

**THE QUOTIENT OF CONVENIENCE:  
ESTIMATION OF THE COST RELATIVE TO RESPONSIBLE FISHING**

Ramon Franquesa & Rosa M. Pérez  
Gabinete de Economía del Mar U.B.

**I. INTRODUCTION**

The objective of this research project is to define the economic impact of public regulations protecting living marine resources in the fisheries activity

Public intervention is essential in the exploitation of every activity of renewable resources in open access to correct the market failures. These failures are produced when the externalities are not taking into account in the decision process. As a consequence resources are over-exploited. This generates economic inefficiencies, social unease and environmental problems in the medium term. Thus, intervention in these cases contributes both to a better allocation of the economic resources and efficiency of the market.

Fishing activity regulations decrease the negative effects of the externalities, which characterise a resource in free access, through mechanisms which result in additional exploitation cost. The study tries to arrive to an approach (first in a conceptual way and after an application to a specific case), of what has been called Quotient of Convenience. This Quotient of Convenience is indicator which makes a comparison between the economical weight of regulations' cost and the incomes of the regulated fleets.

This Quotient of Convenience is sustained from systematising and defining the nature of the Costs of the Responsible Fishing (CRF). Responsible Fishing by an individual enterprise takes into account the externalities that the fishing exploitation generates when resource is caught.

The problem of the Responsible Fishing appears when the fleets, as independent economic units, have the freedom to abide by or ignore regulations. Although this phenomenon can come out in different forms in the territorial waters of each country, in international waters there are a frame of legal regulation and more confusing management. In these waters, the freedom of the fleet is larger, creating a problem of international administration of the marine resources. It is the problem of flags of convenience, which appears when a ship sails under a flag of a country not linked to multilateral conservation agreements.

As a consequence, only through a delimitation of the costs components of a System of Responsible Fishing one can clearly evaluate who support those costs, which is its economic impact and which are the management instruments that should be implemented to correct a distorted allocation of resources for the preservation of the marine resources.

Although the study has a theoretical and conceptual approach, these concepts will be illustrated in an empirical evaluation of cases where the Spanish fleets have to deal with problems of unfair competition with vessels under flags of convenience. In these cases, the evaluation of the Quotient of Convenience (QC) will be attempted.

The Quotient of Convenience is the concept in which the study is centred so its discussion and theoretical definition are presented in part II. Part III. carries out a description of the management systems based on Responsible Fishing in Spain, as a frame of reference for this kind of regulations and the justification and principles on which the Responsible Fishing in Spain are based. Part IV includes the theoretical definitions of the components of cost used for the calculation of the Quotient of Convenience as well as the Costs of Production and the Costs of Responsible Fishing. Part V empirically calculates the Quotient of Convenience for a specific case : the codfish fisheries in NAFO.

## **II. COSTS OF A RESPONSIBLE FISHING. THEORETICAL APPROACH.**

To define the Costs of a Responsible Fishing, it is necessary to determine the components which will be included in this cost. In a preliminary approach to the Costs of Responsible Fishing, they are qualified as those costs added to the fishing activity as a consequence of the protection of the resource. This will be applied through national or international regulations.

The structure of costs of Responsible Fishing is composed on the one hand by the costs of production of goods and on the other hand by other specific costs which we call Cost of responsible Fishing (CRF), (CRF), that are a consequence of additional costs which increase the total cost by internalising the externalities that are generated in the exploitation of a renewable natural resource. These costs are due to regulations assuring that the resource is not over-exploited. In the following sections we examine the elements that compose these costs in the case of the fishing exploitation.

### **II. 1. COSTS OF PRODUCTION**

We define the costs of production only as those that result from the use of productive factors and materials, that is to say, those in which it is unavoidable to incur during the normal practice of the fishing activity. We use the common classification of fixed costs and variable costs.

The Fixed Cost basically reflects the opportunity cost of maintaining the whole investment (vessels, gears, etc.). The Opportunity Cost of the Invested Capital is derived from the use of fixed assets in the economic exploitation , whose economic life goes beyond the fiscal year. In the case of the fishing activity they are basically ships. This cost is not only the opportunity cost of the capital initially used (purchase of ships), but also the annual expenses of maintenance of the ships.

The valuation of the vessels should be done through an economic, but not through an accounting approach, that is to say, through the estimation of their sale price. However, other ways of evaluation must be considered as the value of the vessels can increase or decrease.

Table 1: Composition of the structure of total costs of the Responsible Fishing

Costs of Production	Fixed Cost	Opportunity Cost of Investment
	Variable Costs	Cost of the Fuel Cost of Materials Labour Costs Financial Costs
Costs of Responsible Fishing	Fleet Cost	Licenses Technical Cost Reduction of catch (loss of productivity)
	Social Cost	Institutional Costs of the regulation. Costs of the reconversion of fleets Unemployment Control Cost
	“Lucrum cessans”	

The most common method of evaluation may be carried out starting from the purchase price of each ship subtracting economic depreciation and the value of withdrawal from the market. The economical depreciation can be calculated through the linear distribution of the price of purchase or through the initial investment along the economic life of each ship. With that, the evaluation of the costs corresponds to the real use of the vessels.

The necessary investments for the conservation of the ships will be considered annually as the highest value of the used capital.

With regard to the Variable Cost, the following four kinds of expenditure can be distinguished for the fishing activity: Cost of the Fuel, Cost of Materials, Labour Costs and Financial Costs.

The composition of these are easy to describe.

The Fuel costs equal the amount use per trip to the fishing-ground.

The cost of materials is the price of purchase of the materials necessary for the practice of the activity such as nets, boxes, chords etc.

The Labour Costs are the costs of the other essential factor of production in the activity. They are dedicated to the remuneration of the labour force, including the social charges paid by the company. The labour costs can vary according to the activity and gear, so a classification is necessary to be able to measure them through the average cost per crew member. In addition to labour costs there are salaries and wages, company payments to the Social Security and to the retirement funds and any item considered as a social charge.

The Financial Costs are interest payments for borrowed money used for the development of the activity of the fishing enterprise and the costs of financial administration.

The costs of production have different characteristics for the purpose of this study.

First of all, upon undertaking the problem of the Responsible Fishing from the point of view of added costs, the costs of production would be those that all the fleets incur regardless of their compliance or not of the international regulations in the waters where they fish. That is to say, these costs would be the only ones which would endure in the absence of regulations.

Secondly and as a consequence of the previous point, the costs of production are attributive to each fleet. This implies that they are not external costs which affect the rest of the society or the other fleets fishing in the same waters. This kind of costs are closely linked to the comparative competitiveness of each fleet, but the possible differences which may appear through international comparisons which are not interesting for the study, because they related to the enterprises and to the institutional characteristics of the country that they belong to.

As a consequence, the costs of production are not connected to any international regulation. From the point of view of the estimation of the Coefficient of Convenience, the fleets can, if it's necessary, be treated as homogeneous in their costs of production. This hypothesis solves the problem of measuring the costs of production for the unregulated fleets because the data is not available.

We establish the costs of production as the basis for the study and we consider the additional costs as the Costs of a Responsible Fishing.

## **II. 2. COSTS OF RESPONSIBLE FISHING**

The Costs of the Responsible Fishing (CFR) are additional costs which are necessary to internalise the externalities of the fishing activity, which affect to the fleets and society.

The Costs of Responsible Fishing appear because of public intervention, which establishes the management measures necessary to internalise the externalities of the exploitation of a resource in free access.

a) Regulations protecting the resource always restrict fishing access. Let us emphasize some characteristics which explain this peculiarity: namely the necessity of avoid the overfishing to allow the exploitation at the same rate of reproduction of the resources. Because of that fact, the regulations, while restrictive of the possibilities of production, mean higher costs.

b) The regulative activity of the States in its maritime territory (EEZ) is hardly avoidable by national fleets. However, this doesn't happen in international waters where those regulations are articulated under multilateral agreements between states and by definition the countries which don't sign these agreements aren't linked to them. This is the problem linked with fleets under flags of convenience.

c) The difference which exists between the two kind of fleets in international waters has its economic explanation through the concept of externalities. Externality are those negative or positive effects of an economy activity imposed by other activities or agents.

In this case the fact that a fleet is, and another is not subject to a regulation regarding the exploitation of a same resource, has a negative effects of the last ones over the first. The economic effect which is produced by the regulations is the internalisation of the externalities in terms of higher costs.

Since it is possible to avoid these externalities by means of flag of convenience, an important difference is produced between the fleets. From the point of view of the firm the regulated ones are in a situation of comparative disadvantage. An incentive to change flags is generated and the regulated measures lose effectiveness.

d) Finally, this affects both firms and society.

In a direct way the Costs of the Responsible Fishing are supported not only by the fleets but also by the society which finances the necessary public resources to the management of the resources in international waters and to the adaptation of the fishing sector.

In a more indirect way, (in this study it will be only enunciated because of the empirical difficulties of quantifying it) the non internalization of the CRF reduces stock by overfishing in the short term. This means the destruction of a natural resource and will have effects on final consumption (prices, stable supply of food, etc).

Costs of Responsible Fishing, Social Cost and *lucrum cessans*. However, it's necessary to take in account the that three kind of costs are part of a global concept and that this classification is only used to give a clearer and more systematic explanation. In the following lines we will describe each component.

1) Fleet Cost. Regulations in international waters have as an objective the elimination of overfishing and the preservation of the resources. These regulations will mean the decrease of the catchability through the decrease of the fleet or through technical measures (size of nets and mesh, days of fishing, etc.). In both cases that means an increase in the operative costs of the regulated fleets. Basically, these additional costs are: payments of licenses and sanctions, support of some technical costs and loss of productivity. In the following lines let us comment on each aspect of the Fleet Cost.

1.1. Licenses: The license is an administrative authorization, which is given to a specific vessel, to fish in a certain conditions. Often to get the license means a payment for the right to fish. Nobody can practice the activity without license. Because of that its cost (which includes the cost of its management and its purchase by the firm) is unavoidable to the regulated fleets.

1.3. Technical Costs. We define these technical costs of responsible fishing as those which the firms must support to adapt their procedures of fishing to the regulation's rules of responsible fishing. This chapter defines expenditures as those derived of the change of gears, of the purchase of instruments of localisation, of the maintenance of observers, etc.

1.4. Costs of the decrease of the catch: We define the Costs of the Decrease of the Catch as the economic effect which is supported by the firms because of the underutilization of the capital when it is due to the existence of regulations assuring responsible fishing. These costs reflect a decrease of the catchability by unit of effort: a loss of productivity of the fleet that follows working under conditions set by regulation. It must be noted that this doesn't include the cost of the total reduction of the fleet (decrease of the total number of vessels) but only includes the loss of productivity of the vessels that continue working. This loss has different origins.

- On the one hand there is a loss of catchability in relation to the technical regulations that induce a loss of the potential catches. These regulations are limitation of quotas of fishing, limitation of the fishing days, limitation in gears (mesh, size of nets, etc.), geographical limitation (closed areas), etc.

- There is also a loss of catchability because of the negative externalities of the unregulated fleets in the same waters. Its activity affects to the fleets which respect the Multinational Agreements because they can't complete the assigned quotas.

The Cost of the Decrease of the Catches considers both reasons of increase of the used capital's "inefficiency". Fishing firms with the same capital and the same fixed costs have a lower economical profit when they comply to regulations.

2) Social Cost. This part of the Costs of the Responsible Fishing includes the expenditure that the Administration in relation to a specific regulation. In this case the firms doesn't support this cost but the Public Administration (local, regional, national, supranational). It's dealt a Social Cost because there is a cost of opportunity of the Public Expenditure to society. These funds could be aimed to other functions if the externalities of the exploitation of the marine resources were not to be corrected.

This epigraph must also consider effects which harm to the society such as the reduction of the flow of food, the increase of the costs of production to the consumer or the social effects of unemployment. Those effects are very difficult to quantify. We limit our analysis to consider that part of the Social Cost in the budgets of the Administrations

With this criterion we distinguish the following epigraphs: institutional costs of the regulation, costs of the fleet's reconversion, cost of unemployment and cost of control. We are going to examine the nature of each one.

2.1. Institutional Cost of regulation. It comprises the cost of administration and management of the measures of regulation including public research. In the case of Spain they are costs supported by the Central Administration of the State, the Autonomous Communities and the European Commission.

The quantification of these costs can be got from the budget when the items are clearly assigned to a specific aim which is affected by the regulation of a fishery. When the assignation from the budget was attributed to a larger aim it will be necessary to use weighting systems. For instance, the administrative costs of the specific fleets regulation can be estimated from the attribution of the percentage over the total administrative expenditure that the regulated fleet represents in the total.

2.2. Costs of reconversion of fleets. The social costs of the reconversion of the fleet are those the administration incurs to adapt to the new conditions that are established with the regulation. The larger items of this kind of cost subsidise the dismantling of vessels and finance the temporary mooring of fleets which are waiting the stocks to recover.

The quantifying of the stocks is directly obtained from the budget, which clearly determines the valuation of this kind of program.

2.3. Cost of unemployment. The reconversion of the fleets which means the dismantling of vessels and temporary stops, is a source of elimination of employment in the fishing sector. The social disturbance which is produced by unemployment is very difficult of measure. However, it's possible to make an the assesment of the public resources aimed to the maintenance of the incomes of the workers in the fishing sector. Because of that fact we will consider this cost as that which is supported by the administration as the payment of the unemployment subsidy aimed to finance the dismissed workers due to the reconversion

2.4. Control Costs. They are the costs which the administration has due to the maintenance of the control and supervision structures to assure the compliance of the regulations. They include the maintenance of inspectors team, the control at sea and in a general way all those items directly linked with the tasks of control and compliance of agreements and regulations.

3) Lucrum Cessans. Fleet reduction plans decrease of size of the fleets. That means undercapitalisation of the fleet as a whole. This exit of capital from the fishing activity means the loss of a possibility of investment which previously generated some benefits. That means a lucrum cessans to the investors who have to leave the sector. That is to say a loss of benefit

opportunities has been lost. This loss is especially deceitful in the case of the existence of unregulated fleets which are in the productive space of those fleets which have been obliged to leave the activity.

This "cost" is not supported by those fleets which continue in the activity, but by those which leave it. This social cost resulting from lost incomes due to the departure of the activity affects all of society which loses a possibility of productive and profitable use of capital.

There are ways of estimating this cost. The difference between the capital which existed previously and currently one can be multiplied by the current average rate of benefit and get the *lucrum cessans* caused by the reduction of capital. That is to say, we would be reflecting the added benefit which we would obtain if we would not have reduced our *cessans* fleet.

However, the formulation of the *lucrum cessans* is more theoretical than empirical. In practice it is not evident that by maintaining the fleet in its preceding level, the rate of benefit would be stable. It is difficult to make an estimation of the real dimension of the *lucrum cessans*. Because of that fact, we preferred not to evaluate it in the empirical part of the study. We will limit the analysis to consider the Fleet Cost and the Social Cost. With that we under-estimate the effective dimension of the CFR but will assure a bigger accuracy of its estimation.

### **III. THE SYSTEMS OF RESPONSIBLE FISHING: SPAIN AND THE EUROPEAN UNION.**

Spain is traditionally an important consumer of fish, with a largely deficitary market; this has aided the development of the fishing activity with the aim of satisfy this demand. In the 60's the Spanish fishing fleets worked both in national waters and in international fishing zones.

Although this development was exponential, the management system (of traditional base) avoided collapses in the fisheries of national waters. However several factors occasioned an important crisis in international waters during the 70's.

Firstly, the expanse of the EEZ to 200 miles was enacted. This made it necessary to negotiate for the access to waters where the Spanish fleet have worked before. In some cases the negotiation occasioned the exclusion from those waters. Secondly, Spain lost its sovereignty over the Occidental Sahara in 1973. This was an important fishing zone in the Africa Atlantic. Finally, the technological changes caused an important increase of the productivity (of fishing capacity) of the current fleets.

The Spanish fleet was heading for a necessary reconversion in the 80's in the context of the Spanish entry to the European Community. In 1986 the entry of Spain into the E.C meant following CFP's directives and taking part in international agreements as a Community member. The basic instruments of management used by the EU and Spanish administrations are:

-TAC (Total allowable catch) : This assures the preservation of the fish stock. Every year the EU's Administration establishes a TAC for every regulated species and geographic areas. After it is divided between the different states. Inside every state the Administration distributes these quotas depending on its own criteria.

-LICENSES : It's the necessary permit for the fishing activity. Licenses mean the obligation to adopt technical and specific measures for each case.

-TECHNICAL MEASURES: The most important are: minimum size of the captured species, identification of closed areas ( to prevent the capture of juveniles or to protect the reproductive stock) and limits in fishing days and other technical market measures.

-PLURIANNUAL ORIENTATION PLANS: In the EU's frame, the Pluriannual Orientation Plans (POP) for the fleet reduction are established. These plans help make concessions for the restructuring of the fishing sector. They scale down the capacities of fishery. From 1986 to 1993 the POP have enabled the scaling down of part of the fleet . This process will continue during the following 6 years throughout the IFOP . The funds for this aim will increase. In the last years, the Spanish fleet not only has stopped its expansion but also it has reduced its size to adapt to the possibilities of catch in the different fisheries where they are working.

These regulations are applied in an effective way inside of the EU with the participation of the control systems of all the states. It is clear that there are secondary difficulties in the exact compliance of the rules, as show the existence of some sanctions, but from a general point of view the rules are applied and vessels under flags of convenience do not operate inside these waters. Because of that fact, the fleets internalise the cost of responsible fishing according to the directives of the European CFP.

The Spanish and the Community Administration know the necessity of adapting the fishing exploitations to the possibilities of the maritime environment and they support the concept of Responsible Fishing defined in FAO's frame . The global objectives are:

- To adopt effective planification and regulation of the fisheries.
- To develop professional formation .
- To promote an optimal level of decentralisation between Administrations.
- To ensure the supply of sea products and to guarantee quality and sanitary conditions.
- To adopt necessary mesures to protect the environment.

In the case of the international waters the management is made under multilateral agreements. The EU's commission acts like a juridical subject. Temporary permits to the Spanish vessels which fish in those waters are required. As it's pointed out in the introduction, the main trouble is the appearance of fleets under flags of a country that have not signed the agreement, i.e. the flag of convenience problem.

Nowadays the main objectives of Spanish fishery policy, in line with those of European Union, are:

- To scale down the fishing fleet to a sustainable level.
- To encourage capital investment so as to keep up a modern competitive and efficient fleet.
- To safeguard the social and economic stability of those whose livelihood depends on the exploitation of fishery resources.
- To diversify fisheries activities by means of market structure reforms and improvements.
- To organise the EU's market in such a way as to ensure a steady supply of high quality fishing products.

Those measures mean a cost. Not respecting them creates some externalities. One of the main problems of community fleets respecting these principles in community waters is the

distortion that results from competition with unregulated fleets. A competition which is settled in the EU market and which are more open according to the agreements of GATT. This unfair competition threatens to invalidate the meaning of the multilateral agreements because it stimulates the change of flag and opens the productive space to fleets which do not support the externalities which are incorporated by the fleets of the signing countries. In the following paragraph we will try to see how from a theoretical perspective the dimension of distortion to the free competition can be measured through what we call Quotient of Convenience (QC).

#### IV. THE QUOTIENT OF CONVENIENCE

The Costs of the Responsible Fishing, understood as those resulting from the sustainable utilisation of the fishing resources are difficult to estimate. It will be necessary to contrast in an empirical way if its quantification is more accurate or on the contrary, if it is possible to elaborate indexes which show more accurately the additional costs that the fleets should endure in order to get a sustainable and efficient exploitation of the marine resources.

Obviously, this evaluation of costs only refers to those fleets subject to regulations. In the case of international waters responsible administration implies the compliance of the multilateral agreements. But in those waters there also fleets of countries that have not signed the agreements and that do not endure the costs that they imply.

Despite that fact, the quantification of the Costs of Responsible Fishing (in absolute terms) is not interesting for the international management of the marine resources because, in order to determine the economical weight of the regulations, it is necessary to establish a relation between the Costs and some other magnitude, working with comparable indicators. It is here where the concept of Quotient of Convenience appears.

We define the Quotient of Convenience (QC) as the relation between the Costs of the Responsible Fishing of a fleet and its total income.

We understand for Total Costs the algebraic addition of the Costs of Production and the Costs of Responsible Fishing. In the case of fleets which do not belong to a flag of a country which has signed the agreement the CRF will be equal to zero.

If we consider the Relative Costs in relation to the Income we will have

**Error! Switch argument not specified.** 
$$RC = \frac{CP + CRF}{TI}$$
 **Error! Switch argument not specified.**

RC Fleet of Convenience (fc), if CRF = 0, we will have that

**Error! Switch argument not specified.** 
$$RC_{fc} = \frac{CP + CRF}{TI} = \frac{CP}{TI} + \frac{CRF}{TI} = \frac{CP}{TI}$$
 **Error! Switch argument not specified.**

RC Responsible Fleet (rf), we will have

$$RC_{rr} = \frac{CP + CRF}{TI}$$
 **Error! Switch argument not specified.**

Then the responsible fleet, in comparison to that flag of convenience has a difference in the structure of costs which could be expressed as a difference in comparative terms to the total

revenue. This difference, as a percentage of the income, is what we call Quotient of Convenience which shall be expressed as:

$$QC = RC_{rf} - RC_{fc} = \frac{CRF}{TI} \text{Error! Switch argument not specified.}$$

QC: Quotient of Convenience

RC<sub>rf</sub>: Relative Costs of the responsible fleet

RC<sub>fc</sub>: Relative Costs of the fleet of convenience

CRF: Cost of Responsible Fishing

TI: Total Income

This quotient will be defined through the type of fleet considered:

· Responsible Fleet:  $CRF > 0 \rightarrow \text{Error! Switch argument not specified. } TC = CP +$   
CRF

$QCR > QCI$

· Irresponsible Fleet:  $CRF = 0 \rightarrow TC = CP$

The measure of the competitive disadvantage of the fleets which practice a responsible fishing is determined, consequently, through the difference of costs endured in the fishing activity.

Because of this difference of costs, measures of compensation and protection to the Responsible Fishing could be proposed. The Quotient of Convenience allows the establishment of a reference for the calculation of the charge that the fleets under flags of convenience should support. Thereby, those fleets would internalise the costs of the externalities that they generate when they sell their production to markets of countries that do not accept the internalisation of costs and which are jointly responsible for the regulation of the fishing resources exploitation.

Being a quotient in relation to the total income, that is to say, with the obtained catch, the QC can be referred to the obtained production. That is to say, it is possible to determine the CRF for a concrete fleet, but also for a ton of capture.

That way, we not only have a theoretical instrument but also an instrument to evaluate the compensatory rates which (through a tariff or another kind of measure as the prohibition of discharges, etc.) could balance the economical impact of the unregulated fleets activity.

In this case, the measure is seen as a dissuasive technical instrument which contributes to limit the flags of convenience problem through economic pressure with the purpose of forcing countries to respect the multilateral agreements for responsible fishing in international waters.

## **V. EMPIRICAL ANALYSIS: COD FISHING FLEET IN NAFO**

In this epigraph we will try to show that the QC is empirically measurable and at least there are some cases in which its dimension has an important economic relevance that can produce a distortion in the free competition of the firms. For this study we have chosen the cod fisheries in the area of NAFO where the problem of the flags of convenience was present and it was possible to access to the necessary information and data in an accurate way.

### **1. SPANISH FLEET IN NAFO. HISTORICAL EVOLUTION**

NAFO ( Northwest Atlantic Fisheries Organization ) is situated in international waters of the Atlantic Ocean beyond the 200 miles of Canadian jurisdiction. Fishing-grounds are placed in the Bank of Flemish Cap and in the external zones named nose and tail of the Terranova's Great Shoal. In the map 1 it's possible to see the area where the waters regulated by NAFO to the East of Canada are placed, while map 2 shows the division between Canadian and international waters. The productive areas are approximately in zones with a depth lower than 200 m (continental platform). Because of that fact, the NAFO agreement regulates the external zone to Canada of the platform of Terranova.

In 1974 the spanish codfishing fleet, which worked at the Great Bank's waters, was constituted of 140 vessels. The main seaports were Pasajes and Vigo, where 113 of the codfishing vessels resided, although la Coruña was important too. Despite having district seaports like Cadiz , some ships made their landings in Pasajes. It must be said that the EEZ wasn't established until 1976 and fishing was possible in all the Terranova's Great Shoal freely. From 1976 this possibility was reduced with the establishment of the 200 miles of waters of the exclusive economic zone of Canada. In 1981 a census of the codfishing fleet in Vigo, La Coruña and Pasajes was made.

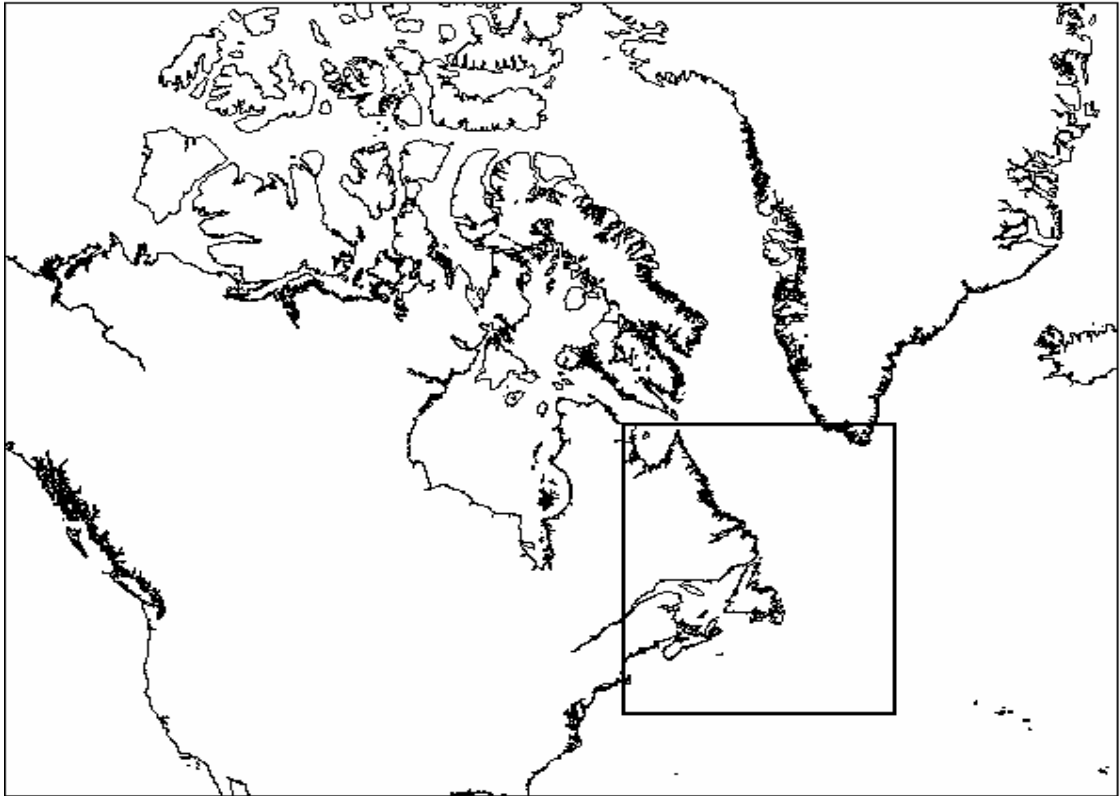
In 1986 the codfishing fleet was made up by 69 vessels. This means 71 ships less than in 1974. The main seaports continued being Pasajes and Vigo, although some vessels appears in districts as La Coruña, Cádiz and Huelva. The average horse power and the average GRT are both similar in 1974 and in 1986.

Nowadays, there are only 11 pairs of ships, which belong to 9 different enterprises assembled in two associations of shipowners placed in Pasajes and Vigo respectively. The biggest number of landings is made in Pasajes. These vessels fish in the modality of pair-trawl. We note that a strong scawling-down of the fishing effort has been carried out following the Fishery Policy of the Community . It has had a reduction in the catch possibilities not only because of the TAC before the entry of Spain in the Community but also because of the fishing moratoriums in the 3M zone because of the resources were down. This means that in the current year the spanish vessels can only fish in 3NO zone.

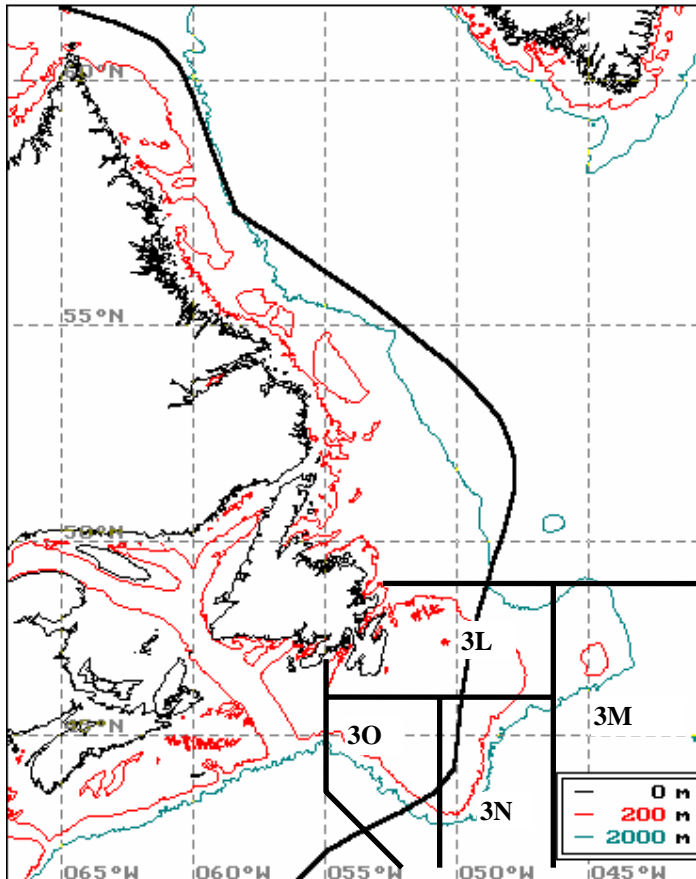
The characteristics of this fishery: practice of responsible fishing, economic signification, disposition of catch and costs, etc, make it suitable to make a specific evaluation of the Quotient of Convenience.

It's clear that this Quotient isn't equal for all the fisheries in international waters. It's necessary to justify the calculation and note the weight of this component in the final price of the product. In the following lines we will try to evaluate what is the difference of costs that are between the vessels which fish under the current multilateral agreements and the vessels which sail without respecting these rules, i.e. vessels under flags of convenience.

In the case of NAFO, most of the ships which sail without signing the agreements fly flags of Panama, Caiman Islands, St. Vicente and Uruguay.



MAP 1. General view of the area where is situated the zone regulated by NAFO to the East of Canada.



MAP 2. Enlarged area of the map 1. NAFO regulates the external waters to the EEZ of Canada: 3M and part of 3N, 3O y 3L.

## 2. COSTS OF PRODUCTION

In spite of its calculation not being necessary, of convenience is interesting to comment on to understand better the cod-fishing fleet which works in NAFO.

### 2.1. Fixed Costs of production

As it has been explained in the introduction of this empirical analysis , there are 22 spanish vessels which fish in NAFO nowadays. Most of them were built in the 70's . There are only one couple of ships constructed before. Nowadays, a new perfectly prepared vessel has a value of 2000 millions of pesetas.

At the moment of selling a codfishing ship, the fishing rights are sold with it. The fishing rights' prices range in an significant way.

The vessel price ranges in a fixed average according to its age. If the vessel is older than 15 years (the economic life of a codfishing ship) the price decreases in an 1.5 % for every year that exceeds. On the contrary, if the vessel is younger than 15 years, the price increases in a 1.5% for every year that lacks to complet that time. The economic life is estimated in 15 years

### 2.2. Variable Costs of production

2.2.1.Costs of fuel, material and maintenance. The costs of fuel and material , taking in account that the vessels which practice the responsible fishing have changed gear, are between Ptas 1.500.000 and Ptas. 2.000.000 per day of sea. A “campaign” lasts a minimum of 80 days and do not surpass the 110 days. It is important to say that this restriction of time does not exist for the vessels which do not practice responsible fishing. They stay in the fishing-grounds the period of time that they wish without any limitation.

The cost of maintenance have an annual import of 30 millions of pesetas by pair of vessels. This figure includes other items such as the mooring in seaport, the insurance when the ship is working and the vigilance costs of the vessel in seaport.

2.2.2.Labour costs. To value the labour the problem of the differences of wages according to the job’s category must be assessed. The salary of the codfishing vessel’s crew is constituted by two different parts: one fixed and another variable. The variable part is a ratio of the sale. This ratio ranges according to the category of the job and according to the place ( for example, in Galicia it is lower than in Basque Country ). The variable part of the salary is around the 0,3% of the catch. As well, the paid quota to the social security must be added which is a percentage marked by law over the fixed part of the salary. The crew of a fishing-cod vessel ranges between 24 and 36 people. The fixed salary ranges according to the categories but the average salary is around Ptas 176.000.

2.2.3.Financial Costs. The Financial Costs must be added to the preceding costs. The financial Costs are those which the shipowner incurs to finance the fishing operations or temporary stops of their vessels and crews.

As the cost of production, fixed or variable, are supported by all fleets. responsible or not, its calculation has not relevance for this study. They are pointed out here to show the cost involved in the capital that this kind of fleets represent.

### **3. RESPONSIBLE FISHING COSTS**

With the adopted methodology it is only necessary to know the Cost of Responsible Fishing (CPR) to estimate the Quotient of Convenience.

The process of calculation begins evaluating the different aspects of the CFR, to associate it to each captured amount and to the obtained total income. As it was pointed out before, the CFR is composed by different aspects which will be developed in the next lines to the specific case in which we are centred. In table 2 the obtained outcomes that we will comment in the following paragraph are shown:

A first part of the CFR is the Fleet Costs

3.1). The Fleet Cost of exploitation of responsible fishing are: licences, sanctions, Technical Costs of regulation and the Cost in relation to the decrease of captures.

3.1.1. In the case that concerns us, there is not a cost of licences because the shipowners do not pay any amount for that concept to the Administration.

3.1.2. In 1993 the technical costs of the regulation were basically the cost of maintenance of the observers and the cost of communication. In other periods there has been the cost of change of material (nets) and equipment (systems of communication and control, etc.). In 1993 the cost of the observers were low to the shipowner because their salary was charged to the

Administration and is taken into account in another epigraph. The shipowner only paid the keep of observers while they stayed on board of his ship. This approximately represented an amount of Ptas 1.200 per day. The total of this item, from the ownerships sources, was in 1993, Ptas 204.000.

We understand as costs of communication those caused by the obligation of contacting with the Administration every time that a vessel enters or exits in any zone of NAFO. This way the zone the ship is and the number of fishing days in every zone is registered. These costs have a relative weight due to the distance of the fishing-ground, from the ownerships sources, it reached a total of Ptas 3.300.000 in 1993.

3.1.4. Finally, in this section, the cost of the decrease of catch, is the most complex of estimation. Here, the losses due to the underutilization of the capital because of the existence of a TAC, the cost of the “discards”, losses due to the decrease of the fishing days and losses for stopping the fishing activity when a high percentage of juveniles is found. This last situation occurs because when volume higher than the 15% of fish which is undersized is found the activity must be stopped and move 5 miles from that place.

As the spanish fleet didn't suffer these restrictions in 1974 it's possible to make a comparison between this fleet and the fleet which nowadays sails under flags of convenience. Because of that fact, to obtain the difference of costs (Costs of responsible Fishing) we calculate the difference between the captures by GRT in 1974 and the captures by GRT in 1993. This difference is multiplied by the current price and by the current GRT.

The outcome is the potential incomes which nowadays vessels lose because they restrict their potential captures to a specific norm (TAC, technical measures, etc.). In 1993, it represented Ptas 1.770.340.000.

The outcome means that this epigraph is the most significant in relation to the costs of exploitation associated to responsible fishing. The figure which is obtained is relatively small in relation to the total income (2,5%). This means that the fleet has kept itself operative finding the means to not lose rentability despite the adverse conditions which it has found.

3.2). Social Cost. In 1993 the most significant part of the CRF is found in the chapter that makes a reference to the Costs of Responsible Fishing to the Society. That is to say, those which don't directly bear on the shipowner. The Social Costs are composed by the Institutional Cost of Regulation, Cost of reconversion of fleets, Unemployment and Control Cost.

3.2.1. Institutional Cost of the Regulation. These are costs of administration and management of the activity of the fishing fleet and of the POP. The costs of research are included. In the case of NAFO these costs are managed by the State and not by the Autonomous Communities as it happens in other fisheries. The percentage of administrative costs which are supported by the European Union aimed to NAFO, should be included.

This is calculated through the establishment of a percentage of the codfishing fleet's GRT in NAFO with regard to the total of fleet administrated by the SGPM. This gives a result of 2,38%. This percentage is multiplied by the administrative expenditure of the SGPM which includes civil servants, expenditures of functioning, expenses allowance and travels, etc. The total of the State administrative expenses attributable to the codfishing fleet in NAFO is Ptas. 66.450.000. To that it's necessary to add the amount which was invested in research by the Instituto Español de Oceanografía (IEO) in this fishery. This amount was 80.000.000 ptas. The expenses of the EU aren't included due to difficulties of estimation in their budget. Because of

that, the total amount of administrative expenditure which was Ptas. 123.183.000 underestimates the real institutional cost.

3.2.2. Cost of reconversion of fleets. Here, the expenditure that the Administration of the State and the EU has paid to reduce the fleet, is included. This is basically subventions for temporary mooring and for definitive stoppage. In 1993 a subvention of 50 millions was given to every pair of vessels for temporary mooring. The total amount was 700 millions of pesetas. Another subvention of Pesetas 1300 millions was given for definitive stoppage.

3.2.3. Unemployment. In spite of the difficulty to measure the social unrest that the unemployment causes, the social wage can be used like an indirect estimator. The social wage is understood as a compensation of all the negative consequences of unemployment. This cost is the minimum social wage of unemployment which is Ptas 960.000 per year and per seaman. The unemployment affected to 959 people of 2.600 people who were affected by the reconversion. The amount in 1993 was Ptas 920.640.000.

3.2.4. Control Cost. During the last two years Spain has kept an average of two observers in NAFO. We take in account the expenditure made by the Administration in these observers and in the information process, which supposed Ptas 22.416.000 and Ptas 13.997.000 respectively.

In the quantifying of the cost of convenience the “lucrum cessans” hasn’t been taken in account. The “lucrum cessans” would be an estimation of the amount which the shipowner loses because of fleet reduction. That is to say, it reflects an opportunity cost to the shipowner. This figure will increase the percentage of the cost of convenience. Because of that fact the cost of responsible fishing will be underestimated.

Through the calculation which has been explained above, we have the outcomes in the Table 2 in 1993. The addition of the Responsible Fishing Costs to the Fleets and the Society gives a result of 3.284.041.000 pesetas

With the formula of the Quotient of Convenience (QC) which considers the proportion with regard to the Total Incomes of the spanish codfishing fleet in NAFO we got a QC around the 46,9%.

The Costs of Responsible Fishing have a structural component and another relating to the current situation. The components relating to the current situation are those associated to the process of reconversion which must be maintained while the sector and society have not adapted the new regulations. This basically implies that the excess fleet disappears and the unemployed have been absorbed by the productive net in fishing or in another sector.

The studied flet is in this process of reconversion for 10 years and the current cost are very high (in 1993).

On the other hand, there are some structural costs that, despite definitely closing the porocess of reconversion, will be supported by the fleets and by the society which work under a framework of responsible fishing: loss of productivity, cost of control and management, etc.

in Table 3 we present the QC in different situations. On the other hand the QC which was supported in 1993 is a 46,9 %. An important part of this is given by current costs such as unemployment, subventions, for mooring and for dismantling.

**Table 2. COST OF RESPONSIBLE FISHING of the spanish cod-fishing fleet in NAFO in 1993**

**1. FLEET COST**

Licences					0
Technical Cost					
	observers keep			204.000	
	comunication			3.300.000	
					3.504.000
Reduction of Cath					
	a=captures 1974	153.25			
		5			
m= captures per GRT 1974	c= TRB 1974	119.00	m= a/c=	1,2876	
		0			
n= captures per GRT 1993	e= captures 1993	13.993			
d= decrease of captures per GRT	f= TRB 1993	13.618	n= e/f =	1,0275	
	b=price 1993	500.00	d=m-n=	0,2601	
		0			
	p= d*p*f=				177.034.000
<b>TOTAL FLEET COST</b>					<b>182.538.000</b>

**2. SOCIAL COST**

Institutional Cost of Regulation					146.450.000
	Research expenditure IEO	80.000.000			
	Administrative Cost	66.450.000			
Cost of reconversion of fleets					2.000.000.000
	Temporary mooring subvention	700.000.000			
	stop subvention	1.300.000.000			
Unemployment					920.640.000
Control Cost					36.413.000
	Observers	22.416.000			
	Information	13.997.000			
<b>TOTAL SOCIAL COST</b>					<b>3.103.503.000</b>
<b>TOTAL RESPONSIBLE FISHING COSTS (RFC)</b>					<b>3.284.041.000</b>
<b>TOTAL INCOMES</b>					<b>6.996.500.000</b>
<b>QUOTIENT OF CPR/IT CONVENIENCE</b>					<b>46,9%</b>

Subtracting these components of 1993 and only considering the structural ones, the Costs of Responsible Fishing would be 5,2 per cent.

**Table 3. Structural and relating to the moment components**

Structural Costs in 1993	363.401.000
Costs relating to the moment in 1993	2.920.400.000
Total Incomes in 1993	6.996.500.000
Real QC in 1993	46,9%
structural QC	5,19%

## VI.CONCLUSIONS

As we have pointed out before, the QC is useful to indicate the part, as a percentage of the incomes which come from the sale of the fishing product, which due the Cost of practising a Responsible Fishing. To assure free competition between the fishing firms of any country and to assure the maintenance of the fishing resources through regulations, it's necessary that all the fleets internalise the externalities. In this case the externalities are evaluated as the Costs of the Responsible Fishing.

To reach this aim there are different alternatives. One of them would be regulation resulting in fishing in a regulated way. This solution is non-viable in international waters. A more effective way is to use regulatory market measures ranging prohibiting import of products of non-regulated fleets to interventions through compensatory tariffs.

The QC allows to make a theoretical demonstration of the use of this type of measure. That is to say, the QC allows the calculation of a tariff to internalise the cost of the responsible fishing. This way, the regulated fleets are in the same conditions than the non-regulated ones because the incentive to change flags and to the non-subscription of the multilateral agreements are stopped. The possibility of using a compensatory tariff would probably dissuade the non-completion of the regulations.

Finally, we have seen how is possible to estimate the costs of responsible fishing and the QC for a period. However, There is an open aspect when we are considering the costs relating to the specific moment: these costs can be taken into account in the period when they are produced or be distributed in larger periods. Because of that fact, there is an important scope of politic discussion about how the costs relating to a moment should be imputed. In this case some factors as the duration, the social cost and the importance of the reconversion's process, the necessities of internal consumption must be taken into account.

Anyway, we know that the QC has a minimum (the one which is considered by the structural costs). This minimum is significant in the studied case and probably in any practice of responsible fishing. There is a maximum too. This maximum is obtained via the addition of costs aimed to assure the practice of responsible fishing to preserve the resource and to maintain the stability of the production in the long term.

**TABLE 1: COMPOSITION OF THE STRUCTURE OF TOTAL COSTS OF THE RESPONSIBLE FISHING**

<i>Costs of Production</i>	<b>Fixed Cost</b>	Opportunity Cost of Investment
	<b>Variable Costs</b>	Cost of the Fuel Cost of Materials Labour Costs Financial Costs
<i>Costs of Responsible Fishing</i>	<b>Fleet Cost</b>	Licences Technical Cost Reduction of catch (loss of productivity)
	<b>Social Cost</b>	Institutional Costs of the regulation. Costs of the reconversion of fleets Unemployment Control Cost
	<b>“Lucrum cessans”</b>	

**TABLA 3. STRUCTURAL AND RELATING TO THE MOMENT COMPONENTS**

Total Incomes in1993	6.996.500.000
Structural Incomes in 1993	363.400.000
Costs relating to the moment in 1993	2.920.640.000
Real QC in 1993	46,9%
Structural QC	5,2%

