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GHOTI

WILEY FISH and FISHERIES

Marine fisheries and future ocean conflict

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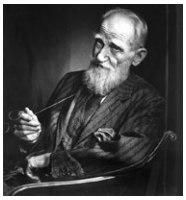
Abstract

Conflict over marine fishery resources is a growing security concern. Experts expect that global changes in our climate, food systems and oceans may spark or exacerbate resource conflicts. An initial scan of 803 relevant papers and subsequent intensive review of 31 fisheries conflict studies, focused on subnational and international conflicts, suggests that four substantial scientific gaps need addressing to improve our understanding of the nature and drivers of fisheries conflict. First, fisheries conflict and levels of conflict intensity are not precisely defined. Second, complex adaptive systems thinking is underutilized but has the potential to produce more realistic causal models of fishery conflict. Third, comparative large-scale data and suitably integrative methodologies are lacking, underscoring the need for a standardized and comparable database of fisheries conflict cases to aid extrapolation beyond single case-studies. Fourth, there is room for a more widespread application of higher order concepts and associated terminology. Importantly, the four gaps highlight the homogenized nature of current methodological and theoretical approaches to understanding fishery conflict, which potentially presents us with an oversimplified understanding of these conflicts. A more nuanced understanding of the complex and dynamic nature of fishery conflict and its causes is not only scientifically critical, but increasingly relevant for policymakers and practitioners in this turbulent world.

KEYWORDS
climate change, complex adaptive systems, disputes, fishery resources, scarcity, security

1 | INTRODUCTION

Policymakers are growing increasingly concerned about conflicts overfishery resources (Germond, 2015; Hassani-Mahmooei & Parris, 2013). Wild capture fisheries production has stagnated over the last 20 years (FAO, 2014; Pauly et al., 2003, Worm, 2016), and climate change is expected to alter the distributions and potential yields of exploited marine species (Cheung et al., 2010; Miller, Munro, Sumaila, & Cheung, 2013; Sumaila, Cheung, Lam, Pauly, & Herrick, 2011; UNEP, 2015). Meanwhile, global demand for marine protein is growing (Béné



Ghoti papers

Ghoti aims to serve as a forum for stimulating and pertinent ideas. Ghoti publishes succinct commentary and opinion that addresses important areas in fish and fisheries science. Ghoti contributions will be innovative and have a perspective that may lead to fresh and productive insight of concepts, issues and research agendas. All Ghoti contributions will be selected by the editors and peer reviewed.

Etymology of Ghoti

George Bernard Shaw (1856–1950), polymath, playwright, Nobel prize winner, and the most prolific letter writer in history, was an advocate of English spelling reform. He was reportedly fond of pointing out its absurdities by proving that 'fish' could be spelt 'ghoti'. That is: 'gh' as in 'rough', 'o' as in 'women' and 'ti' as in palatial.

et al., 2015), particularly in vulnerable regions that depend on fish for food security (Allison et al., 2009; Blasiak et al., 2017; Taylor et al., 2015). A number of militarized international post-World War II conflicts have already been driven by disagreements overfishing quotas and maritime boundaries (Mitchell & Prins, 1999), including many ongoing, high-profile disputes (Box 1). The occurrence of conflicts over-fisheries is thus expected to become more common (EFARO, 2012).

However, there is still limited consensus on the fundamental causes or mechanisms connecting natural resources to conflict, and linkages between changing climate conditions and security issues remain unclear (Gemenne, Barnett, Adger, & Dabelko, 2014). Efforts to describe such linkages in the case of fishery resources have been criticized as overly simplistic (Penney, Wilson, & Rodwell, 2017). This growing criticism stems from the increased understanding that marine social–ecological systems (SESs) are complex adaptive systems (CAS), characterized by nonlinear dynamics and multiple possible outcomes (Hughes, Bellwood, Folke, Steneck, & Wilson, 2005; Morrison, 2017; Österblom et al., 2013), and that conflict over marine resources can itself be an outcome as well as a driver within those systems (Pomeroy, Parks, Mrakovcich, & LaMonica, 2016). In this review, we test the validity of the claim of simplicity (Penney et al., 2017) by assessing the degree to which the fisheries conflict literature, encompassing both subnational and international conflict, has incorporated ideas from complexity theory and SESs theory and identifying areas within this literature that would benefit from further development.

Box 1 Examples of current, unresolved fishery disputes

South China Sea: China, Vietnam, the Philippines, Taiwan, Malaysia and Brunei currently have competing claims over parts of the South China Sea, including the Paracels and Spratlys, and dozens of rocky outcrops, atolls, sandbanks and reefs (BBC News, 2016a; Song & TØnnesson, 2013). In the 1980s and 1990s, Vietnamese and Chinese fatalities occurred in battles over the Paracels and Spratlys. The rich fishing grounds that supply the livelihoods of people across the region are a significant part of the wealth of the South China Sea, although fisheries are often ignored by conventional narratives which focus on the large reserves of natural resources such as minerals and oil that the area under dispute is estimated to harbour (BBC News, 2016a; Dupont & Baker, 2014). In 2016, the Philippines countered Chinese claims through a tribunal of the United Nations Convention on the Law of the Sea (UNCLOS), which ruled in favour of the Philippines (BBC News, 2016a,b). However, China continues to regard these fishery resources as critical to its food security and thus as a strategic commodity (Dupont & Baker, 2014).

Northeast Atlantic: The "mackerel dispute" between Norway, the European Union (EU), Iceland and the Faroe Islands erupted in 2007 when the northeast Atlantic mackerel (*Scomber scombrus*) stocks began spawning further towards the north-west of the Nordic Seas and their surrounding waters (Gänsbauer et al., 2016, ICES Advisory Committee, 2014; Nøttestad et al., 2014). Iceland (which now finds mackerel within its Exclusive Economic Zone) did not originally include mackerel in its coastal state management plans. The migration not only resulted in increased overfishing of the stock, but the subsequent dispute also eroded the legitimacy and functioning of existing management plans (ICES Advisory Committee, 2014, Spijkers & Boonstra, 2017, World Ocean Review, 2016). A few years after the shift in mackerel distribution, the relevant parties attempted, but failed, to include Iceland in the agreement negotiations. At the time of writing, Iceland has still not been formally involved in the agreements on the Total Allowable Catch (TAC) and quota allocations per country.

2 | METHODOLOGY

We used a broad title–abstract keyword search of the Scopus database to identify 1,941 relevant articles, which were analysed using data mining tools provided by the R package tm using the search phrases: "fish" OR "fishery" AND "conflict" OR "dispute" or "war" (Feinerer & Hornik, 2017). This data mining process was executed to understand the geographic focus of the papers (Figure S1). We then narrowed the scope of the analysis by including only those articles within the subject areas of social sciences and economics and excluding papers from disciplines with a less clear connection to conflict (e.g., health sciences). This resulted in a set of 803 articles. We reviewed the abstracts of these articles and selected those dealing with the roots of past or ongoing conflict over a specific marine fish or fishery (excluding, for example, theoretical papers on fishery conflict or papers discussing potential future conflicts). For each of the resulting 31 papers, we extracted information on their geographical focus, species, methodology, data sources and theoretical framing (Appendix S1).

Given the concerns raised by Penney et al. (2017), we approached the review with an a priori interest in the degree to which integrative SES thinking is applied in understanding fisheries conflict. The SES literature deals with questions around sustainable development and promotes the idea of holism rather than fragmentation (Hjorth & Bagheri 2006, Levin et al., 2012). The literature therefore provides a potentially useful integrative lens for a more holistic understanding of fisheries conflicts. SES outcomes result from complex interactions between social and ecological variables; the literature on SESs strives to reflect this complexity through its choice of methodologies, theories and data sources. Work on SESs seeks to unveil and understand the complexity of social–ecological change overtime, accounting for feedbacks and path dependency, and uses empirical data to do so (Österblom et al., 2013). Taking an integrative SES approach helps us understand the diverse social and biophysical outcomes we observe in the world, of which conflict over resources is one.

To identify gaps in the application of SES concepts and complex systems approaches to the fisheries conflict literature, we evaluated existing studies against the following a priori criteria: (i) clarity in definitions and applications of key terms; (ii) consideration of feedbacks, thresholds and nonlinearity; (iii) use of comparative approaches and suitably integrative methodologies; and (iv) usage of higher order systems concepts, as indicated by the presence of associated terminology (e.g., resilience, vulnerability, and emergence).

3 | RESULTS

3.1 | Clarity in definitions and applications of key terms

Comparison of articles on conflict suggested that current fishery conflict typologies often conflate conflicts overfish as a resource with general conflicts taking place within the fisheries space, leaving the concept "fishery conflict" poorly defined. According to one typology, for instance, "types of fisheries-related conflicts" encompass both conflicts overfish stocks as well as maritime crime and general civil unrest (Pomeroy et al., 2016). Another typology (Bennett et al., 2001) does not distinguish between ownership/management conflicts overfish and conflicts between different users of the fisheries space. It therefore could include conflicts between fishermen and the tourist industry over access and use of coastal areas, although such disputes are not necessarily triggered by fish as a resource. These typologies may reflect the complexity of conflicts in marine areas, but differentiating between conflicts overfish as a natural resource and conflicts that simply occur in the same place where fishing is happening is useful if we wish to better understand the root causes of conflict. Such distinctions are possible for common pool resources: access rights refer to "the right to enter a defined physical property," while withdrawal rights describe "the right to obtain the 'products' of a resource (e.g., catch fish)" (Schlager & Ostrom, 1993, pp. 14–15; see also Bavinck, 2005). Using the insights from the common pool resource literature in marine environments, "physical property" relates to the sea space or territory, whereas "products" include fish stocks (Bavinck, 2005). Making this distinction is important when analyzing the different types and potential causes of fishery conflict, as conflicts overfish as a resource could have drivers (such as the value of a particular stock) that would be largely independent of conflicts within the general marine space, where territory represents the resource.

Second, the term "fishery conflict" is applied to diverse case-studies, without explicitly recognizing the differing intensities of conflict. Three papers provide typologies of fisheries conflict (Bennett et al., 2001; Charles, 1992; Pomeroy et al., 2016), and two of these suggest that different intensity levels of conflict exist. But none of these typologies explicitly distinguishes among different intensity levels of conflict, nor how such levels could be identified despite the fact that the existence of a "violence gradient"' has been emphasized "[c]onflicts of this type do not necessarily have to be violent nor highly disruptive, in fact many conflicts that arise as a result of differing interests are low-level, non-violent phenomena" (Bennett et al., 2001, pp. 366). Distinguishing between the different amplitudes and impacts of fisheries conflicts would help determine whether there are separate drivers of conflict leading to different "intensity outcomes." For example, extremely violent conflicts may exhibit very different causal patterns than non-violent disagreements, and cooccur more frequently with certain variables, or contextual conditions. Such an intensity scale would also facilitate differentiation among various levels of conflict and explore patterns and cycles causing non-violent disputes to transform into violent conflict (Hsiang, Burke, & Miguel, 2013; Salehyan, 2008). Likewise, it could aid the identification of variables that have a determining impact on feeding or mitigating conflict, causing cooperative/peaceful systems to shift into "fishery conflict regimes" exhibiting hostility and even violence. A scale of conflict intensities would enable analysis of conflict and cooperation across a gradient, where certain variables could be "tipping points" for a system to shift back into a lesser state of conflict. Researchers dealing with other types of natural resource conflicts have already identified such conflict gradients, for instance for freshwater resources (Wolf, Yoffe, & Giordano, 2003).

Current conceptual typologies of fishery conflict (Bennett et al., 2001; Charles, 1992; Pomeroy et al., 2016) could be enhanced by adding several components that would facilitate comparability in the identification and characterization of fishery conflict. These include (i) a precise definition of what constitutes a fishery conflict; (ii) a gradient or categorization of conflict intensity; (iii) a specification of which actions and behaviours indicate different levels or types of conflict intensity. In Table 1, we propose a new and more generally applicable typology of potential fishery conflict intensities, expanded from examples from the environmental security literature on freshwater resources (e.g., "the BAR Scale of Intensity of Conflict and Cooperation" in Yoffe, Wolf, & Giordano, 2003; Brochmann, 2012; Bernauer & Bohmelt, 2014). Drawing on reviewed case-studies of fisheries conflicts, we linked five different intensities to observable behaviours and actions within international fishery conflicts. The South China Sea conflict (Box 1), for example, has seen many military interventions with displays of violence (Delisle, 2012), while the mackerel dispute has not seen this same level of hostile acts, yet is marked by diplomatic–economic hostile acts such as termination of agreements and trade/landing bans (Spijkers & Boonstra, 2017).

3.2 | Consideration of feedbacks, thresholds, and nonlinearity

Few of the reviewed papers explicitly address causal complexity by comprehensively assessing multiple potential conflict drivers and intervening variables that are empirically derived. Several shed light on the issue of fishery conflict through the theoretical framings of international or customary law, for example (5 of 31). In these papers, the focus generally lies on understanding the use and importance of certain legal measures within disputes, not explicitly identifying potential causes or contributing factors outside of that realm of

TABLE 1 Categorization of fishery conflict intensities, linked to their observable actions and behaviours. Developed as an example for applicability to international fishery conflicts

Intensity of observed behaviour/action	
Intensity	**Description**
5	Military acts causing death
	Attack of foreign vessels, crew members or Coast Guards, with resulting deaths
4	Military acts
	Attack of foreign vessels, crew members or Coast Guards, no death toll
3	Political–military hostile acts
	Sending out police vessels/warships
	Seize vessel and/or crew
	Gear destruction
	Reinforcing borders
2	Diplomatic–economic hostile acts
	Breaking or not adhering to existing agreement
	Lawsuit
	Trial in court
	Seeking international arbitration
	Trade ban
	Fishing ban
	Landing ban
	Monetary penalties
	Close ports
1	Verbal expressions displaying discord or hostility in interaction
	Failing to reach an agreement
	Making threatening demands and accusations
	Threatening sanctions
	Condemning specific actions, behaviours or policies
	Requesting change in policy
	Civilian protests
0	Non-significant acts

study (Appendix S1). Framing an analysis around a particular concept or variable can result in a linear representation of cause and effect, not explicitly recognizing potential feedbacks, thresholds and nonlinearity. In some cases, however, these authors point to the complex causal reality of conflict; Silk (2001), for instance, uses an international law framing, noting that "the issues underlying even a single-species fishery dispute are often complex, ranging from legal issues, biological issues, and economics, to politics" (Silk, 2001, pp. 792). Many papers reference a multitude of variables throughout the text including poor governance (e.g., DuBois & Zografos, 2012; Muawanah, Pomeroy, & Marlessy, 2012) and declining resource abundance (e.g., van Herten & Runhaar, 2013; Perez, 2009; Song, 1997), but these papers never set out to empirically derive these variables nor to test for their relationship with conflict.

Another example of a linear and potentially oversimplified idea of fishery conflict is the concept of eco-scarcity, according to which the scarcity of fishery resources leads to increased competition, which in turn leads to conflict. Little empirical evidence currently exists within the fisheries conflict literature to support claims of eco-scarcity as the driver for conflict (Penney et al., 2017). Yet, it is an a priori assumption underpinning much of the work on fisheries conflict, including the "fish wars cycle" described by Pomeroy et al. (2016). Other scholars have also remarked that "conflicts within fisheries can be oversimplified by resource scarcity narratives" (Penney et al., 2017, pp. 46) and have called for an investigation of more complex and multidimensional causes of conflict.

The two studies of fisheries conflict that have assessed multiple potential conflict drivers (Muawanah et al., 2012; Pomeroy et al., 2007) generated a deeper and more nuanced understanding of how conflict emerges, and how multiple factors have influenced observed conflicts. However, these papers are focused on conflict at the subnational scale. At the regional and international scales, the primary focus has seldom been to assess the relative importance of an array of variables, but instead to tell the story of how the dispute emerged and changed over time. Moreover, scholars who have focused on international fisheries cooperation have generally based their empirical analysis on a single variable, for instance, the maximization of economic incentives in game theoretic applications (Bailey, Sumaila, & Lindroos, 2010; Hannesson, 2011). Attempting to retroactively understand conflict or to predict it with such approaches, especially on international scales, reduces the complexity that underlies such conflicts and can result in simplistic conclusions.

We argue that the scholarship could benefit from explicitly addressing causal complexity. This would require comprehensively assessing multiple potential conflict drivers (biophysical, sociopolitical, institutional and economic) that are empirically derived, and the relationships between them. Moreover, conflict should not be seen as solely the outcome of a process, but also as a variable that can feed back into the system. Complex adaptive systems thinking can be a useful framing tool, as it recognizes nonlinear feedbacks, multiple causes, effects and intervening variables that are linked by interactive, synergistic and nonlinear causation that can also operate across different timescales (Cumming, Olsson, Chapin, & Holling, 2013; Folke, Hahn, Olsson, & Norberg, 2005; Levin et al., 2012; Lubchenco, Cerny-Chipman, Reimer, & Levin, 2016). Researchers dealing with other types of renewable and non-renewable resource conflicts have applied elements of CAS thinking to varying degrees in contexts characterized as complex and dynamic. In the freshwater literature, for example, emphasis has shifted from trying to identify single causes to instead explore environment-conflict connections that are substantially caused or affected by political and socioeconomic factors (Homer-Dixon, 2001; Selby & Hoffmann, 2014; von Uexkull, Croicu, Fjelde, & Buhaug, 2016; Yoffe et al., 2004).

Addressing complexity more explicitly will allow us to distinguish between "necessary" and "sufficient" causes of fishery conflict, and the interactions between the two. In the case of necessary causes, the observed outcome of conflict would not have

happened in the absence of the cause in question; for sufficient causes, the observed conflict outcome might have been the same regardless of the cause in question (Mahoney, 2008). Translated to the world of fisheries conflicts, in some cases, perhaps a decline in the resource is a necessary factor to produce a conflict condition, while an ongoing jurisdictional boundary conflict could be a sufficient one. Understanding the distinction between these two types of causes is pertinent for assessing, the growing concern that climate change will influence the likelihood of conflict overfishery resources.

3.3 | Use of comparative approaches and integrative methodologies

From the 31 papers that we reviewed in depth, only four offered an analysis across multiple conflict case-studies and only two of these used quantitative methods. This means that most papers have analysed single cases of conflict in a qualitative manner, and that little has been done to systematically compile quantitative, historical evidence of fisheries conflict. Although single, qualitative case-studies on fishery conflict are valuable, comprehensive quantitative studies on fishery conflict could help us understand linkages and dynamics across multiple case-studies and over time.

The lack of comparative data and analysis has restricted understanding of the prevalence and geography of fishery conflicts around the world. The majority of the studies assessed here deal with conflicts among states in the North Pacific and North Atlantic; for instance between the US and Canada (8 of 31) or, more recently, conflicts involving Asian actors such as Japan (Appendix S1). Such trends are also apparent from the text-mining analysis applied to the larger set of 1,941 conflict articles. We found that the majority of work has focused on the world's most industrialized countries, with few studies in the least developed countries, a trend that seems to be continuing (Figure 1).

Second, the lack of large sets of comparative data means scholars have not been able to test if certain relationships between variables that have been anecdotally connected to fishery conflict exist across a larger set of cases. Case-studies of fishery conflict (e.g., in Box 1) suggest general patterns, but empirical analysis of (large) comparable datasets is necessary to resolve questions of causality. Obtaining such data can help to validate the robustness of the relationships suggested by case-studies on fisheries conflicts, and to investigate new potential relationships that would inform a realistic model for fisheries conflict. The predominance of qualitative single case-studies has generated depth and richness but also represents a lack of comprehensiveness in methodologies available to understand

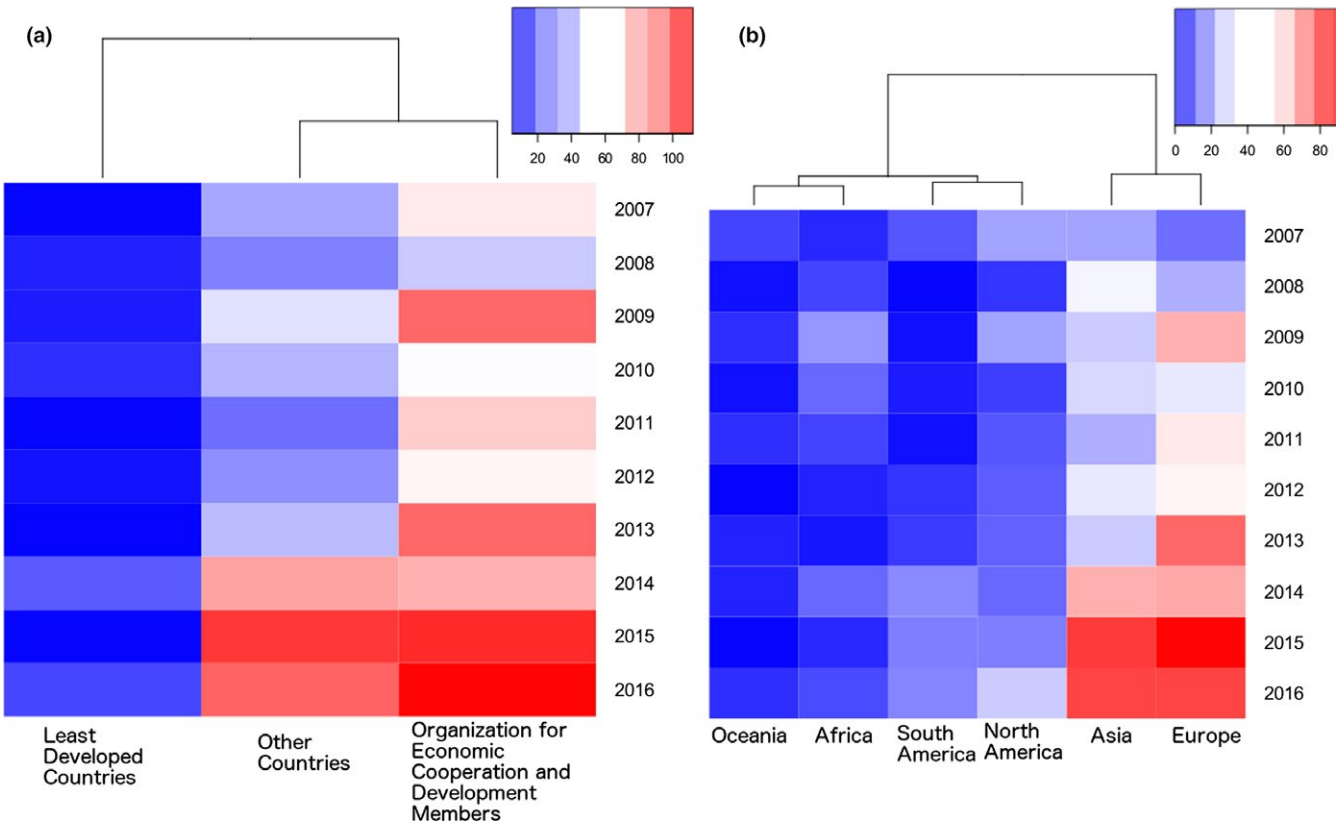


FIGURE 1 Frequency with which the fishery conflict literature from 2007 to 2016 referred to countries within specific (a) socio-economic groupings; (b) regional groupings. The United Nations has identified 47 Least Developed Countries (LDCs), characterized by low levels of socio-economic development; conversely, the 35 members of the Organization for Economic Cooperation and Development (OECD) are among the world's most highly industrialized countries. Hierarchical clustering and color-coded frequency (blue representing the lowest frequency and red the highest) are provided at the top of each heatmap. Data source: Scopus 2016 [Colour figure can be viewed at wileyonlinelibrary.com]

and explain fishery conflict. Expanding the methodological toolbox to include Structural Equation Modelling (SEM) or agent-based computer simulations could advance efforts to understand the variables associated with fishery conflict (Helbing, 2013).

A global database of fishery conflicts would provide the large-scale comparative data needed to (i) get an understanding of the geography and prevalence of fishery disputes over time; (ii) test for relationships between conflict variables across multiple cases; and (iii) open the door for a more diversified repertoire of methodologies. Research on other forms of natural resource conflicts provides useful guidance in this respect. The systematic collection of data on conflict over freshwater resources (Transboundary Freshwater Dispute Database), for example, resulted in a framework for quantitative, global-scale assessments of the relationship between freshwater resources and international cooperation and conflict (Yoffe et al., 2004). Here, the approach was to use a standardized event database to move beyond the case-study approach to include large sets of GIS and contextual data. This theoretical and empirical foundation enabled scholars to use forecasting methods to assess the predictive power of selected explanatory factors (Bernauer & Bohmelt, 2014). Drawing on some of these tested approaches could provide promising avenues for expanding our knowledge of fishery conflicts.

3.4 | Usage of higher order systems concepts and associated terminology

In SES research, higher order concepts and terminology are used to describe pattern–process dynamics that emerge from complex system interactions and dynamics. Scheffran, Brzoska, Kominek, Link, and Schilling (2012) have argued that debates describing links between the climate system, natural resources, societal stability and human security lack complexity. In trying to inject some of that missing complexity back into the research, they use higher order systems terminology to describe the links between natural resources, the climate and conflict, that is the terms "resilience," "adaptation/adaptive capacity," "vulnerability," "sensitivity," "feedbacks," "tipping points" and "thresholds." We searched our selected review articles to determine whether the literature on conflict overfishery resources had implemented this terminology in their analyses.

Twenty of the 31 reviewed papers did not use higher order systems terminology, and the large majority of those not using any such terms are papers from disciplines such as law and international relations. Within those scientific communities, it is not often explicitly recognized that there is a complex set of interactions between the climate system, natural resources, human security and societal stability, as they often approach the topic of fishery conflicts to understand a single variable such as the effectiveness of a particular international regulation. However, several fishery conflict scholars have used higher order systems terminology such as "vulnerability" and "adaptive capacity" to reflect their recognition of complexities in the relationships between natural resources, the climate system and conflict; here, we describe a few of these usages.

The first to explicitly acknowledge the complexity of marine SES, and conflict as a component within that system, through the usage of higher order systems terminology was Charles (1992): "In any bio-socio-economic system as complex and as dynamic as a fishery, with its many interactions amongst natural resources, humans and institutions, it is hardly surprising that conflict tends to be prevalent". In that same year, Mirovitskaya and Haney (1992) also recognized the complexity of marine SES and threshold within those and explicitly mentioned the interconnectedness of conflicts overfishery resources. However, the use of higher order systems terminology was restricted to terms merely describing marine systems as complex and interconnected, not yet using concepts such as "vulnerability," "resilience" or "adaptive capacity" to describe the internal properties of the marine SES.

From 2000, Miller (co)-authored four papers that at first applied the terms "sensitivity," "resilience," and later on used the terms "vulnerability," "adaptive capacity," and "thresholds" in the context of conflict within marine SES. In the latest paper, for example, "resilience" and "adaptability" are used by the authors to connect changing dynamics of fishery resources induced by the climate to emerging conflict: they argue that to effectively govern shared fisheries in the face of changing environmental conditions "(…) mechanisms to improve the resilience and adaptability of cooperative management arrangements to environmental perturbations" are needed (Miller et al., 2013, pp. 326). After Miller, a few authors used the term "vulnerability" (albeit exclusively in papers approaching fishery conflict from a natural resource management perspective) to describe the links between overfishing, vulnerability to climate impacts and conflict.

An important contribution in the usage of higher order systems terminology comes from a paper by Gänsbauer, Bechtold, and Wilfing (2016), where it is explicitly recognized that there is a "necessity to acknowledge [the current international fishery management] as a complex adaptive system". They introduce new concepts such as "emergent properties" and "nested hierarchies" into the description of marine SESs and the role of conflict. However, the terms are used only a single time as a descriptor of the system and not as tools for analysis. Nonetheless, the paper marks a shift into a deeper scientific understanding of the characteristics of marine SESs that can help us to understand conflict overfishery resources.

4 | CONCLUSION: THE FUTURE OF FISHERIES CONFLICT RESEARCH

A rapidly expanding body of research dealing with fisheries conflict suggests a growing interest and concern over the potential for increased conflict overfishery resources. This concern is justified from a historical perspective, as fisheries have been connected to conflict through an array of potential mediating variables such as climate variability, rapid population growth, social inequality and the expansion of economic zones around coastal nations. All of these factors are projected to remain or even intensify in future years. Greater

understanding of the risk potential of commonly cited drivers such as climate variability will depend on filling in gaps in the fisheries conflict literature. The four gaps that we have identified are:

1. The lack of fishery conflict definitions that are precise, that distinguish among degrees of conflict intensity and that specify which actions or behaviours are indicative of different levels of conflict intensity.
2. The absence of (large sets) of comparative conflict data, and consequently narrowness in the methods used to assess the drivers of fishery conflict.
3. The lack of theoretical framings that explicitly recognize nonlinear and dynamic feedbacks, multiple causes, effects and intervening variables; and that are translated into appropriate methodologies for complexity.
4. Although the complexity of marine SES and conflict's role within that system is recognized through the use of terms such as "adaptive capacity" and "vulnerability," there is room for a more widespread extension of higher order concepts and associated terminology.

As the topic of fishery conflict becomes increasingly salient and considering the well-documented importance of fisheries for human well-being, researchers focused on fisheries conflict are well-positioned to make a practical contribution to more sustainable and cooperative use of fisheries resources. Doing so will require supplementing individual case-studies with more generalizable approaches to develop a deeper understanding of the complex interaction between drivers of fisheries conflict and how to avoid or mitigate them. This will enable more precision and a deeper understanding that is not only scientifically significant, but increasingly important for policymakers and practitioners operating in a turbulent world.

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