

AN APPROACH TO STUDY THE INFLUENCE OF FISH ABUNDANCE IN RELATION TO TEMPERATURE USING GIS – A CASE STUDY OF ALIYAR RESERVOIR, TAMILNADU

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Abstract:

The Geographic Information System (GIS) is a rapidly growing technological field that incorporates graphical features with the tabular data in order to access real world problems. It has gained importance in the area of fisheries science and management. The foundation of GIS in mapping makes it as an initiative tool for fishermen. In the area of fisheries management, the GIS community has an opportunity to respond positively to immediate fisheries crisis around the world. For the creation of fish abundance in Aliyar reservoir, we have applied the GIS technique using ARCGIS 9.2. A GIS data case comprising of fish abundance related to temperature is created. The result of the study gives us an enormous knowledge to know about the abundance of fish in relation to temperature in Aliyar reservoir. Since India has a considerable livestock and poultry population, all efforts have to be mobilized to reclaim the resources and put them to use effectively.

Introduction:

The Geographic Information System (GIS) is a rapidly growing technological field that incorporates graphical features with tabular data in order to assess real world problems. The earliest version of a GIS was known as computer cartography and involved simple line work to represent land features. The data used in a GIS environment may be remotely sensed data, digital model of the terrain or point or area data which is compiled in the form of maps, table or reports.

Geographical Information System has been used to predict the pollutants in storm secure network, to monitor non point source of pollution from agricultural areas and urban environment to assist contingency plans and also the environmental impact assessment. Using remotely sensed data, hydrological models were classified that have been applied with GIS.

Our present study aims

- To identify and map the favourable temperature for fish species richness.
- To correlate the fish species richness with temperature.

- To prepare a thematic map for maximum fish catch.
- To propose an action plan for management of fish in the Aliyar reservoir.

METHODOLOGY:

GIS mapping analysis is a process looking at geographical patterns data and their relationship between features. The geographic features are either discrete, continuous phenomena or summarized by an area. The discrete locations, lines and the actual locations can be pinpointed. The continuous data starts out as a series of sample points that are regularly spaced or irregularly spaced.

Mapping Technique:

The toposheet of the present study area, Aliyar reservoir with scale 1:50,000 obtained from the survey of India were scanned using HP Scanner and edited using the MS-photo editor. The scanned image was stored as JPEG file and is used for study.

The image was opened in ArcView 9.2a. Later, these images were projected using projection of the world polyconic. The units were taken as decimal degrees and measuring units were in km. The registration and transformation was done to convert the image to real world co-ordinates.

In the transformation technique, the co-ordinates recorded were opened in the Arc View. The option 'Add Table' present in Arc View, adds the co-ordinates to the map out of which points were created. The created points were coordinated to that of raster layers. Similar features to that of points were identified in the raster layer and a source point was selected in the raster map. The raster layer was assigned the real world coordinates of the study area. On completion of the transformation, further digitized layers are automatically assigned the same co-ordinates.

Digitization:

Digitization is a method of data capture that involves conversion of data in analog form such as maps into a digital form that is directly readable by a computer. Digitizing is the method of converting raster layer to vector layer. Most of the GIS technologies are vector formats are common. Therefore, the raster format is converted into a vector format and the position of the line is determined by the co-ordinates, which are present at the starting and ending points of the line.

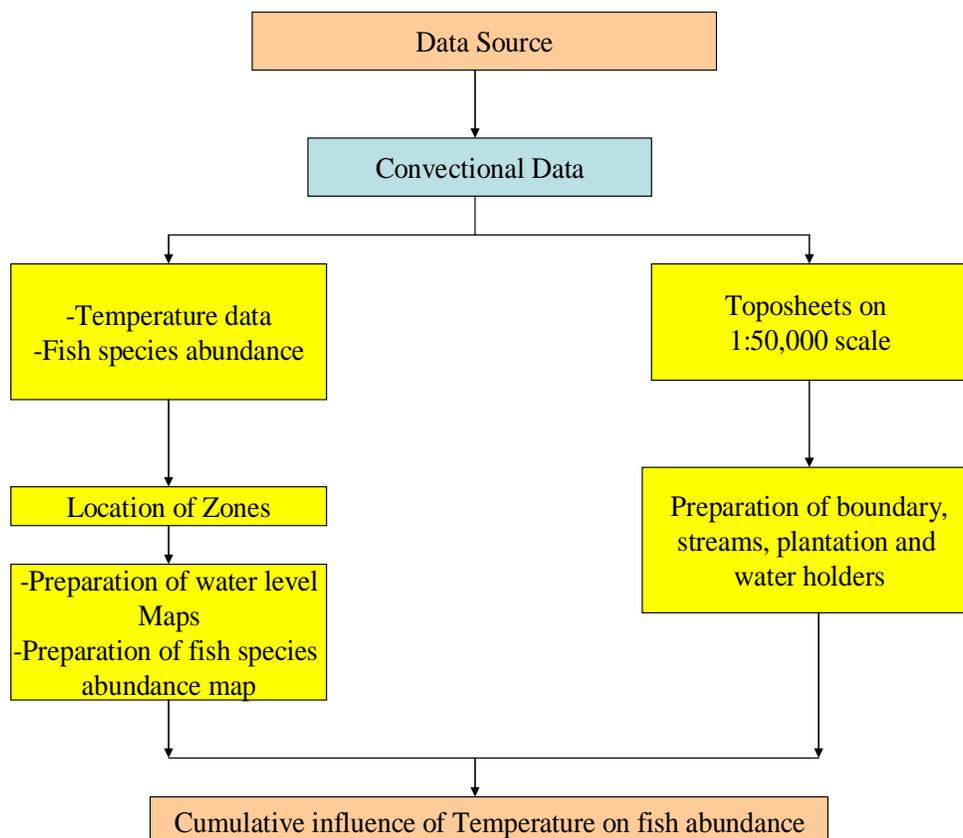
There are two methods of digitization, the first method in which the features in the map are traced using a digitized cursor. Here the system converts the cursor position into a digital signal, which can be induced to show the actual co-ordinates of the points. This is very time consuming one.

In the second method, the scanned image can be changed into a vector format by the heads-up digitization, in which the operator uses a mouse to interactively edit and clean the raster image, to remove stray marks or line gaps picked up in the scanning process.

The first method is called the off-screen digitization, where a digitizer board is used. The second method is on-screen digitization where the digitization process is carried out directly on the computer. Further tools allow the user to select individual raster features for the vector conversion, direct keying of attribute data and the other tools to speed the process of vector conversion.

The reservoir boundary was digitized as a separate layer using polylines. Polygon modules were used to fill the reservoir. The streams, contours, plantations and reserve forest were digitized from the toposheets.

SCHEMATIC ILLUSTRATION OF THE METHODOLOGY.



STUDY AREA DESCRIPTION:

Aliyar reservoir, situated between 10°15' and 103°0' N and 76°50' and 77°10' E, covers 646.0 ha at the FRL of 320.04m above MSL. Current fish yield rate of Aliyar reservoir is one of the highest in the country. The reservoir acted a testing ground for the field trials of the scientific management package developed by the CICFRI and the yield optimization achieved thereof is a standing testimony to the validity of the package:

RESULTS:

The basemap depicting the boundaries of Aliyar reservoir was prepared using survey of India toposheets. Digital analysis was carried out using ArcView 9.2a GIS environment

The total area of the reservoir covers 646.0 ha at the FRL of 320.04m above MSL and the data is collected from TamilNadu Fisheries Development Corporation Ltd., Aliyar reservoir.

Fishing Zones:

The state fisheries department identified four zones (locations) inside the reservoir for fishing based on the depth of the water. These locations are identified by using the latitude/longitude of each site. The locations were geocoded on the reservoir base map. Information records of each zone were created in the notepad. The database contains mean water level at first day and fifteenth day of the month, temperature and the total number of fish species in the location for each zone are represented in the following tables.

Table:1 TEMPERATURE VALUES OF DIFFERENT ZONES:

Zones	2005-2006 (°C)
I	20.20
II	32.70
III	31.40
IV	33.10

Table:2 FISH SPECIES AND TOTAL COUNTS

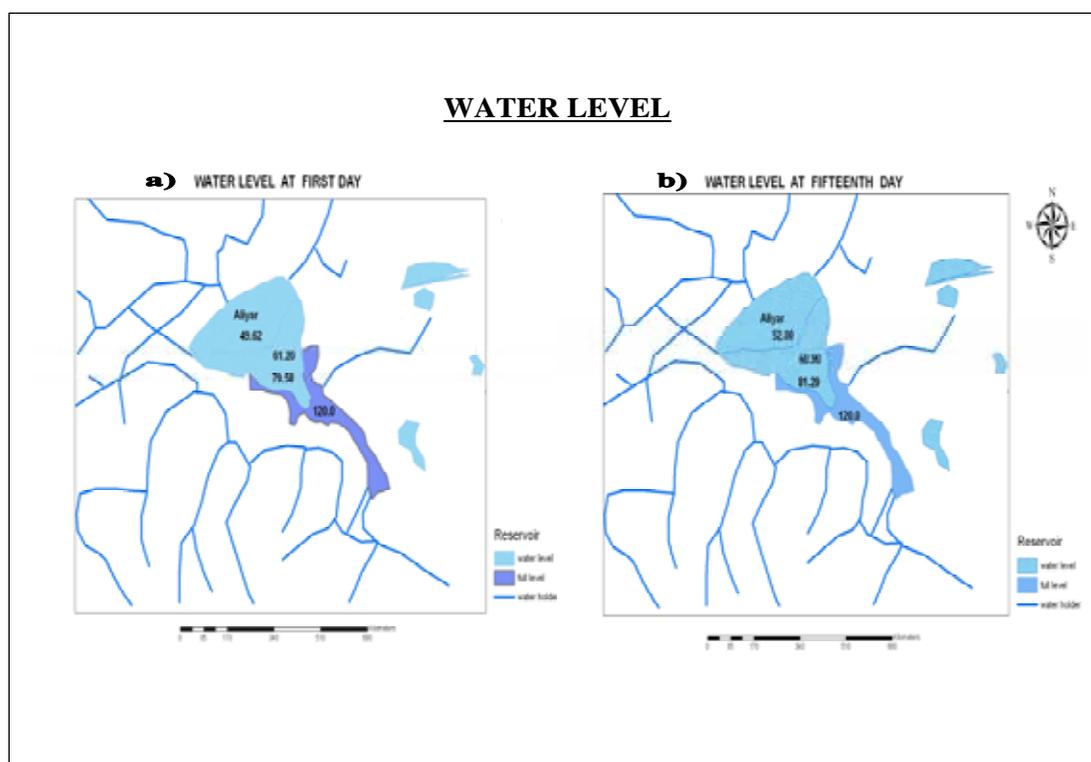
Fish Species	Total Counts
C.Catla	11230
L.Rohu	75300
C.Mrigala	98200
Labio Fimbriates	11250

Table:3 WATER LEVEL AT FIRST AND FIFTEENTH DAY

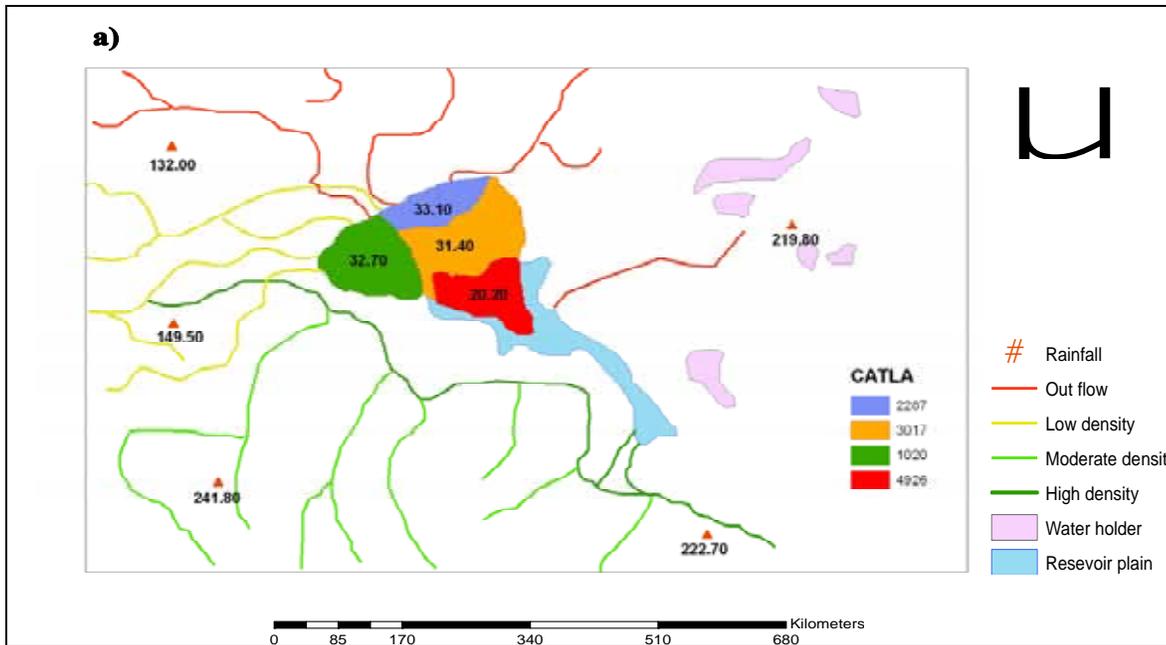
First day water level (in Feet)	Fifteenth day water level (in feet)
49.62	52

The Influence of Temperature on Diversity Species:

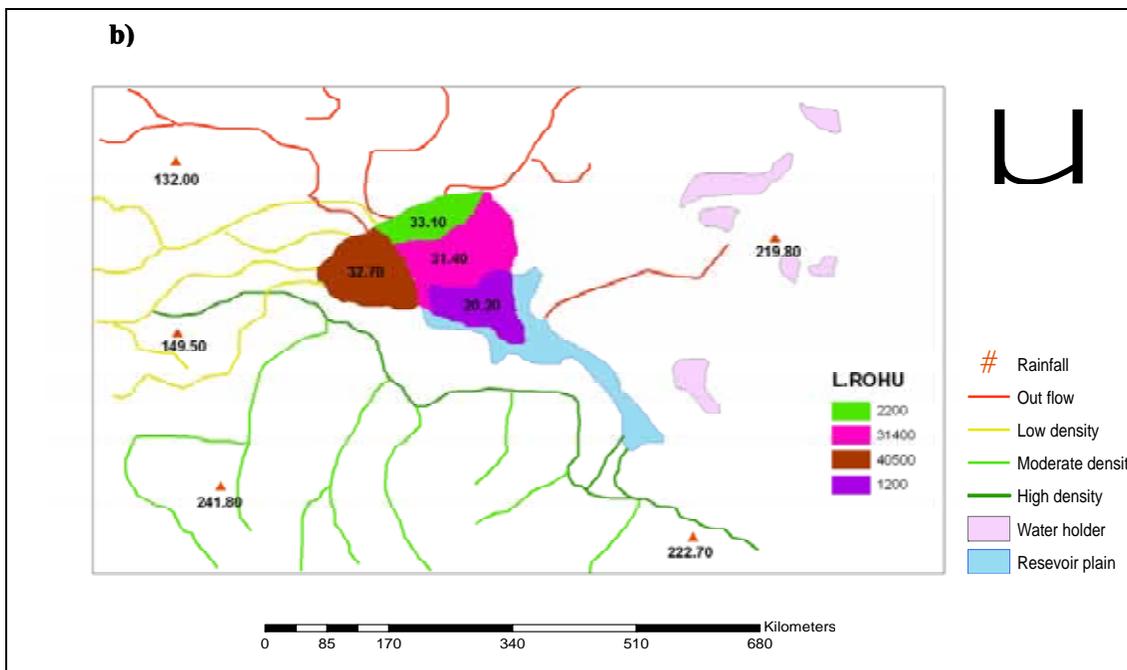
The thematic map for water level was created which is shown below. The water level of first day is 49.62 feet and 81.29 feet in the fifteenth day.



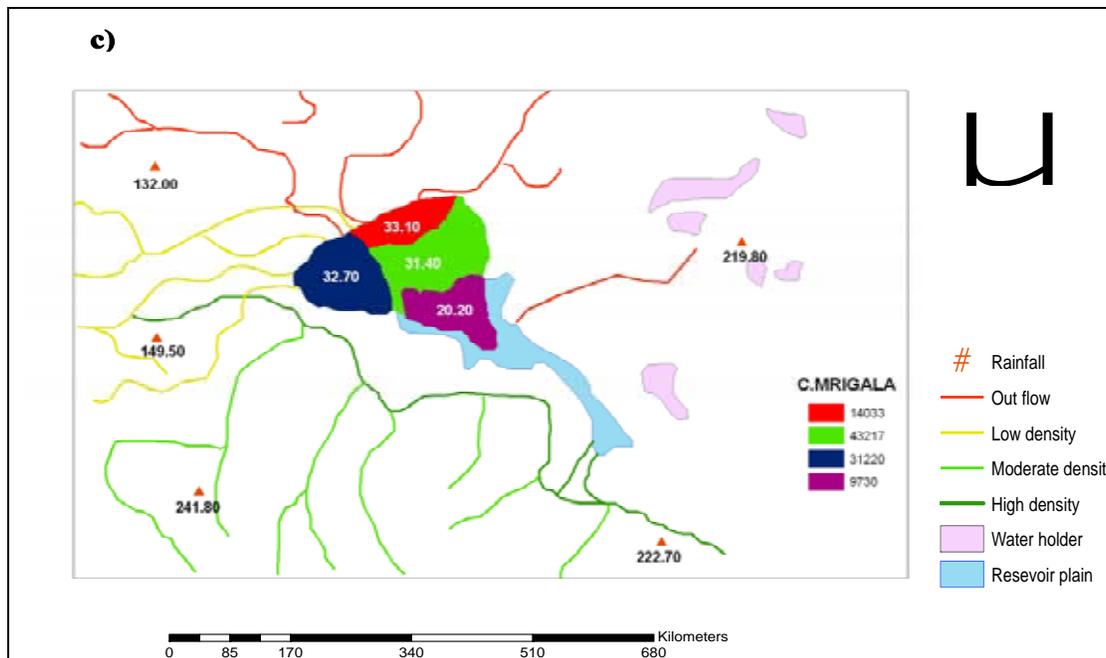
The thematic map (a) shows the abundance of fish species *C. Catla*. Here the maximum number of fish species was observed in Zone I, which comprises a temperature value of 20.20°C and the minimum number was observed in Zone IV, which has a temperature value of 33.10°C.



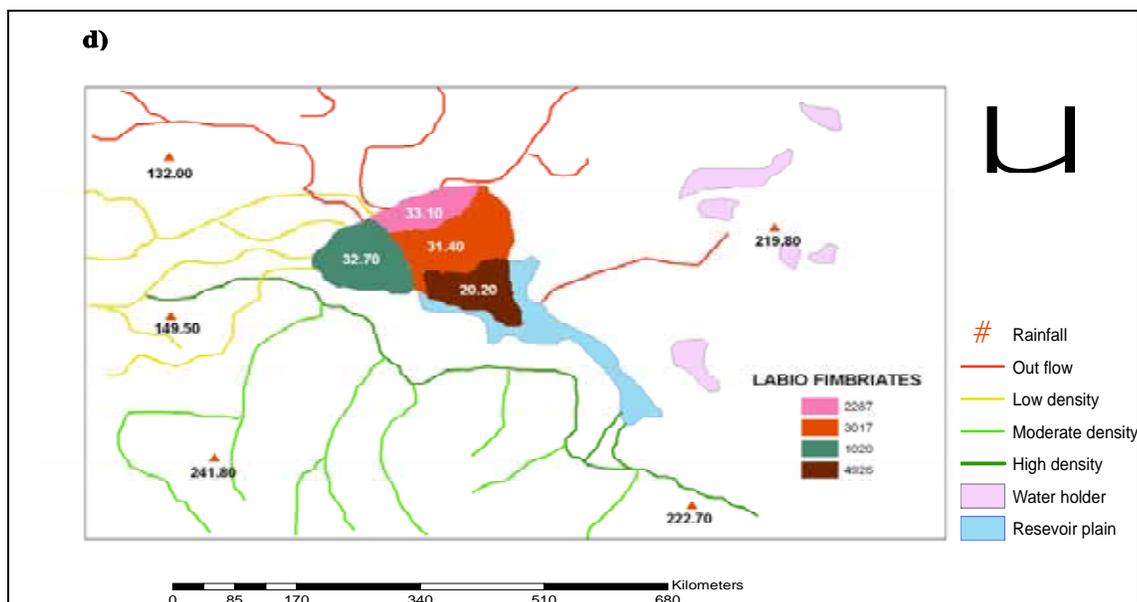
The thematic map (b) revealed the abundance of fish species L.Rohu. Here the maximum number of fish species was observed in Zone II, which comprises a temperature value of 32.70°C and the minimum number was observed in Zone I, which has a temperature value of 20.20°C.



The thematic map (c) shows the abundance of fish species C.Mrigula. Here the maximum number of fish species was observed in Zone III, which comprises a temperature value of 31.70°C and the minimum number was observed in Zone I, which has a temperature value of 20.20°C.



The thematic map (d) revealed the abundance of fish species Labio Fimbriate. Here the maximum number of fish species was observed in Zone I, which comprises a temperature value of 20.20°C and the minimum number was observed in Zone IV, which has a temperature value of 33.10°C.



DISCUSSIONS:

The fauna of the study area included four species confined to Aliyar are C.Catla, L.Rohu, C.Mrigala, and Labio Fimbriates collected from Aliyar are wide spread in distribution. Bartholow (1989), found that air temperature above the stream surface was the greatest factor in increasing water temperature followed in importance by relative humidity and shade. Pool and Berman (1999) also recognize the relationship between increasing air flow over the stream and water temperature elevation Brosofske et al (1997) found that upslop soil temperature were also a predictor of water temperature.

In the present study, there is comparable difference in abundance of fish species in different zone. This is mainly due to the alteration in temperature. Each species is temperature specific i.e., each species have their own temperature for their survival and growth. The studies of present study Allen et al, 2002, Pusey et al.2004, have revealed similar results to the present study. Frissell et al. 1986, Rodriguez and Lewis 1997, Labbe and Fausch 2000, Manush et al.2004 pointed out that water temperature have a tendency to increase distance from the watershed divide.

For the creation of fish abundance in Aliyar reservoir we have applied the GIS technique using ArcGis 9.2a. A GIS data case comprising of fish abundance related to temperature was created. The result of present study gives us an enormous knowledge to know the abundance of fish in relation to temperature in Aliyar reservoir. India has a considerable livestock and poultry population. All efforts have to be mobilized to reclaim the resources and to put them to use effectively.

The current methods of collecting fisheries related data in Aliyar reservoir stock assessment modeling and management decisions failed to consider the tremendous information resources of the fishing community.

Community-based management is a relatively new approach to fisheries science and one that recognizes the importance of fishermen's knowledge. In order to effective organizations and projects that embrace the principles of community-based fisheries management need to employ research methods and tools that will be acceptable to both the scientific and fishing communities. If it is used appropriately, it allows valuable local information to be integrated into a large-scale government policy making concerning local natural resources.

CONCLUSION:

In the area of fisheries management, the GIS community has an opportunity to respond positively to immediate fisheries crisis around the world. At present, the methodology applied is flexible which incorporates GIS technology as an aid for quantitatively sampling large areas that are logistically difficult to sample. The created and stored database in a GIS system can be updated whenever needed and used for hydrological modeling. The results of the present study reveal the success of methodology which uses the ARCGIS software.

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