Marine Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Exploring trade-offs in climate change response in the context of Pacific Island fisheries

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ARTICLE INFO

Keywords:
Climate change
Pacific Islands
Small-scale fisheries
Trade-offs
Response capacity

ABSTRACT

Climate change poses significant and increasing risks for Pacific Island communities. Sea-level rise, coastal flooding, extreme and variable storm events, fish stock redistribution, coral bleaching, and declines in ecosystem health and productivity threaten the wellbeing, health, safety, and national sovereignty of Pacific Islanders, and small-scale fishers in particular. Fostering the response capacity of small-scale fishing communities will become increasingly important for the Pacific Islands. Challenging decisions and trade-offs emerge when choosing and mobilizing different responses to climate change. The trade-offs inherent in different responses can occur between various exposures, across spatial and temporal scales, among segments of society, various objectives, and evaluative criteria. Here we introduce a typology of potential trade-offs inherent in responses, elaborated through examples from the Pacific. We argue that failure to adequately engage with trade-offs across human responses to climate change can potentially result in unintended consequences or lead to adverse outcomes for human vulnerability to climate change. Conversely, proactively identifying and addressing these trade-offs in decision-making processes will be critical for planning hazard mitigation and preparing island nations, communities, and individuals to anticipate and adapt to change, not only for Pacific Islands, but for coastal communities around the world.

1. Introduction

Climate change poses severe – often existential – threats to coastal communities and ecosystems worldwide. Coasts are already experiencing adverse consequences, such as coastal inundation, erosion, ecosystem loss, salinization, increased vulnerability to extreme storm events, and transmission of infectious diseases [1–3]. Over the coming decades, risks related to climate change such as increasing climate variability, sea level rise, warming seas, ocean acidification, and deoxygenation are expected to increase [3]. An anticipated 50% of the global population will live within 100 km of the coast by 2030, further increasing human vulnerability to coastal storms, flooding, and other disturbances [3,4].

Socioeconomic impacts of climate change are unevenly distributed within and among nations, regions, communities, and individuals due to different exposures and vulnerabilities [5]. Globally, there is differential access to and distribution of resources, technology, information, wealth, risk perceptions, social capital, community structure, and institutions addressing climate change hazards, which is compounded by various exposure types, intensities, frequencies, and durations. Furthermore, climate change does not occur in isolation, but interacts with structural processes like poverty and marginalization. Ultimately, these interactions produce a suite of different social and ecological outcomes across temporal, spatial, jurisdictional, and institutional scales [5–7]. The goal of this exploratory paper is to recognize the nature of these different outcomes generated by climate change, and highlight subsequent trade-offs in climate change response, in the context of fishing communities of Pacific Island countries and territories (PICTs).

1.1. Climate change impacts on Pacific Island countries and territories

PICTs are extremely vulnerable to the impacts of climate change and in some cases face complete inundation, potentially requiring forced displacement [8]. Sea-level rise, flooding, and coastal storms are

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http://dx.doi.org/10.1016/j.marpol.2017.09.032
Received 22 March 2017; Received in revised form 31 August 2017; Accepted 25 September 2017

threatening the very existence of small atoll nations such as Kiribati and Tuvalu, by undermining food security, habitability, and human health and safety [9]. Leaders from these vulnerable atoll nations are already planning for relocation and reestablishment in new geographies, balancing the harsh reality of the stress that such actions will place on their people, while developing alternatives to ensure the continuation of cultural ways of life and sovereignty.

In addition to facing inundation from sea-level rise, many Pacific Island communities depend on their local, nearshore fisheries for food security, livelihoods, and cultural purposes [10,11]. In the context of climate change, fisheries in the tropics are currently threatened by major changes in fish distribution, with a predicted net movement of fish stocks out of the tropics into higher latitudes [12,13]. Coral reef degradation, from changes in water temperature and chemistry, is a major threat to essential fisheries habitat. Furthermore, an increase in intensity and variability in coastal storms can pose safety hazards to fishers and reduce access to fishing as an important livelihood source.

1.2. Climate change and human rights

The interactive effects of climate change with inequalities already experienced by PICTs and marginalized populations threaten fundamental human rights; climate change can erode small-scale fishing livelihoods and food security thereby threatening social, economic, and cultural rights. Forced migration and loss of sovereignty severely undermines civil and political rights [14]. Thus, actions must be taken to create and enact climate change policy to alleviate the effects felt by the most vulnerable.

While human rights are threatened by climate change, climate change policy can further exacerbate existing inequalities [15]. Climate change mitigation and adaptation policies can be at odds with development and poverty alleviation goals, generating trade-offs and unintended consequences [16,17]. For example, in the context of the PICTs, marine protected areas designed to buffer the effects of climate change on the local marine environment can preclude access of small-scale fishers to their livelihoods and food sources, making them more vulnerable to subsequent climate-related disasters [18,19]. On the other hand, failure to maintain resources through adequate management and conservation strategies can also result in significant social and economic impacts. Thus, there is an important need to evaluate ancillary costs and benefits of climate change policy against development goals, as well as distributional impacts on different demographics, populations, and communities [16].

1.3. Climate change response

Given the global scale of climate change, the variance in country-level contribution of green house gas emissions, and disproportionate impacts experienced locally and regionally, climate change mitigation usually occurs at the level of the national government in response to international negotiations, while adaptation generally occurs at the local level [20]. Collectively, the degree to which individuals, households, communities, societies or nations can respond to climate change is determined by available assets, the rights afforded to them, and their relative agency to access and leverage these assets and rights [21–23]. The resulting latent quality, response capacity – also defined as a broad pool of development related resources that can be mobilized in the face of risk, describes the ability to both *mitigate* climate change impacts and *adapt* to experienced or anticipated impacts [20]. Response capacity is linked to actual decisions and actions by socio-cultural factors like risk perception and access to information [24]. For example, high response capacity in a given household does not always engender immediate response in the face of climate change if perceived risk is low. These realized responses to climate change can be involuntary, passive, planned, autonomous, reactive (ex-post), or anticipatory (ex-ante) [20,25,26].

Depending on key decisions made during climate change response, alternative outcomes can emerge – putting nations, communities, or households on a pathway that is adaptive or maladaptive [27]. Such decisions may be contingent on addressing questions such as [28]: what climate phenomenon (or non-climate phenomenon) requires immediate response and at what temporal or spatial scale? Who or what is expected or mobilized to respond? How does response occur? For example, is it a reactive coping strategy mobilized by a fishing household after a big storm event? Or is it a fishing cooperative's anticipatory attempt to confront potential hardship by setting aside a disaster relief fund? Is it mangrove restoration by a community organization to improve storm buffers and fish nurseries? Or is it the allocation of development funds by the national government for community health clinics? The response landscape comprises alternative actions that might be considered, each with the potential for tradeoffs or synergies. In other words, the benefits and costs of responses can accrue differentially across scales, sectors, populations, systems, and so on. [23]. These trade-offs and synergies can be a result of explicit choice or completely unexpected and unanticipated dynamic interactions that emerge over time [29].

Remarkably, trade-offs are often overlooked in climate mitigation and adaptation planning and decision-making, as well as other conservation and development policies [30]. Trade-offs are inherently value-laden and thus power and politics play a critical role in the initial recognition of potential trade-offs, and in subsequent decisions to address certain trade-offs (or not). Some trade-offs may be invisible through a difference in values, or be hidden under dominant discourses [31]. Often the most vulnerable do not have a voice in decision-making, thus trade-offs relevant to them will not be brought to the table [30]. Another challenge precluding the explicit consideration of trade-offs are that innovative and novel solutions are likely required to adequately address them, requiring resources and time [31]. Despite these challenges, it will become increasingly critical to bring trade-offs to the forefront of climate policy discussion and decision-making; climate responses that ignore trade-offs can result in unintended consequences or mal-adaptations with severe consequences for the most vulnerable [27].

The central contribution of this paper is to explore the potential trade-offs inherent in mobilizing different responses to climate change, which might be used to encourage explicit attention to trade-offs in decision-making for avoiding maladaptive processes. Next we will propose a trade-off typology and discuss examples of these trade-offs in the context of fishing-dependent communities and households in PICTs.

2. Trade-off typology

Deliberate or dynamic trade-offs inherent in climate response may occur across and within various exposure types, among desired objectives, across and within scales, among segments of society, or in evaluative criteria (Fig. 1, Box 1). Furthermore, alternative actions and subsequent trade-offs in one domain can result in dynamic interactions across domains (Fig. 1). For example, a decision to prioritize economic objectives over socio-cultural objectives in climate change response can generate trade-offs across segments of society (Fig. 1). Thus trade-offs can be sequential or synchronous. Although path dependence among trade-offs may move systems along maladaptive pathways towards social-ecological traps, greater recognition of and preparation for trade-offs in climate change response, can increase the potential for reversing these traps [27]. The subsequent sections are not meant to be an exhaustive or systematic analysis of trade-offs, but rather an exploration of six potential trade-off domains and their relevance to fishing communities in PICTs.

2.1. Trade-offs among and within different exposures

Households, communities, and countries face myriad exposure