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Vulnerable people, vulnerable resources? Exploring the relationship between people's vulnerability and the sustainability of community-managed natural resources

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Participatory approaches to the management of common-pool resources (CPRs) are built on the premise that resource-users are dependent on the productivity of the resource and therefore have the incentive to act as resource stewards if empowered to do so. Yet many CPR users have only temporary interest in using the resources. Moreover, they are vulnerable to a range of stressors and risks unrelated to resource access and sustainability concerns. Both of these may undermine such incentives. Furthermore, discounting theory posits that high vulnerability shortens time horizons so that vulnerable CPR users might be expected to heavily discount future benefits from resource conservation. We present an ethnographic study carried out in two communities on Lake Victoria, Uganda, where fisherfolk face a range of elevated risks to health and security. These immediate risks undermine participatory fishery management but this does not necessarily indicate inherently short time-horizons; for many, fishing and fish-trading are not perceived as a life-long occupation but as a means to generate capital for investment in other businesses. Thus, whether they are vulnerable or not, it cannot simply be assumed that current CPR users will have a long-term interest in participating in resource management. Incentivizing participation in CPR management for long-term sustainability may have to address both people's wider vulnerabilities and aspirations.

Keywords: community-based resource management; fisheries; Uganda; sustainability; incentives

Introduction

Participatory approaches to the management of common-pool resources (CPRs) are built on the premise that resource users have the incentives and capabilities to act as resource stewards. Before state intervention, CPRs were managed by resource users through systems of local rules that responded to a variety of individual and societal needs and aspirations but were not necessarily related to concerns for resource sustainability (Berkes 1989; Charles 1994). With the modernization, monetization and globalization of some common property resources, fisheries and forests for example, through the second half of the twentieth century, accompanying concerns for management led to traditional rules governing resource access and utilization being replaced by a series of science-based technical regulations and controls of the amount of harvesting from CPRs. Such rules were typically imposed by sovereign states (Charles 1994; Ribot 1995; Allison 2001). This process has often failed to prevent continued over-extraction and has marginalized local resource users in the process (Acheson 2006). In the subsequent devolution of power, states and their development partners have focused on (re)building institutional capacity to manage resources at the local level (Leach, Mearns, and Scoones 1999; Pretty and Ward 2001; Berkes 2004) whilst the existence of incentives amongst resource users is usually taken as a given.

The assumption that local communities are incentivized to protect the sustainability of the resource they utilize is based on the neoclassical economic assumption that individuals will make rational economic choices in order to maximize the profit of livelihood activity and that they would recognize the long-term gain from utilizing the resource sustainably, despite potential short-term costs. But the concept of rationality may not reflect the reality of people's economic decision-making as it overlooks what Davis and Ruddle (2012, 246) refer to as the 'real world' – the cultural, historical and social complexities which affect the decisions people make. Furthermore for economic rationality to apply, communities must have a sense of ownership of the resource, whether individual or collective (Davis and Ruddle 2012). The importance of empowerment and ownership as essential components of participatory management of CPR reflects this. But if communities become populated by economic migrants seeking to earn income in the short term, their interest in

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sustainably managing the resource may be limited, because they prioritize generating immediate income rather than the long-term viability and well-being of the community (Barratt 2012).

In Mansfield's discussion of fisheries, an example of a CPR, she posed the question 'Why [should fishers] invest in the long term sustainability of the fishery if what happens tomorrow or next week or next year is highly uncertain?' (2007, 320). Although Mansfield is discussing how, from a neoliberal perspective, a lack of property rights makes the over-exploitation of the resource a rational choice, we believe this question has wider implications. Based on our and others' previous work on livelihoods and fisheries management in sub-Saharan Africa (Sarch and Allison 2000; Béné 2003; Jul-Larsen et al. 2003; Allison 2005), we hypothesize that there are two major factors, in addition to the issue of property rights, that could influence the perceived success and sustainability of management of these and other CPRs. First, many CPR users are vulnerable to a range of stressors and risks, from HIV to climate change, many of which are unrelated to resource access rights and the state of resources, but these may influence how individuals utilize the resource (e.g. Béné 2003; Allison and Seeley 2004; Mills et al. 2011). Also, it cannot be assumed that all resource users aspire to retain their current livelihood activities and therefore have an interest in the long-term sustainability of the resources they use; many users have diverse livelihoods, with both simultaneous and sequential access to other sources of income and food (Allison and Ellis 2001; Abbott et al. 2007; Dorward et al. 2009). These factors may both influence commitment to long-term resource stewardship. Yet an examination of how individuals respond to the risks and livelihood opportunities they face and how these affect their use of the resource has been lacking to date. This paper addresses this knowledge gap by exploring the relationships between people's vulnerabilities, livelihood strategies and aspirations, and their incentives to participate in the management of one of the most globally significant CPR – fisheries.

Vulnerability in fishing communities

Fisherfolk often live in high physical and economic insecurity (Allison 2005; Béné 2009; Mills et al. 2011) and it has been suggested that, in such conditions, the propensity to forego current income for the prospect of future gains may be diminished (Allison et al. 2012; Barratt 2012). The risks that they face come from a wide variety of sources. Fishing is a high-risk occupation; there are an estimated 24,000 deaths worldwide each year in the fishing industry due to drowning and accidents arising from the operation of fishing gear. This is a similar risk to that from other hazardous occupations such as forestry and coal mining (ILO 2004).

Many fisherfolk are exposed to a range of environmental, economic and social hazards (Nunan 2007; Béné 2009), ranging from exceptionally high prevalence of HIV (Kissling et al. 2005; Seeley et al. 2012) to being at particular risk from storms, floods and climate change (Allison et al. 2009). The high mobility of fishing livelihoods also contributes to the vulnerability of fisherfolk because although migration may positively impact income generation, it undermines social networks as men work in locations distant from their partners and children, increasing the vulnerability of both the fishermen and women particularly in relation to contracting HIV (Nunan 2010). Given this risk context, the priority concern amongst fisheries scientists and managers of the risk of fish stock collapse may not be shared by those actually engaged in the fishing industry (Mills et al. 2011). In order for fisherfolk to manage the fishery in a sustainable way they must perceive the risk of fish stock collapse as a key threat in order to be incentivized to take action to prevent it. We now discuss this in relation to co-management.

Fisheries co-management and the problem of assumed incentives

An estimated 520 million people (fishery-sector workers and their dependents) – nearly 8% of the world's population – are to some degree dependent on fishing-based income (FAO 2009, 26) and fish and other aquatic food products provide a range of nutritional benefits from protein to a variety of micronutrients (Kawarazuka and Béné 2011). Finding a way to sustain or increase these benefits is thus of considerable importance but state-led regulation has failed to protect fish stocks, threatening the poverty-alleviating and food security potential of the sector. Nor has it delivered equitable and sustainable benefits to resource users but has contributed instead to their marginalization (Hara and Raakjær-Nielsen 2003; Jul-Larsen et al. 2003; Berkes 2004). To address these deficiencies states and their development partners have been moving from central state-led strategies towards community-based programmes and state–community partnerships for regulating access to and extraction of natural resources (Allison 2001; Nielsen et al. 2004; Pomeroy and Andrew 2011). But this focus on state–community partnerships has been criticized for shifting the burden of fisheries management from the state to resource users whilst retaining (often malign) state interference, advancing a neoliberal economic perspective on the objectives and instruments of fisheries governance and ignoring issues of inequality and class (Davis and Ruddle 2012).

Co-management, the dominant form of contemporary community-based management in the fisheries sector, refers to a system of management where responsibility is shared between the government and user groups (Sen and

Nielsen 1996, 406). Co-management has taken a wide variety of forms and lacks a definite definition. On the one hand this allows for responsiveness to the local context into which it is embedded (Jentoft 2003) but this makes it difficult to assess its success (Welch-Devine 2012) and arguably allows states to design systems which best serve their own ends (Davis and Ruddle 2012). Most commonly, regulations are set by the government with a degree of resource-user consultation whilst responsibility for enforcing them is devolved to a locally elected committee. However, the extent to which this represents empowerment of the fishing communities and not simply an extension of state power has been questioned (Béné 2009; Davis and Ruddle 2012)

Underlying the rationale for co-management are the assumptions that local fishing activities are depleting the resource and local communities which utilize the resource have sufficient incentives to manage the resource sustainably, despite potential short-term costs in the form of income and other benefits foregone. In his discussion of incentives in the management of local commons, Seabright (1993), drawing on the work of Hardin's (1968) description of the 'tragedy of the commons', outlines how if extraction by individual users will impose negative externalities on other users by threatening the sustainability of the resource, sufficient incentives are necessary to dissuade individual resource users from excessive consumption. These may come from informal sources, for example a negative response from the social network in which individuals live and work, to formalized incentives (or disincentives) which are established in law or customary practice. A recent comparison of the success of co-management in different locations found that establishing clear incentives, such as catch shares and conservation benefits in protected areas, was an important predictor of co-management success (Gutierrez et al. 2011).

Implicit in this understanding is the assumption that communities which utilize CPRs are dependent on them and will continue to be so in the future and consequently, as rational economic actors, they are automatically incentivized to manage the resource sustainably. Yet in many settings where communities utilize CPRs, livelihoods are very fluid to help deal with changes in circumstance (Allison and Ellis 2001). Calls for a rights-based approach to fisheries management also rely on the incentives generated by economic rationality – that given secure access to the resource fishers will have sufficient incentives to want to manage the resource in a sustainable way. However, it has been recognized that although insecure property rights increase the vulnerability of fishers, greater attention needs to be paid to the wider context of risk and vulnerability in which fisherfolk live and work if we are to more fully understand fishers' decision-making (Allison et al. 2012; Cinner et al. 2012). Furthermore, co-management programmes are often established in socio-political settings in which corruption is common and as such the incentives that can be established through custom or law may be distorted when interacting with the state (Kolstad and Søreide 2009).

By considering how fisherfolk perceive and experience risk and how this influences their relationship with the resource, this paper critically engages with the concept of incentives which underpins co-management. Learning why people act as they do is fundamental to any attempt to influence behavior and, through policy, to shape it in ways that are seen as socially and economically desirable – and is therefore central to attempts to encourage sustainable natural resource use.

Using discounting to link vulnerability and sustainability

In order to explore whether CPR users, in this case fisherfolk, perceive resource decline or collapse as a priority concern, and are therefore willing to act to restrain their own and others' activities to ensure future resource productivity, we draw on the economic theory of discounting where the value of future rewards is considered of less worth than rewards gained today. We believe that although we use discounting in a qualitative sense (we do not seek to quantify the discount rates of fishers) it is a useful concept that increases our understanding of how vulnerability is linked to the incentives which motivate behavior and in turn affect willingness to comply with or support institutions that aim to enhance resource sustainability. In the fisheries' context we have described above, we hypothesize that the high degree of risk exposure and vulnerability of fisherfolk lead to high discount rates, and limited incentives to participate in managing a fishery, despite being dependent on it. This is an example of the principle, articulated by nineteenth-century economic philosopher John Stuart Mill, that individuals who perceive themselves to be at risk, or to be insecure, discount the future more strongly:

> Where property is less safe, or the vicissitudes ruinous to fortunes are more frequent and severe, fewer persons will save at all, and of those who do, many will require the inducement of a higher rate of profit on capital, to make them prefer a doubtful future to the temptation of present enjoyment. (Mill 1848, XI 4)

This closely describes the context of many fisherfolk whose rights of access to the fishery are not well defined and who, as a result of some of the additional risks mentioned in the previous sections, do indeed appear to have a 'doubtful future'.

This research assesses whether the vulnerability of fisherfolk and their uncertainty regarding whether they will be able to harness the promised future rewards of environmentally responsible fishing practice may result in increased

levels of discounting. If, as is suggested by theory, high levels of discounting with respect to fishing behavior may be a rational response to high levels of personal insecurity then this would have important implications for the design of co-management institutions. It would mean that fishers value the profit they can make today much more than the profit that they could make in a highly uncertain future, even if their rights to access the fishery were to be secure and exclusive.

We now move on to outline the study in more detail, describing the two case study communities and the methods used for data collection.

Research context

The research was carried out at two landing sites on Lake Victoria, Uganda, between April 2007 and July 2008. The Ugandan fisheries sector underwent significant expansion throughout the 1990s. Fish exports from Uganda peaked at almost 37,000 tons in 2005 but declined to approximately 24,000 tons in 2010 (DFRU 2012). But the number of fishers on the Ugandan part of Lake Victoria rose from 34,889 to 54,148 between 2000 and 2006 (DFRU 2006, 14). The overall fish stock in the lake remained quite stable between 1999–2001 and 2005–2006, reducing from 2.17 mt to 2.15 mt, the stock of Nile perch declined more significantly from 1.29 mt to 0.82 mt (LVFO 2009). The appropriateness of these stock assessments as well as the role that fishing effort has played in the decline have been called into question. Kolding et al. (2008) have highlighted that other factors which play a role in determining fish populations, such as the fluctuating carrying capacity of the lake due to natural climatic variability, have not been accounted for and as such the impact of 'overfishing' has been overemphasized. But even if this is the case given the rapid increase in the numbers of fishers on Lake Victoria, and the known vulnerability of larger fish such as Nile perch to depletion due to harvesting pressure (Jennings, Reynolds, and Mills 1998), there is still an important role for fisheries management to play.

The creation of the co-management institutions on Lake Victoria was carried out in response to the concerns of state and international fisheries management agencies that some of the important fish stocks of Lake Victoria were being harvested at levels that threatened their ecological and economic viability. These co-management arrangements formed part of the Implementation of a Fisheries Management Plan project which ran between 1 April 2003 and 31 August 2008. The Beach Management Units (BMUs) that form the key institutions in the co-management strategy on Lake Victoria were formed earlier, under the Lake Victoria Environmental Management Programme which ran from 1997 to 2004. The leadership committees of these units are elected by BMU members and have legal powers to enforce fisheries regulations and can recommend the creation of local by-laws to local government. The Lake Victoria fishery in Uganda is therefore a useful illustrative case of natural resource management in the context of constrained management resources and perceptions of increasing pressure on the resource.

Methods

The fieldwork was carried out over two six-month periods (April–October 2007 and January–June 2008) with the first author spending four months living in each community, during which time data collection was carried out. Structured interviews were carried out to assess households' experiences of particular risks. Purposive sampling was used to ensure that a range of occupational groups was included, for example shop keepers, bar owners, fish processors, fishers and boat owners. In Kitanba 59 respondents completed the interviews, whilst in Mhinga 67 participants were interviewed. Focus group discussions were conducted with Local Council[1] (LC) members, BMU committee members, fishermen and a group of women in each community. Finally, 21 respondents in Kitanba and 20 in Mhinga participated in in-depth interviews during which life histories were collected and narrative analysis was used to gain a sense of how fisherfolk experienced and responded to risk throughout their lives. The analysis here draws from all these data sources as well as informal conversations and field notes made by the first author whilst living in the two communities.

Case study descriptions

The two selected landing sites, Kitanba[2] and Mhinga, are located in Kalangala and Mukono Districts.

Kitanba

Kitanba is situated on one of the Ssese Islands in Lake Victoria. The population of Kitanba was dominated by members of the Buganda tribe (approximately 75% of the total population) but included a wide range of ethnic groups from Uganda, Kenya and Tanzania.

Kitanba had approximately 700 residents. Over 90% of boats in Kitanba had engines compared with just under 21% of all boats in Uganda (DFRU 2006). The main fishing activity was for Nile perch and tilapia using gill nets. The main fish table (the local marketing and handling facility) met the EU minimum standards for hygiene and sanitation. However, beside this organized commercial enterprise was a smaller subsistence fishery dominated by small boat owners, many with dugout canoes. Opportunities to pursue livelihood choices away from fishing were limited because the landing site was

surrounded by commercial oil palm plantations and as a result land available for cultivation was severely limited.

The BMU in Kitanba was created in 2003. The largest boat owner, a woman, was the BMU treasurer, who was considered the community leader and was very well respected. Her strength of leadership had led the BMU to appear reasonably successful and illegal fishing was recognized to have declined since the BMU was created.

Mhinga

Mhinga lies in the Mukono District on the shore of Lake Victoria. The LC area of Mhinga was home to approximately 500 people, 250 of whom actually resided at the landing site. In Mhinga the ethnic mix was greater than in Kitanba but the Buganda group was still the most dominant, especially in farming areas more distant from the landing site.

Boat owners tended to own one or two boats, without engines, and some boat owners fished for themselves which was rare in Kitanba. Demand for boat crew was therefore limited, leading to a paucity of paid fishing work for those that did not own boats. Fishing patterns also differed; Nile perch and tilapia fishing is conducted largely in the daytime, often early in the morning, and *mukene*[3] fishing at night. The majority of people in Mhinga had diversified livelihoods earning money from a combination of farming, fishing and rearing animals. This reflects the trend of households engaged in small-scale fishing, especially in developing countries, to pursue several other income-generating activities simultaneously or sequentially, to supplement or complement fishing income (Allison and Ellis 2001; McGoodwin 2001).

The BMU leadership in Mhinga was not accorded the same respect as that in Kitanba. In discussions with key informants the BMU chairman was described as corrupt and easily bribed – for example he would return illegal nets to fishers in return for a payment from the fisher. The BMU had not made much progress in terms of limiting illegal fishing activity and illegal fishing methods such as 'tycooning'[4] could be witnessed near the shore in daylight hours.

Experiences of risk and vulnerability

The risks identified by research participants related to four themes: economic vulnerability, the direct physical risks of fishing, ill health and theft. Small-scale fishing has long been associated with income poverty, (Bailey 1988, 36). However, an increasing number of studies are showing that those who specialize in fishing can have substantially higher incomes than households engaged in other occupations in the same rural areas (e.g. Allison 2005; Béné 2009). In Mhinga and Kitanba it was tempting to assume that the communities were income-poor due to the poor housing and lack of sanitation. But in a focus group discussion with fishers in Kitanba it was established that some fishers (working as fishing crew members) had earned up to 300,000/- ($178)[5] a month, although the discussion indicated incomes ranging from 100,000/- ($59) to 200,000/- ($118) a month were typical. In Mhinga the low fish catches and the movement of the large boat owners away from the landing site meant that job insecurity was high and earnings low. Fishers who worked as hired crew reported only being able to make 1000/- to 2000/- ($0.59–$1.18) a day, which equates to 30,000–60,000/- ($18–$36) per month if the work is regular. Incomes from fishing therefore varied significantly, but did have the potential to result in wages well above the poverty line of 63,000/- a month (using a measure of $1.25 a day) and above the median monthly income for men working rural areas which was 77,000/- ($46) in 2008 (Kasirye 2011).

The experience of economic vulnerability was different for different occupational groups within the fishery sector, and differed between genders. The income of fishers was dependent on the amount of fish caught as crew were paid a percentage of the catch value. Therefore, a decline in fish catch resulted in reduced incomes and even job losses if boat owners decided to keep their boats ashore. Boat owners, although amongst the richest people in the community, occasionally reported large debts due to the start-up capital that entering the fishing industry requires. In Kitanba the BMU treasurer often lent money to other boat owners when fish catch was low and they could not cover the cost of fuel.

Reduced fish catch was therefore an important source of economic vulnerability for boat owners and fishers and the problem was discussed at both landing sites. It was generally attributed by fishers to illegal fishing or to the increase in the number of fishers on the lake. The BMU chairman in Kitanba remarked 'Previously the fish were seasonal; they could be many in some months and reduced some months, but this time [the period of low catch] has been prolonged.'

However, low fish catch did not just affect those directly involved in fishing. A 39-year-old female health worker in Mhinga emphasized the importance of the fish catch to all businesses at the landing site 'It [low fish catch] is a problem because all the incomes of the people here depend on fish. So it is a problem that affects everyone because no business can profit when the fish catch is low.' For women economic vulnerability resulted from the lack of available work (for them and/or their partner) or separation from their partner. Having a boyfriend or husband was regarded as a valid way of alleviating economic problems. Overt sex work was also common. Furthermore, lack of livelihood diversification options, especially at

Kitanba, and declining returns from agricultural produce added to the economic vulnerability of community members.

Additionally, fishing is widely recognized as a far more dangerous industry than most land-based occupations (Béné, Macfadyen, and Allison 2007). A study of accidents in small-scale fisheries such as those operating from Kitanba and Mhinga notes that loss of life and accident rates are higher amongst artisanal and other small-scale fisheries than in their industrialized counterparts (Ben-Yami 2000). This risk frames the broader risk context of any fishing community and differentiates them from other rural communities. In a focus group discussion in Kitanba, where the fishing was often more dangerous because it was done at night and distant from the shore, the fishers spoke about being on the water as being in the 'death zone'. In Mhinga a fisherman described his fear of being on the lake during the fishermen's focus group discussion:

> For me, I do not see any good thing in the lake because I have to use my strength to reach where I want to go and there is no security that I can be safe in that boat. About two days ago our friend died; he was also in a boat and it just fell in water and he sank in water. So water is very risky.

The economic consequences for the dependent household/s of a fatal accident to a fisher on the water can be devastating, as a major contributor to the household income is lost. Accidents also often result in the loss of boats and equipment.

However, it is not just the risks that fishers are exposed to on the water that pose a threat to fishing communities. Ill health in poor households can result in serious adverse economic consequences for both individuals and households and can bring increasing poverty to those affected (Corbett 1989). Work in the capture fishery is physically demanding and as a result an illness does not have to be serious before output is affected. The close proximity of fishing communities to water increases exposure to diseases such as malaria and schistosomiasis, whilst the poor medical facilities available locally make it difficult and expensive to access effective medical treatment. In Kitanba and Mhinga ill health was clearly perceived by respondents as a risk. It was the most common response when people were asked what they feared and what risks they had experienced in the last year. The high incidence of both HIV (Seeley et al. 2012) and schistosomiasis (Parker et al. 2012) in Lake Victoria fishing communities supports these findings. In Kitanba and Mhinga, although HIV and AIDS were not spoken about openly there was an awareness, which came out during individual interviews and focus group discussions, that prevalence in the communities was high. This was largely blamed on the presence of sex workers in the communities but was also contributed to by the general high level of promiscuity.

Responses to risk and opportunity

Drinking has been related to the high-risk nature of fishing as an occupation which leads to 'high levels of stress, social pressure to drink, boredom and separation from social relationships' (Matheson et al. 2001, 308). In Mhinga and Kitanba both drinking and drug taking were widespread and were frequently associated with reducing people's awareness of risk. Alcohol was easily and cheaply available at both landing sites and was drunk openly by many community members, both men and, to a lesser extent, women. In Mhinga however, alcohol consumption was more widely accepted, included a wide age range of participants and community leaders could often be seen drinking in local bars. In Kitanba the consumption of alcohol was limited to certain groups, especially young fishers and sex workers. Community leaders in Kitanba tended to avoid drinking alcohol. The BMU secretary reported drinking beer when he was in the capital city but would not do this at the landing site for fear of being associated with those that do.

Community members offered several key reasons for why many people within the community drank alcohol or took drugs: to forget their problems; suppress fear and discomfort; and because they have too much spare time and ready cash. In Kitanba direct references were made connecting the risks on the water and the use of drugs and alcohol. Fishermen compared themselves to soldiers, drinking to cover up fear. A further cause of discomfort was leaving their families and communities behind, which makes them 'think so much', and because they are lonely they drink.

Strategies for dealing with risks associated with the fishing industry frequently involved diversified livelihood approaches which reduced dependency on fishing (Allison and Ellis 2001; McGoodwin 2001). For example the extract below was recalled by a 33-year-old fisher in Mhinga. His life story was dominated by the impact of theft on his livelihood and how he had dealt with it:

> … the thieves stole my engine from the shade of my house … I started life again; I went and started cultivating; I grew maize and I bought other boats and started trading again …. In 2003 I bought other nets and a boat; there were 40 nets and they were also stolen from the lake. What I know is that whenever my things are stolen that I get the money from farming, so I went back into farming and rearing chickens. I bought other nets and they were also stolen about 20 times … there is no security on the water.

Although he gave no specific reason for returning to fishing again and again the interviewee suggested that he had few other options and that he thought fishing would eventually prove the most profitable option despite the apparent challenges.

Fishers also reported making changes to their fishing practices in light of their vulnerability and risk events they have experienced. For example in Kitanba when fish catches fell boat owners sometimes chose to keep boats on the shore for several days so that they did not waste money on fuel. The vulnerability of poorer fisherfolk to low fish catch and reduced income was given as a key reason for why fishers in Kitanba and Mhinga use unsustainable fishing methods. In discussion, Mhinga fishermen gave three reasons, all of which related to particular sources of vulnerability: first, people are poor and cannot afford to buy the required materials; one legal net cost more than five or six illegal nets. Second, the fish traders are encouraging illegal fishing by buying small fish, as larger fish were becoming fewer and were not sold at the landing site due to more profitable markets elsewhere, and third declining fish stocks and the small average size of the remaining fish makes catching fish with a legal net difficult due to its mesh size being larger than that of the illegal nets. In Mhinga they also raised the problem of people bringing illegal fishing methods into the community from outside. One fisherman said: 'The fishing techniques which were used before changed … We used to lay nets and catch many fish but these days people beat the water [use tycoons] … and scare the fish away.' Therefore, as the vulnerability of fishers grows the motivations for using illegal fishing methods increase, providing a clear linkage between vulnerability and sustainability.

Opportunities and commitment

As well as being informed by vulnerability, the decisions and attitudes of individuals in fishing communities were also influenced by the economic opportunities and success they achieve. In Kitanba and Mhinga people came to the landing sites because they believed that their lives would be improved through doing so because of the economic opportunities available there. In both communities there has been a significant transition from non-fishing to fishing livelihoods in the span of one generation. Of the 59 respondents to the structured questionnaire in Kitanba 39% were now working as fishers but only 2% had parents that did so. Similarly in Mhinga of the 67 respondents 38% were now working as fishers but only 8% had parents that did so. The significance of this in relation to commitment or motivation to participate in resource management is discussed later.

Fishing in Kitanba and Mhinga was commonly seen as a way of making money which can then be invested in other economic enterprises or to meet other social needs. The higher incomes in Kitanba meant that fishers there had been far more successful in realizing this opportunity than in Mhinga. In Kitanba one fisherman said:

> Fishermen keep on changing: anyone who gets enough money goes and does other businesses. You cannot say that fishermen will always be fishermen. Today I am a fisherman; tomorrow I will be a businessman. I can get enough money and go.

However, in the life history interviews it became apparent that some fishers felt frustrated by their inability to save and make investments. It was repeatedly reported by leaders in both communities that fishers get 'caught up' in life at the landing site and that despite their initial desires to save money and improve their family's life they get involved in the landing site lifestyle and therefore are unable to make the progress initially sought. This supports the idea that fishing was perceived as a temporary occupational alliance, not a long-term commitment, although in practice this is not always realized.

The anthropological literature on fishing engages extensively with the commitment of fisherfolk to fishing and their tendency to stay in the industry despite declining returns (see Acheson 1981; Peace 1991). This is thought to be due to the satisfaction that fishers get from fishing, at the root of which is a strong sense of identity, of being 'a fisherman'. The idea of involving local communities in fisheries management is based on the premise that fishers are committed to fishing in the future, both economically and culturally, but does not fully recognize that many fishing communities have been managing the fishery through their own institutions. However, in Mhinga and Kitanba many of those living at the landing site, both fishers and boat owners, were recent entrants in the industry and hoped that fishing would provide them with income. Joining the fishery was a decision often made through lack of comparable alternatives for making money. This has implications for how individuals and the communities perceived and utilized the resource as well as how the community functioned. Co-management is based upon an idealized notion of community that assumes that community members reside in the same place and share similar perspectives that enable them to work together towards shared objectives but this simplistic ideal has been called into question (Agrawal and Gibson 1999; Allison and Ellis 2001; Pratt 2012). Pratt notes that communities are better understood as 'messy and fractured, always turning up unforeseen complications and disrupting ideals' (2012, 179). In Mhinga and Kitanba the wide range of ethnic groups present, the frequency with which fisherfolk moved between landing sites and the high number of new entrants into the fisheries, whose families had no history of fishing, were all factors which undermined the community ideal on which co-management relies.

Discounting in fishing communities

The propensity of fisherfolk in Mhinga and Kitanba, fishers in particular, to engage in several key risk behaviors suggests that discount rates amongst fisherfolk may be

high. As already mentioned, in Mhinga and Kitanba fisherfolk had a propensity to engage in alcohol consumption and drug taking both of which have been linked with high discount rates. Bishai (2001) found that alcohol consumption and frequency of alcohol consumption correlated with time preference: those with a greater rate of time preference (higher discount rate) were more likely to drink, and to drink more frequently than those with a lower rate of time preference. Similarly, amongst injectors of heroin and amphetamines active users were found to have significantly higher discount rates than non-users and even ex-users (Bretteville-Jensen 1999).

Therefore, in Kitanba and Mhinga we would expect that the mean discount rate would be greater than in a community in which these activities are less common, because the individuals involved in these behaviors, most frequently the boat crew rather than boat owners, are likely to have higher discount rates than those who abstain from such activities. However, not all fisherfolk engage in such behaviors and the literature on addiction raises interesting questions about whether fishers have inherently high discount rates or whether these have changed following their arrival at the landing site. Additionally, exposure to risk may not in itself result in discounting, but the behaviors in which people engage in order to cope with these risks such as drinking alcohol and consuming drugs may cause them to discount the future more greatly.

The lack of savings culture and high expenditure on activities which bring short-term gratification also suggest that discount rates amongst fisherfolk are high. In an informal conversation with a young fisher in Kitanba about whether fishers like fishing, he responded:

> Yes they do, they enjoy the money. In the village it is necessary to be more careful because of the seasonality of the crops and the amount of time between planting and getting money … there are some fishers that have responsibilities elsewhere and take the money and go straight home but the majority just spend, especially the younger ones.

For this young fisher, the distinction between fishing and farming was in the regularity of the cash income which they generate. Fishing results in a regular cash flow which reduces the necessity of saving or thinking about the future: they can just say 'I will get [money] tomorrow.' Conversely, agriculture-based enterprise requires a much greater consideration of the future because the time between periods of cash income is much greater. Another fisher from Mhinga made the following remark

> … a person in the village is far better – they can set goals and achieve them but here we live on probability. That is why you see so many children on the landing site are not educated and we are here just suffering.

The idea of 'living on probability' refers to the wide variety of risks that they face and how nothing is certain, making it difficult to invest and make decisions about the future.

The data from Mhinga and Kitanba presented so far seem to suggest that the conventional narrative, articulated by fishery managers and scientists (and sometimes by fishers themselves), that fisherfolk 'live for today' may apply to the fishermen in these communities and that their daily cash income and the inherent uncertainties in how good the catch will be on a particular day discourage long-term planning (Acheson 1981).

In Kitanba and Mhinga, as already mentioned with regard to savings and investment, there were those individuals who invested wisely and planned for the future. This was predominantly individuals who owned boats, had a successful business and/or had a leadership position. People's plans for their children also indicated how they thought about the future. The high level of motivation amongst parents in Kitanba and Mhinga to educate their children actually implies a long-time horizon in terms of both their children's well-being in the future and their own. Women reported going without food in order to raise sufficient money to pay school fees which is a clear example of deferred gratification, illustrative of low discount rates.

This alternative construction of fisherfolk as long-term planners and savers is also supported in the literature. Poggie (1978) found that the most successful fishers were those most willing to choose long-term investments rather than expending income on goods or services which offered immediate rewards. Firth (1966, 82) notes that the idea that the Malay fishermen he was studying were essentially disorganized and took things as they came was wrong:

> It is true that the scale of their organization is not very large and that there are men here, as everywhere, who are content to work in a rut. But within the scope of their organization their planning is often careful, even anxious, and may be looking months ahead.

Clearly, there was a mix of discount rates in the communities and it is very difficult to identify specific contributing factors. The business success and acumen displayed by some of the boat owners indicate that they have long time horizons with regard to their business and economic well-being. Our research supports Poggie's (1978) contention that success in the fishing industry demands such a perspective. However, you can survive in the fishing industry without being a boat owner and without saving, and this seems to be associated with short time horizons and high discount rates, at least with regard to expenditure. And although many fishers have good intentions of saving and taking money home when they

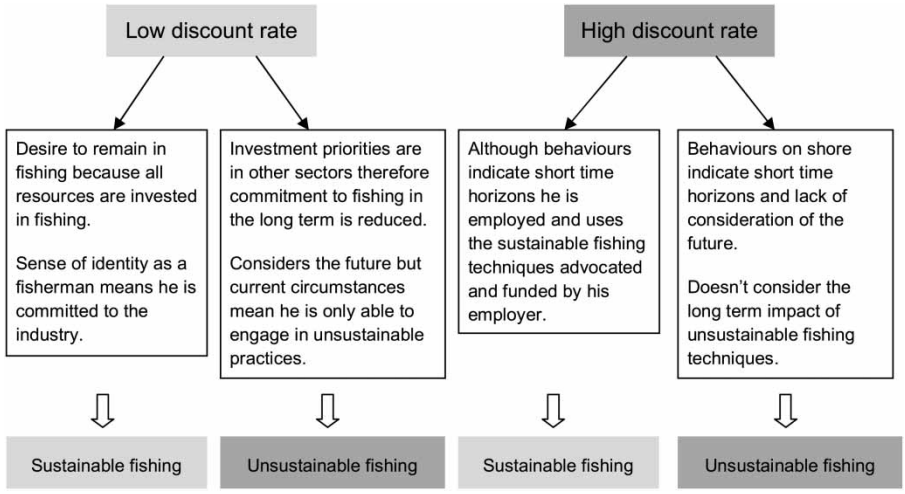

Figure 1. Schematic diagram outlining key factors which may mitigate the influence of a fisherman's discount rate on sustainability.

first arrive, few actually do this for a sustained period of time as they get caught up in the lifestyle of the industry with its focus on short-term gratification. However, whether or not a fisher creates a successful enterprise will not just be dependent upon his or her own capacity and choices but also on issues such as power and class relations within the community. It is contended that class has been overlooked in discussions about co-management, despite the potential relationship between vulnerability and class (Jentoft 2007; Davis and Ruddle 2012), and although we focus on individuals in this paper we recognize that understanding the choices that fisherfolk make would be enriched from research which explored these issues more explicitly.

Relating discounting and sustainability

We have tried to establish that whilst some fisherfolk exhibit behavior indicative of short time horizons and that the occupation of fishing facilitates this, many do not. We now consider how the discount rates amongst fisherfolk may impact on the priority they give to investing in the sustainability of the resource, through compliance and support for fisheries management.

The use of a fixed discount rate in resource management means that the rate of extraction is guided and planned. The lower the discount rate, the more sustainable the rate of extraction will be. However, when we try to transpose this rationality onto human social and economic behavior more broadly, it is found to be wanting. This is because people are trying to make choices in a variety of different arenas in their life in an ever-shifting context. Therefore, first, it is difficult to measure a person's overall discount rate as this will vary according to the area of their life in question; it may be related to livelihood or marriage for example, not to mention the stage of their life, as well as other contextual factors. Second and most importantly, it is difficult to assess how a person's discount rate will influence how they use the natural resources which they are currently drawing on for their livelihood. Figure 1 summarizes potential sources of confusion in this relationship.

Given the relationship between discounting and resource extraction in cost–benefit analyses, the pathways above which link low discount rates with sustainable fishing and high discount rates to unsustainable fishing appear the most logical. However, there are several reasons why this relationship may be altered. First, there may be a lack of commitment to the fishing industry and investment interests outside which result in even those individuals whose behavior indicates low discount rates not taking the future of the fishery into consideration. Alternatively fishers with very high discount rates may actually fish using legal fishing methods because their employer promotes those methods and therefore their individual discount rates are mitigated. When considering incentives within the context of co-management it is therefore important that it is not taken for granted that the individuals who are the least vulnerable, and theoretically more likely to be incentivized to fish sustainably, will do so.

Synthesis – implications of risk context and discounting behavior for co-management

This paper has sought to examine the proposition that fishers, and fisherfolk more widely, have high discount rates due to their high degree of risk exposure and vulnerability and that this may impact on whether or not they are incentivized to fish sustainably. We have shown that not all fisherfolk have high discount rates. There is a noticeable difference between the attitude of boat owners who are apparently less likely to have high discount rates, than the fishing crew possibly due to the financial and managerial responsibility of boat ownership. The presence of other

successful business people at both landing sites including fish traders and shop owners is further evidence that not all those residing in fishing communities have short time horizons. Additionally, women especially placed great emphasis on educating their children, suggesting a willingness to invest in the future. However, to the contrary, in both Mhinga and Kitanba behavior which indicates high rates of discounting have been described and observed amongst men and women, especially boat crew and sex workers. We believe that their high vulnerability causes them to significantly discount the future; thus actions that result in short-term income generation are incentivized over actions which protect resource sustainability.

But low discount rates do not necessarily incentivize biologically sustainable fishing practices. There are many incentives for fisherfolk to use illegal gear or trade in undersized fish even if they could, economically, fish legally. The motivations that push people to the landing sites are not usually a cultural or occupational commitment to fishing but are driven in most cases by economic necessity, and if not necessity, then certainly economic opportunity. If fishing illegally or trading in illegal fish enables a boat owner, fisher or trader to maximize their income and there are no other factors, such as pressure from other community members to fish legally, then this may be a logical choice. If they are not committed to fishing in the long term they are strongly incentivized to use illegal fishing methods irrespective of their vulnerability or time horizon

Having established that one of the underlying assumptions of fisheries co-management – that local communities, acting as 'rational' economic decision-makers are intrinsically incentivized to ensure the sustainability of a resource – may be untenable in certain contexts, the question that remains is whether community management or co-management can still address the fisheries management challenges it was designed to deal with. Instead of ignoring the lack of incentives which local communities may have to sustainably manage natural resources, community management is actually well placed to incentivize sustainable resource use, first by working in partnership with community development initiatives to reduce the risks and uncertainties in fisherfolk's lives thus promoting longer time horizons, and second by engaging a range of fishery-sector actors present at landing sites in a dialogue about the need for resource management and the long-term investment possibilities in well-managed fisheries. Although not straight forward, enabling local fishery management organizations to broaden their role to include concern for the welfare of fisherfolk and other functions of local development organizations may help to address some of the current disincentives of fisherfolk's participation in long-term stewardship that requires short-term losses of income-generating opportunities (Njock, Allison, and Konan 2008).

Whilst not the focus of this paper, we recognize that there are differences in behavior between different classes in the fishing communities, most notably between the boat owners and boat crew in Kitanba. The infiltration of neoliberalism into fishing communities has resulted in a focus on wealth generation and the associated class division that accompanies it (Davis and Ruddle 2012), which needs exploring so that paid workers, e.g. boat crew, do not become even more marginalized and exposed to risk. However, the risk and opportunities that emerge from fisheries within the global market place are not simply due to co-management but much wider economic drivers. Therefore, although we have brought to light more challenges which fisheries co-management faces, this does not suggest that a return to command-and-control methods of management is the only solution. As our awareness of the complexities of fisherfolk's incentives and disincentives increases, so too does our capacity to develop localized solutions which work to reduce vulnerability and build on the adaptability of community-based organizations and individual resource users to better align incentives, opportunities and sustainability.

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Notes

1. The LC is the locally elected political unit which represents the lowest tier of the Ugandan Government's decentralized structure. Both of the case study communities had an operating LC, usually referred to as the 'LC'. The role of the LC Chairman varied between villages but usually he or she played a key role in overcoming disputes in the community. Where BMUs have been established they have taken over some of the tasks of the LC where they are directly related to the fishers or fish traders.
2. The landing site names are pseudonyms.
3. Mukene is the local term for Silver Cyprinid (*Rastrineobola argentea*). It is a small, low-value fish recently used in chicken feed but with a long history of use for human consumption, throughout central, eastern and southern Africa, where it is usually traded in sun-dried form.
4. 'Tycooning' refers to the practice, used by fishers, of hitting the water with a large rock attached to a stick so that the fish are disturbed and swim directly into their nets. It is thought to increase catch size.
5. Based on an exchange rate of US$1 = UG 1690/- correct as of 2 January 2008.

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