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Aquaculture and environment from the perspective of a Spanish fish farmer

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SUMMARY – The Spanish marine aquaculture industry is here described as a new emerging industry, although with a sound background from the trout and mussel production industries. Its impact on the environment is considered not negative and even positive provided a good production and environmental management system is undertaken. A comparison with other industries such as fisheries and other human activities is here described, activities better socially accepted but in some cases more harmful for their negative impact on the environment. The necessity for a well scientifically based regulation by the Environmental Authorities is here stated.

Key words: Aquaculture, environment, marine fish production.

RESUME – "L'aquaculture et l'environnement du point de vue d'un pisciculteur espagnol". L'industrie de l'aquaculture marine en Espagne est décrite ici comme une nouvelle industrie émergente, bien que solidement appuyée sur les acquis des industries productrices de truites et moules. Son impact sur l'environnement est considéré non négatif, et même positif à condition de mettre en place un bon système de production et de gestion environnementale. Une comparaison avec d'autres industries telles que les pêcheries et d'autres activités humaines est présentée dans cet article, activités qui sont mieux acceptées socialement, mais qui parfois sont plus nuisibles en raison de leur impact négatif sur l'environnement. Il y est reconnu la nécessité d'une réglementation bien fondée scientifiquement, édictée par les Autorités Environnementales.

Mots-clés : Aquaculture, environnement, production piscicole marine.

Introduction

The main aim of this article is to show with practical experiences the interactions between Aquaculture and the Environment, in a developed country such as Spain, always bearing in mind the farmer's point of view within the context of legal and practical aspects.

The dimension of Spanish aquaculture today is shown in Figs 1 and 2.

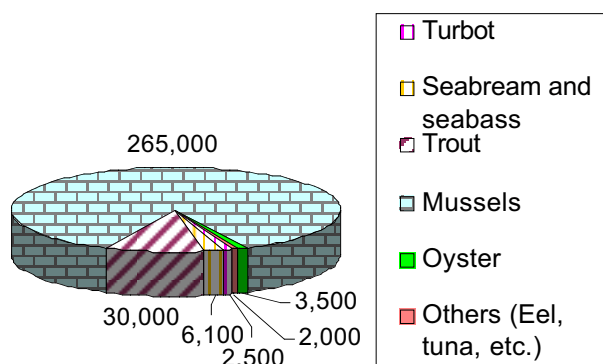


Fig. 1. Spanish aquaculture production in tonnes (1998).

The authors' working experience is more related with fish production, in marine and fresh water fish farming. Mussel farming is the most important type of culture in terms of biomass and the social importance of the industry in Spain, and a close observation of its evolution has led to a different way

of approaching the environmental issues in comparison with the rest of the new aquaculture industries.

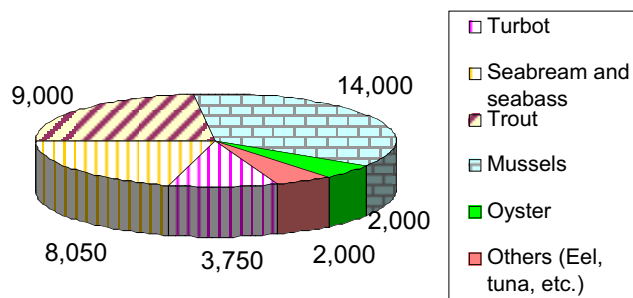


Fig. 2. Spanish aquaculture production in value (million pts) (1998).

The magnitude of the impacts generated by aquaculture are measured in comparison with other human activities. Thus many of the problems that have arisen have been mainly originated by the weakness of the industry itself, that has prevented the producers from dedicating enough effort to improve its image, as other industries have done. For instance, the fisheries industry, where basically many actions are considered to have a serious impact against the environment, is an industry that is widely socially accepted.

The long-standing fisheries tradition allows the fishing vessels to be based in harbours located precisely in the middle of coastal settlements, sites that are generally highly polluted. Traditionally the fishing activity itself exploited the environment with little order and lacked a forecast for the future, although the different Fisheries Authorities, and today some fishing organisations, are making big efforts to organise the fish catches.

These characteristics, together with the special case of Spain, where the number of traditional fishing grounds has been reduced in recent years, have originated a fishing fleet capacity above the available fishing catch within the allowed fishing areas. This situation could be a potential threat to the coastal flora and fauna.

However this Spanish traditional fishing industry has been the base of a very important fish consumption rate per person. Due to the crisis of the Spanish fishing industry and its decrease in catches, our fish consumption today is based on catches of foreign fishing fleets. Despite the fishing activity not being basically environmentally friendly, it is well accepted socially. And moreover, a large percentage of public funding is dedicated to its maintenance.

The high level of fish consumption in developed countries and the limitations of their fishing grounds leads to the exploitation of the fish resources of developing countries, where it is less regulated. Globally speaking, we could say that "it is better/easier to organise fishing activity in developed countries where an environmental awareness exists".

As follows, if the human population only 20 years ago was of 4000 million people, and is currently of 6000 million, and the number continues to increase at the same time as its cultural and purchase level. It is absolutely clear that the supply of fish products will have to be of aquaculture origin.

Thus, we must increase our knowledge in order to be able to organise the activity in a sustainable way, but this must be done with some urgency because of the rising demographic rate and consumer demands, as any delay would mean shutting our eyes to the reality of an excessive exploitation of the resources in far countries.

When speaking about the environmental impacts of Aquaculture, it is very important to do so whilst also considering the impacts of other industries and various human activities. It is important to highlight that aquaculture, being a biological activity, requires good environmental conditions for its

development. That links its development with clean areas where all the Environmental Authorities are concentrating their protective efforts.

Historic review within the Spanish trout farming industry since 1970

In only 30 years Spain has moved from a situation where it was possible to drink from most of the freshwater courses available within the Spanish geography to the current situation where it is only advisable in remote areas. These areas are specifically where the fishfarms are located, with the problems linked to managing the natural environment.

Most of the Spanish fish farms were set up using spring water together with the river intake to guarantee enough good quality water throughout the whole year. The summer period, that is as important for a climate such as the Spanish one, was the limiting factor of production. The evolution of the industry itself, and mainly due to the constant pressure of the sales prices, made the industry change its structure.

During the development of the trout farming sector serious problems related with pollution from other sources have occurred. This has caused the closing down of many fish farms that were not located at the upper part of the rivers, and besides there have been cases where the spring itself has been polluted by pesticides and fertilisers. Thus the trouts' need for a constant high water quality, has been a permanent indicator of the river water quality. The historical problems of damages caused by pollution or changes in river characteristics have always been caused by pollutant and polluting industries, and the Environment Authorities efforts have not been effective in these trials.

Due to the above situation and the lack of legal instruments, the existing Environmental Authorities at those times, developed different laws and regulations, sometimes very quickly and also very restrictively, leading the owners of trout concessions to be charged very high sums of money, yet a proportional effort was lacking in the maintenance of the river water quality in the trout farms intake. The use of these regulations, due to the knowledge that the water is a limited good, led to the closing down of many facilities, that if they had been working today, could have been a witness of the river water quality.

As an example 20 years ago in Spain, a fish farm with a production of 150 t per year was asked by the authorities to pay a fee for the water it used, similar to a Nuclear Power Station with a production capacity of 5% of the total Spanish energy production. That power station with an open water circuit consumed 800 l/s, the fish farm using 100 l/s (the water is not consumed in this case).

The existing rule for trout farm waste water is to use a settling pond for water treatment with a surface equivalent to 10% of the production tanks, the water outlet will have to be within certain limits and these parameters are checked periodically. The farmers pay for the difference in the parameters between the inlet and the outlet. There are some limits for the dry season where the farmers can use only a predetermined water flow from the river. This is called "ecological water flow".

Nowadays, after some decades and conflict between the fish farms and the Authorities with responsibilities in water management, the situation is becoming reasonable. However, new environmental regulations arise and are a permanent threat to fish farms, as they are more focused on and specific to small effluents with a high pollutant load, and not for the high volume with little organic solids related with aquaculture.

Environmental impact project for turbot farming in the 90s

Turbot production in Spain is very recent and started to reach an important production level in 1986. Therefore there are no historical figures that could help to make future decisions.

In general turbot farms are located onland, that pump a large volume of water aiming to create the adequate water quality and environment for the production of this fish species. These onland farms are generally located in fairly exposed coastal sites, where wave frequencies are high, thus without large settlement of debris from the farm activity, as the organic matter is periodically flushed away

allowing the ocean system to digest it. To be able to dimension the digesting capacity of the open sea, it would be interesting to point out a natural process, the summer growth of the sea weeds (Laminaria especially), that in the first autumn gales are pulled and washed towards the beaches by the waves along the coast, thus originating tons and tons of organic matter that in a few weeks are completely digested and assimilated by the sea.

This is precisely one of the advantages of the land sites, in comparison with the floating cages; they can pump water in continuous movement and ocean water quality. Therefore it allows the effluent to be only a few meters from the water intake.

The environmental regulation for these farms is currently being developed and is facing similar problems to those already encountered by the trout farms. As the criteria used have been designed for domestic and industrial effluents, regulations have not focused specifically on this activity and this particular type of effluent. But the problems will have to be solved as they arise due to the lack of previous planning.

Environmental impact projects for cage farming in the 90s and their recent evolution

Cage farming is a recent activity in Spain. There are some cage farms in lakes and some bays in the North of Spain, but enough big projects have not been developed to provide a history of these farm systems.

The first important projects were set up in the Mediterranean coast, farming bass and bream. It is true that Spain is one of the main tourist destinations in the world, and tourism is becoming one of the main industries along our coast. For this reason the first projects found problems from competition with tourism.

Aquaculture in Spain in the 1980's initially represented a solution to the problem of the reduction of international fishing areas, and its development started with a good social image thus making the first attempts from a very positive point of view.

It is clear that the upper structure of the cages affects the traditional appearance of the sea, as these structures are completely new, they stand out and did not exist until this date. However, it is interesting to mention that in Galicia, where around 3500 rafts have existed since the 1950's, the rafts are viewed as part of the landscape.

The development of the cage farms in Spain has typically taken place in sites very exposed to the sea waves in comparison with the places where these cultures started, within the bays and islands of the Aegean Sea, where the farms were located in very sheltered sites. It is for this reason that the Spanish farms have been more robust right from the beginning as there are very few bays available for the development of aquaculture.

All these facts bring about consequences. For offshore sites the investments and risks are greater, but at the same time water movement and renewal is higher, thus improving the culture conditions for the fish and reducing the environmental impact in comparison with in-shore sites.

In relation with the existing environmental regulations, the situation has been similar to the trout farms. The activity has not been carried out on a big enough scale to have a specific regulation, and since the beginning of the 90's, the sector has been affected by a large number of different regulations designed for other types of activities. Concerning the farm activities, these regulations do not clearly define the impacts generated, as the really important parameters are still unknown. For this reason when a parameter shows that the farm is in operation, it is given a high relevance. In particular there is much concern about the Posidonia, protected species of a weed characteristic from oligotrophic waters and sensitive to the entries of organic matter, and which can be affected by the operations of an aquaculture farm.

Again it is convenient to relate the impact of aquaculture farms with the impacts of other activities, i.e. fishing, untreated underwater effluents or the construction of harbours. For example, aquaculture

farms affect *Posidonia* prairies less than the other activities. At present, following a few negative experiences with the *Posidonia* prairies below cages, there is a general rule for permits which stipulate that there should be a minimum distance to the existing *Posidonia* prairies. The fish farmer is under the impression that more pressure is placed on his sector than on others due to it being a new-born activity and thus weaker than others mentioned above.

In the environmental monitoring programmes designed by the different Authorities, it would appear that any negative aspects are sought as indicators. For instance and with few exceptions, no global studies are being undertaken which could assess the positive and negative effects, and no monitoring is made of the management system of the farm, that is vital to be able to make forecasts.

The farms specifically generate a wide amount of life around the rearing area, with a huge variety of many types of organism, from microinvertebrates, to fish and even to abundant bird colonies. In many cases the Environmental Authorities do not even analyse this type of impact. The case of the fish farms in the marine marshlands, that constitute the main attraction for many species and that promote very interesting animal communities is particularly interesting. The old salt works are a similar case in many Mediterranean areas, and by flooding wide areas considerable populations of flamingos, etc. are attracted. However in some cases Environmental Authorities do not always see these positive aspects and attempts to develop aquaculture in these dry salt works, that would generate life again, are opposed for environmental reasons.

Finally, as there are no clearly defined criteria or objectives to evaluate and follow the impacts of aquaculture, great confusion has been created leading to the situation that each office for the different Spanish regions uses a different criterion. This causes serious problems, as these environmental reports are being used politically, and in some cases are creating tremendous confusion to the public opinion that can seriously deter the development of aquaculture on and off our coasts.

The production sector, together with the Administration, have undertaken several actions to progress in this direction. The first of all has been the "White Book of Spanish Aquaculture", that has been a comprehensive review of the complete sector with a whole chapter dedicated to aquaculture and the environment. Along the same lines, the Fundación COTEC book about the Technology Developments Requirements for Aquaculture, although independent in itself forms part of this effort.

The production sector through its Association of Marine Aquaculture Producers (APROMAR), has agreed to follow a Code of Conduct developed by the European Federation of Aquaculture Producers (FEAP) to settle the best practices of production aiming to achieve a sustainable industry.

Main concerns in Spain related to the environmental impacts of aquaculture

The main concerns in Spain related to the environmental impact of aquaculture and the main interactions are shown in Table 1.

Aquaculture management tools

There is a big difference between the well-regulated mature aquaculture industries like the mussel farming and trout farming, and the new industries which are appearing such as cage farming or land based farming along the coast. At the moment, the technology for appropriate management of the cage farms and the other type of aquaculture thus minimising the impacts to an insignificant degree does not exist.

The management tools for allowing sustainable development are included in Table 2, and are the main conclusions from the very recent Spanish aquaculture white paper, the main conclusions being at the implementation stage.

Table 1. Interactions and environmental aspects

Main farms interactions with:	Environmental aspects
Water and sediments	Big water flows use from rivers Ecological water flow during the dry season Sediment accumulation Water quality
Zoosanitary aspects	Resistance to antibiotics Medicine toxicity Disease transmittance Transgenic animals
Other users	Creating jobs in remote areas Visual impacts Noises, bad smell Wastes
Tourism	Visual impact Sport navigation
Wildlife and natural habitats	Ecosystems variations Endangered protected species
Escapees from farms	Hybridisation with wild strains Spreading diseases
Fishing	Navigation obstacles Fisheries market competitors
Fish oil and fish meal	Overfishing in third countries

Table 2. Management tools

Site selection	<ul style="list-style-type: none"> • The key for the farm success • It is basic to make long-term plans
Farm management	<ul style="list-style-type: none"> • Personnel trainee • Feeding and handling techniques • Waste treatment • Emergency procedures for accidents
Disease control	<ul style="list-style-type: none"> • Prevention strategies • Creating public organisms for diagnosis, treatments and disease monitoring centres • Medicines lists
Fish escapees	<ul style="list-style-type: none"> • Management of the farms • Potential sterilisation of farmed aquatic organisms
Coastal planning	<ul style="list-style-type: none"> • The future aquaculture development, need to be designed
Environmental impact evaluation	<ul style="list-style-type: none"> • The basis should be designed for the Public bodies • It should be constant for the whole industry
Monitoring the farms	<ul style="list-style-type: none"> • It will have to be the basis for the modelling and future planning
Modelling	<ul style="list-style-type: none"> • It will have to be designed for each area

Conclusions

(i) Aquaculture is a well-proven environmentally friendly industry, and the technology for developing a sustainable industry with minimum impacts does exist.

(ii) The development of aquaculture along the Spanish coast, the weakness due to it being an infant industry and competition with other existing interests, is affecting the image of the sector creating some specific problems with public opinion.

(iii) Aquaculture activity is no longer an activity regulated with a centralised body in Spain. We have 17 different regulations, one for each autonomous community.

(iv) Spain is developing the environmental laws. Aquaculture, which is based on the more remote and cleaner areas, is suffering continuous new environmental laws, where the activity is not considered specifically.

(v) Aquaculture permits are issued with a lot of non-precise environmental conditions that are creating insecurity among new investors.

(vi) The environmental impact projects are not precisely designed for aquaculture purposes, this creates uncertainties and are giving rise to many doubts for the regional authorities, that generally are not experts in aquaculture.

(vii) It is a general opinion that the future of Spanish aquaculture is of strategic importance and a future strategic plan is hoped to be prepared in the near future.