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Examining the seascape of compliance in U.S. Pacific island fisheries

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ABSTRACT

Noncompliance is a major threat to marine social-ecological systems. Recent noncompliance research has focused on illegal, unreported, and unregulated (IUU) fisheries and capacity shortfalls in marine protected areas (MPAs), but less work has assessed other aspects of noncompliance. Although there is wide recognition of the role of noncompliance in governance failures, the academic literature on compliance rarely acknowledges the connections between governance processes, compliance activities, and management outcomes. Likewise, scholars often highlight instrumental approaches that include law enforcement tools, instead of a diverse suite of non-instrumental interventions that encourage voluntary compliance through education, outreach, and targeted behavior change. We sought to understand the seascape of compliance across the United States Pacific islands region, an area of 5.83 million km^2 that includes Hawai'i, American Samoa, Guam, the Northern Mariana Islands, and one of the world's largest MPAs. The region includes commercial, subsistence, and non-commercial fisheries, and a diversity of cultures that rely on them. To examine compliance, we employed a qualitative approach, including an extensive review of historical and archival data sources, an analysis of the fisheries management literature in the region, and 29 expert interviews. While the literature highlighted the importance of enforcement, experts called attention to multiple factors that affected compliance, such as capacity, governance processes, and a lack of data. Although several fisheries may benefit from an increased enforcement presence, we argue that non-instrumental and governance approaches can complement enforcement and should be part of an integrated compliance approach both in the region and worldwide.

1. Introduction

Rules are the primary way that societies mediate marine social-ecological systems interactions [1]. In fisheries, rules can be formal (*de jure)* and take the form of closed areas, gear restrictions, size limits, or access controls [2]. Rules may also be informal (*de facto)*, such as norms, shared strategies, or values that guide human behavior [3,4]. Governance failures can occur when resource users do not comply with rules, often resulting in adverse social-ecological outcomes. Non-compliant behaviors related to governance failures may include over-harvesting, inaccurate catch reporting, deliberate take of non-target species, high-grading or discarding lower quality target species, destruction of habitat, and harmful interactions with endangered, protected, or threatened species [5,6]. Noncompliance may also involve activities more directly associated with economic aspects of fisheries, such as seafood mislabeling [7] and transshipments that veil illegal fishing activity [8]. Noncompliance can become a social or human rights issue if fishers are forced to work in unsafe or dangerous working conditions [9] or become ensnared in human trafficking, indentured servitude, forced labor, or slavery operations [10,11].

Noncompliance with fisheries rules can be defined as individual or societal behaviors that are either undesirable or illicit depending on the formality of stewardship rules [12–14]. Scholars often split noncompliance interventions into two categories: (1) instrumental approaches that use sanctions and incentives to achieve compliance, and (2) non-instrumental approaches, where education, persuasion, and socialization of codes of conduct help encourage compliance. These two approaches are often described separately, although several scholars have integrated them via conceptual frameworks [15–19]. The instrumental approach enables a parsimonious view of human-environmental interactions [20], but its simplicity belies a diversity of methods that may also encourage regulatory compliance, or promote

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pro-environmental and pro-social behaviors outside of *de jure* sanctions or deterrence. Instrumental approaches are typically used to address formal rules and regulations, whereas non-instrumental approaches and governance can be used to address both formal and informal rules.

Fisheries governance often emphasizes formal rules, and therefore instrumental approaches to compliance. But, this focus misses opportunities to improve compliance through other means. Non-instrumental or normative tools and strategies [18,19,21] that can improve compliance include public outreach, education, social learning, and social marketing to encourage, persuade, or nudge preferred behavioral norms or codes of conduct [16,22,23]. These approaches are most effective when based on audience research and social-psychological theories, and incorporate audience needs, wants, and perceptions [24]. In addition, the desired outcome should be changing attitudes or behaviors for societal benefit [25], but campaigns are often designed with the goal of education or awareness, which do not necessarily induce the intended compliant behaviors [26]. Compliance may also be encouraged through legitimate participation in decision making processes or the governance aspects of compliance [16,27,28]. Much of this scholarship emphasizes the importance of collective choice decision making in order to embed legitimacy into local resource rules, along with graduated sanctions for rule violators [29]. Governance processes can influence compliance via procedural justice, legitimate participation in management processes, and perceived fairness of resource appropriations or outcomes [18]. Procedural justice in governance processes entails fairness, transparency, and accountability in decision-making [16]. Legitimate participation in management processes alludes to the level of community or resource user involvement in management decisions, rulemaking processes, and compliance activities [28,30]. Fairness of resource appropriations or outcomes is related to whether resource users or stakeholders are satisfied with institutional effectiveness and how rules affect resource allocations. There is a large body of scholarship that illustrates how improvements in procedural justice, legitimate participation in management, and perceived fairness improve compliance and result in sustainability of common pool resources such as fisheries [29–31]. Ideally, a comprehensive governance system would address the underlying drivers of noncompliance –not merely its byproducts– by combining instrumental and non-instrumental approaches with procedural justice and legitimate participation in governance processes.

Noncompliance is a management concern in the geographically large and culturally diverse U.S. Pacific islands region [32], an area managed in part by the National Oceanic and Atmospheric Administration (NOAA) that includes Hawai'i, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). The region also contains several large marine monuments and adjacent waters, which include low lying reefs, atolls, and islands known collectively as the Pacific Remote Island Areas (PRIAs), the Marianas Trench Marine National Monument, Rose Atoll Marine National Monument in American Samoa, and the recently expanded Papahānaumokuākea Marine National Monument in Hawai'i (one of the largest no-take MPAs in the world, see Fig. 1). Together, the Exclusive Economic Zones (EEZs) of U.S. jurisdictions and the marine monuments total more than 5.83 million km^2. This combined area is equivalent to 51% of all United States EEZs [33]. Hawai'i, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands devote few resources to compliance activities relative to the scale of resources under their jurisdiction [34,35].

To date, there has been no study documenting or examining noncompliance issues related to marine resource governance in this region. An inventory of compliance issues throughout the U.S. Pacific islands would enable scientists to improve understanding of how

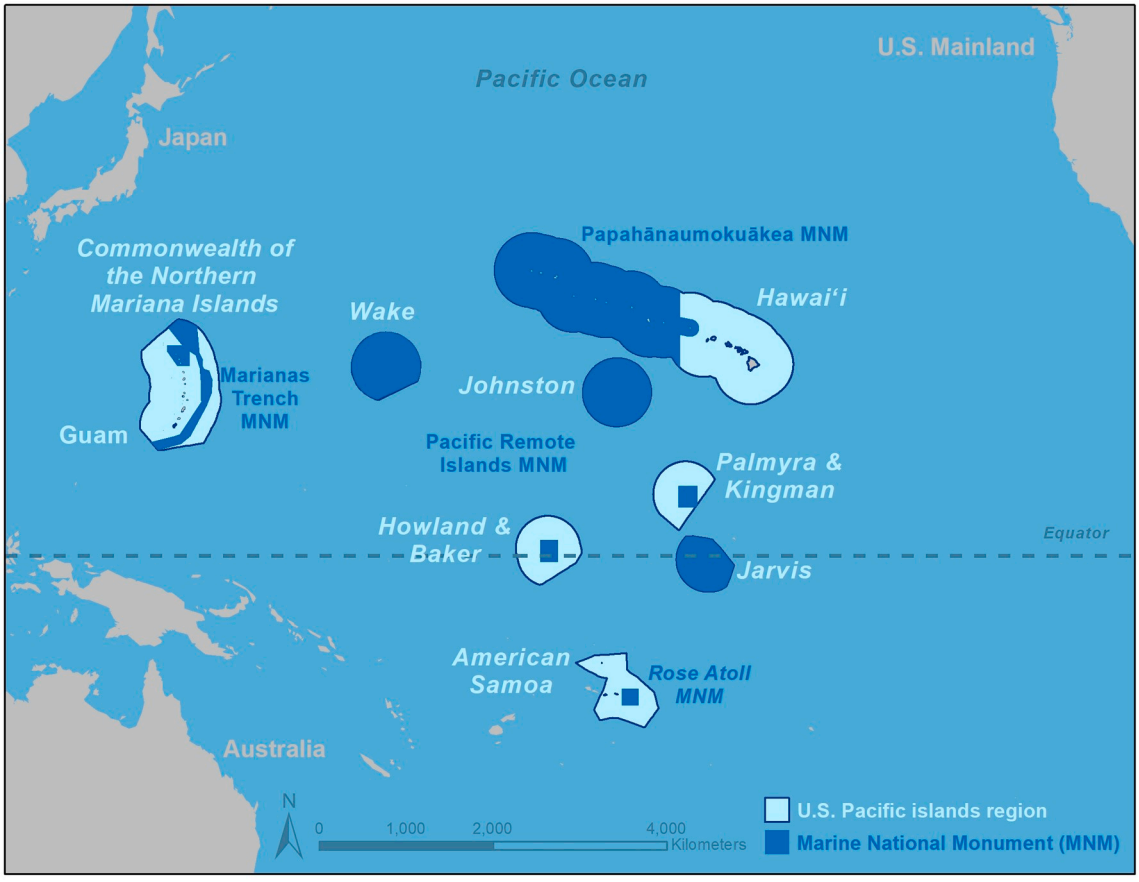

Fig. 1. Map of the U.S. Pacific islands Region, including marine monuments.
Source: Tomoko Acoba and Kirsten Leong, Pacific Islands Fisheries Science Center

noncompliance affects marine social-ecological systems and allow managers to target specific areas to improve stewardship. Therefore, we sought to understand the current breadth or "seascape" of compliance in the U.S. Pacific islands region by examining several data sources, including historical and archival data, the published academic literature, and interviews with fisheries management and compliance experts. We chose the word 'seascape' because it acknowledges that multiple viewpoints exist regarding the scale of compliance activities, the appropriate governance intervention, and the overall efficacy of different compliance actions. Our research was guided by two research questions:

1. What is the seascape of regulatory compliance in terms of published literature and reports?
2. How do experts across the U.S. Pacific islands region perceive the biggest regulatory compliance issues?

By conducting this research, we seek to achieve a greater understanding of the range of compliance issues in the U.S. Pacific islands region, including differences in how experts perceive these issues. It is our hope that conducting this research will provide greater understanding and awareness of the compliance issues and stewardship across the U.S. Pacific islands, and insights to improve compliance in other global contexts.

2. Background and study site

2.1. Target resources and sociocultural importance

In the U.S. Pacific islands region, marine fisheries governed by federal, state, and territorial entities include pelagic, archipelagic, protected, and endangered species, including coral reef and deep bottom fishes, highly migratory species, marine mammals, marine algae, crustaceans, corals, and invertebrates. Socially, the U.S. Pacific Islands region is comprised of participants that fish for a range of non-commercial, subsistence, and commercial reasons. Societal dependence on resources in the Pacific for food, commerce, and conservation highlight the need for effective rules and compliance. Seafood and fishing also serve important sociocultural purposes across the U.S. Pacific islands region [36–41].

2.2. Regulatory and enforcement structure

The U.S. Pacific islands region employs extensive federal management measures, along with compliance monitoring and enforcement, which include permits, limited entry systems, fisheries observers, vessel monitoring for large-scale commercial fishing operations, and a regional law enforcement division to surveil and prosecute resource rule infractions [42]. Management actions are guided by a set of ten national standards that mandate using the best available information to manage fisheries and related marine resources. Despite extensive management and enforcement methods, it is difficult to ensure the entire region is covered, because the U.S. Pacific islands region is the largest NOAA region in the U.S. (see Fig. 1) [43]. NOAA Office of Law Enforcement (OLE) is responsible for enforcing resource laws from 3 to 200 miles from shore for Hawai'i, American Samoa, and Guam, and the CNMI. The U.S. Coast Guard also conducts enforcement actions at sea for the Hawai'i pelagic longline fleet.

Each of the jurisdictions in the region is responsible for enforcing local resource regulations through their own enforcement agency from 0 to 3 miles, but NOAA OLE has joint enforcement agreements with agencies in each of the jurisdictions, including Hawai'i (Division of Conservation and Resource Enforcement), American Samoa (Department of Marine and Wildlife Resources), Guam (Division of Aquatic and Wildlife Resources), and the CNMI (Division of Fisheries and Wildlife). These agreements are in place to help enforce a variety of resource-related laws, including the Magnuson-Stevens Fisheries Conservation and Management Act (MSA), the Endangered Species Act, the Marine Mammal Protection Act, the National Marine Sanctuaries Act, and the Lacey Act. NOAA OLE also partners with the Regional Fisheries Management Organizations, such as the Western and Central Pacific Fisheries Commission, the Inter-American Tropical Tuna Commission, and the United Nations Food and Agricultural Organization (FAO) to help achieve Pacific-wide conservation goals. Other NOAA OLE partners include U.S. Customs, the U.S. Fish and Wildlife Service, and the United States Coast Guard, which help to ensure compliance with laws, international treaties, and agreements.

2.3. Enforcement priorities for NOAA OLE and Hawai'i DOCARE

The following two documents provide some insight about regional enforcement priorities for NOAA OLE and for two highly populated Hawaiian islands. We did not find any documents outlining specific enforcement priorities for American Samoa, Guam, the CNMI, or other Pacific Island Areas. The first document identifies 2018–2022 NOAA OLE Enforcement Priorities. Although OLE is tasked with enforcing multiple laws and regulations in the region, they also identify areas of greatest need to focus effort and resources [43]. The six national OLE priority areas in the Pacific islands region are: (1) sustainable fisheries, (2) protected resources, (3) IUU fishing (internationally), (4) seafood fraud, (5) wildlife trafficking, and (6) outreach and education. These priorities are the same for NOAA OLE's Pacific Islands Division, except that outreach and education are included within the other five.

The second document is a 2012 Enforcement Chain Analysis Report, commissioned for the Hawai'i Department of Land & Natural Resources, Division of Conservation and Resource Enforcement (DOCARE), which examined priorities and organizational effectiveness for the island of O'ahu and the North shore of Maui [44]. The report highlighted four necessary components to achieve enforcement goals: educate the public about resource rules, deter noncompliant behaviors, rehabilitate violators through efforts to improve moral conduct, and restore natural or cultural resources via mitigation or compensation. In addition to these components, the report identified six thematic priorities where DOCARE should focus efforts to strengthen the enforcement chain across Hawai'i [44]. These priorities included: develop educational programs, strengthen educational outreach programs, expand the civil administrative adjudication process, improve the efficiency of the current enforcement process, develop enforcement performance measures, and develop relationships with community groups.

3. Methods

This research employed a qualitative approach, combining a review of published academic and grey literature on compliance in the U.S. Pacific islands, and 29 semi-structured interviews with experts who have extensive fisheries management and compliance experience in the region. We will describe these data sources in more detail in the following subsections.

3.1. Literature review

We used Google Scholar to locate peer-reviewed academic publications and grey literature available online since the year 2000, based upon the following search criteria: (year $\geq$ 2000), and search results from the following queried terms: "State/territory/commonwealth name + fisheries", "State/territory/commonwealth name + fisheries + management", "State/territory/commonwealth name + fisheries + enforcement", "State/territory/commonwealth name + fisheries + compliance." We limited the pool to the first 150 articles from each google scholar query (600 total for the four search queries). From this pool of publications, we read the title and abstract for topical relevance to further narrow our search. Following the title and abstract review, we

selected articles for further analysis that described the fishery or social-ecological system and at a minimum included the regulatory structure for a fishery or provided solutions to improve fisheries governance. There were 33 articles that met these criteria. The dataset of (33) articles was queried using the following search terms: "enforcement", "compliance", "education", "outreach", "participation", and "community involvement." Within each of these articles, we searched for "enforcement" and "compliance" as a proxy for instrumental approaches to compliance, but noted their presence separately to identify differences in how scholars described compliance in their work. We copied strings of text from the articles to capture their description in context and we provide some examples in Table 4. We used the same process to search the dataset for education and outreach as evidence of non-instrumental compliance activities because those are the terms most often used in the region to describe the range of non-instrumental approaches. Lastly, we searched for community involvement or participation to denote participation in rulemaking or the management process. The analysis was limited to academic publications and reports; it did not include Fishery Management Plans or Fishery Ecosystem Plans developed by the Western Pacific Regional Fishery Management Council, Environmental Impact statements, or regulatory analyses. Principally, these documents contained little information on compliance. Plus, manager perspectives were already captured in the enforcement priorities documents and the semi-structured interviews.

3.2. Semi-structured interviews: sampling protocol, justification, interviews, coding, analysis

We used a combination of purposive sampling and network or chain referral sampling approaches to select information-rich individuals with substantial experience in fisheries management and compliance in the U.S. Pacific islands region. Purposive sampling was used to identify experts that met specific criteria that would not often be identified through typical sampling protocols [45]. We began by interviewing experts in a variety of social-ecological contexts and fisheries in the U.S. Pacific islands region, e.g. coral reefs, pelagic ecosystems, and deep bottomfish areas. We also interviewed individuals from law enforcement, fishing, community-level management, biologists/scientists, and non-governmental organizations or foundations. Interviewees also suggested other individuals we should interview. This follow up sampling approach is often described as network or chain referral sampling [46] and is typically used to identify additional interviews until data convergence or data saturation is reached among interviewees. In other words, data collection continues until no new themes or ideas emerge from additional interview respondents. Our interviews were relatively short (30 min to 1 h) and limited to one loosely structured topic (regulatory compliance in the U.S. Pacific islands region), so thematic saturation was reached more quickly than if the interviews were longer and farther ranging [47]. A copy of the interview guide is in the Appendix.

We conducted 29 semi-structured in-person and telephone interviews with individuals that had a mean experience of 23.76 years working in U.S. Pacific islands fisheries (standard deviation: ± 13.54; median 20 years of experience). Our data collection concluded when we determined that we had reached 'data saturation' or informational redundancy [48]. In other words, new data mirrored data collected during previous interviews [49]. Throughout the paper, we use the term 'expert interviews' when referring to this data source. Several of these individuals had worked in multiple jurisdictions and in different fishery sectors during their careers. Similarly, some interviewees began their careers as scientists or biologists, and then later transitioned into a regulatory or management position. Further blurring the lines among stakeholders, many of the individuals not categorized as fishers in our stakeholder categories (described in Table 1) also fished part-time.

Table 1
Total number of U.S. Pacific islands expert interviews by stakeholder type.

Stakeholder group	Total interviews
Law Enforcement (government)	7
Federal/State/Territorial management (government)	7
Fishers (commercial, non-commercial, subsistence)	5
Community-level management (non-commercial, subsistence)	4
Biologist/Scientist (government, academic, contractor)	3
Non-Governmental Organization	3
Total	29

Interviewees were asked to describe the most pressing compliance issues in their area of expertise and we captured these responses in written interview notes. We also asked about criteria they would use to rank or prioritize issues. Many expert interview responses were specific, citing detailed actions to reduce noncompliance in certain fisheries, while others were more general. Interviewees typically listed about three issues. In total, we ended up with 100 issues from 29 expert interviews. We analyzed these responses using an inductive, grounded theory approach [50], categorizing issues into gradually broader themes [51].

4. Results

In the following section, we present our findings from a review of published academic and grey literature on compliance in the U.S. Pacific islands region. Then, we reveal our findings from 29 semi-structured expert interviews.

4.1. Analysis of peer-reviewed literature on compliance in the U.S. Pacific islands region

The review of academic and grey literature highlighted how compliance has been framed as a management issue across fisheries in the region. Our analysis identified how compliance is discussed by fisheries management scholars in the region, what types of problems they addressed, and the range of solutions suggested to improve management. Table 2 presents a thematic analysis of published and grey literature on compliance in the U.S. Pacific islands region since the year 2000. Table 3 displays the geographic coverage of the articles analyzed in Table 2 and Table 4 provides some exemplar quotes to illustrate iterative coding of issues.

Most of the literature focused on formal rules and instrumental approaches to compliance. Several articles described multiple jurisdictions. Most of the academic literature on the region focused on Hawai'i, with relatively fewer articles describing compliance in the CNMI, Guam, and American Samoa. The amount of research conducted on Hawai'i relative to the other jurisdictions should be expected given the population size of Hawai'i, the scale of resources available, and number of universities, students, and scholars in the Hawaiian archipelago. A majority of articles described compliance in coral reef fisheries or coastal pelagics; far fewer described compliance in pelagic fisheries or bottomfish. Most resources devoted to compliance efforts are focused on pelagic commercial fisheries, with comparably fewer resources devoted to compliance in coral reef areas. Below, we separate our review findings into the following topics: instrumental approaches, non-instrumental approaches, and participation and involvement in management.

4.1.1. Instrumental approaches

The articles analyzed were more likely to mention 'enforcement' (31/33 articles) as a problem or a solution than another 'compliance' aspect (17/33 articles). For example, one article that analyzed governance of subsistence-based coral reef fisheries in American Samoa and Hawai'i noted how the absence of legitimate local involvement in enforcement may hinder compliance with community-based management. To address this, the authors suggested that greater local participation in resource monitoring programs related to community-based subsistence fisheries could improve awareness of rules and improve

Table 2
Thematic analysis of peer-reviewed academic and grey literature on fisheries management and compliance in the U.S. Pacific islands region ($N = 33$[a]).

Geographic coverage	Number of articles	Type of fisheries analyzed or described	Instrumental approaches		Non-instrumental approaches		Participation & involvement in management
			Enforcement	Regulatory compliance	Education	Outreach	
Hawai'i	23	- Coral reef fisheries/coastal pelagics (19) - Deep bottomfish (6) - Pelagic fisheries (4)	21	14	14	12	17
CNMI	7	- Coral reef fisheries/coastal pelagics (6) - Pelagic fisheries (3) - Deep bottomfish (2)	7	1	4	3	4
Guam	6	- Coral reef fisheries/coastal pelagics (5) - Pelagic fisheries (1) - Deep bottomfish (1)	6	3	4	3	3
American Samoa	5	- Coral reef fisheries/coastal pelagics (5) - Pelagic fisheries (1)	5	1	5	4	4

[a] Some of the articles analyzed several fisheries and geographic areas.

Table 3
Geographic coverage of peer-reviewed and grey literature published since 2000 on fisheries management and compliance in the U.S. Pacific islands region described in Table 2.

Geographic Coverage	References
Hawai'i	[4,52–73]
CNMI	[57,74–79]
Guam	[57,74–76,80,81]
American Samoa	[54,55,57,82,83]

regulatory compliance [52]. Other articles that described enforcement in Hawai'i noted that compliance was greater in marine managed areas such as Fishery Replenishment Areas or Community-based Subsistence Fishing Areas, due to increased citizen or community-level presence (see Table 4). But in general, articles that described governance problems in Guam, CNMI, and Hawai'i were more likely to mention or suggest instrumental compliance as a solution (either 'enforcement', 'compliance', or both, 31/33 articles analyzed), than non-instrumental compliance (either 'outreach', 'education', or both, 21/33 articles). The instrumental solutions emphasized that in many areas, existing regulatory enforcement is weak and a local community presence helps to deter rulebreaking and improve compliance (see Table 4).

4.1.2. Non-instrumental approaches

In the fisheries analyzed in the articles, education and outreach were not always discussed in terms of compliance, but were frequently mentioned (education, 21 mentions; outreach, 17 mentions) as essential management components. In other words, papers did not always identify education and outreach as specific strategies to achieve compliance *per se*. Instead, they described education and outreach activities as necessary to achieve social and cultural goals not typically met through other management activities [4]. Further, articles that described outreach and education efforts in American Samoa and Hawai'i were not state-led efforts. Non-instrumental efforts were integrated into a co-management approach with greater community involvement or through community-state management partnerships (see Table 4). Other education and outreach efforts in Hawai'i were integrated into Makai Watch, a partnership between DOCARE and Hawai'i communities. In Makai Watch, communities conduct education and outreach activities, monitor their adjacent marine areas, and report illicit activities to DOCARE.

4.1.3. Participation and involvement in management

Scholars often mentioned participation and involvement in management, although no distinction was made in terms of its contribution to processes, outcomes, or appropriate level of community involvement to improve compliance. Similar to education and outreach, participation and involvement in management was described as important to improve management, but not necessarily as a specific approach to address compliance. For example, scholars analyzing nearshore fisheries in Guam and the CNMI found that more extensive stakeholder participation could improve management planning and decision making [53], while most literature focused on Hawai'i and described participation and involvement in marine managed areas. In these initiatives, scholars commented that state-level support is low despite significant community interest in greater participation and involvement in management, either through monitoring, rulemaking, or through informal *de facto* enforcement (see Table 4). Some publications referenced a more formal community role in enforcement, but prefaced that such a role may be limited by United States laws which restrict such an arrangement [54,55].

4.2. Interview results

When we asked interviewees about the pressing compliance issues in the region, we expected to hear a list of resource issues or topics. However, many interviewees raised other types of issues, such as capacity and data needs, even with probes and follow-ups to direct the discussion towards more specific issues related to specific resources or fisheries. Therefore, we summarized our data by the themes described by our interviewees.

Table 5 presents a thematic analysis of our 29 semi-structured expert interviews in the U.S. Pacific islands region. On average, interviewees listed about three compliance issues apiece, resulting in 100 total compliance issues, which were binned into 21 subthemes and 8 major themes (Table 5). Each major theme, except miscellaneous, is discussed more fully in the following paragraphs. In many cases, there were instrumental, non-instrumental, and governance aspects of each theme, although they were not necessarily emphasized that way by the interviewee.

4.2.1. Compliance capacity

'Compliance capacity' was the most frequently mentioned theme. 'Compliance capacity' encompassed several logistical aspects that affected ability to engage in compliance activities, including lack of funding or staffing to conduct surveillance and enforcement activities and to enforce or patrol territorial seas, particularly coastal MPAs.

Table 4
Exemplar quotes and coding of peer-reviewed academic and grey literature on fisheries management and compliance in the U.S. Pacific islands region.

Theme	Geographic coverage	Exemplar quote, citation
Compliance, Enforcement	Hawai'i	"… compliance with Fishery Replenishment Area (FRA) rules and regulations happens primarily through social pressure. Aquarium fishers are required to register with DLNR and prominently display signs and flags indicating that they are aquarium collectors. They are not allowed to have aquarium collecting gear onboard their vessels (except during transit) in any area where aquarium fishing is prohibited. These regulations mean that aquarium collectors are highly visible to the public. Given the fact that aquarium fishing is generally an unpopular profession in Hawai'i, and that aquarium fishermen could potentially lose their license if caught illegally fishing, the risk of being caught and reported outweighs the potential gain of catching fish within the FRA, contributing to very high levels of compliance with FRA boundaries. In the case of the aquarium industry, community-based enforcement (backed by state regulations) has been adequate to ensure compliance with FRA regulations" [53]
	Hawai'i	"Weak enforcement by the Hawai'i Division of Conservation and Resources Enforcement (DOCARE) is a major problem in marine resource management. DOCARE generally does not issue citations unless contacted with a specific complaint. In areas that have active community-based management, community members may serve to facilitate enforcement of regulations by reporting to DOCARE, and this approach has been shown to be effective (CNN, 2006). However, there are few data on rates of compliance so it is difficult to evaluate the effectiveness of regulations [52]."
	Hawai'i	"Further, there is poor compliance with state fishing laws and regulations and insufficient enforcement, which is partially attributed to lack of resources and capacity" [63].
Enforcement	Hawai'i	"Hawai'i Island generally lacks any real enforcement in the marine context, primarily due to the fact that DAR lacks funding and patrolling resources. This has served as a limitation for managing marine resources in Hawai'i [70]. This sentiment was expressed by nearly all who were interviewed, including fishermen. There was also discontent over penalties; in the rare instances when violators were caught, they were thrown into the criminal justice system, where the nature of their crime was minor compared to others, and thus they were rarely punished" [53].
	American Samoa, Hawai'i	"Although traditional village-based management systems are still in place in American Samoa, the strength of many of these has weakened, limiting the ability of villages to engage in management and enforcement activities. The American Samoan government also has limited capacity for enforcement of fisheries regulations throughout the territory because of restricted boat and staff availability" [55].
	Guam, CNMI	"Thus, we argue that both catch size and quota policies are feasible; and provisions initially enforced through the few public markets on each island have the potential to begin improving Micronesian fisheries" [75].
	Guam, CNMI	"As a first step to improving the data collection program, the Government of CNMI passed Public Law 17–89 that establishes a mandatory catch recording and reporting system for commercial dealers. If implemented consistently and properly enforced, this has a potential to reduce the interannual variability brought about by inconsistent reporting and voluntary submission of commercial data" [79].
	Guam	"While numerous damaging projects and examples of governmental failures to require and enforce adequate mitigation measures abound, the key outcome of value is the lesson learned that these islands need to address carrying capacity issues, develop and implement a more effective planning and review process, and communities need to have the political will to manage the next episode if there are to be robust coral reefs left as a legacy for future generations" [84].
	Hawai'i	"To enforce this comprehensive collection of laws and regulations, DLNR is afforded full police power to enforce laws and regulations in its jurisdiction. DLNR designated the Division of Conservation and Resources Enforcement (DOCARE) the enforcement agency responsible for enforcing its regulations" [61]
Outreach and Education	American Samoa, Hawai'i	"Fisheries regulations vary in each village according to the village's management plan. DMWR assists with outreach and education in the participating villages, conducts biological monitoring of key fish species, and has initiated socioeconomic monitoring" [55].
	Hawai'i	"The community in the Ho'olehua Hawaiian Homesteads on the island of Moloka'i is actively engaged in managing their resource as well as educating users about traditional methods" [63].
Participation and Involvement in Management	Hawai'i	"CBSFAs also allow communities to participate in managing the marine resources they depend on for survival.' Currently, nineteen communities across the state are interested or involved in creating CBSFAs. Only two areas, however, are permanently designated CBSFAs" [61].

(*continued on next page*)

Table 4 (*continued*)

Theme	Geographic coverage	Exemplar quote, citation
	American Samoa, Hawai'i	"Both Hawai'i and American Samoa have established enabling legislation to support community-based fisheries management through the CBSFA and the CFMP, but the government agencies charged with participating in fisheries comanagement differ tremendously in the degree to which they support community initiatives. Unlike American Samoa, where the DMWR has approached communities to gauge their interest in the program and works actively to support development of management plans and community regulations, Hawai'i's DLNR has done little to encourage or support community participation in the CBSFA program" [55].
	Hawai'i	"To better enforce existing regulations, community-based enforcement programs have been initiated across Hawai'i, with Maui's 'Āhihi-Kīna'u Natural Area Reserve in 1997, and later in 2003 with the Reef Stewardship Program at Wai 'Opae and Coast Watch at Miloli'i. These efforts resulted in Makai Watch, a formal partnership between the state and nonprofit organizations that focuses on caring for nearshore marine resources with the active participation of local communities. Modeled after the Neighborhood Watch program, Makai Watch volunteers in over 10 communities statewide serve as the "eyes and ears" for conservation and resource enforcement officials" [63].

Table 5
Emergent interview themes and total mentions from analyzing semi-structured expert interviews in the U.S. Pacific islands region ($N = 29$).

Interview Theme	Total mentions by category	Total individuals mentioning theme
Compliance capacity (24)		18
Lack of capacity	10	7
Enforcement	7	7
Poaching in MPAs	7	6
Data (21)		16
Lack of data	9	8
Reporting challenges, inaccuracies	6	6
Multifaceted ecosystem impacts, not compliance	3	3
Socioeconomic and market data	2	2
Behavioral motivations behind illicit behavior	1	1
Interactions with non-target species (14)		10
Protected species	13	10
Wildlife interactions	1	1
Efficient fishing gears/effort (11)		10
Nets	5	5
Commercial fisheries	3	3
Fish Aggregating Devices (FADs)	2	2
Nighttime spearfishing	1	1
Participation and involvement in management (11)		9
Community engagement, participation	5	4
Lack of collaboration	3	3
Lack of trust between fishers and management	3	3
Culture and conflict (10)		9
Culture	6	5
Conflict within and among ethnic groups	4	4
Outreach and education (8)		7
Outreach and education	4	4
Awareness and understanding of regulations	4	3
Miscellaneous (1)		1

Enhanced capacity could also reference an increased officer presence at night or on weekends and enable patrols in more remote areas. Other experts lamented the lack of funding for positions to conduct non-instrumental compliance activities, such as outreach and education, to raise awareness of existing rules and regulations. In general, a lack of capacity was mentioned in reference to low budgets for enforcement divisions in state or territorial areas and by extension, lower organizational capacity to effectively ensure instrumental compliance. There seemed to be less concern among experts about federally managed commercial fisheries, such as Hawai'i and American Samoa longline fisheries, perhaps due to robust data collection programs, and instrumental approaches that include federal fishery observers, and vessel monitoring devices. At least one individual mentioned lack of compliance with federal bottomfish permits in the CNMI, an area with low federal enforcement presence, so perceptions that federal noncompliance is less of an issue may be limited to Hawai'i and American Samoa commercial fisheries.

4.2.2. Data

'Data' was also frequently mentioned during interviews. Experts mentioned 'lack of data' in reference to the lack of stock assessments for coral reef species in some island areas. Without stock assessments, these experts felt that it was difficult to justify or trust management actions. 'Reporting challenges, inaccuracies' referenced challenges associated with gathering fishery-dependent data, whether catch was commercial or non-commercial in origin. Depending on the jurisdiction, catch reports may be voluntary for non-commercial fishers and even some commercial dealers, which led to a deficiency of data available to assess fisheries. Collectively, these issues make it difficult to understand both human impacts on resources and, by extension, the effectiveness of, or compliance with, rules. Also, there are no marine license requirements for most non-commercial fishing activities throughout the region, which complicates fisheries participation estimates. 'Multifaceted ecosystem impacts, not compliance' referenced the multitude of human impacts on marine ecosystems, such as coastal development, introduction of invasive species, climate change, and habitat degradation. Some experts felt that data on these impacts bear mention because the lack of data on other anthropogenic environmental impacts on fisheries was a more pressing issue than instrumental compliance. 'Socioeconomic and market data' concerned the lack of data on fishers and how much catch is sold in commercial markets. One expert felt that it was important to understand the 'Behavioral motivations behind illicit behavior' in order to effectively address compliance issues.

4.2.3. Interactions with non-target species

'Interactions with non-target species' encompass impacts to species other than those targeted by fishers, whether the species were threatened or protected under U.S. laws. The term interaction covers a variety of different activities from approach rules when viewing cetaceans, to hooking sea turtles or monk seals while targeting other species. Interactions may result in animal stress, altered behavior, entanglement, injuries, or even death. Interactions were mentioned in the context of all fisheries, including pelagic, bottomfish, and coral reef species. Interviewees differed in their descriptions of the severity of the problem. Referencing turtle interactions, experts described issues with handling

hooked or entangled animals, such as how closely the line was clipped to the turtle or that tangled fishing line left on coral reefs may eventually trap or entangle other marine mammals. In other areas, such as Guam and the Northern Marianas, some experts described illegal turtle take, which may occur for cultural purposes.

4.2.4. Efficient fishing gears/effort

'Efficient fishing gears/effort' described fishing gear or effort that more easily enabled large catches of fish. These catches could be very selective, such as spearfishing of coral reef fish that are more vulnerable to human predation at night, or less selective, such as with lay gillnets that ensnare most marine life above a certain size or mobility that come in contact with them. Lay gillnets left out for long periods of time (or overnight) can result in high, indiscriminate mortality for marine biota. Nets in general may also get caught and abandoned on coral reefs, and continue to kill tangled fish or marine mammals until removed. Some of the compliance challenges with managing lay gillnets included the difficulty in identifying violations and estimating the scale of noncompliance with regulations. Offshore commercial fisheries or Fish Aggregating Devices (FADs) were mentioned because certain gear types, practices, or techniques used in these fisheries may be illegal and were thought to result in a disproportionate impact on marine resources.

4.2.5. Participation and involvement in management

'Participation and involvement in management' addressed a lack of input and collaboration in management decisions, primarily within coral reef fisheries in the various jurisdictions. Among interviewees, there was a sense that greater participation and involvement in rule-making could lead to improved regulatory compliance. Lack of collaboration described a reluctance to commit resources to address compliance issues with partner communities in fisheries co-management areas and a lack of collaboration among government agencies, such as boating, recreation, scientific, and enforcement divisions. In specific, lack of trust describes the relationship between fishers and the government. Interviewees reported that fishers do not trust assessments of data poor fisheries and lose confidence in government enforcement agencies when they do not respond to reports of rules violations.

4.2.6. Culture and conflict

'Culture and conflict' was mentioned ten times, which highlighted the importance of this sociocultural aspect of compliance in the region. Populations within U.S. Pacific islands region are not ethnically or culturally homogeneous. American Samoa may be the most homogenous of the region, but still includes many other cultures and nationalities (including other Pacific islanders and people from diverse areas of the world). Hawai'i, Guam, and the CNMI are all multicultural and multi-ethnic, and some social tension exists between and among resource users of different cultures and ethnic groups. Some experts highlighted how fishers may use their culture as an excuse to harvest resources in any manner they see fit (appropriate or not), while members of the same culture may exercise what they perceive as their cultural responsibility to care for the resource before harvesting. Both groups may be part of the same culture, but different behaviors undertaken in the name of culture can lead to intercultural disputes, conflict, and noncompliance. Other experts described stereotypes connecting particular cultural or ethnic groups with illicit activities in the different island regions. Tools to address these types of conflicts were not discussed, although tools exist that could address these topics through either conflict management strategies or participatory governance processes.

4.2.7. Outreach and education

These comments stressed the importance of education and awareness of rules for achieving compliance either by mentioning 'outreach and education' activities or the 'awareness and understanding of regulations'. While participation and outreach were identified as important aspects of management, they were not typically discussed in terms of designing outreach and education processes to address noncompliant behaviors.

5. Discussion

Noncompliance is often described as a major issue impeding effective governance of marine social-ecological systems [19]. Recent published research has focused international attention on noncompliance through the lens of IUU fisheries [56–58] and through emerging compliance issues in marine protected areas that manifest through capacity shortfalls or lack of political commitments [59,60]. However, expert interviews indicated that data were lacking on many U.S. Pacific islands fisheries due to reporting challenges, inaccuracies, and a lack of regulatory enforcement (see Table 5). Expert interviews also indicate that compliance capacity may be an issue in many smaller MPAs, marine managed areas, and even co-managed areas. In the subsections below, we will examine the dissonance between the peer-reviewed literature and expert interviews conducted across the region. We then consider the implications of our data in terms of instrumental, non-instrumental, and governance approaches to compliance. We conclude by assessing how an integrated compliance approach could improve stewardship across the region and globally.

5.1. Dissonance between the peer-reviewed literature and expert interviews

5.1.1. Peer-reviewed literature on compliance

Research mentioning compliance was more likely to mention 'enforcement' as a limiting factor or a solution in their article or report, perhaps indicating the importance of instrumental approaches. This focus could also indicate a lack of awareness among some scholars of other non-instrumental compliance measures. None of these articles mentioned social marketing or other potentially effective behavior change interventions as a means to achieve compliance. Scholars that highlighted the importance of participation and involvement in management frequently did so in the context of co-management or community-based management initiatives. Although such efforts can be impactful in targeted areas, it is unclear how much they can be scaled up across the Pacific islands region, particularly if community capacity is low. Not all communities have the capacity to fill in where government capacity is deficient and to date, most governments have not made investments to help support nascent co-management efforts. Many communities, particularly in Hawai'i, have had to absorb significant costs associated with transitioning to a co-management system [61]. Archival data sources, such as the Enforcement Chain Analysis document described in the background section, indicated a high level of detail and nuance in describing compliance on two of the more densely populated Hawaiian Islands, O'ahu and Maui. This document described compliance issues in greater detail than much of the published peer-reviewed and grey literature on management and compliance in the region. Other jurisdictions could benefit from similar work in order to identify compliance strengths or gaps in their respective areas.

5.1.2. Expert interviews

Conversely, expert interviews highlighted several important compliance issues, particularly compliance capacity, which was mentioned in 18 of 29 interviews. In general, 'compliance capacity' referred to the need for greater capacity and investment to address compliance needs, whether those needs were a better fit for instrumental, non-instrumental, or governance approaches. Capacity needs are similarly identified in the global academic literature on IUU fishing and MPAs [56,60]. Most interviewees did not describe specific compliance problems, even when prompted, although many did address issues related to protected species. Instead of focusing on specific problem areas, many interviewees highlighted larger issues that nonetheless

affected noncompliance. These issues – data, participation and involvement in management, and culture and conflict – were not directly related to instrumental compliance activities involving deterrence or incentives. Frequent references to these topics may illustrate that a multitude of factors warrant consideration when trying to address noncompliance, factors that may not be addressed by an increased enforcement presence.

5.1.3. Dissonance between data sources

The academic literature in the region was more likely to highlight enforcement as a means to improve fisheries compliance in the U.S. Pacific islands region. As governance scholars have noted, scientists tend to prescribe simple, 'panacea' solutions to governance issues that rarely take into account social-ecological complexity or the diversity of governance approaches needed for different situations and contexts [62,63]. Improving noncompliance is likely a manifold process that cannot be addressed by increased enforcement alone. Several fisheries in the region could benefit from an increased enforcement presence, but expert interviews were more likely to highlight systemic issues like capacity, data, participation and involvement in management, culture, and conflict. Experts felt like these issues required more immediate attention.

It is important to call attention to the dissonance between our two data sources, because how conversations are framed about compliance can influence or affect the potential set of solutions and eventually, policy. We would be remiss to generalize experts as individuals with intimate knowledge of their particular fisheries or academics as simply outsiders looking in, but both groups have important roles to help improve compliance. Often, as outsiders, academics can reflect upon knowledge from other places and should possess an understanding of previous scholarly efforts to devise nuanced, creative solutions to complex problems related to compliance. But in general, academics in this region were more likely to prescribe a similar, common solution (instrumental approaches such as an increased enforcement presence), either because it is indeed necessary or they lacked the knowledge of non-instrumental approaches. Whereas experts were more likely to draw upon their extensive knowledge of place, the institutional system in which they are embedded, and highlight nuances of compliance. They frequently attributed importance to seemingly tangential issues such as capacity, data, management participation, or culture that are indirectly linked to compliance. If compliance solutions are indeed as diverse as experts suggest, then there must be greater awareness of a diversity of solutions, such as non-instrumental and governance approaches. Academics should be more careful and reflective before prescribing panacea solutions, exhaustively search for ideas from other places or academic disciplines, and partner with experts to better understand the subtleties of their case.

5.2. Implications for compliance and management in the U.S. Pacific islands region

In the following subsections, we consider our findings in terms of instrumental, non-instrumental, and governance approaches to improve compliance and management in the U.S. Pacific islands region.

5.2.1. Instrumental approaches

Many interviewees and the published and grey literature conducted on the U.S. Pacific islands region that examined fisheries management emphasized compliance issues with *de jure* regulations and thus only considered instrumental approaches to achieving compliance. Many of the experts and scholars publishing in the region perceived that enhanced capacity for instrumental approaches (surveillance, detection, prosecution, and adjudication) is necessary to improve compliance. To these individuals, the solution to build capacity is straightforward; hire more officers to patrol shorelines, offshore areas, and inform the public about regulations. Practically, a greater enforcement presence should help reduce noncompliance. But, compliance scholars have noted that instrumental approaches, such as enforcement, are very costly, highlighting the importance of including other means to achieve compliance [15,64].

5.2.2. Non-instrumental approaches

Interviewees emphasized the importance of outreach and education, but fewer individuals demonstrated an awareness of other non-instrumental approaches to compliance. Several interviewees mentioned capacity in terms of enhanced outreach and education effort, perhaps indicating their openness to other non-instrumental approaches. Social marketing is another method of data collection and intervention that has been used for decades in other contexts [23], but was not mentioned in our review of literature on the region. To date, social marketing has not been applied to marine resource compliance issues in the U.S. Pacific islands region. Social marketing is a nuanced non-instrumental compliance strategy that differs substantially from outreach and education activities, which alone are insufficient to influence pro-environmental behaviors [65]. To be effective, social marketing requires trained expertise, thoughtful stakeholder or audience analysis, the development of appropriate messages, a medium to deliver those messages, and evaluation [26].

A review of early social marketing campaigns in ocean conservation found a lack of rigor [66], but recent efforts have been more robust in terms of tangible results. Two social marketing campaigns from Southwest Madagascar are noteworthy due to their effectiveness at changing behavior and improving compliance. One campaign helped decrease the use of destructive fishing methods [67], while another promoted compliance with no-take marine reserves by grounding their establishment in sociocultural norms [68]. At first glance, the U.S. Pacific islands region may not seem to have that much in common with Madagascar, but there are similarities in terms of reliance on marine resources [38] and sociocultural norms [4], with shared Austronesian roots. Grounding social marketing campaigns in sociocultural norms may be one way to improve their uptake and compliance in the U.S. Pacific islands. But, implementing social marketing campaigns requires specialized expertise and most conservation or resource enforcement divisions only hire individuals with a law enforcement background. Therefore, individuals or entities from outside resource enforcement divisions will need to contribute their expertise in implementing non-instrumental compliance tools such as public outreach, education, social learning, social marketing, and other persuasion-based behavior change interventions.

There are even more non-instrumental approaches to help achieve compliance goals. Fishery Improvement Projects (FIPs) and third party sustainability certification programs are additional non-instrumental approaches that, under the right conditions, can leverage the power of market incentives to improve compliance [69]. Still other approaches may utilize information management and dissemination [70] or social learning [71] to scale up governance and compliance practices. It is noteworthy that experts and the academic literature did not draw attention to many of these tools, perhaps because to date, they have not been applied throughout the region or are not intrinsically thought of as methods to improve compliance.

5.2.3. Governance approaches

Instrumental and non-instrumental approaches to address noncompliance are necessary, but other management aspects, including participation, citizen perceptions of fairness, and legitimacy may also influence compliance with regulations [27,28,72]. Contemporary compliance literature has referenced the importance of legitimate rules that emerge from an inclusive process [16,73]. Frequent references to participation and outreach, and culture and conflict as compliance issues may also indicate the need to take a more holistic view of compliance, by combining compliance activities, management, and participation in management decisions to increase legitimacy.

Although interviewees described the need to increase capacity to conduct instrumental and non-instrumental compliance activities, there

are also significant data needs, opportunities for social science to contribute to compliance, and areas to improve management participation processes. Addressing data needs will require capacity increases. The U.S. is one of a handful of national governments worldwide with a focused program on the human dimensions of fisheries, but investments in staff remain low in the U.S. in relation to social science needs, particularly in the U.S. Pacific islands [74]. Building human dimensions capacity takes time. It took the National Marine Fisheries Service nearly three decades to reach their current level of human dimensions capacity [75]. Similar capacity increases are needed in state and territorial governments across the U.S. Pacific islands region, particularly for individuals trained to collect and analyze socioeconomic data, facilitate group processes, and other related skills to enhance the governance aspects of compliance. Lastly, if non-commercial fishing licenses, registries or permit systems were mandatory across the U.S. Pacific Islands region, they would provide foundational data currently unavailable to managers such as improved fishing participation data, a more reliable sampling frame, and could potentially fund compliance activities [35].

Increasing participation and involvement in these governance initiatives may initially involve significant transaction costs, yet they may pay future dividends in terms of improved trust, and social learning, which is particularly important in the Pacific islands region due to the presence of multiple cultures and knowledge types (indigenous and local). Greater integration of social science and public involvement in management can help improve compliance, reduce long term monitoring costs, and improve resource outcomes [76]. Current participatory, management, and scientific processes are not designed to integrate multiple knowledge sources. Changes to participatory processes and greater investments in science and management will be needed to improve governance aspects of compliance. Other geographies would likely benefit from similar investments.

5.3. An integrated compliance approach

As suggested in several compliance publications, an integrated strategy that includes instrumental, non-instrumental, and governance approaches may be the most effective (and economical) means of achieving compliance [15,16,19,73]. While we expected to learn about a range of compliance topics, the specific issues discussed as priorities by interviewees focused predominantly on protected species interactions and a few specific gear types. There are several types of compliance-related protected species interactions that warrant attention, but the remoteness and infrequent nature of the interactions preclude them from many instrumental solutions. In these instances, non-instrumental and governance approaches to promote compliance could prove to be effective. Focusing on specific issues may also advance our capacity to recognize and implement effective non-instrumental and governance aspects of compliance and provide insight into how to integrate them with existing instrumental approaches.

The interview themes of participation and involvement in management, culture and conflict are in alignment with governance research that describes noncompliance as a byproduct of ineffective top-down governance. In this body of research, limited citizen participation and input in management processes may reduce legitimacy and lower compliance with formal rules [77,78]. There is an extensive body of academic literature on the importance of legitimacy in resource rules [28–30]. These findings contrast with a reluctance to invest in management alternatives, such as co-management in the U.S. Pacific islands region [55,79]. The reluctance exists despite substantial research that demonstrates the effectiveness of participatory governance and co-management in the Pacific [80–85] and globally [86–88].

The U.S. legal system complicates and constraints co-management in several ways, such as the equal protection clause and the public trust doctrine, which restrict laws that privilege certain groups over others and ensure that most U.S. rivers, oceans, and coasts are essentially common property shared by all U.S. citizens [83]. But, these constitutional-level constraints [83] do not prohibit creative management solutions from within government and civil society [4,14,89]. Another compliance issue related to capacity, conflict, and culture are the diversity of cultures within many U.S. Pacific islands, all of which have a history of marine resource use and dependence. English may not be the first language for many of them, which can complicate compliance strategies and increase transaction costs, which are already high due to the geography of U.S. Pacific islands [61]. Additionally, whether participation in management occurs in co-management, it often involves conforming to highly structured interactions via public hearings and meetings. Many people are not comfortable participating in these situations, and it contrasts with many Pacific island cultures. Nonetheless, more direct engagement with fishing communities (including cooperative research and joint fact-finding projects), can build trust and communication that can help improve relationships between user groups and managers, and enhance compliance. Many of these projects are underway, including cooperative bottomfish research with fishing communities in Hawai'i [90,91]. In Hawai'i, bottomfish workshops resulted in a better understanding of trip-level reporting, average size, discards, and catch per unit effort (CPUE) estimates in historical catch records [92]. Although the primary goal was to improve the quality of historical datasets, the workshops also helped resolve longstanding data disputes between fishers and scientists. The meetings improved understanding of data reporting, built trust, and should improve reporting compliance in the fishery. Similar work in the jurisdictions could improve data quality, improve trust, and enhance compliance in coral reef systems.

One thematic area not referenced during interviews or the review of academic or grey literature was the political aspect of compliance. This has been addressed in several recent high level publications on protected areas management via capacity shortfalls [60] and a lack of commitment in terms of financial and human capital for effective management [59]. However, most decisions, legislation, or administrative rules enacted to protect particular species or marine areas, to restrict access, or to commit to an integrated compliance approach, stem from a sociopolitical process where problems are defined, are conflict-ridden, and are not value neutral [93]. Thus, any commitment to build compliance capacity across the region involves political processes, coordinated decision making at various levels of government, and potentially collective action at the local level.

6. Conclusions

Noncompliance is a complex issue that can affect social-ecological systems in many different ways, including ecosystem health and functions, sociocultural needs, and livelihoods. Compliance research is relatively new in the U.S. Pacific islands region. Contemporary research describing compliance has thus far mainly been conducted in Hawai'i and in coral reef systems, with a relative paucity of research and reports on the other jurisdictions or offshore fisheries. More compliance work in these areas may identify drivers of noncompliance and provide justification for larger management investments in many areas, an issue identified in the literature reviewed and by most experts interviewed for this research. Outside of enhanced compliance capacity, greater fisher and community participation in research and management (such as cooperative research, co-management, and other novel participatory governance arrangements) should also improve relationships and trust, leading to better compliance with regulations, and eventually, improved social-ecological outcomes. Drawing on a diverse set of compliance tools that includes instrumental, non-instrumental, and governance aspects may help identify creative solutions that are more effective for the unique cultural and management contexts of this large and important region. Such a comprehensive approach could also be used to improve compliance capacity in other U.S. regions and elsewhere across the globe.

CRediT authorship contribution statement

Adam L. Ayers: Funding acquisition, Conceptualization, Methodology, Investigation, Validation, Writing - review & editing, Project administration, Data curation, Formal analysis, Writing - original draft. **Kirsten Leong:** Funding acquisition, Conceptualization, Methodology, Investigation, Validation, Writing - review & editing.

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Appendix. Interview Guide

Understanding the compliance seascape in the U.S. Pacific islands region

Background

Successful management of fisheries, endangered and protected species, and marine national monuments depends on compliance with regulations. A number of systems are in place to ensure compliance, including observers, training on reporting and handling, and outreach/communication. However, there may be issues with regulatory compliance, especially in situations where individuals may not be incentivized to report accurately or truthfully, there is inadequate monitoring and enforcement, or a lack of data to assess fish stocks or noncompliance with regulations. Assessing the level of non-compliance in fisheries can point to areas where interventions can be made. The Western Pacific Regional Fishery Management Council, NOAA's Pacific Islands Regional Office, and other stakeholders are interested assessing regulatory non-compliance in Western Pacific fisheries.

Pending funding, we plan to implement a pilot project to explore this issue further in FY2019, but first we need your help to catalog and prioritize the scope of sensitive/non-compliant fishery issues in Western Pacific fisheries.

Questions

1. Are there any compliance issues in your region/fishery/area of expertise?
   Probes:
   - If so, what are they?
   - Which compliance issue(s) is the most pressing, that needs to be addressed right away?
   - Which compliance issue(s) is the most important for management?
   - Are there any compliance issues that you think might be easy to address, i.e., low-hanging fruit?
2. How would you rank or prioritize the compliance issues in your region/fishery area of expertise?
   Probe 1: evaluative criteria:
   - Importance to society;
   - Ease of intervention;
   - Ability to intervene;
   - Value of the fishery;
   - Cultural importance;
   - Survival of species or acuteness of threat(s);
   - Scope of the problem (local, bounded area vs. diffused, such as all of EEZ or high seas);
   - Sustaining participation in the fishery;
   - Can make a difference in management;

   Probe 2: Why would you rank them in this way? (Based upon however they were ranked)

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.marpol.2020.103820.

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