Technical-Economic Analysis of Small Pelagic Fishing in the Adriatic Regions

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Abstract

*Fishing for small pelagic fish, especially anchovies (*Engraulis encrasicholus*) and sardines (*Sardina pilchardus*), accounts for a significant proportion of Italian sea fishing. Its importance in quantitative terms, however, belies its low value to its producers and highlights the need to implement appropriate measures to optimize the value of the catch right from the beginning of the supply chain.*
This survey will investigate anchovy and sardine fishing among the main Italian fishing fleets operating in the Adriatic Sea, and carry out a detailed business analysis of its technical and economic dynamics using accounting, management and income data.
The ultimate aim is to use the obtained data to provide useful information which can help stakeholders, when preparing and developing policies and strategies, to get the best out of the product.

***Key words**: Anchovy, Sardine, Strategy Management, Accounting.*

Résumé

La pêche des petits pélagiques, en particulier des anchois (*Engraulis encrasicholus*) et des sardines (*Sardina pilchardus*), représente une proportion significative de la pêche en mer en Italie. Toutefois, malgré cette importance quantitative, la valeur pour les producteurs reste limitée, d'où la nécessité d'adopter des mesures appropriées pour optimiser les captures déjà en amont de la filière.
L'objectif de ce travail est d'examiner la pêche des anchois et des sardines réalisée par les principales flottes italiennes dans la mer Adriatique et d'effectuer une analyse détaillée des dynamiques techniques et économiques en s'appuyant sur des données concernant la comptabilité, la gestion et le revenu.
Les résultats obtenus pourraient être élaborés pour donner des informations pertinentes aux acteurs chargés d'élaborer et développer les politiques et les stratégies sectorielles, en vue d'optimiser ce type de produit.

Mots-clés : Anchois, Sardine, Gestion de la Stratégie, Comptabilité

1. Introduction

The Adriatic Sea (referred to as GSA 17 central-northern Adriatic Sea), thanks to its particular geographical and environmental characteristics, has always been regarded as one of the most productive areas in the Mediterranean, especially for small pelagic fish (oily fish) such as anchovies (*Engraulis encrasicholus* – Bleeker, 1852) and sardines (*Sardina pilchardus* – Walbaum, 1792), which find this area optimal for reproduction and development.

According to recent data[1] (www.irepa.org), in fact 77% of the national anchovy catch comes from this region, and in particular from the fishing fleets of Puglia (25%), Emilia-Romagna (25%) and Veneto (24%) (Table 1).

Anchovies and sardines play a fundamental role in the Italian fishing economy, amounting to just over 70 thousand tons, 31.5% of the total national catch, for the year 2010.

However, in economic terms it is a different story; here the same species accounted for only 8.1% of the total revenues in this sector for 2010, part of a negative trend in average prices over the last 5 years (Table 2 and 3).

The disparity between the amount caught and the revenues derived, as well as highlighting the potential for this resource, raises several points which should interest all stakeholders along the supply chain, but which should start from the first phase of the fishing process, during which it is possible to take specific actions to enhance the product and the organization of the fishing itself.

The survey, which was carried out, aimed at analysing companies engaged in small pelagic fishing in the Adriatic area, concentrated on five Italian regions and eight fishing fleets (Marano Lagunare, Chioggia, Pila, Porto Garibaldi and Cesenatico, Rimini, Ancona and Martinsicuro) with a total of 114 boats, all using the fishing method called "a volante in coppia" (*midwater pair trawl*), as this is the most used technique in all the cases examined.

The surveys carried out, for the year 2010, followed two different methodologies; first using a qualitative approach, to acquire descriptive information regarding the fishing fleets being surveyed, which was followed up by an analysis of the financial statements of the most representative fishing enterprises in each area.

The picture that emerged has thrown a lot of light on the financial and economic state of the sector in the entire coastal area under study, showing, with business-like precision, the effectiveness/ineffectiveness of the various entrepreneurial and management strategies adopted.

Finally, putting all these considerations together we tried to determine the most effective strategies for improving small pelagic fishing, taking our cue also from real business cases which had been analysed, and thus trying to make our proposals, which were originally theoretical, more relevant and usable for all entrepreneurs, even those outside the area of investigation.

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[1] Quantity of anchovies caught in the Adriatic regions as compared to national total average calculated over the five-year period 2006-2010.

Table 1 - *Trend of small pelagic fish (anchovies and sardines) catches in the Adriatic region (GSA 17) and in Italy (tons; 2006-2010).*

REGION	2006		2007		2008		2009		2010	
	Anchovies	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*
	Tons									
Friuli-Venezia Giulia	689	110	588	285	531	255	348	240	238	319
Veneto	10,391	809	12,010	1,544	6,294	2,286	12,406	1,415	11,473	2,667
Emilia-Romagna	13,928	1,651	12,536	1,345	9,021	1,046	9,441	1,458	11,345	2,523
Marche	6,189	235	4,973	530	5,685	851	4,185	870	4,587	1,233
Abruzzo	12,391	344	8,206	251	4,656	138	4,846	156	3,022	138
Puglia	15,975	712	12,818	835	9,541	1,477	8,776	722	8,643	1,501
Total	**59,563**	**3,861**	**51,131**	**4,790**	**35,728**	**6,053**	**40,002**	**4,861**	**39,308**	**8,381**
Total in Italy	**78,051**	**13,668**	**61,216**	**14,134**	**45,039**	**12,025**	**54,388**	**15,637**	**54,095**	**16,274**
Overall Italy (all species)	**285,368**		**267,368**		**216,567**		**234,082**		**223,007**	

Source: Our elaborations on IREPA database (www.irepa.org).

Table 2 - *Trend of small pelagic fish (anchovies and sardines) catches in the Adriatic region (GSA 17) and in Italy (000 Euro; 2006-2010).*

REGION	2006		2007		2008		2009		2010	
	Anchovies	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*
	000 euro									
Friuli-Venezia Giulia	1,937	240	1,493	721	1,367	683	987	435	805	568
Veneto	12,078	1,296	12,489	1,681	7,110	2,166	12,676	1,776	11,372	2,782
Emilia-Romagna	13,796	1,616	11,436	977	8,106	766	8,274	1,039	9,478	1,326
Marche	12,062	219	8,747	539	8,249	567	6,436	538	6,453	733
Abruzzo	18,053	361	17,857	241	10,459	126	10,843	160	5,004	105
Puglia	30,169	545	22,587	499	17,356	2,482	17,684	477	13,795	1,255
Total	**88,095**	**4,277**	**74,608**	**4,658**	**52,647**	**6,791**	**56,899**	**4,424**	**46,906**	**6,770**
Total in Italy	**138,891**	**14,274**	**104,123**	**13,512**	**77,200**	**12,972**	**87,800**	**12,694**	**75,954**	**12,882**
Overall Italy (all species)	**842,684**		**745,792**		**589,574**		**644,710**		**596,380**	

Source: Our elaborations on IREPA database (www.irepa.org).

Table 3 - *Trend of the average sales price for anchovies and sardines: comparison between the Adriatic Regions value and the national mean (Euro/kg; 2006-2010).*

REGION	2006		2007		2008		2009		2010	
	Anchovies	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*	*Anchovies*	*Sardines*
	€/kg									
Friuli-Venezia Giulia	2.81	2.18	2.54	2.53	2.57	2.68	2.84	1.81	3.38	1.78
Veneto	1.16	1.60	1.04	1.09	1.13	0.95	1.02	1.26	0.99	1.04
Emilia-Romagna	0.99	0.98	0.91	0.73	0.90	0.73	0.88	0.71	0.84	0.53
Marche	1.95	0.93	1.76	1.02	1.45	0.67	1.54	0.62	1.41	0.59
Abruzzo	1.46	1.05	2.18	0.96	2.25	0.92	2.24	1.02	1.66	0.76
Puglia	1.89	0.76	1.76	0.60	1.82	1.68	2.01	0.66	1.60	0.84
Adriatic Regions mean price (anchovies and sardines)	**1.48**	**1.11**	**1.46**	**0.97**	**1.47**	**1.12**	**1.42**	**0.91**	**1.19**	**0.81**
National mean price (anchovies and sardines)	**1.78**	**1.04**	**1.70**	**0.96**	**1.71**	**1.08**	**1.61**	**0.81**	**1.40**	**0.79**

Source: Our elaborations on IREPA database (www.irepa.org).

2. Materials and method

Sea fishing, to all intents and purposes, could be described as a high risk business, mainly because of the many uncertainties stemming from:

– how policies and the regulatory framework for the sector are set up;
– variability in the cost of certain raw materials;
– quantity and type of fish caught;
– the market price and demand for fishery products;
– weather conditions.

These variables must be taken into account by the operator (entrepreneur) who will have to deal with any developments resulting from such factors when and as they occur.

By carrying out an analysis of business decisions actually made, extrapolated by means of on-the-spot technical-economic surveys and accountancy documents, it is possible to assess the level of business efficiency by evaluating the company's profitability.

The study was conducted in accordance with certain procedures:

1) technical-economic framework of the fleets surveyed fishing for small pelagic fish;

2) budget analysis and calculation of profitability indicators for fishing enterprises;

3) economic comparisons across companies and fleets;

4) proposals for the future.

First of all, for the collection and analysis of technical and economic information from the fishing fleets, a special quality-quantity questionnaire was developed to be compiled by the various stakeholders (owners, representatives of producer organizations, fish auctioneers, etc.).

This instrument was really important, especially for posi-

tioning each of the fishing fleets within a national overview of fisheries and specifically fishing for small pelagic fish.

In this way it was possible to obtain detailed information about the history and the makeup of these fishing fleets, a description of the sales channels used by the fishermen and the OO.PP. (Producers Organizations), the presence of organized groups for the joint purchasing of the raw materials which weigh most on operating costs (e.g. diesel), the total fleet engaged in fishing and, in particular, in fishing for small pelagic fish, the most common techniques used in the various fishing fleets as well as any supplementary sources of income (extra-operations). Other information obtained from the questionnaire, focused on the numbers and professionalism of crews, the length of time of each fishing trip and the number of operational days per year per vessel, as well as the final destination of the sold product.

To carry out an economic and financial analysis of the companies surveyed, however, financial statements were used as they represent each company's official accounts.

The use of financial statements had two basic functions: one intrinsic, regarding the calculation of the company's operating income and capital, and one extrinsic as it contains an external view of the company's finances. Indeed, this is the primary source of intelligence regarding a company's past and present production, economic, financial and business management, and was thus considered highly appropriate for carrying out the study.

The financial statement includes an income statement, which highlights the dynamics of the period's results stated in terms of acquired and consumed productivity factors (costs) as well as the value of goods and services produced and sold[2] (revenues); it also shows the balance sheet, which gives an instant picture of the company's value at the closure of the financial year, indicating the financial conditions for managing future operations (Frattini, 2006).

In this paper we used financial statements for the year 2010 for the fishing fleets surveyed, duly registered under the laws governing companies fishing for small pelagic fish.

In fact, the average for each fishing fleet was calculated using the balance sheet data for various fishing companies, in relation to their size but above all to the varying types of boat they used. This was done to ensure greater statistical reliability of the data for each fleet. The framework described is therefore time specific; a historical analysis has not been provided.

The small pelagic fishing is the most relevant activity in all the observed companies. Consequently, the costs have been fully attributed to this activity, with the only exception of the wages which have been allocated to the different species on the base of the landed volumes. Conversely, fishing for other species was also considered, as well as other activities, among the income categories. This approach was considered useful for assessing what might be the impact of different business activities on generating profit.

The first level of profitability analysis, obtainable from an examination of the income statement, consists of interpreting net income (NI) as the difference between total revenues (V) and the total cost (TC).

To better facilitate this first level of economic analysis, it was necessary to standardize all the budgets being surveyed. This was achieved through the creation of a single, scalar structure for costs and revenues where all the economic data and accounting information in the financial statements under review were reclassified.

This reclassification provided a breakdown of income totals into two components: revenues from operating activities, referring only to fishing, particularly for small pelagic fish, and revenues from non-operating activities, including all other types of income.

A second use of the income statement, however, was the merging of the individual cost-by-category items. This operation was necessary in the study in order to achieve perfect alignment between the financial statements of all the fishing fleets surveyed, thus facilitating comparisons among them.

Ten categories were identified, within which all the business cost items under consideration were classified:

a. purchase of raw materials;
b. ordinary and extraordinary maintenance costs;
c. administrative costs and external services;
d. wages;
e. salaries (1.5% of total revenues);
f. taxes and duties;
g. social security contributions;
h. overheads/other expenses;
i. depreciation and provisions;
j. financial and bank charges.

Cost accounting or industrial accounting were used for the cost analysis, and in particular the *full cost* method as a means of determining economic and quantitative cost (Brusa, 1995) which enables costs, revenues and results to be attributed to specific products or processes.

Cost accounting differs from general accounting in that it can produce not only data regarding past management but also forecasts. At the same time, what is detected is also different inasmuch as cost accounting registers the use of resources in production processes (Brusa, 1995), meaning all operations coordinated with each other in functional terms (Torquati, 2003).

In this case it is essential to classify costs according to their connection with the production processes being considered.

Therefore, when determining the cost of a product, first it should be established whether all the production factors are being employed by the company for its production, or only

[2] A third component of the income statement has been omitted: what remains in stock, in other words, the raw materials left unused or finished products left unsold. These items, in accordance with the principle of responsibility in financial statements, will be designated as a cost when they remain in stock at the end of the year, and as income when they are sold in the following financial year.

some of them, considered in terms of partial and total costs. This helps to identify different cost calculations, depending on the items included in the calculation.

To better understand how the total cost incurred for the production of a single production unit (in this case, a kilogram of fish) is formulated, the following cost items have been identified:

- Variable costs, which include:
  – purchase of raw materials;
  – wages.
- Industrial costs, which include also the costs related to the use of equipment (boats, fishing equipment, etc.), such as:
  – ordinary and extraordinary maintenance;
  – depreciation.
- Full costs, which take into account all the incurred costs by adding to the industrial costs:
  – salaries;
  – administrative costs and external services;
  – social security;
  – taxes and duties;
  – general expenses;
  – financial and banking charges.

From the sum of each cost calculation divided by the total amount, caught in the year of reference (2010), we obtained the unit cost for each company investigated.

This result proved to be a key factor in making an in-depth analysis of companies representing the fishing fleets concerned and, more broadly, for making global comparisons throughout the area surveyed.

In the next phase, the methodology chosen to best achieve the aims of the research, involved the adoption of a model well established in business and useful for determining the best production mixes, trying to identify the limits of the activity, but above all, the point beyond which a profit is made.

The cost/volume/profit analysis provides an effective description of the level of competitiveness of a company by analysing the correlation between total costs, production volumes and economic results achieved. Although the relationships between these variables are, in fact, quite complex and subject to different variables, they can sometimes be presented in linear form (Berti F., 1994 and A. Bubbio, 1999).

To carry out the assessment the model must be based on some basic assumptions:

- it is necessary to distinguish between fixed and variable costs;
- a linear relationship must be assumed between variable cost and revenue even though reality often offers a more dynamic scenario: in fact, as well as *economies of volume* (that the model in question can represent as it distinguishes between fixed and variable costs), there is also a change in the behaviour of costs in relation to modifications in scale of production (economies of scale);
- in any analysis the price level is considered unique and static, while in reality it changes very quickly and is often modified in line with the type of client to be supplied;
- the cost-volume-profit analysis considers the total sale of the full amount of the company's production, without assessing remaining stocks, and thus the production value is represented only by the turnover (sales revenue);
- the analysis is meaningful only if it considers a single-product company, but in this case it is appropriate because the focus of the study is aimed at fishing for small pelagic fish.

The fundamental aim, towards which the search for the break-even point is working, is to show the moment when there is an exact correspondence between costs (fixed and variable) and revenues, with an economic result (profit/loss) of zero.

For an entrepreneur and the choices he/she has to make, it is highly important to identify the point beyond which the operation and/or product become economically viable.

The theoretical approach adopted was as follows.

First, the quantity of finished product over a given period of time is defined as Q; production costs can be expressed as a linear function of Q:

(1) $Production\ costs = FC + vcu * Q$

where:

– FC: stands for the fixed costs of production, i.e. those costs which, over a certain unit of time, do not depend on the quantity produced (the costs of permanent staff, the rent of buildings, repayment instalments of loans, general expenses, taxes and duties, payroll costs, depreciation on the equipment, financial and banking charges, ordinary maintenance, etc);

– vcu is the variable cost per unit of production, the cost that the company incurs in order to produce each additional unit of finished product (the cost of raw and semi-finished materials, the cost of the components used to make the finished product, wages, energy costs, etc.).

– Q: the output obtained.

Sales revenue can also be expressed as a linear function of the quantity produced:

(2) $Sales\ revenues = p * Q$

where:

– p: is the selling price of a unit of finished product.

It follows that the profit earned by the company, i.e. the difference between sales revenue and total costs of production, is also a linear function of the quantity produced:

(3) $Profit = p * Q - vcu * Q - FC$

which becomes

(4) $Profit = (p - vcu) * Q - FC$

The difference (p - vcu) is called the contribution margin per unit (cmu).

The contribution margin per unit is a determinant coefficient for this analysis and represents the net economic benefit (or profit) that each single sale brings to the company; this difference is primarily intended to cover fixed costs, those costs that the company will incur in any case, regardless of the actual production.

Only after any fixed costs are paid are these margins transformed into actual profits.

The product (cmu * Q) is called the total contribution margin (TCM).

We can thus rewrite (4) in the following form:

(5) $Profit = MCT - FC$

However, some clarification is needed regarding fixed costs. In general, most of these consist of the so-called "sunk cost", i.e. the amount of costs already incurred by the company when investing in resources without opportunity cost, i.e. realizable value on the market or useful value in other uses. While being costs in the accounting sense, these "sunk costs" do not become significant financially speaking, having already been incurred. In this case, the entire contribution margin for the company can be a cash flow that economists call quasi-rent.

Fixed costs can be divided into three main categories:

– Sunk costs

– Bound costs (those incurred as a result of contractual obligations, leases, employment costs, mortgages, etc.).

– Discretionary costs (R & D, marketing, training, etc..).

The basic problem is how to determine the "breakeven point" (BEP) for the level of sales which will enable the company, through achieving contribution margins, to completely cover fixed costs. In (4) with a profit of zero and solving for Q, we obtain

$$(6) \quad \textit{Break-even quantity } (Q) = \frac{FC}{cmu}$$

This equation (6) is the starting point for the cost/volume/profit analysis and will be applied to the case study on the fishing companies.

The assessment's aim is to provide answers to some questions such as:

what is the minimum catch needed to at least guarantee the company a non-negative economic result?

given a production level of *Q*, at what selling price can at least a non-negative economic result be achieved?

Assuming that the specific business activity is fishing for small pelagic fish, the combined sales revenues depend on three different variables: days of fishing, quantity caught per day and average unit price. But also some items of variable cost, if their unit cost is modified, can shift the break-even point: consider, for example, the effect of the cost of diesel on a company's profitability.

The variables for which threshold values are calculated are: quantities fished (tons/year), the unit selling price (€/kg) and the unit cost of fuel (€/litre). For each of these items the values at which the balance between costs and revenues and *break-even point* are reached are identified.

This method helps the entrepreneur to understand at what point the enterprise becomes economically viable, defining those thresholds which stimulate such questions as: "can they be reached?", "can they be exceeded?", "what size parameters should be used?"

3. Synthesis of the results

The surveys carried out involved five Italian regions on the Adriatic Sea and eight fishing communities. These were:

Region	*Fishing community*
– Friuli-Venezia Giulia	Marano Lagunare (TS)
– Veneto	Chioggia (VE)
	Pila (RO)
– Emilia-Romagna	Porto Garibaldi (FE)
	Cesenatico (FC)
	Rimini (RN)
– Marche	Ancona (AN)
– Abruzzo	Martinsicuro (TE)

Taken together the fishing communities had a total fleet of 114 vessels, all using the fishing method known as "Larsen trawl" (two boats working together with surrounding nets).

The data collected through the questionnaire (Table 4) enabled comparisons to be made among the fleets surveyed, from which significant differences emerged.

It should be noted that the figures relate to 2010 and, therefore, may be subject to particular adverse economic situations that have occurred, but which are not customary in the contexts surveyed.

A first consideration regarding the data collected through interviews with operators concerns the number of fishing days, which tended to decrease moving from north to south: the highest were recorded in Chioggia (190 days per year), while for Martinsicuro and Cesenatico they fell to 130 days per year.

This first question, which is also undoubtedly conditioned by such national legislation as the August fishing ban and the five fishing days per week limit, was found to be affected by three different variables. First of all, the weather conditions which, when the sea becomes inaccessible, are the main deterrent to fishing. This limitation can be overcome by using a bigger boat (second variable): a 27-30-metres boat can sail even in less favourable conditions (this is the case of Chioggia's vessels).

The third variable is the movement of the shoals of small pelagic fish in the Adriatic Sea, which move clockwise in a circle (Varagnolo, 1965). This causes them to move down from Senigallia (AN) towards the south in the winter months, and then up towards the northern Adriatic from March (Piccinetti, 1970). This important ecological feature of the species in question imposes constraints on the number of working days because of the great distance that the fishing boat must travel before it can effectively cast its nets.

In line with the above, the size of the boats can also partially account for the daily amount of fish caught: while in Marano Lagunare, where the fleet consists of boats between 13 and 17 metres long, an average of 0.26 tons per day of small pelagic fish (per boat) was caught in 2010, Chioggia, whose vessels average about 30 metres in length, reached 4.75 tons per day.

The number of crew members in the fishing boats is related to the size of the vessels: the crews usually consist of four members for small boats in Marano Lagunare, rising to nine in Chioggia vessels.

The last, but certainly not least important, element of comparison between the fishing fleets surveyed was found in the wholesale price in 2010. This was found to be rather

Table 4 - *Comparison through the investigated fishing communities: main indicators (2010).*

Region	Fishing communitiy	Number of vessels per fishing technique		Days of fishing	Small pelagic fish catch		Sale price	Employees
		Technique	*n.*	*Days/year*	*Tons/vessel per year*	*Tons/vessel per day*	*€/kg*	*Crew/vessel*
Friuli-Venezia Giulia	Marano (TS)	Surrounding nets[a]	6	180	47	0.26	1.32	4
Veneto	Chioggia (VE)	Surrounding nets[a]	14	190	903	4.75	0.94	9
	Pila (RO)	Surrounding nets[a]	24	150	383	2.55	0.88	5
Emilia-Romagna	Porto Garibaldi (FE)	Surrounding nets[a]	20	155	150	0.97	0.80	7
	Cesenatico (FC)	Surrounding nets[a]	10	130	431	3.32	0.77	5
	Rimini (RN)	Surrounding nets[a]	8	140	531	3.79	0.77	7
Marche	Ancona (AN)	Surrounding nets[a]	20	140	177	1.26	1.23	7
Abruzzo	Martinsicuro (TE)	Surrounding nets[a]	12	130	168	1.29	1.12	7
		Surrounding nets without purse lines[b]	8	85	58	0.68	1.44	13

[a] Two boats working with surrounding nets.
[b] Lampara nets
Source: direct surveys

Table 5 - *Average revenue and costs structure in the different communities' surveyed firms (% on the total; Euro; 2010).*

Items	Marano Lagunare	Chioggia	Pila	Porto Garibaldi	Cesenatico	Rimini	Ancona	Martin-sicuro	Mean
Revenues from the main activity	98.0%	88.3%	90.6%	85.4%	88.9%	97.9%	95.0%	86.3%	91.3%
Small pelagic fishing	*100.0%*	*98.3%*	*98.6%*	*75.0%*	*93.0%*	*100.0%*	*86.4%*	*100.0%*	***93,9%***
Revenues from other activities	2.0%	11.7%	9.4%	14.6%	11.1%	2.1%	5.0%	13.7%	8.7%
Total revenues	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Purchase of raw materials	39.3%	29.4%	26.9%	40.2%	31.6%	31.7%	45.5%	37.5%	35.3%
. Diesel	*36.3%*	*21.1%*	*21.6%*	*23.1%*	*18.4%*	*26.7%*	*36.1%*	*28.5%*	*26,5%*
Ordinary and maintenance									
Administrative costs and external services	3.7%	15.3%	4.7%	5.6%	3.4%	21.8%	5.8%	7.3%	8.5%
Gross wages	42.9%	22.8%	31.4%	34.0%	45.6%	30.7%	27.6%	33.1%	33.5%
Net salaries[a]	2.5%	1.4%	1.7%	1.3%	1.7%	1.8%	1.6%	1.2%	1.7%
Taxes and duties	0.2%	1.2%	0.9%	0.8%	2.4%	1.1%	0.2%	0.8%	1.0%
Payroll costs[b]	3.4%	3.2%	4.7%	0.9%	1.6%	4.1%	5.9%	1.6%	3.2%
General expenses	1.0%	0.2%	0.1%	2.5%	5.8%	0.2%	4.7%	0.3%	1.8%
Depreciation	0.0%	23.7%	23.1%	11.6%	4.7%	4.5%	5.7%	10.0%	10.4%
Financial and banking charges	0.2%	1.2%	2.5%	1.5%	0.1%	0.1%	0.3%	5.9%	1.5%
Total costs	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Profit/Loss (€)	**25,693**	**-47,026**	**36,515**	**-38,308**	**48,072**	**64,478**	**23,588**	**-65,442**	

[a] Payment for the intellectual work.
[b] Including social security tax, contributions to pension plans, holidays, vacations, and sick days, etc.
Source: Our elaboration from direct surveys.

variable, fluctuating within a range of 1.32 €/kg for Marano Lagunare and 0.77 €/kg for Rimini and Cesenatico. This feature seems to be closely linked to the fish sales channels: where there is sale by auction (Marano Lagunare, Martinsicuro and Ancona), there is a higher selling price (1.12 to 1.32 €/kg), while for direct sales to retailers, where the price and quantity are generally agreed in advance, prices are much lower (0.77 to 0.94 €/kg). It is notable, however, how in all three Emilia-Romagna fishing fleets surveyed the lowest values were recorded, none of them exceeding 0.80 €/kg.

The technical and economic features described above certainly helped us to understand the origin and consistency of certain cost items found in the financial statements analyzed, and the variances between one company and another.

The reclassification of these documents and their representation in percentage terms subsequently enabled more immediate and simplified comparisons to be made among the situations surveyed (Table 5).

Most of all, it is evident that all the businesses in the regions investigated obtain their revenues almost exclusively from what are considered their main production activity, i.e. sea fishing. For the Adriatic region this work accounts for an average of 91.3% of total revenues, varying from 85.4% in Porto Garibaldi to about 98.0% in Marano Lagunare and Rimini. Within these customary operations, the revenues derived exclusively from fishing for small pelagic fish as a proportion of total income from fishing firms were calculated. The enterprises in Marano Lagunare, Rimini and Martinsicuro, derive all of their revenues from this activity, while in Porto Garibaldi, it is around 75%. One immediate point to consider is how within the same region, in this case the Emilia-Romagna region, two not-too-distant fishing fleets (Porto Garibaldi and Rimini) can show such marked differences with respect to the economic weight of fishing for small pelagic fish.

Operating costs were further analysed by comparing different cost items as a proportion of the total. In all the cases examined the main items were the cost of raw materials and wages. As regards the former, only in the case of Pila does it fall below 30% (26.9%), exceeding 45%, however, in the case of Ancona (45.5%). Notable amongst the raw materials is the relative importance of the purchase of diesel fuel, which in the case of Marano Lagunare and Ancona accounts for more than 36% of the total cost of production (the going rate for the purchase of diesel for marine fishing in 2011, shown by direct surveys in the fishing fleets, was considered as 0.74 €/litre).

As regards gross wages, the differences between one fleet and another are considerable and not easily justifiable in

Table 6 - *Average unit full cost in the surveyed firms by fishing communities (Euro per kg of small pelagic fish landed; 2010).*

Cost items	u.m.	Marano Lagunare	Chioggia	Pila	Porto Garibaldi	Cesenatico	Rimini	Ancona	Martinsicuro
Variable cost	€/kg	0.65	0.59	0.52	1.45	0.61	0.41	0.95	1.19
Industrial cost	€/kg	0.71	0.88	0.76	1.74	0.67	0.47	1.06	1.40
Full cost	€/kg	**0.79**	**1.13**	**0.89**	**2.02**	**0.80**	**0.66**	**1.31**	**1.69**

Source: Our elaboration from direct surveys.

terms of crew size: the maximum was recorded in Cesenatico (45.6%) and the minimum in Chioggia (24.2%).

The high rate of amortization and provision for depreciation in the fishing fleets of Pila (23.1%) and Chioggia (23.7%), in contrast to what was observed in the others, was essentially due to recent investments made in both cases: in particular to the presence of "young" boats in Pila and the large size of those in Chioggia.

In monetary terms, of the eight fishing fleets surveyed, only Marano Lagunare, Pila, Cesenatico, Rimini and Ancona, made a profit for the year ending 2010, going from €64,478 in Rimini to € 23,588 in Ancona. Results were not positive in Chioggia, Porto Garibaldi and Martinsicuro, which all suffered an operating loss.

By conducting the analysis of the breakdown of full costs through the cost accounting method, some problems among the surveyed fishing fleets were identified. With this tool, it is possible to make out three cost configurations (variable, industrial and full), which enable comparisons to be made between fishing companies at different levels and promote a wider debate regarding the economic results obtained (Table 6).

First of all, it highlights the high full cost registered in Porto Garibaldi, €2.02 /kg for small pelagic fish, of which 72% is attributable to the purchase of raw materials and to wages (variable cost), amounting to 1.45 €/kg. This, when compared with the current average small pelagic fish selling price in the same fishing fleet seen above (0.80 €/kg), shows a significant negative gap which, however, can partly be bridged by the importance in this fleet of revenues from non-oily fish fishing and other types of operation.

Rather similar is the situation observed in Martinsicuro, where the full cost was 1.69 €/kg, with a variable cost component of 1.19 €/kg. Also in this fishing community, the selling price was less than the full cost (1.12 €/kg) but, unlike Porto Garibaldi, with less compensation from other activities in the total revenues.

The situation in Ancona, however, was that despite a high full cost (1.31 €/kg) there was a higher than average selling price (1.23 € / kg), and fishing companies at the end of the financial year were showing a profit. This can be explained by their revenues originating from different sources (5.0%) and especially by the quantities of other fish species caught (13.6%). Finally, Chioggia had a full cost of 1.13 €/kg but, unlike in the above-mentioned cases, the variable cost accounted for slightly more than half the amount, highlighting the importance of indirect industrial costs (e.g., depreciation).

From cost accounting we see that companies from other fishing fleets managed to contain the full cost of production of small pelagic fish to below 1 €/kg, Rimini having a particularly low value (0.66 €/kg).

The determination of cost categories obtained through analytical accounting enabled us to apply the break-even analysis model. In fact, the resulting full-cost values represent, at the same time, the threshold selling price that small pelagic fish should be able to reach on the market in order to achieve a balance between revenues and total costs (zero profit).

In some Adriatic fleets, as already indicated above, selling prices were found that do not even cover the fishing enterprises' initial cash flow items, given by the variable cost (Porto Garibaldi and Martinsicuro), while for others (Ancona, Chioggia) the difference between unit cost and unit price is within a range of values that could be considered more feasible (0.08 to 0.19 €/kg) (Table 7).

It is a different matter for businesses in Marano Lagunare, Rimini and Cesenatico, where selling prices recorded in 2010 were very positive, and, covering the full cost, guaranteed a profit (up to 0.53 €/kg Marano Lagunare). This means that if price fluctuations are maintained within these ranges, companies have room to manoeuvre before reaching the break-even point between costs and revenues.

Achieving the break-even point by varying the amounts of fish caught, is a difficult proposal for some of the Adriatic fleets surveyed. This is, first of all, because of the size of stocks of small pelagic fish, currently plentiful, but which certainly should be considered a finite resource, and, secondly, because of the consequences which a large increase in catches would have on the selling price of small pelagic fish, which as far as these calculations are concerned, were considered to be constant.

This was precisely the case in Chioggia in 2010 where 903 tons of small pelagic fish were caught, which was to rise to 1,392 tons to reach the break-even point. The situation in Pila was different, where 6 tons more of small pelagic fish would reach the break-even point (383 tonnes caught and 389 tonnes to break even). Porto Garibaldi and Martinsicuro, where variable costs per unit were higher than selling prices, would not benefit economically by increasing the quantities caught; indeed, it could even worsen the budget deficit. Finally, Marano Lagunare and Rimini, which showed satisfactory results, might limit the annual quantities caught (up to 157 tonnes for Rimini) before seeing their profit disappear.

It should also be pointed out that fishing enterprises do not have complete control over the quantities they catch, and have to schedule on a day-to-day basis according to the presence of schools of fish as well as their size.

Table 7 - Break Even Point - *in terms of yearly catches, price per kg and fuel cost per kg compared with their corresponding observed values (2010).*

ITEMS	u.m.	Marano Lagunare	Chioggia	Pila	Porto Garibaldi	Cesenatico	Rimini	Ancona	Martinsicuro
Fishing volume	tons/year	47	903	383	150	431	531	177	167
BEP for fishing volume	tons/year	10	1,392	389	-*	494	374	230	-*
Sale price	€/kg	1.32	0.94	0.88	0.80	0.77	0.77	1.23	1.12
BEP for sale price	€/kg	0.80	1.13	0.89	2.02	0.80	0.66	1.31	1.69
Fuel cost	€/lt	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
BEP for Fuel cost	€/lt	1.55	0.10	0.52	-*	0.37	0.88	0.40	-*

* BEP is unachievable because the variable costs per kg exceed the sale price per kg.
Source: Our elaboration from direct surveys.

By calculating the break-even point through modulations in the unit cost of diesel, we wanted, however, to investigate the significant effect it has on enterprises' operations.

A fixed price of 0.74 €/litre was posited for fuel, the same for all the fleets surveyed, and on the basis of the different consumption levels found for each one, because of the different sizes of their boats, a theoretical price of oil was calculated in such a way as to equalise costs and revenues.

Even while calculating using this variable, all the business parameters discussed earlier remained unchanged, such as the selling price and quantity of small pelagic fish landed.

The calculations obtained show up differences within the area under survey: while in Marano Lagunare and Rimini diesel can increase in price by up to 1.55 €/litre and 0.88 €/litre before costs and revenues are equal (evidently the price is good for them), for Chioggia, Pila, Cesenatico and Ancona, the reduction needed to reach that level is difficult to achieve (0.10 €/litre for Chioggia and 0.37 €/litre in Cesenatico). For Martinsicuro and Porto Garibaldi, even eliminating this cost item (i.e., assuming a cost of diesel fuel of zero €/litre), the difference between revenues and costs would weigh heavily towards the latter and the break-even point would, therefore, be impossible to achieve in these terms.

One should emphasize that a change in the price of diesel could only come from collective bargaining involving the whole fleet; therefore, the individual entrepreneur could at least modify the quantities consumed but would remain with very little room for manoeuvre.

4. Concluding remarks

In the national context, the fishing enterprise, usually small and with high labour and raw material costs, cannot compete on the international market with "undifferentiated" goods like small pelagic fish. The production costs of Italian enterprises are often higher than those for any fish product originating from, for example, Greece, Turkey, Morocco or Spain, so the product needs to be enhanced and differentiated.

The survey which was carried out involved five regions and eight fishing fleets and went through the financial statements for companies fishing for oily fish (especially anchovies and sardines).

Only boats (114) using the fishing method called "Larsen trawl" were considered, as this is the only technique found in all the fleets surveyed and, therefore, was held to be more representative of the area under study.

An initial analysis of budgets for 2010 showed that not all the fleets surveyed reported a business profit. And, if they did, they were particularly low. In addition, the reclassification of financial statements showed, in several cases, the importance of extra-revenues which contributed to improving the modest earnings gained from fishing for small pelagic fish.

It should also be noted that the economic facts and figures for the last two years are certainly not favourable to the sector; subject as they are to negative cyclical phenomena, they add urgency to the pressing argument that the sector needs a new organizational model able to enhance its leverage in specific areas such as production and quality, as well as in regional and collaborative matters. A distinguishing feature must be found which will increase the unit value of its products and maintain its competitive position in existing markets as well as create opportunities to penetrate the new ones.

This analysis has shifted the focus of attention towards a micro perspective which makes it clear that certain choices which are apparently sustainable for the average company in the sector, may have differing impacts on different markets, on different size boats or on the use of different fishing techniques (especially with regard to the amount of time spent at sea and size of catches).

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