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Research Article

Investigating Feeding Regimen of Brown Trout *(Salmo Trutta* Fario*)* in Tonekabon River, Northern Iran

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ABSTRACT

The present study was conducted in a four-season period, from September 2016 to 2017, in Tonekabon River, northern Iran. A total of 91 brown trout (*Salmo Trutta* Fario) fish were collected from five stations using electrofishing equipment. They composed 40 females, 41 males, and 10 of unknown sex. Their age ranged from 1 to 3 years, and they had a minimum and maximum length of 41 mm and 175 mm, respectively. The preys identified within their gastrointestinal tract included insect larvae of *Ephemeroptera, Diptera, Liponeura, Simulium, Hydropsyche, Coleopteran, Trichoptera,* flying insect, spawn, *Odonata, Oligochaeta, Plecoptera* taxonomic groups. The collected fish were classified into three age groups including 1- and <1-year, 2-years, and 3-years old as a scale to define their feeding intensity. The consumption percentage of *Hydropsyche* and *Liponeura* was significantly different among three classes. However, there was no significant difference in the consumption intensities of *Ephemeroptera, Plecoptera*, and *Simulium.* The reproduction season of brown trout fish is within fall. Maximum feeding intensity occurs in spring, whereas minimum feeding takes place within summer and fall seasons. Classes 1 and <1-year-old had higher feeding intensity than other classes (classes 2 and 3 years old). In general, *Plecoptera, Ephemeroptera* and *Simulium* constitute primary preys of the fish, while *Liponeura, Hydropsyche, Dipteral, Trichoptera*, and *Oligochaete, Coleoptera, Oligochaeta, Odonatan*, flying insects, and spawn are considered as the subordinate prey for the feeding regimen of brown trout. The highest amount of prey for stations 1, 2, 3, 4 and 5 included *Simolium, Ephemeroptera, Simolium, Simolium and Liponeura,* respectively. Station 2 had the highest glutting stomach index, followed by station 1, both of which were located on the Se-Hezar River.

Keywords: Brown trout; Feeding habit; Gutting stomach index; Aqous animals

INTRODUCTION

The Tonekabon River is located in western Mazandaran. Thanks to its peculiar physicochemical properties and benthic material, it is brimmed an outstanding biodiversity. This river is one of the most waterfall (Hig-dischange) rivers south of the Caspian Sea. This river comprises the Do-Hezar, Se-Hezar and Valamrod rivers. In addition to aqous animals, it harbors various species, such as salmonidae, cyprinidae and angailidae [1]. Brown trout (*Salmo Trutta* Fario) is one of most important species in the Tonekabon River that inhabits the conflux of these rivers. Due to its physicochemical properties and the ecological condition [2,3], it is considered as a native fish. This species has economic value, especially; it is one of the most popular species among sportsman for angling [4]. The low survival rates of Chinook salmon (*Oncorhynchus Tshawytscha)* smolts in California's central valley have been attributed to multiple biological and physical factors, although the impact of each factor remains unclear [5].

This thesis is on effort to identify feeding regiment of this species in the Tonekabon River. As we know, feeding is one of the most important needs of an organism. Fir Fochetti, first-order necessities of an organism (growth, development and reproduction) altogether conduct with consumed energy from

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food entered to body all of other energy-required processes in fish body accomplish with food consumption [5]. In aquaculture, fish feeding is a critical step that everyone in encounter this issue in fishery industry for solving related issues. At present research on studying fish distribution of fish species [2,5]. It is impossible to design a logical optimization method for commercial fish reserves without identifying how the fish seek their food sources and learning about the relationship between the fish and other consumer of the food source and the connection between predators [1,6]. Understanding the type and composition of food organisms consumed by other competitors, the amount and way of food consumption, and linkage between feeding with time. Place and condition and some of other factors allow researchers to achieve a complete [7], and comprehensive perspective on the life of organisms [8]. The findings of this research can be used to a better understanding of ecological condition of brown trout's habitat in the Tonekabon River.

MATERIALS AND METHODS

The red-spotted trout caught in this article were carried out in compliance with the standards, and no damage was done to the fish and the fish environment was not polluted during. The fishing it is related to a few years ago and it is related to my dissertation. Also in Iran, there is correspondence in the field of observing facial ethics. However, according to the international re, all students observed professional ethics in working with living beings regulations.

First, the Do-Hezar and Se-Hezar rivers in Tonekabon were divided into five stations. Then, the fish were collected using an electroshock instrument with a power of 1.7 KM (DC) and a 300-400 voltage. Immediately after fishing, the biometry properties of the fish were measured. Then, by cutting the gullet (in the throat) and cutting the gut in the rectum, the digestion apparatus was removed from and fixed in 70% alcohol.

The following information was collected and recorded in the sampling process: Total length, fork length, standard length, fish weight, stomach weight, gender determination, gonad weight, age, and gut length. The fixed stomachs were taken from alcohol, rinsed with water, and placed in petri dishes. The stomach was opened, and the swallowed preys were examined thoroughly [9]. The type and the number of prey, and the percentage of prey groups were recorded. The weight of the stomach content was also measured. The sexual maturity index was calculated from the following formula:

Sexual maturity index=((Gonad weight/(Body weight-Entrails weight)) x 100

The relative length of the gut, i.e., the gut length to body length ratio, was calculated. Also, the Gutted Stomach Index (GSI) was calculated based on the following formula [10]: GSI: Stomach content weight/Body weight.

RESULTS

The average percentage of preys fed by brown trout during the perfect period is as follows: The frequency of primary, subordinate, and casual preys of brown trout was calculated using the formula below: $F^p=N^p100/N^1$

F^p: Prey frequency

N^p: Number of N stomach than has P prey

N^1 : Number of investigated gutted stomach

If F^p has a value of above 50, the prey is considered primary; however, if this value is between 10-50, the prey is considered as subordinate prey. Finally, F^p values below 10 are considered as casual prey. Results from this investigation were analyzed using the variance analysis test. The amount of sexual maturity index in various seasons among the male and female fish was calculated based on the following table.

The Relative Length of Gut (RLG) in each studied specimen was less than one, indicating the carnivore nature of the fish studied. Gutted stomach index in males and females was compared in different seasons (Tables 1-3). The maximum and minimum

Period	Percentage	Prey
Primary prey	34.14	*Simulium*
Primary prey	24.36	*Ephemeroptera*
Subordinate prey	16.4	*Liponeura*
Primary prey	11.68	*Plecoptera*
Subordinate prey	9.08	*Hydropsyche*
Subordinate prey	1.58	*Diptera*
Casual prey	0.78	Flying insects
Casual prey	0.73	*Cleoptera*
Subordinate prey	0.53	*Trichoptera*
Casual prey	0.3	*Oligochaeta*
Casual prey	0.27	*Odonata*
Casual prey	0.14	Spawn

Table 1: The average percentage of prey fed by brown trout during the perfect period.

Seasons	Sexual maturity index		
	Male	Female	Average
Winter	0.24	0.34	0.27
Autumn	1.6	0.21	0.73
Summer	3.36	21.3	2.79
Spring	0.38	0.42	0.43

Table 2: The amount of sexual maturity index.

Seasons	Guttled stomach index	
	Male	Female
Winter	166.4	200.65
Autumn	132.42	117.98
Summer	170.93	116.41
Spring	276.92	246.48

Table 3: Guttled Stomach Index (GSI) in males and females in different seasons.

levels of the gutted stomach index in males were observed in spring and autumn. Also, the maximum and minimum levels of the gutted stomach index in females were in spring and summer.

DISCUSSION

For a more accurate age-based analysis of the fish, they were divided into three classes:

Class-1: The fish below equal to or below one year of age.

Class-2: The two-year-old fish

Class-3: The three-year-old fish

The variance analysis test showed a significant difference between different classes in terms of the consumption of hydro psyche. In contrast, this test did not show a significant difference between the designated classes in the consumption percentage of Ephemeroptera. The high sexual maturity index in summer confirms that the spawning season in this fish is from mid-September to autumn.

The mean of RLG in different classes was: Class-1=0. 32; Class-2=0. 33; Class-3=0. 35

The maximum of gutted stomach index is in spring, and the minimum of this index occurs in fall and winter. These results agree with the findings of Fasaic, et al. on brown trout in Bager Lake and the Lepenica River [11]. Also, decreased feeding in summer and fall (especially summer) compared to winter could be a high sexual maturity index in these seasons (summer and autumn) [1].

Results from feeding intensity between three classes-2 and class-3. These findings confirmed that brown trout in the early stages consumed more than later stages. The weight of stomach content in the smallest fish and the larger classes had a significant difference at (1%), but the numbers of organisms in this level had no significant differences, confirming that brown trout could catch larger prey if the prey size increased.

CONCLUSION

The frequency of consumed organisms during different seasons based on presence was changeable, confirming that brown trout fed on the most frequent and most well-known prey. The presence of spawn in one of the samples also verified the selection factor based on the presence of prey. Furthermore, brown trout's summer consumption of flying insects led to two conclusions: first, it could take some of its food (prey) at water level. Second, the feeding somehow varied with season and food (prey) presence because these land-living insects were scarce in other seasons.

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