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THE IMPACT OF WATER POLLUTION ON FISH SPECIES: A CASE STUDY OF VASHISHTI ESTUARY

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Abstract
Water pollution is a major environmental issue and has many consequences on the ecosystem. Pollution can impact aquatic organisms in many ways, decreasing the amount of dissolved oxygen, changing the PH of water, increasing water temperature, and introducing toxic chemicals. These alterations can be lethal to different aquatic organisms and might cause large-scale mortalities. Water pollution can also have long-term impacts on aquatic ecosystems. For example, chronic exposure to even low levels of pollutants can lead to suppression of the immune system, reproductive problems, and the development of abnormalities in aquatic habitats. Effects of heavy metals and pesticides on aquatic animals, particularly fish, cause severe loss in aquaculture production when their levels exceed safe limits. These impacts can reduce the overall health and biodiversity of aquatic environments, and can also hurt human health. In this paper, we have focused on the various sources and types of pollutants, their effects on fish populations, and the broader consequences for aquatic biodiversity and ecosystem health. Additionally, we discuss mitigation strategies, regulatory measures & future research directions to address this critical challenge.

Keywords: Water Pollution, Aquatic Environment, Ecosystem, Impact.

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Introduction:

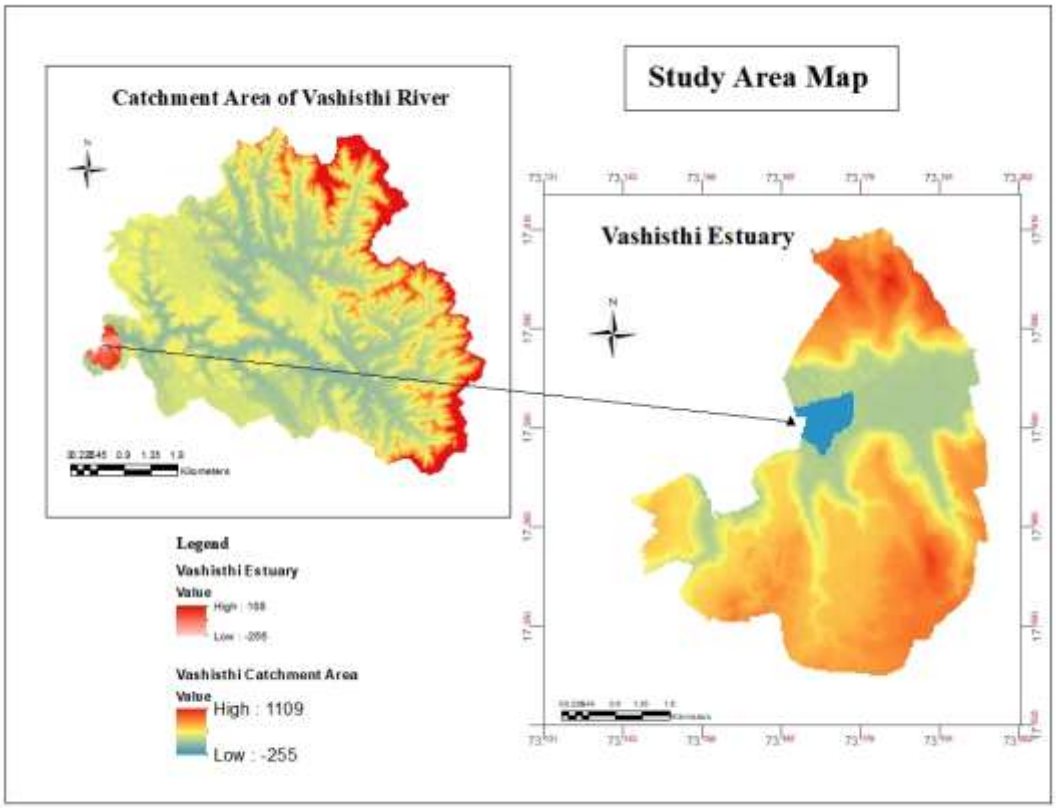
Water pollution is one of the most serious environmental problems worldwide. It affects the river, lake, and groundwater across the world. Rapid industrialization, population growth, and intensive agriculture have increased the release of harmful pollutants such as chemicals, plastics, untreated sewage, and toxic waste into water bodies. In many developing countries, a large percentage of wastewater is discharged without treatment, contaminating drinking water sources and threatening public health. Agricultural runoff rich in fertilizers and pesticides creates “dead zones” where oxygen levels drop so low that fish and other aquatic life cannot survive. Water pollution significantly disrupts aquatic ecosystems, especially affecting fish and other marine organisms that depend on clean and balanced water conditions for survival. When pollutants such as industrial chemicals, plastics, sewage, oil spills, and agricultural runoff enter rivers, lakes, and oceans, they contaminate the water and disturb its natural chemistry. These harmful substances lower oxygen levels, increase water toxicity, increase the temperature of water and damage crucial habitats like coral reefs, wetlands, and breeding grounds. As a result, fish struggle to breathe, grow, and reproduce, leading to reduced populations and weakened species survival. Pollutants can also accumulate in the bodies of aquatic animals, spreading through the food chain and affecting birds, mammals, and even humans. Over time, this widespread degradation causes loss of biodiversity,

disrupts ecological balance, and threatens the health and sustainability of entire aquatic ecosystems.

During 2019-20 is total GSDP is estimated at 2818555 crore, whereas GSDP from Agri, Forestry & Fishing, and GSDP from Fishery is estimated at 5964 crore. Total GSDP and GSDP from Agri, Forestry & Fishing to fishing is a constant by 0.21% & decreased by 2.19% respectively over the previous year. In 2015-16, the percentage share of Fisheries to total GSDP and GSDP from Agri, Forestry & Fishing to Fishing was 0.24% & 2.61 %, respectively. The percentage share of fisheries to total GSDP was 0.29% in the year 2016-17 & and 0.27% in the year 2017-18. In the year 2018-19, total GSDP decreased by 0.21% &, and GSDP from Agri, Forestry & Fishing was 2.36% respectively.

Study Area:

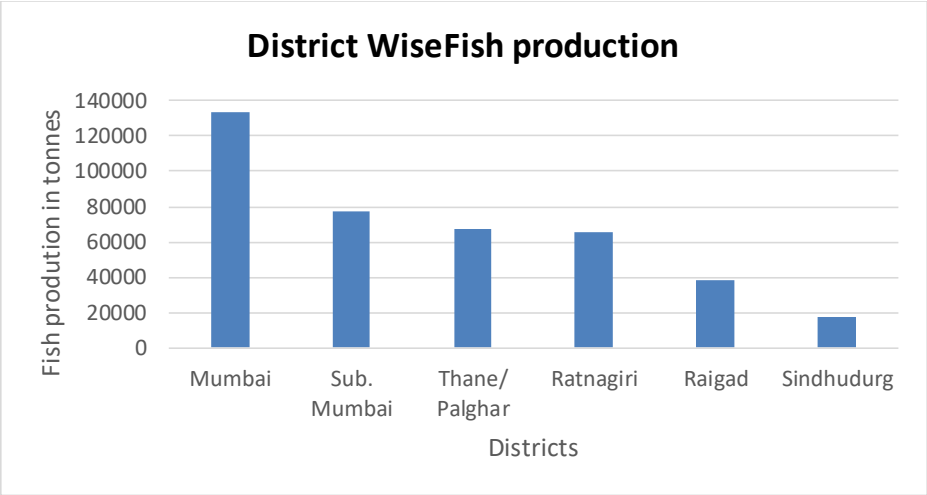
The area selected for the present study is an estuarine region of the Vashisthi watershed located in the Chiplun Taluka of Ratnagiri District. The study area can be identified as the southern part of the Vashisthi Catchment. The Western Ghats are located east of the Vashisthi catchment and the Chiplun tehsil. In the study area, 165 villages are located in the Chiplun tehsil with 1113 sq. km, including 1091.41 sq. km of rural area and 21.5 sq. km of urban area. There are villages in the catchment area of the Vashisthi River, which covers 114.9 sq. km. area respectively. The total geographical area is 133 sq. km. and has a latitudinal extent from 18°23'43" N to 18°28'50" N and a longitudinal extent from 73°27'04" E to 73°41'17" E.



Objectives of the Study:

To investigate multifarious factors that are affecting the fish species in the Vashisthi estuary.

District-wise Marine fish production from 2016-17 to 2020-21 is given in the table. District-wise landings showed a maximum contribution from Mumbai city at 33.43%, followed by Mumbai Sub. District 19.33%, Thane/Palghar 16.95%, Ratnagiri district 16.40%, Raigad district 9.54% & Sindhudurg district it was 4.34% only (which was the lowest contribution) to total Marine fish production during the year 2020-21.



(Fish Production Report 2021-22)

Data Analysis and Methods:

The data employed for the study were collected from primary and secondary sources. The primary data were collected from department officials, cooperative presidents, and members; the relevant secondary data were collected from various journals, magazines, reports of the state fisheries departments, perspective plans, and strategies for fisheries development in Ratnagiri conducted by ICAR-Central Institute of Fisheries Education (2009) and analyzed with appropriate statistical tools. The core focus was to know the present scenario of fisheries, to gain an understanding of the factors affecting fish production and potential for fish production, and to identify the factors affecting fish production. Some variables, such as Industrial Development, Pollution, and Manual Mining, were selected, and it was correlated and regressed with fish production.

According to a report compiled in a document about rivers in Maharashtra, in the estuary of Vashishti, about **70% of estuarine fish and marine species** found earlier in Vashishti's estuary are now "locally extinct." The same states that the traditional estuarine fishing industry has effectively finished. According to the report from lote to dabhol there were around 6000 fishing families that were completely dependent on the fishing industry. Now their livelihoods are destroyed because of the water pollution and the decreasing rate of fish in the Iistury.

Reasons for the Water Pollution:

Lote Parshuram Industrial Area:

In the Maharashtra Industrial Development Corporation (MIDC) appropriated, 570.73 hectares of land of Lote, Awashi, Sonegaon, Dhamandevi, and some other villages of the Chiplun block, Ratnagiri district, for setting up a Chemical Industry Zone. There are around 200 chemicals (agrochemicals, dyes, and pharmaceuticals) and a few engineering units. All the effluents from these industries are being disposed of in the Vashisthi Creek. It is one of the main reasons for the change in the ecology, sociology, and economy of this region.

The release of pollutants in the stream of the Vashisthi River gets polluted, and it impacts the fish and biodiversity of the Vashisthi River. The fishing industry in Vashisthi Estuary is finished. There were around 6000 fishing families from Lote to Dabhol, and the estuarine fish-dependent livelihoods of all of them were destroyed. Income from estuarine fishing started to drop rapidly.
The dabhol is located in the mouth of the Vadhisthi River. According to fisheries cooperative members in Dabhol, fish catching has been falling every year. They used to get approx.10 kilos of fish for every net that they cast, and they did this 3-4 times a day. Now, getting half a kg from the estuary in a day is difficult. Around 90 % of fishermen have moved to Mumbai or work with Trawler ships in the open sea. Around 70% of estuarine fish and marine species found in Vashishthi are now locally extinct.
Recent Water Quality Studies from the Vashishti estuary, according to the National Institute of Oceanography studies, show a marked reduction in DO with high nutrients, indicating that the estuary is under stress due to ongoing discharges. The contents of heavy metals like Cr, Mn, Co, Ni, Cu, and Zn are higher in the upper segment. The source of these metals is suspected to be anthropogenic. Bacterial counts are high both in the coastal and estuarine segments. A high-standing stock of phytoplankton and zooplankton in the estuary suggests organic pollution-induced biological productivity in the estuary.

Use of Chemical Fertilizers for Agriculture:
Nowadays, farmers are using chemical fertilizers in huge amounts. By rainwater, it dissolves in water and finally meets the river water. It also affects the groundwater quality because of chemical fertilizers. The water pollution of rivers has increased in the last few years. It also affects the biodiversity of the water, and it is one of the reasons for the decline of the fish and the biodiversity.

Mechanized Dredgers:
Flood is a major natural disaster in Chiplun. Every year, there is a flood, and it impacts human life and the environment. Every year, to avoid the flood in Chiplun Taluka, the mud and sand in the Vashisthi River are removed with the help of mechanized graders. Mechanized dredgers are destroying the remaining mangroves and fish in the area.

Mining Industry:
Ratnagiri district has a laterite soil. People use laterite to make bricks and use them for the making of houses in many areas of the Konkan region. In Ratnagiri, there are Silica Sand, Laterite, Ilmenite Sand, Bauxite, Quartzite, Sand/River Bed Sand, sandstone, Basalt Stones, and other mineral mines. Manual mining and the use of dredgers are replacing traditional fishing in Ratnagiri district. The guise of ‘desilting’, sand mining, and using illegal dredgers is being practiced.

Conclusion:
The water pollution in the Vashisthi estuary is increasing rapidly. The fish production in the area of the Vashisthi estuary is declining day by day, and many factors are responsible for the decline in fish production. Polluted water is the major factor because of which the number of fish in the area is decreasing. The fish die due to the pollution, which also affects the reproductive ability of the fish. It also affects the overall biodiversity of the river. For that, the government should find ways to reduce the pollution in the area of the Vashisthi river and collaborate with different organizations to conduct development programs.

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