

AQUACULTURE IN TURKEY

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AKVAKULTURA U TURSKOJ

Abstrakt

Turska je zemlja sa velikim potencijalom za dalji razvoj sektora akvakulture sa preko 8,300 km obale i 25 miliona ha upotrebljive površine mora. Akvakultura u Turskoj započinje sa gajenjem kalifornijske pastrmke (*Onchorhynchus mykiss*) i šarana (*Cyprinus carpio*) kasnih šezdesetih, dalje se razvija gajenjem orade (komarče, *Sparus aurata*) i brancina (lubina, *Dicentrarchus labrax*) sredinom osamdesetih. Proizvodnja tri najznačajnije vrste: pastrmke, orade i brancina je brzo rasla tokom devedesetih i sada dostiže 158 000 tona godišnje u 2009: pastrmka, orada, brancin, dagnje, šaran i ostale vrste na 1 855 farmi.

Trenutno, oko 25 procenata po zapremini (158 729 tona od 623 191 tona ukupne proizvodnje) dolazi iz akvakulture. Oko 98 % proizvodnje je iz intenzivnog uzgoja; pastrmka se uglavnom konzumira lokalno, dok se oko 75% orade i brancina izvozi u zemlje EU. Gotovo sva riba se prodaje u svežem stanju.

U ovom radu se daje pregled sadašnjeg stanja i ograničenja, zakonodavstva i administrativnih prepreka vezanih za akvakulturu u Turskoj.

Ključne reči: *akvakultura, Turska, proizvodnja riba, sistemi uzgoja*

INTRODUCTION

Turkey has rich and diverse aquatic resources ranging from fresh to brackish and marine that is 8.333 km of coastline, 151.080 square kilometres of economic coastal zone, 177.714 km total river length, around 900.000 ha natural lakes and 500.000 ha of dam reservoirs (Çelikkale et al., 1999). Despite of these large resources, Turkish fisheries has stagnated at an annual production of around 600.000 tons and depends mainly on small-scale and largely small pelagic species. Therefore, aquaculture has been seen more important than capture fisheries in Turkey.

Current per capita fish consumption in Turkey is very low (around 8 kg) comparing to many European countries but it is expected that the recent developments will lead to increases in domestic fish consumption. On the other hand, wild fish stocks are under pressure from over-fishing, environmental degradation and pollution. Therefore, the country needs aquaculture development for a number of reasons that are: Supporting increased per capita fish consumption and service export demand, rational natural resource utilization and to develop recreational and ornamental fisheries, restocking and ranching, stabilize the domestic market (Okumuş ve Deniz, 2007).

In Turkey, modern aquaculture began in the late 1960s; initially, the first species cultured was the rainbow trout (*Oncorhynchus mykiss*) from eyed eggs imported from Italy. Common carp (*Cyprinus carpio*) farming followed during the 1970s, but little development happened until 1985 which marked the beginning of gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*) farming (FAO, 2010).

The next major developments were commercial mariculture trials with rainbow trout and Atlantic salmon (*Salmo salar*) in the Black Sea during the early 1990s; only one experiment failed with kuruma prawn (*Penaeus japonicus*) on the Mediterranean coast and later mussels in the northern Aegean and the Sea of Marmara during the 1990s were introduced into the aquaculture activities. The Atlantic salmon farming initiative in the Black Sea failed, but rainbow trout mariculture is still practiced (FAO, 2010).

Production of the three major species, namely rainbow trout, seabass and seabream increased rapidly during the 1990s, with efforts having been given to the development of new species, such as the Black Sea turbot (*Scophthalmus maeoticus*) and some Mediterranean species such as sharpsnout seabream (*Diplodus puntazzo*), common seabream (*Pagrus pagrus*), common dentex (*Dentex dentex*) and groupers (*Epinephelus* spp.). Atlantic bluefin tuna (*Thunnus thynnus*) fattening, which started at the turn of the millennium has been the latest development in terms of species diversity. In this paper, the present status and constraints have been discussed.

PRESENT STATUS OF AQUACULTURE

Marine Aquaculture

Turkey has three distinct seas and coastal areas for marine fish production: The Black Sea, characterised by lower salinity levels, the Aegean Sea with warmer waters and sheltered sites and the Mediterranean with warm waters but exposed sites. Most farming is on the Southern Aegean coast.

A wide diversity of aquatic species can be farmed in brackish or salt water using a variety of production systems. Today marine aquaculture plays an increasingly important role in the production of fishery products. The sector can be characterized by limited species and system diversity, small farms, a production oriented approach and export dependent (EU) markets (Okumuş ve Deniz, 2007).

Marine aquaculture on the Mediterranean and Aegean Sea coasts consists mostly of the cage culture of sea bream (*Sparus aurata*) and sea bass (*Dicentrarchus labrax*). The first cage farm was established on the Aegean Sea coast for the production of sea bream and sea bass in 1985 and was stocked with fry collected from natural stocks.

Marine culture of trout and salmon began in the late 1980s. The salmonid species, rainbow trout (*Oncorhynchus mykiss*) and Atlantic salmon (*Salmo salar*), were originally produced in the brackish waters of the northern coast of the Black Sea but because of the intolerance of salmon to the high water temperature, trout eventually replaced

them. These conditions provide better growth conditions for rainbow trout, which are transferred directly from inland fresh water to the brackish waters of the Black Sea without any adverse effect.

In this environment, trout require 60-90 days to grow from 20-30 g to the market size of 200-300 g or 300-360 days to the market size of at least 1,500 g (Çelikkale et al., 1999, Şahin et al., 1999). Fish are harvested during the summer when temperatures are relatively high. With the surprising appropriate ecological supply for trout culture in the marine environment thanks to low salinity the Black Sea has an enormous potential. Shrimp farms in the Mediterranean Sea, established in the mid 1990s, encountered many critical problems that still need to be solved.

In addition, major new or alternative Mediterranean species cultured in experimental or pilot scales are common dentex (*Dentex dentex*), common sea bream (*Pagrus pagrus*), common pandora (*Pagellus erythrinus*), sharpnose sea bream (*Puntazzo puntazzo*), white grouper (*Epinephelus aeneus*), shi drum (*Umbrina cirrosa*), striped sea bream (*Lithognathus mormyrus*), meagre (*Argyrosomus regius*), greater amberjack (*Seriola dumerili*), brown meagre (*Sciaenops ocellatus*), white sea-bream (*Diplodus sargus*), two-banded sea-bream (*Diplodus vulgaris*) (Okumuş ve Deniz, 2007).

Among these species only the common dentex and sharpnose sea bream have been cultured and marketed; other species are still at the experimental stage. Considerable efforts have been made to farm common sea bream but abnormal pigmentation is the major limitation and production has ceased. Currently there several hatcheries trying to develop larvae and fry production, and four farms are registered to culture these new species in addition to sea bass and sea bream.

Efforts are also being made to develop the commercial production of species new to the Black Sea as well. The target species are turbot (*Psetta maxima*), sturgeons (*Acipenser* spp) and native sea going trout (*Salmo trutta*). Considerable progress has been achieved in the hatchery phase for turbot, but there is a need for considerable investment for on-growing (Okumuş ve Deniz, 2007).

Inland Aquaculture

The rainbow trout (*Onchorhynchus mykiss*) has been cultured since the early 1970s and Turkey has become one of the top trout producing countries in Europe with an annual production of 75 567 tonnes, or 47 percent of the country's total aquaculture production (FAO, 2010).

Today there are more than 1 000 freshwater and 20 sea-based farms which are situated in the Black Sea. Approximately, half of the farms have an annual capacity of less than 10 tonnes with the rest producing usually less than 50 tonnes. The great majority of the farms (approx. 80 percent) are family-owned with almost two thirds of the production coming from the Black Sea, Aegean and Marmara regions; one third of the country's trout farms are located in the Central Anatolian region.

Apart from marine and some freshwater cage farms, the majority of the trout farms employ small concrete raceways mainly using stream waters. In the past ten years, trout cage culture in dams has reached a very important level of production. Today, 26 000 tonnes of trout production comes from cage culture at dam lakes (FAO, 2010).

Over 50 percent of the farms have their own hatcheries with eggs being produced during the natural breeding season, i.e. between December and February. On-growing in raceways lasts between 12 and 24 months. The majority of fish are sold locally as portion size white trout. In the Black Sea fish are reared in cages up to 0.5–1.5 kg and sold

as "salmon". Common carp (*Cyprinus carpio*) is recorded as being cultured in 86 farms, however production has hardly exceeded 1 000 tonnes in recent years (FAO, 2010).

On the other hand, possibilities of culturing fish species such as tilapia (*Oreochromis* spp.), pike (*Esox lucius*), European catfish (*Siluris glanis*), eel (*Anguilla anguilla*), etc., must be made to develop inland aquaculture.

CULTURE SYSTEMS AND PRACTICES

Turkey's aquaculture is mainly based on intensive finfish culture; extensive and semi-intensive aquaculture is limited to mussel and common carp production, totalling less than 1 500 tonnes/year. Different rearing systems are employed for intensive finfish production, the most common rearing system used in freshwater trout production is concrete raceways with some larger farms having modern circular concrete tanks; earthen ponds are also used for the intensive rearing of trout. Cages used in reservoirs for trout are generally simple wooden structures locally constructed. The use of semi-intensive earthen ponds is the most common practice for carps. In Table 1, number fish farms, farm capacities and production figures are shown. In addition, annual aquaculture production in Turkey by species and year are given in Table 2.

The most widely used intensive system for seabream and seabass is floating cages. These can be squares measuring from 5x5x5 m or circular, hexagonal or octagon shaped cages up to 12–50 m in diameter. More recently, marine farms have been relocating towards more exposed areas or secondary bays and thus, types and sizes of the cage systems used are changing. There are also seabass and seabream farms which utilize earthen ponds and only one high-tech (recirculation) land-based farm. Semi-intensive culture has also been practiced in some lagoons using large sized earth ponds. Large 50–75 m diameter cages are used for tuna fattening.

Table 1. Number fish farms, farm capacities and production in Turkey. (Anonymous, 2009).

Environment	No. farms	Farms capacity (tonnes/year)	Production (tonnes/year)
Inland aquaculture	1 499	104 629	76 248
Marine aquaculture	356	134 121	77 252
Total	1 855	238 750	158 749

Table 2. Annual aquaculture production in the past decade in Turkey by species and year (tonnes). (Anonymous, 2010).

Species	Trout	Seabream	Seabass	Mussel	Carp	Other	Total
2000	44 533	15 460	17 877	321	813	–	79 031
2001	38 067	12 939	15 546	5	687	-	67 244
2002	34 553	11 681	14 339	2	590	–	61 165
2003	40 868	16 735	20 982	815	543	–	79 943
2004	48 082	20 435	26 297	1 513	683	-	94 010
2005	49 282	27 634	37 290	1 500	571	2 000	118 277
2006	57 659	28 463	38 408	1 545	668	2 200	128 943
2007	61 173	33 500	41 900	1 100	600	1 600	139 873
2008	68 649	31 670	49 270	196	629	1 772	152 186
2009	75 657	28 362	46 454	89	591	2 247	158 729

MARKETS AND TRADE

The per capita consumption of fishery products in Turkey is around 8 kg, although this figure is declining steadily. Cultured fish products constitute only around 10 percent of the total domestic fish consumption, which is quite low in comparison to global and European average figures and also compared to Turkey's availability of aquatic resources. As a result, the government has shown a clear intention to increase the per capita fish consumption by increasing the production in the aquaculture sector which seems to be the only option for achieving this increase, rather than limiting options available to increase fishery production (FAO, 2010).

Appreciation and acceptance of cultured fish species is improving through a series of efforts by relevant government organizations and producers, however, there is an urgent need to improve the distribution infrastructure throughout the whole production chain. In addition, consumption of shellfish and cyprinid fish is low, due to a cultural preference, as well as, a perception of low quality affecting their appreciation among the consumers.

Rainbow trout is consumed almost entirely on the domestic market, while the Mediterranean marine species are exported across southern European countries. Fish are mainly sold as whole fresh and only negligible amounts of farmed fish products are imported into Turkey. In general, market prices, and as a result, profit margins, for all species are declining particularly at the wholesale level.

Trout depends completely on the domestic and in particular local markets. Fish produced from freshwater farms are marketed as portion-size fish, while those produced in sea cages are sold as "salmon" as a result of their larger sizes. No pigmentation has been used in Turkish trout farming; as a result, all trout produced are white fleshed. Similarly, it is rare to find value-added products such as filleted, smoked or frozen trout. Fish reared in freshwater farms are marketed during summer months, while fish grown in sea cages are either sold just before the summer or else they are transferred to freshwater farms. Fish are harvested daily and marketed as fresh product usually directly by the farmers to restaurants, hotels and factory catering services. Many farms have their own restaurants at or close to the farm.

CONTRIBUTION TO THE ECONOMY

Fisheries represent about 0.3 percent of Turkey's GDP (Gross Domestic Product) and 2.7 percent of the country's total agricultural production. Aquaculture represents 13.5 percent of the total production from the fishery sector by volume and approximately 25 percent by value. The contribution from the fisheries sector and particularly aquaculture to the national economy is not considered significant in financial terms. Fish is not an everyday food, but has great significance in coastal regions and restaurants serving local foods and fish (FAO, 2010).

Aquaculture has contributed significantly to rural development and will continue to do so in the future. Marine fish farming is mostly operated by large private enterprises with local communities rarely being involved; on the contrary, trout farming is distributed across the country and constitutes a valuable tool for the promotion of rural economic development. Although farmed fish are not a cheap food source, aquaculture can provide a supply of fresh fish in areas where normally no other fishery products would be available. Even in coastal regions and large cities farmed fish are the only seafood

products that can be found in the markets during the late spring and the summer months (FAO, 2010).

Little concern has so far been shown regarding the social aspects of aquaculture development as the contribution of aquaculture towards food security and poverty alleviation has also been rather limited. Instead aquaculture is mainly aimed at the production of luxury food fish products and source of income.

Currently, aquaculture has no involvement in recreational fishery activities or restocking/ranching operations; however, these may become major development issues in the near future. Aquaculture and related services provide considerable employment opportunities both for local young people and graduates.

CONCLUSION

The aquaculture sector is very dynamic in Turkey and will continue to use its comparative advantage in terms of biological diversity, potential domestic market, climatic conditions and geographical position. Effective promotion and advertising campaigns to increase domestic demand, improving farm management and productivity to decrease production costs, research and development of value-added products and new species, concepts of quality management and product image, environmental considerations and sustainability will be key issues for the coming years.

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