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**Rice, Emma D., Low, Jonathan G., Atkins, Molly ORCID
logoORCID: <https://orcid.org/0009-0002-9916-9596>, Mbilingi,
Bwambale, Mpomwenda, Veronica, Musinguzi, Laban,
Natugonza, Vianny, Nunan, Fiona and Nyboer, Elizabeth A.
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RESEARCH ARTICLE OPEN ACCESS

Perceptions of Governance (Il)Legitimacy Mediate Climate Change Adaptation in the Lake Victoria Basin, Uganda

Emma D. Rice¹  | Jonathan G. Low¹  | Molly Atkins^{2,3} | Bwambale Mbilingi⁴ | Veronica Mpomwenda^{4,5}  | Laban Musinguzi⁴ | Vianny Natugonza⁴  | Fiona Nunan²  | Elizabeth A. Nyboer^{1,6} 

¹Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, USA | ²International Development Department, University of Birmingham, Edgbaston, Birmingham, UK | ³Countryside and Community Research Institute (CCRI), University of Gloucestershire, Cheltenham, UK | ⁴National Fisheries Resources Research Institute (NaFIRRI), Jinja, Uganda | ⁵Environment and Natural Resources Program, School of Engineering and Natural Sciences, University of Iceland, Reykjavik, Iceland | ⁶Department of Biology, McGill University, Montreal, Quebec, Canada

Correspondence: Emma D. Rice (riceemma@vt.edu)

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ABSTRACT

Governance is a well-known dimension of adaptive capacity across various frameworks, however specific links between perceptions of governance (il)legitimacy and adaptive capacity remain relatively unexplored. In this study, we investigate connections between climate change adaptation and perceptions of governance (il)legitimacy using focus group and interview data collected in 2016 in fishing communities of the Lake Victoria Basin, Uganda. We found that perceptions of illegitimate fisheries governance across the four dimensions of legitimacy—state accountability to the local level, legitimacy of local level crafted rules by higher level government, legitimacy of the institution as a whole, and legitimacy of the rules by users—undermined adaptive capacity to climate change and other shocks in these resource-dependent communities. We draw links between perceptions of illegitimate governance and adaptive actions that have negative food security and livelihood impacts, and we illustrate how improved legitimacy could bolster adaptive capacity for local fisheries actors. We argue that (1) improving one dimension of legitimacy improves all other dimensions, (2) improving governance via legitimacy improves all other domains of adaptive capacity, that is, learning and knowledge, access to assets, diversity and flexibility, and natural capital, and (3) the ‘legitimacy crisis’ in fisheries management extends to an adaptation crisis.

1 | Introduction

Small-scale fisheries (SSF) are critical to livelihoods and food security globally, providing livelihoods to 1 in 12 people worldwide and contributing essential micronutrients to the diets of 2.3 billion people (Basurto et al. 2025). However, the sustainability of SSF is undermined by social and ecological shocks and stressors that alter fishing conditions and communities. Severe climatic events, sudden shifts in governance, rapid development, and land-use change present challenges to fishery-based livelihoods, demanding that communities be adaptable and flexible.

Considerable research effort has been put toward understanding the ecological and socio-economic factors that guide community and household responses to system shocks (Baral et al. 2010; Gupta et al. 2010; Baral and Stern 2011; Dutra et al. 2015; Nyboer et al. 2022; Rice, Bennett, et al. 2024).

The concept of adaptive capacity has gained importance across disciplines and sectors over the past several decades and provides a basis for understanding societal responses to climate change, policy shifts, and other social and ecological stressors (Bahadur et al. 2013; Brown 2016; Cinner et al. 2018; Green

Emma D. Rice and Jonathan G. Low are the co-first authors.

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et al. 2021). Adaptive capacity can be defined as the ability of a system to adjust to potential damage, take advantage of opportunities, or respond to the consequences of social or ecological change (IPCC 2014). Building adaptive capacity requires strategies that are both scalable and practical to implement (Paul et al. 2016; Cinner et al. 2018). Many frameworks have been developed to help make sense of the factors that contribute to adaptive capacity for households, communities, and institutions (e.g., Smit and Pilifosova 2003; Adger et al. 2005; Gupta et al. 2010; Engle 2011; Whitney et al. 2017). In one example, Green et al. (2021) suggested a fishery-specific framework that considers three possible response pathways for fishing households and communities: adapt (i.e., implement proactive individual or collective planning based on past or anticipated future stress), react (i.e., enact unplanned responses to stressors), and cope (i.e., passively accept consequences of change). Green further describes five domains of adaptive capacity that mediate selection of those pathways in the face of social and ecological stressors (e.g., biological, climate, economic, political and/or social change). The five domains include: (1) governance and institutions, (2) learning and knowledge, (3) access to assets, (4) diversity and flexibility, and (5) natural capital (Figure 1, Green et al. 2021).

A key strength of Green et al.'s (2021) fishery-specific framework is its explicit inclusion of 'governance and institutions' as a domain of adaptive capacity, given that governance structures

and their surrounding political institutions play a crucial role in shaping fisheries management outcomes and communities' capacity to respond to environmental change (McCay and Jentoft 1998; Nunan 2020). Other adaptive capacity frameworks discuss social organisation but do not specifically mention governance (e.g., Cinner and Barnes 2019) or link governance to institutional adaptive capacity without tying it to lower levels of social organisation (e.g., Gupta et al. 2010). However, Green et al.'s (2021) conceptualisation of governance does not explicitly address legitimacy. Legitimacy is socially defined and refers to stakeholder acceptance of governance processes and perceptions that they are just, correct, or appropriate (Weber 1978); legitimacy serves as a foundation for effective governance and policy implementation (Lawrence 2013). When governance is viewed as legitimate, people are more likely to comply with laws and cooperate with institutions (Brecht 2003). Further, legitimacy can promote trust, stakeholder engagement, social cohesion, and stability, which are particularly important in the context of adaptive capacity (Green et al. 2021; Nyboer et al. 2022). Conversely, illegitimate governance can erode agency, trust and cooperation at local, state, and national levels (Lawrence 2013; Nunan 2018). In fact, scholars have asserted that a 'legitimacy crisis' underpins all governance challenges in the fisheries sector, necessitating further focus on the topic (Jentoft 2000).

Several governance models (e.g., adaptive governance, collaborative governance) have been suggested as approaches

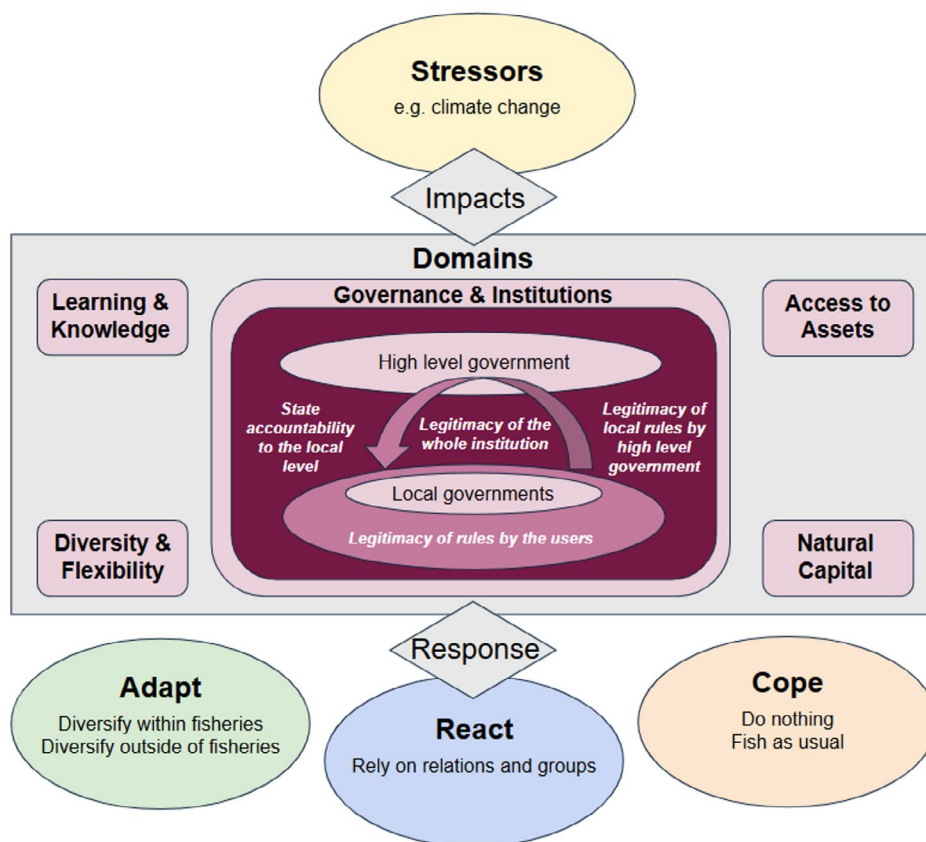


FIGURE 1 | 'Framework within a framework' integrating Green et al.'s (2021) adapt, react, cope (ARC) adaptive capacity framework within the domain of governance expanded with Lawrence (2013) legitimacy framework. We illustrate connections between higher-level government, local level governments (including traditional leaders), and resource users with the four dimensions of legitimacy and give specific examples of how fishers might adapt, react or cope. Figure adapted with permission from Green et al. (2021).

to enhance governance legitimacy in natural resource contexts (Jentoft 2005; Armitage et al. 2009; Berkes 2009). Co-management is one such governance arrangement which seeks to enhance legitimacy by establishing shared responsibility and authority among the central governments and local users. Co-management is designed to empower marginalised groups through inclusive decision-making processes and devolving power to local entities (Berkes and Folke 1998; Jentoft 2005; Pomeroy and Rivera-Guieb 2006). For governance legitimacy to be achieved within co-management, four types of legitimacy must be upheld: (1) state accountability to the local level, (2) legitimacy of local-level crafted rules by higher-level government, (3) legitimacy of the institution as a whole, and (4) legitimacy of the rules by the users (Lawrence 2013).

First, state accountability to the local level can be understood as the centralised national government being aware of and addressing local needs (Ribot 2002; Ribot et al. 2010). Accountability of the central government (referred to as higher-level government by Lawrence (2013)) to local needs helps to create a sense of political efficacy among local actors (i.e., resource users), which can be defined as citizens' belief in their ability to influence state policies (Craig and Maggiotto 1982). State actions (e.g., policies) that align with local level needs can foster trust and acceptance of state rules and regulations (i.e., legitimacy) and encourage citizens' participation in the system (Lawrence 2013). Second, legitimacy of local-level crafted rules by higher-level government, requires a commitment from the higher-level government to share power, authority, and resources with local government entities, in this case Beach Management Units (Pomeroy and Berkes 1997). Power can be defined as agency expressed through transformative capacity (Giddens 1984; May 2013), which is shaped by capital assets available to groups and the contexts in which they are deployed (Bourdieu 1985, 1986). Sharing of power between higher-level and local governments necessarily includes clearly delineated responsibilities and resource sharing (Lawrence 2013). The third component of legitimacy is that of the institution as a whole (Ostrom 1999; Lawrence 2013). In decentralised governance systems, all levels of governance (e.g., higher-level government, local governments) must be perceived by all stakeholders to govern responsibly and fairly. The final type of legitimacy (that of rules by the users) refers to the importance of trust within the community itself. In co-managed systems, resource users must believe in the fairness and efficacy of the rules they are expected to follow and play a role in implementing and enforcing these regulations. This mutual accountability ensures all stakeholders uphold their responsibilities (Ostrom 1990; Ribot 2002; Lawrence 2013).

While legitimacy is recognised to underpin effective governance, existing adaptive capacity frameworks do not adequately include legitimacy. Therefore, we integrate Lawrence's (2013) four types of legitimacy with Green et al.'s (2021) adaptive capacity framework, providing a 'framework within a framework' to structure analyses of the impacts of legitimacy on adaptive capacity (Figure 1). Specifically, we examine how perceptions of governance (il)legitimacy in the fisheries sector shape adaptive capacity to climate change in small scale fishing communities in the Lake Victoria Basin (LVB), Uganda.

1.1 | Governance and Climate Change Adaptation in Lake Victoria

Uganda is an East African nation of approximately 50 million people that shares Lake Victoria with its neighbouring countries, Kenya and Tanzania. Lake Victoria's fisheries make essential contributions to Uganda's economy through exports and domestic sales and contribute to food security and nutrition throughout the country, with fish being the most consumed animal source protein in Uganda (FAO, Duke University, and WorldFish 2023). However, these contributions are currently threatened by climate change and other anthropogenic stressors (Ogutu-Ohwayo et al. 2016; Nyboer et al. 2019).

Lake Victoria was historically dominated by a diverse fish community, including over 500 endemic haplochromine cichlid species (Aloo et al. 2017). Local livelihoods were supported by a multi-species fishery that largely consisted of native *Oreochromis* spp., catfishes, and mormyrids (Ogutu-Ohwayo 1990). In the mid-1900s, a series of introductions of species, especially Nile perch (*Lates niloticus*) and Nile tilapia (*Oreochromis niloticus*), boosted the economic value of the fishery but brought major social and ecological changes (Pringle 2005; Balirwa 2007). By the early 1980s, establishment of introduced species, coupled with increasing population and land use change, led to severe declines in native fishes, reducing biodiversity and simplifying Lake Victoria's food webs, ultimately creating a fishery dominated by three main species: Nile perch, Nile tilapia, and the native silver cyprinid, *Rastrineobola argentea* (Ogutu-Ohwayo 1990; Taabu-Munyaho et al. 2016). Nile perch have been showing signs of overfishing (Matsuishi et al. 2006; Njiru et al. 2007; Natugonza et al. 2022), and the boom-and-bust cycles of various fish species have brought fluctuating socio-economic inequities to fishing communities (Musinguzi et al. 2016; Pringle 2005).

Prior to the centralised governance regime implemented under colonial rule (1894–1962), fisheries management in Uganda was characterised by traditional hierarchical self-governing systems (Jentoft and Chuenpagdee 2015; Mpomwenda et al. 2021). In the post-colonial era, fisheries management continued in the hands of the central government, who used a top-down approach that proved largely ineffective at maintaining fish stocks (Nunan 2006; Mpomwenda et al. 2021). Co-management was proposed as a solution (Béné et al. 2009) and was officially implemented in 2003 through the institutionalisation of Beach Management Units (BMUs) under the 'The Fish (Beach Management) Rules 2003' (AU-IBAR 2018). Goals of the co-management system were to strengthen fisheries resources and sustainability, alleviate poverty and improve livelihoods, recognise a greater number of actors in the fishery sector (e.g., women), and reduce conflict in the sector (AU-IBAR 2018). However, after over a decade of co-management in Uganda, shortfalls of the new system to meet these goals put Ugandan fisheries management at a crossroads (Mpomwenda et al. 2021). In 2015, BMUs were suspended by order of the President of Uganda during an election campaign, and co-management was replaced with the militarisation of fisheries management in Uganda (MAAIF 2017). Data for this study were collected in 2016, only a few months after the dissolution of BMUs but

before the implementation of military enforcement, providing unique insight into perceptions of fisheries governance during this transitional period.

With this history of massive ecological and governance-related change, the Lake Victoria basin has faced many adaptation challenges including climate change. Climate change is a key stressor contributing to increasing water temperatures and unpredictable seasonal rhythms, which are altering fish distribution and abundance, and impacting the productivity of agricultural food systems (Trisos et al. 2022). Severe drought and flood events destroy homes and infrastructure, cause crop failure, and livestock disease. Unexpected wind patterns and frequent storms create unsafe conditions for fishers, limiting opportunities for harvest (Nyboer et al. 2022). Adaptation to climate change has been documented, including changing fishing grounds, fishing methods, and species targeted, diversifying outside of fisheries, using traditional agricultural techniques, and contributing to community-led ecosystem restoration (e.g., planting trees, protecting shoreline habitat) (Nyboer et al. 2022). However, different adaptive strategies have been found to have varying levels of efficacy, with only some strategies leading to long-term positive outcomes on food security and economic stability (Nyboer et al. 2022). Underlying factors that may contribute to the efficacy of adaptive strategies to climate change, like governance, need to be further explored.

In this paper, we build on previous work conducted by Nyboer et al. (2022) that explored climate change adaptation and adaptive efficacy in five fishing communities in the Lake Victoria basin, Uganda. Here we analyze data from the same five communities to assess the experiences of resource users and fisheries authorities to explore how perceptions of (il)legitimate governance either enable or constrain strategies to adapt to climate change. Specifically, we look at whether perceptions of (il)legitimate governance lead to the selection of more or less efficacious adaptive strategies for fishing households experiencing the impacts of climate change. The three objectives of this paper are to: (1) assess perceptions of legitimacy in Uganda's fishery governance structures across the four forms of legitimacy necessary for effective co-management, (2) understand how perceptions of (il)legitimacy influence climate change adaptation strategies, and (3) provide insight on ways to strengthen legitimacy and adaptive capacity.

2 | Methods

2.1 | Site Selection and Data Collection

To understand local fishery actors' perceptions of governance legitimacy, we conducted a series of focus group discussions (FGDs, $n=16$) with members of fishing communities at five landing sites on lakes Victoria (Lambu, Ggolo, Nakiga) and Nabugabo (Luwafu, and Kaziru) in the Masaka and Mpigi Districts of Uganda (Figure 2). To understand the perspective of local leadership (e.g., BMU leaders, village chairpeople), we conducted key informant interviews (KIIs) with community leaders ($n=8$) at the same five landing sites (Table 1). We also conducted semi-structured interviews (SSIs) with fisheries officials in

the Ministry of Agriculture, Animal Industries, and Fisheries (MAAIF) ($n=5$) to understand perspectives of the central government (Figure 2 and Table 1). The FGDs, KIIs, and SSIs were conducted in the fall of 2016 (September–December), and drew on an earlier livelihood survey conducted from February–April of 2016 (analyzed in Nyboer et al. 2022). We opted to work in Masaka and Mpigi Districts because of the significance of fisheries within the districts across Lakes Victoria and Nagubabo (Figure 2), and because our research team had pre-existing relationships with these communities.

The five landing sites were selected to capture variation in population size, socioeconomic status, and fishing capacity within fishing communities (Figure 2). For example, the two largest landing sites, Lambu and Ggolo, were both equipped with good electrical service and managed roadways at the time of data collection, largely as a result of government support to bolster valuable Nile perch export. There were approximately 500 to 1000 active fishers at these sites, typically working in groups of 2–8 in large (7–10 m) wooden boats fitted with outboard engines. Catch at Lambu and Ggolo consists of Nile perch, Nile tilapia, and silver cyprinid, locally called mukene. In contrast, Nakiga is characterised by around 50 active fishers, no electricity, no permanent roads, and few amenities; Nile tilapia is the primary target species, though Nile perch, mukene, and marbled lungfish (*Protopterus aethiopicus*) are also harvested. Both landing sites on Lake Nabugabo (Luwafu and Kaziru) are smaller than the three on Lake Victoria, with approximately 20–30 active fishers at each; at the time of this study, electricity and public services were limited at these sites. Fishing activities were largely performed using paddle propulsion and hand gear. These fishing sites encompass a range of socio-economic capacity and fishing intensity, making our results more generalisable and providing insights that can be useful across Uganda and Lake Victoria more broadly.

A total of 16 FGDs with 8–23 participants each (Table 1) were conducted across the five landing sites. The number of participants in each focus group (Table 1) was based on the size of the landing site and availability of the members of the fishing community. At the smaller landing sites (Luwafu and Kaziru), we attempted to include most or all of the fishers, and at the larger landing sites (Nakiga, Ggolo, and Lambu), we aimed for focus groups of 10–15 participants each. Community leaders helped identify and recruit participants that represented the three major fisheries (Nile perch, Nile tilapia, and mukene) and a wide range of socioeconomic statuses and age groups. At each landing site, FGDs were homogeneous by sex and fishery involvement type—boat owners, boat crew, traders, and trader-processors. All discussions with boat owners, boat crew, and traders were composed entirely of men, and the female trader-processor FGDs were composed entirely of women. FGDs were held for each involvement type in Lambu, Ggolo, and Nakiga, constituting 12 of the 16 FGDs (Table 1). In Luwafu and Kaziru, the number of male traders and women was insufficient for separate focus groups at each site, so individuals from both locations were combined. Additionally, at the Lake Nabugabo sites, the contrast between boat owners and crew members was not as pronounced, as boat owners typically operated their boats with the crew. Considering this, boat owners and crew members were grouped together in the FGDs.

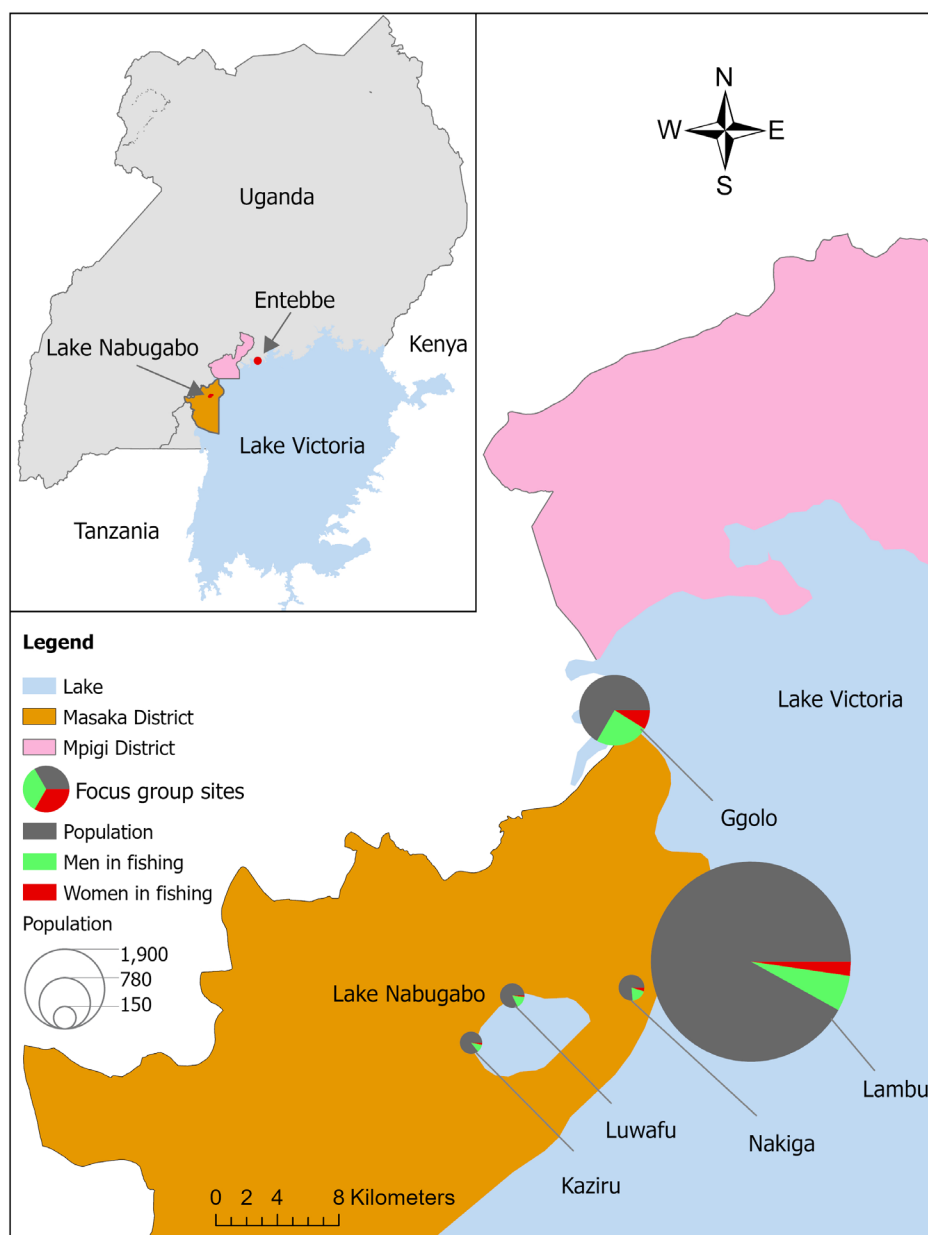


FIGURE 2 | Map of study sites with approximate population sizes indicated by bubble size, and numbers of male and female fishery actors in coloured pie slices.

The eight community leaders selected for KIIs and the five government officials selected for SSIs were identified through a purposive sampling approach based on recommendations from Ugandan colleagues and community members who suggested individuals with a wide range of experience and a good understanding of the history and trajectory of fisheries governance at our study sites. Local community leaders included elected chairpeople and BMU personnel (Table 1). Government personnel included individuals across various ranks, including fishery commissioners (high ranking policy makers and implementers), district fisheries officers (lower level managers), and a senior fisheries officer (higher level managers) (Table 1).

Each interview and focus group was voice recorded and carried out in Luganda or English. One researcher led the

discussions, while another took detailed field notes. At the beginning of each session, written consent was obtained from all participants through the distribution and signing of consent forms. To ensure full comprehension by all participants, the consent forms were available in both English and Luganda and were read aloud by the session moderator at the start of each session. All personal information was kept confidential in accordance with McGill University Research Ethics Board file number 285-1215.

2.2 | Adaptive Strategies and Adaptive Efficacy at Study Sites

Previous research conducted at the same study sites in the present analysis revealed a diverse set of adaptive strategies

TABLE 1 | Sample sizes for focus group discussions (FGDs) and key informant interviews (KIIs) across the two lakes and five different landing sites.

	Lake Nabugabo		Lake Victoria		
Involvement types (FGDs)	Luwafu	Kaziru	Nakiga	Ggolo	Lambu
Women	8		12	14	13
Traders	10		10	11	10
Boat crew	16	23	11	13	14
Boat owners			15	10	12
Role of respondent (KIIs)	Luwafu	Kaziru	Nakiga	Ggolo	Lambu
BMU chairperson/secretary			1	1	1
Local Chairperson 1 (LC1)	1	1	1		1
Youth Chairperson	1				
Role of respondent (SSIs)	MAAIF				
Fishery commissioner	2				
Senior fishery officer	1				
District fishery officer	2				

employed by fishing households faced with climate change in the LVB (Nyboer et al. 2022). That study used surveys to identify and quantify the frequency of adaptive strategies used in the face of climate-related stressors. Adaptive strategies can be categorised according to Green's *cope*, *adapt*, *react* pathways (Figure 3), with *coping* including fishing as usual or doing nothing, *adapting* including adaptations within the fishery, adaptations outside of the fishery, and planning for future disturbances, and *reacting* including emergency responses such as selling livestock or borrowing money (Figure 3). The study further quantified the efficacy of the various adaptive strategies by examining perceptions of the resulting improvements in food security and income (Nyboer et al. 2022). For instance, if a household chose to exit fishing and shift to crop cultivation, fishers were asked whether this decision improved their income and food security. The study found that some strategies had better outcomes than others (Nyboer et al. 2022; Figure 3). Most strategies that involved livelihood diversification outside of fisheries led to positive outcomes, while most adaptation strategies that involved staying in fisheries led to negative or neutral outcomes. Nyboer et al. (2022) found that gender and socio-economic status played a role in shaping the efficacy of adaptive strategies; however, the role of governance was unexplored.

In this paper, we use the adaptive strategies identified by Nyboer et al. (2022) as a foundation and link these strategies to enabling or inhibiting dimensions of governance legitimacy through analysis of the FGDs (specifically focusing on governance questions previously unexplored), KIIs, and SSIs, which are complementary to the FGD and survey data analysed in Nyboer et al. (2022). We apply the 'framework within a framework' approach (Figure 1) to further understand how the governance domain of adaptive capacity mediates the

efficacy of adaptive strategies to climate change for fishing households in the LVB.

2.3 | Analysis

A single translator dictated FGD and interview responses translating from Luganda to English. A second person (co-author E.A.N.) simultaneously transcribed the translations. Transcripts were then used to perform thematic analysis in NVivo software (version 14). A code book was developed using deductive and inductive methods and refined through weekly check-ins and discussions between two independent coders (E.D.R. and J.G.L.). During check-ins, intercoder reliability was examined based on Kappa scores (Kappa > 0.4 = fair to good; Fleiss et al. 2003), and coders discussed inconsistencies between their coding and adjusted as needed.

First, deductive methods were used to structure coding based on the four types of governance legitimacy investigated by Lawrence (2013): (1) state accountability to the local level, (2) legitimacy of local-level crafted rules by higher-level government, (3) legitimacy of the whole institution as viewed by all stakeholders, and (4) legitimacy of the rules by the users. Second, the authors used inductive methods to allow sub-codes to emerge within these four types of legitimacy (e.g., insufficient enforcement, bribes, powerlessness). Third, the authors used deductive methods to identify where participants discussed adaptive strategies to climate change identified by Nyboer et al. (2022). Finally, the authors made links between the identified instances of governance (il)legitimacy and the efficacy of adaptive strategies. Each coder contributed to a spreadsheet of independently selected quotes that concisely captured each qualitative theme identified in the analysis. The spreadsheet was examined by all authors and

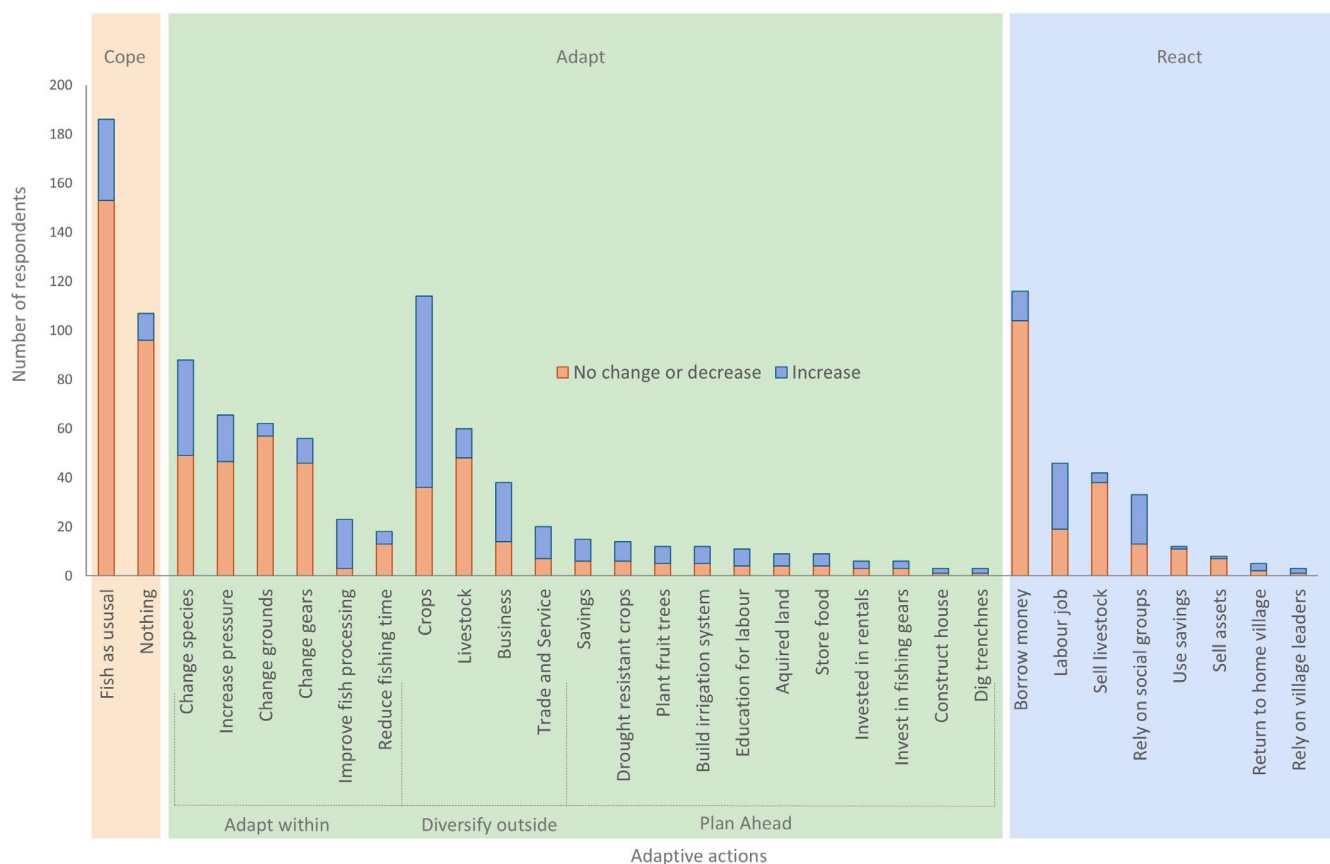


FIGURE 3 | A catalogue of adaptive actions, previously documented by Nyboer et al. (2022), to protect households in the LVB against the impacts of climate change, and the perceived effect of these actions on food security and income. Orange represents the number of respondents who indicated that a given adaptive action led to no change or a decrease in their income and food security and blue represents the number of respondents who indicated that a given adaptive action led to an increase in their income and food security. The number of survey respondents that selected each category is represented by the bars above and adaptive actions are sorted by strategy type according to Green et al.'s (2021) framework—cope, adapt, or react. Figure adapted with permission from Nyboer et al. (2022).

quotes that captured a range of perspectives were integrated into the Section 3.

3 | Results

Our FGDs and interviews revealed that perceptions of illegitimate fisheries governance eroded agency and cooperation among local fisheries actors and undermined adaptive capacity and long-term social-ecological resilience to climate change. Below, we present our findings in four parts based on Lawrence's (2013) four types of governance legitimacy. We use the perspectives of resource users, community leaders, and fisheries officials to demonstrate how the four types of governance (il)legitimacy manifested in Uganda's fisheries at the time of data collection and provide evidence that perceived shortfalls in governance legitimacy contributed to low levels of adaptive capacity to climate change. We point out instances where perceptions of illegitimate governance led to fishers selecting adaptive options that were less effective or presented a barrier to selecting adaptive options that were more effective. We link our findings from FGDs and interviews to the adaptive strategies identified in Nyboer et al. (2022).

3.1 | State Accountability to Local Level

State accountability to the local level requires the state to be aware of and responsive to local level needs. Our qualitative analysis indicated that state accountability to the local level was weak in lakeside communities in Uganda at the time of data collection, which contributed to local level perceptions of fisheries governance as illegitimate. This type of governance illegitimacy undermined the adaptive capacity of local fisherfolk via two key mechanisms: (1) a sense of abandonment emerging from lack of responsiveness to fishfolk needs, and (2) feelings of powerlessness to enact change or have voices heard in decision making (i.e., low political efficacy, agency, and transformative capacity).

3.1.1 | Abandonment

Many local-level fisheries actors who participated in our study, including boat owners, crew members, traders, and processors, expressed a sense of abandonment by the state and elected politicians due to their lack of accountability to local needs. For instance, local fisheries actors noted that they have "been pleading to politicians, especially the area councilors

TABLE 2 | Summary of the mechanisms through which governance (il)legitimacy (Lawrence 2013) promotes or blocks specific adaptive actions identified in Nyboer et al. (2022) within Green et al.'s (2021) three response pathways (adapt, react, cope).

Response pathway	Definition	Adaptive action (based on Fig. 3)	Effect of adaptive action on food security & income	Scale of governance legitimacy at play	Mechanism by which various forms of governance legitimacy promote or prevent adaptive actions
Adapt	Implement proactive actions: <i>Fishing related</i>	Improve processing	Positive	State accountability to the local level	Lack of state accountability to the local level prevents positive adaptive actions like improving fish processing because local level needs (e.g., solar dryers, cold storage) are overlooked.
		Increase fishing pressure	Negative	State accountability to the local level; Legitimacy of the local-level crafted rules recognized by higher level government; Legitimacy of the whole institution viewed by all stakeholders; Legitimacy of the rules by the users	Illegitimate governance across scales prevents sufficient monitoring and enforcement of illegal fishing and promotes increased fishing pressure and use of illegalities with negative impacts on food security and livelihoods.
	Implement proactive actions: <i>Diversify outside of fishing</i>	Crops	Positive	State accountability to the local level	Lack of state accountability to the local level prevents adaptive actions that could improve livelihood diversification (e.g., access to formal financial services and capital) through lack of locally relevant programs and support.
		Livestock	Positive		
		Business	Positive		
		Trade and service	Positive		
	Implement proactive actions: <i>Plan ahead</i>	Plant fruit trees	Positive	State accountability to the local level	Lack of state accountability to the local level creates feelings of powerlessness (e.g., foreign investors given more rights than communities) that prevent local actors from engaging in positive adaptive actions like planting fruit trees.
		Job training	Positive	State accountability to the local level	Lack of state accountability to the local level prevents exploration of positive adaptive actions that could improve livelihood diversification by overlooking community needs for skill training and education.
		Acquire land	Positive	State accountability to the local level	Lack of state accountability to the local level prevents adaptive actions that could improve livelihood diversification (e.g., land for farming) through lack of locally relevant programs and sale of land to foreign investors.
React	Unplanned responses to pressures	Rely on relations and groups	Positive	Legitimacy of the rules by the users	Lack of legitimacy of the rules by the users prevents positive adaptive actions like successful saving groups, community-based organizations, group training programs, and self-policing.
Cope	Passively accept consequences of change	Do nothing	Negative	State accountability to the local level; Legitimacy of the local-level crafted rules recognized by higher level government; Legitimacy of the whole institution viewed by all stakeholders; Legitimacy of the rules by the users	Illegitimate governance across scales has led to declining fish populations through various mechanisms (e.g., shoreline development, illegal and overfishing), which prevents fishing as usual from being a viable livelihood option.
		Fish as usual	Negative		

Note: Orange-highlighted cells indicate adaptive actions that have negative impacts on food security and income, blue highlighted cells indicate those with positive impacts.

and MPs, to bring us training. But when we give votes to them, they don't come back" (FGD, Bbaale Kaziru, woman). According to the perspectives of local fisheries actors, the government did not provide them with sufficient resources (e.g., legal fishing gear, lifejackets) or programs (e.g., training), and many felt forgotten by the government compared to those in the agricultural sector, who tended to receive more government support. For example, a research participant stated: "Those agriculture people only train crop farmers, they don't train fishermen" (FGD, Ggolo, trader). Government officials interviewed in this study concurred that the fisheries sector was overlooked at the time of data collection, as one fisheries officer stated: "They have put a lot of emphasis on crops and less on especially capture fisheries, with some on aquaculture... but people in capture fisheries—there is less help for them" (KII, District Fishery Officer).

We found that this 'abandonment' constituted a barrier for local fisheries actors to enact positive adaptive actions that could lead to long-term livelihood improvements (e.g., diversification outside of fisheries, diversification in fish species and markets, job training, and education) (Table 2). This manifested through three routes: (1) insufficient responsiveness to household and community needs for outreach, intervention, and training, (2) insufficient attention to community infrastructural needs, and (3) insufficient educational and health-care opportunities.

First, local fisheries actors indicated that they would have benefited from two types of government intervention: those that provided resources related to activities in the fisheries sector (e.g., legal gears, lifejackets, and solar dryers) and those that provided education, training, and financial capital for

livelihood diversification outside of fisheries. One example of fishing-related resources frequently mentioned by women participants was solar dryers. Women traders indicated that the provision of solar dryers could have helped to reduce post-harvest losses and improve their earnings; one woman explained: “Especially during floods it would be good to have solar dryers for mukene because then even during floods we would not make losses. It should be the government that supports us with those solar dryers” (FGD, Lambu, Trader). Research participants also indicated a desire for government programs related to education, training, and capital for livelihood diversification outside of fisheries (e.g., skilling centers) (Table 2). For example, women traders explained: “We wish we were trained because we normally hear that most women are trained in making books and making soap, but we lack training. Some learned how to make sanitary pads—we can do such things at home, but we lack training” (FGD, Bbaale Kaziru, Women).

Second, we found that lack of accountability to local level needs was connected to inadequate infrastructure in fishing communities. Inadequate infrastructure (e.g., unpaved roads that became impassable during rains) limited adaptive actions like market expansion (Table 2). Fish traders explained that roads were an important mechanism for enabling market expansion and said that their “work becomes easy when [they] have proper roads” (FGD, Bbaale Kaziru, Trader). However, many lake communities in Uganda had poor connections to road networks at the time of data collection.

Third, fisherfolk stated that access to quality schools and health care centers was critical for the development of their communities. However, due to perceived insufficient government support for education and health care, local fisheries actors did not believe that they had adequate access (Table 2). Research participants indicated a desire for quality schools in their communities, including secondary education and vocational training, to provide more opportunities for their children outside of fisheries, and explained that “having facilities like schools is very important because your child can start studying within the fishing environment...when you attend school normally you go higher” (FGD, Ggolo, Trader). Similarly, one focus group participant shared that “it would be good for [health centers] to be within the locality so that when you get sick you don’t have to go far to look for help or treatment” (FGD, Ggolo, Trader).

3.1.2 | Powerlessness

We found that local fisheries actors felt a general sense of powerlessness over government actions in Uganda (i.e., lack of political efficacy as defined in the introduction). We found that fisherfolk did not feel their voices were represented in decision-making and indicated that decision-makers were out of touch with local level needs. For example, focus group participants expressed frustration and stated that: “Many decision makers are outsider[s] who know nothing about nets or fish. But these things are now based on who has the most money at the landing site” (FGD, Lambu, Crew). Relatedly,

we found that local fisheries actors felt powerless in decisions made about ‘foreign’ investment in the lake and the subsequent development and destruction of shoreline habitat. Fishers frequently mentioned that “the government has sold the lake” (many respondents), indicating that previously perceived communal use of resources is being taken over by private property rights that are not aligned with local community approaches. This left many fisherfolk feeling hopeless about community-led efforts to protect the lake. For instance, one research participant stated:

There are some places where we as a community have no control. For example, Lwera; they have brought in investors for sand mining. And those who are doing that are big people. The government has given that place to the Chinese investors, yet as a community, we were protecting that place all alone. So that place is going to be destroyed, but it is beyond the community’s control; it is the government that is in control.

(FGD, Ggolo, trader)

This sense of powerlessness undermined the implementation of effective adaptive strategies, including those that could mitigate climate change impacts. For example, community members mentioned that they had begun to harvest their forests rather than conserve them as they have historically done. They argued that the destruction of natural resources was inevitable and that they were better off earning short-term profit by harvesting forests themselves rather than having foreign investors and government actors solely benefit. One participant explained:

When you have a mother bird, it is the one which trains the young one, so the public is also seeing what the government is doing, and yet they have nothing to do. But if you say: ‘Let me protect this place’, the government comes to take it away, so for us before the government comes in, we would also destroy because we know the government will just give it away so we have to try to also benefit.

(FGD, Nakiga, Boat Owners)

We also found that feelings of powerlessness and hopelessness limited adaptive capacity for fisherfolk by blocking adaptive actions that could mitigate climate change impacts on a local scale, such as planting trees (Table 2). For example, community-led initiatives to plant fruit trees and contribute to reforestation efforts were perceived as being futile under illegitimate governance. One fisher explained that:

Even places where we were suggesting to plant trees, Mazigo, the government has already sold those places. There is no way you can mobilize people to plant trees because if a rich man comes, he’ll just come and sell the land.

(FGD, Lambu, Crew)

3.2 | Legitimacy of Local-Level Crafted Rules Recognised by Higher-Level Government

In decentralised systems, each scale of government must have the judicial authority and power (i.e., transformative capacity) to influence fisheries legislation and to enforce rules and regulations. However, our qualitative analysis indicated that perceived insufficient devolvement of power from high-level to local governments inhibited legitimate rule-making and enforcement through two key mechanisms: (1) lack of financial resources given to local Beach Management Units (BMUs), and (2) uneven distribution of judicial authority and power.

We found that local BMUs were often unable to execute their responsibilities due to a lack of funding and resources. Concerns about insufficient support were corroborated by government officials, as multiple interviewees noted that there were no available resources to aid enforcement at the local level. For example, fisheries personnel in the central government admitted that ‘BMUs were not paid. It was a community voluntary service and along the way it was like: “What are the benefits? Why should I risk my life? What are the incentives for getting involved in this?”’ (KII, Fishery Commissioner).

We also found that research participants perceived the central government to have never adequately devolved power to the local level (i.e., BMUs and local governments). While Uganda had officially (i.e., on paper) moved toward a decentralised governance structure, in effect, all judicial authority and transformative capacity remained with the central government. For example, a BMU Chairperson indicated that they had limited authority and stated that: “When it comes to management at the landing site, I have no work because I am not given full authority. Even as a chairman, if I see people doing illegal fishing, there is no way I can do anything about it because I don’t have the authority. We were told not to interfere with people’s work” (KII, BMU Chairperson).

Lack of recognition of local level crafted rules by the higher level government prevented effective adaptive actions within the fishery, such as using traditional fishing methods to reduce fishing pressure and enforce traditional seasonal closures. One focus group participant explained how fisheries were successfully user-managed in the past, saying, “I used to fish and even have time to rest the lake—having closed seasons to allow fish to breed and to move freely” (FGD, Ggolo, Boat Owner). However, the centralised governance approach in effect at the time of data collection did not incorporate local knowledge into decision-making nor provide mechanisms through which local level actors could inform rule-making.

Failure of the central government to devolve sufficient resources, power, and authority to local-level government also undermined adaptive capacity to climate change by hindering effective monitoring and enforcement at the local level, ultimately allowing fishers to pursue unfavorable adaptive strategies such as escalating fishing pressure (Figure 3 and Table 2). Research participants suggested that establishing sufficient wages for local officials could be one mechanism to improve monitoring and enforcement at the local level. Provision of sufficient financial resources from the central government to the local governments through the form of high wages to local officials could bolster

local monitoring and enforcement activities and contribute to reducing illegal fishing. However, weaknesses in monitoring and enforcement occur via different mechanisms across multiple layers of governance legitimacy; this concept will be revisited in the sections on *legitimacy of the whole institution* and *legitimacy of the rules by the users*, below.

3.3 | Legitimacy of the Whole Institution as Viewed by All Stakeholders

The third component of governance legitimacy is the legitimacy of the whole institution as viewed by all stakeholders. For the whole institution to be viewed as legitimate, stakeholders must perceive the government to exercise its authority to govern responsibly. However, we found that (1) inadequate monitoring and enforcement against illegalities in the fishery and (2) high-level corruption both deteriorated the legitimacy of the whole institution as viewed by stakeholders, thereby contributing to an erosion of adaptive capacity to climate change.

Qualitative results indicated that fisheries actors, including boat owners, crew members, fish processors, and fish traders, perceived there to be insufficient monitoring and enforcement against illegalities (e.g., illegal fishing, informal cross-border trade, and interpersonal violence) by high-level government officials (e.g., fisheries officers, police) at the time of data collection. Local fisheries actors felt that the government was responsible for the lack of consistent, effective monitoring and enforcement against illegal fishing. For instance, a trader explained that illegal fishing persisted due to inconsistent enforcement and that “it’s the people who are above that are encouraging illegal fishing” (FGD, Lambu, Trader). Others lamented the state of illegal fishing, saying that “the government is to blame. There are no laws governing the lake. Every person fishes the way he likes using illegal gears” (FGD, Lambu, Boat Owner).

The prevalence of illegal fishing was also attributed to informal cross-border trade of immature fish and illegal fishing gear, which was also perceived as being poorly enforced. Focus group participants stated that “if the government can come up and stop the market for immature fish in the Congo, all this illegal fishing would stop” (FGD, Nakiga, Boat Owner) and that “the management system failed because the government allows the importation of illegal gears” (FGD, Lambu, Women). Similar issues were raised by government officials who acknowledged that illegal gears “don’t go through the official customs checkpoints... but you cannot put staff at every footpath” (KII, Senior Fisheries Officer). Community members also expressed concern about the lack of enforcement regarding physical violence on the lake. Participants acknowledged that “at times even they kill fishermen, but nothing is done. For example, on land when robbers attack people they normally punish people, but when you’re attacked on the lake there is no follow-up” (FGD, Ggolo, Crew Member). A government key informant corroborated this perspective, explaining that “illegalities are rampant because of lack of follow up” (KII, District Fisheries Officer).

High-level corruption also contributed to institutional distrust and distrust of high-level authority figures (e.g., fisheries

officers, police) in Uganda. For example, bribes taken by authorities negatively impacted stakeholders' perception of the institution as a whole and contributed to the delegitimation of fisheries management in the LVB. Local fisheries actors perceived the law not to apply to high-income actors (e.g., Nile perch exporters), explaining that "when they get people with money, they accept bribes and allow them to continue fishing illegally. They only disturb those who don't have money, but those who have money, they bribe the enforcers and just keep fishing illegally" (FGD, Lambu, trader). Government fisheries officers also acknowledged the issue of bribes explaining that low pay is, in part, to blame. For example, one government key informant stated:

Imagine a police officer who earns 100 [United States] dollars a month and he is involved in enforcement and he meets this fish trader dealing in illegal undersized fish and offers him 1,000 [United States] dollars to let him through - so that is 10× his salary, and he is promising him, every time I pass here you get your 1,000 [United States] dollars - so what can you do. That is the kind of corruption that affects people - the very people who are supposed to be doing enforcement - they get compromised.

(KII, Fishery Commissioner)

Illegitimacy of the whole institution impacted the entire system and led to the erosion of adaptive capacity for fishing communities in Uganda through multiple mechanisms (Table 2). For example, corruption at high levels impacted actors at all levels by establishing rule-breaking as the norm in the system and contributing to fishers' lack of motivation to follow rules and regulations. In this way, both high level corruption and insufficient monitoring and enforcement led to adaptive actions with negative impacts on food security and income such as increasing fishing pressure (e.g., illegalities) (Figure 3 and Table 2). One participant stated:

Sometimes we fish properly, but then somewhere on the way, things get disorganized and we just relax. At times, we talk to our friends and we say, 'we've started enforcement, but is it going to be sustainable?' After 1-2 months then we go back to zero, whereby within that period most people lose their things; others lose their lives. The problem is if we put things in place, we don't persist and we don't sustain the process. We reach somewhere and then we go back to zero. But all of this is because of the top leaders.

(FGD, Bbaale Kaziru, trader)

3.4 | Legitimacy of the Rules by the Users

Investigation of the fourth dimension of legitimacy (of the rules by the users) revealed that at the local level (1) insufficient monitoring and enforcement by local BMU leaders and community members, and (2) local-level corruption both contributed to

community level distrust and perceived illegitimacy of fisheries governance in fishing communities. In the previous section (*legitimacy of the whole institution*) we discussed corruption and insufficient monitoring and enforcement from high level actors, while here we highlight perceptions of similar shortfalls at the local level.

Many local fisheries actors in our study admitted to engaging in illegalities or observing them firsthand (e.g., illegal fishing, illegal trade, interpersonal violence, theft). For instance, focus group participants explained that "there is no agreement in the community on how to manage the lake because the community members are the lawbreakers themselves" (FGD, Bbaale, crew). Some expressed frustration that they "see other people getting good money from illegal fishing", (FGD, Bbaale, crew) while others admitted to "ty-cooning to get something from the lake", (FGD, Bbaale, crew). Further, we found that lack of monitoring and enforcement of illegalities at the local level amplified distrust among community members. Research participants shared that regular instances of theft eroded cooperation. For example, one participant stated:

The problem comes from the community within. They used to set their gillnets and leave them there, go home and do other activities at home. But those that just come in to fish, for them they carry out beach seines and at times they destroy their nets and at times they steal their nets. There is no cooperation between the native and the migrants because if someone steals or destroys your gillnets there's no way you can cooperate with him or her.

(KII, Bbaale)

Second, local-level corruption was underpinned by the corruption of BMU leaders and local fisheries actors. Respondents perceived local elections to be dominated by individuals who protected illegal fishing, given the short-term benefits officials could gain through bribes and re-election to power. Government officials corroborated this statement, explaining: "We also had imposters. Several people had joined enforcement not for curtailing it but for making money out of it... even the fishermen at the BMUs—they said if we can't defeat them, we join them" (KII, District Fisheries Officer). Corrupt individuals were regularly elected and re-elected to power given that "the same-minded people would elect one of their own because he would protect their interests" (KII, District Fisheries Officer), and allowed illegal fishing to persist. A boat owner from Lambu similarly stated: "When it comes to votes, nobody can [stop illegal fishing] because they will be losing votes ... he [chairman] will not make them stop illegal fishing because his term limit will end there" (FGD, Lambu, Boat Owner). Participants suggested that even when local leaders do confiscate illegal fish and gears, bribes and other forms of corruption were routine. For example, one respondent said: "When the BMU confiscates the illegal gears, it is the BMU that sells them to other people, so there is a lot of corruption within the BMU" (FGD, Lambu, Crew).

We found that perceived governance illegitimacy of the rules by the users constituted a barrier to adaptive capacity for fishing communities. Corruption at local levels contributed

to distrust, which in turn prevented the self-governance and collective action required for selecting favourable adaptive actions to climate change (e.g., diversification; Figure 3 and Table 2). Focus group participants believed that local fisheries actors would come together as a community to protect the fishery if trust were built. One focus group participant explained: “If it is not ourselves as fishermen to control the fishing on the lake, there is no way we can fight illegal fishing” (FGD, Nakiga, Boat Owner), and “why don’t we come together and stop illegal fishing, and we go back to our original methods of fishing” (FGD, Nakiga, Boat Owner). Yet, governance illegitimacy undermined such collective action as many local fisheries actors were fearful of engaging in monitoring and enforcement activities (i.e., self-policing) due to concerns for their safety. One respondent explained “even if you find them on the lake and tell them don’t set nets where I have already set nets they threaten to just knock you and you would just drown in the night so you don’t bother to start a fight” (FGD, Ggolo, Crew). Under perceived illegitimate governance, monitoring and enforcement activities were dangerous not only for community members, but also for BMU leaders, many of whom “have died on the lake” (KII, District Fisheries Officer).

Second, pervasive distrust undermined positive adaptive actions to climate change such as relying on social relations, networks, and groups (e.g., savings groups, community-based organisations; Figure 3 and Table 2). One focus group participant said that being a part of a successful group would enable them to rely on their social relations for school fees and stated: “if you don’t cooperate with others you can’t go to any friend to assist you in anything, for example school fees when your child is being sent out of school” (FDG, Bbaale Kaziru, Women). Further, membership in successful groups could support additional positive adaptive actions like building up savings and improving processing activities (e.g., storage) (Figure 3 and Table 2). One focus group participant explained: “in a group we can start saving and then get loans more easily” (FGD, Ggolo, Women). Furthermore, a government official indicated that:

If the government was doing interventions you could look at something like storage facilities for processed products at the landing site, but because of that individuality, even if you put a storage facility nobody wants to keep the things, but if you have a group and bring products together they can negotiate better prices and negotiate better markets and the government would have a proper entry point for dealing with these people than dealing with individuals.

(KII, Senior Fisheries Officer)

Furthermore, successful groups were more likely to be the beneficiary of training programs that build adaptive capacity to climate change by contributing to a range of positive adaptive actions (e.g., job training, diversification outside of fisheries) (Table 2). For example, a government official stated: “Even the government says that they will not give money to

an individual but likes to give money to support groups” (KII, Fishery Commissioner). However, within the current context of perceived illegitimate governance, we found that distrust in communities and within groups prohibited positive adaptive actions to climate change and contributed to negative ones. For example, one government official recounted: “I remember there was one [group] that was almost like a mini bank, and then one night the accountant and the manager decided to disappear with all the money” (KII, District Fisheries Officer).

4 | Discussion

Our study identified links between governance legitimacy and climate change adaptation in Ugandan fishing communities, and outlined several scenarios in which perceived governance illegitimacy acted as a barrier to positive adaptive actions. In our discussion, we build on our ‘framework within a framework’ (Figure 1) to illustrate how strengthening legitimacy across scales of governance can contribute to building adaptive capacity to climate change in natural resource dependent communities. We make two main arguments: (1) improving one type of legitimacy improves all other types, and (2) improving governance via legitimacy strengthens all domains of adaptive capacity.

Previous work has indicated that climate change adaptation requires support from all levels of government, but that adaptive actions themselves tend to occur on highly localised scales (i.e., household level; Elrick-Barr et al. 2014; Gupta et al. 2010). Therefore, there is a need to think across scales of governance, dimensions of legitimacy, and domains of adaptive capacity to ensure that interactions between them facilitate local-level (household) decisions that are most beneficial. A wide variety of adaptation strategies have been used to combat climatic stress within households; however, not all strategies have the desired outcome of improving long-term wellbeing (Berkes and Jolly 2001; Kalikoski and Allison 2010; Nyboer et al. 2022). Some strategies are short-term or reactive (e.g., increasing fishing pressure, illegal fishing) and can have negative consequences (Goulden et al. 2013; Lowe et al. 2019; Nyboer et al. 2022), exacerbating negative trends in the resource base and undermining social-ecological resilience (i.e., reciprocal feedbacks; Cinner et al. 2011). On the other hand, effective adaptive actions tend to be longer-term activities (e.g., planting drought-resistant crops) that allow the system to absorb, adjust to, and benefit from change, and can stabilise negative ecosystem trends (i.e., dampening feedbacks; Cinner et al. 2011).

In our study, the case of illegal fishing practices and insufficient monitoring and enforcement across all levels of governance demonstrates how illegitimacy in one dimension undermines governance legitimacy in the others through different but related mechanisms. Our findings align with other studies that demonstrate that legal authority alone is not sufficient for governance legitimacy. Governance and management must also be aligned with the moral principles and values of resource users themselves to earn their acceptance (Jentoft 2000; Lawrence 2013). Therefore, fisheries management regimes that do not justly account for the livelihoods

and food security of fishers and fishing communities are likely to be perceived as illegitimate. Under illegitimate fisheries management, fishers do not recognise regulations over their freedom to harvest, and illegal harvesting practices become the norm (Jentoft 2000). Illegal harvesting practices are supported across scales through additional forms of corruption and illegalities, including the import of illegal gears, re-sale of confiscated illegal gears, illegal fish trade—including informal cross-border trade, and bribery.

In the LVB, our findings indicated that weaknesses in enforcement and corruption were common at all levels of governance, causing deep, inter-stakeholder distrust within and among communities and sectors. Corruption can be understood as a collective action problem and has previously been linked to illegalities and illegitimacy in Uganda (Nunan 2020). For instance, fishers are unlikely to invest in legal gear and methods when they perceive corruption in enforcement and illegalities to be the norm (Nunan 2018). This sets up a reciprocal feedback loop (Liu et al. 2007) where actors pursue illegalities, which diminish the fishery, based on the assumption of corruption and illegalities of others. We illustrate this reciprocal feedback loop through multiple levels of governance illegitimacy. First, we identified insufficient or corrupt monitoring and enforcement to contribute to illegitimacy of the whole institution by setting rule breaking as the norm throughout the system. Second, we identified insufficient or corrupt monitoring and enforcement to contribute to the illegitimacy of local-crafted rules by higher level governments. Lack of devolution of resources, power, authority, and transformative capacity from the central government to local governments and fishing communities prohibited local officials from effectively implementing monitoring and enforcement activities. It is this lack of sufficient enforcement that then allows illegalities to thrive on the lake and contributes to illegitimacy of the rules by the users, which further encourages rule breaking. Such 'disembeddedness', or local communities' loss of control over governance (Giddens 1994; McCay and Jentoft 1998), contributes to reciprocal feedback loops and is an example of how perceived illegitimate governance can promote reactive adaptive actions (i.e., increasing fishing pressure primarily through illegal practices) that may have negative long-term livelihood impacts and erode trust and cooperation in the fishery.

4.1 | Interconnections of Governance With Other Domains of Adaptive Capacity

Governance and institutions are well established in the literature as key determinants of adaptive capacity (e.g., Gupta et al. 2010; Cinner and Barnes 2019; Green et al. 2021); however, they are often presented in adaptive capacity frameworks as one of multiple siloed domains and assessed individually, despite research that acknowledges that capacity in one domain is often necessary to access capacity in other domains (Cinner et al. 2018; Nyboer et al. 2022). Therefore, we draw on our results and the literature to make explicit connections between governance and other domains of adaptive capacity, namely natural capital, learning and knowledge, access to assets, and diversity and flexibility (Green et al. 2021).

4.1.1 | Natural Capital

The previously described reciprocal feedback loop between lack of monitoring and enforcement and illegalities undermines the *natural capital* domain of adaptive capacity by contributing to intensification of fishing pressure with negative impacts on fish stocks. Declining fish stocks, exacerbated by climate change, heighten the need for greater fishing pressure to facilitate the same catch and profits from the lake, which further accelerates the reciprocal feedback loop. Previous research supports the idea of a reciprocal feedback loop or social-ecological trap (e.g., Laborde et al. 2016; Holmes et al. 2025), finding that fishing pressure tends to increase when the fishery is already less productive, despite widespread understanding that these actions are unsustainable (Nyboer et al. 2022). Households that follow this pattern often experience decreases in income and are forced to revert to adaptive actions with negative impacts such as selling off assets or incurring debts (Nyboer et al. 2022). These findings are consistent with a growing number of studies showing that low-income households have lower capacity to mobilise resources necessary to manage climatic stressors (Cinner 2009; Cinner et al. 2011; Boonstra and Hanh 2015; Laborde et al. 2016; Cole et al. 2018; Limuwa et al. 2018).

The reciprocal feedback loop between lack of monitoring and enforcement and illegalities may be an example of a social-ecological trap, which can be defined as a resilient and self-reinforcing cycle with undesirable outcomes (Carpenter and Brock 2008). Social-ecological traps can emerge from external forces (e.g., governance) and historical dynamics (Boonstra et al. 2016). For example, top-down governance can hamper sustainable traditional fishing practices (Eckert et al. 2018), large-scale development can cause habitat destruction that impacts fishers' livelihoods (Beck et al. 2012), and climate change can trigger or worsen trap dynamics (Boonstra and de Boer 2014). Social-ecological traps prevent the flexibility needed for adaptation and undermine adaptive capacity (Carpenter and Brock 2008). Therefore, we argue that governance transformation is required within the Lake Victoria fishery to increase adaptive capacity and achieve more desirable social-ecological conditions (Moore et al. 2014).

4.1.2 | Learning and Knowledge

Social groups are well established in the literature to contribute to the *learning and knowledge* domain of adaptive capacity (Adger 2003; Gupta et al. 2010; Cinner et al. 2018; Green et al. 2021) and contribute to adaptive efficacy (Nyboer et al. 2022). Previous work in the LVB with farmers (Andersson and Gabrielsson 2012) and fishers (Nyboer et al. 2022) have identified self-organisation into social groups as a key response with positive impacts on household well-being. Membership in groups can contribute to *learning and knowledge* by helping fishers access information and better understand their rights (Green et al. 2021). Learning via human capital has also been found to support main-available capital (e.g., uptake of technology, ability to improvise, local innovation) and adaptive capacity for fishers in coastal Ghana

(Freduah et al. 2018). Education is linked to higher involvement in community groups and to adaptive capacity in small-scale fishing households in coastal Madagascar and Kenya (D'agata et al. 2020; Green et al. 2021).

Yet, we found that illegitimate fisheries governance, specifically illegitimacy of the rules by the users, undermines the success of groups (e.g., savings groups, community-based organisations) and limits their positive impacts. Illegitimacy in state accountability to the local level has also hindered local fisherfolks' access to education (e.g., training, sensitisation, human capital), directly impacting knowledge and indirectly impacting the success of and participation in groups. Further, our data indicated that illegitimacy undermines trust, which has also been identified in the literature as contributing to *learning and knowledge* and as a necessary component for adaptive capacity within organisations (Gupta et al. 2010). Therefore, in undermining the success of groups, illegitimacy has negative impacts not only on the *governance and institutions* domain but also on *learning and knowledge*. This is notable as group learning through participation in co-management activities has been found to enhance the adaptive capacity of fisheries communities in South Korea (Kim 2023). This is one mechanism in which multiple domains of adaptive capacity (e.g., *learning and knowledge* and *governance and institutions*) can strengthen each other as it can enhance trust (Cinner et al. 2018). We expand on this point in the *Adaptive co-management* section below.

4.1.3 | Access to Assets

Access to assets is another critical dimension of adaptive capacity and includes both human and financial resources (Gupta et al. 2010). By undermining the success of social groups, illegitimacy directly erodes *access to assets* in addition to negative impacts on *learning and knowledge*. Group membership is an important avenue toward building social capital through networks and relationships, which has also been found to facilitate *access to assets* (Adger 2003). For example, membership in women's groups plays an important role in providing access to financial capital and physical resources in small-scale fishing communities in sub-Saharan Africa (Oloko et al. 2022; Rice, Gondwe, et al. 2024).

Credit, aid, and community infrastructure are additional examples of assets that can facilitate adaptation (Green et al. 2021) by providing resources in times of short term need and improving individuals' abilities to diversify for long-term gain (Haque et al. 2015). Community infrastructure, such as nearby and affordable health centers, can also make it so that individuals do not need to travel far in times of illness and do not need to sell a large portion of their income-earning assets to recover (Cinner et al. 2018). In small-scale fisheries contexts, fishing gear is another essential asset for income-earning opportunities (Green et al. 2021). Given the broad diversity of useful assets, we find that strengthening multiple forms of legitimacy (e.g., state accountability to the local level resulting in greater awareness and fulfilment of local needs [credit, aid, infrastructure], and rules by the users resulting in successful social groups) could aid the adaptive capacity of fisherfolk in Uganda. Similar findings have

occurred in other contexts, as lack of credit was cited to prevent adaptation for fisheries communities in Bangladesh (Islam et al. 2014; Cinner et al. 2018), and lower gear diversity and occupational multiplicity were found to decrease adaptive capacity for fishers in Kenya (Cinner et al. 2015). Other forms of assets include education, technology, and markets, are referred to in connected sections (e.g., *learning and knowledge, diversity and flexibility*).

4.1.4 | Diversity and Flexibility

Livelihood diversification contributes to *diversity and flexibility*, which is also a key domain for adaptive capacity (Gupta et al. 2010; Cinner et al. 2018; Green et al. 2021) and adaptive efficacy (Nyboer et al. 2022). For example, Nyboer et al. (2022) found diversification outside of fisheries to have the most substantial positive impacts on household food security and income. However, we found that perceptions of illegitimate fisheries governance limit the ability of fisherfolk to diversify outside of fisheries, primarily through a lack of state accountability to the local level.

Rural livelihoods have been best represented in the literature as portfolios, and to maintain or improve livelihoods in the face of system shocks, households must rely on a diversity of income-earning activities, especially in non-dominant earning areas (i.e., fishing, in this case) (Habib et al. 2023). Income diversification has been identified as a key strategy for addressing vulnerabilities and enhancing resilience in global small-scale fisheries contexts (Cánovas-Molina and García-Frapolli 2022; Wintergalen et al. 2022). If perceptions of illegitimate fisheries governance persist in Uganda, many fisherfolk may continue to use less effective adaptation strategies in the face of increasingly frequent system shocks.

Another important component of *diversity and flexibility* is connectivity. Connectivity enhances adaptive capacity by fostering networks that offer multiple paths forward in response to system shocks. This concept applies not only to social networks but also to physical infrastructure such as roads (Biggs et al. 2012). Legitimate governance—manifested through government projects and programs that are responsive to the needs of local fisheries actors such as the development of reliable transportation corridors—may enhance the adaptive capacity of both communities and individuals. For instance, access to more extensive and reliable road networks gives fisheries actors multiple options for accessing markets during extreme weather events, such as heavy rainfall that renders unpaved roads impassable. Market accessibility has been shown to significantly influence adaptive capacity for small-scale fishing households in coastal Madagascar and Kenya (D'agata et al. 2020), providing evidence for the importance of infrastructural connectivity. Reliable roads can also strengthen social networks by facilitating access to information, extension services, education, and capital. Such access has been shown to increase awareness of climatic changes and equip individuals with the knowledge necessary for adaptive action (Arbuckle Jr et al. 2015; Jha and Gupta 2021). Ultimately, connectivity may support livelihood diversification—a widely recognised strategy for building adaptive capacity (Green et al. 2021; Mohammed et al. 2021; Beltrán-Tolosa

et al. 2022), and one that has been highlighted by communities themselves.

4.2 | The Adaptive Capacity of Institutions and Adaptive Co-Management

Governance institutions themselves must also be adaptive to endure system shocks like climate change. Co-management, as previously defined, focuses on the devolution of power to the local level and increasing user participation in decision making processes (Armitage et al. 2007). Therefore, effective co-management contributes to the adaptive capacity of governance systems by creating variety. Gupta et al. (2010) describe variety as a key component of adaptive capacity for institutions and illustrate devolution of power as a key mechanism to create necessary variety in governance through multiple scales of government. Further, effective co-management can also strengthen the adaptive capacity of fishing communities themselves by building agency and trust among local fisheries actors by integrating local actors and local knowledge into management and policy (Cinner et al. 2018). While it takes time to overcome distrust created by perceived illegitimacy across scales, effective co-management structures have been found to build trust in governance systems and bolster adaptive capacity in fishing communities (Gelcich et al. 2008; Baral et al. 2010; Gupta et al. 2010).

However, we found that perceptions of illegitimacy of the local-level rules by the higher-level government, resulting from insufficient devolution of power, created ineffective co-management in Uganda and undermined the adaptive capacity of government institutions and the adaptive capacity of local communities and households. Recent literature suggests that co-management alone is not sufficient to build adaptive capacity, but that the concept of co-management needs to be combined with the concept of adaptive management, which focuses on learning-by-doing amid uncertainty (Armitage et al. 2007). *Adaptive co-management* links these two concepts and can be defined as 'flexible, community-based systems of resource management tailored to specific places and situations, and supported by and working with, various organisations at different scales' (Olsson et al. 2004; Armitage et al. 2007). Adaptive co-management includes several key elements, including power sharing, institution building, trust building, social learning, problem solving, and good governance (Armitage et al. 2007). While acknowledging that adaptive co-management may face similar legitimacy challenges, we suggest that adaptive co-management can present a way forward in the Lake Victoria Basin. Adaptive co-management has been found to bolster adaptive capacity of institutions and of fishing communities in other geographic contexts (e.g., Australia and South Korea; Nurse-Bray et al. 2018; Kim 2023) and can re-embed management responsibilities within local communities (McCay and Jentoft 1998). However, it is critical to account for the complexity of local communities, including social differences (e.g., gender, socio-economic status), existing social structures and relations (e.g., traditional leaders), and associated power dynamics (Agrawal and Gibson 1999), for adaptive co-management to be successful. Incorporating local realities from across heterogeneous social groups into policy and governance has long been known to aid in reconstructing

legitimacy (McGregor 2004; Coulthard et al. 2011) and may help address the current perceived shortfalls in legitimacy identified in this study. For example, adaptive co-management could build legitimacy of the local-level rules by the higher-level government and state accountability to the local level through community-based systems of resource management. Further, incorporation of Indigenous and local knowledge and single and double loop learning into policy processes could build legitimacy of the rules by the users and of the institution as a whole (Armitage et al. 2007). It has been established for decades that centralised decision making powers can reduce the resilience of a given society (McGovern 1980); adaptive co-management is one possible mechanism through which power can be effectively decentralised and legitimacy, adaptive capacity, and resilience can be built.

5 | Conclusion

Globally, fisheries management faces a 'legitimacy crisis' that remains unresolved (Jentoft 2000) and has only become increasingly complex in an era of climate change. Despite increasing government regulation in the sector and efforts toward sustainable development at the global level, many fisheries remain overfished and many fishery-dependent communities continue to suffer at the local level (Jentoft 2000), including those in the Lake Victoria Basin. While there are notable success stories in western fisheries management (e.g., Grouper in Gökova Bay, Lake Trout in Lake Superior, Arapaima in the Amazon, and California Golden Trout in the Kern River; Krueger et al. 2019), increasing mismatches between government rhetoric and reality on the ground continue to raise the issue of governance legitimacy in Uganda and beyond. In our study, we found that the legitimacy crisis extends to an adaptation crisis as legitimate governance underpins all other domains of adaptive capacity. Therefore, governance transformation is a fundamental step toward addressing these crises and improving fishery health, fisher wellbeing, and social-ecological resilience.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data is not available due to privacy/ethical considerations.

References

- Adger, N. 2003. "Social Aspects of Adaptive Capacity." In *Climate Change, Adaptive Capacity and Development*, 29–49. World Scientific.
- Adger, N., N. Arnell, and E. Tompkins. 2005. "Successful Adaptation to Climate Change Across Scales." *Global Environmental Change* 15, no. 2: 77–86.
- Agrawal, A., and C. C. Gibson. 1999. "Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation." *World Development* 27, no. 4: 629–649.
- Aloo, P., J. Nijiru, J. Balirwa, and C. Nyamweya. 2017. "Impacts of Nile Perch, *Lates niloticus*, Introduction on the Ecology, Economy and Conservation of Lake Victoria, East Africa." *Lakes & Reservoirs* 22, no. 4: 320–333.
- Andersson, E., and S. Gabrielsson. 2012. "'Because of Poverty, We Had to Come Together': Collective Action for Improved Food Security in Rural Kenya and Uganda." *International Journal of Agricultural Sustainability* 10, no. 3: 245–262.
- Arbuckle, J. G., Jr., L. Morton, and J. Hobbs. 2015. "Understanding Farmer Perspectives on Climate Change Adaptation and Mitigation: The Roles of Trust in Sources of Climate Information, Climate Change Beliefs, and Perceived Risk." *Environment and Behavior* 47, no. 2: 205–234.
- Armitage, D., F. Berkes, and N. Doubleday. 2007. *Adaptive Co-Management: Collaboration, Learning, and Multi-Level Governance*. UBC Press.
- Armitage, D. R., R. Plummer, F. Berkes, et al. 2009. "Adaptive Co-Management for Social-Ecological Complexity." *Frontiers in Ecology and the Environment* 7, no. 2: 95–102.
- AU-IBAR. 2018. "Policy Brief: Co Management Practices in Small-Scale Fisheries: The Case of Beach Management Units (BMUs) in Eastern Africa."
- Bahadur, A., M. Ibrahim, and T. Tanner. 2013. "Characterising Resilience: Unpacking the Concept for Tackling Climate Change and Development." *Climate and Development* 5, no. 1: 55–65.
- Balirwa, J. S. 2007. "Ecological, Environmental and Socioeconomic Aspects of the Lake Victoria's Introduced Nile Perch Fishery in Relation to the Native Fisheries and the Species Culture Potential: Lessons to Learn." *African Journal of Ecology* 45, no. 2: 120–129.
- Baral, N., and M. Stern. 2011. "Capital Stocks and Organizational Resilience in the Annapurna Conservation Area, Nepal." *Society & Natural Resources* 24, no. 10: 1011–1026.
- Baral, N., M. J. Stern, and J. T. Heinen. 2010. "Growth, Collapse, and Reorganization of the Annapurna Conservation Area, Nepal: An Analysis of Institutional Resilience." *Ecology and Society* 15, no. 3: 10.
- Basurto, X., N. L. Gutierrez, N. Franz, et al. 2025. "Illuminating the Multidimensional Contributions of Small-Scale Fisheries." *Nature* 637: 875–884.
- Beck, M., A. Claassen, and P. Hundt. 2012. "Environmental and Livelihood Impacts of Dams: Common Lessons Across Development Gradients That Challenge Sustainability." *International Journal of River Basin Management* 10, no. 1: 73–92.
- Beltrán-Tolosa, L., G. Cruz-García, J. Ocampo, P. Pradhan, and M. Quintero. 2022. "Rural Livelihood Diversification Is Associated With Lower Vulnerability to Climate Change in the Andean-Amazon Foothills." *PLOS Climate* 1, no. 11: e0000051.
- Béné, C., E. Belal, M. O. Baba, et al. 2009. "Power Struggle, Dispute and Alliance Over Local Resources: Analyzing 'Democratic' Decentralization of Natural Resources Through the Lenses of Africa Inland Fisheries." *World Development* 37, no. 12: 1935–1950.
- Berkes, F. 2009. "Evolution of Co-Management: Role of Knowledge Generation, Bridging Organizations and Social Learning." *Journal of Environmental Management* 90, no. 5: 1692–1702.
- Berkes, F., and C. Folke. 1998. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge University Press.
- Berkes, F., and D. Jolly. 2001. "Adapting to Climate Change: Social-Ecological Resilience in a Canadian Western Arctic Community." *Conservation Ecology* 5, no. 2: 18.
- Biggs, R., M. Schlüter, D. Biggs, et al. 2012. "Toward Principles for Enhancing the Resilience of Ecosystem Services." *Annual Review of Environment and Resources* 37: 421–448.
- Boonstra, W., E. Björkvik, L. Haider, W. J. Boonstra, L. J. Haider, and V. Masterson. 2016. "Human Responses to Social-Ecological Traps." *Sustainability Science* 11: 877–889.
- Boonstra, W., and F. de Boer. 2014. "The Historical Dynamics of Social-Ecological Traps." *Ambio* 43: 260–274.
- Boonstra, W., and T. Hanh. 2015. "Adaptation to Climate Change as Social-Ecological Trap: A Case Study of Fishing and Aquaculture in the Tam Giang Lagoon, Vietnam." *Environment, Development and Sustainability* 17: 1527–1544.
- Bourdieu, P. 1985. "The Social Space and the Genesis of Groups." *Theory and Society* 14: 723e744.
- Bourdieu, P. 1986. "The Forms of Capital." In *Handbook of Theory and Research for the Sociology of Education*, edited by J. G. Richardson, 241e258. Greenwood Press.
- Brechin, S. R. 2003. "Wandering Boundaries and Illegal Residents the Political Ecology of Protected Area Deforestation in South Sumatra Indonesia From 1979 to 1992." In *Contested Nature: Promoting International Biodiversity Conservation With Social Justice in the Twenty-First Century*. State University of New York Press.
- Brown, K. 2016. *Resilience, Development and Global Change*. Routledge.
- Cánovas-Molina, A., and E. García-Frapolli. 2022. "A Review of Vulnerabilities in Worldwide Small-Scale Fisheries." *Fisheries Management and Ecology* 29, no. 5: 491–501.
- Carpenter, S., and W. Brock. 2008. "Adaptive Capacity and Traps." *Ecology and Society* 13, no. 2: 40.
- Cinner, J. 2009. "Poverty and the Use of Destructive Fishing Gear Near East African Marine Protected Areas." *Environmental Conservation* 36, no. 4: 321–326.
- Cinner, J., W. Adger, E. Allison, et al. 2018. "Building Adaptive Capacity to Climate Change in Tropical Coastal Communities." *Nature Climate Change* 8, no. 2: 117–123.
- Cinner, J., and M. Barnes. 2019. "Social Dimensions of Resilience in Social-Ecological Systems." *One Earth* 1, no. 1: 51–56.
- Cinner, J., C. Folke, T. Daw, and C. Hicks. 2011. "Responding to Change: Using Scenarios to Understand How Socioeconomic Factors May Influence Amplifying or Dampening Exploitation Feedbacks Among Tanzanian Fishers." *Global Environmental Change* 21, no. 1: 7–12.
- Cinner, J. E., C. Huchery, C. C. Hicks, et al. 2015. "Changes in Adaptive Capacity of Kenyan Fishing Communities." *Nature Climate Change* 5, no. 9: 872–876.
- Cole, S., C. McDougall, A. Kaminski, A. Kefi, A. Chilala, and G. Chisule. 2018. "Postharvest Fish Losses and Unequal Gender Relations: Drivers of the Social-Ecological Trap in the Barotse Floodplain Fishery, Zambia." *Ecology and Society* 23, no. 2: 18.
- Coulthard, S., D. Johnson, and J. A. McGregor. 2011. "Poverty, Sustainability and Human Wellbeing: A Social Wellbeing Approach to the Global Fisheries Crisis." *Global Environmental Change* 21: 453–463.
- Craig, S., and M. Maggiotto. 1982. "Measuring Political Efficacy." In *Political Methodology*, 85–109. JSTOR.

- D'agata, S., E. Darling, G. Gurney, et al. 2020. "Multiscale Determinants of Social Adaptive Capacity in Small-Scale Fishing Communities." *Environmental Science & Policy* 108: 56–66.
- Dutra, L., R. Bustamante, I. Sporne, et al. 2015. "Organizational Drivers That Strengthen Adaptive Capacity in the Coastal Zone of Australia." *Ocean and Coastal Management* 109: 64–76.
- Eckert, L., N. Ban, S. Tallio, and N. Turner. 2018. "Linking Marine Conservation and Indigenous Cultural Revitalization: First Nations Free Themselves From Externally Imposed Social-Ecological Traps." *Ecology and Society* 23, no. 4: 23.
- Elrick-Barr, C. E., B. Preston, D. Thomsen, and T. Smith. 2014. "Toward a New Conceptualization of Household Adaptive Capacity to Climate Change: Applying a Risk Governance Lens." *Ecology and Society* 19, no. 4: 12.
- Engle, N. 2011. "Adaptive Capacity and Its Assessment." *Global Environmental Change* 21, no. 2: 647–656.
- FAO, Duke University, and WorldFish. 2023. "7.4 Small-Scale Fisheries, Poverty, and Food Security and Nutrition: Qualitative Data Provide New Insights in Sub-Saharan Africa." In *Illuminating Hidden Harvests—The Contributions of Small-Scale Fisheries to Sustainable Development*. FAO.
- Fleiss, J., B. Levin, and M. Paik. 2003. *Statistical Methods for Rates & Proportions*. 3rd ed. Wiley & Sons.
- Freduah, G., P. Fidelman, and T. Smith. 2018. "Mobilising Adaptive Capacity to Multiple Stressors: Insights From Small-Scale Coastal Fisheries in the Western Region of Ghana." *Geoforum* 91: 61–72.
- Gelcich, S., M. Kaiser, J. Castilla, and G. Edwards-Jones. 2008. "Engagement in Co-Management of Marine Benthic Resources Influences Environmental Perceptions of Artisanal Fishers." *Environmental Conservation* 35, no. 1: 36–45.
- Giddens, A. 1984. *The Constitution of Society: Outline of the Theory of Structuration*. University of California Press.
- Giddens, A. 1994. *The Consequences of Modernity*. Polity Press.
- Goulden, M., W. Adger, E. Allison, and D. Conway. 2013. "Limits to Resilience From Livelihood Diversification and Social Capital in Lake Social-Ecological Systems." *Annals of the Association of American Geographers* 103, no. 4: 906–924.
- Green, K., J. Selgrath, T. Frawley, et al. 2021. "How Adaptive Capacity Shapes the Adapt, React, Cope Response to Climate Impacts: Insights From Small-Scale Fisheries." *Climatic Change* 164: 15.
- Gupta, J., C. Termeer, J. Klostermann, et al. 2010. "The Adaptive Capacity Wheel: A Method to Assess the Inherent Characteristics of Institutions to Enable the Adaptive Capacity of Society." *Environmental Science & Policy* 13, no. 6: 459–471.
- Habib, N., A. Ariyawardana, and A. A. Aziz. 2023. "The Influence and Impact of Livelihood Capitals on Livelihood Diversification Strategies in Developing Countries: A Systematic Literature Review." *Environmental Science and Pollution Research* 30: 69882–69898.
- Haque, C., C. Idrobo, F. Berkes, and D. Giesbrecht. 2015. "Small-Scale Fishers' Adaptations to Change: The Role of Formal and Informal Credit in Paraty, Brazil." *Marine Policy* 51: 401–407.
- Holmes, R., K. McFarlane, E. Challies, C. MacNeil, and J. Arnold. 2025. "The Social-Ecological Fabric of Freshwater Fish Management: Accounting for Feedback Loops in Human–Fish Interactions." *Ecosphere* 16, no. 4: e70249.
- IPCC. 2014. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change." In *Climate Change 2014: Impacts, Adaptation, and Vulnerability*, 1132. IPCC.
- Islam, M., S. Sallu, K. Hubacek, and J. Paavola. 2014. "Limits and Barriers to Adaptation to Climate Variability and Change in Bangladeshi Coastal Fishing Communities." *Marine Policy* 43: 208–216.
- Jentoft, S. 2000. "Legitimacy and Disappointment in Fisheries Management." *Marine Policy* 24, no. 2: 141–148.
- Jentoft, S. 2005. "Fisheries Co-Management as Empowerment." *Marine Policy* 29, no. 1: 1–7.
- Jentoft, S., and R. Chuenpagdee. 2015. "Interactive Governance for Small-Scale." In *Fisheries*, vol. 13. Springer International Publishing.
- Jha, C., and V. Gupta. 2021. "Do Better Agricultural Extension and Climate Information Sources Enhance Adaptive Capacity? A Micro-Level Assessment of Farm Households in Rural India." *Ecofeminism and Climate Change* 2, no. 2: 83–102.
- Kalikoski, D., and E. Allison. 2010. "Learning and Adaptation: The Role of Fisheries Co-management in Building Resilient Social-Ecological Systems." In *Adaptive Capacity and Environmental Governance. Springer Series on Environmental Management*, edited by D. Armitage and R. Plummer. Springer.
- Kim, S. 2023. "Adaptive Capacity and Local-Level Fisheries Co-Management Activities: A Case of South Korea." *Marine Policy* 154: 105665.
- Krueger, C., W. Taylor, and S. Youn. 2019. *From Catastrophe to Recovery: Stories of Fishery Management Success*. American Fisheries Society.
- Laborde, S., A. Fernandez, S. Phang, et al. 2016. "Social-Ecological Feedbacks Lead to Unsustainable Lock-In in an Inland Fishery." *Global Environmental Change* 41: 13–25.
- Lawrence, T. 2013. "Taking the 'Co' Out of 'Co-Management' the Delegitimization of Fishing Communities on Lake Victoria, E. Africa." In *Water Co-Management*. CRC Press.
- Limuwa, M., B. Sitaula, F. Njaya, and T. Storebakken. 2018. "Evaluation of Small-Scale Fishers' Perceptions on Climate Change and Their Coping Strategies: Insights From Lake Malawi." *Climate* 6, no. 2: 34.
- Liu, J., T. Dietz, S. R. Carpenter, et al. 2007. "Complexity of Coupled Human and Natural Systems." *Science* 317: 1513–1516.
- Lowe, B., S. Jacobson, H. Anold, et al. 2019. "Adapting to Change in Inland Fisheries: Analysis From Lake Tanganyika, East Africa." *Regional Environmental Change* 19: 1765–1776.
- MAAIF. 2017. *National Fisheries and Aquaculture Policy*. Ministry of Agriculture, Animal Industry, and Fisheries.
- Matsuishi, T., L. Muhoozi, O. Mkumbo, et al. 2006. "Are the Exploitation Pressures on the Nile Perch Fisheries Resources of Lake Victoria a Cause for Concern?" *Fisheries Management and Ecology* 13, no. 1: 53–71.
- May, C. 2013. "Power Across Scales and Levels of Fisheries Governance: Explaining the Active Non-Participation of Fishers in Two Rivers, North Carolina." *Journal of Rural Studies* 32: 26–37.
- McCay, B., and S. Jentoft. 1998. "Market or Community Failure? Critical Perspectives on Common Property Research." *Human Organization* 57, no. 1: 21–29.
- McGovern, T. H. 1980. "Cows, Harps Seals, and Churchbells: Adaptation and Extinction in Norse Greenland." *Human Ecology* 8: 245–275.
- McGregor, J. 2004. "Researching Wellbeing: Communicating Between the Needs of Policy Makers and the Needs of People." *Global Social Policy* 4, no. 3: 337–358.
- Mohammed, K., E. Batung, M. Kansanga, H. Nyantakyi-Frimpong, and I. Luginaah. 2021. "Livelihood Diversification Strategies and Resilience to Climate Change in Semi-Arid Northern Ghana." *Climatic Change* 164: 1–23.

- Moore, M., O. Tjornbo, E. Enfors, et al. 2014. "Studying the Complexity of Change: Toward an Analytical Framework for Understanding Deliberate Social-Ecological Transformations." *Ecology and Society* 19, no. 4: 54.
- Mpomwenda, V., D. M. Kristófersson, A. Taabu-Munyaho, T. Tómasson, and J. Pétursson. 2021. "Fisheries Management on Lake Victoria at a Crossroads: Assessing Fishers' Perceptions on Future Management Options in Uganda." *Fisheries Management and Ecology* 29, no. 2: 196–211.
- Musinguzi, L., J. Efitre, K. Odongkara, et al. 2016. "Fishers' Perceptions of Climate Change, Impacts on Their Livelihoods and Adaptation Strategies in Environmental Change Hotspots: A Case of Lake Wamala, Uganda." *Environment, Development and Sustainability* 18, no. 4: 1255–1273.
- Natugonza, V., C. Nyamweya, E. Sturludóttir, et al. 2022. "Spatiotemporal Variation in Fishing Patterns and Fishing Pressure in Lake Victoria (East Africa) in Relation to Balanced Harvest." *Fisheries Research* 252: 106355.
- Njiru, M., P. Nzungi, A. Getabu, et al. 2007. "Are Fisheries Management Measures in Lake Victoria Successful? The Case of Nile Perch and Nile Tilapia Fishery." *African Journal of Ecology* 45, no. 3: 315–323.
- Nunan, F. 2006. "Empowerment and Institutions: Managing Fisheries in Uganda." *World Development* 34, no. 7: 1316–1332.
- Nunan, F. 2018. "Compliance, Corruption, and Co-Management: How Corruption Fuels Illegalities and Undermines the Legitimacy of Fisheries Co-Management." *International Journal of the Commons* 12, no. 2: 58–79.
- Nunan, F. 2020. "The Political Economy of Fisheries Co-Management: Challenging the Potential for Success on Lake Victoria." *Global Environmental Change* 63: 102101.
- Nursey-Bray, M., P. Fidelman, and M. Owusu. 2018. "Does Co-Management Facilitate Adaptive Capacity in Times of Environmental Change? Insights From Fisheries in Australia." *Marine Policy* 96: 72–80.
- Nyboer, E., C. Liang, and L. Chapman. 2019. "Assessing the Vulnerability of Africa's Freshwater Fishes to Climate Change: A Continent-Wide Trait-Based Analysis." *Biological Conservation* 236: 505–520.
- Nyboer, E., L. Musinguzi, R. Ogutu-Ohwayo, et al. 2022. "Climate Change Adaptation and Adaptive Efficacy in the Inland Fisheries of the Lake Victoria Basin." *People and Nature* 4, no. 5: 1319–1338.
- Ogutu-Ohwayo, R. 1990. "The Decline of the Native Fishes of Lakes Victoria and Kyoga (East Africa) and the Impact of Introduced Species, Especially the Nile Perch, *Lates niloticus*, and the Nile Tilapia, *Oreochromis niloticus*." *Environmental Biology of Fishes* 27: 81–96.
- Ogutu-Ohwayo, R., V. Natugonza, L. Musinguzi, M. Olokotum, and S. Naigaga. 2016. "Implications of Climate Variability and Change for African Lake Ecosystems, Fisheries Productivity, and Livelihoods." *Journal of Great Lakes Research* 442, no. 3: 498–510.
- Oloko, A., K. Fakoya, S. Ferse, A. Breckwoldt, and S. Harper. 2022. "The Challenges and Prospects of Women Fisherfolk in Makoko, Lagosstate, Nigeria." *Coastal Management* 50, no. 2: 124–141.
- Olsson, P., C. Folke, and F. Berkes. 2004. "Adaptive Co-Management for Building Resilience in Social-Ecological Systems." *Environmental Management* 34, no. 1: 75–90.
- Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.
- Ostrom, E. 1999. *Self-Governance and Forest Resources*. Vol. 15. CIFOR.
- Paul, C., E. Weinthal, M. Bellemare, and M. Jeuland. 2016. "Social Capital, Trust, and Adaptation to Climate Change: Evidence From Rural Ethiopia." *Global Environmental Change* 36: 124–138.
- Pomeroy, R., and F. Berkes. 1997. "Two to Tango: The Role of Government in Fisheries Co-Management." *Marine Policy* 21, no. 5: 465–480.
- Pomeroy, R. S., and R. Rivera-Guieb. 2006. *Fisheries Co-Management: A Practical Handbook*. CABI Publishing.
- Pringle, R. 2005. "The Origins of the Nile Perch in Lake Victoria." *Bioscience* 55, no. 9: 780–787.
- Ribot, J. 2002. *Democratic Decentralization of Natural Resources: Institutionalizing Popular Participation*. World Resources Institute.
- Ribot, J. C., J. F. Lund, and T. Treue. 2010. "Democratic Decentralization in Sub-Saharan Africa: Its Contribution to Forest Management, Livelihoods, and Enfranchisement." *Environmental Conservation* 37, no. 1: 35–44.
- Rice, E., A. Bennett, M. Smith, et al. 2024. "Price Volatility in Fish Food Systems: Spatial Arbitrage as an Adaptive Strategy for Small-Scale Fish Traders." *Ecology and Society* 29, no. 2: 13.
- Rice, E., E. Gondwe, A. Bennett, et al. 2024. "The Future of Gender Research in Small-Scale Fisheries: Priorities and Pathways for Advancing Gender Equity." *Fish and Fisheries* 25: 401–408.
- Smit, B., and O. Pilifosova. 2003. "From Adaptation to Adaptive Capacity and Vulnerability Reduction." In *Climate Change, Adaptive Capacity and Development*. Imperial College Press.
- Taabu-Munyaho, A., B. E. Marshall, T. Tomasson, and G. Marteinsdottir. 2016. "Nile Perch and the Transformation of Lake Victoria." *African Journal of Aquatic Science* 41, no. 2: 127–142.
- Trisos, C. H., I. O. Adelekan, E. Totin, et al. 2022. "Africa." In *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, 1285–1455. Cambridge University Press.
- Weber, M. 1978. *Economy and Society: An Outline of Interpretive Sociology*. University of California Press.
- Whitney, C. K., N. J. Bennett, N. C. Ban, et al. 2017. "Adaptive Capacity: From Assessment to Action in Coastal Social-Ecological Systems." *Ecology and Society* 22, no. 2: 22.
- Wintergalen, E. W., R. Oyanedel, J. C. Villaseñor-Derbez, S. Fulton, and R. Molina. 2022. "Opportunities and Challenges for Livelihood Resilience in Urban and Rural Mexican Small-Scale Fisheries." *Ecology and Society* 27: 3.