish diversity within the river.

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