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Freshwater Fish Population Dynamics: A Study of the Effects of Environmental Factors on Fish Abundance and Distribution

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Abstract: The exact design of the food processing organ in fish with varying feeding behaviors is still being better understood. To put it another way, there are many questions about how herbivore fishes differ from non-herbivore fishes in terms of the structural and functional changes they undergo to make use of the food in their environment. As long as the catchments are at least moderately fertile, it is safe to assume that the productivity will increase with the reservoir's catchment area. The reservoirs are mostly the result of hydroelectric or irrigation projects, and either boards of authority or irrigation/power agencies are the owners. Fisheries are typically seen as a secondary activity in these areas of water. The interests of the fisheries were not taken into consideration throughout the design and building phase because the majority of them were only regarded as fisheries resources after construction.

Keywords: Natural Resources; Agricultural; Marine Systems.

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I. Introduction

One of the most vital natural resources that humans have ever encountered is water. All living things, ecological systems, human health, food production, and economic growth depend on it. Water controls nearly every element of life on Earth. All living creatures, whether they are plants or animals, need it to survive. Despite being the most plentiful resource in nature, it is also the most abused. Despite the fact that the world is a blue planet with 80% of its surface covered by water, the harsh reality is that 97% of the water is trapped in oceans and is too salty to drink or utilize directly for industrial or agricultural reasons (Van Sebille, 2015). 2.4% is stuck in glaciers and polar ice caps, from which icebergs separate and gradually melt at sea. Ponds, lakes, rivers, dams, and other bodies of water contain less than 1% (i.e. 33, 400 m^3) of water that humans use for domestic, industrial, and agricultural purposes (Cózar et al., 2014). Water has a crucial role in thermal regulation and as a source of electricity, while being mostly utilized for drinking and irrigation. Life without it is hard to imagine. The fact that ponds contain a lot of water is something that is rarely included in geography textbooks. In the past, ponds were a prevalent and essential aspect of village and, to a lesser degree, urban life. Numerous freshwater plant and animal species can be found in ponds and reservoirs. Despite making up a very minor portion of the urban landscape, ponds and reservoirs are well acknowledged for their significance. Large bodies of water serve as both drinking water supplies and popular tourist destinations. Additionally, these bodies of water have inherent ecological and environmental significance. Overuse and resource exhaustion are the results of the population growth over the past century, which has increased demand for everything from food and water to housing, transportation, and energy, among other necessities. Consequently, the environment is being altered or transformed (Thushari & Senevirathna, 2020). The quality of the water is deteriorating daily due to human irresponsibility and the large population. The aquatic ecosystem's biotic community is impacted by water quality, which eventually lowers primary productivity (Gall & Thompson, 2015). Freshwater Fish Population Dynamics shown in Figure 1.



Figure 1: Freshwater Fish Population Dynamics

II. Background

In actuality, freshwater supplies are extremely valuable to life as we know it. Over the past few years, there has been a notable growth in the quantity of dams, reservoirs, tanks, etc. The current requirement is to use scientific methods to develop fisheries in these freshwater resources (Ryan et al., 2009). Water bodies' limnological investigations were typically examined to periodically assess the water bodies' contamination levels. The amount and quality of aquatic life that may survive in the water are influenced by both biotic and abiotic influences. Water has a special role in nature for both humans and the many different kinds of life that call it home. Studying the physico-chemical elements affecting the biological productivity in the water bodies is crucial for effectively using freshwater bodies for fish production. A healthy aquatic environment and the creation of adequate water quality guidelines for the management of pond fish culture fish food organisms in ponds to increase fish production depend on a number of factors, including temperature, transparency, turbidity, watercolor, carbon dioxide, pH, alkalinity, hardness, ammonia, nitrite, nitrate, primary productivity, biochemical oxygen demand (BOD), plankton population, etc. Numerous physico-chemical parameters maintain the quality of water, and according to an imbalance in these factors results in the death of species. A high-quality water supply is necessary for life. Water quality can be evaluated by examining its biological and physico-chemical properties. Fish culture relies heavily on the interaction between the physico-chemical parameters and the plankton generation of pond water, as well as the relationship between these factors and plankton fluctuation. Fish rely on physical and chemical factors. Fish growth, development, and maturity may be impacted by any alteration to these parameters. In many aquatic systems, phytoplankton is the main primary producer and a vital source of food for other creatures. In addition to providing food for aquatic animals, a healthy aquatic environment and phytoplankton production are crucial for preserving the water's biological balance and purity (Thompson, 2006). Fish have a variety of adaptations (mouth, gill rakers, dentition, and gastrointestinal system) to exploit a wide range of food sources that varies in size and taxonomic groups in their natural settings. There have been several attempts to identify the relationship between fish anatomy and feeding habits thus far in the feeding ecology of fish. Fish Abundance and Distribution shown in Figure 2 (Schmaltz et al., 2020; Manullang, 2019).

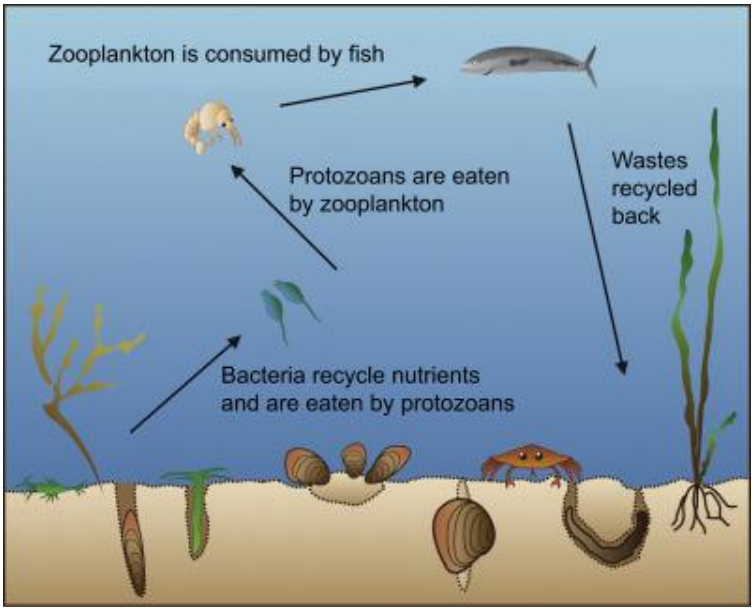


Figure 2: Fish Abundance and Distribution

III. Fish Community and its Importance

Other animals are thought to have descended from fish. In the last 500 million years, ostracoderms swam in the ocean with backbones but no jaws or fins. Fish are therefore considered to be the earliest vertebrates on Earth. The Devonian period, sometimes referred to as the "golden age of fish," saw its dispersal after evolving during the Ordovician period. Because fish come in so many different shapes, colors, and sizes, it is difficult to think that they are all members of the same animal group. The majority of fish are cold-blooded creatures that live mostly in fresh or marine waters found in lakes, rivers, streams, ponds, and oceans. The dominant group of vertebrates is fishes when the quantity of species is concerned. According to www.fishbase.de, there are currently over 33,000 different species of fish, each with unique traits. Given that freshwater may make up less than 0.3% of the world's total water supply, it is astounding that there are over 15,000 kinds of freshwater fish. Millions of individuals work in jobs like fish processing and marketing, and over 250 million people worldwide rely directly on fisheries and aquaculture for their livelihoods. Fishing is frequently the main source of income for many who are extremely poor. Minerals including calcium, iron, zinc, and vitamin A—particularly retinol—are abundant in fish. Fish is a cheap and readily available source of healthful fat and protein that may be added to a balanced diet. Omega-3 fatty acids derived from fish decrease the risk of heart diseases.

IV. Feeding Ecology of Fish

According to teleosts are the main cultivable category of fish that greatly contribute to our food supply and have effectively adapted to practically every kind of aquatic habitat. Their feeding strategy amply demonstrates this versatility. Additionally, it was discovered that fish living in the same area had a variety of feeding patterns in order to maximize feeding and avoid any potential competition for food. According to the basic processes of growth, development, and reproduction in organisms occur at the expense of energy, which is obtained by the organisms through food. The typical diet of fish varies greatly depending on the species and the environment. They can be classified as herbivores, carnivores, or omnivores based on the amount of food items in their digestive tract. For optimal digestion and assimilation of the consumed food, their alimentary canal is appropriately modified based on these major categories. Fish are frequently classified as mixivores, meaning they do not exclusively consume one type of material, such as plant, animal, or detritus, despite the fact that their functional traits, which depend on their feeding strategy,

demonstrate general consistency. The field of a thorough understanding of fish digestive physiology is still in its infancy. But during the past 20 years, a lot of information has been created that reflects the growing significance of fish as industrial animals.

Fish feeding ecology is the study of the species that fish eat, or their eating habits, as well as how they obtain their food and where they forage, or their foraging environment. Teleosts have a complicated life history pattern, and their development, growth, and survival are greatly influenced by their trophic position or food choice in relation to the feeding ecology. During ontogeny, they frequently switch between different food kinds or trophic levels. Understanding foraging techniques and how fish alter food prior to digestion are essential to comprehending how fish obtain their food. Although there are some detours into this area, digestion is mostly ignored here. It's true that the term "feeding ecology" is vast and challenging to define. However, according to the "what, how, and where" questions by themselves do not provide a complete picture of feeding ecology. Predation strategies, such as "hang and wait" or "move and hunt," are crucial to the best harvesting of specialized or generalist food items from a wide range of resources in all fish species. Depending on the biotic and abiotic factors in the environment as well as the fish's own life history, these generalist or specialized approaches to feeding techniques can vary in a number of ways. Fish functional morphology can provide explanations for onto genic food switch changes between species. Since feeding is the most important activity in an animal's life, a thorough understanding of it is essential for any scientific field that studies fisheries. According to fishes' digestive tracts exhibit a remarkable range of morphological and functional traits that are linked to various feeding habits and taxonomy, such as body size, weight, sex, and form. According to it has been observed that the feeding patterns of different fish species' fry and fingerlings differ from those of the adults. The importance of research on fish feeding ecology, according to Parihar (2016), is that by comprehending this specific topic, one may create programs that will improve water bodies and attract more fish. According to the research on the feeding ecology of freshwater fish species is ongoing since it lays the groundwork for bettering fisheries management initiatives. Effective fish farming requires a thorough grasp of the diet and feeding practices.

V. Conclusion

The cultivation of aquatic species, such as fish, mollusks, crustaceans, and aquatic plants, is known as aquaculture. In order to increase productivity, farming entails some kind of rearing process intervention, such as consistent stocking, feeding, predator protection, etc. Additionally, farming suggests that the stock being grown is owned by an individual or organization. For statistical purposes, aquaculture is defined as aquatic organisms harvested by a person or business that has owned them during their rearing period, whereas fisheries harvest is defined as aquatic organisms that are exploitable by the general public as common property resources, whether or not they have the necessary licenses. To sum up, our study is the first to describe the relationship between the fish's internal digestive organ-specific morphological, histological, and biochemical characteristics and its external ecomorphological characteristics. The data regarding the range of acceptability and advantages of plant-based food (Spirulina) for herbivore and carnivore fishes can undoubtedly be used as a guide for future studies that look at how diet, stress, and environmental factors affect the digestive systems of the species under study.

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