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Small-scale seagrass fisheries can reduce social vulnerability: a comparative case study

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ABSTRACT

Small-scale fisheries are in decline, negatively impacting sources of food and employment for coastal communities. Therefore, we need to assess how biological and socio-economic conditions influence vulnerability, or a community's susceptibility to loss and consequent ability to adapt. We characterized two Philippine fishing communities, Gulod and Buagsong with similar seagrass and fish species composition, and compared their social vulnerability, or pre-existing conditions likely to influence their response to changes in the fishing resource. Using a place-based model of vulnerability, we used household, fisher, landing and underwater surveys to compare their sensitivity and adaptive capacity.

Depending on the scale assessed, each community and group within the community differed in their social vulnerability. The Buagsong community was less socially vulnerable, or less sensitive to pertubations to the seagrass resource because it was closer to a major urban center that provided salaried income. When we assessed seagrass fishers as a group within each community, we found that Gulod fishers had greater adaptive capacity than Buagsong fishers because they diversified their catch, gear types, and income sources. We found catch that comprised the greatest landing biomass did not have the highest market value, and fishers continued to capture high value items at low biomass levels. A third of intertidal gleaners were women, and their participation in the fishery enhanced household adaptive capacity by providing additional food and income, in an otherwise male-dominated fishery.

Our research indicates that community context is not the only determinant of social vulnerability, because groups within the community may decrease their sensitivity, enhance their adaptive capabilities, and ultimately reduce social vulnerability by diversifying income sources, seagrass based catches, and workforces to include women.

1. Introduction

Food security is critical from local community to global scales (Godfray et al., 2010) (FAO, 2009). Fisheries provide an important source of food protein (Béné et al., 2016) but global demands on fisheries is predicted to increase to 44% by 2030 (Delgado CL, Wada N, Rosegrant MW, Meijer S, 2003), while fisheries catches are declining (Gómez et al., 2006; Jackson et al., 2001; Worm et al., 2009).

Globally, 200 million people are engaged in small-scale fisheries, which are commercial fisheries with limited technology and economic security (De La Torre-Castro and Rönnbäck, 2004; FAO, 2009; McClanahan et al., 2009). 90% of small-scale fisheries are in the developing world, where they provide a labor buffer in situations of unemployment (Allison and Ellis, 2001; Berkes et al., 2001; FAO, 2014). The decline of small-scale fisheries is of critical concern because they supply over half the catch in developing countries (Béné et al., 2007; FAO and World Fish Center, 2008). In developing and emergent countries, fishing is the main livelihood strategy when there are limited alternatives to fishing (Béné et al., 2016). Small-scale seagrass fisheries provide an important food and income source for coastal communities (Campos et al., 1994; Cullen-Unsworth et al., 2014; De la Torre-Castro et al., 2014; De La Torre-Castro and Rönnbäck, 2004; Fröcklin et al., 2014; Khattabi A, 2011; Kleiber et al., 2014; Nordlund et al., 2011; Nordlund and Gullström, 2013; Unsworth et al., 2010, 2014). However, seagrass distribution has declined due to anthropogenic impacts, reducing their ecosystem services (Short et al., 2011; Waycott et al., 2009).

The social vulnerability of communities represents their ability to

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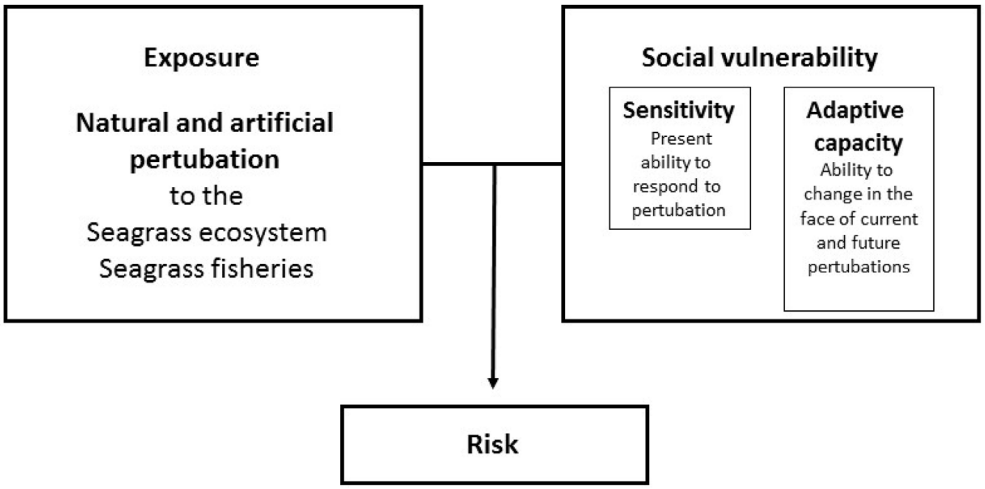

Fig. 1. Conceptual framework used to assess community social vulnerability in the context of seagrass fisheries (Bennett et al., 2014; Cutter et al., 2003; Ekstrom et al., 2015).

resist and recover from exposure events (Buckle et al., 2001; Cutter et al., 2008). Data from fisheries and habitats are critical in assessing vulnerability (UNU-EHS, 2014). Since small-scale fisheries are embedded within complex social-ecological systems, it is important to examine the relationship between social vulnerability and resource use (Berkes et al., 2001; Hughes et al., 2005). First, we need to understand how social and economic development affect income diversity, the ability to cope with crisis, as well as access to markets (Cinner and McClanahan, 2006; Khattabi A, 2011). In small-scale fisheries, poverty is often accompanied by resource degradation (Cinner and Aswani, 2007; McClanahan TR, 2008) and social vulnerability can constrain resource conservation options (Adams et al., 2004). Second, women play an important supportive role in small-scale fisheries and contribute to the household income in times of crisis (Jentoft S, 1999; Kleiber et al., 2015). Often undocumented (Kleiber et al., 2014; Nordlund and Gullström, 2013), women's role in fishing communities can inform adaptive strategies to reduce a community's vulnerability (Beck et al., 2012).

Vulnerability to natural and human-induced hazards has been assessed for coastal communities in the Philippines, but not in a small-scale fisheries context (Orencio and Fujii, 2013). Vulnerability to climate change has been assessed in coral reef and open water fisheries (Mamauag et al., 2013). Here, we present empirical data in a comparative case study assessing social vulnerability in two seagrass fishing communities. We evaluate sensitivity and adaptive capacity and provide specific recommendations to alleviate inherent vulnerability.

2. Methods

2.1. Site description

The Philippines ranks 12th of the capture-fishing nations, with over 1.3 million small-scale fishers (FAO, 2016). In 2010, capture fisheries in the Philippines produced 2.6 million tons, with more than half (1.4 million tons) from small scale fisheries (Asian Development Bank, 2014). 60% of the population lives along the coast, with fish making up 70% of animal protein intake (Asian Development Bank, 2014). Seagrass ecosystems supply important revenue for daily income and other ecosystem services (Campos et al., 1994; Fortes, 2013).

We characterized two small-scale seagrass fishing communities in the Philippines: Buagsong in Cordova, and Gulod in Calatagan (Fig. 2). Buagsong is off Cebu island in the municipality of Cordova, and Gulod is 750 km north on Luzon island in the municipality of Calatagan (Fig. 2). The coastal communities of Buagsong and Gulod have populations of 2,994 and 3,350, respectively. Buagsong is 20 km away from the major metropolitan city of Cebu, with a population of 3.8 million and an international airport, while Gulod is 70 km away from the city of Batangas, with a population of 2.3 million people (Table 2, Fig. 2) (Philippine Statistics Authority, 2016). Philippine municipalities are divided into six classes based on the municipality's average annual income with 1 being highest. Buagsong is in Cordova, a third income class municipality, and Gulod is part of Calatagan, a second income class municipality (National Competitiveness Council Philippines, 2015).

We collected quantitative and qualitative data using underwater surveys, landing surveys, fisher and household surveys, and participant observation, asking similar questions across methods to triangulate information (Cinner et al., 2007), in contrast to vulnerability studies that used rapid assessments, focused group discussions and key informant interviews (Mamauag et al., 2013) or those that mined census data (Orencio and Fujii, 2013).

2.2. Social vulnerability indicators

We use the place-based concept of vulnerability to examine the ability of fishing communities to respond to change (adaptive capacity) and to mitigate their social vulnerability (IPCC, 2012). We view vulnerability in the context of social and environmental processes (IPCC, 2012), and use indicators to measure social vulnerability to better manage risks given underlying socioeconomic conditions and changes to the resource base (Cinner et al., 2009; Jacob et al., 2013; Jepson and Colburn, 2013; Pollnac et al., 2015). We do not evaluate communities with regards to their exposure, or the presence of and extent of stressors, but within the context of their sensitivity, or the degree to which they are affected by the stressor, and their adaptive capacity, or their ability to respond to changes in the seagrass resource base (Marshall et al., 2009). We first described the seagrass ecosystem and fisheries, next we examined community and group sensitivity and adaptive capacity, which combined, contribute to overall risk (Fig. 1). Similar work has addressed the social aspects of fisheries (Jepson and Colburn, 2013), socio-economic responses to natural disasters, changes in fishing practices and regulations, and vulnerability of fishing communities to climate change (Adger et al., 2005; Clay and Olson, 2008; Cutter et al., 2008; González-Correa et al., 2009; Mamauag et al., 2013).

We selected a subset of variables from Jepson and Colburn's demographic, housing, social, and economic indices on social vulnerability (Jepson and Colburn, 2013). We did not quantitatively generate composite indices to rank overall community vulnerabilities from census data (Boyd and Charles, 2006; Jacob et al., 2013; Orencio and Fujii, 2013; Pollnac et al., 2015). We evaluated each community's context, sensitivity and adaptive capacity (Adger, 2006; Bennett et al.,