

### **Current Status, Problems, Solution Suggestions and Future Focuses of Aquaculture in Türkiye**

Türkiye is a peninsula surrounded by the Black Sea, the Sea of Marmara, the Aegean Sea, and the Mediterranean Sea. Also, it has large lakes and rivers. Therefore, its geographical advantage has enabled it to have a significant potential in the aquaculture sector. This potential has been utilized over time. Thus, Türkiye's position has risen to the top in the sector. However, in order for this potential to reach its real value, there is work to be done and subjects to be studied;

#### **Status of Aquaculture:**

In Türkiye, a significant amount of production is carried out by both fishing (sea and freshwater fisheries) and aquaculture. Aquaculture, especially in recent years, offers great potential for sustainable fish production and economic gain.

Gilthead seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*) are popular fish especially in the Mediterranean region (Llorente et al., 2020), and are extensively farmed in Türkiye. Since the 2000s, Türkiye has achieved a great increase in gilt-head sea bream and seabass farming, and has become one of the world leaders in this field. By 2020, Türkiye's total sea bream and sea bass production reached over 200,000 tonnes (FEAP, 2022)

As of 2020, a total of 422,837 tonnes of fish were produced by aquaculture in the Mediterranean. Seabass (*Dicentrarchus labrax*) accounted for 49.8%, gilt-head bream (*Sparus aurata*) 44.7%, meagre (*Argyrosomus regius*) 2.7%, turbot (*Scophthalmus maximus*) 2.6%, and Solea (*Solea senegalensis*) 0.2% of production. 49.3% of these fish were produced by Türkiye, 28.9% by Greece, 10.2% by Spain, 4% by Italy, and 3.5% by Croatia and Cyprus, France, Portugal, respectively (FEAP, 2022).

By 2020, a total of 356,318 tonnes of fish were produced by aquaculture in fresh waters in European countries. According to the species, rainbow trout (*Oncorhynchus mykiss*) was produced at the rate of 77.6%, Eurasian carp (*Cyprinus carpio*) 17.2%, wels catfish (*Silurus glanis*) 2.2%, European eel (*Anguilla anguilla*) 1.3%, and others amounting to 1.8% of production. Approximately a quarter (28.8%) of these fish were produced by Türkiye, 13.8% by Poland, 11.4% by France, 10.8% by Italy, 9.6% by Denmark, 5.1% by Hungary, 5.7% by Czech Republic, 5.6% by Spain, 3.9% by Germany, 2.2% in England, and 1.5% in Holland and Croatia, Switzerland, Portugal, Belgium, Sweden, respectively. (FEAP, 2022)

In addition to gilt-head bream, sea bass and rainbow trout, Türkiye produces bluefin tuna (*Thunnus thynnus*) and Turkish salmon (*Oncorhynchus mykiss*) species. Mussel breeding facilities are also established, and continues to develop.

#### **Problems**

The aquaculture sector in Türkiye has some problems as in every developing aquaculture sector in the world. It is important to analyze these problems and develop appropriate mitigation strategies. At the same time, it is better to incorporate scientific advances into the solution.

Extra nutrient and waste pollution may occur in the waters where aquaculture activities are carried out in the world scale. This kind of situation causes problems. Human-caused terrestrial pollution creates problems in aquaculture production areas. Sustainable application and long-term preservation of healthy marine ecosystems are critical.

In the world aquaculture industry, diseases may lead to inefficiency for producers, decreases in the value of products, and therefore economic losses. Disease may also negatively impact local ecosystems and consumer health. In addition, some zoonotic diseases, which may be transmitted in humans, pose a risk to producer and consumer health.

Some special conditions are required to deliver fresh and high-quality products to consumers, i.e. a short shelf life necessitates rapid storage at appropriate temperatures. Seasonal fluctuations and fishing regulations pause supply to vary periodically. This situation makes logistics planning difficult.

There are also problems with the aquaculture market. Overfishing threatens the marine ecosystem as well as the sustainability of the sector in the long term. Food safety concerns arising from production that does not comply with standards damage consumers' trust in aquatic products. Price fluctuations and trade wars in global markets also adversely affect the sector.

### Future Focuses and Suggestions

- **Increasing Zootechnical Performance:** It is critical for the sustainability, economic efficiency and product quality of aquaculture in parallel with the project outcomes of MedAID (Mediterranean Aquaculture Integrated Development). This is a project, funded by the European Union in the framework of Horizon 2020 (MedAid, 2023).
  - **Growth and Nutrition Studies:** These should be aimed at developing suitable ration and breeding systems in order to achieve faster growth and better nutrient conversion rates.
  - **Genetic Advances:** Fish populations should be improved genetically through breeding studies. Fish that are resistant to diseases, grow quickly, have low feed conversion, and have good nutrition and meat quality should be produced.
  - **Disease, Fish Welfare and Health Studies:** Studies should be carried out on diseases. At the same time, treatment methods for possible diseases that do not threaten the ecosystem and harm the consumer should be developed. Studies and investments on fish welfare and health should be increased. Fish welfare should be increased by improving the conditions in production. Therefore, the resistance of fish diseases will be increased and their frequency will be reduced. Thus, the fish will have a faster growth, and their feed evaluation will improve.
- **Focusing on Customer Demands:** It is not only about guaranteeing that the consumer receives fresh and high quality product. Also, it should include sensitivity to eating habits, health and safety expectations, sustainability principles and ethical values.
  - **Traceability:** Customers need to know where the products come from, how they are produced, and how they are processed. The sector should devote significant effort to transparency, sustainability and ethical approaches.
  - **Presenting New Products to Consumers:** Producers should listen to the voice of consumers, evaluate feedback, update the product range, offer fresh, high quality, healthy, natural, delicious products, gain the trust of consumers and build customer bases.
  - **Supply & Demand Balance:** Consumer demands should be analyzed correctly, market research should be carried out, and it should be determined how much production that the company needs in advance. Thus, overproduction could be prevented.

- **Environmentally Friendly Aquaculture Production:** Water is the source of life and it is everyone's responsibility to protect and utilize it in a sustainable way.
  - **Environmental Impact:** During the production of aquacultural products, the conservation of natural resources should be addressed. Factors, such as water pollution, energy consumption and carbon emissions, should be taken into consideration, and production should be carried out with minimum damage to the environment.
  - **Water Management:** Sustainable water use, water reusability, water saving and effective water management should be the cornerstones of aquaculture production.
  - **Sustainability:** It should be essential to utilize resources sustainably, taking into account the needs of future generations.
  - **Community Benefits:** Production should make a positive contribution to local communities, provide employment and generate economic benefits.
  - **Transparency and Information:** Production processes, content information and sustainability reports should be shared openly and transparently.
  - **Quality and Safety:** Because it directly affects consumer health, quality and safety standards must comply with international standards
  - **International Co-operation:** Water resources have a transboundary and common value. Establishing international collaborations and partnerships in production is of great importance for sustainability.
  - **Training and Research & Development:** In order to develop innovative and sustainable solutions, it is necessary to carry out research and development studies continuously, and organize training programs.
- **Communication, Discussion, Stakeholders' Contribution:** Successful development in the sector is directly proportional to accurate communication, effective discussion and participation of all stakeholders involved in the sector.
  - **Communication:** Accurate information flow should be provided between producers, suppliers, distributors and consumers. The involvement of scientists and governmental organizations that make the relevant regulations will increase collaeficiency.
  - **Discussion:** The aquaculture sector contains many ecological, economic and social challenges. To overcome these challenges, all stakeholders should meet and discuss regularly.
  - **Stakeholders' Contribution:** All individuals and organisations participated in the sector should be included in decision-making processes. The views and suggestions of various stakeholders, such as local communities, fishermen, growers, researchers and government officials, are vital for the future of the sector.

In this context, the impact of some sectors that are indirectly related to the aquaculture sector may also make significant contributions to the process. The most important of these is the energy sector and ensuring the integration of renewable energy systems with the sector will be a noteworthy gain for sustainable breeding (Austin et al., 2022).

When everything is taken into consideration, Türkiye's aquaculture sector has a great potential. In order to utilize this potential in the best way possible, it is necessary to adopt proactive approaches on issues, such as sustainability, technological innovations, quality management and international marketing strategies. With the realization of these approaches, the sector will achieve a more competitive and sustainable structure in the national and international arena in the long term.

I hope that our article will be useful to producers, consumers, lawmakers, practitioners, scientists and all people who want to make an effort to leave an unspoiled world to future generations...

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