

## CONTRIBUTION OF MUSSEL FARMS TO EMPLOYMENT IN THE ISLANDS REGION FOUND AT THE SOUTHERN MARMARA SEA (TURKEY)

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**Abstract:** There is an increasing demand for safely produced bivalve mollusks and seafood in the world and in Turkey. However, despite this increasing demand, unstable and unreliable (unhealthy) commercial fishing, increasing environmental pollution and bivalve production and consumption do not seem to increase. As a solution to this situation, the emphasis is given to bivalve culture studies (such as mussel farming) and their production. Black mussel (*Mytilus galloprovincialis*) is the most widely cultivated species in the world, and its production accounts for 95% of the cultural fishery worldwide. In our country, the amount of product obtained from mussel farming in 2015 was only 3 tons, but as of the end of that year, it has increased to 800 tons in 2018 as a result of the investments started in the islands region found at the Southern Marmara Sea. Therefore, in this study, the socio-economic contribution of mussel farms established in the islands region to the Southern Marmara Sea was investigated.

Bivalve mollusks (mussels, etc.) constitute an important livelihood of the people in the coastal countries, especially in the coastal regions. In the region where the research was carried out, the supply of products obtained from mussel farms to the market emerged as an economic and employment-enhancing investment. In addition to the sales revenues obtained from the products produced in mussel farms and packaging facilities (1 kg of mussels approximately 1 \$), it employs about 100 people and a family of 4 people, it has a direct income gate of 400 people. This is an important investment tool for a region with a population of approximately 9.000. Besides, the production of the stuffed mussel, which is the most consumed form by our people, and the construction of tools and equipment and machinery to be used in aquaculture, means the indirect income as an increase in the supply-demand balance.

**Keywords:** Mussel farm, regional economic contribution, labor potential.

### Introduction

Mussels are the most natural, organic and ecological products that can be reached today and are among the most popular street tastes (Castellani, 2004; Bayraktar and Zencir, 2019). The mussels, which have been consumed in Europe since the 13th century, can be consumed as raw, semi-cooked, salted / pickled, marinated, jellied, smoked, canned, mussel salad, and cocktail (Noble, 1990). However, more is consumed as stuffed mussels and fried mussels in Turkey (Çolakoğlu et al., 2003; Ovalı, 2002; Tatlısu, 2002; Güngörür, 2019). Mussels are a source of quality protein, iron and B12. Iron and B12 content were reported to be higher than red meat (Kılınç et al., 2018; Akkuş, 2017). One portion of mussels is sufficient to meet the need of zinc for the human body; healthy growth, healthy brain functions, influenza and strong immunity to colds are of great importance.

In aquaculture, mussels are one of the species with the highest potential for aquaculture besides fish farming. In mussel farming, spats (mussel larvae) are provided from nature and grown without any feed supplementation. Since mussels are filter-feeding organisms in the sea, they turn into the meat by feeding on the planktons that circulate freely. The natural plankton reproduction is directly related to successful mussel cultivation (Alpbaz, 2005; Karayücel et al., 2010). Hence, the mussel aquaculture areas should be selected considering the seawater plankton abundance. However,

due to being filter-feeding organism, these species can contain harmful components such as microorganisms and chemical substances while filtering their nutrients and they may pose a danger to human consumption due to these elements they accumulate (Kök et al., 2015). Therefore, health surveys are carried out to identify all pollution sources in mussel farms. These monitoring activities in production areas should be carried out periodically. Considering that the mussel is the food of some fish species, it is known that the increase in the mussel population contributes to the nutritional dynamics of the fish (Kamermans et al., 2014).

### **The Evolution of Mussel Farming in Turkey**

Mussel farming began in the Dardanelles in Turkey using the species *Mytilus galloprovincialis* in the early 1990s. Raft culture (20x20 m and 12x12 m) and each of the 12m length of rope breeding studies were made on this facility. However, this farm remained active only a few years before it was closed (Kumlu and Lök, 2007). Although a small scale production was carried out in the Aegean Sea in 2004 on different production models, no progress has been made until 2015. As of 2015, investments have been made on mussel farming in the Erdek and Adalar regions in the south of the Marmara Sea (Çolakoğlu, 2016). A total of 7 mussel aquaculture facilities are found in Turkey of which located in the areas allowed to production by the Turkish government. In the island regions of the southern Marmara Sea, mussel cultivation is carried out by a long rope method between 15-30 m depths. In this system, mussels are cultivated from the ropes which are close to the surface of the water and stretched horizontally between the floats with the help of the ropes suspended in the vertical position. The start and end buoys are fixed to the seafloor using vaults or anchors. The larvae are collected from natural breeding areas with the help of spat ropes. The pups are placed on the ropes to grow. In the farms established in the region, it was determined that the mussels came from the offspring in an average period of 15 months (Yıldız et al., 2006).

Mussel farming with a long rope system is a modern aquaculture system and does not cause any harm to the environment. On the contrary, it is known that there is a significant increase in species diversity and quantity in these areas since fisheries cannot be done and the growing of mussels has positive effects on water quality. Furthermore, it is known that in the regions where mussel farms are established, the marine area contributes significantly to the increase of biodiversity (fish, lobster, sea cucumber, etc.) and acts as a natural reef (Klamt and Schernewski, 2013; Sarı et al., 2016).

There is a prejudice that tourism and mussel farming in the same place and time, could not be performed together. However, mussel farming is an extremely important cultivation area that cleans the seas and filters water (Folke and Kautsky, 1989; Shpigel et al., 1993). In the mussel production areas, where only buoys appear on the surface, seas are cleaned and additional income is obtained through tourism due to cleaned sea waters (Atalay, 2019).

### **Assessment of Mussels in the Economical Perspective**

Bivalve mollusks (such as mussels) constitute an important livelihood of the people in the coastal countries (Çolakoğlu and Tokaç, 2017). Mussels are the most cultivated species in the world and their production constitutes 95% of the cultural product fishery worldwide (Çolakoğlu and Çolakoğlu, 2013). The total income from bivalves grown in the world is \$ 16,913 million (FAO, 2014) and black mussel ranks comes first. Mussel represents approximately 15% of bivalve obtained from aquaculture in 2018. In Europe, mussel farming is particularly intense in countries such as Denmark, Ireland, the Netherlands, and Spain.

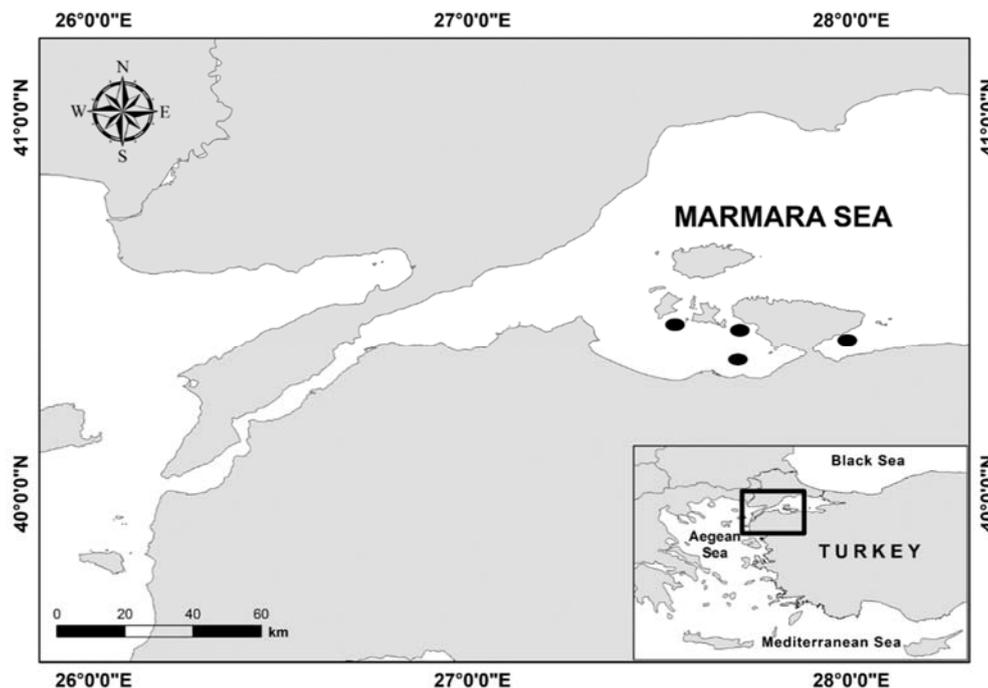
In our country, the production of bivalve mollusks is carried out almost entirely from natural stocks by hunting, and there is very little production realized through cultivation. 67.33% of this production is composed of a clam group (sand mussel and cockle), 32.55% is black mussel and 0.12% is another bivalves (TUİK, 2018). While only 3 tons of production was realized in 2015, it has been determined that the amount of production increased to 907 tons in 2018 as a result of investments made especially in the Marmara Sea (TUİK, 2018). It is estimated that this amount of production will triple in the next 5 years.

Mussels are known as the most consumed bivalve species cultivated in our country. Although the amount of black mussels consumed annually is not known for certain figures, it is mostly sold as stuffed mussels and mussel meat. The production of mussels as stuffed mussels has been a sector in our country and it is highly demanded by consumers. The employment opportunity provided by this production emerges as a distinct attraction center. For example, it is known that 500.000 mussels are processed to the stuffed mussels in İzmir and approximately 10 thousand people earn their living by stuffing mussels and marketing them on the streets (Kemaloğlu, 2016).

Due to the high commercial value and export potential of the mussels, the mussels may be exported from Turkey to abroad with the increase in production. Evaluation of this export potential can only be achieved by the intensive production of mussel farms and the controlled and sustainable cultivation. In this perspective, to obtain both healthy mussel and clean seawaters with using sample model production, it is encouraged entrepreneurs by the Directorate General of Fisheries and Aquaculture in Turkey (Atalay, 2019).

### Contribution of Mussel Farms to Employment in the Islands Region in the Sea of Marmara

The products obtained from mussel farms are not only high quality, healthy and reliable, but also provide income-employment to the national economy and the people of the region. There are 4 facilities actively engaged in aquaculture in the islands region, and investments continue in 3 regions. The average price of grown mussels varies between 7-10 TL. In 2018, approximately 900 tons of mussels were produced in the islands region, which amounts to approximately TL 7-10 million (Figure 1).



**Figure 1.** Mussel Farms found at Islands Region of the Southern Marmara Sea

Considering the contribution of mussel farms to employment in the region, an average of 20-25 people work in 1,000 tons of aquaculture farms. These are constituted the direct income gate for 100 people in families consisted of 4 people. Moreover, 5 people work in the purification and packaging of the mussels, and it is considered as a direct income gate for 20 people in families consisted of 4 people. It is of great importance for 9,000 people living in the islands region of the Southern Marmara Sea and for a district where there is no job opportunity. Mussels grown in these farms are sold to mussel stuffing facilities. Considering that a total of 5 people are employed during

the production of mussels, it is an indirect income gate for 20 people in families consisted of 4 people. There will certainly be an increase in the supply-demand balance in employment with the production of tools-equipment (rope etc.) and machinery used in mussel farming, mussel farms and the increase in production. The introduction of cultivated mussels to the market emerges as an economic and employment-enhancing investment that needs to be evaluated.

These living beings, which play a very important role in the economies of many countries in the world, cannot be sufficiently brought in to the economy of our country due to legal gaps in this field. For example, in the South American country of Chile, 330,000 tons of mussels were produced in 2017 that is an important source of income for the people living in the coastal areas of the country (about 55,000 thousand people). In our country, which is surrounded by seas on three sides, only 900 tons of mussels were produced in 2018. It is clear how far we have been behind from the maximum utilization of these natural abundances.

### Conclusion

Mussel farming has gained importance due to the pressure of overfishing on natural stocks and the inability to meet demand and demand from existing stocks. In our country, which is surrounded by seas, there are many suitable areas for mussel farming. Especially the Marmara Sea is a suitable sea for production due to its water quality and coastal characteristics. It is possible to produce mussels effortlessly and smoothly by culture the fry (spats) that can be obtained from these natural areas until they reach the market sizes in nature.

It is clear that in this period when unemployment in our country exceeds 10%, it will contribute to both the people of the region and the national economy by supporting mussel farming. Also, people will have the opportunity to consume healthy and reliable mussels as a source of protein.

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