

Economic performances indicators of coastal purse seiners: Case of Atlantic Center of Morocco

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Abstract

The small pelagic fishery covers more than 80% of national fish production with more than one million tons of catch near coastal areas. This fishing intensity in such a limited area could lead to overfishing and a decline in the economic activity of the coastal purse seiners. Given the possibility of this threat, this article aims to study the economic performance of coastal purse seiners based on their operating accounts. Of a total of 557 registered coastal purse seiners, 128 were studied. On average, they generate a turnover of 2.97 million MAD/year and an annual added value of 2.02 million MAD/boat. Vessel size, operating costs, composition of landings and destination markets are the main factors influencing the economic performance of coastal purse seiners. The retained economic performance indicators are the return on investment and the profit margin. These represent respectively 9.2 % and 9.7 % for large vessels, and 0 % and -0.1 % for small vessels. These low levels constitute a major obstacle to the regular renewal of fishing units, due to the relatively high average annual bank credit interest rate (12.5 %).

Keywords: Indicators, economic performance, coastal purse seiners, Morocco.

Indicateurs de performance économique des senneurs côtiers: Cas de l'Atlantique Centre du Maroc

Résumé

La pêche aux petits pélagiques couvre plus de 80 % de la production halieutique nationale avec plus d'un million de tonnes de capture près des zones côtières. Cette intensité de pêche dans une zone aussi limitée pourrait entraîner une surpêche et une baisse de l'activité économique des senneurs côtiers. Compte tenu de la possibilité de cette menace, cet article vise à étudier les performances économiques des senneurs côtiers sur la base de leurs comptes d'exploitation. Sur un total de 557 senneurs côtiers enregistrés, 128 ont été étudiés. Ces derniers réalisent en moyenne un chiffre d'affaires de 2,97 millions MAD/an et une valeur ajoutée annuelle de 2,02 millions MAD/bateau. La taille des navires, les coûts d'exploitation, la composition des débarquements et les marchés de destination constituent les principaux facteurs influençant la performance économique des senneurs côtiers. Les indicateurs de performance économique retenus sont le retour sur investissement et la marge bénéficiaire. Ceux-ci représentent respectivement 9,2% et 9,7% pour les grands navires, et 0 % et -0,1 % pour les petits navires. Ces faibles niveaux constituent une entrave majeure au renouvellement régulier des unités de pêche, en raison du taux d'intérêt annuel moyen du crédit bancaire relativement élevé (12,5 %).

Mots-clés: Indicateurs, performance économique, senneurs côtiers, Maroc.

INTRODUCTION

Small pelagic fishing is one of the fishing activities, sociocially and economically important in Morocco. According to the Moroccan National Board of Fisheries (ONP) statistics, it represents more than 80 % of the total landings of which sardine alone accounts for 65 %. This fishery largely contributes to employment, processing industry and export. Thus, sustainability of this fishery is targeted as a priority in the context of the national strategy¹ of the sector development (DPM², 2009).

To develop an effective policy and to evaluate the impact of the current measures based on the national strategy, socio-economic surveys and analyses are essential. Indeed, to achieve sustainable fisheries, it is necessary to investigate and monitor the economic development of

the fishing industry. Since July 2010, Moroccan National Fisheries Research Institute (INRH) in partnership with Japan International Cooperation Agency (JICA) have launched a capacity development project for fisheries monitoring of small pelagic resources. As a part of this project, we focused on the coastal purse seiners in the Atlantic Center of Morocco which account for 62 % of the total of vessels fishing small pelagic (Kamili *et al.*, 2012).

The purpose of this article is to contribute to the knowledge of fishing economic performance and highlight its determining factors, by examining revenues, costs, return on investment, profit and margin of some coastal purse seiners in the studied region. Data was collected from fishing sector government institutions and by use of a questionnaire and interviews with ship-owners, skippers and crewmembers.

¹ "Halieutis" strategy launched by the Moroccan government in 2010

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PROBLEMATIC OF SMALL PELAGIC FISHERY IN MOROCCO

The system of exploitation of small pelagic fish is based on four components constituting the framework of the sector, namely: resource, fishing effort, processing and market. These elements, closely related, are defined as an economic system bringing together the channels of supply, processing and distribution. Constraints that prevent the development of this system are various. The complexity of the institutional environment and the low involvement of professionals in the management process (fishermen and processors) have lead pelagic resources to situations of full or overexploitation with the exception of sardine in zone C “south of Morocco “(FAO, 2013 and 2015). Small pelagic are also highly affected by hydro-climatic conditions, which lead to inter-annual fluctuations in composition, abundance and geographical distribution.

By their mobility, pelagic resources can affect the purse seiners performance. Indeed, fishermen have to go in search of fish and often the search time exceeds the actual fishing time, which leads to additional time and cost loss and affects the regularity of raw material supply for the factories.

The economic benefits expected from the exploitation of small pelagic resources can be sustainable only if specific management measures are applied according to the characteristics of each fish stock. Thus, faced with these constraints, a development strategy of the fisheries sector, called “Halieutis”, was implemented. Among its objectives is the development of the small pelagic fishery in the southern Kingdom, where there is considerable potential for small pelagic resources. These objectives also aim to set up a monitoring and evaluation program for the entire fishery.

This strategy is articulated around three axes (DPM, 2009), namely:

- Sustainability: Sustainable exploitation of resources.
- Competitiveness: Well valued products and competitive on the most promising markets.
- Performance: An organized and equipped sector for high quality, from landing to commercialization.

The choice between exploitation levels and fishing units profitability is one of the main challenges that embarrasses fishery managers. In this context, the purpose of this

paper is to contribute to the knowledge of one of these three axes, namely the performance, focusing on coastal purse seiners. Therefore, the objective is to look for the main determining factors to this performance, taking into account the key economic indicators characterizing this fishery.

METHODOLOGY

The studied fishery

The considered area is defined by the accommodation area of the central stock of sardine, between Safi and Boujdor [Zone A: Safi - Sidi Ifni (32°30'N-29°30'N); Zone B: Sidi Ifni - Cape Boujdor (29°30'N-26°N)] (INRH, 2012). Coastal purse seiners operating in the predefined area compose the studied fleet (Table 1).

Data collection strategy

We analyzed data from 128 coastal purse seiners as an economic system of wealth creation for the benefit of different stakeholders (ship-owners, skippers, fisherman, etc.). In order to analyze the economic performances of Moroccan coastal purse seiners, we examined mainly employment, fishing effort, productivity, operating costs and value-added. Technical and production data were obtained from official sources (MPM and ONP, 2011).

Unavailable data are obtained based on direct interviews and socio-economic surveys by a simple random sampling method. The use of questionnaires, designed for purse seine fisheries, with ship-owners, fishermen, skippers and accountants was in order to gather information mainly about fishing grounds, operating time, catch, vessel characteristics, fishing gears and costs. Details on tax and fees were obtained based on the official data of ONP and DPM. The overall data collection strategy is given in Figure 1.

Calculation method of economic indicators

As the trip duration of coastal purse seiners does not exceed one day, collected data are represented by fishing day. Using the annual revenue and fishing effort per vessel from official data and extrapolating costs over one year, this will be used as a basis to calculate profit and other economic indicators by class of Gross Registered Tonnage (GRT). These economic indicators were calculated based on mounting an operating account founded on the method

Table 1: Characteristics of the studied fishery

Fishing area	Mainly, areas corresponding to the sardine stock A and B. (Atlantic coast of Morocco)
Main species exploited	Sardine (<i>Sardina pilchardus</i>) Mackerel (<i>Scomber japonicus</i> y <i>S. scombrus</i>) Anchovy (<i>Engraulis encrasicolus</i>) Horse mackerel (<i>Trachurus trachurus</i>) Round sardinella (<i>Sardinella aurita</i>)
Reference year	2011
Vessels and gear	All coastal purse seiners operating in coastal fishing zone predefined and using, as a fishing gear, the purse seine (Roullet & Fahfouhi, 1984)

used by Kamili and Maynou in 2011 for small pelagic fisheries. Using net profit or net operating surplus, we can easily calculate economic performance indicators, such as return on revenue (profit margin) and return on investment (Pham *et al.*, 2008). The method is illustrated in Table 2.

Adopted structure of operating account summarizes flows of operating expenditures and revenues through an indicator set. These later are calculated basing on operating costs that consist of common costs, borne both by ship-owner and crewmembers, and annual ship-owner costs.

Table 2: Model of operating account for a coastal purse seiner

Indicators	Calculation method
Investment by vessel (hull, engine and fishing gear)	I
Gross sales	II
Common costs	III = TL + CF
Taxes and levies (TL)	TL
Fishing related costs (CF)	CF
Annual ship-owner costs	IV = VC + FC
Variable costs (VC)	VC
Fixed costs (FC)	FC
Gross Value-added	V = II – (III+IV)
Amount of part / year*	VI
Share of the crewmembers (Labor cost)*	VII = 60% x (II-III)
Share of the ship-owner*	VIII= 40% x (II-III)
Fishing net premium**	IX
Gross income of the ship-owner	X= VIII+ IX
Gross operating surplus	XI = X - IV
Interest loans ¹ and Income tax	XII
Cash-flow	XIII = XI - XII
Depreciation and opportunity cost	XIV
Net Operating Surplus or Net profit	XV= XIII - XIV
Return on Investment (%)	XVI = XV / I
Return on Revenue or Profit margin (%)	XVII = XV / II

*Based on the applied revenue sharing system of studied coastal purse seiners (more details in Kamili and Maynou, 2011).

** Ship-owner has an additional source of income through a “Fishing Net Premium” paid by the buyer. Equal to 10% of the gross sales in the case of fishes intended for canning factories and 45 MAD/ton in case of fishes intended for the by-products factories.

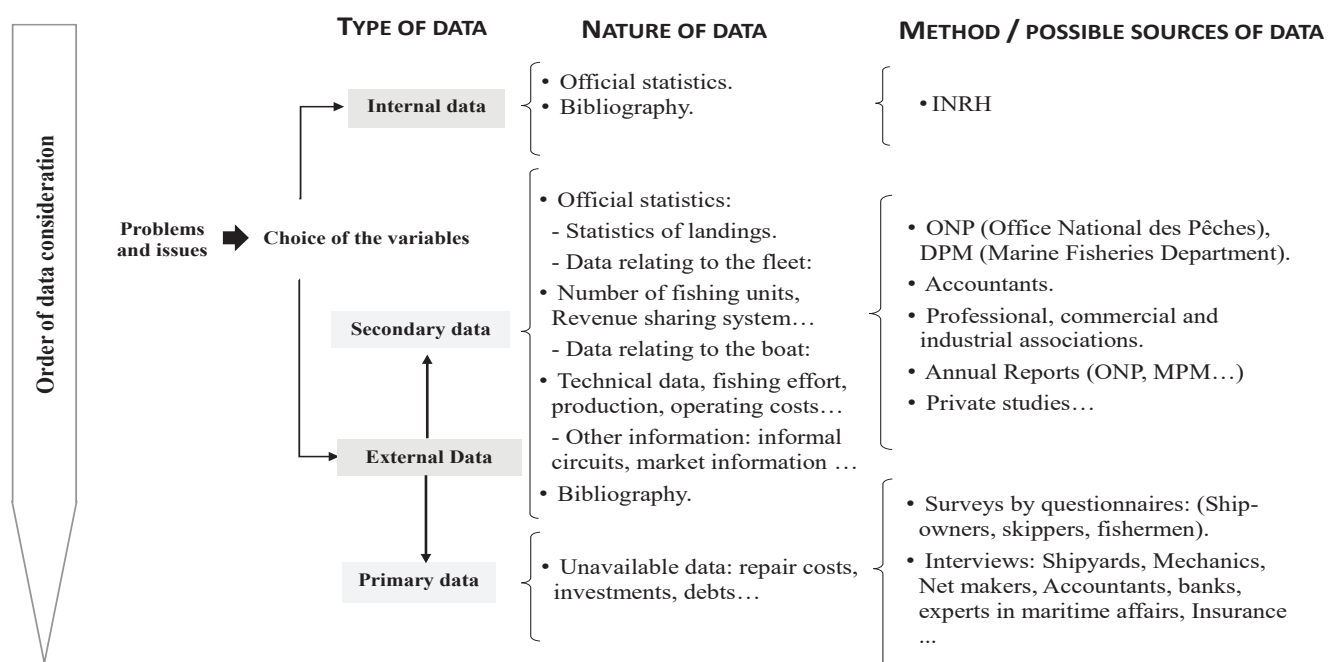


Figure 1 : Mapping of the overall strategy for data collection

Common costs include:

- Taxes and social contributions: That are obtained on the basis of a percentage applied to gross sales. In this category of costs, we have toll tax, auction fee, weighing tax, regional tax, national social security fund, mandatory health insurance, relief fund, contributions to associations, etc.
- Fishing related costs: These costs directly related to the fishing operation imply: Fuel, lubricants, rags, filters, food, water (cooking, cooling engine...), salt for fish, maintenance (minor repairs), unloading, cleaning, security and others.

Annual ship-owner costs are divided to two categories:

- Variable costs: such as those related to repairs (hull, engines and fishing gear).
- Fixed costs: such as those related to insurances, contributions to ship-owners' associations, annual administrative costs, etc.

RESULTS AND DISCUSSION

Spatial dynamic analysis of surveyed boats

The spatial dynamic of the studied boats is very important at the Centre and South of the Kingdom of Morocco. In fact, according to the socioeconomic surveys, these boats have made seasonal movements between different ports in this area following mainly the availability and abundance of resources. The analysis shows that 63 % of sampled vessels might frequent at least 3 to 4 ports/year throughout the Atlantic coast (Figure 2). For this, it is difficult to attribute a particular vessel to a given port.

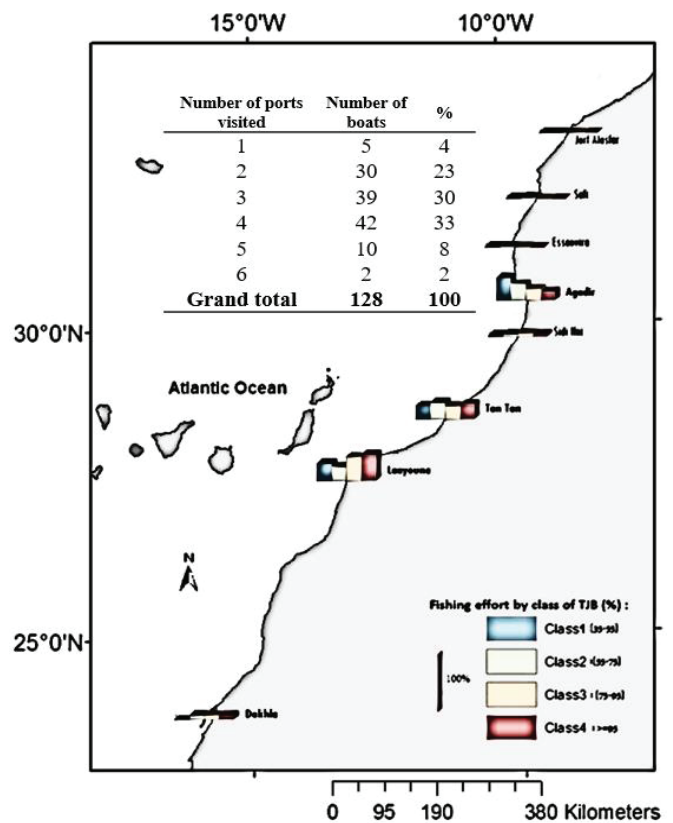
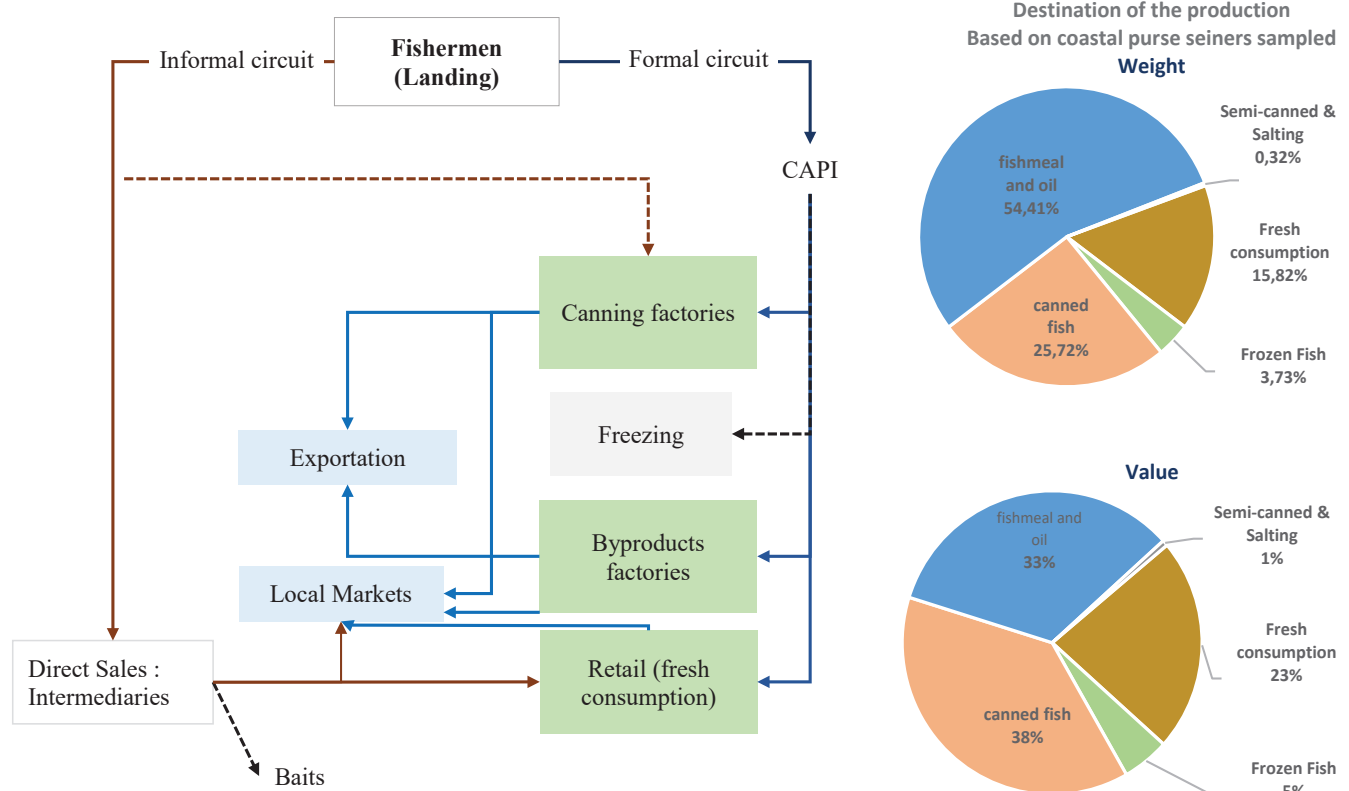


Figure 2: Distribution of fishing effort by class of GRT in the area of the Atlantic Center of Morocco

In this context, it is useful to note that skippers possess good skills and experiences to achieve high catch yields based on their own knowledge of the most productive fishing areas.



Source : Kamili, A. et Maynou, F., 2011.

Figure 3: Commercialization of small pelagic fishes at the Atlantic Central region of Morocco

This is demonstrated by their ability to predict the direction of water current, wind conditions, detecting fish schools, setting nets and then encircling fish schools.

Market analysis of small pelagic

Small pelagic fishes have three principal markets, represented by: fish meal and fish-oil industry (54 %), canning industry (26 %) and fresh consumption market (16 %). Canning industry and fresh consumption market generate over than 60% of sales value (Figure 3). If we consider different target markets, the average price of the same species changes according to its destination. Thus, for example, fishes destined to the by-product factories, are sold at lower prices because of their low quality. In this category of fish, we find particularly sardine (0.85 MAD/kg), and at low degree anchovy, mackerel and round sardinella with an average price of about 0.92 MAD/kg.

Differences between prices of the same specie vary from one specie to another according to the targeted market (canning industry, freezing industry, by-product industry and fresh market). Highest differences, compared to those of other species, were observed for anchovy (Figure 4).

To increase wealth generated by small pelagic landings,

we propose to:

a- Encourage modernization programs that:

- Aim to improve storage conditions on shipboard.
- Aim to increase production capacity for processing industries and creating new products with higher value-added.

b- Promote fresh fish consumption market, at the national level, through awareness campaigns on the importance of the nutritional values of small pelagic fish.

Analysis of the operating accounts

The 128 coastal purse seiners sampled are characterized, on average, by a tonnage of 78 GRT, an engine power of 410 HP, an age of 18 years and a crew of 36 people (Table 3).

As explained previously, and ignoring the labor cost which occupies about 59% of all costs, operating expenditures of coastal purse seiners can be divided into two main categories (Table 4 and Figure 5):

- The first category is related to the common costs (26 % borne by the ship-owner and the crew members. In this category, we include all costs directly related to the fishing

Table 3: Technical characteristics of sampled purse seiners

GRT Classes	[35-55]	[55-75]	[75-95]	>=95	Weighted average
	Average ± s.d.				
Sampled purse seiners	17	40	46	25	--
Gross Registered Tonnage (GRT)	49±6	67±6	87±5	101±6	78±18
Engine power (HP)	319±62	389±57	429±63	468±52	410±74
Crew size (person)	31±5	35±3	37±4	39±4	36 ±5
Total effort (in days/year)	124±43	117±46	136±31	136±28	128±38
Age of vessels (years)*	27±13	22±11	14±10	12±10	18±12
Production (x1000 tons/year)	0.87±0.6	1.31±0.84	2.24±0.88	2.69±0.95	1.85 ±1

* Boats age at 2011

Table 4: Average economic results of the sampled purse seiners by class of GRT

GRT classes	[35-55]	[55-75]	[75-95]	>=95	Weighted average
Investment by vessel	3,492.9	3,972.5	4,209.1	4,538.8	4,104.4
Gross sales	1,425.8	2,050.7	3,628.5	4,302.0	2,974.4
Common costs	391.2	512.7	759.6	814.9	644.3
Taxes and levies	159.3	231.6	408.9	485.7	335.3
Fishing related costs	231.9	281.1	350.7	329.2	309.0
Annual ship-owner costs	190.9	256.8	351.6	383.6	306.9
Variable costs	160.8	198.8	273.3	299.6	240.2
Fixed costs	30.0	58.0	78.3	84.0	66.6
Gross Value-added	843.7	1,281.2	2,517.4	3,103.5	2,023.3
Amount of part / year	15.1	20.9	37.1	43.5	30.4
Share of the crew members (Labor cost)*	581.2	888.1	1,659.3	2,023.0	1,346.1
Share of the ship-owner*	453.4	649.9	1,209.7	1,464.1	984.0
Fishing net premium	61.6	78.8	185.3	221.9	142.7
Gross revenues of the ship-owner	515.0	728.7	1,395.0	1,685.9	1,126.7
Gross operating surplus	324.2	471.9	1,043.4	1,302.3	819.8
Interest loans and Income tax	6.4	7.9	102.4	175.5	74.4
Cash-flow	317.8	464.0	941.0	1,126.8	745.4
Depreciation and opportunity cost	318.8	397.6	526.4	710.5	494.5
Net operating surplus (NOS)	-1.0	66.5	414.6	416.3	250.9
Return on Investment	0.0%	1.7%	9.8%	9.2%	6.1%
Return on Revenue (Profit margin)	-0.1%	3.2%	11.4%	9.7%	7.0%

NB: Values are given in MAD (x1000). In 2011: 1MAD = 0.088€ = 0.124\$.

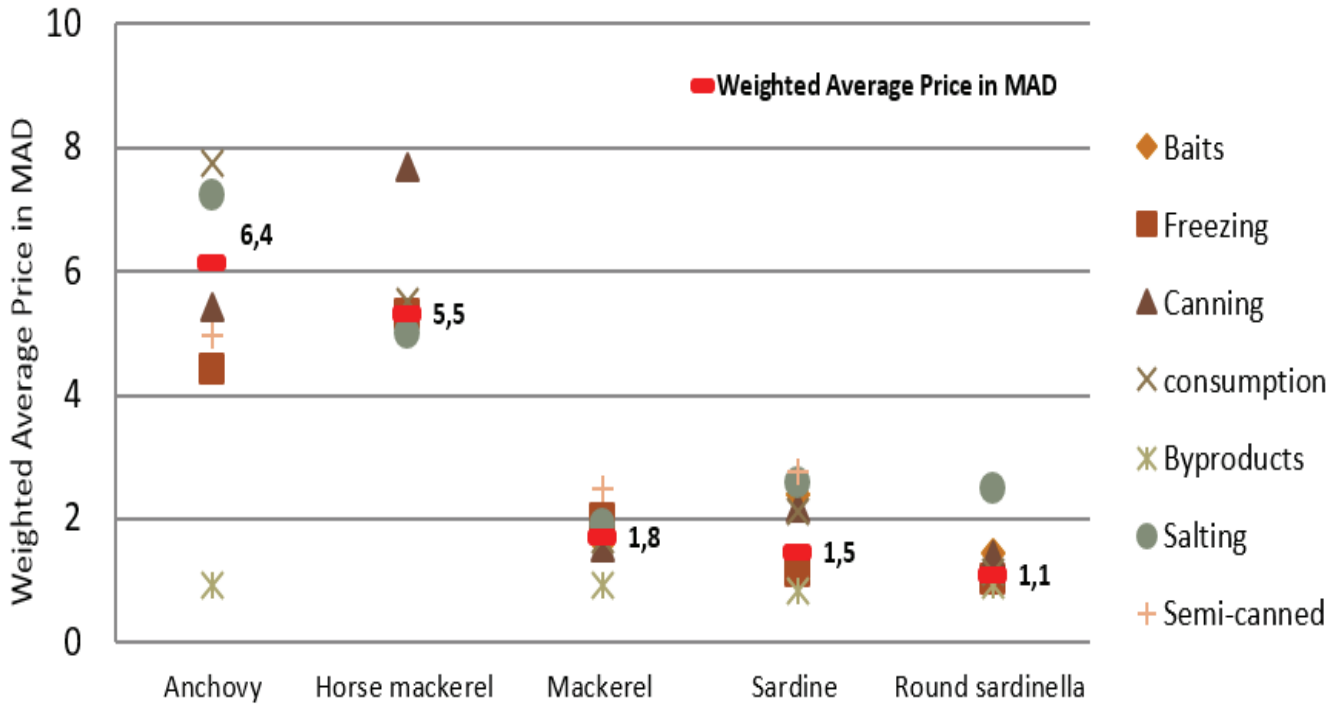


Figure 4: Weighted average price of main species of small pelagic fish according to different markets

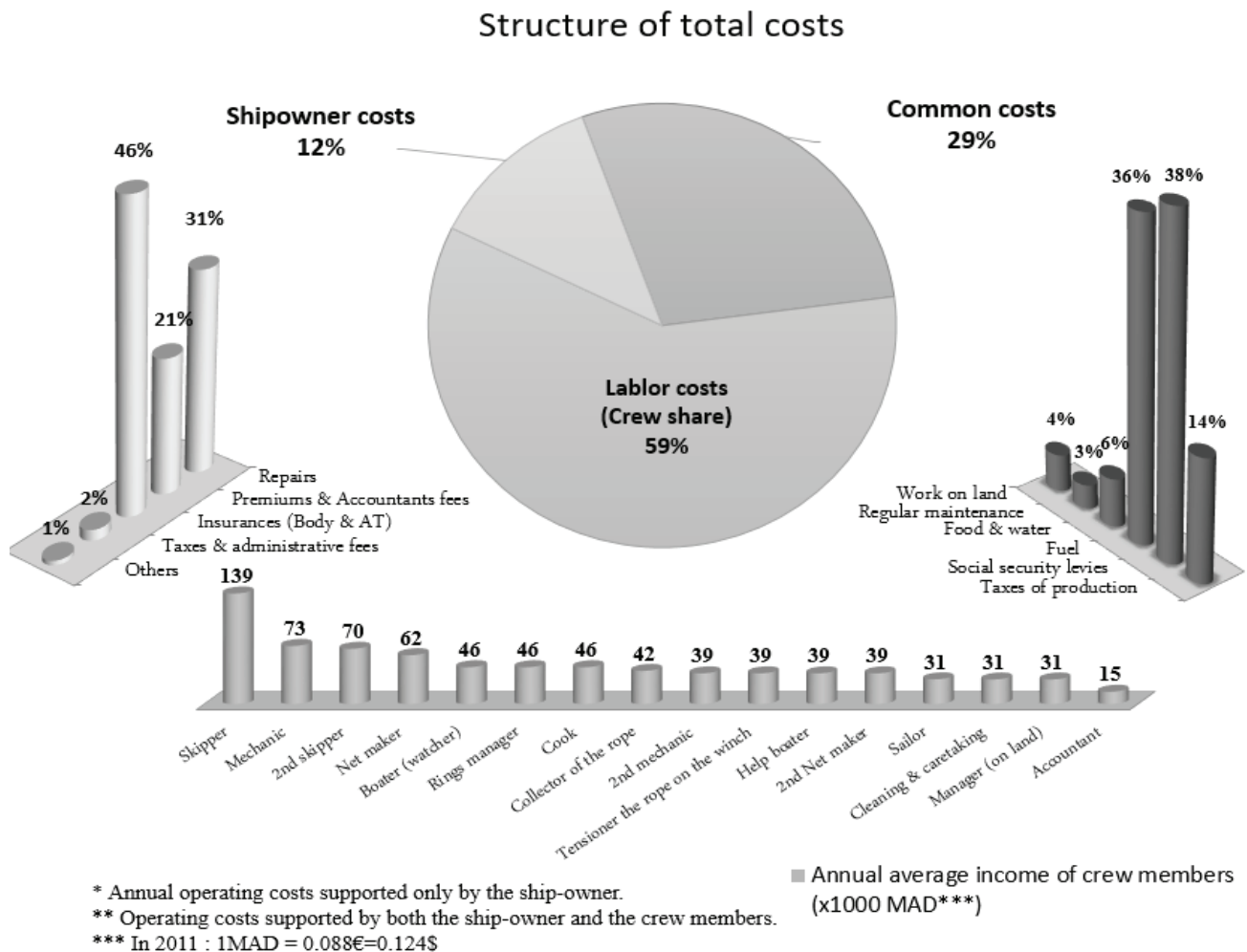


Figure 5: Structure and average composition of costs and incomes of the studied coastal purse seiners

activity, namely for example, fuel (36 %), social security levies (38 %) and production taxes (14 %), etc.

- The second category is associated to costs borne only by the ship-owner (15 %). It includes all annual costs relating mainly to insurances (46 %) and repairs (31 %). After deducting the common costs and the share due to the crew, we obtain this second category of costs.

- The analysis shows that return on investment increases with the size of boats. Indeed, the return on investment goes from 0%, for small boats, with GRT € [35-55[, to 9.2 % for large boats, with GRT >=95. The best performance (9.8 %) is evaluated for boats with GRT within the range of [75-95]. Likewise, the same trend was detected by the second indicator “return on revenue” that began from -0.1% for small boats, with GRT € [35-55[, to 9.7 % for large boats, with GRT >=95. The maximum return on revenue (11.4 %) is calculated for purse seiners with GRT € [75-95]. Average “return on investment” of the whole fleet is 6.1 %, that relating to “return on revenue” is 7 %.

Table 4 shows that the average value of the share increases significantly with the size of boats. This value goes up to threefold going from 15,100 MAD/year for small boats, with GRT € [35-55[, to 43,500 MAD/year for large boats, with GRT >=95. This share value has a direct effect on the income of different crew members by class of boats. The analysis of the revenues structure by nature of work shows that the skipper income is the highest with an average of 139,000 MAD/year, this is due to the nature of the responsibility entrusted to him on vessel board (Figure 5).

CONCLUSION

The data collected in Atlantic Center of Morocco suggests the following interpretation: Coastal purse seiners can generate an annual value-added of about 2 million MAD by vessel (≈ 0.176 million € ≈ 0.248 million \$). Their contribution to the food security and to wealth creation, at the national level, is very important and their economic performance may be affected by several factors, such as:

- Vessel size, because performance indicators (return on investment and profit margin) are higher for large vessels (new ships. 9.2% and 9.7 % respectively) compared with small vessels (old ships. 0 % and -0.1 % respectively).
- Structure of operating costs, specifically fuel, social levies, insurances and repairs.
- Landings composition and their destination markets affect directly the performance levels achieved, given the prices offered by specie and by destination market.

The return on investment for all classes of ships is lower than the average annual bank credit interest rate, which was 12.5%. Consequently, these profitability ratio could hinder the regularly renewal of fishing units. But it should be noted that informal sales are not considered. Indeed, these informal sales may improve the rates of return and therefore reverse the situation.

Furthermore, with the average crew size of about 36 ± 5 persons, purse seine fisheries contribute to the creation of

employment opportunities, not only for the indigenous population, but also for those from other regions of the Kingdom.

In addition, according to the skippers and vessel owners, as well as crew members, the earnings in recent years have decreased due to the increasing price of fuel (diesel) which rose from 3.88 MAD/liter in 2004 to 6.35 MAD/liter in 2011, against an almost stagnating prices of small pelagics in the same period. The weighted average price of the five main small pelagic species was of 1.45 MAD/kg in 2004 and 1.96 MAD/kg in 2011. In addition, over-fishing on the same fishing grounds may have negatively affected the productivity of the fishery.

To increase wealth generated by small pelagic landings, any modernization or renewal, aimed improving storage conditions on vessels board, are highly recommended. Increasing production capacity for processing industries and creating new products with higher value-added, are a way to increase coastal purse seiners performance. Given the importance of fish prices at the fresh fish market comparatively to other distribution channels, it is also encouraged to promote at the national level, fresh fish consumption through awareness campaigns on the importance of the nutritional values of small pelagic fish.

In order to ensure development synchronization of the small pelagic fish sector from upstream to downstream, it is imperative to support industrial activities generating great value-added, particularly canning industry, and develop necessary infrastructures for fresh fish markets.

This paper provides economic data and performance indicators for some purse seine fisheries in Moroccan Atlantic Centre region. Its results allowed us to deepen our knowledge on this fishery. Nevertheless, there is a need for further studies of these coastal fisheries to inform policy makers in designing and implementing better management. During the next phase, verification and extrapolation of these results should be a subject of an extended study taking into account all ports of the Kingdom.

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