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Fishers in a Brazilian Shantytown: Relational wellbeing supports recovery from environmental disaster

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ABSTRACT

How do environmental damages and disasters affect the wellbeing of fishers and fishing communities? How do fishers, and their communities, deal with and recover from such impacts? A three-dimensional wellbeing framework, involving material, relational and subjective wellbeing components, is applied to explore these questions as they arise in the urban coastal community of Vila dos Pescadores, in Southeast Brazil. This analysis examines a range of environmental impacts on fisher wellbeing, the cumulative effects of these impacts, and the particular case of a human-caused environmental disaster, namely a major industrial fire near Vila dos Pescadores. The analysis highlights how a pre-existing state of strong relational wellbeing was a major factor in the resilience of the community, as it recovered from the disaster. Emphasis is also placed on the important potential of conservation initiatives, carried out with the involvement of fishers, not only for ecological recovery but also for building wellbeing and social capital in the community. Based on the insights of fishers and other community members in Vila dos Pescadores, a series of recommendations to improve governmental policy are provided.

1. Introduction

Conventionally, the focus on peoples' wellbeing in development has been on material needs ([28], p. 105). However, current global challenges require a broader policy approach than merely taking income as the sole indicator for societal development, and new conceptualizations of wellbeing go beyond material ([28], p.104). As McGregor [27], (p.1) see it, "wellbeing is a state of being with others, where human needs are met, where one can act meaningfully to pursue one's goals, and where one enjoys a satisfactory quality of life". This paper applies a wellbeing lens to analyse the state of fishers, fisheries and the local environment at a community scale, with the aim of focusing attention within policymaking on the multiple criteria to be considered in the pursuit of sustainable fisheries – including fishers' material needs, but also incorporating their subjective and relational wellbeing.

Specifically, this paper focuses on analyzing the wellbeing of fishers and of the community overall, in Vila dos Pescadores ('Fishers' Village'), a highly-urbanized coastal slum area of Southeast Brazil. To begin, Section 2 describes the conceptual framework, based on the three dimensions of wellbeing, and Section 3 develops the context for a wellbeing analysis specifically for fisheries and fishing communities. Section 4 outlines details of the community of Vila dos Pescadores and the context within it is situated, while Section 5 describes the fishers and fisheries of Vila dos Pescadores. Section 6 explores several environmental impacts on fisher wellbeing, including domestic garbage, loss of mangroves, industrial pollution, and human-caused environmental disasters, as well as discussing the cumulative effects of environmental damage on fisher wellbeing. Section 7 focuses on a specific environmental disaster, in 2015, namely a major industrial fire near Vila dos Pescadores. Section 8 synthesizes the analysis with a discussion of four major factors – the role of relational wellbeing, social issues interacting with environmental ones, the important potential of conservation initiatives, and the need for suitable governmental policy. Finally, Section 9 provides a brief conclusion to the paper.

2. Three dimensions of wellbeing

According to McGregor and Sumner [28], (p. 105), human wellbeing includes three dimensions: the material, the relational and the subjective. The material dimension of wellbeing focuses on the resources of a person, household or community, and what resources are available to people to meet their needs ([6], p. 2). The relational dimension focuses on "social relationships which the person engages in to pursue wellbeing" while the subjective dimension addresses how a

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person gives meanings to the goals he or she achieves and the quality of life the person achieves ([28], p. 105; [6], p. 2). All three dimensions of wellbeing need to be considered in pursuing a better understanding of small-scale fisheries and developing suitable policies to reflect the "multi-objective and multi-scale nature" of fisheries ([47], p. 258).

The material dimension of wellbeing includes "assets, welfare, and standards of living" ([49], p. 161). The lack of material wellbeing leads to poverty, which is a result of peoples' lack of power and resources to achieve basic human wellbeing such as food and shelter, and where society's institutions refrain from supporting or protecting its own citizens ([28], p. 109–110). Kofinas and Chapin [22] state that wellbeing and livelihoods are thus the fundamental components that allow "sustainability, resilience, and adaptability of people to change" to materialize (p. 55).

Relational wellbeing is closely linked to social capital, the ability of people to cooperate and socially organize themselves based of rules of cooperation and a culture of social support ([45], p. 124). O'Malley [34] notes that a social system has "each part individually and collectively fulfilling the system's needs" (p. 139), producing a strong connection between wellbeing and social structure ([34] p. 139). Thus the community is an essential part of relational wellbeing and "having a sense of place" ([29], p. 356). A strong community leadership, spiritual and cultural traditions nurture a sense of meaning in life, security and identity (356). Furthermore, fishers' relational wellbeing, through community cohesion, enables fishers to mobilize themselves against environmental shocks.

Subjective wellbeing is a key element of a 3-D wellbeing approach. The subjective wellbeing addresses how a person gives meanings to the goals he or she achieves and the quality of life the person achieves ([28], p. 105; [6], p. 2). This recognizes, for example, that many rural activities, such as fishing and hunting, are not only professions, but are also parts of the identity and culture of resource users and their communities.

In applying a wellbeing approach, it is important to recognize critiques of its application. For example, there may be a tendency to identify wellbeing with achieve reliance on Western values including desired employment, high income, successful children and marriage, among others ([29], p. 355). In the West, people tend to have highly individualistic life ideologies, in contrast with other cultures' collective orientation ([48], p. 8). Thus, the understanding of wellbeing is culturally and socially constructed ([48], p. 8). In an individualistic culture, "self-affirmation and achievement are the symbols of achievement and thus wellbeing" ([29], p. 355). In a collectivist culture, wellbeing is connected to the "fulfillment of social expectations of the community, rather than the individual" (p. 355). Brazilian society, to be explored here, shows individualistic and subjectivist traits in several aspects: its fragile and individualist institutions; the lack of ability of citizens to think of the collective; and conflicts between the public and the private sphere ([9], p. 9). Awareness of such complexities is important to a successful wellbeing analysis.

3. A wellbeing lens applied to fisheries

In a fishery context, the wellbeing lens connects multiple dimensions (social, economic, environmental and institutional) to reflect the varied reality of sustainable development, allowing a "better understanding and assessment of conflicts and tradeoffs, and improved approaches for fisheries governance to incorporate considerations such as livelihoods, poverty, vulnerability, and social capital" ([6], p. 4). The wellbeing approach has the potential to further understand the complex dynamics of fisheries, and consequently, improve fisheries management and governance ([6], p. 1). Hence, improved fisheries policy must "engage with what people feel, think and aspire to achieve through their choices of action" in order to be successful ([8], p. 459).

Weeratunge et al. [47] note that the wellbeing lens is a broad concept that includes fishers' material and non-material needs (p. 256). It may be seen overall as a "non-analytical lens, which can help draw policy attention to the non-material benefits of fisheries" ([47], p. 256). Fishers' love of fishing, sense of identity and pride of their profession are some of the non-material benefits of fisheries. These non-material benefits enable fishers to attain subjective wellbeing from their livelihoods. Many fishers consider the importance of their livelihood as a way of life due to their love for fishing and job satisfaction ([6], p. 2; Santos, video interview, August 2014). The subjective dimension of wellbeing is demonstrated in what it means to be a fisher - fishing is not only an occupation, but it is a way of life, intrinsically embedded in fishers' lives. Fishers attain social and psychological wellbeing by being able to fish; and social exclusion, lack of identity, self-esteem, and sense of belonging by not being able to fish. Most fishers would not leave fishing for another occupation ([36], p. 542).

The wellbeing 'lens' applies as well at the community level. Notably, small-scale fisheries are intrinsic to community wellbeing, by contributing to communities' food security, livelihoods, identity, health and social cohesion ([7], p. 4). Symes and Phillipson [42] state the "resources of family and community contribute to the "survival strategies of fishing units" in situations of adversity for fishers (p. 2); fishing communities and their networks of social relations characterize the true identity of the inshore artisanal fishing sector (p. 2). Communities have the potential to build community capacity, enabling people to recognize individual and collective capability, allowing "communities to take action around shared issues" ([50], p. 285). Community members can establish their wellbeing and resilience in facing external drivers of change (p. 285), including environmental disasters. Kral et al. [31] explain that, once communities have control of their activities, wellbeing programs may have better outcomes (p. 435). This relates to issues of legal access to fisheries. Mbatha et al. [26] note that harvest restrictions often do not take fishers' livelihoods into consideration (p. 5). Fishers' material and relational wellbeing, especially in developing countries, is also based on peoples' food security. Since fishing is an important source of protein and income for impoverished communities, a wellbeing policy approach emphasizes the importance of focusing on artisanal fisheries to sustain these communities.

4. The community of Vila dos Pescadores

Vila dos Pescadores is a largely fishing-based community located in a coastal mangrove area of the city of Cubatão, within São Paulo state in Southeast Brazil. Vila dos Pescadores lies on the Santos Estuary, near the major Santos Port and the Cubatão industrial hub.

A large number of fishers in the city of Cubatão are northeastern migrants who migrated to the city since the 1960s in search of a better life and better living conditions ([41], p. 88) since the northeastern region of Brazil faced economic stagnation, constant droughts and lack of economic prosperity ([15], p. 38). Migrants were attracted by industrialization and economic growth in Cubatão, leading to strong population growth, especially in the decades from 1960 to 1980 (Alves, 2013, p. 352). Many migrants were looking for work in the petrochemical and steel industries, and since industrialization started in the 1950s, migrant workers also moved into the construction industry ([41], p. 68). Since the 1970s, with the government policy of strengthening industrial centres near the state capital (São Paulo), the area has undergone rapid uncontrolled growth, attracting low-income, low-skilled migrant labor, critical to the expansion of the Cubatão petrochemical hub ([14], p. 23).

The extensive in-migration to the Cubatão area, combined with the lack of housing affordability, led to the growth of slums and many 'mangrove invasions' (informal development of slum housing in coastal mangrove areas), which in turn created situations of high exposure to environmental hazards such as pollution, floods and landslides ([19], p. 187). This negative environmental situation combines with prevalent poverty, and lack of basic urban services in these settlements – sewage, drinking water, electricity and road paving are precarious and are

present only in the more central areas of these districts (p. 187).

This is the context within which Vila dos Pescadores started in the 1960s, when a group of artisanal fishers settled the area for subsistence fishing in the coastal mangroves. The community now has 9244 inhabitants [20] with a total of 3260 registered families [13]. Many live in shacks, about half of which are on stilts, and many of which lack basic urban infrastructure such as sewage treatment. The city of Cubatão plans to urbanize the community through resettlement – moving families who are living in shacks to a neighboring area, where new homes will be built, at a cost estimated at about R$ 150 million [13]. This plan is not without controversy.

A key group is the Community Association of Vila dos Pescadores which was founded in January 23, 1983 ('Mudando a História da Vila dos Pescadores' Facebook page, August 18, 2015). The association is a non-profit organization responsible for small projects in the community that aim to improve the wellbeing of community members and partially compensate for the lack of government actions in the area. Other non-profit organizations work closely with the community association, such as the Salvation Army.

To assess fisher and community wellbeing in Vila dos Pescadores, case study and qualitative research approaches were used, based on field research conducted in 2014 and 2015. The research also involved a review of literature and of media reports, as well as NGO and government webpages, and local archives. Interviews were carried out with 3 policy makers, 22 fishers, 11 community members, and 4 Cubatão municipal employees. Those interviewed included the local community leader and other key members of the communities, such as elders and partners of fishers. Questions asked covered environmental and social aspects that affect fishers' and community members' wellbeing and livelihoods, and other economic and sustainability aspects of their lives. The research also documented the lifestyle and empirical knowledge of community members, including fishers. Local travel, with fishers, enabled identification of wellbeing impacts due to urban and industrial pollution caused by slums, by the port and the industrial hub in the area.

5. Fishers and fisheries of Vila dos Pescadores

Many in Vila dos Pescadores use the mangroves for artisanal fishing of fish and shellfish, which are a large source of income of people living in the neighborhood ([14], p. 24). The main species of crustaceans and fish landed at the Vila dos Pescadores dock are the land crab (*Ucides cordatus*); blue crab (*Callinectes sapidus and Callinectes danae*); white mullet (*Mugil curema*), little snook (*Centropomus parallelus*) and common snook (*Centropomus undecimalis*) ([14], p. 27).

Some fisheries, such as crab gathering, require intensive labor on the part of artisanal fishers. Artisanal crab gatherers of Vila dos Pescadores use the technique of "braçeamento", which is the introduction of the fishers' arm inside the den where the crab lives in order to grab it by hand ([24], p. 48). This technique can lead to physical exhaustion from the effort expended to bring the animals to the surface of the muddy substrate. It is not considered economically viable for larger-scale commercial fishers. The harvest of the mangrove crab uçá is legal only for artisanal fishers who use the "braçeamento" technique [12]. The land crab 'uçá' (*Ucides cordatus*) is a delicacy in several Brazilian resort towns, which are dependent on artisanal fishers to supply restaurants and the local economy.

Indeed, artisanal fishers of Vila dos Pescadores supply restaurant chains with a range of fish and shellfish. Thus for Vila dos Pescadores, fishing is important from an economic angle, as well as culturally. In particular, tourism is a very profitable industry in the Santos Metropolitan Region and artisanal fishers are an essential part of this system. There are, however, many economic challenges faced by fishers, including the uncertainty involved in selling their fish, and a reliance on middlemen, who often do not pay a good price for fish and shellfish. Furthermore, many local fishing companies do not buy from artisanal fishers, who have to sell their fish and shellfish on the 'Anchieta' highway (Interviewee 5, fisher, Aug. 18, 2014) to tourists ("Paulistas") from São Paulo city, visiting resort towns in the Santos Metropolitan Region.

6. Environmental impacts on fisher wellbeing

The community of Vila dos Pescadores suffers from environmental vulnerability by being located in an industrial area in the Santos estuary (where the largest port in Latin America is located) and being a very impoverished neighborhood. Four major sources of environmental declines are discussed here – domestic garbage, loss of coastal mangroves, industrial pollution, and a series of environmental disasters.

6.1. Domestic garbage

Fagundes et al. [14] state that the most common pollution problem in the Vila dos Pescadores area (Cubatão) originates from urban garbage, mainly plastic and wood (p. 28). In addition to the impacts on biodiversity, the plastic waste also affects navigation and causes damage to marine engines [10]. There has been an increase in the levels of garbage discarded in the mangrove areas of Cubatão, affecting Vila dos Pescadores. Community leader Vadinho emphasizes that a large part of the garbage arriving in the community is carried by ocean tides from other neighbouring cities in the Santos estuary (July 18, 2014). This effect may be an indirect impact of the past decade's economic growth in Brazil, which led to a rise in consumption in the country ([16], p. 214), perhaps even consumption patterns, combined with a lack of environmental awareness.

6.2. Loss of mangroves

Declines in the abundance of coastal mangroves have been caused by a range of negative anthropogenic influences of the industrial hub in Cubatão and the Port of Santos ([11], April 7, 2015, para 5), including mangrove invasions in areas of the city, as well as urban and industrial pollution. These have led to related environmental impacts in mangrove areas including destruction of fish and shellfish habitats, and the consequent decline of fisheries. In particular, there were high pollution levels in the 1980s and 1990s that destroyed a large part of the mangroves in the city of Cubatão. As a fisher states: *Fishers don't pollute the mangrove, but the industries and people from our community and other communities pollute the environment. The industries throw chemicals in the rivers, and people throw garbage in the mangroves* (Interviewee 3, July 10, 2014).

6.3. Industrial pollution

There are multiple sources of industrial environmental pollution in the Santos estuary (Interviewee 18, July 16, 2014). Many of the locations where fishing is carried out – in several tributaries of the estuarine system of Santos, as well in the main harbor channel – are contaminated sites, such as the Port of Alemoa, Cosipa (now Usiminas) channel and the port of Santos terminals in the Santos Estuary. Most of the pollutants, thrown into coastal and estuarine areas, settles in sediments, which can generate a source of contamination of the entire ecosystem, since this waste affects the aquatic food chain ([17], p. 29). Further, the dredging of the Port of Santos may allow environmental contaminants in the sediment to be dispersed and absorbed into the benthic community, leading to contamination of the sediment both for the water column and for the benthic community. Gomes et al. [17] emphasize the importance of measures for chemical safety in the Cubatão industrial hub, port activities, the dredging of the harbor channel, domestic sewage and garbage dumps, as well as reducing the environmental impact and risks to public health (p. 31). Even when industrial pollution levels are considered within the limits recommended by

health agencies, it is important to take into consideration the cumulative properties of many heavy metals ([46], p. 782–783). There is also a need for better public information about procedures adopted by Brazilian health agencies with regard to limits on metal contamination, and to determining the safe daily intake of crab meat by the general population (p. 782).

6.4. Environmental disasters

Fishers have expressed concerns about the impacts of environmental disasters, such as oil leaks in the Cubatão estuarine area (Fagundes et al. [14], p. 26) and a fire in the Copersucar storage facility in the Santos estuary (August 18, 2013) which led to the leakage of 180,000 t of sugar into the estuary (A Tribuna, Oct. 23, 2013). The latter disaster led to the irregular release of wastewater directly into the Santos Estuary [1], and environmental impacts, such as the death of fish, crustaceans and reptiles, as shown in laboratory analysis [1]. The syrup formed by burning sugar and low oxygen concentrations in water was responsible for the death of aquatic organisms [1]. One of the research respondents (a fisher) describes how fires and other environmental disasters in the last decade affected their fisheries and how the industries "fill up the mangrove transforming it in landfills" (interviewee 5, Aug. 18, 2014). The present article focuses particularly on a recent case of an environmental disaster that had, and continues to have, a major impact on the community of Vila dos Pescadores.

6.5. Cumulative effects of environmental damage on fisher wellbeing

The above environmental problems, and consequent declines in environmental quality, have led to decreased resource abundance, adversely affecting the community's fisheries. Indeed, the declines in fisheries, compounded by a range of social issues, notably inequality and poverty, has directly harmed fishers' livelihoods. Some have felt it necessary to look for work in the economies of cities in the Santos Metropolitan Region (interviewee 24, August 20, 2014, community member), meeting the call of the Cubatão industrial hub for cheap labor. The pressure on fishers to shift from fishing to industrial and construction work for survival is contrary to their strong love for fishing, and thus reduces their subjective wellbeing. Fishers do not want to leave the fishery, and certainly not as a result of faulty policies that fail to compensate them properly in cases of environmental decline and disasters. Fisher R. S. describes how he feels about fishing*: No one will take me from fishing. I am crazy for fishing, and I will not stop fishing, even though I find a job. Fishing is something I learned to enjoy (Aug. 27, 2014)*. This fisher refers to the impact of resource declines, which caused him to take a job in one of the industries of the Cubatão industrial hub. Nevertheless, fishing still contributes to his family's food security (R. S., April 26, 2015), as he and his wife (who is also a fisher) fish on weekends and sell their fish in São Paulo city's markets. The message here is that the cumulative effects of environmental damage faced by fishers of Vila dos Pescadores can lead to declines in material as well as subjective wellbeing. Indeed, relational wellbeing may be adversely affected as well, when fishers must deal with increased competition for increasingly scarce marine resources.

7. Case study: the 2015 environmental disaster in the Santos Estuary

A major fire at the Ultracargo fuel distribution company in Alemoa district of Santos lasted from April 2 to 10, 2015 [33]. The fire occurred on the Santos Estuary, in a location that houses 175 fuel tanks, with capacity of up to 10,000 m^3 each, in an area of 183,871 m^2 [33]. In the Ultracargo terminal, six tanks with more than three thousand cubic meters of ethanol and gasoline burned [33] until the fire was eventually contained on April 10th.

There were no human fatalities, but the fire led to the release of liquid and gaseous effluents, jeopardizing the security of neighbouring communities, employees and other installations in the same industrial zone, and causing the death of thousands of fish, damaging fishing in the region [39]. An interviewee reported that tons of fish died due to the rise in water temperature and the release of chemicals in the water (Interviewee 15, April 20, 2015). This is supported by the Environmental Company of the State of São Paulo (Cetesb), which noted that seven tons of fish died because of lack of oxygen and high water temperature, which reached 27° Celsius, and polluted water used to fight the flames, which leaked into the estuary [33].

SINDMINÉRIOS (Trade union of workers in the trade of minerals, petroleum products and fuels in Santos and Region) stated that they had alerted the Ultracargo Company of concerns several months before the fire, after complaints from employees about incidents and operational failures in transportation, handling and storage of hazardous liquids [39]. Eventually, the Environmental Company of the State of São Paulo (Cetesb) fined Ultracargo R$ 22.5 million (about $ 5.9 million) for environmental damage to the population and other consequences of the fire in the industrial area of Santos [37]. The company was fined for releasing wastewater in the estuary of Santos, in mangroves and in the pond adjacent to the terminal, and releasing gases in the atmosphere; jeopardizing the safety of nearby communities, employees and other facilities located in the same industrial zone; causing significant nuisance to the wellbeing of the population; and causing the death of fish of various species in the estuary and Rio Casqueiro, damaging fishing in the region [37].

7.1. Negative impacts on fishers

Right after this environmental disaster, many fishers at Vila dos Pescadores were not able to fish, affecting their main sources of income and livelihood. Many fishers had to rely on family members for financial help. Fishers also found informal jobs in construction, but the increased number of workers in the informal sector led to lower salaries. A fisher, who is registered with the fisher's colony (union), noted the lack of compensation for fishers when environmental disasters happen in the Santos Estuary. He states: *Cosipa* (now called "Usiminas" company) *and the Port of Santos pollute the water. How we, fishers, will survive? We enjoy fishing. There will come a day that the pollution will end it all. Our profession has to be respected* (Interviewee 9, fisher, Aug. 18, 2014). His opinion reflects how the majority of interviewed fishers feel about how the industries and government in the Santos Metropolitan Region handle environmental disasters. The impossibility of fishing not only affected fishers economically, but also affected their broader wellbeing, as fishing is part of their identity.

Fishers who were able to continue fishing, or who went back to fishing later, complained that the amount of fish in the estuary diminished considerably, compared to what they used to catch prior to the Ultracargo environmental disaster (Interviewee 15, phone interview, May 30, 2015). The environmental disaster worsened what was already a decline in the fishery that the State of São Paulo has been facing since the 1990s. From mid-1970 to 1984 there was an increase in catches as a result of public policies to stimulate the fisheries sector [3]; São Paulo fisheries production reached 131,000 t. However, this led to overfishing of the main fishing grounds and a consequent drop in the fisheries [3]. The second half of the 1980s and throughout the 1990s saw an abrupt decrease of fisheries in São Paulo, which dropped to 25,000 t of catch in 1999 [3]. The disaster made the situation worse. Indeed, after the disaster, about ten tons of dead fish floating on the surface, together with invertebrates – a bleak scene both for those who fight for a clean ecosystem and for those who rely on fishing for their livelihoods [44]. Furthermore, fishers had to travel greater distances to be able to fish. The future of the fishery is not positive either, as there could be long term impacts. Researcher Mateus Rotundo of the University Santa Cecilia indicates that many reproductive aspects of fish could have been affected by this environmental disaster, because many

species found dead afterwards reproduce only once a year (Vicentini and Schepis, EcoFaxina Institute website, 2015).

The Ultracargo environmental disaster also led to problems with marketing of fish caught from the estuary. Artisanal fishers, despite traveling greater distances to fish in waters free of pollution, encountered scepticism from people who believed their fish came from the area where the environmental disaster took place. This situation leads to loss of income and job uncertainty, as fishers had difficulty marketing their fish in the Santos area. While some fishers – those who own a car and can afford to pay expensive toll fees on the 'Imigrantes' and 'Anchieta' highways, connecting the cities of Santos and São Paulo, including Cubatão – were able to sell their fish for higher prices in the street markets of the Metropolitan São Paulo Region, those who do not own a car were much more limited in their marketing opportunities.

In terms of responses from Ultracargo, company representiaves noted that a series of visits to fishing communities in the Santos Metropolitan Region was carried out, holding discussions with the main community leaders in the region as a diagnosis of the problems faced by fishers after the fire (Diário do Litoral, June 19, 2015, "Fishers do not have guaranteed compensation"). Representatives of Ultracargo commented that the estuary is no longer contaminated with fuel and the oxygen content is back to normal (Diário do Litoral, June 19, 2015, "Fishers do not have guaranteed compensation"), even though the São Paulo State environmental company Cetesb had not yet concluded its study on the quality of fish for consumption (Diário do Litoral, June 19, 2015). > From the fisher perspective, compensation from the company was slow in arriving, and indeed, an Ultracargo representative stated "damages and compensation will only be possible once technical reports are released" ([4], p. 6–7). Fishers continue to have many barriers to sell their fish in the region due to lack of trust from consumers about the quality of fish and shellfish in the Santos estuary.

7.2. Drawing on relational wellbeing following the disaster

In the aftermath of the Ultracargo disaster, the fishers and the community drew effectively on their strong relational wellbeing. Indeed, for many fishers and community members, the Ultracargo disaster represented a common element to unite around fighting for fishers' and their families' rights in the community. A variety of initiatives were undertaken, often the result of actions by the Community Association of Vila dos Pescadores, which played a major role following the disaster. Five specific points are described here, relating to improving the official status of the fishers, developing new partnerships, ensuring the distribution of food after the disaster, a major success in reopening a crucial fishery, and collective actions of women in the community.

7.2.1. Enhanced official status of fishers

The strength of fisher and community organizations – specifically the Community Association of Vila dos Pescadores, and the community's fisher association 'Capatazia Z1' (the local group of fishers organized to discuss problems fishers face) – was crucial in supporting fishers to legalize their status as fishers, through registering for their license card (RPG – record of fishing activity card) at the Ministry of Fishing and Aquaculture (interviewee 18, September 1, 2015; Mudando a História da Vila dos Pescadores Facebook page, Oct 27, 2015). This is important because when artisanal fishers have valid (unexpired) fishing licenses, it allows the government to compensate them in case of environmental disasters. Fishers are only entitled to indemnification if they hold their RPG document, which entitles fishers to exercise their profession (Carrari, May 2015). At Vila dos Pescadores, there were only 37 registered artisanal fishers prior to the Ultracargo disaster (Carrari, May/Jun. 2015), even though the community has over 200 full-time fishers. After the Ultracargo disaster, many fishers obtained their fishing licenses, but others still need to provide proper documentation in order to complete their applications (Vadinho, Facebook message, November 23, 2015).

7.2.2. Enhanced partnerships

The Ultracargo disaster led to the 'wakening' of fishers and community members to fight for their rights and find partners that empowered this community, including several NGOs that became involved with Vila dos Pescadores fishers after the disaster. This included the EcoFaxina Institute – an NGO involved with coastal communities living in mangrove areas of the Santos Estuary. EcoFaxina volunteers, in partnership with Vila dos Pescadores fishers and other community members, collected 1,055 kg of solid waste in the mangroves within the estuary of Santos on April 5, 2015 [21]. They also observed the already visible effects of the waste that originated from water that was used in fighting the flames from the Ultracargo containers [44]. Several newspapers in the region used the photos taken by EcoFaxina staff and volunteers to demonstrate the dimensions of the Ultracargo environmental disaster.

7.2.3. Food distribution

The president of the Community Association of Vila dos Pescadores (Vadinho), the coordinator of the Capatazia Z1 (Santina Barros) and the Cubatão municipality helped to organize the distribution of 'food baskets' for fishers and their families at the Vila dos Pescadores Community Centre on June 22, 2015. In total, 139 families of fishers received food baskets, which contain basic non-perishable food items such as rice, beans, cooking oil, etc. (Mudando a História da Vila dos Pescadores Facebook Page, June 22, 2015). The Ministry of Fisheries and the Ministry of Social Development sought to help fishers and their families affected by the Ultracargo disaster granted the food baskets, transported by Ultracargo. [2]. Foods were obtained from federal interministerial resources after finding that about 10 t of fish died in the Santos Estuary during and after the Ultracargo fire [2]. The 'food baskets' were delivered not only to fishers in Vila dos Pescadores but also to fishers in other communities in the Santos Metropolitan Region. In total, 2227 fishers and their families were registered to receive 'food baskets', plus 273 fishers who were not registered as fishers, but could prove their livelihoods as fishers in order to receive the benefit [2]. This activity, while helpful to fishers, was not without criticism: Maramar [25] noted that many fishers did not want to pick up their 'food baskets' because the value of the rice, beans and oil delivered in the baskets was not worth the cost of missing a day of fishing.

7.2.4. Reopening crab harvesting

After the Ultracargo disaster, pressure from the Community Association of Vila dos Pescadores, fishers, NGOs, local governments, other fishers' association and other local actors led to an important step ensuring fishers livelihoods: the conditional reopening of the land crab harvest. Crab gatherers from the Santos region had their rights restored to capture the land crab uçá, in the mangroves, under certain conditions [38]. A resolution of the Department of the Environment (SMA) 64/15 was published in the Official State Gazette (Diário Oficial, October 1, 2015) allowing the harvesting for two years [38]. The land crab closure, which had been in place since February 7, 2014, was ended on September 30, 2015 [12]. Prior to this date, the São Paulo State government had considered the crab uçá, *Ucides cordatus*, as an endangered wildlife species [23]. The crab gathering was reopened after a joint scientific report from the Fisheries Institute, University of the State of São Paulo (UNESP) and the Area of Environmental Protection of the Central Marine Coast (APAMLC) stated that the mangrove crab uçá (*Ucides cordatus*) is abundant in the Central Coast of São Paulo, and is also an essential economic resource source for the survival of families of crab gatherers in the central coast of São Paulo state (DO, Oct 1, 2015).

The SMA-64 resolution established the rules for the conditional harvest of the land crab uçá, *Ucides cordatus* on the Central Coast of São Paulo (DO, 2015, Oct 1). This resolution allows local, subsistence and artisanal fishers who hold a license from the Ministry of Fisheries and

Aquaculture (MPA) to capture males, transport and store and sell the land crab uçá (DO, 2015, Oct. 1). With the new rules, it is forbidden to capture females, and to use any tools such as traps, sharp instruments and chemicals. (DO, 2015, Oct 1). It is still forbidden to gather crabs during their reproductive time, from October 1st to November 30th.

The conditional reopening of crab gathering in the Santos Metropolitan Region not only improved fishers' material wellbeing, providing more income to fishing families, it also improved their relational wellbeing by improving the relationships between community members in order to sell crabs, relying less on middlemen (Interviewee 38, phone interview, Nov. 14, 2015). Their subjective wellbeing was reinforced by providing for their sense of identity and belonging, in being able to catch crabs again. The reopening also alleviated concerns of some crab gatherers and fishers who, prior to October 1st, 2015, were using the black market to sell their crabs, with risks of being fined or even going to jail (Interviewee 38, phone interview, Nov. 14, 2015).

7.2.5. The role of women

After the Ultracargo disaster, many women in Vila dos Pescadores now meet to discuss fisheries and livelihoods issues. The importance of relational wellbeing to the community is seen by the fact that female fishers and wives of fishers, who were friends in their adolescence, have reunited to fight for fishers' rights and their families following a man-made environmental disaster. Women are proud of contributing to the livelihoods of their husbands and partners through mangrove reforestation and craft skills, and for some, also proud of being fishers themselves. Work with the media was also important following the disaster. The women, through the former 'José Tobias Barros' fishers' association, went to the media to demonstrate how the Ultracargo disaster affected fishers and community members. The former president of the 'José Tobias Barros' and community member, Marly Vicente, gave several interviews to the media to expose the damage that the Ultracargo disaster caused Vila dos Pescadores. This led to media attention, and possibly played a role in the benefits granted to fishers as food baskets, and the fines imposed by the Environmental Company of the State of São Paulo (Cetesb).

8. Discussion

This section synthesizes the results of the analysis so far, focusing on how the interaction of wellbeing and environmental impacts is shaped by four major factors: relational wellbeing, social issues (paralleling environmental ones), governmental policy, and conservation initiatives.

8.1. The role of relational wellbeing

As shown above, the strong relational wellbeing of Vila dos Pescadores was apparent in many ways following the Ultracargo disaster. The various responses to the disaster required a reasonable level of adaptation and resilience among individual fishers and households, and within the community of Vila dos Pescadores overall. This drew strongly on existing relational wellbeing; fishers and community members utilized their social capital in order to gain communal strength, forming the basis by which they were able to implement survival strategies, and unite with external agents, to respond and adapt to negative environmental changes. In this way, relational wellbeing seems to have contributed to greater resilience of the community, as it recovered from the environmental disaster. Although disempowered in many ways through the effects of an unequal society, with its racism and poverty, the relational wellbeing built up within the community of Vila dos Pescadores has helped to unite the community to fight for livelihood rights of fishers and their families, especially in the aftermath of environmental shocks. Furthermore, the difficult times following the disaster actually seems to have inspired within the community a positive feedback in further strengthening social capital and reinforcing the already-impressive existing relational wellbeing.

8.2. The need to link environmental and social challenges

While the discussion in this article has focused on environmental challenges facing fishers at Vila dos Pescadores, these are paralleled by social concerns – social exclusion, racism, poverty, rapid urbanization and growing inequality are all affecting the community. Linking the environmental and the social is environmental racism, which disproportionately affects vulnerable ethnic groups [18], resulting in broader inequality ([18], p. 25). Fishers in Vila dos Pescadores are mainly non-white, and live in areas of environmental risk, near the Cubatão Industrial Hub, where they are susceptible to environmental disasters. Compounding this is the nature of the community, as a slum, where residents suffer social exclusion by not being able to properly access services such as proper housing and sanitation. Accordingly there could be great value in instituting empowerment programs and social programs to build racial consciousness.

Also relevant in considering the impacts of environmental shocks on wellbeing is the reality that there are differences in wellbeing considerations among different stakeholders in the Estuary. For example, for people who work in the industries of Cubatão, compensation provided by the industries for environmental disasters could mean loss of jobs, if industries try to 'cut corners' when fined by the environmental agency Cetesb, leading to laying off employees (Interviewee 25, municipal worker, May 18, 2015). Thus the question must be posed of who wins and who loses, as well as who should be compensated, as a result of any given environmental shock.

8.3. The potential for environmental conservation

While achieving a reasonable level of material wellbeing is a major driver of actions within Vila dos Pescadores, the community also recognizes that its wellbeing depends on the sustainability of fisheries. By improving the local environment and availability of the resource (fish), fishers will have their income-generating capacity improve, and consequently, their wellbeing through long-term livelihood security. Therefore, efforts to improve immediate material wellbeing are accompanied by an interest in undertaking conservation initiatives.

Here we focus on one particular avenue that is seen by fishers as particularly important for this: mangrove conservation. Indeed, many remember a past mangrove conservation activity that still is the source of pride among fishers and their families in Vila dos Pescadores. That initiative, funded by the São Paulo State Environmental Company, Cetesb, in the mid-1990s, involved replanting propagules and seedlings of mangrove trees (*Rhizophora mangle*) ([30], p. 73), with the help of fisher families. Scientists and community members reforested large parts of the mangrove of the city of Cubatão ([30], p. 68), leading to increased amounts of shrimp (Osvaldo Rodrigues, fisher, August 21, 2014). Several fishers indicate that crab, fish and shrimp also increased.

While fishers and community members are eager to join government-funded conservation projects, and there are calls [40] for the Brazilian government to involve local communities in the recovery of mangrove areas, unfortunately governmental mangrove replanting projects are not being implemented due to lack of funding. Such funding is essential for projects to succeed, since already-impoverished fishers cannot afford to volunteer, as they need to work every day to maintain their livelihoods. An interviewee states:

> Fishers do not have the equipment or resources to clean up the mangrove themselves, but the government did not even put garbage collectors in the mangroves. The fishers in the community do not have the resources or equipment to monitor garbage pollution in the mangroves (Interviewee 5, 30 July 2014).

Some mangrove restoration projects are being carried out at present, but by private companies. The program 'Mangue Limpo' [Clean

Mangrove] began in 2003 as an activity developed by the neighboring community of Guarujá, where Dow Chemical Brasil is located ([43], p. 11). Dow Chemical Brasil funds and manages this mangrove conservation initiative, involving a local university (Santa Cecilia University), together with communities and fishers. This program has widespread benefits to all the communities in the Santos Estuary. A similar conservation initiative in Vila dos Pescadores, involving community members and fishers, could help to increase fishers' material, relational and subjective wellbeing in that community.

Whether mangrove conservation is led by government or by a corporation, there is good potential to increase community wellbeing by enhancing community cohesion and the pride of the community members and fishers. While ideally, conservation efforts should be bottom up, for a community like Vila dos Pescadores, which is socially and economically vulnerable, a suitable initial approach might be with the involvement of one or more of government, NGOS, industries, universities and other research centres, leading ultimately to empowerment of fishers to develop their own conservation initiatives, to enhance their own livelihoods.

8.4. The need for suitable governmental policy

The results of this research highlight the need to improve fisheries policies and to enforce environmental policies, in order to improve fishers' wellbeing. While the community has had successes following the Ultracargo disaster, there remains a great need for governmental assistance. As noted by the president of the Community Association of Vila dos Pescadores:

> We will continue demanding assistance of the competent authorities for the 139 families living from fishing (in the community) and remain until this day without any kind of help, except for food baskets donated by the federal government. It is regrettable that in a city like Cubatão, the authorities do not come together to help these families. (Vadinho, community leader, Facebook post, Oct. 2, 2015)

To ensure that governmental benefits flow to fishers, it is important that all fishers of Vila dos Pescadores are registered with the Capatazia Z-1 fishery group, and the Colony of Fishers union organization in Santos. This will also help fishing households to fully access government-funded resources, programs and projects that aim to support artisanal fishing, and which have the potential to not only increase the material wellbeing of fishers, but also their subjective wellbeing through raising self-esteem. Examples include Brazil's Federal program PRONAF (National Program to Strengthen Family Agriculture), which helps small farmers and artisanal fishers to access services, especially lending and financing fishing gear at low interest rates (p. 7), and a program of special lines of credits and microcredit for artisanal fishers, run by the Brazilian federal government, through the Secretary of Infrastructure Development and Fisheries and Aquaculture, and the Department of Development and the General Coordination of Encouragement and Support For Credit [32] (p. 15).

There is also a need for government policy that ensures proper compensation to fishers following environmental disasters, and that supports and/or implements suitable livelihoods programs to enhance the wellbeing of fishers. Already there are home-grown initiatives that could be supported. For example, women in the community, who are fishers or wives of fishers, sell their crafts to supplement their family income from fishing, with the sustainable use of recycled materials such as plastic soda bottles, and enhance marketing of their products – resulting in the generation of income, increased self-esteem and a better quality of life of fishers and community members. This effort is in line with the idea of Paulo et al. [35] that culturally-oriented sale of crafts can build community cohesion and reinforce cultural aspects of communities (p. 515). Ultimately, it is important to shift from paternalistic, top-down approaches to compensating fishers to a more participatory process in the wake of future environmental disasters.

9. Conclusions

By systematically considering the three dimensions of wellbeing – material, relational and subjective wellbeing – we have seen the strong interactions among these dimensions. In particular, it is notable that relational wellbeing can be drawn upon to improve material and subjective wellbeing following an environmental disaster.

We have also seen the importance of all three dimensions of wellbeing for the development of sustainable fishing in Vila dos Pescadores. On the one hand, certainly the pursuit of material wellbeing is in itself a major challenge. Fishers must deal with many factors – uncertain incomes and employment, seasonality and weather issues, fluctuations in fishing stocks and insecurity of markets (Symes and Phillipson [42]; [5]). On the other hand, relational and subjective wellbeing are also needed in the community. This need arises in many ways; for example, Weeratunge et al. [47], (p. 260) emphasize the importance of job satisfaction and happiness, while Symes and Phillipson [42] argues that fishers' self-esteem and self-help should be considered as important factors in fisheries. In many cases, it is clear that fishers' sense of identity and belonging are intrinsically attached to their profession as fishers.

Finally, insights arising from assessing the wellbeing of a fishing community have implications for governmental policy. For the fishers of Vila dos Pescadores, perhaps the most crucial needs from government are in four areas: (1) enforcement of environmental policies, to ensure petrochemical industries do not pollute the area, (2) suitable compensation, when environmental disasters do occur, (3) support to the fishery profession, to minimize the loss of livelihoods and the shifting into other occupations, and (4) suitable conservation measures, and support for community participation, to restore coastal habitats and marine resources, thereby improving long-term material, relational and subjective wellbeing.

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