Segmentation of the Algerian fishing fleet

Mouloud Hachemane*

Abstract:

Mediterranean decision makers tend to accept that fisheries should be managed through an effort control regime to be applied on Mediterranean operational units. The failure of the quotas management system [Gianluigi and all, 2002] has led to propose and introduce a system based on effort regulation. Even though, the concept of fishing effort and capacity measurement has been subject to many theoretical analyses [Erik Lindbo, 2000], which relied upon a production function approach. the applied works to define an appropriate typology of the Mediterranean fleet is still lacking.

This work aims, by theoretical economic background and multivariate analysis, to identify the mean attributes characterizing the segmentation of the Algerian fishing fleet. The actual segmentation based on the fleet length has been analysed and examined where a heterogeneous typology is proposed.

The cross section data used was collected during the end of 2002 until the beginning of 2003, where more than 607 vessels were investigated through out fourteen representative fishing harbours along the Algerian coast.

Keys words: Segmentation, fishing effort, multivariate analysis, Algeria

* Unité de Recherche et de Développement de la Pêche et de l'Aquaculture, Centre National d'études et de Documentation pour la Pêche et l'Aquaculture, Algérie.

Résumé:

Les décideurs méditerranéens dans le domaine de la pêche tendent à ce que leurs pêcheries soient gérées par un régime de contrôle d'efforts, qui serait appliqué sur les unités opérationnelles méditerranéennes. L'échec du système de gestion des quotas a mené à proposer et présenter un système basé sur la régulation de l 'effort de pêche. Le concept de l'effort de pêche a fait l'objet de plusieurs analyses théoriques, basées sur l'approche des fonctions de production. Il est à signaler la carence en matière de travaux appliqués pour définir une typologie appropriée de la flotte méditerranéenne.

Ce travail vise, à travers la théorie économique et l'analyse multi variée, à identifier les attributs dominants qui caractérisent la flottille de pêche algérienne. La segmentation basée sur la longueur du bateau a été analysée et examinée d'où une typologie hétérogène a été proposée.

Les données de coupe utilisées ont été rassemblées durant la période (fin 2002-début 2003), où plus de 607 navires de pêche ont été concernés par l'étude à travers quatorze ports de pêche représentatifs le long de la côte Algérienne.

Mots clés : Segmentation, effort de pêche, analyses multi variées, Algérie.2

Introduction

Mediterranean decision makers tend to accept that fisheries should be managed through an effort control regime to be applied on Mediterranean operational units [Adriamed, 2001; FAO/GFCM/SAC report, 2001]. For many reasons, the quotas management regime has shown to be ineffective [Gianluigi and all, 2002] and the need to determine and identify the structure and composition of the fishing effort[1] became more than necessary. It is a basic question in bio economic models and public regulation, stock assessment ...etc.

The Scientific advisory committee of the FAO/GFCM adopted length based segmentation for Mediterranean countries [SAC, 2001; Adriamed, 2001] and several studies on socioeconomic aspects in the Mediterranean took in consideration, the length based segmentation [Franquesa R, 2005; Hachemane M. et Ferhane D. 2005].

The present study aims, through microeconomic analysis based upon production function approach [15] and multivariate analysis [16], to identify the mean attributes characterizing the typology of Algerian fishing operational units and subsequently examines the effect of vessel length as a coherent factor in the determination of the landing values variable.

2. Material and Methods

The typology analysis is based on a group of data set collected within the framework of a pilot study related to the socio economic indicators for the Mediterranean fisheries, under the sub regional project "CopeMed", during the end of 2002 to the beginning of 2003. Out of 2526 fishing fleet, 609 were subjected to interviewing.

To identify a proper segmentation for Algerian fishing fleet based on the essential attributes, multivariate analysis was undertaken. We considered the landing values as the dependent variable and the characteristics of the fleet as independent variables (attributes).

The empirical model proposed so far, is a technical relationship represented by the neoclassical Cobb – Douglas production function [12] that is:

$$Q = (Kf, L), \ldots\ldots\ldots (1)$$

Where:

a. Q : represents the individual production,
b. L : is the labour input,
c. K : is the capital input.

The above representation is a gross over-simplification in terms of the number of variables. It is based upon consideration of a two inputs model, capital (K) and labour (L). This framework was criticised for this limitation and was amended to take technological progress in case

of time series and pooled data.

- It is an indicator which permits the measurement of the intensity of pressure exercised by fishermen on the resource stock.

To consider the set of variables that may significantly affect the individual production of the preset segments, we selected as capital and labour inputs a set of physical fishing vessels attributes as follows:

TABLE I Dependent and independent variables

Dependent variable	**Inputs representing labour**			**Inputs representing capital**		
Q	Mn	Ns	Ht	Lg	Cv	tgb
Landing values	fishermen	number of trips	Hours spent in fishing activities	Vessel length	Horse power	Gross tonnage

To investigate this issue, we begin by developing the production function model to take into account the proposed aggregate proxies to be used in the measurement of the fishing effort. It consists of landing values and two groups of variables representing labour and capital inputs which are sufficient for analysing the determination of each segment. It is well understood in such matters the difficulties to identify the combination of attributes that best reflect the segment vessels' landing values.

The initial equation takes the general following form:

$$Q = (\ Tjb\ f\ ,.Cv\ ,.Lg\ ,.Nm\ ,\ Ns\ ,\ Ht\ ) \ldots\ldots\ldots (2)$$

i ii i iii

Where: i = ,...,1N . and Nis the sample size. **f,**takes a non linear form which is a generalisation of the Cobb Douglas production function. The generalised non linear framework for the complete data set is given by:

$$a1\ a\,2\ b1 \quad b2$$
$$Ns_i$$

$$Q = Tjb\ .Cv_i\ .Lg^{a3}\ .Nm\ Ht^{b3}\ e^{u} \ldots\ldots\ldots (3)$$

ii iii

$$\mathrm{ll}_{ij} \rightarrow N(,0\ \sigma^2)$$

And $e^{u_{ig}}$ is the exponential of the error term u_i which is a random disturbance assumed to be normally distributed with mean zero and variance σ^2. The parameters a1, a2, a3, b1, b2 and b3 are the production function elasticities of each associated input

Although there are several difficulties associated with this approach, it is recognised that this specification can produce an accepted measurement of fishing effort.

The data used for estimation purposes were collected, processed by segment then transferred for treatment and estimation to Eviews econometric software.

After logarithmic transformation of equation (3) and assuming that the classical assumptions are satisfied, the estimation of the parameters can be achieved by ordinary least squares technique applied on the following equation.

4

$$LQ = a_1{}^* LTjb + a_2{}^* Cv\,L_i + a_3\,.{}^* LLg + b_1{}^* LNm_i + b_2{}^* LNs_i + b_3{}^* LHt_i + u_i \ldots\ldots (4)$$

ii i

Where, L indicates the logarithm of the associated variable.

To investigate the efficiency of the proposed segmentation [6], the reformulation of equation (4) to take into account the sub samples data was settled and various regression operations were performed on the following generalised model:

$LQ_{ij} = a_1 * LTjb_{ij} + a_2 * Cv\,L_{ij} + a_3 . * LLg_{ij} + b_1 * LNm_{ij} + b_2 * LNs_{ij} + b_3 * LHt_{ij} + u_{ij}$ .... (5).

Where;

$j = ,....1\ s :$

$i = ...,3,2\ ,1\ n_j$

With **n**

j and **s** represent the sub sample size and the number of segments respectively.

Results

Over the totality of the sample size, the stepwise regression analysis result presented in TABLE II, indicates the absence of a full and complete effect of vessel length variable on landing values. These findings are to some extent consistent with the results of **Guyade**r [10] in the sense that more than one variable can explain or measure the intensity of pressure exercised over the resources stock.

Landing values variable (**LQ**) is therefore a function of the attributes **(LNs), (LHt)**which represent the labour input and **(LLg)** as capital input (in logarithmic form). The coefficients are statistically significant and bear the expected signs. The goodness of fit and the over all 22

parameters significance is confirmed by the high value of (R_0) and **F** Snédecor test successively.

TABLE II 3
Parameter estimation result

Dependent Variable: logarithm of landing value **LQ**				
Sample(adjusted): 1 609				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNS	2.223713	0.134818	16.49424	0.0000
LHT	1.569731	0.191300	8.205602	0.0000
LLG	2.019713	0.161168	12.53172	0.0000
$2R0$	0.9878	Mean dependent var		14.24894
Adjusted R-squared	-0.092509	Akaike info criterion		3.765976
S.E. of regression	1.586507	Schwarz criterion		3.788103

[2] -Adjusted R-squared to the cases where the intercept is excluded from the regression. [3] -Eviews software output.

From the above specification, we might conclude that the determinants of fishing effort alongside the vessel length are the number of working hours and the number of trips.

To examine the length based model to assess the fishing effort, we first excluded any source of multicolinearity through the work out of covariance matrices for the different attributes. The covariances were insignificant except in the trawls>24 segment, and then multivariate regression analyses were fulfilled on each sub sample [4] [Franquisa R. and all, 2005; Hachemane M., Ferhane D. 2005]. The significant parameters are shown with their corresponding student t test between brackets for each segment.

TABLE III Significant[5] variables for each segment

variables Segments	nj	LNm	LNs	LHt	LLg	LCv	LTjb
Minor gear with engine< 6m.	81	3 (3.21)	3.89 (14.42)				
Minor gear with engine, 6 to 12m	155		1.89 (4.58)		0.03 (3.16)	1.97 (9.31)	
Purse Seine, 6 to 12m	58	1.02 (2.88)	1.12 (4.27)	3.53 (9.93)	0.59 (2.63)		
Purse Seine, 12 to 24 m.	159		1.97 (5.05)	0.91 (2.2)		1.33 (5.97)	0.2 (2.54)
Trawls, 12 to 24 m.	147			2.69 (5.7)		1.42 (7.08)	
Trawls > 24 m.	7		3.14 (18.92)			1.14 (14.86)	
Occurrences		2	5	3	2	4	1

The various specifications searches were based on the stepwise regression technique. Different combinations of independent variables are taken in an attempt to identify the appropriate functional specifications assisted by a group of statistical tests and the Bayesian information criterion for the selection of nested and non nested models.

In the short run and from these results, the choice of vessel length as the sole determinant of fishing effort and hence the landing values is not statistically justified. It is only significant in two out of six pre-set segment specifications.

More over, it may be noted that the over all sample results are not similar or identical. The striking fact in these specifications is focused around the significance of the number of trips variable which

can be assessed as a key variable in this case study.

[4] -The Sub samples represent in this study the segmentation based on the fleet length variable. [5] - For each variable and the corresponding segment, the numbers represent the significant coefficient estimate with the calculated student t- test between brackets.

Conclusion

The model specification proposed to estimate the inputs elasticities exhibits some capabilities in describing the statistical relationships between landing values and the fishing effort expressed in terms of labour and capital components.

The results of the regression analysis pointed out that fishing effort identification is not an easy task and further studies have to be performed on the basis of pooled data, combining cross sectional to time series data relative to the relevant attributes.

The fleet state and the traditional fishing practices let us think that capital attributes are not so significant where as the number of trips need to be considered as a key factor for the majority of the segments.

References:

1-**Adele finco and all** (2003) "Aspects of the Italian and Adriatic fish market", Adriamed, technical documents n° 10.

2-**Adriamed** (2001). "A preliminary contribution to the Mediterranean operational units", Paper presented at the GFCM-SAC working group on operational units (Ancona, 18th–19th March 2001).

3-**Anderson, L , frost, H** (2000);"optimal effort allocation and shadow prices". Proceeding of the XII EAFE: annual conference, Esbjerg (DK).

4-**FAO.** (2001). "Indicateurs pour le développement durable des pêcheries marines".

5-**FAO.** (2004)."La situation mondiale des pêches et de l'aquaculture".

6-**Franquisa R, Hachemane M. and all.** (2005). "la estimacion de indicatores economicos en las pesquerias mediterraneas", proyecto FAO Copemed, 2005.

7-**Gianluigi Gallenti and all.** (2003). "Economic analysis tools and fisheries management: some methodological remarks". Adriamed, technical documents n° 10.

8-**Gordon M. and Colin C.** (2003). "Fishing capacity and resource management objectives". Measuring capacity in Fisheries, FAO, Fisheries technical papers, n° 445.

9-**Gréboval D,** (2003). "The measurement and monitoring of fishing capacity: introduction and major considerations". Measuring capacity in Fisheries, FAO, Fisheries technical papers, n°445.

10-**Guyader O.** (2000). « Evaluation économique de la régulation des pêches, L'harmattan.

11-**Hachemane M. et Ferhane D.** (2005). "Segmentation de la flottille de pêche et la productivité physique", Revue des Sciences

Economiques de gestion et de commerce, n°13.

12-**Kenneth F. Wallis**, (1979), "Topics in Applied Econometrics", Basil Blackwell, Oxford Aspect of fish markets in the Adriatic Sea, Adriamed, and technical documents n ° 10.

13-**Lindebo E.** (2003), "fishing capacity and European union fleet adjustment", measuring capacity in Fisheries, FAO, Fisheries technical papers, n°445.

14-**Nadiri M.I, Rosen S.** (1969), "Inter related factor demand function", American Economic Review, N° 59.

15- **Placenti V. and all**, (1992), "A Bio–Economic Model for the Optimisation of a Multi –Species, Multi-gear Fishery: The Italian case", Marine Resource Economics, Volume 7, pp. 275 – 295.

16-**SAC**, (2001), report of the fourth session of the Scientific Advisory Committee (GFCM),Athens, Greece, 4-7 June 2001.

17-**Stewart & Wallis,** (1981), "Introductory Econometrics", 2nd edition, Basil Blackwell, Oxford.

18-**Taquet and all**, (1997), "Typologie de la flottille chalutière du port de Sète par une méthode de segmentation", Aquaculture. Living ressources. 1997, 10, 13.