

Aquaculture in Suşehri (Sivas-Turkey)

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Abstract: Aquaculture has been one of the fastest growing food sectors in the world for more than two decades. This study was carried out to determine the present situation of aquaculture in Suşehri province. Suşehri is situated in the east of Sivas about 140 km the city centre. Suşehri is in the inner parts of Black Sea Region on the northeastern part of Turkey. Suşehri where altitude is 950 meters has settled on an area of 985 km². In the province which has been named as Suşehri because of the bounty of water in the region. Only three aquaculture farms are present in Suşehri and their total production capacity is about 28 tons/years in project base. All of the aquaculture farms were small-scale and family-run establishments, having a capacity about 10 tons per year. Although aquaculture is very important natural sources both strategic and vital for all world it was determined currently very low in Suşehri. The goal of aquaculture is grow in a manner that does not harm to aquatic ecosystems. Therefore, monitoring of environmental impacts of aquaculture is very important for aquatic ecosystems conservation in Suşehri.

Key Words: Aquaculture, Environment, Suşehri, Sivas, Turkey.

Su ehri'nde (Sivas-T rkiye) Akuak lt r

 zet: D nya'da akuak lt r, yirmi yıldıan fazla en hızlı b y yen gıda sekt rlerinden biridir. Bu alıřma, Su ehri ilesindeki akuak lt r n mevcut durumunun saptanması amacıyla yapılmıřtır. Su ehri, Sivas'ın yaklaşık 140 km doęusunda yer almaktadır. Su ehri, T rkiye'nin kuzeydoęusunda Karadeniz B lgesi'nin i kesimlerindedir. Y ksekliti 950 metre olan Su ehri'nin y z l m  985 km²'dir. İle, su kaynaklarının bolluęundan dolayı Su ehri adını almıřtır. Su ehri'nde, toplam 3 adet akuak lt r iřletmesi mevcuttur ve bunların toplam  retim kapasitesi yaklaşık 28 ton/yıl'dır. Akuak lt r iřletmelerinin hepsi yıllık yaklaşık 10 ton kapasiteye sahip olan k  k aplı ve aile tipi iřletme  zellięine sahiptir. Akuak lt r, b t n d nya iin hem stratejik hem de hayati olan ok  nemli bir doęal kaynak olmasına raęmen Su ehri'nde, akuak lt r n olduka d ř k olduęu saptanmıřtır. Akuak lt r n amacı, sucul ekosistemlere zarar vermeyen bir řekilde b y mektir. Bu nedenle, Su ehri'nde tatlısu ekosistemlerinin korunması iin akuak lt r n evresel etkilerinin izlenmesi olduka  nem tařımaktadır.

Anahtar Kelimeler: Akuak lt r, evre, Su ehri, Sivas, T rkiye.

1. Introduction

The aquaculture is defined as “the farming of aquatic organisms including fish, bivalve mollusks, crustaceans, algae and others with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc” [1, 2]. The farming of aquatic plants and animals is known as aquaculture and has been practised for around 4000 years in some regions of the world [3]. The most important factor differentiating farming from fishing or fisheries is that farming includes private or cooperative ownership. When aquaculture is compared to the conventional agricultural and animal husbandry, it could be noticed that aquaculture manifests important differences in terms of zootechnique and health management. The main reasons are that fishery products are aquatic and contain many species including different taxonomic groups, which have different needs necessitating different rearing systems or techniques. Aquaculture has been one of the fastest growing food sectors in the world for more than two decades. Globally, aquaculture is currently the fastest growing food production sector and will certainly continue to grow in the new millennium [2, 4–7].

Nearly 71% of the Earth is covered by water. Much of this region is convenient for numerous and various aquaculture. These organisms range from single-celled to mammals. Human beings consume or make use of these aquatic organisms, especially

fish, as nutritional sources. Because of that reason, all countries are seeking better ways and methods to utilize their sources more as rational as possible and even to increase present sources as much as ever. Total aquaculture production of the world was nearly 146 million tones in 2003. Nearly 62% of this production was from catching, whereas 38% was from farming. China is the leader country in aquaculture [8].

Turkey is a passage-land between the Balkans and the Middle East with three percent of its landmass (Thrace) lying in Europe and 97 percent (Anatolia) in Asia. Turkey is a large peninsula surrounded by three major water-bodies, the Mediterranean Sea, the Aegean Sea and the Black Sea and the smaller sea of Marmara. Turkey has very rich water resource potential in both marine and inland waters with 8333 km of coastline, 175 thousand km of rivers, 1 million hectare of natural lakes, 170 thousand hectares of dams, and 7 hundred small dams used for local needs such as irrigation and the contribution to drinking water. Turkey is also endowed with rich inland waters (200 lakes, 159 dams lakes, 750 small dam lakes) and river systems (33 rivers) with significant capture fishery and aquaculture potential. The climate, water resources and topography along the coasts create many favorable aquaculture sites. The Aegean Sea, more than others, has many sheltered bays that are very suitable for marine cage culture. The inland water resources in Turkey are suitable for culturing different freshwater fishes [9–11].

Aquaculture in Turkey started with carp and rainbow trout culturing in 1970s. Gained momentum with commencement of seabream and seabass culturing in the Aegean Sea and Mediterranean Sea beginning from the midst of 1980s; cage culture of trout in the Black Sea during 1990s; and bluefin tuna rearing in the Aegean Sea and the Mediterranean Sea in early 2000s. In 1990s, the attempts for salmon culture in the Black Sea and shrimp culture in the Mediterranean Sea (Manavgat) have been made but have not been succeeded. Inland culture of trout and carp; and off-shore culture of seabream, seabass and bluefin tuna are still being made [2, 12].

Aquaculture is a relatively recently established sector in Turkey, starting from 1980's and showing a rapid growth in 1990's. Both freshwater and marine aquaculture are practised, with number of licensed farms increasing from 70 in 1985 to 895 in 1997 [13]. According to data in the year 2003, Turkey has 1659 farms at total, which are

composed of 1215 trout, 86 carp, 358 sea bream, sea bass, and has 21 hatcheries producing 200 million larvae a year [8].

One of the typical characteristics of aquaculture in Turkey is that aquaculture is costly based on the intensive production of carnivorous fish species. 98.5% of the production is from the carnivorous species (rainbow trout, seabass, gilthead seabream and tuna). According to data in the year 2002, trout ranks the first (56.4%) amongst the species cultured, followed by seabass (23.4%), gilthead seabream (19.1%), mussel and carp (1.1%). Bluefin tuna fish captured in the fishing season in last three years have been reared in the cages in the Aegean Sea and the Mediterranean Sea. The total amount of production is approximately 1600 tons/year gained from 7 tuna rearing farms in 2002. Inland fisheries and marine fish culture have almost the same share in the production, but the farming of aquatic organisms varies in terms of species [2].

Freshwater fish culture is a rapidly improving sector in Turkey [14]. Thirty seven aquaculture farms are present in the Sivas and their total production capacity is about 770 tons/years in project base. About 50 % of this production occurs in the farms in the Gürün province [15].

In recent years, aquaculture production has been rapidly developing in all over the world. The recent worldwide expansion of intensive aquaculture has caused severe environmental damage to aquatic ecosystems [16, 17]. Aquaculture is an activity that has many interactions with the surrounding environment using resources and producing changes in the ecological system. Development of aquaculture industry generates profit and income, but it also bears risks of negative environmental impacts which are discharge of untreated wastes into coastal waters, landscape modification, harmful genetic interactions with wild fish, transfer of parasites and diseases, displacement of wild fish populations, use of chemical and antibiotics or biodiversity change [18, 19].

This study was carried out to determine the present situation of aquaculture in the Suşehri province.

2. Materials and Methods

Suşehri which is located at 40°08' N – 38°04' E in northeastern part of Turkey. Suşehri is situated in the east of Sivas about 140 km the city centre. It is in the inner

parts of Black Sea Region on the northeastern part of Turkey. Suşehri where altitude is 950 meters has settled on an area of 985 km². In the province which has been named as Suşehri because of the bounty of water in the region. Kılıçkaya Dam Lake and Çamlığöze Dam Lake have been constructed in Suşehri. The location of Suşehri and Sivas are shown in Figure 1.



Figure 1. The location of Suşehri and Sivas.

This study was performed by using the information about aquaculture in Suşehri from Sivas Provincial Directorate of Agriculture in January 2009.

3. Results

Aquaculture in Suşehri is mainly related to freshwater aquaculture, which shows the best expansion prospects. Ecological and natural conditions of Suşehri are very convenient for aquaculture of rainbow trout. The rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792) culture is done in Suşehri. Rainbow trout is economically and most important cultivated fish. Only three aquaculture farms are present in the Suşehri and their total production capacity is about 28 tons/years in project base. According to data in the year 2009, location and production capacity of the aquaculture farms in Suşehri are given in Table 1. These aquaculture farms are produced on land. One of them are located in Çamlığöze, two in Çataloluk. One of aquaculture farms in Suşehri, belongs to the Cumhuriyet University Suşehri Vocational High School. This aquaculture farm, fish

production and aquaculture facilities program students are given practical training and also contribute towards development in the region are provided aquaculture. Today, all of the aquaculture farms were small-scale and family-run establishments, having a capacity about 10 tons per year in Suşehri.

Table 1. Distribution of Aquaculture Farms in Suşehri.

N	Aquaculture Farm Name	Location	Capacity
1	Çataloluk Trout Training Facility	Çataloluk	9 ton/year
2	Kösedağ Trout Production and Training Facility	Çataloluk	9 ton/year
3	Cumhuriyet University Suşehri Vocational High School Çamlıgöze Fish Production Facility	Çamlıgöze	10 ton/year
Total	-	-	28 ton/year

According to data in the year 2009, preliminary permit and project in stages of aquaculture farms in Suşehri are given in Table 2. There are fifteen aquaculture farms in preliminary permit and project in stages of aquaculture farms in Suşehri and their total production capacity will be about 17400 tons/years in project base. These aquaculture farms will make the production in the Kılıçkaya Dam Lake and Çamlıgöze Dam Lake.

Table 2. Preliminary Permit and Project in Stages of Aquaculture Farms in Suşehri.

N	Production Type	Location	Capacity
1	Trout Production Project in Cage	Çalıgöze Dam Lake	950 ton/year
2	Trout Production Project in Cage	Çalıgöze Dam Lake	950 ton/year
3	Trout Production Project in Cage	Çalıgöze Dam Lake	800 ton/year
4	Trout Production Project in Cage	Çalıgöze Dam Lake	800 ton/year
5	Trout Production Project in Cage	Çalıgöze Dam Lake	800 ton/year
6	Trout Production Project in Cage	Çalıgöze Dam Lake	800 ton/year
7	Trout Production Project in Cage	Çalıgöze Dam Lake	800 ton/year
8	Trout Production Project in Cage	Kılıçkaya Dam Lake	5000 ton/year
9	Trout Production Project in Cage	Kılıçkaya Dam Lake	950 ton/year
10	Trout Production Project in Cage	Kılıçkaya Dam Lake	950 ton/year
11	Trout Production Project in Cage	Kılıçkaya Dam Lake	950 ton/year
12	Trout Production Project in Cage	Kılıçkaya Dam Lake	950 ton/year
13	Trout Production Project in Cage	Kılıçkaya Dam Lake	950 ton/year
14	Trout Production Project in Cage	Kılıçkaya Dam Lake	950 ton/year
15	Trout Production Project in Cage	Kılıçkaya Dam Lake	800 ton/year
Total	-	-	17400 ton/year

The province of Suşehri is located at the eastern part of the Central Anatolian region of Turkey. Kılıçkaya Dam Lake is situated 25 km north-east of Suşehri province centre. The Kılıçkaya Dam was constructed in 1989 on the Kelkit Stream by the State Hydraulic Works. The surface area and maximum depth of the Kılıçkaya Dam Lake are 64.4 km² and 100 m respectively. Average capacity of Kılıçkaya Dam Hydroelectric Station is about 300 GWh/year. Çamlığöze Dam Lake, is located in just below of the Kılıçkaya Dam Lake. Çamlığöze Dam Lake is situated 10 km north-east of Suşehri province centre. The Çamlığöze Dam was constructed in 1998 on the Kelkit stream by the State Hydraulic Works. The surface area and maximum depth of the Çamlığöze Dam Lake are 5 km² and 30 m respectively. Average capacity of Çamlığöze Dam Hydroelectric Station is 102 GWh/year. Kılıçkaya Dam Lake and Çamlığöze Dam Lake are used for irrigation and produce electrical energy [20].

4. Discussion and Conclusion

Aquaculture in Suşehri is mainly related to freshwater aquaculture, which shows the best expansion prospects. The main species of freshwater fish cultured on a commercial basis are the rainbow trout in Suşehri. In conclusion, the above is taken into consideration results, aquaculture will assume significant improvements in the future in Suşehri. In particularly, intensive aquaculture will be in Kılıçkaya Dam Lake and Çamlığöze Dam Lake.

Masser [21], reported that fish can be cultured in one of four culture systems; ponds, raceways, recirculating systems and cages. Cage culture can be established in any suitable body of water, including lakes, ponds, mining pits, streams or rivers with proper water quality, access and legal authority. Cage culture of salmonids in freshwater (principally lakes) commenced around the same time and also experienced rapid expansion during the 70's and 80's [22]. Aquaculture in freshwater and marine environments is a rapidly developing sector in Turkey, and trout is the major fish species used for cage culture in freshwater systems [23]. Cage culture of farmed rainbow trout is widespread in lakes, dams and reservoirs. However, rainbow trout in cage culture is done in Suşehri yet. Within this year in Suşehri, rainbow trout culture will begin raising in cages.

Most food production systems have a negative impact on the environment. Cage culture production of salmonids is increasingly becoming an environmentally sustainable way of producing high quality food. Aquaculture can influence the physical or chemical environment in its vicinity, and this may affect fish populations directly or indirectly as well as positively or negatively [24, 25]. Pearson and Black [26], give an overview of major environmental impacts of fish cage culture. They include impacts due to enrichment of the environment, transference of pests and diseases, and ecological impacts of escaped fish that are exotic to a region, but still manage to reproduce. More subtle effects are also possible [24]. In the end, aquaculture's contribution to the global food supply will likely turn on how well these and other innovations can help fish farms more closely mimic natural ecosystems, with better recycling of nutrients and less waste generation [15]. Turkey has various problems in aqua-production such as catching, stock protecting, environment and pollution, input and support, industry and commerce, societal education and organisation, and adaptation and adjustments according to European Union [8].

Aquaculture is very important natural sources both strategic and vital for all in the world. Aquaculture in Suşehri will continue to play an important role in the global supply of fish in the future. Negative effects of waste from aquaculture to aquatic environment are increasingly recognized, though they were just a small proportion to land-based pollutants. Properly planned use of aquaculture waste alleviates water pollution problems and not only conserves valuable water resources but also takes advantage of the nutrients contained in effluent. It is highly demanding to develop sustainable aquaculture which keeps stocking density and pollution loadings under environmental capacity. The goal of aquaculture is grow in a manner that does not harm to aquatic ecosystems. Therefore, monitoring of environmental impacts of aquaculture is very important for aquatic ecosystems conservation in Suşehri.

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