



## GEOGRAPHICAL DISTRIBUTION OF TROUT FARMING IN TURKEY

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### Abstract

Turkey is a peninsula, surrounded by seas on three sides, with a total coastline of 8.333km. As a result of its heritage from ancient inland living culture, Turkey has a limited development in fishery production. However, there have been significant efforts in developing Trout Farming, compared to the other aquaculture products in Turkey. The recent developments in trout farming in Turkey have led to an increase in trout productions, providing alternatives for public nutrition. This study aims to assess the geographical distribution of trout farming and trout fish consumption in Turkey.

**Key Words:** Trout, aquaculture, geographical distribution, Turkey.

## TÜRKİYE'DE ALABALIK YETİŞTİRİCİLİĞİNİN COĞRAFI DAĞILIMI

### Özet

Türkiye üç tarafı denizlerle çevrili, toplam 8.333 km. kıyı uzunluğuna sahip bir yarımada olma özelliğindedir. Bununla birlikte asırlarca denizden uzak yaşamış olmanın verdiği alışkanlıkla Türk halkı denizcilik ve deniz kültürüne yabancı kalmıştır. Her ne kadar günümüzde Türkiye'nin hatırı sayılır bir su ürünleri kültürü olsa da bu konudaki veriler istenilen düzeyin oldukça altındadır. Bununla birlikte akuakültür içerisinde değerlendirebileceğimiz tatlı su ürünlerimizden alabalık yetiştiriciliği konusunda ülkemizde ciddi çalışmalar yapılmaktadır. Yapılan bu çalışmalarla özellikle iç bölgelerimizde de alabalık tüketiminde artışlar görülmekte, beslenme açısından halkımıza yeni bir alternatif sunulmaktadır. Bu çalışmada, Türkiye'de alabalık yetiştiriciliğinin ülke genelindeki dağılımını ve alabalık tüketiminin mekansal analizini yapmayı amaçlamaktayız.

**Anahtar Kelimeler:** Alabalık, akuakültür, coğrafi dağılım, Türkiye.

### INTRODUCTION

Turkey constitutes a peninsula with a total coastline of 8.333 km, surrounded by Black Sea, Sea of Marmara, Aegean Sea and Mediterranean Sea, with coastlines of 1.701 km, 1.441km, 3.484 km and 1.707 km respectively. Considering the variety of the characteristics of the surrounding seas, Turkish coastal ecosystems offer various types of marine products with economic value. Also, the 1.359 inland freshwater resources, which covers approximately 25,8 million hectare area, is suitable for fisheries (Table 1), (Aydın and Köksal et al., 2005).

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In 1994, through an agreement made between Ministry of Agriculture and Rural Affairs, together with Ministry of Energy and Natural Resources, fisheries production in cages has been allowed. Therefore, currently at 1% of (approx. 3.423 hectare area) of the reservoirs can be utilized for fisheries production.

Resources	Number of available resources	Area (hectare area)
Sea zone	-	24.607.200
Lakes	200	906.118
Small lakes	953	15.500
Reservoirs	206	342.377
Rivers	33	177.714 (km. long)
<b>TOTAL</b>	<b>1.359</b>	<b>25.871.195</b>

**Table 1:** Water resources potential of Turkey for fisheries production (TAGEM)

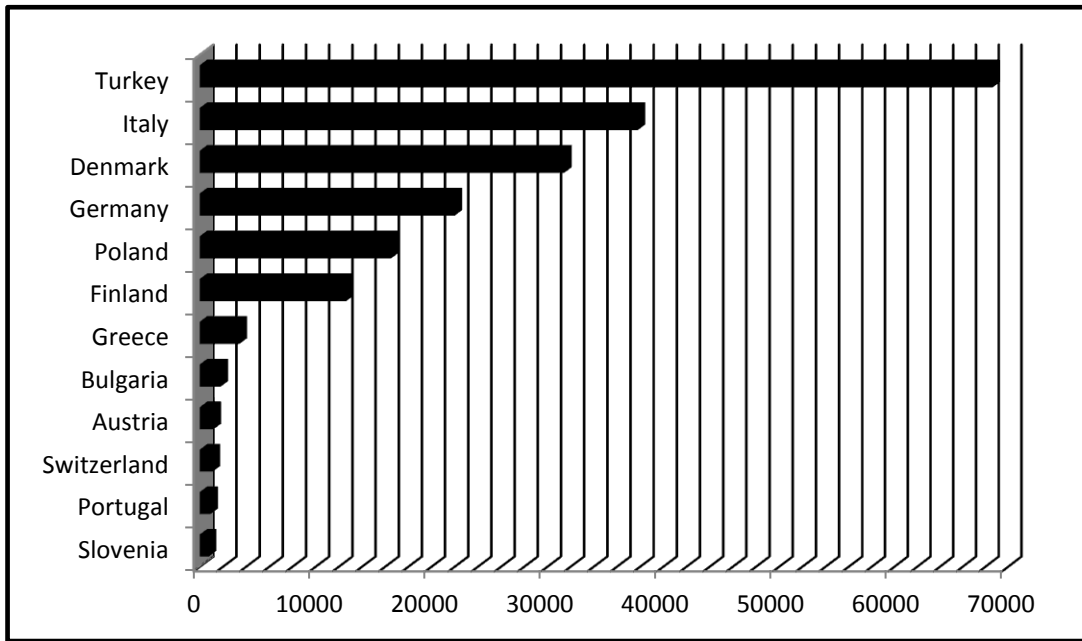
### TROUT FISH PRODUCTION IN TURKEY

According to the FAO, fishery production has the highest growth share among the other food sector products, making fisheries sector among the rapidly growing economic sectors.

The inland fisheries production has started in 1970s in Turkey; however, considering the availability of water resources for production, the actual production and consumption is still relatively low compared to several EU countries. According to FAO data, fishery product consumption in Turkey is the least in Europe. This challenge needs to be assessed economically, ecologically and socially. The biggest handicap for a developed fishery production in rivers and lakes is the environmental pollution. Especially industrial facilities near the rivers dispose their waste in the river, which leads to loss of fisheries together with the other species in the habitat.

Relatively low priority of fishery products in Turkish cuisine can be attributed to the roots of Turkish culture from Central Asia, with no connection to the sea. It is crucial to promote fisheries production and consumption in order to satisfy the increasing protein demand of the growing population, and to prevent the increasing obesity among the young generation. Also, countrywide meat shortage, the loss in quality in meadows and pastures for animal husbandry, lack of a sufficient animal husbandry sector and feed mills can be considered as reasons for fisheries production in Turkey.

Rainbow trout (*Oncorhynchus mykiss*) is the first trout fish species which has been cultivated significantly in Turkey, apart from its local wild derivatives. Rainbow trout originates from the region going up California towards Alaska, and towards west until Sea of Okhotsk in the Pacific Ocean. Trout is a fish species which can adapt to both salty and fresh waters. Also, it is widely preferred due to its short growing period, tolerance for a broad temperature range, and its compatibility for the natural habitats in Turkey. Trout fish production in Turkey has initially been made through artificial fertilization of the trout fish eggs (Korkmaz, Zencir, Coşkun, 2008). The first production started in Yedigöller Natural Park in Zonguldak, and its production at commercial scale has started in 1970 (Uysal and Alpaz, 2002). Today, trout fish production is mainly made in concrete pools. Today trout fish production has relatively low share among the other fishery products, although it had been the first cultivated fishery product in Turkey. However, production in year 2008 far exceeds many other countries, which have long shorelines (Figure 1).



Source: FAO, 2009.

**Figure 1:** Rainbow trout fish production in 2008 in different countries (tonnes)

#### TROUT FISH PRODUCTION-CONSUMPTION AND TRADE

Currently, one of the three most traded cultivated fishery products is the rainbow trout fish, beside sea bass and bream. Beside the imported cultivated species of trout fish, local wild trout fish species (*Salmo sp.*) has been hunted and consumed since earlier than 1970s.

Over the last 20 years, the scientific research on local trout fish species has accelerated, and statistical data has gathered with information on their geographical distribution, phenotype characteristics, consumption patterns etc.

In 2008, 84.129 tones of fishery products have been produces, however only 3% has been trout fish. The geographical distribution of trout fish production is available in Table 2.

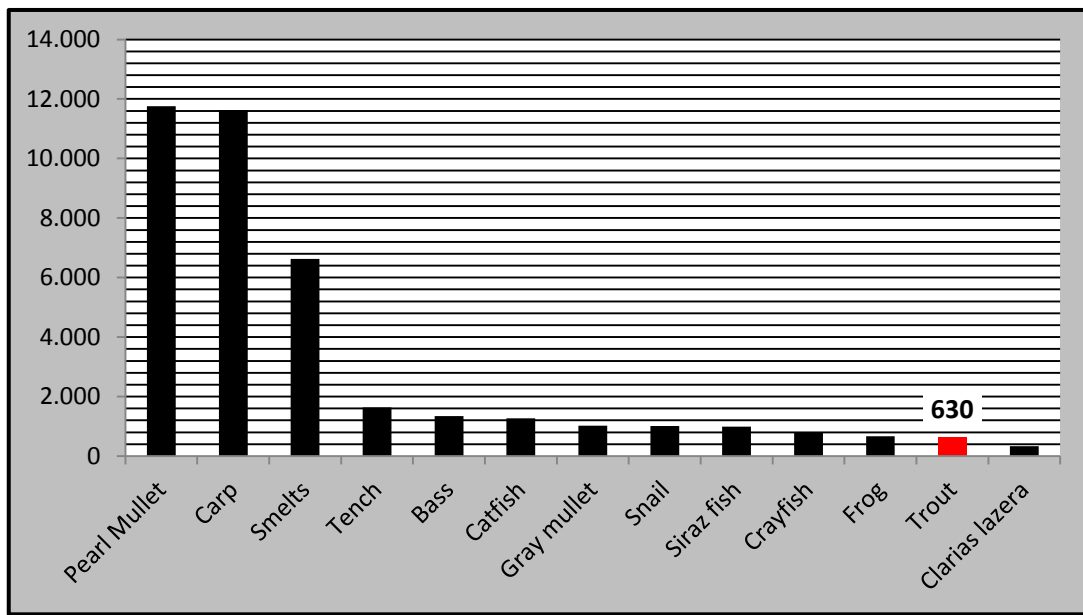
Fishery production	Amount (tonnes)
<b>Trout fish (inland)</b>	<b>65.928</b>
<b>Trout fish (sea)</b>	
Trabzon	1.500
Ordu	585
Rize	573
İstanbul	63
<b>Trout fish (sea)</b>	<b>2.721</b>
<b>TOTAL</b>	<b>68.649</b>

Source: TUIK, 2009.

**Table 2:** Rainbow trout fish production in 2008 in different locations in Turkey (tonnes)

Table 2 shows that trout fish production in sea water constitutes only 3,9 % of Turkey's total trout fish production. Turkey can not utilize the available coastal zone potential for trout fish production. The Black Sea coasts of Turkey can especially considered to be underutilized, due to lack of significant economic development in the region. The factors such as the limitations due to the local climate conditions, limited potential for agriculture in the coastal areas, lack of significant industry have so far limited the economical development in the Black Sea coastal region. Therefore, trout fish production on the rivers of the Black Sea Region should be promoted. So far there are 16 trout fish farms in the region. On top of the numbers given in Table 2, several restaurants in the touristic areas, such as the ones by the seaside and fresh waters also grow their own trout fish for their customers. Although there have been no statistical data regarding the amount of production in these sites, it is considered that such facilities may have a major contribution to the overall production.

In 2008, 630 tones of trout fish have been caught, placing it to 12<sup>th</sup> position (Figure 2) among other inland caught fishes, in terms of amount. However, trout fish takes 9th position in terms of economic value (with 3.150 Turkish Lira), having the 2,7 % share of the total caught fishery product income.

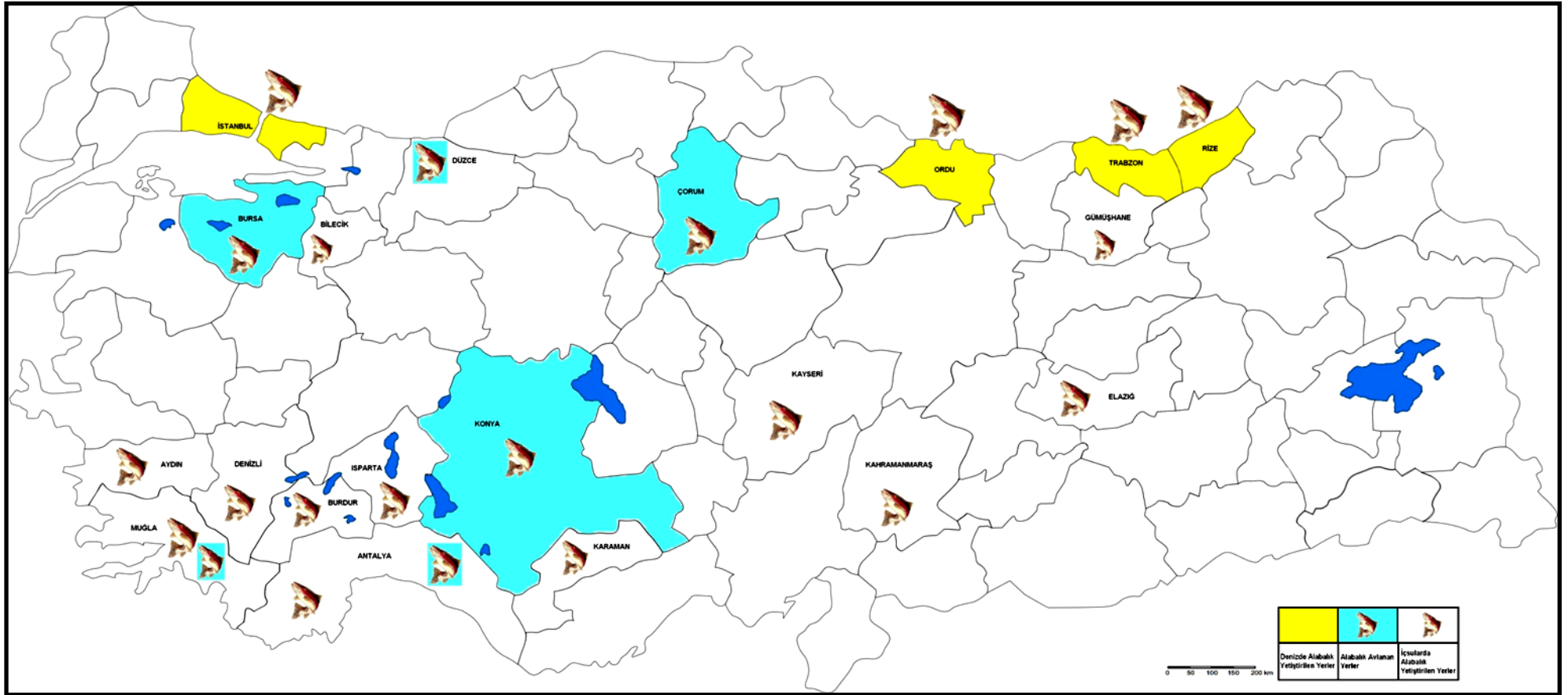


Source: TUIK, 2009.

**Figure 2:** Total amount of inland caught fishery products in year 2008, in Turkey (tones)

The main exported fishery products have been frozen offal (3.298.018 kg.), smoked trout fish (2.127.326 kg.) and frozen filets (325.703 kg.), total of which equals to 10,5 % of Turkey's fishery product exports.

The income from the trout fish exports has grown gradually, even during the recent global financial crisis. The income from trout fish production has been 56.156 TL, 68,768 TL, 149.393 TL, 247.091 TL, 277.317 TL, in years 2000, 2001, 2003, 2006 and 2008, respectively (TUIK, 2008), which is considered to be promising with increasing global fisheries market.

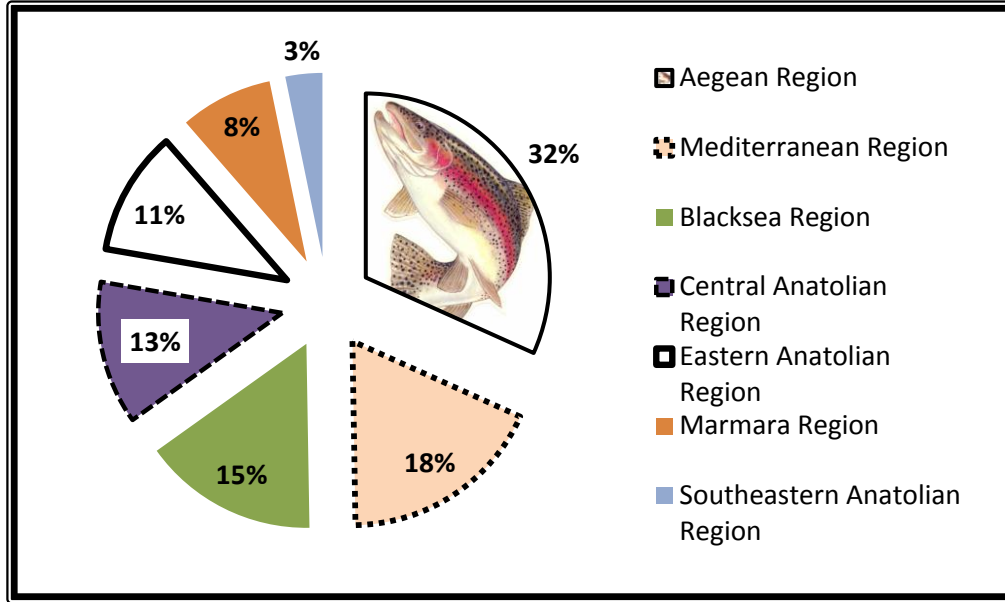


NOTE : Yellow: cities with trout fish production in sea water; Blue trout fish icon: cities where wild trout fish is caught; White trout fish icon: Cities with inland trout fish cultivation.

**Figure 3:** Geographical distribution of trout fish production from wild and cultivated species in Turkey (2008)

### GEOGRAPHICAL DISTRIBUTION OF TROUT FARMING

Trout farming, which is divided into two categories as (1) wild species and (2) cultivated species, is higher in coastal regions where the consumption is increased (Figure 3). However, it is only accumulated in specific cities i.e Trabzon, Ordu, Rize and Istanbul. Aegean region has the highest ranking (32%) on inland farming (20.786 tones). Mugla accounts for the 60% for this region. Aegean is followed by Mediterranean and Black Sea regions with 18% (11.798 tones) and 15%, respectively.



Source: TUIK, 2009.

**Figure 4:** Geographical distribution of trout fish production in Turkey, based on the regions (2008)

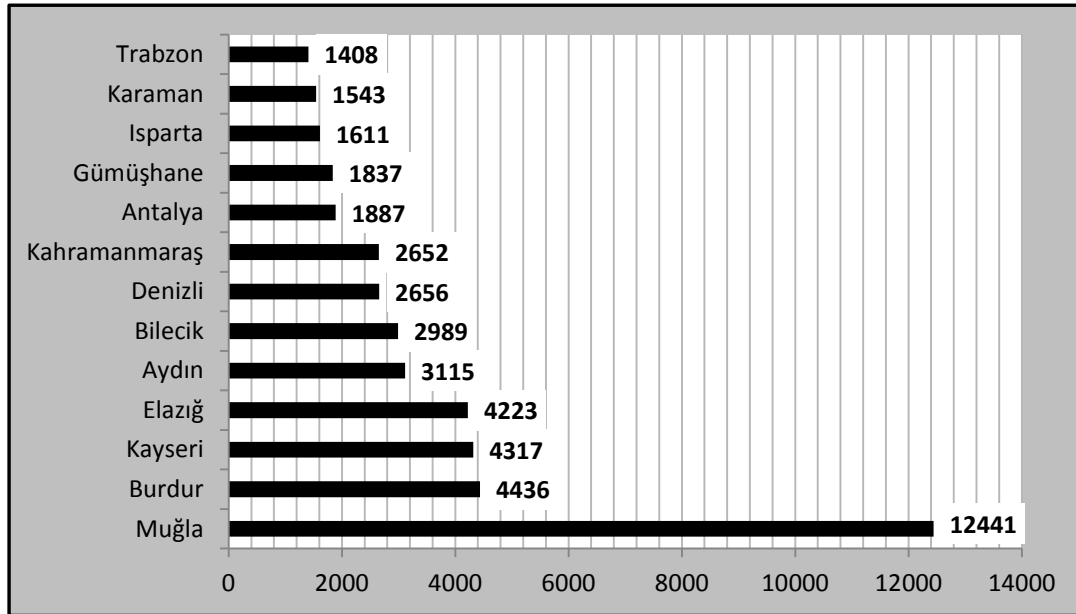
Although Black Sea region is on the third place on trout farming, the Black Sea itself provides the best conditions for this purpose. The most important features are decreased salinity (0,17 - 0,19%) and decreased evaporation compared to other the seas. On the contrary, the parallel lining of the shore to the sea that gives less protection against harsh waves limits the trout farming in the Black Sea coasts. However, more protected cities like Ordu and Sinop provide the optimum conditions in this area. Total inland farming in the central areas of the country is 17.506 tones that cover the 26% of the whole trout fish cultivation in Turkey. Central and Southeastern Anatolia have less share with 8.243 and 2.123 tones, respectively.

Besides, the Black Sea trout (*Salmo trutta labrax* Pallas 1811) has the widest geographical distribution in natural habitats among the extinct wild species (*Salmo sp*). It resides in the ascend rivers of the Black Sea. The anadromous Black Sea trout lays eggs to the upstream parts of the ascend rivers. Young trout migrates towards the sea after spending its first year in these freshwaters (Kocabas, 2009). In 1992, "The Trout Farming in Black Sea Improvement Program" provided invaluable information and in 2001, continued by the beginning of farming of Rainbow trout. This cultivation studies showed that Black Sea trout is more resistant to higher water temperatures, cage breeding and diseases than Rainbow trout (Kara, 2009).

Likewise, another wild species, Brown Trout (*Salmo trutta fario*), also exists in the streams of the Black Sea region. Unlike the Black Sea trout, Brown trout is not anadromous, therefore it is only found in the streams. They migrate in between the origin and the branches of the rivers. Abant Trout (*Salmo trutta abanticus* Tontonese 1954) has got its name from its habitat that are Abant lake, Yedigoller (Seven lakes) and their ascend rivers. In addition to these, it is also produced in the Almus Dam Lake (Tokat) (Kocabas, 2009). The Anatolian trout (*Salmo trutta macrostigma* Dumeril 1858) (aka brown trout or mountain trout) lives in the upstream of

the rivers on the Kaz Mountains in northern Aegean region, Istranca Mountains, Uludag, Ilgaz, Bolu, Kayseri, Taurus Mountains, and higher areas of Black Sea region, specifically Coruh. It can survive the harsh conditions of high attitudes, river fountains and glacial lakes. Caspian trout (*Salmo trutta caspius* Kessler 1877) is originated from Caspian (Khazar) Sea and lives around Kura and Aras rivers in Turkey. It also has a natural habitat in Cildir Lake (Kocabas, 2009).

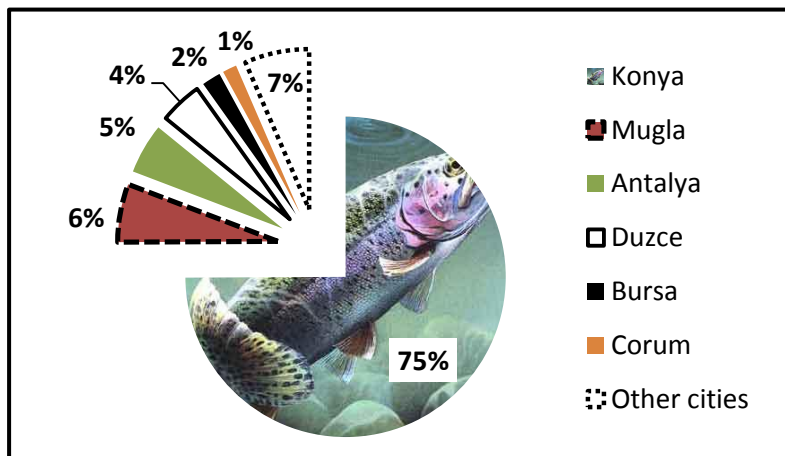
Mugla has the highest share with 12.441 tones (Figure 5) on the distribution of production on city basis and is followed by Burdur (4.436 tones), Kayseri (4.317 tones), Elazig (4.223 tones), Aydın (3.115 tones) and Bilecik (2.989 tones). These six cities provide the 47,8% of the total trout farming of Turkey.



Source: TUIK, 2009.

**Figure 5:** Trout fish production in cities with major production in year 2008 (tonnes)

In 2008, hunting was observed highest in Konya with 472 tones of trout. However, the majority in other cities is on farming where the numbers for hunting are negligible i.e. Mugla (37 tones), Antalya (32 tones), Duzce (27 tones) and Bursa (12 tones) (Figure 6).



Source: TUIK, 2009.

**Figure 6:** Geographical distribution of trout fish catching in 2008 in different cities of Turkey



## RESULTS

Given the huge area of water sources and the total farming on agriculture and animal husbandry, Turkey needs to focus more on fish farming. This effort will be invaluable especially for the protein sources of the threatening increase in population and obesity.

Based on the planning efforts of an interdisciplinary consortium, trout farming in Turkey should be evaluated in two different categories as the coastal farming and inland water farming. As being a peninsula with 8.333km of coastal line, trout farming is achieved in only 4 of the 28 cities lying across the seashore. This reveals the decreased usage of the total potential in trout farming. Therefore, as part of an interdisciplinary planning effort, our coastal regions can be categorized for tourism, industry, natural reserves, and fish farming. Based on the species of the fish that will be produced, suitable regions equipped with necessary tools like net cages and fish breeding pools can be constructed.

Another basic facility that is necessary for fish farming is the fully equipped hatcheries that will ensure the egg and infant fish production throughout the year.

Inland trout farming in Turkey is higher than the coastal line with relatively modernized conditions. However, inland farming needs more comprehensive and technical installation because the most important aspect in inland farming is the transportation to the customer in the fastest and the most economical way. Cold air storages, which are one of the leading problems in agricultural and animal husbandries, also show their negative effects in fish farming. Therefore, most of the inland farms are relatively smaller plants. This results in the decreased national consumption and international exportation and consumption of the trout directly around the fisheries.

Selection of the farming region is one of the important points that should be taken into account in trout farming. Transportation and proximity to the possible costumers are needed. There should not be any industrial or highly populated cities nearby the farming areas. Since most residents are settled around big rivers, farming over these water resources should be carefully organized. Given the fact that most of the rivers has not reached to balanced profiles yet, the flow rate of the river, the quality of the water and the capacity of the trout species around that region must be taken into account. Thus, the protection of the ecological stability and concordance with the wild life will increase the duration of the farms in that area.

Today, mostly rainbow trout is being produced in Turkey. Natural species like Black Sea trout is also protected. The conservation of the biodiversity, determination and phenotyping of the trout species in Turkey, preservation of the natural habitats and cultivation of these species are the major aspects in trout farming. Especially, the protection of the biodiversity has important effects both ecologically and economically. Determination and production of different trout genotypes and their adaptation to various conditions increase the yield not only in food and egg quality but also economically. It also shows the productivity of Turkey, which is settled geographically in the center of a tri-continental region, in trout species as well as the floral species. The study to establish the wild species in Turkey must be immediately addressed and analyzed on CBS.

Today we only have seven registered and geographically established animal species. The same must be done on trout species by researching and ecotyping the wild trout residents in Turkey. Thus, to increase the development, employment and consumption in national fish farming, European Union (EU) Rural Development Funds can be advertised to more people and used in a carefully planned way. As a country that has been on the process of joining to EU, these supports have an important effect on Turkey's



improvement to reach the fish farming criteria of the Union. In the future, these efforts will upgrade Turkish Fish Sector to the leading position among Middle East, Caucasian and Balkan region.

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