

Turkey is the second largest producer of farmed fish in the Mediterranean region. Its current annual fish production is estimated to be about 80,000 tonnes. Its marine aquaculture, primarily centered in the Aegean region and focussed on seabass and seabream species, is expected to double from its current level of about 40,000 tonnes. Its freshwater aquaculture segment, focussed on trout production, is also expected to receive a boost from an on-going project in Southeast Anatolia. The Turkish aqua feed industry, which is currently producing about 65,000 tonnes of feeds, will benefit from these expansions in the next five years.

# Turkey's Aqua Feeds Segment Set to Grow

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**Aquaculture in Turkey**

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 (Fig 1). 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. In the southeastern part of Turkey, the huge Southeast Anatolian Project with its 22 dams, 19



Fig. 1: Regional Map of Turkey

Table 1: The number of fish farms licensed by MARA, production units and production capacities (MARA 2004)

Species	Production Unit	Number of Farms	Total Production (mt/year)
<b>Marine</b>			
Gilthead Sea bream & Sea bass	Floating Cage	136	17,219
Gilthead Sea bream & Sea bass	Off-Shore	10	9,481
Gilthead Sea bream & Sea bass	Earthen Pond	21	542
Gilthead Sea bream, Sea bass & Turbot	Floating Cage	1	600
Gilthead Sea bream, Sea bass & Bluefin tuna	Off-Shore	1	4,000
Sea bass	Floating Cage	5	340
Sea bass	Off-Shore	1	1,000
Bluefin tuna	Off-Shore	8	1,100
Trout & Sea bass	Earthen Pond	2	55
Trout (in Black Sea)	Floating Cage	24	1,194
Dentex, Brown Meagre & Sharpnose sea bream	Floating Cage	1	6,300
Mussel	Long-Line	4	815
<b>Freshwater</b>			
Trout	Pond	1 215	33,707
Common carp	Pond	86	590
Wells	Pond	1	10
Eel	Pond	1	25021

power plants and total water capacity of approximately 43 billion m<sup>3</sup> on 1,7 million ha of land will be used to produce hydroelectric energy and for agriculture, irrigation and aquaculture (Memis et al. 2002).

There has been noticeable development in Turkey's aquaculture from 1980s. Marine aquaculture production has grown from 1,524 tonnes in 1989 to about 40,000 tonnes in 2003. Similarly, fish production in freshwater environment has grown from 4,237 tonnes in 1989 to about 40,000 tonnes in 2003 (Anonymous 2004).

The regulation of all fish and shellfish farms in Turkey is administered by the Ministry of Agriculture and Rural Affairs (MARA). According to current farm records there are 214 marine farms and 1303 freshwater farms. The number of fish farms licensed by MARA, production units and total production by 2003 are presented in Table 1.

Turkey is the second largest in the Mediterranean in terms of its aquaculture production. The main marine fish species grown are sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*). Floating cages are fast becoming a more popular farming practice for sea bass and sea bream as the Aegean and Mediterranean coasts are very suitable for floating cages. Over the last few years there has been a clearly visible development towards the development of hatcheries and the availability of fry. Turkey has 19 private and 2 governmental marine hatcheries that provide the needs of local farmers for 1-5 g fry with a total capacity of approximately 154 million/year sea bass and sea bream fry (Aydin et al. 2005). Growth to commercial size of 300-600 g takes 12-18 months, depending upon the temperature, management, culture systems and feed quality (Memis et al. 2002). Although sea bass and sea bream are by far the dominating fish species produced in the Aegean Sea, trout production (Rainbow trout, *Onchorynchus mykiss* adapted to Black Sea conditions) in the Black Sea has considerably increased. Rainbow trout are transferred directly from inland freshwater to the brackish waters of the Black Sea without any adverse effects. In this environment, trout require 5-6 months to grow from 20-30 grams to the size of at least 500-600 gram (Çelikkale et al. 1999). Turkey has been towards the sustainable fry production of Black Sea turbot (*Psetta maxima*) within the frame of a collaborative project between Japan International Cooperation Agency (JICA) and MARA. In 2001 14,000 turbot juveniles were produced through this project and the target production is at least 10,000 juveniles of 100 mm total length (Hara 2002). Grey-mullet including the different species of Mugilidae family are produced by valliculture (Fish culture in brackish water bodies (valli) based on seasonal migrations).

Turkey has the potential to increase its marine fish production as there are many potential areas for aquaculture in the seas around Turkey. A total of 122 additional areas (29 in Black Sea, 67 in Aegean Sea, 3 in Marmara and 23 in Mediterranean Sea) for mariculture has been recently determined by MARA. It is expected that marine production would reach about 85,000 tonnes/year when these potential areas are utilized (Aydin et al. 2005). Currently, there is noticeable shift towards the cultivation of additional marine species which command a high market price and may help in increasing the market penetration of all farmed fish products. Turbot (*Scophthalmus maximus*), red porgy (*Pagrus pagrus*), grouper (*Epinephelus guaza* and *E. aeneus*), yellow tail (*Seriola dumerilii*), bluefish (*Pomatomus saltator*) are



Floating cages for sea bream and sea bass in the Aegean Sea coast of Turkey

considered as potential species and being cultured although their contribution to the overall farmed output is still marginal.

The trout is the principal cultured freshwater species in Turkey. Cage production of farmed rainbow trout is widespread in lakes and reservoirs. Cage farming of trout only in dam lakes was 4777 tonnes in 2003 (Anonymous 2004). The older trout farms continue production in concrete raceways and ponds. In Turkey, it takes about 10-14 months to grow rainbow trout from egg to marketable size of 250-300 g. There are many inland hatcheries for freshwater fish, but information on the total capacity of these hatcheries is not available. Carp production in Turkey is stable at a low level. Carps are mainly used stock enhancement of lakes and reservoirs and there is limited market demand for the fish. When Southeast Anatolian Project is completed, a total of 220,000 ha will be added to the inland freshwater capacity of Turkey (Çelikkale et al. 1999). The availability of this waterspread area will stimulate an increase in freshwater fish production. Different species of freshwater fish and crustacea such as crayfish, tilapia, wells, pike, perch are considered as potential candidates to be cultured in freshwater environment. Furthermore, interest in the production of sturgeon has increased in recent years. Some progress in the culture of Siberian sturgeon (*Acipenser baeri*) has been achieved and Siberian sturgeon is considered as one of the most suitable species for aquaculture (Köksal et al. 2000).

### Aquafeed industry in Turkey

There are about ten companies that are involved in the aquafeed business in Turkey. Investment in the Turkish feed industry is increasingly oriented towards integrated food production, processing and marketing systems. The feed requirements of cultured fish in Turkey are met by commercially available aquafeeds. Fish feeds are produced mainly for sea bass, gilthead sea bream and trout. Formal statistics for aquafeed production is not well-documented. Domestic aquafeed production in 2003 was approximately 65,000 tonnes (Uruk, Personal Communications). Two foreign companies (from Italy and France) have recently joined the Turkish aquafeed market with an additional amount of 15,000 tonnes/year.

Most of aquafeed production is carried out in the region of Aegea because most of the fish farms, especially sea bass and gilthead sea bream farms, are concentrated on the coasts of Aegean Sea. Six aquafeed mills are located in the region. The total estimated production capacity of these mills is nearly 70,000 tonnes/year. Two of the mills produce feeds only



Handling of sea bass and sea bream larvae



Sea bass and sea bream hatchery on the Aegean Sea coast of Turkey

for their own fish farms. Among the other four feed mills, two mills in the region of Black Sea have a total estimated capacity of 6000 tonnes/year; one in the region of East Anatolia has an estimated capacity of 1000 tonnes/year; and one in the region of Southeast Anatolia has an estimated capacity of 1000 mt/year.

The first aquafeed mill in Turkey was Çamli Feeds. It was established in 1983 to produce marine fish feed. Aquafeed technology has developed rapidly since then. Aquafeed mills in Turkey use advanced technology to produce their feeds (Gill 2003; Ziggers 2004). For example, Çamli Feeds currently uses twin-screw technology and exports the fish feeds. Extruded feed production is common in feed mills due to known advantages of extruded feed. The use pelleted feed is limited and has little scope to grow. Fish farmers prefer extruded feed than pelleted feed.

Turkish natural resources provide considerable quantities of feed ingredients. However, the requirements for ingredients are not always met through local resources. Fish meal demand cannot be totally met through domestic production and some has to be imported. Turkey produces about 10,000 tonnes/year of fish meal, and imports approximately 25,000 tonnes of fish meal from Chile and Peru every year (Anonymous 2004). Turkey is self-sufficient in fish oil with approximate production of 2000 tonnes/year. The increasing demand for fish meal for animal production had stimulated government policies that encourage private companies to establish fish meal factories. In the last 28 years, about 24 fish meal and fish oil factories have been established. Recently, many of these fish meal and fish oil factories have not been operated at full capacity due to insufficient raw material. The wild-catch industry in the seas around Turkey is largely seasonal and subject to increasing restrictions to prevent over-fishing.

Depending on seasonal shortage some plant ingredients such as soybeans, maize, and sunflower and feed additives are imported to complement locally grown ingredients. The major hurdles for feed manufacturers in the import of ingredients are difficulties in the importation procedures and the availability of foreign currency. Costs of aquafeed in Turkey are influenced by the cost of ingredient

importation (Uruk, Personal Communications). With the expansion of aquaculture in Turkey predicted to nearly double in the next five years, aqua feed industry would also expand and double from the current level of about 65,000 tonnes to about 130,000 tonnes per year. This offers immense business opportunities for aqua feed equipment manufacturers and ingredients and additives suppliers in the market.

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