



Destructive gear use in a tropical fishery: Institutional factors influencing the willingness-and capacity to change

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ABSTRACT

The aim of this study was to empirically assess institutional aspects shaping fishers' behavior leading to unsustainable resource use, by using the example of destructive drag-net fishing in Zanzibar, Tanzania. A broad institutional approach was used to specifically assess institutional factors influencing the fishers' reasons for the current use of destructive drag-nets as well as their willingness- and economic capacity to change to less destructive gears. Different regulative, normative, cultural-cognitive and economic factors (tradition, group-belonging, social acceptance, common practice, identity of drag-net users and weak economic capacity) were identified as critical elements influencing the current use of destructive gears, as well as obstructing changes to other gears. Hence, the importance of addressing all of these factors, matching to the different contexts, rather than focusing on fast-moving regulative measures, is emphasized to increase chances of management success. More promising approaches would be resource allocations to more sustainable fishing gears, well-managed gear exchange programs, as well as alterations of slow-moving normative and cultural factors, e.g. awareness raising on the advantages of more sustainable fishing gears, their traditional and cultural values, information on the actual income they generate, as well as education and an exchange of traditional knowledge on how to use them.

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1. Introduction

Many fisheries across the world are considered to be unsustainable and in the need of rebuilding [1–4]. Especially in tropical developing countries, the importance of small-scale fisheries for local economies, poverty reduction, employment, adaptive markets, food security and as a source of animal protein has been emphasized [5,6]. However, small-scale fisheries are often not well-managed [7], and are under considerable pressure both on local and global scales [8,9]. This can have especially devastating consequences for household economies and food security in areas where the dependency on coastal resources is high, poverty extensive, and livelihood alternatives insufficient [6,10].

To meet the short-term food security requirements of coastal communities with fishing methods which allow a responsible and sustainable use of marine resources, poses a great challenge.

Moreover, there is an urgent need for more legitimate and effective management towards more sustainable fisheries to ensure human well-being in the long-run. A promising step in the right direction is the recognition of fisheries as closely connected social-ecological systems from a “human-in-ecosystem perspective” [11] and to see fisheries-related challenges from a holistic and interdisciplinary perspective [12,13]. But being complex and dynamic systems of both human and natural domains, fisheries are in practice extremely difficult to govern [14,15] and their governance has often been labeled as a “wicked problem” [16]. Much focus in fisheries management has been put on property rights, rational choice and governance [17], and management efforts on the establishment of marine protected areas (MPAs), gear restrictions [3,18] and compliance [19–22]. However, shortcomings in institutional design and –dynamics play a major part in the failure of fisheries management [17,23]. Fishers do not make decisions solely on knowledge-based predictions of positive outcomes, as a rational choice perspective would suggest [24]. Therefore, to thoroughly understand fisheries dynamics and human action, and to be able to address them, it is necessary to better understand

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how fishing institutions evolve over time [10], and shape human behavior as complex and multifaceted, dynamic systems. The “broad institutional approach” [25] is expanded from rational choice and compliance thinking, as well as the perception of institutions as being constituted by rules only. It suggests that a wider understanding of institutions including regulative, normative and cultural-cognitive elements is necessary to address today’s challenges in fisheries management more adequately [23–26].

One serious problem in small-scale fisheries is the use of destructive fishing gears like beach seines, or spear guns [18,27–30]. Despite the presence of comprehensive regulations and total use prohibition, beach seines and other drag-nets are commonly used in developing countries, which can lead to habitat degradation as well as overfishing and discards of juvenile fish that diminish resources [27,30,31]. Moreover, beach seine fishers are among the poorer fishers [10,30,32], and often lack the capacity to invest into less destructive gears, which can lead to social-ecological traps (cycles of resource degradation and poverty which are hard to escape) [29]. The cessation of beach seine use in Kenyan coastal fishing communities (as a result of co-management efforts) led to considerable increases in fish catches [18].

In situations where destructive gears are banned but the level of compliance is low, attempts to strengthen controls, law enforcement and sanctions are often seen as quick remedies. But in a context of poverty as well as political and institutional shortcomings, the focus cannot solely lie on rules and regulations [24], as this would likely have poor long-term success and could instead have devastating social consequences for resource users. A much more promising answer to the problem of non-sustainable and currently miss-managed fisheries is to create better institutional arrangements, that in turn lead to a more sustainable use of resources [23,29]. To be able to achieve such institutional and behavioral changes, it is essential to understand the social, economic and institutional dynamics shaping the current conduct of non-sustainable resource extraction like fishing with destructive gears, as well as to investigate ways to a behavioral change. However, in much of the fisheries research, institutional factors are to date mostly neglected and neither well-studied nor understood.

Against this background, the aim of this study was to explore the use of drag-nets based on the perceptions of fishers, and to focus on practical solutions towards more sustainable fisheries by analyzing the possibility to change to less destructive gears. This was accomplished by empirically investigating fishery villages in Zanzibar (Tanzania) as an example for tropical small-scale fisheries in a developing country context. This research addresses a broad set of factors that influence drag-net prevalence as well as the willingness- and capacity to change to other gears as expressed by local fishers. This was done by investigating institutional elements that shape the current use of beach seines in Zanzibar, as well as the institutional arrangements that would be necessary to change this behavior. The study had four specific sub-aims:

i) to investigate the fishers’ reasons for the current use of drag-nets, ii) to analyse the willingness- and iii) economic capacity of fishers to change to less destructive gears, and iv) to conduct a qualitative analysis of institutional (based on Scott’s pillars of institutions; [25]) and economic factors influencing gear use beyond rational choice, as well as the fishers’ willingness- and capacity to change. The results of this study will hopefully contribute to a better understanding of existing fisheries institutions which is a prerequisite for improved governance and sustainability of small-scale fisheries.

2. Conceptual framework

Institutions are complex social arrangements that steadily change, although at very different pace [33]. Looking at institutions as broader structures implies taking activities like rules, habits and knowledge into account, which provide stability and meaning to social life [24,25]. The theoretical framework for the analysis of institutional factors influencing gear use and willingness to change for this study is based on Scott’s broad definition of institutions [25]. Here, institutions rest on three “pillars”: i) the cultural-cognitive, ii) the normative and iii) the regulative elements. The cultural-cognitive pillar implies the shared conceptions of a group, like inherited habits or common knowledge. The normative pillar consists of values (conceptions of the preferred or the desirable) and norms (how things should be done), and the regulative pillar includes rules, regulations, controls and sanctions.

For the qualitative analysis of our study, these three institutional pillars were complemented with an economic analysis, as economic factors are critical to understand fishers’ behavior in small-scale fisheries [34]. The authors believe that the incorporation of economics improves the analysis and understanding of fishers’ behavior, as poverty (e.g. among Zanzibar’s fishers) and the need to satisfy basic needs like the provision of food for the family, might hinder long-term sustainability thinking and planning in the fishing behavior. Further, it might restrain abilities to follow formal regulations or local traditions, and make it difficult (if not impossible) to invest into more sustainable gears.

It is argued that broadening the concept of institutions “helps enhance our understanding of the ever complex and unpredictable fisheries system and fosters an establishment of appropriate institutional arrangements for promoting sustainability and for improving fisheries governance” [26]. Additionally, the cultural-cognitive elements of institutions are of particular importance when analyzing how institutions shape fisher interactions, helping to reveal aspects that have earlier been overlooked in fisheries research [26].

3. Methods

3.1. Drag-net fishing in East Africa

In coastal East Africa, small-scale fisheries sustain a large part of the local population [28,35,36]. Due to an increasing population, an expanding tourism sector and increasing demand from international seafood markets, the demand for fishery resources is growing, resources are dwindling, and signs of overexploitation are frequently reported [18,28,37,38]. One factor contributing to the signs of overexploitation of marine resources in East Africa that poses a great management challenge, is the use of non-sustainable and destructive gears like beach seines and other drag-nets, spear guns or explosives [28,32,39]. Beach seines are in the area weighted, 50–150 m long nets with small mesh sizes (typically \approx 6–20 mm), that are dragged over the seabed in shallow inshore waters [28,40]. Besides beach seines, other kinds of drag-nets are common (any kind of seine net can be used as a drag-net), like boat seines. These are set from boats or the beach, are often used with two boats, run on the bottom and are assisted by divers who chase the fish into the net and untangle it [10,28]. In this paper the term “drag-net” is used to include any kind of beach seine, boat seine or other kind of seine net used with a dragging technique. These nets can be highly damaging to habitat-forming organisms like coral reefs and seagrass beds, and have been reported to catch high proportions of juvenile fish and thereby lower fishery yields [31,41]. Despite being legally banned

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