

MAPPING OF THE INDIAN FISHERIES GROWTH RATE AND FISH CONSUMPTION THROUGH GIS

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ABSTRACT

In the present study, Indian fisheries growth rate and fish consumption have been analyzed through GIS mapping. The analyses were based on the state-level fisheries data of India collected from the secondary sources. Accordingly, the paper contains one thematic map containing two layers. To achieve this, all the data have been brought into a tabular form through Microsoft Excel and then joined to Map Info Professional Version 8.0 GIS software with digitized map of India for further analysis to generate thematic maps. In this thematic map, the first layer represents the growth-rate of fish production for the period 1990-2004 and the second layer represents fish consumption for the year 2003. The thematic map represented in graphic form presents inland, marine and total growth rates, and also the rural and urban fish consumption at the state levels. This study will be useful to fish traders, planners, researchers and administrators in fisheries policy formulation for sustainable development.

Keywords : GIS, thematic map, digitized map, fish production

INTRODUCTION

In recent times, the wide applicability of GIS tools has been evolved rapidly in various sectors globally and fisheries are not an exception to this as it displays geographically referenced information useful for decision making. The fisheries sector occupies a very important place in the socio-economic development of the country. It has been recognized as a powerful income and employment generator as it stimulates

growth of a number of subsidiary industries, and is a source of cheap and nutritious food besides being a foreign exchange earner. Most importantly, it is the source of livelihood for a large section of economically backward population of the country. The main challenges facing fisheries development in the country include accurate data on assessment of fishery resources, and their potential in terms of growth in fish production and fish consumption. There has been significant growth in fish production in

the country in recent years. Fish production during the year 2004-05 was 6,304,000 t comprising 2,778,000 t of marine and 3,526,000 t of inland fish. In the present study, GIS and remote sensing tools were used to provide guidance to planners, researchers and project managers for updating their fisheries policies at the national and international levels, and, therefore, have great scope. Through its use, GIS is revolutionizing the fishing industry, allowing managers to meet their objectives more efficiently and providing them with problem solving capabilities that were never before possible. An attempt has been made in the present study to display the growth rate of fish production during 1990-2004 and the consumption pattern of fish in 2003 through thematic maps.

MATERIAL AND METHODS

This study has been carried out with an objective of developing a GIS tool for Indian fisheries growth rate based on state-level Indian fisheries data collected from secondary sources, viz., Handbook of Fisheries Statistics (Anon, 2003) published by the Ministry of Agriculture, Government of India. Marine, inland and total fish production data of all the states of India for the period 1990-91 to 2003-04 have been brought in the tabular form through Microsoft Excel and their compound growth rate was calculated by using the following growth rate model in Microsoft excel sheet:

Growth in fish production have been analyzed by using the exponential

growth function of the form

$$Y = ab^t e^{\dots} \quad (1)$$

Where, Y = Dependent variable for which growth rate is estimated.

a = Intercept

b = Regression co-efficient

t = Time-variable

e = Error term

The above mentioned equation (1) has been used to obtain the growth rate of marine, inland and total fish production of all the states of India for the period 1990-91 to 2003-04. The linear form of the equation (1) was obtained by taking logarithms on both sides which is given by

$$\log_e Y = \log_e a + t \log_e b \dots \quad (2)$$

The compound growth rate (r) was computed by using the relationship $r = [\text{Anti log}_e \text{ of } b - 1] \times 100 \dots$ (3)

Growth rates have been calculated for marine, inland and total fish production separately for each state using Microsoft Excel. The excel sheet was joined to the digitized map of India by allotting a location code (LC) number to each state. After joining of the excel sheet, geocoding process was adopted. In geocoding, all the state ID and digitized maps were matched to the state-wise location code. After geocoding, by adopting customized layering system in the GIS-Software Map Info, first layer in the thematic map was created for the fisheries profiles of

India. The second layer in the thematic map represents the fish consumption for the year 2003.

RESULTS AND DISCUSSION

Fisheries Growth Rate

The thematic map presented here (Fig. 1) represents Indian fisheries growth rate over the period 1990-2004.

This growth rate has been categorized through GIS tools on natural break system in the following four categories, viz., (i) 10.01 to 48.33, (ii) 1.74 to 10.01, (iii) -1.98 to -1.74 and (iv) -16.25 to -1.98. The first layer of thematic map revealed that, in all, six states have shown maximum total fish growth rate and comes under the first category. These are Chattisgarh (48.30%), Jharkhand (44.01%), Punjab (15.31%),

FISHERIES GROWTH RATE (1990-2004) & FISH CONSUMPTION (2003)

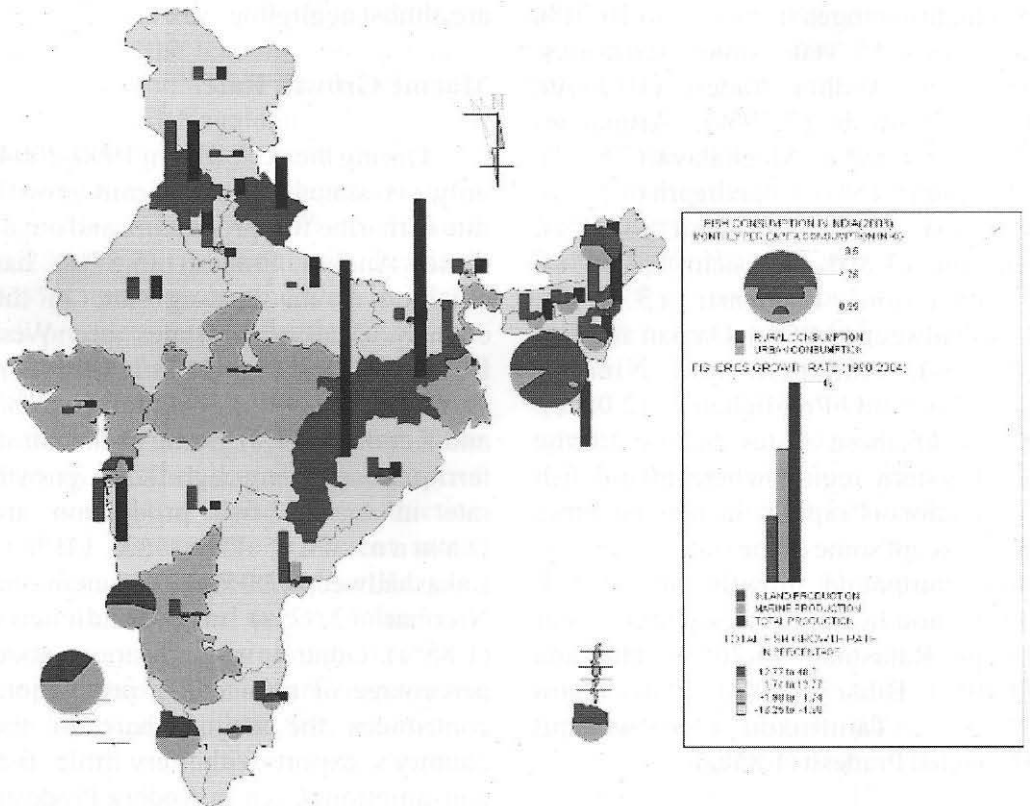


Fig. 1: Fisheries growth rate (1990 – 2004) and fish consumption (2003) in India

Uttaranchal (12.77%), Nagaland (14.37%) and Andhra Pradesh (10.38%). Out of these states, Chattisgarh, Jharkhand and Uttaranchal have been created in India's map from the year 2000 and are dominating in inland fish production. These states have sufficient inland water resources like ponds, tanks and rivers. In these states, fish production increased due to the watershed development programme adopted at village level since 1995.

The second category of the states where the growth in total fish production ranges from 1.74 to 10.01% comprises 15 states/union territories. These are Andhra Pradesh (10.38%), Uttar Pradesh (7.29%), Arunachal Pradesh (5.69%), Meghalaya (7.87%), Manipur (5.15%), Chandigarh (4.57%), Haryana (4.49%), Orissa (3.83%), Sikkim (3.80%), Assam (3.53%), Jammu and Kashmir (3.18%), Lakshadweep (3.05%), Daman and Diu (3.10%), Andaman and Nicobar (2.87%) and Pondicherry (2.03%). Many of these states belong to the northeastern region where inland fish production is rapidly increasing these days except some of the states where the total compound growth rate of fish production lies in the descending order as in Rajasthan (5.76%), Haryana (4.49%), Bihar (3.40%), Maharashtra (2.13%), Tamilnadu (1.88%) and Himachal Pradesh (1.85%).

The third category is the states where the total compound growth rate of fish production ranges from -1.98 to 1.74. The major states of this group are

Kerala (1.80%), Gujarat (1.51%), Madhya Pradesh (1.21%), Tripura (1.09%), Karnataka (0.87%), Goa (0.27%), West Bengal (-1.43%) and Delhi (-1.98%).

The fourth category of the states is where the total compound growth rate of fish production ranges from -16.25 to -1.98. In this category, only two states are there which shows negative growth rate as Dadra and Nagar Haveli (-15.57%) and Mizoram (-16.25%) due to water scarcity in lakes, ponds and tanks so that fish production activities are almost negligible.

Marine Growth Rate

During the period from 1990-2004, only six states got significant growth rate in marine fish production and out of these, Andhra Pradesh (5.57%) has emerged as the leading state in the country. The other states are West Bengal (2.69%), Orissa (2.04%), Tamilnadu (1.99%), Gujarat (1.67%) and Kerala (1.29%). Some of the union territories showing significant growth rate in marine fish production are Daman and Diu (3.10%), Lakshadweep (3.05%), Andaman and Nicobar (2.87%) and Pondicherry (1.85%). Gujarat, which shares a good percentage of marine fish production, contributes the major share in the country's export with very little fish consumption. Even in Andhra Pradesh, consumption of fish is very less as compared to the marine fish production. In these states, marine fishes are

exported to foreign countries and also to the neighbouring states in the country.

Inland Growth Rate

As far as inland fish production is concerned, Delhi, Punjab, West Bengal, Nagaland and Andhra Pradesh are the leading states in the country. The northern states like Delhi (15.38%) and Punjab (14.92%) are the most leading counterparts in inland fish production as these states are bestowed with sufficient water resources such as rivers, lakes, canals and dams, whereas in southern zone, Andhra Pradesh (12.91%) is the leading state in inland fish production. However, West Bengal (14.30%) and Nagaland (14.30%) are also showing a high trend due to the same reason. Even northeastern states like Meghalaya (6.27%), Tripura (6.27%) and Arunachal Pradesh (5.57%) are doing quite well in inland fish production. Past studies show that in some of the northern states like Haryana (4.26%), Bihar (2.99%), Himachal Pradesh (1.78%) and Uttar Pradesh (1.64%), there is great scope of improvement in inland fish production as these states have sufficient water resources. A small state like Haryana showed a very good trend in inland fish production. There is an urgent need to adopt technological advancement in the development of inland fish production in the northern states to increase overall fish production.

Fish Consumption

The thematic map in the present study also includes pie charts,

representing state-wise fish consumption in rural and urban areas. According to the map, Tripura and Lakshadweep have been identified as maximum fish consuming state/union territory. In Tripura alone, the monthly fish consumption in rural areas is 8.5 kg per capita. In Lakshadweep, the monthly fish consumption in rural areas is 2.39 kg per capita, whereas, in urban areas it is 4.04 kg per capita. These are followed by other states like Goa, Arunachal Pradesh, Kerala, Andaman and Nicobar, and Dadra - Nagar Haveli. In Arunachal Pradesh, rural consumption (2.18 kg per capita) is more than urban consumption (1.19 kg per capita).

In northern India, fish consumption is very less as compared to the southern and northeastern regions. Punjab and Haryana are leading in inland fish production with 4,800 kg/ha/yr as the average fish production. In Punjab and Haryana, farmers have started adopting fish culture instead of agriculture with no seasonal constraint as it is economically more beneficial in comparison to other occupations.

In West Bengal, fish consumption in urban areas is high as compared to consumption in rural areas, whereas in Goa, it is vice-versa, *i.e.*, fish consumption is high in rural areas in comparison to urban areas. In the states like Rajasthan, Punjab, Haryana, and Jammu and Kashmir, inland fish production activities are increasing day-by-day and fish production is more than its consumption. In Andhra

Pradesh, fish production is equally high as compared to fish consumption and provides livelihood to the neighbouring states like Maharashtra, West Bengal and some northeastern states where fish consumption is higher in comparison to the production. This state has the major contribution in the export of quality fishes to the neighbouring countries. In Kerala, fish consumption in urban areas is more than that in rural areas. This state has been playing a prominent role in marine fish production over the decades but during the last decade, fish farmers have shown keen interest in adopting inland fish culture. In the present scenario, Tripura is achieving the status of a high fish consuming state in the northeastern region followed by Arunachal Pradesh.

Thus, a GIS study of Indian fisheries reveals that Tripura, Lakshadweep, Goa, Kerala, Arunachal Pradesh, and Andaman and Nicobar Islands are the major fish consuming states/union territories in the country.

CONCLUSION

A quick view of the thematic map in this study directly gives the status of state-wise fisheries in India with reference to marine, inland and total fish growth rate for the period 1990-2004. The growth rates of the leading states are the direct indicators on the map with their fish consumption status shown by pie charts. For sustainable development, this study will be of immense use to fish traders, planners, researchers and project managers for updating the fisheries policy at state-level in the country.

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