

## FISHERIES PROFILE MAPPING OF COASTAL DISTRICTS IN MAHARASHTRA STATE THROUGH GIS

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### ABSTRACT

In recent times, GIS is being increasingly used as a decision support system for management of fisheries and aquaculture. It provides new innovative approaches of the dynamic relations that characterize this sector. In this context, a study is conducted based on the secondary data of a major maritime state, Maharashtra, where mapping of fisheries profile of coastal districts in the state is performed through GIS tool having critical geographic dimensions. This paper aims to map information of the state which can be used for the purpose of planning and decision making as each aspect of map has a different component involved. For this purpose, at the core of the system, the data were accessed and integrated from different sources mainly from the five coastal districts of Maharashtra state. Data were brought in tabular form through Microsoft Excel and then joined to Map info Professional version 8.0 GIS software was used with the digitized map of Maharashtra state to enable mapping. This was further synchronized and integrated to generate four thematic maps searchable on several criteria. Map 1 contains the searchable criteria as regards to the fish growth for the year 1997-2004 and fish seed production for the year 2003-04. Map 2 contains fisher population along with their occupation for the year 1992. Map 3 contains brackish water and shrimp farming production and culture area. Map 4 contains infrastructural facilities which include type of boats etc. With this mapping, planners and various stakeholders have accessible information as regards to the various components of fisheries in the state of Maharashtra.

**Key words:** Fisheries profile, Maharashtra, GIS.

### INTRODUCTION

Fisheries sector has been playing an important role in the growth of Indian economy through employment generation and exports. Many nations are promoting fish products for better nutrition and food security. Considering the average annual growth rate of about 14% in the last five years, in global aquaculture production, it is expected that the sector would play a major role in meeting the protein hunger of the ever

growing human population and also contribute greatly to the economy of the major aquaculture producing countries of the globe. Despite fluctuations in supply and demand, caused by the changing state of fisheries resources, the economic climate and environmental conditions, fisheries and aquaculture remain very important as source of food, employment and revenue generation in many countries and communities. It also seems plausible that in the years to come an

increasing number of developing countries will develop national food security strategies in which fish will occupy an important place in their plan.

Geographic Information System (GIS) is a powerful mapping tool that links information found in databases to geographic locations and is used as a tool that stores information about map features. It guides the users to see and interact with data in new ways by blending maps in order to make analysis for decision making. It is being increasingly used as a decision support system for management of fisheries and aquaculture. The coasts of Maharashtra in India face particular challenges related to the management of spatial resources at the coast, including population growth, increased tourism pressure, economic restructuring, and a inheritance of pollution. In present times, coastal districts in Maharashtra are becoming complex places and subject to multiple resource demands, carry risk for coastal populations, and are ecologically very important. The complexity of coastal districts makes them inherently difficult to manage, however, good quality and timely information can assist better decisions. This places a particular importance on managing information for those tasked with making important decisions about coastal areas.

In this context, present study has been conducted based on the secondary data of a major maritime state, Maharashtra, which ranks 3<sup>rd</sup> in marine production and 6<sup>th</sup> in inland production in India. Mapping of fisheries profile of coastal districts in the state is performed through GIS technology having critical geographic dimensions. This paper aims to map information of the state which can be used for the purpose of planning and decision making as each aspect of map has a different component involved.

## RESEARCH MATERIALS AND METHODOLOGY

For this purpose, data were accessed and integrated from different sources like, district handbook of census of fisheries, Govt. of Maharashtra and its marine production mainly from the five coastal districts of state. Data were brought in tabular form through Microsoft Excel and then joined to Map info Professional version 8.0 GIS software with the digitized map of Maharashtra state to enable mapping. This was further synchronized and integrated to generate four thematic maps searchable on several criteria. Map 1 contains the searchable criteria as regards to the fish growth and fish seed production (in tones) for the year 1997-2004. Map 2 contains fisher population along with their occupation for the year 1992. Map 3 contains brackish water and shrimp farming production (in tones) and culture area (in ha). Map 4 contains infrastructural facilities which include type of boats etc. of Maharashtra state. With this mapping, planners and various stakeholders can have accessible information as regards to the various components of fisheries in the state of Maharashtra.

Growth in fish production has been analyzed by using the exponential growth function of the form

$$Y = ab^t e_t \quad \dots \quad (1)$$

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]. Linear form of the equation (1) is obtained

by taking logarithms on both sides which is given by

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

The compound growth rate (r) can be computed by using the relationship

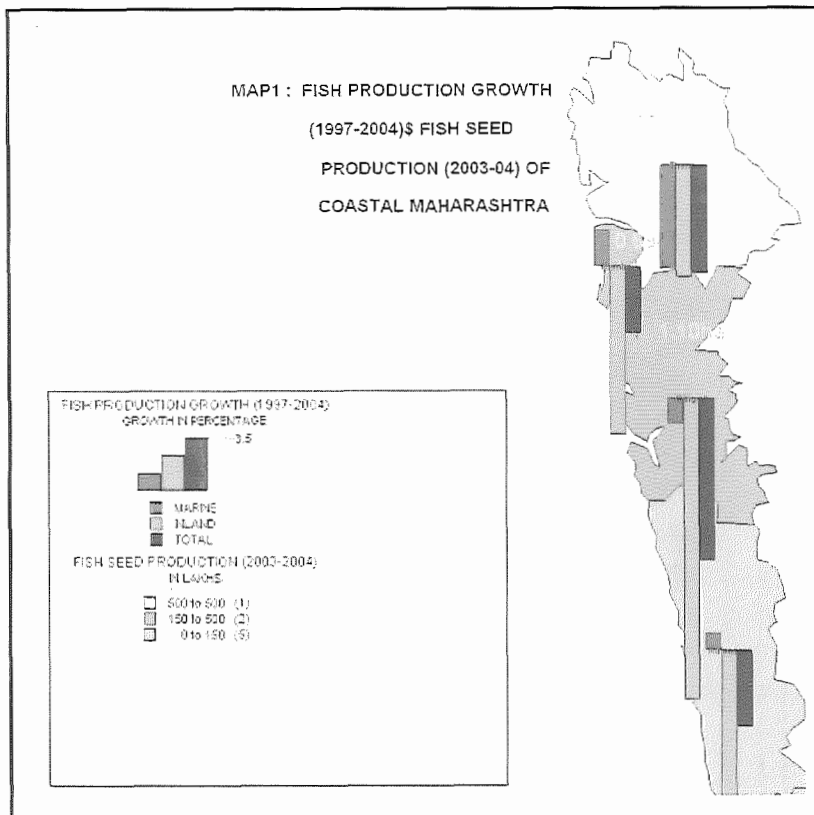
$$r = [\text{Antilog}_e \text{ of } b - 1] \times 100 \quad \dots (3)$$

Growth rates have been calculated for marine, inland and total fish production separately for each district in Micro Soft Excel. The excel sheet was joined to digitized map of Maharashtra state by allotting a location code (LC) number to each district. After joining of the excel sheet, geocoding process is adopted. In geocoding, all the districts ID and digitized maps are matched to district wise location code. After geocoding, by adopting customized layering system in the GIS Software Map Info, first layer in thematic map was created for fisheries profiles of Maharashtra. The second layer in thematic map represents fish consumption for the year 2003-04.

**RESULTS AND DISCUSSIONS**

**Map 1: Fish production growth and fish seed production**

Map 1 mainly depicts two layers via; (i) Fish production growth containing three components marine, inland and total fish production growth during the period 1997-2004 and fish seed production for the year 2003-04. View of this map represents that major coastal districts of Maharashtra state are showing negative fish production growth rate. Further, a GIS analysis reveals that Ratnagiri and Sindhudurg are least productive coastal districts as regards to fish production in Maharashtra with total growth rate of 16.08% and -11.99% respectively. This is followed by the other coastal districts Thane and Greater Mumbai, which are also showing declined negative growth rate as -10.6% and -6.59% respectively.



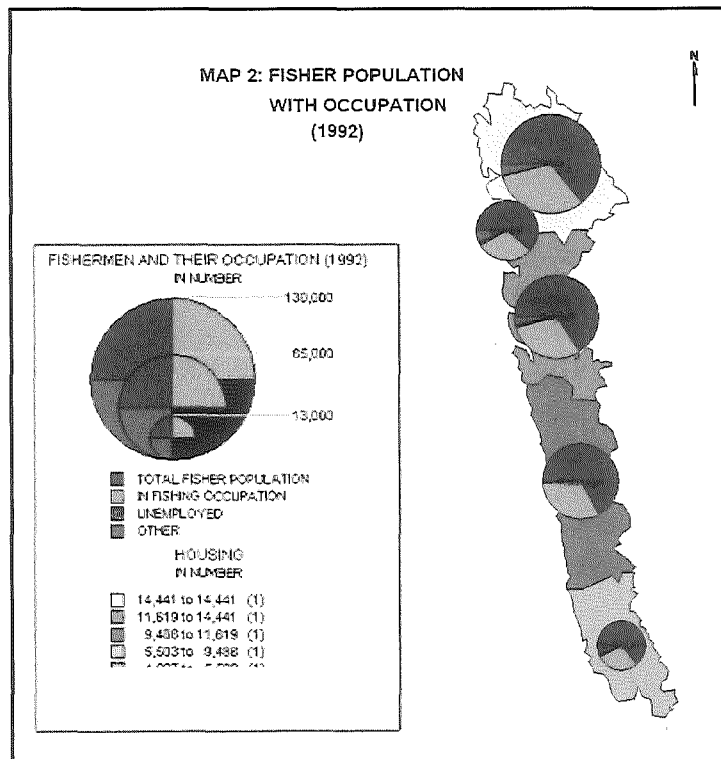
Growth of inland fisheries production in the state is showing a sharp decline in coastal regions with Raigad having -29.58% followed by Gr. Mumbai, Ratnagiri and Sindhudurg with -16.67%. Second layer of the map 1 contains information on fish seed production in coastal districts of Maharashtra for the year 2003-04. Spawn production capacity is highest in Thane district with 500 lakhs followed by Raigad having 300 lakhs and the least is observed in Greater Mumbai with 150 lakhs. According to the available information on government fish seed production centres, available water spread area (in ha) is proportionately more in Thane with 2.36 ha followed by Raigad and Greater Mumbai having 1.10 ha and 0.59 ha respectively. Greater Mumbai centre is located at Aarey, thane's centre at Dapcheri and Raigad's centre is located at Khapoli.

mentioning first layer for Fisher population and their occupation and second layer for housing facilities available with them. A general view of this map reveals that Thane district has maximum number of fisher population in coastal regions figuring 80,695 out of which nearly 50% population is involved in fishing activities. Raigad district ranks second in terms of fisher population with number touching 60,958 and out of which 45% are involved in fishing activities. Ratnagiri ranks third with 52,293 of fisher population, in which 50% population are involved in fishing activities. This is followed by Greater Mumbai, which is also one of the biggest urban cities in India, having 34,580 fisher population in which 47% population are involved in fishing activities.

Number of houses of fishers had touched the maximum number 16,619 in Raigad district followed by Thane having 14,441 houses. In Ratnagiri district, fishers have only 9,488 houses whereas in Greater Mumbai, due to its urbanization and one of the costliest places in India, only 5,503 houses are there for fishers.

**Map 2: Fisher Population, Occupation and Housing**

Map 2 also depicts two layers

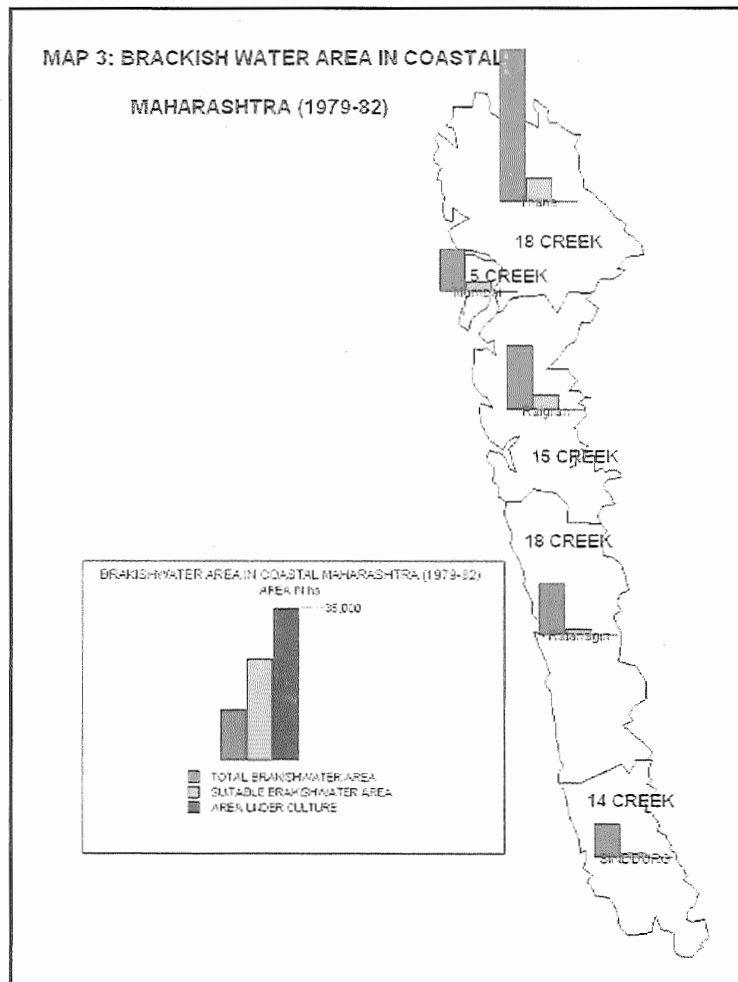


**Map 3: Brackish water and Shrimp Farming**

Map 3 contains information with regards to shrimp farming mainly from brackish water area in five coastal districts of Maharashtra. Accordingly, it has been depicted in two layers, out of which first has three components namely, total brackish water area, suitable brackish water area and area under culture. Second layer contains number of creeks at district level. A GIS analysis reveals that Thane district has maximum brackish water area of 35,000 ha followed by Raigad with area 15,000 ha but total brackish water area is not suitable for culture. In Thane district 5,490 ha is suitable for culture out of the total area 35,000 ha. Likewise in Raigad district 3,655 ha area is suitable for culture out of 15,000ha followed by Ratnagiri district which have only 1,682 ha

area suitable for culture out of 12,000ha total brackish water area. Mumbai has only 10,000 ha brackish area out of which 2,360 ha is only suitable for culture and this is also followed by Sindhudurg district where suitable culture area is only 1,268 ha out of 8,000 ha area.

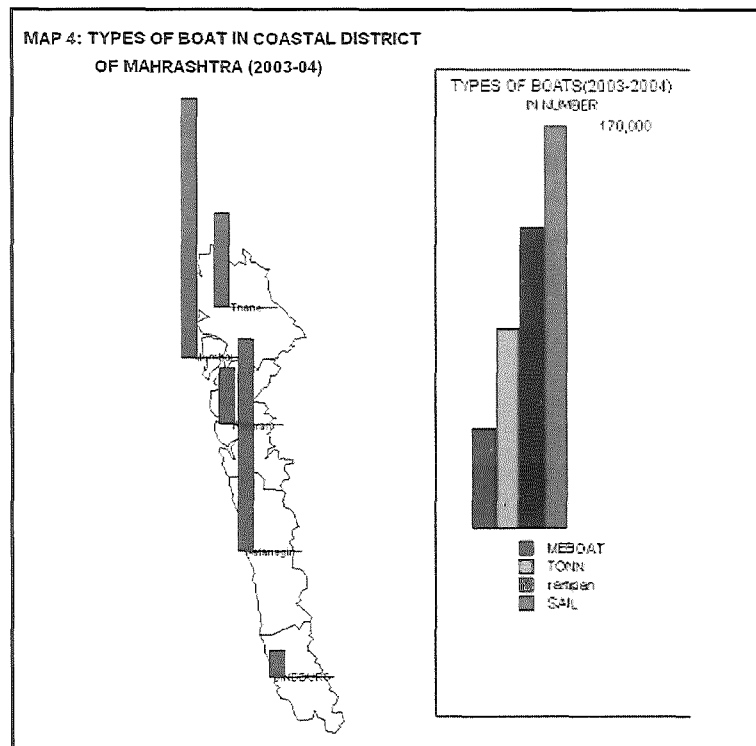
Second layer of Map 3 contains number of creeks at district level. Thane and Ratnagiri districts have maximum number of creeks, *i.e.*, 18 in both the districts. Number of creeks exists in Raigad and Sindhudurg districts are 15 and 14 respectively and this is followed by Mumbai district which contains only 5 creeks. According to the MPEUA, in the year 2000-01, the total cultivable brackish water area is 1032.55 ha which in turn gives total shrimp production of 1,500 tonnes.



#### Map 4: Types of Boats

Map 4 gives information about type of boats used in the coastal districts of Maharashtra. Mapping through GIS reveals that Greater Mumbai has maximum number of mechanized boats, *i.e.*, 1, 64,878 followed by Ratnagiri district which maintains second place by having 1, 35,716 no. of boats but also

occupies other boats like toney and rampan boats. In Raigad district, total no. of mechanized boats is 37,071, no. of sails are 72 and no. of toney boats are 1,536. In Sindhudurg district, no of mechanized boats are less as compared to other coastal districts. This district occupies 17,693 mechanized boats, 37 sail boats and 164 toney boats.



#### CONCLUSION

Thus, with the help of GIS tools, a quick view of thematic maps represented in different layers directly gives the status of various components of fisheries profile of coastal districts in Maharashtra state. For sustainable development, this study will be of immense use for site selection of fish farmers, potential fishing zones especially brackish water culture area in these coastal districts in order to assess marine, inland fisheries resources effectively and accurately. Thus, with this mapping, fish traders, planners, researchers and various stakeholders have

accessible information as regards to the various components of fisheries in the state of Maharashtra.

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