Status of aquaculture in Italy (1998)

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Status of aquaculture in Italy (1998)

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SUMMARY - The data reported in this article describes aquaculture production in Italy with particular regard to: evolution of mussel, freshwater and marine fish production over the period 1983-1997; farmed species and applied technology; fingerling production and emerging hatchery technology; new finfish species candidate for aquaculture diversification. Strategies and constraints for the future development of aquaculture are also summarised.

Key words: Aquaculture production, farming techniques, diversification.

RESUME *- "Situation de l'aquaculture en Italie (1998)". Les données rapportées dans cet article décrivent la production de l'aquaculture en Italie, avec une considération particulière à : l'évolution de la production de moules, de poissons d'eau douce et marine pendant la période 1983-1997; les espèces cultivées et la technologie appliquée; la production d'alevins et la technologie émergeant de l'écloserie; les nouvelles espèces de poisson candidates au processus de diversification de l'aquaculture. Sont aussi analysées les stratégies et contraintes pour le développement futur de l'aquaculture.*

Mots clés*: Production de l'aquaculture, techniques de cultivation, diversification.*

Introduction

Fish consumption in Italy accounts for 24.5% of all animal protein consumption for food, and demand has been constantly rising for the past 10 years. National production covers 55% approximately of consumption while 44% is imported in various forms.

In 1995 national fish production (including capture fishery and aquaculture) amounted to 825,700 t and domestic consumption was estimated at 1,321,500 t. Imports stood at 600,000 t and exports at 104,000 t. The trade balance was negative of about 1,477,400 ECU. With an output of 262,700 t aquaculture accounts for about 50% of total fish production (ISMEA, 1997). Aquaculture and fisheries do not affect as importantly as if compared to GNP. On the contrary these activities play a crucial role in the coastal zone economy employing more than 44,500 people in fisheries and 15,000 in aquaculture.

Evolution of aquaculture production and recent trends

Aquaculture in Italy is characterised by the farming of a wide range of different species and applied technologies owing to the diversity of available sites. Its development should be historically and geographically divided in two main production practices. The first one regards the coastal lagoon management, from culture-based fisheries to valliculture; the second one, started after the second world war in the continental regions, following the modernisation process that accelerated trout farming at world level.

Aquaculture production in 1997, by grouping the cultured species and the rearing techniques, is summarised in Table 1. Time series of aquaculture production (1983-1997) for freshwater fish are shown in Fig. 1 and for euryhaline finfish species are shown in Figs 2, 3, 4 and 5.

Italian aquaculture production has been characterised by a strong increase in output over the last decade (Ingle, 1998). Total production level rose from 100,000 t in 1986 to 243,700 t in 1997, with an increase of 143.7%.

Table 1. Italian aquaculture production (in mt) and correspondence value (US$) in 1997

Species	Intensive production	Extensive production	Total production	Total value (x1000)
Seabass	4,000	600	4,600	36,800
Seabream	3,100	800	3,900	28,971
Sharpnout	200		200	1,257
Mullet		2.900	2,900	11,160
Eel	2,700	400	3,100	32,743
Trout	51,000		51,000	116,571
Cat-fish			800	3,200
Carps			700	2,400
Sturgeons			500	3,428
Other fish			1,000	6,743
Total fish			68,700	243,273
Mussels			130,000	58,857
Manila clams			40,000	91,429
Total shellfish			170,000	150,286
Gracilaria *spp.*			5,000	1,714
Total			243,700	395,273

Source: ICRAM (1998)

For the species groups, mollusc are the faster growing category for production volume and the prevailing group over the period, with an increase (153%) justified by Manila clams production and the allocation of all mollusc production in a single statistic item. Among finfish, freshwater is the second group in terms of volume and had a fast rise, moving from about 25,000 t in 1986 to around 51,000 t in 1997. The increase (over 104%) is mainly due to rainbow trout production.

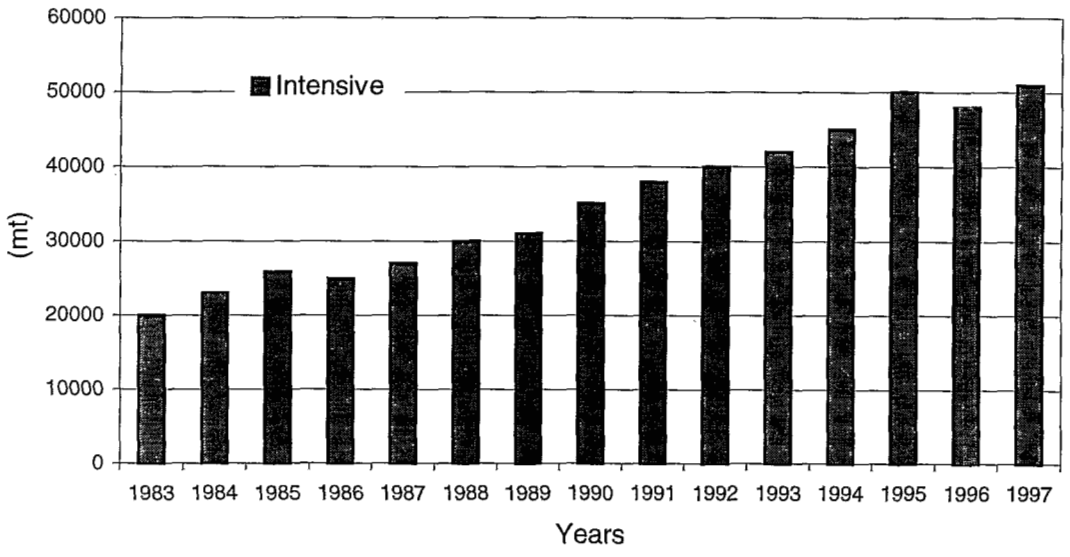

Fig. 1. Evolution of trout production in Italy from 1983 to 1997.

Euryhaline finfish production increased over 66% in the last decade, following a common Mediterranean trend. Total production doubled from approximately 8,700 t in 1986, with mullets and eels as dominating cultured species, to 14,500 t in 1997, accounted for more than 60% by sea bass and sea bream.

The total value of aquaculture production, estimated by transforming the value of Italian lire into US$ using the prevailing exchange rate for each year, accounted for US$293 million in 1991 and increased to approximately US$395 million in 1997. The most important groups in terms of value of production were molluscs (37%), followed by trout (34%). Over the period, aquaculture production value increased six fold more (about 69%) than production volume (10%), mainly for marine finfish species production increases, especially sea bass and sea bream that are the faster growing category in terms of production value.

At present the real trend of Italian aquaculture development is the increasing product of marine species, both mollusc and finfish. The growth of aquaculture production is mainly due to the mastering of seed production techniques for sea bass and sea bream and to the application of new farming technologies. For intensive farming, traditionally land based, limiting factors related to environmental impact and the lack of lands due to intensive use of coastal areas stimulated the development of offshore systems. Mussel's production followed the same trend. National and EU financing of infrastructures largely contributed to the technological optimisation of existing plants as well as the start-up of new facilities.

Euryhaline species production

Italian production of euryhaline species has been intensified over the past ten years and has reached an intensive/extensive production ratio approaching 2:1 while, even recently (1986) it was only about 1:1 (Ingle, 1995). The impact of ichthyophagous bird on extensive fish production and the pronged market reduced the intensification of traditional fish farming in Italian coastal lagoons. This event also reduced the specificity of Italian aquaculture, increasing the negative externalities and reducing the capacity of managing simultaneously both production and environment.

The number of farms and the surface area given over to extensive practices for each euryhaline species is shown in Table 2. In the following paragraphs a short description of Italian aquaculture by group species and applied technology is given.

Table 2. Seabass, seabream and eel farms operating in Italy in 1997

Species	Land based	Cage	Hatcheries	Extensive areas (ha)
Sea bass/sea bream	65	11	20	
Eel	120		7	
Total	185	11	27	63,485

Source: ICRAM (1998)

Eel (*Anguilla anguilla*)

Eel production stands at 3,100 t in 1997 and occupies a leading position in European aquaculture. Eel farming is concentrated in freshwater and low salinity environments and about 87% of output is accomplished through intensive rearing techniques. A large part of production is concentrated in a small number of big farms (10-15 units) located in the North of the country. Extensive production in brackish environment amounts to about 400 t and has shown a decreasing trend over the five past years (Fig. 2).

The present status and the future of eel farming are conditioned by the availability of glass eel from the wild. In Italy, the fluctuation of eel production and the decrease of extensive production from 1992 can mainly be accounted for by the lack of available seed, and consequently to the conversion of some eel plants to sea bass and sea bream productive units. The need of weaning facilities for elvers still represents a priority. In view of the fact that eel seed is exclusively of wild origin and there is a growing demand to supply the international market, a strict policy for the protection of this species should be elaborated at national and international level. The competition between European and Far-East countries and the application of conservation policies to eel stocks management will probably determine, in a near future, new scenarios for eel culture survival.

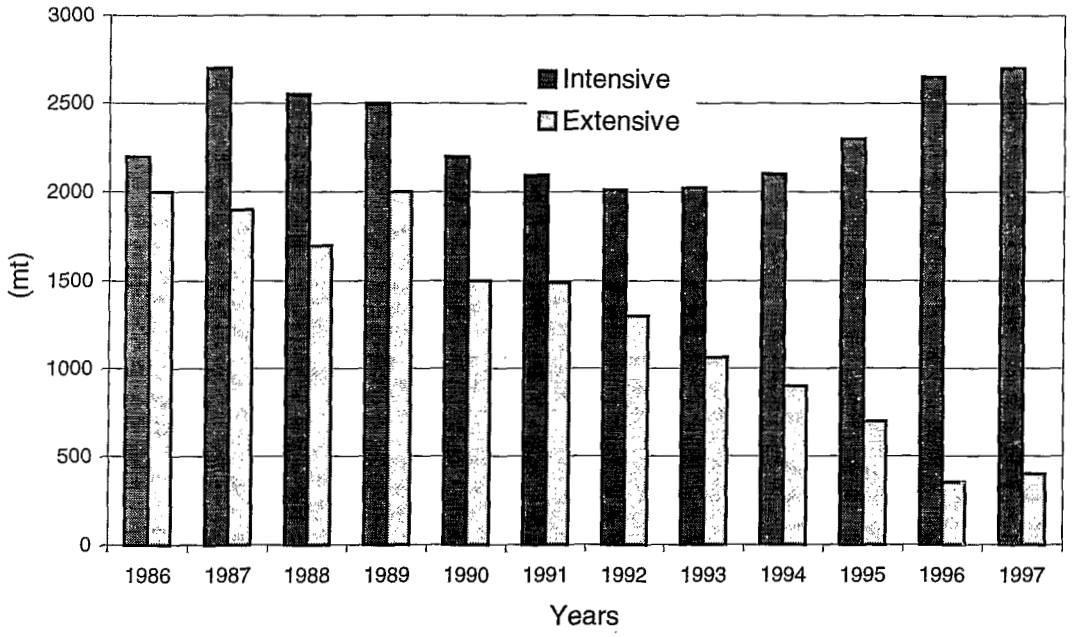

Fig. 2. Evolution of eel production in Italy from 1983 to 1997.

Mullet *(Mugil cephelus, Chelon labrosus, Liza aurata, Liza saliens, Liza ramada)*

Farming is almost entirely based on extensive techniques, with wild juveniles restocked in coastal lagoons and semintensive ponds. Since 1990 mullet production has remained constant at around 3,000 t, according to the market demand (Fig. 2). A slight increase in selling price and consumer demand have been recently observed. Artificial reproduction trials are currently under way to set up controlled reproduction techniques, especially for *M. cephalus* and *C. labrosus*.

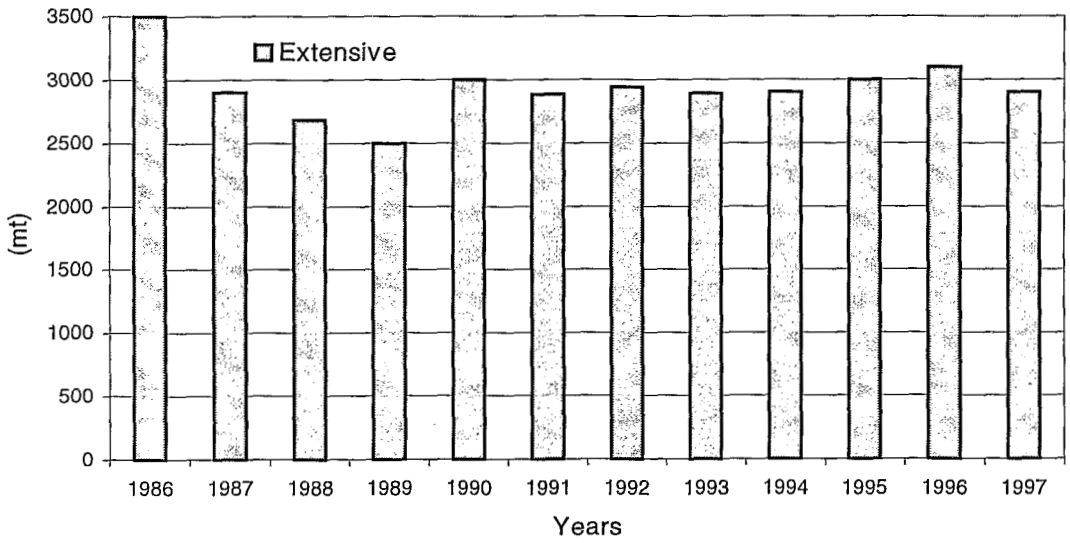

Fig. 3. Evolution of mullet production in Italy from 1983 to 1997.

Sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*)

Sea bass and sea bream production has grown rapidly over the past ten years and in 1997 stood at 4,600 t and 3,900 t, respectively. In the past, production was traditionally carried out in extensive systems, but at present, consists mainly of intensive farming carried out in land-based plants. Intensive production amounts to 4,000 t for sea bass and to 3,100 t for sea bream, representing approximately 86% and 79% of total production, respectively.

The rise in intensive output (Figs 4 and 5) from 1991 can be accounted for by the technological improvement of productive plants, to the availability of seed locally produced and to the new production units that have come into operation over the last three years.

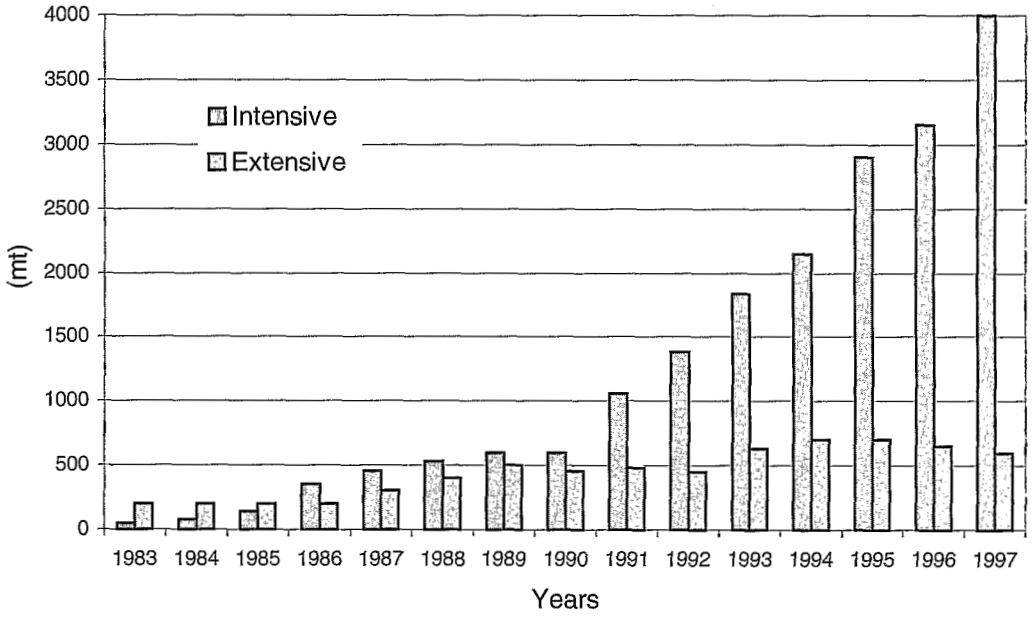

Fig. 4. Evolution of seabass production in Italy from 1983 to 1997.

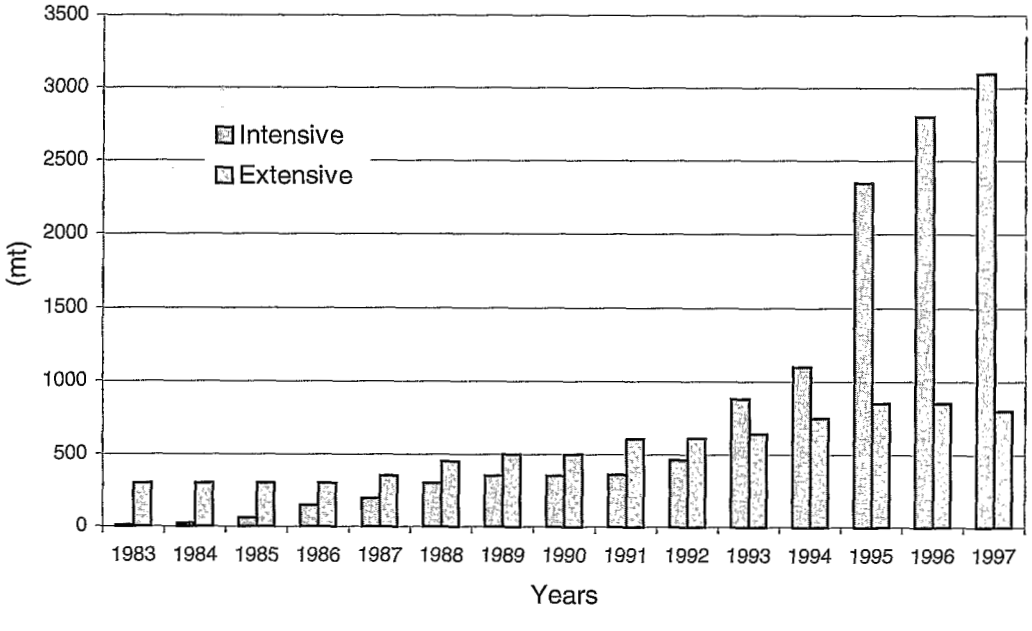

Fig. 5. Evolution of seabream production in Italy from 1983 to 1997.

In 1994-1995 sea bass and sea bream production was lower than expected owing to market difficulties and to the new imported bacterial disease and viral diseases that affected both species. The fast rise of production from 1995 is mainly due to the development of new offshore farms, both floating and submergible, that accounted in 1997 for 15% of total production. The identification of the best siting and appropriate rearing technology still remain open problems. A continuous process to identify reliable technological models to be adapted to the different characteristic of the sites is in progress. In addition, the need of a suitable use of marine coastal environment demands the identification of a clear legal framework in which marine aquaculture will be developed.

The main thrust of extensive production takes place in the northern Adriatic "valli" (70%) and in coastal areas and brackish waters located in Tuscany, Puglia and Sardinia. For extensive production, different productive models are utilised, depending mainly on the trophic resources in the natural environment and human intervention for water flow management. As mentioned, ichthyophagous birds represent one of the most important problems in the management of extensive culture

Fingerling

Italian seed production mainly comprises sea bass and sea bream. Until 1991 seed production was insufficient, but over the past five years it has grown rapidly in quantity and quality and since 1993 nation-wide self sufficiency has practically been attained. In 1997 seed production reached 61 million fingerlings, of which 33 millions sea bass and 28 million sea bream. The trends for seed production and the national demand for sea bass and sea bream from 1987 to 1995 are shown in Figs 5 and 6, respectively. Twenty private hatcheries are now producing both sea bass and sea bream fingerlings (Table 2) and ten of these also produce other marine fish species.

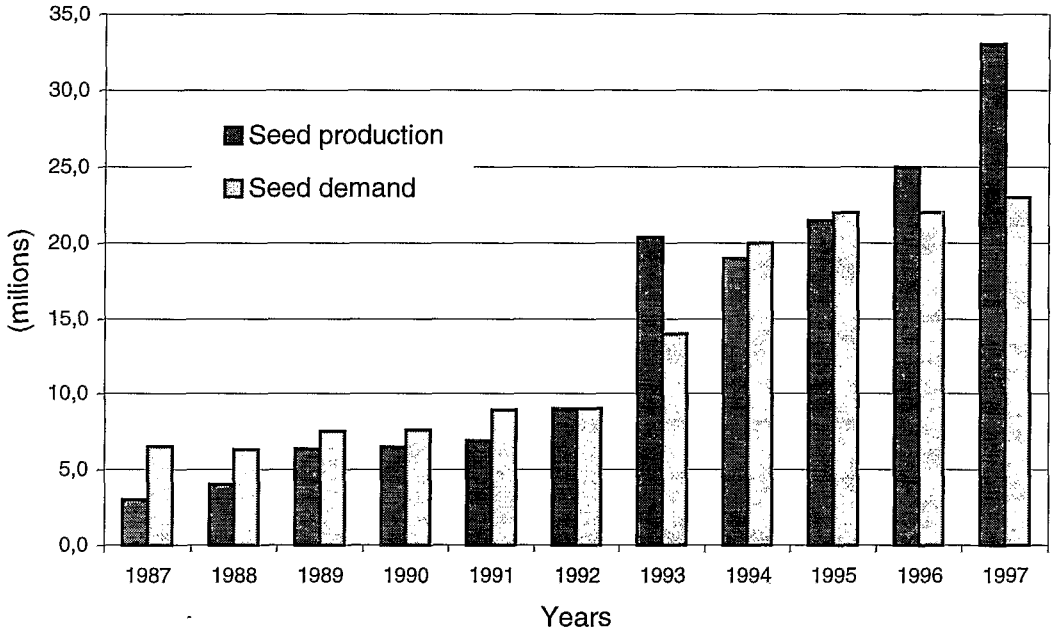

Fig. 6. Production and seed demand of sea bass fingerling in Italy (1987-1997).

The trend of seed production in 1995 was the same as that observed in 1993, although production has not kept pace with growing demand. This is due both to the diminished price of fry, which discourages farmers, and the onset of serious viral diseases which has led to heavy losses. Also the problem of malformations may be included among the "emerging pathologies" being both causes and pathogenic mechanisms not yet well identified. This has entailed increased hatchery production costs and has led to a shortage of quality seed for use in extensive environments.

New hatchery technologies, using large volume tanks, have been recently developed for sea bass and sea bream. These models allowed the production of seed without morphological anomalies and

with morphometrics features like wild phenotype thus resulting suitable for enterprises requiring low level/high quality fry production, for extensive farming supply and stocking actions.

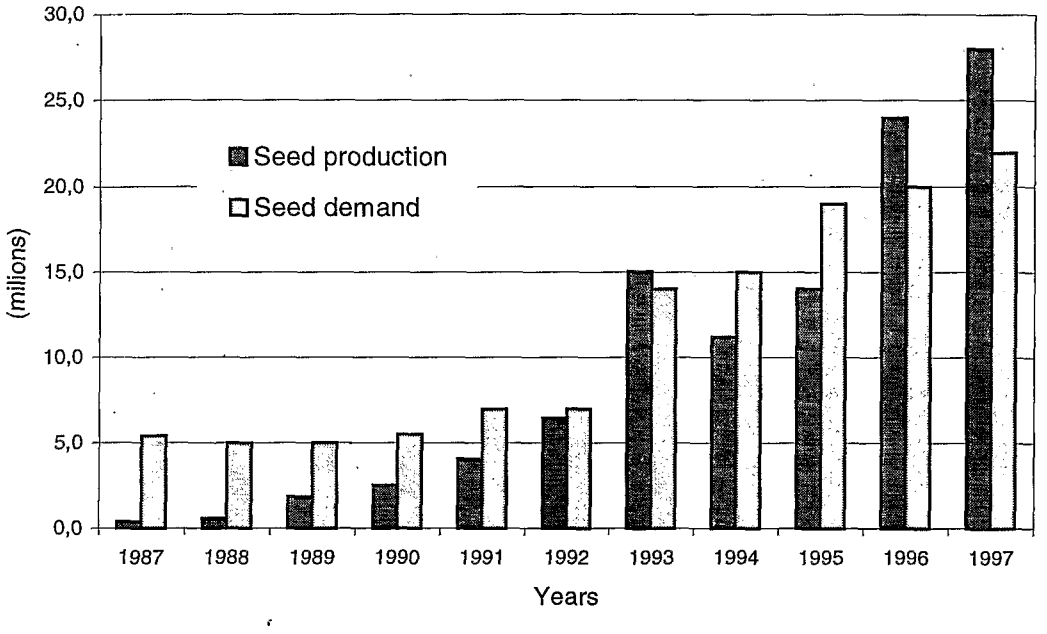

Fig. 7. Production and seed demand of seabream fingerling in Italy (1987-1997).

New finfish for aquaculture diversification

At the end of 1980 the fast decrease of sea bass and sea bream market prices, mainly due to the massive import from Mediterranean countries on Italian market, has motivated an increased interest in the diversification of marine finfish species production. Starting from 1995 a multidisciplinary approach, including analysis of market demand, production potentials and available biological data analysis, have been planned for the selection of new aquaculture species. Actually 14 fish species and 11 shellfish species are cultured and/or being under studied with a view to extending the number of farmed species, diversifying production and enhancing the presentation of aquaculture product on the market.

In the framework of the IV Three-year Plan for Fisheries and Aquaculture (1994-1996), managed by the Ministry of Agricultural Policies (MiPA, ex Ministry for Agriculture, Forestry and Food, MiRAAF), seventeen research projects have been funded to set up controlled reproduction techniques and suitable farming technology for the selected species. Priority was also given to the identification of appropriate larval rearing techniques to obtain qualitatively suitable seed for the various productive strategies. The process involved both private and public Institute of Research, University, Cooperatives and commercial hatchery.

At present, controlled reproduction techniques at commercial level have been set up for *Dentex dentex, Diplodus* sp., *Puntazzo puntazzo, Pagellus erythrynus* and *Umbrina cirrosa*. Fingerlings production in 1997 for each species is detailed in Table 3. Successfully attempts at artificial reproduction and larval rearing for red porgy (*Sparus pagrus*) have been experimentally carried out for the first time in 1998 and resulted in 70,000 fingerlings production. More than 10,000 Mediterranean amberjack (*Seriola dumerilii)* fingerlings were produced by using long acting GnRha hormone to induce spawning and large volume method for larval rearing.

Trials on *Epinephelus marginatus* are still at experimental level. Although hormone induced spawning have been successfully achieved from 1996 on different broodstock, further study is necessary to identify nutritional larval requirements and develop adequate preys as well as suitable rearing environment for larvae. Considering that this species has been selected for stocking programmes and integrated activity in coastal areas, the application of large volume technologies, with opportune adaptations, could be an appropriate approach to fit larval quality.

Table 3. Fingerling production of new finfish species in Italy in 1997

Species	Fingerlings (No.)
Sharpsnout	6,000 000
Common pandora	150,000
Shy drum	100,000
Common dentex	300,000
Total	6,550 000

At present, the production of new finfish species is still restricted in relation to both market demand and the lack of standardised induced breeding and farming techniques. The National Aquaculture Plan makes provision for marketing and promotional policies to improve consumer demand and distribution strategies for such production.

Shellfish

Mussel production (*Mytilus gallopovincialis*) is estimated at 132,000 t, of which approximately 25,000 t is collected from natural banks. The production trend for the period from 1985 to 1995 is reported in Fig. 8. The traditional farming techniques are based on the pole suspended row techniques in protected and lagoon areas, although open sea mariculture was recently started and now is slowly replacing traditional farming practices.

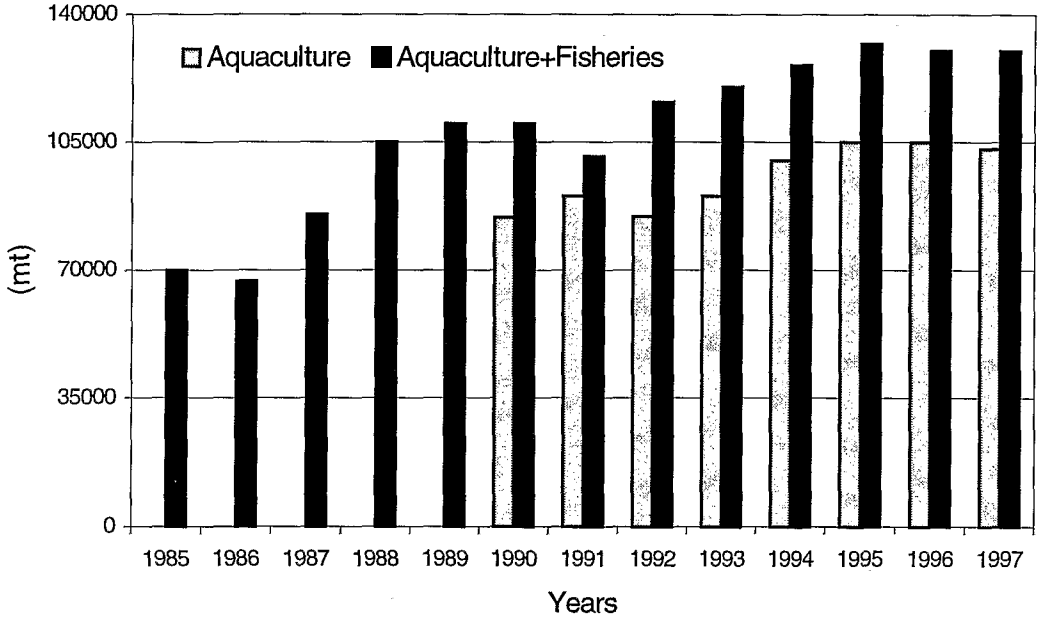

Fig. 8. Evolution of mussel production in Italy from 1985 to 1997.

Production from 1991 to 1997 are given by origin

Manila clams (*Tapes philippinarum*) have undergone a rapid increase since the mid 80s, reaching 60,000 t in 1995 (Fig. 9). Manila clams are harvested empirically using rationalised fishing techniques in confined coastal areas. The productive focus is located in the Po Delta, where productivity, sediment components and the high hydrodynamism of the brackish environment favour clam aquaculture.

Thanks to the introduction of new farming techniques, oyster farming (*Crassostrea gigas*) is now expanding in Italy. With the aim of improving the diversification of bivalve shellfish production also the

culture of *Chamelea gallina*, *Venus verrucosa*, *Modiolus barbatus* and *Pecten jacobeus*, has been undertaken, although only at experimental level.

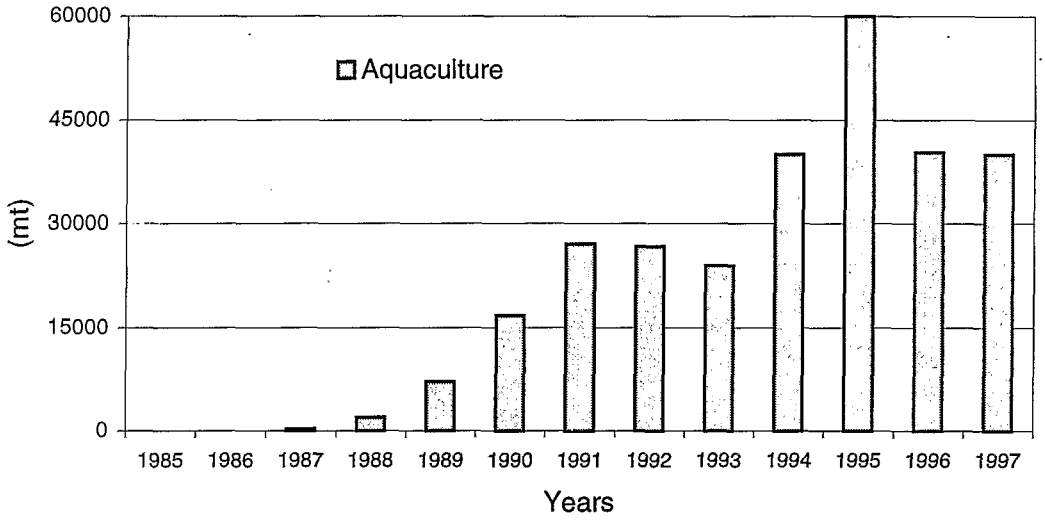

Fig. 9. Evolution of mussel production in Italy from 1985 to 1997.

Development trends in the aquaculture sector according to the national plan for fishing and aquaculture

The aquaculture sector in Italy is today managed by General Directorate of Fisheries and Aquaculture of MiPA, and covers production from inland waters, sea and brackish environments, whereas previously this General Directorate was responsible only for the sea and brackish environments. This means that the fishery sector in Italy is now more effectively coordinated at the national level and thus more closely aligned with other EU countries.

The topics to be addressed in the consolidation and development of Italian aquaculture have been identified in the Three-year Plan for Fishing and Aquaculture. The Plan provides a detailed and appropriate reference framework and an accurate analysis of major constraints limiting the expansion of the sector. Researchers, producers and cooperatives have been deeply involved in its design.

The guidelines set out in the Plan define the national priority objectives in national planning vis-à-vis EU policy and have also been incorporated in the SFOP*. The following strategies were included as priorities:

(i) Environmental resources must be used correctly and fish production can provide a sustainable environmental management tool to safeguard and maintain wetlands and coastal lagoon in Italy. Innovative models to improve hydrodynamic and trophic conditions in these areas, as well as the knowledge and management of the environmental data are of priority importance in enhancing extensive production and in contributing to the conservation of the coastal environments.

(ii) Integrated aquaculture regulations must be promoted and consolidated in order to increase commercial value, also with regard to the potential retraining of surplus workforce from the fishing industry. One good example of this in Italy is clam farming (*Tapes phylippinarum*). This species was introduced for experimental purposes and, although giving rise to various conflicts, has shown how organised fishermen can be converted into farmers and/or managers of the productive environment.

(iii) The integration of mariculture in protected zones (artificial reefs) can represent an effective and innovative productive system, in harmony with national and EU policies concerning the management of stocks and the reduction of the operative fishing fleet.

(iv) Suitable standards for waste disposal geared to the characteristics of the receiving sites must be urgently identified in order to minimize the environmental impact of intensive land-based farms. This could prove to be a useful tool also for enabling the farmers to achieve correct management. Priority must also be given to initiatives aimed at reducing the environmental impact due to the use of chemicals in intensive plants, by producing antibacterial chemotherapy, vaccines and immunostimulants more effective than those currently employed.

(v) With regard to the problems of self-sufficiency in fish production, priority has been given to the adoption of measures to increase the volume and the quality of production. In particular these consist of improved consolidates farming technologies to reduce production costs, as well as developed innovative intensive farming technologies (e.g. offshore) and standardized breeding techniques for new species.

(vi) Available data on marketing of aquaculture products are still scattered and do not allow the identification of Mediterranean and national reference framework. Accurate analysis of Mediterranean aquaculture production, market flows, foreign demand, consumption habits and regulations are necessary to evaluate market perspectives and productive trends.

(vii) The application of identity and origin denomination and quality labels are preferential strategies. According to EU regulation on quality products, the definition of reliable quality standards for water, production process and products are developing, with a view of improving quality, enhancing the image of aquaculture products and controlling the quality of imported products. Also new strategies to diversify distribution channels and to increase the consumption of the processed products are taken into account. Technological updating and modification of marketing facilities to comply with EU directives must be speeded up in order to favour those productions that are better suited to being processed and transformed.

(viii) In this context, scientific research is now taking on an increasingly important role and the research carried out under the Three-year Fishing and Aquaculture Plan represent an important support for the sector. The action of coordinating the efforts of the various scientific workers in the field and with producers means that research is increasingly being focused on priority topics that will have spin-off applications in this sector.

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