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Marine dependent livelihoods and resilience to environmental change: A case study of Anguilla

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ABSTRACT

There is increasing concern over the consequences of environmental change for people and communities that depend on already fragile marine resources, given the mounting evidence of sustained over-exploitation and climate change impacts on marine systems. In order to explore the potential social resilience of marine-dependent livelihoods to environmental change, interviews with fishers and marine-based tourism operators in the Caribbean island of Anguilla were undertaken, to identify the impacts of hurricane events on marine livelihoods, the perceptions of resource-users and their potential adaptability to future change. For both sectors of resource-users, there is evidence that they have diversified livelihoods to achieve financial security, which may provide resilience to future climate related impacts or resource variability. In addition, specific behavioural changes that have been developed following previous hurricane events, e.g. removal of fish pots during hurricane months, or bringing boats to shore, indicate fishers' flexibility to changing conditions. However, strong personal and cultural attachment to occupations, particularly among fishers, may hinder resilience. Additionally, the reliance of all of these marine resource-users on the climate-dependent tourism industry may undermine their capacity to cope with future environmental change. Many of these problems are common throughout the Caribbean, as thousands of marine-dependent livelihoods are vulnerable to marine degradation and climate change impacts. Urgent attention is therefore required to support the development of adaptive, sustainable management of marine resources that may enhance resilience to environmental change.

1. Introduction

Coastal communities throughout the developing world are recognised as being particularly vulnerable to environmental change [1–3]. Many are dependent upon already depleted natural resources and degraded coastal systems, and may consequently be highly susceptible to changes in the condition of the natural resources upon which they rely [4,5]. In tropical regions, coastal ecosystems and communities may also be at risk from the impacts of natural phenomena such as earthquakes, tsunamis and hurricanes, with serious implications for human security and livelihood opportunities [6,7]. In addition, there is growing evidence of global climate change effects on coastal resource-dependent communities; for example through impacts on fish stocks and fisheries [3,8], increases in the frequency and severity of coral bleaching events [9,10] and threats to coastal resources from sea-level rise [11,12]. Consequently, there is considerable concern regarding the repercussions of global and local environmental change on coastal resource-dependent communities and industries [5,13].

Natural resource-dependency describes the direct association between the livelihoods of individuals, sectors or communities, and a natural resource and its local economy [14]. Close links between social and ecological systems, of which coastal resource-dependent users and industries are a prime example, can have major implications for managing and adapting to environmental change [4,15]. The ability of social-ecological systems to adapt to environmental and climatic change has gained prevalence, notably through the concept of 'resilience' for example, see [16,17–19]. The resilience of social-ecological systems is identified by their ability to cope with external stresses and disturbances resulting from social, political, or environmental change [20].

The resilience of many coastal communities largely depends on the flexibility of individual resource-users, or the 'social resilience' available to deal with and adapt to change or variability [14,21], as well as the ability of communities to act collectively i.e. their 'social capital' see [16]. The social resilience of individuals can be

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influenced by a series of key components, including individual perception of risk associated with change, ability to plan, learn and reorganise, and social, economic and environmental dependencies such as the level of attachment to specific occupations and places, employability, family characteristics and financial status [22]. For example, it has been suggested that individuals with few family responsibilities, more financial security, and weak attachment to a resource-dependent occupation, may be more able or willing to change occupation, hence increasing their resilience and reducing their vulnerability [21]. The existence of diverse livelihood systems has also been identified as an important component that can enhance individual and community adaptability to disturbance and change [13]. Livelihood diversification can reduce the threat of livelihood failure in resource-dependent systems, by spreading risk across more than one source of income, and it may help to overcome variations associated with resource seasonality, market failures and uncertainties [23].

Several studies have investigated the vulnerability of coastal and marine resource-dependent communities and nations to climatic change [3,4,24]. However, until recently, the implications of climate variability on the lives and livelihoods of marine resource-users at local scales have been less well explored [13,25]. Investigations of individual perceptions of environmental change have commonly used a livelihoods approach see [13,23]. This approach focuses on local-scale assets (land, stock, savings etc.), capabilities and activities of resource-dependent people, and assesses how different livelihood strategies can affect the ability of people or groups to withstand disturbance or change [23].

Here a livelihoods approach is used to assess the resilience of marine and coastal resource-users to environmental change on the Caribbean island of Anguilla, a country highly dependent on marine and coastal resources, with no other significant economic industries [26,27]. This study focuses on the effects of hurricanes to examine the resilience of communities to environmental change, as the islands of the Caribbean are particularly at risk from these extreme events [28,29]. The impacts from North Atlantic hurricane activity are expected to increase in the Caribbean region in response to changing global climate conditions [2,30], although specific changes in hurricane risk for the Caribbean are not yet fully understood e.g. see [31,32]. Nevertheless, hurricanes have considerable impacts on Caribbean islands and the increasing prevalence of these extreme events is a major concern for the region [28,33,34].

The aim of this study is to explore the social-resilience of marine resource-dependent livelihoods on the Caribbean island of Anguilla to environmental stressors by (1) identifying the characteristics of marine and coastal resource-dependent users and livelihoods, (2) assessing the impacts of previous hurricane events on these resource-dependent livelihoods, and (3) investigating resource-user perceptions of future environmental change on the resource and livelihood security.

2. Methods

2.1. The study location

The study was undertaken in Anguilla, a small island in the Lesser Antilles chain in the Caribbean Sea (Fig. 1). Like many islands in the Caribbean, the island of Anguilla depends heavily on its marine and coastal resources for fisheries and tourism [34,35]. Fishing in Anguilla is largely artisanal, and there are approximately 300 outboard-powered open-top fishing vessels, most of which are between 5 and 10 m in length. The majority of fishers operate close to shore, but due to low inshore catch rates, many vessels have expanded their range to within approximately 65 km radius of the island [27]. The inshore coral reef fishery principally targets reef fish (e.g. groupers (Serranidae), parrotfish (Scaridae)), and lobsters (spiny lobster (*Panulirus argus*) and spotted spiny lobster (*P. guttatus*), known locally as crayfish [35]).

Tourism dominates Anguilla's economy and generates over 70% of the island's gross domestic product (GDP) and employment opportunities [36]. The tourist season in Anguilla is highly seasonal; the official tourist season runs from December to April, with peak tourist arrivals during December, March and April [34]. Since the late 1970s, Anguilla has developed into an upmarket beach tourist destination, and is renowned for its pristine white sand beaches [26]. The rapidly expanding luxury tourism industry on the island has also created a growing demand for seafood products such as lobster, in addition to the high demand for reef fish among the local population [35]. Evidently, the fishing industry has become an important contributor to the island's economy, currently employing an estimated 5% of the

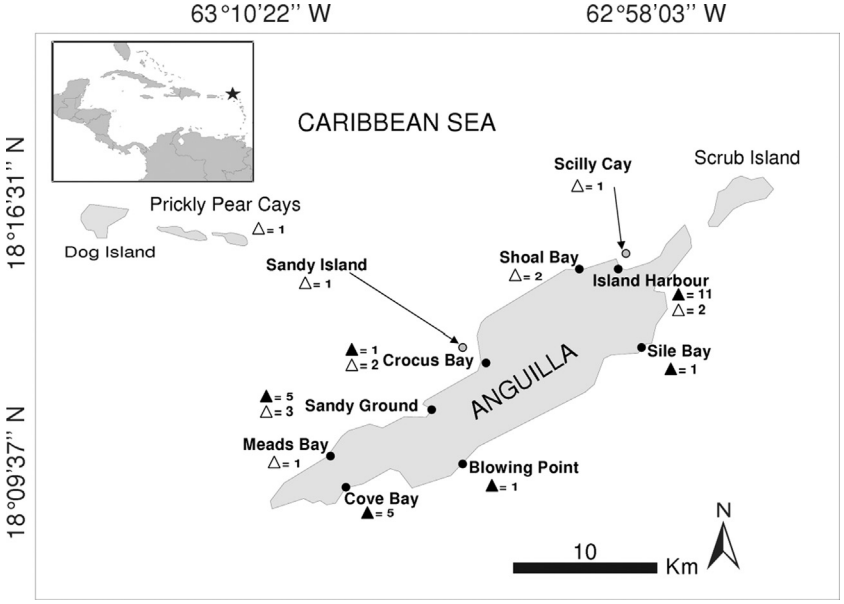

Fig. 1. Anguilla and its associated islands and cays. The location and names of the study sites are indicated, with the numbers of respondents (fishers (black triangle) and tourist operators (white triangle)) interviewed at each site. The inset shows the location of Anguilla within the Caribbean region.