Freshwater fish Fauna and Restock Fish Activities of Reservoir in the Dardanelles (Canakkale-Turkey)

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Abstract

Turkey has, with geographic location including Istanbul and Çanakkale straits the system, 178,000 km in length streams, 906,000 ha of natural lakes, and 411,800 ha of dam lakes, and 28,000 ha of ponds due to richness inland waters which include freshwater fish. The fingerling fish (fry) were restocked approximately 250,000,000 in natural lakes, dam lakes and ponds for fisheries between years of 1979 and 2005. Canakkale has rich freshwater potential with 7 major rivers (Büyükdere, Karamenderes stream, Kavak brook, Kocacay stream, Sarıcay stream, Tuzla brook, Umurbey brook), 7 Dam Lakes (Atikhisar, Zeytinlikoy, Bayramic, Bakacak, Tayfur, Umurbey and Yenice-Gönen Dam lakes). In the studies, it has been determined that 15 fish species belonging to 6 families (Anguillidae, Atherinidae, Salmonidae, Cobitidae, Cyprinidae and Poecilidae) can be found in reservoirs. Fish restocking of the activities of the reservoir until today approximately 1,120,000 (*Cyprinus carpio* L., 1758) is introduced. In this study, the activity of Canakkale province in the fish restocking and reservoir exploiting possibilities were discussed in view of reservoir fisheries potential which is used insufficiently today.

Keywords: Fish fauna, Dardanelles, Freshwater fish, Canakkale, Restocking

Introduction

Addition to being surrounded by Black Sea, Aegean Sea and Mediterranean Sea Turkey has a great freshwater potential with 178,000 km long streams and 906,000 ha natural lakes, 439,800 ha dam lakes and pond areas. Since the country is situated in the meeting point of Asia and Europe continents it also possesses Istanbul and Canakkale Straits (Dardanelles) which offer a suitable habitat for a great number of freshwater fish.

In our country ranking the third in dam construction with increasing the number of dams (ICOLD, 1999). These man-made inland water potential offers important fish production capacity and employments.

In the research concerning Turkey's freshwater, more than 230 species and subspecies of 26 fish familia were recorded (Geldiay and Balık, 1996; Kuru, 2004; Tüfek and Yalçın, 2007).

Stocking of reservoirs with fingerlings economically important, suitable and fast growing species to setle all diverse niches of the biotope is necessary prerequisites in reservoirs fisheries management (Jhingran, 1988)

The main tenets of the restocking are; fish selection of the right species depending on the fish food resources available in the system; determination of a stocking density on the basis of the production potential, growth and mortality; Proper stocking and harvesting Schedule allowing maximum grow out period; small irrigation reservoirs with open sluices, the seoson of overflow and the possibilities of the water level falling too low or completely drying ore taken into consideraiton (Sugunan, 1995).

Materials and Method

Canakkale is a significant port city situated in the northwest of Turkey, east of Balkan Peninsula, between the lands of Gelibolu district and European Biga Peninsula and Continent of Asia (Figure 1). In terms of sea fishery, it is a rich fishing area. It is located in the geographical land covering Western Marmara Sea, Northeast Aegean Sea (Gökçeada, Bozcaada, Saros Gulf, Edremit Gulf) and Dardanelles Strait. In this region more than 110 species of 59 sea fish familia, most of which are of economic importance, were detected. Although many of them lack regular stream flow, it has 11 streams and amongst them the most significant ones are; Karamenderes stream, Koca brook, Kavak brook and Tuzla brook. There are 6 dam lakes and 35 small ponds operating in the streams with regular flows.

Figure 1. Canakkale province map

Results

Canakkale Freshwater Potential

Although there are many stream forms in Canakkale, most of them have irregular flow regimes. The reason for the significance of these streams stems from the fact that they have dams or ponds available or will be available soon. In addition to obtaining drinking water from these dams or ponds, they are densely used in irrigating agricultural lands (Table 1).

Table 1. Dardanelles major rivers and water catchment areas and installations

Streams	Total Length (km)	River Basin (km2)	Dam Lakes (Established or Not)
Karamenderes Stream	109	1586	Bayramic Dam Lake (Established)
Kavak Brook	50	210	Cokal Dam Lake (Established)
Umurbey Brook	22	279	Umurbey Dam Lake (Established)
Tuzla Brook	80	507	Caltı Dam Lake (Established)
Sarıcay Stream	40	407	Atikhisar Dam Lake (Established)
Kocadere Brook	84	279,40	Tasoluk Dam Lake (Established)
Kocacay Brook	62	976	Bakacak Dam Lake (Established)
Tayfur Brook	19	-	Tayfur Dam Lake (Established)
Bayramdere Brook	11	-	Bayramdere Dam Lake (Established)
Buyuk Brook	10	-	Gokceada Dam Lake (Established)
Cınar Brook	28	-	Ayıtdere Dam Lake (Not established)

In the region there are no significant natural lakes. Simply a small portion of Ece Lake which was largely dried in previous years constitutes a natural back water particularly in winter months. City of Canakkale on the other hand has quite a rich potential in terms of artificial reservoir. Within the city borders, there are 7 dam lakes operating and 35 ponds in various sizes.

Canakkale Freshwater Fish Fauna

So far in studies directed to detecting freshwater fish species in small creeks, brooks and streams and artificial reservoirs constructed in front of them, 15 species of 5 familia have been recorded (Table 2).

Table 2. The fish fauna in Dardanelles

Fish species	Reservoir	Literature
European Chub, *Squalius cephalus*	Gonen Stream, Handere Brook, Kocacay Stream, Celebi Brook, Cakırkoy Brook, Atikhisar Dam Lake, Sarı Brook, Yenice Irrigation Pond	Sarı et al., 2006; Akbulut et al., 2008; Berber et al., 2008
Salmo trutta macrostigma	Handere Brook, Celebi Brook	Sarı et al., 2006
Bitterling, *Rhodeus seriseus amarus*	Kocacay Stream, Gonen Brook	
Eurasian minnow, *Phoxinus phoxinus*	Handere Brook, Celebi Brook, Döşeme Brook	
Vimba, *Vimba vimba*	Çakırkoy Brook	
Danube bleak, *Chalcalburnus chalcoides*	Çakırkoy Brook, Kocacay Stream	
European eel, *Anguilla anguilla*	Mıhlı Brook	
Cobitis fahirae	Çakırkoy Brook, Kocacay Stream, Gonen Stream	
Transcaucasian barb, *Capoeta capoeta bergamae*	Kocacay Brook, Çınar Brook, Bakacak Brook, Harmanlı Brook	
Crimean barbel, *Barbus tauricus escherichi*	Gonen Stream, Celebi Brook, Kocacay Stream, Handere Brook,	Sarı et al., 2006; Berber et al., 2008
Gudgeon, *Gobio gobio*	Tuzla Brook, Karamenderes Stream, Adacay Brook, Bakacak Brook, Harmanlı Brook, Bahçeli Barok, Yenice İrrigation Pond	
Tench, *Tinca tinca*	Yenice İrrigation Pond	Berber et al., 2008
Common carp, *Cyprinus carpio*	Yenice İrrigation Pond	
Big-scale sand smelt, *Atherina boyeri*	Sarıcay Stream	Akbulut et al., 2008
Mosquitofish, *Gambusia affinis*	Sarıcay Stream	

Fish Restocking Activities

In Turkey fish restocking activities are legal executed by General Directorate of State Hydraulic Works (DSI) controlled by Ministry of Agriculture and Ministry of Environment and Forestry. Within this context, in several natural lakes, dam lakes and ponds between years 1995 and 2005, 62,000,000 offspring of common carp

were stocked by the institutions of Ministry of Agriculture. Until now, 273,000,000 fish offspring, most of which are common carps have been stocked by breeding stations of DSI. Common carp (*Cyprinus carpio*) was the most important among the species used for fish restocking (Table 3).

In Canakkale fish restocking activities were executed by Directorate of Ministry of Agriculture. In the framework of above mentioned activities which gained impetus in recent years, 425,000 mirror carp were left to 7 ponds in 2004, and 115,000 fish offspring were dropped in 10 ponds in 2007. Up until now over 1,100,000 fish restocking has been conducted in dam lakes and ponds within the city borders (Table 3).

Table 3. Restocking activities in Canakkale province (Anonymous, 2008c)

Countyside	Location	Restocking (number)	Species
Center	Aşagıokçular Lake (small)	20,000+100	*C. carpio* (fingerling)+*Esox lucius* (Broodstock)
Center	Akcapınar Lake (small)	20,000	*C. carpio* (fingerling)
Center	Dumrek Lake (small)	30,000	*C. carpio* (fingerling)
Ayvacık	Kosedere Lake (small)	80,000	*C. carpio* (fingerling)
Bayramiç	Isıkeli Lake (small)	80,000	*C. carpio* (fingerling)
Bayramiç	Cırpılar Lake (small)	50,000	*C. carpio* (fingerling)
Bayramiç	Koyluçay Lake (small)	20,000	*C. carpio* (fingerling)
Ezine	Kemallı Lake (small)	110,000	*C. carpio* (fingerling)
Ezine	Bahceli Lake (small)	30,000	*C. carpio* (fingerling)
Ezine	Sapkoy Lake (small)	30,000	*C. carpio* (fingerling)
Gelibolu	Kavak-Demircili Lake (small)	45,000	*C. carpio* (fingerling)
Gökçeada	Sahinkaya Lake (small)	125,000	*C. carpio* (fingerling)
Gökçeada	Derekoy Lake (small)	60,000	*C. carpio* (fingerling)
Gökçeada	Ugurlu Lake (small)	10,000	*C. carpio* (fingerling)
Gökçeada	Aydıncı Lake (small)	45,000	*C. carpio* (fingerling)
Lapseki	Nusretiye Lake (small)	50,000	*C. carpio* (fingerling)
Yenice	Karakoy Lake (small)	20,000	*C. carpio* (fingerling)
Yenice	Davutkoy Lake (small)	30,000	*C. carpio* (fingerling)
Yenice	Kaklım Lake (small)	30,000	*C. carpio* (fingerling)
Yenice	Cınarcık Lake (small)	10,000	*C. carpio* (fingerling)

Yenice	Korukoy Lake (small)	5,000	*C. carpio* (fingerling)
Çan	Terzialan Lake (small)	70,000	*C. carpio* (fingerling)
Can	Sameteli Lake (small)	70,000	*C. carpio* (fingerling)
Biga	Akyaprak Lake (small)	65,000	*C. carpio* (fingerling)
Biga	Soguksudere Lake (small)	10,000	*C. carpio* (fingerling)
Total	1,120,100		

In the early years of fish restocking sizes of common carp varied between 50 and 70 mm. In studies particularly conducted by DSI it was found out that use these sizes was not efficient enough so the decision was to increase the fish size to 100-120 mm. Besides, the average total size of common carp offspring released in different reservoirs was determined to be 30.71 mm in Canakkale in 2007 (Table 4).

Table 4. Some morphometric characteristics of Restocking carp fish used for restocking in 2007 (N=107)

Cyprinus carpio	TL ±SE (mm)	WT±SE (g)
	30.71±0.325	0.43±0.019
(min-max)	(24.19-44.81)	(0.23-1.52)

Discussions and Conclusion

Water resources-namely dam lakes and ponds which were built for energy generation, drinking water supply and irrigation purposes could be used for fish production and thus create an extra economical income, employment opportunities and produce the protein which is essential in human diet. Globally, fish production is about to reach the top level. Therefore it is a necessity to make the use of freshwater resources more efficient and rational. In this phase, fish restocking activities play a significant role in reservoirs (Marmulla, 2001).

In Turkey the foremost handicap in fish restocking activities is lack of conducting periodical observations in water resources before and after fish restocking. In order to efficiently conduct economically and ecologically sound management, water resources need to be examined periodically in a physical, chemical and biological way (Sugunan, 2000).

Even though fish restocking in freshwater resources has been made to increase stock efficiency and biological fight, it is possible to encounter with undesired outcomes. Amongst them the most important one is that undesired fish species were also released to water resources. In Turkey, Pumpkinseed, *Lepomis gibbosus*, Stone moroko, *Pseudorasbora parva*, Gold Fish, *Carassius auratus*, Crucian carp,

Carassius carassius, Prussian carp, *Carassius gibelio*, and big-scale sand smelt, *Atherina boyeri* are examples of species which were spread by the means of human intervention (Table 5) (Sasi and Balik, 2003; Innal and Erkakan, 2006). It is known that due to their high competition skills they become dominant causeing a decrease or even a total elimination in the number of native fish species. Even though several *Carassius* and *Atherina* species can be used economically in small portion, their introduction may lead to considerably higher economical loss in more precious species. In order to prevent this loss, the material to be used should be obtained from a specific source in a controlled manner and should be studied in detail.

Table 5. Restocking fish species of some reservoirs in Anatolia

Fish species	Reservoirs	Literature
Mosquito fish, *Gambusia affinis*	Amik Lake,	Geldiay and Balık, 1996,
	Many Freshwater Resources	Balık and Ustaoglu, 2006
Grass Carp, *Ctenopharyngodon idella*	Sakaryabası Fish Culture and Research Station	Erk'akan and Yerli, 1988
Common whitefish, *Coregonus laveratus*	Iznik Lake	Geldiay and Balık, 1996;
Coregon, *Coregonus macrophthalmus*	Sapanca Lake	Ozulug et al., 2005
Rainbow trout, *Oncorhynchus mykiss*	Many Freshwater Resources	Geldiay and Balık, 1996, Cetinkaya, 2006
Charr, *Salvelinus alpinus*	Erzurum,	Yanık et al., 2002
Brook trout, *Salvelinus fontinalis*	Dogu Karadeniz	Balık and Ustaoglu, 2006
White bass, *Morone chrysops*	Kemer Dam Lake	Welcomme, 1988,
Striped bass, *Morone saxatilis*		Balık and Ustaoglu, 2006
Common carp, *Cyprinus carpio*	Many Freshwater Resources	Balık and Ustaoglu, 2006,
		Berber et al., 2008
Pike-perch, *Sander lucioperca*	Egirdir Lake, Marmara Lake	Balık and Ustaoğlu, 2006
European perch, *Perca fluviatilis*	Tahtalı Dam Lake,	Geldiay and Balık, 1996

Wels catfish, *Silurus glanis*	Golcuk Lake, Odemis Lake	Geldiay and Tareen, 1972; Balık and Ustaoglu, 1996
Tarek, *Alburnus tarichi*	Burdur Lake,	Balık and Ustaoglu, 2006
Tench, *Tinca tinca*	Beysehir Lake, Egirdir Lake, Isıklı Lake, İznik Lake, Yenice Irrigation Pond	Balık et al., 2004; Berber, 2005
Redbelly tilapia, *Tilapia zillii*	Afrin Canal, Köycegiz Lake, Seyhan Dam Lake,	Balma et al., 1995; Yalcın, 1997; Barlas et al., 2000; Tekelioglu et al., 1999;
Nile tilapia, *Oreochromis niloticus*	Yuvarlak Brook,	
Redbreast tilapia, *Tilapia rendalli*	Hırla Lake, Burdur Lake	Başusta et al., 1996; Celik and Gökce, 2003
Silver carp, *Hypophthalmichthys molitrix*	Many Freshwater Resources	Welcomme, 1988
Northern pike, *Esox lucius*	Karakaya Dam Lake, Kesikköprü Dam Lake	Welcomme, 1988
Siberian sturgeon, *Acipencer boeri*	Sakaryabası Fish Culture and Research Station	Koksal et al., 2000

In specific fish restocking studies, it has been seen that the introduced fish species may have irreversible negative outcomes. In Egirdir and Beysehir Lakes, introduction of pike-perch fish (*Sander lucioperca*) caused elimination of various fish species (6). Particularly in Egirdir Lake, 10 native fish species decreased in their number and merely 3 fish species could continue their existence. Therefore water resources where carnivore fish species will be introduced should be examined thoroughly. Their relation between native fish fauna and introduced species should be studied in detail.

An integrated data base should be prepared for fish restocking activities. Legally a meaningful cooperation should be established between institutions in charge of fish restocking and universities. Fish restocking based on scientific methods and monitoring activities in later phases will contribute greatly to reach the main objective.

It has been detected that negative outcomes in fish restocking are related on the whole to fish introduction activities executed by local fishermen or people who are incompetent. In that respect lack of training is striking. The objective of fish

restocking, its principles and follow up controls and negative impacts should be explained. Thus unauthorized people can be kept away from actions which can cause great disasters in the end.

In making fish restocking plans, water level changes in freshwater resources should be taken into account. Excessive drought, especially making use of dam lakes and ponds for irrigation purposes can create fluctuations in water levels. In a research conducted during the year, an average 15 m depth was found in Yenice Central Irrigation Pond. Water level fluctuations related to time prevented vegetation zone formation in pond shores. Coastal vegetation is particularly important to keep water species alive; to enable their feeding, breeding and growing activities. Besides, excessive waves in water level can cause a decrease in the number of fish eggs and devastating effects in their existence (June 1970; Walburg 1976).

To use irrigation of dam lakes and ponds rented cooperatives or private individuals for breeding purposes may cause some troubles in practice. The foremost cause of poaching of these fishermen in ponds is related to knowing the fish and fauna existent in this resource. That is because nobody would care to invest to ambiguity. Therefore ponds or similar water resources for rent should absolutely be evaluated by the authorized institutions. The vital data for investor are the fish in water resources and their approximate amounts, water level and its fluctuations over time, the age and other physical qualities of reservoir and water quality values. Water resources evaluated in these terms will help the investor to have a pre-knowledge. Therefore both illegal hunting and even more importantly circulation of fishery materials which may be the cause of diseases in different water resources will be prevented.

There are some problems caused by renting the reservoirs for aquacultural work facilities. According to no 2/1 report regulating commercial aquacultural fishing, permissions for aquacultural fishing in freshwater resources are arranged by taking into account the breeding season, sexual maturity age and estimated population stock. In the rented water resources however since the topic is handled in terms of breeding, a continuous yield and marketing can be in question. That means that the species, even though it may be in breeding season, can be marketed for commercial benefits.

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