



Subsistence in isolation: Fishing dependence and perceptions of change on Kiritimati, the world's largest atoll



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ABSTRACT

Small island nations are reliant on local fishery resources due to their geographic isolation. The people of Kiritimati, the world's largest atoll, are ranked amongst the most vulnerable to degradation of their local reef resources because of their high reef dependence and exposure to threats. We conducted semi-structured interviews in 103 households, stratified across the atoll's five villages, to characterize Kiritimati's fishery, and to examine people's perceptions of the fishery status and their fishery dependence (assessed by responses to hypothetical declines in fishery catches). High immigration rates have created a shifting baseline in the community, with more recent immigrants perceiving the local fishery to be in better condition than those who have fished on Kiritimati over the long term. Due to their high dependence on fishery resources and limited alternatives for feeding their families, 70% of respondents anticipated continuing to fish even during a fifty percent hypothetical fishery decline. Despite these limitations to adaptive capacity, the people of Kiritimati were open to discussing new conservation policies that would conserve their fisheries, suggesting that locally supported conservation strategies may aid in alleviating some of their vulnerability. This study demonstrates how poverty and geographic isolation can drive low adaptive capacity to resource changes, and suggests that policy interventions are needed to avoid further reef fishery degradation and to support fishery-dependent livelihoods.

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1. Introduction

Globally, coral reefs are under threat from the combined impacts of local fishing and pollution, global climate change, and other stressors (Pandolfi et al., 2003; Hoegh-Guldberg et al., 2007). In many small-island nations, diminished reef resources also imperil the local communities who depend on these ecosystems for their sustenance and livelihoods (Wilkinson, 2008; Bell et al., 2009; Teh et al., 2013). The long-term sustainability of reef fisheries and reef-dependent communities depends upon the threat exposure to the reef, the level of dependence on reef resources, and the adaptive capacity of the communities (Burke et al., 2011).

Adaptive capacity describes the ability to modify behaviour to adjust to changes, risks, or opportunities (Smit and Wandel, 2006). Social, ecological, and economic characteristics, varying across scales from country to the individual, can influence adaptive

capacity (Smit and Wandel, 2006; Bunce et al., 2010). At a local scale, the willingness of individuals to adapt to changes in resources may be driven by household economic conditions (Cinner et al., 2009; Cinner, 2011), by opportunities for alternative livelihoods (Daw et al., 2012), or by social aspects such as cultural attachment to their way of life (Muallil et al., 2011; Walsh, 2009). Larger scale influences including economic context and geography also may impact the responses of a community to change (Daw et al., 2012). Island nations typically have low capacity to respond to changes in food and economic security due to factors ranging from limited space and infrastructure to high dependence on fisheries (Barnett and Adger, 2003; Turner et al., 2007). This limited adaptive capacity can exacerbate fisheries collapses if external stressors significantly impact the social-ecological system (Bunce et al., 2009). In contrast to previous assessments of fishers' adaptive capacity in more connected coastal communities (Cinner et al., 2009, 2011), we examine community responses to fisheries change on a very isolated Pacific atoll.

Assessing fishers' perceptions of ecosystem change can elucidate how they may react to future changes and how factors that influence their choices can be used to inform fisheries

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management. Individuals' perceptions of the state of their resources are influenced by socioeconomic factors including education, age, and occupation (Cinner and Pollnac, 2004), and can provide important information on how resources are used, valued, and managed. One measure of fishers' dependence on their reef resources and associated adaptive capacity is through their responses to a hypothetical decline in fishery resources (Cinner et al., 2011; Daw et al., 2012). In these studies, fishers are specifically asked whether they would choose to continue fishing as before, to increase their fishing efforts, or to stop fishing entirely. As fishery resources progressively deteriorate, more fishers usually report that they would exit the fishery, indicating changing adaptive strategies at different levels of perceived environmental degradation (Cinner et al., 2011). In a general framework, individual responses can act to cumulatively amplify or dampen fishery resource degradation, with consequences for local fish stocks and management outcomes (Cinner et al., 2011).

The Republic of Kiribati is a nation of 33 atolls and islands scattered over 5 million km² of the equatorial Pacific Ocean. As one of 40 Small Island Developing States (SIDS) it faces distinct developmental and environmental challenges (UN-OHRLS, 2011). Kiribati is one of the world's most vulnerable countries to the impacts of coral reef degradation owing to its high reef dependence, its high exposure to threats including overfishing and climate change, and its low capacity to adapt to changes (Burke et al., 2011). Kiritimati Island (pronounced "Christmas") comprises over half of the Republic of Kiribati's total land area (Office of Te Beretitenti, 2012a; 01°52'N 157°24'W, Northern Line Islands), and is the world's largest coral atoll by land mass (Fig. 1). Kiritimati is very isolated, being over 3000 km distant from the nation's capital of South Tarawa, and 2000 km from Honolulu, Hawaii. The island's population of approximately 5,500 (Kiribati National Statistics Office, 2012) is highly reliant on the reef's resources for subsistence fishing, aquarium fish exports, and sport fishing tourism (Awira et al., 2004; Walsh, 2011). Kiritimati is one of Kiribati's least densely populated islands with a population density of 14 people per km² (compared to 3184 people per km² on South Tarawa; Office of Te Beretitenti, 2012a, 2012b). Despite this, the population is concentrated within a few villages on the northern end of the atoll (Fig. 1) where it has been shown that high fishing pressure has

degraded the local reef fishery's resources (Sandin et al., 2008; Walsh, 2009). Kiritimati's population is also rapidly increasing because of a population re-settlement programme from South Tarawa to Kiritimati that was initiated in the 1980's (Asian Development Bank, 2002). This resettlement programme continues today, and in the 2010 census, over 60% of the people on Kiritimati identified themselves as having migrated to the atoll. Unmanaged population growth and concurrent increasing pressure on marine resources stand to further degrade the island's fishery, as has occurred on South Tarawa (Beets, 2000). The future health and independence of the I-Kiribati (the people of Kiribati) will require sustainable development of the local subsistence fishery.

We interviewed residents of Kiritimati with the aim of assessing how people with very high reef fishery dependence perceive and adapt to changes in their fishery resources. Specifically, we characterized fishery practises and the spatial distribution of current fishing pressure, and assessed perceptions of fishery status, reliance on the fishery, and attitudes towards fishery management. We hypothesized that socioeconomic factors including personal wealth, current occupation, and migration status would influence Kiritimati fishers' perceptions of the state of their local fishery and their individual capacity to adapt to resource changes. Together, this study illustrates that communities with a combination of high reef dependence and geographic isolation have limited capacity to adapt to changes in their reef resources.

2. Methods

2.1. Study design and socioeconomic assessment

Semi-structured interviews were conducted on Kiritimati in August 2013. Interviews were held with the male head of household, but in cases of their absence, their wife or eldest member of the household with knowledge of family and fishing activities was interviewed. Interviewed women did not report taking part in fishing activities, although we observed women during interview work taking part in post-fishing activities such as the processing and preparation of catch. Generally, in Kiribati fishing ability is considered a symbol of social status and respect amongst men and is not seen among women's traditional roles, though women may

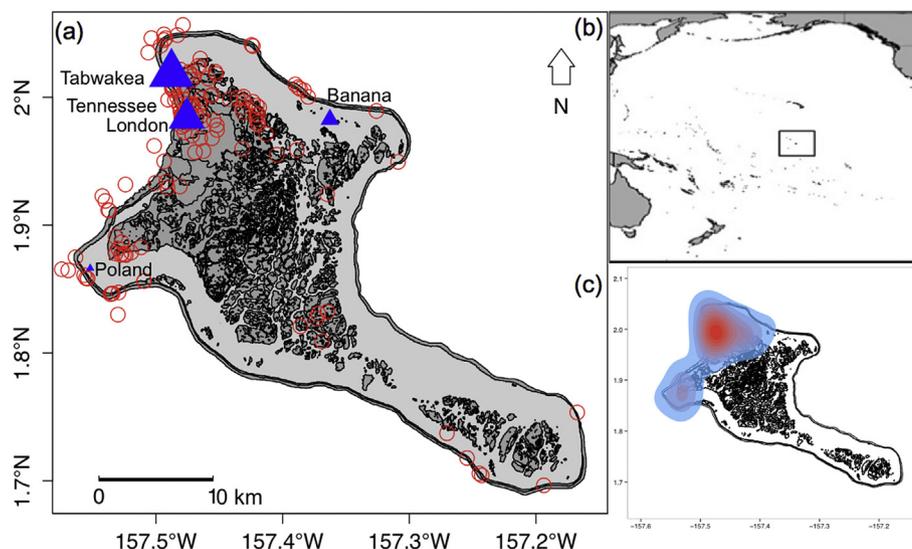


Fig. 1. (a) Map of Kiritimati Island, villages (blue triangles; size indicates relative populations), and survey respondents' regular fishing locations (red circles). (b) Kiritimati's location within the Pacific Ocean. (c) Density of reported fishing locations around the atoll (low density = blue, high density = red). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

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