EMPIRICAL ANALYSIS OF THE STRATEGIES AND ADAPTATIONS OF THE SPANISH FLEET AFTER THE COMMON FISHERIES POLICY REFORM

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ABSTRACT

This work analyses empirically the exploitation dynamics from 1997 to 2003, of the most important segment of the Spanish fishing fleet operating in the EU waters, also known as “300 fleet”. The aim of the analysis is exploring the economic consequences of the coming into force of the new approaches in the EU fisheries management system in the framework of the Common Fisheries Policy Reform, particularly from an institutional point of view. Such analysis is based on the use of suitable index analysis for quantifying the contribution caused by the variation in prices, catches, and capital productivity into the changes in production of this fleet segment during this period.

For this case analysis, It is suggested that the current EU fishing resources management system distorts the biological perception of scarceness or abundance of resources through the institutional framework of quota allocation. Quota allocation is becoming the factor that contributes most to explain the variations in fleet income, as against capital productivity that plays a secondary role. However capital productivity would explain the higher contribution to income generation provided that the biological perception of scarceness was internalised faithfully in the institutional framework for EU fishing quota setting and allocation.

Restrictions on fishing activities, based on quotas and licences limit the range of strategies that the Spanish fleet operating in EU waters can deploy in order to face biological variability, improvement of technology and changes in fish market prices. These observations lead to the conclusion that the current fishing resources management system during the Common Fisheries Policy Reform, could have been distorting the biological perception of scarceness or abundance of natural resources and reduce the capital productivity contribution in the income creation, by making the fishing capital less malleable, and by generating less economic efficiency in the Spanish fleet under TAC regulation.

Keywords: Institutional perception of abundance or scarceness of natural resources, Reform of the Common Fisheries Policy, Index analysis.

INTRODUCTION

According to Green Paper on the Future of the Common Fisheries Policy, almost twenty years from its inception, the Common Fisheries Policy (CFP) is still confronted with major challenges, this policy has not delivered sustainable exploitation of fisheries resources and would need to be changed if it is to do so.
In the 2000-2002 period, a new system for the management of European fishing resources was enforced due to the CFP revision. Within this institutional framework, there is a management regimen in European waters based on the concept of "*metier*", whose aim is to integrate not only the natural elements, but also technological, economic and institutional features in the management of fishing resources in European waters.
Precisely this institutional framework is the axis, which conditions to the greatest extent the strategies and responses of the Galician fleet during this period.
Several studies highlight the importance that institutional aspects may have in the operational decisions of European fishermen within the CFP framework (Davidse W.P. et al., 1999; Surís, J.C. et al., 2002). In this piece of work, we follow this research line, analyzing the effects of the institutional perception of abundance or lack of fishing resources over the European regimen of establishment and allocation of quotas. In order to do so, we conduct an empirical analysis of the Galician fleet operating in European waters from 1997 to 2003, identifying the adaptations and strategies of this segment to the institutional framework created after the revision of the CFP.
The period of analysis, 1997-2003, was a period of profound regulatory revision in the CFP reform. During this time, the fisheries management system in EU waters is modified in order to adjust to different regulations whose aim is to preserve resources more intensely. Particularly, the recovery plans, multiannual management plans and improvement of the scientific fisheries advice to the European Commission.

DESCRIPCPTION OF THE FLEET

The *Gran Sole* fleet represents the most important segment of the Spanish fleet fishing in the EU waters. The standard vessel has around 285 GT and 478 kW, is 33 m long, has 13 crew members and an average age of 16.4 years. The main target species are hake, megrim, anglerfish, and norwegian lobster. The *Grand Sole* fleet, also known as the *300 fleet* because since the accession of Spain to EEC the number of vessels authorized to fish is 300, is now composed of 196 vessels which fish for demersal species (table I and II) in ICES areas Vb, VI, VII and VIIIabd. The fleet vessels are grouped in seven associations, each of them belonging to one of the main base ports of the fleet, which are located along the northern and northwestern coast of the Iberian Peninsula. The Spanish law applicable to the Grand Sole fleet activity establishes that every producers association may have a quota on the total fishery input and output. Thus, these associations are granted a maximum number of fishing days and of tons per regulated species, and both numbers are proportional to the historic rights of all the member vessels together. In their turn, these associations may allocate these rights among their members in individual access quotas and catch quotas. Quotas and licences can not be sold among different EU fleets.

Table I: Coverage of the landings database for the *300 fleet*, 1997-2003.

Year	1997	1998	1999	2000	2001	2002	2003
Spanish Vessels Registered	212	204	201	201	200	196	196
Galician Vessels Registered	126	125	124	125	124	130	129
Sample	14	16	19	36	26	22	22
Ratio Sample	11.11%	12.80%	15.32%	28.80%	20.97%	16.92%	17.05%

Source: Dpto. Economía Aplicada, Univ. Vigo.

Table II: Landings per species *300 fleet.*

Major species	Value (mEUR)							Volume (1000 t)						
	1997	1998	1999	2000	2001	2002	2003	1997	1998	1999	2000	2001	2002	2003
Anglerfish	12.7	22.2	24.9	19.7	29.6	19.3	14.8	17.6	3.8	3.6	3.2	4.5	3.4	2.5
Nephrops	4.3	3.5	5.2	5.1	5.8	5.5	5.4	6	0.5	0.6	0.4	0.5	0.5	0.5
Hake	95.5	95.5	92.6	106.0	52.5	56.0	63.3	3	17.2	19.5	20.6	8.9	9.9	11
Megrim	16.3	17.1	16.7	26.0	34.2	26.0	28.4	0.6	6.5	5.8	7.2	7.4	5.6	6
Other sp	28.5	9.7	8.4	4.4	52.8	67.6	58.7	8.1	2.6	2.8	3	8.6	12.9	12.6
Total	157.3	148.0	147.8	161.2	174.9	174.4	170.7	35.3	30.6	32.3	34.4	29.9	32.2	32.6

Source: Departamento Economía Aplicada, Univ. Vigo. Data estimated from samples. Value series are deflated taking 1997 as basis. Other sp: mainly horse mackerel, blue whiting, pollack, whiting, mackerel, sole, haddock.

Throughout the period of analysis, (1997-2003), the fleet is submitted to the intense change in the management system of fishing resources in European waters, as fostered by the CFP, which conditions many of the operational decisions of Galician ship-owners.

It also coincides with a period in which the biomass levels of some species attain historical minima, which led to the proposal of multi-annual plans for the recovery of different species, in the face of which the ship owners were forced to deploy a series of strategies aiming at adjusting to those circumstances.

Table III: Economic Indicators *300 fleet.*

	1997	1998	1999	2000	2001	2002	2003
Economic indicators (mEUR)							
Value of landings	157.3	148.1	147.8	161.2	174.9	174.4	170.7
Fuel costs	19.6	15.3	13.1	24.8	22.5	22.7	25.2
Other running costs	11.0	16.9	18.1	17.9	17.3	16.7	16.8
Vessel costs	24.9	17.4	15.9	21.3	21.1	23.7	21.7
Crew share	72.1	61.2	59.2	67.5	73.9	78.6	73.8
Gross cash flow	29.6	37.5	41.5	29.6	40.0	32.8	33.3
Depreciation	20.7	19.9	20.5	20.6	20.8	21.5	21.6
Interest	1.2	0.8	1.8	1.8	2.5	1.7	1.9
Net profit	7.7	16.7	19.2	7.3	16.6	9.6	9.9
Gross value added	101.7	98.6	100.5	97.2	114.0	111.4	107.1

Other economic indicators							
Employment on board (FTE)	3574.0	2992.3	2805.7	2901.1	2689.8	2410.5	2150.6
Value of landings/invested capital	4.38	4.28	2.08	1.80	1.37	0.95	0.96
Invested capital (M€)	35.9	34.6	71.2	89.6	127.6	183.6	177.6
Effort (1000 days at sea)	53.4	51.4	50.7	54.5	53.5	51	50.5
Capacity indicators							
Volume of landings (1000t)	35.3	30.6	32.3	34.4	29.9	32.2	32.6
Fleet - number of vessels	212	204	201	201	200	196	196
Fleet - total GRT (1000)	41.3	39.8	41.2	40.8	40.6	39	39
Fleet - total kW (1000)	88.5	85.2	84.6	84	83.8	89.7	89.6
Source: Dpto. Economía Aplicada, Univ. Vigo. Value series are deflated taking 1997 as basis.							

It is also the period encompassing the last years of subsidies for shipbuilding so the ship owners make decisions to invest in fishing capital (new constructions, incorporation of new technologies to the vessels and acquisition of fishing rights), in accordance with the strategies they considered optimal depending on the restrictions stemming from the environmental abundance of fishing resources, quota availability, orientations of the structural policy and availability of new technologies. It is interesting to highlight the decrease in the ratio value of landings-invested capital (Table III). Identifying and analysing the strategies deployed during this period are the main aims of this study, so we will support our conclusions on the statistic analysis of several index values.

METHODOLOGY

The idea of index analysis is to use data on the prices and/or quantities of inputs and outputs to identify the contribution of the growth rates of input prices and quantities on the growth of the total production of a selected fishing fleet (Squires, D. 1992 and 1994). Analysis for a given fleet could take into account measures of capital inputs (e.g. number of vessels, total kW or GT, or any other physical or monetary measure of capital inputs); fishing activity (e.g. number of fishing days per vessel); (iii) apparent productivity of inputs (e.g. catches in kilograms per vessel-day, total or per species); stock abundance (e.g. an index of biomass).

Table IV: Main expressions of the index analysis applied to *300 fleet* data.

PRICES ANALYSIS	QUANTITY ANALYSIS
Laspeyres prices index $LP_{t/0} = \frac{\sum_i^n p_{it} q_{i0}}{\sum_i^n p_{i0} q_{i0}}$	Laspeyres quantity index $LQ_{t/0} = \frac{\sum_i^n p_{i0} q_{it}}{\sum_i^n p_{i0} q_{i0}}$

Paasche prices index $PP_{t/0} = \frac{\sum_i^n p_{it} q_{it}}{\sum_i^n p_{i0} q_{it}}$	Paasche quantity index $PQ_{t/0} = \frac{\sum_i^n p_{it} q_{it}}{\sum_i^n p_{it} q_{i0}}$
Fisher prices index $FP_{t/0} = \sqrt{LP_{t/0} \times PP_{t/0}}$ The Fisher price index measures the rate of change in landing prices taking into account the evolution of the structure of landings in volume. It is derived from the Laspeyres price index and the Paasche price index.	Fisher quantity index $FQ_{t/0} = \sqrt{LQ_{t/0} \times PQ_{t/0}}$ The Fisher quantity index measures the rate of change in landings in volume taking into account the evolution of the structure of prices per species. It is derived from the Laspeyres quantity index and the Paasche quantity index.
Contributions to change in revenue of changes in price of each species are calculated as follows: $\Delta P_{i,t/0} = 100 \times \frac{(q_{i0} + \frac{q_{it}}{FQ_t}) \times (p_{it} - p_{i0})}{\sum_i^n (q_{i0} + \frac{q_{it}}{FQ_t}) \times p_{i0}}$ with $\Delta P_{i,t/0}$ the price contribution of species (*i*) to total variation of value between time period (*t*) and time period (*0*).	contributions to change in revenue of changes in price and quantities landed of each species are calculated as follows: $\Delta Q_{i,t/0} = 100 \times \frac{(p_{i0} + \frac{p_{it}}{FP_t}) \times (q_{it} - q_0)}{\sum_i^n (p_{i0} + \frac{p_{it}}{FP_t}) \times q_{i0}}$ with $\Delta Q_{i,t/0}$ the volume contribution of species (*i*) to total variation of value between time period (*t*) and time period (*0*).
Total revenue variation due to a (Q/K) change for species (*i*) is calculated as follows $\%TR/P_{i,t/0} = \frac{\ln(FP_{t/0})}{\ln(FQ_{t/0} \times FP_{t/0})} \times \%P_{i,t/0}$	Total revenue variation due to a price change of species (*i*) is calculated as follows: $\%TR/Q_{i,t/0} = \frac{\ln(FQ_{t/0})}{\ln(FQ_{t/0} \times FP_{t/0})} \times \%Q_{i,t/0}$

RESULTS

Given that the impact of management measures can be measured on one or several of these factors, it seems possible to quantify the consequences of that management measure on the total production of *300 fleet*. The factors analysed are prices (P), apparent productivity of capital (Q/KA) and resource biological abundance (A). As a measure resource abundance is considered spawning stock biomass. (Figure 1).

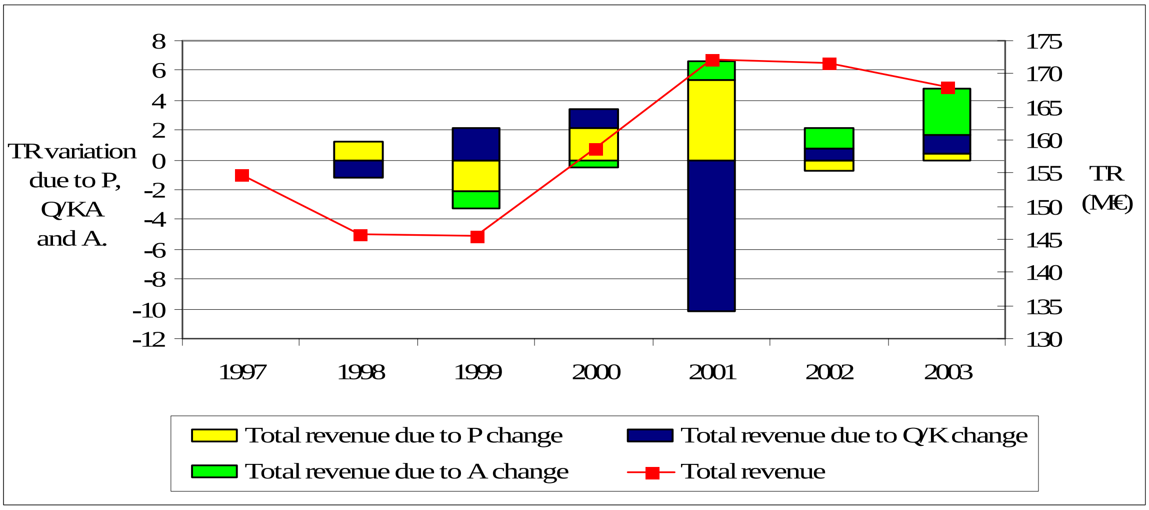

Figure 1. Contribution of P, A and Q/KA changes to TR variation.

The largest contributor to changes in total revenue is apparent productivity of capital, this factor represents 52% of changes in total revenue. Price dynamics would explain 42% of total revenue and abundance 5%. (Figure 2).

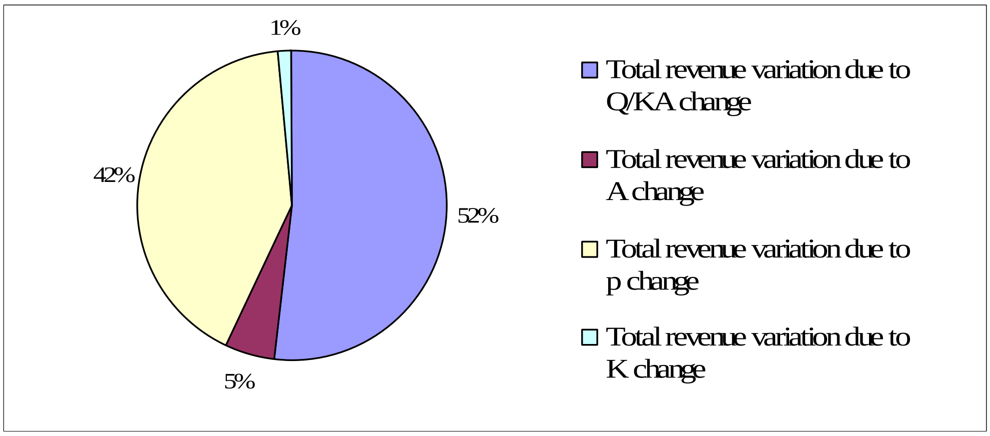

Figure 2. Percent contribution of each factor to cummulated TR variations over the study period, taking abundance as biomass index.

We should not forget that the after the Reform of the CFP, more conservative management instruments are enforced, such as recovery plans aiming at improving the biomass levels of fishing stocks. In the light of these results, the plans for the recovery of European stocks themselves could not be an efficient measure to maintain or to increase the profits of this fleet segment.

However under the current fisheries systems in EU waters the vessels, based on the relative stability principle, fishing vessel must face not only the biological scarceness of abundance of resource, but also the scarceness or abundance given by the institutional process of quota allocation. The process of allocating quota is a rather institutional system, starting from the scientific advice of ICES working groups and STECF and national experts in September, throughout the participation in the process different institutions with different interests such as Members States, European Parliament, different departments of European Commission and stakeholders groups, and finishing in the Council of Ministers of December, where an institutional perception of scarceness or abundance has been strongly applied in decision finally adopted. The political, institutional and negotiation strategies throughout this process determine the final quota, often quite different to the initial proposal given by the scientist.

In the figures 3 and 4, the same structure of index analysis is applied, but introducing the institutional perception of scarceness of abundance of resource, given by the TACs.

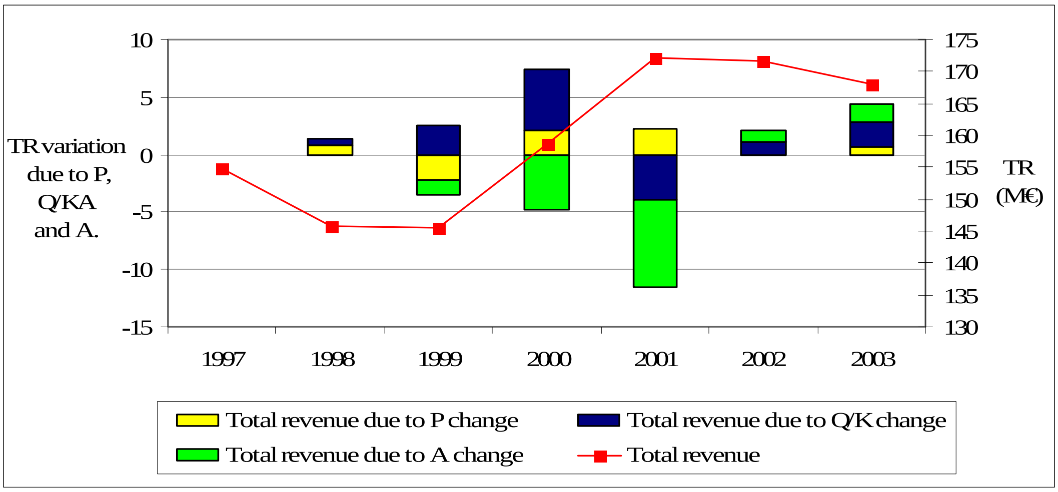

Figure 3. Contribution of P, A and Q/KA changes to TR variation, taking abundance as TAC.

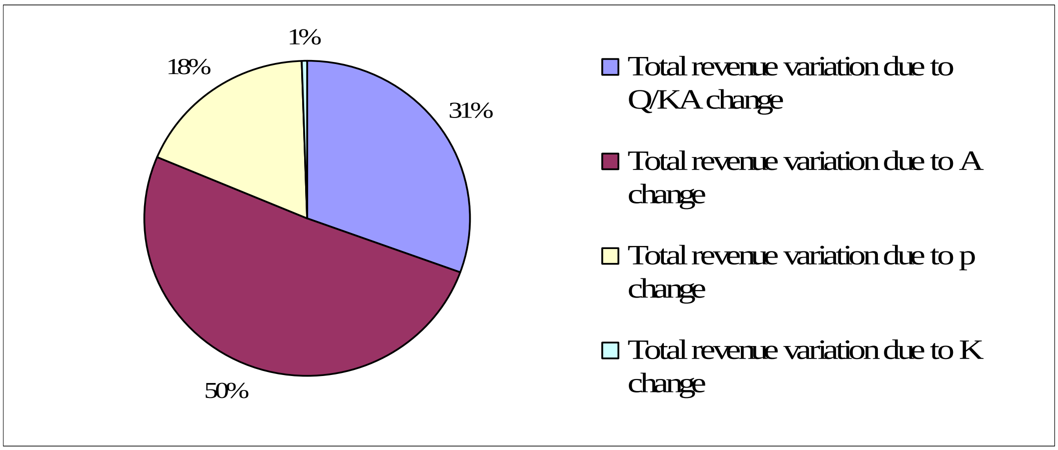

Figure 4. Percent contribution of each factor to cumulated TR variations over the study period, taking abundance as TAC.

In the analytical framework, "institutional perception of abundance of the resource", the TACs are the larger contributor to changes in revenues. Apparent productivity of capital would explain 31% of these changes.
After introducing institutional perception of abundance of the resource, i.e. how the institutions perceive and internalise the scientific advice on biological abundance of the resources, productivity is not the main

explicative factor, but the TAC allocation. The EU fishing resources management system would have been distorting the biological perception of scarceness or abundance of resources through the institutional framework of quota allocation. Quota allocation is becoming the factor that contributes most to explain the variations in fleet income, as against capital productivity that plays a secondary role. Capital productivity would explain the higher contribution to income generation provided that the biological perception of scarceness was internalised faithfully in the institutional framework for EU fishing quota setting and allocation. It is needed the establishment of the appropriate frameworks and mechanisms to obtain scientific advice, as well as the policy-makers need to reflect about its optimal use in the decision-making process. It would suggest that the EU fisheries management system could have been acting inefficiently.

According to this series of data, we build a new database with 42 variables associated to each vessel, which encompass the technological, economic and operational dimension of the vessel. With this database a random utility model is build to analyse *exit/entry* decisions.

The random utility model posits that the benefit an individual receives from a given activity is observable with some degree of uncertainty. The most generalized dorm of this model can be written as,

$$U_{ij} = \beta_{ij} z_{ij} + \varepsilon_{ij}$$

Where for a given fishing trip *i*, choice *j* is made. The explanatory variables z_{ij} can be comprised of attributes of the choice, x_{ij}, and characteristics of the individual, w_i. Through a choice of distribution of the error term, typically logit, then the model can be estimated.

The dependent variable is included taking the value zero if the vessel was not going to stay in the Celtic Sea for next year, and the value one otherwise. A *t-test* was performed, taking as the grouping variable *exit/stay* against the rest of variables in the database.

In addition, other variables, such as engine change, fishing gear change or fishing area change were analysed as target variables. No statistic significance was found in any of these grouping variables with regard to the series of economic, capacity and technological variables.

These results are associated to the limited degree of mobility of the Galician fleet amongst different strategies. In other words, the decisions of operating in a given area, with a given technological equipment and catching some species, are hardly reversible decisions for the ship-owners of the *300 fleet*. The fishing capital is less flexible in the Galician fleet than in other European fleets in the Celtic Sea.

This piece of work also served to conduct a series of interviews to Galician ship-owners operating in the Celtic Sea in order to characterise their perception of the causes of the reduced degree of operational mobility. According to these questionnaires, more than 50% of the ship-owners operate in the same fishing grounds and exploit the same species due to the restrictions imposed by the fishing management system. With regard to the reasons behind not changing the fishing gear, trawlers claim they do not change basically because of tradition and 30% of the longlines due to the institutional framework or the availability of licences. In both segments, more than 50% of the ship-owners claim they do not change target species because of the limitations imposed by the institutional framework.

CONCLUSIONS

This work analyses empirically the exploitation dynamics from 1997 to 2003, of the most important segment of the Spanish fishing fleet operating in the EU waters, also known as "300 fleet". The aim of the analysis is exploring the economic consequences of the coming into force of the new approaches in the EU fisheries management system in the framework of the Common Fisheries Policy Reform, particularly from an institutional point of view. Such analysis is based on the use of suitable index analysis for quantifying the contribution caused by the variation in prices, catches, and capital productivity into the increase in production of this Spanish fleet segment.

For this case analysis, It is found that the current EU fishing resources management system distorts the biological perception of scarceness or abundance of resources through the institutional framework of quota allocation. This instrument is becoming the factor that contributes most to explain the variations in fleet income, as against capital productivity that plays a secondary role. However capital productivity would explain the higher contribution to income generation provided that the biological perception of scarceness was internalised faithfully in the institutional framework for EU fishing quota setting and allocation.

Restrictions on fishing activities, based on TACs and licences limits the range of strategies that the Spanish fleet operating in EU waters can deploy in order to face biological variability, improvement of technology and changes in fish market prices. These observations lead to the conclusion that the current fishing resources management system during the Common Fisheries Policy Reform, could have been distorting the biological perception of scarceness or abundance of natural resources and reducing the apparent productivity of capital contribution in the income creation, by making the fishing capital less malleable, and by generating less economic efficiency in the Spanish fleet under TAC regulation. This observation is in line with the view of a representative sample of ship-owners of *300 fleet*.

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