

3rd EAST-WEST Fisheries Conference

24-26 November 1998 Copenhagen, Denmark

Trends in Freshwater and Marine Aquaculture

ABSTRACT

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The demand for fish products, from freshwater and from the sea, is globally increasing all over the world. This major trend can be explained by the development of mankind, not only in quantity (one billion people more in the last 15 years) but also because food consumption habits are changing: for southern countries, fish products consumption is first a diversification of protein sources. For northern countries, it is a new style of eating with diet, tasteful and original products coming from the attractive « new frontier » symbolised by the sea. Globally speaking, the aquatic product consumption raised from 9 to 13 kg./unhab./year during the last 30 years.

It is now clear that catches from all fisheries cannot match this steady increase of the demand as data collected from all countries reveal the stagnation of the world production since the beginning of the nineties. The reasons are now well-known: over-capacity of fishing fleets, over-fishing of many stocks, poor management of harvested species which results in about 20 millions of tons of waste while the same amount is processed into fishmeal and oil, out of direct human consumption.

The only way to face this gap is aquaculture. In 1996, world aquaculture production represents 26 millions tons without algae, which is 21 % of the total landings of aquatic products (120 Mo T.). The proportion was 8 % only, ten years before, for similar fishery catch. This evolution is a very general trend.

This activity has very ancient roots, in China for carps or in Egypt for tilapia. Therefore, it is logical to record the two third of the world production from freshwater: mainly Asian carps up to 10 millions tons, then tilapia, catfish, trouts and numerous freshwater species.

The rearing of marine species is now developing rapidly: the best example is given by salmon, which production reached 4.000 T from 4 countries in 1980, and scores at 700.000 T. from 15 countries in 1997. Besides well-known productions like yellowtail or japanese seabream, new species are raised successfully today: mediterranean seabass and seabream (up to 70.000 T. in 1997), various flatfishes, tuna, dolfinfish, groupers, pompanos, etc. The main producers in aquaculture are in Asia: China, India, Indonesia, Philippines, Thailand, Japan and South Korea. In the Western hemisphere, the United States, France and Norway play an important role in salmon industry or in shellfish production. Thanks to the combination of an international market, the availability of new species and new technologies and numerous favourable sites, more and more countries may become significant producers in aquaculture in a quite short period of time: Ecuador for shrimp, Chile for salmon, Greece for seabass and seabream are recent and clear examples of this capacity to establish a new sector of activity in a decade.

Various prospective studies foresee that aquaculture will reach the level of fishery catch within the next 25 years. However the predictable shortage of fishmeal, necessary component of most aquaculture diets, will have to be solved through the research of plant substitutes.

Development constraints are numerous, because the strong pressure of human activity both on rivers and on the seashore: town expansion, irrigation, flood control, power plant cooling, industry, mass tourism, etc. This has to be combined with the protection of several areas of ecological interest.

In the same time, consumers are asking for a greater choice of fish products and a perfect sanitary reliability. These two main constraints will determine the characteristics of future aquaculture.

Inland aquaculture will progress still, with more and more intensive systems of rearing. The scarcity of good quality water involves to develop recirculation systems using high technologies to secure production and water quality. In the same time, extensive systems may be used in some areas where aquaculture remains compatible with a rich natural life such as the « valli » in Italy or the mullet production in the great brackish water lakes of Egypt.

*Marine aquaculture will expand through several systems: first, offshore cages offer a huge potential with a limited and reversible impact on environment; second, recirculated intensive inshore farms can propose fresh sea products, close to inland main towns or supermarkets hubs; finally, aquaculture may become one of the major activities in the management of coastal areas including scuba diving tourism, notably with the great potential of three recent technologies, mainly developed in Japan and in some Northern countries: artificial reefs, sea ranching and stock enhancement. Aquaculture has a great potential, as its development takes into account three key-factors: the world market demand for **attractive, diverse and safe products**, the adaptation of a **great diversity of technologies** to sites and social environment, and finally the integration of this activity in fragile and already developed areas, as **one of the major elements in global coastal and rivers management.***

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N.B: This study had been enriched and improved by the management team of the department of Aquaculture, located in the Ifremer research centre of Nantes, France.

Introduction

The demand for aquatic products, from freshwater and from the sea, is globally increasing all over the world. This major trend can be explained by the development of mankind, not only in quantity (one billion people more in the last 15 years) but also because animal proteins consumption is increasing. In this general trend of proteins consumption, the share of aquatic products has been raising from 9 to 13 kg./capita./year during the last 30 years. For southern countries, fish products is an important complement of protein sources. For northern countries, it is a new style of eating with diet, tasteful and original products coming from the attractive « new frontier » symbolised by the sea.

It is now clear that catches from all fisheries cannot match this steady increase of the demand. Indeed, data collected from all countries reveal the stagnation of the world production since the beginning of the nineties. The reasons are now well-known: over-capacity of fishing fleets, over-fishing of many stocks, poor management of harvested species which results in about 20 millions of tons of waste while the same amount is processed into fishmeal and oil, out of direct human consumption.

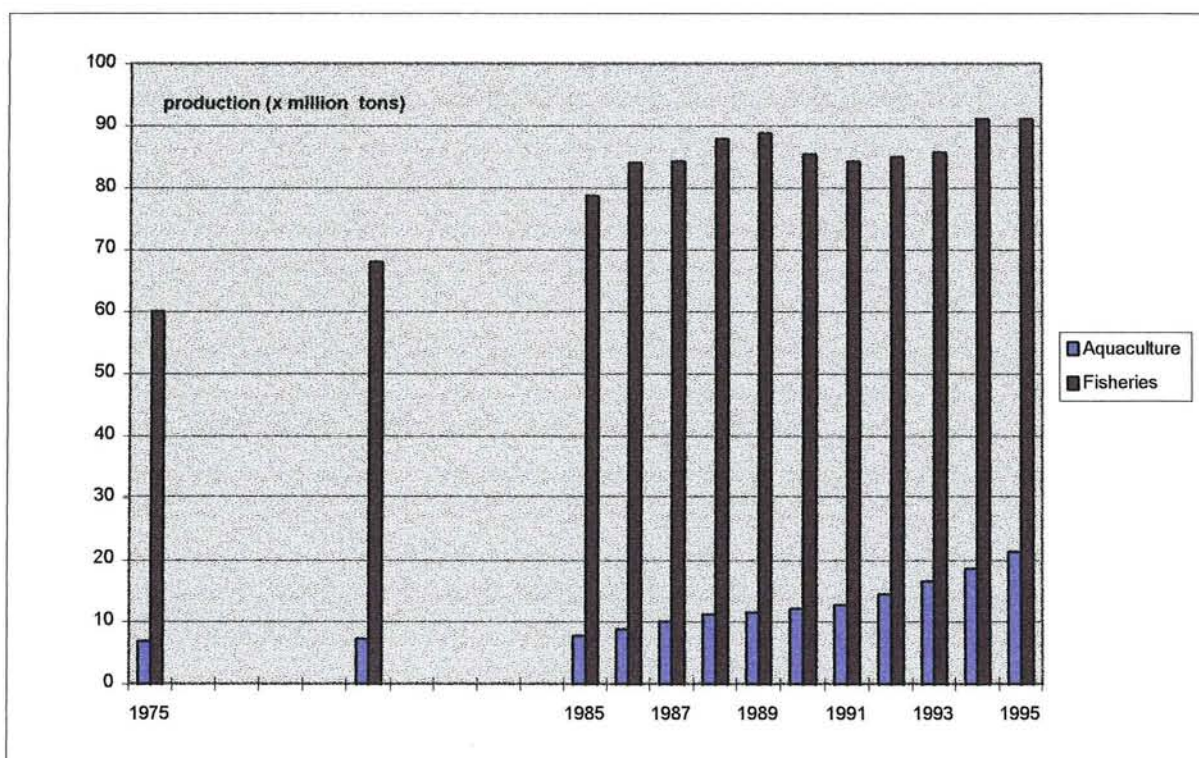


Figure 1: Compared evolution of world fisheries catch and aquaculture production (without algae) from 1975 to 1995 (FAO, 1995)

1. Aquaculture

The only way to face this gap is aquaculture In 1996, world aquaculture production represents 26 millions tons without algae, which is 21 % of the total landings of aquatic products (120,6 Mo T.). The proportion was 8 % only, ten years before, for similar fishery catch. This evolution is a general and steady trend.

The main producers in aquaculture are in Asia: China, India, Indonesia, Philippines, Thailand, Japan and South Korea. In the Western hemisphere, the United States, France and Norway play an important role in salmon industry or in shellfish production.

This activity has very ancient roots, notably in China for carps. Therefore, it is logical to record the two third of the world production from fishes and 57% from freshwater.

Considering the world production of the various groups of species, FAO statistics give 17 millions tons of raised fishes, 8 millions tons from reared shellfish and 1 million tons from cultured crustacean, plus 7,7 millions tons of algae.

In the fish group, the weight of carps and cyprinids is huge as it is related with traditionnal Asian carps production, up to 10 millions tons, then tilapia and catfish in freshwater. In marine water, salmonids and numerous new species have to be taken in account.

For Asia, several species of **carps and cyprinids** belong to traditionnal food of billions people. This can be explained by the complementarity of carp rearing to rice culture, with different levels of intensification: The first level is traditional rice fields with a deeper collect area for selective or complete fishing. Carp culture can be also combined with other animal production, such as poultry, or it can be intensified in floating cages, for example in dams lakes. This entails the steady increase of carp production all over Asia.

Tilapia is also a very ancient and traditionnal culture in Africa. Thanks to recent progress in selection, a very simple rearing technology and numerous niche markets, this culture is expanding in a great number of countries.

The American catfish is an excellent example of a good mix of favourable factors for development: First, the availability of cheap and suitable sites in the declining american cotton belt, second, a well adapted animal raised with good quality infrastructure and technology, third, existing and experienced agro-industry with ready-to-use processing plants, to prepare a great variety of attractive products; finally, an excellent marketing effort with a cheap and original product adapted to the american consumer. All these reasons explain the remarkable development of this new sector of aquaculture in the deep South of America mainland. Today, this regional product is well known all over USA. Similar species could be raised successfully in Europe as an existing demand is available for this type of product.

The rearing of marine species is now developing rapidly: salmon, seabass and seabream show to be the most dynamic species in this general trend

The most spectacular development is **salmon**, which production started in 1970, reached 4.000 T from 4 countries in 1980, and scores at 700.000 T. from 15 countries in 1997. The keys for such a success are classical: abundance of favourable sites in Northern Europe and in Chile, the sister country of Norway at the antipodes, An active research especially in strains selection, feed efficiency and pathology prevention, a permanent effort in worlwide marketing and in the value-adding of quality.

Besides well-known productions like yellowtail or japanese seabream, new species are raised successfully today, notably the **mediterranean seabass and seabream**, which rearing started in France in the eighties and involves all mediterranean countries today with an expected production of 85.000 T. this year.

All these new attractive products are exported in all European countries with two main flows: Salmon from Norway to the European Union and seabass and seabream for the profitable italian market.

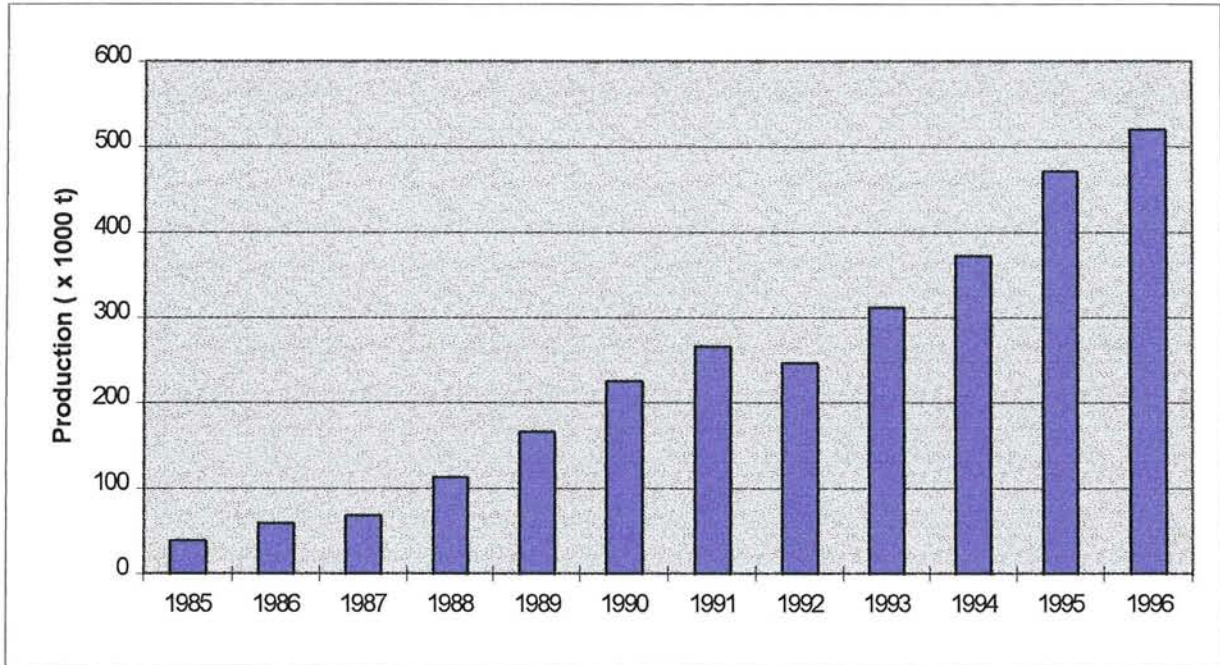


Figure 2: Production evolution of atlantic salmon in Europe from 1985 to 1996

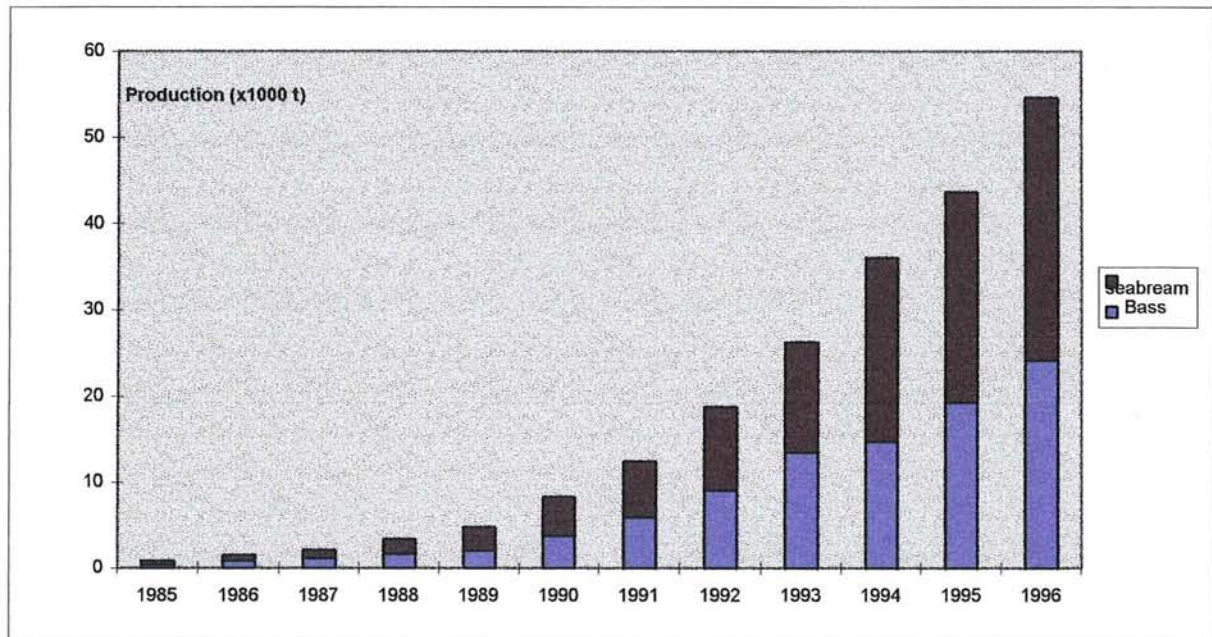


Figure 3 : Evolution of seabass and seabream production in Mediterranean countries from 1985 to 1996

Molluscs culture reached the level of fisheries in 1994. Due to the open system of rearing, this type of production is directly related with the quality of coastal waters. The growth and the sanitary status of molluscs are depending on the whole watershed activity which implies several risks, notably for various anthropic pathologies. This explains why different technologies have been tried to secure a more stable and reliable environment. This explains also why the total production is levelling today also demand is still increasing.

Among the crustacean group, the shrimp development is an interesting success story. It started in favourable places, mainly in Latin America, for the American market, and in Asia, mainly for the Japanese and the European markets.

Rapidly, huge industrial farms played an significant role in the international market. But poor sanitary practices entailed several pathologies in Taiwan, Ecuador and Thailand. This led to a slower pace of development and mechanically, to higher prices, which demonstrates that the pressure of international demand on supply, whatever its origin, fishery or aquaculture, was high and permanent.

2. Market and prices

This stabilization of prices, after a clear reduction related with an industrial production, can be observed for several productions. It may be considered as a « law », with three successive phases: the pioneering phase with few entrepreneurs, the development phase with an increasing number of investors and decreasing prices and the restructuration phase, during which only best performers remain profitable.

Successive cycles with different species may be evolving at different stages. The capacity of prospective is an advantage in this case. **Various prospective studies foresee that aquaculture will reach the level of fishery catch within the next 25 years.** However, the predictable shortage of fishmeal, necessary component of most aquaculture diets, will have to be solved through the research of plant substitutes.

It is interesting to notice that the time required to develop a new species production from 100 tons to 40.000 tons is reducing: 19 years for japanese seabream in the seventies, 16 years for salmon in the eighties, 11 years for mediterranean seabass and seabream in the nineties.

Similarly, more and more countries may become significant producers in aquaculture in a quite short period of time: Ecuador for shrimp, Chile for salmon, Greece for seabass and seabream, perhaps Australia for Tuna in the next decade. Indeed, shrimp industry is now the second source of income for Ecuador, just after oil export but before banana production. In Greece, marine aquaculture fish export represented 200 millions US \$ last year, although this activity didn't even exist 10 years before.

3. Key-factors for development

The criteria for successful aquatic farming are parts of a complex puzzle: a good existing and potential market, the availability of new species and adapted technologies, favourable sites, precise institutional framework and the support of research and development institutes.

Market knowledge is essential: for example fresh fish market represents 70% of the total market in Italy and only 46% in France; Other example, the frozen fish market weights 28% in Spain but 6% only in Italy...Suspicious to meat since the « crazy cow » crisis, consumers are asking for a controlled quality of products and a perfect sanitary reliability.

New species and technologies are actively screened today by several private and public research centers.

A reliable and precise **institutional frame** plays also an important role as it secures investors.

Finally, **the sustainability of environment** has to be considered since the beginning of the development project, otherwise, backlash pathologies are predictable.

Development constraints are numerous, because the strong pressure of human activity both on rivers and on the seashore: town expansion, irrigation, flood control, power plant cooling, industry, mass tourism, searade infrastructures, etc. This has to be combined with the necessary protection of several areas of specific ecological interest.

4. Potential

Inland aquaculture will progress still, with more and more intensive systems of rearing. The scarcity of good quality water involves to develop recirculation systems using high technologies to secure production and water quality. In the same time, extensive systems may be used in some areas where aquaculture remains compatible with a rich natural life such as the « valli » in Italy or the mullet production in the great brackish water lakes of Egypt.

Marine aquaculture will expand through several systems: first, offshore cages offer a huge potential with a limited and reversible impact on environment; second, recirculated intensive inshore farms can propose fresh sea products, close to inland main towns or supermarkets hubs; finally, aquaculture may become one of the major activities in the management of coastal areas including scuba diving tourism, notably with the great potential of three recent technologies, mainly developped in Japan and in some Northern countries: artificial reefs combined with offshore farms, sea ranching and stock enhancement. This is not pure imagination. Each year, Japan releases about 35 billions juveniles of 30 different species and set about 10.000 hectares of artificial reefs in various places. Several european countries like FRANCE or SPAIN are developping programmes in that field.

Conclusion

Aquaculture has a great potential, as much as its development takes into account three key-factors: the world market demand for **attractive, diverse and safe products**, the adaptation of **a great diversity of technologies** to sites and social environment, and finally the integration of this activity in fragile and already developed areas as **one of the major elements in global coastal and rivers management.**

Today, and moreover in the near future, aquaculture development offers to Man the opportunity to create a new resource if he is able to respect Nature sustainability. This is clearly its own interest.

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