Proceeding Paper

Evaluation of genetic pollution risk from data collected from Evoikos gulf fish farm combined with a literature review

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Abstract: Despite all the efforts to eradicate the escape events, this phenomenon is still present and will probably continue to occur, due to many mistakes. Mediterranean finfish aquaculture is mainly represented by the production of the gilthead sea bream (*Sparus aurata)* and the sea bass (*Dicentrachus labrax*). Here, data collected from recorded escapes of a Evoikos Gulf fish farm, in Greece. According to these records fish escapes present a generally stable rate. Low levels of genetic differentiation of Mediterranean *S. aurata* and *D. labrax* populations are generally observed, and in combination with the unaffected genetic structure among wild populations, the ecological risk of escape events seems to be generally low. However, suitable management measurements should be established to avoid future escape events.

Keywords: escape events, *Sparus aurata*, *Dicentrarchus labrax*

1. Introduction

Aquaculture sector is the fastest-growing industry in the food production market [1], with however, some serious threats that exist. Among them, finfish escapes may possess a serious ecological threat [2]. Apart from the ecological concerns, the economic impact of these escapees poses as an important factor for economic losses [3]. Mediterranean finfish aquaculture is represented mainly by the gilthead sea bream (*Sparus aurata*) and the sea bass (*Dicentrarchus labrax*) with Greece being one of the main producers of gilthead sea bream and sea bass in Europe.

The main scope of the present study is the evaluation of the potential environmental risk of sea bream and sea bass escape events based on literature data combined with the collection and analysis of data from a sea bream farm located in the Evoikos Gulf (Western Aegean Sea), Greece. All the above can contribute as a base for designing sustainable aquaculture management practices for eliminating the risk for future escape events.

2. Materials and methods

Firstly, an extended literature review was conducted in an effort to collect data regarding fish escape events, and more specifically escape events regarding *S. aurata* and *D. labrax*. The search was conducted on scientific databases such as Scopus, and Google scholar and all the relevant scientific articles were chosen for further analysis. Apart from the literature review, we collected original data from Evoikos Gulf fish farm (Western Aegean, Greece), which is a typical medium to large aquaculture unit, rearing

gilthead sea bream and sea bass. The data collected referred to years 2016-2021. The data provided detailed assessment regarding the reasons, the size of the net holes in the sea cage, and the number of escapees that was created during these years. Based on the analysis, a diagram was created indicating the adjustment (loss) percentage of fish (AP), total reared fish before adjustment (FBA) and estimation of the fish number in each escape event in Evoikos fish farm during these five years.

3. Results and discussion

Gilthead sea bream is characterized by subtle genetic structure. Although this observation was not confirmed from all the studies conducted on *S. aurata*, the genetic differentiation levels in sea bream studies seem to be lower than those observed in other marine species [4-7]. The low differentiation levels recorded within the Mediterranean basins can be explained keeping in mind the long period of larval dispersion of sea bream (>30 days). Similar patterns were observed concerning the low extent of differentiation in *D. labrax* [8].

From the data collected from the Evoikos fish farm during the years 2016-2021, in total 37 escape events were recorded (Figure 1). Out of them, twenty-three were attributed to unknown reasons, recording only the size of the net hole and the number of escapes. Eight of them were attributed to environmental reasons and more specifically, to sea turtles that apparently cause damage to the materials of the sea cages. From the six escape events remaining, 5 were again attributed to adverse weather conditions, while the last one occurred due to technical reasons, during transfer. The range of fish loss percentage varies from 0 to 2% with only six cases overlapping 2%, presenting a generally stable rate. The adjustment percentage was correlated with the number of escapes, as in high-level escape events the percentage was above 2% in most of the cases. Additionally, it should be noted that during these years, fish numbers exhibited fluctuations on Evoikos fish farm (Figure 1).

Overall, from the data collected from the fish farm in Evoikos during 2016-2021 no stable trend regarding the fish escape events in each year was recorded. Further, the fish number escapes exhibited a fluctuation between 500 and 1500 individuals/case of incidents.
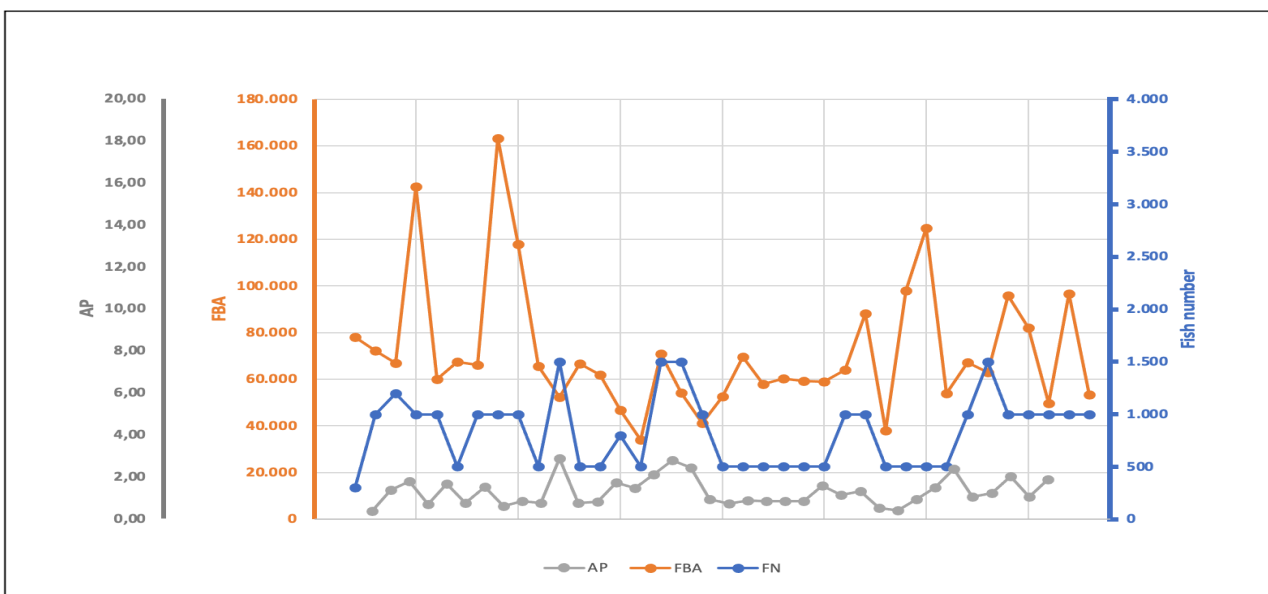

Figure 1. Adjustment (loss) percentage of fish (AP), total reared fish before adjustment (FBA) and estimation of the fish number in each escape event in Evoikos marine fish farm.

4. Conclusions

As aquaculture field represents the fastest-growing food-production industry in the world, the sustainable development of this sector should be a priority. Escape events represent a major threat, both from ecological and economical point of view (Jacksons et al., 2015). As occurred from literature review in sea bream as well as sea bass farming, genetic structure and differentiation among wild populations seem to be unaffected (low but significant) from the so far escape events [4-8].

These events represent a common phenomenon in all aquaculture forms. Despite all the efforts to eradicate this phenomenon, these events are still present and will probably continue to occur, due to many failure types during their operation [9-10]. Especially regarding sea bream, a lack of unequivocal documentation exists, referring to the biological and ecological consequences (productivity, distribution, mortality, abundance, fitness success, resilience, life-history profiles) of introgression in wild populations.

The above conclusions, combined with the generally stable rate of the fish escapes (between 0 and 2 % in each escape event) in Evoikos fish farm and other ones reviewed, can provide some initial assumptions, that escape events represent mainly an economic viability related issue. Nevertheless, as there is still a gap of knowledge and some contradictory results as well, suitable management measurements in Mediterranean countries with many farmed fish escapes are needed, for eliminating future negative effects. These measurements and strategies should be focused on further efforts for recapture programs development, reduced escapes' survival, and proper legislation together with more data on escapes' survival percentage and migration pathways.

Informed Consent Statement: Not applicable

Data Availability Statement: All data of this research are available after communication with the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest

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