Exploring Fish Eating Habits: Factors Influencing Feeding Behavior in Tropical Fish

ABSTRACT

Feeding behavior is the way fish find, select, and consume food. Understanding fish eating behavior is important to knowing the fulfillment of nutrition and optimal growth in fish. The purpose of writing this article is to determine the factors that influence eating behavior and to compare eating habits between different fish species. The writing method used is literature study, with stages of journal search, journal selection, journal analysis, and journal synthesis. Based on the review results of several relevant journals, it is known that the types of fish feed are divided into 3 categories: euryphagic (eats various types of food), stenophagic (eats types of food that are limited to the ecosystem), and monophagic (eats one specific type of food), while based on the food group they are grouped into the three categories are herbivores (eating plants and algae), carnivores (eating meat), and omnivores (eating everything). Factors that influence eating behavior include food availability, environmental conditions, the type of food, and the size of the fish.

Keywords: *Feeding behavior, Fish, Food.*

1. INTRODUCTION

Food is a very important ecological factor in waters because it plays a role in determining the level of population density, population dynamics, growth, and reproduction of fish. Fish have the ability to choose food, so it will affect the food habits of each type of fish [1]. Fish food habits are strongly influenced by the availability of food in the waters [2].

Food habits are related to the quality and quantity of food eaten by fish [3]. Meanwhile, the size of the food niche illustrates the selectivity of a species to certain food resources [4].

Factors that affect whether or not a food is eaten by fish include food size, food color and fish appetite so that not all food contained in waters can be eaten by fish, besides the amount of food needed by fish depends on food abundance, eating habits, food conversion value and food conditions of the fish [5].

In obtaining food, competition occurs when food resources are diminishing, which is common among fishes that have the same food niches and habitats, and can also occur between species of the closest relatives, for example between species of the same family[6];[7]. Competition for limited food resources between individual fish of the same species is also inevitable as they occupy the same niches [8].

The availability of fish food in free water habitats is already available from nature itself, so fish have a tendency to choose and eat. Meanwhile, farmed fish have different food availability from fish in free waters. This is the main purpose of writing this article, namely to find out how eating behavior and factors that influence it and compare eating habits between fish species.

2. MATERIAL AND METHODS

The method used in this research is a literature study. Literature study, also known as literature review, literature review, theoretical study, theoretical basis, literature review, or theoretical review, is a research approach based on written works. Literature research refers to research that uses only written sources, including published and unpublished research results (Embun, 2012).

Several stages were carried out as follows;

1. Journal Search; First of all, a search was conducted for previous journals on factors affecting fish feeding habits. The search was conducted on scientific journal databases such as ScienceDirect, Google Scholar, and ProQuest. The keywords used were "Factors Affecting Feeding Behavior" and "Interspecies feeding habits".

2. Journal Selection; From the search results, journal selection was made based on certain criteria such as relevance, credibility, and accuracy of information. The selected journals should be relevant to the research topic and recognized by the scientific community.
3. Journal Analysis; Once the journals were selected, the articles were analyzed. The analysis includes identification of factors affecting fish feeding habits and explanation of the mechanisms involved in this process.
4. Journal Synthesis; From the analysis, information from relevant journals is synthesized. The information gathered will be used as the basis for compiling the journal being written.

3. RESULT AND DISCUSSION

3.1 Feeding Habits

Fish feeding habits are the quality and quantity of food eaten by fish, while feeding behavior is the eating behavior of fish which includes how the fish gets food, when the fish eats, and where the fish eats. These eating habits depend on the habitat where the fish live [9]. Like other animals, fish commodities need enough food to grow and develop. The mechanism of development of the digestive apparatus adjusts to the organisms available as food [1].

In general, fish natural food in the form of small microorganisms such as plankton, worms, aquatic plants and organisms that are suitable for the mouth opening of the fish [10]. In its early life the fish will eat plankton and microorganisms that are small in size according to the mouth opening [11].

Based on the type of fish food can be divided into 3 types, namely euryphagic (eaters of various types of food), stenophagic (tend to eat only limited types of food in their ecosystem) and monophagic (which only eat one specific type of food) [12]. Based on the type of food consumed, fish are divided into 3 groups, namely herbivores or plant and algae eaters, carnivores or meat eaters and omnivores or all eaters [13].

The value of niche area has a relationship between generalist and specialist traits. Generalist fish tend to exist in habitats that have high niche area values, while specialist fish are found in low niche values. Generalist fish with relatively higher niches have better adaptation to the availability of food available. Conversely, specialist fish are selective in their food choices [14].

The purpose of exploring fish feeding habits is to find out the types of natural foods eaten by fish in a body of water and their feeding behavior [9].

3.2 Factors Affecting Fish Feeding Behavior

Feeding behavior is a complex activity that involves many behavioral reactions associated with eating, including how to eat, food and eating habits, food sensing mechanisms, meal frequency, and food preferences. Feeding behavior in fish has been widely studied from both ecological and behavioral aspects. Fish feeding habits range from plant and detritus eaters to predator eaters in a wide ecological array [15].

Regarding feeding preferences, some fish are opportunists, while others are highly specialized generalists. In general, hunger increases feeding behavior, increases searching and reduces the time taken to handle food, but fish eat more slowly and selectively as feeding time progresses [16]. In starving fish, the number of meals increases more rapidly, but decreases over time, Feeding behavior in fish is influenced by several factors including environmental and habitat factors [17]. Fish feeding habits are determined by several factors, including the condition of the aquatic habitat in which the fish live and the availability of food in the water [12].

3.2.1 Food Availability

Differences in the amount of food organisms consumed by fish occur due to variations in the distribution of these organisms in each region. In addition, there are other factors that influence aquatic organisms'

preferences for food, including the distribution of food organisms, food availability, preferences of the fish themselves, and factors of the aquatic environment [9].
Many fish species have the ability to adapt to the availability of food in the water according to the season. Manyung fish also experience changes in their food composition depending on the season which impacts the availability of food in their habitat [18].

Based on the results of fishing by fishermen in the Situ Gonggong area, there has been a decline in the presence of fish such as gabus (*Channa striata*), bloso (*Glossogobius giuris*) and jeler (*Nemacheilus chrysolaimos*). This decline is caused by several factors, including internal factors such as difficulty in obtaining natural food, as well as external factors such as waste generated by human activities, including household activities and tofu and oncom production waste discharged into the waters. These factors alter the availability of natural food in the waters and disrupt the balance of the ecosystem [19].
Some of the factors that influence whether a fish species will eat a food item include food size, food availability, food color, taste, texture, and fish preference for that food item. In addition, factors such as age, location, and time of day also affect the type and amount of food consumed by a fish species [12].

3.2.2 Environmental Conditions of Feeding Behavior of Tropical Fish

Ecologically, environmental conditions have an impact on the length and weight growth of an organism [20]. Ecological conditions are closely related to food availability and changes in water quality. Food availability will be utilized by fish according to age, food type, and gonad maturity [12].
Several studies have indicated that, although fish are of the same species and size, slight differences in aquatic habitat conditions can result in differences in the type of food consumed by the fish. Fish behavior and mannerisms are reflected in their response to internal and external influences. External environmental factors such as oxygen content in the water, light conditions, and salinity can affect fish behavior. Meanwhile, internal factors such as gonad maturity and growth also have an impact on fish behavior [21].
In this regard, there are several factors to consider. These factors include the distribution of organisms that are food for fish, the availability of food, food preferences chosen by the fish themselves, and environmental factors that affect water conditions [9].
The availability of food in the water always fluctuates due to the life cycle of fish, climatic conditions, and environmental factors [1]. Food has a very important role in the life of organisms and is a factor that can affect the extent of the spread of a species and regulate the population. The life, growth, and reproduction of organisms depend on the energy obtained from their food [9].

3.2.3 Food Type

The type of food consumed by a fish species is generally influenced by factors such as age, location, and time of day. The food habits of fish can be observed through ecological interactions between organisms in the water, such as patterns of predation, competition, and food chains. The life of a fish species in the natural environment is closely related to the availability of its food. The ability of a fish to survive depends on the availability of the type of food it prefers. The type of food consumed by fish species is generally influenced by preferences for certain types of food, size, age, season, and the habitat in which they live [9].
Fish food choices are determined by the availability of food species in the natural environment and also by the physiological adaptations of the fish. Factors such as gut length, nature and condition of digestion, shape of teeth and pharyngeal bones, as well as body shape and behavior of the fish, influence the type of food selected [22].
If the breadth of a fish's food niche is large enough, it indicates that the types of food consumed are more diverse. Conversely, if the food niche area is narrow or small, it indicates that the fish tends to select

certain foods. Organisms that consume a variety of food resources can have a larger niche area, even when available resources are limited [23].

The food consumed by a fish species is usually determined by the fish's preference for a particular type of food, the size and age of the fish, the season, and the habitat in which it lives. A fish's feeding habits include the type, amount and quality of food it consumes. The type of food that will be consumed by a fish depends on the availability of food in nature and the physiological adaptations of the fish, such as gut length, physiological condition of digestion, shape of teeth and pharyngeal bones, body shape, and fish behavior [24].

The types of natural food consumed by fish vary depending on the type of fish and its age stage of development. When fish fry are still foraging, their main food is plant-based plankton or phytoplankton. However, as the fish grows, its diet also changes, this also applies to the lencam fish Lethrinus rubrioperculatus [10].

3.2.4 Fish Size

Variations in fish size are also influenced by environmental factors such as the abundance and availability of food, temperature, and light that differ in each body of water [25]. Mouth size also reflects the ability of the fish to swallow the largest size of food. Ontogenetically, the larger the size of the fish, the larger the size of food it can swallow [26]. The size of a fish's mouth is reflected in its mouth dimensions, which indicate the maximum size of food it can swallow [27].

In general, fish take their first food when starting life from small plankton [11].

3.3 Analysis of Fish Feeding Behavior based on Food Type and Feeding Strategy

Table 1. Feeding Behavior based on Food Type and Feeding Strategy

Fish Species	Food Type	Feeding Strategy	Sources
Tabirin Fish	Fish, Shrimp, Detritus	Predation	[28]
A. *caninus* dan G. *aureus*	*Metapenaeus* sp.	Crustasivores	[7]
Blodok fish (*B. boddarti*)	*Navicula, Pleurosigma, Nitzschia & Coscinodiscus*	Phytobenthos eater	[29]
Ringo fish	Small Shrimp, Fish, *cyclop*, rotifers, dan *coscinodiscus*	Predation	[28]
Semah fish	Nematode worms and moss	Explorers; Omnivores	[28]
Julung fish Julung (*Dermogenys* sp.)	*Formica* sp. dan *Dolichoderus* sp.	Insectivore	[30]
Sembilang fish (*Plotosus canius*)	*Crustacea*, detritus and microalgae	Direct attack	[31]
Lemeduk fish (*Barbonymus Schwanenfeldi*i)	Herbaceous,moss, grains, worms and insect	Explorers; Omnivores	[32]
Grouper (*Epinephelus akaara*)	Shrimp, fish, and crabU	Predation	[33]
Antartic fish dragonfish	Amphipod, krill, squid, octopus	Predation	[34].

(*Pseudotrematomus bernacchi*)	and *crustacean*		
Small tuna	Pygmy herring	Predation	[35]
Whale shark	anchovy	Predation and filter feeding	[36]
Catfish (*Clarias gariepinus*)	Pellets	Artificial	[37]
Snapper fish in the sea	Fish, Squid, and shrimp	Predation (*sit-and-wait*/*ambush*)	[38]
Luciocephalus pulcher	Small fish, shrimp, and insect	Predation *sit-and-wait*	[39]
Ochmacanthus alternus	Blood, body fluids and gill organs	Parasitism	[40]
Largemouth bass	Small fish and crustacean	Predation (chasing)	[41]
Black fish Sacramento	Algae and detritus	*Filter feeding*	[42]
Tet fish (*Johnius belangerii*)	Juvenil prawns penaeid, *Nephtydae, Loligo* sp, *Squilla* sp. and crab debris.	Crustasivores or micro karnivores	[43]
Lontok fish (*Ophiocara porocephala*)	Shrimp, crab, small fish, snails	Predation	[44]

4. CONCLUSIONS

Food plays an important role in the ecology of aquatic environments as it is a determining factor in the population density, growth, dynamics and reproduction of fish. Fish feeding habits are characterized by the quality and quantity of their food, while their feeding behavior includes how, when, and where they eat. Factors that influence fish feeding habits include food availability, environmental conditions, type of food, and fish size.

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