Potentialities of aquaculture in the revitalization of Moroccan exports of sea products
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“If we want to continue to consume fish, aquaculture has to exist and develop in a context of complementarity with fishery”

www.rungisinternational.com
Introduction

Aquaculture constitutes a promising sector in fast growth and carrier of an important potential. It is called to play a major role in food safety, and in the global employment and economic development, and so constitutes a strategic sector for the future. Contrary to several regions worldwide where this activity is growing at a very fast pace, aquaculture in Morocco remains a limited activity with a production not exceeding a volume of 400 tons per year, that is less than 0,1 % of the national fish production.

Aware of its importance, Morocco shows a firm will for the development of this sector implemented through the integration, at the level of the Halieutis plan, of components dedicated to its development. It’s in this context that we should consider the creation of the National Agency of Aquaculture Development (ANDA) having for mission, in particular, to implement a specific strategy to this component and to promote the aquaculture activities. The objective of Halieutis Plan is to achieve 200.000 tons of aquaculture products by the year 2020, which would represent 11 % of the total fish production of Morocco estimated at 1, 75 million tons.

The present work has for objective to draw up an inventory of fixtures of the world aquaculture as well as in Morocco and to estimate the existing potentialities and the export opportunities offered at regional and global levels.

1. Situation and trends of aquaculture worldwide

1.1. Evolution of the global aquaculture production

The total of the production of capture fisheries and aquaculture (except aquatic plants and products not intended for the human consumption), reached approximately 158 million tons of fishes in 2012 of which 43% coming from aquaculture. Since the middle of the 90s, the production of capture fisheries has remained globally stable at approximately 90 million tons whereas the production of aquaculture of continental capture has increased in a spectacular way.

Figure 1: Evolution of world fishery and aquaculture production (in thousands of tons)
In fact, the aquaculture production is developing more and more around the world and has positioned for several years as a viable alternative to the resources depletion of capture fisheries. Thus it registered a supported growth during the last fifty years, increasing from less than 1 million tons at the beginning of the 50s to 60 million tons in 2004, to reach then a level of 66 million tons in 2012. If we include aquatic plants and products not intended for the human consumption supplied by the aquaculture exploitations, the world aquaculture production reached 90 million tons in 2012.

In terms of contribution of aquaculture in the whole fish production, shellfish and mollusks, it increased from only 3 % in 1950, to 13 % in 1990 then to 26 % in 2000 before reaching the peak of 42 % in 2012.

1.2 Structure of the world aquaculture production by environment of culture and produced species

The major part of the aquaculture production comes from marine and fresh waters (contributing to it respectively by 47 % and 46 % in 2012). As for aquaculture in brackish waters, it represented only 7 % of the world aquaculture production during the same year.

In terms of cultivated species, the world aquaculture production consisted, in 2012, of 49 % of fish, 26 % of aquatic plants, 17 % of mollusks and 7 % of shellfish. The distribution of this structure by environment of culture shows that fish are much more produced in fresh water (92 % of the whole aquaculture production of fresh water) that in marine waters (10 % of the total aquaculture production of marine waters), contrary to mollusks and aquatic plants whose major produced part arises from aquaculture practiced in marine waters.

**Figure 2: Composition of the world aquaculture production by species and by environment of culture**
1.3 The main aquaculture producers worldwide

From 1990s, captures stagnate but aquaculture develops and confirms its dynamism and its fundamental role in animal proteins supply. This spectacular increase of aquaculture production worldwide is completely attributable to the Asian countries which contributed together to this production of about 91% during the last ten years. This predominance is essentially due to the enormous Chinese production, which represents about 64% of the world production during the same period.

It is to indicate that from year 2000, other Asian countries experienced a remarkable increase of their production strengthening the position of Asia and allowing increase their contribution from 22% in 2000 to 32% in 2012 in the total of the world aquaculture production.

Figure 3: Evolution of aquaculture production by continent (in thousands of tons)

Next to China, which remains the first and the largest world aquaculture producer, the other Asian countries as Indonesia, India, Vietnam, the Philippines, Bangladesh, South Korea, Thailand, Japan and Myanmar are at the top of the world ranking, allowing Asia to realize an aquaculture production of 82, 5 million tons in 2012, that is more than 90% of the world production during this year.
At the level of the American continent, the aquaculture production registered in 2012 was estimated at 3.2 million tons among which 2.3 million tons realized at the level of the Caribbean and of South America with three countries, namely Chile, Brazil and Ecuador constituting 74.5% of the volume produced by the continent. Besides, in North America, the aquaculture production reached 860,000 tons in 2012 thanks to the salmon of the Atlantic Ocean in Canada and to the brill river in the United States of America.

For Europe, the registered aquaculture production in 2012 bordered some 2.9 million tons consisted mainly of fish (mainly diadromous fish) and mollusks. This European aquaculture leads the production of a number of species with strong value (salmonids, European bass, gilthead bream, and turbot) and contributes in a significant way to the global aquaculture development thanks to the transfer of knowledge and technologies. At the level of this continent, Norway is by far the first producer and also one of the first 10 aquaculture producers worldwide by being ranked 8th.

Nevertheless, for Africa, and in spite of the existence of a known potential, the production remains limited in comparison with the other regions of the world and it is true with the exception of Egypt which ranked 12th worldwide and by far the first aquaculture producer at the level of the African continent (62% of the total of the African aquaculture production), followed by Nigeria (15%) classified in position 22 worldwide. The production of Egypt is dominated by the tilapia and the mullet and that of Nigeria comes essentially from the tilapia and catfish.
1.4 Overview on the global trade in fish products

The statistics of fish trade on an international scale do not establish distinction between products taken in the nature and those coming from aquaculture exploitations. That is why the analysis of the world trade in the present study will concern fish products without their distribution by type of production.

The international trade of sea products, which exceeds the 100 billion dollars a year, favors the exchanges and the diversity of the consumer products. Nevertheless, this trade is characterized by the concentration of import flows in high-income countries (North America, Europe, and Asia). This trend is understandable, on the one hand, by the increase of the domestic demand on behalf of the populations of these countries, which are getting more and more fish-eating and, on the other hand, by the implementation of measures of management and the limitation of fishing activities aiming at the conservation and the reconstruction of fish stocks.

This is the way Europe remains the biggest import market of fish products with a part of 40% of the world imports originating from other regions of the globe as well as from intra-European exchanges.

Asia takes second place out of import zones, marked by a strong contribution of Japan and China by which the imports do not stop increasing to satisfy a growing domestic demand for sea products due, in particular, to the increase of the standard of living and the globalization of food habits.

By countries, China is the first exporter of fish worldwide (4th importer) while the United States and Japan are the first importers.
The main responsible countries for trades in fishery products (average 2008-2012)

Imports in millions of dollars

Exports in millions of dollars

1.5 Preference of the global demand for fishery products

With the stagnation of capture fishery and the growth of the population worldwide, the aquaculture is considered to have the strongest potential to produce the required quantities of fish to satisfy a growing demand for foodstuffs of aquatic origin, which are known for their good quality.
The modes of consumption vary from a region of the world to another. If Latin America produces and uses a lot of flours and non-food oil, in particular for salmon farming in Chile and shrimp farming in Ecuador, it is a little fish-eating region, where people consume fresh or refrigerated fish, in spaces near the ports of landing. In Europe and in North America, two thirds of fish are intended for the human food, either by freezing or by conditioning. As for Asia and Africa, fish is often consumed in the fresh state. Not having enough access to refrigeration systems, the populations of Africa salt but especially dry and smoke fish a lot.

2 Analysis of the aquaculture situation in Morocco

2.1 History of Moroccan aquaculture

In Morocco, the first aquaculture activities began in 1924 with continental fish farming with the creation of the fishing resort of Azrou, the initial objective of which was the promotion of sport fishing. Afterward, this activity was redirected to food fish farming, under the shape of intensive farming in natural and artificial ponds. After the 90s, the private investment witnessed a big development and some private aquaculture units are at present active practicing the farming of rainbow trout, eel, tilapia, oysters and carps. As for the marine aquaculture, its history in Morocco was characterized by main dates below:

- 1950: launch of oyster farming in the lagoon of Oualidia with an annual production of about 200 tons and some oyster companies are still operational.

- 1980: launch of the intensive fish farming in the Mediterranean Sea with two marine exploitations, in this particular case, MAROST Company in the lagoon of Nador and the Aqua M'diq Company in the bay of M'diq. The production of these units is concentrated on the European bar and the gilthead sea bream.

- 1990: launch of red tuna farming in the bay of M'diq using big floating cages.

- 1992: implantation of the "Aquaculture Company of Moulouya (SAM)" in the outfall of Moulouya, directed to the production of oysters, clam, shrimp, the European bar and the gilthead sea bream.

- At the End of the 90s: begin of the of scallops farming in the bay of Imessoune, and mussels in the bay of Imessoune and that of Agadir, and the implantation of oysters fattening activity in the lagoon of Khnifiss.

- Early 2000s: development of shellfish farming in the bay of Dakhla, based on the fattening of bivalve shells (clams and oysters).

2.2 Evolution of Moroccan aquaculture production

In Morocco, the aquaculture production represents only 0, 1 % of the national aquaculture production. In 2013, the national aquaculture production was of 433 tons among which approximately 93 % of fish and 7% of shells. The analysis of the evolution of this production shows that aquaculture was dominated by two main phases:

Before 2006: during this period, the production witnessed an erratic evolution. The fishery production, composed essentially of the bar and the sea bream, quickly increased after its launch in 1990 to reach 1.200 tons in 1995 and, since then, it fell
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until 2001. Then, this production started growing again between 2001 and 2005 and reached its maximum of 1300 tons in 2005. As for the shellfish production, composed essentially of hollow oysters and located in Dakhla and Oualidia, it remained almost constant around 300 tons since the 90s.

After 2006: this phase was marked by the remarkable fall (in 2006) of fishery production after the termination of MAROST Company activities in Nador (because of a financial dispute against its bank). Since this date, the production was limited to levels of less than 400 tons, dominated by shellfish activities. As for fishery production, it did not exceed during this period 35 tons of fish per year (bar and sea bream), produced by a single aquaculture farm (Aquam’diq).

Figure 7: Evolution of Moroccan aquaculture production in volume (in tons)

Source: ANDA

2.3 Constraints hindering the development of aquaculture in Morocco

The Moroccan aquaculture sector was characterized these last years by an important reduction in its production already low before and by a reduction of the number of aquaculture companies in service.

This regression, which this sector witnessed, is largely understandable by the difficulties it faces on the national, as well as the international scale, what hinder seriously its development and survival. These constraints can be classified as follows:

Environmental issues

An inappropriate management of the farming sites can lead to environmental issues. Metallic contaminations were seen in many lagoons, in particular that of Khnifiss and Oualidia as well as the frequent occurrence of biotoxins in the Bay of M’diq.

Sanitary restrictions for export

The shellfish farming (flat oyster and European clam) was very affected by the European sanitary restrictive measures adopted since the end of the 80s, and which were at the origin of the
limitation of the produced quantities and only the oyster farming in the lagoon of Oualidia remained relatively stable in the evolution of its production for the food supply of the national market. Although it always depends on the spat of natural harnessing imported from France, the oyster farming in the lagoon of Oualidia was able to maintain its annual production at around 200 to 300 tons during many years.

**Foreign competition**

The Moroccan aquaculture products are marked by a low competitiveness facing the strong competition on the world market from powerful competitors having benefited, in particular, from public grants particularly in Europe. Thus, the Moroccan aquaculture production of the wolf and the sea bream which is exclusively export-oriented and strongly dependent on the international market, witnessed difficulties in accessing the European market after the price drop in this market and in the face of the competitiveness of the foreign aquaculture. Besides subsidies, other factors tend to raise the competition stakes: it involves in this particular case economies of scale from which benefit the productions that are strongly concentrated in these countries, the advantages in terms of institutional and organizational organization as well as the measures of collective frame of the activity (insurance, marketing, training, etc.).

**Constraints to investment**

The aquaculture is a strongly capital-intensive activity as far as the implementation of production units requires alteration work and preparation of sites as well as important equipments, what infers considerable costs in the entry. To this is added the cycle of production for these activities which is relatively long with a product marketing which intervenes only after 2 or 3 years from the begin of the project. Other constraints hinder the Moroccan aquaculture investment following the example of the complexity in accessing the real estate and the Maritime Public domain.

Besides, the exploitation of sites requires largely imported raw materials (alevins, spats, food, etc.) among which some are subject to customs duties in the entry which affects the competitiveness of the local producers compared to the foreign competitors. To note, however, for food intended for aquaculture, the finance law 2016 plans a reduction of 2.5 % in import duties instead of 25 % in 2015 and within the limits of 25,000 tons a year. This incentive measure will be effective for two years and will come to an end in December, 2017.

All these factors make it so that the success of an aquaculture investment goes first of all through the availability of a working capital (own capital, structural debts) mattering to finance at the same time the costs of installation and the needs for exploitation.

**Absence of a global development vision of the sector**

Before the adoption of the new current strategy, the absence of a development vision of the sector was largely responsible for the unsuccessful committed projects of breeding and it is true because of:

- The absence of a policy of support and accompaniment of the aquaculture projects,
- The absence of adapted financing and possibilities of insurance because of the small size of companies,
- The multiplicity of the administrative participants,
  Very low level of integration of the existing companies of the sector and the absence of
  hatcheries of alevins and spats which generates a dependence on Europe (cf. appendix 1),
- The phase shift between the research and development,
- The low number of food production units,
- The absence of communication and promotion in fisheries products and aquaculture
- The failure to understand the internal market and the preferences of the consumers

### 2.4 Favorable assets for the development of the Moroccan aquaculture

Besides natural potentialities in terms of diversity of favorable zones which could shelter
aquaculture activities (lagoons, bays, high tide or low zones in sea border and of available and
qualified human resources, Morocco has strategic assets to develop the aquaculture sector.

In this way, trade agreements allow the Moroccan products a favored access to markets
applicants as well as the closeness of markets applicants are so much of elements that offer a
climate of business favorable to the development of this activity.

Likewise, the national consumption of fishery and aquaculture products is in permanent
evolution. The important demographic growth, which Morocco is witnessing, combined with the
evolution of the modes of consumption, the significant development of tourism, the deployment
of the mass-market retailing in the whole of Moroccan territory and the development of the
fishery infrastructure; lead to predict a promising future in the sector of aquaculture

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**Figure 8: Favorable strategic assets for the Moroccan aquaculture development**
Potentialities of aquaculture in the revitalization of Moroccan exports of sea products

*Upwelling*: English word which means an oceanographic phenomenon which occurs when strong marine winds push the water of surface of the oceans leaving so a vacuum where bottom waters can raise with an important quantity of nutriments.

2.4 Main contributions of the new strategy to the development of the aquaculture sector in Morocco

Being among the 16 big projects of Halicutsis strategy, aquaculture is positioned at the level of the axis of durability as priority sector led to establish a driver of growth and job creation for the sector of fisheries. For the promotion of aquaculture, Morocco created, in 2009, the National Agency for aquaculture development (ANDA) whose main mission is the promotion and the development of the aquaculture sector in Morocco through:

. The implementation of a specific aquaculture strategy,
. The definition of a legal framework adapted with the government policy regarding aquaculture,
. The elaboration of coast development plans for aquaculture purposes,
. The launch of pilot projects (hatcheries, shellfish farms and algaculture),
. The creation of a "single window" to accompany the investment in this sector,
. The promotion of aquaculture activities and the trade in aquaculture products both in the export and in the national market. To do that, three projects under way.

As regards the calculated objectives, the ambition on the horizon 2020 is to realize 11 % of the national fishery production of Morocco (around 1, 75 million tons), that is 200,000 tons (against 400 tons at present), to generate a 25 billion dirham turnover, and to create 400,000 extra jobs.

In terms of structure, the production would comprise for more than half (55 %) of the shellfish
farming (breeding of the shells among which oysters and mussels and 45 % of the marine fish farming (thin, bar, sea bream, turbot and sole in the medium-term).

**Table 1: possible species for Moroccan aquaculture**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Adapted species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish farming</td>
<td>Wilf, sea bream, meager, sole, etc.</td>
</tr>
<tr>
<td>Shellfish farming</td>
<td>Oysters, mussels, clam, etc.</td>
</tr>
<tr>
<td>Shrimp farming</td>
<td>Shrimps of Penaeidae family</td>
</tr>
<tr>
<td>Algoculture</td>
<td>Micro et macro-algae</td>
</tr>
</tbody>
</table>

*Source: ANDA*

It is planned that the production is assured through four poles of production, namely: M'diq, Agadir and Dakhla (60,000 tons for every site), as well as Oualidia (20,000 tons).
Potentialities of aquaculture in the revitalization of Moroccan exports of sea products

Figure 9: identified zones for aquaculture development on the national level and the estimated production potential

TABLE 2 : Localization of sites at the level of four identified poles

<table>
<thead>
<tr>
<th>Poles</th>
<th>Sheltered sites</th>
<th>offshore</th>
<th>Low-lying area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bay de M’diq, Laguna of Nador</td>
<td>Rass el kebdana, Al hoceima, Jebha, Oued laou</td>
<td>Tahaddart, Loukkous</td>
</tr>
<tr>
<td>2</td>
<td>Oualidia Complex – Sidi Moussa</td>
<td>Sourialkdima</td>
<td>Oualidia–Sidi Abed</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>Bay of Immessouan, Bay of Agadir</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Laguna of khnifiss, Bay of Dakhla</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: ANDA
• From the point of view of the scientific research, the fish farming has benefited from:
• the implementation of a monitoring network of zoo sanitary managed by a national laboratory of pathology of the marine animals;
• the launch of a research and development program regarding diversification and studies on the nutrition of aquaculture species with, in particular, the development of the specific food for the meager as well as the identification and the insulation of the phytoplankton species of shellfish farming interest;
• The launch of projects to implement new aquaculture specialized laboratories and the experimental farms on a regional scale (Dakhla, Amsa to Tétouan).

3 Analysis of the potentialities of marketing of the Moroccan aquaculture products at the world level

Fishery products are among the main foodstuffs of the global trade whose value of their exchanges was about 136 billion dollars in 2013, according to the estimations of the FAO, increasing by more than 5% compared with the previous year. Besides, the consumption of fishery products does not stop increasing and the aquaculture contributes in an increasing way to the international trade in fishery products, by supplying species such as the salmon, the bar, the sea bream, the shrimps and the bouquet, the bivalves and the other mollusks, but also species with low value as the tilapia, the catfish and carp.

At the national level, the domestic consumption of fishery products grows by 8% per year on average in particular thanks to the improvement of the standard of living and to the increasing urbanization of the Moroccan population.

3.1 Dynamics of the global demand for the main fish products targeted by the Moroccan aquaculture

The present study has been restricted to examining the dynamics of the world demand for first-four species among those who could be developed by aquaculture in Morocco namely: mussels, oysters, bar and sea bream.

Sea bream

The evolution of the global demand for the sea bream shows a continuous growing demand, since 1994, on the European continent which saw its imports increasing from 23 million dollars in 1992 to 222 million dollars in 2004 then to 457 million dollars as maximum in 2011. On other continents, the imports of this product remain very marginal exceeding hardly 13 million dollars in Asia and about 100 thousand dollars in Africa.
Wolf bar

As for the world imports of the wolf bar, they remain less important than those of the sea bream. Their dynamics show a positive trend on the European continent since 2005 to reach a 4 million dollar peak in 2011. In contrast, America is marked by an important fall of its imports between 2006 and 2009.

Mussels

Mussels are among the most wanted mollusks worldwide. Thus, the world demand for mussels is characterized by a bullish trend since the middle of the 90s and the strongest rhythm
of its growth was essentially observed in Europe whose mussels imports increased from 207 million dollars in 1994 to 614 million dollars in 2011. These imports reached in 2011 a 115 million dollar value in America and 67 million dollars in Asia, against respectively 21 million dollars and 12 million dollars in 1994.

**Figure 12: Evolution of mussels imports at the level of different continents (in millions of dollars)**

![Graph showing the evolution of mussels imports from 1990 to 2011 across different continents.](image)

*Source: FAO*

**Oysters**

Regarding the world imports of oysters, they considerably increased during the last 10 years, and the largest part of this growth is to be imputed to Asia, Europe and in America which posted, in 2011, respective values of import of 134, 129 and 100 million dollars.

Oceania also saw its imports of oysters increasing these last years, although they limited themselves to approximately 12 million dollars in 2011.

**Figure 13: Evolution of oysters imports at the level of different continents (in millions of dollars)**

![Graph showing the evolution of oysters imports from 1990 to 2011 across different continents.](image)
3.2 Main potential export markets and the exchange flow for some species targeted by Moroccan aquaculture

*Sea Bream and bar*

Europe remains the most important market in the world where demand for sea bream and bar is high. As regards the sea bream, Italy is by far the main importer with 43,000 tons imported in 2013, followed by France (8,800 tons) and Spain (8,500 tons). The countries of the Northeast of Europe and Portugal also demand but with a much less important volume of import. These imports come mainly from two countries, worth namely Greece (53,000 tons) and Turkey (19,000 tons). Other countries of Europe (France, Italy, and Spain) and of the Mediterranean South export the sea bream on the continent but occupy relatively marginal positions.

**Figure 14: main European importers of sea bream and the supply flow in 2013**
For the bar, Italy is also at the head of the European import countries with a volume of 27,900 tons imported in 2013 ahead of Spain (9,000 tons) and France (5,100 tons). The Greece and Turkey are the biggest suppliers of the European countries in bar with exports today achieving in 2013 respectively 29 and 19, 5 thousand tones, far ahead of Spain (4,000 tons).

**Figure 15: Main European importers of bar and the supply flow in 2013**
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Source: www.APROMAR.es

Oysters and mussels

The European market can be considered by far to be the first world importer of mussels following the clear growth of the volume of imports of these products during the last decade. The analysis of mussel imports as well as the big exchange flow shows that the trade in intra-EU mussels is well developed. The majority of the European supplies in mussels come essentially from Netherlands, Ireland and Spain. The big commercial flows leave in particular towards Belgium, France, Italy and Germany. Nevertheless, the Netherlands occupies at the same time the place of the first exporter of mussels and second importer of these products.

<table>
<thead>
<tr>
<th>Country</th>
<th>Import</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Espagne</td>
<td>9.000t</td>
<td>5.650t</td>
</tr>
<tr>
<td>Grèce</td>
<td>60t</td>
<td>29.500t</td>
</tr>
<tr>
<td>Turquie</td>
<td>0t</td>
<td>19.500t</td>
</tr>
<tr>
<td>France</td>
<td>5.100t</td>
<td>2.000t</td>
</tr>
<tr>
<td>Sud méditerranée</td>
<td>1.300t</td>
<td>1.500t</td>
</tr>
<tr>
<td>Portugal</td>
<td>1.800t</td>
<td>160t</td>
</tr>
</tbody>
</table>

Table 1: Overview on the European aquaculture

The European aquaculture production is at present about 1.3 million tons. The predominance of the Mediterranean countries (Spain, France, Italy, Greece) is asserted in tonnages by mollusks and marine fishes (bar, sea bream, meager, turbot ...) with regard to Scandinavian countries, based on their marine salmon farming (780,000 tons of salmon produced in Norway). The Eastern countries are present in carp farming and diversify towards more developing productions (salmon, sturgeon ...).

During the last two decades, an emergence of aquaculture in Turkey and in Greece allowed them today to become two bigger producing countries of bar and sea bream, far ahead of France, Spain and Italy, first Mediterranean countries to have launched into the marine fish farming in the 80s.

The aquaculture production of these countries continues to overtaking captures bound to fisheries, in value as in tonnage, and the FAO plans a strengthening of this trend in the decades to come. As such, there is good reason to indicate that after the profusion of the aquaculture farms, in Greece in the 1990s, we observe that the number of companies in decreasing and their size increasing and they commit to heavy investments heavy in the sea and secure their vertical integration for inputs as in markets.
on the European continent. Besides, the supply outside of Europe is essentially insured by New Zealand.

**Figure 16: Main European mussel importers and the supply flow in 2011**

The oyster is becoming more and more appreciated throughout the world, in particular in restaurants and the evolution of the world imports has registered a positive trend on three continents: Europe, Asia and America. Among the biggest import countries of oysters in 2011, China-Hong-Kong is first with a value of imports of about 60 million dollars, followed by Japan, Italy and the United States (between 30 and 40 million dollars).

**Table 3: Big importers of oysters (alive, fresh, cooled, frozen, dried, salted and in brine) in the world in 2011**

<table>
<thead>
<tr>
<th>Countries</th>
<th>Importations in millions of $</th>
</tr>
</thead>
<tbody>
<tr>
<td>China-Hong Kong</td>
<td>57,08</td>
</tr>
<tr>
<td>Japan</td>
<td>39,9</td>
</tr>
<tr>
<td>Italy</td>
<td>31,7</td>
</tr>
<tr>
<td>United-states</td>
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</tr>
<tr>
<td>France</td>
<td>24,4</td>
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<tr>
<td>Spain</td>
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<tr>
<td>Belgium</td>
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</tr>
<tr>
<td>Singapour</td>
<td>13,99</td>
</tr>
<tr>
<td>Canada</td>
<td>13,86</td>
</tr>
</tbody>
</table>

*Source: Comtrade*
In terms of supply of the main importers of oysters in the world, it was noticed that the Republic of South Korea is the first and main supplier on the Asian and American continents with 92% market shares in Japan, 69% in Canada, 43% in the United States and 45% in Singapore. Nevertheless, in Europe, France, Ireland and Netherlands dominate the supply in the main European import markets of oysters.

Source: comtrade
Figure 17: Main suppliers of big oyster importers in the world in 2011

Source: comtrade
Potentialities of aquaculture in the revitalization of Moroccan exports of sea products
Conclusions and recommendations

Aquaculture became one of the major sectors of the world food production to meet the increasing demand for fishery products and allows, today, to ensure nearly half of the fish production consumed in the world. Indeed, in a world context marked by the decrease of fisheries resource, the growth of the world fish production was essentially ensured by the spectacular aquaculture development. This development of aquaculture production is completely attributable to Asian countries which contributed together about 91 % of this production during the last ten years including China ahead with (64%). On other continents, countries as Norway, Chile and Egypt are also among the first aquaculture producers in the world.

As for the aquaculture production in Morocco, it represents no more than 0,1 % of the total of the national fish production with an annual average volume of production not exceeding 400 tons. This sector came up against great difficulties, on a national scale as well as at the level of its external outlets, hindering seriously its development and its survival. At present, the Moroccan aquaculture is mainly centered on the flat oysters and the European clam whose breeding is practiced in the bay of Dakhla and the lagoon of Oualidia as well as on the European bar and the gilthead sea bream produced by two aquaculture companies still exercising their activities along the Mediterranean Coast (in M'diq)

The new development strategy of the sea fishing sector in Morocco rests on a major axis of durability whose objective is to ensure sustainable resource exploitation for future generations. This objective could not be reached without a real development of aquaculture allowing making of this sector a major engine of growth. According to this new strategy, the Moroccan aquaculture establishes a strong growth driver with two key aquaculture activities in this particular case: the fish farming and the shellfish farming, concerning in the medium term six main products among which oysters, mussels, clam, sea bream, bar and meager. To note that, Morocco has significant assets (natural potentialities, infrastructures ...) favorable to the aquaculture development

Starting from the objectives of this strategy, the examination of the opportunities of marketing on a worldwide scale of the products targeted by the Moroccan aquaculture strategy through the analysis of their dynamics by continent and of their exchange flows, led within the framework of this study, allowed to highlight the following reports:

- The consumption of bar and gilthead sea bream is growing fast since the end of the 90s, mainly in Europe, further to the sharp increase in imports from Greece and from Turkey;

- The statistics of year 2013 show that Italy is by far the main importer of bar and sea bream on the European continent, followed by France and by Spain. These imports come mainly from Greece and Turkey. The countries of the Mediterranean South (Egypt, Morocco) export on this continent the bar and the sea bream but occupy relatively marginal positions;

- Oysters and mussels are among the mollusks that are more and more demanded in the world. The imports of oysters considerably increased during the last 10 years, in Asia, Europe and America as well. As for mussels, their demand is characterized by a positive trend since the middle of the 90s and the strongest growth rate was essentially observed in Europe;
The European market can be considered by far to be the first world importer of mussels and its imports come essentially from Netherlands, Ireland and Spain and go largely to Belgium, France, Italy and Germany;

The Republic of South Korea is the first and main supplier of oysters on the Asian and American continents. Nevertheless, on Europe, France, Ireland and Netherlands dominate the supply of the main European import markets of oysters.

To seize the offered opportunities and guarantee the conditions for the success of the new aquaculture strategy implemented by our country, some stakes arouse inevitably diverse economic, environmental and social concerns and call up to a coordination between the various sector participants. For that purpose, the strategy would be better off taking into account the following main suggestions:

**The promotion of conservation and coastal and continental lands management for a rational exploitation of resources**

- The cement of sustainable development of the aquaculture activity in marine environment is based on the system of election of the most adequate site within the integrated management system of the coastal zones (GIZC). Thus, the preparation of the integrated development plans of coastal zones especially in the aquaculture development poles is imperative with acuteness to estimate better the potential and ensure a long-lasting exploitation. These plans should integrate the social, economic and environmental characteristics of the development area of the activity, so as to reconcile at best the development of the activity within its environment;

- The use of the systems of geographical information allows to model the environment and to establish a development, adapted to every zone, so as to predict the short, medium and long term effects of the activity on the continental and marine environment;

- The development of the fish farming can be of use to the valuation of the farmlands whose exploitation was given up for reasons of soil salinity particularly in the zone of Souss;

- The development of a long-lasting aquaculture requires an ecosystematic approach to optimize the production by ensuring the sustainability of the services mobilized for the aquaculture production: quality of the water, the production of juveniles / spats…;

- The creation of a context favorable to the promotion of aquaculture requires the strengthening and the improvement of the public infrastructures among which, in particular, the access roads to zones identified as having a high potential for aquaculture.

**Strengthening the financial means**

- The direct financial support for the operators of the private sector as aquaculture developers and as suppliers of aquaculture food is vital for the process of launch of aquaculture projects. This support should include the implementation of a program of micro-financing for the smallest operators and financing in reasonable interest rates;
• The encouragement of foreign investments and partnerships between the foreign investors and the local entrepreneurs can strengthen the financing of the aquaculture activity and the transfer of technical expertise and management;

• The help to the identification of potential suppliers of financing (sponsors, development banks, investors, etc.) capable of investing in the private sector is necessary through loans, subsidies etc.

Diversifying markets to ensure the aquaculture sustainability

• The diversification of outlets should be based on strategies for market inspections, by focusing on the study of their potential and their promotion;

• The development and the establishment of the specific quality standards for aquaculture remains essential because on an international scale, the markets of aquaculture products exist but the sanitary restrictions remain very strict requiring an offer of quality products with competitive prices;

• The competitiveness of an aquaculture product depends strongly on its adaptation to the preferences of the consumers which concern, in particular, the visible freshness, the price, the presentation and the species. As such, the big business concerns which target the overseas markets would improve the competitiveness with the availability of storage installations of fresh or frozen products, in particular in airports.

Other prospecting leads

• The model of development of the Moroccan aquaculture should be adapted to its own resources and its specific conditions. Water resources, production costs and valuable structures, markets, not being the same as in other rival countries (China, Viet Nam, Norway, Chile, Greece, Turkey and Egypt), Morocco should, from then on, conceive its own positioning by taking into account its potentialities and its medium and long-term ambition;

• It is essential to improve the independence and the vertical integration of aquaculture farms by producing in Morocco alevins, spats and food necessary for the development of the aquaculture activity;

• The local market of aquaculture products, which remains little developed compared with other countries, is an important field to be explored. In this direction, a better knowledge of the preferences of the national consumers for these products, combined with campaign of communication, turns out to be essential;

• With the development of the national tourism and the growing demand from restaurants for fisheries products, the local market is an important outlet for aquaculture products especially as internal marketing circuits begin to get organized with the implementation of wholesale markets and distribution hypermarkets. An important effort of production,
organization of the networks of retail business, communication and marketing should be granted to make the aquaculture products known by the general public.

**Appendix: Alevins and spats supply in Morocco**

**Dependence on external inputs for alevins and spats**

Among the main bottlenecks preventing the take-off of the Moroccan marine aquaculture today appears, unfortunately, the unavailability of the main inputs at the local level (alevins and food for breeding) essential in the production process. It is advisable to underline at this level that these two inputs represent in a general way more than 70% of the production cost. From then on, an additional cost at the level of these two products subject to customs duties obligations as well as to transportation and transit would challenge the economic viability of our companies in a very competitive current economic environment.

Only the laboratory of the INRH of M’diq produces alevins of fish (bar, sea bream, meager) which is largely used by a national private enterprise. The production capacity of the aquaculture station of M’diq is 500,000 alevins of bar and sea bream a year, with a real production not exceeding 120,000 to 130,000 alevins a year.

As for shells, and for lack of hatcheries at the national level, the spats of oysters are totally imported from France. For mussels, the supply is made by harnessing of natural spats.

Concerning the production of seeds of farmed shrimps, there are no hatcheries, to date, which produce post larvae intended for the sector of shrimp farming.