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Intensive farming potential of *Seriola dumerili* (Risso 1810) in Corsica

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SUMMARY – With the longest regional coastline of France (1100 km), Corsica presents particular environmental potentials suitable for marine fish farming. Practically all the required development conditions are present: quality and purity of seawater, protected coastal environments (bays, creeks). The island of Corsica is the only region in France which offers so many possibilities for this industry (Frisoni, 1992). In Corsica, marine fish farming became one of the most important exportation activities (in value terms). It remains the main agriculture sector and needs a faster development. For these reasons, the priorities for developing fish farming in Corsica must be stated precisely. The new finfish species diversification of the aquaculture production, among other research activities, is considered in this article as one of the most susceptible reinforcements of the Corsican aquaculture sector. So, in 1994, the Territorial Collectivity of Corsica studied the possibility of new species rearing (Lensi, 1995). We were specially interested in a specie such as *Seriola dumerili* which grows quickly.

Keys words: Corsica, new finfish species diversification, *Seriola dumerili,* growth quickly.

RESUME – *"Potentialités de l'élevage intensif de* Seriola dumerili *(Risso 1810) en Corse". Avec la plus longue façade maritime régionale de France (1100 km), la Corse présente des potentialités environnementales particulièrement propices pour l'aquaculture marine. Pratiquement toutes les conditions de son développement sont réunies (Frisoni, 1992) : qualité et pureté de l'eau, milieux protégés... La pisciculture marine corse est devenue l'une des premières activités exportatrices (en valeur) de l'île, elle représente l'une des principales filières agricoles de l'île et ne demande qu'à passer à la vitesse supérieure. Pour cela, la filière piscicole corse doit s'appuyer sur une identification précise des axes de son développement. Dans le cadre de notre exposé, nous avons privilégié parmi les différentes activités de recherches susceptibles de renforcer la filière corse, celles axées sur la maîtrise d'élevage de nouvelles espèces. Ainsi, à partir de l'étude réalisée en 1994 par la Collectivité Territoriale de Corse (Lensi, 1995) axée sur l'opportunité de diversifier la filière aquacole corse. Nous nous sommes plus particulièrement intéressés aux perspectives de diversification offertes par une espèce à croissance rapide, telle que la* Seriola dumerili *(Risso 1810).*

Mots-clés : *Corse, élevage de nouvelles espèces,* Seriola dumerili*, croissance rapide.*

Introduction

With the longest regional coastline of France (1100 km), Corsica presents a particular environmental potential suitable for marine fish farming. Practically all the required development conditions are present: quality and purity of seawater, protected coastal environments (bays, creeks). The island of Corsica is the only region in France which offers so many possibilities for this industry (Frisoni, 1992).

In Corsica, marine fish farming became one of the most important exportation activities (in value terms). It remains the main agriculture sector and needs a faster development.

Marine fish farming production has increased greatly over the last few years. It started with one hundred and went up to a thousand tons and gained a value of approximately 50 million francs (including sea and coastal lagoon productions) (Lensi, 1996). Today, it has to face the international market. It is hard competition, therefore, it must improve to be able to survive.

For these reasons, the priorities for developing fish farming in Corsica must be clearly stated. The

new finfish species diversification of the aquaculture production, among other research activities, is considered in this article as one of the most likely reinforcements of the Corsican aquaculture sector.

So, in 1994, the Territorial Collectivity of Corsica studied the possibility of rearing new species (Lensi, 1995). We were specially interested in a specie such as *Seriola dumerili* which grows quickly.

In the first part of this paper, we comment on the selection criteria which are indispensable to the selection of new aquaculture species. Thus, *Seriola dumerili* presents all the required conditions for the diversification of the Corsican intensive fish farming. The second part presents the Corsican aquaculture potentials in regard to introduction of new finfish species. Finally, the last part concerns the development prospects for the rearing of this fast growth species along the Corsican coast.

Selection criteria for a new specie

We must base aquaculture selection of a new specie on a multicriteria analysis according to the following criteria:

(i) Zootechnic performance.
(ii) Socio-economic aspects.

In order to expand the Corsican fishfarming variety and to gain access to a more open fish market, we decided to start research on a fast growing specie such as *Seriola dumerili*. *Seriola dumerili* is a pelagic fish specie, which has a wide geographic distribution: it can be found along the Mediterranean, Atlantic and Indopacific coasts in temperate waters as well as subtropical waters.

Actually, the two most important genus are produced in aquaculture. Important research is being carried out on them, they are *Seriola quinqueradiata* (Temmick, Schlegel 1844) and *Seriola dumerili*. *Seriola quinqueradiata* together with *Seriola dumerili* are the most popular fishes in the Japanese market, with a production near to 200,000 tons (Lensi, 1995), with the same culture technique (Grau, 1992).

In fact, this semi-industrial production is based on the wild fry catch, which can be found abundantly in the natural environment. Rearing is realised on floating or submerged sea cages, these sites are exposed to all weather conditions. Fish food is usually based on low commercial value fresh or frozen fish, adding a vitamin premix (mixture). This rearing represents more than 50% of the weight and about 40% of the value of total cultured finfish in Japan (Nakada and Murai, 1991).

Unlike in Japan, *Seriola dumerili* is the only genus of the Mediterranean coast, and until now, this specie does not exist in industrial culture. In fact, its culture development is limited by some problems which are studied in excellent research centres [Instituto Español de Oceanografía (IEO), Institute of Marine Biology of Crete (IMBC), etc.] throughout the Mediterranean.

The different observations made in the *Seriola dumerili* rearing, allow us to define its zootechnic performance.

Zootechnic performance

All along the Spanish coast, some experiences of rearing *Seriola dumerili* have been undertaken in floating cages (Navarro *et al.*, 1987; Boix *et al.*, 1993) using the same Japanese technology. Rearing the wild fry caught is carried out with food composed of low commercial frozen (–20°C) or fresh fish. The results of this research, show a high growth rate (weight gain superior to 900 g, during a period of 9 months) (Boix *et al.*, 1993) and an important mortality during the winter caused by a pathogenic agent called *Ichthyophonus hoferi* (Navarro *et al.*, 1987).

The principal factors which limit the culture of *Seriola dumerili* are studied at the Institute Oceanography of Murcia by Antonio García's team. The main research topics developed by this team are:

Feeding

The use of artificial granulated feed, such as soft dry pellets (García and Díaz, 1995) increases profitability since it reduces mortality and maintains the growth of the livestock homogenization (García, 1993b). Moreover, different granule compositions are tested and compared (pub. in press), the food conversion rate is approximately 2.3 (Jover *et al.*, 1997). Table 1 (García, 1993a) shows growth comparison at the same age, of *Seriola dumerili* and other aquacultural species.

Table 1. Comparative growth of different marine cultured specie (García, 1993a)

Years	*Sparus aurata* (sea bream)	*Dicentrarchus labrax* (sea bass)	*Scophthalamus maximus* (turbot)	*Seriola dumerili*
1	100-300	150-200	300-500	1000-1100
2	300-400	200-350	1000-1200	3000-3200
3	600-800	500-700	2000-2500	5000-5200

These data confirm the fast growth rate of the *Seriola dumerili.* Compared to aquaculture species, *Seriola dumerili* grow 10 times more than sea bass at the same growth period.

Furthermore, the oxygen consumption of *Seriola dumerili* under culture conditions are shown and analysed. These values are comparable with those obtained in other cultured species (De la Gándara *et al.*, 1997).

Reproduction

Reproduction remains the principal problem, as the rearing of this specie is difficult in Mediterranean countries. On the contrary, Japan has been successful in controlling the reproduction since they used a hormonal injection (García and Díaz, 1995). The reproduction in captivity failed in the Mediterranean countries. Nowadays, in Spain, numerous studies from known analysis of genitals (ovary, testicle) (Díaz *et al.*, 1997; García *et al*., 1997) and endocrine regulation (García-Ayala *et al.*, 1997) of the reproduction cycle in captivity are also carried out on the *Seriola dumerili*.

In fact, the prospects of these experiments can be proved in a short time.

Pathology

The intensive farming development of the *Seriola dumerili* in the Mediterranean has caused a new pathology which may produce important losses in the *Seriola dumerili* culture. Identification of this pathogenic agent makes the research for the appropriate treatment easier. For information, numerous researches are realised and are based on:

(i) *Ichthyophomus hoferi* (Egusa, 1983) is responsible for the significant losses among the experimental rearing in floating cages (Navarro *et al.*, 1987). *Ichthyophomus hoferi* is abundant in the air bladder of the fish (frozen or fresh) used as the food for the *Seriola dumerili*. Nevertheless, the use of the artificial food permits the suppression of pathologic agent.

(ii) *Paradeontocyilix* sp. (Montero *et al.*, 1997), this parasite is responsible for the appearance and development of sanguinicolidosis follow-up in *Seriola dumerili*. It has provoked an important mortality.

(iii) *Heteraxinosi* sp. (Montero *et al.*, 1999), this parasite was found in branchia of several specimens. It can produce important losses on fish culture.

To improve the knowledge in this domain, it is interesting to follow the control of fish disease (use of drugs and vaccines) evolution in the rearing of Japan (Sano, 1998), country selected for this production.

The good performance in captivity culture (García and Díaz, 1995) of *Seriola dumerili* are characterised by:

(i) Acceptance of commercial and artificial food.
(ii) High growth rate.
(iii) Low mortality.

Socio-economic aspects

Seriola dumerili has an excellent quality flesh (texture, colour, flavour...), and presents a double advantage which can be commercialized with two possible aspects:

Fresh product

In fact, prices of *Seriola dumerili* (García *et al.*, 1995) are in the Mediterranean market (Spain, Italy) around 10-20 Ecus/kg, as in Japan 30 Ecus/kg. Moreover, this fish can be sold at every size (García and Díaz, 1995).

Elaborate product

Zootechnical performance and flesh consistency (covered by flexible scales without bones) gives to *Seriola dumerili* excellent potentialities for its transformation. It looks like its neighbour specie, that is to say tuna. This affords the same technical transformation.

Since there is no competition with the French fishing, it is unknown on the market. *Seriola dumerili* could, through, a promotional and commercial policy, enter into mass distribution, either as fresh products or elaborates.

Fishfarming development potentiality in Corsica

Corsica presents natural, economic and structural advantages for intensive fishfarming. This multitude of advantages represents a primordial potentiality to the aquaculture development (Frisoni, 1992).

Natural advantages

Corsica is the only one French location that affords numerous good sites for this kind of activity, however it's evolution may be slow. Unfortunately this delay prevents other sites from being developed.

Site availability

Two laboratories from the University of Corsica have contributed to the research of good sites with the necessary installation of marine farms along the Corsica coast. Thanks to the development of "the decision assistance tools", site selection can be realised (Muraccioli, 1998). It is founded on an fuzzy logic and takes into account, thanks to the assistance of selected criteria, different types of parameters: biological, technical, economic...

This study privileges the search of sites which are protected and semi-protected from bad weather (wind, heavy swell). Hence, places such as gulfs, bays… have been selected as they are convenient for floating cages (industrial or artisanal).

In fact, the fish farm has to live with its environment. The selection of the site for the culture of a marine specie must satisfy several criteria. According to these criteria, each site is compared to the others. The absolute conditions which are necessary, to evaluate the aquacole potentialities of the different sites are based on: (i) thermal profile; (ii) environment; and (iii) human activity.

These three points have been the base of a subjective multicriteria analysis. The criteria are:

(i) Water quality.
(ii) Degree of site protection against bad water.
(iii) Faunistic and floristic wealth.
(iv) Depth and surface to the flat water.
(v) Degree of the accessibility from the land.
(vi) Land status.
(vii) Acces to the airport or port installations.
(viii) Proximity to the touristic activities.

This is a classification method to obtain adapted sites for the installation of a marine farm along the Corsican coastline. This method shows that Corsica has many natural sites which could be competitively exploited.

Geographic situation

Corsica is in the centre of the Mediterranean basin, near most important European important markets (Riera and Lensi, 1995). The opening of the new airlines and shipping lines shorten the transport and reduces the costs of the aquaculture products.

Economic advantages

Corsica has been considered as a development area priority for the European Community. Another advantage, is the implementation of the free zone, since the first January, which proposes an interesting tax system. Besides these economical advantages, we should underline the decision taken by Territorial Collectivity of Corsica.

Structural advantages

The collaboration between research and production is also an advantage. Corsica has a Technology Transfer Center (CRITT) which works closely together with Corsica University. This organization is entrusted to strengthen this co-operation between the research and the professional activities. This center has modern means of communication (Retecor...). It is able to create a network between different French research organisms (IFREMER, INRA...), institutional partners (ADEC, CTC...), professionals and the University of Corsica. Thanks to its flexibility, the CRITT could conduct the "sea" department. Therefore, the Corsican producers will take advantage of this organism and the research work of the research centers too (IFREMER, IEO...). Centers which are everywhere around the Mediterranean.

In fact, it is interesting to strengthen relationships between professionals and different national and international research organisms. Corsica is able to adapt itself to such a network; thanks to its geographic localisation, its structural contribution and its will to exchange information.

Prospect to the *Seriola dumerili* development

With the culture techniques used for the sea bass and the sea bream, it is interesting to elaborate an experimental project of the *Seriola dumerili* culture around Corsican coastline. This experimental tool will help to define:

(i) Suitability of the Corsican environmental conditions (temperature profile) for the optimal requirements for a good *Seriola dumerili* growth.

(ii) Assessment of the break even point in the natural environment for this culture.

(iii) Implementation of a cooperation between the Corsican professionals, the University of Corsica, the CRITT and the different research centers of the Mediterranean.

In this more competitive context, the Corsican area has a several important advantages for this development. These parameters give Corsica a favourable position with regard to the other French countries. The Corsican fishfarmers are principal pioneers of the development of this activity in the Mediterranean. The conception of an ambitious regional program based on priority axis, such as the diversification program affords the Corsican production to establish both quantitative and qualitative requirements to meet the demands of the market. The Corsican fish farming area is changing its direction, it will strengthen its place in the main export activities of the island.

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