Science of the Total Environment 637–638 (2018) 758–770

Contents lists available at ScienceDirect

Science of the Total Environment

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

A framework to investigate drivers of adaptation decisions in marine fishing: Evidence from urban, semi-urban and rural communities

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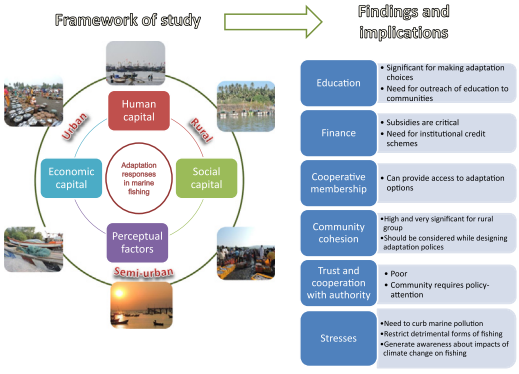
HIGHLIGHTS

- Human, economic, social and perceptual drivers of adaptation decisions are assessed
- Some drivers differ regionally, e.g., community cohesion can influence adaptation decisions specifically in rural region
- Special credit schemes having liberal conditions of eligibility are required
- Need to develop trust of fisherfolk on government authorities through community-engagement
- Redesigning and implementing existing policies can substantially aid capacity-building

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 29 September 2017
Received in revised form 24 April 2018
Accepted 30 April 2018
Available online xxxx

Editor: Simon Pollard

Keywords:
Adaptation
Decision-making
Capital
Perception
Marine fishing
India

ABSTRACT

Traditional fishing livelihoods need to adapt to changing fish catch/populations, led by numerous anthropogenic, environmental and climatic stressors. The decision to adapt can be influenced by a variety of socio-economic and perceptual factors. However, adaptation decision-making in fishing communities has rarely been studied. Based on previous literature and focus group discussions with community, this study identifies few prominent adaptation responses in marine fishing and proposes credible factors driving decisions to adopt them. Further, a household survey is conducted, and the association of these drivers with various adaptation strategies is examined among fisherfolk of Maharashtra (India). This statistical analysis is based on 601 responses collected across three regional fishing groups: urban, semi-urban and rural. Regional segregation is done to understand variability in decision-making among groups which might be having different socio-economic and perceptual attributes. The survey reveals that only few urban fishing households have been able to diversify into other livelihoods. While having economic capital increases the likelihood of adaptation among urban and semi-urban communities, rural fishermen are significantly driven by social capital. Perception of climate change affecting fish catch drives adoption of mechanized boats solely in urban region. But increasing number of extreme events affects decisions of semi-urban and rural fishermen. Further, rising pollution and trade competition is associated with adaptation responses in the urban and semi-urban community. Higher education might help fishermen choose convenient forms of adaptation. Also, cooperative membership and subsidies are critical in adaptation decisions. The framework and insights of the study suggest the importance of acknowledging differential decision-making of individuals and communities, for designing effective adaptation and capacity-building policies.

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https://doi.org/10.1016/j.scitotenv.2018.04.429
0048-9697/

1. Introduction

Climatic, environmental and other human-induced stresses, such as pollution and acidification, have severely altered the marine environment, leading to changes in fish population and distribution (Halpern et al., 2008; Hoegh-Guldberg and Bruno, 2010). Consequently, fish catch appear to be declining (Chassot et al., 2010; Golden et al., 2016), making it crucial for fishing dependent livelihoods to adapt. Climate change is projected to lower fish catch by 38%, and associated revenue by 33%, around the tropics by mid-century (Lam et al., 2016). In Asia, India's marine fishing sector is one of the most sensitive to impacts of climate change, majorly because of the country's nutritional and economic dependence on marine fishing, as well as the poor socio-economic condition of its fishing community (Allison et al., 2005). In 2015, India experienced a 5.3% drop in total fish landings compared to the past year, and a sharp decline of 50% in oil sardines, which is one of the main fish species around the Indian coastline (FRAD CMFRI, 2016). Ecosystem management, through state and community governance, is important for maintaining ocean biodiversity and species population. But individual adaptation/intensification responses, such as using improved gear and changing fishing strategies, are also critical for sustaining fish catch and returns from traditional marine livelihoods (Blythe et al., 2014; Grafton, 2010; Vivekanandan, 2011). Dwindling fish catch may also lead fisherfolk to diversify into other sources of livelihood. Further, as extreme events in the sea pose serious occupational risk to the community, adaptation strategies (such as insuring fishing gear) that can improve resilience are also needed (Badjeck et al., 2010).

The decision to undertake various adaptation strategies can be influenced by a host of social, economic and perceptual factors (Adger et al., 2005; Deng et al., 2017; Grothmann and Patt, 2003), which consequently leads to differential responses among individuals of a community. Understanding the drivers of various adaptation decisions can substantially help in designing policy directives for capacity-building of communities. Although marine fishing is a vulnerable source of livelihood with a dependence of around 260 million people around the globe (Teh and Sumaila, 2013), assessments of determinants of adaptation have rarely been attempted in previous studies. This study proposes a framework to identify the drivers of adaptation responses in marine fishing communities. While such frameworks are almost lacking for fishing communities in the extant literature, there are a number of studies which have analyzed the drivers of adaptation in agricultural communities and have described their implication for adaptation policy (Below et al., 2012; Comoé and Siegrist, 2013; Deressa et al., 2009; Jain et al., 2015; Yegbemey et al., 2013). It is observed that such frameworks can be useful for specifically recognizing and targeting factors, which can assist adaptation, during interventions.

There are various studies which have qualitatively or quantitatively explored adaptation and adaptive capacity of marine fishing communities. Allison and Ellis (2001) suggested understanding adaptation in fishing communities through the lens of Sustainable Livelihoods Approach (SLA) or capitals approach. However, the paper focused mostly on fishery management practices rather than household/individual adaptation. The vulnerability of fisheries sector around the world to climate change was quantified through country-level indices on risk, sensitivity and adaptive capacity by Allison et al. (2005). There are studies which have developed community-level vulnerability indices through primary surveys as well (Cinner et al., 2015; Islam et al., 2014a; Metcalf et al., 2015; Morzaria-Luna et al., 2014; Senapati and Gupta, 2017). Again, Allison and Horemans (2006) used SLA to develop interventions to capacitate, adapt and fight poverty in fishing communities. There are also other qualitative studies which provide insights into the assets/capitals (from SLA) required for adaptation in fishing communities (Blythe et al., 2014; Divakarannair, 2007; Islam et al., 2014b; Iwasaki et al., 2009; Tuler et al., 2008). However, all these studies do not statistically investigate the relevant drivers of adaptation responses. Members of communities can make different adaptation decisions based on their differential capabilities. Thus, the current study attempts to contribute to the literature in two ways. First, the proposed framework which is particularly tailored for marine fishing communities can impart understanding which factors influence adaptation and why fishermen respond differentially. The framework also attempts to give attention to multi-stressors impacting fish catch and fishing livelihoods — by considering fishermen's perceptions of pollution, trade competition and climate change as determinants of adaptation decisions. The framework initially draws upon previous studies which have recognized and described factors/capitals that can induce adaptation in marine fishing as well as other communities around the world. Thereafter, the variables of the framework are refined and finalized based on focus group discussions (FGD) with the community. Primarily, the paper aims to bring together a number of probable drivers of adaption, set them up in a statistical model and test hypotheses to infer the factors which might initiate fishing communities to adapt.

Secondly, the study identifies the predominant adaptation strategies and applies the framework to understand their drivers in fishing communities located in urban, semi-urban and rural areas of Maharashtra, India. Regional segregation of fishing communities, which is not evident in previous studies, is done to envisage whether factors influencing adaptation vary across regional groups. Marine fishing is conducted in the seas and activities, such as docking and fish drying, do not require much land area. Thus, traditional fishing settlements can be found along coastlines of rural, semi-urban as well as urban areas. These communities might have varying levels of access to capitals and their influence on decisions may differ. Urban communities might have better access to human and economic capital such as education and formal credits/banks (Iqbal and Sami, 2017; OECD, 2013). Communities in urban and rural areas might also differ with respect to available social networks (Debertin, 1997). Urban fishermen might be better informed about improved technology and gear as well as have more diversification opportunities. Further, the communities' surroundings might lead to different perceptions about changes, for example, urban fishermen might be experiencing pollution since a longer time than the other two communities. Socio-economic differences between urban and rural communities can be especially pertinent in developing countries, such as India (Fan et al., 2005; Sahn and Stifel, 2004; Sarkar and Mehta, 2010). Thus, it is worth investigating the drivers of adaptation separately for the three communities with different regional backdrops. It can offer further understanding of decision-making in groups, possibly having varied assemblage of socio-economic factors. Consequently, this may be useful for designing appropriate policy measures for building adaptive capacity of communities with common livelihoods but different (socio-economic/regional) backgrounds.

The next section describes the methodology, including the framework, adopted in the study. Section 3 presents the empirical results and discusses some of its implications. The study is concluded in Section 4.

2. Methodology

This study focuses on understanding adaptation decisions among the fishing community of Maharashtra, India. Maharashtra is a coastal state in western India bordering the Arabian Sea and has one of the longest coastlines in the country (GoI, 2013). There are fishing villages almost along its entire coastline. However, Maharashtra has been experiencing a declining fish catch and warming, by approximately 1 °C (in 2005 compared to 1950's) along its coast, which can further adversely impact fish populations (ICOR, 2015; Vivekanandan et al., 2009). Fish landing in Maharashtra declined by 5.4% in 2014 and further lowered by 23.1% in 2015 compared to the previous year (CMFRI, 2015, 2014, 2013). This makes the livelihoods of the marine fishing community in Maharashtra vulnerable.

Multiple methods are used to hypothesize the drivers of adaptation, as well as to obtain both qualitative and quantitative insights from the