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Biodiversity of Fish Species in Haraz River (An Ecological Approach)

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Abstract: Fish diversity of Haraz river has studied from November 1999 To August 2000. This river is situated in the Southern Caspian basin of Iranian Mazandaran province. Five stations were selected along the river. The stations were selected in the following positions: One station in upstream, 1450 meters above sea level. Two stations at a gravel mining site 350 meters asl. Three stations above the Hezar Sangar dam at 220 meters asl. Four stations just below the Hezar Sangar dam, 190 meters asl and five stations at The Estuary with Elevation of-26 above Sea Level (asl). Altogether, 522 specimens were Collected and studied. These belonged to 20 species and 9 families. The names of species and families are cited. Ciprinids comprised 67.2 percent of the species. Seventy percent of species were resident and 30 percent anadromous. Rain bow trout (*Oncorhynchus mykiss*), Gold fish (*Carassius auratus*), (*Liza saliens*) and Stickle back (*Gasterosteus aculeatus)* and Gambusia (*Gambusia holbrooki*) were introduced species.

Key words: Fish biodiversity· Haraz river · Mazandaran province

INTRODUCTION

Iran is located in an area which is very important with regard to animal geographical field. We know little about the fauna of Iranian fish, yet this information is interesting and is worth to pay attention. Studies about fish communities in the rivers showed that non-subsistence parameters such as temperature, the speed of water circulation, and the type of river bed have a vital role in plenty of kinds of fish. So sort enrichment, variety enrichment, and fish productions aren't the same in different parts of the river [1].

Therefore, for a better management and in accordance with fishery goals and objectives, also environmental purposes and factors of fish communities a river can be divided into different segments. Usually each segment has been based on the name of the majority of the kind of fish in that particular part of section. Consequently many rivers like those in Europe have been divided. However these things have not been done for Iranian rivers, and if something have been done that's very little. Not only irregular and immethodical interference of human kind on rivers (construction of dams, agricultural development, construction of centers near the rivers to increase fish reproduction, bringing none native sorts of fish to these areas, and taking sand and fine from the bank and river bed) caused a lot of damages to all kinds of native Iranian fish.

Haraz river in Mazandaran province in the north part of Iran is among of those protected rivers by Iran environment organization which contains lots of kinds of native fish. The main goals and aims of this research are to identify the kinds of fish, study the species of fish in different parts of the river, and ecological niche overlapping, Also food selection in order to recognize the effects of rainbow trout on red mole trout and yet study of human interferences on the rivers (construction of dams, taking sand and fine from the bank and river bed and construction of centers near the rivers to increase fish reproduction).

MATERIALS AND METHODS

Five stations were selected. First station was assigned at the upper of the river (trout area), second station was assigned at the area which sand is taken from

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Table 1: Biodiversity of fish in Haraz river

Species	Exotic/Native	Inhabitant in the river	Immigrant from the sea to the river
(Salmonidae):			
Salmo trutta fario	N	+	-
Oncorhynchus mykiss	E	+	-
(Cyprinidae) :			
Capoeta capoeta	N	+	-
Barbus mursa	N	+	-
Barbus lacerta	N	+	-
Alburnoides bipunctatus	N	+	-
Leuciscus cephalus	N	+	-
Rhodeus sericeus	N	+	-
Carassius auratus	E	+	-
Rutilus frissi kutum	N	-	+
Chalcalburnus chalcoides	N	-	+
Vimba vimba	N	-	+
Rutilus rutilus caspicus	N	-	+
(Gobiidae):			
Neogobius fluviatilis	N	+	-
(Gasterosteidae):			
Gasterosteus aculeatus	E	+	-
(Petromyzontidae) :			
Caspiomyzon wagneri	N	-	+
(Mugilidae):			
Liza saliens	E	-	+
(Cobitidae):			
Cobitis taenia	N	+	-
(Poeciliidae):			
Gambusia holbrooki	E	+	-
(Balitoridae) :			
Nemacheilus malaptrurus	N	+	-

Table 2: Species niche overlapping of rainbow trout and red mole trout

Season	Fall of 1999	Spring of 2000
Overlapping	0.88	0.7

Table 3: food selection for red mole trout, summer of 2000

Trichoptera	Ephemeroptera	Simulidae	Chironomidae	Gammaridae	
1.9	1.09	0.58	0.78	0.16	Food selection

Table 4: the rate of watery insects caught by surber sampler at the first station in percent- summer of 2000

Trichoptera	Ephemeroptera	Simulidae	Chironomidae	Gammaridae	Pelanaridae	Coleoptera	Plecoptera
40.3	47.6	2.4	2.4	3.2	0.8	2.4	0.8

Table 5: The amount of stomach content of red mole trout at the first station in percent

	Spring of 2000	Summer of 2000	Fall of 1999	Winter of 1999
Ephomeroptera	4.4	51.9	87.0	-
Trichoptera	53.9	44.3	11.5	-
Chironomidae	0.6	1.9	0.5	-
Simulidae	-	1.4	0.5	-
Gammaridae	0.6	0.5	0.5	-
Plecoptera	40.5	-	-	-

Table 6: the amount of stomach content of rainbow trout at the first station in percent

	Spring of 2000	Summer of 2000	Fall of 1999	Winter of 1999
Ephemeroptera	1.1	-	45.9	17.4
Trichoptera	11.1	-	31.2	58.4
Gammaridae	-	-	5.8	5.6
Diptera	-	-	0.3	0.6
Simulidae	-	-	1.1	15.5
Chironomidae	1.1	-	7.2	1.9
Tipulidae	-	-	2.5	0.6
Coleoptera	-	-	0.6	-
Odonata	-	-	0.3	-
Nematod	-	-	3.1	-
Annelida	-	-	1.1	-
Gastropoda	-	-	0.3	-
Plecoptera	86.7	-	-	-

the river. Third and fourth stations were appointed at the area which Hezarsangar dam of Amol is located between them. Finally the fifth station was chosen at the mouth of the river. Catching the fish was done by salick net (10 meters in diameter) sampling was taken during the four seasons. At each station for each day of working, six hours of catching fish was considered. Catching the insects living in water was done by surber sampler with dimension of 30 by 30 centimeters. The fish and other insects caught by the mentioned style were fixed in formalin (10%) and transferred to the laboratory of Tarbiat Modarres University. Identification of the fish was based on the family origin, genus and species [2].

The content of the stomach of trout fish and counting the number of insects living in the water, to find out the effects of rainbow trout on red mole trout, food selection comes as:

Species Niche Overlapping: We used the Pianka formula for Species niche overlapping [3].

$$\alpha_{j,k} = \frac{\sum P_{i,j}, P_{i,k}}{\left[(\sum P_{i,j}^2)(\sum P_{i,k}^2)\right]^{\frac{1}{2}}}$$

$P_{i,j}$ is the food material in the stomach of the first fish in percent and $P_{i,k}$ is the food material In the stomach of the second fish in percent.

$$\text{Food selection} = \frac{\text{The food stuff in the stomach of the animal in percent}}{\text{Food stuff in environment in percent}}$$

If the obtained number is greater than one, it means that the animal has selected that food. If it's equal or less than one, it means, the animal hasn't selected that particular food or its indifferent forward that food.

RESULTS

Biodiversity of fish: among those fish kippor fish presents 9 genus and 11 species is the most various. Salmon fish presents 2 genus and 2 species and other kinds of fish present one genus and species. From the existence species, 70% is river inhabitant and 30% is immigrant (from sea to river) (Table 1).

Species Niche Overlapping and Food Selection: To determine the effects of rainbow trout as a none native species over the red mole trout as a native species at the first station (Fig. 6). Two species of ranbow and red mole trout were bserved together in the two seasons; fall and spring. The calculation was done just for these two seasons (Table 2).

In the summer only red mole trout while, in the winter rainbow trout were caught. So the rate of coexistence wasn't calculated. The food selection was calculated only in the summer (Table 3).

Therefore, Tables 4, 5 and 6 revealed the rate of coexistence and food selection.

As indicated in Table 3, the found numbers for Ephemeroptera and Trichoptera are greater than one. Therefore it may conclude that, they have selected this food stuff. But for Chironomidae, Simulidae and Gammaridae, it was less than one. We could concluded that the red mole trout has been selected or with regard to its one food stuff.

DISCUSSION AND CONCLUSION

Considering the results, it's obvious that the river mouth (fifth station) where many immigrant fish entered for reproduction purposes has more variety comparing to the other parts of the river (Fig. 5 and 6).

In fall season from 8 caught fish species, *L. saliens* with 47% had the most shares and *G. aculatus, V. vimba, R. frissi kutum* with only 3% had the least share. Yet in the winter the highest share belonged to *C. chalcoides* with 32% and the lowest share belonged to *C. wagneri* and *L. saliens* with just 2%. The important point is *C. chalcoides* wasn't seen during other seasons, so we can conclude that, this immigrant species has got the highest accumulation in this season. This species usually has been seen in the middle parts of the river whereas the river bed is covered with rocks and pretty small pieces of stones [4].

In this research, the catching of fish was done only at the mouth of the river where its bed is covered with sandy naterials. Also *L. saliens* wasn't observed in the spring. However, it was seen again in the summer season (27%). Therefore it can be concluded that this kind of fish are present at the mouth of the river in the falls and summers. In the winter season 8 species were identified. In the spring season the majority belongs to *C. taenia* (27%) and the least belonged to *L. cephalus and G. aculatus* (5%). *C. taenia* in the seasons of fall and winter was also observed at the second station (Fig. 2).

At the second station sand and small pieces of stones and mud are taken from the bed river as well as the bank river, and the river has been divided into some branches.

In one branch of the river that its bed is covered with sand, mud and small pieces of stone, this type of fish has been observed. Other types of fish such as *N. fluviatilis, B. mursa, B. lacerta* and which need the river bed covered with rock and bigger pieces of stones has been observed [4].

It can be said that if this trend or pattern continues, a destructive effects on the native fish of the river will be observed. These native fish have a vital role on the overall condition of the river and its animals. Of course at the second station the divisions of the river, immethodical withdraw of sand and mud and ecological conditions of the river have been changed too much. *C. taenia* usually lives in the lower parts of the river where the bed river is sandy and mudy [4].

C. taenia wasn't observed at the fifth station and as mentioned before it was the majority of the fish in spring season. In spring 7 species totally were identified in the summer the number of Species decreased rapidly and reached to 4 species. In this season *C. auratus* which is a none native type presents the majority (54%). Of course this kind of fish has been seen in the other catching seasons. The least belonged to *G. holbrooki* (8%). This sort of fish at first was brought to Iran in order to fight malaria fly. At the present time a none-native species may be found in most lakes and rivers and water bodies of the country. This type is also a food competitor for many native species [4].

Gambuzia wasn't seen in other seasons. Altogether 14 species were identified at the fifth station. Third and fourth stations which are located in the both sides of Hezarsangar Amol deviation dam from type of Bed river and the speed of water circulation are very much alike. (Fig. 3 and 4).

Five species *C. capoeta, A. bipunctatus, B. lacerta, B. mursa* and *L. cephalus* were observed in both stations. But *N. fluviatilis* that present in four season was observed at the third station wasn't observed at the 4th station. Interesting to mention that fish cow in the two seasons of fall and winter was the top fish to be caught at the third station (47 and 67%). Now considering the fact that the ecological conditions of the two stations have been very similar and even the same species have been seen in the two stations, why the fish cow hasn't been seen at the 4th station? Is the deviation dam an obstacle for the fish cow so that it can not enter the area or may be there are of reasons that can find the answer to this puzzle? It seems that, it needs more research in this area. Another thing is that the existence of *S. trutta fario* at the 4th station. In the winter just 3% of this kind of fish was caught. Mean while the height of water in this area is 190 meters. In fact this is a plain station.

It could be concluded that the living conditions for this type of fish in its main living place (the upper parts of the river) have been inappropriate or somehow improper? As it was mentioned in the results part coexistence between rainbow trout and red mole trout at the first station is a lot (Fig. 1).

This rate in the fall of 1999 was 88% and in spring of 2000 was lowered to 70%. On the other hand by considering the calculation done in summer of 2000, it was found that the red mole trout is a selector and selects its own food. Also observation with regard to some characteristics of rainbow trout and red mole trout indicates that rainbow trout doesn't allow the red mole trout to get closer to its living place and makes a distance with it [5]. Yet we must pay attention to the fact that

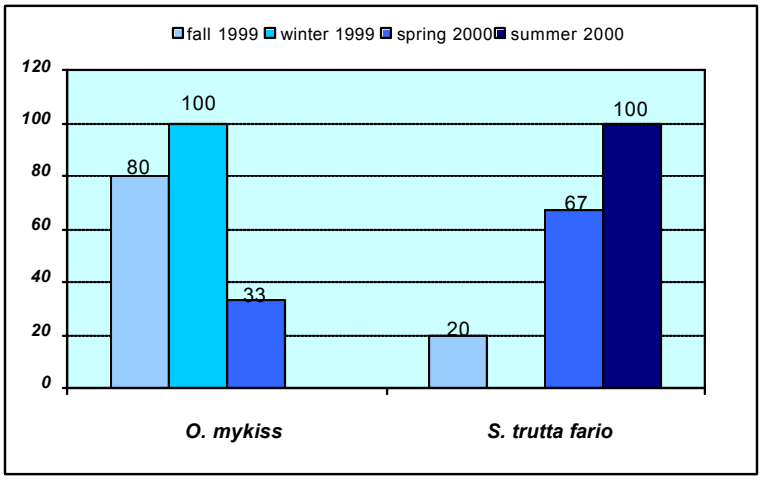

Fig. 1: the plenty of fish species at the first station of Haraz river in percent

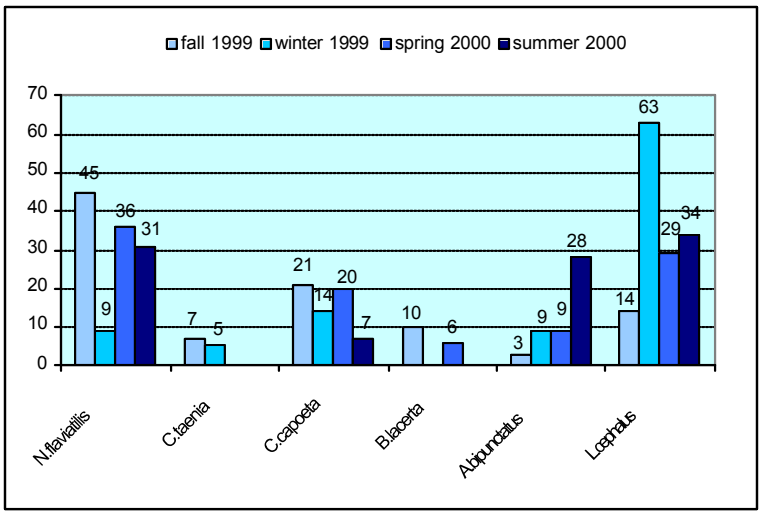

Fig. 2: the plenty of fish species at the second station of Haraz river in percent

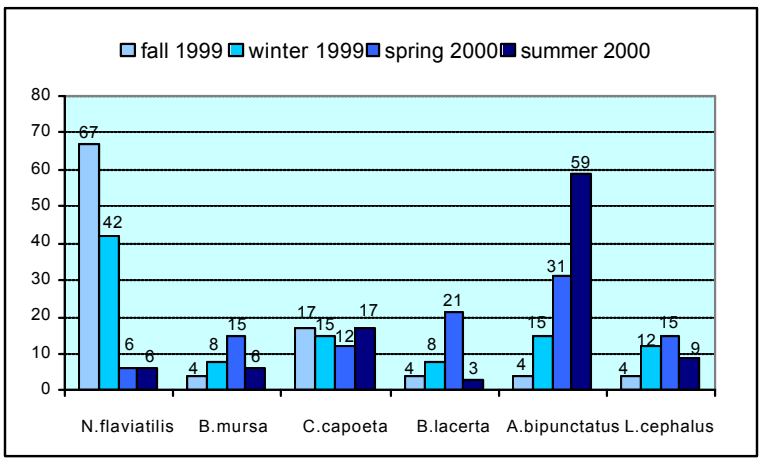

Fig. 3: the plenty of fish species at the third station of Haraz river in percent

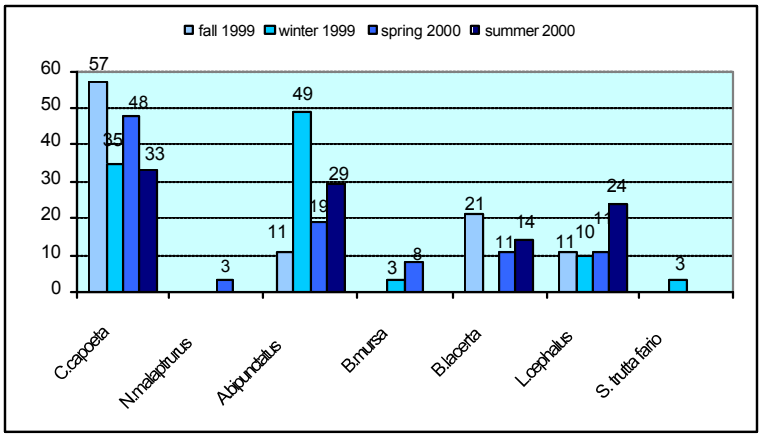

Fig. 4: the plenty of fish species at the fourth station of Haraz river in percent

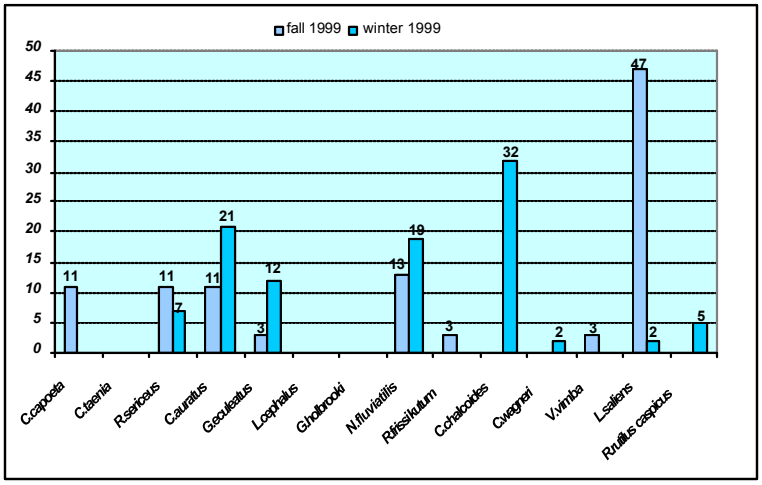

Fig. 5: the plenty of fish species at the fifth station of Haraz river in percent (fall and winter,1999)

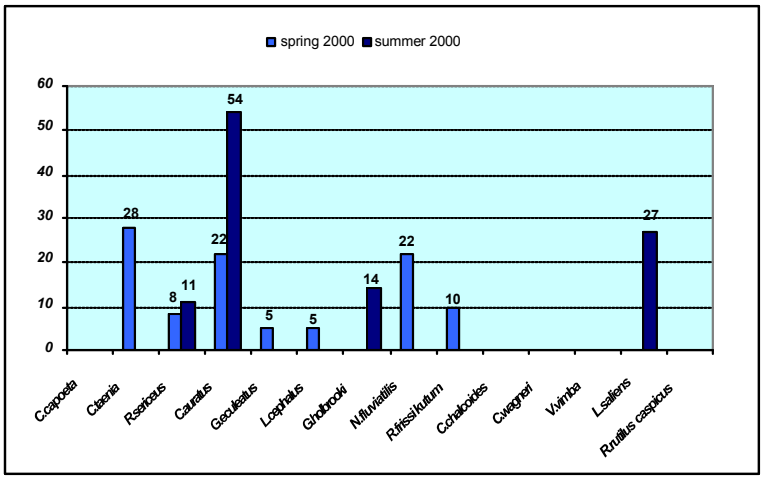

Fig. 6: the plenty of fish species at the fifth station of Haraz river in percent (spring and summer, 2000)

rainbow trout is not very sensitive against changes in water temperature and the present oxygen in the water but red mole trout in fact is very sensitive against these changes and also against food stuff and its changes [5].

So by realizing all of these facts, its possible that in the long run the workshops used for rising and reproducing of the rainbow trout, where the fish after escaping from them and entering the river, could have a destructive effect on the native species of the river (red mole trout). In the two seasons of fall and winter the most fish that was caught at the first station belonged to rainbow trout (80 and 100%). In winter and at the fourth station red mole trout was observed but at the first station where it's the original living place of this kind of fish, it wasn't seen. Also the entrance of rainbow trout to the Caspian sea via Haraz river for *Salmo trutta capius* that according to Kad and Abdoli (1995) has been ranked EN(endangered) in the IUCN rankings will also cause a problem in the future [6].

At the third station six species were caught during the fall season and it happened again during other seasons, the caught species have almost the same conditions. Of course it has mentioned that during the seasons of fall and winter, the majorities belonged to *N. fluviatilis* and during the seasons of spring and summer the majority belonged to *A. bipunctatus* were observed. Interesting to consider that *N. fluviatilis* and *A. bipunctatus* during the spring and the fall have had the least numbers comparing to the other types of fish. At the second station the majorityof fish that were caught belonged to *N. fluviatilis* and *L. cephalus*.The lowest number of fish that were caught belonged to *C. taenia* and *B. lacerta*. Considering the point that 20 species from overall 9 families during 4 seasons of the year by salick net were caught. It can be concluded that Haraz river is very rich with different species of fish comparing to many other rivers in the country. For instance during one year research when sampling was done each month by electro shocker machine and salick net, in the two rivers of Chalous and Sardabroud, totally 17 species from 5 families were identified [4].

Also another study which was done from Farvardin during of 1998 on Helleh river in the Southern part of Iran, 14 species from overall 10 families were identified [7].

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