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GIS Based Inventorization of Fishes in River Ganga

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Abstract

Geographic information system is being applied to various studies to efficiently manage information and project it for decision making and planning purposes. One such application of GIS has been in inland fisheries to inventories availability and distribution of fish species in river Ganga at selected sampling stations. The stations were distributed in four stretches along the entire course of river Ganga from source to sea. Fish samples were not only taken from the main channel but also from adjacent landing centres. Data collected was organized and analysed in the GIS environment using ARC-GIS 9.3. The study was steered towards observing the species distribution in years 2017 and 2020 and changes that took place during that time span. Among other stations, Bijnor recorded the highest number of species while Haridwar recorded the lowest number of species.

Keywords: River Ganga; GIS based data inventory; Fish availability; Abundance

Introduction

Geographic information system (GIS) can be recommended for designing of spatial survey through analysis of spatial data [1]. The application of GIS has been used for many different tasks in fishery biology that involve a spatial dimension, including mapping fish habitats and analyzing spatial and temporal changes in fish distributions, determining the effects of land use on fish populations [2-4]. A GIS can be used to assist with the design of surveys and provide a rational basis for the selection of sites from a river network [5]. Fish species and assemblage relationships with habitat have been studied using two primary approaches that relies on small-scale studies of microhabitat use or habitat partitioning and large-scale studies to test for assemblage patterns that are correlated with environmental variables [6]. Understanding the species - and assemblage-habitat relationships of large river fishes has been historically limited by the large size and spatial complexity of river ecosystems.

However, a GIS constructed with remotely sensed physical data that are spatially explicit for individual occurrences of organisms by species should provide ecologists with appropriate tools to detect habitat use patterns for species and assemblages in these ecosystems [4].

In India, the Ganga is revered as Mother Ganga and has been the source of life for thousands of years, being mentioned in oldest scriptures [7,8]. Impact of manifold increase in human population along the bank of a river is adversely affecting the river waters through discharge of toxic contamination in most of the rivers and there is no exception for river Ganga. In fact, river Ganga passes through three very densely populated states, namely, Uttar Pradesh with 829 persons per sq. kms [9], Bihar with 1106 persons per sq. kms [9] and West Bengal 1028 persons per sq. kms [9]. This strong anthropogenic influence inflicted a sharp deterioration of water quality with increased levels of harmful elements in river water beyond permissible limits [10-13]. Hence, the obvious impact also observed in the habitat of native fish species found in the riverine ecosystem. The alteration of habitat, illegal fishing, pollution, introduction of invasive fish species has become threatening of fish diversity as 29 fish species were recorded under threatened category in Ganga river [14]. In an effort to organise the fish species availability and distribution on GIS platform, an attempt was made to create an inventory of fish species in Ganga river system. This would not only account for the species available but would also be a repository from where data can be retrieved whenever required for further analysis, for example to calculate species abundance at a particular stretch. The study narrows down the broad and vast aspects of the river to focus upon the richness of fish species aggregating and distributed over the entire stretch of river Ganga. Analytical studies carried