

EXTENDED ABSTRACT

Technical assistance for the study of the feasibility of a local hatchery for the production of oyster seed in the Ebro Delta

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Introduction

Climate Change is causing a gradual increase in temperatures in the Ebro Delta bays, causing mussel mortality (*Mytilus sp.*) Mainly in the Alfacs Bay, where temperatures reach 28°C or above for a long time.

Considering adaptation of cultured species to climate change (survival at increasing temperatures), oyster (*C. gigas*) performs better than mussel.

The Federation of Ebro Delta Mollusc Producers (Fepromodel), considers that rearing disease free oyster spat, in the Ebro Delta, is a vital measure of adaptation to climate change enabling aquaculture sector continuity.

From these premises, a study of productive and economic viability of a diploid oyster hatchery for spat production in the Ebro Delta is developed.

Planning the viability study

Following are detailed the objectives and their corresponding actions. Both, are interrelated and will determine the productive and economic viability of the oyster hatchery. Additionally, all of them will be complemented by a training model.

Objective 1. To produce diploid oyster spat (*C. gigas*) by means of a small-scale pilot test with certain local conditions of culture.

Action 1: Phytoplankton culture using a batch culture system of the following species: *Isochrysis tahitiana* (T-ISO), *Chaetoceros gracilis*, *Chaetoceros calcitrans* and *Tetraselmis suecica*.

Action 2: Early and natural conditioning of oyster (*C. gigas*) broodstock phenotypically selected from the bays of the Ebro Delta.

Action 3: Spawning induction and culture of embryos.

Action 4: Culture of larvae until settlement.

Action 5: Production of spat up to an average length of 2mm.

Action 6: Pre growing in suspended baskets in the environment (in the bays) until the grow size (4cm)

Objective 2. Initially define a basic methodology and a technical protocol for the diploid oyster (*C. gigas*) spat production.

Action 7: Technical, descriptive and sequential work method for Actions 1, 2, 3, 4 and 5, which will result, on one hand, in a technical protocol (under local conditions) and a series of data about the staff (types of technical tasks to be performed, hours spent on tasks, etc.) and, on the other hand, the required equipment and materials to carry out all of the actions that, will allow us to analyse and later determine, the economic viability of the hatchery project as a whole.

Objective 3. Make a basic study of productive and economic viability.

Action 8: To design a production model for oyster spat (*C. gigas*) using spreadsheets (Excel). This production model will be an vital tool in determining productive and economic viability and in being used as a tool for continuous improvement and transversal production management for future local aquaculture farmers. To the design the production model will have to:

1. Estimate the annual spat production.
2. Determine the stages of production.
3. Determine the zootechnical parameters typical of each stage of production.

4. Estimate the value of certain zootechnical parameters.
5. Calculate the rest of the zootechnical parameters, from the default values, that will allow us to design the production model completely.

Action 9: Analysis and assessment of the different results and indicators of the technical protocol (A7) and the production model (A8), collected from different computer sources / and statistics (Excel spreadsheets). Depending on the results obtained from a productive, structural and personal nature, a basic economic feasibility study will be carried out for the installation and operation of a oyster hatchery (*C. gigas*) in the Ebro Delta.

Objective 4. To carry out a training model for the business development of future aquaculture activity.

Action 10: A lifelong learning model will be developed, which will allow adapted / customized training to the real needs of companies and individuals, for the business development of future the aquaculture activity (Objectives 1, 2 and 3).

Results and conclusions

From a **productive and health** point of view we can conclude:

- It is technically and technologically viable to produce 2mm diploid oyster spat (*C. gigas*) in a hatchery in the Ebro Delta, according to the productive data of this viability study. Nowadays, the biotechnology is needed to raise this aquaculture species in captivity, its reliability, sustainability and reproducibility of its

production process, has been proven in time, although more R&D is needed to improve certain critical aspects of the hatchery phase.

- As an **innovative fact**, from a small spat of 2mm of average length (T1) produced in a hatchery under controlled conditions, it is viable to carry out the pre-growing in suspension until it reaches the grow size (4cm - 6cm) at the bays of the Ebro Delta. The results showed good growth rates (2mm to 4cm in 45 days) and 97% survival during this phase of the culture. Then the quality of the spat produced in the hatchery is guaranteed, as it has not shown any mortality by pathologies (Herpesvirus OsHV-1 or others) in the natural environment and has had good results in terms of growth in weight and length.

- In the bays of the Ebro Delta, for an estimated annual local production of 700 to 800 tonnes of oyster (*C. gigas*), taking into account a survival rate of 70 - 80% throughout the grow phase, only the annual production and supply of approximately 10 million oyster spats to the local productive sector, through a hatchery, would be required.

Assuming a survival rate of 70-80% throughout the growing phase, just an annual production of approximately 10 million oyster spats and supply to the local productive sector would be required for an estimated yearly production of 700 to 800 tonnes.

- In order to be able to sell the commercially sized diploid oyster (70 - 100g) from October to April (8 months), the combination of 2 annual production cycles of 5 million spats each would be needed. A planned and staggered work lasting from July through March in the hatchery would be required.

- It is advisable for the settlement and start of the productive activity of the oyster hatchery to do so in "Little Venice" spot due to its strategic location, being very close to the cultivated oyster and mussel cultures (phases of pregrowing and growing) and only 2 kilometers away from the only Aquaculture Research and VET Aquaculture School centers in Catalonia. An important added value would be the companies engaged in the purification of bivalve molluscs, since they have very expensive facilities and equipment that could be used for spat production in hatcheries and, in some cases, of underused spaces of their old sewage treatment plants.

From an economic point of view we can conclude the following:

- A hatchery for an annual production of 10 million diploid oyster spats in the Ebro Delta can be economically viable, if spats up to 2mm in length are produced by batch phytoplankton culture and / or FBR for a sale price of 0.006 euros per unit. The economic indicators analysed (profit margin on sales and economic productivity) for 2mm spat production have been positive for both a batch phytoplankton culture system and photobioreactors (FBR). However, they have been negative for 4mm length spat production.
- In this study, as an innovative fact, the productive viability of the Ebro Delta has been detected, from **pre-growing the spat to the natural environment from 2mm through 4cm - 6cm**, with excellent growth and survival yields based on the described strategies. From an economic point of view, this can be a great **local business opportunity**, with the following potential benefits:

- It can make us more competitive compared to or versus the French market (main competitor), as it could offer a final product (spats from 10mm to 6cm) with quality and health guarantees in terms of good growth and survival yields and adapted to their environment (bays of the Ebro Delta). In the Ebro Delta bays a 2mm spat suspended in natural flow can become a 6cm long spat within 2 -3 months' time.
 - It could be a more profitable business, with a maximum income of up to 603,000 euros a year (sale of 6cm spats) with a sale price of 0.067 euros per unit of oyster, significantly higher than the 60000 euros obtained in the nursery for the sale of 2mm seed, with a sale price of 0.006 euros / unit.
 - This new productive activity would involve the creation of local jobs, both direct and indirect, in greater numbers compared to a hatchery.
 - Initial investment payback times could be significantly shorter and offer local producers a range of sizes (1cm - 6cm) to start pre-growing and / growing.
- Pre-growing in suspension in the environment (bays of the Ebro Delta) from spat with an average length of 2mm produced in a nursery in the Ebro Delta, would be a complementary productive activity and necessary to be able to improve the economic profitability of the nursery business. We need to continue improving (optimising) the productive side with larger-scale experiences and to more fully determine its viability from an economic point of view.

From a training point of view we can conclude the following:

Lifelong learning:

An employment training period is set. It would take from October when the season is almost finished) to March of the following year (beginning of the season). In this way people can be trained, in two ways:

- Continuous training, tailored at staff members of companies in the sector of bivalve molluscs fattening in the Ebro Delta, through bonus training (FUNDAE), which would not be an additional expense for the company.
- Occupational training, aimed at unemployed people in the region, if the new business activity were successful and jobs were gradually increasing (mainly in the pre-growing phase).

All this would enable accomplishing the main objective of the suggested training model, that is, to provide the company with qualified personnel in the area, in order to guarantee social cohesion and creation of local jobs, with a minimal expense possible for future of the oyster hatchery investors.