SPAIN - METHODOLOGY AND USE OF SOCIO-ECONOMIC INDICATORS FOR MANAGING FISHERIES [1]

1. Justification, background and aims

1. From a socio-economic perspective, fishing is becoming a more complex activity nearly all over the world. This is a result of the interrelation of different groups of fishermen with sometimes conflicting interests, valuable but limited resources, and a huge consumer market in which demand exceeds supply by far. This delicate situation usually requires management decisions[2]. Any decision, even if this is one of non-intervention, may give rise to a number of problems.

2. For this reason, managers need objective arguments to support their decisions. Economic indicators are a part of these objective arguments. However, having reliable economic indicators is neither easy nor immediate. It often happens that access to the data necessary for constructing the indicators is very difficult. The methods used by researchers for data collection never coincide with each other, and even some data have never been compiled.

3. We are going to try to show in this analysis some of the synthetic indicators that can be used for the control of the fishery's activity, which methodology we can use for obtaining them and finally the utility that they can offer the administrator. This exposition is a kind of synthesis of the work done in the frame work of the Socio-economic Subcommittee of Scientific Advisor Committee of General Council of Mediterranean Fisheries by some Spanish and Moroccan researchers[3].

2. Research methodology: indicators to looked for and data to use

4. After several decades in which fishing has contributed to the development of the economy of many countries and to the welfare of consumers, in some fisheries of the world, the fishery resources have been seriously reduced and even jeopardised. This reduction has environmental, economic, social and cultural costs; so governmental involvement is demanded for both mitigating the consequences and preventing fisheries degradation. In its biological aspect, the duty of governments is to control the stocks of living resources that need to be maintained at a certain point in time.

5. However, it also has an economic dimension: in order to achieve sustainable fisheries, each fishery has to be accorded with a reasonable fishing capacity; which implies using adequate gear types, limiting the number of fishery vessels and fishermen, restricting the number of fishing hours during the year, etc.

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1 Spanish contribution to the study on economic and social fisheries sustainability indicators, Secretariá General de Pesca Marítima. Prepared by Dr. Ramon Franquesa, Gabinete de Economía del Mar de la Universidad de Barcelona(ramon@gemub.com).

2 For a more detailed description of this context, see Rafael Robles ed. (1999).

3 Franquesa, R.; Malouli Idrissi, M.; Alarcón, JM (2001) Feasibility Assessment Study on the Setting-up of a Socio-economic Indicator Database for Managing Fisheries The institutions concerned are: Gabinete de Economía del Mar de la Universidad de Barcelona, Centre Regional de Nador de l'Institut National de la Recherche Haleutique and Laboratorio de Málaga of Instituto Español de Oceanografía, fao.jalarcon@ma.ieo.es

6. In this context, the manager requires objective arguments to back his decisions: why authorising one gear type or not, why allowing only a particular number of fishing hours per year, why granting a certain number of licences in one area, etc. This is the reason why economic indicators may be useful. Nevertheless, if we want these indicators to be useful for the manager, they must meet the following requirements:

a) The indicators should be able to measure the socio-economic impact of changes in the resources (stocks).

b) They should be helpful in assessing fishing effort, being this understood as investment and employment.

c) They should make it easier to compare different gear types, different countries and alternative economic activities.

d) They should be clear enough to all stakeholders, in such way that they do not raise any doubt regarding their reliability.

e) They should allow an assessment, in its widest sense (losses or profits, employment, etc.), of the costs attached to any alternative actions. This includes the capacity to estimate the costs entailed by an orderly transition from a situation of unsustainability to one of sustainability.

f) And finally, while meeting all these requirements, they should not be expensive to work out.

7. The economic indicators may be useful as an additional tool by providing criteria for a better fisheries management. When making a decision, the indicators are not the only condition to be considered; they may be complemented with other indicators, such as the Indicators for Sustainable Development of Marine Capture Fisheries (SDRS) that FAO is currently developing[4] to meet the challenges posed by the introduction of the Code of Conduct. We must stress the fact that economic indicators are linked to the other kinds of indicators[5]. Economic stability means biological stability and sustainability. Accordingly, economic imbalances eventually may cause unsustainability and resource imbalances.

8. The decision-makers of most fisheries face growing difficulties. First, the globalisation of fisheries results in a world market that reduces sale prices and encourages a greater production rate to maintain the income levels. Besides, new technological developments make it possible to increase production while reducing fishing costs. Technological developments cannot stop this process; quite the contrary, they are used to accelerate it (improving port facilities, contributing to modernisation, etc). The said process exerts pressure on resources, which are very limited, and that is the origin of all conflicts between fishermen. These conflicts require the intervention of decision-makers to make a fair assignment of the rights to exploit the existing fishing resources. In addition, society is becoming more and more aware of the progressive degradation of the environment and is demanding a sustainable balance.

9. Nowadays, it is obvious that everyone agrees to try and lead fisheries towards sustainability and compliance with the principles established by FAO's Code of Conduct. Nevertheless, sustainable fisheries are faced with socio-economic difficulties: excess capital, fast technological progress, labour force redundancy, conflicts between fishermen groups which used to co-exist in harmony, price drops, etc. These difficulties are, at the same time, a consequence and a cause of resource overexploitation.

4 FAO (1999), The development and use of indicators for sustainable development of marine capture fisheries.

5 As we may see in FAO (1999) page 46 and subsequent pages, to measure sustainability, the use of economic indicators of the same kind is proposed.

10. Thus the decision-maker is forced to intervene and to mediate in a conflict between different parties. It is essential for him to count on objective data that may serve as a solid support for the measures taken, which are always contested by any of the parties.

11. The decision-maker can benefit from the information provided by the economic indicators, which allow him to obtain a synthesis of the socio-economic traits of each area.

12. A systemic approach to the socio-economic reality by means of the herein indicators may help the decision-maker to:

a) Understand the situation of the fishing sector in management areas of each of the countries involved. Thus, he may compare the situation of every fleet and port under his responsibility.

b) Since the method tries to homogenise the measure units, he may extend this comparison to the current situation in other countries with the same fleet segments.

c) To develop a sensitivity analysis of the impact of changes in **exogenous** factors, such as changes in prices, costs, new technology developments, etc, identifying the effect on every defined area in terms of yields, employment or effort.

d) To develop sensitivity analysis of **endogenous** changes in management, such as number of granted licenses, temporary rest periods, nets, fish sizes etc, in order to estimate their impact on yields, employment or prices.

13. As shown by the economic indicators, there are several assessment tools that allow estimating the effect of management policies and measures used or proposed both ex-post and ex-ante by simulation means.

14. These economic indicators should be a complement to the tools used in biological assessment of resources, so that they provide a clear view of the consequences of the resources degradation on society. For instance, as far as biological degradation is concerned, the economic indicators should help to choose the most appropriate measures to attain sustainability and minimise its impact on society.

15. As long as decision-makers in the EU and some other countries's fisheries turn to regulate fishing effort as a complementary policy to production rates, vessels are becoming a main subject of these managemental decisions.

16. The fleet segments are those that we identify as the management subject. They encompass vessels with similar characteristics. However, that categorisation follows no fixed criteria and there is room for manifold amendments. We may classify vessels according to size (big vessels and small vessels), gear, fishing grounds where they usually operate, etc.

17. The decision-maker's regulations (on fishing schedules, licenses, taxes, etc.) are normally binding upon specific fleet groups. That is why a correct fleet segmentation is essential in the construction of the indicators; otherwise they would prove useless.

18. One way to solve this problem is to establish the concept of "Operating Unit". In the Mediterranean Sea context, our intention was to solve such a delicate question and reach an agreement about the number of segments that have to be established. The vessel categories should be flexible enough to cover the whole of the fishing fleet operating; however, at the same time, they should be precise enough to yield operative (meaningful) answers to the management units.

19. Besides, this segmentation had to be compatible with the concepts being used by the administrators. In this regard, we have adopted the concept "Operating Unit" as it was provisionally defined at SAC of the GFCM[6]. For deeper regional studies it shall be necessary to disaggregate the Operating Units of the Management Units (MU) into Local Operating Units linked to each port in the area.

20. Regarding the economic indicators that were to be used for the studies, the results yielded by previous studies were taken into account. One of them[7], which was presented before the Working Party on Fisheries Economics and Statistics of GFCM (WPFES) in 1998, tried to meet these requirements. As a result of that meeting, an advisory group composed of different experts from the national administrations was set up. That advisory group determined that the available variables for the Mediterranean Sea were limited to only 16.

21. Notwithstanding, a number of indicators have been used that are wide enough to answer the questions made by managers and decision-makers.However, in some countries it will be difficult to reach a systematisation of all these variables. For this reason, it has been tried either to simplify the initial demand for information or to substitute it for samplings in cases where this was methodologically possible. For the design of these indicators, it has been considered the ones used in other studies currently in progress[8].

22. Now we shall define each indicator, dividing them into two parts: the former, those indicators that give a **general information about the country**; the latter, those informing of the specific performance of a kind of vessel in a specific area. This is what we call **Local Operating Unit (LOU)** [9].

23. For the purposes of calculating the **national indicators**, the landings value (LV) and the employment (E) value shown are the addition of LV and E of all the different operating units. Some of the global indicators as well as some of the data permitting their elaboration may be found in statistical sources of FAO or other United Nations bodies. Among the national indicators can be found:

Apparent Consumption shows the gross consumption of fishing products per inhabitant of each country. It can be expressed either as weight of consumed fish per inhabitant (WAC) or as expense per inhabitant (VAC).

6 During a preliminary meeting held at FAO headquarters a number of possible definitions for an "Operational Unit" were discussed. The members at this meeting eventually agreed upon a definition, which seemed to be compatible with all disciplines concerned with fisheries management. It was reviewed at a follow-up meeting held in Barcelona (January 2000, 25-27) and the following definition was suggested: "For the sake of managing fishing effort within a Management Unit, an operational unit is the group of fishing vessels practising the same type of fishing operation, targeting the same species or group of species and presenting similar economic structure. The grouping of fishing vessels should not be understand as fixed over time but be function of the management objectives to be reached"

7 Working Party on Fisheries Economics and Statistics of GFCM, Denis Bailly & Ramon Franquesa WP/98/3 Les indicateurs socio-économiques dans l'aménagement des pêches en Méditerranée: éléments de réflexion, March 1998.

8 Can be stressed among them: definitions as Net Operating Income from Sean Pascoe (1999, p. 18) or Estimated Capital Value from AER (1999). A part of these concepts has been also used in the workshop held in Kuala Lumpur (Malaysia) from 15 to 18 December 1997 (FAO, Fisheries Technical Paper, n. 377).

9 Employment can be defined in the terms that are being currently discussed within the SAC. **Management Unit** can be understood as a geographical division established on the sea defined by a maritime area where fishing activities are being carried out. **Operating Unit** is a fleet segment which operates within this management unit (MU) and which is composed of vessels with similar characteristics, which have the same way of fishing, and which try to catch the same kind of species. Every Operational Unit is composed of several **Local Operating Units** (LOU) that can be seen in each port or local area of fishing. Since the economic indicators of the OU can be only estimated upon the local available data, only a certain homogeneity between LOU may confirm the validity of a OU. If the LOU of two countries are outstandingly different, in the Management Unit it should be considered the existence of two LOU.

Fish Commercial Balance (CB), shows whether exports or imports of fishing products are higher in a given country.

Ratio Fish Employment (RFE), indicates the ratio of employment created directly by the fishing industry in a country.

Fish Coverage Rate (CR), shows the rate of apparent consumption covered by the national production.

Extraversion Rate (DR), shows to what extent the fishing sector of a country depends upon foreign trade, both for imports and exports.

Fish Contribution to the GNP (FCG), shows the importance of fishing production in the Gross National Product.

Ratio Harvesting Value (RHV), shows the importance of fishing in comparison to aquaculture in terms of income.

Ratio Harvesting Weight (RHW), shows the importance of fishing in comparison to aquaculture in terms of production weight.

24. The following indicators refer to particular data of each **local operating unit**. That is why in the second group of indicators, each one of them is represented by a subscript: fleet (f) and port (p). Besides, we may add a last subscript referring to the time unit, for instance years. Thus, physical productivity would be expressed as follows:

$$FP_{f,p,t}$$

where **f** stands for fleet segment, **p** for port and **t** for year.

Thus, the decision-maker counts on objective data on each fleet segment and port.

25. The **indicators for each local operating unit** are:

Vessel Physical Productivity (VFP), shows the average production of each vessel in terms of weight of landings.

Capacity Physical Productivity (CFP), indicates average production in terms of weight of landings for each capacity unit (GT) of the vessels.

Power Physical Productivity (PFP), shows the average production in terms of weight of landings for each power unit (HP) of the vessels.

Per vessel Hour Physical Productivity (HFP), indicates the average production in terms of weight of landings for each full fishing hour. The total fishing time (T) results from multiplying the number of fishing hours by working days and then by the number of working days in one year (TD).

Capacity Productivity (PGT), shows average production in terms of market value in the first sale for each capacity unit installed (GT) in the vessels.

Vessel Productivity (PV), shows average production in terms of market value in the first sale for each vessel.

Power Productivity (PP), shows the average production in terms of market value in the first sale for each power unit (HP) of the vessels.

Per Vessel Hour Productivity (PVH), shows the average production in terms of market value in the first sale for each fishing hour.

Man Physical Productivity (MFP), shows the average production in terms of weight of landings for each man employed.

Man Productivity (MP) shows average production in terms of value in the first sale for each man used.

Average wage (AW) indicates the average salary obtained by each man employed.

Landing prices (LP) represents the average market price of landings.

Invested capital (IC) shows the current value of the whole of the vessels. Invested capital is very difficult to measure in the Mediterranean Sea. A recommended method will be explained below.

Salary Cost (SC) indicates the fishermen's income. To measure the salary cost, we must bear in mind the parts in which landings of each kind of fleet are divided. This indicator tends to underestimate the actual figures, since fishermen usually keep a small part of landings as salary in kind. Often, in artisanal fisheries, each fisherman's earnings depend on his condition, i.e., whether he is a sailor (salary) or the owner (salary plus profits). For the purposes of making an economic analysis, we should make a distinction between the natures of each distinctive part of the income.

Opportunity Cost (OP) shows the yields that the owner could obtain should he invest his money in National Debt instead of investing in his business. This means that the owner is relinquishing that potential income. There is a profit in its economic sense when the yields of the invested capital surpass the opportunity cost[10].

Gross Estimated Profit (GEP), which indicates the total profits obtained by the whole of the vessel owners, once the operating costs have been deducted. Such costs include: Salary Cost (SC), Opportunity Cost (OP), Costs related to Fishing (CDxTD) and Yearly Fixed Costs (YFC). How to calculate CD and YFC is explained below.

Net Estimated Profit (NEP), which shows the total earnings obtained by the whole of the owners, once the depreciation cost has been deducted from the GEP. This cost is calculated following the criterion that the shelf life of a vessel is 10 years. In fact, the shelf life of vessels is normally longer, but in that subsequent period repair costs equal the value of a new vessel.

10 In economics, any investment tends to have a profit equal to zero, understanding that this profit is additional income that exceeds the average capital earnings in a given economy. These earnings tend to equal the opportunity cost. A sector with profits will attract investments from other economic activities with no profits.

Profit Rate (PR), which indicates the percent ratio of yearly net profits plus the opportunity cost in relation with the investment. It should be borne in mind that this figure does not include the additional earnings obtained by the owner as an employee in artisanal fisheries.

Gross Added Value (GAV), which expresses the Added Value that the segment in question contributes to the National Economy. This includes: salaries, profits, opportunity cost and depreciations.

26. The indicators are as follows: Economic indicators (FCG, PGT, PV, PP, PVH, MP, IC, OP, GEP, NEP, PR, GAV), social indicators (RFE, AW, SC), market indicators (VAC, WAC, CB, CR, DR, RHV, RHW, LP) and technical indicators (VFP, CFP, PFP, HFP, MFP).

27. Several difficulties may occur when obtaining accurate information to elaborate these indicators. Also some methodological constraints have arisen during the analysis. The biggest problems have appeared when defining the dimension of the invested capital and some of the production costs.

28. Calculating the Invested Capital indicator is not an easy task. There are several methods:

To ignore the capital devaluation, but, on the contrary, to consider only its purchase value. Should that be the case, the real value is overestimated.

To deduct a certain amount of money from the purchase value according to the vessel's age. Should that be the case, modernisations are underestimated. A long shelf life of the vessels, which often undergo renovation along their lives, would make the final figure quite low compared to the real one.

To take the insured value as a KI indicator. However, there can be considerable differences between the insured value and the real value for a number of reasons. As long as the whole of the capital is not insured, this method is not very useful. To assume that the current value of the Invested Capital is half of the purchase cost of the whole fleet now. It is a simple mathematical method that brings us closer to the real value. This method works well if the vessels' age distribution is homogeneous.

To assume that the current value of the Invested Capital is half of the purchase cost of the whole fleet now[11]. It is a simple mathematical method that brings us closer to the real value. This method works well if the vessels' age distribution is homogeneous.

11 The rationality behind this option is the following: let's assume that ships have an age limit, for instance 10 years. As a result of wear suffered by the vessel's structure, the value of the vessels decreases by 10% every year. Accordingly, one-year-old vessels keep 90% of its original value, two-year-old vessels keep 80%, etc. If the vessels of a given fleet have a normal distribution, each generation will represent 10% of the total. At a given moment in time, the average value of that whole fleet is 50% of the value it would have if it were composed of new vessels exclusively.
It should be considered that the average shelf life of a vessel as being 15 or 20 years, 15 or 20 years, the percentage of value lost each year by one vessel would be lower. However, the calculation would also include more vessel generations, the global value would still be 50% of their value should all of them be new. To consider this method as useful, it is necessary to assume that the average shelf life of the fleet is the same for all the vessels (which is normal if all the vessels in the fleet have the same technical characteristics), and that age is homogeneously distributed. This last requirement has more exceptions. For instance, let's assume that one fleet's vessels have been built in the same year and that they all become old at the same time. This could be the case when ship construction is encouraged by law or by any governmental economic aid at one particular moment in time. In that case, if there is the need to assess the current value of the fleet, it has to be considered the age distribution in comparison to its initial value.

To assess the current price assigned to the vessel and the vessel's tackle by the owner, in case he had to sell it or purchase it in the same condition.

29. The recommendation placed on this proposal is to use the method mentioned in the last place, as a first approach to the total value of investments.

30. Costs assessment raises some other problems. According to their nature and importance, costs have been divided in wide categories: salary costs (SC), opportunity costs (OP), daily costs related to fishing (CD), and yearly costs related to the vessel's maintenance. The yearly costs related to the vessel's maintenance are defined as follows:

(CD) Costs related to the number of fishing days. In other words, these costs are fuel and food (salary costs have not been included in CD). These costs arise from each fishing day.

(YFC) Yearly fixed costs. These include dockage, insurance and license fees. They also include the maintenance cost to keep the vessel in working condition. It is regarded as a fixed cost for each vessel in every segment.

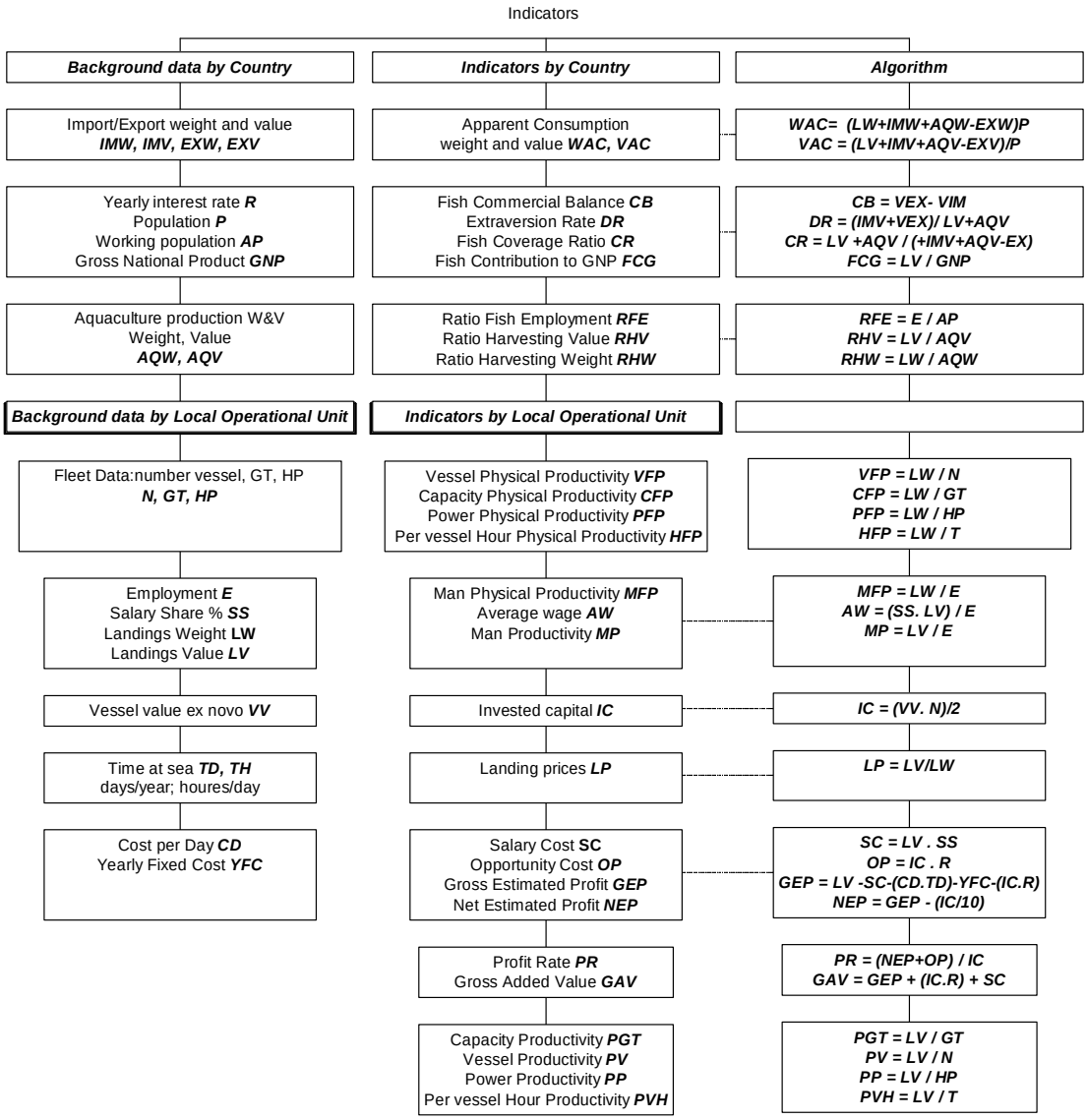
31. In all these cases, the information must be obtained by means of samplings carried out in Local Operating Units.

32. It has to be taken into account that the estimated profits (IC) may have been flawed by an underestimation of sales, but this is the approach that gets closer to reality. The IC value is very relative and is bound to not to remain constant in time. It has to be carefully considered when comparing two geographical areas or two operating units having different socio-economic structures. Significant differences may be found between the two areas or units if, for example, the stated sales level is different.

33. Finally, another variable that is difficult to define is employment, since there is a high rate of part-time employment, in which some of the employees combine their job in the fishing sector with another job in agriculture or in the tourism industry. Sometimes, several people may hold the same position in a year if rotation is high (for instance in purse seine fishing). For study purposes, an employment unit represents a one-year full-time job performed by one person.

34. Table 1 shows the indicators and their acronyms indicating how to obtain them. On the first column appears the data required to elaborate these indicators.

Table 1: Data requirements and calculation of indicators



3. An example of the use of this indicators: The Alboran Sea

35. In order to show the convenience of indicators and their valuable use in real situations, there is going to be presented a pilot study case focused in an area of the Mediterranean Sea: the Alboran Sea.

36. The Sea of Alboran, like the Gulf of Lions, is one of the most productive areas of the Western Mediterranean. Two countries share the exploitation of these highly productive waters: Spain and Morocco. Although the Spanish and the Moroccan coastlines enjoy an unequal degree of development, the long fishing tradition, tourist development and unemployment exert a high pressure on the environment in both seashores.

37. The northern coast is hit by pollution caused by tourist areas. These areas are densely populated and their inhabitants have a liking for larvae (called whitebait), which exerts pressure on regulations, in virtue of which larvae catch and sale is forbidden. The southern coast faces quite a different problem:

fishing is virtually the only chance for men to find employment. Nevertheless, in both places, they have similar management problems (although in different degrees of intensity): a strong pressure and competition for resources. Thus, an excessive fishing effort has provoked a reduction of sardine and anchovy catches in the last years.

38. Taking the national indicators all together, they show us two quite different structures of the fishing activity; even though they are based on a similar resource. The socio-economic differences between both countries explains the diversified position on fishing that each of these societies have.

39. From the frame that the national indicators give, we can analyse the local indicators. The local level indicators allow us to examine the ways in which a resource is exploited by every one of the fishing fleets and zones (LOU) in each country

40. There are different ports and zones in this area. We should not consider each of these ports as an area delimiting a Local Operating Unit. Both an excessive number of small points to be studied and the small size of many of them make it impossible to carry out a comprehensive sampling considering our time constraints and limited means. In order to solve this problem, several geographical areas were delimited. In some cases, they cover several landing sites surrounding a fishing port. This is how the geographical areas of this study were finally defined. On the one side, the huge number of landing sites in Spain was cut down to areas found in the surroundings of a fishing port equipped with a computerised fish market. There are many ports that are basically marinas where only a few vessels are true fishing vessels. For that reason, we decided that a distinctive aspect of a true fishing port is the existence of a fish market that reports sales figures on a regular basis. Thus, only 10 areas were identified. In Morocco, the landing sites were grouped together around each of the 7 seaports existing in the region. This means that the smaller landing sites were associated and grouped together with the nearest major port and, for the purposes of the study, the fleet of the area was taken as constituting one Local Operative Unit.

41. Table 2 indicates the areas that have been finally set up as geographical location of each operative unit. All these areas represent both one trading centre (computerised or, in the case of Morocco, expected to be equipped soon) and one stable port settlement with a fishing fleet. A total of 16 areas, 6 in Morocco and 10 in Spain were established.

Table 2: Operating Units

Operating Units: Major ports in Morocco				
IdRegion	**IdPort**		**LatDMS**	**LongDMS**
Tangiers	TAN	Tanger / Ksar Sgher	35°47,2 N	05°48,5 W
Tetouan	MDP	M'dik port	35°40,9 N	05°18,8 W
Chefchaouen	JEB	Jebha	35°12,6 N	04°39,9 W
Al Hoceima	ALH	Port Al Hoceima/ Cala Iris	35°14,9 N	03°55,4 W
Nador	BEN	Port Béni Ansar	35°16,1 N	02°55,5 W
Nador	RAS	Ras Kebdana	35°08,7 N	02°25,4 W
Operating Units: Major ports in Spain				
Málaga	ESP	Estepona	36º24’48’’N	5º09’12’’W
Málaga	MAR	Marbella	36º30’24’’N	4º53’24’’W
Málaga	FUE	Fuengirola	36º32’36’’N	4º36’48’’W
Málaga	MAL	Málaga	36º42’36’’N	4º25’12’’W
Málaga	CLV	Caleta de Velez	36º44’54’’N	4º04’06’’W
Granada	MOT	Motril	36º43’18’’N	3º31’24’’W
Almeria	ADR	Adra	36º44’36’’N	3º01’06’’W
Almeria	ROQ	Roquetas	36º45’30’’N	2º36’06’’W
Almeria	ALM	Almería	36º49’54’’N	2º29’00’’W
Ceuta	CEU	Ceuta	35º53’42’’N	5º18’24’’W

42. The basic unit of analysis for an economist is the fleet that has in common a structure of costs, employment and markets of a specific product. Since fleets are based in particular geographical areas (base ports), a parallel analysis may be made with emphasis on geographical areas where fisheries are exploited. This may also yield interesting information on geographical distribution of employment, production, income lev 3 shows the div el, etc.

43. Table version of the fleet segments in the Alboran Sea, with specification of their characteristics:

Table 3: Fleet Segments in the pilot study

Fleet segments in the pilot study		
Segment fleet	**Definition**	**Characteristics**
1. Minor gears OfS	Multipurpose, < 6 m. length	1 to 3 people Outboard engine Gillnets predominantly
2. Bottom Trawler	Trawler >300 HP	It can work at practical depth > 200 metres
3. Small Trawler	Trawler < 299 HP	It can't work at practical depth > 200 metres
4. Medium Purse Seiner	Seine > 30 TRB	
5. Small Purse Seiner	Seine < 29 TRB	Not afar from the coastline
6. Surface Longliner	Longliner > 6 m. length	Target species: big pelagics (tuna, swordfish)
7. Longliner + Seiner	Longliner + Seiner	All-year-round activity Not in Spain
8. Drag	Drag	2 or 3 people Target species: molluscs Not in Morocco
9. Minor gear OnS	Multipurpose, >6 and <10 m. length	1 to 3 people Onboard engine Gillnets predominant

44. Due to this distribution of the analysis, the study was defined by the existence of 9 fleets and 16 geographic areas. For each of these, 15 indicators for the year 1998 were used. This resulted in 15 matrixes, each of 144 variables of dimension.

45. The study obtained a large amount of results that we are going to develop briefly with the help of some graphic illustrations in order to understand the utility of these indicators.

46. The first rank of indicators refers to the **Physical Production** expressed by the weight of catches landed by all the fleet segments.

47. Looking at the Vessel Physical Productivity (VFP) it can be seen how the average production of vessels in terms of weight of landings varies greatly from one vessel to another; LOUs with greater power and tonnage stand out.

48. On the Capacity Physical Productivity (CFP) can be seen the average production of each LOU in terms of weight of landings per capacity unit (expressed in GRT) and the Power Physical Productivity (PFP) that shows the average production in terms of weight of landings per power unit (measured in HP). In both cases the values are not as dispersed, but, again, bigger vessels obtain a higher productivity. It also becomes evident how productivity is growing in ports located in the very eastern areas.

49. The Per Vessel Hour Physical Productivity (HFP) shows the average production in terms of weight of landings per hour of fishing, including, therefore, time spent at sea. Two big groups can be differentiated. Whereas higher-capacity vessels catch around 50 to 100 kg per hour of fishing (except

medium purse seiners from Beni Ansar, which achieve 250 kg.), the other ones (artisanal-like and longliners) catch about 5 kg per hour or less.

50. A second series of indicators refer to **Economic Productivity** in terms of the value of landings of all the fleet segments.

51. Vessel Productivity (PV) shows the average production of each vessel according to the value at first sale. A first approach reveals, in terms of value of landings in each segment, the differences between ports are more significant than between countries.

52. The Capacity Productivity (PGT) shows the average production in terms of value at first sale per installed capacity unit (GRT). When the resulting pictures are similar, productivity is high with regard to the capacity of longliners in segment 6, especially for some Spanish ports. Again, the global differences between ports are more significant than between countries.

53. The Power Productivity (PP) shows the average production in terms of value at first sale per power unit (HP) of vessels of each LOU. This time, we find a higher productivity among some Spanish segments, mostly among small trawlers (3), longliners (5) and dredgers (8). This may be due to a more efficient use of power by these medium-sized segments, which is usually excessive in the Western Mediterranean area anyway. The structure of the other segments is similar.

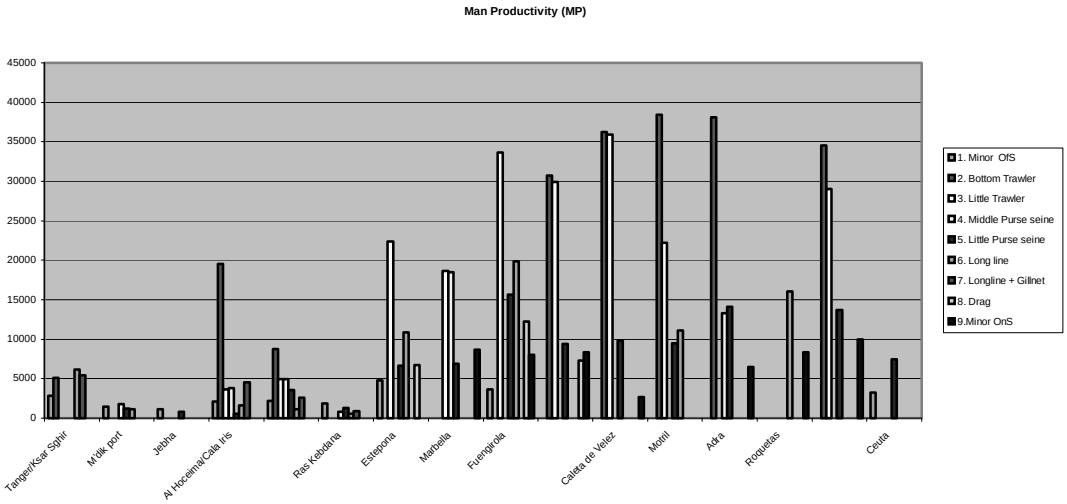
54. The Per Vessel Hour Productivity (PVH) shows the average productivity in terms of value at first sale per fishing hour. Again, there are similar patterns in Spain and in Morocco. Although there may be some differences regarding time schedules, the productivity per hour tends to be similar. Some Morocco LOUs achieves very high results.

55. **Indicators related to employment.** To sum up, it is on the labour field that there are greater differences among the countries surveyed, even though there are remarkable similarities. The Man Physical Productivity (MFP), which shows the average productivity in terms of weight of landings per employed man. It is remarkable the high physical productivity of purse seiners, despite the big crew they employ.

56. The figure 1 shows the outcomes of Man Productivity (MP) as the average productivity in terms of value at first sale per employed man (in dollars). The results, except in the case of middle trawlers of Al Hoceima, are far better for Spain. Undoubtedly, this is due to the lower number of sailors per vessel in purse seiners and trawlers (segments 2, 3, 4 and 5).

57. The Average Wage (AW) expresses the mean salary (in dollars) gained in each LOU. Since we know that the structure of the parts is similar between Spain and Morocco and since we count on the results achieved concerning MP, the wage levels can be anticipated. The salaries are significantly higher in Spain. This is due to a higher standard of living in Spain (consequently, the costs are higher too). The worst salaries in Spain can be attributed to part-time activities (remember that we are talking about annual income). In Morocco, the lowest salaries are paid in ports found in areas with insufficient road communication and in the more artisanal-like activities. In spite of the differences existing between the two countries, we find LOU with similar levels in the two countries. This tells us that, in some segments, as the standards (and the costs) of living are different between the two countries, a given salary is an inviting salary in Morocco, while being little attractive in the Spanish labour market.

Figure1



58. The Salary Costs (SC) shows the costs in dollars for the owner or businessman. These data may underrate reality, since sailors usually keep a little share of the catches as salary in kind. We may appreciate that the costs are quite similar in some segments (2, 3, 4 and 7), whereas in other cases they are significantly lower in Morocco. Although in Morocco the salaries are lower (as compared to the standard of living), the salary costs for some Moroccan owners are quite similar to those in Spain, due to the great number of crewmembers, especially in medium purse seiners and trawlers.

59. To sum up, it is on the labour field that there are greater differences among the countries surveyed, even though there are remarkable similarities. It would be very interesting to have time series of these indicators to assess the labour trends in time.

60. **Capital-related indicators** As a result, it can be summarized that yields are negative for a considerable group of segments in both countries, even the GEP without deducting OP in any case. The reason is that the fishing activity in these segments has a negative resultant if all costs are adequately considered. However, once the investment has been made, and once there is no alternative for the capital used, a given activity is often kept without taking into account opportunity costs or depreciation either.

61. The Landing Prices (LP) represent, the average prices of catches. We find remarkable the high prices achieved by artisanal segments (1 and 6), as well as the low prices at which catches were sold in the most isolated ports. This is so even in Morocco the segments of purse seiners (4 and 5) and even the segments of trawlers (2 and 3). In these segments the prices were about 1 dollar/kg, well below the European markets (frequently the final destination of this production). Many causes may explain this, but most of them have to do with product quality (product processing and preservation) and transportation.

62. The Invested Capital (IC) indicates the current average value of vessels for all segments of a LOU. As you can see, there is a great resemblance between the two countries as far as investment figures are concerned. Differences among ports are to be accounted to the wide range of vessel sizes.

63. On the basis of the available data, we can make an estimation of the total capital invested in the area, which would be as high as 300 million dollars approximately. The figures 2 and 3 show the results of

this estimation. Contrary to the situation in Morocco (where investments are concentrated in a few ports), in Spain investments are quite evenly distributed; although in Morocco some of the artisanal-like ports are located in other ports or rather landing sites). The estimation shows the important investing effort made by Morocco in the fishing sector. In figure 4 we may appreciate that there is a virtually equivalent investing effort, although investments focus on partially different aspects.

Figure 2

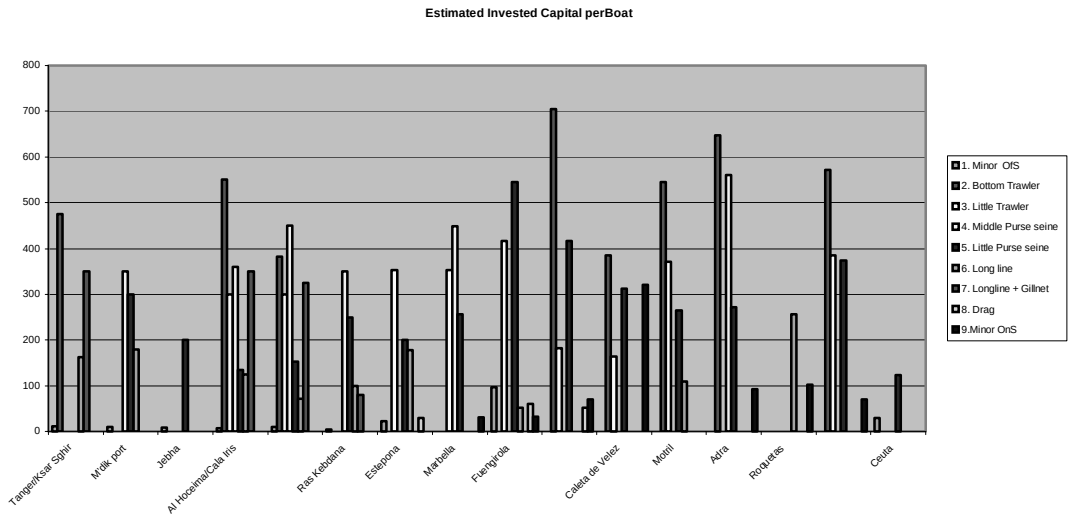


Figure 3

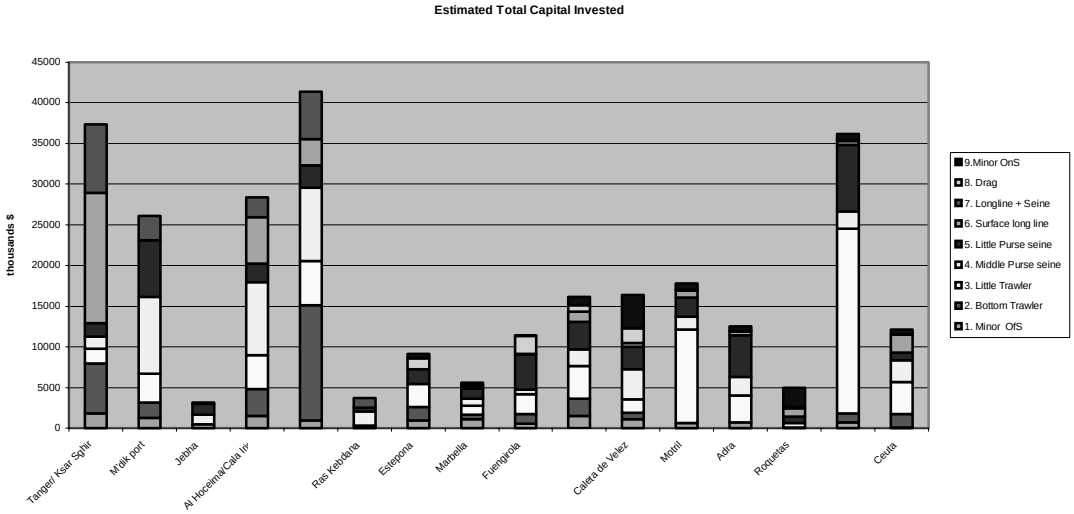
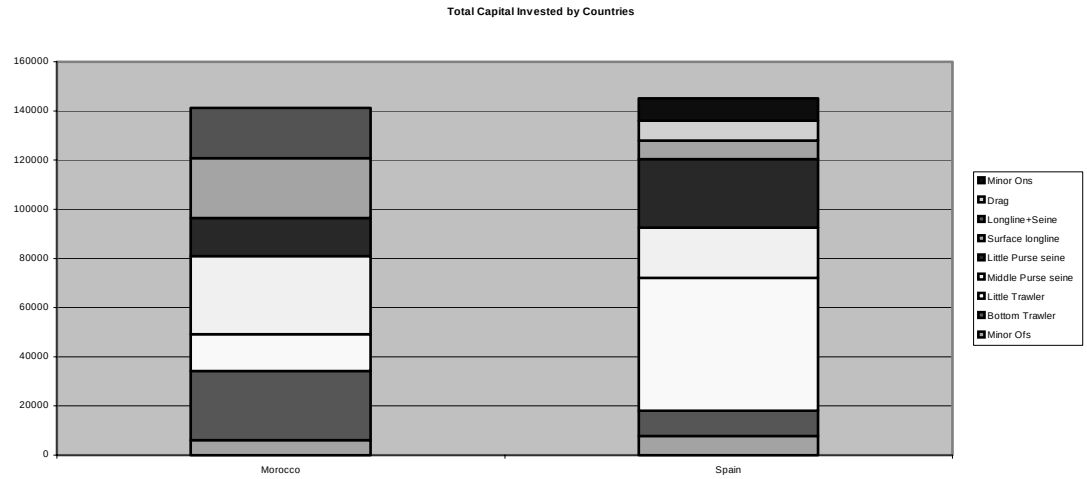


Figure 4



64. Costs assessment and profits deduction have been illustrated in the figures 5 and 6 provide a global view. On them we may see the aggregate costs (OP, SC, CD, YFC[12]) of the two countries and of all the fleet segments related to each kind of GEP result without deducting OP[13], GEP and NEP[14].

65. As a result, we may see that yields are negative for a considerable group of segments in both countries, even the GEP without deducting OP in any case. The reason is that the fishing activity in these segments has a negative resultant if all costs are adequately considered. However, once the investment has been made, and once there is no alternative for the capital used, a given activity is often kept without taking into account no opportunity costs or depreciation either.

66. These results were only apparently unexpected, since in small enterprises losses entail a reduction of wages for the investor himself, who is also a worker and has no other employment alternative.

67. Despite all these reasons, and especially in those cases where the OP cost is not deducted from the GEP, it is highly probable that any fishing enterprise yielding negative results will eventually disappear. The question here would be why that activity was implemented. And the most likely answer is that, at the beginning, investing in such enterprise seemed worthwhile and had good prospects. In this regard, these negative results may be warning us of a deterioration of either the resources or the markets.

12 Opportunity Cost (OP), Salary Costs, Costs related to fishing activities (Costs per output x Number of outputs) and Year Fixed Costs (YFC)

13 In our estimations, we have considered 5% as real interest rate for Morocco, instead of 12% nominal rate in 1999. This is meant to prevent an excessive lowering effect of the opportunity cost, which should be carefully considered in the light of the interest rates of each international financial market, altogether deducting the effects of local inflation.

14 The Gross Estimated Profit (GEP) expresses the amount of income obtained by ship owners as a whole, once operational costs have been deducted. These include: Salary Cost (SC), Opportunity Cost (OP), Costs related to Fishing Activities (CD) and Year Fixed Costs (YFC). In order to assess the effects of Opportunity Costs, which are not usually regarded by fishers, it has been incorporated in the GEP without deducting this cost. On the other hand, the Net Estimated Profit (NEP) shows the volume of income obtained by the owners, once depreciation has been deducted from the GEP. It strictly shows profits in a theoretical sense as explained in the methodological introduction of this study. A feasible activity must have a NEP above zero (not negative).

Figure 5

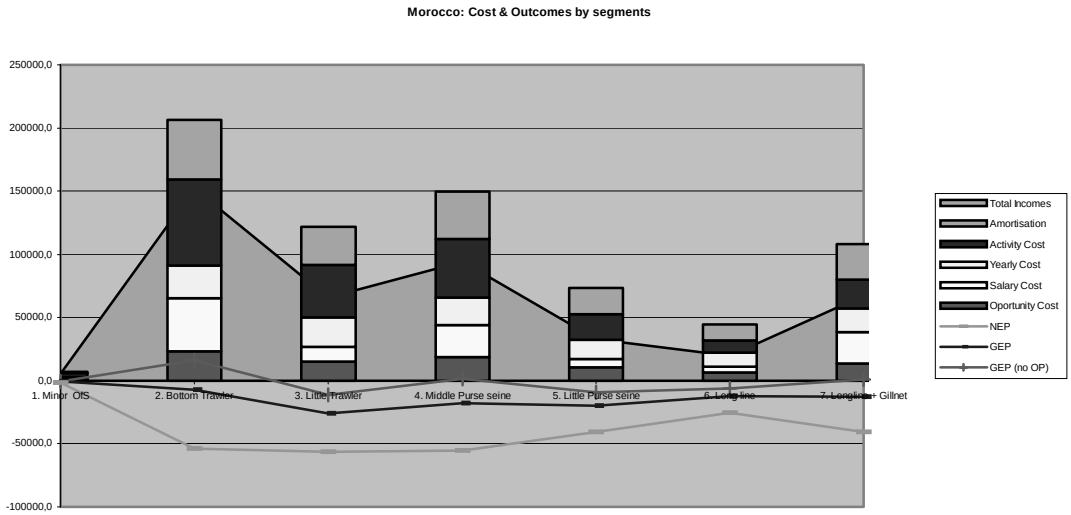
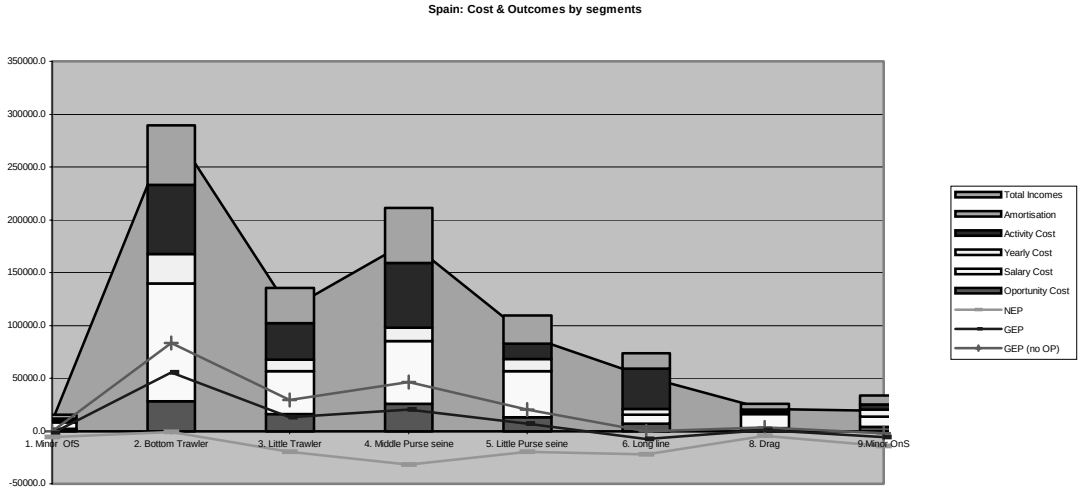
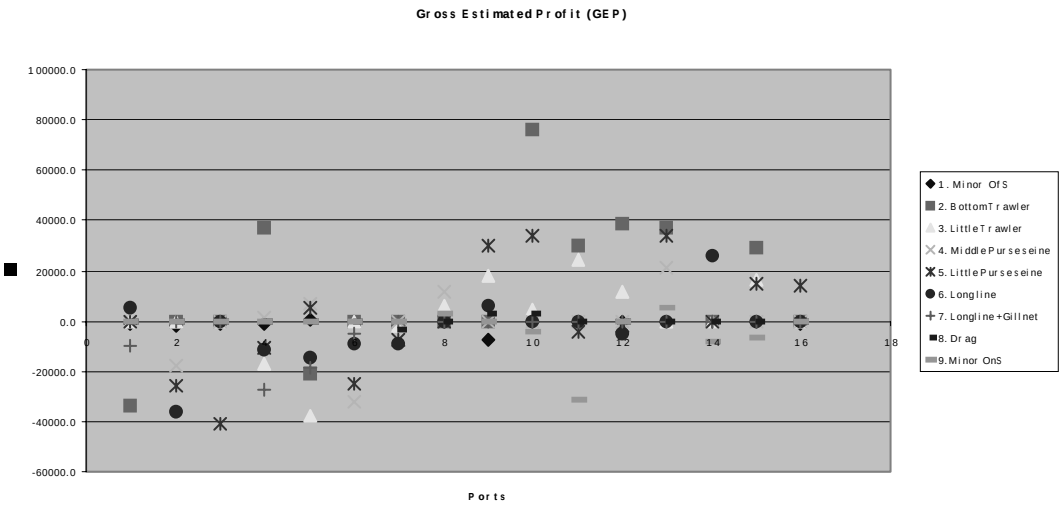


Figure 6



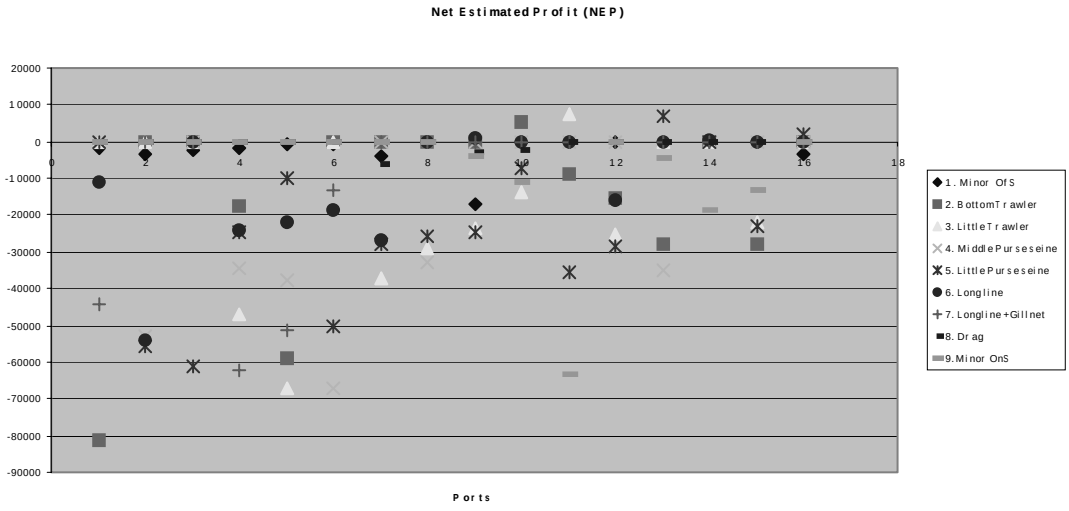
68. Figure 7 shows the structure of the Gross Estimated Profit (GEP) for the whole set of segments analysed. The ports have been arranged from 1 to 16 in the x-axis (from Tangiers to Ceuta, in the same order as in the tables). You can see how the GEP values are higher in the Spanish ports. The value of most segments is close to zero. You can also see that some values differ greatly between ports within the same segment.

Figure 7



69. Figure 8 shows the Net Estimated Profit (NEP), which is the size of profits obtained by the owners as a whole after deducting depreciation costs[15]. The results here are even more negative. Almost all segments, both in Spain and in Morocco, with higher production capacity have yielded clearly negative results. Remember that, on the long term, only those segments with values above zero are sustainable.

Figure 8

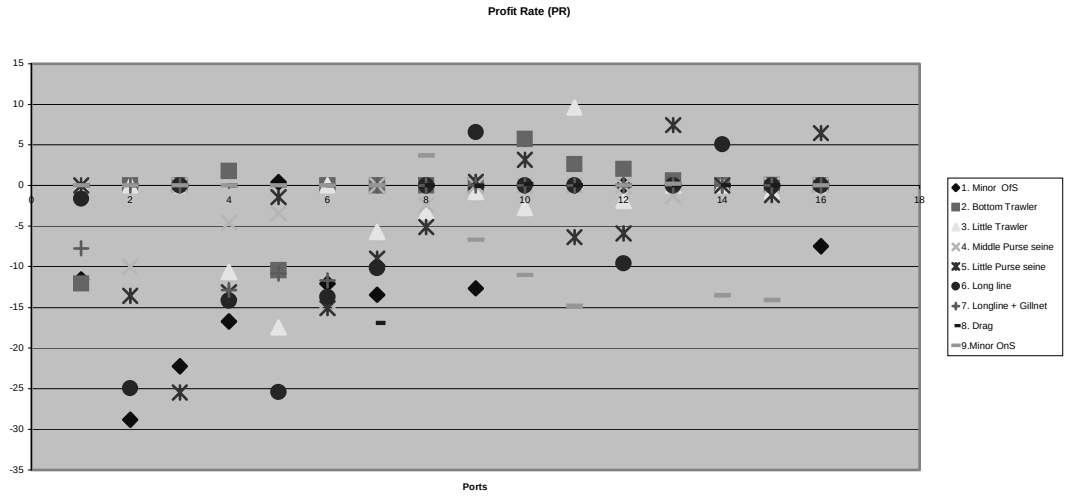


70. The pessimistic picture drawn by the previous graph is slightly lessened by figure 9. This graph shows the Profit Rate (PR) level, which is the percent ratio of annual net profits plus the lost-opportunity cost to the amount invested. Here the profits are most apparent. Even though they are lower than interest rates (real interest rate is 5%), they are positive in a greater number of segments. The most remarkable aspect of this graph is that if we look at the results in relation with the invested amount, some artisanal

15 Remember that, in calculating the depreciation costs, the shelf life has been estimated as being 10 years.

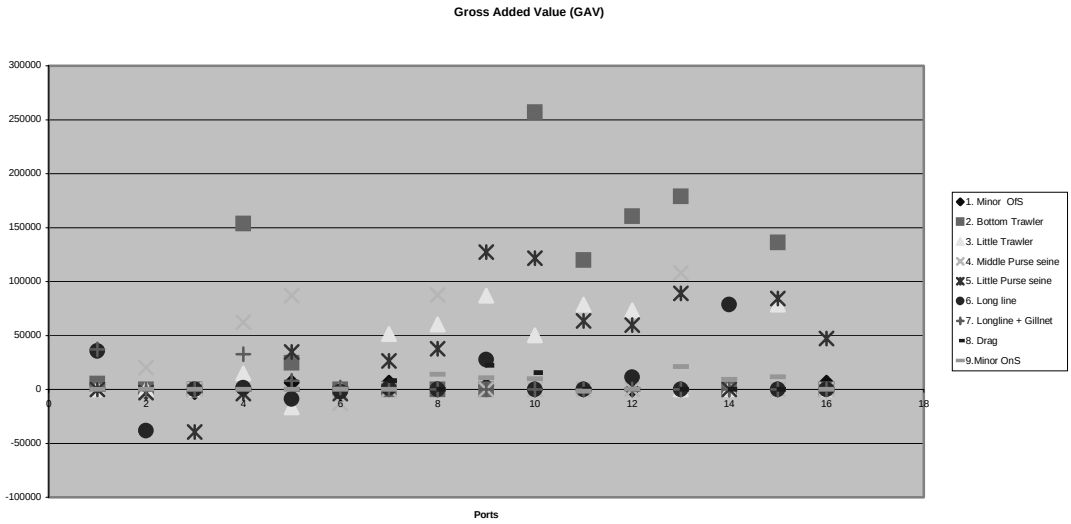
segments whose NEP was negative but seemingly close to zero have highly negative results if expressed in percent values, their negative PR ranging from 15% to 30%.

Figure 9



71. Finally, figure 10 shows the Gross Added Value (GAV). This indicator expresses the added value provided by each segment to the economy of that country. Accordingly, the graph considers salaries, profits, lost-opportunity cost and depreciation (which eventually implies a demand for new machinery and equipment). Although in some cases the NEP is negative, the GAV is positive for most segments. This suggests that fisheries produce a positive economic effect on the national and regional economies where they are found. In theory, the large amount of capital invested in these fisheries (as we have seen earlier, the amount of capital invested amounts to approximately $ 300 million) should prove more rewarding and more cost-effective than it actually is. In practice, however, the yields of that capital are as positive as they can be and could be improved only if other better alternatives were implemented. Notwithstanding, those better alternatives may be in some cases unaffordable to the communities living on the coasts. For that reason, even though the indicators advise in many segments against any further increase of investments (i.e., building more vessels), it does not follow from that investments need to be reduced, at least as long as any re-structuring is achievable. The GAV figures suggest that fisheries have a positive effect on the economies in the short term. That explains why fishermen are reluctant to quit their occupations. And this is the case even of fishermen from segments where yields are significantly below what is considered as financially sustainable on the long term.

Figure 10



72. These results were only apparently unexpected, since in small enterprises losses entail a reduction of wages for the investor himself, who is also a worker and has no other alternative employment.

4. Conclusions

73. The use of these economic indicators should permit to know the capacity level of the main fleets and gear types; on the other hand, together with other indicators (especially biological indicators), they should be used as an objective guide for the analysis of management proposals made or measures taken for any region.

74. The decision-makers can benefit from the information provided by the economic indicators, which allow them to obtain a synthesis of the socio-economic traits of each area. As it is essential for them to count on objective data in order to support the measures taken and direct fisheries towards sustainability.

75. One important suggestion would be to incorporate a time perspective into the database in order to obtain dynamic studies for the indicators, which will help to monitor the evolution across time of regions, segments and measures taken. National administrations should ensure a systematic compilation of at least part of the information used in order to guarantee the continuity of the task.

76. On a more specific basis, the pilot study case in the Alboran Sea has revealed how investment on fisheries is distributed as well as the economic impact of investment. It has also allowed the assessment of the difficulties suffered by each segment and a detailed analysis of the fishery models applied in each country and port.

77. The study has also demonstrated that there are fewer differences between the costs and investment structures than could be thought at first. It has provided a more detailed insight into the existing social differences.

78. This study has analysed what segments and LOU are in better and in worse conditions. This information is of paramount importance for the decision-maker, since it will provide him with objective data that will guide him in making all sorts of decisions, especially when these decisions concern different ports and segments.

79. This analysis has shown that highly diverse situations can be found: there are both segments in crisis and highly dynamic LOUs. It should not be forgotten that each of these situations requires an approach and solutions of its own.

80. Finally, this study has contributed to a better definition of the specific characteristics within the management area, which has revealed where the main difficulties are found as well as the economic and social impacts of those difficulties.

81. This kind of analysis allows the elaboration of maps of resources, conflicts and potentialities from an economic perspective. It has also shown the distribution and the extent of investments, exploitation and use as well as of profits, thus enabling a clear picture of both similarities and dissimilarities between segments, ports and countries.

82. Neither the methodology proposed nor the indicators selected in the present study are the only possibility. For instance, it has been suggested that it would be interesting to include more social indicators, such as mean age of fishermen, number of children, education, etc. The point is actually to find equilibrium between what information is necessary and the effort required compiling any data. All in all, the most demanding task in preparing a study like this is the information compilation.

83. The indicators herein should eventually enable the development of a simulation methodology. In fact, the information that is available at the moment makes it possible to perform simulations on the basis of alternative scenarios (for instance, on the productivity of capital or of manpower). However, any such simulation has to be developed relying on the existing results. This requires an effort to take better advantage on the new possibilities for fisheries management offered by these indicators. To sum up, our aim now is to develop simulation systems that make it possible to anticipate how different management alternatives may help fishing communities to adjust their fishing capacity so that fisheries become sustainable both in economic and in biological terms.

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