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A PRELIMINARY STUDY OF THE INTERNATIONAL MARKETING OF SHRIMP

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Abstract

*This paper aims to supply a comprehensive account of a particular sector of the fisheries industry. The increase of demand for fish products has involved an uncontrolled exploitation of marine reserves and fishing has reached its threshold of biological sustainability. For these reasons, aquaculture has grown in a corresponding manner in the recent past. The present survey starts from these considerations and aims to describe the general situation of world-wide, European and Italian aquaculture and then to examine the farming and marketing of a particular kind of product, *Penaeus* spp., which significantly affects global production in terms of value but not of quantity.*

Keywords: Aquaculture and Fishery; Shrimp farming; International trade

JEL :Q13 Agricultural Markets and Marketing; Q17 Agriculture in International Trade; Q22 Fishery Aquaculture

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Introduction

In recent years, there has been a boom in aquaculture both in Italy and worldwide. Among the many reasons for this trend worth mentioning are the development of specific technology, and improved knowledge of the biology and physiology of the farmed species. Not least, however, is the increase in demand for fish as food, which traditional fishing has not been able to satisfy any longer. The present preliminary study examines several aspects relating to a particular aquaculture sector, namely shrimp farming. The issues involved have acquired ever-greater relevance following the calamity caused in south-east Asia by the December 2004 tsunami. Its significance of this sector in terms of overall fish farming production worldwide and especially of value makes it of great economic relevance.

As regards Italy, salt-water shrimp farming has an important role to play in the development of the aquaculture sector in the Mediterranean. There is in fact a great demand for this product still waiting to be satisfied not only in EU countries but in Japan and the US as well. Moreover, such farming would also help diversify production, enhancing aquaculture productivity and competitiveness. Many interests are in fact pushing for a fast and strong increase in this sector.

However, such intense demand risks putting the environment under severe pressure. The dramatic deforestation in several areas of south-east Asia and South America is for instance chiefly ascribed to intensive shrimp farming. The most adversely affected would appear to be the coastline mangrove forests. As this is the habitat where young shrimp typically develop and grow to adulthood and where seawater is abundantly available for quick and easy recycling, these areas have been naturally preferred.

Given the profitability of shrimp farming, the growth and development of these installations in Italy is to be hoped for. Environmental friendliness must however have absolute priority in terms of management, farming intensity, the adoption of low-environmental-impact technologies, and appropriate reclamation of the areas concerned once the activity has ceased.

The present paper sets out to identify the aspects and issues that need to be focused on for a thorough-going study of the shrimp farming sector. What needs to be considered is first and foremost the actual extent of this activity and its potential, applicable standards and criteria, and world trading trends. A closer look at the main areas of production and consumption will help to highlight the more important aspects of the process from production through to marketing and consumption.

1. The Global Scenario

Shrimp farming is a typical and traditional activity in many areas of south-east Asia, which, area-wise, is still today the leading producer worldwide. Traditionally, this activity was conducted by capturing natural seed in the typical Indonesian hatcheries called “tambaks”. These hatcheries essentially consisted of earthen basins where the renewal of seawater was limited, relying on the ebb and flow of the tides. Farming density was fairly low, indeed less than 2 shrimps per square meter, and shrimp were farmed either alone or in association with another local fish species, the *milkfish* (*Chanos chanos*). In other words, farm practice was essentially extensive, without artificial feeding or the use of fertilisers. Yield was hence extremely variable, ranging from a few kilograms to a tonne per hectare in

boom seasons, but overall rather low. Under such conditions the activity could hardly be considered competitive, let alone profitable, and was hence of poor trading interest. To reach commercial standards, a lot of studies were required. The turning point came from studies conducted in Japan² in the 1930s, but it was only in the 1960s that the production of the local species *Penaeus japonicus* attained standards of commercial interest. Since then, shrimp farming has grown at an increasingly fast rate worldwide, far more than that of other related sectors such as fish, shellfish and algae farming.

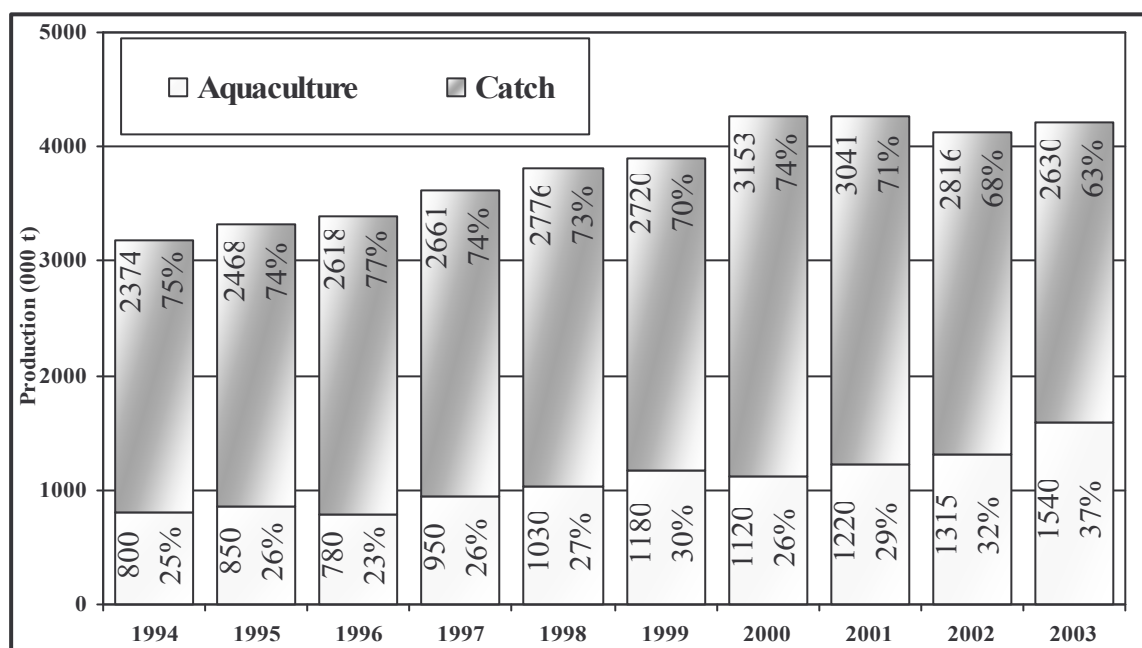
In 2003, world production of shrimp (including catch) amounted to approximately 4.2 million tonnes, with a stable production trend over the four previous years after a progressive and constant increase recorded for the preceding ones (Figure 1). But if overall production was stable, the make-up of production began to change, beginning in 2000. In fact, aquaculture has played an increasingly important role, accounting for 37% of overall production, up from 26% over a period of only four years.

China is the leading world producer with about 1.4 million tonnes, mainly intended for the domestic market (Figure 2). Production has been fairly stable since 2001, accounting for 30% of world production. It is worth noting that the five top producers, namely China, Indonesia, Thailand, India and Vietnam, account for 66% of world production, and the top ten for 81%.

In 2001, about 1.2 million tonnes of shrimp derived from farming, accounting for 29% of overall aquaculture production worldwide, and for 35% when the first 5-10 top producers are considered (Fishstat, 2004).

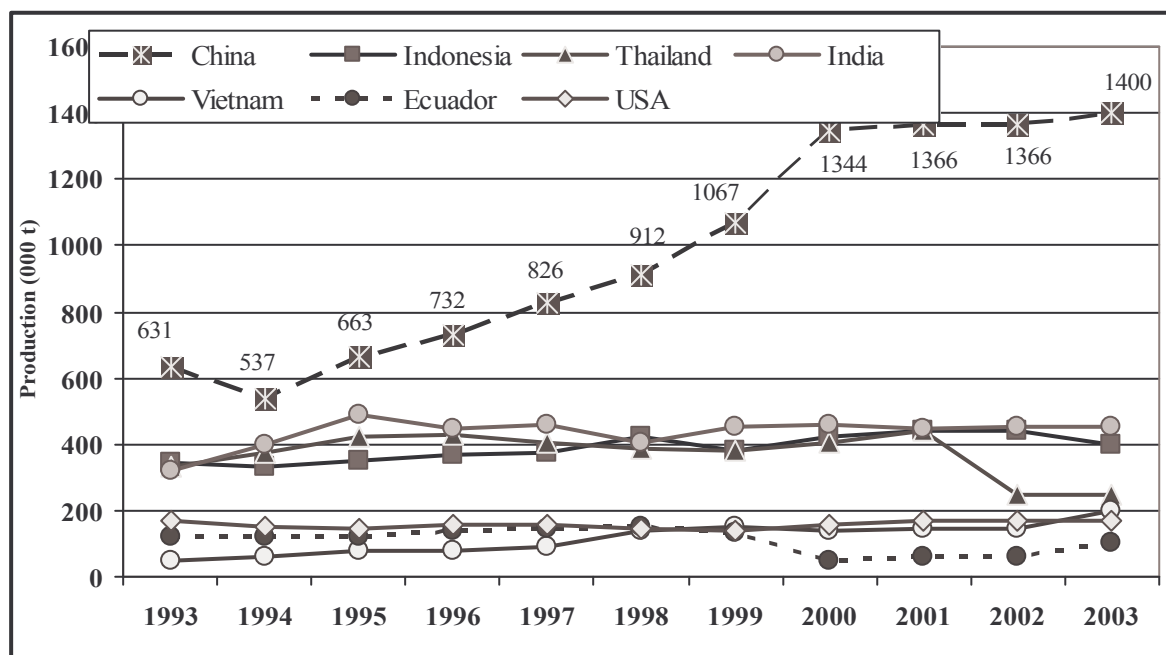
² These studies were conducted by the Japanese biologist Motosaku Fujinaga on *penaeid* shrimps. In 1933 he developed a technique for the artificial reproduction of a local species of shrimp, "*Penaeus japonicus*".

Figure 1 –World production of shrimp, , 1994-2003



Source: from Globefish Data, 2004

Figure 2 - Production of shrimp – most important countries, 1993-2003



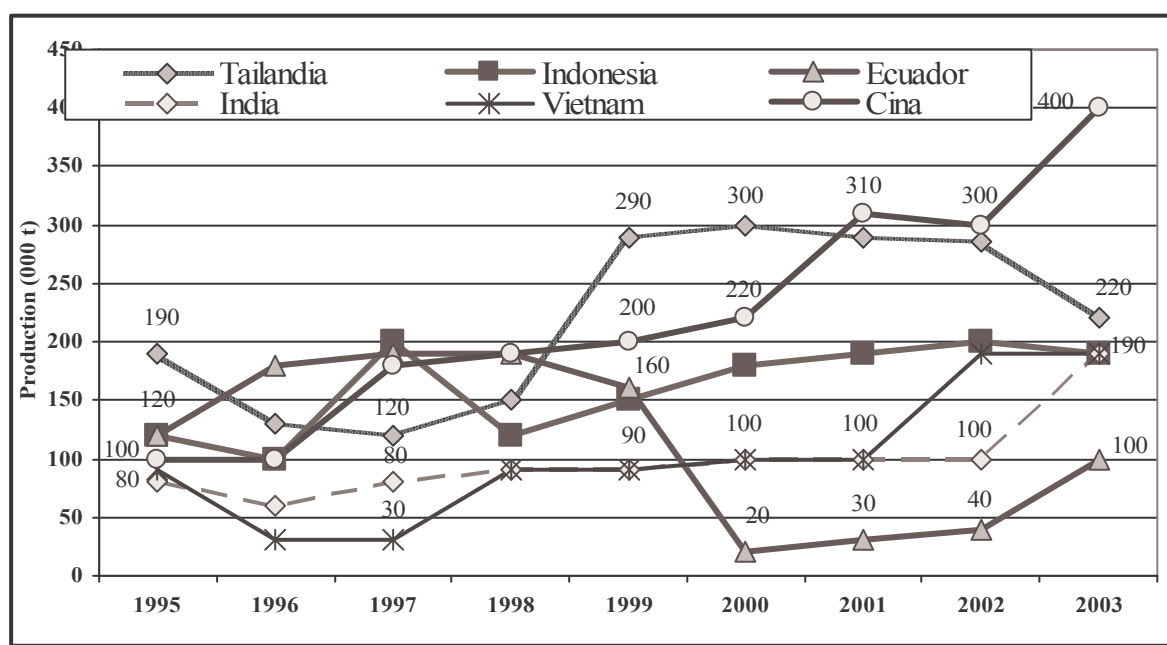
Source: from Globefish Data, 2004.

Over the last three years for which data is available, aquaculture production has continued to increase. In 2003 it reached 1.6 million tonnes. Against a substantially stable figure in overall production, shrimp accounted for 37%.

Compared to 2001, the market share of the five top producers slightly diminished in 2003 against a substantial stability in overall production, dropping from 66.49 to 63.37%. Such a drop may be chiefly accounted for by a general crisis in the fishing industry, but at the same time aquaculture's share of overall production increased considerably, reaching 45%.

According to Fishstat 2004, the leading shrimp farming country is still China. Important changes have been recorded, with an exponential increase in the number of shrimp farms which in both 2002 and 2003 accounted for production in this country of 400,000 tonnes (Figure 3). It should be noted that in the same period Thai farms were severely hit by a virus infection.

Figure 3 –Production of farmed shrimp– most important countries, 1995-2003



Source: from Globefish Data, 2004.

There are about 49,800 shrimp farms worldwide, 78% of which are in Asia, 21% in Central and South America, and only 1% in North America and Europe. Area-wise, the extent and distribution of shrimp farms more or less follows this same pattern in percentage terms.

Until 1998, the two leading producers were Thailand and Ecuador, which jointly accounted for almost 50% of overall world production. Currently, the leading producers are mostly countries in the eastern hemisphere, and more precisely in south-east Asia, which accounts for over 80% of world production, inclusive of China. Runner-up to this major concentration of world production but with far less production (about 20% of the overall figure) is Central and South America, chiefly Ecuador, Mexico, Honduras, Brazil, Panama, and Belize. Ecuador deserves a special mention: in recent years production has dropped dramatically from over 160,000 tonnes in 1998 to about 50,000 tonnes in 2002 owing to a virus infection³ which has raged through the country's shrimp farms. On the other hand, in

³ The virus concerned was the so-called "macha blanca" or white spot.

2002 a strong boost in production was recorded for Brazil and Mexico (60,000 and 45,000 tonnes, respectively). In 2003, a gradual come-back was recorded for Ecuador. After overcoming the effects of the virus infection, its production recovered to about 100,000 tonnes. In the same year, Brazil consolidated its position, with a production of 90,000 tonnes.

The most widely reared species in the world is the giant tiger prawn (*Penaeus monodon*), typical of tropical areas. It owes its name to its size which may reach a length of as much as 365 mm although on average it is fished when between 180 to 250 mm long. It grows and survives in warm climates, and easily adapts to extremely low salinity. Indeed, it may even be reared in freshwaters. In 2002, the production of this species was around 550,000 tonnes, far ahead of all others, and accounting for about 42% of world shrimp production. It is reared throughout practically all Asian countries, especially in Thailand, India and Vietnam, as well as in South Africa and Mozambique.

The white leg shrimp (*Penaeus vannamei* and *Penaeus stylirostris*) is common to the Pacific and is chiefly found in the Western hemisphere, in Peru, Mexico, Ecuador, Honduras and Panama; in recent years it has also been introduced into China and Korea. It may reach a length of 230 mm, and lives in warm, well-oxygenated, and very salty waters. *P. stylirostris* is capable of withstanding lower temperatures than *P. vannamei*. Around 300,000 tonnes of this species, accounting for 23% of world shrimp production, were farmed in 2002.

The fleshy prawn (*Penaeus chinensis*), a native to the waters east of China and the west coast of Korea, does not reach the same length as the above species. However, it is a hardier species and capable of better withstanding low temperatures and poor salinity. The leading producers are China and Korea, and world production of this species amounts to almost 200,000 tonnes, equal to around 15% of overall production. In recent years, farming of this species in the two countries where its habitat is naturally found seems to have been gradually reduced and replaced by that of *P. vannamei*; production of the latter species has in fact increased considerably not only in these two countries but also worldwide.

Together, these three species account for almost the full amount, namely around 80%, of farmed product.

In the present study, our focus has been on the Japanese kuruma shrimp (*Penaeus japonicus*), a native to the seas of Japan. This species, in fact, is currently the only one farmed in Europe (France, Spain, and Italy) thanks to its good adaptability to the waters of the Mediterranean and to seasonal changes in water temperature.

This Japanese species has been preferred to the indigenous one, *Penaeus keratourus*, because it has proved to grow far better in captivity, with an enhanced food conversion index and resistance to handling during rearing.

European aquaculture production is markedly lower than that of other world producers, and practically of little relevance. In 2002 it was 163 tonnes, 77% of which came from Spain (126 tonnes). After France with 20 tonnes, Italy ranks third with 13 tonnes, the main rearing grounds being in the Veneto, Emilia-Romagna, Tuscany, Apulia, Basilicata and Sardinia regions. Several penaeid shrimp farming initiatives in the Gargano area in Apulia and around the Island of San Pietro in Sardinia are worth noting.

Unfavourable environmental conditions are chiefly to blame for lack of growth in this sector. Seasonal temperature patterns in European countries of the Mediterranean are such as to allow for only one production cycle a year against the 2 to 2.5 cycles a year in countries with a tropical climate.

The need to create special fry hatcheries for artificial reproduction and larva weaning in the cooler periods of the year has further hindered the development of European shrimp farming. The extra costs involved have not made it possible for the industry to adequately compete with markets outside Europe.

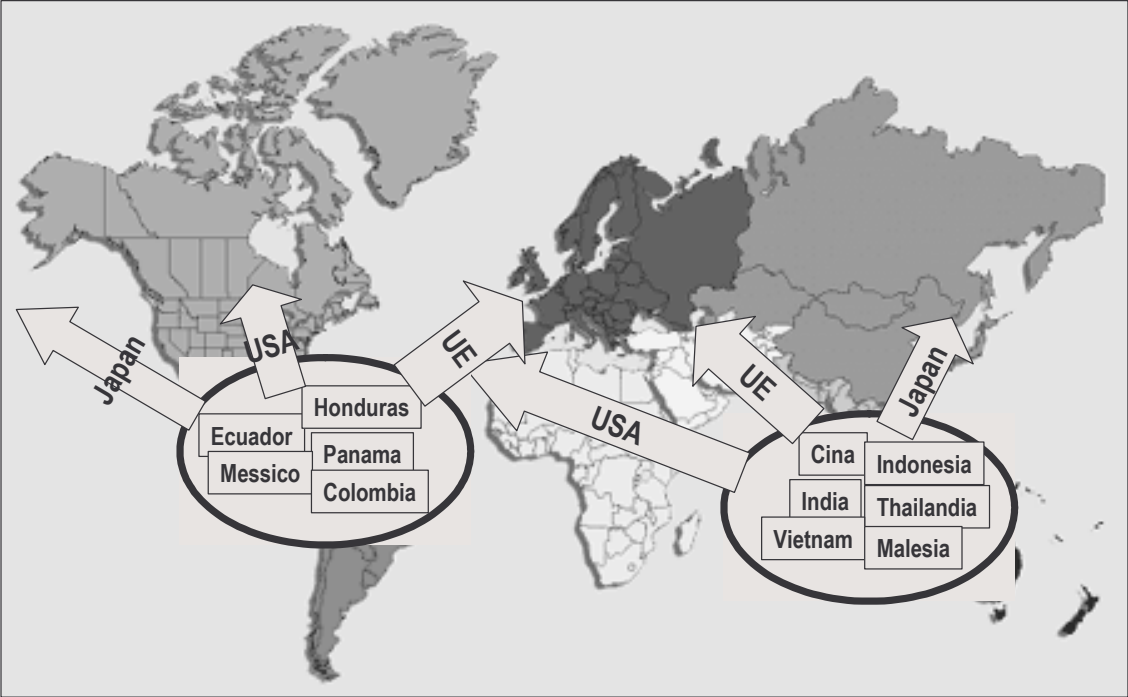
In addition to thermal factors that allow for only one production cycle a year, fresh and sea water in the required quantities has not always proved readily available. What is more, the collection of shrimp seed in the natural environment has proved impossible, so that special hatcheries have had to be set up, the number of which in Italy is currently still very low. Shrimp farms in Italy are indeed very few and far between; farming practices are in almost all cases extensive or semi-extensive, and the young shrimps are purchased in France or Spain, and only fattened in Italy. Very few fisheries are endowed with working hatcheries; although some are currently being set up, others are still very much at the design stage.

2. The Shrimp Market

While shrimp production is chiefly carried out in developing countries, demand comes largely from highly developed countries which thus have to import the product. The only exception to the rule is China, where the product is practically all taken up by the domestic market. The biggest importers include the US, Japan and the EU (Figure 4). Supply and demand, and hence trading, essentially follow the route between the two main poles of production and these three main regions of consumption.

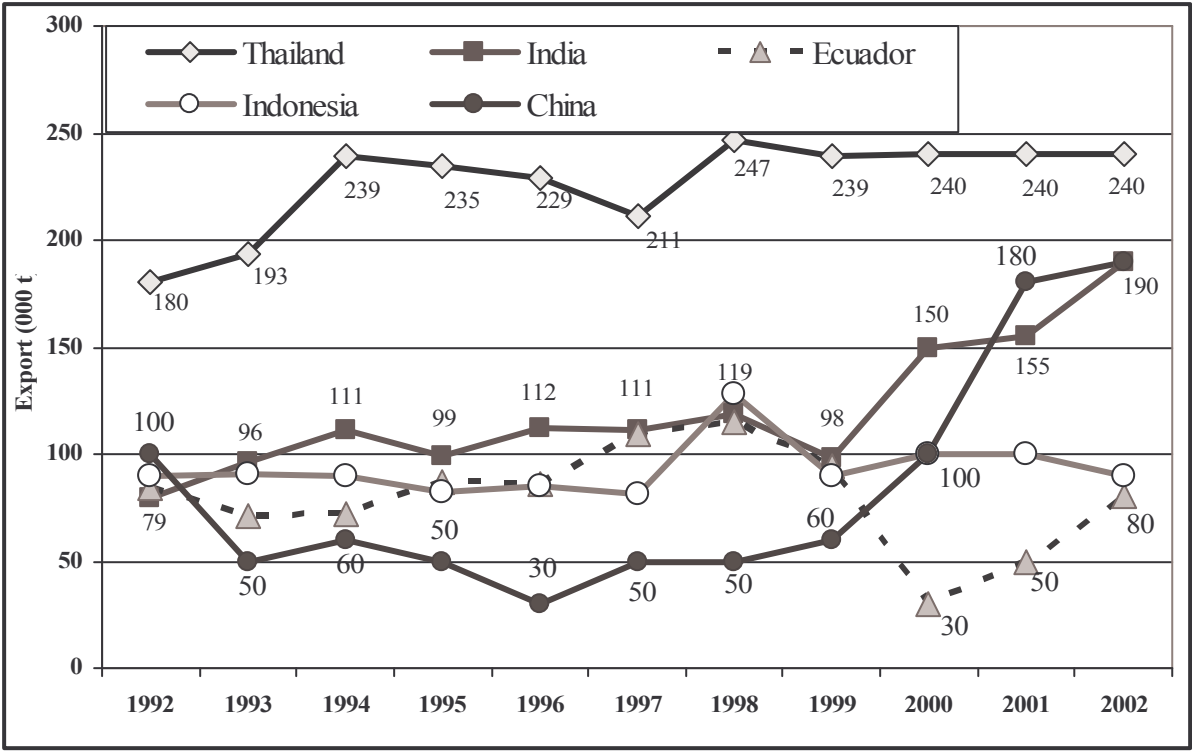
Thailand is the biggest exporter. Despite a negative trend, in 2001 the country exported almost 135,000 tonnes of frozen product (Figure 5) and 110,000 tonnes of processed or canned shrimp. These figures were more or less the same also in 2002 (240,000 tonnes). Practically all of Thai production is intended for export, chiefly to the US. Shrimp account for almost a quarter of overall Thai food exports, and farmed shrimp clearly loom high in the country's economy. China's export share of farmed shrimp is also growing considerably, even though the share of overall production is low given the large domestic demand.

Figure 4 – Commercial flows of shrimp trade



Source: from Globefish Data, 2004.

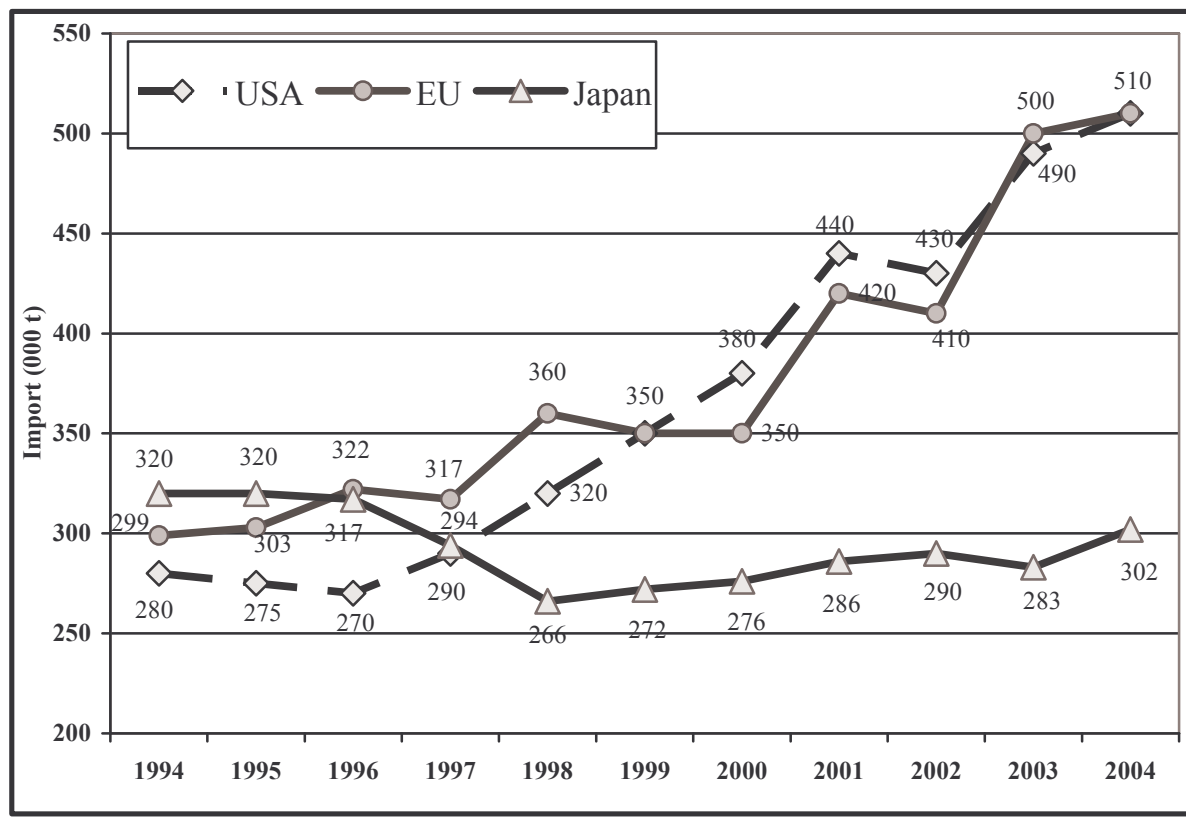
Figure 5 - World exports of shrimp, 1992-2002 – most important countries



Source: from Globefish Data, 2004

The greater part of world production is imported by the US and Europe, and the trend is growing. In 2004, overall imports by countries in these regions amounted to 500,000 tonnes. Japanese imports, vice versa, have tended to stabilise around 300,000 tonnes a year, clearly indicating that the market is potentially saturated (Figure 6).

Figure 6 - Imports of shrimp by USA, EU and Japan, 1994-2004



Source: from Globefish Data, 2004

In 2004, shrimp accounted for a surprising 34% or more of overall fish imports by the United States. Per capita shrimp consumption is therefore above that of tinned tunny (tuna), and shrimp is hence the average American's favourite fish food.

3. Prevailing Standards and Tariffs Governing the Marketing of Shrimp

At the WTO Meeting in Geneva on 27th to 29th July 2004, special attention was given in the negotiations to the "access to the market of non-agricultural products" (NAMA). The products concerned included both caught and farmed fish. Within this more general discussion, the importation of shrimp and of fish products in general from south-east Asia and Central and South America into EU countries is currently governed by a number of standards and regulations which set out restrictions and guidelines for imports from non-member countries.

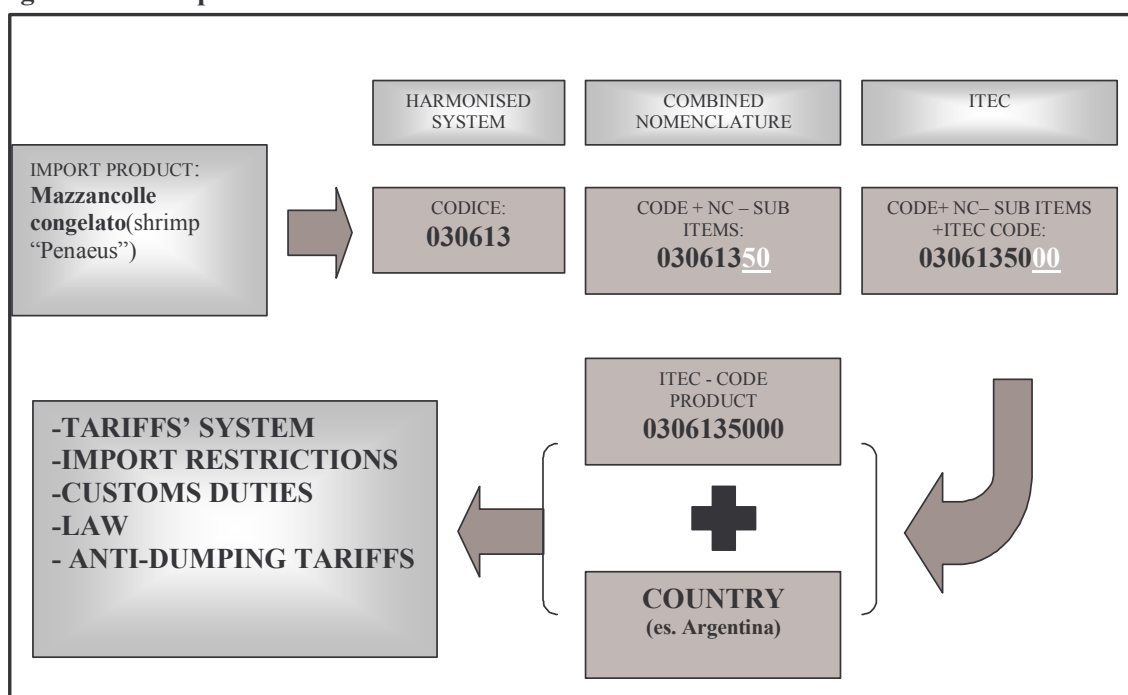
The two most important EU standards and regulations applicable to this sector are EEC Regulation No. 2658/1987 and EC Regulation No. 104/2000.

EEC Regulation No. 2658/1987 governs standardised product categories, statistics, and customs duty rates common to all member countries. A new type of product description is given here for the first time, that partly carries over from that already traditionally provided for in the so-called “Harmonised System”, called “Combined Nomenclature” (NC). According to the Regulation, each imported or exported product is identified by means of an eight-digit code which, in the case for instance of frozen penaeid shrimp, also known as “prawns”, is 03061350. The first six digits of the code are the same as those in the traditional nomenclature of the Harmonised System, while the seventh and the eighth digits are a further product specification characterising the new nomenclature (so-called “NC sub-items”). This new classification is defined as “combined” since it contemplates a single, comprehensive number for each product. This number replaces the two traditional nomenclatures, namely that of the Common Customs Tariffs and of the Nimex system governing foreign trade statistics, and fully characterises the product by combining these two different functions within the same code.

Regulation 2658/1987 also introduces the Integrated Tariff of the European Community (ITEC). This new and practical information tool is also accessible on-line by any operator or office dealing with international trade. It sets out the collection of provisions, rules to be complied with, and tax information governing the import and export of goods within and from the customs territory of the Community. Each incoming and outgoing product is identified by an eight-digit code. In the case of imports, the product is given a specific integrated tariff code identifying it in terms of product category, country of origin, and special applicable Community measures and other classifications. With ITEC, another two digits are added to the product code as a further specification. By way of example, in the case of the kind of prawns previously mentioned and assuming that they are imported from Argentina, the ITEC code for this product is 0306135000. It may be noted that in the case considered the last two digits indicate that there is no restriction to the import of the product from this country and that it is not subject to any anti-dumping tariff (Figure 7).

EC Regulation No. 104/2000, and more precisely Title V (Provisions applicable to trading with third non-member countries), governs trading organisation in the caught and farmed fish sector common to member countries. The Regulation is aimed at ensuring a certain degree of market stability within the European Union by means of appropriate measures. In any case, the Regulation requires that such measures be applied in compliance with international conventions, as for instance those made within the WTO. In fact, what is ultimately aimed for is the creation of free market conditions by abolishing, whenever possible, either fully or partially, customs duties on products imported from third non-member countries. Be this as it may, the Regulation allows the annual fixing for each product category of minimum reference prices determined according to different criteria depending on the product, and applicable throughout the Community. In the case, for example, of the price of a third-country imported product declared at customs being less than the set reference price, the advantages of a full or partial reduction of customs duties are forfeited. Such measures are adopted to prevent serious EU market turbulence which may be irremediably detrimental to European producers.

Figure 7 - Example of “ITEC Code”



Source: from European Union web site Data, 2004

Another important aspect that cannot be overlooked is that all previous measures are in any case subordinate to the safety of the imported product. In other words, the imported product must first and foremost fully comply with strict sanitary and hygienic standards before passing customs (EC Directive 96/23). A case in point is that of the chloramphenicol⁴ found in shrimp several years ago. After residues of the antibiotic were detected in several caught and farmed fish including shrimp imported from China and Vietnam, countermeasures were taken by the EU Commission in September 2001 under Decision 699, which enforced stricter controls on animal products imported from China and Vietnam. Member countries were required to adopt adequate sampling plans and methods for identifying any trace of the antibiotic, and to run chemical analyses on all shipments of shrimps originating or coming from these two countries so as to ensure that the product was fully safe for human consumption.

Despite these measures, controls have continued to reveal traces of this substance in the products, which have also exhibited conditions ascribable to poor hygiene. This has induced the Commission to adopt even more drastic measures. By Decision EC 69/2002, the importation of any product of animal origin coming from China or Vietnam has been prohibited, the only exception being fish (not including shellfish) caught, frozen and conditioned in their final packaging at sea and unloaded directly from ship on Community territory.

⁴ Chloramphenicol is a wide-spectrum antibiotic especially effective against G+ and G- bacteria, and acting as a protein synthesis inhibitor. It is often used in aquaculture to treat bacterial infections in fish. The antibiotic is however especially toxic to humans even at therapeutic doses and may cause functional depression of bone marrow leading to anaemia, genetic damage, allergic and hypersensitivity symptoms, vomit, nausea, diarrhoea, and so on. Given its extreme toxicity, no drug residue tolerance limit (MRL) has been established (EEC Regulations 2377/90). Its use in animals intended for human consumption has hence altogether been prohibited by EU Regulations.

European countries appear to be striving to adhere to free market principles as expressed in WTO's NAMA document. As a matter of fact, however, the protection of European producers and the safety of imported food products appear to take considerable priority in EU trading policies. Notwithstanding the good reasons for this approach, it cannot be denied that such policies tend to hinder the adoption of suitable measures for abolishing restrictions and customs duties as contemplated by WTO conventions. Whenever the internal market for a given product appears to be threatened by imports costing less than the same product when sold in its market of origin, then the administration feels authorised to adopt exceptional anti-dumping measures.

With regard to shrimp imports to the EU, it may be said that dumping is generally not an issue, if nothing else because inland production is fairly low and the greater part of consumption is based on imports from Argentina, Brazil, and Ecuador. A look at the ITEC table shows that this product is only burdened by the general duty levied on products imported from third countries (12% of its price for all three of the aforementioned countries) and by 10% VAT.

The scenario is quite different in the United States, where a good part of domestic demand (about 15-20%, mostly catch) is met by domestic production. Most of this share is supplied by southern States such as Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina and Texas. To strengthen their position on the American market and distinguish their products, these eight States have in recent years set up an Association called the "Southern Shrimp Alliance" (SSA). The SSA has been especially active and effective in keeping close tabs on trading activity in the United States, consistently lobbying to ensure against the adverse effects on the domestic market of third-country imported shrimp whenever any unfair trading activity is alleged.

In December 2003, for instance, the SSA drafted and submitted to the Department of Commerce a petition against the dumping practices of six countries exporting shrimp to the United States, namely China, Thailand, India, Vietnam, Ecuador and Brazil. Shrimp from these countries amounted to almost 74% of overall US imports of this product. In January 2004, the Department set up an anti-dumping enquiry that was concluded in December of the same year and led to the levying of heavy tariffs (up to 100% of product price in several cases) on shrimp imports from these countries.

4. Trading and Consumption Patterns in Europe

To best characterise trading patterns in Europe and consumption trends in each member country, it is important to take a closer look at shrimp processing and preservation steps before the marketing of the finished product.

The product is largely delivered frozen at -18°C in cold stores. In the case of catch, the product is usually deep-frozen directly on board, or in fishery facilities in the case of the farmed product. A number of North European countries, such as Norway, require that the product be heat-treated immediately after being caught so that the product unloaded from the ships on the wharf is pre-cooked.

Whole shrimps are sorted by size before marketing. Five commercial sizes are contemplated by the international market, with a number of sub-categories depending on overall dimensions. These sizes include: large, extra large, medium, jumbo, and colossal.

Pursuant to Ministerial Decree of 27th March 2002 governing fish product labelling and controls, operators in Italy are required to provide certain information for product marketing. This provision by the Italian Ministry concerned (MIPAF) enacts Article 9 of EU Regulation 2065/2001 governing the information to be given to consumers relating to caught and farmed fish.

In particular, products displayed in retail outlets must bear the following information, three of which are mandatory and the fourth optional:

- commercial name (example: “Prawn” or “King Shrimp”);
- production method, namely whether caught at sea, fished in freshwaters or farmed (example: “Prawn - Farmed”);
- catching or farming area (example: “Prawn – Farmed – Ecuador”);

scientific name of the product (optional at the retail stage but mandatory at all other production stages) (example: “*Penaeus Vannamei* – Prawn – Farmed – Ecuador”).

Aside from sorting according to size, the product may also undergo “sprucing up” operations to a greater or lesser extent depending on market demand and consumer preferences in the countries concerned.

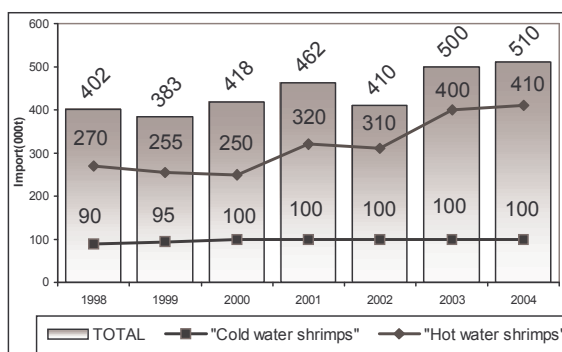
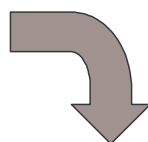
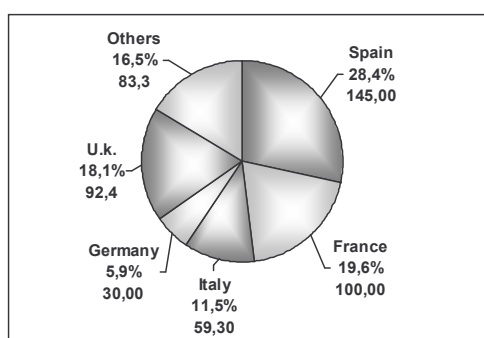
In 2004, imports from countries outside Europe markedly increased, amounting to over 500,000 tonnes (Globefish, 2005). When this figure is considered in conjunction with the fact that trading among European countries remained essentially stable at around 270,000 tonnes and that cold-water shrimp imports amounted to around 100,000 tonnes, the overall amount of shrimp marketed in Europe was about 780,000 tonnes, corresponding to an increase of 22% in just three years, largely accounted for by a marked increase in shrimp imports from tropical regions (Figure 8).

Figure 8 – Trading activity within the European Union and shrimp imports from extra E.U. countries (2004)

The overall amount of shrimps marketed in Europe: 780.000 t (2004)



**Import from extra-E.U. countries:
510.000 t (2004)**



Source: from Globefish Data, 2004

Major European importers include Spain, France, Great Britain, Germany and Italy. In 2004 these countries together imported about 426,000 tonnes, corresponding to 84% of the overall quantities marketed with countries outside Europe. A special case deserving attention is Denmark. It is one of the leading importers in Europe, chiefly of cold-water shrimp, which is practically all re-exported to other EU member countries. Great Britain is a similar case, acquiring considerable amounts of cold- and tropical-water shrimp which it then largely resells to other European countries.

Imports into Europe are mostly from Central and South America, chiefly Argentina, Ecuador and Brazil. Spain is the largest importer, and since 1995 there has always been an upward trend, reaching the current figure of 145,000 tonnes. France and the United Kingdom come next, with about 100,000 tonnes; Italy's imports are also increasing, and

now reach a little under 60,000 tonnes. Finally, Germany imports only about 30,000 tonnes (Figure 9).

A closer look at this pattern reveals the following:

- Spain: 95% of Spanish imports is frozen. The two chief suppliers are Argentina and Brazil, with imports from the former decreasing and those from the latter increasing. Imports from Indonesia have increased markedly, going from 1,500 tonnes in 2003 to 5,600 tonnes in 2004. Other important suppliers are Morocco and Colombia. Spain is hence Europe's number one shrimp producer, importer and consumer.

- France: in recent years, imports have considerably increased from 73,000 tonnes in 2001 to over 100,000 tonnes in 2004. This trend is accounted for by the excellent performance of domestic production and the considerable drop in price of the Brazilian product.

- Italy: imports in 2004 were up 3% compared to the previous year, going from 57,000 to 59,000 tonnes. Italy chiefly imports frozen product (about 83%). Only a very small part is pre-cooked and then frozen; 13% of the product is processed and used for ready-made dishes. Until 2003, Argentina was the main supplier, accounting for about 70% of Italian imports, followed at a distance by India (about 10%). The remaining 20% was made up by imports of *Penaeus vannamei* from Ecuador (about 10%), and of Giant tiger prawn (7%) and giant freshwater prawn (3%) from Thailand.

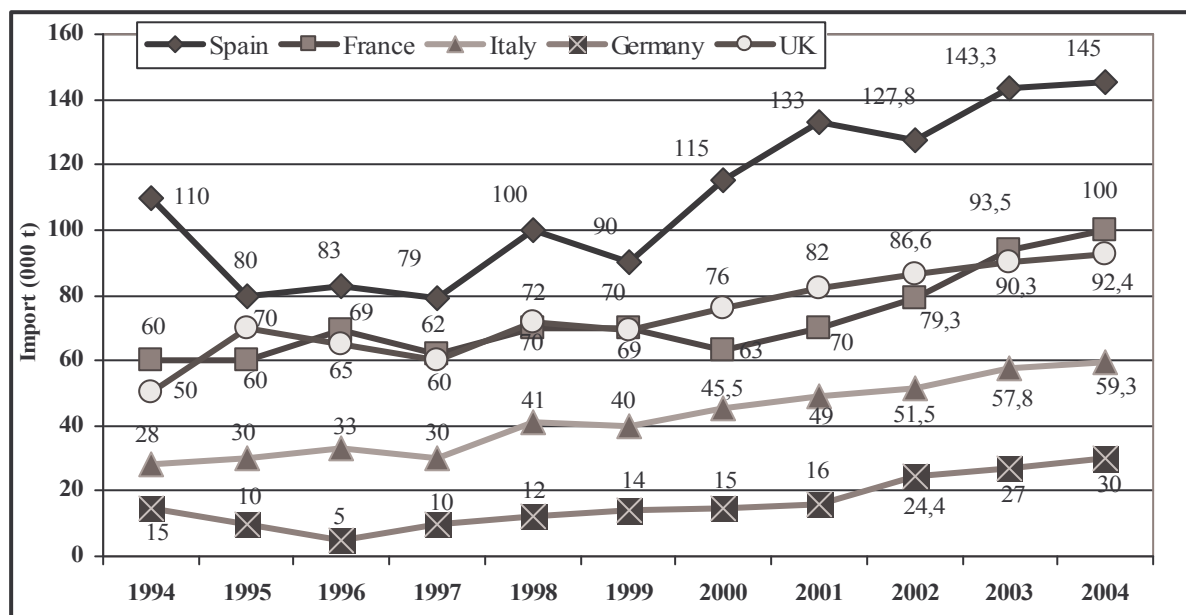
However, in the first semester of 2004, a poor catch caused the price of Argentine shrimp to increase by 30-40%. Imports from this supplier hence diminished, from 9,200 tonnes in 2003 to 6,100 tonnes in 2004 (-34%). This loss was made up by increased imports from Ecuador fisheries, which hence became Italy's number one supplier with 10,300 tonnes in 2004 (+51% compared to 2003). Imports from India also increased in the same period, up 10% to 4,400 tonnes.

In Italy the product is largely marketed as shrimp tails and only a small part is sold whole. Shrimp tails in Northern Italy account for 90% of sales against 10% whole, while in central and southern Italy the whole product amounts to about 25% of sales.

British and German imports have increased considerably over the last years, reaching quantities close to those of Europe's three leading importers.

"Apparent" per capita consumption has been estimated taking into consideration imports, exports and domestic production data over the period 1995-2001. As may be seen, in Spain per capita consumption has increased by 53% reaching nearly 4 kg. Italy has also recorded an increase up about 37% to a little more than 1 kg per capita. Per capita consumption has also increased in Great Britain, up 30% to over 0.6 kg. French per capita consumption, which in a number of years has been more than 1 kg, has instead been fairly stable or indeed has slightly dropped (-7%). However, considering French import trends over the last few years, it may be said that consumption has increased, even if only slightly. Of the countries considered, Germany's per capita consumption rate has been the lowest, increasing by 15%, corresponding to about 400 grams a year.

Figure 9 - Shrimp Imports - most important European Countries, 1994-2004



Source: from Globefish Data, 2004

5. Conclusions

According to FAO estimates, in 2020 world aquaculture production will reach about 50 million tonnes, thanks to the development of techniques for the rearing and farming of about 50 new species of aquatic organisms. It is worth noting that, apart from genetic improvements conducted on a limited number of species, the majority of farmed aquatic organisms are very similar if not indeed identical to the species in the wild.

The countries which stand to gain most from these developments are in south-east Asia, and more precisely China, India, Indonesia and Thailand. Increased aquaculture production will chiefly concern shellfish, especially penaeid shrimp, largely thanks to the availability of vast areas still waiting to be exploited and the development of new production methods that are already beginning to greatly enhance production. In fact, over only a few years, farming practices have changed radically, going from extensive or semi-intensive with yields around 100 to 400 and 2,000 to 3,000 kilos/ha/year, to intensive with yields of 5 to 10 tonnes/ha/year, and finally, thanks to high-tech fisheries, to hyper-intensive, with yield capacities of over 100 tonnes/ha/year.

The increased interest in penaeid shrimp farming compared to that for other species may be ascribed to a number of factors including:

- the wide distribution of habitats potentially suitable for farming;
- the high price fetched on the market, and hence good profitability;
- the quick growth rate of the species, the specimens of which may reach market size in 3 to 4 months thus permitting as many as 2 to 2.5 production cycles a year in native areas;
- the high natural resistance and adaptability of the species to even extreme ambient conditions;

e) generally well-defined and developed reproduction and fattening methods capable of guaranteeing successful farming.

It should in any case be noted that fishing trends greatly affect shrimp farming, both in terms of quantities sold and product price. Over the last 3 to 4 years, farming has developed considerably, not only in areas traditionally given over to this type of activity, but also in other, so far more marginal areas, such as the Mediterranean. This trend is chiefly due to the recent sharp drop in catch and to the consequent steep increase in prices, and to greater demand.

Satisfactory results have so far not been achieved by attempts at penaeid shrimp farming in Italy. These attempts, made with Japanese shrimp, date back to over twenty years ago and were essentially experimental.

Despite this poor record, in recent years there have been positive developments in Italy in this sector. As the market for farmed gilthead and bass has become saturated, great efforts have in fact been made to diversify the offer of farmed fish products. Several Italian farmers are hence strongly engaged in experiments involving all stages of penaeid shrimp production, from reproduction to larva weaning and fattening.

Shrimp farming initiatives in Italy need to be supported with adequate measures and tools to be carefully planned so as to properly sustain these efforts. More precisely, what is required is:

- 1) the study and development of appropriate rearing and farming methods for new species;
- the development of suitable hatching methods so as to ensure self-sufficient hatcheries capable of fully managing this stage of the production process;
- facility upgrading;
- product image enhancement and promotion through appropriate marketing strategies.

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