



SEACASE

Promoting extensive and semi-intensive aquaculture in southern Europe

The Challenge

In Europe, extensive and semi-intensive aquaculture systems have been developed over the last century. Some of these traditional systems are still effective economic activities in many coastal areas of southern Europe with a significant socio-economic impact. However, their activities are being challenged by today's high labour and land-use costs. Their sustainability is threatened by the low productivity of the systems and their inability to compete in the market with lower priced products from intensive aquaculture. In addition, these systems are under pressure by increased competition for coastal areas by other users such as tourism, agriculture and industry.

In spite of this, the positive effects of extensive and semi-intensive aquaculture in coastal areas have been clearly recognised within EU policy. In its "Strategy on the Sustainable Development of European Aquaculture" (COM(2002) 511), the Commission stressed the beneficial impact of extensive systems as regards the protection and restoration of the environment in areas of particular ecological interest, as well as the development of employment opportunities in rural and coastal areas. Moreover, the Strategy underlines their potential for tourism, recreation and education to nature.

By promoting extensive and semi-intensive aquaculture in coastal areas, the SEACASE project aimed to contribute to the better management of coastal areas of particular ecological interest, support sustainable production, employment and, in the longer term the development of ecotourism and environmental education. Greater application of scientific knowledge to these traditional methods would benefit the local communities and economies that still depend on traditional aquaculture methods. This expertise would also maximise the environmental and ecological benefits that these traditional methods have to offer.

Project Objective

The SEACASE project aimed to develop effective tools for the maintenance of competitiveness, productivity and profitability of extensive and semi-intensive aquaculture production in southern Europe, while minimizing its environmental impacts and improving the quality and public image of its products.



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EATiP Thematic Area of Relevance

TA1: Product Quality, Consumer Safety and Health

TA2: Technology and Systems

TA3: Managing the Biological Lifecycle

TA4: Sustainable Feed Production

TA5: Integration with the Environment

TA6: Knowledge Management

TA7: Aquatic Animal Health and Welfare

TA8: Socio-Economics and Management

Key Words

Extensive Aquaculture, semi-intensive aquaculture, competitiveness, sustainability, quality

Project Information

Contract number:

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Specific Targeted Research Project

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POLICIES-1.3 The modernisation and sustainability of fisheries policies

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Key Points

Case-Studies

The project was based on case studies covering a wide variety of production systems and geographical locations. A socio-economic assessment of the production systems used in the case studies was produced and this analysis was completed by an assessment of potential non-market benefits and costs, including social and patrimonial aspects, in one selected case-study.

- Semi-extensive nurseries in lagoons/ponds (Greece, France, Italy, Portugal)
Aim: optimise the initial rearing stage of marine fish species under extensive or semi-extensive conditions.
Workshop: "Extensive Aquaculture in the Mediterranean" December 2009, Greece (HCMR)
- Semi-intensive polyculture in earthen ponds (Portugal and Spain)
Aim: test several improved production protocols for Gilthead seabream and Senegalese sole, at different densities and using eco-friendly diets.
Workshop: "Semi-intensive Polyculture" January 2010, Portugal (CCMAR)
- Integrated system: Fish – microalgae – shellfish as an effluent treatment pond system (France)
Aim: Value the integration of extensive aquaculture in a marine fish hatchery, as treatment of intensive system effluents.
Workshop: "Des systemes integres multitrophiques pour une aquaculture durables" October 2009, France (IFREMER)
- Valliculture (Italy)
Aim: provide "added-value" to valliculture by optimizing farming protocols for gilthead seabream. Diversification of seeding (wild vs reared, time of seeding) and harvesting strategies were tested. Genetic tagging was used as a stock identification tool.
Workshop: "Extensive Aquaculture - Valliculture" December 2009, Italy (ISPRA-UTV)
- Integrated management of marine extensive ponds and lagoons for a sustainable eel fishery (France)
Aim: promote the use of coastal wetlands as extensive systems to produce eel genitors for restocking of natural populations.
Workshop: "Anguilles et Marais Littoraux" October 2009, France (CREAA)
- Extensive polyculture in intertidal earthen ponds, "esteros" (Spain)
Aim: Evaluate the use of traditional extensive farming system in the earthen ponds "esteros" which are used to on-growing fish in the south of Spain.
Workshop: "Cultivos acuícolas extensivos y semiextensivos sostenibles en el zonas costeras" March 2009, Spain (CSIC)

Technical Improvements

Several approaches were used to provide 'added-value' to the extensive and semi-intensive sector aquaculture in Southern Europe, by optimising the production systems, while maintaining sound environmental conditions in coastal zones:

- Improved diet formulations
- New research tools provided by molecular biology
- A synthesis of pond management technique
- Optimizing slaughter procedures of fish

Quality and Certification

The simple recognition of non-market benefits associated to extensive aquaculture such as the maintenance of wetland functionalities, landscape structure or sentinel of coastal ecosystem integrity does not ensure improved economic viability of these productions. Several options may be undertaken to overcome this problem, such as the differentiation of products based on collective action to build niche markets offering premiums to products from extensive and semi-extensive aquaculture.

To achieve the consumer perception in an easier way and with more efficacy European countries developed several certification systems to make more visible the advantages of such products. The adoption of certification processes is certainly desirable and advisable. The project considered various approaches and studied the certification possibilities, identified quality markers, and developed "codes of conduct" in this endeavour.

Socio-economics

Extensive and semi-intensive aquaculture systems in coastal areas in Southern Europe are known to preserve

the landscape, wetlands functionality and increase biodiversity. To maintain and support these systems as an economic activity in protected wetlands will, in the long term, be more valuable for the society and the environment, when compared to abandoned coastal areas. Such abandonment leads to eutrophication or siltation, bringing up the risk of disappearance to ancestral wetlands. Several technical improvements studied within the project SEACASE scope were shown to be effective in non-intensive systems, allowing reduced environmental impacts, or increased productivity without major effects to the environment. The possibility of combining aquaculture with multifunctional (e.g., tourist, educational, recreational) activities involving new generations of stakeholders and land managers represents a focal issue for management continuity and the conservation of a traditional husbandry, both of which are essential for ecosystem protection.

Output Highlights

Status of Non-intensive Aquaculture in Southern Europe

A detailed report on extensive and semi-intensive aquaculture systems in Southern Europe was produced. The report highlights that these systems are responsible for a significant production, at least 100 000 tons/year, and for using a large area, at least 92 000 ha, along the southern European coastal zone (e.g., confined areas of coastal lagoons, natural and managed deltas, and semi-closed bays and estuaries, encompassing polders with earthen ponds). Nevertheless, further geographical studies are required to better estimate the evolution of land use by farmers, and wetland abandonment.

Technical improvements

Technical improvements within the SEACASE project sought to add value to extensive and semi-intensive systems aquaculture while increasing sustainable production, improving management practices and resources conservation. These improvements included:

- Development of innovative eco-friendly diets, using plant-based ingredients, to reduce the pressure on natural resources and minimize farm waste and nutrient output in semi-intensive farming;
- Optimisation of slaughter procedures for the ice slurry method and resulted in reduced time to death and improved general sensory attributes;
- Identification of genes that confer a higher adaptability to low temperature allowing the selection of best performing strains in extensive aquaculture.

Case-studies

Six independent case studies were developed to demonstrate the feasibility for productivity enhancement in coastal extensive or/and semi-intensive aquaculture in Southern Europe under sound environmental conditions. Environmentally-friendly farming protocols were developed and recommendations to farmers, to policy makers to the society and were postulated.

Quality

The project investigated quality criteria as potential markers to differentiate fish (seabream) reared in different systems. Sanitary and nutritional quality, yields and body traits, colour, sensory quality and muscle structure were monitored. The rearing system seems to modulate the muscle structure, and environmental conditions have been identified as an influential factor on odour and taste characteristics of reared fish.

In addition, an artificial intelligence application was developed in order to distinguish between fish juveniles reared in intensive and non-intensive systems, and showed that semi-intensive rearing methodologies (large volumes or mesocosms) are able to guarantee wild-like juveniles with a certain uniformity both in seabream and in Senegalese sole.

Certification

After a review of certification procedures at national level, six specific Codes of Conduct for each of the SEACASE case studies were developed. These Codes of Conduct were used as a starting point to build up a proposal for a Joint European Certification System for Products of Non-Intensive Sustainable Aquaculture.

Socio-economics

The socio-economic patrimonial value of aquaculture was assessed over the case study of integrated eel fisheries and oyster refinement, through a patrimonial audit approach. This illustrated the importance of non-intensive aquaculture in maintaining ecosystems functionalities and services supported by the ecosystems in confined and intertidal areas. It also pleaded in favour of maintaining such systems beyond farms' private profitability alone. In the long run it will be less costly to maintain low technology systems, like extensive and semi-intensive coastal aquaculture, than to recover abandon wetlands with previous human intervention.

The Full Report:

For a description of the research project, visit <http://www.seacase.org/>

Next Steps – Suggested Actions/Follow On

The SEACASE consortium identified several needs for further research relevant to the sustainable development of extensive and semi-intensive aquaculture:

- Scientific and technical research should be developed in many specific areas, namely on hygienic-sanitary condition, stress, pain and welfare measurements, quality evaluations in different farming conditions, improved slaughter methods and corresponding rapidity by combination of existent methods (e.g., ice slurry combined with electricity and carbon dioxide; mechanization of simple methods like the percussion) on a wide range of cultured species.
- Welfare of fish reared in semi-intensive and extensive aquaculture, including a list of specific welfare indicators for future extensive and semi-intensive aquaculture certification schemes (e.g., organic aquaculture).
- Comparison of the relative performances of hatchery and wild juveniles, and among juveniles obtained under different larviculture protocols, in different valli. Better understanding of gene networks playing a role in the cold adaptation process is needed, in order to start experimental marker assisted selections (MAS) of cold tolerant fish strains.
- Experimental studies on limiting ichthyophagous birds predation on extensively reared fish emerged, taking into account that almost all extensive productions are carried out in wetlands protected by the Ramsar Convention, the EU Habitats Directive, or the WWF 'oases'.
- Further studies on the optimisation of semi-intensive polyculture fish farming are required, namely in defining the carrying capacity for the different species being farmed, and its relation with the pond geochemistry, while maintaining sound environmental conditions.
- Developing environmentally friendly diets at low cost for semi-intensive farming in earthen ponds should be pursued. To go beyond macro-nutrient composition, the contribution of natural food in ponds to meet vitamin, mineral and PUFA requirements, would need to be assessed.
- Extensive and semi-intensive productions should not only consider marine species that can feed people directly, but also prey species, or species to extract compounds of high added value. Identification of such additional products, and development/refining of farming protocol requires considerable research effort. Their possible production in IMTS is also of obvious interest.
- Patrimonial assessment of all major of extensive and semi-intensive production systems, in order to evaluate and propose mechanisms for supporting farmers whom contribute with non-market benefits to public interest wetlands.

Related Publications/Projects

Scientific Articles

Technical Improvements

Jorge Dias, Luís E.C. Conceição, Ana Ramalho Ribeiro, Pedro Borges, Luísa M.P. Valente and Maria Teresa Dinis (2009). Practical diet with low fish-derived protein is able to sustain growth performance in gilthead seabream (*Sparus aurata*) during the grow-out phase. *Aquaculture*, Volume 293, Issues 3-4, 16 August 2009, Pages 255-262. doi:10.1016/j.aquaculture.2009.04.042

Jorge Dias, Manuel Yúfera, Luísa M.P. Valente and Paulo Rema (2010). Feed transit and apparent protein, phosphorus and energy digestibility of practical feed ingredients by Senegalese sole (*Solea senegalensis*) *Aquaculture*, Volume 302, Issues 1-2, 1 April 2010, Pages 94-99. doi:10.1016/j.aquaculture.2010.02.013

Elisabete Matos, Amparo Gonçalves, Maria Leonor Nunes, Maria Teresa Dinis and Jorge Dias. Effect of harvesting stress and slaughter conditions on selected flesh quality criteria of gilthead seabream (*Sparus aurata*). *Aquaculture*, Volume 305, Issues 1-4, 1 July 2010, Pages 66-72. doi:10.1016/j.aquaculture.2010.04.020

Case-studies

M. Richard, C. Trottier, M.C.J. Verdegem, J.M.E. Hussenot (2009). Submersion time, depth, substrate type and sampling method as variation sources of marine periphyton. *Aquaculture*, Volume 295, Issues 3-4, 16 October 2009, Pages 209-217. doi:10.1016/j.aquaculture.2009.07.005

Quality

M. Cardinal, J. Cornet, C. Donnay-Moreno, J.P. Gouygou, J.P. Bergé, E. Rocha, S. Soares, C. Escórcio, P. Borges, L.M.P. Valente (2011). Seasonal variation of physical, chemical and sensory characteristics of sea bream (*Sparus aurata*) reared under intensive conditions in Southern Europe. *Food Control*, Volume 22, Issues 3-4, March-April 2011, Pages 574 – 585. doi:10.1016/j.foodcont.2010.10.007

L.M.P. Valente, J. Cornet, C. Donnay-Moreno, J.P. Gouygou, J.P. Bergé, M. Bacelar, C. Escórcio, E. Rocha, F. Malhão, M. Cardinal (2011). Quality differences of gilthead sea bream from distinct production systems in Southern Europe: Intensive, integrated, semi-intensive or extensive systems. *Food Control*, In Press, Corrected Proof, Available online 11 November 2010. doi:10.1016/j.foodcont.2010.11.001

Technical Publications

Paulo Vaz-Pires and Sílvia Soares (2008). Optimising Fish Slaughtering Procedures (Technical Manual). <http://www.seacase.org/>

Paulo Vaz-Pires (2009). Slaughtering procedures: fish from extensive and semi-intensive production. <http://www.seacase.org/>