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PARLIAMENTARY OFFICE FOR THE EVALUATION OF SCIENTIFIC AND TECHNOLOGICAL CHOICES

REPORT

on

"Science's contribution to the evaluation of halieutic resources and to fisheries management"

by Mr Marcel-Pierre CLEACH,

Senator

Filed with the Bureau of the National Assembly
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C O N T E N T S

INTRODUCTION

"Sea fishing is free,
for it is impossible to exhaust marine resources"

Grotius, 1609

"A marine ecosystem is not an organism, it has no final function.
It can be a viable assemblage of abundant and prolific species
or a desert of mud, home to jellyfish and gobies."

Philippe Cury and Yves Miserey, 2007

Ladies and Gentlemen,

The role of the fishing industry is often summed up by way of a comparison: in the agricultural sector, it could be considered equivalent to tomato farming; in other words, of very little consequence to the French economy as a whole. If one also considers the fact that 85% of the fish consumed in France is imported, the French fishing industry appears as a marginal sector in little position to attract the attention of the public authorities, outside the occasional social crisis. Faced with such an apparently minor economic activity in constant decline, one might be expected to let the subject drop.

But can fishing be limited to the above considerations?

Certainly not, for fishing is an **essential activity**, in the literal sense of the term; in other words, **a distinctively human activity from the very beginning**. Like hunting and farming, fishing is a fundamental subsistence activity for predaceous, omnivorous man shaping his environment. Indeed, this particular form of hunting and gathering is as old as our species.

Moreover, fishing continues to play a fundamental role in human sustenance, **providing the world population with 20% of its animal proteins and representing the main animal-protein source for some one billion men and women**, essentially in the Southern Hemisphere.

Fishing is also essential because it constitutes a considerable harvesting of the Earth's "living production". Although not a form of farming, the fishing of wild stocks is becoming equivalent in scale and directly raises the question of its own sustainability. Indeed, when one examines the world's oceans, "mortality by fishing" - to use the scientific term - today dominates, outranking all other possible factors.

However, **on a blue planet, 70% of which is covered by oceans, man has reached the limits of its exploitation**. The oceans, which had previously seemed immense, inexhaustible and all-absorbing or all-tolerating, have now also become **a finite universe**, whose limits are set by the capacities of man and which is therefore **subject to management**. Less understood than even terrestrial biodiversity, marine biodiversity is a resource and asset for humanity whose importance and precious, unique and, indeed, irreplaceable character we are only now beginning to appreciate.

This is a cardinal point, for if through fishing we are reaching the limits of the oceans, we are also approaching **an essential limit of the Earth's ecosystem**.

Today, man is also forced to manage the oceans because **the maritime fisheries are in crisis**. Although this crisis was expected due to the overcapacities and obvious weaknesses of the management methods in place, it is no less serious for the fishermen affected, especially considering the exacerbating rise in fuel prices. These actors are more often than not the victims of an evolution beyond their control, caught up in the spiral of having to continue fishing to make their living, whatever the costs.

The general public has not been spared this fishing crisis now occupying the media's attention. This is evident at several levels, first and foremost with regard to the public's pocket book. The price of fish is rising and the public is the first to suffer. The public is then asked to consume responsibly by referring to a list of approved fish and fishing grounds so as not to buy any boycotted products. As can be seen at any fishmonger's, the fish available for purchase today are no longer the same: there are new, unknown species from distant or deep fisheries and mass-produced, inexpensive products from aquaculture. There are also those fish that are becoming increasingly rare and expensive. Finally, there is a rash of labels indicating origin, fishing method and geographic zone. While very much present at the fish stand, the crisis is difficult to decipher and understand.

This essential industry undergoing a prolonged crisis also stands out for being **one of the most scientifically-controlled economic sectors**. There is certainly no other sector, excepting that of high-technology, whose nature and volume are determined by scientific assessment. Total allowable catches (TAC), quotas and other management systems are the result of political decisions based on scientific data. Indeed, some believe that the fishing industry is or should be "science-driven".

The time has come for the political class and, in particular, for a member of Parliament belonging to the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST) **to consider the role of scientists and experts in the public decision-making process**. What should this role be? Should the scientific assessment be literally transcribed? Or is it instead flexible? If so, depending on what factor(s) and to what extent?

It is striking to note that within the fishing domain, no party seems satisfied by this scientific assessment. Scientists are unhappy because they consider themselves insufficiently respected, even completely ignored or scorned. Fishermen complain that their point of view does not receive sufficient attention and has little effect on the decisions made by scientists who, they claim, do not know the sea. Finally, NGOs seem to have rallied to the scientists' side against the fishermen and politicians and call upon public opinion to witness to the situation.

However, on what are managerial decisions to be based if not scientific data? Who are to decide public policy if not the elected representatives responsible for looking after the general interest?

In addition to these questions of fundamental importance for our modern societies, there are those concerned with the management of natural environments. Fishing represents the last great hunting-gathering activity carried out in wild nature. This was long a free, unrestricted activity, with fishermen removing as much as they could from an infinite resource. This is no longer the case. In several regions, fish stocks seem to have been exploited beyond a reasonable extent, thereby endangering the species. The fishing crisis also means that there is no longer any wild territory on Earth on which man's actions do not have a decisive impact. Today, all regions have been anthropized and among all those elements external to any given environment, man has the greatest impact. While the development of fishing is now nearing its limits, the demand for food by an ever-growing human population remains a strong source of pressure. **Is fishing, like its terrestrial predecessors, doomed to disappear as a habitual source of sustenance?**

One set of questions raised concerns the possibility of a "sea without fish"[1]. Is this outcome as near as it is inevitable? Can man afford to take this risk? How would the destruction of the marine environment affect the human race?

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[1] *The title of the book by Philippe Cury and Yves Miserey, Une mer sans poissons ("A Sea Without Fish"), Paris, Calman-Lévy, 2008, 283 pages.*

Another set of questions concerns possible alternatives. Can aquaculture replace fishing, just as animal husbandry succeeded hunting and gathering? Many believe so. Indeed, according to statistics and forecasts of the United Nation's Food and Agriculture Organization (FAO), this scenario is unavoidable. For the past two decades, aquaculture has accounted for all growth made in fish production. This trend is expected to intensify, with the fisheries remaining at their current maximum production and aquaculture representing by 2030 a source of production as great as fishing and providing the greater part of man's fish-based sustenance. However, is this realistic with today's aquaculture? Is it desirable?

Your *rapporteur* has undertaken this report commissioned by the Bureau of the Senate in order to answer all of the above questions, as well as to meet a certain **transgenerational responsibility**. The sea, fishing and wild fish constitute **a tradition, a civilization and a taste that together form a heritage that must not disappear**. Finally, fishing plays a major socio-economic role in several French regions.

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The questions raised by fish management are not only global in scale. They are also concretely embodied at the French and European levels. Since 1983, the fishing industry has been the subject of a common policy (the Common Fisheries Policy or CFP) set by the European Commission via a negotiation with the member states. This policy is at the heart of important, lively debates. The main actors, starting with Commission Member Joe Borg, are perfectly aware of its limits and would like to overhaul the policy. What is more, in a recent document, the European Commission approved the immediate and complete revision of the CFP. The present report is meant as a contribution of the French Parliament to this European-level debate and reflection, with a view to the publication in early 2009 of a document to serve as the point of departure for a wide-based consultation among EU member states and the concerned parties. The stakes are too high for us to choose not to rise to the occasion.

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It is worth clarifying the subject matter of this report. The term "halieutic resources" employed by this report could be misconstrued as taking into account freshwater resources (rivers, lakes, etc.) as marine resources. However, for the sake of clarity, it seemed more logical to here concentrate on the principal consideration: marine resources. The situation of freshwater species and continental or inland fishing depends upon a different set of issues.

However, it also seemed pertinent to include marine and coastal aquaculture in the present report. In the current context of stagnating world catches, it is aquaculture that is meeting the markets' ever-growing demand for fish. This sector is often seen as a panacea and constitutes a new frontier of research, as much for food production as for species conservation.

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Within this framework, your *rapporteur* will first present a quick overview of our knowledge of the oceans. I will then analyze the situation of the world's fisheries, before painting a more precise picture of the French and European fishing grounds. I will then conclude this report by considering the real prospects offered by aquaculture and by the measures that could be recommended to remedy the current situation.

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Before moving on to the report proper, your *rapporteur* would first like to take the opportunity to thank the scientists and various administrative services, both French and foreign, as well as representatives of the fishing and shipping sectors, with whom I was able to meet and who shared with me their analysis of the global fishing situation. These many meetings allowed for the formation of a diagnosis, of which this present report is the result. I would especially like to thank Philippe Cury, Director of the Centre de Recherche Halieutique Méditerranéenne et Tropicale ("Mediterranean and Tropical Halieutic Research Centre" or CRH) in Sète, whose work has played an important role in my consideration of this subject.

I. THE OCEANS DURING THE "ANTHROPOCENE" PERIOD

According to Paul Crutzen, the Dutch winner of the 1995 Nobel Prize in Chemistry, the Holocene period has come to an end. This geological epoch covering the past 10,000 years was first defined during the International Geological Congress of 1885 to describe an entirely new period of time marked by humanity's transformation from a nomadic, hunting-gathering society to a sedentary society practicing animal husbandry and agriculture.

According to Crutzen, the Earth has now entered the Anthropocene, a new era that began sometime around the late 18th and early 19th centuries with the Industrial Revolution. The Anthropocene is characterized by the decisive impact of man on the Earth's ecosystem. According to this view, man has become *the* dominant factor, outstripping all others that had previously prevailed. Having acquired the capacity to modify their environment, humans are thought to have an influence on world climate and to disrupt the balance of the Earth's biosphere. **All over the planet, man's exploitation of natural resources and his environmental impact is considered to prevail over any natural factors and/or fluctuations.**

Compared with the terrestrial ecosystems, **the oceans enter the Anthropocene little understood and in a situation of deterioration.**

Xavier de La Gorce, General Secretary of the French action at sea, sums up the situation of the oceans well when he writes: "Is it normal that today we know much more about outer space than we do about the sea [...] which alone covers 70% of the planet?".

Indeed, the oceans and their biodiversity remain infinitely less understood than the terrestrial ecosystems. Even the large emblematic species such as bluefin tuna, cetaceans, sturgeon and cod remain largely mysterious.

In the United States, the Joint Ocean Commission Initiative (JOCI) pointed out that while 400 men have climbed Mount Everest, 300 have entered space and 12 have walked on the moon, only 2 have penetrated the ocean depths, which remain the least explored of any territory. Deep-sea fishing has brought to the surface hitherto unknown species whose biology is little understood. Science lags behind fishing. Another example is offered by Claire Nouvian's 2006 book entitled *Abysses*[1]. Nearly a third of the organisms photographed are unknown species whose discovery was made possible only by their chance encounter with the exploratory submarine.

[1] *Fayard, Paris, 2006, 256 pages.*

Marine biodiversity is far from having been completely inventoried, including for the more well-known species. In the beginning of 2008, Bernard Séret, a researcher at the Institut de Recherche pour le Développement ("Research Institute for Development" or IRD), reported the discovery of twelve new species of sharks, rays and chimaeras between New Zealand and New Caledonia during a single month of exploration. During a period of fifteen years, 130 species of sharks had been described for the first time. In addition, this same researcher estimated that there undoubtedly exists between 1,500 and 2,000 species of sharks and rays, although only 500 have so far been identified. He explained that "Our current knowledge of sharks is based upon the study of only ten or so species. How can a fishery be effectively managed under these conditions?"[1]

Even while they remain insufficiently understood, the oceans, on the one hand, have been made vulnerable by global warming and manmade pollution and, on the other hand, are subjected to ever greater exploitation necessitating an ever more astute scientific management. This is felt directly by Fishermen, who view themselves as the victims of phenomena that are beyond their control, but the consequences of which they are often blamed for.

A. THE IMPACT OF CLIMATE CHANGE

Climate change impacts the oceans in multiple ways, which have long remained difficult to measure. It is not possible for your *rapporteur* to here enumerate all such effects. However, I would like to emphasize a few: acidification, desertification and species displacement, as well as chronobiological phase shifts.

1. Acidic oceans

Carbon dioxide present in the atmosphere is dissolved into the ocean, where it can be stored when the ocean serves as a carbon sink. This faculty of the oceans, considering their importance in the Earth's ecosystem, is a powerful factor of climatic inertia. But **the absorption of CO_2 also results in the acidification of the oceans** by increasing their concentration of hydrogen ions.

Since the beginning of industrialization, the oceans' pH has dropped from 8.2 to 8.1 and could reach 7.9 by 2100.

This situation could have **serious consequences by 2030 for a certain number of organisms using carbonate for their shell or skeleton**. For instance, a portion of "shelled" zooplankton, such as pteropods, could disappear in certain areas of the ocean due to overly-acidic water. This would also signal the disappearance of an essential link between the ecosystem's

[1] *Cited by Paul Molga, Les Echos, Wednesday, 6 February 2008, p.13.*

phytoplankton and its predatory fish. The same would hold true for deepwater corals - in particular, those off the coast of Europe - whose important role in the ecosystems we are only beginning to discover; two thirds could disappear by the year 2100.

These serious prospects remain the subject of scientific debate and the impact of acidification remains uncertain. Recent studies on a species of phytoplankton, the alga *Emiliana huxleyi*, tend to show that acidification does not necessarily entail a decrease in calcification. This very common species of alga is of particular interest because it uses dissolved CO_2 to carry out not only its photosynthesis but also to synthesize plates of calcium carbonate around its cell. A recent article by Debora Iglesias-Rodriguez et al.[1] published in the revue *Science* pointed out that acidification could, on the contrary, lead to an increased calcification and primary production. However, the resulting organic matter would be richer in carbon. According to French scientist Antoine Sciandra (CNRS, oceanography laboratory of Villefranche-sur-Mer), the difference in laboratory results could be explained by the particular method used: the dilution of CO_2, a method similar to natural conditions, rather than the hydrochloric acid method.[2]

2. The desertification of the oceans

A recent article by Jeffrey Polovina et al. published in the *Geophysical Research Letters*[3] has shed light on an expansion of the ocean's "desert" zones.

This researcher processed data from the past nine years on the colour of the ocean provided by the SeaWiFS (Sea-viewing Wide Field-of-view Sensor), in orbit around the Earth since 1997. This instrument is capable of identifying those zones devoid of photosynthetic vegetation and therefore barren because lacking the very first element of the food chain. **According to these results, the ocean's desert zones have grown by 6.6 million km² (15%) since 1998**, equivalent to twelve times the surface area of France. The most affected zone would be the North Atlantic, whose oceanic deserts would have grown by 8.3% per year.

These zones vary in size depending on the time of year, increasing during the winter.

This desertification could be explained by the warming of the surface layer of the ocean and a greater stratification, resulting in a decreased mixing with the deeper, colder layers rich in nutrients consumed by phytoplankton during photosynthesis.

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[1] *Science, 320, 336, 2008.*
[2] *La Recherche, no. 420, June 2008, pp. 16-17.*
[3] *Vol. 35, L03618, 2008.*

However, the article's authors believe it impossible to determine whether this trend is entirely due to climate change and whether it will continue at the same rate in the future.

These results could just as well be interpreted as demonstrating an acceleration of the phenomenon as the intervention of other factors, such as a yet unknown, natural variability.

In any case, this issue is very important, because it could have a considerable impact on the abundance of halieutic resources, concerning as it does the very basis of the food chain.

It is the subject of in-depth international studies; in particular, a joint programme between CNES, ESA and NASA is currently being set up in the Mediterranean (Moose 2). Its goal will be to complement the optic satellite observations that are hampered by cloud cover and the atmosphere. Buoys will measure the state of aquatic life by collecting long-term data on the colour of the ocean.

3. Species displacement and chronobiological phase shifts

Fishermen increasingly remark that the contents of their nets are changing due to global warming. These variations go beyond the traditional fluctuations that are normally observed.

The first consequence of global warming is **a displacement of species to the north**. A growing number of species from the subtropical zones or warm waters are seeing their populations increase in our waters. The most emblematic example of this phenomenon is the red mullet, now common in the English Channel and even in the North Sea.

However, certain species suffer directly from global warming and no longer find in our waters a zone propitious to their reproduction. The most famous example of this second phenomenon is the cod in the English Channel and even in a section of the North Sea. Too high temperatures prevent this fish from reproducing by killing its eggs.

Important Norwegian and Franco-Norwegian studies on Greenlandic cod and on the Barents Sea have allowed scientists to compare changes in water temperature, the cyclicity of Atlantic Ocean oscillations and the cod's food chain. In 2004, Johannenssen et al. were able to demonstrate that since the year 1900, the distribution of cod along the eastern coast of Greenland has varied according to temperature (the warmer the temperature, the further north cod are to be found, and vice versa). With regard to the Barents Sea, Cury et al. published an article in 2008 which closely examined the link between oceanic conditions and the abundance of phytoplankton, zooplankton, capelin, herring and cod.

The links of interdependence within the ecosystem are also time-based. During the most sensitive phases of an alevin's life – for instance, its

first few days – it needs to be able to feed upon one or several specific prey that are normally abundant at the time of reproduction. However, global warming frequently produces a time-lag between the plankton bloom and the moment of reproduction, thereby resulting in the latter's failure.

Finally, climate change seems to **amplify the consequences of overfishing**. In several ecosystems where upwelling occurs – accounting for 3% of the ocean's surface, but providing 30-40% of its productivity - global warming is thought to increase the waters' temperature-based stratification, to **limit the upwelling of deep waters** and to **weaken the trade winds**, all principal characteristics of these zones. Warmer and less "mixed", the surface waters would become less and less oxygenated as organic decomposition would become more and more concentrated. This natural mechanism would greatly favour the anoxia of those ecosystems devastated by overfishing, such as that of Benguela, where the disappearance of predators and pelagic fish allows for the development of invertebrates, jellyfish and gobies. Anoxia is also a very common phenomenon in the ocean depths because the phytoplankton are no longer fed upon and fall while decomposing. The lack of oxygen even forces lobsters to leave the water and invade the beaches of Namibia, where they consequently die of dehydration.

B. THE DIRECT IMPACT OF HUMAN ACTIVITIES AND POLLUTION

Pollution's impact on marine waters is poorly measured and it is difficult to determine its consequences on animal life.

Fishermen believe that they can directly measure the impact on their catches. They point out that while marine zones are less and less free, they are being subjected to an ever-growing number of activities that pollute or disturb the environment. They are more and more openly concerned regarding the outflows of rivers such as the Rhône, the Loire, the Seine and the Garonne. The PCB crisis gave voice to fishermen who previously were unable to make themselves heard in opposition to the industrial and, more generally, terrestrial interests. Fishermen are fearful that the entire "plume" at the mouth of France's main rivers may be polluted, thereby rendering fishing impossible.

This issue is of great importance for IFREMER ("French Research Institute for Sea Exploration"). In its 2007 activity report, of the 28 research projects or programmes under the heading "Monitoring, use and promotion of the coastal seas", 13 (or nearly half) were concerned with toxicity and pollution.

1. Plastics, macro- and micro-waste

Pollution in the form of plastics is one of the most readily visible examples of this phenomenon. Everyone has in mind the far from brilliant spectacle of beaches before their cleanup. Sailors often testify to the ever-

growing amount of waste that they encounter during their voyages. The perfect example of this form of pollution at the world level is the **"Great Pacific Garbage Patch"** (see Curtis Ebbesmeyer), a zone in which the central gyre[1] of the Pacific Ocean concentrates considerable quantities of waste. This area is said to be 1.25 times the size of France and to include more than 3 million tonnes of diverse plastics. While the area's microparticles of plastic, which are estimated to outweigh the zone's plankton by six to one, are continually disintegrating, they do not disappear.

2. 40% of the oceans' surface is greatly influenced by man

The issue of **measuring man's global impact on the marine environment** is the subject of numerous studies. A threshold was recently crossed by American researchers at the National Center for Ecological Analysis and Synthesis (NCEAS) under the direction of Benjamin Hapern of the University of California at Santa Barbara. They managed to draw up a special world map, published in the revue *Science* in February 2008[2], showing that **more than 40% of the oceans' surface is very strongly affected by human activities**. This map represented a real breakthrough, because up until then, measurements had existed only for localized impacts or the effects of only one or a few activities.

The researchers created this composite map in four steps. Firstly, they collected or created world maps covering all types of human activity having an impact on the marine environment, for a total of 17 activities, from fishing to climate change to pollution. They then estimated the ecological consequences of these activities and developed a method for quantifying the vulnerability of each ecosystem. The third step consisted in their combining the impact and vulnerability maps. Finally, they cross-checked the maps available on the state of the ecosystems with the results obtained concerning human activities and ecosystem vulnerabilities.

The authors felt that this map sounded an **alarm** for the state of the oceans, even though much of the damage remained hidden or was seen in an isolated manner. They admitted that they were astonished by the results, which were worse than they had imagined.

Indeed, large areas of the North Sea, the China Sea, the Mediterranean Sea and the eastern coast of the United States are extremely affected.

However, rather than constituting a hopeless observation, this map remains an ever-changing tool which will grow in precision with the improvement of the available data in a cooperative process involving the rest of the interested scientific community. Above all, **this map represents a**

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[1] *Circular current.*
[2] *14 February 2008, 319, 948-952.*

management and conservation tool to be used by government authorities in defining and optimizing protected marine zones and in developing an ecosystem-based system of management. Indeed, such a map can help authorities set priority zones and measures, by identifying not only the most- but also the least-damaged zones.

C. THE SCIENTIFIC CHALLENGE OF MANAGING HALIEUTIC RESOURCES

Fishermen often explain that fishing is similar to farming, even ploughing. The sea is less productive wherever fishing isn't pursued.

This assertion may come as a surprise, for fishing is a form of "gathering", but it does have a scientific basis. Indeed, fishing exploits the capacity of an animal population to regain its original biomass following its temporary reduction resulting from an additional mortality.

"**When the abundance of a natural population is reduced by fishing, the population reacts to the removal of individuals by increased survival and growth rates and the recruitment of survivors who now enjoy greater space and food**," explains Jean-Paul Troadec, Jean Boncoeur and Jean Boucher in the 2003 report of the Académie des Sciences ("French Academy of Sciences").

Therefore, fishing can - to a certain extent, depending on each stock (species, environment, climatic conditions) - maintain a heightened level of productivity and give this impression of "farming". However, it nevertheless remains a form of gathering, with over-exploitation eventually leading to a decreased catch.

The two levers of this management are the fishing effort, which determines the "mortality by fishing" (not to be confused with "natural mortality"), and the distribution of this effort in accordance to age class (juveniles, spawners, etc.).

Scientists continue to be extremely sceptical regarding man's ability to actually increase an ecosystem's natural productivity in the long term by way of planning, because it would seem extremely difficult to really increase food production, even if one can encourage refuges or concentrations. In fact, **it is the abundance of nutrient salts that determines the amount of phytoplankton, which in turn determines the amount of zooplankton, which in turn controls the amount of small pelagic fish and their predators**. **Ecosystems are thus controlled from the bottom up.** This explains the natural fluctuations of herring in the North Sea or of sardines off the coast of Brittany. Winds play a decisive role in this food chain by mixing the deep ocean waters with the surface waters, as well as the marine currents.

Therefore, a natural productivity "ceiling" exists which applies as much to fishing as it does to shellfish farming, the capacities of any given body of water being limited.

Having explained this important principal, your *rapporteur* would now like to take a more detailed look at the principles upon which the management of halieutic stocks are based, for several differ significantly from their terrestrial counterparts and may therefore appear counterintuitive.

1. Is the objective of a Maximum Sustainable Yield (MSY) attainable?

The idea of managing marine resources and being able to maximize their exploitation has a scientific history. We have come a long way since Grotius stated in 1609 in his *Mare Liberum* that "Sea fishing is free, for it is impossible to exhaust marine resources" - as compared to the fishing of rivers, whose stocks can be rapidly exhausted. In this section, your *rapporteur* will refer to the work carried out by Philippe Cury and Yves Miserey.

It was only in the mid-19th century that scientists began studying the management of our halieutic resources.

Previously, it was believed that it would be possible to restock the seas, as was done for rivers by introducing a large number of alevins. Beginning in 1911, the French ichthyologist Louis Roule demonstrated the futility of attempting to repopulate the oceans to any extent comparable to natural levels. Nevertheless, such attempts would continue up until the First World War.

At the same time, the Norwegian researchers Axel Boeck and Ossian Sars began carrying out their first studies in the late 1850s on the Arctic cod fishery of the Lofoten archipelago. They managed to demonstrate the **twofold process regulating the Arctic cod population, with the resource's natural variation on the one hand and the "overcapacity mechanism", which periodically resulted in the fishery's collapse, on the other**.

Also at the same time, quantitative and statistical analysis methods were developed and widely accepted; these would eventually lead to the construction of a fishing theory which allowed for the scientific and therefore "certain" definition of a given stock's optimal, rational management. **In many respects, the very idea of a maximum sustainable yield is therefore the product of the mid-19th century's scientific rationalism.**

One of the founding fathers of this movement was the English biologist **Michael Graham**. He based his findings on observations of the North Sea plaice fishery. In particular, he remarked that lower catches during the First World War had allowed the stock to recover. He therefore demonstrated that the amount of fish caught did not increase in step with the overall fishing effort; rather, an ever greater fishing effort could result in a

decrease in profitability and overall tonnage. Graham concluded that **regulation of the fishing effort was the key to fishery management**. In addition, he observed that attention must be paid to age classes, with a very different number of fish able to account for the same catch weight. Therefore, **he also demonstrated that fishing is capable of stimulating, to a certain extent, the productivity of a given stock**. Graham's work greatly influenced the research of the 1930s and paved the way to a veritable scientific calculation of the ideal maximum catch.

In 1954, it was Schaefer who proposed a mathematical formula for calculating the catch that would allow a given stock to regain its initial equilibrium by increasing its natural growth and to establish a new exploitation equilibrium.

Schaefer was therefore the first to define this concept of the maximum catch that could be sustained by a given stock, resulting in the Total Allowable Catch (TAC) and the Maximum Sustainable Yield (MSY).

However, the productivity of a given stock is determined by three factors:

- Recruitment; in other words, the number of eggs produced, which is determined by the mass of spawners. The overfishing of spawners, especially among long-lived species with low reproductive rates, can rapidly result in the stock's decline and what is referred to as "recruitment overfishing". What is more, the most commonly fished species are or were very prolific species, such as cod, herring and sardines.

- The environment also plays a decisive role in the survival rate of the early stages: eggs, larvae and alevins. Many species are very fragile: should the water temperature rise or decline by a few degrees or the necessary prey prove scarce, the stock's effective recruitment may collapse. Most fish stocks are therefore subject to a high level of interannual variability, the effects of which are normally cushioned in a healthy population by the number of age classes. Therefore, due to unfavourable conditions, a stock can prove incapable of sustaining an increased mortality rate linked to fishing.

In addition, when considering the collapse of a given stock, it is often difficult to distinguish between the effects of overfishing and the effects of temporary environmental conditions. Frequently, both these factors are to blame.

- Finally and thirdly, the catch volume depends on the exploitation profile of the stock's age classes. It is generally accepted that sparing juveniles and allowing fish to reproduce at least once will eventually allow for an increase in captures. However, catch selectivity remains limited by its being almost always multispecific in character and by the levelling nature of a given selection method.

The concepts of TAC and MSY apply to a single species and, in theory, can only apply to monospecific fisheries. This constitutes a major weakness. **However, at the time of the Schaefer model's formulation and in the midst of the world fisheries' expansion and the extension of the exclusive economic zones, this model was seen as the quantitative and scientific solution guaranteeing the most effective exploitation of marine resources.** It also allowed for overfishing to be defined as an overstepping of this mathematical limit.

An additional consideration was supposed to be addressed with the appearance of the "structural models"; in other words, taking into consideration a population's structure, or its size and age. These models were first developed by Wicker who studied salmon and haddock and established a link between the number of spawners and the number of recruits. Then Beverton and Holt, carrying out studies on these same species, as well as on the plaice, succeeded beginning in 1957 to provoke management measures seeking to more scientifically regulate net-mesh sizes. These studies reinforced the idea that a scientific and quantitative management of catches would provide the necessary guaranties for a fishery's successful exploitation. At the time, this scientific approach also allowed for the blocking of all or almost all catch constraints, as long as the MSY was respected.

These management principles were officially and internationally adopted by the FAO in Rome in 1955 by a very close vote of 18 to 17, for behind the scientific theory, the freedom of access to fishing zones was at stake and this access had to remain unlimited. The United States made all of its weight felt to guarantee its continued access to such zones as Peru and Mexico.

Over the following years, fish catches would be managed according to these halieutic models of population dynamics, sidelining the studies which, from the very beginning, had allowed for the establishment of the twofold bio-economic process between fish and fishermen.

2. What is the maximum potential of the world's oceans?

In parallel to these efforts to manage fishing stock by stock, researchers have attempted to calculate the overall catch potential of the world's oceans. In most cases, these attempts have proved hazardous due to the climate at the time and insufficient data. In 1951, an estimation of 22 million tonnes was put forward (Thompson); later, in the early 1970s, the figure varied between 200 million and 2 billion tonnes! From 1978 to 1994, the estimations remained very large and optimistic, varying between 100 and 350 million tonnes. Today, and considering the evolution of catches over the past twenty years and the state of fish stocks, **it seems most likely that future marine catches will vary between 80 and 100 million tonnes maximum**.

Daniel Pauly used another approach to estimate the oceans' potential. **He sought to determine the volume of the ocean's primary production appropriated by man via fishing.** Early figures from the 1980s had led scientists to estimate man's impact as being equal or inferior to 2.2%, an extraordinarily low estimation when one considers that 35-40% of terrestrial primary production is used by man.

Daniel Pauly set out to reanalyze these same data, while integrating rejected catches and, above all, taking into consideration the trophic level of catches, aware that the yield is some 10% from one predator to the next (10 kg of prey for 1 kg of predator). His calculations resulted in a new estimation of 8%, four times greater than the first, though still far removed from the terrestrial figures.

These data were distorted by the fact that the ocean is not uniformly productive; by limiting the catches to the "fertile" zones, the actual rate of appropriation varies between 24.2% and 35.3%, depending on the zone. These results clearly indicated that fishing had undoubtedly reached its maximum sustainable potential.

3. Collapses, irreversible changes and questioning traditional halieutics

Generally speaking, it has been the stock collapses that have occurred since the 1950s (the California sardine, the North Sea herring and, above all, the Canadian cod) that have led to a questioning of monospecific and quantitative halieutics.

It has since been shown that **stocks can collapse without forewarning** (Mullon et al., 2005). **Since 1950, a quarter of the 1,519 species studied have collapsed, a fifth of which did so brutally following a plateau of production**. This is explained by the fact that there exists a "spawner threshold" below which reproduction is no longer assured; however and at the same time, the fishing effort may continue to grow - if only due to technological progress - allowing for a stability of catches and masking the evolution under way. Therefore, catch stability is not an indicator of a healthy stock or effective management. Much more detailed data are required.

In addition, once the stock has collapsed, it is not enough to stop fishing to allow the population to recover. In a certain number of cases, it entails a **change of regime**, with a new species becoming dominate within the ecosystem and preventing the ousted species from recovering its previous place due to the predator-prey relationship that is essentially dependent upon size in the marine food chain. **The change is therefore irreversible.** For example, it has been demonstrated that the collapse of the North Sea herring stock resulted in a lack of food for the capelin and therefore for the cod which eat herring and capelan; this in turn led to cannibalism within the cod

population, with adults eating juveniles, thereby greatly limiting the stock's growth.

In a much more dramatic manner, **in the North Benguela upwelling[1] off the coast of Namibia**, the over-exploitation of sardines, anchovies and hake has also led to this type of evolution. **In the same zone in which 1.5 million tonnes of sardines were fished in the 1960s, the last scientific evaluation programme in 2007 was only able to capture two sardines in the entire ecosystem.** The disappearance of entire trophic levels favours the lower levels (sponges, macro-algae, jellyfish, bacteria, sea urchins), which become dominate within the ecosystem.

Unfortunately, there are many such zones, some of which are linked to telluric pollution such as the anoxic zone at the mouth of the Mississippi Delta. 60 such zones have been recorded in the world (Robert Diaz).

They are to be explained by the fact that the ecosystem's primary production is no longer recycled, falls to the ocean floor and decomposes, thereby monopolizing the dissolved oxygen to this single end.

Chesapeake Bay and the Black Sea are other well known examples. Other systems are not as greatly damaged, but give worrying signs, such as the waters off the coasts of Morocco, Mauritania and Senegal, whose main resource is now the octopus, an animal entirely absent only twenty years ago.

The proliferation of jellyfish in the Mediterranean or the dramatically small size and low weight of the fish caught in the Bay of Biscay (23 cm) and the North Sea (fish weighing over 4 kg have decreased by 98%) are warning signals that should catch our attention.

In addition to this risk of a stock collapsing without forewarning, one must also consider a new complexity: **numerous species of fish change sex**. Common sea bream and white sea bream are "protandrous functional hermaphrodites"; meaning, they change sex as they age. When young, the fish are male and become female. The opposite also exists: "protogynous functional hermaphroditism"; this is the case with the grouper, the salema and the anthias. In other species, such as the Mediterranean porgy, it is the proportion of males and females which varies according to age. Finally, water temperature determines the sex of certain other species, such as sea bass; this could have serious consequences as a result of global warming.

It is therefore essential to consider this phenomenon of "sexual flexibility" when managing fisheries, in particular when selectivity is based primarily upon size. It could therefore become necessary to favour selection methods that allow the largest fish to escape, so as not to provoke too great an imbalance between the sexes.

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[1] *Coastal oceanic zone in which nutrient salts and cold water are pushed to the surface by marine currents, winds and the particular morphology of the ocean floor.*

It is probable that the West African grouper is a victim of this situation. Overfished, it was the largest specimens which were the first to be caught. The wild population could now lack enough males to reproduce.

What is more, **the exploitation's economic aspect** plays an important role. Fishing does not necessarily come to a stop due to a lack of fish. As a fish becomes more and more rare, its price rises, as does its demand as a luxury product; at a certain point, there may no longer exist an economic check with which to protect the species from becoming extinct. Indeed, this is the case with certain large terrestrial mammals. Such a situation can also be observed with regard to sturgeons and certain crustaceans.

In addition, the listing of common halieutic species on the red list of endangered species has become a topical subject. This list already includes the Altantic cod, the North Sea haddock, the Antarctic bluefin tuna and some one hundred other species. The Mediterranean bluefin tuna could soon be added.

II. ARE THE GLOBAL FISHERIES HEADED FOR COLLAPSE?

The question may seem abrupt or biased. However, when considering the history of fishery development, one confronts almost systematically the issue of the "tragedy of commons". Is non-sustainable fishing an inevitability? Does reason enter the equation only after the onset of a crisis? These questions also lead to a precise, consensual assessment of both the state of the resource and the industry's economic health, so as to better understand the causes and therefore initiate solutions.

A. THE INEVITABLE RISE OF NON-SUSTAINABLE FISHING?

The development of deep-sea fishing in Europe is a centuries-old story that has deeply marked our mentalities and civilization.

The very affirmation of the free-sea principle – and, for the fisheries, of free access to marine resources - is directly linked to the Anglo-Dutch dispute over the exploitation of North Sea herring. It also formed the backdrop for Grotius' *Mare Liberum* of 1609. Since then, many scientific and historical studies allow us to have a long-term vision of the fisheries' evolution and to recognize the "Copernician revolution" necessary for the implementation of sustainable fishing.

1. From aboriginal fishing to global fishing

In their book *Une mer sans poissons* ("A sea without fish")[1], Philippe Cury and Yves Miserey very usefully shed light on the present fisheries situation by presenting a history of deep-sea fishing, which is often a history of raids and a race for fish, which the "Anglo-Saxon" NGOs today denounce via the expression "Fishing is not mining". They make particular reference to the scientist Jeremy Jackson who, within the framework of a study carried out by the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California, distinguished between **three historical periods for fisheries: the aboriginal period, the colonial period and the global period**.

The aboriginal period is defined as the period dominated by subsistence fishing in small boasts along the coasts. This period lasted a very long time.

The colonial period began in the European fisheries with the large maritime expeditions financed by a capitalist economy and based upon an ever-more-intensive exploitation of natural resources, particularly new marine resources, the most eminent example being cod. Certain archaeologists date the transition from the aboriginal period to the colonial period based upon the

[1] *Une mer sans poissons, Philippe Cury and Yves Miserey, Calman Levy, Paris, 2008, 283 pages.*

apparition of marine fish as a food staple in the countryside and cities far from the coast, while at the same time continental (inland) resources are being exhausted and water quality is deteriorating. Based upon these criteria and according to James Barnett of the University of York, this second historical period would have begun around the year 1000 AD.

The global period corresponds to the current period and to a complete and often excessive exploitation of all of the world's oceans and resources, at all depths and distances.

More generally speaking, **the development of fisheries obeys a universal rule of an intensified exploitation, a diversification of the species exploited and a geographical extension in which the two precedent phenomena are repeated** up until the complete exploitation of the oceans, characteristic of the global period defined by Jackson.

2. Herring, cod and cetaceans: examples of raids?

Your *rapporteur* will here rely on several expositions made by Philippe Cury and Yves Miserey, who shed light on this type of behaviour in several historic fisheries: herring, cod and cetaceans.

a) Herring, the first industrial fishery

Herring fishing surely cannot be completely considered a colonial fishery for Europe, since herrings are a North Sea resource. However, it undoubtedly represents the first industrialized form of fishing.

The profits made by the exploitation of this natural resource allowed for the economic development of the Netherlands and of Denmark and drove England's maritime expansion.

The North Sea's herring schools seemed as miraculous as they did inexhaustible. In 1861, they were the subject of incredible descriptions in Jules Michelet's *La Mer* ("The Sea"), in which the author evoked the unlimited fertility of herring, the rise of schools so dense and numerous as to resemble upswelling islands...

The processing of these prolific catches provoked the fishery's industrialization. During the 14th century, the herring fishery is estimated to have employed one million people in the Netherlands.

The herring fishery is also thought to have been at the origin of the fishing trade as a fulltime, year-long profession. This evolution would have been encouraged by the British Parliament's decision in 1808 to subsidize herring fishing in order to encourage its development at other countries' expense. Indeed, the number of herring ships in Scotland rose from 32 in 1790 to 830 in 1835.[1]

[1] *Michael Wigan, The last of the Hunter Gatherers.*

Before the First World War, Scotland, the Netherlands and Norway were catching around one million tonnes of herring per year. However, due to over-exploitation, herring fishing had to be stopped during the 1970s. Today, European scientists recommend a TAC of less than 300,000 tonnes.

b) Cod, the first colonial fishery

Cod fishing on the Grand Banks of Newfoundland constituted the first true colonial fishery. Michelet wrote that "Cod, all by itself, created colonies and founded trading posts and towns". This zone is half the size of France and less than 100 metres deep, on average. It is located at the confluence of the Saint Laurence River, the (cold) Labrador Current and the (warm) Gulf Stream and, during the springtime, constitutes an ideal biotope for cod reproduction. There, cod were so numerous and their schools so dense that it was possible to catch the fish using baskets.

In all likelihood, the Grand Banks were first discovered by Basque and English whalers prior even to the discovery of the Americas. Their exploitation perhaps dates as far back as the beginning of the 15th century (the fishery is mentioned on an Italian world map of 1436). However, the fishing grounds were kept secret. Nevertheless, several historical studies today tend to support this hypothesis.[1]

Salted or dried, cod made up an essential element of the European diet. Between the 16th and 18th centuries, this fish is thought to have accounted for 60% of all fish consumed in Europe. Canadian cod production amounted to some 100,000 tonnes per year.

Cod production rose during the 19th century to 300,000 tonnes per year and **peaked in 1968 at 810,000 tonnes**.

Cod fishing was an important political and legal issue. Since 1950, it has been the main reason motivating several nations to extend their marine sovereignty and claim ever-larger exclusive economic zones (EEZ). The reason behind these extensions was to transfer the historic rights of foreign (French and English) fishermen to the nations' own domestic fishermen. Three periods of great tension between Great Britain and Iceland accompanied the latter's extension of its territorial waters from 4 to 12 miles in 1964, then the creation of a 50-mile EEZ in 1972 and its extension to 200 miles in 1975. Likewise, Canada's creation of an EEZ in Newfoundland in 1977 provoked serious tensions, in particular with the fishermen of Saint-Pierre-et-Miquelon which led to an international ruling unfavourable to our country. This appropriation directly profited Canada's fishermen because this country accounted for 73% of the global cod catch beginning in 1979. In Newfoundland, it allowed the number of fishermen to increase by 41%, the

[1] *Mark Kurlansky, Cod: A Biography of the Fish that Changed the World.*

number of ships by 23% and the cod catch by 27% between the years 1977 and 1981.

What is more, this appropriation was undoubtedly one of the causes of **the stock's collapse, rendered official by the fishery's complete closure on 2 July 1992 by Canada's Federal Minister of Fisheries and Oceans. 500 years after the discovery of America, one of the New World's most important natural resources had been exhausted. Since then, the fishery's recovery has remained superficial and sporadic.**

The stock's collapse and its inability to recover continue to constitute a scientific enigma. However, **a range of causes** has been identified, though it remains impossible to measure their exact relative importance.

The underestimation of **the fishery's over-exploitation is clearly the most important of these causes**. Cod's legendary prolificity incited an exploitation ever at the limits of what the stock could truly sustain. The weakness of the stock had therefore been hidden by the phenomenon of cod's natural concentration in order to reproduce. Even if they were less numerous, their concentrations gave the impression of an abundant population and allowed ever greater catches. It is the spatial analysis of catches rather than the actual volumes caught that could have sounded the alarm.

This intensive fishing led to the stock's collapse, because the fishing effort remained constant even though cod suffered from **particularly unfavourable climatic conditions**. These two main criteria therefore produced a combined effect.

It is probable that **other factors** also contributed to the collapse, such as the growth of the **seal** population, which progressively benefitted from protection.

Following its collapse, the fishery's non-recovery is likely to be explained by **the ecosystem's definitive evolution**. In a way, cod found itself "downgraded". Too weak and too scarce, it became the prey of other species prospering in its place, though they fail to render the same ecological services. Fisheries such as that of shrimp also developed, profiting from their predator's disappearance.

Most specialists today believe that cod will probably never regain its former dominant position, incapable of developing in an environment that has become too unfavourable to the species.

c) Large cetaceans

The large-cetacean fishery offers an excellent example of the destruction of a natural resource by man beginning with its discovery.

Indeed, from the 12th century and the beginning of whaling by the Basques up until the implementation of a moratorium on cetacean hunting, the entire Cetacea order has been progressively decimated as each new species has been discovered. The first to be affected was the North Atlantic right whale (*Eubalaena glacialis*), followed by the bowhead whale of the Arctic Ocean (*Balaena mysticetus*), the sperm whale (*Balaena catodon*) and the grey whale (*Eschrichtius robustus*).

In the mid-19th century, the invention of the explosive harpoon and the development of the process of injecting compressed air (which allowed whalers to float the carcasses of all cetacean species[1]) led to the exhaustion of the stocks in the Northern Hemisphere, forcing whalers to concentrate on the Southern Hemisphere. Whale hunting then became an ever-more-efficient industrial activity. In the 1930s, 320,000 cetaceans (blue whales, humpback whales and fin whales) were slaughtered. Then, from 1947 to 1962, 550,000 cetaceans fell victim to hunting. During this period, the stocks of the larger animals having already been wiped out, whalers targeted almost exclusively the smaller cetaceans; this explains the continued high catch numbers.

The management of cetacean stocks that fell to the International Whaling Commission starting in 1946 was unable to develop on a scientific basis, the quotas being attributed according to a Blue Whale Unit (BWU) equivalency in which one blue whale equalled two fin whales, two and a half humpback whales or six sei whales. Eventually, in order to save the species from extinction, a ban on whale hunting became inevitable (in 1966 for the humpback whale and in 1967 for the blue whale). In 1971, a new management system was adopted, but not respected. **Whale hunting finally came to an end due to a lack of resources and profits.** The 1982 moratorium on commercial whaling, which came into effect in 1986 and was renewed in 1996, testifies to this state of affairs.

Cetacean hunting is still carried out by certain native communities and, above all, by certain countries such as Iceland and Norway which have resumed the commercial exploitation of the minke whale and Japan which pursues so-called "scientific fishing".

The North Atlantic right whale, the first exploited cetacean, has been protected since 1936. This once abundant species has not been observed near the French coast since the three beachings of 1852. Today, only a relic population remains near Greenland.

3. Ever further, ever deeper

The development of fishing follows a threefold process: the intensified exploitation of the "noble" species, diversification via the

[1] *Certain species, such as the blue whale, sink when dead.*

development in these same fishing zones of new species of lesser commercial value or abundance, **and, finally, the geographical extension** and the development of deep-sea fishing flotillas, at which point the same mechanism is repeated.

The development of Peruvian-anchoveta fishing is of particular interest, because it is linked to the collapse of another resource. As is often the case in the history of fisheries, the exhaustion of an initial stock forced a reconversion toward a more distant, deeper stock of (at least in the beginning) lesser commercial value.

This is the case of the Peruvian anchoveta, which owes its development to the collapse in the 1950s of the California sardine stock and which led the Americans to transfer their fishing effort to other small pelagic fish of upwelling systems. Beginning in the mid-1960s, the Peruvian anchoveta became the world's largest fishery, with 12 million tonnes accounting for 20% of the world fish catch.

The signs of over-exploitation and the mechanisms by which the fishing effort is transferred to other stocks are not recent, having been identified as early as the 15th century. Therefore, it has been possible to draw up a **map of the geographical development of overfishing in the North Atlantic** during the modern era[1], listing **the dates at which the intensification of exploitation did not result in a higher catch**.

Beginning in the 1920s, hake were over-exploited in the Irish Sea. Cod were over-exploited in the North Sea beginning in 1920, off the coast of Scotland beginning in 1930 and on all the other banks from the 1950s up until the mid-1960s. **Therefore, cod, haddock, hake, herring, plaice and rosefish have all been overfished since 1965 (at the latest) in the entire North Atlantic.** We are consequently less surprised by today's difficulties and the collapses that have since occurred.

This mechanism is not only to be explained by stock exhaustion; another possible cause is the near inevitability of overcapacity formation. For instance, in the Moroccan cephalopod fishery, the per-man yield (as measured in kilogrammes) decreased 10 fold between 1965 and 1990 due to an increased fishing effort (a 100-fold increase in the number of fishing hours), while the catch volume stagnated.

B. OVERFISHING AND ENDANGERED STOCKS: A UNANIMOUS WORLDWIDE DIAGNOSIS

The period of fishing's expansion is today over. The reserve of virgin stocks is being exhausted. The intensified fishing of those stocks still

[1] Troadec 1976, Académie des Sciences 2003.

under-exploited barely compensates for the decreased production of the over-exploited stocks.

**Halieutic resources and the human food industry:
a global view (source: SOFIA 2006).**

In 2004, global fish production reached 140.5 million tonnes, according to the FAO.

However, this production includes several very different elements, not all of which will be taken into account by your *rapporteur*:

- **Caught fish totalled 95 million tonnes**, with 9.2 million tonnes for continental (inland) catches and **85.8 million tonnes for the marine catches** which will be at the heart of the developments to follow.

- Aquaculture represented 45.5 million tonnes, with 27.2 million tonnes from freshwater and 18.3 million tonnes from the sea.

Of these resources, **105.6 million tonnes were used for human consumption** and 34.8 million tonnes for other uses, in particular animal food (including aquaculture).

Therefore, in 2004, the world supply of **fish destined for consumption came to 16.6 kg per inhabitant**; this represented the highest level since the collection of such data (1974). Fish consumption was **only 9 kg per inhabitant in 1961**. But fish consumption is very unequal, varying according to wealth. The wealthier a person, the more fish he or she consumes (29.7 kg per inhabitant in the industrialized countries), but the less he or she depends on fish as a source of food (7.8% of the animal-protein intake). Of the 104 million tonnes destined for human consumption, only 7 million tonnes were consumed in Africa (8.2 kg per inhabitant).

43% of all aquatic food products destined for human consumption are provided by aquaculture, which appears to represent the new frontier of halieutic resources (this subject will be expounded upon further on in the report).

Globally, fish provided more than 2.6 billion people with at least 20% of their animal-protein intake; the average figure came to around 15%.

According to official statistics, **China** is by far the world's number one fish producer, itself providing **47.5 million tonnes**.

Four large fishing zones produce 68% of the world catch: the Pacific Northwest with 21.6 million tonnes or 25% of the total (sardines, Japanese anchovies, pollock), the Southeast Pacific with 15.4 million tonnes (Peruvian anchoveta, Chilean jack mackerel), the central Western Pacific with 11 million tonnes and the Northeast Atlantic with 9.9 million tonnes.

1. The continued deterioration of the halieutic stocks

Contrary to certain statements, **the fishery crisis and the particularly degraded condition of stocks are both well known in biological terms and are the subject of a wide global consensus**.

The crisis is quite real. It is neither a fad nor a hallucination on the part of scientists and environmentalists. Cod have not grouped together

beneath the Arctic ice shelf and red tuna are not hiding out in some Mediterranean trench. In many cases, the fish in question has not retreated to more distant waters, but has simply disappeared from the ocean.

Of course, it is always possible to deny the assessment of all scientists from around the world because "they don't know how to fish" or "they conduct their survey where there aren't any fish", etc. Nevertheless, the sector's economic crisis and diminishing catches prove the contrary. If the fish were still there in the same quantity, then we would not be observing stagnating or decreasing catches, collapsing stocks, descents in the food chain, etc.

a) Stagnating or diminishing catches around the world

Since 1950, the marine fish catch has enjoyed spectacular growth, rising from 15 million to 85.4 million tonnes in 2004.

However, since the 1980s, volumes have stagnated despite an increase in the number of fishermen and a greater fishing effort.

It should be pointed out that the FAO has publicly indicated that, considering the importance of the Chinese fisheries and the limits of this country's statistical system, Chinese production should be considered separately. The 2006 SOFIA[1] report notes: "However, diverse elements still suggest that the statistics provided for China's halieutic and aquacultural production are too high". In addition, outside China, world fish production (including aquaculture) has stagnated at around 90 million tonnes since the end of the 1980s. All subsequent growth has come from China. It is even probable that the global catch volume has already begun to decline since the end of the 1980s.

A second element reinforces this indication. It seems that the rejection of low-value fish, previously deemed unfit for consumption, is decreasing due to the demand for fish meal or simply their commercialization as human food. While previously this catch remained unrecorded because dumped at sea, it may now be brought into port, thereby lending the impression of catch stability. This newly-retained catch has been estimated at 10 million tonnes between 1994 and 2004 (Kelleher, 2005 and Tacon, 2006).

b) "Fishing down marine food webs" (Pauly et al. 1998)

As has been shown by the great French halieutics specialist **Daniel Pauly** in a much-cited study, **if total catches have not decreased, it is because we are fishing ever farther, ever deeper, ever more species and ever lower in the food chain**.

[1] *The State of World Fisheries and Aquaculture.*

(1) From demersal to pelagic species

Indeed, **at the global level, catches of demersal fish[1] have stagnated since 1970, a period of nearly 40 years.**

Global catches have only risen due to **increased fishing pressure on the pelagic species. From 1950 to 1994, the global pelagic catch rose from 10 to 40 million tonnes**, to the point that global statistics (not including China) are now directly affected by the production of a single fishery: that of the Peruvian anchoveta**.** Indeed, this fishery is very sensitive to climatic phenomena and its production has varied over the past decade from 1.7 million tonnes in 1998 to over 10 million tonnes these past few years. Pelagic fish currently represent 50% of the total catch volume, but only 40% of the total catch value. The only exception is that of tuna, the open-sea fishing of which has recently grown; the tuna catch has risen from 0.7 million tonnes in 1950 to 4.5 million tonnes in 1994.

Pelagic species account for the bulk of the very diversified global fish catch. Indeed, in 2004, the ten largest fisheries were: the Peruvian anchoveta (10.7 million tonnes), the Alaska pollock (2.7 million tonnes), the blue whiting (2.4 million tonnes), the skipjack tuna (2.1 million tonnes), the Atlantic herring and Spanish mackerel (2 million tonnes each), the Japanese anchovy and Chilean jack mackerel (1.8 million tonnes each), the capelin (1.6 million tonnes) and the cutlassfish (1.4 million tonnes). Together, they represent 28.5 million tonnes or around 1/3 of the global fish catch.

(2) The geographical expansion of the fishing effort

This evolution is also observable geographically. **The date of maximum production has already been reached in all of the world's oceans:** 1967 for the Northwest Atlantic, the 1980s in the North Pacific, and the early 1990s in the Mediterranean, South Pacific and Indian Ocean. **As compared to this maximum amount, certain zones have already registered a very appreciable decrease in production: by 61% in the Northwest Atlantic and by 33% in the central East Atlantic** (FAO 1997).

(3) Toward oceanic and deepwater pelagic species

The fisheries' geographical extension is evident in the exploitation data for the oceanic pelagic species, including tuna. These fisheries have been constantly growing since 1950, rising from under 2 to over 6 million tonnes. **Since 1965, there are no longer any virgin or unexploited stocks. In 2004,**

[1] *Species living and feeding on or near the bottom of the ocean.*

30% were still considered developing, while 35% were identified as recovering or senescent.

The fishing of deepwater species has exploded, with the FAO now listing nearly 115 different species. In 1950, less than 20% of this oceanic resource was exploited. From 1975 to 1979, the entire resource fell under exploitation and nearly 40% of these deepwater fisheries were already considered senescent. This pourcentage is now over 50%. Less than 20% are considered to have reached maturity, with the remainder under development. This demonstrates the great fragility of this resource, which very rapidly moves from full exploitation to over-exploitation.

c) The over-exploitation of an increasing number of stocks

This situation is evident in the classification by the **FAO** of halieutic stocks. The world's 200 fisheries are divided into **four separate groups**:

- **Latent fisheries**: low catches; under-exploited fisheries.

- **Developing fisheries**: rising catches.

- **Mature fisheries: the production level fluctuates around a sustainable maximum; fully-exploited stocks.**

- **Senescent fisheries: a decline in production; over-exploited, exhausted or recovering stocks.**

According to this pattern, **fishing's historic process of diversification and intensification is entering its final phase. According to this view, there have been no latent fisheries since 1970 and mature or declining fisheries represent more than two thirds of the overall total** (FAO, 1997).

25% of stocks evaluated by the FAO are either over-exploited (17%), exhausted (7%) or recovering (1%). 52% are fully exploited. The final quarter consists of those species of little commercial interest.

In 1974, only 50% of fish stocks were fully- or over-exploited (10%). The potential of expansion to new stocks was around 40%.

Today, the stocks of the world's ten most important species in terms of catch volume are all over- or fully-exploited according to the FAO.

In geographical terms, the level of full-exploitation varies greatly. In the central East Atlantic, the West Atlantic, the Northwest Atlantic, the western Indian Ocean and the Pacific Northwest, 69-77% of stocks are fully-exploited.

In the Northeast Atlantic, Southeast Atlantic, Southeast Pacific and Indian Ocean, 46-60% of tuna stocks are over-exploited, exhausted or recovering.

These zones in which the fishing pressure is extreme or excessive are therefore becoming apparent.

d) The question of rejections

All of these statistics ignore the question of rejections. Many fishing ships are insufficiently selective regarding the species targeted; in other words, those species the fishermen plan on bringing back to port and selling because marketable.

These incidental, involuntary catches and these rejections are nevertheless important. They are especially difficult to evaluate, because they are usually thrown back into the sea and therefore are not recorded. They represent **a real waste, because these rejected fish are almost always dead**.

In its 2003 report[1], the Académie des Sciences estimated that, at the global level, rejections amounted to 16-40 million tonnes, or 20-50% of the world's total sold catch.

This situation varies from fishery to fishery. Industrial fisheries targeting a single species, such as tropical shrimp, seem to be the most destructive, with all other fish being rejected. However, the smaller, more traditional fisheries tend to sell their entire catch.

Likewise, the type of fishery plays an important role. For example, according to this same report, trawling for hake in the Bay of Biscay entails the rejection of half of the total catch, while the same figure for the black-seabream fishery of the Normandy-Brittany Gulf exceeds the two-thirds mark. These estimations can also vary greatly depending on the time of year.

Due to these data, it is highly probable that rejections contribute significantly to global overfishing. That is why most managers seek to limit as much as possible or even ban this practice. However, banning rejections is very problematic. It is not easy to monitor and, above all, it would have important consequences for fishermen by entailing a significant decrease in their income.

However, rejections directly benefit seabirds, which use fishing boats as a nursery. In the North Sea, it has been established that the seabird population has greatly increased for this reason and would appreciably decline if rejections were banned.

C. A POSSIBLE OR A CERTAIN COLLAPSE?

In this context of fish stocks subjected to a level of fishing pressure unprecedented since the beginning of the resource's exploitation – the consequences of which could be serious - a scientific article published in the review *Science* made considerable waves, as though it had unintentionally

[1] *Alberson et al., 1994.*

crystallized the current climate. Its main author was **Boris Worm** and **it was presented as predicting the disappearance of the world's halieutic resources and the end of fishing for 2048**.

It seems essential to your *rapporteur* to here address this article and the resulting commentary.

1. Will the halieutic resources collapse? Boris Worm's thesis.

Boris Worm is a researcher in the Biology Department of Dalhousie University in Halifax (Nova Scotia, Canada). Along with numerous co-authors, he published **an article entitled "Impacts of Biodiversity Loss on Ocean Ecosystem Services" in *Science* (Vol. 314, 3 November 2006)**.

The very title illustrates the fact that the article's most wave-making argument – namely, the scheduled collapse of all fisheries by the year 2048 – was not, in fact, at the heart of the study.

Instead, Worm et al. were seeking **to answer the following question: "What is the role of biodiversity in maintaining the ecosystem services on which a growing human population depends?"** For the research team, it amounted to applying terrestrial-based research themes to the oceans, this aspect remaining particularly "enigmatic".

"Ecosystem services include not only food production via fishing, but also – and for various reasons – the maintenance of water and environmental quality."

To carry out their study, the authors analyzed and compared four types of data.

First, they used 32 controlled experiments measuring the effects of variations in marine biodiversity (genetic or species richness) on the primary and secondary production of the oceans and on ecosystem stability. Following this first wave of analyses, they concluded that biodiversity, productivity and stability are closely connected, no matter the ecosystems' trophic levels.

They then compiled long-term data from 12 coastal and estuary ecosystems, as well as from a few other sources. For each ecosystem, they concentrated on 30 to 80 important species. These data confirmed their initial results: in other words, that the richest (most biodiverse) systems are also the most stable and the least susceptible to either collapse or the disappearance of important commercial species. Analyzing data covering the past one thousand years, they demonstrated the collapse rate's very spectacular growth starting in the beginning of the 19th century. These losses of regional biodiversity have adversely impacted three types of ecosystem services: the number of viable fisheries has decreased by one third, nursery habitats (oyster reefs, seagrass beds, wetlands) have diminished by 66%, and filtering and detoxification functions by 63%. In addition, a vicious cycle sets in, with the destruction of

certain environments, diminished water quality, the disappearance of habitat and the collapse of certain species.

The authors also observed an increase in invasive species accompanying a decrease in the original biodiversity. These new species are unable to compensate for the lost biodiversity and ecosystem services.

The long-term examination of these coastal and estuary ecosystems confirmed the first series of data.

A third series of data was examined. The authors analyzed the world catch data from the FAO since 1974 and from 64 very large marine ecosystems (150,000+ square kilometres) from 1950 to 2003. Together, these regions represent 83% of the world's fisheries for the past 50 years.

They observed that the number of collapsed fisheries (with a catch less than or equal to 10% of the highest recorded annual total) had risen to 29% of the world's fisheries. Cumulative collapses since 1950 were estimated at 65%.

Once again, they observed that the richer the ecosystem, the less frequent the collapses. The researchers hypothesized that a rich ecosystem encourages a lower fishing pressure and greater diversification, which in turn helps the weakest stocks recover. Likewise, the volume and interannual variation of catches are correlated with ecosystem richness: the richer the ecosystem, the more stable and productive it is.

All of these findings in favour of rich ecosystems led the authors to consider the impact of protected marine zones (marine reserves, sanctuaries, fishing areas, etc.). They therefore studied data available for 44 marine reserves and 4 large fishing areas. They discovered an average increase in ecosystem richness of around 23%. Most importantly, for those zones surrounding the reserves, they observed a 400% increase in productivity per unit of fishing effort, without, however, observing a significant catch increase (most likely due to management measures).

In conclusion, the authors affirm that there exists a proven link between a) the richness of an ecosystem, its stability and, therefore, its capacity to resist natural variations and exterior aggressions and b) its productivity in terms of ecosystem services provided, fishing included.

The gathered data also shed light on the societal consequences of **the continued acceleration of biodiversity degradation**, such as has been observed up to now, because **this trend, it is argued, will lead to the collapse of all fisheries by 2048**.

Not only does this evolution threaten the capacity of a growing human population to procure its food from the sea, but it will also most likely prevent the marine ecosystems from regaining their initial state.

For the report's authors, there is no dichotomy between the protection of biodiversity and long-term economic development, because these two social goods are, in fact, interdependent. Because it guarantees an ecosystem's resistance and resilience, biodiversity is even acquiring insurance value; it should therefore be valued as such.

Finally, the authors argue that "By restoring marine biodiversity through sustainable fisheries management, pollution control, maintenance of essential habitats, and the creation of marine reserves, we can invest in the productivity and reliability of the goods and services that the ocean provides to humanity. **Our analyses suggest that business as usual would foreshadow serious threats to global food security, coastal water quality, and ecosystem stability, affecting current and future generations**".

Despite this rather gloomy tableau, the authors believe that the strength of the established connections also allows them to affirm that, **at this point, the highlighted trends (an exponential link between the acceleration of biodiversity degradation and the reduction of environmental services) are still reversible if adequate management measures are implemented**.

2. The scientific debate

The above dire **forecast** – the collapse of all fisheries by 2048 – was often all that was retained from the article; this was most likely not the authors' intention.

Scientific and technical critiques of the article have essentially concentrated on two aspects of this forecast: its truthfulness and the notion of a fishery collapsing. Other less important criticisms have also been made.

The American distributor of *Science* was able to present the article as a direct accusation of the government administration in charge of American halieutic resources: the National Marine Fisheries Service of the National Oceanic and Atmospheric Association (NOAA). The administration responded that catches are a poor indicator of fish abundance and the real state of a given stock, because low catches can just as easily be explained by an unhealthy ecosystem as by low prices or restrictive management measures. The American administration points, in particular, to the example of the Georges Bank haddock fishery, whose highest catch level dates from 1965 (150,362 tonnes), as compared to only 12,576 tonnes in 2003 (just over 8% of the maximum 1965 catch). According to the criteria set by Worm et al., this

stock would have collapsed; however, in 2003, the fishery's spawning biomass reached 91% of the 1965 figure. Therefore, the administration concludes that Worm et al, by relying on the least common denominator, produced only a rough approximation of the world's stocks and should have attempted to correct this imprecision.

Considering the overall situation of those stocks monitored by NOAA, they remark a slight improvement (decrease) of 2% in the number of overfished stocks between 2003 and 2004 and point out that, at this rate, there will be no overfished stocks in waters under American jurisdiction by 2018. However, this positive evolution should come about even sooner, because the Magnuson Stevens Fishery Conservation and Management Act (MSA) requires that all overfishing come to an end by 2010 among the 532 stocks managed by the federal government.

A more fundamental criticism was undoubtedly that put forward by Michael J. Wilberg and Thomas J. Miller (*Science*, Vol. 316, 1 June 2007), who argued that the prediction made by Worm et al. was more the result of statistical chance linked to the analysis's point of departure than any analytical reality, due to the team's chosen definition of "over-exploitation", which they based upon the fishery's historic maximum catch. However, this historic maximum is hardly an attainable or desirable goal with regard to the fishery's sustainable management; on the contrary, it is often preferable to distance oneself from this maximum catch.

Other authors, such as John C. Briggs of the University of Oregon, have challenged the article's concept of "biodiversity", arguing that, rather, it amounted to a decrease in the population of the species under consideration, thereby rendering them unsuitable to fishing due to their low numbers. What is more, Briggs argues that species rarely disappear in the marine environment and he even points out the potential positive impact of so-called "invasive species".

Worm et al. have responded to these criticisms, in particular regarding the scientific value of using commercialized-catch statistics. With regard to the Georges Bank haddock example, they pointed out that this fishery had been the victim of a double collapse. The first occurred in the 1960s and was successfully countered by the setting up of a 200-mile EEZ in 1977. The second collapse took place in the 1980s, due to a too great national fishing effort and could only be countered by the emergency closure of half of the fishery in 1994. In both cases, these protective measures allowed for an increase in the fishery's biomass in 1 to 6 years time, thereby demonstrating the interest of large-scale reserves. Under these circumstances and with regard to catches (-90%), the stock was exhausted from 1970 to 1977 and from 1983 to 2003. With regard to biomass, it was exhausted from 1970 and 1977 and from 1982 to 1997. What is more, the National Marine Fisheries Service considered it overfished from 1967 to 2002 and in 2004. Therefore, it is

evident that the catch-rate criterion while less precise, remains valid for judging the overall state of a given stock.

Worm et al. also pointed out that the prospect of a global collapse was not simply a statistical result. There is no cause-and-effect link between the date of the point of departure and the probability of a collapse; indeed, it is rather the opposite that is true.

With regard to population vs. biodiversity, Worm et al. do not accept the distinction, for, they argue, the two are inseparable. While extinctions are rare in the ocean at the global level, they are frequent at the local level. Likewise, the ecosystem consequences of local population losses or disappearances come into effect long before the species' global extinction and can prove irreversible.

Other critiques have concentrated on the article's choice of data with regard to marine reserves (Hölker et al), pointing out a prevalence - and therefore a bias – for tropical zones. For Worm et al., this criticism is not wholly justified, for temperate zones represent 40% of the study sample and, above all, they demonstrate the same trends; in other words, a recovery of biodiversity, even if temporal variability diminishes in tropical waters and the fishing-effort yield shows a greater increase in temperate waters. In any case, **Worm et al. deny having wanted to present these data as a panacea**. On the contrary, they believe that they constitute useful reference points and in no way exclude wider management measures for the restoration of marine environments and populations.

Finally and more generally, they rejected those critiques that would seek to ban all forecasts based upon past data. **In any case, Worm et al. argue that they were not seeking to produce a certain forecast, but simply to consider what the consequences would be were the trend to continue.**

For them, this questioning is all the more pertinent given the fact that it has been proven that marine environments and fisheries evolve in a gradual manner that is difficult to observe, even though abrupt and irreversible regime changes can occur, allowing for the establishment of a different type of ecosystem.

D. AN ECONOMIC SECTOR IN CRISIS

In a recent report published in 2008 and entitled "The Sunken Billions. The Economic Justification for Fisheries Reform"[1], the World Bank paints a particularly bleak picture of the global fishing sector. The

[1] *The World Bank, Washington, DC (USA), 2008, 80 pages.*

report's authors were Rolf Willmann of the FAO's Fisheries and Aquaculture Department and Kieran Kelleher of the World Bank's Agriculture and Rural Development Department. It received the backing of the Agence Française de Développement ("French Development Agency" or AFD), as well as the scientific approval of such reputable figures in this domain as Rebecca Lent (NOAA), Serge Garcia (FAO) and Carl-Christian Schmidt (OECD).

This document, which your *rapporteur* will rely upon in the exposition that follows, underlines **the loss of $51 billion per year as a result of poor fishery management**.

Above all, it sheds light on the sector's long-standing, poor structural health, a weakness that has only exacerbated the rise in fuel costs. However, this must not hide the reality and seriousness of the problem, or exacerbate it even further.

1. A greatly deteriorated economic performance

The fisheries' economic performance is determined by catch quantity, the price of the fish, the costs of fishing and overall productivity.

In 2004, the base year for the World Bank report, **the nominal value of fish production was $148 billion, including $85 billion for wild fisheries and $63 billion for aquaculture.**

Globally, fish prices have changed little in real terms since the late 1980s, in particular due to the rising market share of low-price species, which more than compensates for the rising prices of the most sought-after and increasingly rare species.

In the world market, the rise in demand is concentrated in the developing countries, which are seeing both their standard of living rise and their population grow. For example, in China, fish and seafood consumption doubled between 1998 and 2005 in low-income households and grew by 250% in high-income households. Similarly, demand continues to grow in the United States, favouring long-term growth in the real price for fresh fish.

In terms of costs, hardly any global data are available. However, the report proposes the following distribution, which provides useful references that vary depending on the fishery:

- Work: 30-50%
- Fuel: 10-25%
- Maintenance: 5-10%
- Amortization, remuneration of capital: 5-25%.

In general, **fisheries are very dependent on oil prices**. Indeed, **½ tonne of oil is required to catch 1 tonne of fish**. For example, for an average price of $918 per tonne of fish, $282 (31% of the total value) was spent on fuel. This demonstrates the impact of a doubling of fuel prices on the sector's profitability.

One of the most commonly implemented solutions to counter this problem is increasing productivity via the incorporation of technological advances. For example, seiners in the Indian Ocean are today capable of catching three times more fish than in the mid-1980s. However, without a reduction of the fishing fleat, this race toward productivity is a race toward overcapacity and will lead to just as rapid a decrease in profitability.

a) An increased number of fishermen

In addition, **for the past 30 years, the number of fishermen and aquaculturalists has risen more rapidly than the world population**. In 2004, there were **41 million fishermen and aquaculturalists** (part- and full-time), including 13 million in China, and **around 123 million industry-wide jobs, for a production (fishing)-to-job ratio of around 1:3**. Fishermen and aquaculturalists represent 3.1% of the agricultural workforce.

This increase in the number of maritime workers at the world level is due to the developing countries, because **the opposite trend is observed in the developed countries**. The large fishing countries of the Northern Hemisphere have seen a significant drop in their number of fishermen. Between 1970 and 2004, their number fell by 58% in Japan and by 54% in Norway. In 2004, the world's industrialized countries numbered 1 million fishermen, or 18% less than in 1990. The average age of fishermen in these countries is rising rapidly; this trend is especially evident in Japan, 47% of whose fishermen are older than 60. **In the poorer countries, fishing - which serves as a free and accessible job source - is actually a poverty trap and a last-minute means of subsistence**. In Asia, this growth has been the strongest (300%), as much in fishing as in aquaculture.

However, due to stagnating catches for the past 20 years, **the average catch weight per fisherman fell by 42% between 1970 and 2000, falling from over 5 annual tonnes to only 3.1 tonnes**.

This situation perhaps explains the fact that **the number of full-time fishermen is decreasing, while that of part-time fishermen is increasing**. Indeed, in many zones, fishing is a seasonal activity that sometimes lasts only a few dozen days each year, though without proving very profitable for all that (thereby necessitating more than one source of income).

b) An increase in the fishing effort

The fishing effort has also greatly increased, placing even more pressure on the resource. This effort is **a combination of the number of boats, their size, and the power of their motors, as well as of their fishing devices**.

Over the past thirty years, the number of fishing boats has increased by 75% to over 4 million vessels, including both decked and non-decked boats (1.3 and 2.7 million, respectively). Above all, the number of motorized, decked boats has more than doubled. 86% of decked ships are to be found in Asia, while Europe accounts for less than 8% of the total.

As no more precise data exist on ship tonnage and power, it is difficult to draw too many conclusions from these figures.

Nevertheless, it is evident that the fishing fleet has grown not only numerically, but also in terms of its catch capacity. **The most common coefficient put forward is around 4.2% per year** (Fitzpatrick, 1996)**, due to technological advances.**

However, similar to fishermen's per capita **productivity**, **shipping-vessel productivity is falling rapidly**, due to the upper catch limit having already been reached; indeed, per-vessel productivity has **decreased 6 fold on average since 1970**. This is essentially due to the formation of overcapacities. Despite the identification of this phenomenon, fleet-reduction measures most often affect the most run-down and the least productive vessels, thereby failing to reduce the overall fishing effort.

Under these conditions and to maintain its profitability, the world fleet places pressure on the salaries of its sailors and continues its race to integrate technological advances. In addition, while fishing regulations set a limit to the number of days at sea, they fail to address the root of the problem: overcapacity.

What is more, considering these important trends, the authorities have reacted by mitigating the downward pressure on salaries by implementing various relief measures and subsidies, just as they helped reduce the cost of fuel, facilitated modernization, and maintained elevated fish prices; however, all of these measures run counter to a more sustainable and profitable management of the fisheries.

Indeed, the World Bank argues that numerous subsidies attributed to the fishing sector are pernicious, because they exacerbate overcapacities and over-exploitation. Fundamentally speaking, they diminish or even eliminate all those market mechanisms that would otherwise allow this trend to be stopped.

Fuel-related subsidies typically seek to reduce the cost of fishing; however, by so doing, they create an incentive to continue fishing even though catches are falling and prices – and, therefore, demand – do not allow for a continuation under such economic conditions. The results are over-fishing, overcapacities, a reduction of economic efficiency, and the dissipation of financial resources.

Therefore, the World Bank has drawn up an imperfect-yet-clear, synthetic inventory of fishing-sector subsidies for the year 2000:

Estimation of fishing-sector subsidies having a direct impact on the fishing effort (in millions of dollars per year)[1]:

Subsidies	Developing countries	Developed countries	Total	%
Fuel	1.3	5.08	6.4	63.5%
Purchase of catch surpluses	-	0.03	0.03	0.3%
Construction and modernization of the fleet	0.6	1.3	1.9	18.9%
Tax exemptions	0.4	0.34	0.7	7.3%
Fishing agreements	-	1	1	9.9%
Total	2.3	7.75	10.05	100%

Therefore, some $10 billion is estimated to be spent each year on fishing-sector subsidies, unfortunately too often contributing to the vicious cycle of over-exploitation.

c) The bias in favour of capital intensity: the example of Brittany

In its 2003 report[2], the Académie des Sciences emphasizes, among the negative impacts of government subsidies on the management of halieutic resources, that of maintaining or increasing over-capacities by introducing a bias in favour of augmenting the capital intensity of the fishing sector in Brittany in the 1980s.

During this period, government aid for the purchase of new or used vessels clearly favoured the larger boats (16-25 metres) for which such subsidies were almost systematic and reached the highest percentages

[1] *Ibid. and Milazzo 1998, Sumaila and Pauly 2006, Sharp and Sumaila 2007.*
[2] *Ibid. p. 42 sqq., Hénaff et al. 1995, Parrès 1997.*

(21-22%), as compared to a frequency of 27-43% for ships under 10 metres and an average rate of 11-13%.

However, the report argues that a strong link exists between the crisis of the small-scale fishing industry in the 1990s and this subsidy policy of the 1980s.

What is more, the justifications habitually put forward seem ill-founded in the case of fishing.

The argument that fishing represents a heavy, "traditional" industry is hardly convincing, for subsidies introduce a bias and systematic government aid to capital-intensive economic activities is hardly sustainable.

The second argument commonly put forward concentrates on the jobs engendered by the fishing sector in fishing-dependent zones without any other alternatives. Once again, studies would tend to undermine this argument. Fishing jobs never represent more than 4% of all jobs in the most fishing-dependent zone (Quimper) and 2-3% in the three following zones (Les Sables d'Olonne, Fécamp and Boulogne). Taking into account the entire industry, all fishing-related jobs never exceed 10% of the total; indeed, as your *rapporteur* has already pointed out, such jobs are often independent of the local - and even French - fishing sector. In addition, fishing jobs always represent less than 3.3% of added value for the four concerned zones, with the entire sector accounting for less than 5.3%.

The third and final argument concerns our competitiveness with regard to heavily-subsidized, foreign fisheries. While this argument seems to be the most economically justified, it also sheds light on the general imbalance of a system lacking coordination and an overall vision.

2. The billions swallowed up by fishing

Several studies preceding the World Bank report tend to confirm the 2008 results.

An initial study carried out by the FAO in 1992 estimated the loss in revenue at $54 billion per year (base year: 1989), for a global fisheries revenue of $70 billion.

In a second report published in 1997 and building upon the previous 1992 study, Garcia and Newton confirmed the earlier study's conclusions and estimated that economically efficient fisheries should lead to a 43% decrease in the cost of fishing, a 71% increase in the price of fish, or a 25-50% decrease in catch capacity.

In its report, the World Bank sought to calculate **the amount of potential savings if global catches were well managed**. **The results are striking.**

a) $51 billion of potential savings for the global fishing industry

The report estimates **the loss of revenue at around $51 billion**, knowing that this figure lies between $37 billion and $67 billion and with an 80% confidence rate in its estimation, **while the global fishing product is estimated at around $85 billion**.

Therefore, the World Bank estimates the loss in wealth from 1974 to 2004 at $2.2 trillion.

For the World Bank, these estimations, while considerable, remain prudent and conservative, because all negative costs have not been taken into consideration (natural capital, environmental services, biodiversity and tourist appeal, not to mention illegal fishing and their overall impact on the sector, as well as the cost in terms of the greenhouse effect, etc.). What is more, two earlier studies had estimated the loss in revenue at $80 to 90 billion, an amount equal to the total fishing product (Sanchirico and Wilen 2002, Wilen 2005).

Globally, the annual loss is therefore equivalent to 64% of the total commercialized catch and 71% of the total fish value traded at the international level.

The principal weakness of this assessment could be its global, aggregated nature. However, once again, several case studies confirm the validity of this evaluation. For example, one study estimates the economic potential represented by the recovery of 17 overfished stocks in the United States at $567 million or three times more than these fisheries' current revenue (Sumaila and Suatoni, 2006).

Even in several zones whose fisheries are reputed to be managed in an exemplary manner, the potential gains could, in exceptional cases, be spectacular. They are estimated at 55% for the Icelandic cod and 29% for the Peruvian anchoveta.

In this country – whose example your *rapporteur* will revisit later in greater detail - potential savings are estimated at $228 million per year. This is to be explained by the enormous overcapacity of the fleet, which is some 250-350% larger than would be necessary to carry out a sustainable form of fishing (MSY quota), while that of the fish-meal factories is similarly estimated at 300-400% the useful capacity. For this reason, the fishing season has been reduced by 60 days per year.

This situation becomes all the more detrimental the more countries are dependent on fishing, both economically (the share of national wealth, the share of exports, a source of currency, etc.) and socially (jobs, food production, the social fabric).

b) Fishing in the English Channel from 1996 to 1997: a model of overcapacity

Even before these results, which - as your *rapporteur* has already pointed out – are a prolongation of other studies, the Académie des Sciences, in its 2003 report[1], wanted to consider the example of the French fisheries in the English Channel, in order to lend greater substance to evaluations that are necessarily too general in nature.

Rather than pointing the finger at French fishermen, for the other fisheries were confronted with the same issues, the Académie wanted to **demonstrate the impact of overcapacities on fishing profitability** by attempting to model the profile of the French fleet in the English Channel if **the objective were maximizing profits rather than maintaining jobs**.

In the base situation – in other words, for the 1996-1997 season – the net result was very low: less than 3% of the commercialized value for 1,674 boats and 4,840 fishermen.

Applying the net-result maximization model would allow for an increase of 760% and €46 million in value, despite a €25 million fall in the value of the commercialized catch.

But such an evolution would be costly in terms of the number of boats: -526 (around 1/3 of the fleet) and jobs: -2,000. According to the same model, the cost of maintaining these excess jobs would then amount to €23,300 per year.

This model did not take into account the side-effects on jobs; however, the Académie des Sciences emphasized the extent to which – not only in this sector, but in France, in general – a large portion of the "post-production" industry is actually independent of the catch, relying as it does on imported products destined for France or for re-exportation.

Your *rapporteur* does not believe that these figures, which are already dated and the result of a theoretical model, should be interpreted as a recommendation. However, they do perfectly illustrate the fragility of an economic sector in a situation of overcapacity and the interest of reducing this same overcapacity, as much in the interest of the halieutic stocks as the public coffers and the fishermen themselves. They also shed full light on the political choice of maintaining fishing jobs at an elevated cost.

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[1] *Ibid. p. 36 sqq.*

"Catastrophic and inacceptable": such an assessment remains masked by a few fisheries in good health and, above all, by a system whereby profits are privatized and visible, while losses are socialized and hidden.

The policies carried out with short-term goals have too often acted as mere bandages or expedients and, in the long run, have acted to exacerbate the problem; what is more, they have created an economic and social dependency on government subsidies.

In this regard, it would be preferable for the national accounts to be able to take into consideration the positive and negative impacts of the deterioration or improvement of halieutic stocks on the country's national wealth. It would be better to point out the socially counter-productive or, on the contrary, constructive nature of certain policies.

It would seem only sensible to invest the money currently wasted at the world level on a deep-seated reform, the transition toward sustainable fishing and science.

This reform of the fishing industry could be based upon three main lines:

- The stocks' intergenerational sustainability.

- The fisheries' economic profitability.

- Fairness, taking into consideration the social aspects of these changes and the equilibrium of both the industry and the regions.

Because any such reform must be the result of a shared diagnosis, it seemed essential to your *rapporteur* to more widely distribute these data which are the subject of a wide scientific consensus, among both economists and halieutics specialists.

In this respect, and contrary to what is too often argued by the opposing "friends of the fishermen" and "friends of the fish", the Johannesburg goal - in other words, returning stocks to their Maximum Sustainable Yield by 2015 – cannot be the only objective. Such an objective is much too "halieutics-centric" and, what is more, species-by-species. It is necessary to develop a wider, economic and social vision which seeks to organize economically- and socially-profitable fisheries and, fundamentally, to consider the best way in which to exploit the halieutic resources.

III. THE FRENCH AND EUROPEAN FISHERIES: A POLICY FAILURE

The common fishing policy is one of Europe's oldest and most integrated policies. The earliest common measures adopted for the fishing sector date from 1970, when the European Community decided to grant equal fishing-zone access to the fishermen of all member states, while at the same time setting aside the coastal fishing zones for the smaller-scale, more "traditional" forms of fishing with historical rights. At the same time appeared a common market policy, as well as a coordinated policy for the modernization of Europe's fishing fleets.

These measures assumed a new dimension with the collective decision in 1976 to extend from 12 to 200 nautical miles the exclusive economic zones of the member states.

The common fishing policy appeared several years later, in 1983.

Without over-simplifying, it could be said that, inspired by the common agricultural policy and imbued with the spirit of the times marked by the development of fisheries and the extension of EEZs, **the first objective of the CFP was to raise the capacity of the European Community's fishing industry**. This seemed all the more necessary with a large trade deficit which appeared as though it could be absorbed, at least in part, by increasing the fishing effort in the waters of both the European Community and non-European countries. Therefore, the CFP initially pursued a policy of increased production. **Only progressively and, above all, following the serious industry crisis of the 1990s, did the necessity become apparent to reduce capacities and seek a sustainable management of the halieutic resources rather than an increase in catches.**

Since 1990, the European Commission is aware of the fact that the European fleet suffers from both a large overcapacity (estimated at 40% at the time) and serious difficulties with its stock-management method. In its 2003 report, the Académie des Sciences noted: "Unable to adjust production capacities to the halieutic stocks' potential for renewal, for the past ten years or so, European authorities have abandoned the Maximum Sustainable Yield objective, preferring - for safety's sake - to confine themselves to catch limits below which the stocks' survival would be in jeopardy".

While the turning point had been reached, it is not in the nature of European politicians to change direction so rapidly in such a short period of time, especially as the systems of governance encourage the member states to resist these changes and the fishermen, whose boats had been subsidized, find themselves obliged to fish in order to cover their increased expenses.

Your *rapporteur* will here return to an analysis of the common fishing policy via the green paper of 2001, the reform of 2002 and future prospects. I will also consider one of the most obvious European-fishery examples by turning my attention to the situation in the Mediterranean. Finally, I will draw a panoramic picture of the French fishing industry.

The fishing industry within the European Union

The fishing industry represents **1% of the European Union's GDP**. This modest figure masks the fact that the EU is one of the world's largest fishing powers, second only to China, with a production of 7 million tonnes from fishing and aquaculture in 2005. Although the EU exports 2 million tonnes, it remains extremely **dependent on foreign fishermen, importing 6 million tonnes, for a trade deficit of over €13 billion**.

There are some **88,000 fishing boats in the EU**. While fishing is no longer very important in terms of jobs at the European level, it remains important in certain fishing-dependent regions (Galicia, the Algarve, the Azores, Scotland, etc.). In total, an estimated **190,000 fishermen work full- or part-time** in Europe.

Aquaculture represents 1.3 million tonnes for the same period.

In 2006, the EU's most productive member state was Denmark (17.4%), followed by Spain (15.2%) and France (12%).

A. THE 2001 GREEN PAPER: AN EVER-TOPICAL DOCUMENT

The "Green paper on the future of the common fisheries policy" was published in March 2001 by the European Commission as preparation for the reform of the CFP planned for 2002. It was meant to frame the European debate. In the opinion of your *rapporteur*, it constituted an important step, because, with its publication, the Commission demonstrated its capacity to present **a lucid panoramic picture of the CFP and the necessity for its reform**.

Published no less than eight years ago, this document **remains astonishingly topical** and could almost be republished word-for-word today. Not only is the diagnosis of the European fisheries as valid as ever, but most of the report's recommendations remain equally pertinent. **While reading the green paper, one at times has the impression of having lost a decade. Your *rapporteur* has found in the report some of the same observations that I have collected during my various meetings.**

Your *rapporteur* would here like to cursorily revisit this document, in order **to measure, firstly, the "expert consensus" on the paper's analysis and proposals for reform, and, secondly, the report's topicality**.

1. The observed failure

For the Commission, the CFP "faced great challenges", for "it **did not allow for the attainment of its objective; namely, a sustainable exploitation of resources**". The Commission considered that "numerous stocks saw their volumes settle below reasonable biological limits" due to over-exploitation, the situation being particularly serious with regard to the demersal stocks, such as cod, hake and whiting. At the time, it estimated that "if the current trends continue, numerous stocks will collapse" and pointed out that "the European Community's various fishing fleets enjoy a capacity well above that which is necessary to carry out a sustainable form of fishing. The current reduction in stocks is largely due to the fixing of annual catch limits above those proposed by the European Commission based on scientific assessment and to insufficiently ambitious plans for the management of the fishing fleet. The weak application of the decisions made has also contributed to overfishing". The Commission added that "All over the world, concern is strong regarding the disastrous state of numerous fish stocks and the overcapacity of the fishing fleet".

In addition, "the fishing sector is characterized by its economic fragility resulting from overinvestment, a rapid rise in costs and a dwindling resource, an evolution reflected in the industry's mediocre profitability and constant decline in jobs".

Finally, "at the political level, fishing-industry actors feel that they are insufficiently involved in the CFP's management and many of them cite unfair treatment when it comes to respecting and applying the implemented measures."

After presenting this realistic if rather dismal summary, the Commission made a more positive observation: "However, not everything is negative. The CFP has provided a few positive results over the past twenty years. To a large extent, it has managed to check ocean conflicts, to lend a certain amount of stability to the fishing sector, and to forecast - at least, upon until today – the stocks' collapse, a phenomenon that has occasionally occurred in other parts of the world. However, we have paid dearly for these few positive results, if one considers the long-term viability of the fishing sector. The current situation requires immediate, deep-seated reform of the CFP, independent of the legal obligations linked to the 2002 deadline."

Following this general presentation, the Commission revisited **the fundamental principles** of the CFP. It considered the wide consensus in favour of the general goal of **a responsible fishing industry** as defined by the FAO: one which provides for the protection, management and development of marine resources, while respecting the ecosystems and biodiversity, allowing the current and future generations to continue to profit from the oceans' environmental services.

It also pointed out that, according to Article 174 of the treaty, **the CFP, interacting with the environment, must be founded upon the principle of precaution**.

However, the Commission observed that the objectives forced upon the CFP were contradictory, even incompatible:

- Ensure the protection of increasingly fragile stocks, while encouraging the pursuit of fishing.

- Modernize the means of production, while limiting the fishing effort.

- Appropriately implement protective measures, it being understood, however, that the member states retain the upper hand with regard to monitoring and the imposition of sanctions.

- Maintain jobs, while reducing the capacity of the fishing fleet.

- Ensure fishermen a decent revenue, even while the Community imports more and more fish products.

2. The prospects without CFP reform

The Commission then analyzed the prospects without reform of the CFP and this from several perspectives: the protection of stocks, the environmental aspect, the fishing fleet, the decision-making process, monitoring, the socio-economic aspect, and fishing in the Mediterranean.

The state of the principal fish stocks was a cause of alarm. The International Council for the Exploration of the Sea (ICES) was able to demonstrate that the quantities of adult demersal fish have decreased significantly over the past 25 years; between 1970 and 1990, their stocks diminished by 90%. Commercialized tonnages posted similar decreases. Pelagic fish, on the other hand, saw their numbers increase, due in large part to the restoration of the herring stock, as well as, no doubt, the decreased numbers of predators. The continuity of many stocks was all the more in jeopardy due to a lower-than-predicted regeneration rate, necessitating specific measures for the stocks' reconstitution.

This situation was to be explained by shortcomings in the management of the CFP. The CFP relied almost exclusively on yearly catch limits (Total Allowable Catches or TACs and national quotas), combined with

technical measures and the controlling of the fishing effort. "These measures have largely failed."

In addition, the Commission observed that **"nor was it possible to sufficiently involve the fishermen in the implemented policy, though this would have made it possible to win their adherence and take advantage of their savoir-faire"**. Furthermore, the tools proved largely ineffective for managing the multispecific fish stocks and numerous technical measures went unheeded, especially in the Mediterranean.

The environmental aspect was also worrying. The Commission estimated that the CFP should, in the future, integrate environmental concerns in a much more vigorous manner. Habitat degradation due to fishing activities was a source of ever greater anxiety, while our knowledge of how marine ecosystems work and the side effects of fishing remained insufficiently complete.

In this respect, **the Commission admitted that: "To be fair, it should be pointed out that many questions raised with regard to the marine environment are not linked to the fishing industry, which itself has suffered from environmental degradation. Pollution is detrimental to the quality of fish offered consumers. Pollution and climate change have also contributed to the decrease in stock and the increased scarcity of fish in certain zones. In addition to these factors, there are the effects of tourism."**

With regard to the fleet, **the Commission estimated that "the current fleet is much too large**. Technological advances increase fishing-boat efficiency, while reducing the effectiveness of efforts tending towards a scheduled reduction in capacity". It observed that reports published in 1990 and 1995 recommended an average reduction in the mortality-by-fishing rate of 40% (and sometimes much higher) and, therefore, a strong decrease in the fishing effort. In particular, it regretted that following an effort of around 15% between 1992 and 1996, the single goal of a 3% reduction from 1997 to 2001 in reality led to an increase in the catch rate due to significant technological advances having been made. For this reason, the Commission deemed that "If the course currently being pursued is not corrected, not only will it prove impossible to reduce the fleet's excessive catch, but the fishing effort will again increase, even though it is already too great with regard to the state of the stocks".

The decision-making process did not seem well suited to the necessity of reacting to local problems or to crisis situations, such as the immediate closure of fishing zones. What is more, "the fishing-industry actors have the impression of being insufficiently involved in certain important aspects of the CFP (for instance, the elaboration of scientific assessments or the adoption of technical measures). **In particular, many fishermen feel that their opinions and knowledge are not given the consideration they deserve by the decision makers and scientists. This lack of participation weakens their**

adherence to the protective measures adopted." Once again, the Commission concluded that "**the CFP cannot be successfully reformed if the fishermen feel that their interests, viewpoints and experience are neglected**".

With regard to **surveillance and monitoring**, the "current" measures were judged **insufficient and their effectiveness not up to task vis-à-vis the needs of the European Union**.

The assessment was rather serious: "The surveillance and monitoring actions implemented for the CFP's objectives are considered by many as being **insufficient and discriminatory. In almost all member states, the fishermen request** that **a more centralized and harmonious monitoring system** be set up at the European Community level; this, they feel, would allow for more effective action and **ensure fair treatment** throughout the Community." Once again, the Commission underlined the seriousness of the situation: "If this opportunity is not taken advantage of, the CFP could lose all credibility".

Socio-economic considerations were not absent from the green paper, but these were limited to pointing out the importance of government subsidies provided to the sector, the "regrettable" effects of overcapacity on the fleet's profitability, an ever declining employment, and that "if the current policies and approaches are not reconsidered, the economic sustainability and viability of the fishing industry will increasingly deteriorate."

The Commission very clearly pointed out the strong correlation between overcapacity, the fleet's profitability and the halieutic resources available: "In a situation of overcapacity, the more-or-less-constant total commercialized fish catch must be shared among a greater number of actors. Overcapacity has a certain number of regrettable economic consequences: each ship, considered separately, is less able to procure an adequate revenue; fleet profitability suffers from the underuse of investments; concomitantly, the insufficient return on investment delays modernization and further weakens competitiveness."

Its judgement of government subsidies was severe: "Regarding the subsidies today benefitting investments carried out in the fishing sector and certain fiscal measures such as a reduction of the fuel tax, they certainly do not contribute to the attainment of these goals; by artificially reducing the costs, as well as the risks inherent to investment, they in fact aggravate the difficulties of a sector already suffering from overcapitalization. When a ship is granted a subsidy, every ship in the concerned fleet sees its productivity and profitability suffer. The policy of granting subsidies also has a perverse effect on competition, given the fact that the ships, both subsidized and non-subsidized, share the same fishing zones and the same market."

According to the Commission, using subsidies to protect fishing jobs is just as detrimental and doomed to failure. Subsidies have not managed to prevent a 2%-per-year decrease in employment due to the

combined effect of an ever-scarcer resource and technological advances; what is more, the fleet's low profitability prevents an increase in remuneration.

Once again, the Commission's conclusion was unambiguous: "The economic policies so far carried out in the fishing industry at the European and national levels leave much to be desired."

Finally, with regard to fishing in the Mediterranean, the Commission observed that: "It has proven difficult to apply and enforce minimum catch sizes. The existence of a market for the smallest fish, the absence – traditional, in certain regions of the Mediterranean - of rigorous controls, and the widespread feeling among fishermen of not having been sufficiently involved in the decision-making process" together have resulted in a particularly unsatisfactory situation, especially considering that the non-EU fleets were far from being subject to the same regulations.

3. The desirable reforms

Backed by this analysis - which remains, it should once again be emphasized, strikingly topical - the Commission put forward in 2001 **a certain number of proposals for strengthening and improving the CFP with regard to the various aspects considered**.

To strengthen resource protection, the Commission proposed, first and foremost, **a multiyear, multispecific and ecosystemic management of the stocks**. Multiyear plans **based upon the principle of precaution** should serve as the basis of stock management, no matter the state of the stocks, in order to escape the serious disadvantages resulting from the annual fixing of TACs and quotas, in particular, the postponement of difficult decisions and, "back to the wall", sudden changes. **The Commission recommended a duration of 3 to 5 years**, as is the case with agreements made with non-EU states such as Norway.

Among the other measures meant to remedy the stock situation, the Commission put forward banning rejections in certain fisheries or closing certain zones and fixing a percentage for those species the victims of incidental catches. While there was a need for a new debate on technical measures, it was also **necessary to involve the fishermen in the rule-defining process, to encourage closer cooperation between fishermen and scientists, and to promote greater transparency with regard to scientific assessments**.

With regard to the fleet, the Commission deemed it necessary to accept the fact that **technological progress was, each year, automatically increasing the fishing effort and that it would therefore be necessary to establish a reduction rate of sufficient magnitude to, at the very least, neutralize this effect**, while at the same time specifying the outlines according to the member states and the different fisheries. The Commission

also advocated **abolishing all government aid likely to increase fleet capacity**.

In addition, improving the governance of the CFP seemed an important line of reform to be carried out, via the promotion of greater involvement on the part of concerned actors by their closer and earlier involvement in the process.

This objective also implied according **greater consideration to scientific assessments**. In this regard, the Commission believed that "A healthy scientific foundation is necessary to be able to help the fishing-sector representatives and other concerned parties to finalize their decision. **The CFP must be based upon assessments that are the fruit of a multidisciplinary approach that combines, in particular, biology, ecology and the socio-economic sciences.**"

More generally, in terms of research, the Commission **called for a much deeper knowledge and understanding of ecosystems** to take into account all implications of the measures taken within the framework of the CFP. The Commission rightly pointed out that this research **could not be purely instrumental insofar as it would only serve to justify technical measures**. **It insisted on the fact that it must also be enriched with the knowledge and understanding of the fishermen themselves. While remaining independent, it would have to both remain credible and act as a source of consensus.**

In light of this correct analysis and these ambitious proposals, the reform of 2002 proved unsuccessful.

B. 2002: AN UNSUCCESSFUL REFORM

Following the reform of 2002, **the CFP's current objective is to guarantee the sustainable exploitation of halieutic resources; to this end, the European Community is attempting to apply the principle of precaution.**

Armed with such tools as Total Allowable Catches (TAC), the limitation of the fishing effort, technical measures, and the obligation to declare all catches (both commercialized and rejected), the European Community tries to prevent an excessive pressure on the stocks.

The European Fisheries Fund is the financial and structural instrument of this policy and follows the Financial Instrument for Fisheries Guidance (FIFG). It was adopted on 19 June 2006 by the Council of the European Union for a sever-year period (2007-2013). It is endowed with €3.8 billion, 33% less than the FIFG.

With regard to fisheries control, an EU inspection body was set up in 2007: the Community Fisheries Control Agency (CFCA), whose mission is to

enforce the rules and regulations in a more effective and homogeneous manner. Its headquarters are in Spain.

As concerns the fleet, **the reform of 2002 essentially led to the halt of subsidies for the construction of new boats starting 1 January 2005**. The current objective is that each new construction be compensated for by the destruction of an equivalent or greater capacity. Government subsidies can now only be devoted to improving the safety, selectivity and quality of production.

1. TACs and quotas

EU-level TACs and quantitative catch limits remain an important CFP tool. In accordance with halieutic research, they seek to maximize fishery yield by removing as much as is possible without compromising the stock's equilibrium and renewal.

These TACs are divided among the member countries in the form of national quotas that obey historic allocation rates based upon the fishing precedence of each state and the rule of "relative stability"; in other words, the maintenance of each state's share.

They are fixed according to a yearly or two-yearly schedule following a long process during which the International Council for the Exploration of the Sea (ICES), an international scientific authority overseeing the Northeast Atlantic and headquartered in Copenhagen, furnishes a scientific assessment for all fish stocks, excepting those of the Mediterranean. French scientists, for the most part from IFREMER, are well represented in the formulation of these assessments, which are then submitted to the European Union's Scientific, Technical and Economic Committee for Fisheries (STECF). Of the 32 members chosen by the Commission, two are French. Backed by this double scientific examination, the Commission then proposes TACs and quotas to the member states and submits them to negotiation during a Council of Fisheries Ministers during the month of December. During the following year, the states manage and control their assigned quotas. They also keep the Commission informed, so that it is able to follow the situation at the global European Union level.

Since 2002, the Commission has set up multiyear management plans that can also act as restoration plans if needed by the stocks. In addition, these plans seek to acquire a multispecific dimension as soon as interdependent stocks are concerned.

2. The management of deepwater species

One of the most striking examples of this new approach is the case of **deepwater species**, which are **fished for at depths of over 400 metres**. These species are characterized by **a long longevity, slow growth rate and late**

maturity. They are therefore **highly vulnerable to overfishing**, for their stocks can only recover at a very slow rate.

In Europe, five species are particularly concerned: the cusk, the blue ling, the roundnose grenadier, the orange roughy and the black scabbardfish. These fish live several decades (up to 150 years for the roughy) and usually reach reproductive maturity after 10 years, though sometimes later.

The exploitation of these fish grew especially starting in the early 1990s, in order to compensate for resource losses due essentially to the poor state of the North Sea demersal fish stocks.

Forming aggregations, these species can be subjected to intense exploitation, while remaining limited in quantity; in other words, their geographical zones are exhausted one after the other, just like mineral deposits.

This state of affairs has led scientists to recommend a strong decrease in the fishing effort and a ban on the development of any new fisheries without prior scientific approval. Stock by stock, ICES recommendations range from a 30% reduction to a complete ban on fishing, for certain species are simply incapable of withstanding such pressure.

Faced with this situation, Europe has set up specific permits, raised the number of stocks subject to quota, and has taken measures for the reduction or closure of fishing activities in certain zones or for certain species; however, it has not acted as rapidly as requested by scientists.

3. Selectivity and reducing rejections

Another goal of the CFP is to limit the environmental impact of fishing, in particular to protect non-targeted species that can constitute incidental catches.

The Commission continued to highlight the **selectivity of fishing devices**.

Selectivity is a particularly complex subject. It, of course, seeks to preserve a stock's "spawning capital" by minimizing the juvenile catch. Its goal is also to limit catches of non-targeted species, both commercialized and non-commercialized species of fish, mammals and birds, not to mention those animals that are the subject of protective measures. This policy is necessarily a compromise, for European fisheries (allowing for exceptions) do not lend themselves to monospecific management; rather, catches always consist of a combination of species co-existing within the same zone and which may hardly be fished separately.

It results in the imposition of not only mesh sizes, but also particular mesh forms (such as the trawl nets' square mesh which remain open), as well as the installation of selection grids.

Selectivity can also lead to seasonal or geographic fishery closures, in particular to preserve juveniles and nurseries.

This attempt at selectivity increasingly seeks to reduce or even eliminate rejections; in other words, all organic, animal-based materials caught by the fishing machinery and which are then rejected (thrown back into the sea), more often than not dead. While these rejections can be involuntary, they are often voluntary, because a well-known pernicious effect of fishery management is the fact that it is in the fishermen's interest to maximize the commercial value of their holds. Finally, rejections can be due to differences in consumer taste, with certain fish failing to find buyers on the local market.

In Europe, rejections account for an estimated 10-60% of the catch, depending on the fishery. In certain cases, this percentage is even higher. At the global level, the FAO's estimation is 8% of the total catch weight and 7.3 million tonnes in 2005.

Such rejection levels reduce the impact of any measure taken to manage and protect the ecosystem, for these rejections include juveniles, over-the-quota catches and protected species.

This unutilized resource represents a veritable economic, ecological and food waste.

In Europe, the problem of rejections has become all the more acute with the poor state of the stocks. Indeed, the more fragile the stock, the greater the percentage of juveniles and other species rejected due to the target fish becoming increasingly rare.

Following the example of foreign countries, **it is becoming increasingly necessary to transform this objective of limiting rejections, from a procedural or means-based obligation into a results-based obligation, via the progressive elimination** and banning of rejections (the entire catch having to be brought back to port) with the implementation of a maximum percentage of authorized incidental catches.

Although particularly restrictive and costly in the short term, this policy's economic impact is usually not as great as professionals fear and, above all, ensures the latter medium-term profits.

4. Fishermen's involvement in the decision-making process

A final aspect is **the greater involvement in the decision-making process of all concerned parties**. Created in 1970, the Advisory Committee on Fisheries was first expanded in 2000 to include NGOs and aquaculturalists. This reform was accompanied by a much more extensive information campaign targeting professionals and the financing of their participation in the

Community dialogue. However, centralized at the European level, it could not really guarantee their involvement in the decision-making process. The reflections that led to the reform of 2002 had strongly emphasized this shortcoming; that is why **a network of Regional Advisory Councils was created**. Their mission is to provide assessments and, in certain cases, they must be consulted. **There are 7 such councils for all of Europe.** Having only recently been set up, they no doubt have yet to prove their full effectiveness.

However, **your *rapporteur* feels that greater dialogue is still needed. These councils remain too distant from the field and still cover fishing zones that are too large with too many actors. It would seem necessary to create a lower level of greater pertinence with regard to the fishing grounds.**

Your *rapporteur* also believes that, if we want to treat the various industry actors as being truly responsible for the management and future of the industry, then we must certainly consider giving these councils additional powers. **Limited to a strictly advisory role, they can only be expected to adopt an anti-establishment and corporatist position vis-à-vis Brussels. Your *rapporteur* proposes that these councils be granted real management and decision-making powers over the fisheries located within their geographical zones.**

Despite these evolutions and the fact that the reform has undoubtedly prevented a catastrophic evolution of the fisheries, it is clear that most of the problems identified in 2001 are still around in 2008.

For Commissioner Joe Borg, while there is no alternative to the Common Fisheries Policy, the resource being shared and mobile, nevertheless "**in its current form, the CFP does not encourage responsible behaviour on the part of fishermen or policy decision-makers.** The instruments [...] favour a partial, short-term decision-making process". This results in a vicious cycle that penalizes those fishermen that respect the rules, the industry's economic profitability, and the health of the oceans.

At this stage and looking to the publication of a future document laying the groundwork for a new, extensive reform of the CFP, the Commission has identified the following main obstacles:

- The overcapacity of the fleet, which today is capable of capturing two to three times the maximum constant yield.

- Accountability on the part of fishermen faced with the objective of ecological sustainability.

- The complexity of the rules and regulations and the necessity to develop subsidiarity.

C. EXAMPLE OF FISHING IN THE MEDITERRANEAN, IN PARTICULAR BLUEFIN TUNA FISHING

Fishing in the Mediterranean stands out for the high level of specificity in its management and its examination must distinguish between the general situation and tuna fishing in particular.

1. General set of issues concerning fishing in the Mediterranean

At the European level, fishing in the Mediterranean stands out for its different management measures. There are no EEZs, no TACs and no quotas. Fishing is regulated via technical measures, except for the bluefin tuna. The Mediterranean's continental shelves are relatively small, the shared stocks limited in number, and the dominant form of fishing is small in scale and multispecific (the exception, once again, being bluefin-tuna fishing).

The Mediterranean fishing fleet consists of around 100,000 boats, 45% of which are European and 90% of which are small crafts.

The catch volume accounts for some **1 million tonnes, or around 1% of the world fish catch**. Of **the European catch, which account for 60%** of the total Mediterranean catch, Italy accounts for 53%, Spain for 25%, Greece for 15% and France for 7%.

While this fishery represents only 20% of the European catch volume, it accounts for 35% of its value.

Small pelagic species and demersal fish each make up of 35% of the total commercialized volume, with crustaceans and molluscs accounting for 25% and the large migratory fish (tuna and swordfish) accounting for 5%.

The French Mediterranean fleet consists of **1,600 boats, 21% of the national total**. This fleet is made up of **small crafts (1,500),** trawlers (90) and tuna seiners (35).

The fleet's production is concentrated in the Gulf of Lion (90%) and around Sète (48%).

Half of the Gulf of Lion catch, excepting tuna, is made up of demersal species (80% fish and 20% molluscs and crustaceans), with the other half consisting of small pelagic fish (75% sardines and 25% anchovies). **The total catch volume is 35,000 tonnes** (5.6% of the national volume), for a value of **€100 million** (10% of the national total).

In the absence of TACs and quotas, fishing is limited only by technical measures, initially issued by elected industrial tribunals.

The General Fisheries Commission for the Mediterranean (GFCM) oversees fishing for the entire Mediterranean basin. This body is responsible for fishery management and must decree management measures. 23 countries belong to the commission. It would seem to function far from perfectly, insofar as **the member states are hardly determined to communicate their scientific data and apply the commonly undertaken measures**. The Mediterranean is characterized by the weakness of its fishing controls and the frequency of its illegal fishing activities. **During his meetings, your *rapporteur* had the strong impression that the authorities did not feel authorized to sanction their fishermen insofar as they feared being the only ones to apply such strict management measures.**

However, the narrowness of the continental shelves and the meagre number of shared resources make Mediterranean fishing an essentially national issue.

More than elsewhere, it would therefore be **necessary to make fishermen more aware of their responsibility and increase their involvement in management**. To this end, one must **increase the links with the scientific community** and **significantly strengthen the means of the fishing committees and industrial tribunals**, whose actions would be rendered all the more effective to the extent that **the states fully carry out their monitoring and sanctioning mission.**

In the Mediterranean as in other geographical zones, **the fisheries are regressing**. The analysis of commercialized catches since 1970 shows that the Mediterranean-wide maximum catch was reached during the 1995-1996 period and that catches have diminished ever since then. **At the European level, the maximum was reached in 1986 (750,000 tonnes), with today's catches amounting to 563,000 tonnes.**

According to scientists, while the stocks of small pelagic fish are generally under-exploited, demersal-fish stocks are being fully exploited in a largely unsustainable manner. Indeed, there exists **a large market for fish measuring around 10 cm, far below the mature size**. This situation's relative longevity could be explained by the preservation of large sires in the underwater canyons, allowing for a reasonable extraction of juvenile fish. However, this situation continues to worry both scientists and fishermen. The former because they fear that by over-fishing juveniles, too few fish will reach maturity; the latter because they denounce the Spanish fleet's destructive fishing of underwater canyons located outside this country's territorial waters.

2. Bluefin tuna: the predicted catastrophe

Bluefin tuna has become at once the focal point of all international attention with regard to fishing management, symbolic of an international malaise, and the great taboo wherever it can be avoided so as not to speak only

about the bluefin tuna, so as not to discuss such a contentious subject, or simply, and above all, because **the reality of the situation can hardly be contested – but such an acknowledgement would necessitate action**.

The bluefin is one of many species of tuna, along with albacore, skipjack and bonito. Bluefin tuna can grow up to 3 metres in length, weigh up to 700 kg, and live as long as 40 years. This great migratory fish lives throughout the Atlantic Ocean and adjoining seas. Its two reproduction zones are the Mediterranean and the Caribbean. In the Mediterranean, the bluefin reaches sexual maturity at the age of 4, for a weight of 35 kg and a length of 1 m. In the Caribbean, sexual maturity is reached at the age of 8, for a weight of 130 kg and a length of 2 m. The fish spawn in open water, resulting in large concentrations that coincide with the traditional fishing periods and make the species very vulnerable.

As is the case with many marine species, **the biology of the bluefin tuna remains quite mysterious.** The number of independent or interdependent stocks making up the tuna population remains unknown. Traditionally – and this forms the basis of the species' international management – it has been thought that two distinct stocks exist: one in the west, reproducing in the Gulf of Mexico, and the other in the east, reproducing in the Mediterranean. This division is a management convention and undoubtedly not a scientific fact. Indeed, by examining their otoliths[1], American researchers have demonstrated that many tuna from the Mediterranean are to be found off the east coast of North America. They have thereby shown that the stocks are much more porous than was previously thought. Many researchers consider that both Americans and Europeans exploit this debate for their own ends, with the former long defending the stock's uniqueness and the latter its division due to differences over preferred fishery management, for if the stock were unique, the United States would have a say in the Mediterranean fishery. However, here American and European interests diverge because bluefin tuna are, in particular, the subject of a large sports-fishing industry in North America.

This quarrel is perhaps outdated, because the existence of a third stock has recently been hypothesized. Reproducing in the western Mediterranean, this stock would migrate, while the eastern Mediterranean stock would migrate but little or not at all.

Bluefin migrations themselves remain mysterious. Do they follow an unchanging cycle or, on the contrary, are they influenced by currents and climate changes? Are they linked to the populations of small pelagic fish? Do they depend on the size of the stock? These hypotheses are likely with regard to the now-extinct bluefin fisheries off the coasts of Brittany and Norway.

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[1] *Otoliths are bones located in the inner ears of fish. They are marked by annual - sometimes intra-annual or even daily - stria that allow scientists to determine the fish's age. Their isotopic composition also allows scientists to determine their geographic origin.*

Traditionally, bluefin tuna were fished using the "tunny net" technique, a sort of labyrinth of nets near the coasts. This limited-impact method accounted for 90% of the bluefin tuna catch up until the early 20th century and today represents no more than 5%. **Today, the purse seine accounts for 60% of the bluefin catch; these immense circular seines, 2 km long and 250 m deep, are closed from the bottom up. Long-lining still accounts for one fifth of the catch; long-lines can be over 100 km in length, with more than 3,000 hooks attached.**

Bluefin fishing is essentially carried out in the Mediterranean, the other zones being much smaller and, in certain cases, exhausted, such as the Antarctic bluefin fishery. While the actual catch volume for the Mediterranean is a source of contention, this figure likely exceeds 50,000 tonnes.

European fishermen account for the greater part of this catch: 20% for France, 16% for Spain, 14% for Italy and 1% for Greece. Japan accounts for only 9% of the catch and the United States 7%. **Although carried out in international waters, bluefin fishing is mostly a European problem.**

The development of bluefin fishing is a relatively recent phenomenon. It was only in the 1980s that the export market to Japan was developed and the practice of eating raw fish spread. At the same time, prices sharply increased, making bluefin tuna a highly sought-after, luxury product. To meet demand, compensate for the smaller catches, and guarantee the provision of fresh fish of excellent quality all year round, the practice of bluefin **fattening** developed starting in the mid-1990s. Between 1996 and 2006, the number of fattening pens increased 25 fold and **production grew from 200 to 25,000 tonnes**.

The consequences of this practice are very serious, for not only does fattening further blur fishing statistics and interfere with controls, it is also disastrous for the environment, as are most methods for the intensive farming of carnivorous fish. **According to IFREMER researchers, 20 kg of wild fish are required to produce 1 kg of bluefin tuna.**

But the greatest cause of concern is overfishing.

As is the case for all marine species, the bluefin tuna population is subject to short- and long-term interannual variations, depending on factors all the more mysterious as reliable historic data are lacking. This analysis has led scientists to estimate that, **since the 1950s, the stock's average natural production amounts to some 25,000 tonnes**. **According to these same scientists, since 1990 and the doubling of the catch which officially reached 50,000 tonnes in 1998, we have surpassed this natural limit**, for the current period is not one of natural "over-productivity" for bluefin tuna. To ensure this growth, the tuna fleet's catch capacity has grown exponentially for the past 30 years. In France, engine power has tripled over the past 20 years, while advances in technology have provided fishermen with sonar, aeroplanes, etc.

What is more, the international management system complicates attempts at analyzing the situation of the bluefin tuna.

Bluefin tuna are managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT), which has fixed, **since 1996, a TAC** and national quotas which are meant to be respected. However, the official and fallacious respect of quotas results in an under-declaration of catch volumes, which was already the subject of a 20% correction in 1998. **In addition, it is often estimated that the bluefin catch, despite the lowered quota, has remained unchanged since this period (in other words, between 50,000 and 60,000 tonnes).**

Up until recently, no Mediterranean state has considered these quotas as obligatory, which in fact they are.

No state has incurred sanctions for surpassing these quotas.

In Europe, this was made all the more difficult by the fact that all modern ships were acquired via European subsidies following ministerial authorization, even though the problem of overfishing was already a recognized fact.

A recent exception was France, which admitted to having greatly surpassed its quota. This action was well received and France hoped to attract a following among its closest partners, beginning with Italy and Spain, but this effort failed. France remained isolated in its attempt at truthfulness. At the same time, it is likely that French seiners are far from being exemplary. It is common knowledge, following several news reports in the written press and on television, that laid up ships replaced by the most modern, subsidized vessels are thought to have been registered in Libya, while remaining the property of the same financial interests. Likewise, in the summer, the Commission clearly expressed its suspicions concerning a French fleet that had declared having used up only half of its quota and several of whose ships had supposedly fished nothing after three weeks at sea.

Such a situation cannot be sustainable. Scientists observe a mortality-by-fishing rate 2.5 times greater than the optimal value and **a collapse of the spawner population**, though it remains for the time being capable of providing a sufficient recruitment**.** The population pyramid for bluefin tuna increasingly resembles an upside down hammer: a wide base made up of the yet-to-be-fished young and a handle made up of the very small number of surviving adults.

For the past several years, scientists have issued very conservative assessments regarding the bluefin tuna and have called for a great decrease in quotas. For 2009, the bracket was fixed between 8,000 and 15,000 tonnes. ICCAT decided to fix the quota at 22,000 tonnes. It was 28,500 tonnes in 2008, but actual catch volumes would remain at their previous levels. In fact, the Mediterranean tuna fleet is growing and it must fish to remain profitable. The WWF has estimated the capacity of the

617 identified ships at 42,000 tonnes. **The fishing capacity of France's seiners has been estimated at 15,000 tonnes, while their quota is fixed at 4,800 tonnes.**

The bluefin tuna situation would perhaps be less serious if it were reversible and concerned only this one species.

However, it has today been shown that the collapse of a superior-predator stock in an ecosystem is liable to entail an irreversible regime change, with the species in question incapable of ever recovering its initial state.

But, **there is perhaps already evidence of this regime change in the Mediterranean**, with an abundance of tuna prey, the small pelagic species and jellyfish.

If the bluefin tuna population were to collapse (as can now be expected), this would not only have economic consequences on the fishing industry, which would then call for government assistance, it would also affect the entire ecosystem, which would become less rich, less productive and less resistant to outside aggressions. The loss of value in the Mediterranean would therefore be much greater than a lower turnover for the tuna boats!

All things considered, the Mediterranean would appear to be a basin in which **the absence of any real cooperation with regard to the management of marine resources represents an obstacle to their protection and even their simple scientific understanding**. In the Mediterranean, the decrease in catches and the occasional spikes in the jellyfish population are plausible evidence of a degradation of the marine environment. However, such an evolution is not inevitable, the Mediterranean is not doomed to become, like the Black Sea, a collapsed ecosystem.

For this reason, your *rapporteur* **proposes that fishery management and halieutic research become a federative theme of the Union for the Mediterranean**. Such an initiative would likely be welcomed by several countries, beginning with Italy, the basin's principal fishing power.

I also propose that **Europe, which accounts for half of the bluefin catch and is largely to blame for overcapacities, take its full share of responsibility for the management of this fishery**. **Important fleet reductions** must be carried out, **quotas must be drastically reduced, and control measures significantly reinforced**.

Those European states which do not cooperate must be heavily sanctioned by the Commission, which must initiate the necessary disciplinary procedures. Likewise, the Commission must apply effective pressure on southern Mediterranean countries which act irresponsibly.

To prevent other fishermen from benefitting from a strict European policy, the EU could **close its territory to illegal fishing practices, by closing its market to commercialization or its coasts to fattening**. It should also **unilaterally decree marine reserves**, in particular **sanctuaries for tuna reproduction, modelled after those which already exist for the protection of marine mammals** and in which the EU would enforce its fishing policy. Ideally, the entire Mediterranean should be closed to tuna fishing for several years during the reproductive period of May and June.

At the same time, it will also be necessary to **strongly support research to further our understanding of bluefin biology, essential for the future sustainable management of this species**.

To this end, it would seem equally **essential to locate reliable fishing statistics**. **The gap between officially declared catches and estimated catches has never ceased to grow since the establishment of a fishing quota for the species in 1996. The ratio for 2007 is estimated at 1:2; this discrepancy will perhaps increase if we continue to lower quotas without imposing other measures for their enforcement.** This obviously makes it problematic to know the fishery's real situation.

D. THE FRENCH FISHING INDUSTRY AT THE TIME FOR MAKING CHOICES

1. The analysis of the Poseidon Report: a sector in difficulty

The Poseidon Report of December 2006 analyzed the French fishing industry, which it described as being "confronted with new issues", "at the time for making choices", with its "industry-based approach - which implies a policy of supporting structures, ship owners and crews - [being] insufficient".[1]

a) The analysis of the International and European framework

The report judged that the international studies converged to demonstrate:

- That the catch had ceilinged out, despite an ever-greater fishing effort.

- Above all, the insufficient application of regional regulations meant to bring fishing practices back to their optimal quotas, thereby harming "reasonable" fishermen and encouraging illegal fishing whose production, for certain stocks, outweighs the authorized catch.

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[1] *P. 52 and following pages, Poseidon Group report, Une ambition maritime pour la France ("A maritime goal for France"), Centre d'Analyse Stratégique ("Strategic Analysis Centre") and Secrétariat Général à la Mer ("General Secretariat for the French Action at Sea"), Paris, La Documentation Française, no. 5-2006, 160 pp.*

- The growing dependence on aquaculture to meet our needs, thereby provoking collateral problems such as increased pressure on the so-called "fish-meal species"[1], local pollution and the contamination of wild species.

The report also pointed out the growing contamination risk posed by terrestrial pollutants to fish and seafood, making them dangerous for consumption.

At the European level, the constant modernization of fishing capacities over the previous 30 years had, according to the report, progressively entailed the over-exploitation of a large share of the principal halieutic stocks present in European waters. "The Common Fisheries Policy has so far failed to check this serious trend".

For this reason, **the report observed that "Much of the sector is, as a result, currently losing its profitability, aggravated by the constant rise in fuel prices. The very viability, in the short- and medium-term, of the fishing industry is therefore in danger"**.

Faced with this situation, **the report observed that the European Commission "rightly imposes ever greater constraints and ever more catch limits"**, thereby provoking conflicts with and between fishing professionals due to the shortage. It concluded that **a "true European fishery policy" had to be voluntarist and will necessarily be difficult to assume by the states**.

The Poseidon Report pointed out the particularly topical case of the end-of-the-year negotiations over TACs and quotas, which gives "a deplorable image" of Europe and leads the Commission to accept compromises that are "precarious and sometimes unenforceable".

For the past several years, the Commission has, in addition, sought to ensure the states' proper application of fishing regulations – **as a respect for the shared rules is the essential starting point for any fishery policy** – thanks to the creation of the Community Fisheries Control Agency (CFCA) and increased European inspection missions.

The report concluded that:

"**The uncertainty of annual decisions centered on stock management today penalizes all industry actors.** Therefore, it would be best for the scientific models to produce multiyear recommendations that take into account the economic perspectives.

"Otherwise, **fishing-industry decisions will remain the fruit of a conflictual conjuncture of scientific recommendations, economic worries and political issues linked to the current economic climate**, during bitter annual negotiations between the European countries. The shift to sustainable management will make profitability possible and result in a serene European

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[1] *Species targeted by the fishing industry for the manufacture, in particular, of fish meals and oils.*

climate. **The central issue is determining the nonbiased direction to be taken in order to attain more profitable conditions (restoring the potential of the halieutic stocks, an appropriate fishing effort).**

"In this regard, [...] **the economically-necessary industry evolutions [are]: balancing the fleet with the exploited resources, favouring the technical evolution toward more selective fishing devices and greater safety, and improving the supervision of fishery access.**"

b) The difficulties facing the French fishing industry

Within this European framework, of which France is an integral part, our national fisheries appear to be in **particular difficulty**.

The French fishing industry currently produces only 15% of the fish and seafood consumed nationally, and the processing centres of Lorient and Boulogne now depend more upon import-export than upon French fisheries. In Boulogne, 350,000 tonnes are processed annually, while only 60,000 tonnes are actually fished.

The report also observed overcapacities that are to blame for profitability and overfishing problems.

This situation results in a high level of government aid, which "naturally" led the authors to **"question the pertinence of maintaining such assistance: more than €800 million including social assistance - more if one also includes temporary subsidies linked to the rise in fuel prices - compared to a turnover of €1.1 billion at the first sale in 2004. Other European countries have chosen to abandon this sector, especially as imports are competitive and meet the market's demands** [...]. Various reports (by the OECD, for example) note the perverse effect of permanent assistance. **The ever-shrinking leeway to preserve jobs and competitiveness foretells the inexorable erosion of activities within the sector, an evolution liable to generate social conflict. Certain technical choices favoured in France (trawl netting) are becoming handicaps with the rise in energy prices.** Fuel can represent one third of a small-scale fishing operation's turnover. **This statement of fact should serve as an impetus for work, research, innovation and modification of practices** to produce fishing devices suited to the new constraints".

2. The evolution of the French fishing industry over the past 20 years

To continue further in this analysis, one must reconsider the overall state and evolution of the French fishing industry over the past 20 years. Your *rapporteur* will here rely on statistical data furnished by IFREMER and, more particularly, on a paper I was presented with by Patrick Berthou.

The French fishing industry provides some **16,000 fulltime jobs, with an estimated 24,000 people at sea**.

The Atlantic, English Channel and North Sea fleet is largely concentrated along the coast of Brittany, which accounts for 41% of the industry's ships, 45% of its nominal on-board power, 55% of its gross tonnage and 41% of its direct at-sea employment. The Pays de la Loire and Basse-Normandie regions each constitute around 15% of the national fleet.

Since 1983, the number of metropolitan ships has fallen by 54%, from nearly 12,000 to around 5,000 vessels; this drop was especially sudden between the late 1980s and the early 1990s. The fleet remains essentially made up of boats under 12 metres in length (4,000), but it was this category that was the most affected, for there were over 9,400 such boats in 1983. Ships over 12 metres in length have also decreased significantly, dropping by 39%, from 2,200 to 1,400 vessels.

However, the **average nominal power** has, over this same period which saw the fleet's size shrink, **grown by 68%. Considering the fleet in its entirety**, this evolution resulted in an increase in total power up until 1989 (+8%), followed by a decrease over the remaining period. In total, **the drop in power amounted to -26%; however, this decrease has been compensated for by advances in technology.**

Despite these major evolutions, the fleet's geographic distribution has remained stable over the past ten years. The metropolitan fleet – 70% of which is stationed along the western seaboard - represents 70% of the French fleet.

Since 1990, this North Sea/English Channel/Atlantic fleet has decreased in number by 36% (3,900 in 2003), though average ship size has grown by 6% (12.3 metres) and average power by 19%.

This fleet has also aged, with average vessel age rising from 15 to 20 years and the percentage of ships more than 25 years old rising from 14 to 28%. **However, in the "Europe of fifteen", the French fleet remains by far the youngest.**

While the western fleet's activity is concentrated along the coast, more and more fishing is being done on the high sea. In number, coastal ships represent 72% of the fleet (compared to 16% for open-sea vessels), in number of sailors 46% (compared to 38%) and in total power 37% (compared to 48%).

In terms of production value, the high-sea catch represents 54% of the western-seaboard total, compared to only 30% for the coastal ships.

This fleet practices an **especially wide variety of fishing types**, the four most important of which utilize trawlers, nets, pots and dragnets. High-sea fishing relies principally upon trawlers. The French fleet is also highly **versatile**; while 1,800 ships are equipped with only one mechanical harvesting

device (most of the high-sea fishery), more than 1,200 have two and 600 have three such devices.

If one separates the fleet's turnover into different fishing types, the **prominence of trawl netting** becomes clear; out of a total of a little more than €1 billion, dedicated trawlers account for nearly €600 million, nearly €500 million of which is produced by high-sea trawling. If one also considers non-dedicated trawlers, then **this fishing method alone represents nearly 70% of the value of the western seaboard fishery**.

Finally, excepting a few high-sea fisheries (in particular, for langoustines), **the greater part of the fishing value is produced within the 12-mile strip and, in all cases, within the EEZ**.

On the western seaboard, **53 stocks represent 90% of the commercialized catch from the Bay of Biscay and 50% from the English Channel.**

Of these 53 stocks, 10 are deemed to be in good condition, 33 to be at risk and 10 to be in critical danger.

The above overview explains the difficult situation of the French fishing industry.

The situation of these resources is not better than elsewhere in Europe; however, **due to the predominance of trawling, the French industry is much more vulnerable to the rise in energy costs (as has been demonstrated these past few months) and to the desire to increase selectivity**.

The fleet's organization also shows the greatly divergent interests separating French fishermen, depending on their particular fishing method and, therefore, their targeted species. Likewise, the gap is growing between high-sea fishing, which accounts for the greater part of production, and the important small-scale fishing sector, although the French fleet provides only a small share of the national fish-and-seafood market.

Another obvious question concerns the concentration and evolution of the various fishing methods. For instance, shifting to the Danish-seine method, which is much more energy efficient, would imply a significant reduction of the fleet.

To help alleviate the difficulties plaguing the sector, the government set up **a 2-year, €310 million assistance plan which came into effect in early 2008** and which is financed, in part, by a new tax on the retail sale of fish (product estimated at €80 million per year).

It **mainly consists of fleet reductions**. It also includes other assistance measures liable to improve the sector's long-term orientation: modernization in favour of safety and energy efficiency, the creation of a minimum monthly salary to move away from catch-based remuneration, assistance dealing with stock-restoration measures, help in setting up young workers, and the creation of an ecolabel.

Well received by the profession, **this plan has above all revealed a deep unrest, for destruction and retirement requests were double the expected amount**.

It includes **a research section placed at the forefront of the group of measures, but provided with €2.6 million; your *rapporteur* was puzzled by this section's formulation in the electronic flyer sent out by Michel Barnier to the Members of Parliament**: "The amendments will target sensitive stocks to which French fisheries are constrained, in order to strengthen the arguments of the French delegation during negotiations pertaining to the fixing of Total Allowable Catches"!

Concurrent with the announcement of this plan, the President of the Republic gave a speech on 19 January in Boulogne-sur-Mer which appeared to advocate the abolition of TACs and fishing quotas. This speech was very poorly received in Europe.

Taken overall, **this plan remains a temporary economic adjustment that ignores the four fundamental issues explaining the French fleet's deficient profitability**:

- The insufficient halieutic resource.

- The overcapacity maintained by advances in technology.

- The dependency on subsidies.

- **The specialization in trawling.**

IV. AQUACULTURE: FROM MIRAGE TO MIRACLE

Faced with the fishing crisis, with fish representing the last great wild biological resource to be exploited for human food, many see aquaculture as the natural and inescapable solution, just as man has shifted from hunting to breeding and from gathering to farming.

And yet, if aquaculture is indeed crucial for the future of human food production, its current form does not yet offer sufficient guarantees with regard to sustainability and may seem to offer false hope. For there to be a miraculous "blue revolution", a certain number of conditions must first be met.

A. AQUACULTURE: A NECESSARY FOOD SOURCE AT THE WORLD LEVEL

Based on worldwide halieutic-production statistics, aquaculture would appear to be not only **an immediate necessity, but also a future pressing obligation** in order to ensure food production for a human population that is ever growing and ever more eager to eat fish.

1. Aquaculture today: a necessary food source

According to FAO statistics (SOFIA 2006), **aquaculture is the fasting growing animal-based food-production sector, posting an 8.8% increase per year since 1970**, compared to only 1.2% for fishing and 2.8% for terrestrial systems.

In 2004, aquacultural production reached 45.5 million tonnes for a value of $63.3 billion, and 59.4 million tonnes and $70.3 billion if one also includes aquatic plants. **China represents more than 70% of the total tonnage and more than 50% of the total value. The Asian Pacific region accounts for 91.5% of the worldwide tonnage and 80.5% of the worldwide value (99.8% of plants, 97.5% of cyprinids, 87.4% of shrimp and 93.4% of oysters).** Salmonid production is the only aquacultural sector dominated by Europe (55%). In Africa, aquaculture is concentrated within the Nile Basin, with Lake Victoria for perch and Egypt itself for the tilapia (second only to China) and the mullet (number one worldwide producer).

Within these global figures, it should be pointed out that **freshwater aquaculture remains dominant (56.6% of volume and 50.1% of value), with carp alone representing 40% of the total tonnage**. Carp production is traditional in China, where it is associated with rice farming. Indeed, bovids requires 7 kg of fodder for every 1 kg of meat, compared to only 3 kg for carp,

and their production does not necessitate the requisition of arable land. Therefore, carp farming saves both cereals and agricultural land.

Nevertheless, while **aquaculture represented only 3.9% of halieutic production in 1970, it represented 32.4% in 2004**. The aquacultural supply per inhabitant grew from 0.7 kg per year in 1970 to 7.1 kg per year in 2004.

Concerning **fish produced for human consumption, worldwide aquaculture (excluding China) produced 15 million tonnes, compared to 54 million tonnes for fishing. In China, aquaculture represented 31 million tonnes, compared to only 6 million tonnes for fishing**.

For the moment, in terms of species, aquacultural production remains extremely concentred, with 10 large groups accounting for 90% of production, although aquaculture is becomes increasingly diversified. The two largest groups are carp and shrimp. Of this production, **saltwater fish represent only 1.4 million tonnes**.

At the global level, **aquaculture provided 43% of the total volume of table fish in 2004**.

Aquaculture plays **an essential role in the food security of numerous developing countries**, starting with China and India, the world's two largest producers. In China, the supply per inhabitant rose from 10.9 kg in 1994 to 23.7 kg in 2004.

While aquaculture is a major source of world food production, one must not mistake its true nature.

The current form of **aquaculture relies overwhelmingly on freshwater fish. Very few marine species are farmed; their production is negligible compared to the world sea catch. Therefore, with regard to world food production via marine resources, it offers no alternative to fishing**.

This aquaculture is highly concentrated geographically, nor does it represent a viable alternative to the European fisheries.

The small number of concerned species and their often mediocre gustatory quality would represent an important setback in terms of biodiversity and food quality compared to the wild-fish catch.

2. Developing aquaculture: an obligation for tomorrow

For the past 20 years, the world catch volume has stagnated, as has already been mentioned; it is even possible that it has already started to decline.

At the same time, **worldwide per capita consumption of halieutic products is increasing, rising from 9 kg in 1961 to 16.6 kg in 2004.**

In the continental or inland waters (China included)**, aquaculture already represents more than three times the volume of the freshwater fish catch** (28.9 million tonnes compared to 9.6 million tonnes). **At sea, the fish catch is around four times as great as saltwater aquacultural production** (84.2 million tonnes compared to 18.9 million tonnes), but the gap is narrowing. Indeed, 2008 is expected to be the first year in which aquacultural production will match fresh- and saltwater catches for human food production.

Considering the much deteriorated state of the marine fish stocks, we can expect no increase in catches. Hardly any virgin stocks remain, with most stocks being fully exploited or even over-exploited.

Therefore, only aquaculture will be able to meet the future demand for halieutic products and fill the gap between fish consumption and the wild fish catch.

In addition, in its **forecasts for 2030**, the FAO counts on a stable marine catch (87 million tonnes), only a slight decrease in the inland catch volume, and a marked **increase in aquacultural production**, which is **expected to reach 83 million tonnes**. The FAO predicts that aquacultural production will continue to increase at the very high rate of 8% per year worldwide. **This would allow table-fish production to reach 150 million tonnes, which is nearly equivalent to a 50% increase compared to the 2004 volume** of 105.6 million tonnes.

According to its forecasts, **over the next 20 years, aquaculture will account for the greater part of table-fish production**.

At the same time, the FAO estimates that the share of total production used for consumption will increase (to 85% instead of 75%), with **the volume dedicated to non-food uses decreasing by one third, dropping from 34.8 million tonnes to only 26 million tonnes**. **This represents a bold bet on the ability of aquaculture to depend upon an ever decreasing amount of wild or non-farmed products**, for we would witness a near doubling of production along with a one-third reduction in the amount of "wild" inputs.

The FAO is perfectly aware of the challenge constituted by this forecast and recognizes that, at least until 2015, the demand for fish meal will continue to increase along with the pressures on this market and therefore on the wild resources. After this date, it believes that the research under way will be able to begin to produce its fruit and will rapidly help to alleviate demand.

However, the FAO believes that the rising cost of fish meal could slow aquacultural growth and could even result in a decreased volume of table fish starting at the end of the present decade.

3. French marine aquaculture: a strategic issue

According to the Poseidon Report, French marine aquaculture presents distinctive characteristics: the sector's **highly technical and competent nature "upstream"** and the **marked preponderance of shellfish farming** (in particular, oyster farming; French oyster farming accounts for 90% of European production and represents the number one aquacultural activity in terms of value at the national level, coming in second at the European level). However, France counts **very few marine fish farms**.

In our country, the major obstacles to this sector's future development are the conflicts of use and the difficulties of obtaining administrative authorization. The solution, no doubt, resides in a national inventory of favourable sites (already carried out in 2001 by IFREMER) and its incorporation into the coastal development and management plans.

French aquaculture is specialized in a small number of shellfish species farmed by small businesses. This makes the sector especially sensitive to health incidents, as was illustrated last season. IFREMER's aquacultural research logically concentrates on shellfish (in particular, hatcheries, so as not to depend upon the capturing of wild seed oysters, heavily concentrated in Arcachon Bay) and on resistance to diseases and the development of alternative species in the event of a new epidemic. Shellfish farms are also highly dependent upon water quality and terrestrial effluents.

However, French marine fish farming is very limited, with an annual production of around 7,000 tonnes. Nevertheless, French hatcheries are successful, producing over 60 million alevins (over two thirds of which are exported), accounting for one quarter of the sector's turnover. Production is concentrated on three species: sea bass, turbot and bream.

This situation is hardly satisfactory, especially considering its paradoxical nature. We are importing ever greater quantities of farmed fish and shellfish, while at the same time deploring the conditions in which these same fish are raised and preventing the development of a downstream sector in France.

Considering the international stakes of aquaculture and the evolution of fishing, **the development of the French aquacultural sector represents an important issue for the future with regard to both national food production and coastal economic activity**.

What is more, the various aspects of the strategic importance of aquacultural development have been well identified by the French authorities:

- Guarantee favourable sites for marine fish farms.

- Ensure good water quality, even if this task remains difficult and though protected marine zones located directly offshore will offer new means of control.

- **Develop the downstream fish-farming sector.**

- Diversify the species farmed and strengthen protection against diseases.

B. A NON-SUSTAINABLE AQUACULTURE

Necessary and inevitable, aquaculture would appear to represent **a "blue revolution" similar to the "green revolution" which saw an increase in agricultural production beginning in the 1950s and which has allowed numerous countries to avoid a food crisis**.[1]

While certainly constituting a revolution, we are nevertheless far from the aquacultural miracle that is sometimes described: not only would aquaculture provide us with food, it would also render fishing unnecessary and minimize our environmental impact. **Unfortunately, this radiant picture is inaccurate and can still be likened to a mirage.**

1. The impact on the "wild" resources

Most aquacultural fish and all maricultural fish are carnivorous; in their natural environment, these superior predators feed on other fish. In captivity, they must be provided with their prey, in the form of fish meal and oil.

This fish meal and oil are made from the **non-food forage fish catch**, generally small pelagic species such as anchovies, jack mackerels, gilt sardines and sand-eels from the North Sea. However, this fish-meal catch of some 35 million tonnes is not dedicated exclusively to aquaculture (46% of meal, 90% of oil), for the use of fish meal in poultry farming (22%) and pig farming (24%[2]) continues despite the strong rise in the prices of these inputs.

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[1] *For Science, no. 373, November 2008, Jeffrey Sachs, Director of the Earth Institute, University of Columbia, New York.*

[2] *2003 figures, source: IFREMER, André Gérard.*

It is generally estimated that **one tonne of fish is needed to produce 200-250 kg of meal and 40-50 kg of oil**.

World production has reached its ceiling of 6-7 million tonnes of meal and 1-1.7 million tonnes of oil.

The production of fish meal and oil and worldwide aquaculture are completely dependent upon a few highly targeted halieutic resources, the most important of which is the Peruvian anchoveta and a few other species of the Humboldt Current. Peru provides 30% and Chile 15% of total world production; **therefore, 45% of total world production is dependent upon the management and productivity of a single ecosystem!** An additional 40% is provided by only seven countries.

In addition to this dependency, there is the negative yield of superior-predator farming. Today, it is estimated that in order **to produce one kilo of farmed fish (such as salmon), some 3-5 kg of wild fish are needed**. However, this yield is positive for the farming of freshwater, herbivorous or omnivorous fish (such as milkfish, tilapias, panga and carp), with only 0.2-0.3 kg of wild fish needed to produce 1 kg of farmed fish.

The problem of meal-fish production is not limited to the question of aquacultural profitability.

Two other important issues must also be considered. Firstly, **the direct use of some of these resources as food**. While this was largely a non-issue in the case of the Peruvian anchoveta, since traditionally this species was not fished for and consumed, it is already an issue in other regions of the world where this pelagic fish could serve as a basic table fish, in particular for the poorest populations. In Peru itself, the act of transforming some ten million tonnes of perfectly consumable fish into meal for exportation, while the country's own population can still suffer from malnutrition, is a subject of debate. Indeed, the Peruvian authorities have decided to launch campaigns promoting the domestic consumption of this fish as food.

One must also consider **the impact on the food chain**. Forage fish that are transformed into meal play an essential role in ecosystem balance by eating plankton, which is thereby incorporated into the food chain. In addition, these fish are also the prey of all the other predators, whether fish, birds or mammals. Therefore, the fishing of forage species raises the question of the fish-meal catch's impact on the rest of the ecosystem.

In reality, this impact remains very poorly understood. The information available is disparate and fragmentary and leaves very ample room for hypothesizing. Commissioned in 2002 and 2003 by the European Commission, ICES produced an evasive assessment while calling for a better understanding of the subject matter. In 1997, it had estimated natural predation of the sand-eel in the North Sea at 1.9 million tonnes for predatory fish (cod, haddock, whiting, mackerel, pollock, coalfish and sea robins), 200,000 tonnes

for birds and 300,000 tonnes for mammals and other fish. Seabirds' dependency on this prey is best understood, for forage fish constitute an indispensable source of lipids during the reproductive period; this has led to the creation of a 20,000-square-kilometre fishing reserve to the west of Scotland. In Peru, one observes the same dependency of seabirds vis-à-vis anchovies, as well as decreasing populations.

Even more poorly documented is the long-term impact of such a large biomass's withdrawal from the ecosystem.

Finally, the exploitation of these forage fish is rendered all the more delicate by the limited longevity of the stocks, which therefore boast few age classes. While extremely prolific during normal times, these fish are very sensitive to climate changes and overfishing; the combination of a poor recruitment and overfishing can lead to the fishery's closure, with its ensuing chain of consequences on the ecosystem.

These mechanisms render aquaculture heavily dependent upon wild ecosystems, which are themselves subjected to very great pressure.

But wild resources are not impacted only by fishing; one must also acknowledge the existence of **a genetic pollution**.

The cages in which fish are farmed are never completely impermeable and numerous fish escape, thereby threatening to mate and form hybrids with their wild relatives. These fish contribute to the genetic weakening of the wild populations.

The best known cases concern the salmonids, which are specially monitored to measure their hybridization with the wild salmon of the rivers.

For example, in early October 2008, a 7 kg salmon was caught in the Seine at Suresnes. This event was enthusiastically greeted by most media outlets, for a salmon had not been caught this far up the river in 70 years. This "bioindicator" salmon was welcomed as signalling a significant improvement in water quality and the crowning achievement of water-quality measures. While this is undoubtedly true, one must not forget the environmental destruction that has made what would have been considered an ordinary catch at the beginning of the last century, quite an event today, nor the ban imposed by the prefect of the Haute-Normandie department on eating fish caught downstream due to the presence of PCBs. Nor should one forget that this salmon would undoubtedly have had trouble reproducing, for its having been caught at Suresnes is due to the fact that the Suresnes dam lacks a fish pass. Finally and most importantly, this salmon was a hatchery fish that had escaped from its cage several years preceding its capture.[1]

[1] *See Le Chasseur français, December 2008.*

The escape of fish from their cages can have a more dramatic effect when the species is farmed outside its natural environment, in which case it becomes invasive. In Chile, the rivers have lost their original fish population as the result of introductions dating from the 19th century and intensive fish farming.

2. The impact on the natural environment

In its current form, marine aquaculture also suffers from excessive discharges of food and pesticides. These two inconveniences are directly linked to the more or less intense nature of fish farming, as well as to its management.

The concentration of fish threatens excessive organic discharges into the marine environment, and even the terrestrial environment for the skins, heads and bones. These discharges are of two kinds: excess food and excrement. They can lead to a **eutrophication** of the sea bed; in other words, the depletion of dissolved oxygen due to increased decomposition and plant growth (phytoplankton, algae).

Overpopulation is also a powerful vector of **diseases**, some of which may be vaccinated against. For example, in Norway, all farmed salmonids are vaccinated by hand. Other diseases, however, may lead to the poorly-regulated use of antibiotics and other medicines, which are then diffused throughout the environment. Farmed fish can also have **parasites**, such as sea lice on salmon, which they pass on to their wild brethren.

In Chile, environmental associations report that the county's intensive salmon farms have had to relocate far south to virgin zones due to the impossibility of controlling diseases and the environmental destruction of the initial maricultural zones which have become unsuitable for fish farming.

C. THE ENVIRONMENTALLY FRIENDLY AQUACULTURAL OPTIONS

Despite these very great limitations, aquaculture remains a promising sector if it truly helps to protect certain threatened species and if it manages to reduce its environmental impact and the pressure it exerts on the wild fish stocks.

1. A role in the preservation of wild species

Aquaculture could be the only solution to save a certain number of threatened, wild species, just as certain land animals are the subject of international breeding-in-captivity programmes within zoos, in order to first save and later reintroduce these species back into their natural environment.

Most progress has undoubtedly been made with regard to sturgeon and eel farming.

The former was ignored until the discovery of the method for producing and the culinary popularity of caviar, while the latter was scorned and occasionally used as fertilizer. Both species migrate between the sea and freshwater and both are today seriously endangered. Sturgeon and eels are the subject of research for their farming and reproduction.

Sturgeon, which produces the different varieties of caviar, is one of the world's most threatened species of fish, the victim of an anarchical system of fishing in the Caspian Sea since the collapse of the Soviet Union. The very high prices fetched by wild caviar and the partial ban on its commercialization have opened the way to the farming of a few species in order to satisfy demand and relieve pressure on the surviving wild populations. Sturgeon farming has become a very famous French speciality. Aquacultural research has also concentrated on the European species once common in France's Gironde department and in other European waterways. This species has been protected in France since 1982 and at the European level since 1988. Since 2007, after 15 years of breeding, several reintroductions have been carried out in the Garonne and Dordogne Rivers. At the same time, in 2008, several releases were carried out in the Elbe River, from which sturgeon had been absent for at least fifty years. New European partners will undoubtedly allow for a wider European reintroduction effort in the future. This project is currently being carried out by CEMAGREF in Bordeaux and the Leibniz Institute of Freshwater Ecology and Inland Fisheries in Berlin.

Less progress has been made with regard to **eels**. European eel stocks are today exhausted, **victims (along with all other migratory diadromous[1] fish) of poor freshwater quality, development and the destruction of spawning zones**. The case of eels is rendered more complex by the fact that **we still do not know how to breed this fish in captivity**. All farmed eels have been caught as wild elvers in our estuaries. Indeed, in its natural state, the European eel is never sexually mature in our rivers. It is during its journey back to the Sargasso Sea, where the eel will reproduce and die, that it becomes sexually mature and its body is radically transformed and mobilizes all of its resources for reproduction. Producing individuals capable of reproducing therefore entails various complex stimulations simulating the effects produced by the fish's Atlantic migration. One must then succeed in raising the alevins, by providing them with the physical conditions and prey that they would naturally find in the Sargasso Sea at the time of their hatching. During my investigations, I have been able to observe very encouraging experiments that lead me to believe that researchers, particularly in Denmark and Japan, are

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[1] *Fish dividing their lives between fresh- and saltwater (living in one and reproducing in the other, depending on the particular species).*

about to succeed in the laboratory. Combined with other efforts, aquacultural research could perhaps allow the wild species to regain its historic abundance.

2. Reducing the impact on the natural environment

Reducing the impact on the natural environments in which aquacultural cages are set up represents a second challenge. To succeed, all farming methods must be improved.

Excess nutriments in the water and sediment are the first obstacle. A variety of solutions could be implemented: reducing the nutriment supply, changing the fish food, reducing densities, or even setting up **closed fish farms with recirculation**. Though complex and costly, the latter **certainly represent the future of aquaculture, at least in freshwater**, for they guarantee complete control of the fish-farming process. For mariculture, the question of cage location is also being considered in order to ensure proper discharge dispersal; one option being studied is the setting up of fish farms on the high sea, where all pollution would be eliminated by the currents. An important avenue of research is also the mixed farming of multiple species; for example, filter-feeder molluscs farmed alongside fish cages or combinations with other fishing activities, with artificial reefs that would provide habitat to a greater density of fish benefitting from the excess nutriments.

The excessive use of antibiotics has also been identified as the cause of increasingly **resistant bacteria in fish-farming zones**, prompting first a decrease in biodiversity due to the spread of disease, then the abandonment of the farm, the strains becoming too resistant. Here, the solution resides in a preventive approach which seeks to avoid the unexpected appearance of disease via an appropriate environment and diet, a vaccination, greater surveillance and, perhaps, isolated treatment systems.

Other, more specific problems must also be considered, such as the use of new habitats for shrimp farming in order to avoid the destruction of mangroves, which has a dramatic impact on biodiversity and the tropical coasts. The same is true for excesses linked to shellfish farming, which can result in a decreased biomass of phytoplankton, a decreased number of natural seed oysters, or excessive discharges.

3. Reduce or eliminate the catching of wild species

Finally, reducing or nearly-eliminating the catching of wild species will **first entail the choosing of species more in accordance with this priority and the farming of omnivorous or herbivorous species whose yield is markedly greater though often of lesser value.**

For the carnivorous species, extensive studies must be carried out to **further reduce the amount of fish meal and oil in the diet of these farmed fish**. For the time being, this is very difficult, for farmed fish lose the nutritional qualities (fat content, fatty acids, etc.) that make them interesting, if they are not fed a sufficient quantity of halieutic elements, in which case they also lose their gustatory qualities and, in some cases, the physical appeal of their meat. In addition to these problems, there is the increased risk of disease during farming and, in the longer term, of the denaturation of carnivorous animals that have become herbivores, similar to cattle that are fed animal meals.

To find a substitute for fish meal and oil, IFREMER's André Gérard discovered that **animal meals and oils** were initially favoured by fish farmers. Animal meals present a good amino-acid content, but they also contain lipids of poor quality for fish and too much bone-based mineral material. Animal oils are too rich in saturated fatty acids. **They were progressively abandoned and finally banned in 1996, though they are still used in Asia.**

Aquaculturalists have therefore turned toward plant-based food sources. Plants can provide amino acids similar to fish meals, though in different proportions. In most cases, they must therefore be mixed to obtain an adequate nutritional profile as fish food. In addition, in order to avoid antinutritional factors affecting digestion or disrupting natural hormonal functions, a sorting out or a specific treatment must be carried out. Finally, since fish have great difficulty metabolizing carbohydrates (unlike shrimp), oil cakes or gluten are required. It turns out that, in total, these plant-based substitutes cost about as much as fish meal. The advantage is that, **at the experimental level, a replacement rate of 75% can be reached with trout and sea bass, without any detectable effect on the growth or quality of the meat (compared to the current replacement rate of 30-50%). The use of plant meal should also allow for a decrease in the quantity of mercury found concentrated in certain meals.**

Vegetable oils are exceptionally well suited to replace fish oils, which can be reduced to only 2-4% during farming. Vegetable oil has the added advantage of very markedly decreasing the concentrations of lipophilic pollutants, such as dioxins and PCBs, which become concentrated in the marine food chain. However, this diet modifies the meat's omega-3 content, which is incorporated but not synthesized by fish. It is therefore indispensable to provide these fish at the end of their farming life cycle with a diet rich in fish oil.

In addition to this research on fish food, researchers are searching for fish that will better accept this modified food and be better suited to intensive aquaculture.

The goal is not only environmental in nature: fish meal and oil together constitute a limited resource, since the fish catch will not increase in the future. This resource will therefore be directed toward the most productive and profitable use. It can be supposed that the use of these meals to feed poultry and pigs will be abandonned to the benefit of aquaculture, for they are not required by land animals. But it may become more profitable to transform these small pelagic fish and fish waste into end products directly destined for human consumption, such as surimi or "fish-grade fish".

The stakes of this research are therefore fourfold:

- Relieve pressure on the wild fish stocks and preserve the natural environment.

- Lower food costs.

- Guarantee consumers food security.

- Guarantee the organoleptic quality of food.

V. WHAT PROPOSALS FOR AN IMPROVED, SCIENTIFICALLY-BASED FISHERIES MANAGEMENT?

Following this diagnosis, it is now time to formulate possible directions for the improvement of fisheries management based as much upon halieutic as upon economic scientific data.

No solution is a panacea. The history of fisheries and of their management, as well as the limits, even today, of our understanding favour modesty, especially considering the fact that the sector's prolonged crisis renders any reform difficult. However, these precautions must no longer delay the formulation of proposals and the making of decisions.

According to your *rapporteur*, these proposals may be grouped into five main lines: constructing a shared vision; building decision-making and management tools; placing fishermen at the heart of any responsible fisheries management; demanding that the authorities exercise their prerogatives; and, finally, favouring responsible consumer behaviour.

A. CONSTRUCTING A SHARED VISION: THE DIALOGUE BETWEEN FISHERMEN, SCIENTISTS AND POLITICAL DECISION-MAKERS

Due, no doubt, to an especially demands-oriented culture compared to other countries, **France stands out at the international level for the difficulty, if not impossibility, of holding a constructive dialogue between fishermen, scientists and politicians**.

This situation, which explains and prevents any sustainable fishery management, must be brought to an end.

1. The French exception

The reopening of dialogue between fishermen and scientists was a ubiquitous theme in the interviews conducted by your *rapporteur*. Indeed, this request was systematically uttered during every one of my meetings, from the first to the last.

It is also striking to observe that **fishermen express even greater interest than scientists in pursuing a dialogue**.

Nevertheless, it will take more than a snap of the fingers to gather fishermen and scientists around the same table.

The accumulated liabilities are too great. **Every category of marine professionals has its own share of reasons for criticizing scientists**, especially those of IFREMER.

To summarize the criticisms heard by your *rapporteur*, it could be said that fishermen believe the following:

- IFREMER scientists should be at the service of fishermen, rather than pursuing a fundamental science without concrete application. Research operates according to a different time scale than business; for example, is the response adequate when, in order to resolve a problem that has an immediate impact on turnover, a future thesis is proposed, the results of which will not be known before a few years? In this regard, the fusion of CNEXO[1] and ISTPM[2] in 1984 seems to be the root of all evil. Fishing was sacrificed during this fusion, with IFREMER losing interest in an economic sector on the decline. Fishermen corroborate this point of view by citing exchanges they have had with halieutics specialists of IFREMER, disadvantaged within their institution. Fishermen regret having but a single representative remaining on the board of directors (instead of the previous two); what is more, this representative feels marginalized, largely ignored and occupying the role of a simple figurehead. The Ministry of Agriculture and Fishing has little influence over IFREMER. Therefore, 1984 signalled the end of a golden age in France for dialogue between scientists and fishermen.

- In addition, scientists are insufficiently familiar with the sea. They are unfamiliar with the fishing trade and do not know how to fish. When scientists do fish, they use outdated equipment in zones devoid of fish. Many skippers believe that if they were the ones to carry out these scientific programmes, they would have much better results…

- Rather than being neutral observers, scientists are the instruments of hidden interests (environmentalists, in particular) or the toy of economic interests, such as aquaculture or foreign industrial fishermen. In order to obtain their desired results, they purposefully underestimate fish stocks so as to compensate for the inevitable corrections made during European or international negotiations. The TACs and quotas are therefore in accordance with their desires and very unfavourable to fishermen.

- IFREMER embodies a certain "official science" that will allow for no contradiction or outside expertise, such as that of marine professionals.

- Finally, fishermen are private-sector entrepreneurs and artisans, while researchers are bureaucrats.

As for scientists, their criticisms are hardly more flattering. They suspect fishermen of being dishonest, of deliberately cheating (and in great

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[1] *Centre National pour l'EXploitation des Océans ("National Centre for the Exploitation of the Oceans"), created in 1967.*

[2] *Institut Scientifique et Technique des Pêches Maritimes ("Scientific and Technical Institute of Marine Fisheries"), created in 1918.*

quantity), and of consciously destroying the environment, certain as they are of forever being able to fish somewhere else. According to scientists, great complicity exists between fishermen and politicians, resulting - regardless of the scientists' assessments - in the collapse of ecosystems.

Therefore, it must be observed that the gulf separating these two groups is immense, though both are essential for proper fishery management.

Following or in comparison to the above views which combine actual experiences, received ideas and prejudices, another trend is emerging which should only be encouraged.

In private, fishermen accept to consider that they are discredited by such or such a labour leader by his or her extreme or unrealistic positions or lack of reliability. Likewise, they often acknowledge that the scientists' assessment is not completely erroneous and, what is more, that such or such a group of scientists that they are familiar with works honestly. Several also observe that their profession's "radicalization" is to be explained by the repeated crises and the massive reduction of the fishing fleet over the past twenty years.

As for the scientists, identical premises for a rapprochement can be found. One admits that such or such a colleague is inept at dialoguing, despite his or her scientific acuity. One recognizes an incomplete understanding of the sea or of a certain set of issues.

In addition, observations of this kind are not new: **the fishing industry and IFREMER have already made certain efforts at bringing together scientists and fishermen**.

But without minimizing what has been accomplished, it is clear that these advances have not yet been able to modify the general feeling of distrust and even hostility separating these two worlds.

However, in the opinion of your *rapporteur*, nothing can be accomplished with regard to fishery management if we do not succeed in reconciling these two groups and making them work together.

IFREMER's four-year contract should clearly set out as its priority in the halieutic domain the reopening of dialogue with fishermen, by basing their effort upon the successful experiments of the past few years.

The fishing industry is undergoing real difficulties, of which it is well aware. Though it does not always admit it, it often realizes that the solution must, in any case, be scientific in nature, if only because of the role played by researchers in the setting of TACs and quotas. It seeks dialogue and greater involvement in the formulation of scientific measures. Numerous fishing professionals are the victims of telluric pollution, environmental destruction and climate change, for which they expect scientists to provide the proof and solutions to allow them to continue their activity.

But your *rapporteur* met too many skippers who told me they no longer wanted to work with IFREMER, because such cooperation engenders constraints, but never any returns, neither for themselves nor in the form of information on their fisheries. Many are discouraged and no longer want to make any effort, the "first step" they believe they have already made. Some even believe themselves to be deceived by the scientists. One fisherman who accepted to take onboard a scientist eventually had the feeling of having an "inspector" or "spy" collecting data well beyond the announced programme.

Via these collected accounts, your *rapporteur* does not want to lend judgement, but rather underline the necessity of re-establishing confidence.

I have the feeling that scientists must much more systematically seek to involve fishermen in the process and share with them their results. They must explain their procedures and the manner in which their evaluations are constructed. They absolutely must quit their "ivory tower", where they too often seem to confine themselves. They must be incited to do this. **It would be perfectly legitimate for halieutics researchers to be evaluated according to the success of their partnerships concluded with the fishermen and the latter's degree of involvement in the scientific programmes. Given the current state of affairs, this is perhaps even more important than the publications.**

As an example, it is striking to note **the poor understanding of how scientific programmes function**. To be of scientific value, a fishing programme must be perfectly reproducible and it must be systematically carried out in the same location(s), at the same date(s) and with the same equipment each year. Therefore, when one changes boats, it is best to carry out a simultaneous programme using both the old and the new systems, so as to be able to join the two series of measurements. The goal of such a programme is not to maximize the catch, as though it were a fishing boat, but to carry out a standard scientific sampling.

Likewise, your *rapporteur* very often heard fishermen complain that the scientific programmes were insufficiently frequent to allow for a readjustment of quotas during the same year and to adapt to the resource's real abundance at a given location. For them, the scientists describe an out-of-date reality and impose upon the fishermen constraints that are unsuited to their actual fishing conditions.

While it is necessary to take into account this request on the part of fishermen, for it clearly shows their desire for a scientific assessment that corroborates their experimental observations made at sea, it is also the sign of a certain incomprehension. There inevitably exists a certain time lag between reality and the scientific data. What is more, a new research programme will not immediately provide the expected results, since the data collected becomes completely meaningful only in the long term.

Another example is the case of cod. For fishermen working the English Channel and the North Sea, cod is once again abundant and they should be able to fish it more. This observation by the fishermen is correct, since the current cod population is greater than in previous years. Scientists are not ignorant of this fact, for it is the desired effect of fishing restrictions (an increased population); however, the fact that cod are more abundant does not mean that they are sufficiently abundant. Indeed, when it comes to fishing, man's memory functions according to threshold and habit; one might consider "large" fish and catches that are, in fact, small and modest. This is exactly the case with regard to cod. Cod are more numerous, but the large specimens and schools are no longer present. Previously, one could find cod some 20 years of age that measured nearly 2 metres in length and weighed a little under 100 kg. Such fish are but a distant memory compared with today's "large cod" that measure 50 cm. The same is true with regard to overall catches.

2. The foreign examples

Outside France, your *rapporteur* would like to cite the example of **two countries in which relations between scientists, fishermen and political decision-makers are calmer and more constructive**. Indeed, the IRD's French scientists are often the first to be astonished and alarmed by the situation in France, compared with their experiences abroad, where they cooperate not only with other scientists, but also with the local fishermen, in Peru, South Africa and West Africa.

a) Canada

Canada offers a good example of the quality relations that are possible between fishermen, scientists and political decision-makers. Nevertheless, a serious crisis first had to be overcome in order to obtain a change in behaviour. This crisis came about when, in a rather unexpected manner, the Canadian government decided to put a stop to cod fishing in 1992. This decision was all the more spectacular given the fact that the Grand Banks of Newfoundland had been fished for over 500 years. It is likely that this decision would not continue to have as great a repercussion if the resource had been built up again and if the fishery had been reopened, nor would it have such an effect if the stock's collapse were the result of an overexploitation in total disregard for a unanimous scientific assessment.

On the contrary, no one really foresaw this crisis. The scientists that your *rapporteur* met with in Canada explained that, in hindsight, by considering the data available at the time, they could have predicted the stock's collapse, but they acknowledge that such was not the case. While it is true that the scientific assessments had not always been respected, no researcher can claim to have been right before or against everyone else. Likewise, as has already been pointed out, it had not been expected that the

stock would not rebuild itself or even continue to diminish, despite the fishery closure. The hypothesis that is progressively imposing itself as the main explanation - to wit: an irreversible systemic change of the natural environment - is the fruit of some fifteen years of research.

Faced with this situation, your *rapporteur* met in Canada scientists who are particularly modest and prudent with regard to their assessments, results and predictions. It is certainly no exaggeration to say that they are still shocked by the cultural change they have witnessed in the fishing domain.

In the situation of great unrest, social drama and scientific uncertainty that prevailed in the years following the fishing ban, dialogue between scientists and fishermen became a necessity. The scientists presented this dialogue as having been imposed upon them by the government and by circumstances. They are now obliged to discuss with the fishermen, to explain their results and to take into consideration the fishermen's expertise to complement their data. These exchanges, which are open to everyone, remain occasionally bumpy.

Nevertheless, while it surpasses what they would have preferred, the Canadian scientists met with by your *rapporteur* recognize the advantage of a trusting relationship with the fishermen. The latter now accept without difficulty taking part in scientific programmes, sharing information on their catches, and backing up or invalidating the scientists' stock evaluations. In particular, one fisherman explained that this is essential in order to have a fine geographic understanding of the fish schools, in particular in order to evaluate their abundance or reproductive success; he underlined the extent to which this dialogue was taking shape on the docks and in the ports and necessitates his not hesitating to move about and be transparent for the scientists concerning his own results.

b) Peru

Peru can be seen as **a good example of collaboration between scientists and government authorities.**

Once again, wisdom was the result of a crisis: the collapse of the anchovy stock in the early 1970s; this fishery's level of production did not recover until the early 1990s.

As in Canada, the collapse occurred as the result of overfishing combined with unfavourable climatic conditions. All concerned parties then realized that it was necessary to adapt the fishing pressure to the new state of the anchovy fishery.

This fishery is very important. Indeed, it is the world's largest, with less than 2 months of activity accounting for nearly 10% of the world catch, with a daily tonnage during the anchovy season capable of surpassing 120,000 tonnes. The fishing frenzy is, in fact, so great that each year some 25 seiners sink under the weight of too many fish! Indeed, managed by a

collective, global TAC, each shipowner is very keen to appropriate the greatest share possible.

To retain control of this resource essential for Peru's external trade and currency returns, the authorities set up a tight management system for this fishery. Ships are monitored via satellite. Catches are very well monitored and sampled in an almost exhaustive manner, rendering fraud very difficult. Fishing data are used to complement the forecasts stemming from the scientific programmes upon which the catch quota is based; this quota is monitored daily and can be adjusted during the season.

Thanks to these various measures, authorities **can decide to close the fishery within 24 hours on the recommendation of the specialized Peruvian scientific institute, IMARPE**, and following several back-and-forths between scientists and the ministry.

For this fishery, relations are therefore optimal between scientists and government authorities.

Relations with fishermen are perhaps not as good, for it does not seem that the scientific data are completely taken into account by the shipowners. Firstly, the quota's strict management and its almost exclusively-scientific foundation have not prevented an overcapacity of some 300%, which is only compensated for by an ever shorter fishing season. While the fishery was still open all-year-round in 1987, today it remains open only 50 days during the year. Secondly, this overinvestment does not take into account the extreme volatility of the anchovy resource determined by the natural, cyclical variability of the Pacific Ocean. Likewise, the scientific results tend to show that the Peruvian anchoveta, whose exploitation dates from the 1950s following the collapse of the California sardine stock, is not a permanent resource. Indeed, despite the incredible productivity of this upwelling zone, there have been past periods during which there were no anchovies, such as at the beginning of the 19th century.

B. BUILDING POLITICAL DECISION-MAKING TOOLS

Reopening a dialogue between fishermen and scientists and developing a more constructive and responsible relationship will necessitate renewing the halieutic-research effort and developing an ecosystem-based approach. The newly created Marine Protected Areas could be used as a tool and opportunity for dialogue and management.

1. A new priority for halieutic research

Compared to other marine-science fields, halieutics have seemed to play a secondary role to the exploration of the ocean depths and to new exploitation techniques.

However, present circumstances should lead bodies such as IFREMER to place halieutics higher in their list of priorities. The halieutic resources and the fishing sector are undergoing a serious crisis of long duration. However, any management of these resources and any restructuring of this sector must be based primarily upon the most recent scientific data. We must therefore allow this sector to benefit from adequate support.

For the time being, activity centred around halieutic research and support of the fishing industry is not sufficiently well identified from among IFREMER's various activity and performance indicators in its annual activity report. Neither the inventory of scientific communications, nor that of specialized activities, nor that of scientific programmes allows the reader to have an overall vision of this field compared to the others.

The same can be said with regard to the budget. In the chapter on resources, it is impossible to measure how they are distributed among the great sets of scientific themes.

In the future, it would be especially desirable for **it to be possible to know how the resources are distributed and how they evolve in relation to various subjects of interest and to management and supervisory decisions**.

Your *rapporteur* also believes that it would be useful for **the dialogue and cooperation with the fishermen to be laid out according to indicators and goals, so as to be able to measure their progress**.

2. The "ecosystemic" approach

In both the scientific world and the fishing industry, an overwhelming consensus has emerged in favour of an ecosystem-based approach and which considers as out-of-date a stock-based approach.

Fishermen see themselves as the victims of changes beyond their control and appeal to scientists for proof. Indeed, fishermen believe that the fish stocks' evolution cannot be explained by fishing alone; rather, they cite three other factors: pollution, environmental destruction and global warming.

In their opinion, they are primarily the victims of rising marine pollution due to the waste generated by terrestrial activities, which is carried, above all, by the rivers and includes both nitrates and PCBs. Water quality is obviously essential for the health and reproduction of marine plants and animals.

They are also the victims of damage done to zones in which fish spawn, feed and live. This destruction is linked to the development of estuaries and coasts, the extraction of aggregates, gas and oil, and other activities that drive away resources or prevent fishing in certain zones, such as wind farms and underwater cables. Fishermen feel progressively excluded

from the sea, which to them appears to be "nibbled away" by other uses, even while it remains their workplace and environment.

Finally, they believe that researchers underestimate climate change's impact on the halieutic resources, while overestimating the impact of mortality by fishing. According to fishermen, unfavourable climatic conditions explain the poor recruitments of cod in the English Channel and the North Sea, while the same warming trend favours an increase in the red mullet stock which previously was little fished in this zone.

As for scientists, their dissatisfaction is almost as great vis-à-vis present species-by-species management systems. Indeed, the only species to be carefully monitored are those under quota and which are the subject of a scientific assessment, and then only in specific zones. However, it has been clearly observed - in particular, following the collapse of certain stocks - that this monitoring is insufficient. Concentrating solely on demographic statistics does not allow scientists to fully predict the stock's evolution, especially if it is in poor health. Indeed, as has already been emphasized, the overexploitation of an ecosystem element can significantly modify its ability to recover and even lead to its irreversible substitution by another species.

To manage the halieutic stocks, it would appear increasingly necessary to attempt to manage ecosystems in their globality; to do this, one must try to understand them in a global, scientific manner.

This represents **a considerable scientific challenge**, given the fact that our understanding of the marine environment and the halieutic resources is still incomplete.

For the reader to grasp the stakes involved, this report will now succinctly present what could be considered the issue's **three main aspects**.

The first such aspect concerns the food chain and is biological and vertical in nature. In the marine environment, size generally determines the predator-prey relationship; this implies various forms of "cannibalism". It is therefore a question of understanding the dependencies between the different trophic levels, from an ecosystem's phytoplankton to its superior predator.

The second aspect is the interface between the physical environment and the biological productivity of a given zone. Here it is a question of understanding how abundance is influenced by the marine environment's physical data: its nutriments and temperature and, of course, their intra- and interannual variability.

The third aspect is spatial in nature and results from the interaction of different zones and environments: the ocean with the coast, or the earth with the marine environment.

This ecosystem-based approach for an integrated fisheries management was **adopted by the FAO in 2001 and turned up in the plan issued by the Johannesburg World Summit on Sustainable Development in 2002.**

IFREMER initiated a strategic consideration of and authored a document on this approach in collaboration with international experts.[1]

The goal of this document was, first and foremost, to specify the contents of one of IFREMER's most extensive research programmes: DEMOSTEM (DEMarche écOSysTEMique pour une gestion intégrée des ressources halieutiques or "Ecosystem Approach for an Integrated Management of Halieutic Resources").

For the authors, the goal of the Ecosystem Approach to Fisheries (EAF) is, firstly, to help **solve the sector's crisis of overcapacity**. The failure of TAC-based management has led to overcapacities, which "exert social pressure favouring the adoption of insufficient conservation standards and the insufficient enforcement or control of management recommendations advocated by independent scientific bodies. In addition, with the dominance of short-term interests, the insufficient participation of various actors, the lack of transparency, the incomplete and unorganized communication effort, the often unacknowledged scientific uncertainty and the ineffective system of coercion, all the necessary elements are brought together for a crisis situation of the kind we are currently facing at the planetary level."

At the international level, the EAF is supported by various measures, most of which can be found in **the conclusions of the Johannesburg Summit (26 August to 4 September, 2002)**: applying the Code of Conduct for Responsible Fisheries, established by the FAO in 1995; significantly reducing the rate of biodiversity loss by 2010; reversing the trend toward living-resource degradation; restoring the fisheries to their level of maximum production (MSY or Maximum Sustainable Yield) by 2015 and eliminating undeclared and unregulated illegal fishing in 2004 (!); creating a network of Marine Protected Areas representative of marine biodiversity by 2012; and applying the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities.

The third and final aspect is the evolution of the scientific context and the reorientation of halieutic themes toward a more integrated vision of the various elements of marine ecosystems, accompanied by an openness to other fields.

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[1] *J.M. Fromentin, B. Planque, O. Thébaud, 2007, L'approche écosystémique des pêches : quelles priorités pour la recherche ? ("The ecosystem-based fisheries approach: what priorities for research?"),* http://www.ifremer.fr/docelec/doc/2007/rapport-2567.pdf

Indeed, for the authors: "Research must now progress toward a better understanding of fishing's impact on all components of marine ecosystems, especially as concerns:

- *Ecosystem diversity.*

- *Biodiversity within each ecosystem.*

- *Intraspecific genetic diversity.*

- *Exploitation's direct effects on targeted species and indirect effects on non-targeted species.*

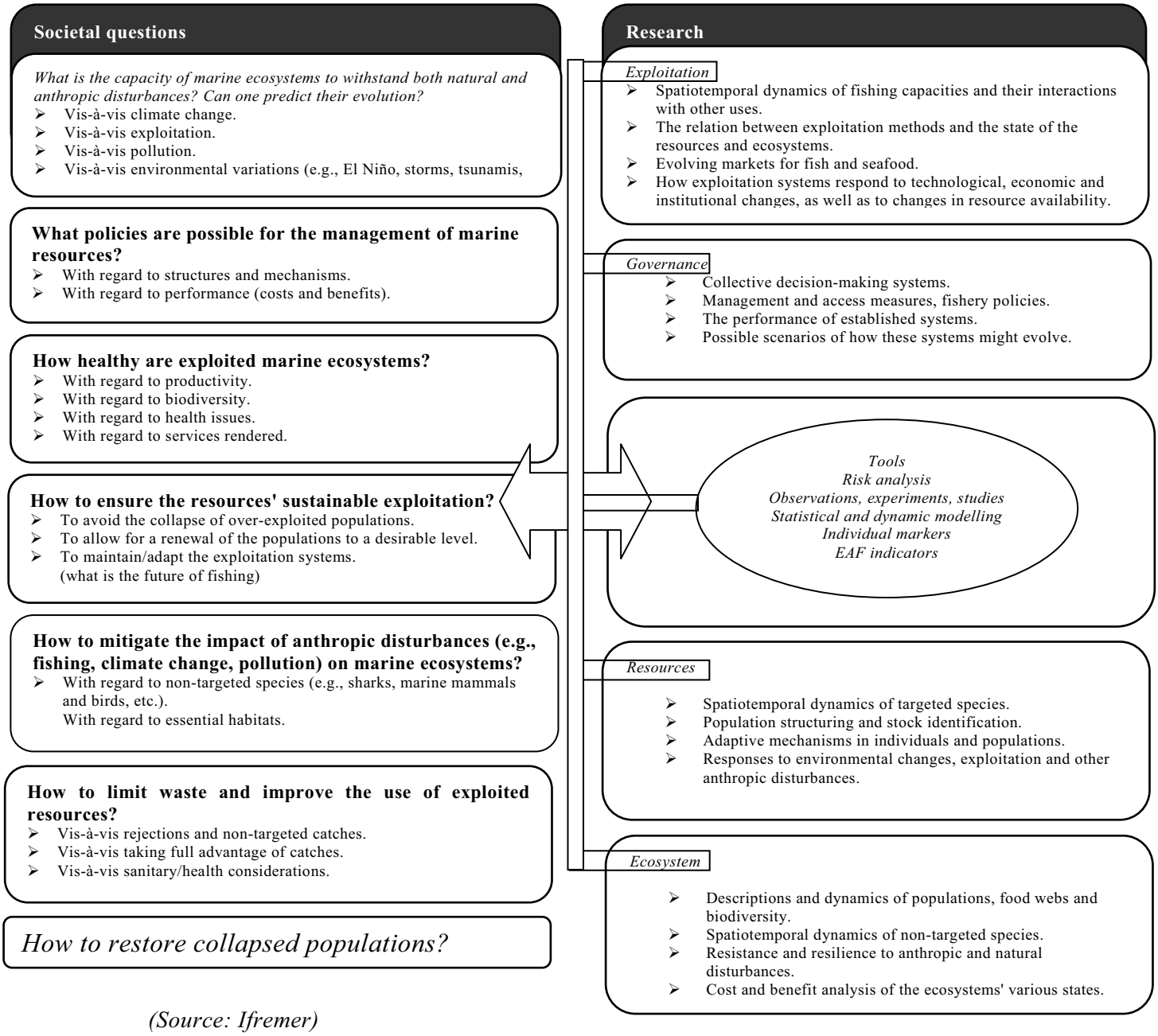
- *Exploitation's effects on food webs and habitats."*

The EAF also bears society's very great demand vis-à-vis research and expertise. Its scope is being considerably broadened, from the narrowly-defined exploited population to the entire ecosystem, from a ternary "fishing-administration-science" relationship to a quaternary "fishing-administration-science-society" relationship, from the operational short-term to the long-term integrating, in particular, climate change, and from a sector's sustainability to this sector's contribution to the sustainable development of coastal societies.

By considerably widening its scope and the number of variables, **the EAF runs the risk of "overselling" research's capacity for expertise and management, even though its scientific foundations have yet to be created, or, on the contrary, of carrying out research as a pretext and thereby delaying decisions for which we already have the necessary elements**.

Widening its scope will therefore be carried out in stages: the impact of fishing on non-targeted species and habitats, then the interactions between impacted species, and, finally, the interactions between fishing and other anthropic activities. This leads to a grounding of halieutics in the wider concept of Integrated Coastal Zone Management (ICZM). But here again, researchers point out the limits: "The attraction currently exerted by this concept is not enough to guarantee its operational fecundity. Indeed, in additional to the previously mentioned ecological and environmental uncertainties, there is also the difficulty of characterizing the potentially numerous interactions between often diffuse uses, whose ecological support is rarely well understood."

Consequently, if the EAF manages to impose itself, it must be considered with a certain pragmatism. One can identify five main fields of knowledge to be applied to societal questions:



(Source: Ifremer)

3. Marine Protected Areas (MPA)

The creation and promotion of Marine Protected Areas have **two main goals: creating sanctuaries and establishing an integrated management of ecosystems (both coastal and non-coastal)**.

Generally presented as a European obligation (Natura 2000, Birds and Habitats Directives) or an international obligation (the Oslo and Paris Convention for the Protection of the Marine Environment of the North-East Atlantic or OSPAR), **the creation of such zones is a real scientific and operational need with regard to the situation of the marine environment and of its management**.

Indeed, **the sea is not a homogeneous area in which the fishable biomass is evenly distributed. On the contrary, 75% of the sea's resources are concentrated within only 5% of its area, usually near the coasts.**

This calls for a voluntarist approach on the part of fishing professionals, who should call for the setting up of MPAs and demand that they be among the main actors, rather than a hostile attitude fed by fears of additional constraints. These marine reserves are a prolongation of the autoregulatory measures already enacted by the fishing industry.

However, the development of these MPAs - which your *rapporteur* hopes and prays for - has gotten off to **a poor start**. Because our country had fallen considerably behind, but wanted to catch up during its presidency of the European Union, its definition of Natura 2000 zones was carried out in extreme haste and almost without consultation. It is not even certain that their scientific foundations have all been perfectly established. All the actors regret that the government repeated the same mistakes it had already made a decade earlier during the definition of its Natura 2000 zones on land. We can expect the same detrimental effect this time round; that is to say, that it will not be before many years that the local actors appropriate these zones as opportunities. Several projects that finally gained consensus took 10 or 20 years to come to fruition.

Nevertheless, 76 marine sites covering a surface area of 24,000 square kilometres off of France's three coastlines were presented in Brussels during a Council of Ministers in early November. Four marine parks and three national parks - including that of the Calanques - are being planned; the only such park currently in existence in France is that of the Iroise Sea.

Prior to these recent declarations, the situation of France's Marine Protected Areas was as follows:

	Type	Number	Surface area in km²
Created by the Law of 14 April 2006	Natura 2000 sites	208	6.970
	National/Corsica nature reserves	26	1.220
	Nature reserves of the TAAF (French Southern and Antarctic Lands)	1	15.000
	Marine parks	1	3.550
	National parks	1	13
	Public maritime domain of the Conservatoire du Littoral (« Coastal Protection Agency »)	4	55
	Biotope-protection decree	3	13
Not created by the Law of 14 April 2006	Côte Bleue Marine Park (joint association)	1	91
	Special reserve (New Caledonia)	1	86
	Special marine reserve (New Caledonia)	6	96
	Integral reserve (New Caledonia)	1	157
	Specially Protected Areas of the Antarctic	1	2

A Marine Protected Area (MPA) is a delimited marine zone with an objective for long-term nature protection. It is rarely exclusive and often results from a combination of local development and sustainable environmental management.

Different categories of MPA exist, legally defined by the Law of 14 April 2006, which draws up an open list. Other zone types, such as marine mammal sanctuaries[1] or fishing areas, may be added.

The Law also created an Agency for Marine Protected Areas, a public administrative body placed under the supervision of MEEDDAT[2], provided with some fifty staff members and headquartered in Brest. Its mission is to coordinate and, in certain cases, finance and help manage the MPAs that will be created.

Compared to other countries, France is extremely behind in the definition and management of its MPAs. The parks are, for the most part, small and those that are large are of recent creation. Indeed, the creation of the Iroise Marine Park increased the surface area of the French park system overseen by the OSPAR Convention from 270 to 3,800 square kilometres!

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[1] *Such as the Pelagos Sanctuary between France, Italy and Monaco in 2002.*
[2] *Ministry of Ecology, Energy, Sustainable Development and Territorial Development.*

Despite this delay, the creation of a complete, representative and coherent network of MPAs in metropolitan and overseas France by 2012 remains a strong political commitment of our country vis-à-vis its international partners. It should be pointed out that **France controls the world's second largest maritime zone, with 11 million square kilometres (four times the size of the Mediterranean), of which 320,000 square kilometres are within metropolitan France (equivalent to 60% of France's terrestrial territory)**.

The make up of this network will obey the following principles:

- Fit within an overall process of understanding and monitoring the marine environment.

- Cover a representative share of the more remarkable elements of our natural heritage, based upon the lists of habitats and species.

- Protect those ecosystems with important ecological functions, such as the large estuaries, the foreshores and the coastal wetlands.

- Contribute to the maintenance and reasoned economic development of marine activities.

- Manage coastal zones via a land-sea approach.

Several projects are in progress or the subject of "strategic regional analyses". The official studies are concerned with the Vermillion Coast, Mayotte and the estuaries of the Somme, the Authie and the Canche. In the longer term, attention will turn to the Straits of the Charente, Arcachon Bay and the Gironde Estuary. In a less precise manner, projects are also planned for the Norman-Breton Gulf, the tidal mud flats of southwestern Brittany, and around Corsica.

Even if the goal is not to create sanctuaries or "total reserves" which exclude all traditional actors, these projects and studies are the cause of much concern. The MPAs already created will serve as tests for the entire coast.

The oldest nature reserve is that of Sandola in Corsica, in the Gulf of Porto & Girolata. Created in 1975, this reserve covers 10 square kilometres, only 0.8 square kilometres of which constitutes a total reserve. This reserve has been listed a World Heritage Site by UNESCO. Biologically, it is a great success, since a satisfactory natural state has been regained (a reference in the matter for the Mediterranean). In the reserve, all species attain their maximum size. It is also a unanimous success among fishermen, who now really benefit from the reserve.

However, this model - in particular, the existence of a total reserve – could not be transposed to a larger scale, which undoubtedly explains, in part, the slow gestation of the **Iroise Sea Marine Park project.** Launched in 1989,

it did not see the light of day until a decree of 28 September 2007. The park covers 3,550 square kilometres from Porspoder in the north (48°31'N) to Plouhinec in the south (47°59'N) and extending west to the limit of French territorial waters; in addition, the entire southern coastal zone from Douarnenez to Plouhinec is the subject of a deferred public study, with further extensions also under consideration. The Roadstead of Brest is not contained within the park.

The Iroise Sea was chosen for its richness, its diversity, its representative nature, and its quality as a refuge for numerous species of birds and mammals.

The park's management will fall to the Management Council, presided by the President of the Finistère Departmental Council, Pierre Maille. The management plan will be drawn up in 2009. To this day, only two meetings have taken place. As its president explains, while the park's creation was made possible by the rallying of a majority, many remain to be convinced who are either reluctant partners or still opposed to the project.

First and foremost, it was essential to constitute the council in such a way as to allow all concerned parties to be represented and satisfied with their representation. In particular, this was the prerequisite for fishing professionals, who hold a quarter of the council's seats (all categories combined).

The fishermen finally agreed not to oppose the project, for their demands had been met: no total reserve; their involvement in the decision-making process; strengthening their weight vis-à-vis other sea users; and potential for the development/promotion of fishing and the financing of initiative management projects. For the time being, they declare themselves to be satisfied, insofar as the management goals are in accordance with those desired by the fishing industry.

The park has so far defined ten management goals:

- Deepening and spreading our knowledge of marine ecosystems.

- Maintaining the populations and habitats of protected species.

- Reduction of terrestrial- and land-based pollutions.

- Management of material-extraction activities.

- Support of professional coastal fishing (250 ships, mainly *fileyeurs* or "netters" under 15 metres).

- Sustainable exploitation of the halieutic resources.

- Sustainable exploitation of kelp beds.

- Support of marine activities on the islands.

- Conservation and promotion of the marine architectural and archaeological heritage.

- Reasoned development of water-based tourist and leisure activities.

Much, therefore, remains to be done. With regard to the fishing industry, fishermen readily threaten their disengagement and a violent reaction if the park's management should turn to their disadvantage.

More generally, these MPAs are seen as a new constraint and a non-recognition of the self-regulatory measures already in place. The fishing industry dismisses the idea that MPAs can be used as fishery management tools.

However, your *rapporteur* believes that MPAs are essential for fishery management, must be actively supported and will most benefit fishermen.

MPAs are, first and foremost, essential in the French context for the reopening of dialogue between fishermen, scientists, politicians and society. It is from this dialogue that an effective fisheries management will emerge. While MPAs alone will not provide a solution, they offer an opportunity to do so around a common project.

In addition, they must receive the authorities' active support, for they represent an opportunity to impose essential environmental protections and to favour stock restoration. They provide hope of maintaining healthier, richer and more balanced ecosystems that will better resist external disturbances (anthropic or otherwise) and that will render fish stocks more resilient.

Finally, it is clear that these MPAs will benefit primarily fishermen. Perhaps, in the short term, a few preliminary restrictions will be resented; but fishermen must not miss the historic opportunity that is offered them. In many respects, professional fishermen are a minority at sea compared to a wide range of other uses: leisure, underwater exploitation, electrical production, cables, etc. Above all, even in regions such as Finistère, they carry little weight compared to the land-based economic interests that are to blame for most of the pollution and destruction of the marine environment. Likewise, careful observation of marine ecosystems will allow for a better understanding of fishing's role in stock fluctuations, compared to global warming and other causes.

In fact, your *rapporteur* believes that **the fishing industry's defiant attitude with regard to MPAs is unjustified and counterproductive**. **It cannot be a partner if it threatens to quit the management councils as soon as its recommendations are no longer followed.** This attitude runs contrary to the very functioning of such a council and risks marginalizing the industry. **It is time for professional fishermen to abandon their register of protest for one of responsible management.**

C. FISHERMEN: THE PRIMARY ACTORS OF RESPONSIBLE FISHING

Fishermen are the primary actors of responsible fishing. Contrary to the impression that certain NGOs or expert declarations may give in the media, **nothing is possible against them**. **Furthermore, nothing is possible *without* them, without their consent and active collaboration.**

Setting up **a sustainable form of fishing is certainly a planetary and global-food issue, but it also represents fishermen's very livelihood and means of survival**.

During his meetings, your *rapporteur* became convinced that fishermen would be ready to commit themselves to sustainable, reasoned fishing if they could only be presented with a coherent framework.

Such an evolution is no doubt attained via three other evolutions: reducing the catch capacity, abandoning the culture of "free-riding", and the ability of fishermen to manage their own resource.

1. The inevitable reduction of capacity

Following a period during which it supported increases in fishing capacity, Europe rapidly changed course in favour of reduction and restructuring measures, though so far without any significant success.

Particularly unpopular, reducing fishing capacity is nevertheless necessary, for two fundamental reasons. Firstly, the state of the halieutic stocks, even if overfishing is not the principal cause, would necessitate reducing capacities to allow for their restoration. **Second, the poor economic state of the fishing industry**, no matter the price of petrol or fish, which are only cyclical indices. Indeed, this is clearly illustrated by the industry's extremely high level of government aid, to the tune of some 73% of turnover.

Once again and contrary to what is most often declared publicly, your *rapporteur* is convinced that **the greater majority of fishermen are fully aware of the economic-environmental equation that applies to their sector**. The exchanges I was able to have certainly point in this direction. Furthermore, fishermen "voted with their feet", via their massive response to the fleet-reduction plan proposed by the Minister. More than two times the number of requests were recorded than had been predicted. If fishermen had been confident in the future profitability of their sector, they probably would not have reacted in this manner and would have instead waited. In a port, it was even pointed out to your *rapporteur* that certain ships to benefit from the plan should not have been selected for they were too old and destined for the scrap yard; their removal, therefore, did not constitute a real reduction in capacity and provoked jealousy on the part of active fishermen or those whose requests had been denied.

Up until now, fleet reductions have always been compensated for by a modernization of the remaining ships; this practice has been encouraged by the European system and the lack of confidence between countries.

Indeed, the Common Fisheries Policy maintains a vicious cycle that combines historic rights and a "race to the fish". On the one hand, quotas are attributed based on past catches for the same zone and species. It is in the interest of each country to defend and effectively fish its quota-share, out of fear of seeing it reduced in the future. At the same time, the "Europeanization" of European waters means that, in principle, each country's waters are open to other EU members, in a regulated manner only for those fish under quota. As a result, any national reduction in capacity that is not collectively applied at the European level will benefit the home industry's competitors, rather than the resource's sustainable management. Therefore, **a priori, there is no wiser national policy at the European level than advocating the reduction of others' fishing effort while at the same time carrying out a restructuring of one's own fleet that retains its real fishing capacity**. Unless all EU members carry out this policy, overfishing will continue and the situation will only worsen.

2. Abandoning the culture of fraud and "free-riding"

A cultural change must also be carried out. The world of fishing stands out for what is commonly called a "race to the fish".

Fish being *res nullius*, they belong - like game - to the first who manage to capture them. The entire fishing culture is based upon this principle: knowing where to find the fish and being the first to catch them. This knowledge is jealously guarded and can make or break the reputation of such or such a skipper, as well as determine the wealth of his crew (each of whose members is paid a share of the catch), their income overwhelmingly dependent upon the success of their fishing effort.

This culture was well suited to a context of unlimited resources, although even then – as has already been pointed out – it led to excesses and resource crises.

Within the framework of the Common Fisheries Policy and even at the world level, this culture has remained largely the same or even been amplified.

Firstly, the management of European waters has been Europeanized and historic fishing rights in foreign waters have become established rights. While in accordance with proper management, this new rule has unfortunately resulted in a decreased sense of responsibility vis-à-vis the resource. In the mouths of fishermen, the abuses (overfishing, nonregulation devices,

undersized catches, excessive rejections, etc.) are usually to be blamed on foreign boats which "catch everything" and are not concerned with our coast's future. The definition of rights and regulations seems to take place at a level beyond the fishermen's influence or control. To fishermen, these regulations seem unfair, incoherent or incomprehensible. They often fluctuate, encouraging fishermen to buy new boats but "preventing them from working" and therefore strangling them financially, even while others are given free reign to "scrape" the sea floor. Fishermen, therefore, try to make the most of things by giving priority to their short-term interests.

Secondly, the system of national quotas - even if the subject of a subsequent distribution among producer organizations and among professionals - seems only to amplify the "race to the fish" phenomenon. In a nutshell, it is in each fisherman's interest to appropriate as quickly as possible the greatest share of the quota. Everyone your *rapporteur* met with in the fishing world regretted the impossibility of freely managing his or her quota according to the reality of the fishery and of the market, so as to ensure an optimal economic outcome. But how can they wait for the opportune moment if the entire quota has already been caught by the others?

In the system as it existed until recently, there was almost no cultural framework nor any regulatory incentive to develop sustainable practices. On the contrary, many elements encouraged an attempt to profit from other fishermen and other countries carrying out the management efforts (a form of behaviour termed "free-riding" by economists).

This state of mind is aggravated by the fact that within several European countries – though this is also true at the international level – it is still believed that the fishing sector has no need of extensive management. Numerous reasons for this view are put forward, with the sector's economic weight and socio-political importance placed in counterpoint to halieutic resources that are deemed inexhaustible (or at least in the short-term), and with the protection of the national fishing industry in counterpoint to foreign fishermen who are presumed to be pirates and guilty of fraud. **So, based on the conviction that a too-tight fishery management would only disadvantage one's own local or national fishermen to the benefit of others, a culture of fraud has developed, both at the local level vis-à-vis the national level, and at the national level vis-à-vis regional, European and/or global authorities.**

One can cite numerous examples, such as: allowing for the fishing of all fish leaving a national exclusive economic zone and headed toward that of another country; closing the eyes on under-declared catches (of up to more than 50% of the national quota); not sanctioning shipowners practicing illegal fishing in the EEZs of friendly countries; judging as credible a reduction of the national fishing capacity even though the ships did nothing more than change flags, etc. Though incomplete, this list of leniencies, non-interventions and

laxities sufficiently illustrates the need to regain control of this sector and the seriousness required for the management of a finite resource.

Such an evolution is not impossible. Most fishermen are ready, but feel caught within a system and rightly call for a more coherent implementation of the regulations and desire that national, European and international rules be applied to everyone in the same manner.

3. Fishermen who own their resources

To escape this "race to the fish", this short-term culture of every man for himself that maintains overcapacities and over-exploitation, "**we must put an end to competition between fishermen and therefore limit individual access to the resource**. If a share of the stock is guaranteed, a race for ever more efficient and technologically-advanced ships is no longer necessary".[1]

The establishment of individual quotas was also mentioned by the Poseidon Report as one possible solution for the French fishing industry; it had also been proposed by the Grenelle Environment Round Table for the bluefin tuna fishery. Moreover, the European Commission went beyond the Grenelle recommendations, by imposing individual quotas via the Council Regulation CE 1159/2007 of 12 December 2007.

For the other fisheries, the Grenelle Round Table and Operational Committee no. 12 ("Integrated management of the sea and coast"), the only principles retained were those governing CFP revision and the definition of management territories considered coherent with regard to the fisheries and local realities.

Nevertheless, Individual Transferable Quotas (ITQ) systematically reappear at the international level as a solution to promote for the improvement of halieutic resource management.

Fundamentally, **two advantages** are put forward:[2]

- **Ending the "race to the fish".**

- **The exploitation of capital by fishermen-managers.**

Stopping the race-to-the-fish phenomenon should enable putting a stop to overcapitalization and excess equipment, and therefore significantly increase the sector's profitability. It should also allow for an increase in the duration of the fishing season, while at the same time decreasing the fishing pressure.

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[1] *Philippe Gros, IFREMER, Libération, 11 and 12 November 2006, p. 35.*

[2] *Your rapporteur is here referring to a study carried out by the Department of Economic Studies and Environmental Evaluation of the MEDD, published in 2007, by Maud Barnley and Guillemette Buisson.*

In fact, **economically speaking, the establishment of ITQs should put an end to the economic overcapitalization of stocks.** The exploitation of a natural resource produces a profit or income which, for the fishing industry, is the difference between the total catch value and the total cost of the fishing effort. A stock is economically under-exploited as long as its income has not been maximized. Continuing beyond this optimal amount constitutes over-exploitation; in other words, for a rising cost, income first increases less rapidly, then diminishes, is cancelled out and, finally, becomes negative.

The interest of ITQs resides in their being individual and transferable. By putting an end to the race-to-the-fish phenomenon, **the individual nature of ITQs allows the fisherman** to stop seeking to capture the largest share possible of the collective quota and **to shift instead toward a situation in which his goal is to minimize the cost of catching that share of the halieutic resources already attributed to him**. The **transferable nature of ITQs increases their economic efficiency**, because the least efficient fishermen or those incapable a given year of fishing their quota can dispose of their fishing rights. **Therefore, ITQs imply a voluntary concentration of the sector.**

The second advantage of ITQs is environmental in nature. ITQs are meant to encourage fishermen to treat their resource carefully, for as owners, it is in their best interest to manage the resource like a business in order to increase its value and thereby increase their income and eventually resell it at a higher price.

This would represent a very profound cultural change. It has the support of numerous fishermen who would like to be able to fish more freely and optimize their fishing effort by basing it upon current market values. The individual quota would allow fishermen to fish less and better and to sell their catch at a higher price.

A recent study published in the magazine *Science* would tend to support the hypothesis that Individual Transferable Quotas are liable to create incentives for an improved fisheries management.[1] Basing their analysis on a database of 11,135 fisheries from 1950 to 2003, the authors demonstrate that the adoption of such management methods would allow for a cessation of stock collapses and a facilitation of their recovery. According to their study, in 2003, fisheries subjected to ITQs were twice less likely to collapse, which the authors judge a conservative estimate, given the recent adoption of this management method. Furthermore, they estimate that if this system had been brought into general use starting in the 1970s and not limited to only 121 fisheries, only 9% of stocks would have collapsed, as compared to 27%.[2] However, the authors voice certain reserves for the proper understanding of

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[1] 19 September 2008, Science, Vol. 321, no. 5896, pp. 1678-1681, "Can Catch Shares Prevent Fisheries Collapse?", Christopher Costello et al.

[2] The concept of a "collapsed stock" is the same as that used by Worm et al. in 2006; in other words, a stock is considered "collapsed" when a given year's catch is less than or equal to 10% of its historic maximum.

their results, which must not be taken as "a *carte blanche* endorsement", for they only considered a single form of ITQ and did not take into account other aspects of fishery management.

ITQs are often seen as cure-alls, essential for any proper management system. **However**, when emphasized, **they also turn away many French fishermen**.

In the opinion of your *rapporteur*, one must take things into consideration. Individual quotas are not the universal solution and collective quotas are not synonymous with poor management. One of the most convincing examples is that of the Peruvian anchoveta fishery, one of the best managed fisheries in the world. During the fishing season (open from 30 to 60 days each year), catches are monitored in an extraordinarily precise manner by both scientists and government authorities. Each ship is monitored via satellite. The president of the Peruvian equivalent of IFREMER who follows the catches is provided with a direct line to the fisheries minister, who can close the fishery within 24 hours, depending on scientific assessments. This very effective management system is based upon TACs and collective quotas, but it has several characteristics that allow for its success. The fact that the fishery is national, monospecific, industrial and seasonal makes it all the easier to monitor. This rigorous management has not prevented a very great overcapacity. What is more, in Peru, with the same actors, the exemplary nature of its anchovy management does not extend to all of the nation's other fisheries, in particular, those of the demersal species.

Then again, **many French fishermen** are distrustful of the implementation of Individual Transferable Quotas, for they **fear a capitalization and a "financialization" of fishing**. **A typical example is that of Iceland**, where, it is argued, the implementation of individual quotas has led to the fishing industry's being greatly concentrated in the hands of only a few non-fishing investors. Via an unexpected process, many small fishing outfits seized upon the opportunity to sell their quotas; however, by doing so, they lost their right to fish. Their suppliers and the fish-processing companies that relied on them then disappeared, contributing to the desertification of coastal zones whose livelihood had depended upon fishing.

This example is a cause of concern. First of all, it signals the end of a principal considered eternal, that of free and open access to the fishing trade. The sea is free and the fish belong to whoever catches them; therefore, everyone has the right and the freedom to become a fisherman. But this mythic vision, though often resuscitated, no longer rhymes with reality. In developed countries with fisheries management, not only must one have capital and equipment, one must also solicit an operator for the right to a production quota. In developing countries, its application constitutes a veritable poverty trap. As soon as quotas are attentively followed and respected, each ship situated outside this management system suddenly finds

itself operating illegally and therefore subject to, at least in principle, prosecution by the authorities or wronged fishermen, as in Iceland. Not taking into account ITQ systems, it has been demonstrated that in France, the value of a used ship increases 30-50% depending on its associated fishing rights (according to estimates by Deputy Hélène Tanguy and IFREMER). In developing countries such as Senegal, free access to the sea is, in fact, the cause of very considerable overfishing by smaller, more traditional outfits, itself a source of poverty and social and interethnic tensions.

The fear of a concentration of the fishing sector is also shared by elected officials along the coast, who worry about the fleet reduction and its implications for the sector further down the line, as well as the geographic mobility of investors who will no longer feel any attachment to a particular port or even country.

In addition to these criticisms, environmental organizations point out the risk that large financial groups consider fishing concessions as they would mining concessions: to be exploited as quickly and profitably as possible until the resource is exhausted; according to these NGOs, only coastal communities are capable of carrying out a long-term management of their resources. In general, economically speaking, the interest of protecting a fishery's capital depends on its resale value as compared to the profitability of its over-exploitation. Indeed, it can make economic sense for an individual or group to over-exploit a natural resource in order to then invest in other - particularly industrial - economic sectors.

Though these fears are not unfounded, they are certainly exaggerated. The establishment of individual quotas does not automatically entail the uncontrolled or uncontrollable concentration of the sector. In Europe, Denmark has shown that it is possible to implement them while at the same time setting up safeguards according to fishery type.

While individual quotas may appear to be an ideal management tool, they nevertheless remain difficult to define technically at the European level.

Indeed, in a monospecific and well-delimited fishery, it is not very complicated to share out the catches. But many European fisheries are multispecific and spread out over different zones. In addition, fish are not like cattle in a field or stall; they migrate freely over the course of one or several years. This is the case with the herring of the North Sea, which carry out - depending on their age - a long migration from the coasts of Norway to Iceland. Although long considered separate populations and the subject of specific fishing traditions, these herring in fact belong to a single stock. What is more, the movements of certain species remain unexplained. So, how to share out ownership?

These difficulties can be overcome, in part, if one takes into account the variety of methods for the privatization of halieutic resources.

Quotas can be attributed to individual fishermen or ships, but they can also be attributed on a larger scale, to communities or cooperatives. Likewise, they can be more or less spatialized and target one or several species. Furthermore, their transferability is not necessarily without limit. The most frequent form is even that of a limited transferability, which depends upon the type of fishing and the targeted species. All of these variables seek to adapt the system to the fisheries, the structure of the fleet, and the authorities' willingness to maintain a fabric of more traditional, smaller-scale fishing or, instead, favour a concentration of the sector. Finally, opting for a system of individualized quotas does not imply abandoning TACs; on the contrary, the setting up of ITQs is meant to better enforce the overall catch volume that is fixed in a scientific manner.

Therefore, it is not at all a question of a rigid system or a panacea, but rather a remedy to be applied by adapting the "dosage" to the diagnosis, with a strong emphasis on experimentation.

Finally, one must not forget that this privatization of resources and the delegation of their management to fishermen cannot succeed if the authorities do not fully assume their share of responsibility. Indeed, in Europe and in France, the current system of quota distribution is rather similar to a cooperative or community-based quota system with individualization; however, this system by itself is insufficient to ensure the fisheries' sustainable management.

If fisheries under ITQ have the reputation of succeeding so well, it is undoubtedly because the adoption of this management method signals a modification of the actors' culture and a new involvement on the part of authorities.

In any event, this is shown by foreign examples (see *ibid.*, MEDD 2007).

In Iceland, New Zealand and the Netherlands, it is not possible to establish a connection between this management method and the state of the fish stocks. In Iceland, where the ITQ system was extended from 1975 to 1990, the herring and haddock stocks are healthy, as opposed to the cod and capelin stocks. It would appear that, for cod, before the institution of ITQs, scientific recommendations were not followed and systematically exceeded by first the attribution of TACs then real catches. Nevertheless, the institution of ITQs has not allowed stocks to rebuild, either because the quotas' adoption is too recent (1994) or, more likely, due to warmer waters. However, the haddock TAC is at its highest level in 40 years; but is this really due to ITQs? After all, this fish from the south benefits from the warmer waters. Iceland's rate of rejections is much lower than the estimated international rate: 6% compared to 35%.

However, the impact on the sector's economic health is certain. The catch per fisherman greatly increased between 1988 and 1998, from less

than 300 tonnes to over 380 tonnes, illustrating the sector's concentration and reduction in the number of fishermen.

Furthermore, governments play a very important role. Controls are numerous and rigorous, with significant financial sanctions. For example, when the authorities observe a repeated discrepancy between catches and declarations, they can force a shipowner to take onboard an inspector for one year. This management and sanctioning system is reinforced by measures for the protection of spawning and juvenile-fish zones.

In New Zealand, the ITQ system was set up between 1986 and 2004 and now covers 85% of the commercialized catch. It has resulted in a very marked concentration of the fishing industry, with 80% of quotas being owned by 10% of allottees. The loss of fishing jobs has been more than compensated for by the creation of jobs further downstream. The system's positive impact on the resources' sustainability has yet to be really proven, especially considering the fact that the sector's concentration has strengthened its influence and ability to obtain higher TACs.

In the Netherlands, the IQ system dates from 1976, but it has greatly evolved since then. It concerns only the largest fisheries. It seems to rely heavily upon self-management organized by nine co-management groups representing 98% of Dutch fishermen due to heavy financial sanctions.

In France, Article 1 of the Loi d'Orientation de la Pêche ("Framework Law for Fishing") of 18 November 1997 describes halieutic resources as a "collective patrimony" and reaffirms the non-patrimonial nature of access rights. There are no TACs or quotas for the Mediterranean.[1]

If the national quota fixed at the European level can be divided up into smaller quotas to be attributed to producer organizations (POs), with these quotas then being distributed among PO members, this distribution is based upon precedence and the quotas remain non-patrimonial in nature. They can be exchanged, but only at the PO level and subject to ministry approval. If a national quota is exceeded, France can carry out an exchange with another country for the same or a different species. This hybrid system lacks clarity. It does not put an end to the "race-to-the-fish" phenomenon and does not allow for individual sanctions, because there is no individual attribution of quotas.

Therefore, your *rapporteur* considers that a more serious fisheries management must rely upon two principles:

- A stricter limitation of access to the resource.

- Making the various actors accountable.

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[1] *Except tuna.*

They should result in a reduction of fishing capacity and the progressive and experimental development of fishery-management systems based upon Individual Transferable Quotas.

These evolutions will entail a reform of the Law of 1997, bringing to an end the ban on the "patrimonialization" of access rights.

This reform could be introduced upon examination of the first bill of the implementation programme for the Grenelle Environment Round Table.

D. AUTHORITIES WHO EXERCISE THEIR PREROGATIVES

At the international level, the creation and extension of exclusive economic zone since the Second World War has transferred **to coastal states control of 90% of the world's halieutic potential**. **Only the great oceanic migrators escape state legislation. Piracy in international waters and a few defaulting states cannot exonerate the states from assuming their responsibilities with regard to fisheries management**, especially considering the fact that those countries who manage best their fisheries are not necessarily the wealthiest or most developed.

Following his investigation, **your *rapporteur* is convinced that the difficulties met with in France and Europe stem, in large part, from the authorities not exercising their prerogatives due to weakness or complicity**. The current situation calls for a clearer position on the part of the Ministry of Agriculture, a firmer exercise of power, and an effective war on piracy.

1. A ministry of fishermen or a ministry of fish? Combining the "social" with the "sustainable"

Today, the Ministry of Agriculture and Fishing is at a turning point; this is the feeling shared by several of its managers and several outside observers.

Put simply, the Ministry of Fishing must choose between being the "ministry of fishermen" or the "ministry of fish". This Manichaean choice is obviously false, for there can be no fishermen without fish. But it has a deeper meaning than this.

The great majority of ministers in charge of fishing have up until now considered that **their role was primarily social in nature**. It consisted of taking charge politically of a population (to wit, fishermen) with a reputation for being rowdy, protesting and even aggressive. For this reason, their success could be judged by the level of social satisfaction achieved and, especially vis-à-vis the Prime Minister or the President, their capacity to avoid port

blockades and other violent demonstrations. **The long-term vision of the industry and the management of halieutic resources were relegated to the background.** What was important was to obtain good quotas in Brussels, cover up known frauds, and supply the industry with the tax exemptions and subsidies it desired using French or European funds. With regard to fishing, the authorities had the habit of not lodging complaints against damages linked to violent actions, of managing weakly, and of often closing their eyes. "Avoid making waves" was an order followed as well at the local level as issued at the highest level.

This attitude went hand-in-hand with a rather pronounced paternalism that is sometimes still present. For instance, several interviewees indicated to your *rapporteur* that the maritime authorities' mission was to "manage" the profession. The local maritime authority was seen as something of a "father figure" for the fishermen, with the latter leaving to the authority and to their wives all financial and administrative questions.

This well-oiled machine would have kept on going if a few grains of sand had not been thrown into the works.

These first came from the industry itself, which became alarmed at having an ever greater number of politicians and bureaucrats as contacts, including in the coastal regions, who considered it suitable to jointly manage with the fishermen and socially accompany the industry's unavoidable decline. Many also became concerned with being represented by the most radical elements and thereby running the risk of losing public support.

They then came from the European Commission which, by questioning France in its fisheries-control mission and by obtaining from the European Court of Justice (ECJ) an important fine and penalty, forceably brought about a certain awareness and a change of practice. The Commission also exerts necessary pressure with regard to the restructuring and respect of quotas.

They also came from "civil society", NGOs, public opinion and supermarkets that communicated or reacted with regard to the fisheries crisis.

Finally, within the ministry, a new vision – which should not be underestimated – emerged of its mission, taking into account the new context.

Although not yet universally shared, this vision undoubtedly enjoys majority support.

It is based upon the idea that the fisheries must now be managed "seriously"; in other words, that scientific management criteria, the respect of TACs and quotas, of minimum catch sizes and of authorized techniques must now be universally applied (which is in the fishermen's best interest) and enforced by the state.

Generally speaking, this means that, while it is still necessary to support the industry, **the fishermen's future can no longer be considered without also taking into account the resource's future and anticipate future economic evolutions**.

It is no longer taboo to discuss the possibility of ending the fishing industry's subsidies and making it sustainable and economically profitable in and of itself. As an example, the Poseidon Report states: "The high level of government aid accorded this 'small' sector naturally leads one to question the pertinence of its maintenance: more than €800 million - including social assistance, more if one also includes temporary economic aid linked to the rise in oil prices - compared to the sector's first-sale turnover of €1.1 billion in 2004." In the long term, no economic sector can depend to such an extent on government assistance. **The fishing industry must regain the path of economic development free from state aid.**

2. Monitor and sanction

Although assessing fisheries management by the state was not the mandate of your *rapporteur*, this task proved inevitable. It should be tackled in a succinct manner.

Firstly, as has already been pointed out, the European Commission's legal action against France was the initial cause of a growing awareness that continues to spread. It has led our country to recognize its having exceeded its bluefin-tuna quotas and to impose individual quotas for this fishery.

Secondly, **it is the fishermen themselves who are hoping and praying for such an assessment**. Your *rapporteur* noticed that, in private, they were the first to denounce their less scrupulous colleagues' behaviour that is banned or harmful vis-à-vis the resource and which they are able to witness at sea. For while professional solidarity prevents denunciations, many are aware of the excesses and the danger posed by such behaviour to the future of their profession. Those who respect the rules feel disadvantaged compared to their less scrupulous colleagues who remain unsanctioned.

What is more, even if they generally desire greater autonomy in the management of their fisheries, praising the merits of a local management system aware of the at-sea realities, they recognize that **monitoring and sanctions are, first and foremost, the responsibility of the authorities and that it would be all the easier for them to monitor their own practices if such state control were firm and sanctions were applied in a fair and equal manner**.

Finally, it must be pointed out that such an attitude is **essential to ensure a certain local and international credibility**. Here, your *rapporteur* simply echoes the feeling of helplessness expressed by researchers who explain the extent to which foreign observers can be surprised and shocked by certain French laisser-faire practices.

3. Fighting piracy

Directly linked to the state's responsibility with regard to fisheries management is the fight against piracy.

The seriousness required for fisheries management and the discipline called for on the part of fishermen can only succeed and be understood and shared if such a policy fits **entirely within a coherent framework**.

However, everywhere in the world, illegal, undeclared and unregulated fishing, carried out in good and bad faith, is denounced as a scourge and the cause of numerous evils. Particularly in the Mediterranean - due to the absence of any exclusive economic zones and with regard, in particular, to the bluefin-tuna fishery – **piracy is a powerful incentive to continue free-riding**. **Why make any effort, when it will only benefit some pirate who, what is more, has often been identified and is well known?**

Yet states are not powerless, even if total control is impossible.

First of all, states can close their exclusive economic zones to pirates. In France, the most telling example is that of the Patagonian-toothfish fishery in its southern waters.

The southern-water fisheries

The main resource of the French Austral and Antarctic Territories (TAAF), amounting to some €5 million, is the sustainable management of the Patagonian-toothfish fisheries of the Crozet and Kerguelen Islands (around 6,000 tonnes) and the crayfish fisheries of Saint Paul and Amsterdam Islands (around 400 tonnes).

The Patagonian-toothfish fishery alone represents some €30 million. It is managed within an exclusive economic zone (EEZ) of nearly 1.8 million square kilometres, equivalent to three times the size of metropolitan France. The prefect is responsible for fixing the Total Allowable Catch (TAC) and attributing quotas. Scientists - in particular, from the Muséum National d'Histoire Naturelle ("National Natural History Museum" or MNHN) and the Chizé laboratory - serve as scientific advisors for the evaluation of fish stocks, the definition of fishing methods, and the reduction of the accidental fishing of protected species.

Confronted with very considerable illegal fishing - certainly double the authorized quota - the government decided, beginning in 1996, to call upon the military means of the French navy. The prefect of Réunion is responsible for state intervention at sea in the southern zone of the Indian Ocean. He has overall authority of the French coastguard and is responsible for law enforcement, the protection of French sovereign rights, the maintenance of public order, and the protection of people and property. The High Command of the Réunion navy lends the prefect its support in carrying out these missions. For fishery surveillance, the navy relies upon three vessels: the frigates *Nivôse* and *Floréal* and the patrol boat *Albatros*, for a total of 250 days at sea in the EEZ. An additional patrol boat, the *Osiris*, is financed by the TAAF and the regional council. This

boat had been inspected and confiscated in 2003 by the navy, out of a total of 23 boarded for inspection since 1997.

The navy's operational effectiveness has been greatly improved with the setting up, in February 2004, of a satellite surveillance system. The Radarsat satellite, which allows for photos to be taken from space, enables its users to count the number of ships at sea, to identify and locate those ships operating illegally, and to rapidly intervene. While illegal fishing has greatly diminished within our zone, it has moved toward the international waters bordering the EEZ. This success now opens the way to international cooperative efforts with those countries facing the same difficulties: South Africa (Marion Island) and Australia (Heard Island and McDonald Islands), with whom an agreement was signed on 23 November 2003. This cooperation is a real success, for it allows both countries to jointly plan their actions, with French vessels even being allowed to patrol Australian waters. A similar agreement should be signed with South Africa.

This mission is carried out effectively to great benefit of Réunion's shipowners and the local jobmarket, with a turnover of €45 million and 250 fulltime jobs. Six outfitters (eight boats) are authorized to fish. The southern high-sea fishery now represents the island's second largest export sector.

Illegal fishing also had a significant impact on animal life. Birds greatly suffered from long-lining, because they came to eat the bait on the hooks when the lines were let out into the water and were carried down and drowned as a result. It was therefore necessary to require that lines be set only at night. Unfortunately, certain species, such as white-chinned petrels, fish at night and are therefore still victims of this technique. Other solutions must therefore be found.

In the case of killer whales, the situation is of great concern. These very intelligent animals have discovered that they can feed off of long-lines when these are pulled to the surface, leaving only the heads attached to the hooks and causing very considerable losses (over 30%). Now, less scrupulous fishermen are eliminating killer whales; dynamite used to this end has even been discovered on boarded pirate boats! This practice is obviously banned for all fishing boats operating legally within our EEZ. However, around the Crozet Islands - whose entire killer-whale population had been identified and monitored during successive programmes starting in 1964, thanks to photographs taken of their dorsal fins which, with their notches and scars, serve as a sort of ID card – a sudden drop has been observed. From 1988 to 1989, there were 93 individuals, but only 43 from 1998 to 2000. Likewise, between 1981 and 1990, nine juveniles had been observed, compared to only one between 1991 and 2000. The population has been seriously destabilized and the reduction in the number of females threatens its complete disappearance.

Source: Report by Senator Christian Gaudin on polar research, OPECST, 2007.

Therefore, suitable means of surveillance (via satellite) and intervention, military means included, allow authorities to get the better of pirates in the most remote areas of our EEZs. There is little reason to believe that identical measures will not allow for tighter fisheries control.

In this regard, in Peru, the French company CLS has been chosen by the government to monitor the region's fishing boats via satellite. Even if this requires a permanent educational programme and an unfailing capacity to monitor and sanction illegal fishermen, it is possible to enjoy a very complete vision of the fishing fleet's activity and to use these data for research. These measures run contrary to the fishing culture, which revolves around maintaining good "fishing holes" secret. Therefore, fishermen are little inclined to accept this "informer" or this "black box" onboard their ships. What is more, not all technical possibilities have been fully exploited to avoid conflicts with the fishing industry. Nevertheless, it constitutes **an essential system for a modern monitoring of the fishing effort, for identifying ships and, therefore, for fighting piracy**.

These satellite-surveillance measures are spreading to the fisheries of all large migratory species, such as tuna. They were just recently adopted by the Comoro Islands to monitor the activity of European seiners and longliners operating within their waters, as well as the activity of their own fishing fleet.

In addition, in the TAAF as in many other fishing zones, **illegal fishing is carried out not by ships from defaulting states, but rather by ships from developed and, for the most part, European and Asian countries**.

At the opposite end of the chain, it is essential to **prevent the pirates' products from reaching the markets**. Once again, a complete closure is impossible, without carrying out a DNA test on each fillet of fish. But effective management is not all that difficult, if a real monitoring of commercialized catches is carried out and if the main markets close their doors to catches that are known to be illegal. The bluefin-tuna fishery is obviously the best known case, as well as the most characteristic of the disproportion between officially authorized quotas and commercialized catches. But this is also the case for other stocks, such as the Patagonian toothfish in the past.

Therefore, the state's mission must be reaffirmed and coherent:

- Actively promote a sustainable form of fishing, which entails the continuity of both an economically-profitable fishery and healthy fish stocks.

- Fully and unflinchingly carry out its mission of monitoring and sanctions.

- Actively fight piracy, including that carried out by its own nationals.

4. Greater monitoring on the part of Parliament

While preparing this report, your *rapporteur* realized that few members of Parliament attentively followed those issues relative to fishing, aquaculture and halieutic-resource management.

This weakness is a handicap as much for the fishing professionals, administration and government as for our country at the European level.

That is why your *rapporteur* proposes **the creation of a joint marine fisheries and aquaculture committee gathering together European and national members of Parliament, both deputies and senators**.

Its objective would be to encourage sustainable, responsible fishing.

E. BETTER-INFORMED AND MORE RESPONSIBLE CONSUMERS

To steer the fishing industry toward greater responsibility and sustainability, the signals delivered by consumers to professionals are of the utmost importance.

Without diminishing in any way the responsibility of authorities, fishermen and wholesale fish merchants, consumers can act by privileging those species whose stocks are not over-exploited and, when shopping, favouring small-scale fishing or eco-certified products; consumers can also abandon certain forms of behaviour, such as eating juvenile fish, and sport fish in a more environmentally-responsible manner.

1. Educating consumers

a) The risk of losing the "halieutic culture"

Consumer education is an important issue for the fishing sector. We risk witnessing a cultural abandonment of fresh fish that are too complicated to buy and prepare, in favour of ready-to-consume products; this would constitute a real break in the culinary transmission from one generation to the next.

More generally, in a rural country such as France, the ability to appreciate quality, seasonal fish has always been uncommon; however, it has been weakened further by the internationalization of trade, which provides consumers with all, or almost all, species all year round. In this respect, the consumption of fish is undergoing the same evolution as that of all other food products.

Combined, these two evolutions produce fish that are ready to consume and of standard quality all year round, the equivalent of industrial, standardized and inexpensive meats. In this market, a frozen or fresh

aquacultural product is fully at home in the form of a fillet or steak, for catering professionals as much as for individual consumers.

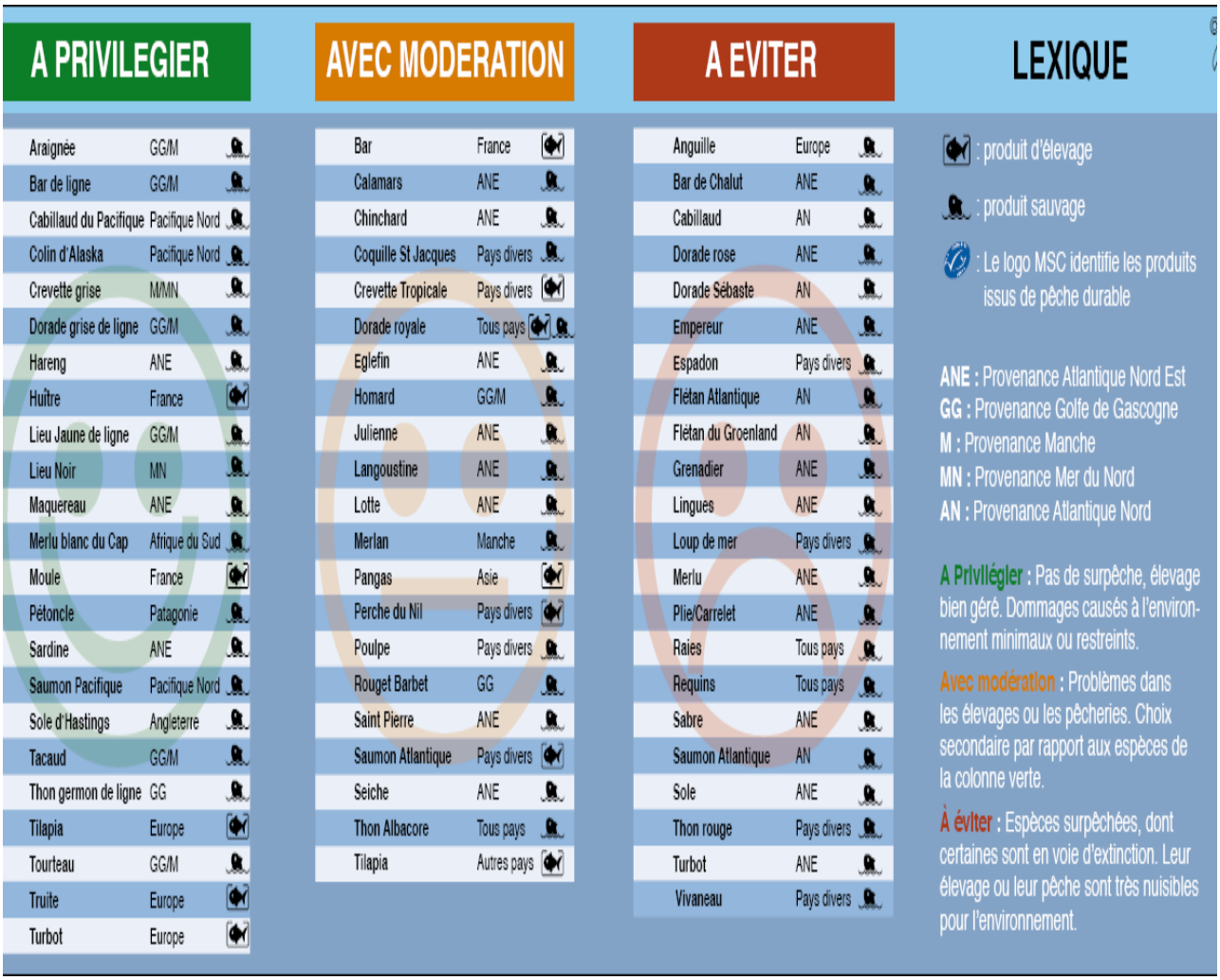
Yet any initiative to improve the quality of halieutic products necessarily entails a break from this purchasing mechanism thanks to increased public awareness and appropriate labelling.

b) Initiatives for the promotion of a sustainable consumption

During my investigations, I have noticed that several initiatives of this type have already been carried out in the form of purchasing guides for consumers.

In this case, an association publishes a list of fish and seafood to either favour or avoid.

Certain are produced by NGOs, such as the list published by the **WWF**: *(See English Table next page)*



A PRIVILEGIER

Araignée	GG/M	
Bar de ligne	GG/M	
Cabillaud du Pacifique	Pacifique Nord	
Colin d'Alaska	Pacifique Nord	
Crevette grise	M/MN	
Dorade grise de ligne	GG/M	
Hareng	ANE	
Huître	France	
Lieu Jaune de ligne	GG/M	
Lieu Noir	MN	
Maquereau	ANE	
Merlu blanc du Cap	Afrique du Sud	
Moule	France	
Pétoncle	Patagonie	
Sardine	ANE	
Saumon Pacifique	Pacifique Nord	
Sole d'Hastings	Angleterre	
Tacaud	GG/M	
Thon germon de ligne	GG	
Tilapia	Europe	
Tourteau	GG/M	
Truite	Europe	
Turbot	Europe	

AVEC MODERATION

Bar	France	
Calamars	ANE	
Chinchard	ANE	
Coquille St Jacques	Pays divers	
Crevette Tropicale	Pays divers	
Dorade royale	Tous pays	
Eglefin	ANE	
Homard	GG/M	
Julienne	ANE	
Langoustine	ANE	
Lotte	ANE	
Merlan	Manche	
Pangas	Asie	
Perche du Nil	Pays divers	
Poulpe	Pays divers	
Rouget Barbet	GG	
Saint Pierre	ANE	
Saumon Atlantique	Pays divers	
Seiche	ANE	
Thon Albacore	Tous pays	
Tilapia	Autres pays	

A EVITER

Anguille	Europe	
Bar de Chalut	ANE	
Cabillaud	AN	
Dorade rose	ANE	
Dorade Sébaste	AN	
Empereur	ANE	
Espadon	Pays divers	
Flétan Atlantique	AN	
Flétan du Groenland	AN	
Grenadier	ANE	
Lingues	ANE	
Loup de mer	Pays divers	
Merlu	ANE	
Plie/Carrelet	ANE	
Raies	Tous pays	
Requins	Tous pays	
Sabre	ANE	
Saumon Atlantique	AN	
Sole	ANE	
Thon rouge	Pays divers	
Turbot	ANE	
Vivaneau	Pays divers	

LEXIQUE

: produit d'élevage

: produit sauvage

: Le logo MSC identifie les produits issus de pêche durable

ANE : Provenance Atlantique Nord Est
GG : Provenance Golfe de Gascogne
M : Provenance Manche
MN : Provenance Mer du Nord
AN : Provenance Atlantique Nord

A Privilégier : Pas de surpêche, élevage bien géré. Dommages causés à l'environnement minimaux ou restreints.

Avec modération : Problèmes dans les élevages ou les pêcheries. Choix secondaire par rapport aux espèces de la colonne verte.

À éviter : Espèces surpêchées, dont certaines sont en voie d'extinction. Leur élevage ou leur pêche sont très nuisibles pour l'environnement.

This type of guide, already relatively complex, is not very easy to use. Yet, it has been greatly streamlined and is presented in the form of a small brochure the size of a credit card. It fits within a purse or wallet. Specialists, however, would undoubtedly find fault with its recommendations in favour or against certain species.

Other initiatives also exist. Some are the fruit of local collaborative efforts between fishing professionals, researchers and an oceanographic museum, such as at **Boulogne-sur-Mer. Nausicaa** is undoubtedly one location where this initiative has been taken the furthest in connection with the local fisheries committee and the IFREMER laboratory for the English Channel and the North Sea.

English Table

TO FAVOUR		WITH MODERATION		TO AVOID		KEY
Spider crabs	*BB/EC*	*Sea bass*	*France*	*Eel*	*Europe*	*Farmed fish & seafood*
Wild sea bass	*BB/EC*	*Squid*	*NEA*	*Sea bass (trawl-caught)*	*NEA*	
Pacific cod	*North Pacific*	*Jack mackerel*	*NEA*			*Wild fish & seafood*
Alaska pollock	*North Pacific*	*Scallops*	*Various countries*	*Cod*	*NA*	
Shrimp	*EC/NS*	*Tropical shrimp*	*Various countries*	*Red sea bream*	*NEA*	*The MSO logo identifies sustainable-fishing products*
Wild black sea bream	*BB/EC*	*Gilthead bream*	*All countries*	*Rosefish*	*NA*	
Herring	*NEA*	*Haddock*	*NEA*	*Emperor*	*NEA*	
Oysters	*France*	*Lobster*	*BB/EC*	*Swordfish*	*Various countries*	
Wild pollack	*BB/EC*	*Ling*	*NEA*	*Atlantic halibut*	*NA*	*NEA: from the Northeast Atlantic*
Coalfish	*NS*	*Langoustine*	*NEA*			
Mackerel	*NEA*	*Monkfish*	*NEA*	*Greenland halibut*	*NA*	*BB: from the Bay of Biscay*
White hake from the Cape	*South Africa*	*Whiting*	*English Channel*	*Grenadier*	*NEA*	
Mussels	*France*	*Panga*	*Asia*	*Ling*	*NEA*	*EC: from the English Channel*
Queen scallops	*Patagonia*	*Nile perch*	*Various countries*	*Seawolf*	*Various countries*	
Sardines	*NEA*	*Octupus*				*NS: from the North Sea*
Pacific salmon	*North Pacific*	*Red mullet*	*Various countries*	*Hake*	*NEA*	
Sole from Hastings	*England*	*John Dory*	*BB*	*Plaice*	*NEA*	*NA: from the North Atlantic*
Pout	*BB/EC*	*Atlantic salmon*	*NEA*	*Skates*	*All countries*	
Wild albacore	*BB*	*Cuttlefish*	*Various countries*	*Sharks*	*All countries*	***To favour:*** *No overfishing, well-managed farming.*
Tilapia	*Europe*	*Albacore tuna*	*NEA*	*Cutlassfish*	*NEA*	
Crabs	*BB/EC*		*All countries*	*Atlantic salmon*	*NA*	*Minimal or limited environmental damage.*
Trout	*Europe*	*Tilapia*	*Other countries*	*Sole*	*NEA*	
Turbot	*Europe*			*Bluefin tuna*	*Various countries*	
				Turbot	*NEA*	
				Silk snapper	*Various countries*	***To avoid:*** *Overfished species, some of which are threatened with extinction. Their fishing or farming is very harmful to the environment.*

The published list contains only recommended species; there are no "prohibited" species. These recommendations are presented by season and updated according to the fishery. Scientific descriptions present each species in a succinct manner. Finally, recipes are also proposed (http://www.nausicaa.fr/liste-pour-la-saison-article-233-fr.htm). The only thing lacking is a link allowing Internet users to sign up to automatically receive the updated recommendations each new season.

These pages "Agir pour la planète" ("Take action for the planet") are presented in the following manner for winter 2008:

List for the season

Your passport to correct fish and seafood consumption

Winter 2008-2009
Valid until 31.01.2009
We recommend
(list created with advice from the IFREMER laboratory for the English Channel and the North Sea):

At all points of sale in France, fished in the Northeast Atlantic	Video recipes
Coalfish (35 cm) *	
Pout (125 g)*	
At all points of sale, fresh from the ports of the English Channel and the North Sea.	
Scallops (11 cm)*	Video recipes
Herring (23 cm)*	
Red mullet (40 g)*	Video recipes
Sea bass (36 cm)*	Video recipes
Whiting (27 cm)*	
Red gurnard (60 g)	
Squid (200 g)	
Small-spotted catshark (500 g)*	
Farmed species From France, the Netherlands, Spain:	
Oysters	
Mussels	
Farmed species From Madagascar:	
Shrimp ("Label Rouge" quality label)	
Shrimp ("Label Bio" ecolabel)	
Wild species from overseas:	
Madagascar shrimp	

* Minimum size for consumption (dependent upon the fishing zone).

These examples show that consumer-education initiatives in favour of a more sustainable form of fishing already exist and find a certain echo.

c) Launching an initiative in favour of small-scale, sustainable fishing

In addition, it should be pointed out that, to my knowledge, **no initiative equivalent to the AMAP exists in the fishing sector**.

The Association pour le Maintien d'une Agriculture Paysanne (AMAP, also known as Community-Supported Agriculture or CSAs in English-speaking countries) is based upon experiments carried out in Japan and Switzerland in the 1960s and 1970s. This movement then spread to the United States in the 1980s and finally to France starting in 2001, upon the initiative of the ATTAC committee of Aubagne. Today, there are some 50 AMAPs in France.

The goal of this movement is to establish a direct-sales link between peri-urban, organic farmers and groups of consumers who sign up in advance to receive a weekly "basket" of seasonal produce. The system functions similarly to the sale of nouveau wines; in other words, the farmer enjoys a guaranteed income, with each consumer pre-purchasing a share of the upcoming harvest. This community-based model promoting a community-based economy has proved truly successful, well beyond the movement's original activist circles and in and outside the greater Paris region, due to a combination of values, pricing and quality.

Launching a similar project for the fishing sector would be an extremely useful and practical initiative in the coastal departments, where small-scale fishing is still considerable, while being careful not to disadvantage the areas' small, local shops.

The sustainable nature of and the need to preserve small-scale fishing are intuitive convictions for anyone intimately familiar with the French coast. This intuition was recently confirmed by a Canadian study that shows that small-scale fishing (with boats under 15 metres) is more selective and less destructive thanks to the tools and devices used.[1] Its carbon footprint is also smaller (8 times less fuel than industrial fishing). It also ensures a more complete commercialization of its catch, with a maximum number of species directed toward human consumption. However, subsidy mechanisms and the cost of quality-label procedures tend to penalize this form of fishing.

It could be suitably supported by strengthening its integration into the local economic fabric and by measures to guarantee fisherman income, as well as the quality and sustainability of consumer food supplies.

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[1] *"Funding priorities: big barriers to small-scale fisheries", Conservation Biology, Vol.22, Issue 4, pp. 832-835, August 2008, J. Jacquet and D. Pauly.*

Therefore, the proposals of your *rapporteur* are as follows:

- **Develop citizen-based initiatives to inform consumers regarding their consumption of fish and seafood, in cooperation with both fishing professionals and researchers, while relying on oceanographic centres open to the public.**

- **Launch community-based projects similar to the AMAPs** for organic agriculture, with the goal of providing consumers with fish from small-scale, sustainable fishing operations, thereby forming Associations pour le Maintien d'une Pêche Artisanale Durable ("Associations for the Maintaining of Small-Scale, Sustainable Fishing") or AMPADs.

2. Ecolabelling

a) Why label fish and seafood?

The rising awareness over more than the past ten years of the critical situation facing the marine fisheries has led NGOs, private groups and international institutions to promote and set up a labelling system for fish and seafood.

This initiative is based upon a simple set of principles. The world's fisheries are in poor health, often poorly managed and little monitored. Pirate-based fishing activities known as INNs ("Illegal, Non-declared or Non-regulated") are numerous and difficult to eliminate. Consumers, who are increasingly aware of this situation, are also increasingly concerned and risk turning away from fish and seafood. The sector's professionals are increasingly fearful of the actions carried out by environmental NGOs and the boycotting of their products, as has already happened in the United States for the Patagonian toothfish and for tuna, fishing for which killed dolphins and tortoises in great number.

It is now necessary to "separate the wheat from the chaff", by indicating to consumers which products they can buy without contradicting their civic convictions.

Indeed, the large industrial groups have been the first to commit to this approach, aware of the risks in the medium and long term of a break in supply or a loss of consumer confidence as has already been seen during past crises, some of which they were unable to overcome until many years later. For them and not to deny a real commitment on the part of their managers in favour of the general interest, it amounts to enjoying **a competitive advantage** by adopting a pioneering approach. Labels are a powerful tool to improve a product's standing and image and to increase or preserve profit margins, especially vis-à-vis supermarkets. They may also allow for market-share gains vis-à-vis competing products.

The attitudes of the large French and foreign distributors (e.g., Wal-Mart) and large fish buyers also raise the fear that certification may become essential for product referencing.

The very existence of a label is today seen as a national competitive advantage. Their especially strong development in the Anglo-Saxon countries and, to a lesser extent, in Germany and northern Europe serves as an advantage vis-à-vis foreign companies in both their domestic and export markets.

So, **for the French fishing industry, the absence of a national label and the possible dependence on foreign labels seems increasingly like an ever greater disadvantage**.

The reluctance on the part of authorities and the industry and the lack of recognition vis-à-vis the stakes involved and of a strategic vision mean that, today, **France is behind** in the world market, **potentially placing the national industry in a vulnerable situation**.

This explains the converging interests of NGOs and various industry actors: producer bodies, large shipowners, wholesale fish merchants, processors and everyone else involved in the international fish and seafood trade.

b) A commitment of the Grenelle Environment Round Table

It is therefore logical that the ecolabelling of fish and seafood starting in 2008 proved **one of the few fishing-related commitments of the Grenelle Environment Round Table**.

Its implementation was handed over to Operational Committee no. 12 "Integrated Management of the Sea and Coast", presided over by Deputy Jérôme Bignon, who presented his conclusions in July 2008.

A subgroup to the committee, presided over by the President of the Comité National des Pêches Maritimes ("National Marine Fisheries Committee" or CNPEM), Pierre-Georges Dachicourt, proposed an article for the creation of a fishing ecolabel, whose details would be worked out by OFIMER. The following wording had been proposed: "Fish and seafood from sustainably-managed fisheries can benefit from an ecolabel. A decree fixes the conditions required for fish and seafood to benefit from this ecolabel, as well as the monitoring methods."

The bill relative to the implementation of the Grenelle Environment Round Table, that received its first reading before Parliament in October 2008, includes this proposal in Article 30 (paragraph 4): "France will strengthen its policy of sustainable and concerted management with regard to its halieutic resources by establishing an ecolabelling system for fish and seafood no later than 2009".

c) An assessment of today's labels

While the principle of labelling has been established, **the content and scope of labelling raises questions**.

Indeed, labelling can only meet the expectations of consumers and fulfil the long-term interests of fishermen if it represents a real standard and constitutes a step forward. However, it is clear that **many would simply like to see certified those fisheries which respect current regulations**, the management measures being ipso facto considered guarantees of sustainability. **This would obviously be a mistake.**

In early 2008, OFIMER published a feasibility study for the implementation of an ecolabel for the marine fish-and-seafood sector.

This document, to which your *rapporteur* will refer to in the following section, presents a particularly pertinent summary of the existing labels, the initiatives undertaken by distributors, and the prospects for certifying two representative fisheries: the langoustine fishery of the Bay of Biscay and the coalfish fishery of the North Sea, western Scotland and Norway.

(1) The international framework of any future creation

OFIMER begins by pointing out that **any new label must fit within an international framework that strictly determines its outline**.

Firstly, there are the FAO's *Code of Conduct for Responsible Fisheries*, published in 1995, and its *Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries*, published in 2005.

Secondly, at the European level, the Council of Ministers, in April of 2007, declared its support for the framing of ecolabels; regulations should soon be proposed by the European Commission.

The FAO's directives today constitute the essential foundations of any certification initiative with regard to method.

This must be carried out in three main steps:

1- The definition of standards; in other words, the definition of specifications by a suitable body.

2- The accreditation of a certifying body. An accrediting body verifies the competence of the certifying body, which will serve as the third party enforcing the standard.

3- The certification of standards. This task is carried out by the third party or a separate certifying body.

The FAO has also specified that the specifications must take into account the following:

- Management conditions: respecting national and international legislation; evaluating stocks; making decisions based upon the best scientific data available, as well as pertinent, "traditional" knowledge; evaluating the impact on the ecosystem; undertaking appropriate measures to ensure sustainability; and implementing a precautionary approach.

- Concerned halieutic stocks, which must not be over-exploited, be preserved for future generations, and benefit from possible restoration measures.

- Exploited ecosystems, on which the negative impact of fishing must be measured and solutions provided.

For this reason, certification can only be applied to specific fisheries (one or a few fishing devices or stocks) that call for it.

The chosen process must ensure universal transparency and participation. It must be perfectly documented. It must also be carried out within a completely independent and non-discriminatory framework.

Certification and the certification standards are not attributed once and for all, but are subject to regular revisions and verifications.

(2) Current ecolabels for fish and seafood

The existing ecolabels can be divided into two main categories: those attributed by NGOs and those attributed by the distributors themselves.

The principal ecolabel is the Marine Stewardship Council or MSC, which certifies 7% of the world catch. This is also the oldest label and the only one to really meet FAO standards, according to OFIMER, for which the MSC stands out for its real scientific approach, independence and transparency.

It is the fruit of a joint study carried out by Unilever and the WWF starting in 1996 and was created in 1999. It has the legal status of an independent NGO and is financed as such; 5% of its resources come from income provided by the licensing of its logo and from private companies. Its headquarters are located in the United Kingdom.

OFIMER believes that the French professionals' fears vis-à-vis the MSC are unfounded: "One also regularly criticizes the MSC for having been created by and being financially dependent upon the WWF and Unilever. However, since 1999, the MSC has opened its board of directors and its board of stakeholders to representatives of many other structures. Indeed, these founding structures are now simply two donors among many others".

The certification process is complex and very complete. For this reason, it is relatively long, varying between 5 and 24 months. Its cost is high, anywhere from €15,000 (wild mackerel from Cornwall) to €200,000 (Alaska pollock). Permission to use the logo costs from €250 to €2,000, depending on turnover, with an additional 0.5% tax on turnover for products sold directly to consumers.

At the beginning of 2008, 22 fisheries had already been certified and 18 were in the process of being certified.

This is **the only label to have acquired a high level of recognition and credibility at the international level**. The largest American distributor, **Wal-Mart**, has committed itself to selling only MSC-certified products for the next five years. The company **Findus-Foodvest**, which is the largest fish-and-seafood group in Europe and represents 10% of world cod purchases and €500 million of fish purchases annually, has also committed itself to a progressive, MSC-certification procedure. It is currently the largest purchaser of MSC products in the world. Its management is betting that within five years, 50% of the fish-and-seafood market will be certified.

This label is still little known in France. OFIMER correctly points out that both the label's acronym and its full name have little meaning for French consumers. However, increasing the label's fame greatly depends upon the Findus company's communication efforts to promote its practices in our country, and so could change rapidly.

While other certification procedures exist, none rival the MSC in scope. Most are rather recent creations (less than five years) and, according to OFIMER, none meet the FAO's standards, often due to a lack of independence, seriousness or transparency.

This is the case of the Friend of the Sea or FOS label, created in 2006 by the same NGO that created the "Dolphin safe" label. It enjoys a certain level of recognition in Italy.

The KRAV label was created in Sweden in 2004. It certifies only a few boats operating within two fisheries.

The Naturland fishing label, created in 2007, has the particularity of essentially targeting developing countries. It was developed by a German NGO.

The second group of labels consists of the industry's own initiatives.

Within this group, the most successful labelling system is that of Intermarché and its outfitter Scapêche, France's largest outfitter, which calls upon the services of a "second party". The principal species concerned is the Patagonian toothfish, which is fished for in the TAAF and whose catches are closely monitored by the Muséum National d'Histoire Naturelle.

Your *rapporteur* believes that this approach represents **a real strategic vision on the part of companies** having to deal with Europe's evolving fisheries. It provides a real added value and is a clear sign of the sector's need for greater visibility and closer collaboration with researchers.

This trend is fully confirmed by the qualitative study carried out by OFIMER, based on the perusal of 45 different questionnaires. As it turns out, 95% of respondents think that consumers are interested in these labels, even if their readiness to pay more remains unknown; 70% of bodies declare that they considering certification.

However, OFIMER expresses its opinion in a severe, but realistic manner: "Despite the presence of a certifying body, this approach does not meet the standards of the FAO 2005 ecolabel, given the fact that the company sets its own criteria without involving the other stakeholders in the process. For this reason, it cannot be considered an ecolabel."

Other distributors have committed themselves to the labelling of certain products for their customers; however, for OFIMER, these are but "environmental claims". This is the case with Carrefour's *Pêche responsable* ("Responsible fishing") logo created in 2004, Auchan's *Consommer mieux* ("Consume better") logo, and Casino's *Produit sélectionné pour une mer préservée* ("Product chosen to protect the sea") logo.

With regard to these labels, OFIMER is of the opinion that: "It cannot be argued that these labels meet the FAO 2005 standards, because the distributors define their own conditions for the attribution of their logos - generally accompanied with an environmental claim - and they themselves assess the various fisheries' compliance with these same conditions. Therefore, in this case, there is but one party that can create a standard, verify its compliance, and attribute a 'label"; but this is not an ecolabel".

In the end, these "labels" create confusion and blur the message and damage the legitimacy of ecolabels. They remain suspected of being based more upon marketing than sustainable-development objectives, no matter the distributors' sincerity, their desire to meet the expectations of consumers and guarantee their own supply lines, the non-negligible costs engendered by these initiatives, and the educational effect on their customers due to their labels' impact.

The consideration of these factors leads to one conclusion. Our country must choose between three options:

- Rally around an existing label that meets the FAO criteria or create a national variation; in other words, the MSC.

- Create a private, dedicated label for the French fishing industry, possibly in cooperation with an NGO.

- Create a label by government decree.

d) Toward a French government label?

By tradition and by reticence vis-à-vis a foreign or private label, the industry has, for the most part, come out in favour of creating a government label.

Indeed, like other agricultural sectors, the fishing industry desires a unified approach that applies to everyone and dismisses initiatives deemed "unserious", so as to assure consumers.

A large gap remains between the various certification methods and the magnitude that this system will take, which will directly determine the label's cost and weight.

OFIMER has carried out two simulations for the langoustine of the Bay of Biscay and the coalfish of the North Sea, western Scotland and Norway, taking into consideration a complete certification of each fishery (fishing and the downstream sector) and with regard to two levels of criteria: "resource and biodiversity" and "resource, biodiversity, environment, safety, social dimension and product quality".

In the case of the langoustine fishery and for 250 boats:

1st level: €28,000 for initial certification + €17,000 annually

+ living-langoustine chain: €12,000 + €5,000.

2nd level: €50,000 for initial certification + €25,000 annually

+ living-langoustine chain: €12,000 + €5,000.

In the case of the coalfish fishery and for 15 boats:

1st level: €27,000 for initial certification + €11,000 annually

+ guaranteed downstream chain: €29,000 + €15,000.

2nd level: €38,000 for initial certification + €16,000 annually

+ guaranteed downstream chain: €29,000 + €15,000.

Faced with these costs and the difficulty of establishing a certification system, OFIMER also proposes an intermediary solution: the

creation of a "responsible fishing" label for wholesale fish merchants, processors and distributors. This would allow more parties to attain certification and would constitute a way forward.

More generally, OFIMER deems it necessary for the sector to choose a certification system that is as closely in line with consumer needs as possible, thereby limiting costs and allowing them to be passed on to consumers. The problem is that, so far, the MSC does not seem to have allowed producers to sell their goods at a higher price.

The limits of a purely national approach are reinforced by the structure of the French market. The French fishing industry supplies only 15% of consumption and the large processing centres function as import-export platforms. Therefore, outside France, the label will have no impact, compared to an international certification system such as the MSC. Likewise, it will not be possible to certify imported products from foreign fisheries (85% of the market) and, once again, a foreign certification system will very likely prove necessary. Therefore, national certification will apply to a limited portion of the sector: that part of the French catch sold in France.

Furthermore, as a tool, certification is meant to instruct consumers, whether groups or individuals. An intermediary solution would undoubtedly be sufficient for the industry, but it would meet neither societal expectations nor the legal requirements.

Therefore, your *rapporteur* believes that it is desirable to:

- Encourage the certification and ecolabelling of French fisheries, so as to encourage an evolution in fish-and-seafood consumption and, therefore, a change in behaviour on the part of the fishing industry. Certification is now of strategic importance for the industry.

- More precisely measure the interest of a purely national, government certification system, even though the "nationalization" of the existing MSC label or even a European-wide, non-private solution present a number of advantages in terms of speed, legitimacy, efficiency and international recognition.

3. Fighting the fishing and consumption of juveniles: distributing a "fish-meter"

The fishing of juvenile fish represents an important problem for fisheries management. **Fishing and eating fish that have not been able to reproduce a single time is the surest means of condemning a species to extinction. This basic principle must be shared by everyone.**

In certain countries, such as Spain, or in certain regions, the consumption of juvenile fish is part of the culture. The most famous example is that of elvers, or young eels, caught while swimming up the rivers.

On a wider scale, this consumption of juveniles has spread due to insufficient monitoring by authorities, both at the time of unloading and within the distribution channels, granting free reign to unscrupulous fishermen who are often unaware of the impact of their activity.

Philippe Cury points out that, today, 95% of fish caught in the Bay of Biscay are less than 23 cm in length. Considering swordfish, he observes that specimens over 1.75 metres now represent less than 1% of the population.

In France, certain authorities, like certain fishermen, emphasized to your *rapporteur* the newness of this culture of complying with official minimum catch sizes, dating from the fine passed by the European Commission in 2006. Up until then, a large scale fraud existed in our country.

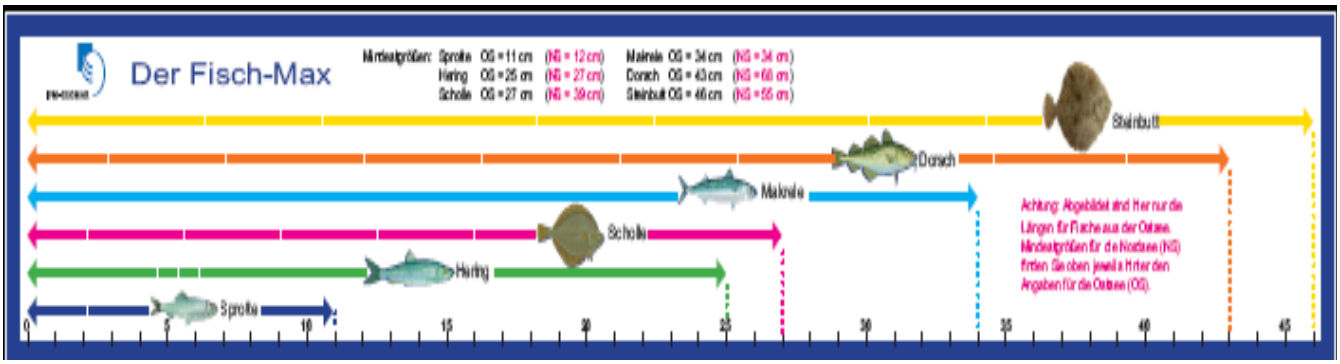
Judging by certain stalls, this culture of fishery management and of complying with the regulations is not yet universally shared.

That is why your *rapporteur* believes it useful to **call the consumer as a witness and to give him/her a sense of responsibility**.

This raising of awareness is not easy, given the fact that the fish offered consumers have often been reduced to fillets or servings, rendering their identification impossible.

However, with many species still being sold or presented whole, in certain countries, the authorities, scientists and associations have decided to **provide fishermen and consumers with the means to verify for themselves if the fish caught or sold had attained the minimum catch size**.

This movement originated in Germany, where Rainer Froese of the Institute of Marine Sciences in Kiel perfected a small plastic ruler, indicating the legal catch size for the main species of fish and allowing consumers to boycott undersized specimens. This ruler, called a "Fisch-Max", looks like this:



This initiative was adopted by a large consumer association, rebaptized the "Fish-O-Meter" (www.fisch-o-meter.de) and distributed by a German daily, the Hamburger Abendblatt. It looks like this:

In Germany, these small rulers received a cold welcome by fishermen, for they were felt to cast doubt on their profession.

They then **spread to Peru in 2006 and to Senegal in 2008**, where the tool was renamed the *poisson-mètre* ("fish meter").

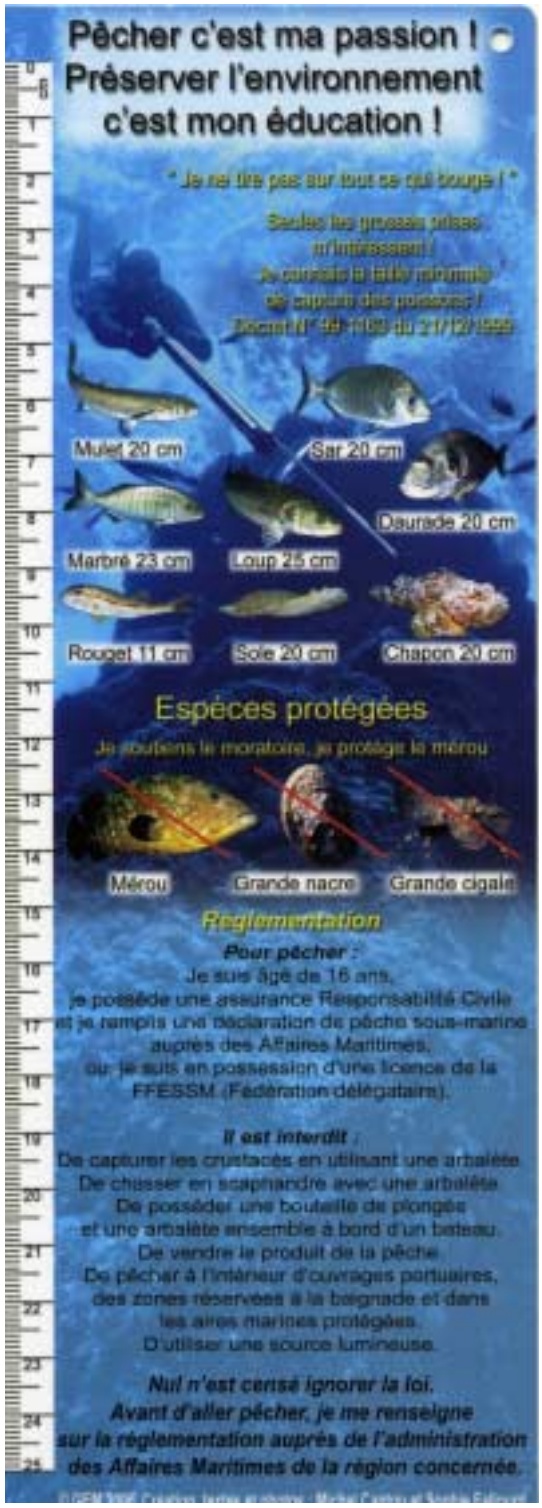
In Senegal, the initiative is supported by the WWF, in cooperation with the Centre de Recherches Océanographiques de Dakar-Thiaroye ("Dakar-Thiaroye Centre for Oceanographic Research"). It enjoys the authorities' full support for the education of both fishermen and consumers. The *poisson-mètre* is a cloth, graduated ruler 50 cm long, with the images of six fish species, along with their minimum reproductive size.

Even in France, such an initiative is not completely unknown. A small ruler of this type is provided to underwater fishermen in the Mediterranean, as a sort of "crib sheet" of regulations concerning minimum sizes, protected species and safety measures.

The success and simplicity of this type of measure in educating fishermen and consumers pleads in favour of its wide distribution in France.

That is why your *rapporteur* proposes that the French government ensure the development and free distribution of its own *poisson-mètre*.

Failing that, I would like to see this initiative undertaken by the civil society - by an NGO as in Senegal (WWF), by a consumer organization such as UFC - Que choisir ?, or, as in Germany, by a large regional daily such as Ouest-France - and thereby help the public consume in a more responsible manner.



See English Table next page

I am
a responsible
underwater fisherman.

Careful: a speargun is a weapon!

*To use a speargun, I must be over **16 years old**.*

I must never load my speargun out of the water.

When I load my speargun in the water, I take care not to point it at anyone.

When fishing, I never point my speargun at another diver.

When swimming, I keep my finger off the trigger.

I signal my presence with a buoy.

I raise the Alpha flag in full view on my boat.

These measures are necessary for my safety.

For our mutual safety, I never fish alone.

For lessons or to learn more about my sport, I contact a club specialized in underwater fishing.

An underwater fisherman loves and respects the sea.

Free handout

Fishing is my passion!
Protecting the environment
is my natural reflex!

"I don't shoot anything that moves!"

I'm only interested in large fish!
I know the minimum catch sizes.
Decree no. 99-1163 of 21.12.1999.

Mullet: 20 cm White sea bream: 20 cm

Sea bream: 20 cm

Marbled grouper: 23 cm Sea bass: 25 cm

Red mullet: 11 cm Sole: 20 cm Scorpion fish: 20 cm

Protected species

I support the moratorium, I protect the grouper.

Grouper Noble pen shell Giant slipper lobster

Regulations

To fish:

I am 16 or older.
I have civil responsibility insurance and I have filled out a "declaration of underwater-fishing" form for the Marine Affairs office,
or I have an FFESSM licence (proxy federation).

I am not allowed to:

Fish for shellfish using a speargun.
Use a diving suit when fishing with a speargun.
Have a diving cylinder and a speargun together on my boat.
Sell my catch.
Fish within port facilities, swimming zones and Marine Protected Areas.
Use a light source.

Everyone is expected to know the law.
Before going fishing, I familiarize myself with the regulations by contacting the regional Marine Affairs office.

4. Recreational fishing finally regulated

a) A real problem

The Poseidon Report of 2006 tactfully noted that: "A particular case is presented by recreational fishing, whose weight can be economically and quantitatively significant with regard to certain species of great added value, such as sea bass. The debates on Marine Protected Areas note the importance of this activity, which proves quite profitable; this 'false recreation' supports a parallel economy in direct competition with professional fishing, though without being subject to the same fiscal, social or regulatory obligations".

In fact, **for sea bass (a species not under quota), it has been estimated that one half of the catch is accounted for by sport fishermen** who often sell their fish, though this is completely illegal; indeed, the whole point of recreational fishing is consuming one's own fish.

In fact, this question remains poorly understood. Very few studies are available. The research most often cited, such as that above, comes from a study carried out by IFREMER in 2004 and 2005 within the framework of the "Défi Golfe de Gascogne" ("Bay of Biscay Challenge").[1]

The sea bass fishery was seen as emblematic of metropolitan sport fishing and allowing for an initial assessment of this activity at the national level. This study relied on telephone interviews conducted by a specialized institute. The target population consisted of French citizens 15 and older. Based on the "quota method", the survey was broken down into 14 waves. A total of 14,000 interviews were carried out during 2004.

This study estimated **the number of recreational fishermen for 2003 at 1.4 million**, 900,000 of whom fished for sea bass, with a third of these 900,000 fishing more than seven times per year. Based upon the interviewees' declarations, the recreational catch was estimated at a volume equivalent to that of professional fishermen.

Other studies have been carried out, especially on tuna in the Mediterranean, though in this case the catch seems low (around 10 tonnes).

A wider study requested by the Ministry of Agriculture was carried out in 2007 and 2008; its results have yet to be released.

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[1] *"Évaluation de la pêche de loisir en France : l'exemple du bar" ("An assessment of recreational fishing in France: the example of sea bass"), Y. Morizur, B. Drouot and O. Thébaud.*

For certain species under quota, such as **cod** (for which an IFREMER study is currently being carried out), **professional fishermen complained to your *rapporteur* that sport fishermen now have greater rights than they do**. **This year, the tension was so great in the English Channel that the prefect of the Haute-Normandie region was forced to issue a specific order** limiting the recreational fishing of cod to 10 fish over 35 cm per boat and per outing (Order of 17 April 2008), pointing out the serious risk to law and order if the difference in treatment between professionals and non-professionals was not resolved. Indeed, with quotas used up, professional cod fishing was effectively banned.

On the coast, this parallel activity would appear to be significant and could even be used for the retraining of professional fishermen.

Recreational fishing has long been considered as negligible and the resulting commerce has often been tolerated. However, it has become a problem that needs solving, because, firstly, the constraints weighing on professional fishermen are very great due to the lack of resources and, secondly, professional technology is now available to sport fishermen.

b) Hunting permit, sea-fishing permit: a pertinent parallel

At this stage, it is surprising to consider that an approach similar to that taken with regard to hunting has yet to see the light.

Some believe that "small-game hunting has fallen victim to industrialized agriculture and the freezer". Let us beware of fishing falling victim to the same excesses. Starting off as simply recreational, "sport" fishing changes scale when it becomes a question of filling several freezers, supplying food well beyond one's own household, or even serving as a source of additional income or a non-declared professional activity.

On land, the law has for many years banned a certain number of tools and methods in order to protect land game and maintain the "recreational" aspect and ethical spirit of hunting. Indeed, if the game is given no chance, can it still be considered hunting?

Consequently, it is curious to observe that these principles, so firmly established on land, have not seemed necessarily applicable at sea. While no one would agree to authorize the hunting of large game using infrared detectors, this is exactly the sort of method used in fishing, with the sounders now available to sport fishermen.

The rejection of the sea-fishing licence also provokes a certain astonishment, unless one points out the debate that took place over thirty years ago surrounding the institution of the hunting-permit exam, which is no longer an issue. Indeed, it has become an effective educational and safety tool. Therefore, it is unclear why the fisherman at sea would not also need to be better informed with regard to marine biology and safety rules. This licence

could also serve as a useful "classroom" for fisheries management and environmental protection.

In addition, hunting incorporates a variety of management measures which allow for a more precise assessment of each species: population estimations (countings), permitted hunter-kill ratios, species-specific or universal logbooks, etc. Finally, one could also point to the specific regulations applicable to hunting on the public maritime domain.

In fact, the reservations provoked by the possibility of a sea-fishing licence are indicative of **a cultural problem**: recreational fishermen still all too often consider the resource unlimited and their impact negligible. However, as was also the case when the hunting licence was first introduced, it is the sense of an obligation to manage and the understanding of the limited nature of the resource that are insufficiently shared. **It is necessary to recognize**, even at the recreational-fishing level, **that the sea can no longer be considered completely free; this is not because it would no longer be considered public property, but rather because this public property must be protected for everyone's benefit.**

c) The Grenelle Environment Round Table: an insufficient outcome vis-à-vis the stakes

At the end of the Grenelle Environment Round Table and the meeting of Operational Committee no. 12 "Integrated Management of the Sea and Coast" (COMOP 12), "The participants felt that the chosen objectives could, for the most part, be reached by **voluntary measures and that it would be up to the administration to judge, based upon the results, if restrictive measures should be imposed by law or via regulations**".

For this reason, the idea of creating a sea-fishing licence was abandoned in favour of a simple, free declaration to be made only once, the marking of caught fish (by cutting or notching the caudal fin) to prevent their commercialization, and the drawing up of a charter between the various industry actors. Deterrent sanctions, such as boat or vehicle seisures, could be applied following infractions. A period of biological rest and new catch-size limits could be defined, and certain species could benefit from specific protections if threatened.

A licence will nevertheless be created for underwater fishing. This exception is justified on two grounds: the large "bag" of an experienced hunter and the safety issues surrounding hunting underwater and the use of a 6th or 7th category arm whose possession must be declared.

Furthermore, the bill relative to the implementation of the Grenelle Environment Round Table retains, in Article 30 (paragraph 4), "the supervision of recreational fishing" as a mere principle, without providing any details.

Your *rapporteur* has taken note of the work carried out by the Grenelle Round Table and COMOP 12 presented in July 2008. A compromise was found.

However, your *rapporteur* finds the proposed measures insufficient with regard to protection and management issues, the real competition that now exists for certain species between recreational and professional fishermen and the rising social tensions this engenders. In my opinion, government intervention that goes beyond the consensus found by COMOP 12 is inevitable and desirable, especially as the distortion created between the different types of recreational fishing is inconsistent with the objective of scientifically managing our natural resources.

Your *rapporteur* therefore proposes a more rigorous regulatory system for recreational fishing, based upon five principles:

- A **better statistical understanding**, thanks to scientific research and the initiative of NGOs (tagging, fishing logbooks, etc.).

- The **eventual creation of an exam-based sea-fishing licence**, such as that used for hunting, designed as an educational, management and safety tool and applying to all types of recreational fishing (except shellfish gathering).

- **Limiting which devices** may be used for sport fishing, in order to preserve its recreational spirit and code of ethics.

- **Establishing catch limits and regulation coherency**, so that when professional fishing is banned, recreational fishing must also be halted.

- The **more frequent monitoring,** carried out by government authorities, of landings and the commercialization ban, as well as the systematic monitoring of shellfish gathering during spring tides.

CONCLUSION

Fishing represents the last large-scale hunting-gathering activity. It continues to play **an essential role as a food source**, providing humans with 20% of their animal proteins and representing the main protein-animal source for 1 billion men and women.

The demand for fish and seafood is greater each year, growing faster than the world population and accompanying the rise in the standard of living.

But the growing appetite for fish places **ever greater pressure on the wild marine resources and raises the question of this exploitation's sustainability** and the possible shift to aquaculture, as man has abandoned hunting and gathering for breeding and farming.

On a blue planet, 70% of which is covered by the oceans, arriving at the limits of halieutic exploitation means arriving at the limits of the Earth's very ecosystem.

It is almost certain that we have already reached this limit.

Therefore, the future of fishing and of the halieutic resources is an essential aspect of sustainable development and of our legacy for future generations.

However, **the oceans are being increasingly altered by human activity**. Outside the two poles, there is no longer any virgin ocean. On the contrary, 40% of the world's oceans and seas are subjected to extremely high anthropic pressure. To borrow the term coined by Paul Crutzen, the oceans have entered the "Anthropocene" period.

Climate change provokes acidification, desertification and species displacement. The seas suffer from rising **pollution**, essentially washed down from the continents, that threatens marine life and its capacity to serve as a human food source.

Among these disturbances, fishing now occupies a dominant position. There are few marine zones in which it does not exert an influence that exceeds all natural factors.

Managing fishing and the halieutic resources represents an ever greater scientific challenge. Since the 19th century, researchers have tackled this problem. They have forged the idea according to which man could sustainably maximize his exploitation of the oceans. But this positivist vision of man in nature is increasingly confronted with the limits of knowledge and of effective management capacities.

In the past, man has failed to moderate his exploitation or manage the resources so as to avoid an ever greater number of collapsed stocks. This has led to a recognition of the extreme complexity and the fragility of marine ecosystems that remain little-known.

It is not always enough to stop fishing in order to regain the abundance of yesteryear; indeed, very often, an irreversible change occurs within the ecosystem and man is incapable of turning back the clock. Furthermore, this collapse can take place unexpectedly. The eventual disappearance of the world's fisheries is no longer purely hypothetical.

In fact, **the situation of the fisheries, at both the European and global levels, is serious. Marine catches have stagnated for some twenty years, despite an ever greater fishing effort.** Numerous indicators even tend to show that they have begun to decline. Fishing has spread to all of the world's oceans and today targets almost all species, ever further down the food chain, ever deeper in the ocean, and ever further from the coast. There no longer exists any virgin stock capable of supporting a new growth in catches; on the contrary, it is the over-exploited stocks that are on the rise.

Stagnating or falling catches combined with an ever greater fishing effort: this is the fundamental equation of an **economic sector facing a profound crisis**. Overcapacity is both the engine of over-exploitation and the fruit of a "race to the fish" that we have been unable to stop. At the global level, an estimated $51 billion is lost each year, out of a turnover of $85 billion.

At the EU level, the European Commission itself deems **the Common Fisheries Policy a failure**, having proved incapable of sustainably managing the stocks, of avoiding the fleet's overcapacity, and of improving the sector's profitability. Technological progress is faster than reductions in capacity. The TACs and quotas are almost always higher than those recommended by scientists. Monitoring is weak.

In France, despite very great restructuring over the past twenty years, **the fishing industry moves from one crisis to the next**, ever more dependent on government subsidies, though unable to protect jobs or find any encouraging prospects for the future.

Faced with the serious economic situation of the sector and the biological state of the fish stocks, **a raising of awareness is necessary**. **Courageous measures are needed**.

Aquaculture is all too often presented as a miracle solution, offering the possibility of a "blue revolution" following the "green revolution" in agriculture.

While aquaculture currently provides 43% of fish and seafood destined for human consumption and while it will prove essential by the year 2030 to continue to meet demand, this cannot be at any cost.

In many respects, aquaculture as it exists today increases the fishing pressure on wild species and contributes to the destruction of the natural environment.

Only a significant research effort will allow us to overcome these obstacles and avoid the world population seeing its consumption of fish decline.

The development of aquaculture will constitute a food revolution, for it will lead to the consumption of species that are currently unknown or uncommon and, above all, it will account for the greater part of fish and seafood consumption.

However, before the year 2030, aquaculture will provide no way of avoiding the necessity of finally managing the world's fisheries in a rigorous manner, for, while it will undoubtedly be able to meet the rise in demand, it will not replace the wild-fish catch.

Seriously managing the wild fisheries also entails a profound change in mentality, a sort of revolution, for we must abandon the idea of infinite space and unlimited resources.

To this end, **your *rapporteur* proposes five main lines for action**:

1- Reopen the dialogue between fishermen, scientists and political decision-makers.

Though today largely broken, **this dialogue is essential, for nothing is possible without a certain consensus**, if only regarding the mission and responsibilities of each party.

This amounts to an evolution in behaviour that cannot be brought about by decree, but rather by strong administrative and financial incentives to cooperate, via shared objectives and contracts.

2- Building political decision-making tools.

The oceans remain too little known and research too indispensable for fisheries management not to **make halieutics a true priority** within such bodies as IFREMER and the IRD. Science will provide a large share of the solutions. The challenge is great, with an **ecosystem-based approach** now being needed. However, if appropriate support is not provided, this approach will simply be a reassuring illusion and serve as a loophole toward an improbable mastery of nature.

The Marine Protected Areas offer a formidable opportunity for fishermen and scientists to come together and increase our respect for the sea and for those who live off of it. As conservation, development and management tools, MPAs must be strongly encouraged, for both the present and future generations.

3- Make fishermen the primary actors of responsible fishing.

Fishermen would like to, can and must become the primary actors of fisheries management. Nothing is possible without or against them. They must participate in, adhere to and, to a large extent, decide on the measures that will ensure the stocks' preservation and the future of their own economic sector.

There are two essential preconditions. The first is **the reduction of capacities**. The world catch has ceilinged out, but fishing capacity continues to increase by around 4% per year, due to advances in technology. Therefore, any serious management system necessitates the extensive and continuous regulation of the fishing effort.

The second precondition is **abandoning the unfortunately wide-spread culture of fraud and free-riding** that encourages actors to profit from others' management efforts. Greater self discipline must be promoted.

Finally, to be responsible, fishermen must become the owners, at least to a certain extent, of their resources. **The taboo of Individual Transferable Quotas must be done away with.** ITQs must be experimented with, if only to crystallize a change in mentality and to help the industry regain its economic profitability.

4- Authorities who exercise their prerogatives.

In France, as in other countries, **the authorities must stop - in the fishermen's own interest - to consider the resource subsidiary to the social assistance of the fishing industry**.

Scientific assessments must no longer be ignored.

In addition, the authorities should have the courage to develop a far-seeing policy, despite the social difficulties that such a policy could provoke from time to time.

The authorities must also stop considering that they are not directly responsible for the proper management of the halieutic resources. Indeed, the states have the greatest responsibility. At the global level, they control - thanks to their exclusive economic zones - 90% of the halieutic potential. France's marine territory is the second largest in the world.

It is the responsibility of the state **to monitor effectively and to sanction without fail. Renouncing the exercise of this kingly prerogative is clearly at the origin of the industry's crisis**.

The case of the **Mediterranean bluefin** tuna is but the most obvious example of this failing on the part of authorities: disdain for scientific assessments in favour of short-term profits, insufficient monitoring, and insufficient sanctioning.

What is more, states will have to **vigorously fight piracy, both at sea and on land**, including that carried out by their own nationals.

Finally, the **French Parliament** will have to be more active regarding this issue, by creating a **joint committee** of the Senate, the National Assembly and the European Parliament.

5- Better-informed and more responsible citizens.

Lastly, your *rapporteur* proposes that we take energetic action with regard to consumers and recreational fishermen.

This entails **information campaigns**, with the goal of indicating to consumers which fish-and-seafood products they should favour in order to preserve the halieutic resources. These campaigns must be encouraged within the framework of a cooperative effort between scientists and the fishing industry.

Cooperative initiatives, modelled after the AMAPs, could also be encouraged, in partnership with small-scale fishermen carrying out a form of fishing that is more respectful of the resources.

In addition to educational and cooperative measures, the authorities must favour the creation of an **ecolable** for fishing, which informs and improves the safety of the consumer. This has become an economic and competitive necessity for the sector. A purely national, French approach would perhaps not be the best option; rather, **a "Frenchification" of the internationally famous MSC label from England or a European label would be preferable.**

Your *rapporteur* also deems it useful to mobilize the citizenry via the widespread distribution of **a "fish-meter"** with the help of the media and of

NGOs, as in several other countries. This graduated ruler allows consumers and recreational fishermen to verify that a fish is of minimum size and has been able to reproduce at least once.

Finally, the impact of **recreational fishing must no longer be underestimated**. For several species, sport fishing is as important as professional fishing. With regard to threatened stocks, it is unacceptable that recreational fishing be less rigorously regulated. **Much stricter regulations must therefore be implemented concerning marine-fishing seasons, devices and catch sizes**, both at sea and on shore during the spring tides. **An exam-based sea-fishing licence will eventually need to be created.**

*

Having reached the end of this report, your *rapporteur* is convinced that the gravity of the situation with regard to the world's fisheries and halieutic resources must not paralyze us with fear, but rather motivate us to act.

If courageous measures are undertaken based upon reopened dialogue between fishermen, scientists and political decision-makers, it is possible to ensure the fishermen's future and the availability of wild fish as a food source for future generations.

TEN PROPOSALS
FOR SUSTAINABLE FISHING

1. Re-establish the dialogue between scientists, fishermen and political decision-makers to **reach a consensual diagnosis of the state of the fish stocks and of the fisheries**:

1.1. Develop partnerships (*contrats bleus* or "blue contracts", fish surveys, experimenting with selective methods as alternatives to trawling, etc.).

1.2. Incorporate this objective for the reopening of dialogue into the four-year contract between IFREMER and the French government.

1.3. Evaluate researchers regarding their capacity to carry out projects in partnership with fishing professionals and to explain their results to fishermen.

2. Reform the Common Fisheries Policy (CFP), to manage the halieutic resources in a more responsible manner:

2.1. **Respect scientific assessments regarding TACs** and quotas and justify any decisions made to depart from them.

2.2. **Enforce the TACs and quotas and the fishing regulations via effective monitoring and sanctioning.**

2.3. **Render the TACs and quotas predictable over a period of several years**, to as great an extent as possible.

2.4. **Abandon the culture of "free-riding".**

2.5. **Reduce fishing capacities** according to the state of the stocks and taking into account technological advances.

2.6. **Reduce or eliminate rejections and incidental catches** by improving selectivity and developing fisheries management so as not to harm the ships' profitability.

2.7. **Make fishermen the owners and managers of their resources: experiment with individual transferable quotas (ITQs).**

3. Improve the economic profitability of fishing and wean the sector from government assistance.

4. Manage ecosystems globally:

4.1. Support research to implement **the Ecosystem Approach to Fisheries (EAF).**

4.2. **Develop a network of Marine Protected Areas**, as a tool to protect the marine environment and to manage the halieutic resources.

5. Allow for the emergence of a sustainable form of aquaculture:

5.1. By supporting research to:

- lower the fishing pressure on wild resources;

- mitigate the impact on the natural environment;

- develop new aquacultural species.

5.2. In addition, allow for the development of aquaculture in France via the elimination of administrative hurdles.

6. Promote the sustainable consumption of fish and seafood via:

6.1. **Educational initiatives**, in cooperation with both fishing professionals and scientists, such as the distribution of **recommended-product lists**.

6.2. **Local, cooperative initiatives for fish and seafood**.

6.3. The development in France of a **European-wide or international ecolabel**.

6.4. The mobilization of consumers and recreational fishermen via the **distribution of a "fish-meter" to combat the catching of undersized fish**.

7. More strictly regulate recreational fishing:

7.1. Establish **a set of regulations that is consistent with professional fishing** and that seeks, in particular, to limit the fishing of recovering stocks.

7.2. **Preserve the athletic, ethical and "family-oriented" nature of sport fishing** by more strictly limiting the authorized seasons, devices and quantities.

7.3. **Create**, eventually, **an exam-based licence for recreational saltwater fishing**, based on the hunting licence.

7.4. **More rigorously monitor the gathering of shellfish**, particularly during the spring tides.

8. Amend Article 30 of the "Grenelle I" bill, so as to:

8.1. More strictly regulate **recreational fishing**.

8.2. Allow for a rapid experimentation with ITQs, by **reconsidering the non-patrimonial nature of access rights** (Law of 18 November 1997).

9. Create a joint committee on "marine fisheries and cultures" with French members of Parliament (Senate, National Assembly and European Parliament).

10. Take action at the international level:

10.1. **Make fisheries management a theme of the Union for the Mediterranean**.

10.2. **Fight piracy**, beginning with European-based operations.

10.3. **Prevent the collapse of the Mediterranean bluefin tuna stock, by:**

- setting TACs and quotas based upon scientific assessments;

- reducing fishing capacity;

- closing the European Union to tuna fished over the authorized quota;

- sanctions by the European Commission against EU-member states and by Europe against non-member states which do not respect the fishing regulations in place;

- c**reating sanctuaries**, like those which already exist for marine mammals, taking into account that, ideally, the fisheries should be completely closed during the reproductive period (May and June), for a few years;

- supporting research on the bluefin tuna.

EXAMINATION OF THE REPORT BY THE OPECST

The OPECST carried out an examination of the report prepared by Senator Marcel-Pierre Cléach. Following the Senator's presentation of the report, the following exchange took place:

In answer to Deputy and OPECST President Claude Birraux's question regarding how best to improve the effectiveness of scientific assessments to benefit the CFP, particularly with regard to the minimum catch size, Senator and *rapporteur* Marcel-Pierre Cléach stated that, in his opinion, the solution primarily resided in a shared diagnosis established by fishermen and scientists while reopening dialogue. He furthermore pointed out selectivity was a central issue, for it was necessary to progressively eliminate rejections, which represent a real waste of resources.

Senator Marie-Christine Blandin hailed what she considered an exemplary and courageous report and testified to the intensification of fishing and the importance of rejections. She underlined the necessity of an educational campaign targeting the general public, as well as the urgent need to involve researchers in this effort. Finally, she pointed out that France demonstrated little respect with regard to its international commitments in the matter.

Deputy and OPECST President Claude Birraux also deemed the report courageous and felt that it constituted an opportunity to denounce the inconsistencies of a management system that results in the resources' over-exploitation.

Senator and First Vice-President of the OPECST Jean-Claude Etienne emphasized dialogue between actors, citing the example of the deep-sea species which, though little known, are nevertheless of economic importance for fishermen. Managerial decisions must be based upon up-to-date knowledge. A cooperative effort is, therefore, desirable.

The OPECST unanimously adopted the report.

APPENDICES

APPENDIX I

LETTER OF REFERRAL

RÉPUBLIQUE FRANÇAISE

SÉNAT

GROUPE UMP

Le Président

Monsieur Christian PONCELET
Président
Sénat

Paris, le 15 mars 2006

Monsieur le Président,

La gestion des ressources halieutiques est devenue une question d'autant plus sensible en France, en Europe et dans le monde, que la pression de pêche s'est fortement accrue et que les données scientifiques sont contestées.

Or, il est indiscutable qu'une gestion durable des ressources conforme à l'intérêt des pêcheurs comme à la préservation de l'environnement ne peut s'appuyer que sur des connaissances scientifiques pour déterminer les volumes et les méthodes de capture.

Aussi, ai-je l'honneur de vous demander de bien vouloir proposer au Bureau du Sénat de saisir l'Office parlementaire d'évaluation des choix scientifiques et technologiques d'une étude sur « *L'apport de la recherche à l'évaluation des ressources halieutiques et à la gestion des pêches* ».

Je vous prie d'agréer, Monsieur le Président, l'expression de ma haute considération.

Josselin de ROHAN

APPENDIX II

PERSONS INTERVIEWED

Mr	*Loïc*	*ABALLEA*			*France*
Dr	*Francesco Saverio*	*ABATE*	*General Director of Marine Fishing and of Aquaculture*	*Ministerio delle Politiche agricole alimentari e forestali*	*Italy*
Mr	*Olivier*	*ABELLARD*		*Agence des Aires Maritimes Protégées ("Agency of Marine Protected Areas")*	*France*
Mr	*Enrique*	*ACCORSI*	*Recursos naturales*	*Chamber of Deputies*	*Chile*
Mr	*Sebastian*	*AINZUA A.*	*Coordinator Programa Economia y globalización*	*TERRAM*	*Chile*
Ms	*Caroline*	*ALIBERT*	*Communications officer on fisheries*	*WWF*	*European institutions*
Dr	*Karl A.*	*ALMÅS*	*President*	*SINTEF competitiveness cluster*	*Norway*
Dr	*Franco*	*ANDALORO*	*Manager of the "Sustainable Use of Resources" Department*	*ICRAM (Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare)*	*Italy*
Mr	*Viggo*	*ANDREASSEN*	*Special adviser*	*Innovation Norway*	*Norway*
Mr	*Loïc*	*ANTOINE*	*Assistant Director*	*IFREMER*	*France*
Dr		*ARNERI*		*Istituto scienze marine d'Ancona*	*Italy*
Mr	*Armando*	*ASTUDILLO*		*DG Mare*	
Mr	*Yves*	*AUFFRET*	*Councillor for fishing, aquaculture and the DOM-TOM*	*Ministry of Agriculture and Fishing*	*France*
Mr	*Nelson*	*AVILA*	*Marine, fishing and agricultural interests*	*Senate*	*Chile*
Mr	*Hector*	*BACIGALUPO FALCON*	*General Manager*	*Industrial Fisheries Asociation of Chile*	*Chile*
Mr	*Stéphane*	*BEAUCHER*		*Greenpeace-France*	*France*
Mr	*Guy*	*BEAUPRE*	*General Director*	*Dept. of Fisheries and Oceans*	*Canada*
Mr	*Adel*	*BEN YOUSSEF*	*Assistant Attaché for Agricultural*	*French Embassy*	*Italy*

Mr	*Christian*	*BERGER*	*Councillor*	*French Embassy*	*United States*
Mr	*Francesco*	*BERGUÑO*	*Head of the "Marine Affairs Department"*	*Ministry of Foreign Relations*	*Chile*
Mr	*Patrick*	*BERTHOU*	*Assistant Director*	*IFREMER*	*France*
Dr	*Arnaud*	*BERTRAND*	*Fisheries ecologist*	*Institut de Recherche pour le Développement ("Research Institute for Development" or IRD)*	*Peru*
Ms	*Sophie*	*BERTRAND*	*Fisheries ecologist*	*Institut de Recherche pour le Développement ("Research Institute for Development" or IRD)*	*Peru*
Mr	*Jérôme*	*BIGNON*		*Agence des Aires Marines Protégées ("Agency of Marine Protected Areas")*	*France*
Mr	*Thomas*	*BINET*	*Consultant*	*OECD*	*France*
Ms	*Siri*	*BJERKE*	*Division Vice President*	*Innovasjon Norge*	*Norway*
Mr	*Joe*	*BORG*	*Commissioner of Fishing and Marine Affairs*	*Fishing and Marine Affairs Commission*	*Belgium*
Mr	*Jean*	*BOUCHER*		*IFREMER*	*France*
Mr	*Jacques*	*BOULÈGUE*	*Director of the "Habitats and Environment Department"*	*Institut de Recherche pour le Développement ("Research Institute for Development" or IRD)*	*France*
Mr	*Goulven*	*BREST*	*President*	*Conseil national de la conchyliculture ("National Federation of Shellfish Farmers" or CNC)*	*France*
Mr	*Jean-Claude*	*BRETHES*	*President of the Institutional Assembly*	*University of Quebec at Rimouski*	*Canada (Quebec)*
Mr	*Pierre*	*BRUNHES*	*Assistant Director of Economic Affairs*	*Overseas Ministry*	*France*
Mr	*André*	*CARPENTIER*	*Director of the "Halieutic Department for the English Channel/North Sea"*	*IFREMER*	*France*

Mr	*Hubert*	*CARRE*		*CNPMEM*	*France*
Mr	*Martin*	*CASTONGUAI*	*Head of the "Biology and Conservation of Fish Department"*	*Maurice Lamontagne Institute*	*Canada (Quebec)*
Dr	*Giuseppe*	*CAVARETTA*	*Director of the "Terra et ambiente" Department*	*CNR (Consiglio Nazionale delle Richerche)*	Italy
Mr	*Patrick*	*CAYRÉ*	*Director of the "Living Resources Department"*	*Institut de Recherche pour le Développement ("Research Institute for Development" or IRD)*	*France*
Mr	*Damien*	*CAZE*	*Director of Marine Fisheries and Aquaculture*	*Ministry of Agriculture and Fishing*	*France*
Mr	*Jorge*	*CHOCAIR*	*Under-Secretary of Fishing*	*MineCom*	*Chile*
Mr	*Franck*	*COPPIN*	*Research manager*	*IFREMER*	*France*
Mr	*Juan*	*CORREA*	*International Marine Biology Laboratory*	*Catholic University*	*Chile*
Ms	*Alexandra*	*COUSTEAU*	*Co-founder and Director*	*Eartheco International*	*United States*
Mr	*Jorge*	*CSIRKE*	*Director, Fisheries and Aquaculture Management Division*	*Food and Agriculture Organization of the United Nations – FAO*	*France*
Mr	*Philippe*	*CURY*	*Director*	*IRD*	*France*
Dr	*Edward*	*CYR*	*Marine Ecosystems Division*	*Office of Sustainable Fisheries (NOAA – National Marine Fisheries Service)*	United States
Mr	*Pierre-Georges*	*DACHICOURT*	*President*	*Comité National des Pêches et des Elevages Marins ("National Committee for Marine Fisheries and Aquaculture" or CNPMEM)*	*France*
Dr	*Cabell*	*DAVIS*		*WHOI*	*France*
Mr	*Xavier*	*de la GORCE*	*Secretary General of the Seas*		*France*

Mr	*Bernard*	*DELAY*	*Director of the "Department for the Environment and Sustainable Development"*	*Centre National de la Recherche Scientifique ("National Scientific Research Centre" or CNRS)*	*France*
Mr	*Jean-Paul*	*DELPECH*	*Head of the Halieutic Resources Laboratory*	*IFREMER – English Channel-North Sea Centre*	*France*
Mr	*Jean-Baptiste*	*DELPIERRE*	*President of the Cluster and of the Producer Organization*	*CRPMEM Boulogne-sur-Mer*	*France*
Mr	*Paul*	*DIODATI*	*Director*	*Marine Fisheries (State of Massachusetts)*	*United States*
Mr	*Gilles*	*DOIGNON*		*Oceana*	*France*
Ms	*Céline*	*DUHAMEL*		*Agence des Aires Marines Protégées ("Agency of Marine Protected Areas")*	*France*
Mr	*Guy*	*DUHAMEL*	*"Department of Community Dynamics and Biodiversity"*	*Muséum national d'histoire naturelle ("National Natural History Museum")*	*France*
Mr	*Geir*	*ERVIK*	*Advisor*	*Ministry of Fisheries and Coastal Affairs*	*Norway*
Mr	*Juan Manuel*	*ESTRADA ARIAS*	*Académico Investigador*	*Universidad Andres Bello*	*Chile*
Dr	*Francesco*	*FAVOCCIA*	*(AGGI Agriculture – "General Association of Italian Cooperatives")*	*Chamber of Deputies*	Italy
Mr	*Ramon*	*FIGUEROA*	*Director*	*Instituto de FOmento Pesquero (IFOP)*	*Chile*
Mr	*Jean*	*FLEMMA*	*House of Representatives, Subcommittee on Fisheries, Wildlife and Oceans*	*House Committee on Natural Resources*	*United States*
Mr	*Alain*	*FONTENEAU*	*Fisheries biologist*	*IRD*	*France*
Mr	*Alain*	*FRÉCHET*	*Aquatic sciences biologist*	*Maurice Lamontagne Institute*	*Canada (Quebec)*
Mr	*Christopher*	*G. RONBECK*	*Higher Executive Officer*	*Ministry of Fisheries and Coastal Affairs*	*Norway*

Mr	*Wilar*	*GAMARRA MOLINA*	*Major General, FAP*	*SENAMHI*	*Peru*
Mr	*Dominique*	*GASCON*	*Director, "Halieutic Sciences and Aquaculture Department"*	*Maurice Lamontagne Institute*	*Canada (Quebec)*
Mr	*François*	*GAUTHIEZ*	*Assistant Director of Fisheries*	*Ministry of Agriculture and Fishing*	France
Mr	*Grégory*	*GERMAIN*	*Director of the Boulogne Model Basin*		*France*
Mr	*Laurent*	*GERMAIN*		*Agence des Aires Marines Protégées ("Agency of Marine Protected Areas")*	*France*
Mr	*Dominique*	*GODEFROY*	*Director of the English Channel-North Sea Centre*	*IFREMER*	*France*
Dr	*Silvestro*	*GRECO*	*Scientific Director*	*ICRAM (Istituto Centrale par la Ricerca scientifica et tecnologica Applicata al Mare)*	Italy
Mr	*Henri*	*GRONZIO*		*CRPMEM Languedoc-Roussillon*	*France*
Mr	*Benoît*	*GUÉRIN*		*WWF France*	*France*
Mr	*Ndiaga*	*GUEYE*	*Head, International Institutions and Liaison Service, Fisheries and Aquaculture Department*	*Food and Agriculture Organization of the United Nations – FAO*	*France*
Dr	*Jean Loup*	*GUYOT*	*Director of the HIBAM observatory*	*Institut de Recherche pour le Développement ("Research Institute for Development" or IRD)*	*Peru*
Ms	*Amanda*	*HALLBERG*	*Parliamentary Attachée*	*Commission pour le commerce, la science et le transport du Sénat ("Senate Commission on Trade, Science and Transportation")*	*France*
Mr	*Svein*	*HALLBJØRN STEIEN*	*Veterinary advisor on scientific research and agriculture*	*Innovation Norway*	*Norway*

Mr	*Stewart*	*HARRIS*	*Office of Legislative Affairs*	*National Oceanic and Atmospheric Administration (NOAA)*	United States
Mr	*Bob*	*HAYES*		*Recreational fishery representative*	United States
Mr	*Douglas*	*HELTON*	*Legislative Fellow*	*United States Senate*	United States
Mr	*Patrick*	*HERVE*	*Councillor for economics and trade*	*French Embassy*	*Chile*
Mr	*Liv*	*HOLMEFJORD*	*Deputy Director General of Fisheries*	*Directorate of Fisheries*	*Norway*
Mr	*Gerd*	*HUBOLD*	*Secretary General*	*CIEM*	*Denmark*
Mr	*Pierre*	*JAMES*	*Assistant Director*	*OFIMER*	*France*
Ms	*Florence*	*JEANBLANC RISLER*	*Minister-Councillor for Economic Affairs*	*French Embassy*	*Canada*
Mr Ms?	*Jen*	*KASSAKIAN*	*Knauss Sea Grant Fellow*	*House of Representatives – Committee on Natural Resources*	United States
Mr	*Les*	*KAUFMAN*		*Boston University*	United States
Admiral	*Jean-Pierre*	*LABONNE*	*Assistant Secretary General*		*France*
Mr	*Serge*	*LABONTE*	*Senior Director General, Science Renewal*	*Department of Fisheries and Oceans*	*Canada*
Mr	*Loïc*	*LAISNE*	*Assistant Director*	*Ministry of Agriculture and Fishing*	*France*
Mr	*Jean-Marc*	*LE GARREC*	*President*	*LE GARREC & Cie*	*France*
Mr	*Gilbert*	*LE LANN*	*Official Representative*		*France*
Dr	*Rebecca*	*LENT*	*Director of International Affairs*	*NOAA Fisheries*	United States
Mr	*Thierry*	*LEPRETRE*	*Shipowner*	*Boulogne-sur-mer*	*France*
Mr	*Christophe*	*LHOMEL*	*Owner of a fleet of* fileyeurs *or "netters"*	*CRPMEM Boulogne-sur-Mer*	*France*
Ms	*Gulliana*	*M FIRCI G-N*	*Coordinadora Programa de Salmonicultura*	*TERRAM*	*Chile*

Mr	*Craig*	*MACDONALD*	*Superintendent*	*Stellwagen Bank National Marine Sanctuary*	United States
Dr	*Larry*	*MADIN*	*Acting Director of Research*	*WHOI*	United States
Mr	*François*	*MAITIA*		*Aquitaine Regional Council*	*France*
Mr	*Kjell*	*MARONI*	*Director R&D*	*FHL*	*Norway*
Dr	*Francis*	*MARSAC*	*Directeur UR Thétis*	*IRD*	*France*
Ms	*Catherine*	*MARZIN*	*National Programs Branch*	*Office of Sustainable Fisheries*	*France*
Mr	*Philippe*	*MAZENC*	*Ministry of Transportation*		*France*
Dr	*Salo*	*MAZZOLA*	*Laboratory head*	*IAMC (Istituto per l'Ambiente Marino Costiero in Naples)*	Italy
Mr	*Emmanuel*	*MICHAUD*	*Councillor for Cooperation and Cultural Activities*	*French Embassy in Norway*	*Norway*
Dr	*Giovanni*	*MININNI*	*Trade union for the food-processing sector (FLAI CGIL)*	*CGIL (Confederazione Generale Italiana del Lavoro)*	Italy
Mr	*Alfonso*	*MIRANDA EYZAGUIRRE*	*Viceministro de Pesqueria*	*Ministerio de la Producción*	*Peru*
Mr	*Thierry*	*MISSONNIER*	*Director*	*Pôle Filière Produits Aquatiques ("Cluster for the Aquacultural Products Sector")*	*France*
Mr	*Martial*	*MONNIER*	*Secretary General*	*Conseil National de la Conchyliculture ("National Federation of Shellfish Farmers" or CNC)*	*France*
Dr	*Pier Francesco*	*MORETTI*	*Assistant to the Director of the "Terra et ambiente" Department*	*CNR (Consiglio Nazionale delle Richerche)*	Italy
Mr	*Philippe*	*MORILLON*	*Chair of the Committee on Fisheries*	*European Parliament*	*European institutions*
Mr	*Alejandro*	*NAVARRO*	*Medio ambiente*	*Senate*	*Chile*

Mr	*Marcelo*	*NILO GATICA*	*Jefe Seccio Economica*	*Instituto de Fomento Pesquero*	*Chile*
Mr	*Leonardo*	*NUÑEZ*	*Head of the "Administrative Fisheries Department"*	*"National Fisheries Service"*	*Chile*
Mr	*Kari*	*OSTERVOLD TOFT*	*Communications director*	*Institute of Marine Research*	*Norway*
Mr	*Halvard*	*P. JOHANSEN*	*Deputy Director General*	*Ministry of Fisheries and Coastal Affairs*	*Norway*
Dr	*Marco*	*PASSARIELLO*		*AGCI AGRITAL*	*France*
Mr	*François*	*PATSOURIS*		*AGLIA*	France
Mr	*Michel*	*PELTIER*	*Councillor*	*Ministry of Agriculture and Fishing*	*France*
Mr	*José*	*PEREZ*		*IFREMER*	*France*
Mr	*Jean-Yves*	*PERROT*	*President*	*IFREMER*	*France*
Ms	*Pascale*	*PESSEY-MARTINEAU*	*Director of Institutional Relations, under the President*	*IFREMER*	*France*
Mr	*Mark*	*PETERS*		*WWF*	*United States*
Mr	*Michel*	*PETIT*	*Research Director*	*Institut de Recherche pour le Développement ("Research Institute for Development" or IRD)*	*France*
Mr	*Stéphane*	*PINTO*	*Owner of a fleet of* fileyeurs *or "netters"*	*CRPMEM Boulogne-sur-Mer*	*France*
Ms	*Ariane*	*PLOURDE*	*Director*	*Institute of Marine Research*	*Norway*
Mr	*Bernard*	*POIGNANT*	*Mayor of Quimper*		*France*
Mr	*Olivier*	*POUPARD*	*Chief Councillor*	*French Embassy in Norway*	*Norway*
Mr	*Patrick*	*PROUZET*		*IFREMER – DPCP*	*France*
Mr	*Jean-François*	*PULVENIS DE SELIGNY-MAUREL*	*Director of the Fisheries and Aquaculture Economics and Policy Division*	*Food and Agriculture Organization of the United Nations – FAO*	*Italy*
Mr	*Renato*	*QUIÑONES*		*University of Concepción,*	*Chile*

				IRD partner	
Mr	*René*	*QUIRIN*	*Attaché for Scientific, University and Technical Cooperation*	*French Embassy*	*Chile*
Mr	*Galen*	*R. TROMBLE*	*Director*	*NORA - Domestic Fisheries Division*	*United States*
Mr	*José*	*RAMON GUTTIEREZ*	*President*	*Multiexport*	*Chile*
Ms	*Ghislaine*	*RIMMEN-MOHL*	*Trade Attaché*	*French Embassy*	*Chile*
Mr	*José*	*RIZO MARTIN*	*Policy Officer for the Protection of Water and Marine Environment Unit*	*European Commission*	*Belgium*
Mr	*Martin A.*	*ROGOFF*	*Professor of law*	*University of Maine*	*United States*
Ms	*Delphine*	*RONCIN*		*CRPMEM Nord-Pas de Calais/Picardie*	*France*
Mr	*Håvard*	*RØSVIK*	*Research Director (fishing technology)*	*SINTEF competitiveness cluster*	*Norway*
Mr	*Brian*	*ROTSCHILD*	*Director*	*Massachusetts Fisheries Institute*	*United States*
Dr	*Michael*	*RUBINO*	*Aquaculture Manager*	*NOAA – Aquaculture Program*	*United States*
Mr	*Alvaro*	*SAPAG*	*Director*	*CONAMA*	*Chile*
Mr	*Alvaro*	*SAPAG RAJEVIC*	*Executive Director*	*Chilean government*	*Chile*
Mr	*Carl-Christian*	*SCHMIDT*	*Head of the Fisheries Division*	*OECD*	*France*
Mr	*Fabien*	*SCHNEEGANS*	*Deputy Councillor*	*French Embassy*	*United States*
Mr	*Mogens*	*SCHOU*	*Head of Development*	*Danish Ministry of Food, Agriculture and Fishing*	*Denmark*
Mr	*Jannick*	*SCHOUGAARD*	*Director*	*Danish Fishmeal Association*	*Denmark*
Mr	*Gérard*	*SIRECH*	*General Director*	*CLS PERU*	*Peru*
Dr	*Michael*	*SISSENWINE*		*National Oceanic and Atmospheric Administration*	*United States*

Ms	*Inger*	*SOLBERG*	*Director of the "Department of Agriculture and Marine Food Products"*	*Innovation Norway*	*Norway*
Dr	*Andrew*	*SOLOW*		*WHOI*	*United States*
Mr	*Jean-Jacques*	*SOULA*	*Scientific councillor for the permanent French delegation*	*FAO*	*Italy*
Mr	*Giorgio*	*STARACE*	*Consigliere Diplomatico del Ministro*	*Ministero delle politiche agricole*	*Italy*
Mr	*Einar*	*SVENDSEN*	*Research Director*	*Institute of Marine Research*	*Norway*
Mr	*Marc*	*TACONET*	*FIGIS Officer (Fisheries Global Information System project)*	*Food and Agriculture Organization of the United Nations - FAO*	*Italy*
Ms	*Lise*	*TALBOT BARRE*	*First Secretary*	*French Embassy*	*Canada*
Ms	*Hélène*	*TANGUY*	*Honorary Deputy of Finistère* Mayor *of Guilvinec*		*France*
Mr	*Leopoldo*	*TARTAGLIA*	*International Department*	*CGIL*	*Italy*
Ms	*Heather*	*TAUSIG*	*Director of Conservation*	*New England Aquarium*	*United States*
Mr	*Randi*	*THOMAS*		*Commercial fishery representative*	*United States*
Mr	*Brian*	*THOMSEN*	*Director*	*Association of aquaculturalists*	*Denmark*
Mr	*Stetson*	*TINKHAM*	*Director of International Affairs*	*National Fisheries Institute*	*United States*
Mr	*Vincent*	*TOULOUMON*	*Director*	*Marine Cooperative Boulogne-sur-mer*	*France*
Mr	*Nelson*	*VALLEJO-GOMEZ*	*Attaché for University Cooperation*	*French Embassy*	*Peru*
Mr	*Samuel*	*VENEGAS*	*Marine, Fishing and Agricultural Interests*	*Chamber of Deputies*	*Chile*
Mr	*Gert*	*VERREET*	*Policy Office - Marine Protection*	*European Commission*	*European institutions*
Dr	*Antonio*	*VIZZOCCARO*	*Legislative Councillor*	*Chamber of Deputies*	*Italy*

			to the President of the Agricultural Commission		
Mr	*Bertrand*	*WENDLING*	*Director*	*"Sète-Qualité" private cooperative*	*France*
Mr	*Dave*	*WHALEY*		*House of Representatives – Committee on Natural Resources*	*United States*
Mr	*Niels*	*WICHMANN*	*Director*	*Association of Danish fishermen*	*Denmark*
Mr	*Ulf*	*WINTHER*	*Research director (international projects and consultancy)*	*SINTEF competitiveness cluster*	*Norway*
Mr	*Simon*	*WOODSWORTH*		*CRPMEM Languedoc-Roussillon*	*France*
Mr	*Eleuterio*	*YANEZ*		*Pontificia universidad catolica de Valparaiso*	*Chile*
Ms	*Cécile*	*ZANNONI*	*Official Representative, Responsible Fishing*	*SCA PECHE*	*France*

APPENDIX III

AGLIA BIARRITZ COLLOQUIUM

"MARINE PROTECTED AREAS, FISHERIES AND MARICULTURE"

Programme

Wednesday, 29 October 2008

2 PM Introduction
François MAÏTIA, Vice President of the Aquitaine Region
François PATSOURIS, President of AGLIA

2:30 PM MPAs: "instructions". The prospects for the French Atlantic coast.
Laurent GERMAIN, Agency for Marine Protected Areas

3:15 PM The Iroise Sea marine reserve: the first large-scale French MPA

➡ *A marine reserve, to what end?*
Thierry CANTERI, Agency for Marine Protected Areas

➡ *Professionals relate their everyday work within the reserve*
Gérald HUSSENOT, CRPMEM of Brittany

5 PM Round table discussion on "MPAs: constraints and opportunities for fishermen and shellfish farmers"
Laurent SOULIER, IMA
Martial MONNIER, CNC
Hubert CARRE, CNPMEM
Geneviève ROUSSEAU, Agency for Marine Protected Areas
Raynal VALLEE, DRAM Aquitaine
Andy PAPACOSTIA, DIREN Aquitaine

6:30 PM The day's conclusions
Jérôme BIGNON, President of the Agency for Marine Protected Areas

Thursday, 30 October 2008

9 AM	European fisheries policy and MPAs *Armando ASTUDILLO, General Director of MARE*
9:30 AM	MPAs as seen by our European neighbours *Tom HOOPER, Finding Sanctuary* *Juan DIMAS GARCIA ACEBAL, Federation of Cofradias of Asturias, "El Cachudo"*
11 AM	The place and role of RACs in considering the MPAs: the example of the CCR.S *Jean-Pierre PLORMEL, CCR.S*
11:30 AM	Toward a European network of MPAs on the Atlantic coast: an Interreg project under preparation *Olivier ABELLARD, Agency for Marine Protected Areas* *Céline DUHAMEL, Agency for Marine Protected Areas*
12:30 noon	Conclusions *Alain ROUSSET, President of the Aquitaine Region*

APPENDIX IV

GLOSSARY OF ACRONYMS/ABBREVIATIONS

CFCA	*Community Fisheries Control Agency*
EAF	*Ecosystem Approach to Fisheries*
AFD	*Agence Française de Développement ("French Development Agency")*
AMAP	*Association pour le Maintien d'une Agriculture Paysanne (also known as Community-Supported Agriculture or CSAs in English-speaking countries)*
MPA	*Marine Protected Areas*
BWU	*Blue Whale Unit*
CEMAGREF	*Research institute for agricultural and environmental engineering*
GFCM	*General Fisheries Commission for the Mediterranean*
ICCAT	*International Commission for the Conservation of Atlantic Tunas*
ICES	*International Council for the Exploration of the Sea*
CNEEXO	*Centre National pour l'EXploitation des Océans ("National Centre for the Exploitation of the Oceans")*
CNES	*Centre National d'Etudes Spatiales (the French government space agency)*
CNRS	*Centre National de la Recherche Scientifique ("National Centre for Scientific Research")*
CRH	*Centre de Recherche Halieutique Méditerranéenne et Tropicale ("Mediterranean and Tropical Halieutic Research Centre"), based in Sète*
STECF	*Scientific, Technical and Economic Committee for Fisheries*
DEMOSTEM	*DEMarche écOSysTEMique pour une gestion intégrée des ressources halieutiques ("Ecosystemic Approach for an Integrated Management of Halieutic Resources")*
ESA	*The European Space Agency*
FAO	*Food and Agriculture Organization of the United Nations*
ICZM	*Integrated Coastal Zone Management*

FIFG	*Financial Instrument for Fisheries Guidance*
IFREMER	*Institut Français de Recherche pour l'Exploration de la MER ("French Research Institute for the Exploitation of the Sea")*
IMARPE	*Instituto del Mar del Perú ("Marine Institute of Peru")*
IRD	*Institut de Recherche pour le Développement ("Research Institute for Development")*
ISTPM	*Institut Scientifique et Technique des Pêches Maritimes ("Scientific and Technical Institute of Marine Fisheries")*
JOCI	*Joint Ocean Commission Initiative (USA)*
MEEDDAT	*Ministry of Ecology, Energy, Sustainable Development and Territorial Development*
MSC	*Marine Stewardship Council*
MSA	*Magnusson Stevens Fishery Conservation and Management Act (USA)*
MSY	*Maximum Sustainable Yield*
NASA	*National Aeronautics and Space Administration (USA)*
NCEAS	*National Center for Ecological Analysis and Synthesis University of California at Santa Barbara (USA)*
NOAA	*National Oceanic and Atmospheric Administration (USA)*
OECD	*Organisation for Economic Co-operation and Development*
NGO	*Non-Governmental Organization*
PCB	*Polychlorinated biphenyls (PCBs) constitute a class of aromatic organochloride compounds derived from industrially synthesized biphenyls; similar to polychlorinated terphenyls (PCTs), polychlorinated dibenzofurans (PCDFs) and dioxins (PCDDs).*
CFP	*Common Fisheries Policy*
ITQ	*Individual Transferable Quota*
SOFIA	*State of World Fisheries and Aquaculture*
TAAF	*French Southern-Hemispheric and Antarctic Regions.* *Group of overseas French territories comprising four*

districts: three sub-Antarctic islands/archipelagos in the southern Indian Ocean (the Kerguelen, Crozet, and Saint-Paul and Amsterdam Islands), as well as a section of Antarctica known as Adélie Land.

TAC — *Total Allowable Catch*

EEZ — *Exclusive Economic Zones were legally defined by the United Nations Convention on the Law of the Sea (also known as the Montego Bay Convention), signed on 10 December 1982.*

A country's EEZ extends to a distance of up to 200 nautical miles (370.4 km) from its coastal baselines, which are also used to determine the country's territorial waters (Article 57).