AN ANALYSE OF COASTAL MARINE AQUACULTURE IN SOUTHEASTERN PART OF THE BLACK SEA

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Abstract

The development of domestic coastal marine aquaculture industry is depended of 4 basic factors: high water quality locations, access to the aquaculture site, assertion of exclusive fishing and culturing rights and financial investment. The current study is an aquaculture analyse of production at a regional level – South Eastern Coast of the Black Sea. In order to collect data, face to face interviews were made for each hatchery; production methods, species cultured and marketing techniques were investigated and conflicts, opportunities, prospects and structure of the aquaculture sector from the area in question were evaluated by questionnaires. Small fish-farms with a total production capacity between 10 - 30 tonnes were found to be most common for the studied region, the main reason being the lack of buyers from the fishing markets. The main problems faced by inland and marine aquaculture in this South Eastern region are related to environmental concerns, engineering cage systems for offshore or exposed environments or limiting factors as increasing price of feed.

Key words: aquaculture production, South Eastern Coast of the Black Sea, environmental concerns, limiting factors, domestic marine aquaculture industry

INTRODUCTION

Today marine aquaculture plays an increasingly important role in the production of fishery products. A wide diversity of aquatic species can be farmed in brackish or salt water using a variety of production systems [3]. Marine aquaculture in coastal and offshore waters must be developed with an eye toward sustainability - with a goal of producing products while conserving natural resources. Its development must have a solid ecological perspective that is compatible with the social, economic, and environmental goals of coastal communities, which requires the active involvement of community leaders and other relevant parties in the process [4].

Trout marine aquaculture has been practices in South Eastern Coast of the Black Sea since the beginning of 1990's while seabream and sea bass marine aquaculture has been carried out since 1984, using net cages. During early 1990's Atlantic salmon (*Salmo salar*) marine aquaculture in the study area has attracted considerable attention and efforts, but trials for salmon farming had to be terminated due to high water temperatures during summer.

Efforts were made to develop the commercial production of new species like 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 [3].

MATERIAL AND METHODS

The area proposed for study in this work is the South Eastern Coast of the Black Sea. Data from fish farms situated in each one of 6 provinces (Trabzon, Artvin, Rize, Gümüshane, Bayburt, Giresun) were taken and analyzed. This region was marked in figure 1:

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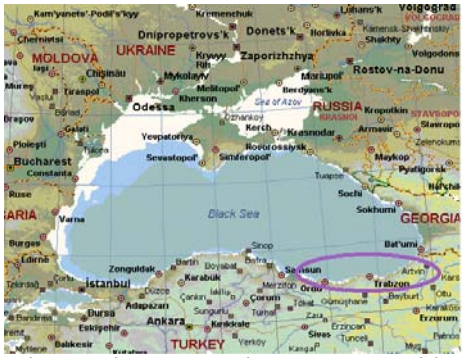

Fig.1: Study area – South Eastern Coast of the Black Sea

The steps made for obtaining the data for this work were: identifying the fish farms and researching institutes existent in the study area, distribution of questionnaires to fish farms all over the studied area, conversations with the fishery engineers or fish farms owners, obtaining data from governmental institutions like city-hall, national archives or other specialized authorities that have the necessary competence to give useful information for this work, using statistics found in international organizations web-sites and also using some data found in other previous studies/projects like this.

Data about fish farms production capacity and production techniques, their surface, dominant production species, stocking density, mortality rates, number and type of rearing and larvae tanks, feed consumption, marketing techniques, existing conflicts from the sector, new opportunities and plans for the future were collected, arranged, structured, organized and analyzed after some well-established criteria.

After analyzing the data, the main problems that the aquaculture (fish farms facilities), from the studied area is confronting with, begin to appear. This problem were also analyzed in order to underline the causes of their occurrence.

RESULTS AND DISCUSSIONS

Fish farms from the study area were divided into four groups by their level of production capacity. First group (F1 and F2) covers ,,small scale and family fish farms", in the second group (F3) we can find ,,middle scale fish farms", in the third group (F4),,big scale fish farms" and eventually, in the fourth group (F5) ,,floating cages", (table 1).

Table 1: Groups of fish-farms

Small scale fish farm		Middle scale fish farms	Big scale fish farms	Net Cages
F1	F2	F3	F4	F5

An exception is found in the first group; because there were significant differences among farms from ,,small scale fish farms" group, this ones were divided into two subgroups (F1 and F2).

In the study region, growth patterns of rainbow trout in fresh and salt water are presented by Akbulut et al., 2009 in the following graph (figure 2):

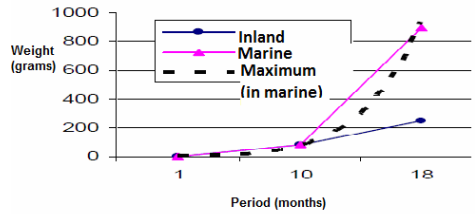

Fig. 2: Growth patterns of rainbow trout in fresh and salt water in the studied region [1]

The average real and also projected production capacity for each group is presented in table 2.

Table 2: The average of real and projected production capacity for each group of fish farms

Fish farm groups	Real production capacity (kg)	Projected production capacity (kg)
F1	10,000	20,000
F2	30,000	30,000
F3	40,000	24,000
F4	150,000	150,000
F5	1,800,000	1,800,000

It can be seen that among F1 fish-farms group, the real average production capacity is 10,000 kg/year, although the projected average production capacity is double, 20,000 kg/year. This situation is possible because of the lack of well-defined contracts with the clients – consumers. If the real average production capacity will rise to 20,000 kg/year, it will appear a big risk of not selling a big part of this

production. On the other hand, at F3 group the situation is exactly opposite the real production capacity is almost two times bigger than the projected production capacity. This situation is possible because at the end of the season, the entire quantity of fish is transported into floating cages - the reason is neither one except water quality. A big disadvantage is that Black Sea water temperature varies from 7 to 28°C, fact which represents an obstacle for producing salmon species in floating cages. The water temperature on surface, on summer time is over 20°C and because of that, only between November to June fishes can be kept or grow in floating cages. Before June, the fishes must be sold or they must be moved to some cold water places, like is happening among F3 fish farms group. Marine water temperature, in rearing period – October to June, is more stable than fresh water one in the same period and its salinity is 16 – 20 ‰, so this gives a large advantage to it.

The average area surface per farm is presented in figure 3.

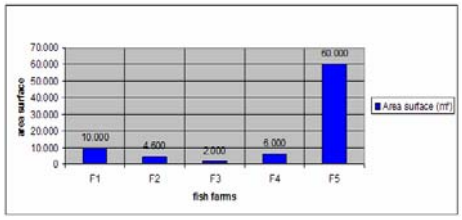

Fig. 3: Average area surface per farm for each group of fish farms

It can be seen that ,,middle scale'' fish farms haven't got a very big area surface comparing to their production capacity, thing that is explained by their high levels of stocking density. On the other hand, the first group of ,,small scale'' fish farms, so called ,,family fish farms'', occupy a considerable area surface comparing to their production capacity. This particularity is among the special characteristics of aquaculture from study area – South Eastern Coast of the Black Sea and it could be the cause of the fact that many of ,,family fish farms'' owners attached both their families and their houses to farms, making from their small business a kind of ,,family business''.

The main species of fish produced among analysed fish-farm groups are presented in table 3.

Table 3: Dominant fish species production in analysed groups of fish farms

Fish farm groups	Fish species produced
F1	Rainbow trout (*Oncorhynchus mykiss*)
F2	Rainbow trout (*Oncorhynchus mykiss*)
F3	Rainbow trout (*Oncorhynchus mykiss*)
F4	Rainbow trout (*Oncorhynchus mykiss*); Sea trout (*Salmo trutta trutta*)
F5	Rainbow trout (*Oncorhynchus mykiss*) ; Sea bass (*Dicentrarchus labrax*)

As it can be observed from this table, the predominant species is rainbow trout (*Oncorhynchus mykiss*). As secondary species, we find sea trout (*Salmo trutta trutta*) and also sea bass (*Dicentrarchus labrax*). In the future, some fish farms owners expressed desire for rearing sturgeon species and also increasing sea trout production.

Most small fish farms obtain their juveniles from the wild, though there are also many big commercial and government fish farms using modern technology. Larger commercial fish farms produce their own juveniles from hatcheries and selling the remainder to other farms [2].

Sea bass production has been more successful than that for sea bream, where the rate of mortality in juveniles is high due to abnormalities, shortened opercula, and deficiencies in feeding and swim bladder inflation [2].

Three main production systems are employed: floating cages, ponds and raceways. Raceways are used mainly for juvenile production, floating cages for on-growing all species (sea bass, sea trout and trout), while ponds are used mainly for sea bass. Fibreglass tanks are mostly preferred in hatcheries and juvenile production [3].

The cages used are mostly circular, made from High Density Polyethylene (HDPE), with diameters (ø) ranging from 12 to 70 m. Sea bass farms are using ø 16-30 m, while trout producers use cages smaller than ø 20 m [3].

Information about types and number of tanks and also about stocking density are presented in fig.4:

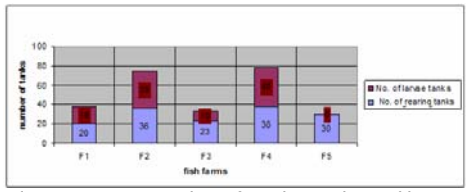

Fig. 4: Average number of rearing tanks and larvae tanks per farm for each group of fish farms

The tank cleaning process is made manually, with lime or vinegar. Rearing tanks are cleaned generally once per month (in spring season they are cleaned more frequently) while the larvae tanks are cleaned daily. In the case of F5 fish farms group, the nets are cleaned with special nets washing machines once a season.

The floating cages farms are located in Ordu – Perşembe, Trabzon – Yomra and Rize, because comparing to others places, these ones are more protected from big waves and strong winds.

Three techniques of producing rainbow trout are used in the cage farms:

1.) In the beginning of the November, juvenile fishes (50 – 100g) are placed into cages and till middle of the June those fish must have harvested as 0.5 – 1 kg per fish.

2.) The fishes are placed in the cages when their weight is almost 200g and they are taken from cages at 600 – 700g per fish and placed in inland tanks (basins). This method is very common around the studied area.

3.) Starting from middle of the June, fishes can be transferred to the inland farms for the summer pasture until beginning of the November. This method is applied for obtain fish for filets. But bigger fish transportation, from cage farms to the inland farms, requires too much efforts. Because of that, this type of production method isn't so common in the studied region.

It can be seen from fig.5 that middle scale fish farms prefer a bigger stocking density and a smaller number of rearing tanks comparing to the others. Also, tank dimensions and volume are bigger here.

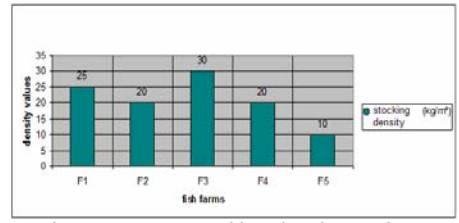

Fig. 5: Average stocking density per farm corresponding to each group of fish farms

The average annual feed consumption quantity is presented for each group of fish farms in figure 6.

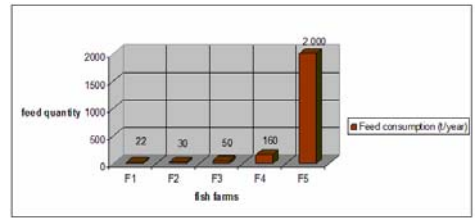

Fig. 6: Annual average feed consumption rate per farm for each group of fish farms

For larvae tanks, the feeding process is automated while for rearing tanks is manual. Data taken from F1 fish farms group attests that for consumption size fish, feed is given two times per day and for juveniles between five to seven times per day. Generally, in summer season, the studied fish-farms give feed more than three times per day. The studied fish farms do not have fish preparation units, so they buy the necessary quantity of feed from specialized factories. Dimension of granulated feed varies depending by fish size, among 300µm - 500µm - 800µm -1000µm - 1500µm - 2mm - 3mm - 4mm -6mm - 9mm.

Regarding disease problems, F1 fish farms group peculiarly reported intestinal parasitic diseases that were identified from fish behaviour. The methods of treatment applied were based on salt baths, use of chloramine T powder, formaldehyde and also the administration of vitamins. In case of F2, there were reported as frequent diseases like fungal, red-mounth (*Yersinia ruckeri*) and also ichthyophthiriosis. These diseases are treated with vinegar, antibiotics and also trilissen. F3 reported an entire series of diseases indentified in their specialized laboratories as: columnaris disease, Costia

and red-mounth infections (*Yersinia ruckeri*), aeromonads or ichthyophthiriosis. Fungal diseases (*Saprolegnia*), ichthyophthiriosis and red month infections (*Yersinia ruckeri*) disease were reported by F4 as well. At F5 – floating cages fish farms group, there were no disease reported, the only problem being the water temperature during summer season.

The average mortality rate due to diseases and also the average loss percentage per each fish evolution stage are presented in the next two graphs, figure 7 and figure 8.

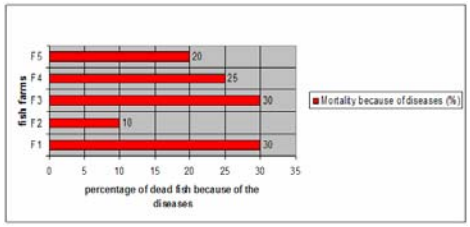

Fig. 7: Total average mortality rates due to fish diseases

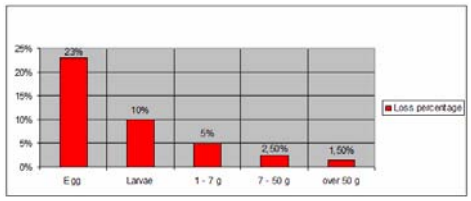

Fig. 8: Mortality rates during different fish evolution stages(%)

Generally, the fish-farms use two types of water sources: underground source and also stream. The underground source is used especially for incubators while the water from streams is used for rearing tanks supply. An exception we can find in F5 case, where we are speaking about floating cages that are situated in the sea.

Most of fish farms are selling their production on the local markets. Because they have big production capacities, farms from F5 group are also selling their production to export.

This coast region has rapid growing in industrialization so, more and more land mainly for aquaculture purposes was converted to industry zone. This reducing of the aquaculture lands for ponds construction leads to rise of pond leasing fees in the region. As a result, farmers increased their output per area in order to cover the increasing leasing fees. Also, there are other issues that have constrained the development of marine aquaculture in this region. The complex and diverse nature of the industry, conflicts with other, traditional uses of the waters, environmental concerns and the existing legal and regulatory climate all contribute to this situation.

The aquaculture sector in this South Eastern costal region of Black Sea is facing a series of constraints, mainly related to the evolution of markets, site availability, inputs, diseases, planning, infrastructures, and human resources.

Some of the main problems faced by marine aquaculture industry from the study region are marine pollution and difficulties in renting coastal land. Other current problems of the sector are: very small dimensions of cages and also the lack of flexibility, lack of automatic feeders and fact that farms are close to each other.

Conflict between coastal aquaculture development and other users of the coastal environment is not unusual, most notably with the tourism sector. There are also conflicts with summer house owners, local people and environmental groups.

As a solution to environmental problems there must be drawn strict guideline for fish culture activity that will only allow farmers to use the compound floating feed and not others fertilizer of animal faeces to reduce the pollution to the water resources.

Although resource or space use is the major issue, marine aquaculture development has drawn the following general criticisms: spoiling of the natural aesthetics of coastline; preventing public access to boating, swimming and hiking activities and obstructing marine traffic; excluding fishermen from fishing grounds (the area of the fish farm plus a 200m circumference exclusion zone); the destruction of valuable habitats; generation of considerable amount of faecal waste to the sea bed and dissolved nutrients into the water column; transmission of pathogens to wild fish; assemblage of wild fish around cages and genetic influence of cultured fish escaping from farms [3].

Cage farms have started to move off-shore or more exposed sites. There is no doubt that moving off-shore will reduce conflicts between coastal zone users, increase production capacity while reducing environmental concerns, and

improve productivity and profitability. Stocking pre-growing juveniles into offshore cages provides important strategic advantages, including low mortalities, better quality control, reduced net cost, no need to handle fish at sea, increasing farm turn-over and stocking, production and commercial strategic options. However, this requires either pre-growing cage sites in sheltered bays or land-based systems [3].

A common situation found in the study area is that some companies didn't make enough research work before they establish themselves and so, they didn't manage to resist on this aquaculture industry. That is why, before establish a company, research work must be made for improving the quality of water, also national and international standards must be respected and last but not least, an analysis of the economic and social environment must be made.

CONCLUSIONS

One of the urgent demands of aquaculture sector from the studied region is the improvement of governance related to it for a more orderly, rapid and sustainable development. The desired outcome must be strengthening fisheries and aquaculture sector policies and also legal and institutional frameworks. Policies and strategic frameworks must be analyzed and updated. Another urgent demand could be strengthening institutional support services. The goal of this demand must be to improve capacities for research and technology development, extension, training and information and access to credit and markets to encourage private investments in inland fisheries and aquaculture enterprises.

Newcomers to this industry suffer from a lack of experience, inappropriate advice on site selection, inadequate evaluation of market opportunities and product diversification and a lack of understanding of marine aquaculture development in relation to other forms of competition. It is good to point out that if there will be too many small scale fish farms in the studied area, their capacity must be developed and not the number of them.

In my opinion, here are some of the things that should be made for improving the situation in aquaculture sector: active and increasing support and interest in the opportunities may be provided by the sector from FAO, World Bank and other bilateral and international development agencies and banks; an attractive environment could be created for investors, including foreign investments; illegal, unreported and unregulated fishing could be reduced by establishing or improving the monitoring, control and surveillance methodologies; international organizations and financial institutions could be involved in development planning of the sector; infrastructure and support services for fishery and aquaculture could be improved; demand for fish could be increased through promotional campaigns emphasizing good quality and health aspects.

A few problems that we signalised as the long term ones and worth's taking them into account are: the lack of good processing facilities, especially packaging facilities – this causes food safety concerns related to fish consumption, hampering fish consumption growth; fish market facilities are poor in rural areas; the concept ot teaming up in cooperatives and associations between aquaculturists and fishers is yet to be developed – on the contrary, they see each other rather as competitors.

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