The importance of Aquaculture
in the European diet
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International Academy of Gastronomy
This book has been made possible thanks to the funding provided by the Spanish Ministry of the Environment and Rural and Marine Affairs, through the Secretariat General of the Sea.
Europeans like to eat fish and shellfish products. We consume an average 22 kgs of seafood per year per capita and this figure is likely to continue to increase in the coming decades. This average comprises different scenarios ranging from 3 kgs per capita in Romania to 60 kgs per capita in Portugal. Obviously, tastes also differ considerably from one country to the other. This diversity in both production and consumption of seafood is an essential characteristic of the European Union.

In view of stagnating wild fish catches, the only way to meet an increasing demand for fish products in the EU is through aquaculture or imports. The European Commission, therefore, considers that it is of strategic importance for the European Union to create the best possible environment for the sustainable development of its aquaculture production. It is with this objective in mind that we have undertaken to prepare a revised strategy for the sustainable development of EU aquaculture in 2008.

The EU has considerable assets to achieve this objective. We have a strong aquaculture tradition covering both fish and shellfish farming. We have good sites that allow the development of a wide variety of products, including both freshwater and seawater species. We have a strong and increasing demand for fish and seafood products. We have world class aquaculture research and technology and we have a vibrant aquaculture community that is innovative, market oriented and responsible.

All this allows our industry to deliver not only safe and environmentally sustainable aquaculture fish and shellfish, but also healthy and tasty products. It is important to highlight these beneficial attributes and improve the public knowledge and appreciation of Europe’s aquaculture products. Aquaculture, like all food related industries can produce a wide range of quality products, responding to different needs and markets, including those of gourmets and chefs in our best restaurants.

This book and its recipes, prepared by some of our leading chefs, will do a lot to help European consumer to better understand the aquaculture sector and its ability to deliver high quality, safe and tasty seafood to the European consumers. I invite all readers to try these recipes and experience for themselves European aquaculture products.

Bon appétit!

Joe Borg
European Commissioner with responsibility for Fisheries and Maritime Affairs
It is a pleasure to present a recipe book focusing on how to prepare fish, the most health-giving food that Mother Nature has given us.

The history of aquatic product consumption is as old as Mankind itself. Homo erectus, apart from hunting land animals, was undoubtedly a fisherman, thus broadening his palate of culinary preferences. The marine environment, throughout prehistory and history, has always conveyed a certain “mystique” bristling with suggestions which, in certain cases, was linked to beliefs that were not only cultural but also religious. In the 2nd century B.C., the first book of recipes appeared. Athenaeus wrote the book, “The Deipnosophists”, a treaty, among other things, on the delights of the palate enjoyed by the Hellenists in their long tradition of exquisite meals that were one of the most important elements in their philosophical debates during the evening banquets: “the symposiums”.

Nevertheless, as a result of man’s action, the marine environment has gradually deteriorated, and the living beings that used to occupy it now see their natural habitat threatened.

Fish farming on an industrial scale made its first appearance in the 20th century, with the creation of the necessary transition from catching to farming, something that had already occurred some 8,000 years ago with land animals. Aquaculture products are not only similar but, in certain aspects, are better than their equivalents in the wild. More importantly, they reach the market first, thus guaranteeing the freshness and quality associated with them.

Nowadays, the greater part of the world’s population is aware of the quality of European aquaculture products as regards their taste and health-giving properties. For this reason, they are increasingly in demand.

It is up to the talent of European chefs to obtain the best from this book of recipes, which can be considered as a preamble to their endless imagination in using products from aquatic farms. In this manner, this compilation is designed as a “suggestion” and stimulus for a future edition with many additional contributions on how to prepare our fish.

JOHN STEPHANIS
President of the Federation of European Aquaculture Producers (FEAP)
The darkest forecasts point to world fishing activities slowing down over the next three decades, as a result of stagnation in the fishing grounds. For this reason, the only way to meet the demand for fish, which is growing exponentially, is to rear aquatic species in captivity, i.e., aquaculture, invented by the Chinese way back in time, although as an industrial activity, it is barely 30 years old. Such is the recommendation of the FAO (Food and Agriculture Organization of the United Nations) itself, as a need to improve global food security.

This is a sector involved in a non-stop growing process where, due to the demands of consumers, controls are increasingly strict, both from the sanitary and environmental conservation points of view.

Federation of European Aquaculture Producers (FEAP)

Aquaculture also entails a substantial backing for gastronomy and, to illustrate this, the International Academy of Gastronomy, with the support of its Spanish counterpart, and the FEAP (Federation of European Aquaculture Producers) present you this book with one essential message: fish and seafood from aquaculture (nearly 50% of all that is marketed worldwide) have an excellent quality and can be prepared in similar ways to wild fish caught at sea, which means an excellent alternative in these times of widespread inflation in food prices.

Spanish Government and E.U. support

This work has been made possible thanks to the funding provided by the Spanish Ministry of the Environment and Rural and Marine Affairs, through the Secretariat General of the sea. The book has also been supported by the European Union and, for this reason, the Commissioner with responsibility for Fisheries and Maritime Affairs, the Maltese Joe Borg, has contributed with a preamble, highlighting the specific weight and importance of this emerging sector.

Recipes by the best chefs

To demonstrate this, over the following pages you will find the contributions of some of the best chefs in Europe, selected by the National Academies of Gastronomy, each presenting recipes, all built on species from aquaculture, opening up to us a marvellous vista of possibilities.

But this is not only about “cuisine”, as this work draws together contributions from the leading European experts in aquaculture, headed by the FEAP President and Secretary General, John Stephanis and Courtney Hough, respectively, who look into the subject of “rearing” from all angles.

The associations in Greece, Spain, Italy, France and Poland also express their points of view, delving into the realities of the sector from different approaches such as research, sustainable development or market matters.

Reared fish

After a look at the “corpus” of this book, some very optimistic conclusions may be drawn. For example, that after several decades of research, improvements have been made to farming methods, fish health and their nutrition, thus improving their welfare and growth characteristics. For this reason, the European aquaculture sector is very optimistic as long as there is a commitment to technological development and diversification of farmed species, a by now unstoppable trend.

So we invite you to discover, in all its diversity, many interesting aspects, from the angles of industry and good cooking, of the marvellous world of “reared fish” as a priority ingredient in 21st century ovens.

RAFAEL ANSÓN  
Honorary Chairman of the International Academy of Gastronomy

GEORGES HUSNI  
Chairman of the International Academy of Gastronomy
Introduction

Eating fish and shellfish is a unique pleasure that provides memorable moments of gastronomy, which are exemplified by the extraordinary recipes contained in this innovative book. The reputations of the leading chefs need little explanation but their choices amongst the products of European aquaculture reflect the quality of the raw materials and the growing importance of this young and dynamic food sector.

European aquaculture, through its growing contribution to the fish and seafood value chains, now supplies more than 25% of the total European landings (fish and shellfish combined). It is an important social and economic participant in European society, providing more than 80,000 jobs, predominantly in coastal and rural areas. The sector gives year-round employment, supplies opportunities to reduce urban migration, particularly in areas affected by reduced fisheries activities, giving additional dimensions of social and economic cohesion in fragile communities.

Elsewhere in the world, notably in Asia, aquaculture has also grown and made important advances, providing significant contributions to nutritional and food security demands, poverty alleviation and social well-being.

As the activities of processing and product distribution have progressed, so has the development of the national and international trade of aquaculture products, providing new incentives for investment and diversification in many areas of the world. Salmon, trout, sea bass, sea bream, shrimps, oysters, mussels and tilapia—all products of aquaculture—are now commonly available to the European consumer, on a year-round basis.

The knowledge and technology required for aquaculture’s growth have developed rapidly over the last 30 years, raising a small-scale skilled family activity to that of an advanced technically-qualified profession. The image and structure of European aquaculture has thus changed dramatically, influenced by consumer preferences, changing market structures and conditions, as well as European and National legislation concerning the environment and food safety.

There are now many family-based and small businesses active in European aquaculture but growth has also brought changes in the sector’s structure. The sector now includes multinational companies, active in different countries and even continents, all of which developed from small beginnings.

The common interests of the profession are represented through Regional and National Associa-
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Why did European Aquaculture develop?

For centuries, Europe’s citizens have benefited from the abundance of the oceans which has given fish and shellfish that became traditional and appreciated components of their diet. Fish in particular plays an essential role within a healthy diet, providing a variety of excellent nutrients –including poly-unsaturated fats, minerals, vitamins and a range of oligo-elements– all of which contribute positively to human health and wellbeing.

Fish, shellfish and crustaceans form integral parts of different culinary traditions throughout Europe, where the different gastronomic qualities of the wide variety of species available –both marine and freshwater– from an important part of Regional, National and European heritage.

Traditionally supplied from marine fisheries, European coastal communities have been strongly linked to this way of life and have high consumption levels of the many different seafood species available. The decline in fisheries landings of the European fleets has been evident in recent decades, where the effects of overfishing have resulted in reduced fish stock levels in European waters. Management regimes, imposed by European and National authorities, have thus lowered the activities of marine fisheries within major efforts to restore the natural stocks for fisheries in the future. After peaking, whereas European waters gave over 9.5 million tonnes in 1989\(^1\), the landings had reduced to some 6.2 million tons by 2003\(^2\).

European aquaculture has grown very quickly, rising from 230,000 tonnes in 1955 to over 2 million tonnes 50 years later, nearly a ten-fold increase and confirms that it is the fastest growing agrifood sector in Europe.

Most of this production was, in fact, shellfish production –mainly mussels, oysters and clams– which is made in many of the coastal areas of Europe, although France, Italy and Spain are predominant farming areas (see the below figure).

As can be seen, shellfish production stabilised in the 1980s while fish aquaculture has continued to increase significantly during the last 20 years.

In inland Europe, where freshwater fisheries are less important than their marine equivalent, aquaculture started in the Middle Ages so as to provide fresh fish that was otherwise unavailable and to follow the centuries-old law of meat abstinence on Fridays.

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1 Source: Fishstat database (2007).
2 Source: Data on the Common Fisheries Policy (European Commission: 2006).
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Fish farming methods and conditions are highly technical.

Carp and other freshwater cyprinid fish were the first fish species to be reared, using techniques that are still practised today, in large freshwater ponds. Carp production eventually became a very important activity in central Europe, providing over 160,000 tonnes of fish by the late 1980s 1.

Brown trout (Salmo trutta) and Rainbow trout (Oncorhynchus mykiss), both salmonid species, were the next major species to be successfully cultivated in freshwater, once the farmer had mastered the mysteries of the life-cycle and was able to use mature individuals to provide the fertilized eggs that are nurtured to become juvenile fish (fry or fingerlings) for ongrowing. Trout aquaculture has the unique position of existing in every European country and, if the appropriate conditioning is made, many trout species can also be reared in marine conditions (e.g., in Finland, Denmark and Norway). The peak production period was in 2002, when nearly 330,000 tonnes of trout were produced throughout Europe.

Europeans know well and highly appreciate the Atlantic salmon (Salmo salar), an amazing fish that is born in freshwater and then transforms itself so as to migrate to the sea to grow; upon reaching maturity, the salmon returns to freshwater to reproduce, usually to the same river that it was born in – providing one of biology’s long-standing mysteries – how do they do it? This remains mysterious but is thought to be the result of a combination of smell and location guidance.

During the 1970s, the first salmon farms started in Northern Europe – once the techniques had been developed for mastering the physical transition of the freshwater juvenile to be able to support marine conditions. With quite a narrow range of climatic demands, mainly water temperature, and the geographic characteristics of the countries concerned, Norway and Scotland rapidly became the European leaders of this sector, with the Faeroe Islands and Ireland also investing in this area. By 2005, salmon aquaculture was providing more than 750,000 tonnes of fish, where most of this was for the European marketplace.

During this period, engineering developments allowed significant advances to be made, designing new systems for on-land and coastal farms, accompanied by innovatory equipment to improve husbandry and technical operations.

This figure shows how the profile of European fish farming has changed. While freshwater farming dominated until 1980, mainly trout and cyprinid species, the last 25 years has seen fantastic growth in marine aquaculture; in the first instance, the main development was the farming of Atlantic salmon in the northern parts of Europe.

At the same time, increased understanding was being obtained on the nutritional requirements of fish – which change radically at different life stages.

The need to establish knowledge on how to breed different species was exemplified by the start of the Mediterranean fish farming sector, which has been

3 All aquaculture production data (unless otherwise stated) has been taken from the FAO database (2007) of the Food and Agriculture Organisation (FAO) of the United Nations, and reflects data provided for the following countries – Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Faeroe Islands, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Former Yugoslav Republic of Macedonia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Yugoslavia SFR.

4 Source: FEAP 2007.
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The Diversity of European Aquaculture

New species and new activities continue to enter European aquaculture, offering elements for diversification within this dynamic activity.

In the Mediterranean, it is possible to rear a range of breams, such as Red Porgy (Pagrus major) and Dentex (Dentex dentex), as well as Meagre (Argyrosomus regius) and Cobia (Rachycentron canadum). Further north, the production of Atlantic cod (Gadus morhua) is now increasing in importance, with Norway rearing some 13,000 tonnes in 2007, while halibut (Hippoglossus hippoglossus) and sole (Solea solea) are also receiving attention.

Freshwater farmers are also diversifying their production, one of the most notable being the new activity of rearing sturgeon (a range of Acipenser species and Huso huso), both for the caviar and the meat. In addition, a range of catfish species have been examined – including wels (Silurus glanis) and the African catfish (Clarias gariepinus) – as well as fish such as the perch (Perca fluviatilis) and pike-perch, otherwise known as zander (Lucioperca lucioperca).

For some species, it has not yet been possible to master the conditions needed for reproduction, although the husbandry for ongrowing has been established – this is the case for the European eel (Anguilla anguilla) and Tuna (Thunnus thynnus). The rearing of both species depends on being able to find juvenile stocks for placement in farms that grow the fish to market size.

As one can see from this overview, more than 20 marine and freshwater fish species are cultivated professionally for the benefit of the European consumer, providing a wide range of choice to restaurateurs and home cooking.
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Changing lifestyles, where the European consumer increasingly appreciated convenience food preparations, shifted the way in which seafood was purchased—moving from the seashore or the fishmonger to the supermarket—giving an emphatic challenge to all fish and seafood suppliers. This has been reflected by an increased accent on processing, widening the product range and developing ‘consumer-friendly’ preparations that are now commonly available throughout Europe.

As a relative newcomer to the food supply sector—European aquaculture has been faced with the challenges of providing the consumer with desirable and affordable products, understanding a rapidly changing market, adapting to legislation affecting aquaculture production and food supply and finding new solutions to technical and operating conditions so as to occupy its rightful place within society.

Although the sector can be seen as a complex patchwork, characterized by the production of different species, different production zones and culture techniques—whether in marine or freshwater conditions—the diversity of the activity imposes extreme adaptability and responsibility and at all levels of the supply chain.

This diversity is the source of a dynamic approach to the current and future role of aquaculture in Europe. The profession is highly skilled and is committed to consolidating its development.

It is anticipated that the position and importance of aquaculture will continue to grow since the European consumer’s demand for healthy and quality food is rising. Declining fisheries landings and rising imports—now more than 65% of seafood supplies—provide new opportunities for growth in European aquaculture.

The influence of the consumer on development

There is broad agreement that the overall consumption of food in Europe has reached a plateau in terms of volume but is changing in respect of preference and choice. Historically, the choice of the consumer was determined by a combination of product availability and price but has changed to be increasingly linked to quality and convenience. The Multiple Retail Stores (supermarkets and hypermarkets) radically increased their impact on the sales of consumer goods and now form the major point of direct sale of fish and seafood in Europe. A range of international issues concerning food safety also altered the food supply chain, with food safety checks and traceability assurance becoming integral to all producers and suppliers. The modern consumer expects to be provided with safe food of the highest quality.

As the consumer learns more about food and how it is produced, agriculture, fisheries and aquaculture are increasingly scrutinized for the manner in which they work. Public concern has led to the development of certification schemes reflecting different approaches, such as organic production or respect for the environment. Ethical considerations on livestock rearing and transport have also had to be addressed.

To be able to adapt to consumer awareness in an information-rich and transparent marketplace, the competitiveness and future development of European aquaculture is expected to rest on providing products that meet consumer expectations, responding to new and emerging needs and preferences, adjusting to changing product distribution and retailing patterns.

Are Aquaculture products safe to eat?

There have been several food crises in Europe, concerning food safety and farming practices, which affected consumer confidence and led to radical changes in the way that the food producers and suppliers work.

In the 21st century, assuring consumer safety and traceability throughout the food chain—from the fork back to the farm—has become the core credo for all European aquaculture producers. Starting from the finished product, one can trace back the identity of the broodstock fish, the eggs and the newly-hatched juveniles, through to the mature individual. The farmer can also identify the feeds used, their components and the purity of all the resources used within the rearing...
horizon, so as to be able to guarantee—following inter-
nationally-agreed quality standards—the excellence of
his products and his activity.
Respecting and assuring these guarantees are es-
sential components of modern-day aquaculture.

The evident diversity seen in European aquaculture
and the public expectations of responsibility for food
producers and market suppliers creates, as for other
sectors, the need for visible and transparent control
mechanisms.

The European aquaculture sector follows Codes of
Conduct, Codes of Practice and Quality Schemes that
provide the basis for the responsibilities and actions of
the different components of the sector—at European
and National levels.

Farmed or Wild?

Most of the products of European aquaculture can be
found as wild or as farmed products and the question
is often posed as to whether there is a difference be-
tween farmed or wild fish species. The position is quite
complex, since there may be slightly different practices
or species but high farming standards are always re-
lected in an excellent quality of fish. The consumer is
provided with a range of choices—depending on the
country or the region—in terms of officially-recognised
quality schemes or production techniques, such as or-
ganic methodology. All supermarkets insist that aqua-
culture producers respect such quality protocols so as
to be a recognised supplier.

All fresh fish should have a gloss on the surface of
the skin, pink gills and clear eyes; the meat should be
springy in texture. Fresh fish fillets should be firm and
bright white—or pink in the case of salmon.

Blind tests, conducted with consumer panels, indi-
cate little to no difference between wild and farmed fish
and this reflects the rising and consistent quality of the
products of modern European aquaculture.

Preparing and Cooking
Aquaculture Products

The health benefits of fish and seafood consumption
are increasingly well recognised but one cannot forget
the enjoyment associated with eating fish and shell-
fish. This book serves to underline the importance of
pleasure in both the preparation and consumption of
excellent aquaculture products that this diverse pro-
ession takes the highest pride in bringing to the Euro-
pean citizen.

One of the most common statements from the
modern consumer is that ‘I like fish but I don’t know
how to prepare it or cook it’ and this book aims to
clear the mysteries and open the door to new, exci-
ting recipes that are the favourites of top European
chefs.

Preparations presented here are appropriate for
both the restaurateur and home cooking, for treating
dinner guests to the best that aquaculture can offer
while respecting an affordable price.

What can be better than following a delightful, bal-
anced and healthy diet suggested by the leading Eu-
ropean chefs?

A salmon farm in the west of Scotland.

A land-based marine fish farm in Italy.
The Mediterranean, cradle of western civilization. A region chosen by the gods as their eternal dwelling, and by humans, as a scenario for their splendid efforts.

The sea and the sun, vital ingredients for the Mediterranean socio-economic environment, have contributed, and still continue to do so, to the achievements of those who live around the Mediterranean basin.

The richness of the sea, together with the sun’s warmth, have been sensibly put to good use without ever having been abused, where a natural, environmental reserve unique in Europe has been built up.

The sea water, transparent as glass, is the natural habitat for many species which, for centuries now, have been part of man’s food. Two particularly distinguished members of this habitat are sea bream (*Sparus aurata*) and sea bass (*Dicentrarchus labrax*), both for their beauty and for their delicious taste. The beauty of these species has been portrayed in artistic works and objects, and their exquisite taste finds its echo in the number of recipes that continue to be experienced and enjoyed, by locals and visitors alike.

Mediterranean aquaculture, respecting nature and its rules, produces these outstanding fish in an effort to share this exquisite health-giving food with consumers around the world.

Aquaculture has become increasingly important in the Mediterranean area. Today, the sector produces more than 230,000 tonnes of key species (sea bass, sea bream and turbot), plus significant volumes of flatfish and tuna.

In some countries, it has become an activity of high national importance. For example, in Greece, it provided more than 54% of the total national seafood production in 2003 (aquaculture and fisheries combined) and is also a leading food exporter (sea bass and sea bream).

In the same sea, under the same sun, with a minimum of human intervention in their biological cycle, Mediterranean fish farmers produce fish with an unbeatable quality, which are equal and even superior, in certain aspects, to their brothers bred in the open sea. Consumers receiving products from Mediterranean aquaculture become addicted to the quality of these fish. A quality that is acknowledged by European clientele that demand Mediterranean production, both bream and bass.

Take the sun to your table and keep a souvenir of the Mediterranean, is the slogan of Mediterranean aquaculture which, most certainly, extends the efforts made by nature.

John Stephanis
President of the Federation of European Aquaculture Producers (FEAP)
and President of the Federation of Greek Maricultures
Marine aquaculture in society represents:

• The only way that mankind can meet its needs for protein extracted from the sea. FAO (Food and Agriculture Organisation of the United Nations).

• The only natural way of supplying our population with the required amounts of Omega-3 – polyunsaturated fatty acids.

• The only way to obtain health-giving fish in sufficient quantities in order to meet the gastronomic requirements of the demanding European consumer.

These considerations incorporate the essence and the raison d’être of aquaculture as a business: the market requirements that need to be met are enormous.

In addition to this, we are fortunate enough to be able to meet these needs with products of an extraordinary outstanding intrinsic quality: sea bass and sea bream, turbot, sole, convice, trout, Atlantic salmon, mussels, clams and oysters. We have also learnt to achieve this while assuring an extremely high quality and at more than reasonable costs.

Fish consumption

Fish is a special food in man’s diet; it is essential for maintaining a balanced diet and protects our health and well-being. Fish is a natural source of Omega-3 oils that help to keep cholesterol in check, to reduce arterial pressure and protect us from cardiovascular diseases. Their importance has recently been demonstrated in the development of the nervous system and in the prevention of many other ailments. Fish also contains important mineral salts (including calcium, iron, iodine, fluoride, phosphorus, potassium, magnesium and sodium) and vitamins (A, B and D), with a moderate caloric value, as well as being easily digestible.

Aquaculture products have a series of characteristics that endow them with important market advantages in terms of their wild counterparts, such as their freshness, homogeneous quality, year-round availability and stable prices; this leads to better commercial planning of supply and distribution, providing the right amount on the right date. They also guarantee food safety and full compliance with hygiene-sanitary requirements through continuous monitoring and analysis of the fish and their feed, which is reflected in their complete traceability.
Fish consumption worldwide

It is estimated that the global per capita consumption of fish has increased over the last few decades from 9.0 kilograms per annum in 1961 to an estimated figure of 16.5 kg in 2003. Over the next few decades, it is expected that this consumption figure will rise to an average of 30 kg per capita. This figure may also become a strategic objective, in the medium term, for the fishing and aquaculture sector worldwide.

Fish consumption in the EU

In the EU as a whole, there is an increasing trend to consume fish. This increase is due to a higher consumption of convenience foods as opposed to a levelling off in fresh fish consumption and a drop in frozen fish consumption.

The future increase required in the net supply for the European market will be possible thanks to the expansion of fish farming production in some European countries (Spain, Greece, Norway and the United Kingdom), although more especially due to imports from third countries (mainly from Asia, South America and Africa) which, in turn, are products of aquaculture. So the EU is faced with the possibility of an even greater increase in its commercial deficit. In 2003, the European Union needed to import over 60% of the fish products it consumed. The only way to reverse this trend is through the development of European aquaculture and, within this sector, to expand marine aquaculture.

According to a FAO study\(^1\) on long-term fish consumption, within the EU-25\(^2\) countries during the period 2005-2030, fish consumption per capita will continue with a rising trend (ranging from 1 to 12%) in 19 countries (Germany, Austria, Belgium-Luxembourg, Denmark, Slovakia, Slovenia, Finland, France, Greece, Hungary, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, United Kingdom and the Czech Republic), and a descending tendency (from 1 to 4%) in 6 countries (Cyprus, Spain, Estonia, Ireland, Portugal and Sweden).

The FAO forecasts that the species consumed in 2030 will essentially be the same as now, since all the large fish “stocks” are being exploited. In the future, some species will be produced in a more noticeable manner than at present, thanks to aquaculture, and there will be changes in the way in which they are obtained, rather than by introducing new species into the diet.

Fish consumption in Spain

Spain is the third most important market in the world for fish products, following the U.S.A. and Japan and is, therefore, the leading country in the European markets.

The latest data on food consumption in Spain, from consumer habits studies conducted by the Spanish Ministry of the Environment and Rural and Marine Affairs (MARM), indicate that the consumption of fish products in 2006 rose to 36.7 kg/inhabitant/year, and the total expenditure on such foodstuffs (households + hotels + restaurant and catering trade + institutions) amounted to €11,074.39 million, representing 13.5% of the total food expenditure for Spaniards.

Spain is not indifferent to the European trend to be increasingly dependent on imports of fishing products, its own coverage rate being only 42.8% in 2004.

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\(^1\) FAO study relative to the 1998 reference base.

\(^2\) EU-25: Germany, Austria, Belgium-Luxembourg, Cyprus, Denmark, Slovakia, Slovenia, Spain, Estonia, Finland, France, Greece, Hungary, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, Portugal, United Kingdom, Czech Republic and Sweden.
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Product supply

In Europe, the main aquaculture products are high commercial value fish species and molluscs. Farming methods and conditions are highly technical, with substantial control exercised over the processes. Aquaculture production in Europe accounts for around 2.6% of world production volumes, although it is the leader for some species - such as Atlantic salmon, rainbow trout, bass, sea bream, turbot and mussel. This means that this production volume represents 4.6% of the total worldwide value. In Europe, fish farming accounts for some 19% of the volume of fish production, including both fisheries and aquaculture, and around 30% of its total value.

The growth rate of European fish farming has remained at 7% per annum over the last 10 years, rising to volumes of over 1.3 million tonnes and an ex-farm value of over 3,700 million euros.

Apart from fish, mollusc production is also important, especially mussels, which in 2005 rose to over 450 thousand tonnes in the EU-27, according to Eurostat. Oyster and clam also rank among the top ten species in aquaculture production in Europe.

In view of the scenario described above, as far as demand is concerned, we as producers know that we have a brilliant future ahead of us and that this depends mainly on ourselves and on our ability to present the benefits of our products. We need to inform the consumer on the excellent quality that we offer and the care that we put into the production process.

Sea bream and sea bass farm in Melenara (Gran Canaria, Spain).

The technology necessary to produce the amounts required is in place; the sites for developing production are adequate and sufficient; the companies have the human and financial capital to fully meet the demand. With this outlook, the only “but” is that the sector is a very young one, from an entrepreneurial point of view.

We are shifting from being a production-oriented sector to a market-oriented industry. The fact is that, until now, aquaculture production has focused on providing a generic (commodity), unsophisticated product (fresh or whole), where seasonal aspects affect supply considerably. However, it is no less certain that the production sector has the capacity to find innovative ways of responding to the challenges of the markets.

Another intrinsic characteristic of this business is that it is an industry that started out globalised. Let us...
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The intrinsic quality of these fish products, however, deserves far more. We producers should do all that we can to reposition the products on the market, giving them their true culinary, gastronomic and dietary values.

To achieve this goal, we producers have proposed to put our strengths together, over the length and breadth of Europe, to launch collective pan-European communication campaigns. Initially, this would involve launching ideas and concepts of prestige onto the market—this book being a clear example of this—in order to make the excellent qualities of the product better known and to communicate the production methods that we use.

Marketing channels

Marine aquaculture has never been a stranger to changes in the traditional marketing chain for fish products. In fact, half of all aquaculture products are currently marketed through modern distribution chains (supermarkets and department stores).

Today’s marketing chain is characterized by three main factors: the multiplication of channels, the lack of relevance of the differentiation between origin and final markets, an imbalance between the fragmentation of supply—especially in the case of bream and bass—and the high concentration of demand.

The production sector itself realizes its weakness in this field and, therefore, the need to concentrate its supply position. This can be achieved in different manners—by establishing trade agreements, through cooperatives, producer organisations, joint ventures or with financial concentration through mergers and acquisitions at the entrepreneurial level. The case of the Canary Islands may illustrate the benefits of this kind of initiative. Thanks to the dream of a small nucleus of fish farming entrepreneurs, nowadays in the Canary Islands there are two large marketing groups in operation. Between these two groups, the production of 18 companies is marketed.

By setting up this type of grouped marketing, the trade’s capacity to deal with demand is much increased, giving greater price stability. Also, in this manner, the critical mass needed to take on more important challenges is achieved more readily and more easily, for activities such as exporting or manufacturing added-value products.

The product’s intrinsic value

Although this is an ex profeso chapter in this book, I must refer to a series of characteristics that highlight the goodness of these products. Fish in general have a very low lipid content; the fattest have a 5 to 10% lipid content. Nevertheless, they have a particular kind of fatty acid that is very useful in the prevention of cardiovascular disease—the famous Omega-3. Fish is equally rich in vitamins A, B and D, in iodine, iron, calcium, fluoride, potassium, magnesium and phosphorus. Additionally, in terms of protein contribution, fish is equivalent to the best meat, although it is less rich in fat. Weight for weight, even the fattest fish will always have half the fat of pork meat, for example. Furthermore, fish is easier to digest than meat since it has a lower proportion of conjunctive tissue, one of the most difficult tissues for the gastric juices to process. White fish are also low in calories, containing around 80 calories for every 100 grams.

Fatty fish is the best meat, although it is less rich in fat. Weight for weight, even the fattest fish will always have half the fat of pork meat, for example. Furthermore, fish is easier to digest than meat since it has a lower proportion of conjunctive tissue, one of the most difficult tissues for the gastric juices to process. White fish are also low in calories, containing around 80 calories for every 100 grams.

With these characteristics, they contribute to preventing illness and protecting the heart and arteries; they are important in the development of the nervous system, can alleviate the symptoms of inflammation, strengthen the bones and help in the growth and development of the body during childhood and adolescence.

Final thoughts

Awareness for the need to improve the European consumer’s diet is now a reality; the Mediterranean diet is widely known and appreciated, and fish is an essential part of such a diet; Europe’s commercial deficit is notorious with only a 40% coverage rate of consumption. Hence there is no doubt about the fact that the potential consumption of the species currently farmed is certainly not less than double the current figures.

Moreover, we must account for the potential of the new species that are currently being researched: soles, conives, octopus, pollack and cod. Within a few years, our tables will be all the richer. By that time, the consumption of species produced by aquaculture techniques will have significantly surpassed that of wild catch.

The sea on its own has no more to give. It cannot meet our needs. It needs our help, in the same way that agriculture and livestock farming helped the development and spread of the consumption of vegetables, cereals and land animals respectively, which are an integral part of the human diet. The FAO and other prestigious bodies have taken it upon themselves to explain this situation and to demonstrate that, if we are willing and need larger amounts of proteins of marine origin, these must essentially come from marine aquaculture.

look, for instance, at the case of sea bream and bass. Their commercial rearing started barely two decades ago; however, it is now produced in 15 different countries, on numerous small fish farms. It is also true to say that, nowadays, it is a product targeting markets that already know these species, whose popularization is only recent.

Nevertheless, in order to be able to deliver the product that an expanding market requires, we producers know that we have to migrate to more sophisticated presentations—towards added-value products with their own identification. In this regard, the presentation and launching in Spain of the collective brand of “Crianza del Mar” (“Bred in the Sea”)—in France “Red Label” the brand already exists—is important. This marks the first attempt made by the National sector to add value to the product by clear identification, guaranteeing the European consumer with traceability and efficiency.

Spanish collective brand for sea breams and sea basses “Crianza del Mar”.
The European Union supplies around 3% of the volume and 4.3% of the value of world aquaculture production. Although such figures are not particularly high, the European Union is world leader in the production of numerous species—including trout and European eel—in the field of freshwater aquaculture in continental Europe.

Freshwater production is almost exclusively based on fish, although some countries (particularly in Scandinavia) farm modest quantities of prawn. In practice, freshwater aquaculture is developed in all European countries, mostly due to the widespread farming of trout. Because of its value, this species is the most important species produced in European freshwater, with a production value figure of around 750 million euros. The main producers are: France, Italy, Denmark and Germany.

Some background

Aquaculture is a time-honoured activity, its origins can be traced back over 5,000 years. In a bas-relief in the tomb of Akhtetep (2,500 B.C.), a man catching tilapias (a tropical freshwater fish) in a pond is clearly depicted. Carp farming began in China in the same period. From 1135 to 1122 B.C., one of the fathers of Chinese fish farming, Fang, built ponds for farming fish. Without leaving China, in 475 B.C. Fan Li wrote the first fish farming treaty that we know. The interest shown by the Phoenicians, the Etruscans and the Romans in fish farming activities, along the coastal areas, dates back to ancient Egyptian practices. In medieval monasteries and abbeys, ponds for breeding freshwater species could be found. This tradition was to continue over the following centuries: in fact, in villas and royal residences of the 17th-18th century, ponds ("peschiere") were very common. In Europe, modern fish farming set out with a relevant technical-scientific result: the first artificial fertilization of brook trout eggs, carried out by Stephen Ludwig Jacobi, in 1793. This technique, rediscovered in 1842 by Professor Coste –at the Collège de France– meant the first step in making trout farming known which, one century later, was to turn into the most widely spread fish farming practice in the north western world. At a later date, specific techniques for reproduction were invented and developed, apart from breeding an increasingly large number of species. The term "aquaculture" now covers the farming of trout and other freshwater salmonidæ, cyprinidæ, European eel, catfish and sturgeon.
The importance of Aquaculture in the European diet

Trout and other freshwater salmonidae

In the field of continental freshwater aquaculture, cold-water trout farming is the most widely spread. This includes rainbow trout – and to a lesser extent – apart from the brook trout, species belonging to the family of salmonidae.

Trout farming, unlike other types of fish farming, is fairly recent. It can be said that this dates back to when man learnt how to recognize nature’s cycles of reproduction.

Rainbow trout (Oncorhynchus mykiss) is native to North America and is usually preferred to brown trout (Salmo trutta) – already present in Europe.

Rainbow trout has a smaller head and jaw than the brown trout; the back is greenish with a white belly, a lengthwise pink stripe on each side and small black spots all over the body. It is a carnivorous salmonid, with a large mouth equipped with sturdy, elongated teeth, being a coursing predator and highly demanding as regards the quality of the water. Trout farming is typical in fresh spring waters.

Brook trout (Salvelinus fontinalis) is a medium sized fish, with a fusiform, elongated shape, very similar to the alpine trout (Salvelinus alpinus), and easily distinguished from the latter by its characteristic colouration.

In fact, the basic colour is grey-brownish with violet parts; the back has dorsal and caudal fins, with the typical yellow or greenish stripes; on the sides, we note a number of white and yellowish spots and a few red ones, with a blue halo.

Trout need a large amount of fresh, pure water, with a continuous flow all year long. The ideal temperature for farming lies at around 12-14 °C.

There are diverse types of production in European trout farming, the majority of the trout farmed in Europe are for human consumption: whole, gutted or filleted, with different weights (from 300 g to over 1 kg), white or salmonised. Other fish farms specialize in farming trouts and charrs for restocking natural water courses or reserved areas for angling.

Production of trout in portion size (up to 500 g) in Europe is over 200,000 tonnes per annum (see Table). The delicate meat of trout makes for exquisite, highly balanced dishes from a nutritional point of view. These meats have 3 to 8% fat content, mostly comprising polysaturated fatty acids, including Omega-3, essential for preventing cardiovascular diseases and tumours.

Carp farming

Carp is a species originating in Asia Minor and Central Asia, introduced into Europe and Italy in Roman times. It has an ovoidal shaped body, with a slightly convex back and compressed sides. There are three different types: fully scaled (queen carp), with few scales and with no scales. Carps can live for up to 15 years, reaching up to one metre in length and a weight of 20-25 kg. The origins of farming this species hark back to remote antiquity, the first practices probably being in 2,000 B.C. in China. During the Middle Ages, carp farming was practiced in Europe, especially in monasteries; from 1,800 onwards it began to decline. In fact, many ponds for this activity were reorganized for use in agricultural farming. Carp farming has expanded worldwide, and common carp (Cyprinus carpio L.) is the most common farmed fish species.

The latitude and height above sea level have greatly influenced the possibilities of setting up a carp farm as it is essential for the water to be over 20 °C in the summer season. Rearing carp, a typical freshwater species, depends on the duration of the summer, while during the winter months interruption of growth is almost total. In general terms, farming in Europe involves using the intensive and semi-intensive system, based on the use of trophic resources, backed up by farming techniques.
The importance of Aquaculture in the European diet

European eel

Eel farming (Anguilla Anguilla) has grown significantly in fish farming, especially in the Far East and in Europe, geographical areas where fish consumption is high. Eel is a very common species in the Mediterranean and West Atlantic, where it reproduces (Sargasso Sea). After reproduction, the larvae (leptocephali) and, later, the fry (elvers) return to European freshwaters. After 8-15 years, an internal clock sends the eels back to the Ocean. Before setting out on this journey, they eat until in fat makes up a third of their body weight. Then they stop eating, at which point their eyes grow larger to adapt to the lack of light at depth and they start their journey. This instinct is so strong that they overcome enormous obstacles to colonize rivers and lakes. Eel farming goes back to ancient times. In modern times, eel farming is especially intensive (ponds), in fresh water. It only reproduces in natural conditions, in a period that is still unknown. Optimum temperature for the eel lies at around 22 ºC.

The European eel is a euryhaline fish, its life cycle starting with the leptocephalus stage. This is followed—after a metamorphosis—by the elver stage, which is morphologically similar to the adult individual. Later on comes the yellow eel stage and, finally, the pre-silver eel stage when it becomes a pre-reproducer. Controlled reproduction is still not possible with the eel and...
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Reproduction occurs under controlled conditions, towards the end of spring and in summer. Caviar is made from the roe (eggs). This fish is marketed as whole fresh fish (partly processed or smoked), the larger sizes being 5-6 kg. A small percentage is sold to be introduced into lakes for angling. The caviar produced with farmed sturgeon is increasingly prized, and this is also due to the continued decrease of this species caught in the wild.

It should not be forgotten that all farmed sturgeons are subject to protection regulations established by the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) applicable to their marketing.

The leading producers in Europe are: Italy, France and Spain.

Current production of catfish in Europe is at around 6,500 tonnes. The main producing countries are: Holland, Hungary and Italy.

Sturgeon farming (Acipenseridae)

In Roman times, sturgeon meat was highly prized and served at table decked in flowers. In its origins, sturgeon culture was for restocking, and it was only later on in history –in the early 1990’s– that it became relevant from a commercial point of view. Nowadays, a dozen or so pure species and their hybrids are farmed. In terms of the amounts produced, the main species farmed for commercial purposes are:

• White or American sturgeon from the Pacific (Acipenser transmontanus);
• Italo-Siberian sturgeon and its hybrids (A. naccari);
• Siberian sturgeon and its hybrids (A. baerii).

Sturgeon. Illustration by courtesy of API.

Bibliography

The early beginnings of aquaculture in Poland hark back over 700 years. The construction methods applied to ponds and farming in these fish hatcheries reached Poland between the 12th and 13th centuries, with the Cistercian Order, which introduced carp as the main species for farming. Aquaculture in ponds rapidly developed and —by the 15th century— the first manual on farming fish in hatcheries was published, in Polish, and written by Olbrycht Strumienski.

Even today, carp continues to be the main aquaculture species in Poland, with an annual production figure of up to 20,000 tonnes. Despite being the most produced species, other species share the same ponds, such as white amur, “tolpiga pstr”, tench, Crucian carp, zander, pike or European catfish.

The production cycle for carp to be consumed in Poland, mostly from hatcheries, takes three years, and the commercial size preferred by consumers is of pieces from 1,300 to 1,500 grams. The most characteristic feature in carp farming is that about 90% of the annual production is sold during the Christmas season. The deeply rooted tradition of eating carp at the Christmas Eve dinner forces producers and traders to put special solutions into place in order to ensure the distribution of this fish in a short period of time.

The production cycle for carp is not, however, the only objective in operating these aquaculture ponds. These have a series of characteristics of no less importance than fish production itself.

The ponds for farming carp are a vital regional element in the so-called “small water retention” system, although if we take its national scope into account, it is by no means “small” since around 700 million cubic metres of water annually are stored in Poland for such exploitations. Carp production technology requires filling or emptying these ponds on a seasonal basis. The ponds are filled in spring when the river has excess water coming from melting ice, whereas the autumn fish “harvesting”, occurring when the ponds are emptied, coincides with the period of water deficit in the rivers, in autumn. Thus, carp farming tools play a vital role in stabilizing the water flow in Poland’s rivers.

The nitrogen or phosphorus compounds in these ponds undergo a natural transformation within the trophic chain, which is a network of relationships with...
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numerous functional levels linked to the flow of matter and energy. Based on these relationships, in the pond ecosystem, a rich development of forms of life occurs, many of which are part of the carp’s natural food. Thanks to this system, in the ponds it is possible to produce fish based on a natural food source with just a small part of cereal feeds to round off the energy contribution in fish nutrition. Considering the intensity of usage, it is not difficult to determine the vital protective role played by carp farming ponds over river basins, particularly with regard to the eutrophic basins.

In the general flow diagram of water vapour in the earth’s atmosphere, carp farming ponds cause water vapour to be retained near the earth’s surface. This is possible thanks to the significant difference between the temperature of the air and of the water in the ponds, in the course of the day. One of the effects of this are changes, especially where large areas of ponds are involved, towards more humid microclimates that promote exuberant vegetation growth, which in turn, creates more suitable conditions for fauna, particularly ornithofauna. This growth in biodiversity that we can observe in the land surrounding the carp farming ponds also has different, less positive effects. Among the numerous plant and animal species, we find some whose presence in the ponds is less desirable for fish producers. These are especially fish-eating birds and mammals (marine crows, grey herons and otters), besides mammals that damage the dikes in the ponds such as beavers.

In most European countries where ponds are used in aquaculture, this activity is deeply rooted in time-honoured traditions. The presence of these ponds over the centuries as one of the ways of farming has become consolidated as an economic and cultural element. A good deal of customs, traditions or definitions have links to the ponds and fish farmers themselves. If we take a human life or a generation as a reference time frame, we see that these ponds have always been there, even in the legends of our ancestors. The ties and relationships with aquaculture farms, wherever they may be, is something quite natural, consecrated by secular references. This element is considered under the categories of culture and identity, which also precondion the perception of aquaculture in the new generations. Labour relations of course are involved. Aquaculture farms, especially those covering hundreds of hectares, are a decisive factor in the use of rural areas. Thanks to the work on aquaculture farms, not only direct employees but also their family members have their source of income.

Aquaculture farms have an essential role, not only for the local environment. Some farms organize agricultural tourism activities targeting city folk. This activity is becoming increasingly popular among urban dwellers. In this manner aquaculture farms bring town dwellers nearer to contamination-free nature, where they can learn what is practically exotic for the urbanite, providing a balance between the city–country side or civilization and nature. Walks and leisure activities in such a delightful setting, with the sun’s rays reflecting on the beauty of the pond waters, gives tranquillity and rest. The growing interest in this form of recreation points to another important role to be played by aquaculture farms.

Many aquaculture farms also have an important educational role since they are the ground zero for professional school field trips designed for school children and students coming from agricultural colleges specializing in fishing and fish farming. In the course of these professional practices, they acquire useful know-how and skills that can later be applied to their profession. Such activities, however, are not restricted to professional education. Aquaculture farms often host educational trips organized by general teaching centres, as mentioned above. This makes for a greater understanding of the principles governing the working of a society in harmony with nature, in ways that also make it possible to achieve economic benefits. It is precisely this way of operating, when striking a balance between the economy, nature and social issues, that has been termed as sustainable development. This is the balance that we find in carp farming.
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Rainbow trout farming in Poland

The first rainbow trouts were produced in Poland in the early nineteen-twenties. Until the sixties, this species was farmed by a few Polish Anglers Association hatcheries as a luxury and costly product. At the beginning of the seventies, a new rainbow trout farm was built by the government owned companies in conjunction with the Polish Anglers Association and private farmers. This activity was enhanced by access to the easy to repay, soft loans and supported by the Inland Fisheries Institute training and extension activities. The political changes in 1989 accelerated the increase in rainbow trout production. Polish farmers were trained by Danish experts and became acquainted with modern farming and environment protection technologies. As a result, old farms were modernized and new ones equipped with discharger cleaning systems (sedimentation ponds, Fig. 1, microsieves, Fig. 2, recirculation, Fig. 3).

After joining the EU and Poland becoming a member country, modernization was further accelerated, backed by the Sector Operational Project.

Fast and steady development was based on several factors, including:

- The enormous potential of internal markets where fish consumption is still low: 9 kg per capita per year and a growing demand for healthy food.
- The high level of education, as more than 60% of trout farmers have university degrees.
- The farmers are well organized as the line of business is represented within the Polish Fishermen Association by the Polish Trout Breeders Association (FEAP member since 1992).
- Modern fish processing industry facilitates exports of high quality rainbow trout products.
- Effective cooperation with research institutions, which facilitates the exchange of opinions and a quick extension of new technologies and methods in fish farming.

In the course of 2007, Poland had 171 trout farms, 147 of which were reported to have a total market production of 15500 tonnes. Besides rainbow trout, many farms produce restocking salmon, sea and brown trout, grayling, anadromus whitefish and huchen (Danube salmon), making it possible to preserve these endangered species. The economic effort undertaken to make better use of water (aeration, recirculation) and the cleaning of farm effluents, proves that Polish trout farming is an example of the sustainable use of freshwater ecosystems.

Rainbow trout production in the years 1970-2004 (tonnes)

<table>
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<tr>
<td>1972</td>
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<td>2004</td>
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The modern fish processing industry facilitates exports of high quality rainbow trout products.

Effective cooperation with research institutions, which facilitates the exchange of opinions and a quick extension of new technologies and methods in fish farming.

The economic effort undertaken to make better use of water (aeration, recirculation) and the cleaning of farm effluents, proves that Polish trout farming is an example of the sustainable use of freshwater ecosystems.
Sustainable Development is one of the key concepts in human development in the 21st century. The principle of Sustainability is widely used by practically all the economic sectors: all activities nowadays presume to be sustainable, all sectors are committed to being sustainable, but in actual fact, it is not easy to put it into practice. Furthermore, Sustainability is not a final condition nor an achievable goal; Sustainability is a way ahead, a way of working, it is a way of acting. It is especially important to understand and duly considerate that Sustainability does not only depend on people, on companies or on the organizations directly involved in each particular sector, but rather is a shared responsibility.

Aquaculture, on the other hand, although it has documented historical precedents reaching back thousands of years has, over the past 50 years, developed significantly. Aquaculture, in the form we know it in Europe, is a highly technological primary activity that is constantly evolving. For this reason, research and technological innovation play a vital role in its consolidation and in promoting Sustainability.

The Earth is a relatively small planet, with limited resources, most of which are non-renewable. Man’s technological genius has led the way to discovering them, putting them to good use and even to replacing some resources with others when required, whether it be because they had been exhausted or because other more efficient ones were discovered. But mankind has reached a point of consuming natural resources with such a powerful industrial and technological capacity that it faces the exhaustion of the natural resources: both in the woodlands, herds of wild animals, water resources, energy resources or banks of fish. All of these may, at any given moment in time, appear to be inexhaustible, but man’s relentless pressure has led them to exhaustion. The economic development model that assumes that the Earth has unlimited resources is deceptive. Even though the future of mankind is evidently open, despite science offering new solutions, despite the likely emergence of currently unimaginable technologies over the next few decades, despite the assurance that there are natural resources which, right now, are not even considered as being useful; and despite the fact that improvements to catching and production processes can still be rendered more efficient… there is a reality that cannot be overlooked: world overpopulation.
The importance of Aquaculture in the European diet

World population, which had been stable for the first thousand years of history below the 300 million inhabitants mark, slowly began to grow. But it was not until the last three centuries when it began to grow at a dizzy rate, now with over 6,500 million inhabitants. The U.N. forecasts reaching 7,000 million inhabitants in 2010, and 9,000 towards the year 2050. Forecasts have it that the increase in world population will slow down towards the end of the 21st century reaching 10,000 million, and will stabilize, in the 22nd century, at 11,000 million inhabitants. Such population increases on Earth have been the result of technological advancements and improvements in health, but they have been consolidated thanks to revolutions in food production systems, which have been able to adapt to this marked growth in demand, despite catastrophic theses, such as that put forward by Thomas Malthus.

The time has come to reorganize the way in which mankind relates to Planet Earth and how it is to continue to progress. Up until now, economic development has been linked to consuming natural resources: the more development there is, the more natural resources are consumed, and vice versa, the more natural resources are consumed, and vice versa, the more development there is. Now this binomial must be dismantled. This is a particu-
lary delicate matter at a time when countries such as China, India or Brazil—which account for 40% of the world’s population—are starting to take off economically and are attempting, quite legitimately, to attain a level of material welfare similar to that of the Western world. Therefore, the tremendous challenge right now is how to continue with economic development—both in the developing and the developed countries—without increasing consumption of natural resources. This is what underlies the principle of sustainable development. And we, as producers of a primary asset such as fish, should become deeply involved in it. If we talk about Sustainable Development today, it is not just a whim of fashion, nor is merely frivolous, nor is it a passing environmentalist phase: it is an absolute necessity.

Over the past few decades, various high level initiatives are underway to deal with the Sustainable development of human activities. According to the FAO’s definition of Sustainable Development, it is taken to be, “the management and conservation of natural resources, as well as a technological and institutional orientation to ensure achieving and maintaining the satisfaction of human needs, both in present and future generations”. Applying this definition to aquaculture, sustainable development is “how to work such that, in the present and in the future, aquaculture can continue to provide society with a healthy, safe, quality food—as are water-dwelling products—without degrad-ing the environment, this being socially acceptable and economically viable”.

Sustainable Development is conceived on three clearly defined but, at once, interrelated, dimensions: the environmental dimension, the social dimension and the economic dimension. Aquaculture, in common with any other activity striving to be Sustainable, needs to deal with these three dimensions. A fail mark in any of them will also make it unviable in the other two, leading to its disappearance as a relevant production sector, to a lesser or greater extent. The fact is that the concepts underpinning Sustainability are by no means new. Now they are presented in a more analytical, more holistic manner, applying the Precautionary Approach. Furthermore, Sustainability is not a static state which, once reached, will ensure survival, nor is it the same in different places or countries. On the contrary, it is a dynamic state in which to move in order to stay in the same place: new social demands, new technological advancements, new commercial trends or new scientific discoveries herald in new conditions for Sustainability so that it is main-tained environmentally acceptable, socially equitable and integrating while being economically viable and competitive.

The environmental dimension of Sustainability

Fish farmers must promote an activity that respects the environment and is responsible with the consump-
tion of natural resources. It is an undeniable fact that all human activity has a certain impact on the envi-
ronment in which it is applied, and it is senseless to deny this. What is important is for that impact to be foreseeable—by means of environmental impact stud-
ies—it must be manageable, i.e., identifiable, measurable and controllable, assumable—where the impact-
benefit ratio is accepted by society at large, and also, reversible.
Aquaculture is an activity in the primary sector, carried out immersed in nature, inseparable from a healthy environment in the right conditions. This is the sine qua non condition for aquaculture to be able to be developed in all its potential. Except in the case of closed circuit installations, in the majority of aquaculture installations, the quality of the water is not modifiable nor can it be modulated. The water has the quality that is available in the immediate surroundings. It can not be compared to a land cattle farm, which may be set up practically anywhere because the space taken up by the animals can be sealed off from the outside. In aquaculture this is not the case, which is why the concept that fish farmers are the first to be interested in keeping the environment unpolluted is an underlying principle. In reality, what causes most concern to the fish farmer about the environment is that it might become degraded due to other nearby activities that may contaminate it. The reality is that most of the contamination that regrettably affects the seas comes from sources on land: town waste, industrial waste, nutrients from agricultural and livestock farms, pesticides, antibiotics for human use, etc. Such is the reality, all too often overlooked when taking a close look, in isolation, at the impact of aquaculture, but this should be taken into account when evaluating the impact of aquaculture and ecosystemic approaches.

Thanks to both national and European research projects, there is now an important body of knowledge regarding the interactions of aquaculture with the environment that is leading the way for implementing good practices Systems and environmental management. What has been learnt is that controlling environmental impact in aquaculture is feasible, that it can be achieved, and that to do so, two tools need to be applied: firstly, the correct geographical location of the installations, both from technical-productive and socio-economic point of views. Secondly, the appropriate management of farms in all matters concerning production, food, etc.

It can be asserted, and this is backed by numerous scientific studies that, in general terms, marine aquaculture in Europe today is not a significant cause of loss of natural habitats nor of negative effects on local flora and fauna. Also, the organic matter poured into the effluents is assimilated without any difficulty by ecosystems, the health of fish and veterinary treatments cause no problem to wild populations, the use of other chemical products (anti-fouling, disinfectants...) is of little relevance and autochthonous species are produced.

The social dimension of Sustainability

Companies are the best type of human organization for generating economic added value, but these companies also have a considerable capacity to generate social added value. This creates a responsibility in aquaculture companies that lies in the foundations of the social dimension of its Sustainability: it is Social Responsibility, which involves being a source of employment, providing stable, quality jobs (with personal job satisfaction and competitive salaries), offering ongoing training (to broaden knowledge and qualifications), opening up the way for job promotion (offering employees prospects for the future) with no discrimination of any kind.

Sustainable Development in European aquaculture—especially taking into account the current growth rate—needs to draw in good, competent professionals: operators, technicians, degree students, directors, divers, sales personnel, ship’s skippers, etc. Aquaculture companies need to be able to win over the best professionals for this sector in each particular area of work. Furthermore, aquaculture should attract the interest of scientists and researchers for them to handle projects in this field, building up multidisciplinary work teams for dealing with the different aspects of the activity.

Aquaculture is an activity that is developed, to a lesser or greater extent, in publicly owned areas and that is also conspicuous in a setting which, until recently, was almost free from human intervention, as is the case of the sea. The administrative authorizations for granting this right of use do not only depend on technical or environmental criterion, but also require the approval of local communities, which need to see that, when setting up an aquaculture farm in their neighbourhood, it is something positive, either for creating employment, for improving the local economy or for the modern image that it may entail. To secure this social backing for Sustainability in aquaculture, it must be integrated in society. To achieve this objective, efforts should be made such that the local community can identify with the activity and build up a positive public image (modern, environmentally friendly, offering a future, etc.). It is important to maintain a positive, constructive co-existence with other activities sharing the use of the area (tourism, fishing, protecting nature, etc.). Its social responsibility needs to be highlighted, especially by creating quality, long term employment. The local communities should participate, in some way, in some of the decisions related to company planning (exact location, enlargements, etc.).

But the social dimension of Sustainability is far more than social responsibility or integration in society. Both the Consumers and the Administrations have important doses of direct responsibility in making Sustainable Development in European aquaculture possible, and this needs to be acknowledged. Consumers exercise their responsibility toward sustainable development every time that they fill the shopping trolley. Until recently, the most up-to-date model on the food-related decision and information chain was what could be described as "from the Farm to the Table". This advocated control in managing the production processes so that the consumer could have in-depth information on the steps that a particular food had gone through, from the start of production on the farms until it reached the table.

This model has now changed and has been inverted. The decision chain is "from the Table to the Farm", meaning that it is the social concerns that decide the production processes. This means that from a sector guided by supply conditions, we have shifted over to a sector guided by customer demand, and this crucially affects the entire decision chain on Sustainability since company viability depends on the consumer making...
The importance of Aquaculture in the European diet

Quantity purchases with a sufficient price level for the products. Buying depends on the consumer’s trust in a product, i.e., on a favourable quality-price ratio (a good buy) from the information available on the product in question (transparency) and on the perception that the consumer may have of the product’s quality (objective and subjective attributes).

One social issue with a considerable bearing on Sustainable Development in aquaculture is the clearly beneficial effect of fish consumption on human health. Numerous studies have demonstrated the benefits for human health of consuming modest amounts of fish each week, rich in proteins and Omega-3 series fatty acids. Every now and again, we can read in the media about the discovery of new positive effects on human health, such as how the above contribute to fighting against cardiovascular diseases, help develop the nervous system, prevent Alzheimer, diabetes, or some types of cancer. In fact, if a consumer may have of the product’s quality (subjective attribute) and on the perception that the consumer may have of the product’s quality (objective and subjective attributes).

The Administrations play a very important role in Sustainable Development of European aquaculture. Among their obligations is that of establishing a propositional framework to encourage the initiatives of people and of companies. Furthermore, they should ensure that consumers can have healthy, safe, quality products and enforce strict regulations on animal sanitation and welfare. The lack of legal regulations is detrimental, but at the same time, an excess of regulations or an inappropriate regulation will only suffocate companies. What is needed is an administrative framework able to encourage entrepreneurial activity in aquaculture and to promote the activity. As far as this activity is concerned—which is more sensitive than other activities to legislative framework and to public policy—this need has become increasingly pressing. To illustrate this, let us look at how concessions are obtained to physically locate plants: for other sectors, such as chicken producers, for instance, all they have to do is to buy a farm on the free market, apply for simple land authorization and start to produce. But however for fish farmers, concessions are granted and controlled by the administration following very strict conditions subject to other sectors claiming preferential rights over marine areas. This is the reason why organizations as important as the Aquaculture Committee of the General Fisheries Commission for the Mediterranean, under the FAO, recommended in 2006 that countries “create clear legal frameworks for aquaculture in order to provide incentive for the activity and protect investors”. Or Eurofish which, in its conclusions at the conference held in Duino (Italy), in September 2006, recommended that, “licensing and taxing issues be addressed so as to provide more manageable and equitable conditions for aquaculture producers”.

Backing from the Administrations in the Sustainability of aquaculture is demonstrated when efforts are made to accelerate and simplify the procedures for new plants or enlargements of existing ones while at the same time coordinating and standardizing legislation in the different Member States. Also important is the development and application of Strategic Plans to guarantee balance and coherence in the development of strategies and activities designed to promote aquaculture, and the backing of promotion and communication plans on aquaculture and its products. Likewise, it is essential to promote marine research and transform its results into added value technologies for the sector.

Apart from the merely administrative aspects in many regulatory fronts, aquaculture faces the problem of horizontal application of regulations conceived for other sectors, but which suddenly become compulsory for aquaculture. This occurs both in taxation issues as well as in sanitary, training or animal welfare matters, overlooking the specific conditions for fish production.

One aspect of the regulations that is becoming a cornerstone in the sustainable development of aquaculture is planning the use of coastal areas through Integrated Management.

There is an increasing number of human activities in search of a place along the coastal belt: town planning, tourism, professional fishing, sports fishing, maritime transport, oil and gas prospecting and extracting, wind parks, other systems for renewable energies, and extraction, etc. As an activity developed in the coastal belt for a few decades now, the fish farming sector is very much aware of the need to reconcile the interests of highly diverse sectors—at times with opposing in-
The importance of Aquaculture in the European diet

The economic dimension of Sustainability

This is the most traditional dimension of Sustainability. Aquaculture, from the economic standpoint, should be a viable, competitive, self-sufficient activity, driven by private initiative, i.e., where the market forces model the sector. But we should also pause for thought on this issue. Now it is possible to approach aquaculture as good business because there is increasingly less fish in the sea, catches have touched rock bottom, the demand for fish is on the rise and because fish is an extraordinarily healthy food. But the sector is not economically as brilliant as it could be and, occasionally, is in crisis. So what is going on? Why does aquaculture fail to take off? On the one hand, as far as marketing its products is concerned, aquaculture involves a series of differential characteristics, with respect to the fishing industry, which allow it to comply with the latest requirements of the agricultural-food trading channels, such as stable prices, a controlled production, a regular supply, uniform quality and the ability to offer homogeneous sizes. And as far as consumption is concerned, aquaculture offers the highest quality, freshness second to none, outstanding nutritional values and a strict food safety monitoring based on traceability.

Furthermore, cultivating the seas and oceans makes sense on planet Earth because the seas take up two thirds of the planet’s surface, which is increasingly populated and where the use of land space is very much disputed. Also, because one out of every two species of vertebrates that exist on the planet are fish, and interests—about which many questions need to be answered through more scientific research, technologies and innovation.

Nowadays, the reality is that ordinance and management plants for the coast only offer aquaculture spaces that are not occupied or reserved for other activities. Nonetheless, for aquaculture to be a Sustainable activity, it is essential that it be granted good locations—in line with environmental but also socio-economic considerations—and not simply displaced to more distant locations exposed to the adversities of the oceanographic environment that entail a higher risk of suffering losses due to storms, more costly installations, more demanding maintenance and higher operational costs due to the greater distance from port. This is a feasible possibility, but it should not be the only one, and in any case, it should be coupled with better accesses to port infrastructures (moorings and port space). The trend to move aquaculture away from the coast should not prevent it from being considered as a user of coastal areas with the same rights conferred to other human activity. A voluntary and imaginative effort must be made to seek synergies that are known to exist with other activities, such as infrastructures for making use of wind energy at sea, aquaculture’s compatibility with certain elements of environmental protection (e.g., marine reserves), or with the fish catching industry and its professionals.
The importance of Aquaculture in the European diet

Apart from the comments made earlier on environmental and social Sustainabilities, the aquaculture sector has to deal with a number of challenges that must be faced in order to ensure its future. There are general issues such as how to improve its marketing capacity and how to correct the imbalance between the capacity to negotiate supply and the demand purchase, differentiating the products by using tools, such as quality brands, or improving the industry’s image and organizing promotional campaigns. Likewise, it is essential to open up new markets, improve the products and, finally, diversify the products, bringing in added value products and new species.

The objective for European aquaculture is to ensure that the supply of nutritional, safe and quality foods for the consumer makes economic sense, taking into account environmental considerations, consumer demands and market forces. Our most important challenge entails producing these products for a market that is constantly evolving and which, many a time, does not appear to be willing to pay any extra whatsoever for these efforts. Therefore, we should demonstrate imagination and capacity to meet the new demands.

Europe is equipped with the natural, human and entrepreneurial resources to be one of the main and most profitable aquaculture producing regions in the world. Nevertheless, even though those chiefly responsible for Sustainable Development of aquaculture are the producers themselves and their suppliers, the consumers and the administrations have an important dose of responsibility. We should all work together to achieve the balance and the commitment needed for Sustainability.

Flow map of sea bream and sea bass in Europe.

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However, even though Aquaculture producers and their suppliers are primarily responsible for Sustainable Development, the consumers and Administrators hold an important share of responsibility. All must work together to achieve an adequate equilibrium and this necessary commitment to Sustainability.
What are the challenges encountered by aquaculture?

There are many, but here I will deal with three main aspects:
- The image of farmed fish and the fish-farmer
- The expectations of European consumers
- The worldwide challenge for feeding the planet

But the first challenge for the European sector... is you, citizen consumer!

Answer these questions, honestly:
- A priori, are you favourably disposed towards aquaculture?
- And what do you really know about aquaculture?
- When you do your shopping, what criteria govern the fish you buy?

It is certain that, having started this book, you know a little more about our sector, but even so, perhaps your mind is full of pre-conceived notions.

So then, you, the reader, are our first challenge!

As an informed consumer, you will know that fish is an important constituent of your diet.

As a European consumer, you have high expectations as regards nutritional quality, traceability, and food safety.

As a European citizen you are not insensitive to the phenomenal European commercial deficit in fish and marine products.

And in addition, you want to keep the employment level in Europe as high as possible.

But at the same time...

You do not want on your doorstep those activities that you do not really know about, activities that some people think are harmful to the environment, or simply that they seem to you a visual pollution there where you like to spend your holidays.

You have heard it said that in the end, aquaculture is not really a solution to the problem of over-fishing, because the fish that it produces are fed on a feed-stuff which itself is based on fish, and it is therefore a factor contributing to the exhaustion of resources.

You have worries about the feed given to farmed fish, about the conditions of their rearing and about their welfare, as well as the impact of fish-farms on the environment.

But after all this, when you stand at the fish stall, what is it that guides your choice? Quite often, it is simply the price that is the determining factor!

And so, you are our first challenge. We must try to get you to know us better.
The importance of Aquaculture in the European diet

First of all then, some figures.

On average, what weight of aquatic products is consumed in a year by a European citizen?

And of this weight, what proportion is farmed fish?

The annual consumption of aquatic products (fish and shellfish) in the European Union 25 is 13 million tonnes, which represents 27 kg per year (live weight) per inhabitant, of which 20 kg is fish.

This consumption of fish varies considerably depending on the country. For example, it is five times greater in Portugal (50 kg per inhabitant per year) than in Austria (10 kg).

Two thirds of the total European market for aquatic products is concentrated in five countries: Spain and France (17% each) and then Germany, Italy and the United Kingdom (11% each).

As far as aquaculture is concerned, the consumption of shellfish varies widely from one country to another. On the other hand, the consumption of farmed fish is fairly homogeneous from one country to another; it is between 2 and 3 kg per year per inhabitant.

Are these aquatic products fished or produced in Europe?

Look at these figures, which show the balance of supplies of aquatic products for the European Union 25 (tonnes, live weight) in 2006:

- European fish-catch is constantly falling, but the increase in European aquaculture is not enough at present to make up for the decrease.
- The consumption of aquatic products in the European Union is 70% imported, of which 64% is shellfish. 73% of the fish from fishing consumed in the European Union is imported, as well as 60% of farmed fish. Thus the commercial balance of European products is considerably in deficit, a deficit which is increasing.
- In the nineties, the proportion of farmed fish consumed in Europe more than doubled (from 7 to 15%) with the development of salmon to begin with, then sea bass and sea bream. Stabilized in the first years of this new century, it has again started to increase with the arrival on the market of farmed tropical fish reared in fresh-water, such as the pangasius and the tilapia. The proportion of farmed fish can reach 30% for household purchases of fresh fish, and 40% for restaurant chains.
- So, my European consumer, the main part of the fish you eat does not come from Europe, and you eat more and more farmed fish!

But do you do it in good faith; and do you know why?

Many European studies have been made on the perception of farmed fish, and although it is changing, the perception is more often than not negative compared to wild fish. No-one dreams about farmed fish! But in some countries, such as Germany and the United Kingdom, the dreaming is replaced by a real confidence in the perfected and reassuring rearing techniques, whereas in countries such as France and Italy, mistrust of fish farming remains strong.
A recent French study concerning the improvement of the image of farmed fish (Via Aqua, November 2007), commissioned by OFIMER, showed that apart from those in the know (often very frequent purchasers from the coastal regions), 69% of the sample population were unaware of whether it was wild fish or farmed fish that they were buying. However, one in three of these consumers had a negative image of farmed fish.

With only a meagre understanding of aquaculture products and their conditions of production, the consumer falls back on his notions of commercial fishing and farm animals to form his opinions.

In order for the consumer to take up farmed fish without preconceptions, we need to give him the means to become better acquainted with the product and the rearing conditions, particularly in Europe and more especially in his own country. This must be done not just by the sector itself, but also by the member States and the scientists who have to show the consumers, for this activity in Europe, what is at stake from both an economic and an environmental point of view.

Now consider… when you buy a chicken, you are aware that the period of its rearing is between a few weeks and slightly more that eighty days for a “Red Label” quality chicken of 1 to 2 kg. Perhaps you think it’s the same for fish? Then you should know that for a sea bass or a sea-bream weighing 1 kg, it takes approximately two-and-a-half years!

When you buy your fresh fish at the stall, look at the label – and if there isn’t one, ask for one. Made obligatory by European regulations since 1st January 2002, it must show the commercial name of the species, whether it is a wild fish or a farmed fish, and its origin. The nearer the country in which the fish is reared, the more likely you are to appreciate its freshness.

We all know that Europe piles up layers of regulations, and perhaps sometimes it is annoying. But however, as far as the food on your plate is concerned, Europe has probably set up more checks and firewalls than any other region of the world.

In spite of the tendencies to uniformity in life styles at the heart of the European Union, there are still genuine differences in the buying and the cooking of food. Nevertheless, in every European country the expectations of the consumer are oriented towards products, which are more and easier to prepare, with good nutritional qualities and at a price, which remains attractive.

The market sector, which has evolved fastest, is that of prepared refrigerated products (smoked salmon, pre-cooked shrimps, surimi…). Equally, consumers are attracted by pre-packed fish fillets.

The markets of refrigerated prepared products and pre-packed frozen products need to be supplied with products, which are regularly available, in large volumes and at a price, which is sufficiently low to be affordable after processing and packaging. Apart from a few products, European aquaculture will find it hard to meet these demands. It must, therefore, continue to position itself on fresh products, responding to the quality demands of the consumer.

Our second challenge is to respond to the expectations of the European consumer.
The importance of Aquaculture in the European diet

But who exactly are the purchasers of aquatic products?

Here is a test. At the request of ORIMER, the TNS Worldpanel divided consumers into nine general groups. Do you recognize yourself in one or more of these groups?

• The fashion victims: being “with it”! (13%). To be in with the crowd, they try new products.
• The hedonists: live life to the full! (10%). They live wholly for the moment and like novelty.
• The cautious: enquiry, caution, information and reassurance! (9%). Fidelity to the brand, to the composition of the product, and concern for safety.
• The promotion-hunters: through necessity! (8%). Looking at their budget, they search for low prices.
• The bio-citizens: eat healthily and authentically! (10%). They prefer biological products, the town market, small shops, and they reject GMO food.
• The rustics: traditional food! (14%). Close to nature, they look for products which most respect nature.
• The couch-potatoes: no cooking, the TV always on! (11%). They buy supermarket food, easy to eat sat in front of the TV.
• The economical: don’t get tempted! (12%). They make a shopping list, stick to it, and compare prices before buying.
• The blinkered: uninterested in eating! (13%). Not at all interested in food. Doing the shopping is a hassle.

The main consumers of aquatic products are couples or single people, middle-aged or older, retired folk, and also middle class and comfortably-off people who belong to the three following groups: the rustics, the bio-citizens and the cautious.

And who buys fresh fish?

These are older or middle-aged couples who purchase more than half of the volume of fresh fish, and also those of the comfortably-off group. What they buy depends equally on the region. Such purchasers have the profile of bio-citizens or rustic.

And the profiles also vary according to the species eaten. For each species there is a consumer profile, younger or older, married or single.....

The smoked fish concerns a clientele less rustic and less bio-citizen than the fresh fish, but more fashion-victim, less aged, less of the class couples, more of the family class.

So that a challenge that we share with our friends in the fishing industry is to attract other groups to our products.

A sea bream and sea bass farm in Canary Islands (Spain).
**Nutritional qualities**

**To** improve the dietary equilibrium of the consumer, the World Health Organisation recommends eating fish at least twice a week. This recommendation is often taken up by national programmes, such as the Programme National Nutrition Santé (PNNS) in France. Fish are rich in proteins, a source of minerals and oligo-elements, and even the most fatty contain less fats than the leanest meat. And in addition, fish are a source of Omega-3, the famous poly-unsaturated acids which contribute to the good functioning of the cardio-vascular system. They are found particularly in the more fatty fish.

Anxious to respond to the expectations of European consumers, the European Union gives financial support to research programmes such as SEAFOODplus.

Launched in January 2004, this is the biggest project in the sphere of seafood that the European Union has financed. Seventy partners from sixteen European countries cooperate on 20 research projects aimed at promoting the benefits of sea products for the health and well-being of the consumers. One part of the programme concerns aquaculture in order to respond to the needs of the consumer, employing a sustainable approach.

**Sustainability!**

It is impossible to be unaware of the risks facing our planet in the years to come. We are all led to reflect on the means to be put in place for our society to check the downward slide.

When you do your shopping, you will be induced to ask yourself questions on the things you eat. How much energy was expended in bringing this product to the shop? Has it been several times around the world between the production, the processing and the consumption? Should we not go back to food which is produced in the region where it is eaten?

The fish resources of the sea are in constant decrease, and the European fishing industry pays a high price. We need to give time for the stocks to reconstitute themselves. But, as certain groups claim, is aquaculture a false solution to the decrease of resources? European consumers prefer carnivorous fish, which feed on other fish. The majority of species farmed in Europe are thus carnivores. So are we in the process of emptying the sea to make the food that our farmed fish eat?

Let us consider the feed-stuff used in aquaculture. The composition of this fish-food is in constant evolution. This is due both to the evolution of the availability of the primary materials (fish-meal and fish-oil) and to advances in the substitution by vegetable products on the one hand, and the impact on the environment on the other hand.

Concerning the use of marine-origin products for farmed fish, we need first to look at some figures, taking as an example the trout, one of the main species of fish produced by European aquaculture (source: CIPA).

Among all the species farmed, fish are the most efficient converters of feed!

<table>
<thead>
<tr>
<th>Species</th>
<th>Weight of feed to make 1 kg of product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pork</td>
<td>3</td>
</tr>
<tr>
<td>Chicken</td>
<td>1.9</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.45</td>
</tr>
<tr>
<td>Trout</td>
<td>1</td>
</tr>
</tbody>
</table>

The feed conversion rate (weight of feed to produce 1 kg of farmed fish) has greatly improved over the last 20 years, falling from 1.7 for portion trout (250 g) in 1985 to 0.8 in 2005, due to nutrition research and improvements in the technologies for making fish-feed.

On average, it takes 2 kg of low-value sea-fish to produce 1 kg of farmed trout.

But in its natural state, the same fish will eat 5 to 10 kg of prey-fish (sources: IFREMER – Akvaforsk 1998–Forster, 1999). A farmed fish thus eats three to five times less fish than its wild equivalent. Another example. Let us compare the effectiveness of chinchard, a small fish of low commercial value, for direct consumption or as an ingredient in the feed for farmed fish, in this case the salmon, a fish which is highly prized by the consumer:

<table>
<thead>
<tr>
<th>DIRECT CONSUMPTION</th>
<th>AS FISH FEED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gutted</td>
<td>1000 kg of chinchard, a small low-value marine fish</td>
</tr>
<tr>
<td>Headed</td>
<td>1200 kg of horse mackerel</td>
</tr>
<tr>
<td>240 kg product of fishmeal (24% turnover)</td>
<td>2940 kg of fishmeal (30% turnover)</td>
</tr>
<tr>
<td>470 kg of fish for consumption (yield 47%)</td>
<td>These 800 kg will produce 615 kg of farmed salmon (1.3 kg of food per kg of salmon produced)</td>
</tr>
<tr>
<td>Headed &amp; Gutted</td>
<td>1000 kg of chinchard</td>
</tr>
<tr>
<td>240 kg product of fishmeal (24% turnover)</td>
<td>474 kg salmon for consumption (yield 77%)</td>
</tr>
</tbody>
</table>

And moreover, you should know that at present the majority of fish meal is used to feed other animal productions, as is shown by the following charts.

Estimations (2002) and forecasts for 2012 for the utilisation of fish meal by the different sectors of rearing at the world level (source: IFFO, 2004). On the other hand, the fish oils are already mainly used in aquaculture: Estimations (2002) and forecasts for 2012 of the outlets for fish oil at the world level (source: IFFO, 2004).
The importance of Aquaculture in the European diet

Throughout Europe, similar reflections may be taking place. The path which will be followed will not be without consequences for you the consumer, as far as the choice of fish that will be available in the years to come. The evolution of your eating habits in terms of being an eco-citizen will influence the future of the fishing industry and aquaculture in Europe.

But aquaculture must face another much more global challenge, which is to satisfy the future demands of the planet for fish.

For the last twenty years, the global supplies of seafood from fishing have remained relatively stable at a level of approximately 90 million tonnes. Two thirds of this are for human consumption, the remainder is used as fish meal or fish oil for animal feed. We must not forget that at the present day, roughly half of the inhabitants of the planet are dependant on the oceans for their main source of food!

According to the FAO, with regard to the global population growth, aquaculture production will need to double between now and 2030 simply to keep the world consumption of aquatic products at its present level (12 kg per person per year). Moreover, the growth of incomes in developing countries will accelerate the consumption per person in these countries.

The premier aquaculture region of the planet is Asia; China alone is responsible for 70% of world aquaculture production. But aquaculture must face another much more global challenge, which is to satisfy the future demands of the planet for fish.

The European aquaculture sector has therefore, at one and the same time, to meet the demands of the consumers as to the nutritional quality of its products, the ease of use, the price, the strictures of sustainable development, and a production within the vicinity of the consumer, and all this while taking into account the evolution of resources, the careful management of energy and the protection of the environment.

This is our challenge, and over the last one or two years, prospective thinking has flowered here and there to envisage the possible scenarios, to identify as from now the challenges to be faced, to integrate the local and national things at stake within the international context, and to select the best orientation of research.

In France, the research organizations IFREMER and INRA have both worked on the prospects in the course of the last two years.

For example, the work done by the Fish Sector Commission of INRA in 2007 (Scénarios pour la piscicuture française en 2021 – INRA) puts forward five possible evolution scenarios for aquaculture in France in the context of the present. According to the scenarios, aquaculture could be destined perhaps to disappear or, on the contrary, to show strong development.

- **Scenario 1**: Here and better, a regional aquaculture under the watchful eye of the public.
- **Scenario 2**: Vertically structured and globalised, aquaculture must adapt itself to an industrial-type context with little regulation.
- **Scenario 3**: An impasse, too many obstacles and insurmountable constraints.
- **Scenario 4**: With all working together, the renewal of aquaculture carried along by political will.
- **Scenario 5**: All change, a new consumer and a new producer re-examine farmed fish.

In the context of the development of aquaculture on the world level and the reduction of wild-fish resources, and in order to respond to a growing demand for raw materials for feeding fish, there must be recourse to the available renewable materials, and with the least impact on the environment. Research organizations, feed manufacturers and the aquaculture sector are continually working together on this matter. In France, a specific research unit, INRA/IFREMER is working on the partial substitution of fish-oil and fish-meal by plant-derived materials, while preserving the organoleptic and nutritional values of the end product.

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This is our challenge, and over the last one or two years, prospective thinking has flowered here and there to envisage the possible scenarios, to identify as from now the challenges to be faced.
Aquaculture is understood as the production of hydrobiological resources in controlled environments, under conditions able to improve the turnover of the same organisms when compared to that which takes place in their natural habitat. It is necessary then for the farmed organism to be in conditions such that its growth is faster and with the best turnover possible, which means that it should be in suitable environmental and health conditions.

This is exactly the same phenomenon that occurred in the domestication of land based animal species, the difference being that, while the historical perspective in the case of land animals is very long, in aquaculture, despite attempts made many centuries ago, only recently has it been possible to adapt aquatic species to a controlled environment, once the biological (genetic, reproductive, food, environmental) factors were identified and mastered. This is the case since in some cases we still have little information on many of the aspects of some aquatic species, and it is still not possible to rear those species in a completed cycle.

The point is that the quality of the product depends on various factors. To the extent that controlled breeding makes possible to obtain fish that comply with all the quality properties expected from them. In this regard, it should be noted that time and scientific and technical advances, open up the way for making improvements that are gradually being introduced into fish farming.

The genetics, resistance to disease, reproductive capacity and the treatment required for farmed species as regards sperm, eggs, larva, fry and mature forms are the subject of much study. Likewise, growth curves, how to identify the ideal timing for marketing, the most efficient food and its influence on the quality of the end product, are some of the considerations taken into account, as with all animal species, the feeds consumed by fish affect the final quality of the product. Handling, the separation in batches according to age, the water temperature, the required level of oxygen, luminosity, harvesting, etc. are all vital considerations. Operating conditions are vital but so too is the effect on the environment, because it may cause a certain alteration that could affect animal and vegetable species living in the vicinity and, in a way, the ecological balance.

Setting up a fish farm, therefore, calls for a profound knowledge of the activity, apart from the need to satisfy numerous administrative controls before the facility is accepted. All this bearing in mind the respect for the environment, but also the possibility to obtain top quality products, in terms of food safety and the characteristics of the end product.

Rafael Ansón
Chairman of the Spanish Academy of Gastronomy
and Honorary Chairman of the International Academy of Gastronomy

Aquaculture products in Spanish gastronomy
The importance of Aquaculture in the European diet

Aquaculture products

Spain is a leading consumer of fish, with the particularity that the gap between consumption in the coastal provinces and in inland areas is closing. This is because the cold chain and the means of preservation are increasingly efficient. Furthermore, as it is a highly prized product from all points of view (the sanitary, nutritional and the gastronomic), potential demand tends to increase due to the increasing availability of new presentations and the increase in the standard of living. The growth in population and the ongoing improvement in the supply of the top quality products triggers the rise in the demand for fish.

The possibility of satisfying this demand by increasing the capture of fish at sea is not viable since, as the FAO has pointed out, world catches in general, and the Spaniards' in particular, are stabilized or grow to a very limited extent. Also, the application of the precautionary approach in fisheries management systems, the much needed regulations for responsible fishing and the sustainable development of this activity, constitute the chief argument for considering aquaculture as the largest sustainable growth sector able to meet consumer needs.

Different systems for rearing marine fish species

Estuary fish

Marine aquaculture began in Spain when the Cadiz salt marsh exploitations were no longer viable and when appropriate techniques came into play that made it possible to retain the fish entering with the high tide. This was the so-called "cornal" system, built on the "channels", making use of the numerous natural incoming water courses. A variation on this was "estuary rearing" which, as in the prior case, involves individuals of different species, ages and sizes, so that in these areas they could be ongrown until they reached commercial size. Generally, fish coming up with the high tides in autumn and winter, mostly at the juvenile stage, become adults in spring and summer thanks to the natural food from plankton, seaweed and small crustaceans. The most prosperous species are those that best adapt to the salinity (which can be very high). These are the bream, bass, soles, mussels, sea bass and eels. But other species commonly found in the estuaries, where the degree of salinity is generally lower, are king prawn, prawns, shrimp, cuttlefish, calling crab, cockles clam and other bivalves. Such fish have an extraordinary quality and freshness as a result them being freshly caught. No feed is used in this case.

A slightly more sophisticated technique involves introducing farmed juveniles, helped along with feed, into the estuaries or channels. An "improved extensive farming" system is used. The species that best respond are sea bream and sole, which experience a marked percentage increase in terms of total catches, but without a considerable increase in the total biomass. In other words, rather than an increase in production, what is sought after is a greater involvement of the higher commercial quality species.

Fattening cages

This is a more developed system for producing fish, involving translocating the caught fish before reaching commercial size, to installations where they are fed. The production area of highest density is on the coast of Murcia, in floating cages, which are polyethylene structures from which a submerged, suitably anchored net is hung. The fish are fed inside the cages mainly with mackerel and sardines. This system has made it possible for fresh tuna, previously only available at the end of spring and early summer, to be on the market all year round, offering a very good quality fish which is mostly for the Japanese market where it reaps very high prices.

Although the system has been specially developed for ongrowing tunids, particularly for bluefin tuna, there are promising results for grey mullet, mullet, alonsino and croaker.

A true gastronomic luxury is fish from the estuary, grilled on "kursik" embers, which is a plant species similar to rock rose growing in areas of a high salinity. Freshly caught, they are grilled, without scaling or gutting, placed on a tile. The muscular mass enclosing all the taste of the sea is spread out by hand. This country-style food, exclusive to privileged fishermen or companions, is hard to forget when accompanied by a manzanilla or fresh fino wine. Other delights are king prawn cooked in the same water taken from the channels and, as far as fish are concerned, mullet which, due to the abundance of food, is covered with an interior layer of extremely tasty fat that impregnates the whole fish when grilled on salt. Rota style snapper, a speciality of the best restaurants along the Cadiz coastline; rice dishes with clam and king prawn; small Spanish omelettes with shrimp and fried estuary fish, are other gastronomic specialties held in high esteem.

Intensive production

Modern systems have made it possible to intensify production, closing a five-stage cycle: a) spawning in-duction centres, b) hatchery, c) pre-ongrowing or nursey, d) ongrowing and, e) completion to commercial size. Among the reasons that have led to exploitation is the fact that this controlled production entails an interesting economic turnover because the transformation rate (name given to the ratio between the number of kilos of food that the fish must eat to reach one kilo of weight) is quite favourable as it is around two and a half. Also, turnover from the body (the edible part in terms of the total weight) is very favourable, and is generally better than its kindred caught in the wild with the same weight. This is because its meat is always in good condition.

A further advantage of this type of production is that, despite the added cost associated with feeding, the manpower requirement is relatively low. To illustrate this point, a 250 tonnes catch of fish out at sea requires from 25 to 30 people whereas only 6 are required when using intensive systems.

This kind of exploitation has other advantages, the most important of which is the possibility to manage reproduction. In this way, it is possible to combat at least some of the problems caused by overfishing in traditional grounds.

Almost the entire cycle is developed in the cages, which may be submerged or floating and, in turn, fixed or rotating, normally in the vicinity of the coast. It should be pointed out that these installations are in the sea, so that the water in which these fish live is clean and controlled, just as it is for their wild counterparts. Their faster growth is due to the fact that these fish have constant access to food which, furthermore, is balanced in nutrients with a controlled composition.
The importance of Aquaculture in the European diet

The production of turbot, sea bass and sea bream using this system has already begun to be considerable and the presence on the market of these three species is increasingly common. On saying that, some important advancements are being made in sole, alfonsino, croaker, striped jack and Pollack. In some cases, the problems in closing the cycle have been solved, the chief difficulties being in the initial ages and, in other cases, this is on the verge of being solved, as occurs with red mullet, white bream, yellowtail, snapper and swallowtail seaperch, so that it is hoped that in the next few years, the supply will diversify considerably.

Fish obtained by this system is normally marketed before reaching maturity, so the muscular masses are in a period of growth and the texture of their meat is highly acclaimed. As regards the taste and aroma, in several blind tastings, it has been demonstrated that they have a very high level of quality and that it is difficult to distinguish, in terms of refinement and elegance, from wild captured individuals. On many an occasion, farmed fish is discriminated in function of its size which, curiously enough, in fact represents one of its most significant commercial advantages. Most commonly farmed species –sea bass and sea bream– are usually in “ration size”. One additional quality factor is the uniformity of presentation, size and state of preservation of the meat, which is not always possible with fish captured at sea.

Continental aquaculture

Trout is the most commonly farmed species, with around 30,000 MT per annum, although over the last few years, a downhill trend has been noted. The first Spanish fish farm was set up at Monasterio de Piedra, with very good results, although at present the only trout produced at this site is for restocking purposes. Ways of preparing trout are varied, with some traditional presentations such as Navarra style trout, the trout soup and tart from León, the “blue” trout, which is introduced live into boiling water and fried trout, made in olive oil and gently fried in a frying pan.

Tench are produced in small amounts using extensive systems, specially making use of ponds in Extremadura and the two provinces of Castille. Before eating them, it is essential to keep them for a couple of days in clean water to avoid any off-taste which may occur if the appropriate measures are not taken. It is an excellent fish, with a wide range of cooking possibilities, as shown at the exhibition held in Malpartida de Plasencia (Cáceres) each year.

There are two sturgeon fish farms. One in the province of Granada and the other in the Lleida province. In both, very good quality caviar is produced and sturgeon itself is beginning to be marketed, which gives a fatty meat, with a very high content of Omega-3 fatty acids and an excellent taste. Grilled loin and fillet in green sauce are nothing but excellent. For their intense taste and the texture of the meat, it goes very well with potatoes, or Galician style with a hint of good paprika.

The quality of aquaculture products

In all animal species, the end quality of the product is very much influenced by the production conditions, and in the same way that not all bovine meats are the same, so too is the case with the quality of the various fish farmed using this system. Providing animals the ideal conditions, the appropriate treatment and the correct food, are factors that exert a very direct influence on the final quality of the product. For this reason, it is possible to note a certain diversity, among fish of the same species, coming from different fish farms.

Cristino Álvarez, a fine taster of all foods in general, and of fish and seafood in particular, has it that it is advisable to prepare these fish on seasoned dishes, in other words, as part of preparations involving other ingredients. He particularly praises the quality of fish farmed alfonsino in pickling brine which, by the way, was the preparation most preferred by Madrid locals back in the days when this fish was found in abundance, so much so that it became a typical dish in the capital and a delicacy on special occasions such as Christmas.

Yves Sinclair was a firm believer in fish from aquaculture, and pointed out that they present notable advantages, with the proviso that they are reared in a controlled process “based on a quality guarantee, on the analysis of dangers and the control of critical points, scrupulously respecting the traceability times established”. As far as Sinclair was concerned, these products are optimum for catering and dish preparation since the chef will find in them the appropriate sizes, compositions and textures for the various processes to which they are subject prior to being served.

Personally, I like to praise the organoleptic virtues of oven roasted turbot on a bed of thinly sliced golden potatoes, or Galician style with a hint of good paprika. As far as sea bass and sea bream are concerned, they are an excellent choice simply grilled, although they improve considerably if, before serving, a dash of virgin olive oil is added, preferably of the Arbequina variety.
Aquaculture is well established in “haute cuisine”, as shown by the leading European chefs who have backed and put their trust in this industry through their cooking.

The different National Academies of Gastronomy have selected some of the most representative chefs from each country to collaborate in this book… and here we have the result.

44 evocative recipes, all made with fish from aquaculture, such as sea bream, sea bass, turbot or salmon, signed by true masters of “cuisine”. This way, among others, we have the invaluable collaboration of Ferran Adrià, Juan Mari Arzak or Carme Ruscalleda from Spain, Joël Robuchon, Paul Bocuse or Michel Guérard from France, Alfonso Iaccarino, Nadia Santini or Franca Checchi from Italy, Vitor Sobral or Nuno Diniz, from Portugal, Nilüfer Goodson from Turkey, and such well known Greek chefs as Yannis Baxevanis, Michalis Dounetas or Christoforos Peskias. Apart from the more avant-garde proposals, we have a sample of traditional Mediterranean recipes, made with fish from aquaculture; some classic dishes from the “cuisine” of Spain, France, Portugal, Italy, Greece and Turkey are included in this recipe book which, once again, echo the great quality and versatility of this type of fish.
The importance of Aquaculture in the European diet

Juan Mari Arzak
RESTAURANT ARZAK
Spain

One of the best Spanish chefs of all times, icon of the new Basque cooking. His restaurant in San Sebastián has 3 Michelin stars and 3 Campsia suns and has been elected N.º 8 in “The Best Restaurant of the World” list.

INGREDIENTS (Serves 4)

For the sea bass in schizandra brine:

- 4 fillets of sea bass (125 g/unit)
- ½ lt of schizandra infusion (*)
- 30 g of fine salt

For the garlic and oil based sauce:

- 1 onion
- 1 leek
- 1 clove of garlic
- 15 g of fried bread
- 10 schizandra berries
- 50 g of olive oil
- Salt and pepper

For the red confetti vegetables:

- 1 can of red peppers, “piquillo” type
- Salt and sugar

For the green confetti vegetables:

- 180 g of spinach leaves
- Salt

For the potato with red and green paper:

- 100 g of boiled potato
- 3 anchovies in olive oil (preserve)
- 5 “Ibarra” chilli peppers
- A dash of parsley and diced sage
- Salt and pepper

(*) For the schizandra infusion:

- ½ lt. of water, 10 g of schizandra flower

Boil the water and add the schizandra off the boil. Cover and leave to rest for 5 mins. Filter.

Other ingredients:

- Sage leaves and schizandra berries

Preparation

For the sea bass in schizandra brine: Dilute the salt thoroughly in the cold schizandra infusion. Place the sea bass fillets into the infusion and leave to rest for 25 minutes. After that time, slightly dry with a piece of drying paper and dry with an iron applying a drop of oil after dipping in the garlic and oil based sauce for a very short moment. Complete the cooking by crystallizing it in olive oil. Set aside.

For the seabass garlic and oil based sauce: Poach the greens with a dash of olive oil. Add the fried bread and the rest of the ingredients. Grind and then add salt and pepper.

For the red confetti: Grind the peppers to create a homogenous paste. Season with salt and sugar. Thinly spread the paste between two papers and leave to dry at 60 °C. Once they are dry, cut them with a paper drill to make confetti. Use the rest of the green strips.

For the green confetti: Put the spinach leaves in boiling salted water. Once they are cooked, drain and grind. Spread between two sheets of kitchen paper and leave to dry at 60 ºC. Once they are dry, cut them with a paper drill to make confetti. Put aside the remaining spinach slats.

For the potato with red and green paper: Dice the anchovy thickly together with the chilli pepper. Mix it with the boiled potato and mash it with a fork to make a purée. Add sage and parsley then salt and pepper. Wrap this purée with the rest of the green peppers and fish bones left over from making the confetti, and make rolls lining them with the purée. Set aside.

For the stock and schizandra: Place all the ingredients except the aniseed and cover with water. Cook for 3 hours over a slow heat. Foam at the start of cooking or whenever required. Sieve. Infuse with the schizandra and sage. Sieve and season.

Finishing and presentation

Present the sea bass on a dish accompanied by the infused stock. Pour the confetti, schizandra berries and sage leaves onto the sea bass.
INGREDIENTS (Serves 4)

**For the sea bream:**
- 2 sea breams (500 g each)

**For the chicken juice:**
- 500 g of chicken wings, 50 ml of sunflower garlic oil
- 100 ml of chicken juice

**For the artichokes:**
- 800 g of artichokes
- 6 ml of sunflower oil
- 2 g of fine salt
- 40 g of whipped cream with rosemary
- 15 g of fresh Rosemary
- 100 ml of liquid “crème fraîche”
- 0.5 units of gelatine leaves
- 100 g of whipped cream with bay leaf
- 1 egg yolk
- 100 ml of liquid “crème fraîche”
- 0.5 units of gelatine leaves
- 100 g of whipped cream with thyme
- 1 egg yolk
- 10 g of bay leaf
- 6 ml of sunflower oil
- 2 g of fine salt
- 100 ml of single cream
- 100 g of light wheat flour, 100 g of strong wheat flour
- 100 g of whipped cream thyme
- 0.4 g of fine salt, 25 ml of olive oil 0.4

**Preparation**

**For the sea bream:**
Clean the sea bream by scaling and gutting. Separate the two loins from the main spine and split each loin in half lengthwise. Wrap in cellulose paper, keep as dry as possible and in the fridge until needed for use.

**For the chicken juice:**
Cut the chicken wings into small pieces. Roast the wings along with the oil first in a frying pan over a high heat and then over a medium heat. Stir now and again to ensure that they are golden all over. They must be almost crunchy. Fully degrease and deglaze with wine. Stir well to bring out all the juices. Leave to caramelize over a low heat until the wine has fully evaporated. When the juices start to take on a toasted colour, add water. Cook over a low heat so that they boil gradually, for 40 minutes. Continually defoam. Sieve and leave to cool to allow the fat to solidify; remove the fat. Reduce until a tasty, consistent base forms. Put through a serge.

**For the garlic oil:**
Cut the heads in half horizontally. Place the lightly salted artichoke strips into the hot frying pan. Leave to rest for 2 minutes. Add salt to the sea bream to taste and pour a dash of olive oil in a hot frying pan. Leave to rest for 2 minutes. Place the lightly salted artichoke strips parallel to the sea bream. Place three raviolis on top of the fish – one of each type of cream – with the fold facing downwards. Fold over two parallel sides onto the cream, overlapping them by 0.3 cm. Fold over the two other sides so that the raviolis are fully closed but without the sides overlapping each other.

**For the raviolis with aromatic herbs:**
With the rolled-out pasta, make 4 cream filled raviolis. Put in the centre of each strip of pasta 8 g of whipped cream. Place the lightly salted artichoke strips in the cream for 30 minutes then cover.

**For the whipped cream with thyme:**
Blanch the egg yolk with a rod. Sieve the infusion, heat and add it onto the yolk without stopping stirring. Put over a medium heat without stopping stirring, with a rubber spatula until the thermometer reads 85 °C. Add salt to taste and dissolve the gelatine. Sieve and cool “au bain-marie” with ice. Keep in the fridge and leave to stabilize for 12 hours. Whip the cream in the whipping machine and place on a cream filler.

**For the bay leaf infusion:**
Boil the cream in a saucepan and put in the dry bay leaf. Infuse the herb in the cream for 30 minutes then cover.

**For the whipped cream with thyme:**
Blanch the egg yolk with a rod. Sieve the infusion, heat and add it to the yolk without stopping stirring. Boil over a medium heat without stopping stirring with a rubber spatula until the thermometer reads 85 °C. Add salt to taste and dissolve the gelatine. Sieve and cool “au bain-marie” with ice. Keep in the fridge and leave to stabilize for 12 hours. Whip the cream in the whipping machine and place on a cream filler.

**For the rosemary infusion:**
Boil the cream in a saucepan and put in the dry rosemary. Infuse the herb in the cream for 30 minutes then cover.

**For the raviolis with aromatic herbs:**
With the rolled-out pasta, make 4 cream filled raviolis. Put in the centre of each strip of pasta 8 g of whipped cream. Fold over two parallel sides onto the cream, overlapping them by 0.3 cm. Fold over the two other sides so that the raviolis are fully closed but without the sides overlapping each other.

**Finishing and presentation**
Add salt to the sea bream to taste and pour a dash of olive oil in a hot frying pan. Leave to rest for 2 minutes. Place the lightly salted artichoke strips into the hot frying pan. Place the portion of sea bream on one side of the dish. Place the artichoke strips parallel to the sea bream. Place three raviolis on top of the fish – one of each type of cream – with the fold facing downwards. Heat in the salamander stove until the raviolis melt. Finish off by dressing the dish with the chicken juice sauce and garlic oil.

For the third consecutive year, “El Bulli” has been awarded “The Best Restaurant in the World”. Additionally, he has 3 Michelin stars and 3 Campsa Guide suns.

Spanish

**PREPARATION**

**Sea bream with raviolis and aromatic herbs**

Stretch out the pasta to obtain 12 strips as fine as possible, 6 x 6 cm. Boil the pasta in water and cool in water, ice and salt. When cold, place it on a cotton cloth to dry and ensure that there are no pores.

**For the whipped cream with bay leaf:**
Blanch the egg yolk with a rod. Sieve the infusion, heat and add it onto the yolk without stopping stirring. Put over a medium heat without stopping stirring, with a rubber spatula until the thermometer reads 85 °C. Add salt to taste and dissolve the gelatine. Sieve and cool “au bain-marie” with ice. Keep in the fridge and leave to stabilize for 12 hours. Whip the cream in the whipping machine and place on a cream filler.

**For the bay leaf infusion:**
Boil the cream in a saucepan and put in the dry bay leaf. Infuse the herb in the cream for 30 minutes then cover.

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**For the whipped cream with rosemary:**
Blanch the egg yolk with a rod. Sieve the infusion, heat and add it to the yolk without stopping stirring. Boil over a medium heat without stopping stirring with a rubber spatula until the thermometer reads 85 °C. Add salt to taste and dissolve the gelatine. Sieve and cool “au bain-marie” with ice. Keep in the fridge and leave to stabilize for 12 hours. Whip the cream in the whipping machine and place on a cream filler.

**For the raviolis with aromatic herbs:**
With the rolled-out pasta, make 4 cream filled raviolis. Put in the centre of each strip of pasta 8 g of whipped cream. Fold over two parallel sides onto the cream, overlapping them by 0.3 cm. Fold over the two other sides so that the raviolis are fully closed but without the sides overlapping each other.

**Finishing and presentation**
Add salt to the sea bream to taste and pour a dash of olive oil in a hot frying pan. Leave to rest for 2 minutes. Place the lightly salted artichoke strips into the hot frying pan. Place the portion of sea bream on one side of the dish. Place the artichoke strips parallel to the sea bream. Place three raviolis on top of the fish – one of each type of cream – with the fold facing downwards. Heat in the salamander stove until the raviolis melt. Finish off by dressing the dish with the chicken juice sauce and garlic oil.
The importance of Aquaculture in the European diet

Pedro Subijana
RESTAURANT AKELARRE
Spain

Pedro Subijana’s San Sebastian restaurant “Akelarre” is a reference in Spain’s national gastronomy. It has received all sorts of national and international recognition endorsed by 3 Michelin stars and 3 Guía Campsa suns.

INGREDIENTS (Serves 4)

For the turbot:
- 4 loins of turbot, about 180 g each
- 3 g of transglutaminase enzyme

For the turbot stock:
- Turbot loin bone
- 250 g of water

For the herb and spice oil:
- 100 g of virgin olive oil
- 10 g of parsley
- 5 g of black pepper
- 10 g of diced shallot
- 1 g of dried chilli pepper
- 5 g of garlic

For the turbot emulsion:
- 100 g of turbot stock
- 20 g of herb oil
- 7 g of Resource

For the seaweed pearls:
- 100 g of water
- 25 g of sea lettuce
- 1 g of agar-agar

For the baby squid sauce:
- 50 g of onion
- 25 g of green pepper
- 10 g of red pepper
- 50 g of natural tomatoes
- 100 g of baby squid pieces
- 10 g of baby squid ink
- 500 g of cold water

For the baby squid pearls:
- Slightly cook all the ingredients of the cuttlefish sauce and cook until reduced by half, sieve and leave to reduce by half again. Sieve and leave to cool. Add the agar-agar and turn up the temperature. Do the same operation with the drops on the oil. Put to one side.

For the rice pearls:
- Blend all the ingredients in a bowl, fill a cornet to make small balls. Put on a non-stick baking pan liner into the oven for 20 minutes at 170-180 °C. Put to one side.

Preparation

For the turbot: Remove the turbot loin fillets placing the meat upwards, sprinkle the transglutaminase and put the upper and lower fillets together. Allow the loins to join for 3 hours in the fridge at 4 °C.

For the stock: Put the vertebrae and bones on the grill, cook for 25 mns with water, sieve and put through a serge. Set aside.

For the herb oil: Take the oil to a temperature of 100 °C with the herbs and spices. Leave to cool and sieve. Prepare the emulsion: Blend all the ingredients together and blend in the mixer. Put to one side.

For the black pearls: Grind the seaweed in water, sieve and add the agar. Boil and allow the liquid to drip into the cold oil. When set, dry and set to one side.

For the roe: Cook the turbot roe in abundant salt and water for 10 mns, on a medium heat. When cooked, cool and put into a salt and water solution where they will break and separate. Sieve using the serge, drain thoroughly and put to one side.

For the rice pearls: Blend all the ingredients in a bowl, fill a cornet to make small balls. Put on a non-stick baking pan liner into the oven for 20 minutes at 170-180 °C. Put to one side.

For the seaweed pearls: Grind the seaweed in water, sieve and add the agar. Boil and allow the liquid to drip into the cold oil. When set, dry and set to one side.

For the baby squid sauce: Slightly cook all the ingredients of the cuttlefish sauce and cook until reduced by half, sieve and leave to reduce by half again. Sieve and leave to cool. Add the agar-agar and turn up the temperature. Do the same operation with the drops on the oil. Put to one side.

For the rice pearls: Blend all the ingredients in a bowl, fill a cornet to make small balls. Put on a non-stick baking pan liner into the oven for 20 minutes at 170-180 °C. Put to one side.

Finishing and presentation

Briefly heat the turbot on both sides in a frying pan placing a ring of roe in the central part of the dish. On top, place some rice pearls and roe of seaweed and cuttlefish, as well as 2 redcurrants, some emulsion around the sides and, as a finishing touch, place the turbot on either side.

Turbot in a sea of coral
The importance of Aquaculture in the European diet

Preparation

Once cleaned and scaled, cut the fish into fillets to make 4 helpings. Set aside. Cut the onions into thin strips and fry them in a frying pan, with a dash of oil, salt and pepper, for about 10 minutes until softened. Set aside. Cut the garlic into thin strips and dice the parsley. Set aside. When clean, cut the mushrooms into regular sized pieces and lightly fry in a frying pan with oil, salt and pepper until the excess water has evaporated. 7 minutes should be enough. Add the strips of garlic and parsley, continue frying for a few more minutes and set aside. Cut the pumpkin into finger-thick strips and cook them in boiling water for 3 minutes. Set aside. Place the onion in an oven tray on top of the pumpkin, sprinkle the mushrooms on top and cover them with the previously salted fish fillets, with the skin facing upwards. Sprinkle the whole dish with sherry and add a dash of oil. Cook in the oven at 200 ºC for 7 minutes.

Finishing and preparation

Lay the sea bream on a plate with the mushrooms and pumpkin. This is attractively coloured fish dish with autumn aromas.

INGREDIENTS (Serves 4)

3 sea breams of about 500 g
2 onions
4 cloves of garlic and parsley
800 g of mushrooms – one type or assortment, e.g., hygrophorus mushrooms (llegenues), edible boletuses (caps), saffron milk-cap (rovellons), grey agaric (fresdelec) or chéereille (basimyces).
400 g of pumpkin
100 ml of dry sherry
Salt, pepper and olive oil

Sea bream with mushrooms and pumpkin

Carmen Ruscalleda
RESTAURANT SANT PAU
Spain

The best Spanish female cook, her restaurant “Sant Pau,” has received fantastic recognition. Carmen recently opened a subsidiary in Tokyo, with lots of success. Her restaurant has 3 Michelin stars and 3 Campsa suns.
### INGREDIENTS (Serves 4)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><strong>Sea Bass</strong></td>
<td>3 units of sea bass, 500 g each</td>
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</table>
| **For the apple purée:** | 250 g of golden apple  
|                   | 250 g of granny Smith apple  
|                   | 30 g of butter  
|                   | 1 g of citric acid                |
| **For the sea anemones:** | 50 g of sea anemones  
|                   | 50 g of wheat flour               |
| **For the lime sauce:** | 20 ml of natural lime juice  
|                   | 20 g of sugar                     |
|                   | 50 ml of sherry vinegar           |
|                   | 50 ml of soy sauce                |
|                   | 25 g of ginger                    |
|                   | 0.3 g of Xantham gum              |

### Preparation

Clean the sea bass by scaling and deboning. Remove the two loins and divide into portions. Put aside in the fridge until needed.

**For the apple purée:**
Peel the apples, remove the core and cut into irregular shaped segments. Poach with the butter and citric acid until soft. Grind, sieve and put aside keeping it warm until needed.

**For the sea anemones:**
Cut into 2 or 3 parts depending on the size. Flour and fry in hot abundant olive oil until a crust forms on the outside remaining soft on the inside. Sieve. Remove the excess oil and freeze until needed.

**For the lime sauce:**
Mix the soya sauce and "Jerez" (Sherry) vinegar and allow to boil. Add the ginger, cover and allow to infuse during approx 25 minutes. Filter. Blend the lime juice and sugar and add to the infusion made previously. Mix. Add the Xantham gum and mix in the blender until the Xantham gum is fully hydrated and the mixture has a light creamy texture.

### Presentation

In the centre of the dish, place a spoonful of lime sauce. On the left, add 4 dollops of apple purée and, on top of these, 4 fried, seasoned sea anemones. Place the slightly grilled sea bass on top of the lime sauce.
The importance of Aquaculture in the European diet

Joël Robuchon
RESTAURANT L’ATELIER DE ROBUCHON
France

Joël Robuchon is the great chef of the 20th century and considered as one of the best cooks in the world. He has numerous Michelin stars and his cooking can be found at “L’Atelier de Robuchon” over 3 continents.

INGREDIENTS (Serves 4)

For the fish:
- 2 sea bass of 400-500 g each
- 12 young garlics
- 3 dry tomatoes
- 100 g of leeks
- Salt and pepper a pinch

For the grated lemon sauce:
- 150 g of balm seeds
- 30 g of sliced shallots
- 70 ml of dry white wine
- 200 ml of cream
- 30 g of butter
- 1 lemon

For the grated lemon oil:
- 5 fresh balm leaves
- 200 g of balm seeds
- 10 g of curcuma (powder)
- 100 ml of peanut oil
- 100 ml of olive oil

Preparation

For the fish: Scale and clean the sea bass, take off the skin prepare the loins by cutting them in portions of 150 g maximum. Remove the green part of the young leeks and boil for 1 minute. Pass under cold water. Peel and dice the tomatoes. Season with olive oil, thyme, thinly diced garlic, salt, pepper and sugar. Put them in the oven (medium heat) for 1.5 and a half hours. Thinly slice the white part of the leeks, and boil for 30 seconds. Dry the diced leeks and fry with peanut oil, without browning.

For the lemongrass cream: Stir-fry the shallots with butter for 3 minutes, add sliced balm seeds and braise for 15 minutes. Add the wine and allow half the quantity to evaporate. Add the cream, keep over low heat for 15 minutes and then set aside 15 minutes more. Sieve the sauce and at the last moment, add the butter and the lemon juice.

For the lemongrass oil: Mix all the ingredients, thinly diced, put them into olive oil and boil (80 ºC) for 2 hours. Set aside.

Finishing and presentation

In a serving platter, put the fish with the lemongrass oil. Cover with the young leeks, the 3 dry tomatoes, and the fried leeks. Spread the lemongrass cream and lemongrass oil over it.

Lemongrass sea bass on a bed of young leeks
The importance of Aquaculture in the European diet

Paul Bocuse
RESTAURANT L’AUBERGE DU PONT DE COLLONGES
France
One of the “kings” of French Gastronomy, Bocuse is one of the great renovators of the French “nouvelle cuisine”. His restaurant has been awarded 3 Michelin stars for years.

INGREDIENTS (Serves 4)
- 3 sea bass of 500 g
- Salt
- Black pepper (mill)
- 1 tablespoon of olive oil

For the filling:
- 100 g of clean scallops
- 100 g of perch (without the skin)
- Salt and black pepper (mill)
- 200 g of double cream
- 30 g of peeled pistachios
- Eggs: 2 yolks + 1 white
- 50 g of softened butter (not melted)

For the choron sauce:
- 2 shallots
- 150 g of wine vinegar
- Pepper
- Eggs (3 yolks)
- 150 g of butter
- 1 dash of concentrated tomato paste
- 1 tablespoon of diced fresh tarragon

Preparation
Remove the skin from the fish and season. Mix the other fish (very cold). Season, sieve or mill and leave in a cold place. Add the cream and the pistachios. Fill the sea bass with the preparation of scallop and perch. Split the puff-pastry paste into two parts and flatten with a rolling pin. Lay the fish over one part and cover with the other. Press the edges firmly. With a knife mark the shape of the fish and the fish bones. Use the remaining pastry to enhance the presentation. Put the fish in a Pyrex and varnish with the egg. Bake in the oven for 10 minutes (in a pre-heated oven at 220 ºC) and then lower to 180 ºC and leave for 25-30 minutes more.

Finishing and presentation
Serve the sea bass with the “choron” sauce.

Minoret soup of sea bream

Michel Guérard
RESTAURANT LES PRÉS D’EUGÉNIE
France
Responsible for the French “nouvelle cuisine”, with 3 Michelin stars, Guérard has received a great deal of recognition. He is also a wine producer, an entrepreneur in the thermal water business and an expert in gastronomy and nutrition.

INGREDIENTS (Serves 8)
- 3 sea breams, 600 g each
- 8 shrimps
- 24 prawns (3 per person)
- 16 clams (2 per person)
- 250 g total (160 g net weight) of small squids
- 1 l of vegetable drained stock
- 3 sheets of Kaffir lime
- 80 g of Kaffir lime oil
- 80 g aromatic herbs
- 8 Brussel sprouts
- 8 small apples
- 150 g of butter
- 30 g of truffles juice
- beaten butter with truffles
- 30 g of diced truffles
- 8 units of spiral-cut lemon rind
- 8 sprigs of salad burnet
- lemon leaves

Preparation
Dice the Brussel sprouts and boil in generously salted water. Scale and clean the sea bream. Cut considering the individual portions. Finely slice the Kaffir lime, and boil it in the vegetable stock. Sieve. Note: if the stock has no taste, add half of a concentrated stock cube.
Boil the loin in the oven spreading the Kaffir lime oil on top. Grill the small squids. Boil in low heat in salty water (like sea water) the peeled prawns (leaving only the tail), the shrimps and the clams.

Finishing and presentation
Place the aromatic herbs in a deep serving platter; lay the fish, then the seafood all around, and finally the stock. For a better presentation, put a lemon leaf on one side of the serving platter, a dash of Kaffir lime oil, natural salt, salad burnet and lemon spiral-cut rind.
The importance of Aquaculture in the European diet

Alain Solivérès
RESTAURANT TAILLEVENT
France
A pure Parisian gastronomy tradition which Alain Solivérès leads since 2002 with great success. Michelin stars follow year after year. He is currently qualified with 2 Michelin stars.

Baked sea bass
with small onions, Provence artichokes, black truffle and fine potato raviolis

INGREDIENTS (Serves 8)
- 8 Violet Provence artichokes
- 8 laminated small onions
- 15 g of black truffle
- 2 c.s. of olive oil
- Fine salt, mill pepper
- 20 g of butter
- 4 fillets of sea bass of 180 g each, skin off
- 8 c.s. of mushroom stock

For the potato raviolis:
- 40 g of acorn Spanish “serrano” ham, cut into small cubes
- 8 mushrooms cut into small cubes
- 4 cloves of garlic and 4 finely chopped shallots
- Olive oil, sea salt, mill pepper
- 2 c.s. of freshly grated Parmesan cheese
- 120 g of cow’s brain, cooked with butter and cut into pieces
- 8 Pompadour potatoes, peeled and washed
- Peanut oil

Preparation
Peel the artichokes to remove the hearts. Cut them into fine, equally sized slices. In a salad bowl, mix the artichoke hearts and small onions well, dress with truffles, olive oil, salt and pepper. Grease the central part of 4 aluminium sheets with butter and place the previously salted and peppered sea bass fillets. Dress. Sprinkle with the mushroom stock and close the wrappings well. Perheat the oven to 200 °C. Bake for 7 minutes just before serving.

For the potato raviolis: Lightly fry the ham, mushrooms, garlic and shallot in a dash of olive oil. Salt and pepper then add the Parmesan cheese and cover the brain. Blend well. Dry the potatoes with absorbent paper and cut them lengthwise into fine strips. Dry again. Spread the dressing over 1/2 of the potato slices and cover with the other 1/2 to make raviolis. Cook these raviolis in the frying pan with very hot peanut oil until crunchy and brown on both sides. Put to one side hot until serving.

Presentation
Carefully open the envelopes and pour in the cooking juice on a small ladle. Keep the fish hot. Reduce the juice for a few minutes over a medium heat to thicken it slightly. Away from the heat, with the 2 c.s. of olive oil rod, pour with the rod. Place the fish in the centre of each dish, pouring on the juice. Spread out the raviolis and serve.

INGREDIENTS (Serves 4)
- 4 portions of sea bass, 180/200 g each
- 12 small, young artichokes or, more simply, 12 frozen artichokes hearts
- 200 g of peas (fresh to give better quality, or frozen)
- 18 round radishes or a bunch
- 1 spoonful of mild butter
- 2 spoonfuls of olive oil
- 15 cl of milk
- 1 spoonful of single cream
- 2 spoonfuls of grated Parmesan cheese

Preparation
Clean and cut the fish, put aside for later use. Peel the artichokes and remove the inside with a slicer. Cut the trunk into 4 pieces and leave to soak in water with lemon. If the hearts are frozen, depending on the size, cut into 6 or 8 pieces. Do not throw away the radish leaves because they can be added at the end of the preparation, but remove them from the radish. Wash the radish in abundant water and cut into 4 or 6 pieces. Remove the peas from the pods and set the pods to one side for adorning the dish, boil in water with salt for 2 minutes and rinse under very cold tap water. Put a small cassero-role on the heat. Place the sea bass, skin facing down, for about 6 or 7 minutes, depending on how thick the sea bass is, and cover the frying pan. To ensure that the sea bass is well cooked, prick with a toothpick and, if it penetrates easily to the bottom, the fish is ready.

Finishing and presentation
Check the dressing and arrange it in the centre of a deep dish. Blend the mixture based on milk, cream and Parmesan cheese to obtain a foamy sauce. Sprinkle the edge of the dish with a few dashes of foamy sauce. Place the sea bass on top of the dressing and decorate to taste.

Sea bass with “sautéed” baby artichokes, peas and round radishes, foamy creamy sauce with Parmesan cheese

Olivier Guyon
RESTAURANT GOUMARD
France
At “Goumard”, possibly the best fish restaurant in Paris, Guyon elaborates a brilliant kitchen since 2003, awarded with numerous prizes.
The importance of Aquaculture in the European diet

Nadia Santini
RESTAURANT DAL PESCATORE
Italy

Santini heads the prestigious restaurant “Dal Pescatore” in Mantua, in which 3 generations of great chefs have worked. It has 3 Michelin stars.

INGREDIENTS (Serves 4)
- 240 g of “Vialone Nano” rice
- 2 medium sized catfish (about 200 g)
- 60 g of butter
- ½ onion
- 1 small spoonful of ground celery
- 400 g of vegetable broth
- Spring onion
- ¼ anchovy
- 200 g of extra virgin olive oil for frying
- Ground nutmeg, cinnamon, cloves, pepper

Preparation
Fry the cleaned catfish in the oil, having removed the central bone and head. When crispy, place on absorbent paper. In the frying pan, add a dollop butter, onion and ground celery; add the fish and ¼ anchovy. Add pepper, cinnamon, ground nutmeg and cloves (a dash of each ingredient) and leave to cook for a few minutes. Remove from the heat.

To prepare the rice: In the pot, heat the remaining butter with 2-3 strips of ground onion. Add the rice, leave to cook for a moment whilst stirring. Add the boiling broth (1 ladle). Gradually add the broth in 3-4 times before it is fully cooked (a total cooking time of 11 minutes). Add the catfish.

Finishing and presentation
After having removed the rice from the heat, place into a serving bowl and sprinkle the dish with spring onion.
The importance of Aquaculture in the European diet

Nadia Santini
RESTAURANT DAL PESCATORE
Italy

The importance of Aquaculture in the European diet

Mara Martin
RESTAURANT DA FIORE
Italy

Mara Martin manages, together with her husband Maurizio “Da Fiore”, considered as the best restaurant in Venice, with 1 Michelin star for the past 12 years.

INGREDIENTS (Serves 6)

- 6 sole of about 150-200 g each
- 50 g of butter
- Salt, pepper
- 1.5 l of spinach
- Garlic-spring onion-parsley
- Bread crumbs
- “Grana Padano” cheese
- Fish stock

Preparation

Take the black skin off the back of the fish and the white skin off the belly. With a small, fine blade knife, make a cut half way in the upper part of the sole, from head to tail. With the same knife, remove the bone, gradually taking out the left fillet then the right. Turn the sole over and repeat this operation on the other side to obtain 4 fillets. After rinsing them, with a wet meat mincer—or the blade of a large knife—stretch very gently to flatten the internal fibres. Prepare a litre of sole stock. First and foremost, clean and rinse the bones and heads. Put them into a pot with some onion, a dash of parsley and some grains of pepper. Add water and white wine, a pinch of salt, and leave cooking over a low heat for 20 minutes. Filter the stock with a sieve. Place the fillets on the work top, season with salt and pepper; make small rolls and close them with a toothpick. Clean and cut the Treviso radish into strips, leave to soak in water with ice for 1 hour; then drain and centrifuge. Clean the spinach and the sea bass rolls and the cooking sauce. Season the radish with salt and olive oil and set aside for ornamenting. Serve immediately.

Presentation

In the centre of each pre-heated plate, place the spinach and the sea bass rolls and the cooking sauce. Season the radish with salt and olive oil and set aside for ornamenting. Serve immediately.
The importance of Aquaculture in the European diet

Alfonso Iaccarino
RESTAURANT DON ALFONSO 1890
Italy
A great amount of recognition for this prestigious restaurant in Sorrento, endorsed by 3 Michelin stars, creating a modern Mediterranean cooking based on local products.

**Eel with blueberries**

in mature vinegar sauce, country lettuce and green beans

**Preparation**
Put the sugar over the heat with the vinegar to reduce it; do the same with the amaretti sauce until achieving a syrup texture. Cut the eel fillets into equal pieces of about 10-12 cm. Roll and place them with the sprigs of blueberry. Prepare a salad, adding the carrots and wild radish that have been into strips. Cook the green beans and slice them lengthwise. Roast the eel brochettes on the grill.

**Presentation**
Put the salad, wild radishes, carrots and beans, seasoned with part of the vinegar sauce, on a dish. Arrange the brochettes creating a pyramid on top of the salad. Season with what is left of the vinegar and the blueberry sauce. Ornament the dish with mustard seeds.

**INGREDIENTS (Serves 4)**

- 400 g of eel fillet
- 12 sprigs of blueberry
- 1 dl of mature red wine vinegar
- 25 g of sugar
- Salt
- 150 g of lettuce
- 120 g of wild radish
- 50 g of carrots
- 8 cl of extra virgin olive oil
- 40 g of mustard seeds
- 200 g of sour cherry amaretti sauce

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**Sea bass “acqua pazza”**

with courgettes, eggplants and peppers

**Preparation**
Grind the onions, leave to fry gently in oil and add the cut tomatoes. After 5 minutes, add the fish fillet and continue cooking for a few more minutes. Sauté the courgettes, peppers and eggplants cut into very small cubes.

**Presentation**
Place the fish fillets on a dish on top of a slice of nettle bread; add the vegetable cubes, tomato sauce and basil leaf. Sprinkle with a thread of extra virgin olive oil.

**INGREDIENTS (Serves 4)**

- 1 Sea bass fillet of 500 g
- 60 g of eggplants
- 50 g of onions
- 60 g of peppers
- 60 g of courgettes
- 120 g of nettle bread
- 7 cl of extra virgin olive oil
- 500 g of cherry tomatoes
- 4 sprigs of parsley
- Salt
The importance of Aquaculture in the European diet

Franca Checchi
RESTAURANT ROMANO
Italy

Franca Checchi is the chef at this well reputed seafood restaurant, kingdom of the Franceschini family. It has 1 Michelin star.

Braided sole on a bed of potatoes and San Miniato white truffle strips

**INGREDIENTS (Serves 4)**
- 4 sole, of about 200 g each
- 400 g of potatoes
- 2 cups of fish stock
- Extra virgin olive oil
- 30 g of butter
- Salt and pepper
- San Miniato white truffle, to taste

**Preparation**
Clean the sole and fillet them to get 16 fillets. Split each one into three strips to braid them together. Peel the potatoes and cut them into fine strips. Pour 100 g of extra virgin olive oil into a frying pan, add 2 dollops of butter, 2 cups of fish stock and potatoes. Cook on a low heat (to avoid the potatoes breaking) for about 15 minutes. Put them into an oven dish and place the sole fillets on top. Put into a pre-heated oven at 200 °C. Leave for around 7-8 minutes or the time needed to cook the fish.

**Presentation**
Serve on individual dishes, placing the sole fillets on the bed of potatoes. Decorate with fine strips of San Miniato white truffle, to taste.

Meagre in “eau folle”

**INGREDIENTS (Serves 4)**
- 4 Meagre weighing approx. 200-300g each
- 20 Cherry tomatoes
- 1 fresh white onion
- 200 g of sepia
- 1 chilli
- 1 garlic pod
- 6 basil leaves
- 2 soup spoon full of fish fumet
- 1 tsp of salt
- 1 tsp of pepper

**Preparation**
Carefully clean the fish. Cut each meagre to obtain 2 fillets. Thoroughly clean the sepia, removing the eyes and bladder. In a saucepan, pour the olive oil and add the peeled and finely sliced onion, the chilli, the peeled garlic, the cherry tomatoes cut in half, the fish fumet, the parsley and basil. Add salt and pepper. Place over the heat and allow to simmer for at least 10 minutes. During this time, batter the meagre (skin side only) in flour and add them to the sauce and continue to cook for another 10 minutes. Add the sepia and allow to cook for an extra 3 minutes.

**Presentation**
Remove from the heat and serve immediately on individual plates.
The importance of Aquaculture in the European diet

Yannis Baxevanis
RESTAURANT L’ATELIER BAXEVAANIS
Greece

Numerous prizes endorse his international experience. After managing some of the best restaurants in his country, Baxevanis has his own restaurant and has become one the best Chefs in Greece.

Sea bass with roe “en croûte” on a bed of dandelions and seafood “jus”

INGREDIENTS (Serves 4)

- 4 sea bass loins (300 g each)
- 80 g of roe
- 1 egg yolk
- 2 dl fresh cream
- 600 g of dandelion
- 100 g of spinach
- 1 sprig of celery
- Olive oil
- 1 onion
- 1 leek
- 3 garlic cloves
- Ouzo Greek liquor
- Carrot “purée”
- 400 g seafood mix

Preparation

Gently cut the sea bass loins into cubes and mix with a portion of roe. Leave in the refrigerator for a few hours. Season. Sieve, add the egg yolk and 100 g of whipped cream. Add some dandelions and some finely diced roe. Wrap the sea bass loins in the roe cream and steam-boil for 1 minute.

Boil the dandelion for some minutes and then finely dice them. Add the spinach, the celery and finely mill the preparation into a purée. Sieve.

Season the loins with salt and pepper and fry in olive oil. Cover to keep the temperature.

Open the sea shells in a pan with onions, celery, leeks and garlic. Add the greek ouzo liquor. Sieve the stock and add it to the carrot “purée”, also adding the clean seafood.

Finishing and presentation

Serve the fish over the dandelion “purée”, cover with the seafood sauce.
The importance of Aquaculture in the European diet

Yannis Baxevanis
RESTAURANT L’ATELIER BAXEVANIS
Greece

**INGREDIENTS (Serves 4)**
- 4 sea bass loins of 160 g each
- 2 kg of tangerines
- coriander beans
- juniper berries
- black pepper
- 1 dl of greek ouzo liquor
- orange blossom
- 60 g of butter
- saffron
- 100 g of sugar
- prickly pears enough for 5 dl of nectar

**Preparation**
Toast the juniper berries, the coriander and the pepper beans in a frying pan. Add the liquor, the tangerine juice and the orange blossom. Leave it over a low heat for 15 minutes. In another frying pan with a dash of saffron, stir-fry the fish loins over a low heat. Remove the loins from the frying pan, leave until the sauce thickens and add the butter (very cold). Blend well.

**Prickly pear ice-cream**: liquefy enough prickly pears for 5 dl of nectar, season them with a bit of salt and 100 g of sugar. Mix thoroughly until the sugar has dissolved. Then, to finish the ice-cream, follow the instructions of your ice-cream machine.

**Presentation**
Lay the loins in a serving platter over the sauce, and serve the ice-cream in a separate bowl.

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**INGREDIENTS (Serves 4)**
- 2 sea bream (500 g each)
- fennel beans
- olive oil
- turmeric
- 100 g of mushrooms
- ouzo greek liquor
- seasoned diced fish
- 80 g of black olives
- 1 onion
- 1 leek
- 3 garlic cloves
- 1 tomato
- 4 artichokes
- 1 lemon
- 1 sprig of celery
- sunflower oil

**Preparation**

**For the fennel sauce**: Toast the fennel in a frying pan, add the olive oil, onions, leeks, garlic and mushrooms, all finely diced. Stir and season with turmeric. Clean the artichokes, keeping the soft inner leaves untouched. With the external parts prepare a stock, with a dash of lemon juice. Salt.

**For the celery sauce**: Boil the sprig of celery for some minutes, finely dice it, and mix it with the artichoke stock. Add olive oil. Clean the sea bream by scaling and gutting. Cut the fish into fillets. With some olive oil, stir-fry the sea bream loins and add the fennel sauce. Add the grated tomato. Fry the artichokes in the sunflower oil and cut the black olives into small cubes.

**Presentation**
Serve the sea bream loins and the artichokes with the fennel sauce, pour over some olive oil and the celery sauce.
The importance of Aquaculture in the European diet

Christoforos Peskias
48 THE RESTAURANT
Greece

Considered one of the best chefs in Greece, he makes a style of “cuisine” full of produce, talent and imagination, with Greek roots, influenced by modern & international techniques acquired throughout his extensive experience, endorsed by numerous prizes and recognition.

“Sautéed” sea bass on a bed of marinated cucumbers and “tarama” mousse

INGREDIENTS (Serves 6)
- 2 sea bass (500 g each) or 6 fillets (160 g each)
- with the skin off
- 3 thick cucumbers
- 10 leaves of diced mint
- 100 g of white cod eggs
- 4.5 dl of fish fumet
- Lemon juice
- 2 dl of olive oil
- Salt, pepper

Preparation
Cut the cucumbers into very fine slices. Salt them and leave to macerate for 1 hour. Wash for 30 minutes under running water. Beat the cod eggs in the mixer with the fish fumet for 2 minutes. Gradually add the olive oil until the sauce thickens. Add the lemon juice. In a frying pan, heat the cucumber strips with the mint in a very small amount of oil (do not allow to boil). Clean the sea bass by scaling and gutting. Cut the fish into fillets. Salt and pepper the fish fillets and fry in a pan on each side for 2 minutes. Beat the sauce using a mixer to make a mousse.

Finishing and presentation
Place a small portion of cucumbers on a dish, arrange the fish and surround with the sauce.
The importance of Aquaculture in the European diet

Christoforos Peskias
48 THE RESTAURANT
Greece

INGREDIENTS (Serves 6)

3 sea breams of 400-500 g each, in fillets
Salt, pepper
A quart of olive oil

For the Greek spinach rice:
350 g of spinach leaves
100 g diced leek
100 g diced spring onions
1 small bunch of dill (finely cut)
1 small bunch of parsley (finely cut)
1 small bunch of chervil (finely cut)
1 small bunch of fennel leaves (finely cut)
1 dl of dry white wine
1 dl of water
100 of rice
Juice of one and a half lemons
0.75 dl of olive oil
Salt, pepper

Preparation

For the Greek spinach rice: In a pot, place the leek and spring onions in olive oil. Turn up the heat and add the spinach, then toss them over. Add the rice and sauté in a pan for 1 minute. Sprinkle on the wine and water, cover the pot and leave to cook over a low heat for 25 minutes. The preparation is ready to be removed from the heat. Add the fine herbs and lemon. Salt and pepper.

For the yogurt sauce: Heat the fish fumet and blend with the other ingredients in the mixer. Lay on the sauce in a small pot and keep it hot “au bain-marie”.

For the fish: Sauté the sea bream fillets in olive oil. Salt, pepper.

Finishing and presentation

Arrange a dome-shape helping of Greek spinach rice in the centre of the dish. Place the fish fillet on top and pour the sauce on top.

INGREDIENTS (Serves 5)

3 sea bream 400-500 g each (without skin)
200 g of carrots cut into “julienne” strips
1 white of a large leek cut into “julienne” strips
300 g of courgettes cut into “julienne” strips
6 blades of thyme
0.5 dl of olive oil
0.5 dl of dry white wine
6 double leaves of filo pastry rounded off with a diameter of 26 cm.
Melted butter on the pastry fine pastry
Salt, white pepper

Preparation

Cook the leek with olive oil for 5 minutes. Add the carrot and stir the mix for a further 3 minutes. Add the courgette and stir for 1 minute. Add the white wine, turn up the heat until the liquid has fully evaporated. Salt and pepper.

Butter both sides of the filo pastry. Arrange the sea bream fillets in the centre of the dish, cover with the greens and place a blade of thyme on top. Fold over the filo pastry into a half-moon and close off the ends. Place the fish on a non-stick plate and leave in the oven for 10 minutes at 190 ºC. Serve with the sauce.

For the sauce: Place the fumet into a mixer. Beat at high speed. Gradually add the olive oil until the sauce thickens. Add the fennel leaves and lemon, continue beating for an extra minute. Put through the vegetable mill, salt and pepper.

Finishing and presentation

Place the fillets of sea bream in the centre of a plate and surround with the sauce.

Sea bream with greek spinach, rice and yogurt sauce

Sea bream fillets in filo pastry with olive oil and lemon emulsion
The importance of Aquaculture in the European diet

The reputed chef, Dounetas makes exquisite Mediterranean dishes and his “cuisine” has made “Baraonda” one of the “must visit” restaurants in Athens.

Michalis Dounetas

RESTAURANT BARAONDA

Greece

Sea bass loin with mushroom crust in garlic and coriander creamy sauce

INGREDIENTS (Serves 4)
- 4 loins of sea bass (500 g each fish)
- 1 carrot, 1 courgette
- Sprig of fresh basil
- 2 tomatoes
- 1.5 dl of olive oil
- 2 cloves of garlic, sprig of fresh coriander

For the garlic and coriander creamy sauce:
- 2.5 dl concentrated fish stock
- 6 g of gelatin (sheets)
- 5 g of fresh coriander (diced)
- 2 g of garlic, 2 g of salt
- 0.6 dl of olive oil

For the garlic and coriander creamy sauce:
- Mix "A"
  - 0.3 dl of olive oil
  - 100 g of diced shallots
- 250 g fresh mushrooms, cut into small cubes
- Mix "B"
  - 300 g of bechamel
  - 10 g garlic, 2 eggs, 40 g of parsley
  - 20 g of white wine
  - 50 g grated Parmesan cheese
  - Salt and pepper

Preparation
Cut the tomatoes in pieces, peel and clean. Put them into a marinade with olive oil, salt, pepper and some coriander leaves. Cook in the oven (70 °C) for 1 hour. With a mandolin, cut the carrots in slices and boil them in salty water. When cooked, run them under cold water. Do the same with the courgette. Then stir-fry both. Wrap the two vegetables with the marinated tomato pulp and add the basil. Stir fry the mushrooms and shallots with olive oil and leave to cool. Blend all ingredients of mix "B" and then add them to mix "A". Slightly cook the loins on both sides. Wrap them in the mushroom crust and fry on both sides.

For the garlic and coriander creamy sauce: Braise the garlic in olive oil, add the concentrated fish stock, leave to cook for a few minutes, add the gelatin previously soaked for some seconds. Sieve the preparation and let it cool down. Add the diced coriander and place in a double charger siphon.

Presentation
Lay the fried vegetable roll on one side of the serving platter and the fish loin crusts on the other. For a better presentation, spread the garlic and coriander creamy sauce all over the dish.

INGREDIENTS (Serves 4)
- 100 g of sea bass (500-600 g each fish with skin)
- 100 g of missolonghi boutargue

For the “mayiritsa”:
- 500 g of green onions
- 1.2 dl of olive oil
- 1 lettuce (roman)
- 400 g of chards
- 0.4 dl of lemon juice
- 0.8 dl of dry white wine
- 4 dl of concentrated fish stock
- 45 g of egg lecitin
- 5 g of agar–agar

For the mousse of lime and verveine:
- 5 dl of milk
- 20 g of verveine
- Thinly grated lime
- 2 gelatin sheets, salt and pepper

For the rice:
- 100 g of basmati rice
- 3 dl of concentrated fish stock
- 0.5 dl of lemon juice
- 5 g of agar–agar

Preparation
For the “Mayiritsa”: Boil the rice with the concentrated fish stock, the lemon juice and the agar-agar. Season with salt and leave to cool in a serving bowl.

Finishing and presentation
Lay the rice bowls and the vegetables on the centre of the serving platter and place the fish loin and the verveine and lime mousse on top. Thinly spread the roe around the fish and cover the dish with the remaining sauce.
Sea bass, oyster gelatin, beetroot pudding and candied lemon syrup

**INGREDIENTS (Serves 4)**

- Loins of 2 sea bass (600 g each) without skin
- 200 g of concentrated fish stock
- For the oyster gelatin:
  - 100 g of clean oysters
  - 200 g of oyster sauce
  - 3 g of agar-agar
  - Salt and pepper
- For the beetroot pudding:
  - 250 g of boiled beetrots
  - 100 g of fresh cream
  - 50 g of stir-fried onions
- For the candied lemons:
  - 3-4 lemons
  - 6–8 aromatic cloves
- For the lemon syrup:
  - 120 g of syrup (temperature 30º)
  - 200 g of lemon (for the juice)
  - 1 dl of olive oil
  - 1 bay leaf
  - Salt and pepper

**Preparation**

**For the sea bass:** Wrap the loins in aluminium foil and softly poach them in olive oil (85 ºC). Remove the foil, slightly cook the loins and add the concentrated fish stock.

**For the oyster gelatin:** Boil the oyster sauce with the agar-agar, remove from heat. Spread lemon juice over the diced oysters and season with salt and pepper. Lay this preparation giving it an oval shape.

**For the candied lemons:** Put 2 aromatic cloves in each one of the 3 or 4 lemons. One by one wrap them in aluminium foil and put them into the pre-heated oven at 150 ºC for 40-50 minutes. When they are cold enough, remove the cloves, cut them into 2 halves and remove the seeds.

**For the lemon syrup:** Blend 120 g of still hot candied lemons for 5 minutes with the olive oil and gradually add the remaining ingredients until the preparation is homogeneous. Check the salt.

**For the beetroot pudding:** Mill all ingredients and cook them in the oven (150 ºC), in a silpat mould for 15 minutes.

**Finishing and presentation**

Slice the oyster gelatin and the beetroot pudding 1 cm x 1 cm x 10 cm thick and lay the fish on top. Spread the sauce all over.
The importance of Aquaculture in the European diet

Nilüfer Goodson
RESTAURANT DIWAN BEBEK BRASSERIE
Turkey
Considered by many as the leading Turkish female chef, her international experience has transformed her “cuisine” into a fusion between Turkish tradition and foreign influence.

Royal sea bream with fennel and saffron compote

INGREDIENTS (Serves 4)

For the compote:
- 50 g of pine nuts
- 4 cl extra-virgin olive oil
- 1 medium onion, halved and sliced
- 1 fennel bulb, cored and sliced
- 3 cloves garlic, peeled and smashed
- 2 large strips lemon peel
- 1¼ of teaspoons salt, plus additional for seasoning
- 1 teaspoon fennel seeds
- Pinch of saffron threads
- Freshly ground black pepper
- 200 g of golden raisins
- 3 tablespoons chopped fresh flat-leaf parsley

For the fish:
- 4 pieces of fillet of sea bream, each about 300 g
- Extra virgin olive oil, for brushing
- 1/8 teaspoon cayenne pepper
- Salt, freshly ground black pepper

Preparation

For the compote: Toast the pine nuts in the olive oil in a skillet over a high heat, swirling the pan, until they are golden, about 3 minutes. Transfer the nuts to a dish and set aside, leaving the oil behind in the pan. Add the onion, fennel, garlic, lemon peel, salt, fennel seeds, saffron, and black pepper to taste, and cook until the onion and fennel are slightly wilted. Add the raisins and cook until mixture softens. Stir in 50 ml of water, the pine nuts and the parsley. Cook until the liquid evaporates and the compote thickens. Set aside.

For the fish: Prepare the grill at a high temperature. Brush the fish with oil and sprinkle with the cayenne. Salt to taste. Lay the fish on the grill about 3-4 minutes and flip the fish another 3 to 4 minutes. Place the compote in the middle of the plate.

Presentation
Place the fish on top of the compote. If you wish, you can give the finishing touch with lemon wedges or lemon peel.
Seared sea bass and smoked eggplant with herbal pine nut sauce

**INGREDIENTS (Serves 4)**

**For the fish:**
- 2 sea bass (600 g each) in 4 fillets
- 4 sprigs of thyme
- 3 tablespoons of olive oil
- Salt and black pepper to taste

**For the eggplant:**
- 1 cup olive oil
- 6 each eggplant (2 for the sauce)
- ½ fresh lemon juice
- 1 tablespoon of sugar, 1 tsp salt, 1 tsp red peppercorn

**For the sauce:**
- 35 g toasted pine nuts
- 1 tablespoon of fine chopped basil
- 1 tablespoon of fine chopped mint
- 1¼ tablespoon of fine chopped parsley
- 2 each eggplant
- Lemon juice to taste
- Salt, pepper to taste
- 1 fillet of anchovy (finely chopped)

**Preparation**

**For the fish:** Thoroughly dry the fish skin in a paper towel, and keep on the paper towel until ready to cook (this helps the fish skin turn crispy). Salt the fish immediately before searing because salt makes the skin watery and prevents it from becoming crispy. When the pan with olive oil is really hot, put the fish, skin side down, into the pan. To avoid the skin curling, press the fish with a fish spatula or spoon and put the fresh thyme sprig on each fish to give a pleasant fragrance and flavour. When the skin is crispy, you can turn the fish around easily. If you cannot turn it easily, it means that it is not crispy enough. Once you have managed to turn the fish around, turn the oven off and tallow the fish to continue cooking in the pan for a further 2 minutes.

**For the eggplant:** In a small pot, bring to a boil the lemon juice, salt, sugar and peppercorn. Add the olive oil and turn it off. Place in a small deep baking pan to allow the eggplant to marinate. Grill the eggplants with the skin at a very high temperature. When they are cooked, peel them right away and put them in the hot oil mixture. This way, the eggplants will continue to cook and keep their white color. You can keep the eggplants up to one week in this mixture. Before serving, take them out of the oil mixture and bring them to room temperature.

**For the sauce:** Put all the ingredients and the marinated sauce for the 2 eggplants in the food processor and mix until saucey but not too liquid. You should be able to see chunks of pine nuts. Salt and pepper to taste. Serve at room temperature. You can keep for up to 4 days in the fridge.

**Finishing and presentation**

Place the sea bass in the centre of a serving dish with the aubergines around it and a small amount of herb and pine nut sauce on top. The remaining sauce will be placed in a sauce bowl beside the plate.
The importance of Aquaculture in the European diet

Vitor Sobral
RESTAURANT TERREIRO DO PAÇO
Portugal

One of the greatest figures of Portuguese gastronomy, Vitor Sobral makes, in his restaurant in Lisbon, a “cuisine” based on Portuguese products and culinary tradition.

INGREDIENTS (Serves 10)

- 3 units of bar (500 g each)
- 1 dl Extra virgin olive oil
- Traditional sea salt (to taste)
- Pepper mill (to taste)
- 5 dl Fish stock

For the rice:

- 600 g of tree rice, 20 g of diced garlic
- 200 g of diced onion, 150 g of crystallized tomato
- 1 kg of cockles, 300 g of cod tongues
- Extra virgin olive oil (to taste)
- 2 dl of white wine
- Chicken stock (to taste)
- 2 dl of white wine
- Traditional sea salt (to taste)
- Pepper mill (to taste), diced parsley (to taste)

For the sauce:

- 2 dl extra virgin olive oil
- 0.5 dl squid ink, 1 dl of fish stock

For the filling:

- 20 unit of baby courgettes
- 0.5 dl of extra virgin olive oil
- Pure salt (to taste)
- Diced spring onion (to taste)
- Chervil (to taste)

Preparation

Salt the fish (in individual doses) with abundant salt, for 30 minutes. Rinse in ice-cold water to remove any surplus salt. Dry with absorbent paper and place on an oven dish, add the other ingredients. Cover and put in the oven to bake at 100 °C for about 30 minutes.

Finishing and presentation

Sauté the spinach in olive oil, Season with pure salt and place in the centre of the dish. Place the fish and the other ingredients on top. Finally, decorate with the spring onion.

Poached sea bass, rice with cockles and cod tongue, crystallized tomato and squid ink oil

INGREDIENTS (Serves 10)

- 2 kg of clean turbot
- 50 g of diced dry apricots
- 40 g of diced dry tomatoes
- 80 g of diced pistachios
- 60 g of roast pine nuts
- Rosemary (to taste)
- Traditional sea salt (to taste)
- Extra virgin olive oil (to taste)

For the filling:

- 600 g of spinach
- 30 g of laminated garlic
- 1 dl of extra virgin olive oil
- Traditional sea salt (to taste)
- Spring onion (bunch) (to taste)

Preparation

Salt the fish (in individual doses) with abundant salt, for 30 minutes. Rinse in ice-cold water to remove any excess salt, slightly cook in hot olive oil with the skin facing downwards. When the skin is brown, turn the fish over and sprinkle with the stock and leave cooking over a medium heat.

For the rice: Place the previously soaked cod tongues in an oven dish, dress with olive oil and 1 dl of white wine, cover and put in the oven at 150 °C for about 30 minutes. Emulsion and put to one side. Place the cockles in a frying pan, cover and cook until they open over a medium heat. When open, shell and sieve the cooking juice. In a pot, prepare a sauce with olive oil, garlic and onion. Add the rice, stir well and refresh with the remaining white wine. Add the boiling chicken stock little by little and wait for the excess liquid to evaporate before pouring more. When the rice is almost ready, add the candied tomatoes and the cockles and their juice. Add the right amount of salt, take off the heat and add the preparation of cod tongues. Lastly, season with chopped parsley.

For the sauce: Boil the fish stock in a casserole and add the rest of the ingredients.

For the filling: Season the courgettes with olive oil, grill and sprinkle the pure salt on top.

Presentation

Place the squid ink oil in the oven dish, a dash of rice in the centre, and on top, the grilled courgette, the fish and decorate with the chervil.
**The importance of Aquaculture in the European diet**

**Henrique Sá Pessoa**

RESTAURANT PANORAMA

Portugal

Promising young mediat and versatile chef, who makes a modern Portuguese “cuisine”, based on tradition with international influences.

His objective is to take the restaurant from the Sheraton Hotel to the conquest of the Michelin Stars.

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**INGREDIENTS (Serves 4)**

- 4 sea bream (500 g each)
- 250 g of baby spinach
- 8 units of cherry tomatoes
- Oil, sugar, salt and pepper to taste
- 8 cloves of garlic
- 250 ml of cream
- 150 ml of fish stock
- 1 spoonful of soup of fresh thyme leaves

**Preparation**

Cut the tomato into halves, season with salt and pepper, sugar, oil and fresh thyme, roast in the oven at 100 °C for 4 hours. Boil the garlic in water for 3 minutes to soften its taste. Repeat this process 3 times. Reduce the cream with garlic by half, add the fish stock and reduce by half again. Mix with the blender. Season and if necessary, add a dash of stock if the sauce is too thick. Clean the sea bream by scaling and gutting. Cut the fish into fillets. Sauté the fish fillets skin facing down in a non-stick frying pan for about 2 minutes until the skin becomes crunchy. Sauté the spinach with a dash of salt and season.

**Presentation**

Place on a serving dish and create a “millefeuille” effect by alternating the fish with the tomato and spinach. Finish off by covering the dish with the sauce.

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**INGREDIENTS (Serves 4)**

- 240 g of “Gallo Carnaroli” type rice
- 20 ml of olive oil
- 4 turbot fillets of 120 g each
- 100 g of fresh mushrooms
- 15 g of dried mushrooms soaked in warm water
- 1 diced shallot
- 2 cloves of diced garlic
- 30 ml of dry white wine
- 50 g of butter with no salt
- 30 g of Parmesan cheese
- 5 leaves of diced basil
- 1 soup spoonful of diced parsley
- 900 ml of greens or chicken stock
- Salt and pepper to taste

**For the chestnut cream:**

- 100 g of boiled, peeled chestnuts
- 300 ml of chicken stock
- 50 ml of cream
- 30 g of butter
- Salt and pepper to taste

**Preparation**

Start with the chestnut cream by boiling the chestnuts in chicken stock and leaving until the stock is reduced by half. Then add the cream, the butter and the dressing, and grind well. If too thick, add a dash of stock. Set aside. In a thick bottomed pot, lightly fry the shallot, diced garlic and dry mushrooms with half of the olive oil. Add the rice and lightly fry until translucent. Add the white wine and allow to evaporate, stirring well all the time. Add the stock and wait until it has been absorbed before adding more. Boil the rice for around 12 minutes until slightly undercooked. While the rice is boiling, sauté the turbot in a frying pan with the remaining olive oil (2 to 3 minutes). Salt and pepper and put to one side. In the same frying pan, sauté the fresh mushrooms with a dash of olive oil. Salt and pepper and add half of the parsley. Finish the rice by adding the butter, Parmesan cheese, half of the fresh mushrooms, the remaining parsley and basil. Stir well until all blended together.

**Presentation**

Serve immediately with the turbot on top of the rice and the remaining mushrooms and chestnut sauce (lukewarm) around it.
The importance of Aquaculture in the European diet

INGREDIENTS (Serves 4)
1 sea bass loin of 600 g
Juice from 1 lemon
Olive oil
Sliced bread
A small amount of diced “chorizo” sausages
Parsley, thyme, marjoram
1 clove of garlic

Preparation
For the crust: Grate the bread with the mixer. Add the herbs, “chorizo” sausage and garlic. Blend with olive oil with the lemon juice. Blend with the mixer.

Season with pure salt and pepper. Leave to cool for 10 minutes. Place between 2 sheets of vegetable paper, flattening them out well with the roller until it is 2 mm thick. Freeze.

For the chards: Boil the stems for 2 minutes. Put in water with ice. Put to one side. When serving, heat in olive oil with two cloves of garlic (crushed with the skin on).

For the rice: Boil for 40 minutes in water with salt.

For the sea bass: Salt. Slightly cook in olive oil for 2 minutes on each side. Place the crust on top and put in a salamandra oven for 45 seconds.

For the sauce for the sea bass: Melt the butter and add the onion, shallots and leek cut into small pieces. Fry lightly without letting it go dark. Add the bones and shavings and cook for 5 minutes. Add the wine, paprika and leave until reduced to 2 soup spoonful. Add the cream and leave boiling for 3 minutes.

For the take off the heat: Add the rosemary and garlic, then salt and pepper. Cover and leave for 30 minutes. Serve with the vegetable mill, season with lemon juice and sprinkle the diced spring onion.

Presentation
Place the bar with crust in the centre of a serving plate with the rice around it and the chards on top. Pour a small amount of sauce on the fish and serve the rest in a sauce dish, next to the serving plate.

INGREDIENTS (Serves 4)
1 turbot (1 kg)
200 g white beans
Fresh pinto bean pods
1 kg of tomatoes
3 asparagus
250 ml of coco milk
100 ml of chicken stock
7 garlic cloves
Butter, olive oil
Red wine vinegar
Salt “fleur de sel”, pepper, curry, sage
1 branch of thym
10 grains of black pepper
Aromatic herbs
Zest of a grated lemon

Préparation
For the turbot: Season the turbot with salt. Melt a little butter and add a dash of curry. Sauté for 1 minute and remove the fish. Add the 250 ml of coconut milk to the butter and 100 ml of chicken stock. Bring to a boil and allow the temperature to drop to 70 °C. Add the fish and poach for 5 minutes without letting the temperature rise. Remove from the heat and leave the fish in the liquid. Season with “Fleur de sel”.

For the white bean purée: Leave 200 g of white beans to soak for 12 hours. In the same water, bring to boil and remove the foam. Add a pinch of sage, clove of ground garlic, 1 small sprig of thyme and ten grains of black pepper. Cook over a low heat, adding salt when the beans are almost ready. Drain, put some of the cooking stock to one side. Remove the aromatic herbs. Mash the beans with a little bit of liquid and sieve with the vegetable mill. Add a dash of olive oil, pepper and red wine vinegar. Put to one side. Add the fresh pinto bean pods previously cooked and sautéed in olive oil and garlic.

For the asparagus: 3 asparagus in water with salt, for 3 minutes. Put in ice-cold water. Heat in water and olive oil.

For the candied tomatoes: 1 kg of skinned, seeded tomatoes, cut into small squares with a dressing of olive oil, thyme, salt, grated lemon peel and 6 cloves of garlic cut into slices. Leave in the oven at 90 °C for 3 hours, turning the tomatoes over after 1 hour and a 1/2. Keep for at least 3 days in olive oil.

Presentation
Place the poached turbot in the centre of a serving dish. To one side of the fish place the white bean purée and the candied tomatoes to the other. Place the asparagus on top of the fish.
### Oven baked sea bream with “béarnaise” sauce

**Preparation**

**For the sea bream:** Scale, gut and clean the sea breams with cold water. Place on an oven tray together with 1 cl of olive oil and finely sliced potatoes; then, cover the bottom of the tray with the 4 “julienne” cut onions and the 4 unpeeled garlic cloves. Add salt and place the 2 sea bream—also salted—on top. Lightly bake in the oven at a temperature of 180 ºC for 15 minutes.

**For the béarnaise sauce:** Crack open 2 eggs and put the yolks into a separate bowl along with the vinegar, shallot—“julienne” cut—, crushed black pepper and half of the tarragon—chopped—. Beat the mixture with a whisk and place the container over the heat until it becomes a thick emulsion. Add the liquid butter—previously melted over a low flame—. To avoid curdling, continuously move the container to avoid the heat building up only on one side. Add salt and drain through a fine mesh sieve to obtain a liquid sauce. Finely chop and add the rest of the tarragon.

**Finishing touches and presentation**

As soon as they are cooked, take the sea bream out of the oven, cut them into 2 halves and lay them on top of the potatoes, spring onions and garlic. Garnish with a tablespoon of “béarnaise” sauce and serve the rest on a separate sauce boat.

### Baked sea bass with hazelnut saffron sauce

**Preparation**

**For the fish:** In a frying pan, poach a finely chopped onion in some oil and add the tomatoes (peeled and diced) and fry lightly. Immediately after, add a glass of white wine and a small glass of fish stock. Bring to boil for about 15 minutes. Set aside. Once the sea bass has been scaled, gutted and cleaned, cut the upper part of the fish and sprinkle it with some oil. Put it all in a preheated oven (at medium temperature) and bake for about 5 minutes. Coat it with the previously made sauce and place in the oven again, at a high temperature.

**For the hazelnut sauce:** While the fish is cooking in the oven, prepare the hazelnut sauce by crushing the garlic cloves, hazelnuts and saffron threads in a mortar and dissolve everything with some of the juice released from the cooked fish. Pour this sauce onto the sea bass about 5 minutes prior to removing the fish from the oven. As soon as it is ready, serve immediately.

**Finishing touches and presentation**

Place the sea bass in the centre of a plate with the tomatoes around it and a dash of sauce on top. Put the rest of the sauce in a gravy boat next to the fish dish.

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**INGREDIENTS (Serves 4)**

For the sea bream:
- 4 sea breams (500 g each)
- 4 spring onions
- 4 unpeeled garlic cloves
- 2 potatoes

For the béarnaise sauce:
- 1 cl of olive oil
- 50 g of butter
- 4 ml of apple vinegar
- 4 grains of black pepper, 2 egg yolks
- 1 shallot and a sprig of tarragon

For the fish:
- 4 sea bass (500 g each)
- 3 tomatoes
- 1 white onion
- 1 glass of white wine
- 1 glass of fish stock
- oil, salt
- white pepper (optional)

For the sauce:
- 3 garlic cloves
- 18 toasted hazelnuts
- 1 sachet of saffron threads
The importance of Aquaculture in the European diet

Traditional recipes with turbot

Preparation

For the turbot fillets: Wash the turbot fillets and season. Next, sauté the garlic in a frying pan with a dash of olive oil over medium heat, leave for 2 minutes, making sure that they do not go brown nor burn, and then set aside. Boil the fish in water over a high heat and add a dissolved fish stock cube. After 4 to 5 minutes, take the fish out and set aside whilst keeping it heated. Place a frying pan with some oil and already sautéed garlic. Then, sprinkle the paprika and stir vigorously, leaving it for about 1 minute and making sure that it does not burn. To finish, pour the sauce over the fish.

For the whole turbot: Wash the turbot, season and place it on an oven-proof dish. Then add a splash of stock to it. The stock should be made previously with 1/2 a litre of water along with a fish stock-cube. Once in the oven, keep it at 200 °C for 30 minutes and add stock every now and then. Meanwhile, sauté the garlic in a frying pan with olive oil over a medium flame for 2 minutes. Lower the heat to a low flame, sprinkle on the paprika and stir the sauce vigorously, ensuring that it does not burn. Leave for about 1 minute.

Finishing touches and presentation

Take the turbot from the oven and carefully place it on a platter removing the juice that has formed whilst cooking the fish. Finally pour the very hot paprika sauce on top.

INGREDIENTS (Serves 4)

- A turbot weighing 1.5 kg in fillets or whole
- 2 dl of olive oil
- 1 tablespoon of paprika
- 1 fish stock-cube
- 1/2 l of water
- 4 garlic cloves
- Salt

INGREDIENTS (Serves 4)

- 1 turbot of 1 kg
- 2 leeks only the white part
- 1 large onion
- 350 cc of white wine
- Oil and salt

Traditional recipes with turbot

Preparation

Remove the hard outer areas, along with the bone and innards of the turbot. Finely chop the leeks and onions and cook them in a frying pan with olive oil on a very low flame. The moment they are half done, place them on an oven-proof dish with the turbot on top. Insert into a preheated oven at 220 °C for about 10 minutes. After 10 minutes, pour white wine on top along with the rest of the onion and leeks mixture. Keep everything in the oven for another 10 minutes. Once it looks juicy, the turbot is done.

Finishing touches and presentation

After removing the skin, separate the loins and serve accompanied with the onions and leeks. Finish off by pouring the juice released from cooking on top.
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Traditional recipes with salmon

Pickled salmon

Preparation
Neatly arrange the salmon loins, cleaned and seasoned on both sides, in an ovenproof dish. Fry the garlic in a frying pan with heated oil. Add the bay leaves along with the pepper, salt and the vinegar. Allow to cook over a low flame for about 5 minutes. Immediately after, coat the salmon with the prepared sauce, cover it completely with foil paper and put it in the oven for 8 minutes at 170 °C. Once the recommended time has passed, remove the fish from the oven ensuring it is cooked “à point”.

Finishing touches and presentation
Can be eaten hot or cold, with a side dish of your choice.

INGREDIENTS (Serves 4)
- 1 kg of salmon loins
- 1 l of oil
- 1/4 l of vinegar
- 2 bay leaves
- 10 g of black pepper
- 6 unpeeled garlic cloves
- Salt

INGREDIENTS (Serves 4)
- 1 salmon loin (approx. 500g skinned and deboned)
- Salt
- Pepper
- Oregano
- Coriander
- Parsley
- Rosemary
- Sage
- 20 g of Modena vinegar
- 4 glasses of very cold Brut champagne

Preparation
Divide the loin into 8 pieces and grill until the outer parts turns golden, leaving the inside part juicy. Sprinkle all the fresh herbs –finely chopped– along with the vinegar.

Finishing touches and presentation
Accompany with a glass of very cold champagne per guest.

Salmon with champagne
The importance of Aquaculture in the European diet

Traditional recipes with trout

Trout “en papillote” with tuber “purée”

Preparation
Cut the vegetables into strips and sauté in a frying pan over a low flame with a dash of extra virgin olive oil. Clean the trout, gut, cut open through the middle and season. Spread out a sheet of aluminium foil and place half of the poached vegetables on it with the trout on top, and top it off with the remaining vegetables. Splash some olive oil on top, pour a glass of white wine and add 2 spoonfuls of fumet (if you do not have fumet, you can use flavoured fish stock or water). Tighten all the corners of the foil used to wrap the trout and vegetables well and seal hermetically; then, bake for 12 minutes in a preheated oven at 200 ºC. Remove from the oven and leave for a further 2 minutes. When opening the foil, be careful not to burn yourself with the steam from the inside.

For the tuber purée: Peel the tubers and boil them in water with a pinch of salt until they turn white. Scald the fresh basil in boiling water and chill in iced water to avoid it losing its colour. Grind the tubers together with the basil, salt, a dash of grinded pepper and a splash of single cream; immediately after, strain with a sieve.

Finishing touches and presentation
Place 1 tablespoon of “purée” on the edge of the plate, place the vegetables in the centre and the de-boned trout loins on top.

INGREDIENTS (Serves 2)
- 1 trout (500-600 g)
- 2 cs of fumet
- 1 glass of white wine
- 1 spring onion
- 1 celery stick
- 1 carrot
- 1 garlic clove
- Virgin olive oil
- Aluminium foil

For the tuber purée:
- 2 big potatoes
- 2 basil sprigs
- 1 yucca
- A piece of celery turnip
- Salt
- Grinded pepper
- Fresh cream

INGREDIENTS (Serves 4)
- 4 trout (250 g each)
- 8 slices of cured Spanish cured ham or Italian Parma ham
- 2 golden potatoes prepared “à la boulangerie” (very finely sliced)
- Olive oil, flour and salt

Preparation
Use scissors to open each trout through the belly, clean and remove the black strip that runs next to the backbone. Dry with a tea towel, add a little salt and place a slice of cured ham in the inner part of each trout. To prevent the belly bursting open during frying, sew it up with a woollen thread and long stitches. Flour each trout lightly and place in a pan with very hot oil. Then fry over a low flame and allow to cook. Lightly fry the potatoes, with the olive oil, over a low heat. Lightly fry the 4 remaining slices of ham.

Finishing touches and presentation
In the centre of a big plate, lay the 4 trouts over each of the slices of ham that you have just lightly fried. Accompany with finely sliced “boulangerie” style potatoes.

Spanish cured “Serrano” ham

INGREDIENTS (Serves 2)
- 1 trout (500-600 g)
- 1 glass of white wine
- 1 spring onion
- 1 celery stick
- 1 carrot
- 1 garlic clove
- Virgin olive oil
- Aluminium foil

For the tuber purée:
- 2 big potatoes
- 2 basil sprigs
- 1 yucca
- A piece of celery turnip
- Salt
- Grinded pepper
- Fresh cream

Preparation
Use scissors to open each trout through the belly, clean and remove the black strip that runs next to the backbone. Dry with a tea towel, add a little salt and place a slice of cured ham in the inner part of each trout. To prevent the belly bursting open during frying, sew it up with a woollen thread and long stitches. Flour each trout lightly and place in a pan with very hot oil. Then fry over a low flame and allow to cook. Lightly fry the potatoes, with the olive oil, over a low heat. Lightly fry the 4 remaining slices of ham.

Finishing touches and presentation
In the centre of a big plate, lay the 4 trouts over each of the slices of ham that you have just lightly fried. Accompany with finely sliced “boulangerie” style potatoes.

Traditional recipes with trout

The importance of Aquaculture in the European diet
The importance of Aquaculture in the European diet

Traditional recipes
with cod

Preparation
Leave the cod in cold water for 12h, changing the water 3 times. Poach 1 cut onion and the cut green pepper, add the sliced tomatoes, cook together for 30 minutes and add salt and sugar before putting through the food mill. Place the red peppers on a hot baking tray with salt and 1 cs of oil, put into the oven, preheated at 180 ºC, for 20 minutes. Bake on both sides, peel, cut into strips and put to one side. Desalted and dried, coat the cod with flour and fry in a frying pan with a dash of oil, turning the fish around halfway into cooking. Cut 1 onion into strips, fry lightly in a pan with part of the oil used to fry the cod, and place the slices with the skin face upwards. To finish off, add the strips of pepper and leave to boil for 10 minutes before adding salt and sprinkling on parsley.

Finishing touches and presentation
Place the cod on a plate, with the skin facing downwards, and the tomatoes and peppers around it.

INGREDIENTS (Serves 4)
- 4 pieces of salted cod (250 g each)
- 500 g of plum tomatoes
- 3 red peppers
- 2 onions
- 1 green pepper
- Olive oil
- Sugar
- Salt

Cod
with tomato

INGREDIENTS (Serves 4)
- 4 carps of 250 g each
- 4 slices of veined cured ham
- A bunch of thyme
- 100 g of crumbled spiced bread
- 150 g of ground nuts
- A handful of parsley
- Oil, salt and pepper

Carp
with thyme

Preparation
Clean the carps and remove the loins. In a frying pan over a high heat, brown the carp loins in oil with the skin part facing upwards. Season with salt and pepper and set to one side. In the same frying pan over the heat, sauté the nuts, diced parsley and spiced bread. Finally, in a greased baking tray, place the 4 carp loins with the skin face downwards; on top of each piece of fish, place a slice of the ham and sprinkle a dash of fresh thyme on top. Cover with the other 4 loins and sprinkle the mix of nuts, parsley and spiced bread all over. Complete by roasting in the oven at 180 ºC for about 8 minutes.

Finishing touches and presentation
Serve as is, in an attractive oven dish.
Fish and its importance in diet

Fish, seafood and their products are an extremely important food group in our daily diet from a nutritional and gastronomic point of view are one of the cornerstones of the proven benefits of the traditional Mediterranean Diet.

Marine aquaculture takes in many species of considerable interest from a nutritional point of view. Furthermore, it should be pointed out that aquaculture production areas are out at sea, the waters in which the fish live being clean and monitored, but at the same time they are the same waters in which their wild counterparts live. Their faster growth rate is due to the fact that fish have a constant supply of foodstuffs, which are balanced in terms of nutrients, with a controlled composition.

The clear advantages of farmed fish entail referring to the fact that monitoring the farms makes it possible to keep parasites, bacteria and virus in check. More specifically, the presence of anisakis in these individuals is practically impossible. Also, and none the less important as it is a topic of today, is the presence of heavy metals which, at times, appear in fish caught that inhabit contaminated waters. This is minimal in the case of farmed fish. Farmed fish reaches its destination in an extremely fresh, almost live state, without having suffered the depletion it would go through if caught at sea. It dies in a cooling down process, with no suffering or fatigue, and this is important for the quality of its meat.

Nutritional composition of fish

MINERALS

Fish and seafood have a wide variety of minerals, the most abundant being calcium, phosphorus, sodium, potassium and magnesium. And in lower quantities, iodine, copper, fluoride, cobalt and zinc.

Iron

Fish products have an important complementary source of this mineral. We should not overlook the fact that mineral deficiency is one of the most common in Spain, especially in small children and pre-menopausal women. Adolescence is another critical age group.

Their most well known functions are related to conveying oxygen from the lungs to the tissues, myoglobin for storing oxygen in muscle and release to cover the increase in metabolic requirements, and the cytochromes for the oxidative production of cellular energy in the form of ATPs essential in the respiratory metabolism.
Zinc

Some seafood and shellfish products are especially rich in this nutrient, which is becoming increasingly important. It should be recalled that this mineral element participates in a large number of enzymes—in over 120—in metabolic carbohydrates, lipids and proteins. It is a basic nutrient at the growth stage for maintaining the sense of taste (critically important in elderly people) and, therefore, appetite. It promotes the formation of scar tissue and takes on an increasing role in maintaining the immune function.

Magnesium

Molluscs and crustaceans are a considerable dietary source, even when considering that magnesium is widely distributed throughout foodstuffs. It takes part in a large number of intermediary metabolism reactions, its role being as a co-factor in processes of biosynthesis, glycolysis, formation of cyclic AMP, in neuromuscular activity, in transmitting the genetic code and in regulating body calcium.

Calcium

Fish that are consumed whole are a good source of calcium. Fish canned with their bone (sardines, pilchard) are especially good sources of calcium. Molluscs and crustaceans are also a good source of this mineral, which is found in most of the organism. Known for its critical role in growth and consolidating our body skeleton, it is also essential in maintenance of the same. There is also a small amount of calcium that is not going to be "structural", but is rather found in blood, fluids and soft tissues, where it intervenes in functions such as maintenance of neuromuscular activity or in blood clotting processes.

Sodium

Finally, the sodium content in fish, in comparison with other foods, can be said to be low and, in fact, consumption is recommended in people with low sodium content diets. Some canned products, due to the salt added during the process can, however, be rich in sodium.

Vitamins

The content of vitamins in fish varies according to the species, age, season, sexual maturity and geographical area where caught.

Vitamin A concentrates in the guts, especially in the liver. Fish liver oils, especially those found in cod and various types of shark, are excellent sources of this vitamin. The dark coloured muscle, as it is richer in fat than the light coloured muscle, is also rich in vitamin A. The vitamin D content depends on the species. Fatty fish such as mackerel or herring contain higher amounts than the leaner species.

Unlike the liposoluble vitamins, the hydrosoluble vitamins are more abundant in the meat than in the guts. Thiamine, niacin and riboflavin are the most notable. Whole fish is a good source of pyridoxine and vitamin B_{12} is found in significant amounts, especially in fatty fish.