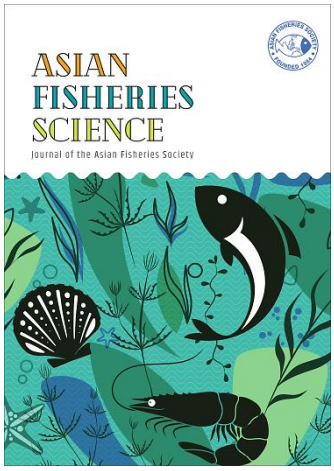

Modelling Compliance in Small-scale Fisheries: A Case Study from the Sultanate of Oman

IBRAHIM ABDULLAH AL-QARTOUBI[1,*], HUSSEIN AL-MASROORI[1], SHEKAR BOSE[2]
[1]College of Agricultural and Marine Sciences, Sultan Qaboos University, P.O. Box 34, Muscat PC:123, Oman
[2]Department of Natural Resource Economics, Sultan Qaboos University, Muscat, Oman

*E-mail: ibrahim.alqartoubi@gmail.com | Received: 14/11/2019; Accepted: 28/05/2020

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Abstract

Despite extensive research in fisheries compliance, the artisanal fisheries sector has received little attention. A total of 397 artisanal fishers were interviewed using face-to-face questionnaires and stratified random sampling in an attempt to understand the social and economic factors impacting the compliance level. Two types of logit economic models (basic deterrence and extended economic) were used to evaluate violation decisions made by artisanal fishers. In general, the extended economic model generated better results than the basic deterrence model using primary probabilities. Demographic factors, legitimacy variables and biological factors (e.g. catch per unit of effort) were found to play key roles in violation decisions, unlike moral norms which had no impact. The study provides empirical support for the theory that potential profits, ethical standards, legitimacy, and social impact are the key variables for encouraging compliance in the artisanal fisheries sector. In the light of current operational challenges in terms of human and institutional capacity and inadequate financial and logistical resources, a heterogeneous approach to the fisheries management program was recommended. This research can be carried out by any fisheries agency to help inform their management decisions with unbiased data on the strategic choices made by fishers with regard to regulation.

Keywords: enforcement, socioeconomics, MCS, fishers' view

Introduction

Most developed and developing countries suffer from the depletion of fish stocks due to illegal, unreported and unregulated (IUU) fishing activities (Lee and Viswanathan, 2020) and the lack of efficient monitoring, controlling and surveillance (MCS) systems to enforce fisheries regulations (Daliri et al., 2016). Fisheries management is struggling to strike a balance between the protection of fish stocks, the sustainable exploitation of fishers' assets, and the advancement of economic efficiency (Wilson et al., 2003). Oman seeks to balance the rational exploitation of fisheries resources with the enhancement of fishers' incomes (Al-Rahbi, 2008). The Ministry of Agriculture and Fisheries (MAF) in Oman plays a significant role in managing fishery resources and thereby protecting the livelihoods of thousands of artisanal fishers through the enforcement of fisheries legislation (Bose et al., 2017).

In Oman, fisheries legislation is enshrined in the Law of Living Aquatic Wealth ('Fisheries Law', hereinafter) (Ministry of Legal Affairs, 2019) and enacted through MCS programs. To enhance compliance and the effectiveness of the law, MAF developed a National Plan of Action (NPOA) in 2006, to prevent, deter and eliminate IUU fishing (Ministry of Agriculture and Fisheries, 2006). This national plan was developed following the International Plan of Action (IPOA) adopted by the Food and Agriculture Organization (FAO) of the United Nations (UN) in 2001 (Food and Agriculture Organization, 2008).

The fisheries sector has been identified recently in the National Program for Enhancing Economic Diversification (Tanfeedh) as one of five promising

sectors for economic diversification and enhancement of non-oil revenues of the Sultanate (Support Implementation Unit and Follow-up, 2017). Tanfeedh is an action-oriented program derived from the 9th Five-Year Development Plan (2016–2020).

The Omani government's most significant task is not only the development of policies and laws, but also the implementation of MCS instruments to achieve more results-oriented strategies (Al-Subhi et al., 2013). With operational constraints and limited economic and human resources, efficient monitoring of fishing operations is challenging for the management authority. Other issues facing the authority are the efficacy of the legal regulations and the impact of enforcement on compliance. In particular, Oman has many fish landing sites, some of which are hard to reach owing to geography (Bose et al., 2017). The artisanal small-scale fisheries sector has received little attention in compliance research (Garza-Gil et al., 2020). Therefore, there is a strong need for research to help understand the social and economic factors motivating people to fish in contradiction of fishery regulations.

The objective of this study is to empirically examine the factors affecting compliance level with fisheries regulations in small scale fisheries. A case study of Al-Batinah and Al-Wusta governorates in Oman was considered. The study aimed at, i) investigating fishers' views on enforcement and compliance in order to identify factors that affect their compliance behaviour, ii) verifying compliance behaviour with respect to fishers' decisions towards the enforcement mechanism (e.g. sanctions), individual morals, social pressures, and perceptions of the legitimacy of regulation, and iii) comparing the two sites and identifying any socio-economic factors affecting compliance.

Small Scale Fisheries and Compliance Level in Oman

Oman's fishery is divided into three broad sectors: artisanal (traditional), coastal and commercial (industrial) (Ministry of Agriculture and Fisheries, 2018). Total fish production from the three sectors was estimated at 348 thousand tons in 2017, with a total value of about OMR227 million (OMR1 = USD2.58) (Ministry of Agriculture and Fisheries, 2018). Of the three sectors, the artisanal sector represents the backbone of fisheries production, contributing 99 % of the recorded landings in the seven coastal governorates in 2017 (Fig. 1). The estimated number of artisanal fishers in 2017 was 49299. The artisanal fishery is defined as a small scale fishery represented by local fishers working full or part-time, using limited fishing gear, onboard small fibre reinforced plastic (FRP) fishing boats (from 5–9 m long) in addition to traditional dhows (from 10 - 32 m long), operating between 0 and 7 mile out from shore (Stengel and Al-Harthy, 2002).

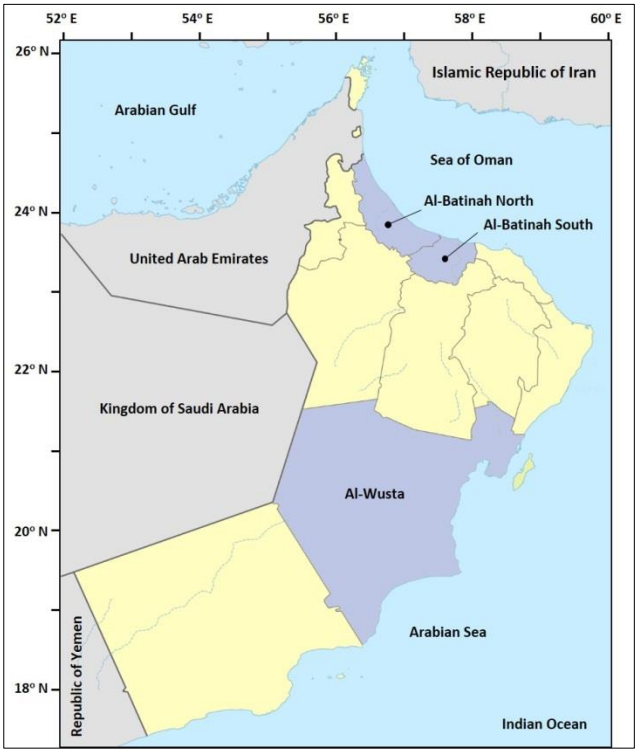

Fig. 1. Map of the Sultanate of Oman, highlighting the two study locations (Al-Batinah and Al-Wusta governorates).
Note: Al-Batinah North and Al-Batinah South are statistically (in fisheries statistics books) combined as one governorate named Al-Batinah.

Fishery statistics for 2017 indicate that the artisanal fishing sector in the Al-Batinah and Al-Wusta governorates was larger than other governorates in terms of the number of fishers, fish landings, and market value. Al-Wusta governorate has the highest fish landings (112,323 tons, about 33 % of total landings in Oman) with a total value of about OMR45 million. Al-Batinah governorate had the second highest landings (49,213 tons, about 14 % of the total landings) with a total value of OMR56 million.

Most of the fish production in 2017 in Al-Batinah governorate was larger pelagic fish with higher market value, whereas in Al-Wusta governorate, production was of smaller fish with lower market value. The number of registered fishers in the governorate of Al-Batinah in 2017 was 14,216, working with 6,144 boats, while the number in Al-Wusta was 3,859 fishers, operating 2,670 boats (Ministry of Agriculture and Fisheries, 2018). The owners and operators of the artisanal fishing boats in Al-Batinah governorate were exclusively Omani fishers while in Al-Wusta, Omani owners were using unregistered and illegal foreigner workers (Ministry of Agriculture and Fisheries, 2017). This could be due to the weak MCS program in the area. Of a total of 4,704 inspection patrols conducted in all governorates in 2017, 78 % were coastal and 22 % were sea patrols (Ministry of Agriculture and Fisheries, 2017). The percentage of total coastal patrols in the governorates of Al Batinah and Al-Wusta was about 19 % and 39 %

respectively, while the percentage of total sea patrols in both governorates was 22 % and 15 %, correspondingly.

In 2017, Al-Batinah governorate recorded 1,003 offences of fisheries regulations (about 39.7 % of the total for Oman), and Al-Wusta governorate, 575 offences (about 22.8 % of the total number) (Table 1). The most common offence in Al-Batinah was 'no fishing license' (44.5 %) and in Al-Wusta was 'illegal foreign workers' (29.1 %).

Table 2 shows the modest financial and human resources available for the MCS system, compared to the fishing effort employed. For example, there are only 50 fishery observers for the whole Omani coastline, of whom 20 % are assigned to Al-Batinah and 16 % to Al-Wusta. Observers are usually escorted by security officers during their jobs as they do not have the right of judicial seizure. The MCS department owns only 13 boats, which are responsible for monitoring the entire coastline. Each boat is, therefore, responsible for monitoring 3,792 fishers, 1,839 fishing boats and 243 km of coastline.

Table 1. Number of violations and type of sanctioning in the artisanal fisheries sector of two governorates in 2017.

Violation type	Total number of written offences in					
	Al-Batinah	%	Al-Wusta	%	All Oman	%
Fishing license	644	64.2	24	4.2	1124	44.5
Illegal foreign workers	131	13.1	465	80.9	736	29.1
Vessels plate number	165	16.5	8	1.4	342	13.5
Illegal fishing gear and methods	56	5.6	28	4.9	146	5.8
Closed area	4	0.4	15	2.6	72	2.8
Closed season	3	0.3	35	6.1	107	4.2
Total (% of violations in Oman)	1003	39.7	575	22.8	2527	100

Table 2. Status of monitoring, controlling and surveillance Resources in Al-Batinah and Al-Wusta governorates in 2017.

Items	Al-Batinah	%	Al-Wusta	%	All Oman
Coastline (km)	275		534		3165
Fisheries observers	10	20	8	16	50
Security officer	4	11	8	22	36
Patrol boats	2	15	2	15	13
Patrol cars	2	9	4	18	22
Observers' residence	0	0	4	33	12
Boat captain	1	20	0	0	5

Source: Ministry of Agriculture and Fisheries report (unpublished)(2017).

Fisheries Deterrence Model

The philosophy of fisheries surveillance in Oman has been grounded on the principle of basic presence on fish landing sites by the MCS officials' available. The goal is to achieve compliance with fisheries law. Any comprehensive enforcement program depends on three factors, the ability to: detect irregularities in a timely manner, arrest offenders, and impose deterrent penalties (Ayers and Leong, 2020).

The economic theory of law enforcement initiated by Becker (1968) draws on different economic models (e.g. Kuperan and Sutinen, 1998; Bun et al., 2019). Becker (1968) assumes that "a person commits a crime if the expected benefit exceeds the benefit that he can obtain by using his time and other resources in other activities". Stigler (1970) argues that limited deterrence occurs when a more serious crime is deterred because its punishment goes beyond the penalty of a less severe crime.

Despite a large number of pioneering studies using econometric modelling, there is arguably no consensus on whether there is a strong deterrent impact of law enforcement policies on criminal activity or not (Bun et al., 2019; Bisack and Clay, 2020). Kuperan and Sutinen (1998) studied the compliance behaviour of fishers using positive theory (deterrent theory) and normative theory (social influence and cognitive theory). The normative theory is based on self-interest (Kazmierow et al., 2010; Boonstra et al., 2017). Deterrence is the theory that penalties for illegal actions do not just discipline violators, but also discourage other people from committing similar crimes (Ali and Abdullah, 2010). While some authors indicate that deterrence is about

the immediate change in people's behaviour towards the law, others argue that a stronger deterrence may prevent future illegal activity (Boonstra et al., 2017; Johnson, 2019). For example, the increased severity and certainty of punishment for breaking the law are seen as an effective means of improving compliance (Garza-Gil et al., 2020; Marin-Monroy et al., 2020).

The principal theory in the economic analysis of illegal behaviour is that the individual is the responsible decision-maker who responds to the costs and benefits of engaging in unlawful activities (Marin-Monroy et al., 2020). Some efforts have been made to study the role of factors other than those directly related to the monetary gains of infringement (Freeman III et al., 2014). Gigerenzer and Selten (2001) looked at non-monetary factors that can influence individual behaviour on law enforcement, through so-called "cognitive" decision-making theories that allow non-cognitive influences such as emotions or behavioural norms as guides or "rules of cessation" in the decision-making process.

Furlong (1991) and Sutinen et al. (1989) conclude that non-monetary factors, such as age, years of experience in the fishery, and level of education, are significant determinants of higher fisher income. Sutinen and Kuperan (1999) demonstrated the effect of variables involving social influence, moral norms, and the legitimacy of the regulator and the regulations, on compliance. Hatcher et al. (2000) argued that the significant variables for compliance in the behavioural model were: the expected risks of detection, the size of the penalty if detected, and the judgement of liability in the design and implementation of the rules.

Law enforcement and compliance have been studied by economists, sociologists, criminologists, and psychologists. From a sociological perspective, Tyler (2006) shows that there are two basic approaches; an instrumental approach, and a normative approach. The instrumental approach follows a coercive theory to law enforcement and thus encourages sanction-based deterrence by the legal authorities (Becker, 1968; Elster, 1989). The normative approach promotes normative actions experienced and enforced by community members for collective welfare (Gezelius, 2007). In recent years, researchers have begun to benefit more from other approaches, such as "homo-economicus", guided by the concept of rationality and "homo-sociologicus" guided by social norms (Bose et al., 2017).

Given the importance of the role of MCS, especially in the artisanal fishing sector, this study surveys the fishers' views to elicit their assessments on the effectiveness of the current enforcement and implementation programs. The study using descriptive statistical measures, also examines whether there is consistency (or otherwise) in the views expressed in both governorates. The criteria for assessing fisheries law enforcement and compliance derive from the classical economic view of regulatory enforcement, which emphasises deterrence through legal sanctions, and actual practice in Oman's artisanal fisheries sector.

Methods

The empirical framework of compliance and enforcement

The Justice and Law Enforcement Expert Group from the Ministry of Justice in the Netherlands has created a table for compliance and enforcement factors (Table of Eleven, T_{11}) to enable policymakers to address these factors (Brewer, 2017). The T_{11} contains two parts: spontaneous (voluntary) compliance factors and enforced compliance (legitimacy) factors. Spontaneous compliance factors encourage people to comply with the rules in the absence of enforcement regulations (Parker and Nielsen, 2017). The forced compliance model assumes that individuals are interested in illegal gains regardless of the severity and certainty of sanction (Marin-Monroy et al., 2020).

The model is estimated to study the relationship between dependent (comply or violate) and independent (compliance factors) variables. In bilateral response models, the economic agent has two options that define one event, such as compliance or non-compliance with fishery rules. The dependent variable of "violations" has been coded as zero and the other two variables (non-violators and possible violators) have been coded as one. The dependent variable for fishers who had committed at least one type of offence during the last two years ('violators') was given the value zero, and compliant fishers ('non-violators') were given the value one.

The following general econometric model was used to examine the level of enforcement and compliance in the artisanal fisheries in Al-Batinah and Al-Wusta governorates:

$$Yi = CONSTANT + \beta Xi + Error\ term \quad (1)$$

where Yi measures the individual's non-compliance behaviour (dependent variable). The variable Yi either measures whether the regulation is violated (the dichotomous variable) or the extent of the violation (the number of times the regulation is violated per period). CONSTANT is the intercept in the equation. Xi measures the potential explanatory factors (independent variables): age, experience, education, fishing involvement (full time or part-time), illegal gains, the risk of detection and arrest, moral development, institutional legitimacy, and social influence.

There are three important factors assumed to influence the compliance decision: biological, deterrence and social factors (Hatcher and Pascoe, 2006; Karimi et al., 2008). Economic conditions are also considered as factors influencing compliance

(Hønneland, 1999) and (Nielsen and Mathiesen, 2003). The biological factors are the state of the fishery resource. The differences in stock levels in the fishing zone and other fisheries will stimulate fishers to fish in restricted areas (Gell and Roberts, 2003). This factor is accounted for by the catch per unit of effort (CPUE) in the artisanal fishery. The CPUE in each fishing area was obtained by dividing the landings per fishing day by the total fishing hours per day.

The basic deterrence model

The common empirical results of modelling behaviour suggest that the compliance ratio should not only be related to the expected gains from the violation and the penalty size but also other non-monetary factors (Friesen, 2012). In the basic deterrence model, violation (VIOLT) is made a function of various factors:

$$VIOLT = f^{v}(CONSTANT, Xi, CPUE, JOINTPROB) \quad (2)$$

where VIOLT (Violation) = 0 for a fisher who has violated at least once during the last two years, and 1 for compliant fishers. Furlong (1991) proposed that the joint probability rule determines the overall probability of conviction. The joint probability (JOINTPROB) followed in this study includes five measures of the probability: i) Probability of being inspected while fishing (PROBI), ii) Probability of being detected given inspection (PROBID), iii) Probability of being arrested given detection (PROBIDA), iv) Probability of being prosecuted given arrest (PROBIDAP), v) Probability of being convicted given prosecution (PROBIDAPC), and vi) Probability of being found guilty and the size of the penalty given conviction (PROBIDAPCG).

$$JOINTPROB = PROBI*PROBID*PROBIDA*PROBIDAP*PROBIDAPC*PROBIDAPCG \quad (3)$$

To measure the subjective probability of enforcement in the fisheries, a measuring scale from 0 to 1 was used, where '0' represents no chance at all and '1' represents a 100 % certainty of enforcement.

The extended model of compliance

There are many factors that may affect the compliance model, including the effects of moral obligation and social norms on compliance behaviour (Viswanathan et al., 1997). In this study, the spontaneous compliance factors are the level of knowledge or understanding of the rules, the benefits and costs of complying, the level of acceptance of the regulations, moral norms, and informal social control. The fishers' compliance factors for fishing legislations were measured by several variables that reflect the individual fisher's assessment of the results and procedures associated with the regulation and the regulating authority. The developed model can be represented thus:

$$VIOLT = f^{v}(CONSTANT, Xi, CPUE, JOINTPROB, I, K, M, S, L) \quad (4)$$

where, incentive variables (I) are related to the expected cost and gains from the violation of the rules. Knowledge or awareness (K) of the rules represents the familiarity with the rules and the degree of clarity of the rules for the target groups. The spontaneous variables or moral norms (M) are the individual morals or the obligations which influence the fisher in the absence of external pressure to do what is right or wrong. The social influence (S) represents the pressure exerted by specific groups of persons (peers, authorities, and community) on the fisher's behaviour. Legitimacy (L) represents the perceived responsibility to obey the regulations. For each of these variables, the respondent chooses their level of agreement on a scale of one to five, where the highest score indicates the strongest agreement. In theory, individuals who agree with the outcome variables give a higher level of legitimacy and thus will show greater compliance with regulations (Tyler et al., 1990).

Data

A field survey questionnaire (Appendix 1) was drawn up to elicit relevant information from the primary stakeholders (i.e., fishers). It included 22 closed-ended and open-ended questions and probability questions which are derived from the literature and categorised into five groups. All questions were designed to measure answers on an appropriate scale to ensure that the range of options was finite, jointly exclusive and collectively exhaustive.

Taking into account that some variables are associated with more than one factor, the factors were grouped as follows: i) The characteristics of the fisher (e.g. age, fishing involvement, level of experience, education level), ii) the level of awareness and knowledge of types of violations (information about the regulations), iii) compliance factors questions related to social norm influence (such as influence of community and peers; perception of other's judgment), judgment of the regulatory regime (such as the legitimacy of laws, their fairness and effectiveness; the level of participation in the management system), degree of acceptance of law and authorities that induce fishers to comply with or infringe regulations, iv) judgment on the enforcement system (questions related to the likelihood of enforcement being effective (such as the probability of inspections, detection, prosecution, conviction, penalty, and violation repetitions), and v) open questions about punishment methods, and compliance and non-compliance factors.

A pilot study to test the questionnaires was conducted by interviewing 25 artisanal fishers to ensure that the questions were appropriate,

relevant and understandable to the interviewees. It resulted in rephrasing some of the questions in language that would be understood by ordinary fishers without changing the intended meaning of the question.

The required sample size was calculated using an equation developed by Yamane (1967) assuming a 95% confidence level. A total of 397 artisanal fishers were selected from the two governorates (320 from Al-Batinah and 77 from Al-Wusta) (Table 3). They were divided into two groups. The first group was the legal fishers ('non-violators') who didn't have any violations recorded during the previous 2 years. These were randomly selected from the MAF artisanal fishers database of Al-Batinah, and Al-Wusta governorates. The second group was the illegal fishers ('violators') who had violated and have offences recorded during the previous 2 years. This was randomly extracted from a section of the Surveillance and Fishing Licenses (SSFL) database of the Al-Batinah Al-Wusta governorates. The groups of fishers were made confidential and not revealed to any individuals involved in the research except the principal investigator.

The questionnaire was conducted by face-to-face interview with the selected fishers. This method was chosen in order to increase the response rate and to clarify questions if necessary. Responses were measured and coded using descriptive statistical techniques and classified into topics according to research objectives. It is common in economic and social studies to use either the normal (Probit model) or logistic (Logit model) distribution to define the cumulative distribution of the likelihood, i.e., in this study, the probability of violation. In the empirical study, the choice between Probit or Logit does not seem to be an issue and many investigators study results for both distributions (Gambino et al., 2003).

Results

Respondents' profile and views

The data for this study were collected from 1 August to 30 September 2018 from 119 fisher villages from two governorates (103 from Al-Batinah and 16 from Al-Wusta). The average time taken for each interview in both governorates was about 21 minutes with 100 % response rate. Although 50 % of the targeted fishers were non-violators (see Table 3), the results indicate that 61 % of the fishers from both study areas claim that they did not commit any type of violation (about 84 % from Al-Batinah and 16 % from Al-Wusta), whereas 39% of admitted that they have made violation (79 % from Al-Batinah and 21% from Al-Wusta).

Table 4 presents the respondents' profile. The result indicates that around 43 % of respondents from Al-Batinah have another source of income, whereas 57 % were fully engaged in fishing and dependent on fisheries as the source of their livelihood. In contrast, the situation was different in the Al-Wusta governorate, where the proportion of full-time fishers was less than part-time fishers (44 % and 56 % respectively). This finding suggests that fishing in this governorate is a second profession for earning a living. This is an important finding for the long-term conservation and sustainability of fish stocks, especially in this governorate.

The average age of fishers from Al-Batinah and Al-Wusta governorates was 40 and 37 years respectively, with a combined average age of 39 years. The results also indicate that the majority of the fishers questioned from both study areas (94 % and 91 % from Al-Batinah and Al-Wusta, respectively) had been involved in artisanal fisheries for more than 5 years (Table 4). This indicates that most of the respondents have taken fishing as a long-term occupation. The results also show that 45 % and 27 % of respondents from Al-Batinah and Al-Wusta have general diploma (secondary) level education and 27 % and 32 % have an elementary and preparatory level, respectively (Table 4). This finding shows a higher educational level in Al-Batinah compared to Al-Wusta. In general, most respondents are able to communicate with administrators and contribute to decision-making for fisheries through sharing their experiences.

Violation decision variables

The philosophy of this study is to test the hypothesised relationships between the illegal activities of fishers and a group of intrinsic and extrinsic factors. Table 5 presents the sample fishers' responses to the compliance factors in Al-Batinah and Al-Wusta governorates. The costs and benefits of compliance are always related to the socio-economic motives of individuals (Braithwaite, 2009). The results show that 59 % and 57 % of respondents from Al-Batinah and Al-Wusta respectively, will violate if this will provide a financial gain, while 41 % and 43 % of fishers believe there are no financial benefits from breaking the rules. To measure the clarity of fishing rules, the survey indicates that around 80 % of Al-Batinah fishers believed the law was clear, whereas 39 % of the Al-Wusta fishers thought the law was not clear at all for them.

Almost 76 % and 40 % of respondents from Al-Batinah and Al-Wusta respectively believed that it is easy to comply, whereas around 24 % and 60 % said it is difficult to comply all the time. Moral norms also appeared to influence the compliance level. In this regard, the fishers were questioned on the impact of "obedience to the law" and the impact of "conflicts with authority" on the level of compliance. The results show that 85 % and 83 % of the respondents from Al-Batinah and Al-Wusta governorates respectively believe that fishers should always obey the law. On the other hand, 48 % of the Al-Batinah fishers believe that miscommunication between the fishery

Table 3. Stratified random sample size in Al-Batinah and Al-Wusta governorates.

Governorates	Al-Batinah	Al-Wusta	Total
Fishers	13834	3411	17245
Targeted sample size	320	77	397
No. of states (Wilayats*)	8	3	11
No. of sample / Wilayat	40	26	66
Group no. 1 (non-violators fishers)	20	13	33
Group no. 2 (violators fishers)	20	13	33

* Wilayat is used to refer to an administrative sub-division of a governorate.
Source: Ministry of Agriculture and Fisheries (2018).

Table 4. Respondents profile in Al-Batinah and Al-Wusta governorates.

Item	Al-Batinah (320)	Al-Wusta (77)
Age (average years)	40	37
Fishing involvement		
a) Full time (%)	57	44
b) Part time (%)	43	56
Experience in fishing (years) %		
a) 1–5	6	9
b) 6–10	17	25
c) 11–15	10	23
d) 16–20	21	20
e) >20	46	23
Level of education (%)		
a) No education	13	20
b) Read and write (traditional)	11	20
c) Elementary and preparatory	27	32
d) General diploma (secondary)	45	27
e) Undergraduate	4	0
f) Postgraduate	0	1

Table 5. Level of responses to the compliance factors in Al-Batinah and Al-Wusta governorates.

Compliance factors	Al-Batinah (320)				Al-Wusta (77)			
	Low		High		Low		High	
	No	%	No	%	No	%	No	%
Financial benefits from breaking the fishing rules	131	41	189	59	33	43	44	57
Clarity of existing fishing rules	65	20	255	80	30	39	47	61
Easy to comply with fishing rules	77	24	243	76	46	60	31	40
Obey the law	48	15	272	85	13	17	64	83
Conflicts between fishers and fisheries managers	154	48	166	52	16	21	61	79
Peer noticing into consideration	89	28	231	72	18	23	59	77
Calling-up violators by the court	72	23	248	78	9	12	68	88
Affected fisher's good name (reputation)	90	28	230	72	16	21	61	79
Rejection by the fishing community	119	37	201	63	22	29	55	71
Rules consistency	144	45	176	55	38	49	39	51
Effectiveness of the fine payment	89	28	231	72	16	21	61	79
Fairness in court decision	106	33	214	67	9	12	68	88

authorities and the fishers has no impact on compliance, while the largest proportion 79 % of the Al-Wusta fishers assert that conflicts with authority encourage fishers to violate the law.

The impact of social factors on compliance decisions is frequently highlighted in the literature, which pays special attention to the role of trust and reciprocity (Hønneland, 2000). Ethics, within the normative perspective, is linked to the moral duty of a person to do the right thing, and compliance in terms of individual morality tends to be interpreted using cognitive theory (Alm and Torgler, 2011). In this regard, the fishers were questioned about "peer noticing consideration", "calling up by the court", "fisher's reputation", and "community rejection". The results indicate that 72 % and 77 % of the respondents from Al-Batinah and Al-Wusta governorates were highly concerned about their peers noticing. To enhance the effectiveness of sanctions against violators, around 78 % and 88 % of the fishers from Al-Batinah and Al-Wusta indicated that summons by the court is one of the effective ways to repel violators in the community.

On the other hand, the survey shows that 72 % and 79 % of the fishers from Al-Batinah and Al-Wusta, respectively, thought that the reputation of a good name plays a major role in deterring violators due to feelings of guilt. Moreover, the results found that around 63 % and 71 % of respondents from Al-Batinah and Al-Wusta governorates indicate that society's rejection of the violator was a highly effective way to deter fishers from committing offences.

The enforced (compulsory) compliance factors are the various government activities that affect compliance and non-compliance (Parker and Nielsen, 2017) through the imposition of legal legitimacy. Legitimacy also appears to influence the compliance level. In this regard, the fishers were questioned on "rules consistency", "effectiveness of fine payment", and "fairness in court decisions". The survey shows that around 55 % and 51 % of fishers from Al-Batinah and Al-Wusta governorates, respectively, thought that rules were applied in a fair and consistent manner. In addition, around 72 % and 79 % of interviewees from the Al-Batinah and Al-Wusta governorates believe that current sanctions are adequate. With regard to the fairness of decisions of the courts, nearly 67 % and 88 % of the correspondents from Al-Batinah and Al-Wusta believed that the penalties were fair.

Subjective probability of detection, prosecution, conviction, and penalty

The mean and modal values of subjective probability estimates for the key enforcement factors for Al-Batinah and Al-Wusta governorates are presented in Table 6. The subjective probability scores concerning prosecution, conviction, and penalty for the Al-Batinah governorate were relatively high compared to Al-Wusta. However, the probability score in relation to 'confiscation' and 'detection' is similar and low for both study locations. The probability score related to "reporting violation by others" was relatively high for Al-Batinah compared to Al-Wusta. A more-or-less similar pattern of pair-wise correlation coefficient (r) estimates based on the mean probability values for the two governorates was observed in all cases.

Economic results

The basic deterrence model

Table 7 shows the deterrence model of equation (2) using the estimated probabilities for the two governorates. The basic deterrence model contains biological (CPUE), demographic and enforced (legitimacy) factors. Out of 11 explanatory variables tested, 5 variables (CPUE, EXPERIENCE, PROBI, PROBIDA, and PROBIDAP) were statistically significant at the 5 % level, 2 of them (EXPERIENCE and PROBIDA) with the expected sign (see Appendix 2 for definitions of the variables). Three variables were significant at the 1 % level (EDUCATION, PROBID, and PROBIDA), one with an unexpected sign (PROBID) from Al-Batinah governorate. Generally, the result indicates that eight variables hold an unexpected sign in both governorates.

Although the CPUE, was significant at the 5 % level with a negative sign in Al-Wusta governorate, the positive sign on the CPUE variable in Al-Batinah governorate shows that the higher the catch, the higher the probability of a violation. The deterrence model used to estimate the violation decision for demographic factors (e.g. AGE, INVOLVEMENT, EDUCATION, and EXPERIENCE) shows that there was only one significant variable with the expected sign in each governorate. While the variable of EDUCATION was statistically significant at the 1 % level in Al-Batinah, the EXPERIENCE variable was significant at the 5% level in Al-Wusta.

The deterrence model, meanwhile, contains six enforced factors (e.g. PROBI, PROBID, PROBIDA, PROBIDAP, PROBIDAPC, and PROBIDAPCG) that may affect an individual's decision to commit an offense. For the Al-Batinah governorate, the results reveal that two variables (PROBI, PROBIDAP) were statistically significant at the 5 % level, with one of them (PROBI) having an unexpected sign (PROBI). On the other hand, half of the probability variables in Al-Wusta were statistically significant, two of them (PROBID and PROBIDA) at the 1% level and one (PROBIDAP) at the 5 % level.

The extended model of compliance

Table 8 shows the extended model of equation (3) using exogenous variables for two governorates. The

Table 6. Mean and modal values of subjective probability estimates involving fishers for Al-Batinah and Al-Wusta governorates.

What is the probability of	Al-Batinah (N = 320)		Al-Wusta (N = 77)	
	Mode	Mean	Mode	Mean
Repeating violation	0.5	0.54	0.5	0.53
Noticing violation by others	0.5	0.59	0.7	0.71
Reporting violation by others	1	0.63	0.5	0.55
Inspection	0.5	0.51	0.3	0.38
Detection	0.5	0.59	0.5	0.45
Confiscation	1	0.55	1	0.63
Prosecution	1	0.67	0.5	0.54
Conviction	1	0.72	0.4	0.66
Penalty	1	0.73	0.5	0.59

Table 7. Logit estimates of the basic deterrence model using estimated probabilities for two governorates.

Compliance variables	Expected sign	Al-Batinah			Al-Wusta		
		B	P-value	Rejection of Ho (α = 0.05)	B	P-value	Rejection of Ho (α = 0.05)
Biological factor							
CPUE	+ ve	0.19	0.476	No	-0.11	0.012**#	Yes
Demographic factors							
AGE	+ ve	0.02	0.293	No	-0.05	0.413#	No
INVOLVEMENT	+ ve	0.16	0.602	No	-0.82	0.283#	No
EDUCATION	+ ve	0.46	0.003*	Yes	0.09	0.796	No
EXPERIENCE	+ ve	0.17	0.151	No	1.16	0.020**	Yes
Enforced (legitimacy) factors							
PROBI	+ ve	-1.07	0.060**#	No	-1.16	0.569#	No
PROBID	+ ve	0.78	0.183	No	-6.56	0.009*#	Yes
PROBIDA	+ ve	0.80	0.087**	No	5.66	0.003*	Yes
PROBIDAP	+ ve	-0.81	0.298#	No	-3.85	0.074**#	No
PROBIDAPC	+ ve	-1.07	0.215#	No	3.91	0.150	No
PROBIDAPCG	+ ve	0.09	0.915	No	-2.58	0.294#	No
Constant		-2.31	0.100		4.64	0.135	
-2 Log likelihood		407.27			61.14		
Cox & Snell R Square		0.07			0.37		
Nagelkerke R Square		0.10			0.52		
No.		320			77		

*: significant at 1 %; **: significant at 5 %; #: unexpected sign.

Note: See Appendix 2 for definitions of the variables.

extended model contains biological (CPUE), demographic, spontaneous and enforced (legitimacy) factors. Interestingly, out of 18 explanatory variables tested by the model, five variables (INVOLVEMENT, EDUCATION, EASYCOMPLY, REJECTION, and SUFFICENTPAYMENT) were statistically significant in determining the compliance behaviour of fishers. Two variables were statistically significant at the 1 % level, with an unexpected sign (EASYCOMPLY and SUFFICENTPAYMENT) in both governorates, while three variables (INVOLVEMENT, EDUCATION, and REJECTION) were significant at the 5 % level, with the expected sign, except one variable (INVOLVEMENT) with an unexpected sign from Al-Wusta governorate. The model reveals that two variables (JOINTPROB and CPUE) were insignificant in both governorates, although there is an unexpected sign in Al-Wusta governorate only. Generally, the results show that 13 variables hold unexpected signs in both governorates.

The extended model, meanwhile, tested nine spontaneous (voluntary) factors (BENEFIT, CLARITY, EASYCOMPLY, OBEYING, CONFLICT, PEERNOTICE, CALLINGUP, REPUTATION, and REJECTION) that may affect an individual's decision to comply or not. For both governorates, the economic variable (BENEFIT) is insignificant, with unexpected sign in Al-Wusta only. For the two cognitive variables tested, the study shows that the (EASYCOMPLY) variable was significant at the 1 % level with an unexpected sign in the Al-Wusta governorate, while the variable (CLARITY) was insignificant in both governorates. For the two governorates, only one variable (REJECTION) out of four social control variables tested (including PEERNOTICE, CALLINGUP, and REPUTATION) was

Table 8. Logit estimation of extended compliance models using exogenous variables for two governorates.

Compliance variables	Expected sign	Al-Batinah			Al-Wusta		
		B	P-value	Rejection of Ho ($\alpha = 0.05$)	B	P-value	Rejection of Ho ($\alpha = 0.05$)
Biological factor							
CPUE	+ ve	0.02	0.946	No	-0.08	0.103#	No
Demographic factors							
AGE	+ ve	0.01	0.362	No	-0.04	0.543#	No
INVOLVEMENT	+ ve	0.20	0.520	No	-1.91	0.047**#	Yes
EDUCATION	+ ve	0.41	0.011**	Yes	-0.03	0.932#	No
EXPERIENCE	+ ve	0.11	0.357	No	0.57	0.233	No
Spontaneous factors							
BENEFIT	- ve	-0.13	0.663	No	0.40	0.703#	No
CLARITY	+ ve	0.26	0.427	No	0.16	0.841	No
EASYCOMPLY	+ ve	-0.07	0.831	No	-2.69	0.007*#	Yes
OBEYING	+ ve	-0.28	0.499	No	-0.32	0.785#	No
CONFLICT	- ve	0.24	0.352#	No	-1.78	0.128	No
PEERNOTICE	+ ve	0.11	0.718	No	1.06	0.361	No
CALLINGUP	+ ve	-0.37	0.294#	No	-1.05	0.409#	No
REPUTATION	+ ve	0.24	0.435	No	0.84	0.513	No
REJECTION	+ ve	0.62	0.045**	No	-0.66	0.471#	No
Enforced (legitimacy) factors							
CONSISTENCY	+ ve	0.02	0.935	No	1.31	0.101	No
SUFFICENTPAYMENT	+ ve	-1.48	0.000*#	Yes	-0.45	0.695#	No
FAIRNESS	+ ve	0.01	0.987	No	-0.30	0.840#	No
JOINTPROB	+ ve	0.49	0.231	No	-2.29	0.463#	No
Constant		-1.55	0.282		8.64	0.045	
-2 Log likelihood		396.15			65.80		
Cox & Snell R Square		0.10			0.33		
Nagelkerke R Square		0.14			0.47		
No.		320			77		

*: significant at 1 %; **: significant at 5 %; #: unexpected sign.
Note: See Appendix 2 for definitions of the variables.

significant at the 5% level in Al-Batinah governorate. Of three legitimacy variables (including CONSISTENCY and FAIRNESS), only (SUFFICENTPAYMENT) was significant at the 1 % level, and with an unexpected sign, in Al-Batinah governorate.

Discussion

The basic deterrence model

As shown in Table 7, the results of this study clearly indicate that CPUE is one of the factors that might influence a fisher's decision to violate laws, especially in Al-Wusta, due to the potential earnings from the violations. This variable, reflecting relative fish stock abundance and revenue potential, plays a major role in compliance behaviour (Clark, 2007).

The demographic variables also play a major role in compliance behaviour. The significant demographic variables are AGE, INVOLVEMENT, the level of EDUCATION, and professional EXPERIENCE in fishing. The positive signs for all four demographic factors in the governorate of Al-Batinah indicate that the higher the level of these variables, the higher the probability of compliance (and the lower the probability of violation). In Al-Wusta governorate, the sign was negative for (AGE and INVOLVEMENT) indicating that the higher the level of these variables, the higher the probability of violations (and the lower the probability of compliance).

One of the important findings of the study is the inconsistent performance of the variables measuring the probability of enforcement (PROBI, PROBID, PROBIDA, PROBIDAP, PROBIDAPC, and PROBIDAPCG), which might indicate a weak MCS system. This could be due to the lack of financial and human resources for the MCS system (Ministry of Agriculture and Fisheries unpubl, 2017). Another explanation may be the difficulty of analysing these subjective probabilities. Kuperan and Sutinen (1998) state that it is difficult to analyse subjective probabilities because we do not know how these subjective possibilities are generated, and what biases are inherent in them. A third explanation may be that fishers have difficulty understanding of the concept of probabilities. It is possible that fishers from both governorates were unable to give a good and specific estimate for the overall likelihood of being inspected while fishing, or

the probability of prosecution given arrest, but were able - with assistance - to provide estimates for the probability of being arrested. Fishers have reported that monitoring and control plans are known in advance by fishers, so that violators can avoid detection and capture.

The extended model of compliance

A study carried out by Kuperan and Sutinen (1998) indicates that the behaviour of fishers is influenced by the behaviour of others. Consequently, if a large proportion of fishers are violators, non-violators lose out to them in competition for fishery resources. In the artisanal fishing sector in Oman, for example, compliant fishers are facing severe competition in the fishery from violators using illegal fishing methods and gear, and from unlicensed fishers, especially in Al-Wusta governorate (Ministry of Agriculture and Fisheries unpubl, 2017).

Voluntary compliance depends on several factors, such as the economic factors, cognitive factors, moral norms, social control factors, and the legitimacy factors of the regulatory institution. Table 8 shows the results of the inclusion of external variables in the extended compliance model to describe the individual's violation decision. It seems that the economic factor and the 'knowledge of regulations' factor have great potential for use in regulatory policy to increase the level of compliance in a more cost-effective manner than to use enforcement alone. It also seems that the 'level of acceptance of the rules' factor is very important in interpreting irregularities in the study area, especially in the Al-Wusta governorate. This supports the theory in the compliance literature (Bose et al., 2017).

The variables of moral judgment appear not to be important variables for fisher behaviour in the study area. Out of four variables of social control, only one variable (REJECTION) appears to be important in explaining violation decisions in the study, especially in the Al-Batinah governorate. This also supports the theory in the compliance literature (Karimi et al., 2008). Community rejection of the violator is an important factor for increasing compliance. This implies that the authorities should strengthen communication with the community, revitalise the role of fishers' committees, and increase community participation in the decision-making process to promote mutual trust and legitimacy. A joint management approach between the authorities and the fishers will foster individual responsibility and a progressive shift in the compliance approach, thus positively influencing the sustainability of the fisheries (Kuperan and Sutinen, 1998).

In theory, legitimacy variables have a significant role in ensuring compliance with regulations. From our estimates, the normative perspective does not strongly support compliance behaviour. There is no set of legitimacy variables that is consistently significant in the study with the sign predicted, only one variable (SUFFICENTPAYMENT) which is significant, particularly in Al-Batinah governorate. Tyler et al. (1990) assumed that compliance with the regulations was influenced by the extent to which an individual's legitimacy was granted to executing agencies. Fishers who agree to the distributional objectives of regulations are more likely to comply with regulations than those who do not agree.

Conclusion and Recommendation

This study explores the Omani fishers' views on compliance and enforcement factors and examines the extent of their impact on compliance behaviour in the artisanal fishing sector with a view to improving compliance performance. The analysis shows that the basic deterrence model is not only influenced by the enforced legitimacy variables, but also by the spontaneous compliance variables such as moral norms, cognitive factors, and social control, resulting in poorer compliance behaviour. These variables are important for studying compliance behaviour and for designing and implementing regulatory policy. The results indicate that the number of violations in artisanal fisheries can be reduced by enhancing enforcement, i.e. by increasing the likelihood of detection and conviction.

This study provides empirical support for the theory that potential gains and self-interest, together with moral obligation, legitimacy, and social influence, are the keys to enhancing compliance and enforcement in the artisanal fishery sector.

The empirical analysis of compliance behaviour in artisanal fisheries proposes that economic motivations are a key factor determining the level of compliance. The motivation to not obey relate to the benefits of non-compliance and the expected costs of non-compliance through either increasing enforcement or increasing the penalty. Compliance incentives may be improved through increased involvement of the fishers in fisheries co-management.

The importance of the CPUE variable in the violation decision and the extent of the violation pose some problems for legislators. In the artisanal fishing sector, for example, fishers are facing severe competition for the resource. As a result, the compliant fishers are losing out to violators. CPUE, which reflects the stock abundance, plays a major role in fisheries compliance decisions.

According to compliance theory, readiness to comply starts from moral obligation, and social community impact is based on the perceived legitimacy of the authorities responsible for managing the fishery. The management authorities must determine policies and

methods that are judged to be fair by the fishers. For example, the value of penalties and other sanctions must be equivalent in value to the greatest damage that has occurred or the gains made through non-compliance. Also, the fishers should participate in the preparation of regulations. Moral commitment and social control factors were seen to have little or no effect on fisher behaviour.

In conclusion, when developing compliance policies, it is worth considering the distinction in compliance motivations between groups. Social planners need to invest more in Al-Wusta governorate to improve the compliance level, which is currently low due to high productivity, high number of part-time fishers and low education. There is still significant space for further investigation into the efficacy of the authorities management strategy for the artisanal fisheries sector in Oman. A full survey covering the whole coast will assure a holistic assessment of the compliance level in the country.

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Appendix 1. Questionnaire survey for fisher.

Interviewer Name: ..... Date: ..... Survey Group:..... No.: .....
Time: Start: Finish:
Section 1: Personal Information
1. Governorate: .....2. Wilayat:.....3. Village:.....
4. Age (years): .....
5. Fishing involvement? ☐ Full-time ☐ Part-time
6. Level of education: ☐ No education ☐ Read & write (traditional) ☐ Elementary & Preparatory
☐ General Diploma (Secondary) ☐ Undergraduate ☐ Postgraduate
7. Experience in fishing (years): ☐ 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ >20

Section 2: Violation
8. Assess your level of awareness of the prohibited activities stated in the fisheries law.

Item	Type of violation	Article No.	Scale 1= Not aware at all ←--→ 5= Fully aware)
A	Closed season	14, 15E	☐1 ☐2 ☐3 ☐4 ☐5
B	Fishing methods	16, 22	☐1 ☐2 ☐3 ☐4 ☐5
C	Illegal gear	18E, 28E	☐1 ☐2 ☐3 ☐4 ☐5
D	Minimum fish size	14E, 15E	☐1 ☐2 ☐3 ☐4 ☐5
E	Egg bearing	14, 14E	☐1 ☐2 ☐3 ☐4 ☐5
F	License	7, 35E	☐1 ☐2 ☐3 ☐4 ☐5
G	Fish discards	17E	☐1 ☐2 ☐3 ☐4 ☐5
H	Waste and harmful substances discards	15	☐1 ☐2 ☐3 ☐4 ☐5
I	Employing expatriate in fishing	4E, 46E	☐1 ☐2 ☐3 ☐4 ☐5
J	Area	24E, 23E	☐1 ☐2 ☐3 ☐4 ☐5

9. How clear do you find the existing fishing rules?
☐1 ☐2 ☐3 ☐4 ☐5 (1= not clear at all ←--→ 5= Very clear)
10. How important do you believe fisheries compliance is?
☐1 ☐2 ☐3 ☐4 ☐5 (1= not important ←--→ 5= very important)

11. What is your assessment about the level of existing fisheries compliance?
☐1 ☐2 ☐3 ☐4 ☐5 (1= very low ←--→ 5= very high)
12. Have you violated rules related to the following cases in the last 2 years?

Item	Type of violation	Article No.	Violated?
A	Closed season	14, 15E	☐Yes ☐No ☐NA
B	Fishing methods	16, 22	☐Yes ☐No ☐NA
C	Illegal gear	18E, 28E	☐Yes ☐No ☐NA
D	Minimum fish size	14E, 15E	☐Yes ☐No ☐NA
E	Egg bearing	14, 14E	☐Yes ☐No ☐NA
F	License	7, 35E	☐Yes ☐No ☐NA
G	Fish discards	17E	☐Yes ☐No ☐NA
H	Waste and harmful substances discards	15	☐Yes ☐No ☐NA
I	Employing expatriate in fishing	4E, 46E	☐Yes ☐No ☐NA
J	Area	24E, 23E	☐Yes ☐No ☐NA

NA: Not Applicable

Section 3: Compliance Factors

13. Answer the following questions:

Item	T_{11}	Factors of Fisheries Compliance	Scale				
A	T2	How great do you think the financial benefits would be if you were to break the fishing rules?	1= No benefits at all ←--→ 5=Very large benefits				
			1	2	3	4	5
B	T3	Do you think it is easy to comply with the fishing rules?	1= Not easy at all ←--→ 5=Very easy				
			1	2	3	4	5
C	T4	Do you agree that fishers should always obey the Authority?	1= Not agree at all ←--→ 5=Completely agree				
			1	2	3	4	5
D	T4	Do you agree that fishers should always obey the law?	1= Not agree at all ←--→ 5=Completely agree				
			1	2	3	4	5
E	T5	What is the chance that other fishers would notice if you break the rules?	1= No chance at all ←--→ 5=Full chance				
			1	2	3	4	5
F	T5	Would you take "peer noticing" into consideration when violating fishing rules?	1= Not at all ←--→ 5=Definitely				
			1	2	3	4	5
G	T5	Would your peers support you if you violated fishing rules?	1= Not at all ←--→ 5=Support fully				
			1	2	3	4	5
H	T6	What is the chance of other fishers reporting your violation to the authority?	1= No chance at all ←--→ 5=Full chance				
			1	2	3	4	5
I	T6	Would you take "other fishers reporting your violation to the authority" into consideration when violating fishing rules?	1= Not at all ←--→ 5=Definitely				
			1	2	3	4	5
J	T7	Do you think that "application of rules to all fishers in the fishery" is consistent?	1= No benefits at all ←--→ 5=Very large benefits				
			1	2	3	4	5
K		Do you think that conflicts between fishers and fisheries managers encourage non-compliance?	1= Not at all ←--→ 5=Definitely				
			1	2	3	4	5
L		Do you think that the current fine payment is sufficient?	1= Not sufficient at all ←--→ 5=fully sufficient				
			1	2	3	4	5
M		Do you think calling-up violators by the court (i.e. guilt and shame) is effective?	1= Not effective at all ←--→ 5=Highly effective				
			1	2	3	4	5
N		Do you think that the rejection by fishing community when violating fishing rules is effective?	1= Not effective at all ←--→ 5=Highly effective				
			1	2	3	4	5
O		Do you think that your level of education affects your knowledge and awareness about fishing rules?	1= No affect ←--→ 5=Very high affect				
			1	2	3	4	5
P		Do you think that Senate Al-Bahar Committee is effective in raising knowledge and awareness among fishers about fishing rules?	1= Not effective at all ←--→ 5=Highly effective				
			1	2	3	4	5
Q		Do you think that the existing court sentences (court decisions) are fair?	1= Not fair at all ←--→ 5=Very fair				
			1	2	3	4	5

Section 4: Enforcement

14. Answer the following questions on a scale of 0 to 10:

No.	Question	Scale 0= No chance ←--→ 10= 100% chance										
A	What is the chance of the violations being done again by the same person?	0	1	2	3	4	5	6	7	8	9	10
B	What is the chance that other fishers would notice the violator?	0	1	2	3	4	5	6	7	8	9	10
C	What is the chance of other fishers reporting violation to the authority?	0	1	2	3	4	5	6	7	8	9	10
D	What do you think is the chance that the authorities would pass by and check on fishers?	0	1	2	3	4	5	6	7	8	9	10
E	What is the chance that the authority would detect your violation?	0	1	2	3	4	5	6	7	8	9	10
F	What is the chance of confiscation the catch, gear or license?	0	1	2	3	4	5	6	7	8	9	10

G	What is the chance of being prosecuted by the authority if a fisher has made a violation?	0	1	2	3	4	5	6	7	8	9	10
H	What is the chance of being convicted by the court if a fisher has done a violation?	0	1	2	3	4	5	6	7	8	9	10
I	What is the probability of being penalised by the court if a fisher has done a violation?	0	1	2	3	4	5	6	7	8	9	10

15. How do you rate the court process in dealing with fisheries violations?
☐1 ☐2 ☐3 ☐4 ☐5 (1= not satisfactory at all ←--→ 5= highly satisfactory)

16. How do you rate the severity of the usual penalty by the court for disobey with the fisheries law?
☐1 ☐2 ☐3 ☐4 ☐5 (1= not sever at all ←--→ 5= highly sever)

17. How severely would a fisher's good name be affected if it were to become known that he had made a violation in fisheries?
☐1 ☐2 ☐3 ☐4 ☐5 (1= not affected at all ←--→ 5= highly affected)

18. In your opinion, is the severity of the penalty such that the offender would take it into consideration when deciding whether to disobey the law again?
☐1 ☐2 ☐3 ☐4 ☐5 (5= highly considered ←--→ 1= not considered at all)

19. Assess the effectiveness of existing fisheries enforcement program (MCS and Sanctioning)?
MCS: ☐1 ☐2 ☐3 ☐4 ☐5 (1= not effective at all ←--→ 5= very effective)
Sanctioning: ☐1 ☐2 ☐3 ☐4 ☐5 (1= not effective at all ←--→ 5= very effective)

Section 5: Other
20. In your opinion, what would be the most effective punishment method to reduce fisheries non-compliance?

.....
.....
21. In your opinion, what would make people more likely to follow the rules and regulations?

.....
.....
22. Identify three (3) most important reasons for fisheries non-compliance?

1.
.....
2.
.....
3.
.....

Appendix 2. Definitions of the variables.

Compliance variable	Definition/Questions
AGE	Age of fisher
INVOLVEMENT	Fisher involvement in artisanal fisheries, in years
EDUCATION	Educational Level
EXPERIENCE	Fisher Experience, in years
CPUE	Total fish landing per unit of effort during the study period
Spontaneous Compliance factors	
BENEFIT	Financial benefits from breaking the fishing rules
CLARITY	Clarity of existing fishing rules
EASYCOMPLY	Ease to comply with fishing rules
OBEYING	Obeying the law
CONFLICT	Conflicts between fishers and fisheries managers
PEERNOTICE	Peer noticing taken into consideration
CALLINGUP	Calling-up violators by the court
REPUTATION	Affected fisher's good name
REJECTION	Rejection by the fishing community
Enforced compliance factors (Legitimacy)	
CONSISTENCY	Consistency of fishing rules
SUFFICENTPAYMENT	Sufficiency of current fine payment
FAIRNESS	Fairness of existing court sentences
PROBI	Probability of being inspected while fishing
PROBID	Probability of being detected in an inspection
PROBIDA	Probability of being arrested given detection
PROBIDAP	Probability of prosecution given arrest
PROBIDAPC	Probability of conviction given prosecution
PROBIDAPCG	Probability of being found guilty and paying a penalty given conviction