



**MODULE ON ENVIRONMENTAL  
AWARENESS FOR THE FISHERY  
SECTOR**



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## INTRODUCTION

The future of fishery shall depend, in a direct proportional manner, upon two aspects: having a proper aquatic environment and guaranteeing the survival of the species. In order for this to be possible, it is necessary for the main protagonists who take part in this field to understand the dynamics for the sustainability of fishery activity and to protect it in order to make it a real fact. This is the main objective of this Module.

The present Module is addressed to community persons linked to the field of The Common Fisheries Policy (CFP), that covers conservation, management and exploitation of live aquatic resources and aquaculture, as well as the processing and marketing of products (Regulation (EC) N° 2371/2002).

Within the addressees of this Module there are about 59.000 sea workers that fish in Spain, both in their own fishing grounds and in others on board over 16.000 ships and crafts (1). It is also addressed to promoters, managers and workers from aquaculture centres, processing industries and marketing installations, nautical fisheries training centres, Civil Service employees, as well as those from its Organizations and Companies and, in general, from the fishery sector and marine products. It is not meant to be an informative document, its aim is to make men and women aware of the fishery sector on the environmental circumstances in which their daily work takes place and the importance these have for their daily work and for their professional future.

Over the last thirty years Spanish fishery has been overtaking deep changes and the words “restructuring” and “adjustment of the fishing effort” have not stopped being mentioned in relation to our fleet. This fact has become more persistent from the 70’s and, with greater intensity, from the moment Spain joined the European Union in 1986 as a full member. Our integration in the Community has not meant the beginning or the end of the adjustments in the sector, but the beginning of the understanding of these and the approach to middle and long term solutions.

These first considerations may seem distant to the content and objectives of the Module. However, the reform and adaptation of the Spanish fishery sector involves approaching issues like the Conservation of Natural Resources and the balance of the ecosystems, the survival of the fishing grounds, the quality of the marine environment and its products, as well as the improvement of the workers’ welfare.

At the same time, and always from the point of view of environmental considerations, the fishery sector is a direct victim of the problems that affect the quality of marine waters, since oceans and seas are the final destiny of emissions and societies dump. Equally, the impacts of the human activities on the coastal zone through tourism, infrastructures or development processes, may have negative repercussions on marine ecosystems and affect the activities of the sector.

These considerations are part of the environmental policy in the European Union developed in the last twenty years. A policy which pursues higher levels of welfare and quality of life for the population and which is seriously affecting the fishery sector in Europe. For this reason, the first pages of this Module cover the factors put at risk and the situation of fishery and marine resources at the beginning of the XXI Century.

(1) In 2002, there were 58.400 fishermen and 16.177 censored fishing ships in Spain.



# I. FISHERY AND ENVIRONMENT

## 1. Marine environment

Until the beginning of the XVIII Century, about three hundred years ago, the ocean was considered an inexhaustible source of food. There was hardly any awareness of the limitation of the sea natural resources and of the importance of the oceans as climate and life on the planet adjusters, providing food, water and energy to mankind. Now, after scarcely some dozen years, the warning signs sent by the oceans have begun to arouse concerns.

Some of these concerns are due to the situation of overfishing in some fishing grounds, the advance in industrial and intensive fishing, the loss of biodiversity and the alteration of marine habits, pollution of the marine environment from land and from navigation ships, illegal trade in people and trade across the sea, the congestion of the marine marketing routes, piracy, coastline alteration and its ecosystems, the loss of identity and culture in the marine communities, etc.

It may be observed that the practice of the fishery activity is present in the origin of some trouble suffered in the marine environment. Yet many others stem from human activities on land and are a consequence of the model application development adopted by our society. In any case, the planet's oceans form a unity and any problem arising from any marine zone may have repercussions on the other side of the globe.

Today, we know a lot more about the sea and its capacity to provide natural resources to mankind, specially food. However, the role oceans play in the operating of the whole planet is hardly beginning to be revealed by scientists. Many fishermen will have heard about the climatological phenomenon "El Niño" which takes place in the Pacific Ocean every four or five years and affects anchoveta (anchovy) capture in Peru dramatically. Yet, "El Niño" also produces droughts in Australia, flooding in Central America and alterations of the monsoons that water India. Fishermen also know how the change in water temperature affects seasonal commercial species and their respective coastal fish (anchovy, tuna, mackerel, sardine, red tuna, etc.) and why cold water and deep submarine currents create areas of great fishery richness in the coasts where they emerge, when the presence of mineral salts, plankton and therefore of fish increases, just as it happens in Galicia, Malaga or on the Canary - Saharan Bank.

Marine climate, oceanography, ecosystems and fishery health are closely linked to each other. It is not surprising that marine investigation centres, such as IEO (Spanish Oceanographic Institute ), have a strong fishing and investigation component of the ecosystems, because any alteration in the sea vital signs usually has unpredictable consequences of fishery, whether it is plenty or scarce.

### **Water planet**

The first forms of life appeared in the oceans, giving rise to the great current diversity, including the human form. We ourselves are 86% water. Our salty blood seems to be the inside memory of our remote marine origin. In addition, the great mass of oceanic water has a significant influence on the planet's climate, it is the beginning of the rain cycle and it regulates the ozone layer, making life possible.

We do not live in the sea, but we cannot live without it



It may be said that fishermen have their working place in a natural environment that acts as a great laboratory which regulates, together with the terrestrial atmosphere, life in the biosphere. This natural environment is today pursued by numerous problems, and fishermen and aquaculturers may suffer, without wanting to neither causing them, their consequences.

Another fact is the complete interconnection there is among the planet's seas. If we enjoy a mild climate in Occidental Europe is thanks to the mild effects of the Gulf warm current which, at the same time, is part of what scientists name "conveyor belt" that makes oceanic water circulate from Northern Pacific up to the Norwegian seas. The ocean, the atmosphere and the world climate balance suffers nowadays the effects of the climatological change attributed to greenhouse gases (CO<sub>2</sub> methane, oxides of nitrogen, CFC) in the atmosphere and the increase in the average temperature of the planet earth.

In February 2004, the German Council Adviser on Environment considered that the climatological change could involve the following for Europe:

- 1.5°C increase in the average temperature
- Increase in the average marine waters level between 25 and 95 cm
- Greater incidence of intensive rain
- Larger terrestrial erosion due to runoff
- Larger number of violent storms

In short, the world fishery activity is carried out in a natural environment, which is sensitive to the great and complex climatological variations, suffering the consequences of environmental disorders occurring "in situ" or in the far distance.

## **2. Ocean natural resources**

The world's oceans provide an annual average of 85 million tons of marine capture fisheries. When considering the total fish production, 38 million tons of marine products generated by continental fishery and aquaculture should be added to this figure. However, returning to the current marine production, from the 17 million tons obtained at the beginning of the 50's, the number of catch has increased to practically equalling the present 85 million (83.663.000 Tm in 2001 – FAO).

This standstill phenomenon has been produced although the countries' fishing effort has increased, more effective fishing techniques have been developed, with a larger number of ships with greater power and virgin fishing grounds have been exploited.

The consequence of the fishing effort intensity is that the capacity of many traditional fishing grounds are on the borderline of their possibility to renovate their natural resources. That is, they are in an untenable situation. The problem arises when the resources in a fishing ground are exhausted, its recovery is practically impossible, or if not very long periods of time are needed to achieve this recovery. As an example it may be mentioned the crisis of herring populations in the Northern Sea, now in recovery, or the cod crisis in Terranova Grand Bank.

This situation has some factors that make the exploitation of marine resources and the maintenance of balance in marine ecosystems a complex matter.



- a) Marine resources, such as commercial fish, may be defined as the “common good”. That is, they belong to the society as a whole and to nobody in particular. For this reason, in the past centuries they were freely exploited by the first one to arrive and without excessive control mechanisms.
- b) Today, marine resources are considered a world resource and mankind’s heritage.
- c) The investigations of the characteristics of the marine environment and the state of its resources are part of a relatively new science, as it began in the XIX century, requiring strong investments in human capital and material.
- d) The countries’ rights over the resources they consider to be of their own have been expanded through the passing of the years until they have covered a strip of ocean 200 miles wide, known as the Exclusive Economic Zone (EEZ).
- e) Taking into account that the oceans cover over 70% of the Earth’s surface, control and data gathering on fishery activities is complicated. It was not after the Second World War when Regional Fisheries Organizations began their task, such as ICCAT (1945) that regulates the fishing of tuna species in the Atlantic. More recently, together with the United Nations Activity, and the FAO *Code of Conduct for Responsible Fisheries*, the “European Code of Good Practice for sustainable and responsible fisheries practice” or with the *Agreement on fish populations for the conservation and management of transnational fish and highly migratory fish stocks* (1995), and the Community Fishery Policy itself, management measures have been developed to guarantee the sustainable results of the exploitation of resources. Some matters, such as the fight against illegal fishing and the capture of immature fish, have been specially monitored for many years by the General Secretariat for Marine Fisheries and by the Autonomic Communities with competence in the matter.
- f) The ocean has been considered until very recently mankind’s rubbish, suffering from chronic pollution episodes that affect the health of marine ecosystems and consequently, fishing and aquaculture.
- g) The extraction of unauthorized marine resources carried out by mankind may have consequences in the balance of the trofic or nutritious food chain for the living species and it is likely to alter the few known biological mechanisms of the oceans.
- h) Finally, there is no nutritious product whose trade is as internationalized or globalized as those coming from fishing and aquaculture.

Next, some of these matters are dealt with in greater detail



### 3. Ocean pollution

Whenever environment is spoken of, in general and at once we think of “pollution”. If we refer to the sea, almost simultaneously the accidents suffered by ship tanks and the subsequent hydrocarbon spilt into the sea come to our minds.

Without underestimating the seriousness and the impact these accidents have on the local ecosystems and on the economy related to them, such as in the cases of the “*Prestige*” and the “*Aegean Sea*”, accidents in marine transport are a small part of pollution problems in the ocean. The real important pollution in the seas is caused in land by the daily activity of the planet’s habitants. Without an appropriate treatment, residual waters and solid residues of urban and industrial characteristics created in the interior of the continents, end up reaching the sea and contaminating the waters.

Regular marine traffic is another permanent source of pollution, since it has been, unfortunately, estimated that 33 % of the hydrocarbon spilt into the ocean comes from ships routine operations (cleaning of tanks and bilges). Also the emissions of contaminant products into the atmosphere, produced by the terrestrial transport, agriculture or industries, reach the sea by means of rain and through rivers.

Fishing is also included in this chain of contaminant activities, although in a minor way, since the fishing vessel’s crew are likely to throw any kind of waste into the sea, including biological residues such as the “discarding” or remains of fish cleaning. In addition, fishery, aquaculture and transformation industry may be a general source of pollution and emissions.

### 4. Beyond pollution

Focusing the ocean’s problems on voluntary or involuntary pollution in its waters means forgetting an important part of the problem. The coastal strip and the so-called wet spaces on the coast have an inestimable value to mankind. If the oceans render irreplaceable ecological services, regulating CO<sub>2</sub>, oxygen and ozone cycles, one third of these functions take place on the narrow coastline. The coastline, as border between sea and land carries out a fundamental protection and regulation job against storms and flooding, being responsible for nutrients assimilation cycles and controlling plants and animals productivity.

The importance of this coastal strip is so significant for the health of our planet that, although it represents only 6 % of the terrestrial surface, it takes up 43% of the estimated value for all the world ecological systems (*Commission on Sustainable Development 1997*). Estuaries, rivers, mangrove swamps, lagoons, deltas and marshes must receive a special protection and thus it is recognized in the United Nations Agreement on the Sea’s Rights held in Montego Bay in 1982.

The reduction of continental water contributions and mineral nutrients that are transported, because of their diversion through transfers for terrestrial use, conditions the survival of those coastal ecosystems which are so significant for the fishing activity.



## **5. Terrestrial activities and fishery**

The changes and transformations of the coastal strip, together with human activities developed on land, may affect fishing negatively. This is so, due to the fact that fishing is carried out in a natural environment and in ecosystems sensitive to alterations in the environment.

Any alteration of the coast shape and quality, whether it is caused by the construction of ports, transport links or simply by urbanization and population settlement by the seaside, might have repercussions on marine environment. Inland, river basins receive the products used in agriculture, specially chemical fertilizers and phytosanitary products, passing through non-purified residual water that comes from urban and industrial zones.

In this sense, pollution generated by organic products in marine waters and, in particular in continental waters, causes eutrofization and a decrease in the oxygen content, with survival problems for the fauna and a possible increase in phytoplankton populations that, as a consequence, could originate an increase in biotoxins in bivalve molluscs, equinoderms and tunicates. In relation to pollution produced by chemical products and heavy metals, it might have accumulative effects on the food chain in the sea and reach consumers, especially if they are persistent chemical products. With this situation, one of the greatest virtues of marine fishing production is being threatened, which is obtaining natural food in a wild environment and free of pollution.

Freshwater reaches the sea loaded with sediments whose quantity and composition might be altered because of reservoir construction. On the other hand, excess contribution of sediments to coastal waters, caused by an excessive terrestrial erosion, provokes cloudiness likely to affect certain marine organisms negatively. Although in Spain there are no mangrove swamps or coralline reefs, thought to be two of the richest ecosystems on the planet, interruption of river beds for reservoirs and fluvial water pollution for terrestrial activities have put an end to historic fisheries extremely productive such as salmon, shad or sturgeon.

For these reasons, understanding and trying to resolve the ocean's environmental problems means entering a complex world of interactions with processes generated on land and which, often have a short, middle and long term non-desirable effects on the traditional fishery activity.

## **6. 2004 Fishery**

Since 1950 there has been a constant growth and by 2000 a world fleet was reached, composed of over 35.000 large freezer trawlers capable, each of them, of processing a ton of fish per hour. On the other hand, over the course of the past half century world captures have been multiplied by seven.

Although it is hard to specify the number of people related to this sector in the planet, it may be estimated that, approximately, 200 million human beings depend upon fishing to survive. Paying attention to the strict number of full time fishermen and employees in aquaculture, the figure reaches 38 million men and women, the majority living in Asia. Only in India there are 6 million fishermen, the majority artisanal and practicing



survival fishing. In relation to transformation and marketing industry, the model of estimating a minimum of 4 persons on land for one on board may be followed.

In relation to the resources that support the fishing industry, according to FAO data (The State of World Fisheries and Aquaculture – SOFIA – 2002), 47% of fish populations or species groups were being fully exploited, 18% were into a state of overexploitation, 10% had notably been exhausted and 25% appeared underexploited or moderately exploited.

Meanwhile, the population's demand continues to grow. Japan maintains its world leadership in fish consumption per habitant and year, estimated at 67 Kilograms, while in Spain the figure reached 36.63 Kg in 2002. China is, nowadays, the greatest fish consumer in the world, almost reaching now 20 million tons annually out of which its fishing fleet captures over 15 million, followed by Japan with 13 million (captures 5.2 million) and by United States with 6 million. Spain maintains its 1.5 million tons of fish consumption a year, out of which almost half must be imported from other countries.

## **7. Fishery, seas distribution and globalization**

Commercial policy carried out in the Occidental world, specially in Europe, United States and Japan, has created a market and an increasing demand for sea products. Over the last years fish holds a significant part of peoples' diet, especially in the Mediterranean area . The problem is that there is not sufficient fish in the European and Occidental seas to satisfy that market since the European and Occidental fishing grounds are now being exploited beyond its regeneration capacity limit.

In the past, the solution adopted by large occidental fishing fleets was to defend the “right of freedom on the seas”, going to the inshore waters of other countries in search of the fish claimed by their markets, invoking that the equal use of sea resources benefited everyone. In fact with this, third countries interests were damaged, as they lacked the necessary technology in that moment to exploit their own marine resources.

Between 1960 – 1970 some countries in Latin America, such as Peru, extended their waters jurisdiction up to 200 miles from the coast, creating the so-called Exclusive Economic Zone (EEZ). Other countries followed the same track in the following years until the EEZs were implemented in the whole planet. A similar national sovereignty extension placed up to 90% of world fish captures under the direct control of the corresponding Seashore States. The EEZs had great consequences of achieving equality among the seas, since they stated that the access to marine resources was not subject to the technical capacity in order to exploit them.

For Spanish and Community Fishery, the creation of the EEZ meant searching for agreements with other States to be able to continue fishing beyond waters (The European Union has fishing agreements signed with 22 third countries. Data for January 2004). The compensation was, initially, contributing to financial funds in order that these States would accelerate their economic development. Later, mixed companies, vessel register in the States that practiced sovereignty over the fishing grounds as well as contribution to fishing technology, etc. arose.

The second stage of the process began in the 80s. Some of the Seaside Members with sovereignty over the rich fishing grounds, decided to definitely expel foreign fishing



fleets that were fishing in their EEZ, in order to fully exploit their own resources once the fishing technology had been controlled and in order to offer jobs to their citizens. However, the problems did not cease because markets in developed countries maintained a strong demand for sea products. Although they could no longer capture fish, developed countries could buy them and they began to install marketing nets and transformation factories in third countries.

Fish prices in these countries increased. Local shipowners knew that they would obtain a much higher profit if they sold their captures to the occidental transformation companies instead of supplying local markets. The consequence was, according to FAO data, that fish consumption in Africa and Latin America decreased to 15% between 1980 and 1995.

In response to this, the International Conference on Fishing Contribution to Food Safety, held in Kyoto in 1995, agreed to suggest that, The Fishing Products International Commerce should not have unfavourable consequences for the local populations' environment and supply.

## **8. Fishing in the European Union**

The fishing industry in the European Union (with 15 Member States) is the world's top three largest, with some 7.5 annual million tons of marine product captures (2002) and a fishing fleet composed of some 91.000 crafts, out of which 80% is less than 12 meters long.

Within the 15 Member States there are almost 260.000 fishermen (2002 data), another 32.500 take in conjunction with these, after the ten new Members joined in. Fishery sectors in Poland, Leetonia, Estonia and Lithuania are considered to be quite significant.

Greece is the Member State with a larger number of fishing vessels (21% of the total amount) although this fishing fleet is mainly composed of small crafts since they represent, at the same time, 6% of the whole Community fleet tonnage. Spain has 19% of the ships, but hoards 31% of Community tonnage. Extractive fishing practices in the EU contribute to 3% of the employment in the primary sector, although in some European Atlantic coastal areas it supplies 10% of the jobs. If we add aquaculture and transformation industry labour to the number of fishermen, there is a total of almost 600.000 jobs (7.5% in the primary sector).

Strong demand from the markets is one of the elements that may have a negative influence on marine environment, since Community water resources shows their insufficiency to meet such demand. The European Union exports an average of 1.6 million tons of fishing products, but it imports over 9 million tons (Eurostat 2003).

## **9. Fishing in Spain**

As well as having a fishing fleet of greater tonnage in the EU and a larger number of men on board, our ships are present in the Atlantic, Indian and Pacific fishing grounds, supplying a highly technified and high quality transformation industry. By standing out the presence of Spanish vessels in international waters and in third countries, most of Spanish fishermen are artisanal and daily fish from the so-called inshore fleet.



The average marine catch from our fleet has been stabilized at approximately one million annual tons (929.931 tons in 2002). According to the figures that our Exterior Commerce shows in 2002, it points out that we export 833.573 tons and that we import 1.489.268 tons, what shows a deficit of 655.695 tons in view of the demand from the national market. Part of this demand is covered by aquaculture, booming activity that centres mainly on mussel, sea bream, sea bass, turbot, thin clam, Japanese clam, oyster, big oyster and fresh water species production, such as trout.

The structure of catch and supply to the national market is arranged in the following way: national fishing grounds in their own waters provide less and less products, estimated to approximately 400.000 annual tons. The rest comes from Community waters, third country waters and international waters.

Maintaining the Spanish artisanal fleet activity is a priority for the Autonomous, National and Community fishing authorities, due to its strong effect on employment and on the continuity of the culture and ways of living in numerous marine Communities.

## **10. Equal opportunities between women and men in the fishery sector**

The adjective “fisherman” and “fishermen” in masculine, appears repeatedly throughout the text in this Module, drawing attention to a reality in this sector, not only in Spain, but in the rest of the countries: extractive fishing is considered one of the most dangerous jobs in the world, it requires considerable physical effort and fishing ship decks are practically occupied exclusively by men, the presence of women on board is only symbolic.

But in this context, different jobs that accompany the merely extractive activity, especially in artisanal fishery, have been taken up by women in a traditional way and as a cultural expression in each Spanish Region. Thus, “net” activity is women’s exclusive patrimony in Galicia, el Pais Vasco or Cantabria, but not in Andalusia and other Mediterranean Regions. Shellfish fishing “on foot” is basically practiced by women in Galicia, including the hazardous goose barnacle fishing (Roncudo – Galicia), but not “afloat” shellfish fishing. Available data point out that women take up 20% of the employment in extractive fishing, centred on shellfish fishing and support activities (nets). Galicia takes up seven out of ten women’s jobs in fisheries, estimated at over 11.000 all over Spain.

In the marketing of artisanal fisheries products, the role of women in the Autonomic Communities is, in general, historical and intense. It may be said that traditional extractive fishery, as a cultural expression, has carried out sharing of tasks and functions which still continue throughout the time: *men fish and women sell fish*.

A similar social reality is a reflection upon the citizenship to whom this Module is addressed, whereas on board ships men target for environmental awareness, the role of women in the protection and improvement of the environment in docks and fish markets is essential.

However, the presence of women in the fishery sector is greater in shellfish fishing and in transformation and marketing industry. In relation to fish-canning industry, labour is basically carried out by women in all Regions, even if they are only temporary jobs on



some occasions. Regarding aquaculture, it is one of women top jobs, overall in management and at a middle and superior engineering level.



## II. FISHERIES PRACTICES

### 1. Responsible and sustainable fishing

The first thinkers who raised the alarm about the damage overfishing was causing arose three hundred years ago, as a result of the appearance of new fishing gear and methods, such as the extension of trawling in the Mediterranean, the Bou method at the end of XVII Century, or the transfer of fishing equipment from one coastal zone to another, as it happened with the Mediterranean sea xebecs and their implementation in the Galician rias around 1750.

Even though these concerns have continued throughout the centuries, they have become more intense in recent times. The FAO developed the International Code of Conduct for Responsible Fisheries in 1995, after the recommendation sent by the Declaration of Cancun 1992 (International Conference on Responsible Fishing).

Speaking of responsible fishing means acting in a way in which fishermen's daily work does not go so far as to produce a collapse of the activity itself through lack of fish. Fishing must, therefore, be considered from the sustainability point of view, which is the only way to assure the constant continuity of fish species, industry profitability and its use by the coming generation of fishermen.

### 2. Extractive fishery modality and aquaculture

Although fishing practice may be classified in many different ways, two great categories of Spanish extractive fishing have been established for the purpose of this Module: artisanal or coastal fishing and industrial or deep-sea fishing.

#### COASTAL AND ARTISANAL FISHING

Generally practiced on board small crafts, coastal and artisanal fishing includes most extractive fishing employment and it is practiced in both local and Community waters. It uses all type of fishing equipment and gear, and leads to a higher incidence of seasonal or "coastal" fisheries. Because of its capacity to maintain high levels of employment and because it forms part of towns fishing history, culture, tourism and gastronomy, artisanal fishing receives special attention from the Autonomic, National and Community fisheries authorities. In this sense, artisanal fishing could even be considered as a multifunctional activity.

The fact of working regularly on a traditional fishing ground, near the coast, allows for greater scientific knowledge about its environmental implications. Also artisanal fishermen are asked to play an important role in space and protected marine reserves management. The negative aspects are that artisanal fishing may hide illegal fishing, as well as the use of poorly selected equipment. It is also the most affected, together with aquaculture, because of the pollution caused by marine accidents and due to situations caused by chronic pollution in the sea. On the other hand, the mechanism that artisanal fishing has experimented, localization advanced technology and the progressive implementation of synthetic materials for making fishing equipment and gear, have led to intensive exploitation situations of local resources.



## DEEP-SEA AND INDUSTRIAL FISHING

In this chapter we include fleets that fish in Community fishing grounds, such as “Gran Sol” in third country waters, for instance Mauritania and in international waters such as the tuna freezer fleet. It is usually composed of enormous size vessels, with freezing capacity of the catch and using three fundamental types of fishing methods: bottom trawling, fries in frame and paternoster line, either at the sea surface (“sword” or “mackerel” fleet) or at the bottom sea.

From the environmental point of view, it involves concerns about aspects such as the intensity of fishing effort and its effects on fish populations, continental platform ecosystems and on the open sea, the elimination generation, the energy consumption, the widespread of non- autochthonous species through the emptying of ballast water, waste production and the emissions of certain gases into the atmosphere. On the other hand, its activity is regulated by international agreements, the Community fleet that fishes distant waters may be a vehicle for spreading the Community environmental policy and the promotion of sustainable development in other countries.

## AQUACULTURE

Cultivating the ocean has been one of society’s aspiration from the middle of the XX century. This dream, of which there were already antecedents in the old Greece, went so far as to identify the achievements of agriculture with possibilities in aquaculture, providing a new source of food to human beings.

After some encouraging steps, aquaculture industry has turned into a reality. But before fully replacing fisheries, it became a promising complement to this sector. Within aquaculture’s expectations, the most optimistic figures aimed at contributing up to 40% of the needs of marine products to the human population. We are still far short of this percentage, and with practice and experience the biological and environmental implications have arisen.

In the European Union, the first steps in aquaculture began in rivers and lagoons, aiming at the breeding of eel, trout and flatfish. According to the latest available data, 35.000 people work directly in aquaculture in the EU, with capacity of creating another 50.000 seasonal jobs. Production is close to two million tons (1.813.000 m t in 2001). The greatest producer in the EU is France, followed by Spain, Italy, Netherlands, United Kingdom and Denmark. 95% of the total production and value of aquaculture is based on trout, mussel, salmon, oyster, big oyster, clam, eel, sea bream and sea bass.

Spain bet its future on aquaculture in a decisive manner, practising mussel semi-cultivation in the Galician Rias or in the Ebre Delta, installing numerous hatcheries in our coast for induced reproduction of mussels and fish, and locating on-growing farms on land (Salinas Gaditanas) or in floating cages. Production, both marine and continental, reached 328.832 t in 2002). The most successful species through this process, apart from mussel, are trout, clam, oyster, big oyster, turbot, sea bass, sea bream, salmon and milt. With species such as sole, octopus, sturgeon and grouper an active process is used.



The objective of this Module is the understanding of the factors and environmental considerations avoiding aquaculture, and correcting their possible negative effects as far as possible.



### III. ENVIRONMENTAL ASPECTS OF EXTRACTIVE FISHERY

As a citizen, workers, shipowners and managers belonging to the extractive fishing sector, to aquaculture and to the transformation industry, all play a fundamental role when putting respectful behaviour and attitude into practice towards environment.

There is no doubt that there are deeply-rooted habits and behaviours and that in order to change them support from the institutions is required. But there is no doubt either that institutions' awareness with regard to protection and improvement of the environment must go side to side with citizens' awareness.

#### 1. FISHING EQUIPMENT AND GEAR

##### **a) Exhaustion of resources**

Nobody seems to question the fact that European fishing is going through a difficult social, economic and ecological situation from the beginning of the new millennium. Recommendations drawn up for the convenience of reducing the amount of catch in Community waters between 1996 and 2000 were based on the idea that 37% of Community fish stocks are considered overfished or exhausted.

According to CIEM-ICES (International Agreement for the Exploitation of the Sea), the situation in the North Sea, North oriental Atlantic, the Vizcaya Gulf and the waters surrounding the Iberian Peninsula is especially delicate, mainly affecting hake and cod stocks.

According to CIEM data, the biomass of cod in the North Sea was 250.000 tons in 1970 and 40.000 in 2001
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The Common Fisheries Policy (CFP) essentially aims at reaching a stable and lasting balance between the capacity of marine ecosystems to produce renewable fishing resources and the fishing effort carried out over these ecosystems. Identifying where the optimal limits are for this exploitation, fishing ground by fishing ground and specie by specie, is not a simple task. While the exact knowledge of the mechanisms that regulate fishing grounds' biology is achieved, the CFP tends to apply the principle of "precaution".

On the other hand, due to technological advances the fishing industry requires important investments (vessels, equipment, training, creation and maintenance of marketing networks). Shipowners may come across difficulties in the amortization of their investments if a fishing resource decreases or exhausts. For this reason, it is necessary to increase research quality and to have the industry act on middle and long-term pluriannual plans.



## GOOD ENVIRONMENTAL PRACTICES

- The first Good Environmental Practice to avoid resources exhaustion is to become aware of the problem. It is a necessary condition, although not sufficient.
- To take into account that excess fleet capacity and fishing effort, as well as the use of poor selective fishing methods contribute to exhausting a good fishing ground in a short period of time.
- Fishermen themselves should be the first ones to promote the adoption of conservation measures within their traditional grounds in their Guilds and Associations, assisting scientists with their task and Public Administrations management with their data and experience.
- These conservation measures are fully experimented and described (closed season, quotas, shorter time to the fishing grounds, more selective fishing gear,...)
- To take into account that excessive “discarding” may show evidence that selective fishing gears are not being used and that behind every fisherman or fleet, management systems should be improved.

### **b) More selective fishing equipment**

The use of selective fishing equipment and gears is a good environmental practice and a good defence of marine habitats. Theoretically, the mesh size of a net and the hook line or hook paternoster size, establish a selection according to pursued species' size. Other fishing methods are less selective due to their own concept, as for instance trawling.

Fishing and environmental authorities concern is reflected in the fishing legislation, where it prohibits the use of certain methods. This is the case of beach nets (skittle, dragnets, fishing nets, etc), very aggressive when catching small fry or immature fish that frequent beach areas in their juvenile period.

For this reason, the achievement of the Community, National and Autonomic Fishing Legislation, is the best way to protect the future of commercial species and the integrity of marine habitats.

### **c) The difficulty in discarding**

According to FAO data, between 20 and 40 million tons of fish and other marine species are returned dead to the sea by fishermen after having been caught by nets and gears. On many occasions, these catches are accidental, non-commercial and involuntarily accompany catches that are considered commercial. These are the so-called associated species.

In other cases, discarding is due to small size catch, when exceeding the catch quota limit permitted by the Regulation or to technical mistakes in identifying pursued commercial species or to accidental deterioration of specimen caught or to the low market prices of a specie at certain moments and at certain places.



In the European Union fleet accounts for 3.7 million tons every year of the total discarding. FAO estimates that 84% accounts for discarding in shrimp fisheries and 26% in average fisheries. No doubt this is a problem since fishing methods such as trawling, may equal the weight of unloaded fish with those which are thrown overboard

Fishermen who only respect the rules a little or do not respect them at all are able to face up to the discarding phenomenon since this fact is due to factors quite alien to them. The truth is that some of the rejected species could find a market if there were commercial circuits for them. However, the use of more selective fishing gear could help to diminish the problem. In this sense, and with certain species, hook gears are considered to be more selective than some mesh nets and trawling.

In the case of fly fishing gear, slightly affected by discarding, mistakes are likely to be made due to the difficult appreciation of fish size that make up the school of fish or pursued bank fish or even the accurate identification of the specie. Better localization and identification instruments (fishing sounding line), allow to avoid a weapon frame having to be returned to the water. On the other hand, fishermen's accumulated experience from the fishing boats "traíñas" allows them to avoid fishing during times and in places where fish size is smaller than the legal size limit.

The difficulty to the solution of the problem of discarding may be appreciated in the following consideration: very exclusive fishing for certain species may also alter the ecosystem since it produces imbalance in fish populations of a marine zone.

### **GOOD PRACTICES IN DISCARDING**

- Respect the existing Regulation on fishing methods.
- As far as it is possible, return species alive to the sea that are involuntary caught by fishing nets.
- Use more selective fishing equipment and gears.
- Try to equip good fish detection systems to avoid unproductive weapons from a commercial point of view.
- Search for discarding commercial opportunities in Producers Union and Guilds Associations.
- Avoid fishing in zones and during times when there is a high risk of catching species smaller than the legal size limit or non-commercial species.

Non-desired and by-catch species, including fish, marine birds and mammals, reptiles (turtles) or marine bottom invertebrates, are as well another problem in both habitats and marine ecosystems. The methods which produce greater impacts are trawling because of non-desired catches, enmesh and trammel nets because of their capacity to catch marine birds, turtles and small dolphins, and surface pasternoster line that is likely to cause damage too, as it is likely to catch marine birds or turtles.



## d) Ecolabelling and sustainability certificates

Certain fisheries first quality initiatives arose from the product marketing point of view. Producers Associations, Fishermen's Guilds and Fisheries Authorities began to use the same marketing strategies for marine products as they did with farming products: Guarantee of Origin. Thus "brands" supported by tradition and quality, such as Tarragona Blue Fish, Palamos Red Shrimp, Cantabric hake or the North Tuna.

The first environmental reference for a Spanish fishery was the North Tuna and its Green label or "collar". It emerged as an identification of fish caught with hook, one by one, opposition to drift nets that caught tuna fish aggressively for marine environment (and recessively regarding employment).

Now, in certain Member States of the European Union there is an attempt to establish Ecolabelling of marine products caught in a responsible and sustainable way. The intention is to transmit the message to the population that fish which is bought in markets is caught in such a way that marine environment and the oceans' health do not suffer any danger, ensuring at the same time the duration and balance of fisheries.

However, the position defended by Spain and the European Union in relation to Ecolabelling is that it should be guided by FAO in order to avoid falling into the hands of private associations. The reason is that certain Ecolabelling practices could hide commercial interests.

## 2. RESIDUES

The sea cannot be considered a rubbish dump. Regardless of the applicable international agreements of obliged fulfilment signed by Spain, it is not reasonable to use the sea as indiscriminate dumping of all kinds of waste. Even less if it is dangerous waste.

For centuries, hiding and scattering of waste in nature has been mankind's usual practice of all civilizations. Rivers took away the waste from city centres and the sea was the place to bury our waste.

Times when only tree trunks uprooted by floods or shipwreck message bottles reached the beaches have gone by. Today our beaches are an unpleasant sampler of our plastic and container civilization, covering the sand with multicoloured stains. On the other hand, containers and any type of metallic waste are accumulated at the sea bottom.

All worker's first good practice on board craft is not to throw any type of waste into the water.
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MARPOL 73/78 Agreement, was initially established to control dumping of oil and hydrocarbon waste from vessels and rubbish and solid waste extended over the black waters, at present, it also prohibits throwing plastic waste into the sea, under any circumstance and in any place on the planet. The following Table shows an example of the damage waste produces to the ocean.



### The amount of time it takes to dissolve some objects thrown into the sea

A cardboard bus ticket	2 to 4 weeks
A cotton rag	1 to 5 months
A piece of natural fibre rope	3 to 14 months (according to thickness)
A woollen rag	1 year
A piece of painted wood	13 years
A food can	100 years
An aluminium tin can or beer can	200 to 500 years
A plastic bottle	450 years

Source: Greek Marine Environment Protection Association (Helmepa)

Other waste, such as glass bottle or one piece of ceramics will remain intact inside marine water for thousands of years. In addition, the physical form of some waste, especially plastic, may cause a slow death to marine species. Net and rope remains are especially harmful, in which marine mammals and birds may be trapped, the plastic loops which hold six pack aluminium cans of drinks together are also seriously harmful because of their ring shape, in which fish, marine birds and mammals such as dolphins may get strangled.

There should be appropriate containers on board any fishing craft to collect non-organic and organic waste (remember that Directive 2000/59/EC will make this container compulsory). The first ones should be taken to port and placed in bins that are located on docks. The second could be thrown into the sea as long as this is not done near the coast (less than 12 miles inshore) or in Special Zones.

MARPOL 73/78 Agreement plans that ships over a certain tonnage, should have storage and/or waste treatment systems and plants. This measure may affect big fishing vessels.

#### **a) Waste generated on board ships**

Daily life on board a fishing vessel generates six main types of waste:

- a) Domestic waste: kitchen and food waste. Only organic waste thrown into the sea is permitted, but never near the coast or inside fishing docks. However, for health reasons throwing food scraps overboard is not a good practice.
- b) Waste hoisted on board by fishing methods. They are never organic and should be taken to port, instead of being thrown back into the sea while the fish is striated. The case of trawling vessels is especially conflictive, since they act as “sea sweepers”, that lift all types of waste up (plastic, cans, bottles) together with the fish.

In 1996, the Government of Murcia and different Fisheries Associations subscribed an Agreement over which trawling fleet vessels undertook to carry the waste hoisted on board into their nets to port.

- c) Hydrocarbon waste (oil, gas oil, sentinel water). The MARPOL Agreement regulates the management of these waste and its dumping into the sea according to the type of vessel. Vessels larger than 400 GT should carry on board a



sentinel water separator and a mud tank. They are permitted to throw hydrocarbon into the sea if it is dissolved in water in a 100 parts per million proportion. In Special Zones, this concentration should be lower than 15 parts per million.

In all cases, carrying on board retention tanks for hydrocarbon should be a practice adopted by every fishing fleet. Once they arrive at port, hydrocarbon should be placed in the MARPOL Reception stations located on docks.

- d) Dirty waters. Waste waters coming from the kitchen and toilets which are generated in vessels over 400 GT, should be stored in Reception tanks and taken to port to be treated.
- e) Fish remains. The work on board produces manipulated fish organic remains that, according to Agreements, may be thrown to the sea as long as it is done far from the coast and never inside the fishing docks.

### **Warning!**

Fish remains which are thrown into the sea, especially fish entrails after manipulation of catch, may contain parasites such as “Anisakis”. Its reintroduction in the sea may break parasite’s cycle and spread them.

- f) Toxic waste. They aren’t usually plentiful on board fishing vessels, but there is no doubt there are always cans and paint remains, turpentine, energetic cleaning products, second hand batteries, etc, that must not be thrown into the sea because of their dangerousness.

### **GOOD ENVIRONMENTAL PRACTICES ON BOARD**

- Do not throw any type of waste overboard.
- Behave on board as you would at home and make a selective separation of the waste generated: organic and cans.
- Make sure you have on board a bin or container (bag) in your working area. If the ship has a kitchen place a bin in there too.
- Keep all waste on board until you reach port and place them inside an appropriate dumpster. If a selective collection has been arranged in the Base port Town Hall, place waste inside the corresponding thematic bin.
- Inside the engine room, take care that oil products do not escape into the sea. Keep the cloths used to clean the engine, and take them to port in order to deliver them to the appropriate place. As they contain hydrocarbon they must be delivered to MARPOL installations.
- Shipowners and skippers should make their crew aware in order to avoid them throwing waste into the sea, providing them with bins and containers.



- If dangerous waste is carried on board, such as paint cans, cleaning liquids, turpentine and solvents, engine oils, etc. they must be loaded carefully in order to avoid accidental spillage.
- Pay maximum attention when making consumption (fuel recharge) in piers to avoid accidental spillage of the fuel on docks.
- When choosing anti-incrusting paint (“patent”) to careen or paint the boat’s bright work, you should choose the most efficient product but the least harmful to marine environment. (TBT Tributyltin based “anti-incrusting” paints, may interfere with marine species’ hormone system). It is better to resort to traditional paints containing copper compounds, although their biological effects have still to be proven).

According to data from CIEM, between 1993 and 2003, copper content has been doubled in cultivated oysters from Arcachon (France)

- Check that insulating material for refrigerators is in perfect condition and that it fulfils the Regulations. Better catch preservation, longer duration of ice refrigeration and energy saving will be achieved.
- Check that refrigeration equipments fulfil the international Regulations concerning gases that harm ozone layer.
- Use low sulphur contents of fuel in the ship, in compliance with the National and Community Regulation on the use of fuel oil (SO<sub>2</sub> emissions which then provoke “Acid Rain”).
- Have the main engine and the auxiliary engines ready in order to avoid excess energy consumption.
- If any fishing equipment is lost during fishing, try everything you can to find it in order to avoid that lost nets or creels cause damage to marine environment for a long time providing no benefit to anyone (Ghost Fishing).
- The largest waste that a fishing boat can throw into the sea is the boat itself. Therefore, avoid shipwrecks and accidents by navigating carefully, professionally and without running unnecessary risks.

OSPAR Agreement for the protection of the Northeast Atlantic, for which Spain is part of, bans voluntary sinking of vessels and aircrafts in the sea from 2004. Barcelona Agreement carries the same prohibition in the Mediterranean since 2000

## **b) Waste management in ports and harbours**

Having piers well cared for shows the professionalism and concern men and women from the fishery sector have for their product quality. A visit to a clean and neat port encourages fish consumption.



Taking into account that workers spend many hours on docks, repairing fishing equipment and gear, organizing their tackle, slapping their nets or taking care of their boats, it is important to manage the waste which is generated in the daily work.

#### Recommendations to maintain ports free of waste and tidy

- Do not throw waste onto the ground, neither organic nor inorganic.
- Slap the nets over canvas to make the collection of the remains hooked between the mesh easier.
- Keep the walls and grounds which are near the dry docks, fish markets and in any part of the port clean free of graffiti or paint test.
- Use or demand (if there aren't any) the installation of waste paper bins, trash dumpers or Clean Points in piers to store waste coming from the sea or generated on the pier itself.
- Always use oil waste Reception installations placed at the port in compliance with MARPOL Agreement.
- If engine repairs are carried out on the dock, avoid spilling fuel or oils on it.
- Keep ramps, stairs and extending ladders free of slime and algae in order to avoid dock's water pollution.
- Do not ever burn broken or irreparable nets and gear made of artificial fibre. Its combustion produces contaminant emissions and it negatively affects the space at port where incineration takes place. The rest of fishing equipment and gear should be placed in appropriate places for its recycling or treatment.
- Shipowners and skippers should make their crew aware of the above mentioned points and should give good example.
- Where carrying out repairs, paint replacement or ship maintenance tasks, spread canvas out before you start in order to collect used paint remains, stripping products or fresh paint. Place these waste in the appropriate dumper.
- Whenever the vessel is at a dry dock, demand good environmental practices to the owners or workers of the installation.

These solid waste takes in conjunction with other types of waste less visible. We are referring to combustion gas emissions through the engine escape. Annex VI of MARPOL Agreement (1997 Convention), points out the need to limit sulphur oxide emissions to the atmosphere with the use of less sulphur content gas oil. It also achieves to limit nitrogen oxide emissions. Both gases are related to the increase in the greenhouse effect and the climatic change.

Due to its incidence in the ozone layer and in the climatic change, refrigeration installations in vessels should be free from CFC (Freon) refrigerating gases.



Unfortunately, fishing docks have been identified with a dirty and foul place for many years. This image must change in order to make Fishing Ports a pleasant area for all citizens. This change does not only benefit environment and fishermen's image before the rest of the population, but it also has marketing, social, touristic and safety advantages.

### **c) Tidy piers**

The picture of piers packed with nets and ropes should be changed. It is not a problem easy to solve since the space available in Fish Markets and Warehouses is always insufficient for the fishery work. Yet, there are solutions.

In certain Spanish Fishing Ports plastic bins and containers are beginning to be used, at a low cost, where to load the fishing equipment. Thus, this avoids people from tripping over nylon meshes (practically invisible) that overflow the grounds as well as avoiding accidents happening. This system allows greater use of available space, permitting visitors and fishermen to walk safe through all the fishing equipment stored.

### **d) Clean docks**

The fishing ports' water should not be used as a trash dump. At docks where water is periodically renewed, thanks to the tides, this problem may be easily forgotten. However, there will always be some waste going down to the bottom of the dock, while the rest comes out through the pier entrance polluting the water and nearby coasts. In closed ports where there are no tides, waste is a greater problem from the waste concentration point of view and even for navigation safety.

## **GOOD ENVIRONMENTAL PRACTICES ON THE DOCKS**

- Never throw any type of waste inside the docks.
- Try to wash down ship decks with the "horse" or hose before entering port to get rid of organic remains generated during striating.
- Do not sweep the piers in direction to the docks.
- After auction, clean up all fish remains at the Fish Markets (Canchas or Rulas) to avoid these reaching the water.
- Pay special attention to plastic control (bags, containers).
- Try to avoid that Extended Polyurethane boxes and bins of fragile consistency and which are used more and more do not get destroyed. The remains are so light that they are practically indestructible, the wind blows them away and they set everywhere.
- Never throw pieces of net or rope into the water, no matter how small they are. They may be caught by the propeller or block the ship's refrigeration intake.



- Remove the floats in disuse from the port's bottom of the docks and from the surface of the water.
- Comply with, the utmost severity, MARPOL Agreement 73/78.

The cleaning up of the waters inside docks should be such, to allow vessels that fish live bait to pump this water into the hatchery carried on board without putting in danger the integrity of the fish used as bait.

#### GHOST FISHING

The so-called fishing is carried out during an indefinite period of time with fishing equipment and devices lost in the sea.

When fishing equipment was made of fibers and natural material (cotton, linen, canvas, esparto, wood, cork) the equipment lost in the sea used to degrade. Today, with the general use of plastic and artificial fibers the rapid biological degradation does not occur.

Attention must be drawn to stainless steel frame creels and baskets, plastic meshes and copper joints. They are indestructible and when they are lost they are fishing for years. It is also important to avoid losing mesh and trammel cloths, because of their capacity to kill unuseful fish.

### 3. LIFE ON BOARD

Where speaking about environment we must not stop to consider protection considerations and nature improvement nor the sustainability of the fishery activity. Environment goes beyond that, and thus, it is recognized by the European Union Policy taking into account populations' health, both in their urban and rural life and in their homes or at work as part of the environment.

The Common Fishery Policy achieves, among other purposes to improve the living conditions of fishermen on board vessels and increase safety.

Making fishermen's life more comfortable and safe on board ships forms part of the Environmental Policy and the PPC

It is essential to have the necessary elements, equipment and fishing tackle, that increase workers' safety in their daily lives and ship navigation safety in order to achieve higher levels of quality of life.

#### Good personal safety practices, both for fishermen and fishery workers

Use appropriate waterproof clothing and in good state, wear a life jacket whenever the Regulations indicate so and when fishing on deck in bad weather, use approved footwear and have a clear knowledge of the safety and rescue location, its use and activation (life rings, life rafts, radio beacons, fire extinguishers).

Skippers and shipowners must comply with the legislation regarding safety on board and ensure that their men are trained for an emergency situation. The periodical inspections carried out by the corresponding Marine Headquarters is not a simple



administrative procedure, but a guarantee that the vessel may face up, more successfully, to a dangerous situation.

### Good practices regarding vessels

Fishermen spend about half of their life on a fishing boat. Making the boat and its premises (deck, engine room, ranch, bridge) a pleasant, clean and habitable space increases comfort on board.

A dirty vessel, crammed with fishing tackle, fishing boxes and equipment that give off a bad odor, an impassable deck in bad conditions are factors that reduce crewmembers' quality of life and diminish safety, as well as representing a health problem when striating catch.

In general, fishing boats have sanitary requirements and obligatory self-control practices. These requirements are summed up in a guide to techniques for manipulation of fishing products on board, edited by General Secretariat for Marine Fisheries. Among others, the following points should be underlined:

- The cleaning and the quality of the surface of a vessel (decks)
- Hygienic procedures on board
- Fish manipulation
- Disinfection, fumigation and rat-catching, etc.

### The Ballast Water Problem

Vessels fishing distant grounds may see themselves involved in a worrying phenomenon for the balance of marine ecosystems. That is, the marine water transport from one end of the planet to the other carried in large vessels with ballast tanks. Ballast water from one place may contain marine organisms travelling like “stowaways” and will then be released in their destination and at a far distance, penetrating new ecosystems, adapting to the environment and causing problems.

An example of this could be that, many fisheries of the North Zone in the Black Sea have disappeared because of a small American jellyfish that devours fish eggs and larvae (ctenoforo *Mnemiopsis leidyi*) likely introduced via by ballast waters. Spain knows cases of introduction of alien species to our environment, such as the green seaweed “*Caulerpa Taxifolia*”, the “zebra” mussel or the Japanese clam.

The International Maritime Organization (IMO), is going ahead with the “Globalballast” 2000-2004 Programme, in search of technical solutions to minimize the dispersion of marine species out of their traditional habitats. The International Agreement on sediments and ballast waters in IMO, shall come into force in February 2005 if it is ratified by at least 30 States before that date.

## 4. FISHERY AND HUMAN SOCIETY

Opening up fishing piers and fish auction markets in the people's interest guarantees the integration of the fishery Community among the rest of the society. By respecting the marine environment, sea workers show that they are making the best possible use of



the natural environment, the sea, natural resources and marine products that are a heritage we all share.

When opening Fish Markets and fish preparation and exhibition areas to public, working spaces should be kept in perfect hygienic conditions (free of direct visits) and without disturbing the professionals.

If seamen and women took care of their family environment, their port, they would invite the rest of Society to share with them a unique culture and tradition. Respect for these traditions and for marine culture is another way of creating an environment.

On the other hand, Spanish fishermen do not exclusively fish in National or Community waters, but also operate in Oceans around the world. Applying a Good Environment to the strict environment in European waters would be Bad Practice. Expanding environmental protection and improvement to the planet as a whole is a legal obligation, under international Agreement, as well as a moral obligation. In this sense, fishing in international waters or in waters belonging to other States as if they were Spanish or belonged to the Community has been made compulsory. This is likely to be the only way in which globalization would not be an almost exclusively economic process, but would acquire an environmental dimension.

Another main objective of the PPC, is to establish harmonious links between the fishery sector and society.

<p>The project for the construction of Fisterra Fish Market (Galicia), already has spaces designed for touristic visits, conveniently isolated from fishing products for sanitary reasons</p>
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#### **IV. ENVIRONMENTAL ASPECTS OF AQUACULTURE**

The young fish or the cultivation of aquatic organisms using techniques aimed at increasing, over the natural environment capacity, the production of certain species, has been one of Society's aspirations since the middle of the last XX Century. This dream identified the achievements in agriculture with possibilities in aquaculture, making a new source of food accessible to human beings.

Nowadays, extractive fishing covers with some difficulty, the increasing worldwide demand for fish for human consumption. According to FAO's forecast, aquaculture shall be about the only possibility of maintaining the current proportion of fish in the diet.

According to FAO's statistics, the contribution of aquaculture to the worldwide supply of fish, crustacean and mollusks continues to grow, since it went up from 3.9 percent of total production by weight in 1970 to 27.3 percent in 2000. Aquaculture grows faster than any other animal food production sector. In the World Wide field, this sector has increased on average by 9.2 percent annually since 1970, opposite to only 1.4 percent rise registered in by-catch and 2.8 percent in terrestrial meat production systems using young fish.

More than half of the total world aquaculture production in 2000 consisted of fish strictly speaking, and production growth of the main species continues so far, having registered no apparent drop.



In the European Union, the first steps in aquaculture began in rivers and lakes, aiming at the breeding of eel, trout and flatfish. According to 1995 data, around 35.000 people work directly in aquaculture in the EU, with capacity of creating another 50.000 seasonal jobs. Production now exceeds one million tons, representing 14% of marine products obtained in the Community. The greatest producer in the EU is France, followed by Spain, Italy, Netherlands, United Kingdom and Denmark. 95% of the total production and value of aquaculture is based on trout, mussel, salmon, oyster, clam, eel, sea bream and sea bass.

<b>AQUACULTURE PRODUCTION EU</b>	<b>1988</b>	<b>1992</b>	<b>1996</b>	<b>2000</b>
CONTINENTAL (miles)	195	226	250	240
TOTAL WORLD PERCENTAGE	2.7	2.4	1.6	1.1
MARINE (miles)	7.4	686	889	1049
TOTAL WORLD PERCENTAGE	15.7	11.2	8.2	7.4

Spain has bet on aquaculture in a decisive manner, practising mussel cultivation in the Galician Rias or in the Ebre Delta, installing numerous Hatcheries in our coast for induced reproduction of certain molluscs (such as clam) and fish, and locating on-growing farms on solid ground or in the open sea. The most successful species through this process, apart from mussel, are trout, clam, oyster, turbot, and sea bream. With species such as sole and octopus an active process is used.

The objective of this Module is the understanding of the factors and environmental considerations avoiding aquaculture, and correcting their possible negative effects as far as possible.

## **1. PRIOR ENVIRONMENTAL CONSIDERATIONS**

An aquaculture installation, whether it is a hatchery, an on growing farm or shellfish bed area, is a space where species breeding is practiced (although there could be a case of seaweed breeding too), likely to cause environmental problems. In addition, these installations are usually located on the coast, likely to produce effects on the nearest marine ecosystems, effects on the quality of local marine waters and alterations in the traditional landscape. In the case of aquaculture installations for continental species are usually located in high quality water rivers, generally situated at the top of the river basins.

As cultivated species need high quality marine or fresh water, installations choose places that are especially protected against other environmental agressions that could affect the animals, therefore, they are generally placed far from industrial centres and urban crowds. This is why, Installation Management as well as the designing of the centre must carefully be taken care of.

The European Union has become aware of the environmental considerations surrounding aquaculture and have included intensive fish breeding installations within Category Projects that, depending on its production, may need an Environmental Impact Evaluation (EIE) before being approved by the Authorities.



Spain has surpassed Directive 97/11/ EC under By-law 6/2001, including intensive fish breeding installations among the EIE obliged. Some Autonomous Communities have also legislated into the matter, at times more strictly than the Directive itself.

Consequently, any promoter who decides to carry out a fish breeding project must seek advice from the competent environmental authorities, National (Ministry of the Environment) or Regional (Environment Ministries) depending on the case, must also present his or her project for a previous study and carry out, if production is higher than 500 tons per year, the necessary Environmental Impact Evaluation EIE. This requirement is indispensable in order to obtain the corresponding authorizations.

The EIE procedure escapes the objectives of this Module, therefore the promoter shall need to go to other sources of information.

An operating aquaculture installation requires special environmental care which are summed up in the following main sections:

## **2. Residues**

Thousands of animals, whether they are molluscs or fish, grouped or cultivated intensively, feeding and emitting organic residues, may constitute a source of pollution. Intensive livestock has the same problem with excrements, while this dumping is always easier to control when they are produced on the land surface.

In aquaculture, possible food surplus provided to the animals and the excrements produced are scattered all over aquatic environment and may produce unpredictable effects, especially “eutrofization”.

Depending upon the type of cultivation (cages in the open sea, salt marshes, ponds on land and in rivers) and on the cultivated specie (fish or molluscs), the problem of waste changes.

### **GOOD WASTE PRACTICES**

- When breeding with cages in the open sea, you must contribute the exact amount of food to each cage indicated by technicians and biologists in the centre. Non-consumed feed remains fall to the bottom attracting opportunist wild species, likely to alter the natural behaviour of ecosystems.
- Perform the specifications and measures contemplated in the Environmental Impact Declaration (EID) scrupulously where necessary, and carry out a periodic analysis of organic matter content from the bottom surface beneath the breeding cages in the open sea.
- If feeding is carried out through automatic systems, check its correct operation.
- When choosing the type of food, select the compound of minor consequences for marine environment in case the dosis is exceeded.



- Place the cages in places where marine current facilitates the dispersion of waste that falls to marine bottom.
- Avoid that routine work of shellfish beds or cages produces any more waste. Specifically, splitting, scraping or cleaning stringed or harvested mussels cannot be done inside the docks, it must be carried out on the dock side. Hopefully, this practice shall not increase the volume of detritus accumulated on the sea bottom.
- On solid ground installations, either in continental or marine aquaculture, water from ponds sent back into the environment must be treated appropriately and according to the legislation to eliminate excess nutrients. Non-treated waters may cause pollution and alterations in fluvial or marine environment (eutrofization). Installations must have water purification and treatment systems with the corresponding authorization for water dumping.
- Ensure the perfect operating effluent purification equipment.

### **3. Taking care of installations**

A massive animal death toll is not only a serious economic problem for companies but it is also an environmental problem, since the dead animals must be handled appropriately. A massive animal escape is another economic problem as well as environmental, since thousands of individuals from the same specie are let free in the sea, possibly altering the local marine ecosystem.

While animals are used to artificial feeding, their burst in the depths of nature may cause a variation between animals and seaweed in the zone, scaring away commercial species which fishers catch in that area.

On the other hand, animals born and bred by means of aquaculture may reproduce after escaping an aquaculture facility by crossbreeding within the same specie, having unpredictable consequences for ecosystems. With respect to the cultivated species that have suffered over some type of artificial genetic modification, their involuntary presence in nature may do incalculable harm to the wild specie, since the modified one could be more dominant and resistant.

#### **GOOD ENVIRONMENTAL PRACTICES IN INSTALLATIONS**

- In ground installations (ponds or saline rivers), maintain constant surveillance over sea water intakes in order to avoid blockage (seaweed) that can stop water flow.
- In floating cages, check net meshes carefully and immediately repair any damage. Its safer to use a net or two bags.
- In case of storm, cages' moorings must be reinforced.
- Reuse plastic bags containing food or place them in the appropriate waste bin.
- In case of having to apply medication to animals, respect the correct dose.



- In installations where cages are located in the open sea, an accident is likely to happen causing a generation of sea bream or sea bass to escape. It is therefore, safer to concentrate production on similar animals to the ones in the environment.
- If you wish to culture species genetically modified, use solid ground installations under very strict control so that no egg, larvae, fry or adult escape into the sea. It is highly recommended to use closed water circuits in installations that cultivate these modified species.
- In ground installations, carry out periodic controls of water effluent treatment installations and water pump systems to avoid installation from collapsing and animals from dying. Be provided with an emergency circuit.
- Practice energy saving and predict the possibility of using renewable alternative energy.
- When slaughtering animals (fish) apply Community Regulation of animal welfare to avoid unnecessary suffering. (The most commonly used method is immersion in frozen water).
- Provide environmental training courses to installation workers.
- Apply chemical products that help production, complying with the existing standards and be extremely cautious.
- An environmental management system (ISO 14.001 and/or EMAS) should be provided.

#### **4. Other effects on wild fauna species and its habitats**

##### Fishing Resources Conservation

Food fish supply from aquaculture usually has a protein feed basis. Under certain circumstances, intensive fish breeding may cause the phenomenon of overfishing other species destined for food in aquaculture. Having interest in the origin of food and choosing the type that has the least impact possible on marine species is a good environmental practice.

##### Diseases and chemical products

Life in small size pools, in tanks or inside cages may cause effects of stress on animals and may reduce their defence capacity or immunity to diseases. An aquaculture installation is likely to become a source of disease transmission to native fish that live in the vicinity.

In order to diminish the risk, different chemical and pharmaceutical products are used in aquaculture, including some organophosphorus pesticide and insecticide that may cause environmental problems.



In areas destined for on growing molluscs (cockles, clams, etc.), the old practice of spreading quicklime and other poisonous products over the quagmire before sowing the seeds in order to clean and eliminate possible parasites, must be eradicated.

#### Water intake and changes in nearby habitat

In the case of continental aquaculture installations (rivers or lakes), the need to receive and divert clean water for ponds needs may cause trouble in the surrounding habitats. There is a need for a previous study on whether this clean water makes up for dumping water and will not represent a significant loss to environmental balance.

#### Wild fauna

Certain kind of predators are attracted to aquaculture installations, specially marine birds. Before fighting violently the natural behaviour of these species attracted by the concentration of stable supply, it is preferable to dissuade their act in any passive way.

Nets or meshes covering floating cages on the surface to protect fish from marine birds' attack, must not cause them damage and only constitute a simple barrier. In some places these meshes have been replaced by ping-pong balls floating on the water surface (hiding fish presence from birds but letting light and air pass through). Exterior nets covering cages under water, must resist the possible attack from other fish and marine mammals but, at the same time avoid their possible enmeshment and hooking. Floats, cables and anchoring stays should be designed to avoid accidental fish, marine mammals, reptiles (turtle) and birds catch.

Regarding extensive ground installations, such as salt marsh, its own muddy water offers fish and crustacean (prawn) some protection, although this is not quite enough. In any case, wooden stakes at the end of the rope along the shores make birds approximation on foot and in flight up to the seaside more difficult.

#### Collateral effects

The continuance of on growing cages in certain places of the coast during long periods of time cause two effects whose consequences are still quite unknown. One is the "shade" effect of the cages, which attracts other wild fish, not so much for the remaining supply, but for the feeling of protection installations offer.

This effect, together with the presence of food remains and organic waste, may provoke a "drain" effect. It consists of other species' capacity of attraction that, being concentrated in the vicinity of the installations, are caught more easily by fishermen. The consequence is a progressive impoverishment of the surrounding areas.

The solution to repeal and invert the sense of these effects is, in addition to the reduction of the presence of food, to consider Aquaculture installations, floating or on ground as well as a perimetral space as areas limited to fishing, acting then as real marine reserves in the zone's benefit.



Another effect stemming from the previous one, is the touristic attraction that involves the largest presence of wild fauna in zones near the cages, both for marine birds and marine fish and mammals. This way, an aquaculture installation may be transformed into a centre of touristic interest.



## **V. ENVIRONMENTAL ASPECTS OF TRANSFORMATION AND MARKETING FISHERY INDUSTRY**

### **1. Prior considerations**

When we speak about the fishery industry, a great number of related and dependant sub-sectors appear, what reinforces the reality of fishery and aquaculture implications in employment and the productive tissue. Refrigerator warehouses, equipment factories for fishing and aquaculture, shipyards, naval equipment manufacturers, marketing and transport nets, as well as fish canning and transformation manufacturers, are accompanied by other complementary industries.

For the purpose of this Module, we only take into consideration fish canning and transformation industry, although environmental considerations in this section should be included in the broadest subject of industry in general.

### **2. Environmental situation of the sector**

The most significant environmental problems in this sector are those relating to waste water dumping, waste container and packing generation and the use of subproducts.

- Waste waters in this sector have high organic matter content, solids in suspension, oils, fats and salts, that may cause pollution to channels, beaches and ports.
- Just like the food and drinks industry, this sector generates great amount of waste container and packing which must be handled correctly.
- The subproducts generated in this sector contain substances and chemical compounds of great value that can be used as raw materials in other industrial processes.

### **3. Environmental management**

From the point of view of conservation and environmental protection, the conservation and transformation of fishing and aquaculture products industry has several environmental mechanisms, such as the European Parliament and Council Regulation (EC) n° 761/2001, under which organizations are permitted to join a voluntary audit and environmental management (EMAS) or the Regulation ISO 14.001: 1996 (Environmental systems. Specifications and guide for use).

The most relevant aspects are centered in Sustainable Management of Natural Resources, waste management and Integrated Product Policy. Matters concerning product quality are not included since it involves food supply which is subject to specific regulation.



## Environmental Diagnosis and Management

The first action is carrying out Environmental Diagnosis of the company leading towards obtaining an Environmental Certification. The study, case by case of the adoption of the Best Available Techniques is possible today, thanks to the technical task carried out by organisms and public and private institutions.

## Sustainable Management of Resources

Good practices within the industry go through the appropriate management of natural resources by means of:

- Establishing water saving systems.
- Implementing saving systems and energy efficiency to manufacturing, management and lighting processes.
- Protecting ground resources, avoiding as far as possible compression, waterproofing and degradation.
- Establishing raw materials saving systems in all manufacturing processes.

## Emission and Waste Management

- Collaborating with environmental authorities and obtaining all the information available.
- In case of a new plant, complying with urban regulation. Adapting civil works project to the architectural and landscape environment, especially in coastal zones. Trying to adapt productive needs to a bioclimatic design of the buildings.
- Studying and reducing the incidence of gas emissions to the atmosphere.
- Reducing noise production.
- Complying with the regional, national and community regulation in relation to waste waters.
- Managing generated waste according to the Regional Waste Management Plan. Respecting the hierarchy that was established in the current regulation for the correct waste management, recycling as far as possible dangerous waste, by means of its delivery to an authorized agent.
- Since they are products whose previous conservation in factory needs cold-stores, strictly comply with the regulation on refrigeration gases and avoid, as far as possible, these being chlorinated as soon as the elimination or loss of these substances contribute to the reduction of the ozone layer . In the above mentioned stores, watch over their thermal stagnation in order to save energy.



### Best Available Technologies (BATs)

Council Directive 96/61/EC of 24<sup>th</sup> September 1996, relating to integrated pollution prevention and control (IPPC Directive) aims at integrated prevention and reduction of pollution coming from certain activities, among which transformation and marketing of fishing products industry is included.

This Directive establishes measures to avoid or where this is not possible to reduce emissions of the aforementioned activities into the atmosphere, water and ground, including waste relative measures, in order to reach a high level of environment protection considered as a whole.

In order to achieve the fixed objectives, the Directive establishes the need for environmental authorities to make sure that in affected installations exploitation “best available techniques” shall be applied, referring to those which in production processes, are the most environmentally respectful to carry out the activity.

### Integrated Product Policy and Integrated Production

Tending towards Integrated Production means establishing production systems for obtaining products using natural resources and production mechanisms in the most sustainable manner possible, thus ensuring long term production maintenance. Where Integrated Production is approached, resources or raw materials consumption is taken into account in an efficient manner (water, air, energy, raw materials etc.) and waste generation minimization in the whole production process and in the final waste after use of the product. That is, considering the whole product “life cycle”, from its design, transformation, packing, transport, marketing and consumption.

In order to apply integrated product policy the following actions are proposed:

- To design every single product put on the market following Life Cycle guidelines.
- In the design, as they are perishable goods, clearly emphasize the final destiny of containers, the efficient use of raw materials, water and energy, and valuation of subproducts.
- In accordance with environmental community policy, respect the principles of Preventive, Corrective Action in source pollution, Whoever pollutes, pays and Shared Responsibility in the processes design and in decision making.



## VI. FISHERY AND AQUACULTURE EFFECTS ON THE ENVIRONMENT

### 1. Fishery and environment

Fishery policy and environmental policy are closely linked. This is so, due to the fact that both have some influence on health and on the good operation of marine ecosystems which are the basis of a sustained and durable fishery activity. If marine ecosystems are protected and taken care of, fishery will be able to develop in an indefinite way since it is the exploitation of a renewable resource. If human activities on the coastline are respectful of marine dynamic and watch over good condition of coastal waters, ecosystems will then operate. If rivers environmental health is taken care of and hydrographic river basins are managed carefully, marine ecosystems shall not be altered.

Scientists describe the relation between Fishery and Environment as “Pluridisciplinary”. That is, they are relations in which numerous factors take place. Fishery and environmental policies in the European Union take into account this reality which, on the other hand, is a constant phenomenon when we approach worldwide environmental problems. There are no borders in environment, especially in the seas and oceans. So, in case there is any doubt, the European Union applies the Principle of Prevention.

*In spite of strict conservation measures, fishery is the sector which has the most impact on biodiversity, with direct or indirect effects on marine species and ecosystems.  
(European Environment Agency. 1999)*

The major fishery and aquaculture environmental matters are the following:

- **A) Exhaustion of fishing grounds**
- **B) Impacts on non commercial marine species**
- **C) Alteration of marine and coastal habitats**
- **D) Impacts caused by aquaculture**

#### **A. Exhaustion of fishing grounds**

The most obvious negative environmental effect of fishery consists in the possibility of reaching an overfishing situation and the consistent exhaustion of a specie in a fishing ground. The CFP aims to find the balance between renewable resources given by a fishing ground (or a seasonable fishery) and the fishing effort applied to that fishing ground. In this way, the existing population of a resource (specie) is renewed in a natural way, in spite of fishers' actions.

#### **B. Impacts on non commercial marine species**

Impacts may be direct and indirect. In the first type, non commercial species are involuntary trapped by fishing equipment and gear (by-catch). The reduction of this impact passes through the adoption of more selective fishing systems.

Indirect impacts are difficult to quantify since they are produced when population of commercial species is reduced or completely eliminated. These species may constitute



the food supply to the non commercial ones since they are related to predator and prey species, or have another type of biological association. For instance, the extinction of sturgeon population, which we call here “Sollos” has favoured the gradual extinction of big oysters “margaritiferus”, producers of nacre in the Ebre river, before abundant in the Delta Zone. The reason is that sturgeon’s gills were used as a vehicle for propagation of oysters’ larvae, now deprived of this “service”.

### **C. Alteration of marine and coastal habitats**

The fishing activity may have biological effects and physical effects. In the first type, when modifying the number and composition of species that constitute a specific habitat, fishing has the capacity to alter the above mentioned habitat and to establish new balances, since the emptiness caused by an exploited marine specie may be covered by another specie.

For example, it is well known that when exploitation of hake fishing grounds begins, it usually results in an increase in hake population. Fishermen, when eliminating adult specimen that feed on the limited resources of the place and that no longer grow, they are permitting young hake to grow more quickly, since they have more opportunities.

Other physical actions capable of producing alterations are dumping of polluted products into the sea and the introduction of aloctone species to the environment through vessels ballast water.

As regards to the physical effects, some fishing equipment and gear, such as trawling, may alter the habitats due to its physical action on the marine bottom. The impacts on coastal zones are social, economic and environmental. Fishing, especially artisanal and its infrastructures (ports, installations, transforming industry) take place on the coastline and must take part of the integrated coastal zones management that includes urban development, tourism, net communications and the rest of economic activities.

### **D. Impacts caused by aquaculture**

Purely sectorial aspects (pollution, waste and effects on the environment) have already been included in previous chapters.

But there are other kind of possible impacts which refer to relations among marine aquaculture installations, coastal landscape, tourism, aquaculture, urban development and communications. For this reason, aquaculture should be part of the Integrated Coastal Zones Management.

Equally, when cultivated species are introduced to the environment through Aquaculture, in a free manner, whether it is accidentally or with the intention of “overpopulating” marine areas, it is important to analyse the possible consequences for ecosystems.



## VII. FISHERY AND ENVIRONMENT REGULATION FRAME

### 1. Prior considerations

Ever since Spain became member of the European Community on 1<sup>st</sup> January 1986, its main lines of environmental and fishery policies have been established under common consensus within other Member States. Spain takes an active part in Community decisions through the Council of the European Union, where each Member State is represented by a Minister. In this Council, with executive and decision-making power, the national policies are coordinated with each matter, seeking the common good.

The Ministers' Council resolutions are subject to the standards and law represented in the Treaties upon which the European Union is governed. The first Treaty came into effect on 1<sup>st</sup> January 1958 "Treaty of Rome". The second was the object of lengthy deliberations which began with a study of a European Union Treaty, taking the first step with the Single European Act coming into force on 1<sup>st</sup> July 1987.

On 1<sup>st</sup> November 1993 the Treaty on European Union came into effect, also known as Treaty of Maastricht. Finally, a variety of changes were made by means of the Treaty of Amsterdam which took effect on May 1<sup>st</sup> 1999. Overlooking the enlargement of the European Union up to 25 members, the Treaty of Amsterdam shall be modified and the European Constitution is now in preparation.

### 2. Community Fishery Policy

Entry of Denmark, Ireland and United Kingdom into the Community, in 1973, resulted in a need to consider the Common Fisheries Policy (CFP) for the nine Member States which formed the EC in that moment. In 1981 the Common Fishing Market Policy was already approved.

The new comers had major commercial fishing interests in the North Sea which took over ten years to be harmonized after tough negotiations. In this way, in January 1983 an agreement was reached on establishing a Common Policy on fishing resources. Negotiations were marked by the sinking of herring and cod fisheries in the North Sea and ascertainment of a dangerous and irreversible overfishing situation had been reached as well as the exhaustion of these species.

Member States took the decision of preventing, at the same time they harmonized their national policies with those of other Member States, that a similar case to the one in the North Sea would happen again with any other commercial marine specie present in Community waters. In order to achieve this, they sought out Scientists' assistance and the need for fishermen, who are definitely the first ones interested in preserving their living environment, to understand the problem.

Today, there are four key areas in the Common Fisheries Policy: Fishing Structures; Fisheries Management and Conservation; Fishery Markets; Foreign Relations. Out of these four areas, environmental considerations specially insist on the two first ones. How does the European Union intervene in these areas?



In the case of Fisheries Management and Conservation, two measures are taken: Total Admissible Catch (TAC) and Technical Conservation Measures (TCMs). That is, limiting the number of tons of commercial specie caught in Community waters, establishing minimum measures related to catch, using gear designed to reduce the capture of immature/juvenile fishes, protecting zones and reproduction and breeding periods “nurseries”, reducing associated catch or discards, etc.

Appropriate fisheries management may achieve the recovery of threatened fisheries. This is the case of herring fisheries in the North Sea, closed between 1977 and 1980 due to fishing fall in fish catch, and managed since 1996 with a spectacular increase in biomass and fisheries boom

With respect to fishery structures, the CFP seeks to adjust the fleet’s fishing capacity to the real possibilities of the fishing grounds, improve the quality of fishing processes, create protected zones in order that vulnerable stocks can regenerate, improve environmental management on aquaculture, etc. To assist the sector to carry out these measures, the EU created the Financial Instrument for Fisheries Guidance (FIFG) and the Plurianual Orientation Programs (POP). These last two basically destined to balance fleets.

### **3. The Financial Instrument for Fisheries Guidance (FIFG) and Environment**

While this Structural Fund has no specific measures on environmental matters included in the 2000-2006 Programme, FIFG has centred a significant part of its aid on adjustment of the fishing effort and on renewal and modernization of the fishing fleet. These acts include an environmental component that tends to the conservation of resources and to a more appropriate management.

In addition, modernization and renewal of the fleet, has the possibility of providing more efficient vessels from an energetic point of view, increasing the crew’s safety and the quality of life at work, what contributes to improving the environment and the sector’s sustainability. Although this specific measure will be limited in the new CFP, the aid concerning safety and quality of life on board and the quality and hygiene of fishing products will be maintained. On the other hand, the measures in defence of artisanal fishing act in favour of sustainability watching over the maintenance of employment and the origin of its culture.

Over the Programme period 2000-2006, investments in installations and modernization of productive installations (aquaculture, transformation and marketing of products) referring to the use of techniques or collective installations that significantly reduce the effects on the environment, would have bonus for financial aid, although it would come from national cofinancing (Regulation EC N° 2792/1999).

### **4. The need to reform the CFP**

It has been 20 years since the basis for the Common Fisheries Policy were laid down and from 1<sup>st</sup> January 2003 there is a new CFP. Previously in 2001, the European Commission Communications with respect to the integration of environmental demands



and the Environment Integration Strategy in the CFP and the Biodiversity Action Plan in Fishing came up.

The publication of the Green Book on fishery, in March 2001, was useful as a starting point for a reform whose main objective is the sustainable development. Its basis is the necessary coordination between the fisheries policy and the Community environmental policy.

## **5. Community Environmental Policy**

The concern among the citizens of the European Union about the protection and improvement of the environment is more and more significant. This concern has been demonstrated through the texts of Treaties in such a way that it has become the main protagonist of all the Community policy.

The Amsterdam Treaty already includes Environment in Article 2 and highlights the promotion of Sustainable Development as one of the main European Union missions. This New Model of Development is accompanied, as Article 6 of the Treaty points out, by an obligation to integrate environmental considerations in all actions carried out by the European Union, this means that environment must be integrated into all policies and into all economic sectors.

In a priority manner, environment should be integrated into energy sectors, transport, agriculture, industry and tourism (*5<sup>th</sup> Community Programme of Action on Environmental Matter 1995-1999*). Environment should also be integrated in fishery, urban environment, domestic trade, international cooperation, etc.

The actions carried out by the Member States and by the Regions with financial aid from the Community Funds (ERDF, EAGGF, ESF, FIFG, Cohesion Fund), integrate environmental considerations in a compulsory manner. Equally, the Community Environmental Policy is reflected in the Directives that propose which aims must be achieved in this matter. The Directives on Environmental Impact and Birds and Habitats Directives for the protection of fauna, flora and habitats are especially significant. These Directives may affect extractive fishing and aquaculture.

## **6. The new CFP**

The reform intends to find solutions to four matters:

- The conservation of fish population
- Marine environment protection
- Ensuring the economic viability of the fishing fleets
- Obtaining good quality food products for consumers

To achieve this, the CFP has established long term objectives, adapting fleet capacity to the capacity of fisheries. Aid for renewal and modernization of the fleet will be stopped, except for increasing safety and improving workers' labour conditions. In parallel, the CFP will establish more control mechanisms and greater uniformity, favouring the participation of the sector through the Regional Consultive Councils.



In addition to these major reform lines, the CFP is accompanied by several strategies and plans:

- Strategy for sustainable development of European aquaculture
- Mediterranean Action Plan
- Inclusion of environmental protection requirements within the CFP
- Plan for the eradication of Illegal fishing
- Discards reduction Plan
- Measures to stand up to economic and social consequences of the restructuring of the fleet
- The Creation of unique inspection structures

## 7. Regulations

Marine environmental protection and, especially fishery resources protection, is subject to a collection of agreements, regulations and standards at all levels: regional, national, community and international.

With respect to the legislation itself, we may establish three action fields:

- 1). Regulations on marine pollution.
- 2). Regulations on fishery activity
- 3). Regulations on the protection and improvement of the environment

### 1.Regulations for the prevention of sea pollution.

Oceans have historically been considered humanity's heritage and thus, was recognized by the United Nations General Assembly Resolution in 1970. Navigating its waters and exploiting its wealth was within everybody's reach because the sea was no man's. However, in this large open space it was necessary to establish some minimum rules to ensure free access to the seas, the right of vessels to pass through its waters and a resolution of the possible conflicts. It was a question of regulating an international space. For this reason, the first regulations affecting the oceans, their use, their exploitation and their sovereignty were Agreements at an international level.

The International Maritime Organization (IMO) is a United Nations organism with its headquarters in London. It was created in 1948 and among its other objectives aimed at "...encouraging and facilitating the general adoption of regulations at any level as long as they would be feasible in matters related to marine safety, navigation efficiency and prevention and control of sea pollution caused by vessels". Spain became a Member State of IMO in 1962.

In 1972, IMO created the development of an international Agreement for the prevention of sea pollution by vessels. This Agreement was ratified in 1973 and it is known worldwide as MARPOL 73/78. In the following years, MARPOL has undergone several changes and enlargement, the latest being in 1997 with the inclusion of new Protocols.

Fishing fleet vessels have been affected by MARPOL from the moment it regulated the dumping of hydrocarbon (Annex I) and toxic substances such as paints, as well as dirty water (Annex IV), waste (Annex V) and atmosphere pollution (Annex VI), taking into



account the waters where possible dumping would be likely to take place, the distance from the coast and vessel size. Spain ratified this Agreement in 1984 and set the National Coverage Plan for Vessels Oil Waste Reception Installations in motion, aiming to comply with it.

In addition to MARPOL 73/78, other Agreements for the protection of marine environment have been signed by Spain:

- Convention for the Protection of the Environment in the Northeast (1992) (OSPAR/Oslo-Paris Agreement) to prevent and eliminate waste dump in the sea coming from land.
- Barcelona or Protection in the Mediterranean, 1976 Convention.
- Bonn Convention
- Copenhagen Convention
- Helsinki Convention
- Lisbon Convention
- Montreal Convention, 1983 to stop emissions into freon gas atmosphere (CFC), which damages the ozone layer (affecting fishing fleet vessels that use refrigeration systems on board).

All these international Agreements oblige the States which join them to set effective legal mechanisms and actions in motion. Thus, Spain took into account MARPOL 73/78 Agreement for the Law on Coasts (1988), Law on State Ports and for the 1992 Merchant Marine and the National Coverage Plan above mentioned.

The Directive 2000/59/EC on port reception facilities for ship-generated waste and cargo residues, is in addition to the effort made by the MARPOL Agreement and the European Union to keep our seas clean. This Directive affects all Community ships and vessels, including fishing boats, and demands the adoption of Port Facilities Plan which try to solve forever, the problem with all types of ship-generated waste. The following are being discussed: garbage bins on board ships, containers placed on decks, containers collection systems, subsequent waste treatment, etc. Member States had a deadline 28<sup>th</sup> December of 2002 to surpass the Directive to its National Legislation.

## 2. Fishing Regulations

The fact that fishing and aquaculture make up an economic sector of great importance to our economy as a whole in Spain is unquestionable. The Spanish Constitution 1978, in its Article 130.1, invites our Public Powers to modernize and develop all the economic sectors, with special reference to the Fishing sector. In this activity, as it happens with the rest of economic sectors, there are two major legislative frameworks.

- a) Community and International Framework
- b) National and Autonomic Framework



### *a) Community and International Framework*

Since the integration of Spain in the European Union, Community institutions have assumed great part of the fields that the State had concerning fishing, in accordance with the forecast contained in Articles 93 and 96 of the 1978 Constitution. Thus, the Community Right, and therefore the Common Fisheries Policy, have become part of our internal organisation.

Within this Common Fisheries Policy, the European Union has exclusive competence of Marine Biological Resources Management. On the other hand, the great number of Fishing Agreements between the Community and Third Countries, subscribed on behalf of the Member States, contain the regulations that our fleet shall have to respect in these States' waters, with the corresponding obligation of watching over its fulfilment. The Common Fisheries Policy develops the Legal Regulation by means of Establishment Regulations and through Communications, some of which are listed in further chapters.

At international level, international Agreements lay down compromises for the States that orientate their fishing policy towards specific goals. The objectives stemmed from the Environment Conference and FAO Code of Conduct for Responsible Fisheries, which are part of the Legal Framework applicable to fishery, could be highlighted. Equally, and in commercial field, fishery products trade is framed within the World Trade Organization Agreements, as may be technical barriers to trade, sanitary and phytosanitary measures, etc.

### *b) National and Autonomic Framework*

In accordance with the jurisprudence of the Constitutional Court, the exercise of the State Regulation Authority demands an interpretation of the scope and the State's limits on legislative competence, defined in the Constitution and the Statutes of Autonomy.

Article 149.1.19 of the Constitution attributes exclusive competence to the State concerning marine fishing, with no damage on the competences attributed to the Autonomic Communities in the sector's organisation. At the same time, Article 114.1.11, lays down the exclusive competence of the Autonomic Communities as regards fishing in deep waters, shellfishing and aquaculture.

The Statutes of Autonomy attribute competences for the development and carrying out of the State's Basic Regulation concerning organisation of the fishery Sector to the Autonomic Community.

The Law 3/2001 on the State's Marine Fisheries, regulates the strict field of marine fisheries, exclusive competence of the State and therefore, prohibited to the Regulation and Executive Act of Autonomic Communities. The Law contains the essential guarantees of the legal certainty in the definition of the Basic Regulation as regards the organisation of fishery sector, what would permit the Autonomic Communities to exert their development and carrying out competences of the State's Legal Framework, establishing the complementary organizations that meet their own interests.

Finally, in relation to aquaculture, its significant to emphasize that Law 23/1984 on Marine Cultures, aims at the regulation and organization of marine cultures in national



territory, maritime terrestrial zones, rías, estuaries and lagoons in permanent or temporary communication with the sea, territorial sea and Exclusive Economic Zone (EEZ), both public domain goods and private property. All this, with no loss of competences and faculties assumed by the Autonomous Communities.

Respecting Regulations and Agreements on the fishery activity, whether they are international, Community, national or regional, is one the major protection guarantees and improvement of the marine environment

### 3. Protection Regulations and Environment improvement

As mentioned in previous pages, any of the interventions, acts and policies developed for the protection and improvement of the environment, sooner or later have an impact on the oceans.

Regulations that affect the appropriate treatment of all kinds of waste, protect the continental waters (rivers) that end up reaching the sea. The ones referring to the protection of the atmosphere limit or eliminate emissions that through the rain reach the sea. The efforts to reduce the presence of greenhouse gases seek to eliminate or limit the Climate Change effects, which are affecting the oceans. The legislation relating to biodiversity conservation enriches the wealth in the biosphere, which marine environment is an important part of. Regulation on water quality, its treatment and purification affects the sea through the river basins. Regulation on protection and improvement of urban environment affects coastal populations, which evidently, very directly affect the coastal zone. To sum up, remember the multidiscipline character of the relations among fishery, aquaculture and the environment.

Protection and good use of marine protected areas may very well be a source of employment and opportunities for the local fishery Community, attracting tourism and relaunching catch from controlled fishing



## ANNEX 1

### **Community Regulations**

- Council Directive 79/409/EEC on the conservation of wild birds.
- Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
- Council Directive 96/61/EEC concerning integrated pollution prevention and control (IPPC).
- Council Directive 2000/59/EEC on port reception facilities for ship-generated waste.
- Council Directive 2001/18/EEC on genetically modified organisms.
- Regulation (EC) 2341/2002 fixing for 2003 the fishing opportunities and the corresponding conditions for certain fish populations, applied in Community waters, and in the case of Community vessels, in other waters where it may be necessary to establish catch limitations.
- Regulation (EC) (proposal) COM (2001) 764 final relative to fishing opportunities for deep water fish.
- Regulation (EC) 2371/2002 on the conservation and sustainable exploitation of fisheries resources under the CFP.
- Regulation (EC) 2370/2002 establishing an emergency Community measure for scrapping fishing vessels.
- Regulation (EC) 104/2000 on the Common Organisation of the Markets in fishery and aquaculture products.

### **State Regulations**

- Law 4/1989 modified by Laws 40/1997 and 41/1997 on the conservation of natural areas and wild flora and fauna.
- Law 3/2001 on State Marine Fishery.
- Law 10/1998 concerning waste.
- Law 16/2002 concerning integrated pollution prevention and control.
- Law 23/1984 concerning marine culture.
- Royal decree 1997/1995 establishing measures which will guarantee biodiversity through the conservation of natural habitats and wild flora and fauna (Directive 92/43 EC).
- Royal Decree 261/1996 on combating pollution caused by nitrates of agricultural origin. (Directive 91/676/EC).



## **Autonomic Regulations**

Autonomic Communities have Regulation framework that regulate aquaculture, environment etc.



## ANNEX 2

### Agreements

International and regional Agreements (for which Spain is a contracting part) on fishery and environment protection.

#### Pollution

- London Convention (1972). Control of all sources of marine pollution by dumping of waste.
- Stockholm Convention (2001). Control of production, import, export, elimination and use of persistent organic pollutants (POP).
- OSPAR Convention (1992). Protection of the Marine Environment of the North East Atlantic.
- Barcelona Convention (1976). Protection of the Marine Environment and Coastal Region of the Mediterranean.
- Lisbon Agreement. Cooperation in the fight against pollution caused by hydrocarbons and other dangerous substances.
- Bonn Agreement (1979). Cooperation in the fight against pollution of the North Sea caused by hydrocarbons and other dangerous substances.
- MARPOL Convention 73/78. Prevention and minimum Reduction of Maritime Pollution of Ships for operating or accidental reasons.
- IMO International Convention concerning the Control of Harmful Anti-fouling Systems on Ships (2001).
- Washington Convention (CITES) (1973)
- IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments. February 2004.

#### Fishing and biodiversity

- FAO Code of Conduct for Responsible Fishing.
- The European Code of Good Practices for sustainable and responsible fisheries practices (2004).
- UNCLOS. United Nations Convention on the Law of the Sea: Conservation and management of transzonal fish species. Management of the Oceanic Area.
- International Commission for the Conservation of Atlantic Tuna (ICCAT).
- ACCOBAMS. Conservation of Migratory Species (birds, marine and terrestrial species).
- Convention on Biological Diversity. Jakarta Mandate on the protection of marine and coastal biological diversity.
- Bonn Convention. Conservation of Migratory Species (birds, marine and terrestrial species).
- Convention for International Council for the Exploitation of the Sea. (CIEM)



## ANNEX 3

### **GLOSSARY**

#### **Natural Resources**

Are, in a broad definition, the Wealth of Nature. Some of this wealth, such as air, water or landscape, have recently been considered protected Natural Resources.

Fishermen constantly use natural resources as energy (wind, fossil fuel) and ocean live species.

#### **Renewable Natural Resources**

A Resource is renewable where, once having been used in a specific place and in any given moment, it is susceptible to being used again in a relatively short time. To fishermen par excellence renewable Resources for their work are fish and other live species in the sea.

#### **Non-Renewable Natural Resources**

Are those Resources whose exploitation leads to their irreversible decrease. The fuel (gas oil or petrol) that a fisherman uses as energy to move his ship and fishing mechanisms is a non-renewable resource, whereas if he uses the wind or solar energy, he is using a renewable resource.

#### **Trophic Chain**

A set of existing food supply relations among members of a biological community. In the ocean there are very different trofic chains, such as the one that relates herbivorous (anchovy) to carnivorous species (marine tuna and birds).

#### **Waste**

Any material or form of energy discharged into the environment by man and is susceptible to causing pollution.

#### **Pollution**

Artificial release of substances or energy into the environment causing adverse effects on man or on the environment, directly or indirectly.

#### **Environmental Impact**

Effect produced by present or future actions in a certain environment. Impacts may be positive or negative and depend on the “reception” capacity of a territory or environment. Generally, the significance of an impact depends primarily on the conditions of vulnerability, fragility or risk of the environment receiving it.

Marine environment has always been considered capable of receiving and assimilating the impacts of human activities. But this idea is now rejected and the oceans today appear to be a fragile and sensitive environment.

#### **Sustainable Development**

Several versions can be given of Sustainable Development and Sustainability. One defined it as “development that meets the needs of the present without compromising



the ability of future generations to meet their own needs” (World Commission on Environment and Development in 1987).

However, other subsequent definitions for this is “capacity improvement for reaching a constant level of use of natural resources satisfying more and more human needs”

The European Union has defined Sustainable Development in a broader manner and taking into account three basic pillars, in order that if one fails sustainable development will not occur.

- Society’s solid and constant economic growth and development.
- Citizen’s high quality social protection concerning their level and quality of life.
- Protection and improvement of the Environment.

### **Fishing Effort**

The amount of energy a fisherman puts into fishing (consumed fuel, number of days, etc.)

### **Principle of Prevention in Fisheries**

Assurance that the number of breeding fish does not reduce so much so that it interrupts its reproduction

### **Biomass Limit**

Level of fish stocks below which its reproduction is interrupted or deteriorated

### **Prevention Biomass Limit**

Level scientifically estimated and established over the Biomass Limit, as safety and absorption zone.

### **Safety Biological Limits**

When a stock is over Prevention Biomass, we say that it is Within its Safety Biological Limits. When it is below, it is Beyond its Safety Biological Limits.

Even if a certain stock is Within its Safety Biological Limits, intensive fishing may be so high that could lead the specie Beyond its Safety Biological Limits in a short period of time. In these cases we say that the stock is being “fished” Beyond its Safety Biological Limits.