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LETTER

Motivations for (non-)compliance with conservation rules by small-scale resource users

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Abstract

Understanding compliance with conservation rules is key for biodiversity conservation. Here, we assess compliance and its underlying motivations in a small-scale fishery in Chile. We adapt a framework originally developed for forestry to unpack compliance motivations at within-individual and between-individuals levels while accounting for contextual factors. We find that 92–100% fishers comply with temporal or gear rules, while only 3% comply with the quota limit. Legitimacy-based motivations are more important in explaining why individual fishers comply with temporal/gear rules than they are for compliance with the quota. At the between-individuals level, we find that normative motivations are significantly related to the degree of non-compliance with the quota. Contextual factors such as quota levels are key in explaining broader non-compliance patterns. Our results suggest that considering compliance at appropriate analytical levels is necessary to unpack motivations, guide local and national natural resource management policies, and move toward a better theory of compliance.

KEYWORDS

compliance, enforcement, fisheries, framework, instrumental, legitimacy, motivations, norms, rules, small-scale

1 | INTRODUCTION

The conservation and sustainable management of natural resources depends on people complying with conservation rules. However, rules are not always appropriate or fair in how costs and benefits are distributed, or could be out-dated (Wells, 1992). As such, compliance cannot and should not be taken for granted (Keane, Jones, Edwards-Jones, & Milner-Gulland, 2008). The ecological, economic, and social impacts of non-compliance with conservation rules have been widely documented across diverse settings (Maxwell, Fuller, Brooks, & Watson, 2016). Yet, research is still needed that informs policies and interventions to address the potential threat to biodiversity of non-compliance. Effectively addressing non-compliance first requires disentangling resource users' underlying motivations (Travers et al., 2019).

Researchers from different disciplines emphasize how social, institutional, behavioral and economic motivations affect compliance with rules (Becker, 1968; Boonstra, Birnbaum, & Björkvik, 2017; Nielsen, 2003; Ostrom, 1990). However, it is challenging to discern between such diverse motivations for non-compliance with conservation rules at the local level, which is necessary for developing effective strategies to address it. Frameworks combining these motivations can guide the study and understanding of compliance and unpack heterogeneous motivations. Ramcilovic-Suominen

TABLE 1 Individual motivations from the analytical framework for compliance (Ramcilovic-Suominen & Epstein, 2012) adapted for the context of our case study. Table shows individual motivations for compliance with the sub-components assessed in this study and the rationale behind these sub-components

Motivation	Sub-component assessed	Rationale	References
Instrumental	Perceived probability of detection Perceived probability of sanction	Perceived probability of detection and sanction relate to the cost (deterrent) component of the instrumental motivation. We could not include the benefit side as a motivation because of the difficulty to assess perceived benefits of non-compliance across different conservation rules which provide benefits not easily accountable or comparable.	(Arias & Sutton, 2013; Becker, 1968; King & Sutinen, 2010; Kuperan & Sutinen, 1998; Nielsen & Mathiesen, 2003)
Normative	Feeling of guilt Colleague disapproval Perceived colleagues non-compliance	Normative motivations can influence behavior through three distinct mechanisms: personal norms (feeling of guilt), or a person's own values regarding the behavior; social injunctive norms (colleague disapproval), or perceived moral values of a group; and descriptive norms (perceived colleagues non-compliance) or the perception of what others do.	(Bergseth & Roscher, 2018; Cialdini & Trost, 1998; Hatcher et al., 2000; Thomas et al., 2016)
Legitimacy-based	Legitimacy of authorities Equity of rules Effectiveness of rules	Legitimacy can act as a motivation for compliance when resource users perceive that authorities and decision-makers are trustworthy and act honestly (legitimacy of authorities) and when rules outcome are fair and effective.	(Levi et al., 2009; Nielsen, 2003; Thomas et al., 2016)

and Epstein (2012) provide one such analytical framework, originally designed to study forest law compliance (hereafter the "Compliance Framework"). This framework has the advantage of combining different motivations into three dominant components: instrumental, normative, and legitimacy-based (Table 1). Categorizing motivations into these discrete components allows simultaneous evaluation of their relative importance, enabling the assessment of what motivates compliance at different analytical levels, with the potential to guide the study of compliance motivations in other settings, such as fisheries. This can then help in building an empirically informed theory of compliance for conservation.

The instrumental component in the Compliance Framework highlights that one motivation for compliance relates to an economic calculation of the costs and benefits of complying. This balances the potential benefits of non-compliant behaviors (such as higher catches) against the potential costs (including the probability of detection and severity of sanctions). This utilitarian understanding of compliance has roots in the economic theory of law (Becker, 1968) and has been used to explain compliance with natural resource rules (e.g., for fisheries; Sutinen & Kuperan, 1999), and rhino poaching; Milner-Gulland & Leader-Williams, 1992). The normative component emphasizes social and personal norms as motivations for compliance. Norms are defined as prescriptions commonly accepted in a group, supporting desirable behaviors and forbidding undesirable ones (Ramcilovic-Suominen & Epstein, 2012). Norms can have a significant effect in reinforcing non-compliance or strengthening adherence to conservation rules, depending on the specific rule and its outcomes for the person's reference group (Cialdini & Trost, 1998). Finally, the legitimacy-based component assesses how the acceptance of decision-making and its outcomes by citizens motivates compliance (Levi, Sacks, & Tyler, 2009). Higher legitimacy has been linked with enhanced compliance, making governance easier and more effective (Jentoft, 1989).

The relative influence of these motivations (instrumental, normative, and legitimacy-based) on actual compliance, and their interaction, is influenced by both the contextual factors (e.g., economic, social, cultural) in which decisions are made and the types of rules in place (Ramcilovic-Suominen & Epstein, 2012). For instance, locally crafted and enforced rules tend to give resource users a sense of ownership over decision-making processes, enhancing legitimacy and motivating compliance (Nielsen & Mathiesen, 2003). By contrast, conservation rules that are imposed on resource users by external authorities can backfire, by aligning normative motivations against compliance (Hatcher, Jaffry, Thébaud, & Bennett, 2000). Different rule-types can co-occur within one context, creating heterogeneity in an individual's compliance responses. This is especially the case in many small-scale fisheries, which operate under diverse institutional

arrangements, combining self-governance, co-management and top-down systems each with different rule-types attached (Lindkvist, Basurto, & Schlüter, 2017; Ostrom, 2010). Small-scale fisheries, therefore, provide an interesting setting to disentangle the effect that contextual factors and rule-types have in motivating compliance with conservation rules.

Here, we empirically assess what motivates compliance in the common hake (*Merluccious gayi gayi*) small-scale fishery of south-central Chile. A suite of conservation rule-types are in place for this fishery, emerging from different institutional arrangements. High levels of non-compliance with the fishery's quota limit have been documented (Plotnek, Paredes, Galvez, & Pérez-Ramírez, 2016), but there is no understanding of what motivates this behavior or the heterogeneity in compliance between rule-types and fishers. We adapted the Compliance Framework from its original use in forestry to first characterize the diversity of compliance responses and motivations for the main conservation rules for this fishery. Then, we assessed the relative role that instrumental, normative, and legitimacy-based motivations play in explaining the degree of non-compliance with the quota limit. Finally, we discuss the implications of these findings for conservation more broadly.

2 | METHODS

2.1 | Research setting

The common hake plays a key ecological and economic role in the upwelling ecosystem off central Chile's coast but under-reported fishing, in excess of quota limits, is threatening the conservation of the stock and the >3000 livelihoods it supports (Plotnek et al., 2016). Anecdotal evidence and enforcement records from Chile's National Fisheries and Aquaculture Service (SERNAPESCA) indicate that underreporting is particularly serious in Chile's VII region (see Figure 1b for a map). In this region around 300 boats, operating with 3–4 crew and averaging 9.5 m in length, are registered as part of the hake fishery.

A suite of nested, interrelated conservation rule-types governs the fishery in the VII region (Figure 1a). The four main rules are: (a) a yearly quota-limit, set by a national-level scientific committee and allocated in fixed proportions to boat owners or fishers' associations; (b) a national-level reproductive ban to protect hake's spawning peak during September; (c) a minimum mesh size for fishing gear, managed by a national co-management committee in which fishers participate; and (d) a 3-day a week fishing limit, set voluntarily by fishers' organizations of the VII region.

2.2 | Survey instrument

After piloting and revision of the survey instrument, data were gathered in March to April 2019 in four ports (A, B, C and D for anonymity) of Chile's VII region (Figure 1b). We used snowballing sampling, after getting endorsement for the study from leaders of the main fishers' associations in these ports. In total, we surveyed 159 fishers (limited to one fisher per boat), representing 53% and 74% of the total number of boats registered in the region and in these four ports, respectively. Before each survey, we informed fishers that participation was voluntary and that they could refuse to answer any particular question. The study complied with Oxford University's ethical requirements (approval number R61136/RE001).

Because we assessed behaviors that might be sensitive, we used the randomized response technique (RRT) (Boruch, 1971) and direct questions (DQ) to assess non-compliance with conservation rules and estimate quantities of under-reporting (questions in Table S1). Based on the Compliance Framework, we assessed instrumental, normative and legitimacy-based motivations for compliance using a Likert scale to measure agreement/disagreement with two to three statements per component for each rule. The scores for each statement were averaged to get a measure of the strength of agreement with each component for each rule, after having checked for consistency between statements with Cohen's Kappa test (for normative and instrumental components that had two statements) and Fleiss's Kappa test (for the legitimacy-based component that had three statements). Descriptive norms were dropped from the normative motivation component of the analysis due to low variance which prevented consistency analysis. We framed statements so that agreement meant fishers perceived the statement as a motivation for compliance (Table S3).

2.3 | Data analysis

Data were analyzed using R Studio v1.1.456 (R Development Core Team, 2011). To understand what motivates compliance with conservation rules, we assessed heterogeneity in compliance at three levels: (a) *within-individual*, regarding how fishers respond to different rule-types and what motivates these responses; and at two levels regarding the degree of non-compliance with the quota limit; (b) *between-individuals*, and (c) *between-ports*.

For (a) we calculated (i) the proportion of fishers admitting non-compliance by adapting Boruch's (1971) forced RRT response model (Figure S1), and (ii) per-trip underreporting rates using a quantitative adaptation of the RRT (Figure S2 and Table S2), following Oyanedel, Keim, Castilla, and Gelcich (2018). To assess heterogeneity at levels (b) and (c) we fitted an ordinal mixed-effects model, using the R package *Ordinal* (Christensen, 2015), where the degree of underreporting was expressed as a five-category response variable (from the direct question data, see results). We only considered this response variable because the other compliance estimates were consistently close to 0% or 100%, and

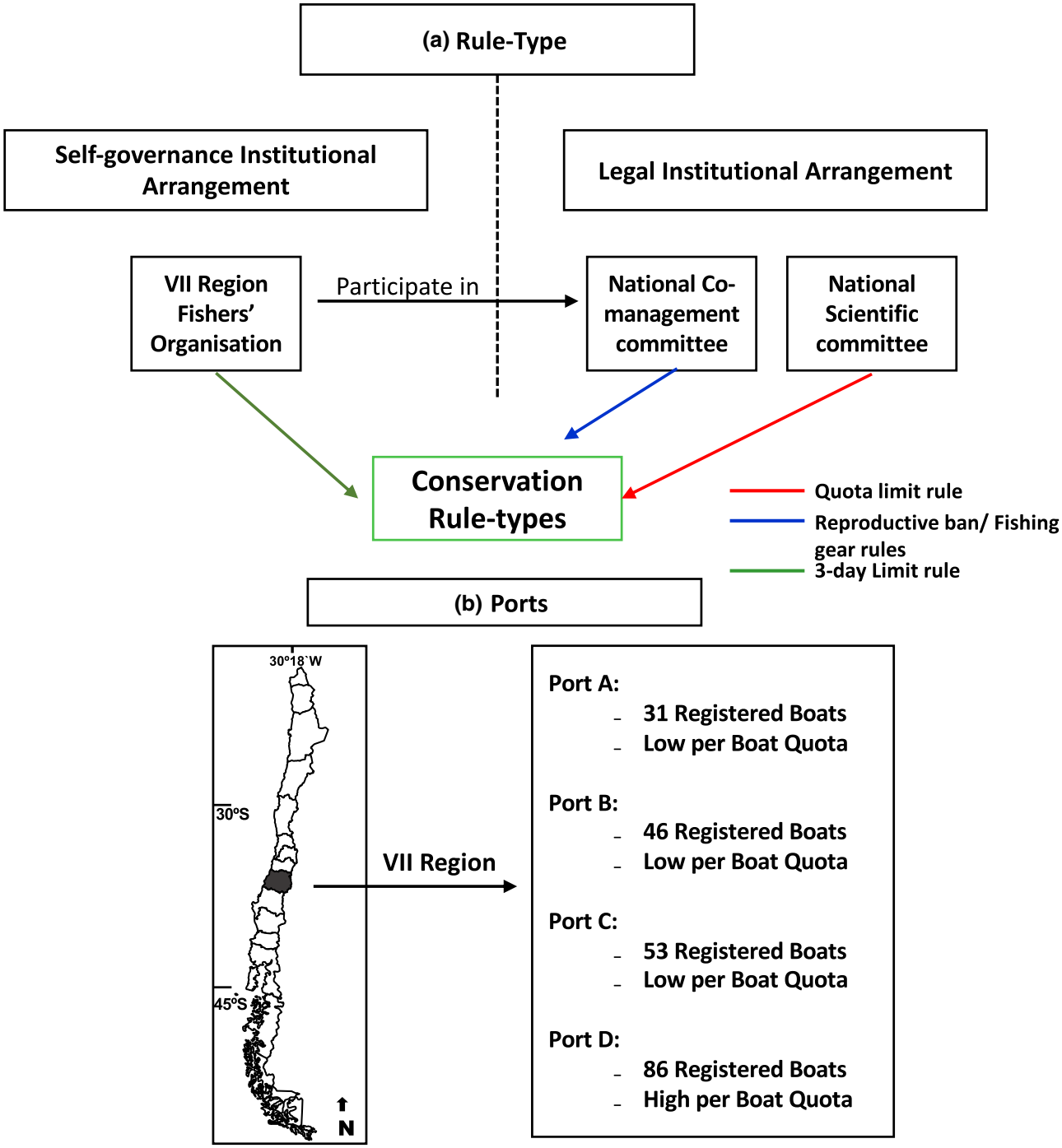

FIGURE 1 Contextual factors from the analytical framework for compliance (Ramcilovic-Suominen & Epstein, 2012), adapted for the context of the common-hake small-scale fishery of south-central Chile. (a) A conceptual framework of the conservation rule-types for the fishery. (b) A map of the study area and information of the four ports assessed

therefore unsuitable for modeling because of class imbalance. For this model we considered the motivational component scores as fixed effects, having checked for collinearity, and used Port as random effect. Given the anonymity of our survey, port was the only contextual factor we could control for. However, data from SERNAPESCA is available on the quotas that boats in each port receive; therefore, port captures the effect of quota level on non-compliance (Figure 1b). To analyze the effect of port on non-compliance levels we estimated best linear unbiased predictors (BLUPs) from the model.

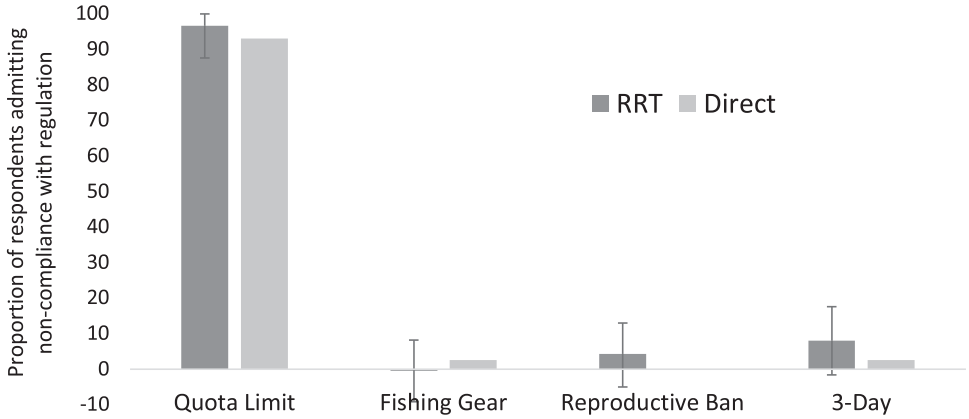

FIGURE 2 Estimates of non-compliance with 4 conservation rules using the randomized response technique (RRT) and direct questions (Direct). Bars represent 95% confidence intervals on the RRT estimate

3 | RESULTS

Estimates of the proportion of respondents admitting non-compliance from direct questions fall within the 95% confidence interval of RRT estimates, suggesting fishers answered the questions honestly (Figure 2). For three of the four conservation rules, estimates of non-compliance were low and not significantly different from zero (fishing gear [$t = -.107$, df = 158, $p = .91$], reproductive ban [$t = .9$, df = 158, $p = .36$], and 3-day rule [$t = 1.62$, df = 158, $p = .106$]). For the quota limit, non-compliance estimates were much higher, in contrast to the other rules (RRT = 97% [87%–100%], direct = 93%).

Between 74% and 97% of fishers agreed or strongly agreed with statements reflecting instrumental motivations for compliance with the four assessed conservation rules (Figure 3a). Similarly, 90% of respondents agreed or strongly agreed with statements reflecting normative motivations for compliance with the fishing gear, reproductive ban and 3-day rules. However, agreement with statements reflecting normative motivations for compliance was lower for the quota limit (26% agreed or strongly agreed, Figure 3b). Between 55% and 87% of respondents agreed or strongly agreed with statements reflecting legitimacy-based motivations for compliance with the fishing gear, reproductive ban and 3-day rules. Conversely, most fishers disagreed with statements reflecting legitimacy-based motivations for compliance with the quota limit (95% disagreed or strongly disagreed, Figure 3c).

We used direct question data as response variables in our model, since estimates from RRT and direct questions were similar for the quantitative estimates of underreporting (RRT = 20.31 [SE = 2.46]; direct question = 22.02 [SE = 1.25]). Fishers that scored instrumental, normative and legitimacy-based motivations higher, underreported less (Table 2). However, the relative role of these components differs importantly between individuals. In particular, individual differences in the normative component were significantly related to the degree of non-compliance with the quota limit ($\beta = -0.158$ [0.06], $p = .014$). Instrumental motivations were nearly significantly related to the degree of non-compliance with the quota limit ($\beta = -0.145$ [0.07], $p = .059$). Legitimacy-based motivations had a low and non-significant effect on the degree of non-compliance with the quota limit.

The port that a fisher is based in had a large effect on the degree of non-compliance with the quota limit. Ports A ($\beta = 0.789$ [0.17], $p \leq .0001$) and B ($\beta = 0.367$ [0.09], $p = .0002$) had significantly more underreporting, port C had a negative, non-significant coefficient ($\beta = -0.03$ [0.08], $p = .976$), while port D was strongly significantly less likely to underreport ($\beta = -1.117$ [0.04], $p \leq .0001$).

4 | DISCUSSION

Our results support previous estimates of substantial levels of non-compliance with the quota limit in the Chilean common-hake fishery (Plotnek et al., 2016). However, our results also shed light on the diversity of motivations for compliance across rule-types and fishers. At *within-individual* level we found that fishers comply with temporal and gear restrictions, but not the quota limit (Figure 2). These distinct compliance responses are associated with heterogeneity in what motivates compliance with each conservation rule, especially reflecting the importance of legitimacy-based motivations to comply with temporal and gear restrictions but not the quota limit (Figure 3c).

At the *between-individuals* level, we found normative motivations best explained the degree of non-compliance with the quota limit, followed by instrumental motivations (Table 2). As such, our results sit between previous work that highlights the role of instrumental motivations for compliance in commercial fisheries (King & Sutinen, 2010; Nielsen & Mathiesen, 2003; Sutinen & Andersen, 1985) and the role of normative motivations for compliance in recreational fisheries (Bergseth & Roscher, 2018; Bova, Halse, Aswani, & Potts, 2017; Thomas, Milfont, & Gavin, 2016). However,

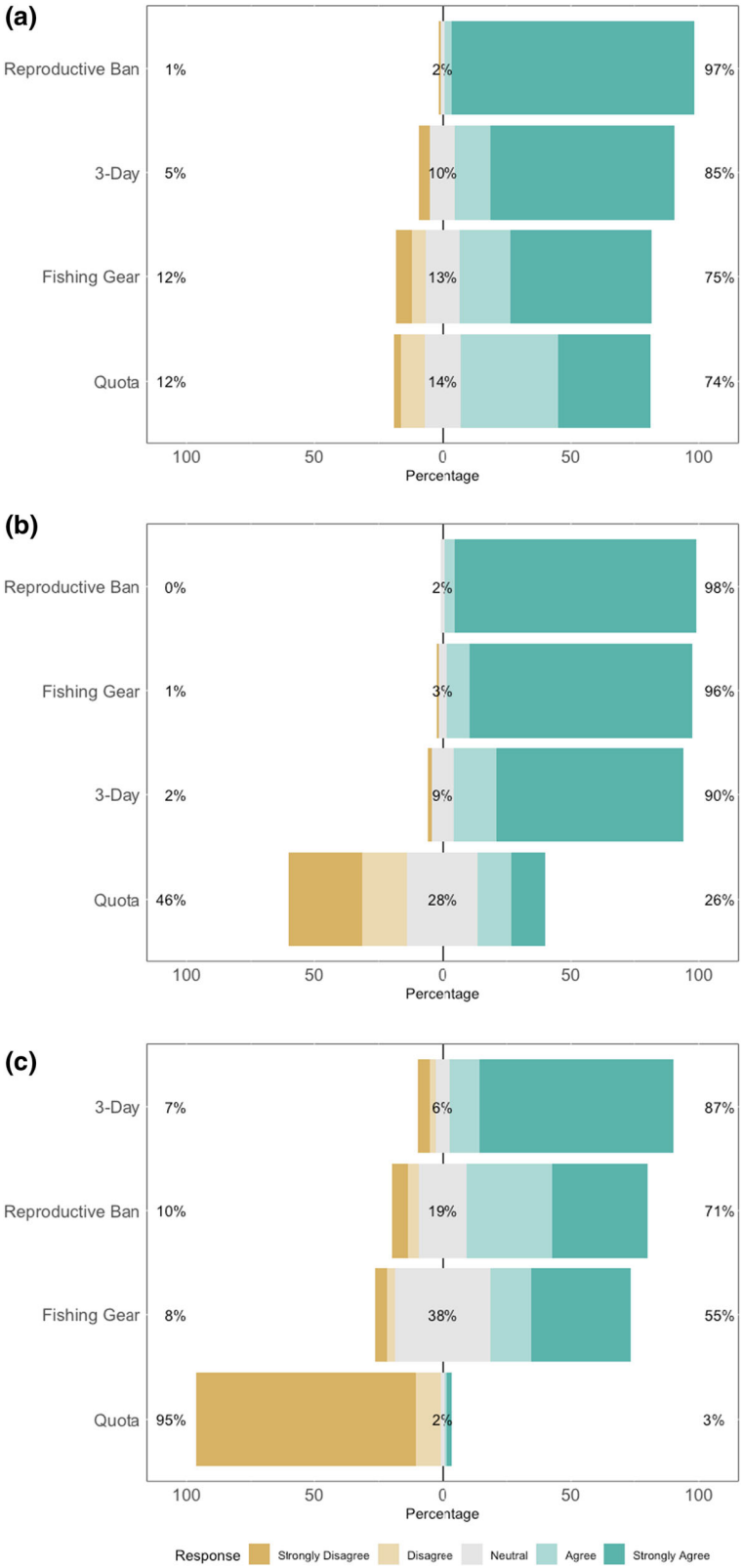

FIGURE 3 Likert scores of respondents' agreement with statements regarding their (a) instrumental, (b) normative, and (c) legitimacy-based motivations for complying with the four conservation rules (e.g., for a normative motivation statement, fishers were asked to indicate how much they agreed with the following: "I would feel guilty if I violate this [conservation rule]," see Table S3). The percentage on the right side of each panel represents the sum of agree and strongly agree responses, the percentage in the middle represents neutral responses and the percentage on the left represents the sum of disagree and strongly disagree responses

previous work that emphasizes the role of normative motivations was carried out in high compliance contexts. For instance, Bergseth and Roscher (2018), found that most recreational fishers in the Great Barrier Reef Marine Park in Australia had strong normative motivations for compliance. But, contrary to our case study, non-compliance among fishers was 3–18% (Bergseth, Williamson, Russ, Sutton, & Cinner, 2017). As such, our results expand on previous work by demonstrating that normative motivations can have a role in motivating compliance even in high non-compliance contexts.

TABLE 2 Result from multiple regression mixed effect model. Estimates of the effect that motivational components (fixed effects) and ports (random effect, estimates from BLUPs) have on the degree of non-compliance with the quota limit (ordinal model)

		Degree of non-compliance with quota limit	
		β (SE)	p
Motivation (fixed effects)	Instrumental	−0.145 (0.07)	.059
	Normative	−0.158 (0.06)	.014*
	Legitimacy-based	−0.056 (0.10)	.584
Port (BLUPs)	A	0.789 (0.17)	<.0001*
	B	0.367 (0.09)	.0002*
	C	−0.03 (0.08)	.976
	D	−1.117 (0.04)	<.0001*

*Indicate significant variables at $p < .05$.

Further, by assessing the degree of non-compliance with the quota limit (i.e., by *how much* fishers exceeded their quotas) as a response variable at the *between-individuals* level, we expand on previous studies using dichotomous assessments of non-compliance as response variables (i.e., whether fishers violate rules or not), such as the studies by Arias and Sutton (2013), Bergseth and Roscher (2018), Bergseth, Russ, and Cinner (2015), and Thomas et al. (2016). Our results reveal how motivations affect not only the decision to engage in non-compliance but also the degree or extent of non-compliance. As such, this study allowed us to unpack the previously unidentified role of normative factors in motivating the extent of fishers' non-compliance. Moving from a dichotomous framing of compliance toward a holistic understanding of the diversity and extent of non-compliance responses and their motivations can aid in better managing and predicting non-compliance (Arias, 2015; Boonstra et al., 2017).

The high heterogeneity we found *between-ports* show that port D fishers, who have high quotas, were more likely to comply. Our finding that fishers from lower quota ports comply less suggests that underreporting in this region is partially caused by the low quotas assigned to fishers, which relates to the instrumental motivation (i.e., economic factors). However, our results also reveal an important geographical pattern in compliance responses, with differences between the low-quota ports A, B, and C, indicating that port-level factors beyond the quota were important determinants of compliance. More research is needed to understand the role that context-specific variables such as local market pressure, culture, equity, poverty, and corruption might have in influencing compliance and the relative role of different motivations (Ramcilovic-Suominen & Epstein, 2012).

Unpacking fishers' underlying motivations for compliance with different conservation rule-types, at different analytical levels, can help guide tailored interventions at the appropriate level (Arias, 2015; Thomas et al., 2016). Fisheries are complex adaptive systems, and diverse motivations for compliance need to be addressed differently by managers (Mahon, McConney, & Roy, 2008). For instance, the *within-individual* heterogeneity suggests that allowing more participation by fishers in decision-making about quota limits could increase their legitimacy, ultimately improving compliance (Pares, Dresdner, & Salgado, 2015). *Between-individuals*, our results suggest that compliance could be improved by tapping into fishers' normative motivations. For instance, interventions could correct negative interpretations of how others are responding to rules, and highlight positive behaviors, such as through targeted advertising campaigns (Berkowitz, 2005; Bova et al., 2017). Similarly, block leaders could be empowered to shape port-level normative perceptions toward the need to comply with the quota limit (Bergseth & Roscher, 2018). Since fishers are well-organized in our case study, existing leaders could potentially fulfill this role. Heterogeneity *between-ports* suggests that higher quotas motivate fishers to comply. Auctioning and redistribution programs could be designed to deal with the problems of initial quota allocation and their equity implications (Sumaila, 2018). This way, quota could be better allocated without increasing pressure on the overexploited stock.

Conservationists have two ways to deal with issues of compliance. One involves using technical fixes, such as increasing fines or the (real or perceived) probability of getting caught and sanctioned, to incentivize compliance (our instrumental component) (Becker, 1968). This has been the primary approach because it makes use of empirical data to estimate the effect of enforcement on compliance levels (Doumbouya et al., 2017; Hilborn et al., 2006) and relies on the assumption that human behavior is governed by profit-maximizing self-interest (Schill et al., 2019). However, empirical evidence is mounting that non-economic factors play an important role in motivating compliance (our normative and legitimacy-based components) (Bergseth & Roscher, 2018; Bova et al., 2017; Thomas et al., 2016). The tension between these approaches cannot be resolved without digging deeper into the heterogeneity of compliance responses, the motivations behind them, and how they vary between scales. This is especially necessary in small-scale resource user systems, because their diversity and dynamism precludes simple generalizations (Mahon et al., 2008; Waylen, Fischer, McGowan, & Milner-Gulland, 2013). Ultimately, a robust and empirically-based theory of compliance should guide conservationists in understanding the circumstances and scales for which technical fixes can motivate compliance, and when other approaches that tap into non-economic motivations are needed. Creative ways to deal with compliance issues will emerge if combinations of policy instruments are used at nested levels, accounting for the heterogeneity of motivations and

contextual factors that ultimately drive compliance at each level.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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