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Socio-economic quantification of fishing in a European urban area: The case of Vigo

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Abstract

General data would seem to indicate that aquaculture and extractive fishing are primary activities with a greater presence in developing and less industrial economies. Despite the scant importance of fishing in the EU (in terms of GDP and employment), it remains a focal point of EU activity by means of the Common Fisheries Policy (CFP). The CFP establishes measures aimed at supporting fishing, often assuming that it is localised activity in rural, less developed regions. This study looks to quantify the importance and economic and social impact of primary fisheries and aquaculture activities in a European urban region (the area of the Ria of Vigo, in Galicia, Spain) through an exercise based on an input-output approach. The exercise carried out will provide results that imply a total impact that could reach around 7 per cent of the study region's income and employment. From these results it can be concluded that fishing as a primary activity may also be relevant in EU urban areas; therefore, fishery management and support measures within the CFP should bear this differentiated reality in mind.

Keywords

Socio-economic impact, fisheries sector, Vigo.

1. Introduction

According to the FAO [1], in 2010 the world's primary fisheries and aquaculture sector reached a global production of almost 150 million tonnes, a large proportion of which (86 per cent) was mainly destined for human consumption (18.4 kg per person per year). Most of this production took place in developing countries, mainly in Asia (China, Indonesia, India, Vietnam, Bangladesh, Thailand, and so on). In spite of the importance of fish as a food, in most countries these primary activities of fishing and aquaculture represent less than 1 per cent of the total GDP [2]. The fish consumption needs of developed countries are satisfied to a large extent through imports. These developed countries absorb approximately 76 per cent of global imports in terms of value [1], which, for the most part, come from developing countries. For its part, in the European Union the primary fisheries and aquaculture sector accounts for less than 0.06 per cent of total GDP and 0.13 per cent of total employment in the EU (27 countries) [3].

In a recent study, Morrissey and O'Donoghue [4] showed how in a European urban area such as Dublin, the main marine activities can be relevant with regard to their contribution to the GDP and employment but, mainly, in the marine services sector (ship owners, port & maritime logistics, marine tourism, international cruise, marine commerce, etc.). If focuses attention on the activities which directly impact on living resources (sectors with 03.11 and 03.21 codes of the statistical nomenclature of economic activities NACE Rev.2 [5-6]), general data would seem to indicate that aquaculture and extractive fishing are primary activities more typical of developing economies which are of scant economic relevance in countries with higher income levels and more industrial and urban economies. In spite of this, fishery and aquaculture activities continue to occupy a significant part of government action within EC institutions, action which is focused on the Common Fisheries Policy (CFP) [7-12]. These European policies – and in particular the structural aid provided to the fisheries sector – establish measures aimed at supporting activities in the sector [13-17]. To a large extent, such aid mechanisms are justified by the assumption that fishing is an important economic activity in rural, less developed regions where communities that depend on fishing are located – communities that have very few possibilities of directing their economies towards alternative productive sectors [18-20].

Although this general vision of fishery activity in Europe is to a large extent correct, there are also urban areas with a certain degree of industrialisation where primary fishery and aquaculture activities still continue to be extremely relevant to the region's total production, income and employment. Political action in fishery affairs can also have significant effects on these areas. In order to evaluate these effects, it is common to use approaches based on input-output or social accounting matrixes (SAM) [21]. Insofar as fishing is concerned, these methodologies have been applied for the analysis of regional economic impacts [22-30], for

the evaluation of the impact of certain situations in the fisheries or the marine environment [31-34], and for the evaluation of the impact derived from the application of fisheries policy measures [35-37].

The aim of this study is to evaluate the importance and economic impact (in terms of production and value added) and social impact (in terms of employment) of primary fisheries and aquaculture activity in a European urban zone (the area of the Ria of Vigo), through an exercise based on an input-output approach adapted to the specific needs and characteristics of the subject to be studied. To this end, the agents in the fisheries sector to be considered and the field of study are identified and defined in section 2, and the information available will be showed in order to be able to quantify the basic economic aggregates of fishery activity in the region. Section 3 comprises a brief presentation of the input-output methodology used to quantify the socio-economic impacts. In section 4, the results of the quantification of impacts is shown, differentiating between those linked to the production activity itself and other direct, indirect and induced impacts on the remaining economic activity sectors. Lastly, in section 5, the study's main conclusions are summarized.

2. Definition of the nature of the study and the information available

The basic objective of this study consists of estimating the global socio-economic impact of the fisheries sector in the Ria of Vigo deriving from production activity itself but also from the additional effect that this activity has on the associated branches of production and on the local economy as a whole. This additional impact will be linked to the injection of demand in the other branches of economic activity that derive from the expenditure related to the existence of the fisheries sector in the Ria of Vigo.

2.1. Definition of the agents and study area

From a broad perspective, the fisheries sector can be defined as the set of processes and activities which makes it possible to have fish products available to satisfy people's food requirements. Such a definition, therefore, encompasses all the activities linked to the production, processing, manufacturing, distribution, management and marketing of marine products. However, in this study it will employ a more restrictive definition of the fisheries sector since it will only take into consideration extractive fishery activities (code 03.11 in NACE Rev.2) and production linked to marine aquaculture (code 03.21 in NACE Rev.2) in the municipalities of the Ria of Vigo.

The Ria of Vigo is a natural estuary with an important fisheries tradition. It is located in the south-east of the province of Pontevedra (NUT3 region), in the Autonomous Community of Galicia (NUT2 region), Spain (See Figure 1).

Figure 1

In terms of administration, this study area is made up of eight municipalities (Cangas, Moaña,

Vilaboa, Soutomaior, Redondela, Vigo, Nigrán and Baiona): basic data for these regions from the end of 2009 is shown in Table 1. It is a densely populated area: its population accounts for 43.2 per cent of the total population of the region NUT3 to which it belongs [38]. The area has an income that is slightly higher than the average with respect to both the province of Pontevedra and the region of Galicia as a whole.

Table 1

In spite of the mainly urban nature of the municipalities of the Ria of Vigo – more than 50 per cent of the population live in high-density clusters [39] – the activities linked to fishing and aquaculture are very varied and continue to have a high presence today. In the official registries of fishing vessels [40-41], some 835 vessels are still linked to different fishery activities or segments (see Table 2). This fleet represents approximately 16.95% of the GT of the Spanish fishing fleet as a whole. In principle, it is possible to identify six different activity segments: shellfish harvesting, aquaculture, artisanal fishing, coastal fishing, deep sea fishing and distant water fishing.

Table 2

Shellfishing is a specific type of fishing activity focusing mainly on shellfish harvesting (for the most part, bivalve molluscs). It is an activity half-way between gathering and extensive aquaculture, as most of the work is carried out on intertidal beach areas with very elementary production means; normally, a support vessel is not necessary, and it is not a very professionalized segment (most of those working in this segment are women working part-time to supplement the family income with what they earn from shellfishing).

The Aquaculture segment is made up of floating platforms installed in the middle of the ria ("bateas" or rafts) and other land-based aquaculture facilities. According to the Xunta de Galicia [40], in 2011 there were 731 aquaculture facilities in the Ria of Vigo, of which almost 90 per cent were rafts used mainly for mussel farming. This activity requires auxiliary vessels (see Table 2) with the equipment required for this type of floating aquaculture farming.

The artisanal fleet segment is made up of the smaller fleet vessels, which normally operate some 200 days a year in the inland waters of the Ria of Vigo. The average length of these vessels is approximately six metres; they have a low capacity, small-powered main engines and are manned by one or two crew members, who are normally not salaried employees [42]. These artisanal fishing vessels use different types of fishing equipment that they can change over the course of the year, and their catches are on average highly-valued species (mainly crustaceans, molluscs and groundfish) which are sold fresh in the daily fish auctions at the markets in the area.

The coastal fleet segment includes small-sized fisheries which operate in the fishing grounds of the Galician-Portuguese coast, preferably outside the rias. The vessels are considerable in size and capacity (an average of 20 m in length and some 100 GT) and have an average of around

8 crewmen per vessel [42], although this varies according to the type of fishery (hake, sardine, horse mackerel, mackerel, etc.). They also sell their fish fresh, mainly in the fish market of the Port of Vigo.

The deep sea segment is made up of an industrial fleet, whose radius of action is much more extensive than that of the aforementioned segments. These vessels, measuring on average almost 37 m in length, fish in the Community waters of the Celtic Sea, in third-country waters such as North Africa or the international waters of the Atlantic Ocean. Average crew numbers in this segment are 10 in the case of trawlers and 12 in the case of longliners [42]. In the majority of cases, Vigo is the base port for this segment, and vessels make use of that city's port facilities for the sale of their products. However, given the remoteness of habitual fishing grounds, vessels may also land their catches in other ports and transport their products to Vigo fish market over land.

The distant water segment encompasses the larger enterprises and fishing vessels, usually measuring more than 50 m in length for trawlers or freezer seiners and 30 m in the case of surface longliners. Average crew numbers vary from eight or nine in the case of longliners to 16 in the case of trawlers and seiners [42]. The vessels operating in this segment fish in very distant areas, both in international and third-country waters. A large proportion of their frozen products are destined for the port facilities of Vigo, transported in merchant ships in refrigerated containers, while another proportion of products is still landed by the fishing vessels themselves. These frozen products are treated as merchandise, and do not have to be sold at auctions in fish markets. Once the products have been landed they are stored in the numerous refrigerated warehouses in Vigo's port area, which specialize in fish products and have a storage capacity of almost 700,000 m^3 [43].

2.2. Available information and estimates of key aggregates

Once the agents in the fisheries sector and study area have been defined, it is necessary to identify the precise information that makes it possible to estimate key economic aggregates for fishing activity in the Ria of Vigo. In order to calculate the revenue generated by the fisheries sector by segment, two sources can be used according to the competent administrative body: regional or state. On the one hand, the data on first sale of fresh fish and shellfish in the markets of the Ria of Vigo are registered by the regional authorities (the Xunta de Galicia, [44]) and published according to species and market on the virtual portal www.pescadegalicia.com. On the other hand, data on first sale of fresh fish and seafood in the Port of Vigo (Vigo Port Authorities, [43]), which is dependent on the Spanish state government, is also available, as well as data on the fish products landed which are frozen or salted in Vigo's port facilities. In 2010, a total of 787,458 tonnes of fish and aquaculture products were landed in the port facilities of the Ria of Vigo (see Table 3).

Table 3

In principle, it can be assumed that the fresh products landed in the ports of the Ria of Vigo

come from the fishing fleet in the study area or a fleet with strong trade links to the area. Nevertheless, it is not known what proportion of the total frozen catch managed by the port facilities of Vigo correspond to the fleet with an actual link with the economy of the study area, since the products landed by merchant or container ships are mainly imported. Given such difficulties, it seems wise to only take into consideration the frozen fish landed by the vessels belonging to the distant water segment, since there is at least clear evidence of its links to the area's economy. These are usually vessels that, regardless of their flag state, have strong links with fishing enterprises in the local economy (fishing companies with branches in other countries, refrigeration companies, fish processing companies, and so on). In any case, the very fact that these vessels dock in the Port of Vigo to land their products generates significant economic activity, both in terms of sales and trade of their catches and in terms of activities related to the provision of various port services, the recruitment of crew, the demand for provisions and supplies for vessels, or the demand for vessel repair and maintenance services, fishing equipment and tackle, onboard preserving and processing, and so on. Therefore, it is assumed that the only fisheries production that will have an influence in the area of the Ria of Vigo is that which is traded fresh in the area's fish markets and the frozen or salted fish products that are landed by the fishing vessels themselves (so landings of frozen fish from container ships or reefers were not taken into consideration). This conservative hypothesis means restricting the production considered to have a potential socio-economic impact in the study area to 167,746 tonnes, which represents just 21.3 per cent of the total fish products landed in the port facilities of the area.

Once the fisheries production to be taken into consideration by the study has been defined, it must proceed to assess the value of this production. In the case of fresh products, information on the value attained by these products at first sale in fish markets is available. In the case of frozen and salted products, the available information is that reported by Vigo Port Authority, which corresponds to the value declared by fishing enterprises on the initial value of products landed. This information takes the form of the payments corresponding to the appropriate port taxes. Thus, in both cases it is talking about values calculated before the application of indirect taxes on products and before that any other distribution or sales process has taken place, meaning that it can assume that these are sales at basic prices. With a view to being able to estimate the main economic aggregates related to revenue of the fisheries and aquaculture sector linked to the Ria of Vigo, it is necessary to assign this production to each of the six different segments of activity. Evidently, the capacity to generate value added or employment varies enormously from one kind of activity to another. This classification of the production according to segment is carried out in line with the type of product landed and the characteristics of the vessel and fishing method employed. A summary of the classification carried out can be found in Table 4.

Table 4

The 167,746 tonnes of fisheries production considered to be linked to the area of the Ria of Vigo in 2010 generated a total revenue at basic prices of EUR 394.4 million. A total of 45.7 per cent of this revenue corresponds to the distant water fishing segment and 27.4 per cent to deep sea fishing, while the remaining 26.9 per cent corresponds to the other 4 segments of fishing activity taken into account (shellfishing, aquaculture, artisanal and coastal fishing). Based on figures of Table 4, it is possible to estimate the main socio-economic aggregates of these segments of activity. To this end, data published by the Ministry of the Environment and Rural and Marine Affairs of the Spanish national government on the structure of inputs and main economic data per segment and fleet type [42, 45] is used. This data was obtained by means of surveys representing a large number of fishing and aquaculture enterprises in Spain and referring to their economic performance for the year 2010. In the case of extractive fishing, the survey distinguished between three fleet types according to fishing zone (North Atlantic, Mediterranean and Other Regions). Within each region, a distinction was also made between different segments according to the fishing method employed and the length of fishing vessel. In the case of marine aquaculture, the population of aquaculture enterprises were ordered according to the type of establishment (dry land, natural areas, horizontal farming, vertical farming, and cage farming) and according to the main species farmed (fish, molluscs, crustaceans, invertebrates and aquatic plants).

Applying the results of the aforementioned surveys to the segments and fishing and aquaculture types examined by this study, the results shown in Table 5 were estimated.

Table 5

For the set of fishery segments taken into consideration, the expenditure on intermediate consumption represented 45.5 per cent of their production at basic prices, while the remaining 54.5 per cent denotes the value added generated. These EUR 214.9 million in value added reported for fishing and aquaculture activity directly accounted for 3.1 per cent of Gross Primary Income and 3.35 per cent of Gross Disposable Income of the set of 8 municipalities in the Ria of Vigo (see Table 1). Of this total value added, 58.2 per cent is allocated to employee remuneration. Moreover, a significant proportion of the Gross Operating Surplus (GOS) / Mixed incomes (approximately 18 per cent of the total) are mixed incomes related both to the work and the property of the fishing enterprise. This proportion of mixed incomes is greater in the segments of activity that are less industrialized – such as shellfishing, aquaculture and artisanal fishing – in which it is common for owners of vessels or enterprises to also form part of the crew or staff. Estimated employment in full-time equivalents (FTEs) reached a total of 6,602 people. The aspect of full-time employment varied across the different segments, although it was always situated between 1,700 and 1,800 annual hours of work. A total of 25.9 per cent of the total employment was generated in the deep sea segment of activity, while 21.2 per cent corresponded to distant water, 19.3 per cent to aquaculture, 14.3 per cent to coastal fishing and the remaining 19.3 per cent to shellfishing and artisanal fishing. This

overall employment figure accounts for approximately 3.9 per cent of the population in employment in the eight municipalities that make up the Ria of Vigo.

3. Methodology employed in the evaluation of socio-economic impacts

In the previous section it was estimated that the activity carried out by fishing agents in itself represents a significant proportion of production, income and employment in the area of influence of the Ria of Vigo. However, the socio-economic effects of the activity are not limited to its contribution to each fishery segment. In order to carry out their activity, the economic agents in the fisheries sector make expenditures on goods and services in other economic sectors. A substantial proportion of the income generated by fishing activity is also spent on meeting the normal consumption needs of households. In other words, the activity of agents in the extractive fisheries sector carries with it an associated set of expenses that are eventually translated into an increase in output, value added (income) and employment in the branches of activities that fulfil this additional demand for goods and services. Evidently a large proportion of these supplier enterprises that fulfil demand are also located in the area of the Ria of Vigo, meaning that the existence of the fisheries sector has a clear additional socio-economic impact on the economy of the area as a whole.

In general terms, the evaluation of the economic impact of a particular activity involves measuring the effect that this activity has on production, income and employment. It is possible to identify two types of impact generated by an activity:

- Direct and indirect impacts: These derive from an increase or decrease in the demand for products from those sectors that directly supply inputs to the fishery segments, as well as those deriving from the variation in the output and intermediate consumption of these supplier sectors and other related sectors (cumulative effect).
- Induced impacts: These are the impacts that derive from the ripple effect caused by the reduced or increased availability of households' incomes for spending on products in the local economy.

This kind of analysis is based on what is called a "counterfactual" exercise, since it involves evaluating the possible socio-economic repercussions that would be generated for the economy of the study area if the segments of the fisheries sector did not exist. The overall economic impacts linked to a particular activity and associated with an increased demand can be estimated as the sum total of the direct, indirect and induced effects [46]. In order to estimate these impacts it can use the input-output method, since it expressly takes into account the different multiplying effects for each of the sectors of an economy which are interrelated in different ways and to varying degrees.

An input-output table is a well-known method of offering a description of the real functioning of an economy over a certain period of time, highlighting and quantifying the interrelations

between all the elements that make up that economy. On the one hand, tables of this kind offer statistical information that helps to describe the flow of the outputs (goods and services) between the different agents that make up production sectors and from these sectors to consumers (households or public institutions), investment (capital formation) or foreign trade (exports). On the other hand, such tables also provide information that makes it possible to identify the costs and inputs structure required by production branches and the value added generated in each branch (their contribution to Gross Domestic Product, GDP), as well as providing a way of calculating the economic behaviour of consumers, investors and external customers for the products generated in the economy [47-48].

For countries that form part of the European Union, the generation of Symmetric Input-Output Tables (SIOT) is currently carried out according to a common control that obliges the member States to comply with the five-yearly transmission of these tables as of the year 2000 [49]. These SIOTs are created based on Supply and Use Tables that relate products to branches of activity. SIOTs highlight the relationships between the different branches of activity, both in their role as producers of outputs and that of consumers of inputs. While Supply and Use Tables have an essentially statistical nature, symmetric tables have a greater scope for analytical application, and for this reason the latter are usually employed in input-output models in economic analysis (Spanish National Statistics Institute, INE [50]). Moreover, if the flows generated in a territory are taken into consideration exclusively, it is possible to create a domestic SIOT (without imports) which is used to measure socio-economic impacts.

The basic structure of a SIOT can be expressed in the form of algebraic formulae. If homogeneous branches of activity can be identified within a particular economy, the total value of the domestic output of a Branch of Activity i (X_i) can be destined for the Intermediate Consumption of the other Branches of Activity within an economy (X_{ij}), or can be destined to satisfying Final Demand (Y_i) as follows:

$$X_{i\,1} + X_{i\,2} + X_{i\,3} + \ldots + X_{i\,j} + \ldots + X_{i\,n} + Y_i = X_i \qquad (1)$$

By generalizing for the set of n Branches of Activity, it can achieve a system of n linear equations. If it is assumed the Leontief production function ($X_{ij} = a_{ij}\ X_j$), it is possible to quantify the relationships between the different branches of activity. The Technical Coefficient (a_{ij}) represents the factor quantity for the branch i required to obtain an additional product unit from branch j. This relationship requires to assume that the intermediate inputs acquired by a production sector (X_{ij}) will vary in proportion to the actual production of a sector. If it is also assumed the hypothesis of the constancy of technical coefficients, the production function will be linear and stable over the medium term, which means constant returns to scale in production processes and the possibility of estimating production in line with the evolution of demand.

By substituting the technological relationship in the system of n equations previously identified and operating, it is obtained a new system of n equations that can be reformulated in the form

of matrix algebra:

$$(I_{nxn} - A_{nxn}) X_{nx1} = Y_{nx1} \quad (2)$$

Where Y_{nx1} is the matrix column representing Final demand, X_{nx1} is the matrix column representing Output Totals, I_{nxn} is a unit diagonal matrix and A_{nxn} is the matrix containing the Technical Coefficients (a_{ij}).

The result of the operation (I_{nxn} - A_{nxn}) is known as the Leontief Matrix (it is also a matrix that employs n rows and n columns). From the aforementioned calculation it can obtain:

$$X_{nx1} = R_{nxn} Y_{nx1} \quad (3)$$

Where $R_{nxn} = (I_{nxn} - A_{nxn})^{-1}$ is known as the Leontief inverse, comprising the total requirements r_{ij} , which represent the total value of the input coming from sector i directly and indirectly required in order to generate a unit from sector j destined to final demand. If the elements in column j of the Leontief Inverse Matrix add together, then it obtains an indicator of the production required from all the sectors of an economy in order to address a unit increase in the final demand for products (goods and services) generated by sector j. This outcome is known as type 1 Output Multiplier ($MO1_j$):

$$MO1_j = \sum_{i=1}^{n} r_{ij} \quad (4)$$

This indicator reflects the direct and indirect impact that the growth in the final demand of a certain sector can have on the output on the economic system as a whole. MO1 is equal to or greater than 1 unit ($MO1_j \geq 1$), with the understanding that the multiplying effect increases as the value of the multiplier increases.

This type of indicator can also be used to quantify the capacity to stimulate the generation of income and employment deriving from variations in demand. The type 1 Income Multiplier ($MR1_j$) and type 1 Employment Multiplier ($ME1_j$) simply consider the direct and indirect effects on income and employment deriving from increases in final demand in sector j of this economy. In analytical terms it could define them as follows:

$$MR1_j = \sum_{i=1}^{n} v_i r_{ij} \quad (5)$$

$$ME1_j = \sum_{i=1}^{n} t_i r_{ij} \quad (6)$$

where r_{ij} are the elements of the Leontief Inverse Matrix (R_{nxn}), v_i represents the capacity for generating income (Gross Value Added, V_i) by unit of product in sector i ($v_i = V_i / X_i$) and t_i is the technical coefficient for work that represents the number of jobs required in sector i (T_i) in order to generate a unit of its output ($t_i = T_i / X_i$).

In order to be able to estimate the induced effects on output, income and employment it needed obtain the type 2 multipliers. In order to be able to calculate these multipliers it is necessary to incorporate the domestic economies, aiming for the consumption of those economies to be endogenous in the input-output model [51]. To this end, it need to expand

the Intersectoral Transaction Matrix by one column and one row, reflecting the elements X_{ij}, adding the sector of domestic economies as if they were a new production sector (n+1). It can express this new expanded intersectoral transaction matrix as $TA_{(n+1)x(n+1)}$. The elements in the additional column (n+1) of this Matrix (elements $X_{i\ n+1}$) will express the proportion of the output of production sector i destined for final consumption in domestic economies (information which is generally specified in the Input-Output Tables). The elements in the additional row (n+1) of this Matrix (elements $X_{n+1\ j}$) should cover the total incomes generated in each sector destined for household units. In other words, in order to obtain the elements in this additional row would be necessary to deduct all the items that are not channelled into domestic economies (such as retained earnings, social security payments, direct taxes and so on) from the value added of the sector. Nevertheless, this information, disaggregated into production sectors, is not reflected in the Input-Output Tables, and it is not easy to obtain from the existing sectoral statistics [52]. Therefore, in order to estimate their value it is necessary to assume certain simplifying assumptions such as redistributing household consumption according to sector in line with the contribution made by each branch of activity to the total income [53].

From Matrix $TA_{(n+1)x(n+1)}$ and the diagonal total outputs matrix diag X_{nxn} (where the elements of the main diagonal are the values of the vector of Total Outputs X_{nx1}) a new Extended Matrix of Technical Coefficients can be obtained (which it can express as $AA_{(n+1)x(n+1)}$):

$$AA_{(n+1)x(n+1)} = TA_{(n+1)x(n+1)} (\text{diag } X_{nxn})^{-1} \quad (7)$$

The coefficients of the additional column (n+1) of this Matrix $AA_{(n+1)x(n+1)}$ will indicate the direct needs of the production of sector i in order to fulfil a final consumption unit of the domestic economies. Meanwhile, the coefficients of row n+1 of this Matrix $AA_{(n+1)x(n+1)}$ indicate the domestic income generated by each output unit produced in sector j in the economy. Once it has estimated Matrix $AA_{(n+1)x(n+1)}$, it can produce the Extended Leontief Inverse Matrix ($RA_{(n+1)x(n+1)}$):

$$RA_{(n+1)x(n+1)} = (I_{nxn} - AA_{(n+1)x(n+1)})^{-1} \quad (8)$$

Each element of this Extended Leontief Inverse Matrix, which can be expressed as ra_{ij}, will incorporate the total impacts (direct, indirect and induced) a unit increase in the final demand of sector j of the economy will have on the output of sector i. Therefore, it can calculate the type 2 Output Multiplier of production sector j ($MO2_j$) in the following way:

$$MO2_j = \sum_{i=1}^{n} ra_{ij} \quad (9)$$

The changes in final demand will eventually have an impact on the income and consumption of the domestic units which, in turn, will affect final demand. This interactive relationship between demand and income takes place in successive phases until the effect induced by the first variation in final demand disappears [54]. The consideration of this induced effect allows for the definition of the type 2 Income Multiplier ($MR2_j$), which can be expressed as follows:

$$MR2_j = ra_{n+1\,j} + \sum_{i=1}^{n} vr_i\, ra_{ij} \quad (10)$$

where $ra_{n+1\ j}$ represents the elements in the last row (n+1) of the Extended Leontief Inverse Matrix, the ra_{ij} are the remaining elements in the n first rows and columns of the same matrix and vr_i represents the remaining capacity to generate income per product unit in sector i. In order to calculate vr_i, the income already incorporated in row n+1 of the domestic economies of the Matrix $TA_{(n+1)x(n+1)}$ should be subtracted from the value added in order to obtain the quantification of Remaining Value Added: $VR_i = (V_i - X_{n+1\ i})$.

As well as taking direct and indirect effects into account, the type 2 Employment Multiplier ($ME2_j$), also considers the induced impacts on employment deriving from an initial increase in the final demand of sector j and can be defined as follows:

$$ME2_j = \sum_{i=1}^{n} t_i\, ra_{ij} \quad (11)$$

If the Technical Coefficients of an economy (a_{ij}) are known and assuming that these will remain stable over the short term, the equations contained in these algebraic systems allow to carry out simple estimation exercises. Thus, in the case of a predictable final demand, it is possible to estimate the precise production of each branch of activity within the economy required to fulfil this final demand. And in contrast, faced with a fall in demand it is possible to estimate how this will affect the production of each branch of activity within the economy.

It must be borne in mind that these simple models have a set of limitations that should be taken into account when issuing definitive conclusions based on this kind of analysis. Firstly, such models work within the hypothesis of homogeneous branches of activity, when it is known that the technological structure is not identical for all agents in the same branch of activity. The linear production functions of the Leontief model make the intersectoral substitution of intermediate inputs (one primary material for another) or primary inputs (substituting work with capital, for example) impossible, and prevent the existence of increasing or decreasing returns or externalities. On the other hand, the stability of technological coefficients does not seem to be a very viable hypothesis over the long term, above all in a growing and changing world characterized by intense technological innovation in production processes. In any case, and given that these technological changes and variations in coefficients do not usually happen very suddenly, input-output models are very useful instruments for the analysis of the short-term repercussions of impacts on the production mechanism.

In this work, the statistics provided by the Input-Output Framework of the Galician Economy for 2005 [55-56], which is the most recent available input-output source on the economy of the area, will be used to estimate these impacts. Moreover, it is necessary to assume and explain various restrictive working hypotheses (which are explained at each stage) in which the intention is always to adopt a cautious attitude that translates into conservative estimates regarding the final magnitude of the impacts described. It must also take into consideration

that the impact estimate is confined to the Galician economy, and does not deal with the clear influence that this activity may have on the rest of the Spanish economy or abroad.

4. Results of the quantification of the socio-economic impacts

In general terms, the following three different phases have to be completed in order to quantify the socio-economic impacts:

1) Identify the economic agents. As has been detailed in previous sections, this study only takes into account the aquaculture and extractive fishing activities where products are landed in the ports of the Ria of Vigo. A complete analysis should take into account all the agents involved, including – for example – fish traders and fish processing industries. This very restrictive interpretation of the fisheries sector in the Ria of Vigo makes it necessary to assume that the rest of the agents linked to the fishing industry (traders, processing plants, and so on) can carry on their production activity in a normal fashion even if the local extractive fisheries sector (aquaculture and extractive fishing on the Ria of Vigo) did not exist, an assumption which evidently seems highly unlikely in some cases.

2) Quantification of expenditure vectors. It is assumed that the discontinuation of activity in a segment of the fisheries sector in the Ria of Vigo would mean that, at the very least, expenditure linked to its ordinary functioning, investment and fixed capital formation would cease, and that there would be a decrease in disposable income for the everyday consumption of households. Therefore, a vector should be generated to represent the total annual expenditure for each fisheries segment taken into account. The expenditure that would discontinue should be distributed over the different branches of production activity in the economy (in the case of the input-output context in Galicia 73 activity branches were distinguished). In accordance with the standard input-output methodology [57], these Total Expenditure Vectors are expressed in acquisition prices (VTE ap), which have to be converted into basic prices (VTE bp) taking the information on net taxes on the product (principally, VAT) into account, as well as distribution costs (trade margins and transport costs). Taking the potential contribution made by each product type into account, it is then possible to obtain sectoralized vectors for Domestic Expenditure at basic prices (VDE bp), which are the vectors that should be used for the quantification of the impacts.

3) Estimation of the socio-economic impact. The overall economic impact of the fisheries sector of the Ria of Vigo will be the result of aggregating the main data for each segment of fishing activity and the direct, indirect and induced impacts on the rest of the activities associated with the local economy. The estimation of the overall impacts on the rest of the activities is carried out by applying the type 2 multipliers explained previously. The direct and indirect impacts are identified thanks to the application of the type 1 multipliers.

Moreover, applying the input-output analysis makes it possible to estimate the sectoral distribution of the set of estimated impacts.

The first of these cases has already been completed, so the discussion must now proceed to quantifying the expenditure vectors for each segment of the fisheries sector taken into account.

As already noted in previous sections, if all six segments of the fisheries sector of the Ria of Vigo were to discontinue their activity, the demand for intermediate products to a value of EUR 179.5 million a year would also cease (see Table 5). Surveys carried out by the Ministry of the Environment and Rural and Marine Affairs of the Spanish government [42, 45] make it possible to produce an approximate distribution of this expenditure vector over the 73 branches of activity that form part of the economy of Galicia. This calculation was carried out for each of the six fishing segments, since the need for productive inputs changes considerably depending on the activity type, fleet type or fishing method. Once these cost vectors have been estimated, they should be expressed in basic prices through the application of the information gained from the Input-Output Framework on the average net taxes that apply to the products in each branch of activity and the correction of the sectoral distribution according to the average distribution costs for each branch of activity (trade margins and transport costs). Once the vectors for expenditure at basic prices have been expressed, it is necessary to estimate what proportion of this expenditure is usually covered by production generated in the economy of the area (domestic production). In order to estimate these new expenditure vectors, it is necessary to multiply the demand of each branch of activity by 1 less the import propensity of each product type (the relationship between the value of what is supplied and domestic production in relation to the total, which includes imports of this type of product). This import propensity is applied to goods destined for intermediate demand. This gives a Vector Domestic Expenditure at basic prices linked to the intermediate demand of each of the fishery segments taken into consideration.

Based on the information provided by the Matrix of Gross Fixed Capital Formation of the Input-Output Framework of Galicia [55-56], an estimate was made of the volume of investment that would cease to be made each year should the activity of the six fishery segments considered in this work be discontinued. As in the previous case, a sector allocation was made of this expenditure and, following a similar procedure, an estimate was made of the Vector of Domestic Expenditure at basic prices, in this case associated to Gross Capital Formation of each of the fishery segments considered.

If these six fishery segments did not exist, the available income for the final consumption of households in the area would be reduced. In order to obtain an approximation of the quantity of this expenditure vector, it is assumed that the salary incomes and mixed incomes of each segment form part of this vector. It is evident that part of the operating surplus also ends up forming part of household income, but there is not sufficient information available to be able to

estimate this quantity for each segment of the fleet. Therefore, this expenditure vector would solely be made up of salaries and mixed incomes. In order to sectoralize this expenditure, it is assumed that households that have these incomes exercise a consumption demand similar to that of the average Galician consumer. Based on this hypothesis, it is possible to construct the Vectors for Expenditure on Final Consumption for each segment of the fleet. Once again, it must estimate this vector in terms of the domestic context, evaluating it on the basis of basic prices following a similar procedure to that described above.

Once these calculations have been made, and taking into account all the expenditures that would cease (linked to intermediate demand, capital formation and final consumption) for each fishery segment, it is possible to construct the Vector for Total Expenditure at acquisition prices (VTE ap), the Vector for Total Expenditure at basic prices (VTE bp) and the Vector for Domestic Expenditure at basic prices (VDE bp). Table 6 shows some of the estimated results corresponding to the main branches of activity with the greatest links to the set of six fishery segments arranged in decreasing order according to the quantity of the domestic expenditure at basic prices.

Table 6

As can be seen from the above, it is estimated that a discontinuation of activities of the set of six fishery segments would cause a decrease in expenditure levels equivalent to EUR 353.1 million. When this amount is converted into basic prices, this total quantity is reduced to EUR 329.8 million. However, a significant proportion of the goods and services often come from imports, meaning that the hypothetical decrease in expenditure would not have an influence on the local economy, although it would have an effect on the economies exporting these products. The decrease in expenditure in the domestic economy is estimated at almost EUR 234 million. The branch of activity that would experience the most significant reduction in demand would be ship and boat building (repair and maintenance included), which represents some 14.3 per cent of the total value of e Vector for Domestic Expenditure at basic prices. Other branches that would be seriously affected would be food services, retail and wholesale trade, oil refinery, real estate activity and transport activities. When taken together, the 10 branches of activity set out in Table 6 represent something over 70 per cent of the total value of the Vector for Domestic Expenditure at basic prices.

Once the Vectors for Domestic Expenditure at basic prices (VDE bp) have been estimated and assumed for each fishery segment it can proceed to the third phase, which is the estimation of the socio-economic impacts. The first step in this phase consisted in calculating the type 1 multipliers (direct and indirect) and type 2 multipliers (direct, indirect and induced) for the output, income and employment of each of the 73 branches of activity included in the Input-Output Framework of the Economy of Galicia. A summary of these multipliers for the 10 most important branches of activity are shown in Table 7.

Table 7

The interpretation of these multipliers is that usually applied in an input-output analysis. According to this reading, in order to fulfil a unit increase in the final demand for products in the branch of activity of naval construction (R35), the economy as a whole must increase its total direct and indirect output by 1.4419 times (MO1). If induced effects are added, the output of the economy as a whole should be increased by 1.9873 times (MO2). A similar reading would apply to income (value added generated). So the total effects of an additional unit of final demand for products in branch R35 would generate additional value added of 0.7305 units in the economy as a whole (MR2), of which 0.4440 would be linked to direct and indirect impacts (MR1).

The calculation of employment multipliers is more complex, and requires a prior updating of the employment requirements according to output unit. In this case, the adaptation of units to the year 2010 was carried out by constructing a series of deflators by product group based on the annual inflation rates provided by the Spanish Institute of Statistics. In this way, based on the Input-Output Framework of Galicia for 2005 (IGE: 2009, 2010) it can obtain employment multipliers for each of the 73 branches of activity expressed in full-time equivalent (FTE) jobs for each EUR 1,000 for the year 2010. Thus, for each additional EUR 1 million of final demand the ship and boat building branch has the direct and indirect capacity to generate 9.7 FTE jobs and a total capacity (direct, indirect and induced) to generate 16.3 FTE jobs.

In this counterfactual exercise, it assumes that in the event of a fall in demand, the direct, indirect and induced effects would work in the inverse direction, reducing production, income and employment in the local economy. Therefore, by applying the estimated multipliers to the Vector of Domestic Expenditure at basic prices of each of the fishery segments, it is possible to calculate the quantity of the additional impacts on the economy as a whole. It must be taken into account that these are additional impacts, meaning that in order to quantify the total socio-economic impacts it is necessary to add together those impacts associated with the "disappearance" of the fishery segments themselves.

Tables 8, 9 and 10 provide a summary of the set of quantified impacts on output, income and employment in the economy. It is assumed that these effects will mainly influence the local economy of the Ria of Vigo.

The set of impacts for the six fishery segments contemplated here would represent a decrease in the output of the local economy of almost EUR 923 million (see Table 8), of which 42.74 per cent is linked to the discontinuation of production activity in the fisheries sector (EUR 394.4 million), while the remaining 57.26 per cent is accounted for by the direct, indirect and induced impacts caused in the rest of the economy's activities (EUR 528.5 million). The segment with the greatest importance within this decrease would be that of distant water fishing, which accounts for almost 45.5 per cent of the total impact. If it divides the value of the total impact by the value of the output produced by the fishery segments, a total multiplier of 2.34 is obtained. In other words, each unit of output generated by the extractive fishing

sectors would represent an average of 2.34 units of the economy as a whole. Not all the fishery segments have the same relative capacity for impact on the output, since shellfishing, artisanal fishing and coastal fishing have global multipliers that are above average (2.78; 2.59 and 2.42 respectively), while the other segments are below average (2.25 for aquaculture and 2.33 for deep and distant water fishing).

Table 8

The hypothetical reduction in output linked to the discontinuation of fishing activity in the Ria of Vigo would have clear repercussions on the generation of income (value added). Thus, it is estimated that the total impact on income would reach something over EUR 469 million (see Table 9): 45.8 per cent of the decrease in income would be caused by the discontinuation of activity in the fisheries segments themselves, while the remaining 54.2 per cent would be linked to the impacts that this cessation of activity would cause in the remaining activities within the local economy. As in the case of the output, distant water fishing represents 46.3 per cent of the total impact, followed in order of importance by the deep sea fishing segment (26.1 per cent). On average, each unit of value added contributed by the fishing segments examined would account for 2.18 units of income within the economy as a whole. On this occasion, the segments with the greatest capacity for relative impact on income would be shellfishing (with a global income multiplier equivalent to 2.39), deep sea fishing (2.27) and artisanal fishing (2.23). The sector with the lowest relative capacity to impact income would be aquaculture (2.11) and the segments of coastal fishing and distant water fishing (with multipliers of around 2.15).

Table 9

In terms of employment, it is estimated that the total impact of the six fishery segments would be of around 12,320 full-time equivalent jobs (see Table 10): almost 53.6 per cent of these would derive from the discontinuation of activity in the fish production sector itself while the remaining 46.4 per cent would be linked to the direct, indirect and induced effects on the rest of the activities in the local economy. In terms of employment, the relative importance of the total impact of distant water fishing would still be the most important (32.3 per cent of the total), although it would not be as high as in the cases of output and income. The less industrialized fishery segments (shellfishing, aquaculture, artisanal fishing and coastal fishing) provide employment for a higher number of people per output unit, but the structure and characteristics of their expenditure vectors mean that these activities have a smaller relative impact on employment within the economy as a whole. On average for the six fishing segments as a whole, 1.87 jobs are generated in the local economy per FTE job. The less industrialized segments have global employment multipliers that are below average: 1.2 for shellfishing; 1.39 for artisanal fishing, 1.5 for the case of coastal fishing and 1.57 for aquaculture. The deep sea fishing segment reveals a global employment multiplier of 1.91 and that of distant water fishing is equivalent to 2.84. In other words, the latter segment has a

demand vector which, for each FTE job, almost triples employment in the economy where the activity takes place.

Table 10

As already pointed out, the socio-economic impacts of the hypothetical discontinuation of activity in the 6 fishery segments analyzed would have a significant magnitude. In terms of income, the added value affected would reach EUR 469 million. The estimated loss of fishing activity would also have an impact on employment, with 12,320 FTE jobs being lost. These impacts would also affect the different branches of activity within the local economy in various ways. By resolving the matrix system for the 73 branches of activity taken into account for this economy it can be estimated which of these would be affected to the greatest extent. In principle, the economic agents belonging to branches of activity characterized by few intersectoral relations with fishery segments should be less affected by the hypothetical cessation of fishing activity in the area. However, economies are composed of interrelated and interdependent parts, in which each branch of activity can be affected in an indirect or induced way by the evolution and results of other branches of activity with which they may not have a direct connection. Table 11 summarizes the distribution by sectors of the total impacts on output, added value and employment for the 10 branches of activity in the local economy that would be most affected in order of the criteria of impact on income.

Table 11

These 10 branches of activity would between them absorb around three quarters of the impacts, both in terms of output as well as income and employment. Obviously the branch of activity that would be most affected by the hypothetical disappearance of the fishery segments would be that of fishing and aquaculture itself. But in terms of value added, the sectors related to real estate activities, trade (both retail and wholesale), restaurants, the financial sector, ship and boat building, construction and transport would also suffer significant reductions in their contribution of value added to the local economy, which would not always be translated in a symmetrical way to reductions in employment levels.

5. Discussion of results and conclusions

The statistical data available on the main primary fish producers – and, above all, the international commercial flows of this kind of product – seem to support the idea that fishing activities and aquaculture are of great importance in developing countries. In contrast, in developed countries, the relative economic importance of fishing activity has decreased notably, meaning that they only contribute 1 per cent of the GDP and total employment in these economies. This situation also applies to the EU, where the primary fisheries and aquaculture sector represents scarcely 0.06 per cent of GDP and 0.13 per cent of total employment in the 27 EU countries. Despite these statistics, the Common Fisheries Policy

(CFP) still has an important role within government action as a whole in the institutions of the European Community. Within the CFP, a series of measures and aid actions are developed that are targeted at supporting fishing activities, since it is assumed that these activities have a socio-economic importance in rural and less developed regions where there are communities that depend on fishing and that have few possibilities of directing their economic activity towards alternative production sectors.

While it can be accepted this general vision of fishing in Europe to be correct, it is also true that there are urban areas characterized by a certain level of industrialization in which fishing and aquaculture primary activities are also very important. Therefore, political action in fishing matters can also have an important impact on these areas. The present study has set out a quantification of the importance of this activity and their economic impact (in terms of production and value added) and social impact (in terms of employment) on the area of the Ria of Vigo, in Galicia, Spain. The area is mainly urban, with a population density of more than 1,135 inhabitants per km^2, but where fisheries and aquaculture activities are very varied and continue to have a certain importance within the local economy. The activities taking place in this area include aquaculture, shellfishing and different segments of the fishing fleet encompassing vessel types from artisanal fishing boats to large-scale freezer vessels. The economic importance of fishing activity is evidenced by the volume of the landings of fish and aquaculture products that each year pass through the port facilities of the area, which reached more than 787,000 tonnes in 2010.

This study has sought to quantify the importance of the primary fishing activity in the area of the Ria of Vigo, and for this reason it has excluded a significant portion of this volume of landings (the proportion corresponding to imports), and only taken into consideration the landings carried out by fishing vessels. This restrictive criterion was employed with a view to considering only those landings with an actual link with the local primary fishing activity, a volume of production which, in 2010, was estimated at something over 167,000 tonnes and had a total value of EUR 394 million. Based on this statistic and the surveys carried out by the Spanish government in the fisheries sector, an estimate was made of the main economic figures related to the primary sector in the Ria of Vigo, identifying six different segments of fishing activity.

In accordance with the estimates produced, the intermediate consumption of products and services represents 45.5 per cent of the total value of the primary fisheries sector's production in the Ria of Vigo. Logically, the relative importance of intermediate consumption is greater in the case of aquaculture and the more industrialized fisheries segments (deep sea and distant water fishing). The remaining 54.5 per cent – representing almost EUR 215 million – is contributed by Gross Value Added, an amount that directly accounts for 3.1 per cent of the total of Gross Primary Income of the area of the Ria of Vigo. In terms of full-time equivalent employment, it was estimated that the primary fisheries sector generates around 6,600 jobs, a figure that represents approximately 3.9 per cent of the total population in employment in the

area of the Ria of Vigo. These estimated figures on the direct relative importance of the primary fisheries sector in the Ria of Vigo are between 30 and 50 times higher than the average figures for the EU as a whole (27 countries), despite the restrictive hypothesis employed. This confirms that the primary activities of aquaculture and fishing may also be of great importance in urban areas of the EU.

Nevertheless, as already known, the economic and social importance of a primary activity is not limited to its direct contribution to income and employment. On the one hand, networks of enterprises dedicated to the sale and processing of primary products develop around these types of activities. On the other, the mere existence of the extractive fishing sector is linked to a demand for intermediate products (intermediate consumption) and investment goods (vessels, motors, facilities, navigation and detection equipment, and so on) which will have a clear effect on the economic activity of the area. Moreover, a significant proportion of the income generated by this activity will be channelled into households (in the form of employee compensation, mixed incomes, and so on), which will most likely have an influence on consumption demand in the local area. In other words, the primary activity of fisheries and aquaculture will also have a clear direct, indirect and induced impact on the remaining production activities taking place in the study area.

In order to quantify this impact, a method based on input-output analysis was employed. An application was developed that was adapted to the case study in question, based on a counterfactual exercise which aimed to quantify what would happen in this economy were the primary fisheries sector to discontinue its activity for the period of one year. This type of exercise tends to adopt conservative hypotheses with the aim of avoiding an overestimation of the impacts incurred. Therefore, apart from the aforementioned restrictive hypothesis on the fishery agents taken into account (which considered only the fishing fleet that lands catches in the Ria of Vigo), it was assumed that the hypothetical discontinuation of activity in this primary sector would not affect the normal activity of fishing traders and processors (who would be able to substitute these products for other, imported items).

Having calculated the various income vectors associated with each of the six segments of activity considered, as well as the output, income and employment multipliers for each of the 73 different branches of activity, the hypothetical direct, indirect and induced impacts on the rest of the economic activity in the area it was then estimated. In terms of the total value of production and the contribution to income, it was estimated that the impacts on the remaining economic activities would surpass the figures corresponding to the primary fishing and aquaculture activity in the Ria of Vigo. This was not the case for full-time employment: 5,717 jobs would be affected in the remaining activities compared with the 6,602 jobs directly generated by the primary activity. This is due to the greater need for labour input in the fisheries sector in comparison with the average for the economy as a whole.

If the impacts related to production activity and those estimated for the rest of the economic activities are considered all together, the hypothetical reduction in output linked to the discontinuation of activity would mean a loss of Value Added equivalent to EUR 469 million per year, which amounts to 6.76 per cent of the Gross Primary Income of the area of the Ria of Vigo. The amount of full-time equivalent jobs that would hypothetically be lost would reach 12,320, equivalent to 7.33 per cent of the population in employment in the study area. These negative impacts would be distributed throughout all the branches of activity of the economy. Apart from the fisheries and aquaculture sector itself, the sectors that would be most affected would be those related to real estate activity, trade (both retail and wholesale), the restaurant sector, ship and boat building, construction, and transport.

The results obtained in this study demonstrate that the primary activities linked to the fisheries sector can also have social and economic importance for urban areas with developed economies. The case study analysed here (the area of the Ria of Vigo) may constitute an exception in the context of the EU as a whole, but it is, nevertheless, a relevant one. Thus, any management and aid measures that might be adopted by the Common Fisheries Policy should take this situation into account.

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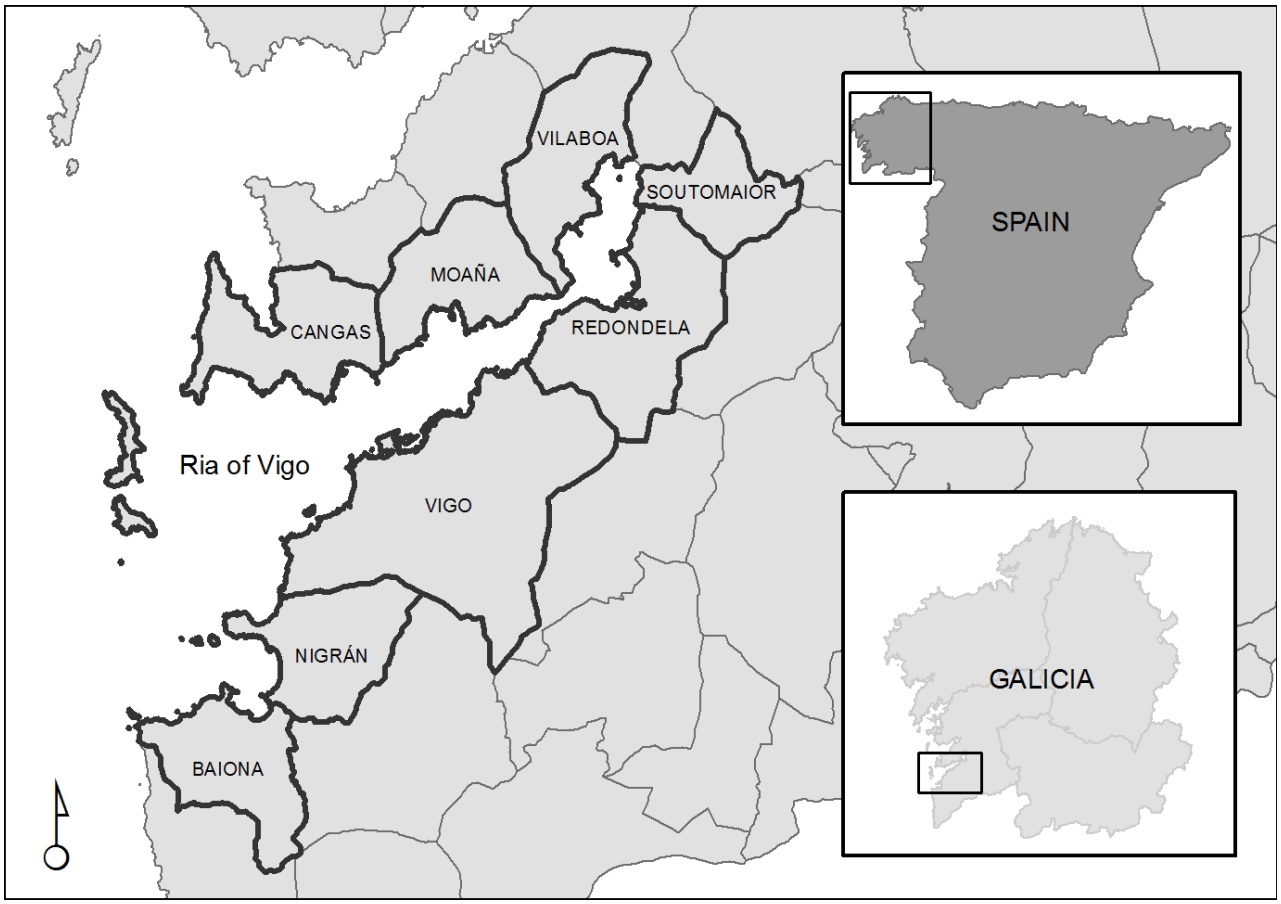
Figure

Figure 1



Tables

Table 1. Basic socio-economic data on the area of the Ria of Vigo

Main socioeconomic data, 2009	**Municipalities Ria of Vigo**	**NUT3 Pontevedra**	**NUT2 Galicia**
Population	415,295	961,134	2,796,951
Working-age population: 4th Quarter, 2009	198,679	459,700	1,307,300
Employed population: 4th Quarter, 2009	168,080	388,900	1,138,900
Surface area (square kilometres)	365.6	4,494.6	29,574.8
Population density (inhabitants/km^2)	1,135.9	213.8	94.6
Allocation of income (thousands of euros)	**Municipalities Ria of Vigo**	**NUT3 Pontevedra**	**NUT2 Galicia**
1. Gross Operating Surplus (GOS)/Mixed income	1,701,806	3,984,850	12,558,015
2. Employee remunerations	4,942,190	9,839,841	28,408,222
3. Property income (balance)	295,155	575,064	2,153,505
Primary Gross Income (PGI=1+2+3)	6,939,151	14,399,755	43,119,742
Gross Disposable Income (GDI) *	6,412,173	13,746,860	41,857,615
PGI per inhabitant (thousands of Euros/inh.)	16.71	14.98	15.42
GDI per inhabitant (thousands of Euros/inh.)	15.44	14.30	14.97

* GDI is calculated on the basis of the PGI, subtracting current taxes and paid social contributions and adding social welfare benefits and other current transfers received.

Source: Galician Institute of Statistics [38].

Table 2. Fishing fleet in the Ria of Vigo per fishery segment

	No. vessels (v)	**Average length** (metres)	**Average GT** (GT/v)	**Average kW** (kW/v)
Auxiliary fleet, sea-based fish farming	118	14.8	29.9	175.7
Artisanal fleet	585	5.8	1.6	28.4
Coastal	50	20.2	99.7	284.5
Deep sea fleet	24	36.7	403.7	675.5
Distant water fleet	58	47.7	794.6	1,229.2
TOTAL	835	11.8	78.1	176.5

Source: Xunta de Galicia [40].

Table 3: Fish products landed in the ports of the Ria of Vigo, 2010

Ports of the Autonomous Community of Galicia		**Tonnes**
Fresh products	Arcade	146
	Baiona	342
	Cangas	449
	Moaña	213
	Redondela	286
	Canido	73
	Vilaboa	68
	Total in ports of the Autonomous Community of Galicia	1,577
Port of Vigo (State Administration)		**Tonnes**
Fresh products	In Vigo fish market	87,737
Frozen products	In container ships	380,487
	In reefers	239,225
	Landed by fishing vessels	77,831
Salted products	Landed by fishing vessels	601
Total catch landed in the Port of Vigo		785,881
Total catch landed in ports of the Ria of Vigo		**787,458**

Sources: Xunta de Galicia [44] and Vigo Port Authority [43].

Table 4: Fish production linked to the Ria of Vigo according to segment of activity

Year 2010	**Tonnes**	**1,000 Euros**
Shellfishing	654	5,229
Aquaculture	39,456	54,407
Artisanal fishing	2,578	16,169
Coastal fishing	14,611	30,090
Coastal seine fishing	8,645	8,826
Coastal trawling	3,240	7,843
Coastal gillnetting	2,726	13,421
Deep sea fishing	32,016	108,172
Deep sea trawling	23,737	81,269
Deep sea longlining	8,279	26,903
Distant water fishing	78,432	180,356
TOTAL	**167,746**	**394,423**

Sources: Own compilation based on data from the Xunta de Galicia [44] and Vigo Port Authority [43].

Table 5: Main economic variables according to fishery segments in the Ria of Vigo, 2010.

Variables (€1,000)	Shellf.	Aqua.	Artis.	Coast.	Deep.	Distant.	TOTAL
Production at basic prices	5,229	54,407	16,169	30,090	108,172	180,356	**394,423**
Intermediate consumption	1,912	25,959	5,959	12,181	54,211	79,320	**179,542**
Gross Value Added (GVA) (basic prices)	3,317	28,448	10,210	17,909	53,961	101,036	**214,881**
Employee remunerations	401	4,171	3,043	12,651	40,285	64,546	**125,097**
GOS/Mixed incomes	2,988	24,243	7,164	6,508	15,181	39,183	**95,267**
GOS	325	16,575	1,490	5,568	14,936	39,183	**78,076**
Mixed incomes	2,663	7,668	5,674	940	244	0	**17,191**
Net taxes on products	-71	33	2	-1,251	-1,504	-2,692	**-5,483**
Employment (Full-time equivalent, FTE no.)	536	1,274	738	944	1,708	1,402	**6,602**

Source: Own compilation based on data from Table 4 and surveys carried out by the Ministry of the Environment and Rural and Marine Affairs [42,45].

Table 6: Expenditure vectors for the fisheries sector by branch of activity, 2010

Code	Branch of activity	VTE ap (€1,000)	VTE bp (€1,000)	VDE bp (€1,000)
R35	Ship and boat building	50,110	48,212	33,386
R55B	Food services	24,365	22,822	22,822
R52	Retail trade	16,014	21,547	21,547
R51	Wholesale trade	12,742	21,075	19,536
R23	Oil and fossil fuels	66,669	48,771	17,233
R70	Real estate activities	17,319	17,081	17,066
R63A	Activities linked to transport	16,235	16,121	10,141
R60B	Land transport	7,737	8,847	8,345
R15D	Feed manufacturing	8,979	8,585	8,052
R40	Energy production and supply	6,587	6,300	5,912
	Remaining 63 branches of activity	126,390	110,438	69,957
	TOTAL	**353,147**	**329,799**	**233,997**

Codes: codes representing branches of activity as set out in the Input-Output Tables of Galicia [55-56].
VTE ap: Vector for Total Expenditure at acquisition prices.
VTE bp: Vector for Total Expenditure at basic prices.
VDE bp: Vector for Domestic Expenditure at basic prices.
Source: Own compilation.

Table 7: Estimated multipliers for some branches of activity, 2010.

		Output multipliers		Income multipliers		Employment multipliers	
Code	**Branch of activity**	**MO1**	**MO2**	**MR1**	**MR2**	**ME1**	**ME2**
R35	Ship and boat building	1.4419	1.9873	0.4440	0.7305	0.0097	0.0163
R55B	Food services	1.4676	2.3161	0.6907	1.1364	0.0144	0.0246
R52	Retail trade	1.4289	2.5422	0.9063	1.4912	0.0293	0.0427
R51	Wholesale trade	1.5329	2.5008	0.7879	1.2963	0.0156	0.0272
R23	Oil and fossil fuels	1.0809	1.3028	0.1806	0.2972	0.0009	0.0036
R70	Real estate activities	1.3913	2.4880	0.8927	1.4688	0.0053	0.0184
R63A	Activities linked to transport	1.5738	2.4743	0.7330	1.2061	0.0126	0.0233
R60B	Land transport	1.4684	2.2337	0.6230	1.0250	0.0166	0.0258
R15D	Feed manufacturing	1.7407	2.3447	0.4916	0.8089	0.0134	0.0206
R40	Energy production and supply	1.5649	2.3223	0.6165	1.0144	0.0037	0.0128

Table 8: Impacts of fishing sector on the output of the local economy as a whole (€1,000)

	Production activity	**Effect on the rest of the activities**			**Total impact**
		Direct and indirect	Induced	**Subtotal**	
Shellfishing	5,229	5,909	3,413	9,323	**14,552**
Aquaculture	54,407	44,209	23,680	67,889	**122,296**
Artisanal	16,169	16,408	9,364	25,772	**41,941**
Coastal	30,090	27,188	15,436	42,624	**72,714**
Deep sea	108,172	92,185	51,188	143,373	**251,545**
Distant water	180,356	152,761	86,755	239,516	**419,872**
TOTAL	**394,423**	**338,661**	**189,836**	**528,496**	**922,920**

Table 9: Impacts of fishing sector on the Gross Value Added at basic prices of the local economy as a whole (€1,000)

	Production activity	**Effect on the rest of the activities**			**Total impact**
		Direct and indirect	Induced	**Subtotal**	
Shellfishing	3,317	2,779	1,793	4,572	**7,889**
Aquaculture	28,448	19,276	12,439	31,716	**60,164**
Artisanal	10,210	7,623	4,919	12,542	**22,752**
Coastal	17,909	12,566	8,109	20,675	**38,584**
Deep sea	53,961	41,670	26,890	68,560	**122,521**
Distant water	101,036	70,623	45,574	116,197	**217,233**
TOTAL	**214,881**	**154,537**	**99,724**	**254,261**	**469,142**

Table 10: Impacts of fishing sector on employment within the local economy as a whole (FTE no.)

	Production activity	Effect on the rest of the activities			Total impact
		Direct and indirect	Induced	Subtotal	
Shellfishing	536	68	41	108	**645**
Aquaculture	1,274	439	284	723	**1,997**
Artisanal	738	173	112	285	**1,023**
Coastal	944	284	185	469	**1,412**
Deep sea	1,708	938	613	1,551	**3,259**
Distant water	1,402	1,543	1,039	2,582	**3,984**
TOTAL	**6,602**	**3,444**	**2,273**	**5,717**	**12,320**

Table 11: Distribution of total impacts on local economy by branches of activity

Code	Branch of activity	Total impact on output (1000 €)	Total impact on value added (1000 €)	Total impact on employment (FTE no.)
R05	Fishing and aquaculture	401,095	218,595	6,790
R70	Real estate activity	50,874	36,387	87
R52	Retail trade	38,751	26,139	995
R55B	Food services	50,956	24,400	503
R51	Wholesale trade	33,928	17,621	364
R65	Financial intermediation	14,119	10,578	110
R35	Ship and boat building	38,807	10,566	240
R45	Construction	24,057	8,561	203
R63A	Activities linked to transport	17,257	8,065	127
R60B	Land transport	18,765	7,684	234
	Remaining 63 branches of activity	234,308	100,547	2,666
	TOTAL	**922,920**	**469,142**	**12,320**