In your hands

Knowing what you consume to decide how you consume

Conscientious fish consumption

Are you Fishy?

Regional Activity Centre
for Cleaner Production

The conscientious fish consumer:

This document has been produced in collaboration with the **Centre for Research and Information on Consumption (CRIC)**, a non-profit Catalan citizens' association that has been working for more than ten years providing information to the public on responsible consumption. www.cric.cat

How much fish do we eat?

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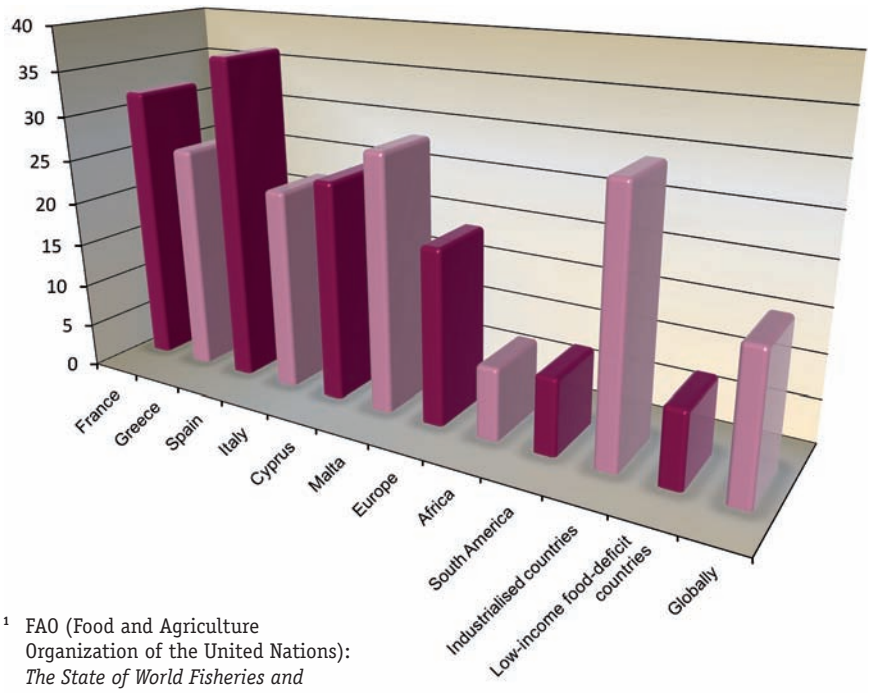
Over the last 30 years, the global fish supply and the population have grown at a similar rate, which means that average global fish consumption per head has remained very stable. However, as we can see in the graph below, this varies a great deal according to the level of development of the country (in line with the United Nations definition of *development*). One trend we can see is that, paradoxically, some of the regions in which fish is a traditional part of the diet, such as coastal countries in Africa and Asia, are among those with the lowest fish consumption.[1]

In other cases a great deal of fish is consumed, such as in the richest Mediterranean countries in the region.

Per capita consumption of fish (kg/person/year)

France	32
Greece	26
Spain	37
Italy	23
Cyprus	25
Malta	29
Europe	19.9
Africa	8.2
South America	8.7
Industrialised countries	29.7
Low-income food-deficit countries	8.7
Globally	16.5

Source: FAO.
The State of the World Fisheries and Aquaculture 2006.
Table 10 and Fisheries Circular N° 872/4 part 1 Table-Annex 5-9.



[1] FAO (Food and Agriculture Organization of the United Nations): *The State of World Fisheries and Aquaculture 2006.*

1. What do we get from fish?

Fish provide us with protein, fat, vitamins and minerals.

The **protein** in fish contains all of the essential amino acids, which means our body can use it fully.

Fat is found in what is known as *oily fish*; seafood and *white fish* contain very little fat.

Most of the fat found in fish is **unsaturated**. This type of fat is particularly beneficial for people with too much *bad cholesterol in their body* (this comes from the saturated fat contained in meat and meat products and in industrially processed foods). The types of fat contained in fish include Omega 3 (Ω3), which is necessary for the regulation of certain circulatory functions and for the development of the brain and the retina, particularly during pregnancy and childhood. In nature, Ω3 can only be synthesised by phytoplankton, seaweed, grasses and other plants, while other living creatures obtain it from the food they eat.

There is currently much talk about the need to consume Ω3. However, it is not so widely explained that what is really important is the proportion of Omega 3 and Omega 6 in our diet, rather than purely the amount of the former that we consume. In fact, the growing popularity of Omega 3 is due largely to the fact that our diet contains large amounts of Omega 6, which generates a dangerous imbalance. This is caused among other things by the large amounts of industrially farmed meat that we consume, the excess of vegetable fats that we consume directly or in processed foods (particularly sunflower, maize and soya oil), etc.

Farmed fish contain more fat than wild fish, because they are less active and their diet is rich in fat, but this fat contains less Ω3 because farmed fish eat less phytoplankton.

Fish also contain vitamins (A and B) and minerals (iodine, zinc, phosphorous, calcium, iron, etc.). We obtain these nutrients mainly from small fish that we eat whole, and from stock made from fish.

Many of the pollutants generated by industrial activity end up in the sea, either through the air, the water that flows into the sea or discharges from boats. The most common of these pollutants are dioxins, PCBs and heavy metals (mercury, lead, arsenic, cadmium, etc.). When animals ingest these substances, they remain in their bodies (dioxins and PCBs are stored in their fat). Fish that only eat plankton ingest all of the toxic substances that are present in the water, those that eat small fish ingest those present in the water as well as those that have accumulated in their prey and so on (this is what is known as *bioaccumulation in the food chain*).

This means that the fish containing the highest levels of toxins are the fattiest fish, those with the longest lifespan, those that are high-

est in the food chain and those that live in the most polluted areas (this is why recreational fishing in zones close to sources of pollution such as certain industries or major cities is advised against.) Some species also accumulate more toxins than others, for example molluscs, because they feed by continually filtering the water. Some species contain such high levels of pollutants that the maximum permitted levels applied to them must be increased in comparison to other foods in order not to drastically reduce their consumption. This is the case for some species of tuna, which are permitted to contain twice the mercury levels of other species.[2]

The fat of **farmed fish** can accumulate more toxins that that of wild fish, as the fish are fed on fish that are at the same level on the food chain. This difference is most significant in the case of salmon, as it lives longer. Salmon can also contain other harmful substances: antiparasitic drugs, antibiotics (living in crowded conditions mean the fish can become ill very easily) and additives such as colourings. In fish farms in non-European countries (the source of the majority of prawns, shrimps and a significant proportion of salmon), antibiotics are used that are prohibited in Europe.[3]

These toxins (and those originating in other foods) can also accumulate in our bodies over the course of our lives. If they reach a certain level of concentration (which varies according to the individual), they can encourage certain cancers and various illnesses affecting the nervous system (including those affecting the brain and mental illnesses), the immune system, the hormone system and the reproductive system.

What the health authorities say

The health authorities recommend certain minimum levels of fish consumption for nutritional reasons (in some cases they recommend the consumption of a minimum of one portion of fish per day).[4] However, recommendations of maximum consumption limits for toxicity reasons are still very hesitant and rarely appear in informative material aimed at the public. For example, the World Health Organisation says in an internal report that the recommended limit for the ingestion of dioxins and PCBs would not be exceeded if two portions of farmed salmon were consumed per week, but that it should be remembered that these toxins are also present in other foods.[5] The European Union recommends that children and women who are pregnant or of childbearing age eat a maximum of two portions of fish per week and that one of these portions should not consist of top predatory fish.

2. The different sources of fish

FISHING

The fish that we consume may come from sea fishing or aquaculture. *Inland fishing* (fishing in rivers and lakes) is marginal in Spain and is mainly recreational. It is also marginal on the international market (7% of the total),[6] but it is a fundamental source of food in some parts of the world.

In terms of **sea fishing**, the fishing fleet can be divided into three groups according to the scale on which the boats work. The table shows a summary of the characteristics that define each group, including technical, environmental and socio-economic aspects. On a very general level, we can say that industrial and semi-industrial fishing use similar methods and that the impact of the two types differs based on the scope (the larger the scale, the greater the impact), while non-industrial fishing uses very different methods. However, the divisions between the groups are not clear-cut and characteristics vary in different areas.

[2] European Food Safety Authority: *Background note on EFSA risk assessment related to the safety of wild and farmed fish,* 2005.

[3] Organisation of Consumers and Users: *Compra Maestra* magazine no. 314, April 2007.

[4] Catalan Food Safety Agency: *Guia pràctica per al consum de peix i marisc,* 2007.

[5] World Health Organisation: *Organochlorine contamination of salmon,* January 2004.

[6] FAO: *Review of the state of world marine fisheries resources,* 2007.

The different sources of fish

IMPACT ON THE MARINE ENVIRONMENT

The interaction of fishing with the marine environment can be respectable or sustainable to different extents, according to the scale of fishing and the fishing method used. It is therefore fundamental that we understand the difference between non-industrial or small-scale fishing and large-scale industrial fishing, as shown in the table. Between these types comes semi-industrial fishing, which as its name suggests is fishing on a medium scale.

Non-industrial fishing uses *small-scale* fishing techniques (dredging, fish pots, fish hooks, troll fishing, small drift lines and various types of net: anchored gillnets, tangle nets, shore nets, etc.), while industrial fishing uses *large-scale* techniques (trawling, seine nets and drifting longlines); the most commonly used technique in large-scale fishing is trawling.

There are four basic differences between the fishing techniques:

1. Selectiveness

This is a reference to the possibility a fishing technique offers for selecting the fish it catches according to two criteria:

– The **size**: it is possible that immature fish are caught (these are fish that have not reproduced a minimum of once). Although prohibited by law, it is common to sell immature fish alongside mature fish and in fact they are sometimes more highly valued.

– The **species**: as well as the species that the fishing technique aims to catch, other fish or other animals (turtles, dolphins, birds, etc.) may also be caught; these are what is known as the *by-catch*. They may be used to manufacture fish meal or (and this is more common) simply be thrown overboard; in this case they are known as *discards*. Estimates for discards made by the FAO vary greatly, ranging between 8% and 20% of total catch.[7]

In general terms, small-scale fishing is more selective than industrial (large-scale) fishing. The least selective technique is trawling, which is a technique used in industrial and semi-industrial fishing (see table).

According to the FAO, trawling for shrimps in the Caribbean is the least selective fishing technique in the world, with an average of 13 kilos of discards per kilo of shrimps caught (the shrimp is one of the species of which consumption is increasing most).[8]

[7] FAO: *A global assessment of fisheries by-catch and discards,* 1994; *Reevaluation,* 1998, and *Discards in the world's marine fisheries: an update,* 2005.

[8] FAO: *Review of the state of world marine fisheries resources,* 2007.

The other large-scale techniques (drifting longlines and seine nets) can be fairly selective, with some exceptions. The small-scale methods used in non-industrial fishing are the most selective and non-industrial fishermen usually make use of by-catch. In addition, the same non-industrial fishing boat will use different methods and will vary the species it catches on a seasonal basis.

In the Mediterranean, 3 of the 5 most wasteful techniques due to the amount of discards they generate are based on bottom trawling, intended to catch species such as hake, red mullet, shrimps, sole, octopus, pandora, sea bass, gilthead bream, sea bream, skate, squid, etc.[9] Although the information available concerning discards in the Mediterranean is not very precise, estimates suggest that levels may be very high, reaching figures of between 13,000 and 22,000 tonnes each year, or some 12% of total catch. However, the European Commission estimates that these figures are higher in the case of trawlers, estimating that for this type of fishing a minimum of 20% of the total biomass caught is discards, although the figure could be closer to 40-70%.[10]

[9] Álvarez, F. (coord.): *Factors affecting catch rates of NW Mediterranean trawl fleets and derivation of standardised abundance indices.* Final Report. EU Project 98/053, 2001.

[10] EC: *Communication from the Commission to the Council and the European Parliament on a Community Action Plan to reduce discards of fish.* Brussels, COM(2002) 656 final. 26.11.2002.

2. Impact on the sea bed

For trawling, the net used is fitted with weights to keep it at the bottom of the sea. As the net trawls the ocean floor, these weights destroy the sea bed. This causes major damage to the ecosystem, destroying for example the areas where fish lay their eggs and the places they use to hide from predators. Small-scale fishing techniques have least impact on the marine environment.

3. Overfishing

The intensity and the capacity of industrial fishing (hours, volume, mobility, depth, etc.) generate a stronger tendency towards overfishing than non-industrial or smaller-scale fishing.

Non-industrial fishing, on the other hand, is linked to coastal communities that throughout the generations have depended on fishing resources, which is an incentive to preserve fish stocks. Industrial vessels can move between fishing grounds, which means that they are not so reliant on specific resources. What does motivate them, however, is the need to make the investment profitable (which is not easy, as we will see in the next section). As a result, the incentive to avoid overfishing is lower in the case of industrial fishing.

4. Energy consumption

This is another major factor affecting environmental impact, although it is not so directly linked to the marine ecosystem. Energy is consumed mainly by the engines powering those boats that travel thousands of miles and trawl with vast nets, and by the freezers on board. Energy consumption is obviously greater the larger the scale of the fishing operation.

SOCIO-ECONOMIC ASPECTS

Sometimes the measures to be taken to encourage more sustainable fishing are slowed down or obstructed by the argument that they have economic or social drawbacks. However, this does not have to be the case. Smaller-scale fishing, as we have seen, is better for sustainability, but it also has socio-economic benefits.

Employment

Non-industrial fishing uses more manual methods, which means it generates more employment per kilo of fish. For example, in the case of the bluefin tuna, which we will look at in more detail later, an industrial seine fishing boat (which creates 8-10 jobs) can fish in one day more than a trap net[11] (which employs over 100 people) will catch in the whole fishing year.

Profitability

Surprisingly, several studies seem to show that in many cases industrial fishing is not particularly cost-effective: it requires major investments in large boats, fuel and technology and the results do not provide sufficient compensation. In the 1990s, for example, Span-

[11] This is a fixed net in which tuna are enclosed when they enter. This type of fishing in the Mediterranean goes back to the Phoenicians and is used in several regions, such as the south of Spain.

The different sources of fish

ish Mediterranean trawlers recorded a negative profit margin of -8.5%, which means that they did not even cover their costs.[12] Public subsidies enable this situation to continue over time; according to a study published by the World Bank in 1997, subsidies accounted for around 23% of the income of fishing companies globally.[13]

Costs for non-industrial fishing are lower, more money is paid for the product (because there is less of a supply and the quality is better) and the method is therefore more cost-effective. According to a European Union study of fishing operations with available profitability data, the most profitable fishing method was Italian non-industrial fishing (with profit levels of 37% of the capital invested); the investment per employee on a Greek coastal trawler was six times greater and profitability was negative, which means that the investment was not recovered (-4.7%), a situation which is mirrored in the case of Spanish and French trawlers.

Distribution of wealth

Non-industrial fishermen are usually self-employed and the crew on their boats in many cases are family members and neighbours. Income is distributed among the fishermen using the "piece work" system (the owner of the boat takes half, having provided the material resources, and the other half is divided equally among the rest of the crew).

Industrial ships belong to companies and the crew receive very unequal salaries according to their position in the workplace hierarchy. Fishing in general is an area with growing numbers of immigrant workers, particularly in the lowest positions on industrial ships, where conditions are hard and the pay is low.

Cultural identity

Non-industrial fishing is linked to the cultural identities of coastal areas and it keeps alive experiential knowledge of its ecosystems that is not linked to technology. For example, non-industrial shellfishers know that if they cannot see any spider crabs it is because they are sheltering between the rocks, something that they begin to do a few days before a storm hits.[14]

[12] European Commission: *Green paper on the future of the common fisheries policy*, 2001.

[13] Matteo Milazzo: "Subsidies in World Fisheries: A Reexamination". *Note to the World Bank Technical Paper no. 406*, 1998.

[14] Antonio García-Allut: "La pesca artesanal, el cambio y la patrimonialización del conocimiento". *Journal of the Andalusian Historical Heritage Institute no. 44*, 2003.

IS NON-INDUSTRIAL FISHING THE SOLUTION?

To summarise, we can see that non-industrial or smaller-scale fishing is in general easier to sustain, is economically more equitable and cost-effective and is socio-culturally valuable. We should not think that it is a minority occupation or an obsolete remnant of the past; the majority of fisherman and the vast majority of fishing boats in the world are involved in non-industrial fishing and this type of fishing is of major social and productive importance in the Mediterranean: 80% of the European fleet in the Mediterranean consists of relatively small boats (under 12m in length) and therefore uses non-industrial fishing methods.

We have also seen that industrial fishing is less sustainable, requires the contribution of large sums of capital and only manages to be economically viable due to state financial aid which is much higher in the industrial sector than in the non-industrial sector (between 2000 and 2006 only 0.13% of European spending on fishing was for *small-scale coastal fishing*.[15] However, non-industrial fishing is not possible everywhere; this means that non-industrial fishing should probably be re-evaluated, seeking to complement the sub-sectors of industrial and semi-industrial fishing, making the scale and practices of these methods more sustainable.

Finding a balance

The **MSC** (Marine Stewardship Council) has created the MSC ecolabel, which *guarantees that the product comes from a well-managed fishery which has not contributed to the environmental problem of overfishing*. It has been criticised for certifying certain industrial operations of doubtful sustainability and for the fact that it has little capacity to certify small-scale fishing. However, this is nonetheless an interesting attempt to provide us with tools to encourage us to consume fish consciously. Nonetheless, we cannot use this tool in the Mediterranean because, firstly, there are no certified fisheries in the Mediterranean and, secondly, the label is almost non-existent in businesses in many Mediterranean countries (France, Italy, Spain, Greece and Croatia), while in the others it is entirely absent. For more information, see www.msc.org.

The **Slow Fish** initiative, which is part of the international Slow Food movement (www.slowfood.com) supports small-scale coastal fishing and promotes the consumption of varieties of fish that form part of our cultural identity. It organises educational activities and lobbies institutions to act for the more sustainable management of the sea. It is currently strongest in Italy.

AQUACULTURE

The other major source of fish is aquaculture. In recent decades the amount of fish that we have taken from the seas has remained the same while supply has increased thanks to the development of aquaculture. In 1970 this sector produced 4% of fish globally, while in 2006 it provided 21% globally with the exclusion of China. 83% of fish consumed in China comes from aquaculture, but as we will see this is aquaculture that produces a lower impact and requires fewer resources.

[15] Word Wildlife Fund: *Subsidios pesqueros europeos y medio ambiente marino. Caso español,* September 2003.

The different sources of fish

Aquaculture has also expanded a great deal in the Mediterranean, growing some 140% in 12 years.

Throughout the world, seaweed and some 240 species of fish and shellfish are farmed. These can be divided into two major aquaculture groups with very different characteristics.

AQUACULTURE FARMING OF MOLLUSCS

Bivalve molluscs are immobile animals that feed from the nutrients in the water around them (zooplankton and phytoplankton). This means that they can be cultivated with no radical change to their normal way of life, without the need for much technology (they can simply be stuck to a rope in the sea) and there is no need to feed them. Herbivorous fish (those that eat algae and plankton, such as carps) and some omnivorous fish can also be farmed by feeding them waste from agriculture or domestic animals, which means that this type of farming can also be small-scale and simple.

This type of fish farming is the most widespread throughout the world and has been used since ancient times to produce fish for home consumption or to supply local markets, particularly in Asia and above all in China (where 70% of global fish farming production takes place today).

This type of fish farming accounts for just over half of the aquaculture in the Mediterranean and is based on mussels, oysters and clams.

AQUACULTURE FARMING OF FISH AND CRUSTACEANS

Farming carnivorous fish or crustaceans (which eat fish, larvae, worms, etc.) is another story: they must be given fish to eat. In order for this to be cost-effective, a huge quantity must be farmed, which means that small-scale operations are not generally viable. In contrast to farming molluscs or herbivorous fish, farming this type of fish is a complex activity: installations are required (coastal pools or cages etc. in the sea) with a certain level of technology (the water should have controlled oxygen, pH, temperature, etc.), the food must be manufactured (this consists mainly of fish meal and oils and cereal), genetic selection takes place in order to obtain varieties of fish that adapt well to being kept in captivity or that have certain desirable genetic characteristics, etc.

This type of aquaculture has developed a great deal in recent decades, mainly due to the fact that it is impossible to fish more extensively in the sea. Species such as salmon, trout, gilthead bream, sea bass, turbot and prawns are farmed. Aquaculture in the Mediterranean focuses on gilthead bream, sea bass, eels and golden grey mullet. The way the fish are kept is very different from their natural living conditions. Since large numbers of fish are living in close proximity they get ill easily, which means they must be given drugs such as antiparasitic drugs, vaccines and antibiotics. They are also given additives such as colouring (when they are living in the wild, they take on the colour of marine nutrients).

Since aquaculture installations require major investments, they are only viable for supplying the markets in rich countries where the prices can compensate for the investment made. The majority of these installations belong to major companies in the North, although they may also be located in countries in the South, either because they are farming warm water species (prawns, for example)[16] or because the installations may be more profitable there (see box Salmon pink stories).

[16] See the "Trampas" section in *Opcions* issue 13.

Effects on marine ecosystems

Although the fish reared are in captivity, fish farming causes major changes to the marine environment. Waste from pools and cages (food, drugs, excrement, etc.) leads to concentrations of organic materials that are much higher than normal levels and some fish escape from the cages (90% of salmon living freely in the Norwegian fjords come from escaped stock from fish farms), spreading their diseases and altering genetic diversity.[17]

The sad story of bluefin tuna in the Mediterranean

The bluefin tuna is one of the largest fish to be found in the oceans (they can weigh up to 700 kg).

Tuna fishing has taken place in the Mediterranean for thousands of years, dating back to the Phoenicians and the Romans. However, for some two decades, the situation of this majestic fish has worsened dramatically. As early as 1999 a Greenpeace study estimated a decline of some 80% with regard to numbers 20 years before. Warnings were given by scientific committees about the unsustainable situation of the fish, due particularly to the catching of young fish.

Many industrial fleets in Mediterranean countries are dedicated to this lucrative business. However, international trade in the bluefin tuna is dominated by two major Japanese multinationals, while a major part of the catching and fattening of the fish is carried out by a few large-scale fishing businesses.

Different types of fishing exist, but by far the most commonly used is fishing with seine nets. Since the end of the 1990s there has been a boom in what is known as "fattening". Groups of tuna are traced using powerful technology (radar, satellite, aeroplane, etc.) and are trapped alive in a seine net by large industrial fishing boats. They are then "towed" to what are known as fattening farms near the coast, where they are directed into cages. There, they are fed with small fish that are generally caught in far-away seas (for example in West Africa). In 2004, it was estimated that 225,000 tonnes of fish were fed to caged tuna in the Mediterranean.[18]

No one knows the real figures for tuna caught as many catches are not declared.[19] Some estimates suggest 44,000 tonnes caught in 2005.[20] This is some 37% more than the "legal" quota agreed among governments, which in turn exceeds the quota recommended by scientists. It can therefore be said that the real number caught exceeds the amount recommended by scientists by around 77%.

As well as marine ecosystems and the tuna population and the danger that this type of food may be unavailable to future generations, there is a long list of direct and indirect consequences of this problem. For example, societies in faraway places, some-

[17] Salvador Arijo: "La acuicultura: una actividad muy alejada de la sostenibilidad". Journal of the Spanish association Ecologists in Action: *El Ecologista*, Spring 2005.

[18] Tudela, *S. Risk on local fish populations and ecosystems posed by the use of imported fish by the tuna farming industry in the Mediterranean*. Programme WWF 2005.

[19] Annual Report 2004-05. International Commission for the Conservation of Atlantic Tunas. A multilateral body responsible for the conservation of bluefin tuna, which consists of the governments of 41 countries, plus the EU.

[20] Greenpeace estimates based on ICCAT figures; a specialist ATRT consultant and the Lovatelli study for the FAO 2005.

What do we get from fish?

times with nutritional problems, such as in West Africa, see fish caught in their waters transported to other parts of the world to be fed to caged tuna. 25 kg of bait fish is required to generate 1 kg of tuna. Turkey, for example, imports 95% of the fish used in its fattening farms.

The population of small fish in the Mediterranean is also affected by the situation. Croatian tuna farms, for example, use thousands of tonnes of anchovies from the Adriatic Sea despite the fact that these fish are only now recovering from a collapse in their numbers caused by fishing.

Local fishermen are also clearly affected. For example, conflicts have occurred in Spain because local fishermen have noticed a decline in the catch of small fish, which have been scared away by the presence of fish farms and the large boats that capture the tuna (a major predator). Fishermen using trap nets (a thousand-year-old tuna fishing system in the Mediterranean that is considerably more sustainable and creates far more jobs) have even taken part in demonstrations in the south of Spain alongside environmental groups, demanding drastic policies to control the plundering of the bluefin tuna in the Mediterranean.

Other sectors are also affected, such as tour operators in Malta, who have complained about the pollution generated by tuna farms.

At present, some governments set quota levels that are far higher than those recommended by scientists and do not take effective measures to control illegal fishing (catching more fish than stipulated in the quotas and unregistered fishing, which is widespread). Subsidies have even been given (at least 19-20 million have been distributed by the EU) for the modernisation of industrial fleets used to fish for bluefin tuna, contributing to the sector's excessive capacity. In fact, the total capacity of declared tuna farms is 60% greater than permitted maximum catch levels, which generates a strong trend for exceeding quotas.[21]

Fortunately there are also some hopeful examples. In Spain, for example, it was announced that for the fishing year 2006, tunas should be labelled to indicate whether they had in fact been fished within legal quotas.

WHAT ARE THE SOLUTIONS?

On an individual level

We can ask the fishmonger what tuna they are selling and where it comes from. The environmental organisation WWF has called for a boycott by consumers and supermarkets of the sale of bluefin tuna in the Mediterranean.

On a collective level:

We can support organisations fighting for the creation of protected areas where tuna can reproduce and an emergency plan for quotas and controls as a response to the current situation.

[21] Figures from the report "El estado del Atún rojo en el Mediterráneo" Greenpeace. June 2006

STORIES IN OTHER REGIONS

Until not long ago, the salmon was a little-known fish reserved for people of a certain status or for very special occasions. With the industrialisation of salmon production, the price has decreased and consumption has become widespread. The graph shows this evolution for the region of Catalonia, in Spain.

At the end of the 1980s, levels of wild salmon and farmed salmon in the traditional areas (the Nordic countries) came to a standstill, but demand had already begun to grow, as had the industry to supply this demand. The solution reached was to move the production of farmed salmon to Chile, where this species is not native to the marine habitat.

Today, Chile is the main global salmon-producing country, exporting almost all of the salmon produced (98%) to the USA, Europe and Japan. 71% of this trade is controlled by 12 companies, of which 6 are Chilean. Of every 100 dollars made from salmon exports, 4 go to salaries and 40 are profit. The salmon-producing region in Chile has gone from being the sixth in terms of family income to being the second last (12th); it is the region with the highest education problems and greatest number of socially vulnerable people in the country.[22]

Peru is the main global producer of fish meal by a long way. A study commissioned by the World Bank and carried out in 2006 shows that this economic activity leads to *significant losses in rent and high environmental and social costs for the Peruvian State… generating huge foreign-exchange earnings that benefit a minimal fraction of the industry*. For example, the State receives 5 dollars for each tonne of fish meal exported, while its market price is between $600 and $1,400. The profits of just one company (the largest in Peru) are 10 times higher than the State income generated by the country's entire fishing industry.[23]

IS AQUACULTURE THE SOLUTION?

The FAO anticipates that by 2030, most of the fish that we eat will come from aquaculture (of all the different types). Many put aquaculture forward as the solution to the absence of growth or the reduction in fishing levels and even suggest that it could be a major contender for providing the world with animal protein. However, with regard to aquaculture that uses fishmeal (the farming of carnivorous fish and crustaceans, which accounts for 35% of aquaculture globally),[24] which is the type that is growing most quickly, there is a major limiting factor: the production of fish meal currently consumes one third of fish caught in the sea and it does not seem possible to increase this volume of fish given the poor state of fish stocks; in fact the opposite seems to be the case. This means that there will be no food available to feed fish reared in captivity.

How will we feed farmed fish?

Those who have an optimistic vision of the development of aquaculture state that wild salmon eat more fish than farmed salmon in order to reach the same weight.[25] Critics of the method, however, go beyond a simple calculation of the kilos of fish ingested and note that within the marine ecosystem, stocks of salmon (like that of any other species) will grow according to stocks of the fish it eats, maintaining a balance. In fact, in the case of the anchoveta, the species which is used most in the production of fishmeal (57%), two of the main fisheries are overfished, while of the next 5 most-used species, 4 of them are also overfished.

[24] F. Piferrer: *Las dos caras de Jano de la acuicultura: necesidad de recursos marinos y riesgos ecológicos*. Opening paper of the X National Aquaculture Conference.

[22] Ferran García: *Salmones en Chile. El negocio de comerse el mar*. Veterinarians Without Borders 2005. Available at www.notecomaselmundo.org > Salmón.

[23] Brian O'Riordan: "Fishmeal fishery: Golden goose or albatross?" *Report in Samudra no. 46*, March 2007.

[25] European Parliament: *The fishmeal and fish oil industry. Its role in the common fisheries policy*. Working paper, March 2004.

How much fish can we eat?

The option has also been put forward of substituting fishmeal with plant meal and oils from sources such as soya. However, to date it has become clear that many species cannot cope with this change in diet, which would additionally exacerbate the problem of the intensive cultivation of soya and other plants.[26]

Could farmed fish mean an end to fish?

Pro-aquaculture sectors maintain that 90% of species used for fishmeal do not have significant alternative markets for human consumption. In addition, they say that since a large part of fish for fishmeal comes from non-industrialised countries, exporting this fish provides these countries with valuable income that helps them to develop. Sectors that are critical of the practice state that these fish could indeed be used for human consumption.

In Peru, which is the main global source of fish used as feed in the aquaculture industry, the anchoveta fishing fleet is so oversized (its capacity is more than five times larger than the maximum catch allowed in abundant years and the capacity of processing plants is 20 times greater than this maximum) that it invades the 5-mile zone reserved for non-industrial fishing that provides the local population with fish. This small-scale fishing has seen catches decrease by 40% in just six years. Now a quarter of non-industrial fishing is for shortfin squid, a species that was previously not widely consumed and which provides fishermen with lower levels of income than the traditional hake, the population of which has decreased, probably due to the fact that one of its main food sources is the anchoveta. One in five Peruvian children suffers from malnutrition, a figure which could be reduced by half if just 10% of the anchoveta catch was used for human consumption.

In the face of these dilemmas, one approach could be that it is perhaps more realistic to see aquaculture not as a solution but as complementary to traditional fishing, looking for more sustainable options based on farming herbivorous animals such as molluscs.

There are some facilities that, although they farm carnivorous fish (and therefore feed them with fishmeal), do try to opt for less intensive farming methods. This has been called ecological aquaculture and is a sector that is currently being developed but that is still very marginal. In some countries we can find salmon, trout, sturgeon, etc. and in certain places, such as Spain for example, businesses in the aquaculture sector have created a quality brand (*Crianza del Mar* or sea-reared), which is somewhere between ecological and conventional aquaculture.

3. How much fish can we eat?

The authorities have been warning us for many years about unsustainable fish consumption, such as the consumption of young fish. *"El mar no tiene límites"* (The

[26] The monoculture of genetically modified soya for exportation, which is very widespread in some countries in the South in order to supply industrial farming, causes major environmental and social problems. www.lasojamata.org.

sea has no limits), is the advertising slogan for a certain company that manufactures engines for fishing boats and the feeling that contemplating the immensity of the ocean arouses in us. However, seeing the number of tonnes of fish that a large trawler can catch in a single day (these are fishing nets in which 16 Boeing 747 aeroplanes would fit), a doubt emerges: is this "unlimited" source of fish really "inexhaustible"?

Fishing does not *produce* fish, instead *removing* it from the environment; it is the equivalent of hunting land animals, which today has practically disappeared as a significant food source in industrialised countries. In fact, the amount of fish that we remove from the sea has remained roughly the same since the end of the 1980s; since then, increases in the global supply have been due to the development of fish *farming*: aquaculture.

IS THE FISH RUNNING OUT?

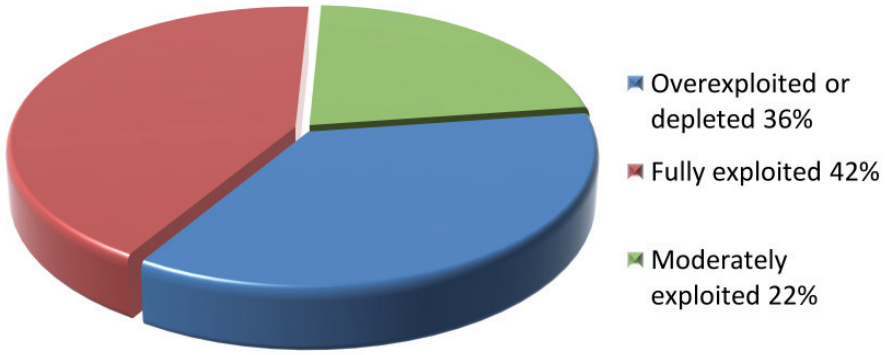
The second graph shows FAO estimates of the state of exploitation of different fish species; to summarise, half of these species are at the maximum level of exploitation, quarter are below this level and quarter are already overfished or have been exhausted. After many years of growing significantly worse, the situation has stabilised in the last 10 years, although the proportion of fish populations at the maximum level of exploitation continues to increase gradually. According to the European Commission, in community waters *many stocks are at present outside or almost outside safe biological levels [..] If current trends continue, many stocks will collapse. Improvement in the state of many fish stocks is important.*[27]

In autumn 2007, a group of 14 marine scientists from different countries published a study in the influential journal Science that had been carried out over four years in which they predicted that, if the current rate of fishing continued, *in 40 years the catches of marine species that we habitually consume will reduce by at least 10%.*[28] Some see this as overly alarmist, while others see it as reasonably realistic; there are different responses to the question "Is the fish running out?" depending on who we ask.

In the particular case of the Mediterranean, the situation is no different; we could even say that it is slightly worse, particularly in terms of the species that have dropped below the sustainable limit. The hake can be taken as an illustrative example of the dynamic of fish stocks in the Mediterranean. There was a continual increase in amounts caught from the 1950s onwards. This reached its peak in 1985, but since then has fallen fairly sharply to below half of the levels in the 1980s, due to poor levels of stocks.

Making a general assessment of the situation of fisheries in the Mediterranean is quite complex due to the number of countries involved and the scattered and diverse nature of fishing fleets. There is also a lack of continual and global studies that would enable a reliable assessment to be made; in fact the FAO estimates that there is an absence of significant information concerning some 20% of fishery resources in the Mediterranean. All of these factors mean that there is considerable scope for uncertainty.[30] In fact, we can see that there are differences between the data for the FAO and the European

The state of known fisheries in the Mediterranean. FAO 2004 [29]



[27] European Commission: *Green Paper - The Future of the Common Fisheries Policy*, 2001.

[28] Boris Worm et al: *Impacts of biodiversity loss on ocean ecosystem services. Science* journal vol. 314, November 2006.

[29] *Review of the State of World Marine Fishery Resources*. Rome, 2005.

[30] FAO Fisheries Department: *Review of the State of World Marine Fishery Resources*. Rome, 2005.

How much fish can we eat?

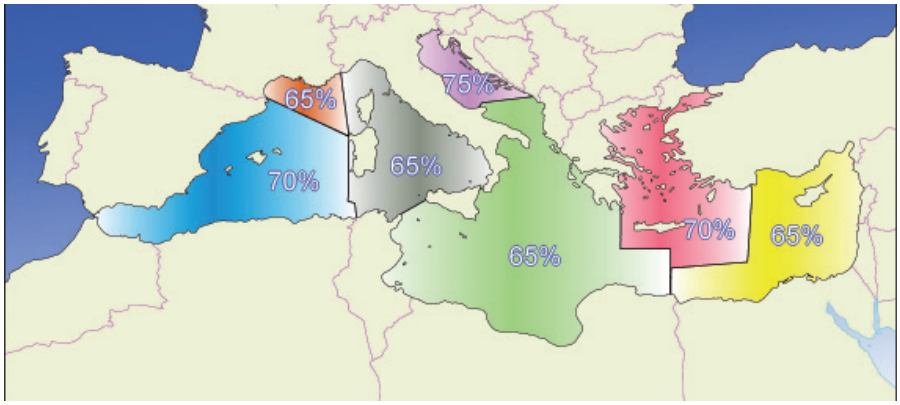
Environment Agency that point towards the same trend.

It can also be said that although there are variations, the situation is similar in the different regions of the Mediterranean.

which means that the vast majority comes from other seas.[31]

The most optimistic sources (some governments, the industrial fishing sector and some scientific fields) reiterate scientific uncertainty and the fact

Percentage of overfished commercial fishing grounds in the Mediterranean

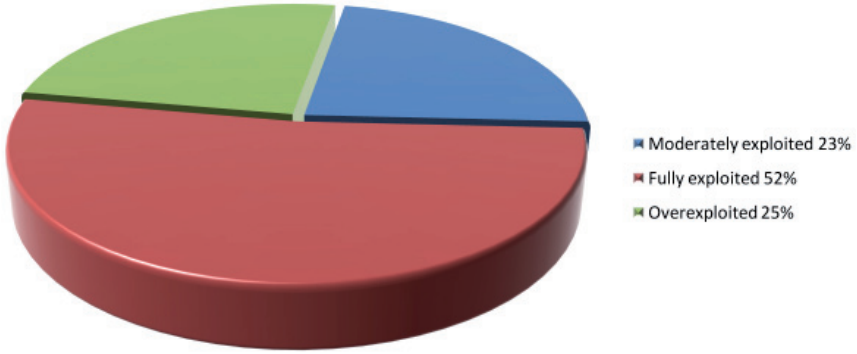


Source: European Environment Agency (2002). Environmental signals 2002. EEA. Fisheries, pp.-54-59.

In any case, consumers in the Mediterranean countries cannot stop at just analysing the situation of their own sea, as a very large proportion of the fish that they consume comes from other seas and oceans. For example, in the case of a highly populated region on the Mediterranean with significant fishing activity such as Catalonia, only 18% of the fish consumed in the region is caught there,

that, according to the FAO, the trend has stabilised.[32] They feel that there is a tendency towards alarmism and excessive caution and highlight the positive aspects of fishing on a socio-economic level (jobs, wealth generated, the market demand for protein, etc.); although, as we saw above, some of these aspects are less significant in the case of the most industrialised fishing methods.

The state of global fisheries FAO 2004



The assessment made by the most highly critical (environmental organisations, scientists and some governments and institutions) is that, while the figures provided by the FAO are worrying, the reality may be much worse. This is firstly because the figures are provided by governments that in some cases may have an interest in not recognising certain situations or may simply be lacking good studies (something indirectly recognised by the FAO itself); and secondly because the methodology used in the studies is reductionist (in fact, one of its creators now advises against its use)[33] as it studies species in isolation rather than studying the global situation of the ecosystems concerned.

It is probably impossible to make a definitive diagnosis of the fishing situation. One thing on which all of those involved agree, however, is that a close watch should be kept on the situation and that a joint effort is required to manage it. We can see indications that this inexhaustible source of fish is in fact beginning to reach certain limits:

- In the last 50 years, the proportion of fish in the middle of the food chain caught has increased, as stocks of fish at the top level, which are less numerous, has reduced due to the impact of fishing.[34] Of the major predators such as tuna, swordfish or salmon, only 10% of the pre-industrial population remains.

[31] Statement in *La Vanguardia* newspaper by the President of the Guild of Fish Wholesalers of Barcelona. "Vivir (Living)" section. 12 September 2007.

[32] *Pesca Internacional* journal no. 73, December 2006.

[33] In 1992, Ray Beverton made a critical reassessment of the way that his own MSY (Maximum Sustainable Yield) methodology is used. The method was created in 1957 and is the current basis for governmental management and assessment systems.

[34] D. Pauly et al: *Fishing down marine food webs. Science* journal vol. 279, 1998.

- Species that were previously not commercially valuable are beginning to be seen as such and on some occasions the fish we buy is not in fact the species we are told as there are insufficient numbers caught to supply the market. For example, we are sold conger eel as hake, halibut as sole or brill, shortfin squid as common squid, etc. This is more common for filleted fish, where it is more difficult to detect.
- The proportion of fish that arrives frozen is increasing (for example in Spain in the last 10 years it has increased from 30% to 67% and on a global level it has grown from 28% to 36%),[35] because it is being brought from increasingly far away.
- Increasingly small fish are being caught, as to maintain the volume of fish caught it is not possible to wait for them to grow. In some Mediterranean regions such as Alicante (on the Spanish coast), only 6% of the hake captured were above the legal minimum size.[36]
- More and more *fishing effort* (going to new areas, to deeper waters, etc.) has to be made in order to fish the same amount or even less. It is now more economical to farm certain species than to fish for them, despite the fact that farming them is very costly.

CAN WE CATCH MORE FISH THAN THERE ARE?

Why are marine stocks becoming so depleted? This is no doubt because fishing takes place as though the sea really has no limits, helped by the technology that constantly allows us to go beyond our natural limits. It is increasingly easy to locate shoals of fish using radar, satellite and aeroplanes etc. and then to reach them more quickly, fish for them more quickly and for longer, etc. Current fishing methods include *supertrawlers*, enormous ships (124 metres in length) which have the potential to trawl with nets in which 16 Boeing 747 aircraft would fit.

According to the institutions that deal with fisheries managements, including the FAO and the European Union, we have reached the point where the global fishing fleet that we have built up has more capacity to fish than the marine ecosystems can sustainably supply. In the 1980s global fishing capacity grew almost twice as much as the average growth of global fishing catches. Around three quarters of this capacity corresponds to the large-scale industrial sector.[37] In recent years attempts have been made to put an end to this excess capacity, but this has not happened effectively; according to the FAO, one new ship can catch as much fish as three ships before 1980.

ARE WE DEPLETING OR PRESERVING?

There have been several examples in recent history of fishing grounds that have been fished to the point of the commercial extinction of a species (the species does not disappear entirely but can no longer be fished because there are so few fish left that too much effort must be made to catch them). One of the most emblematic cases of this is the **cod of Terranova**, which became the most important fishing ground in the world. From the 1950s onwards, the industrialisation of fishing fleets brought with it a period of unchecked fishing that was already beginning to have an impact by the mid-1960s. In spite of the warnings given, particularly by local fishermen, overfishing continued and by the

[35] Consultora Ceinsa: *Plan Galego de Acuicultura de la Xunta de Galicia.*

[36] García-Rodríguez M. & A.Esteban (2002). "Population dynamics of the Mediterranean hake (Merluccius merluccius) in the gulf of Alicante (se. Iberian peninsula)". Working Paper no. 5. GFCM. Rome 2002.

[37] A. Platt: *Promoting Sustainable Fisheries, in the State of the World 1998* (report by the Worldwatch Institute for the Environment and Development). Icaria Editorial, 1998. http://www.worldwatch.org/node/1037.

Non-industrial fishing versus industrial fishing

1. In 2000, a campaign led by non-industrial fishermen and environmental groups convinced the European Union to **prohibit the use of drift nets in the Mediterranean and the Cantabrian seas**, which meant that in three years the situation of the bonito improved greatly. These groups are still fighting for their cause, however, as trawling is still permitted as a method of fishing for bonito.

2. For the last few years, the fishermen's associations from all along the Cantabrian coast (the main Spanish fishing area, where non-industrial fisherman represent a clear majority) have come together to denounce the devastating effect of semi-industrial coastal trawlers. As part of their campaign, they have reprinted **The Cedeira Charter** several times–a document in which they warn that they do not want to see the same thing happened as happened with the anchovy in the Bay of Biscay (the gulf between Spain and France that has been completely overfished) happen to the hake and the mackerel in the Cantabrian Sea. They request clearer controls on the use of trawlers, a revision of the minimum size of fish that may be caught, an increase of the closed period from four to six months and the creation of marine reserves to protect reproduction areas. Since the first charter in 2000, there has been a response to some of their requests, which have been put into practice, and the situation of hake stocks has noticeably improved.

3. Another example in the **Mediterranean** of conflict between unsustainable industrial fishing and sustainable non-industrial fishing is the case of the **bluefin tuna, which we looked at previously**.
Families of fishermen who use trap nets (a non-industrial type of tuna fishing) in Spain and Morocco, as well as environmentalists, organised a demonstration with the title *Por el Atún Rojo, Por Nuestros Hijos* ("Protect the bluefin tuna, protect our children") before the approximately 500 delegates at a meeting of ICCAT, the body responsible for the management of bluefin tuna, among other species. A representative of the fishermen summarised: "Fishermen who use trap nets are only asking for sustainability, because this will determine the future of thousands of families and because a significant proportion of the industrial fleet is systematically violating the conservation measures protecting this common resource, exhausting a fishing ground that is 3,000 years old in just a few years."[38]

1990s there were no fish stocks left. In 1992 Canada was forced to close the fishing ground entirely for an indefinite period, which meant that 40,000 people lost their jobs and their way of life. It was not possible for local fisherman to travel to other cod fishing grounds, which is what the industrial ships that had exhausted the stocks did. More than 10 years have passed since then and the fishing ground has not yet recovered.[39]

On the other hand, there are also some examples where restrictions that were made in time following the demands of fishermen along with civil organisations were able to avert a situation of possible exhaustion of stocks by limiting the unsustainable exploitation of resources.

[38] http://www.wwf.es/mares_atunrojo_manifestacion.php.

[39] "Sights & sounds of global fisheries." *National Geographic Magazine*, April 2007.

NOT JUST FISHING

It has been said that *we take too much from the sea but we also leave too much in the sea*. Our fishing activity has a major impact on the marine environment, but also has an effect in terms of air pollution, waste discharge on land and from boats, climate change, construction along our coastlines, the dredging of the ocean floor, etc.

In fact, in the Mediterranean some 80% of marine pollution is generated on land. The major causes of this are diffuse pollution from industrial agriculture; chemical pollution from industry; organic and microbiological pollution from wastewater (industrial, domestic, etc); various types of rubbish; and solid and hazardous waste, with an estimated quantity of between 30 and 40 million tonnes. This is combined with the erosion of the coast due to coastal construction, the extraction of sand, and the construction of jetties, etc. which have reduced the flow of solids out of the sea by some 90% in 50 years. On the other hand, there is the important phenomenon of the introduction into the sea of non-native species as a result of human activity; it is calculated that some 500 invasive species have been introduced, 64% of which enter as a result of maritime traffic from the Suez Canal. All of this generates a process of destruction of coastal marine habitats and a loss of biodiversity that will have a significant effect on fishing. The Mediterranean is one of the most threatened seas in the world, with 104 species recorded as being in danger of extinction.

These imbalances in marine ecosystems generate problems for fisheries, as we have seen, but also have varied and sometimes unexpected effects, such as plagues of jellyfish along the Mediterranean coast, with some summers being reported in the media due to the threat that they pose to tourism.

The importance of the high-quality food provided by the oceans and the millions of people who make a living from the sea should be sufficient reasons for us to seriously reconsider our relationship with the sea. As citizens, we can demand the brave and effective management of the sea and its resources by our governments, while also supporting organisations that are fighting for that very cause.

In the Mediterranean, for example, Greenpeace has proposed the creation of a network of marine reserves that would protect 40% of the surface area of the sea, in order to guarantee the reproduction and sustainability of fish stocks. Other organisations are also fighting on an international level to defend the oceans and there are probably local organisations near where you live that are involved in this same fight (www.greenpeace.org, www.wwf.org, www.oceana.org,).

As well as this, as conscious consumers with a desire to change unsustainable practices, we also have the power to use our consumption choices to bring about change; we can reduce our fish consumption and include the criteria in the easy guide when we go shopping.

4. Where we buy fish

FISHMONGER OR SUPERMARKET?

There are two main routes for selling fish: supplying fishmongers and supplying supermarkets and frozen food chains.

There are lots of **fishmongers** (including those in local markets) and each of them deals with a fairly small volume of stock. The majority buy their fish in a *central market* (these are markets where producers and distributors sell their merchandise wholesale to retail traders), either directly or through distributors; here they will find fish from all sources (fish that has been fished nearby or far away and also farmed fish). Some fishmongers also buy their stock in special wholesale fish markets located in fishing ports and managed by associations of fishermen, where the fishermen sell the catch they have made that day, usually wholesale and by auction; buyers are usually distributors, fishmongers and restaurants. The fish sold at these markets is usually from local non-industrial and not very large semi-industrial fleets.[40]

Supermarket and hypermarket chains belong to a small number of companies that sell large volumes (as each chain has a large number of outlets). Their suppliers are usually industrial fleets and fish farms, where the product adapts very well to supermarket criteria: standard sizes, regular deliveries, etc. The largest chains buy directly from their suppliers and in fact order their stock in advance, while smaller chains use wholesalers that specialise in large volumes and which are separate from the central markets. This is the same route used to supply frozen fish companies. Some smaller supermarket chains on a local scale do not use this route, instead buying their fish from the same places as the fishmongers.

We can therefore see that in all types of fish businesses we can find fish coming from industrial fishing in the open sea, both fresh and frozen (although fishmongers usually sell little frozen fish). We saw in point 2 previously that this fishing sector has major social and environmental disadvantages and to this we can add other disadvantages:

[40] The fish from industrial fleets also pass through the central wholesale fish markets, but only to be recorded. However, it seems that this "formality" is often ignored.

- **Poorer quality:** in many cases, what is sold as fresh fish can be semi-frozen: since it is caught several days before it reaches the store (up to 8 or 10), in order to ensure it keeps well the fish is gutted and sometimes the head is removed when it is caught, and it is kept at between 0 and 3 degrees.
- **Worse for climate change:** In Catalonia, 82% of the fish consumed comes from elsewhere and 21% of the imported fish that is brought to the central fish market in Barcelona arrives by aeroplane.[41] We should also remember the energy needed to keep the fish cold throughout the distribution chain.

We will also find farmed fish of the species that are reared in captivity in all types of outlets. Sometimes the same species will be available from the wild, at between two and four times the price.[42]

The advantage of fishmongers is that it is **more likely that they will have fresh coastal fish** than a supermarket, particularly in coastal areas, although this type of fish will not be in the majority. The idea, then, is to look for fishmongers that offer this type of local coastal fish. In this way we can also support the local economy.

There is a third way that fish reaches the stores, which is **direct sales** from fishermen's associations to consumers, restaurants or stores. This is still very much the minority route, but it is currently expanding quickly as for many fishermen it is difficult to sell their catch at the same price as imported fish. This is why many fishermen's associations, particularly of semi-industrial fishermen, are organising into collectives so that they can increase their bargaining power in relation to wholesalers, differentiate their fish using quality stamps, or sell directly to consumers with consumers setting the price they pay themselves.[43]

Non-industrial fisherman do not have as much of a need to open new sales channels as their fish stands out because of its far higher quality, which means that it continues to fetch high prices on the market.

What is interesting for consumers is the opportunity to learn more about fish and perhaps to buy it more cheaply while allowing the fisherman to take a larger cut of the price by avoiding middle men (usually, between the wholesale fish market and the fishmonger the price of the fish increases threefold).[44]

LONXANET: AN EXAMPLE OF DIRECT SELLING FROM NON-INDUSTRIAL FISHING

In 2001, four non-industrial fishermen's associations from Galicia got together to create the company Lonxanet[45] (their number has since increased to seven), with the aim of selling fish caught using non-industrial methods at a real price and at the same time raising awareness of the cultural background hidden behind this practice, which dates back hundreds of years. The company works to encourage mutual support among non-industrial fishermen from different countries, manages two protected marine areas, provides marine tourism and has created a foundation working towards sustainable fishing.
Direct sales through Lonxanet are based on advance orders. Customers order the fish that they want before it is brought in to the port (the day before or the morning of the same day); the different fishermen can then be informed of estimated sales so that they have an idea of what they will need to catch, saving themselves from unnecessary fishing efforts.
On arrival at the different wholesale fish markets, the fish is bought by Lonxanet itself and then transported to a reception and distribution centre in A Coruña, where it is packed and loaded for distribution to the different clients (mainly individuals and restaurants).
Lonxanet is perhaps the only direct sales initiative in Spain where the fishermen are exclusively non-industrial, although in low seasons it does receive supplies from other Galician fleets.

[41] Own figures based on statistics from the Statistical Institute of Catalonia.

[42] Mercabarna: *Informació setmanal i acumulada per productes: preus mitjans,* 2007.

[43] "El sector pesquero apuesta por la diferenciación del producto y por nuevas vías de comercialización". Article as part of the VIII Seminar on marketing the products of the sea, June 2007.

[44] Own figures based on data from the Ministry of Agriculture, Fisheries and Food.

[45] www.lonxanet.com.

Fishing and climate change

Although this may be surprising, fishing is an activity that uses a great deal of energy. This aspect is much more closely linked to industrial and semi-industrial fishing and is greater the bigger the boats, the extent of mechanisation, the size of the nets and the distances travelled. The energy is used mainly by the vast motors that move the boats and the kilometres of nets, as well as by the freezers.

An energy balance of 0.5 implies that in order to fish half a calorie in the form of sardine, one whole calorie (double the amount) has been invested in the form of oil and this is without counting processing and transportation.[46]

Bottom feeders (hake, sole)	from 0.02 to 1
Small pelagic fish (sardines or anchovy)	0.5
Large pelagic fish (tuna)	0.02

5. At home

Fish is highly perishable. Preserving it well will allow us to enjoy it fully and will prevent it from going to waste. Almost all of the fish can be used, and if we know how, we can make three meals from it instead of one!

REFRIGERATION

Fish can last for two or three days in the fridge, but should not be left uncovered. We can help it last for a few days longer by covering it with ice and a damp cloth, or by vacuum packing it. Alternatively, if we put the fish in brine, lemon or vinegar, it can last for over a week (a refreshing option for the summer). Don't forget it's there! If it begins to go off, rinse the fish to remove the bacteria from the surface and cook it, or dry it well and wrap it in greaseproof paper or cling film before storing it again.

FREEZING AND DEFROSTING

If fish is not to be consumed in the next few days, it should be frozen as soon as possible.

The sooner fish is frozen, the better it will keep (that way you prevent it from losing water and stop crystals that cut into the flesh from forming). This will work in a powerful freezer; it should be at least -18ºC. The best way to freeze fish is by wrapping it tightly in cling film (that is suitable for food use) so that it is not in contact with the air. It is practical to freeze fish in portions depending on how we intend to use it later.

In contrast to this, it is a good idea to defrost fish slowly, so that it loses a minimal amount of water (where much of the proteins, vitamins and minerals are stored). Put the fish in the fridge 24 hours before you want to cook it, covered and with a rack underneath so that it is not lying in the liquid it loses. Another good method is to submerge the fish (without unwrapping it) in cold water with ice cubes a few hours before eating it.

Once the fish is defrosted, it must not be frozen again unless it has been cooked first.

MAKING THE MOST OF IT

The bits are not usually eaten (head, tail and bones):

- These can be used to make excellent stock for soup, rice or noodle dishes, which will also ensure you make the most of the nutrients in the fish. These bits will keep well

[46] D. Pauly (et al.): *The future of fisheries*, www.fisheries.ubc.ca/members/dpauly/journalArticles/TheFutureOfFisheries.pdf.

when frozen. If you do not have enough, you can freeze pieces in a bag and add more each time you make fish until there is enough there to make stock.

- They can be given to cats or chickens to eat.
- They can be dried and ground and then used as plant fertiliser.
- They can be thrown out with the other organic waste.

LEFTOVERS

Fish that has been cooked and not eaten can be used in other dishes:

- Croquettes and similar dishes.
- Cut up in summer salads: with chick peas and fresh herbs, with peppers and onions, etc.
- Omelettes made with fish sautéed with garlic and parsley, etc.

If there is only a small amount left over, it can be stored in the freezer and more leftovers can be added until there is enough to make one of these dishes.

Some sources of information that we have consulted

Professional associations (Asociación Empresarial de Productores de Cultivos Marinos de España (Spanish Business Association of Marine Fish Farm Producers), the fishermen's associations of L'Escala, L'Ampolla and Cambrils (Catalonia) and Cedeira (Galicia), Confederación Española de Pesca (Spanish Fishing Confederation - a fishermen's and fishing boat owners' association), Cooperativa de Armadores de Vigo (Vigo Fishing Boat Owners' Association), Federación de Cofradías de Tarragona (Federation of Fishermen's Associations of Tarragona), Federación Nacional de Cofradías de Pescadores (National Federation of Fishermen's Associations), World Forum of Fish Harvesters and Fishworkers, Gremi de Peixaters de Catalunya (Catalan Fishermen's Guild)), **businesses** in the sector (Frigoríffics Ferrer, Mercabarna, La Sirena, Lonja de Blanes (Catalonia), Lonxanet, Mercabarna, Mercasa, Riofrío, various fishmongers), **academic centres** (the Toxicology Department of the Faculty of Veterinary Medicine and the Research Group for Aquaculture Pathology and Immunology of the Autonomous University of Barcelona, Institute of Marine Sciences of Barcelona–Spanish National Research Council, Spanish Institute of Oceanography, Ribepeix Programme at Rovira i Virgili University, Sociedad Española de Acuicultura (Spanish Aquaculture Society)), **experts** (Joan Lluís Alegret (social anthropologist), Antonio García-Allut (fishing anthropologist), Eduard Azuaza (chef), Ramon Franquesa (economist specialising in fishing), Alicia Langreo (agricultural engineer), Rosa Solà (culinary specialist), José Luis Sánchez-Lizaso (marine scientist)), **public bodies** (The Regulation and Organization Fund for the Fish and Marine Cultures Market of the Spanish Ministry of Agriculture, Food and Fisheries, FAO Fisheries and Aquaculture Department - Mediterranean division)), **books** (H. McGee: *On Food and Cooking. The Science and Lore of the Kitchen*, World Conservation Union - IUCN: *Interactions Between Aquaculture and the Environment*, Worldwatch Institute: *State of the World 1996, 1999* and *2003*)), periodicals (Distribución y Consumo, El Ecologista, Industrias Pesqueras, Pesca Internacional), **organisations** (Itsas Geroa Association, International Collective in Support of Fishworkers, Ecodesarrollo Gaia, Ecologists in Action, Greenpeace, Observatorio Galego de la Deuda y la Globalización (the Galician Debt and Globalisation Observatory), Puresalmon, Veterinarios sin Fronteras (Veterinarians Without Borders), Word Wildlife Fund-Adena) and all those referenced in the footnotes.

This document has been produced in collaboration with Alvaro Porro González of the **Centre for Research and Information on Consumption (CRIC)**, a non-profit Catalan citizens' association that has been working for more than ten years informing the public on responsible consumption. The CRIC publishes *Opcions*, a magazine that provides information for conscious and transformative consumption (www.opcions.org).

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