DETERMINANTS OF FISHERMEN'S COMPLIANCE - LESSONS FROM A COASTAL FISHERY IN BISCAY BAY

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ABSTRACT

This paper focuses on a coastal fishery in Biscay Bay where a variety of fishing vessels operate. To prevent overfishing in this very coastal and very sensitive area, a lot of regulations apply, linked to a licensing system implemented since the beginning of the 80s by fishermen's representatives. A survey has been circulated among fishermen of the area, to collect both information on the compliance behaviours and their determinants. The survey data have been balanced in an econometric model to assess how regarding the regulation scheme, they are affecting compliance with regulations. The model analyses the economic incentives and the impact of the fishermen's regulatory, professionnal and personnal environments (moral and social norms, involvement in the decision process…) on their compliance behaviour.

Keywords: Coastal fisheries, compliance, regulations, econometrics

INTRODUCTION

Coastal areas usually are places where lots of different activities developped, which are often sources of conflicts. Users compete for space or for the access rights to the resources. Fishing is then in conflict with aquaculture, tourism or recreational activities. But coastal fishing also compete with industrial fishing. Apart from "top-down" regulations, local rules have sometimes been implemented as the result of collaborations between professionals and administration to prevent conflicts [1], and to preserve resources by regulating some specific fishing practicies. This management system implies high enforcement costs for the regulatory authority. The problem for the management body is then to try to assess the effectiveness of the regulation scheme, and the impact of enforcement on compliance. While the traditional determinants of non-compliance have been found in the balance of expected gains and losses from illegal activities [2], many studies on compliance with fisheries regulations have outlined that even when the financial incentives to cheat were quite high, with low levels of enforcement, a lot of fishermen were still complying [3]. Other determinants have then been investigated, in the scope of different fields of the social sciences, and especially sociology [4]. The involvement of fishermen in the design of regulations, as well as social and moral norms, have been found to be an important factor for achieving a greater compliance by the fishermen [5]. From the answers to a survey circulated in a coastal fishery in Biscay Bay, this paper will try to assess the respective influence of these factors in the decision to comply or not with regulations[i].

The methodology for both data collection and econometric analysis, have been defined in the context of a european research programe [6]. The french case-study in this research programe targets coastal fisheries in Biscay Bay, to try to assess a great range of potential incentives of compliance behaviours in fisheries. In this area has been implemented at the beginning of the 80's licensing systems, and it was expected that this exclusion system strengthened communities' role and sensitivity to the regulations to preserve the resource and manage the various activities at sea. The vessels from the study area are on the one hand vessels under the licensing system, and on the other hand, vessels excluded from the fishery because they do not fit the licences' requirements in term of length or power. The results of the survey are presented firstly in the perspective of the comments during face-to-face interviews, and secondly, balanced in an econometric model.

Description of the fishing production system and its legal frame

The main features of this fishing area are on one hand the geographical limits of the area, and the variety of the fleets operating, on the other hand, the originality of the production system [7]. The regulatory system has emerged as the result of the strategies of the main players, fishermen, administration and scientists. Strategies themselves have depended very much on patterns of social organisation such as fishing communities. Some coastal fishermen came to a voluntary action to both preserve them from larger vessels' competition and to preserve the resources: licences for nets aimed at the exclusion of some of the players, licences for trawling, on the contrary, aimed at changing fishing effort to promote the use of more selective practices (limitation of length and power of the vessels) [8].

Table 1. Vessels' population of the study area

Metiers	Other dragnets		Bottom trawls		Nets		Pelagic trawls		Trammel		TOTAL
Mean length (meters)	9		11,5		9,8		9,7		10,8		**10,9**
Number of vessels	16	(9,6%)	98	(58,7%)	17	(10,2%)	1	(0,6%)	31	(18,6%)	**167**

Source: from "Directory of vessel owners, 2000", Infomer/Le Marin, 2000.

A lot of other regulations apply to the vessels operating in the area: 76 local decrees have been identified in the fishing area [9]. Under the licensing system, fishermen may apply for a licence if the vessel fits technical requirements, length, power, anteriority. Then several regulations are dealing with the different fishing practicies (restrictions of areas, of periods of fishing, number and type of gears...). For the vessels fishing outside the area where the licensing system has been implemented, in the context of the European regulation R(CEE) n°3760/92, the main access regulation applying to trawlers operating in the coastal fishing zone is National decree n°90/94 of 1990/01/25. This regulation aims at banning trawling from the 3 Nautic Miles. Beyond the limits of 3 NM, there is no major areas nor time restriction, except safety ones. The general European regulations apply to the vessels.

Questionnaire design

The fieldwork had to document the european research project[ii]. A common methodology has been used within the different national case-studies. The questionnaires have only been adjusted to the specificities of the coastal fleets of the French Atlantic and Mediterranean case-studies. The way the questionnaire has been designed "offers a check on the accuracy of the survey in that fisherman's response to compliance questions early in the survey should be consistent with compliance questions further on in the survey. This rough procedure will not, *however*, catch those who false report *consistently* throughout the questionnaire" [6]. After a test, some of the questions however, have been removed from the French questionnaire as they were redundant, and incurred mistrust from the fishermen. It has actually been the case with questions on the gains from non-compliance. The extend of violation has been precisely asked in term of the number of times the fisherman was cheating a year, and only one question on the expected gains has been asked. On these topics, indirect questions, on the perceived compliance level of other groups of fishermen, have been preferred in the questionnaire. The following themes have been addressed in the survey.

- Legitimacy: involvement in and knowledge of regulations, effectivity and fairness of enforcement, fairness of regulations...
- Deterrence: perceived probability and level of sanction for non-compliance (probability of detection? Probability of sanction if detected? Expected penalty if convicted)...
- Economic incentives: loss in revenue, expected gain from violation...
- Influence of normative and moral judgements
- Perceived social influences: perception of non-compliance behaviours by peers

- Compliance behaviour
- Other potentially significant variables : fisherman's age, fishing experience, average income, characteristics of the vessel…

Characterisation of the surveyed population

The surveying stage resulted in 62 face-to-face interviews conducted. If a feature of this coastal fleet is the practice of several metiers, the main fishing practice is trawling, and this clearly appears in the sample population: 77,5 % of the sample use bottom trawl (87 % adding pelagic trawlers), while the passive gears represent less than 15 % of the sample. 41 on 62 of the vessels have reported at least 2 metiers, even if the licensing system sometimes restricts this poly-activity. This problem has been reported by several surveyed fishermen: when the licensing system has been implemented, a lot of people have only applied for one or two costly licence(s) to carry on their fishing activity. But later, in the context of the depletion of the resource, they realized that poly-activity could be a way to secure regular earnings with the advantage of decreasing the effort on only one specie. The main characteristics of the sample are summarised in table 2.

Table 2. Characteristics of the surveyed population

Characteristics	Nb of obs.	Mean	Std. Dev.	Min.	Max.
Length (m)	62	14.1	3.2	8.7	24.4
Nb < 12 m	*21*				
Nb 12 - 14 m	*10*				
Nb 14 - 16 m	*15*				
Nb > 16 m	*16*				
Power (kw)	62	233.5	116.4	73	478
Vessel's buying date	61	1995	7	1972	2002
Vessel age (years)	62	19.4	8.7	2	49
Service of the captain	62	21.3	7.6	6	46
Captain's age	62	39	8	25	60

Source: Survey results

On the whole sample, owners are experienced (mean of years in fishing: 21 years), and their age is near 40. The vessels are quite old, around 20 years, which is a little lower than the late information on the population (respectively 24 years and 21 years in the two main ports in 2002)[iii]. But the sample confirms the difficulties of the fleet to renew.

Any questions have been addressed to the fishermen at the beginning of the questionnaire, firstly to make off contact with the person, and secondly to collect some basic information on the fishery, conservation problems, and general management appraisal. These answers have not been used in the model (as they could have been difficult to interpret, or present obvious answers), but are a way to present the survey population.

69% of the fishermen said that the selfish attitude of fishermen had no important consequence on the depletion of the resource, almost the same distribution than the question on the lack of knowledge[iv] of fishermen (75% : "not a problem" or "minor problem"). This percentage increases in the response to the question on whether the lack of controls or enforcement could have had consequences on the resource : 90% of the fishermen answered "No problem", and 95% said that the number of fishermen wasn't a problem either. The reasons of the resources' depletion are, to their views, the technical progress (56%) and mainly the lack of knowledge among scientists (78%). That is to say, for the surveyed fishermen, the reasons of the depletion of the resource is much more seen to have "hexogeneous" causes, pointing out the industrial fishing and problems of scientific advices.

Lots of factors have been reported to have an incidence on cheating behaviour, and some of them can be balanced. Controls influence cheating behaviour (81%), but captain's experience (68%) too. 75% of the fishermen reported that debt may have an impact on cheating behaviour. The metier (60%) or the weather (57%) may have any influence. Only one determinant, the prices at auctions, would have a lower influence on cheating behaviours (46%), but the "resources abundance" (or in-aboundance), plays a great role in the decision to cheat (70%). The quantities (harvested fish for a trip at sea) have a strong influence on cheating behaviours, but the prices at auctions, so the wholesaling system or quality of the production doesn't really influence this behaviour. This could be a first conclusion on the way the fisherman behaves regarding fishing strategies : the decision seems to be mainly taken onboard the vessel, and what happens at auctions doesn't influence its behaviour[v].

Overview of survey results

Enforcement and deterrence
A third of the respondents reported a "poor or very poor job" of the authorities, and less than 12% reported that they didn't have enough resources (personnel and equipment) to enforce the regulations. Near ¾ of them reported a "high / very high" probability of being caught if they were to violate access restrictions. 97% reported that if they were caught in infringement, their probability of being prosecuted and fined would be "high / very high". 61 fishermen on 62 reported that they would might up with a fine. This confirms a quite good enforcement of the regulations, even when on these questions, a biais can not be excluded, fishermen trying to preserve themselves.

Only a half of the fishermen reported to have been controlled the year before the interview took place, that is to say one vessel on two has been checked by authorities the past year. Only 16% of the remaining respondents have experienced 3 and more controls. From these results, considering ½ the probability of being controlled a year, it seems surprising that 20% of the surveyed fishermen reported that they have never been controlled in the past five years, while a half of the sample, on the contrary, reported to have been controlled more than 5 times within 5 years. From these results, it seems that authorities are targeting likely offenders in the fishing area, or at least are perceived to do so. This has been confirmed by several fishermen.

Legitimacy
If the surveyed fishermen didn't feel involved in the regulatory process (80%), the results show that they recognize to their representatives a greater ability to participate in the design of regulations : the fishing industry, in general, is then reported to be a little bit more involved (61% "not involved"), and the local specificities have been partially taken into account (54.2% answered "poorly / not at all"). The local level is reported to be the second level of responsibility in the design of regulations, but far behind the EU (25% against 82%). From these answers, differences between small boats and larger ones appear to be significative. Within the vessels under 12 meters, 60% of the fishermen reported that local specificities have been taken into account, while this percentage decreases when the length increase: 33% of the owners of vessels between 14 and 16 meters, 30% of the owners of vessels from 16 to 18 meters.

For 61% of the fishermen, regulations are ineffective in conserving fish stocks, indicating a mistrust in the management system. Near 70% disagreed with the statement "access restrictions would be effective in conserving fish stocks if fishermen complied with them?". Some fishermen have mentionned an ineffectivity of the regulations, either in the sense that they are inadequate to the fishing area[vi], or in the sense that there is nothing more to do to recover the resource because it is too late according to their views, as it has been mentioned by several fishermen.

Regarding the fairness of inspections, 83% of the fishermen have reported "fair or very fair" inspections, and 81% told the interviewers that they were treated fairly when they were convicted of an infringement. But the result isn't so straightforward when fishermen talk about the fairness of the fines imposed in court : a third of the sample reported that court's sentences were somewhat unfair.

Social influences
The responses regarding the reported influence of peers, PO's and family on their decision to cheat is straitforward. Peers seem to have any influence on their decision (31% of the fishermen), more than PO's (22%) or far more than other fishermen (12%) or family (8%). This set of answers confirms that the decision to cheat is taken onboard the vessel. Only the opinion of peers might have an influence, but the family or the POs on land have no influence. The reported overall level of non-compliance among local fishermen can be regarded as beeing "high", "none" or "few" of them are thought to comply for a third (33%) of the respondents. This level is reported to be a little lower among fishermen practicing the same metier as them (28%), or other metiers (25%). But it is greater when asking for the level of compliance of other fishermen, outside their fishing area (37%).

Moral determinants
The fishermen seem to be very sensitive to "moral" determinants, such as the respect of the Law (61%), or conservation motives (56%), but their decision to comply or not will be balanced by the effective results or implementations of the Law or the management system: 66% of them reported that they shouldn't comply with regulations if these regulations are ineffective in conserving fish stocks, 54% if they are "unfair".

Compliance
The questions on personal experience of enforcement and compliance have reached significant response rates. In coastal communities, people who do not regularly comply are well known, even by the administration, and they generally do not hesitate to report that they are not complying. Some other people have reported that they are usually cheating, but at a *marginal* level: for instance, in the case of the 1 mile regulation for trawlers, a fisherman reported that at night or when there was few risk of being caught, he fished once just a bit inside the limit of 1 nautical mile, and it was only a 15 minutes trawling. It has been argued that this is because this limit is not so obvious, firstly because they say they cannot always check to know if they really are outside the limit. Another explanation might be put forward regarding the perception of regulations by the fishermen under a licensing system: as the entry is strictly limited and regulated, and additional constraints seem to them to be superfluous.

Fishermen have very well answered the question on the extent to which they have been in infringement the year before. From the sample results, three categories of fishermen may be identified:

1. people who reported to comply all the time with access restrictions (26 "compliers", 42% of the sample)
2. people who reported to have been "once or twice" to "sometimes" in infringement (24 "occasional non-compliers", i.e. 39% of the sample)
3. people who reported to cheat with access restrictions "quite often" or "frequently" or "most of the time" (12 "non compliers", 20% of the sample)

Few of the interviewed fishermen however have answered the questions either on the expected gains or losses of non-compliance with regulations, nor on the expected penalty in case of conviction of non compliance. The information on financial incentives are fishermen's judgement on non-compliance as a condition for a vessel to remain viable (60% agreed), and on the fact that non compliance is understandable when people have a living to make (77% agreed). The fishermen have been less reluctant to answer these questions rather than giving their own experience of gains from non-compliance.

The reported amount of the fine if caught fishing in restricted times or areas is "less than 1500 euros" for a third of the fishermen, and "between 1500 and 8000 euros" for a half of the sample, that is a little higher than the fines usually imposed by french courts [10]. This fines' amount is however reported to be "high or too high" by 84 % of the fishermen, and is "deterrent / very deterrent" for 65 % of them, answers that have to be considered with care. Regarding the frequency of inspections, at sea or in ports, the answers are straightforward : around 95% of the fishermen declared that they were sufficiently frequent (or too frequent).

Compliance behaviour : the model

Using the methodology defined in the project "methodological report" [6], the model will contribute to assess whether economic incentives, but also social, moral influences, legitimacy or deterrence, may have an impact on compliance behaviour of the surveyed fishermen. Stata software[vii] will be used in the estimation procedures, which follow the guidelines agreed in the methodological report: the use of ordered probit estimates to deal with categorical qualitative variables.

Two simultaneous equations have then been defined. The first one is a violation equation, measuring the extent of non-compliance of the fishermen, by the self reported number of violations the year before. This self-reported violation is a function of a self-reported probability of getting caught, and a set of other variables: financial incentives, deterrence of the enforcement of the regulations, social and moral variables measuring the influence of personnal construction and peers attitudes on compliance behaviour, and variables of the perceived legitimacy of authorities, finally variables defining characteristics of the vessel or the skipper. å is a measure of random effects influencing violations.

Reported Violations = ƒ (economic incentives, deterrence, social, moral, legitimacy, vessel) + å (1)

Reported Probability of getting caught = ƒ (boardings, landings, penalties, convictions) + ν   (2)

The first concern were to assess the possible endogeneity of the probability of getting caught as a regressor of the violation equation. Following the methodological plan, a test based on the Davidson-MacKinnon version of the Hausman test has been used, applied to an ordered probit model. The equation (2), so called "secondary equation", comes from the assumption that the fisherman's perceived probability of getting caught depends on several variables : experience of controls and convictions (ncont : number of controls the year before ; nconv : number of convictions the past five years), and perceptions regarding the enforcement (probf : probability of being fined if caught ; fris : reported assessment of the frequency of inspections at sea), finally the expected amount of the fine if caught.

The results of the test allows for the estimation of the violation in a single equation, where the self-reported violation is the dependant variable. The probability of being caught is then used as a regressor with some other deterrence variables. The other explicative variables belong to different types of determinants of the compliance behaviours. According to the methodological report, these variables can be divided into 6 categories:

   a) detterence (experience of convictions, expected amount of the fine if caught)
   b) incentives (economic incentives of non-compliance)
   c) social norms (how the fishing community influences compliance behaviour)
   d) moral (how the fisherman deals with his own moral norms when he has to decide to comply or not)
   e) legitimacy (variables assessing the fairness of the regulations and their efficiency)
   f) vessel characteristics (vessel age, engine power, number of metiers…)

The variables presenting obvious answers, with high levels of agreement to only one item, or variables subject to biaised answers, have been removed from the model. The generic term "legitimacy" groups different questions related to the regulations (efficiency of access restrictions), the way these regulations are enforced (job of the authorities), then the fairness of both regulations and their enforcement, and questions on the reported involvement of the fishing industry in the design of regulations.

Three variables of the skipper have been used in the final violation equation, which might be a factor influencing compliance : age of the vessel, power of the vessel, and the number of métiers. A description of the other variables used in the model are presented in the tables 3 and 4, and the results

of the ordered probit estimates of the primary and the secondary equations are presented in tables 5 and 6.

Table 3. Description of the variables used in the secondary equation (2)

Variables	Description
probd	Dependant variable : perceived probability of being caught while in infringement to access restrictions, coded from 1:very low to 4: very high
nconv	Reported number of convictions the past 5 years, coded from 1 (more than 5 times) to 7 (never)
ncont	Reported number of controls the year before, coded from 1 (more than 5 times) to 7 (never)
fine	Reported amount of the expected fine for an infringement to access restrictions, coded 0: amount <1500€ and 1: amount >1500€
probd	Perceived probability of being fined if caught while in infringement to access restrictions, coded from 1:very low to 4: very high
fris	Reported frequency of inspections at sea, coded 1: not quite frequent enough, to 3: too frequent

Table 4. Description of the variables used in the primary equation (1)

Variables	Description
ninf	Dependent variable : number of reported infringements to access restrictions last year, coded from 1 (most of the time) to 6 (never)
probd	Perceived probability of being caught while in infringement to access restrictions, coded from 1 (very low) to 4 (very high)
nconv	Reported number of convictions the year before, coded from 1 (more than 5 times) to 7 (never)
invind	Involvement of the fishing industry, coded 0: (totally) involved to 1: (actively) ignored
freg	Fairness of regulations, coded from 1 (very fair) to 4 (very unfair)
viab	Non-compliance as a condition for a vessel to remain viable, coded o if Yes, 1 if No
resppro	Professionals themselves are responsible for the implementation of regulations, code 0: agreee, 1: disagree
lspe	Local specificities have been taken into account in the implementation of access restrictions, coded 0: disagree, 1: agree
cons	Access restrictions are necessary to conserve fish stocks, coded 0: disagree, 1: agree
equity	Access restrictions should be complied with because otherwise you are taking more than your fair share, coded 0 if disagree, 1 otherwise
fine	Reported amount of the expected fine for an infringement to access restrictions, coded 0: amount <1500€ and 1: amount >1500€
living	Non-compliance is understandable when fishermen have a living to make, coded 0: disagree, 1: agree
oppeers	Assessment of peers' opinion if you were seen fishing in a restricted area, coded from 1: go up to 4: go down a lot
lcmet	Perceived level of compliance of fishermen doing the same métier, coded 1: none to 4: almost all of them
nmet	Number of metiers (licences), coded 1: one to 3: three and more
invpro	Access restrictions should be complied with because professionals have been involved, coded 0: disagree to 1: agree
power	Power of the vessel (continuous)
vage	Age of the vessel (continuous)

Table 5. Results of the ordered-probit estimates for the primary equation (1)

Variable name	Coefficient	P-value
probd	1.767	0.000
nconv	1.462	0.000
invind	.874	0.034
freg	-.487	0.004
viab	2.464	0.000
resppro	-1.336	0.032
lspe	2.375	0.000
cons	1.919	0.000
equity	-1.147	0.016
fine	2.467	0.000
living	-1.070	0.098
oppeers	-1.546	0.025
lcmet	1.074	0.000
nmet	-1.181	0.006
invpro	-.206	0.716
power	-.014	0.000
vage	-.139	0.000

Probability cut points

	value	Standard error
cut1	5.717	2.998
cut2	7.468	3.164
cut 3	7.986	3.187
cut 4	9.207	3.248
cut 5	10.447	3.276

Log-likelihood = -53.744538
LR chi-squared = 80.73
N = 62

Table 6. Results of the ordered-probit estimates for the secondary equation (2)

Variable name	Coefficient	P-value
ncont	-.189	0.074
nconv	-.394	0.130
fine	-.138	0.694
probf	.556	0.056
fris	.538	0.117

Probability cut points

	value	Standard error
cut1	-1.536	2.302
cut2	.319	2.300

Log-likelihood = -52.638419
LR chi-squared = 16.73
N = 62

Discussion of the results

Looking firstly at the secondary equation, the perceived probability of detection doesn't seem to be closely linked to any of the variables used in this equation. As it was expected, the number of controls the year before seems to have an influence on the perceived probability of detection. The p-value is 0,074, with a coefficient of −1,89. The negative sign of this variable, as well as for the number of convictions, is reliable when looking at the coding of the variables:

- the perceived probability of detection is coded from 1 (very low) to 4 (very high)
- the numbers of controls and prosecutions are coded from 1 (more than 5 times) to 7 (never been controlled or prosecuted).

Then a negative sign indicates that the perceived probability of detection decreases when the number of controls or convictions decreases. The other variables, number of convictions and perception of the frequency of inspections at sea, seem to have a smaller incidence on the perceived probability of detection. The expected amount of fine has a high p-value, which indicates that the level of the fine would not influence the perception of the risk to be detected when violating access restrictions.

In the primary equation, two alternative variables from the secondary equation have been used. The selection of these variables was firstly based on the p-values of the secondary equation. Following the methodological report, the dependent variable (number of infringements) was related primarily to the deterrence variable probd (perceived probability of detection). To avoid redundancy and possible endogeneity problems, the variables which seem to have the weakest link with the probability of detection have then been used in the primary equation: the expected amount of the fine, and the number of convictions.

The primary equation is finally one dependent variable (number of reported infringements) and a set of 17 right-hand side variables. The first comment is on the liability of the results: a great stability of the variables has been observed in the different types of model tested.

Most of the variables used in the model seem to have significant influence on the level of compliance. Firstly, economic constraints are strongly associated with the number of infringements. The viability of an ownership appears to be highly positively linked with the number of infringements. As a consequence, we could say that debt influences cheating behaviour. Another variable confirms and precises the influence of economic constraints: are fishermen accepting the idea of violation when "they have a living to make"? This variable is negatively related to violation, which is consistent when looking at the coding of the variable, but with smaller p-value and coefficient. This could reveal a gradation in the financial constraints, as the question of living seem to have a lower influence on violation than debt. The last financial determinant is related to deterrence and has one of the most important coefficients in the violation equation: the expected amount of fine. This variable is highly positively related to the number of violation, i.e. when the expected amount of the fine is low, fishermen will have a tendency to cheat more. This first set of variables in the model confirm traditional determinants of frauds [11]. Economic incentives, actually constraints, and disincentives, are confirmed to pay a great role in violation behaviours.

The second set of variables is deterrence: how do enforcement and prosecutions influence violation? The perceived probability of detection and the number of times the fisherman has been convinced of an offence the past 5 years are positively related to violation, with strong coefficients. Regarding the first variable, this result is consistent with expectations. The perceived probability of detection, if reported to be high, seems to be an incentive to comply. But in the case of convictions, this result could be counter intuitive. These two answers may reflect the several behaviours already identified, and especially a group of fishermen who have reported to be "non-compliers", identified as so in the fishing community, and who do not hesitate to report to have been prosecuted.

The preliminary analysis have outlined that legitimacy could be of a great importance in the decision to violate. As it was unexpected, the reported involvement of the fishing industry in the design of access restrictions is not so determining, even when it seems significant. Much more unexpected, the sign of this variable is counter-intuitive: the involvement of the fishing industry in the design of access

restrictions is not a condition for a vessel owner to comply with these regulations. An explanation could lie in the mistrust of the fishermen towards their representatives. Surveyed fishermen have often reported not to be part of the professional organisations, to have experienced it sometimes, but to have been disappointed: for many of them, representatives are mostly defending their own interests (metier, fishery…, depending on who is in charge). If you don't agree with that or if you are outside the inner circle, you will not benefit from representatives' actions. Looking at the variable "responsibility of the professionals themselves", the negative sign is this time consistent with the expectations due to the coding: the more professionals are thought to be responsible for the regulations, the more fishermen comply. This would confirm the mistrust towards representatives. Another explanation can be found, in the specific case in areas where fishermen have been actually involved in the design of the regulations (licensing system). This licensing system seems to work like a closure from where other vessels are excluded, and belonging to the group of fishermen who have granted access to a (several) licence(s) free these fishermen from some other constraints, for instance access restrictions. The licence is then thought for some of the fishermen to be sufficient for the management of the fishery. The violation equation confirms nevertheless that legitimacy is a determinant of importance in the decision to comply or not. When local specificities are thought to have been forgotten in the design of regulations fishermen are more likely to cheat. Unlike the other legitimacy variables, "local specificities" is really consistent with strong p-value and coefficient. To go on with the legitimacy variables, the influence of fairness of regulations seem to be of importance in our model: with a very low p-value but a smaller coefficient than other variables. The introduction in the model of the variable "regulations should be complied with because professionals have been involved" is not linked with violation. Although we get a high rate of answers to this question, no relationship appears between this variable and violation. This confirms the previously mentioned relative importance of the variable "involvement" in the decision to comply or not.

Turning now to social and moral influences, the results are interesting in the sense that norms influence fishermen's behaviour. In this model, conservation is an important factor affecting compliance with fisheries regulations. This result was perceptible during interviews in a previous study [10], but is confirmed in this survey. With a strong coefficient, the link between the necessity of having access regulations to preserve fish stocks and compliance is very positive: fishermen who disagree with this statement are more likely to violate.

Surprisingly a negative sign is found when looking at the variable on equity: fishermen who agreed on compliance for equity reasons ("otherwise you are taking more than your fair share") didn't reported to comply. The opinion of peers on compliance behaviour presents the same counter-intuitive sign. As a consequence, it could be argued that the opinion of peers, unless they seem to be of importance in the model, reflects the preliminary results and comments of fishermen during the interviews: their decision to violate has been reported to be personal: neither peers nor family nor other fishermen's opinion is of importance.

But an interseting result comes from the positive relationship between the perceived level of compliance of peers and violation. With a strong p-value and a coefficient of 1,074, fishermen who have reported to be violators themselves consider that other fishermen in the fishery do not comply either. The level of non compliance in the fishery seems then to have a strong impact on fishermen's decision to violate or not.

Finally, any variables of "activity" and "production tool" that were supposed to have an influence on fishermen's behaviour have been introduced in the model. The licensing system may have any drawbacks, especially when fishermen have only applyed for one licence when the system has been implemented, and would like to diversify their activity. The introduction of the variable "number of metiers" was then thought to be able to explain part of violation. The result in the model doesn't confirm this hypothesis, mainly based on comments made by fishermen, the coefficient of this variable presenting a negative sign: the more the vessel owners are practicing several metiers the more they violate. Due to the broader sample than vessels under a licensing system, this result maybe doesn't reflect the specificities of one particular area. Moreover, the choice of this variable is maybe not

relevant, numerous vessels of the sample having a poly-activity. An explanation to this result could then lie in the extended possibilities to violate when you have several gears onboard, and then you have to face several regulations.

The last set of variables is related to physical characteristics of the vessel: age and power. The p-values of these two variables are significant even when their coefficients are low. But with a negative sign in both case, powerful vessels and older ones are more likely to commit infringements.

CONCLUSIONS

The results from both descriptive and econometric analysis of the survey have highlighted the difficulties to deal with qualitative and categorical data. Descriptive analysis presents sometimes results which differ at the margins, and econometric modelling on moral or social variables for instance doesn't always spresent straightforward answers. Nevertheless, these analysis give some interesting information on the determinants on compliance.

In the determination of compliance behaviours, survey analysis have highlighted the importance of "traditional" factors as deterrence and financial incentives. In our case, it would be more adequate to say financial "constraints", as the question of gains from non-compliance didn't reach high rate of answers. The variable "incentives"may recover different realities: do the fishermen expect to increase their earnings only to have a higher living standart, or is it a way to face financial constraints? It could be interesting in further work to try to cross these potential determinants. Analysis of financial constraints in the model seem to allow to identify a gradation in the cheating behaviour depending on the level of debts.

Regarding deterrence, a quite good enforcement of regulations emerged from the results, even when regarding the probability of detection (1/2 a year) 20% of the sample reported not to have been controlled in the past 5 years. No reason appeared from the interviews to reject the liability of the assessment of quite good enforcement: this result could come to the conclusion that authorities are targeting likely offender fishermen. Furthermore, the specificity of access restrictions is that infringements to these regulations are highly visible, especially because we are talking about coastal fisheries. Controls can not be intended "a posteriori" and the only way of detecting and prosecuting cheating behaviours is to catch the fisherman in the fact. From the model, the perceived probability of detection and the number of convictions the past 5 years is positively related to violation, with strong coefficients

On the whole sample, when dealing with violation behaviour, the question of "legitimacy" presents surprising results. In the model its importance in compliance behaviour does not seem to be as significant as expected. Some of the coefficients are relatively low, and the variable "involvement in the design of regulations" has counter-intuitive sign: the more fishing industry is reported to have been involved, the more the fisherman does not comply. Any explanations have been found in the role of representatives and the mistrust professionals sometimes have in their representatives, but this result on involvement is interesting. On the contrary, when regulations are thought to have taken into account local specificities, the link with compliance is straightforward.

The introduction in the model of social or moral variables came to the conclusion that conservation is a strong determinant for compliance, counterbalanced by contradictory feelings: the influence of peers or equity reason does not seem to lead to greater comply, whereas the level of compliance within peers influences the surveyed fisherman: the more peers are thought to violate, the more a fisherman will too.

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[i] For confidentiality reasons as agreed with the fishermen on such a sensitive subject, precise data on the fishery's location have been removed from this paper.

[ii] "FISHREG", see [5]

[iii] In Le Marin, 2002 June 07.

[iv] In a broad sense : knowledge of the resource biology, the regulations, the management system…

[v] This general statement could be explained in the case of the vessels selling at the auctions of the main port of the area. This port has the specificity of not having an auction place for fresh fish. High-seas vessels land when they come back to the main port and products are stocked before being sold in the next morning. This could be the reason why fishermen selling at this auctions' place do not expect to differenciate their products from the industrial ones, and usually do not pay a great attention to the prices at auction.

[vi] For them, they are anappropriate, and this might be confirmed by the following question : 70% of the fishermen reported that access regulations aren't linked with field realities

[vii] http://www.stata.com/