Research

Interactions between individual, household, and fishing community resilience in southeast Brazil

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ABSTRACT. Resilience is recognized as a multilevel phenomenon, yet few studies have examined how the levels interact. This is partly because individual-level resilience and social-ecological systems resilience have developed in different fields. Here we explore the shocks and stresses experienced by a fishing community and its members, their responses, and how resilience features were expressed at individual, household, and community levels in southeast Brazil. First, both connections and disjunctions were found between resilience features at the three levels. Second, the greater resilience of certain individuals and households within the community contributed to increased social differentiation and reduced overall community resilience. Third, understanding resilience at multiple levels highlighted the consideration of persistence, adaptation, and transformation processes as potentially complementary, rather than conflicting. These conclusions underline the importance of understanding the particularities of each level, and how they relate to one another. A multilevel approach provides insight into aspects of resilience that would not be apparent if only one level were explored.

Key Words: *adaptation; Caiçara; multilevel resilience; persistence; shocks and stresses; small-scale fisheries; transformation; vulnerability*

INTRODUCTION

Coastal ecosystems are impacted by many drivers of change, a number of them directly affecting small-scale fisher livelihoods (Jentoft and Chuenpagdee 2015). Examples include overfishing, intensifying tourism and real estate speculation, out-migration and immigration, competition with large-scale fisheries, climate change, and degradation of terrestrial and marine ecosystems (Badjeck et al. 2010, Hanazaki et al. 2013). Aggravating these struggles are restrictive fishing policies such as marine protected areas, quota systems, and closed seasons, among the many of the technical "fixes" adopted by managers (Degnbol et al. 2006). Yet, despite these challenges, many small-scale fishers remain in fisheries (Allison and Ellis 2001, Coulthard 2008). Understanding the processes by which fishers respond and adjust to change is fundamental to mitigating the negative impacts of change in their communities and their ways of life (Trimble and Johnson 2013).

Resilience thinking offers a valuable lens to understand responses to multiple, and often concurrent, shocks and stresses brought by change. Shocks (or perturbations) can be defined as abrupt and often unexpected events, usually outside the range of expected variability, and stresses as ongoing pressures (Turner et al. 2003, Marschke and Berkes 2006). Resilience is a concept that developed simultaneously in different academic fields, including social-ecological systems (SES) and psychology of development and mental health, as well as in certain policy arenas such as disaster management (Brown and Westaway 2011, Maclean et al. 2014, Brown 2016). The common thread among these different treatments of resilience is "the ability to successfully deal with change ... a characteristic that can be applied to individuals, communities, states, ecosystems or linked social-ecological systems, tightly coupled systems of people and environment" (Brown 2016:2).

The social-ecological systems literature defines resilience as the capacity of an SES to withstand shocks in order to maintain the same basic identity, structures, functions, and feedbacks (Gunderson and Holling 2002, Folke 2006). Here, the idea of

resilience as maintaining the same structure and identity contrasts with the transformation of the system (Brown 2014). The concept of "panarchy," which describes SES as composed of nested levels and cross-scale interactions, e.g., in time and space, is central to resilience thinking. The multiple levels of a panarchy are influenced by processes occurring at other levels, as well as inside each level (Gunderson and Holling 2002). Many levels may play important roles in fisheries, from the individual, e.g. the fisher, to the global, e.g., international shrimp markets, with the potential that all levels are interacting and responding to these shocks, stresses, and/or opportunities (Berkes and Ross 2016). As Gelcich et al. (2010) show with respect to a managed transformation in Chilean fisheries governance, interactions among levels over time can be crucial. These interactions will have important impacts on how different levels of a system resist change, adapt, or transform. Here we deal with three levels: individual, household, and community.

First, individual resilience refers to a person's abilities to beat the odds and take positive life trajectories despite being exposed to adversity, hardships, and trauma (Luthar 2006, Buikstra et al. 2010). The literature that is concerned with the resilience of individuals derives from the fields of psychology of development and mental health (Brown and Westaway 2011, Berkes and Ross 2013). The process of developing resilience encompasses interactions and adjustments of the individual with both social and physical environments, alongside particular personal, emotional, and cognitive attributes (Luthar 2006, Schoon 2006). Here, vulnerabilities, as well as protective factors, are crucial (Luthar 2006). Vulnerabilities relate to factors that magnify conditions of risk, e.g., poverty and political instability, and protective factors are those that minimize the effects of risk, e.g., high neighborhood quality and social networks of support (Luthar 2006, Masten and Obradović 2006). Particularly, caring parents and being part of a stable home have been identified as central factors enhancing children's ability to overcome traumas (Wright et al. 2013). Therefore, one might assume that a resilient household assists individuals to overcome life adversities.

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Second, household resilience, a concept used less frequently in the literature, tends to be restricted to specific issues, such as food security (Alinovi et al. 2009, 2010) or climatic events (Nguyen and James 2013, Opiyo et al. 2014). For example, Alinovi et al. (2009) propose a methodology based on household resilience (as opposed to vulnerability) to food insecurity. The model considers many variables including income, access to food, assets, access to public services, and social safety nets, where stability and adaptive capacity are variables that cut across all other variables. However, their analysis of resilience does not approach household resilience more broadly (or address simultaneously occurring shocks and stresses) as the literature on individual and community resilience often does. Resilient households may be expected to add up to resilient communities, but this may not be necessarily so.

Third, community resilience can be defined as the "existence, development and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (Magis 2010:401). A related concept is social resilience, "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (Adger 2000:347). Here, whatever the level considered, community or social, collective resilience involves agency on the part of the community, including ability to self-organize (Berkes and Ross 2013).

There have been several attempts to explore the relationships between resilience at different social and ecological levels (Brown and Westaway 2011, Berkes and Ross 2013, 2016, Maclean et al. 2014, Brown 2016). Buikstra et al. (2010) explored relationships between individual and community resilience in an Australian rural context, identifying 11 resilience-promoting factors common to individual and community resilience. The main ones were networks of support and sense of belonging to a community, learning from experience, early experiences, environment and lifestyle, infrastructure and support services, sense of purpose, diverse and innovative economy, embracing differences, beliefs, and good leadership. The authors concluded that factors contributing to resilience at the individual and community levels were, for the most part, common to both.

In another example, Marschke and Berkes (2006) employed a multilevel approach to study fishing household resilience in Cambodia and found that the general features that affected households also affected the resilience of the community at large: learning to live with change and uncertainty; nurturing learning and adaptation though ecological and social memory; and creating opportunity for self-organization. However, the specific resilience-building strategies observed were quite different at the three levels examined, household, village, and nation. Berkes and Ross (2016) used panarchy as a theoretical framework to explore the interactions between resilience at multiple levels, and found that the relationships between different levels are not necessarily neatly nested. Each level tended to interact most strongly with adjacent levels, but in some cases, e.g., pandemics, there were direct vertical "jumps" from local to global, bypassing other levels.

The importance of interactions among levels within a social-ecological system is well recognized and theorized (Gunderson and Holling 2002, Folke et al. 2010, Berkes and Ross 2013, 2016,

Brown 2016). But empirical studies in social sciences have produced mixed results; the actual nature of these interactions is not well known. Moreover, what literature does exist emphasizes the connections of resilience at different levels, rather than their possible disjunctions. The assumption that resilience at different levels is necessarily interconnected needs further examination. The objective of this paper is to address this gap by studying responses to shocks, stresses, and new opportunities in a small-scale fishing community in Brazil since the 1970s. We draw on concepts from various disciplinary approaches to resilience in doing so.

STUDY AREA

The municipality of Ubatuba, situated in southeastern Brazil, on the north coast of the state of São Paulo encompasses an area of 71,078 km², and as of 2017 had an estimated population of 88,313 according to IBGE (The Brazilian Institute of Geography and Statistics). However, during the high tourism season (December to February, and during holidays), the area's population increases several-fold.

The study area comprises two contiguous neighborhoods: Lázaro and Saco da Ribeira, located on the southern coast of the municipality (Fig. 1). Approximately 500 families live in the community, including 43 fishing-dependent households. The research focused exclusively on the fishing community. The two neighborhoods were considered one community because there is no physical division between them, and the fishers and their families interact daily.

Fig. 1. Lázaro and Saco da Ribeira Community, Ubatuba, São Paulo, Brazil.
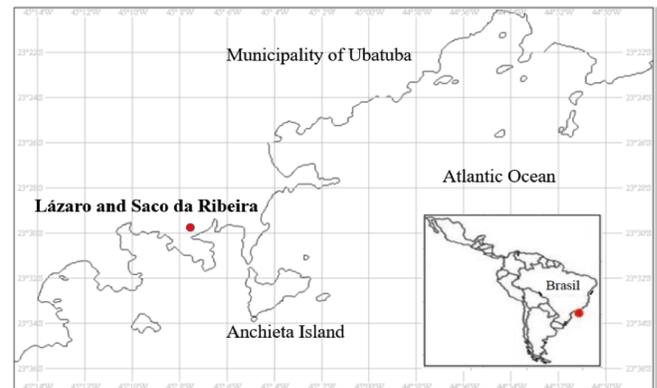
This community was chosen because as well as being one of the most active fishing communities of Ubatuba, the Saco da Ribeira Bay hosts the largest landing site of the municipality, where both small and large-scale fisheries are present. Fish landings, people selling and buying fish locally, and the presence of middlemen and fishmongers are a day-to-day routine. Moreover, the bay also hosts eight marinas and boathouses.

In this research, all participants were Caiçaras, a mixed-heritage group descended from Amerindians, Portuguese colonists, Africans, and other immigrants such as Japanese (Begossi 1998). The Caiçara of the region historically relied on the cultivation of cassava, sugarcane, fruits, e.g., bananas and oranges, and coffee,

as well as on fishing, hunting, and the extraction of forest products such as wood for building fishing canoes for livelihoods (Diegues 2004; Denadai et al. 2009, *unpublished manuscript,* http://www.pesnochao.org.br/memorias/ebook_com_quantas_memorias_se-_faz_uma_canoa.pdf).

Fishing has played an important subsistence and social role in Caiçara communities for the three centuries of their existence, but the earliest records of fishing as an economic activity date back only to the early 1900s, with the traditional mullet (*Mugil platanus*) fishery (Diegues 1974). In the 1940s, Japanese immigrants introduced a pound net fishery, locally called *cercos flutuantes* (Begosi 2006, Idrobo 2014), which is still used in many Caiçara communities. In the 1960s, the first trawlers, targeting shrimp, arrived in Ubatuba, and by the early 1970s, fishing had become one of the main local economic activities (Diegues 1983).

During the 1970s, with the construction of the coastal highway connecting the study area with cities such as Santos, São Paulo, and Rio de Janeiro, Caiçaras began experiencing rapid social and economic changes. The influx of immigrants and tourists resulted in a growing demand for seafood resources and increasing pressure on important local commercial species, including sardines, shrimps, sharks, and several fish stocks. Many of these stocks were significantly reduced because of perverse incentives and lack of proper management, including policy incentives in the 1970s to reduce interest rates and to encourage investment in industrial fishing enterprises in Brazil (Abdallah and Sumaila 2007).

The 1970s also saw the creation of state parks and the emergence of new conservation measures in the region, which led to regional and local conflicts regarding the use of natural resources. Over 80% of the land base in Ubatuba falls within the Serra do Mar State Park and other protected areas, designed to protect the remnants of the native Atlantic Forest. Further, in the late 1990s, large-scale commercial fisheries started accessing the coastal areas of São Paulo state, and soon fish scarcity became a significant challenge for artisanal fishers. As a consequence, the coast of Ubatuba was included as part of a marine protected area, created in the state of Sao Paulo in 2008. Despite some descriptions in the literature of these impacts on small-scale fisher livelihoods over the last 50 years, studies on fishing communities' struggles and resilience strategies remain rare (see Prado et al. 2015).

Both small-scale and industrial fisheries land their catches in Ubatuba, with small-scale predominating in shallower coastal waters (Leite 2018). Most small-scale fisheries are multispecies, catching several species using different fishing gear according to seasons and availability. The main fishing gear are small gillnets, pound nets, hook and line, hand jigs, and small (about 7 m) shrimp trawlers (Leite 2018). Some of the main commercial species are sea-bob shrimp (*Xiphopenaeus kroyeri*) and white shrimp (*Litopenaeus schmitti*), whitemouth croaker (*Micropogonias furnieri*), several weakfishes (*Cynoscion jamaicensis, Cyonoscion striatus, Cynoscion acoupa, Macrodon ancylodon*), species from the *Caranx* and *Scomberomorus* genera (*Caranx crysos, Caranx hippos, Scomberomorus brasiliensis, Scomberomorus cavalla*), groupers (e.g., *Epinephelus marginatus*), and squids (*Doryteuthis plei* and *Doryteuthis sanpaulensis*; for a more comprehensive list, see Leite 2018).

METHODS

In this study multiple methods, including participant observation, household surveys, open-ended and semistructured interviews, and focus groups were employed. Fieldwork was conducted over one year, from July 2014 to July 2015. Only households that relied on fisheries for income were approached to participate in this research; recreational or occasional fishers were not included. Out of the 44 fishing-dependent households within the community, 41 participated. Three households opted to not take part in this study, for various reasons, including sickness of a family member, and lack of interest in taking part in research projects.

Participant observation (Bernard 2006, Hay 2008, Creswell 2009) was used as a way of building familiarity with the community and its members, and learning the social context for data obtained by other methods. Subsequently, household surveys, following the questionnaire developed by Hanazaki et al. (2013), were conducted with fishers or fishers' wives (whomever was available) belonging to the 41 participating households. The main objective was to identify fishing households' profiles. Next, open-ended interviews (Bernard 2006, Creswell 2009) were conducted with 16 community members (6 women and 10 men) who had also participated in the household survey. This allowed for the identification of the most relevant shocks, stresses, and new opportunities faced by local fishers and their families over time.

Based on the data gathered through the previous methods, semistructured interviews (Hay 2008, Creswell 2009) were developed to explore resilience processes at individual, household, and community levels. Thirty participants (16 men and 14 women) were purposively selected to represent different genders, fishing-gear groups, education levels, wealth status, and age-groups, so as to cover the diversity of fishers in the study area. Age-groups were divided into youth (18–29 years), adults (30–59 years), and elders (over 60 years). Last, three focus groups were conducted: with men (11 fishers, adults and elders), women (six fisher wives, adults and elders), and youth (seven participants, three women and four men), to gather additional data on community resilience, with an emphasis on community-level relations and fishers' engagement in fisheries management.

RESULTS

Shocks and stresses

Fishers and their families reported experiencing many shocks and stresses after the 1970s. Although several stressors were not directly associated with fisheries, we focused on the shocks and stresses related to fishing (Table 1). These were identified during open-ended interviews, and confirmed through follow-ups. Other shocks and stresses, relevant to individual resilience, are explored below. For a complete view of all shocks and stresses identified by participants, refer to Leite (2018).

In Table 1 we deliberately chose not to differentiate between shocks and stresses because many of the shocks to older generations have turned into current stressors. For example, the creation of fishing no-take areas initially represented a loss of rights and therefore a shock, but is currently experienced as a stress because fishers frequently conduct illegal fishing and so risk arrest to remain productive. Meanwhile illegal fishing can lead to a shock if the fisher is apprehended by enforcement agents.

Table 1. Shocks and stresses described by participants, responses and consequences for livelihoods.

Shocks and stresses	Description	Response	Consequences
Fish scarcity	Declines in fish stocks in Ubatuba have been reported by fishers and scientists for decades.	Diversify to livelihoods focused on tourism activities. Diversify to target different species.	Impoverishment of households that have less access to financial resources to invest in diversification.
Creation of fishing no-take areas	Banning of important fishing grounds has had a significant impact on fishing activities.	Intensified use of other fishing grounds that are "not as good." Illegal fishing.	A widespread sense of injustice. Distrust of government environmental agencies.
Illegal fishing	Many fishers chose to risk fishing illegally, both in no-take areas and closed seasons.	Fishing at night without lights to reduce the risk of detection.	Arrest, seizure of fishing gear and catch, and fines. Conflicts with enforcement agents. Increased risk of accidents at sea.
Level of bureaucracy to obtain necessary fishing licenses	Fishers find paperwork excessive and an obstacle to proper registration and legal documentation.	Fishing undocumented or with expired licenses.	Arrest, seizure of fishing gear and catch, fines. Conflicts with enforcement agents.
Lack of available crew members	Growing difficulty in finding crew members because: (1) Substance abuse affecting fishers' capacity to commit to the job; (2) Most youth are not interested in fishing.	Fishing alone, or else risk working with crew members who compromise safety at sea, or who cannot be relied on to show up regularly.	Fishers placing their boats on the market. Abandoned boats on the coast.

Note: More details and a longer list of shocks and stresses identified by participants are documented in Leite (2018).

Importantly, participants' responses to such stresses and shocks did not always occur at the organizational level where the given shock/stress took place. To elaborate, Table 2 presents the main level affected by each shock/stress and the main level where responses occurred. The main level affected by a shock/stress was not necessarily the only level impacted. For example, shocks and stresses that affect individuals were very likely to affect their households, even if emotionally, e.g., fisher's wife worries when her husband fishes illegally. Additionally, shocks and stresses that affected the great majority of participants were considered impacts at the fishing community level. A clear pattern in this community was the absence of community-level responses to shocks and stresses that had impacts at the community level; responses seemed always to occur at the household and individual levels.

Although rapid change in the region brought on these diverse shocks and stresses, of equal importance were new opportunities, and responses, that arose. Participants identified new opportunities during open-ended and semistructured interviews. Table 3 presents a collection of new opportunities, along with different responses and corresponding consequences for local livelihoods. The following explores individual, household, and community resilience processes related to the stresses and shocks described above, as well as additional level-relevant challenges.

Individual resilience: protective factors and vulnerabilities
Here, we consider shocks and stresses that are significant when approaching resilience from a psychological perspective. For example, elders experienced a vast array of shocks or traumas, including loss of land and of rights to access natural resources (including agriculture, hunting, and important fishing grounds), while the younger generations face obstacles related to drug abuse and absence of life goals. Indeed, the youth focus group revealed that only two participants out of seven had a clear idea of what they would like to achieve in the near future. Table 4 summarizes the protective factors and the vulnerabilities found, as well as the genders and ages most affected.

Interestingly, 8 out of 30 individuals (adults, both male and female) who participated in the semistructured interviews reported seeking psychological counseling for themselves or household members, either recently or in the past. This number is particularly high considering there was no specific question nor probe about psychological counseling during interviews, and thus one might reason that the rate of occurrence is even greater. Reasons varied, including women feeling their freedom was constrained by husbands, traumas caused by past experiences of domestic violence, mental health problems, and the loss of fishing rights because of illegal fishing. The search for psychological counseling was more common among women (5) than men (3). A key informant suggested an explanation:

> *Men have the sea, and for them, the sea is like therapy. It makes them feel better about themselves and their problems. We, women, stay* [on land] *and have no escape like them.* (Adult female)

Indeed, when asked about the meaning of fishing, all fishers (including three fisherwomen) described the sea and fishing with a reverence beyond what could simply be ascribed to an income source. They described their intimate contact with nature as well as being physically active and greeting the constant challenges of the sea as reinvigorating. Some important aspects of fishing activities cited included stress reduction, positive emotions, feelings of freedom, and the pride in a good catch:

> *I am retired, yet I do not want to stop fishing, I know that the day I stop is the day I die. Fishing is not just about money; it is health. To breathe the sea air! The waves wash our problems away.* (Older male fisher)

> *In the sea I am my own boss. Many times I have a bad day, a bad catch, even though it is good because I feel free, there is no one to tell me what to do, only my wife* [laughs]. (Adult male fisher)

Table 2. Stresses and shocks described by participants, the main level affected, responses, and the level at which responses took place.

Shocks and stresses	Main level(s) affected	Main coping/adaptation response	Main level(s) of response
Fish scarcity	Community level	Livelihood diversification Greater focus on tourism activities	Household level
Creation of fishing no-take areas	Community level	Intensified use of other fishing grounds Illegal fishing	Individual and household levels
Illegal fishing	Individual level	Fishing in banned areas/seasons (especially at night without lights to reduce the risk of detection)	Individual level
Level of bureaucracy to obtain necessary fishing licenses	Household level	Fishing undocumented or with expired license	Individual level
Lack of available crew members	Individual level	Fish alone, or else risk working with crew members who might compromise safety at sea, or who cannot be relied on to show up regularly	Individual level

Despite such high importance placed on the sea and fishing activities for fishers' psychological resilience, the creation of restrictive fishing policies (such as no-take fishing areas and closed seasons) has exposed fishers to vulnerabilities not previously experienced. Illegal fishing brought many cases of power abuse by enforcement agents, as cited by the majority of fishers. These conflicts were characterized as an imbalanced power dynamic, based on fear and subordination. Participants explained that it is common for fishers to be approached by agents with firearms, even when fishing legally. The case below reflects on how relationships with enforcement agents can have significant impacts on fishers' psychological health:

> My father was caught fishing illegally when I was young. He has a strong personality. He got in a discussion with the enforcement agent because he thought it [fishing] was his right. He got bitten [literally] and offended by that man. He lost everything that day: gear, catch, his pride. My father started drinking. He never went back to fishing. He couldn't even take care of himself, always drunk... . My mother started working more and more, buying and processing shrimp from other fishers; she even had many other women working for her. My father took more than 10 years to stop drinking. I helped my mother selling the shrimp at home. (Adult female)

As shown above, in instances when fishers engaged in discussions with agents, consequences could be significant, ranging from predefined punishments (arrest, seizure of fishing gear and catch) to verbal and physical abuse (violent threats and beatings). Conversely, according to participants, if fishers show subordination, a second chance may be given:

> They got me fishing close to the Anchieta Island [no-take area]. I am sure I was out of the restricted area, but they said I was in it. I just put my head down and said "Yes Sir" to everything they said. I could not afford to lose my gear. They said I could go, and that they did not want to see me around anymore, or I would regret it. (Adult male fisher)

Mistreatment by enforcement agents, as well as low-job satisfaction and higher rates of substance abuse among crew members contributed to youths' lack of interest in engaging with fishing activities. Indeed, the youth focus group participants agreed that some of the reasons that made fishing unattractive to them included fish scarcity, restrictive policies, laborious bureaucracy to obtain a fishing license, and on top of all that, fear of conflict with enforcement agents. The lack of interest among youth, together with the difficulty in finding reliable crew members, represented a challenge especially for trawler fishers who frequently hired an extra fisher to assist the main fisher (or master). Even though youth generally showed little interest in fishing, with potential implications for the future of artisanal fishing in the area, households have demonstrated notable resilience in finding ways to retain fishing as part of their livelihood portfolios.

Household resilience: diversification and flexibility
Despite the fact that all participant households were able to maintain fishing as a source of income, some were merely coping, while others demonstrated an ability to adapt positively to changing circumstances. There were several attributes common to those able to better adapt: (1) possessing land and houses to rent to tourists; (2) owning their boats and diverse fishing gear; (3) having freezers to store catches (and therefore sell the catch directly to consumers); (4) coupled formal education and local knowledge; and (5) having extended families in the community. Importantly, livelihood diversification, together with women's contributions to household income, played a crucial role in fishing household resilience. Having an alternative source of income (both from fishers diversifying activities and women's wage jobs) frequently provided the financial security required for fishers to continue investing time and money in fishing activities.

Households with less access to the assets described above used shorter term and less secure activities. Examples include construction work as day laborers, working as occasional maids or babysitters, working at landing sites to handle catches of large-scale vessels, and relying on middlemen to sell their fish. Among these households, it was common to find an "if, then" type of strategy (Table 5).

When livelihood diversification becomes a prominent response to change, variation in household capacities to take advantage of new opportunities can intensify social stratification. Moreover, some opportunities represented gains for some but a loss for others. Marinas and boathouses, for example, brought

Table 3. New opportunities that arose in the study area after the 1970s, responses and consequences for participants' livelihoods.

Opportunities	Responses	Consequences
Tourism and increased job opportunities	After the 1970s Caiçaras started engaging in tourism-related activities such as working in grocery stores, hotels, construction, home services, selling pastries, renting out beach equipment, etc.	Livelihood diversification. Locals that were formerly dependent on fisheries, small-scale agriculture, and hunting, increasingly diversified to tourism-related activities.
Renting houses to tourists	Households are maximizing the construction of rental housing on their lands to cater to tourist demands. Many households had one or more houses used for renting on their properties.	Important income source in high seasons and holidays. Households that do not have land are excluded from this opportunity. Increased social differentiation. Properties are continuously subdivided into smaller parcels.
Guiding tourists on fishing, beach, or island excursions.	Many participants combined their traditional knowledge/skills with learned skills/knowledge to take advantage of tourism, e.g., navigation and fishing grounds knowledge with new ability of how to deal with tourists and administer budgets.	Fishers found a way to continue fishing and to apply their knowledge in this direction. Nevertheless, only fishers that have motorized boats and gear, and financial assets to adapt their boats to accommodate tourists, can pursue this opportunity.
Working as a *marinheiro* (captain-for-hire) for yacht owners	Working as a *marinheiro* for wealthy yacht owners. The area had eight marinas/yacht clubs in 2016. Fishers are investing in education because they need good literacy to pass special license test.	Marinas create stronger social stratification locally. *Marinheiros* are better paid than those engaged in other local activities. The job offers the security of a monthly wage, and at the same time the freedom to fish whenever they are not on duty.

opportunities for many fishers to work for high-end tourists as *marinheiros* (in charge of sailing and maintaining the yacht). From these fishers' perspective, the development of high-end boat tourism improved their livelihoods. Other community members, however, have a different viewpoint:

> The marinas brought a lot of jobs to our place, jobs as marinheiros, marinheiros' assistants, mechanics, electrician, security guards... I am a marinheiro, and so are my brother and brother-in-law. My son is my assistant. (Adult male fisher)

> Despite all the jobs, the marinas introduced a lot of pollution to our sea, and we lost access to the Saco da Ribeira bay [location of most yacht clubs and boat houses] where we used to collect mussels, swim, and fish. (Older female)

A central component of diversification was the role of women's contributions to household resilience. Out of 41 households, 21 (51%) had women contributing financially to the household income by engaging in activities not directly related to fisheries. Women contributed to household income through both paid jobs (76%) and by conducting their own businesses (24%). Paid jobs included housekeeping, teaching assistantships, and working in restaurants, among others. Businesses included making pastries to sell at the beach or at home, and working out of small family shops.

Also contributing to household income, five women went out fishing with their husbands, and one of these was considered a top fisher in the community. All five fisherwomen were also involved with postfishing activities (cleaning and packing the fish, selling fish, and managing budget). Eleven other women did not fish, but were responsible for cleaning and/or selling their husbands' catches from home. Those women who had paid jobs normally earned less income per year than the men; however, their income sources were generally more stable compared to the unpredictability of fishing. A fisher's wife explained:

> My job, as housekeeper, is what makes us sure that we will pay the bills at the end of the month. When my husband has a good fishing day, it is great, good money, but there are hard months too. Sometimes the fish just disappear from the water, and the catch does not pay the investment in going fishing, you know? (Adult female)

In addition to contributing to household income, women also demonstrated awareness of the need to save money for future "surprises." At the time of the fieldwork, less than 20% of households had debts (only two of these over US$5000) demonstrating participants' general capacity to maintain financial control over their expenses. Yet, only 10% of participants had a savings account for "emergencies," all of them being women. Other women expressed their frustration in not having any savings, and a sense of insecurity to deal with future uncertainties. Nevertheless, many participants would invest in what they called "other forms of savings." For example, common statements included, "I do not have a savings account, but I have land, and in case of an emergency, I can sell it" (Adult male fisher); "I do not trust banks, and the interests [rates] are not very good anyway. If I ever need to sell my second house, I will" (Older male fisher); "My boat is my savings account" (Adult male fisher).

Finally, combining strategies, such as those presented in Table 5, provides households with a degree of flexibility to deal with uncertain events, such as a bad catch and tourism fluctuations. In this sense, households in general managed to find ways of responding to changes triggered by economic development, some in more secure ways than others. Yet, development and tourism brought clear implications for resilience at the community-level.

Community resilience: lack of community cohesion and collective action
When asked how economic development had affected the community over the last several decades, participants characterized change in terms of trade-offs. All three focus groups (with youth, women, and men) recognized a trade-off between

Table 4. Protective factors and vulnerabilities identified as affecting individual resilience.

Protective factors	Gender/Age group	Vulnerabilities	Gender/Age group
Household and extended family support	Both genders, most commonly adults and older males	Constraints on freedom due to restrictions on fishing rights	Both genders, most commonly adult and older males
Psychological counseling	Both genders, most commonly adult females	Illegal fishing and conflicts with enforcement agents	Adults and older males[†]
Fishing as an invigorating environment	Both genders, most commonly adult and older males (three fisherwoman mentions)	Substance abuse and easy access to illegal drugs in the community	Both genders, most commonly male adults and youth
Faith and church circles	Both genders, most commonly adult females and youth	Domestic violence (verbal and physical)	Both genders, most commonly older females and youth
Friendship ties	Both genders, most commonly adult females and youth		
Formal education	Both genders, most commonly adults and youth		
Local knowledge	Both genders, most commonly adult and older males		
Autonomy	Both genders, adults and older		

[†]However, women fear for their husbands fishing illegally and being caught by enforcement agents.

economic development, and community cohesion and collective action. For instance, all agreed that employment opportunities had improved, and this effect of development and tourism was viewed positively. However, these opportunities also led to loss of community social capital through the erosion of traditional norms and customs. Economic development permitted community members to be less dependent on one another, initiating a shift toward more individualistic lifestyles. Additionally, economic development, and especially opportunities related to tourism, intensified social stratification because not all could take advantage of these new opportunities.

As a consequence of both more individualistic lifestyles and stronger social stratification, community networks became weaker and in some cases lost altogether. An example is the gathering known as *multirões* that used to unite locals to construct a house for a community member. Community-wide *multirões* no longer occur; instead, contractors are hired or construction is simply carried out by the family. Certain fishing activities also relied on collective work. Although the beach seines were owned by a handful of fishermen, this fishing method required large numbers of fishers and helpers to haul the net and sort the fish, men, women, and children alike. The fish (mainly mullets) were then divided according to a formula, all participants receiving part of the catch. Fishing with beach seines has been banned by the government since the 1980s, supposedly because of a high incidence of juveniles in the catch. Nevertheless, one fisher stated the following:

> Even if the beach seine was allowed, it would not happen as often because now everyone has their own boats and gillnets, they do not need to come together any more. (Older male fisher)

Participants also explained that networks of support have shifted, with less reliance on the broader community of fishers than in the past. Indeed, when asked who participants relied on in difficult times, the vast majority pointed either to their immediate household or extended family members. Focus groups confirmed churches as influential groups within the community. As

participants explained, churches have diversified, with one Catholic and three evangelical operating in the area, and they have also gained significantly in strength. As a consequence, the once more unified fishing community has fractured along lines of church affiliation, ultimately weakening the fishing community as a whole.

However, some kinds of community-level coordination and rule making were evident. For example, informal rules did exist when defining where an individual fisher's gear and boats (skiffs and canoes) could be stored on the beachfront, and for trawlers, on the landing spot. Moreover, a moral code stipulates any fisher under distress at sea shall be assisted without question. All fishers strongly agreed with this rule. Exchanging information about fishing grounds and resources is also a common habit among local fishers; however, information regarding good catch locations is shared only with closest friends and fishers in the family.

Aside from concerns such as these, fishers of the study area conducted no formal meetings. Even though members of the Ubatuba fishing community are bonded through shared ethnicity and culture, occupation, and extended family networks, there is no formal organization such as fishing associations or co-operatives, and few attempts to organize collectively. Until the end of fieldwork in July 2015, fishers were not engaged in any active organizations. Three fishers from the men's focus group commented on this lack of collective action: "We are small [small-scale fisheries], we have no power, no voice [insinuating there is no point to organize]" (Adult male fisher); "Fishers are not united here, there is no effort to come together to fight for the benefit of all" (Adult male fisher); "The hard part is to agree. Canoe fishers think differently from shrimp trawlers" (Older male fisher).

DISCUSSION
Findings from this research suggest that resilience at different levels (individual, household, and community) is manifested independently from the other levels, yet there are certain connections, and disjunctions, between some of the resilience features at the different levels. Confounding the analysis, the boundaries among the three levels were often hard to define.

Table 5. "If, then" strategies adopted by households. Adult and older fisher quotations.

If	Then
If the catch is big	then I sell to the middleman [prices fall, and normally others also have good catches, making local markets saturated, less lucrative, and more competitive].
If the catch is small	then I sell at home to tourists [there is limited space for storage at fishers' houses].[†]
If the fish [species] caught has high market value	then we sell it directly to tourists, or keep it for special occasions [festivities].
If the fish [species] caught has low market value	then I sell it to the middleman, or to other community members, or then, I share more with friends and neighbors.
If the large-scale fisheries land big catches, and the prices fall	then I buy fish from these fisheries and sell it locally.
When [If] there are sardine or pink shrimp landings [from large-scale fisheries] I work landing their catches and get paid in cash and fish.	then I resell it to tourists [if shrimp] or to community members [if sardines or other cheaper bulk fish].

[†]Women are frequently in charge of processing and selling the catch at home, while men are in charge of negotiating and selling the catch to the middleman.

Households are made up of individuals, and are part of communities; thus, dealing with discrete levels risks oversimplification. Nevertheless, contemplating resilience at multiple levels allowed for a fuller understanding of the impacts of diverse drivers on individuals, households, and the broader fishing community.

Although many shocks and stresses that affected the community level to some degree also affected households and individuals, other shocks and stresses were particular to specific levels, or actors within levels, requiring different resilience strategies. For example, environmental policies and fish scarcity generally affected all levels. Diversifying income-generating activities thus became a common strategy, whereby the fisher, or other members of the household, involved themselves in different economic sectors as a way of reducing vulnerability and the risk of livelihood failure. Women frequently had a central role in a family's diversified income portfolio. Livelihood diversification, or engaging in activities outside fishing, is a commonly described strategy in the literature on coastal fishers' responses to social-ecological changes (Ellis 2000, Allison and Ellis 2001, Grant et al. 2007). Hanazaki et al. (2013), found that Caiçara fishers in the Paraty area, north of Ubatuba, commonly combined fishing activities with tourism, day-wage jobs, agriculture, and commerce, among others. Similarly, Prado et al. (2015) found livelihood diversification, especially tourism, to be central to small-scale fisher livelihood resilience in the neighboring municipality of Angra dos Reis.

Livelihood diversification can be complex. Béné et al. (2003) describe two different forces driving livelihood diversification. In the first, called "diversification for accumulation," diversification appears to be associated with higher household well-being and is considered a proactive strategy generally pursued by wealthier households. In the second, "diversification for survival," diversification occurs as a form of coping with challenges or as a reactive response to crises (Béné et al. 2003). This research indicates that the two types of diversification can coexist: the same household could engage in both forms of diversification over time, depending on which household member is considered, and the context. That said, livelihood diversification toward tourism activities was a strategy generally pursued by wealthier households, characterizing "diversification for accumulation." Further, individuals who were able to diversify in secure ways were

frequently more educated. Similarly, Islam and Chuenpagdee (2013) found that in mangrove fishing communities in Bangladesh, the better-off households were able to employ more effective resilience strategies than those with lesser financial resources. Thus, in both Ubatuba and the Bangladesh case, wealthier households seemed to demonstrate greater capacity to manage their own resilience pathways in times of crisis.

Moreover, individuals and households with stronger social capital, especially family-centered systems of support, were more capable of diversifying activities proactively. Blythe et al. (2014) also found family networks to facilitate adaptation processes among fishers in Mozambique. However, contrary to our findings, they showed that wealthier fishers tended to intensify fishing effort in response to declines in catches, while the poorer fishers normally diversified livelihood sources. A central difference between the two cases is the strong influence of tourism in Ubatuba after the 1970s, and the opportunities that arose from this new economic sector to "remain in the game" of fishing (Ross and Berkes 2014). In Ubatuba, fishers who kept fishing as their household's primary or sole source of income were frequently facing vulnerabilities such as substance abuse and impoverishment. Here, increased household resilience to stay "in the game" of fishing translated into decreased individual resilience.

Buikstra et al. (2010) identified resilience-promoting strategies common to individual and community levels in Australia, for instance pointing to networks of support as a common thread. In this research, networks of support were found to be essential to individual and household resilience, but these networks occurred mainly through family and church circles and not at the broader community level. In fact, churches, which contributed significantly toward individual resilience (especially for women), were also described as responsible for creating divisions among families belonging to different churches, undermining the resilience of the community as a whole. Buikstra et al. (2010) points to embracing differences and the existence of shared religious beliefs and practices as factors promoting resilient communities. This perhaps explains why in Ubatuba participants blamed the lack of acceptance of different beliefs as responsible for decreasing community cohesion, and consequently resilience. This is an important disconnection between resilience among individual and community levels.

Fig. 2. Main resilience features among the three levels (individual, household, and community), and the connections and disjunctions among them. The red dashed boxes represent features that decreased community resilience. The black boxes represent features that contributed to the resilience of at least one level. The red dashed lines represent disjunctions, or "negative" connections, while the black lines represent "positive" connections among level-specific resilience features.
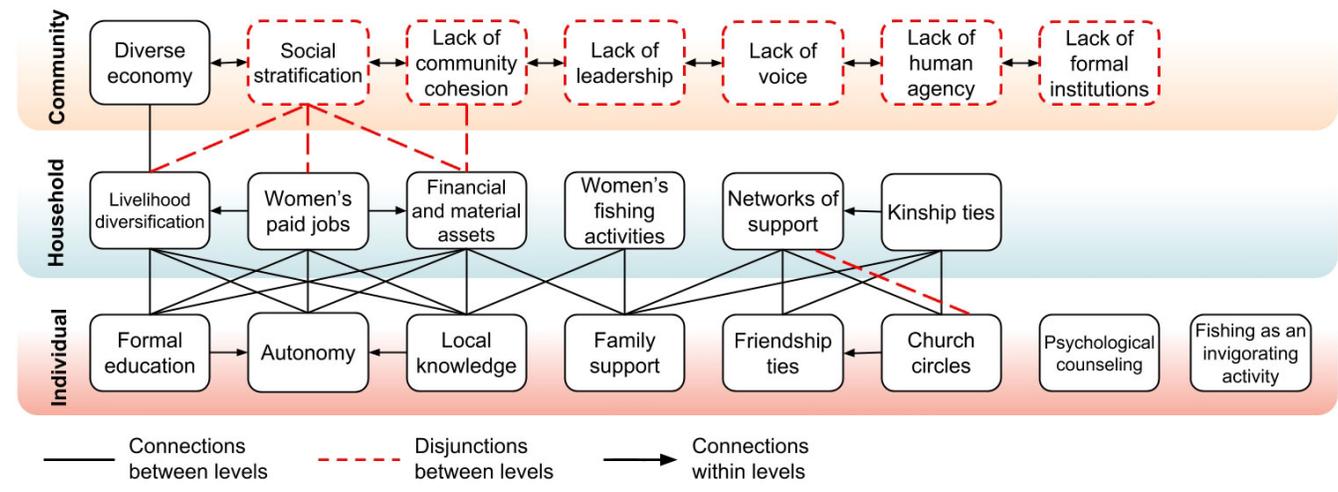
In a nutshell, resilience varied widely both within and across the three levels, depending on the shock, stress, or opportunity considered. For example, lack of resilience at the individual level did not necessarily translate into lack of household resilience, even when it affected the head of the family. This is best represented by the case where a fisher suffered from alcoholism, and yet the household responded with strength on account of the wife and daughter's efforts. Whereas one household member may have struggled to deal with adversity, the household remained remarkably resilient by maintaining fisheries as a livelihood source.

At the household level, resilience showed considerably less variability than the individual level. This may be because households managed to remain in the community and retain fishing as part of their livelihood portfolios, as opposed to many other Caiçara families who out-migrated to Ubatuba urban area or other cities. Moreover, despite wealth and standard-of-living differences, none of the surveyed households reported food insecurity. Even with diminished fish abundance and limited access to fish stocks, participants still reported considerable availability of fish. As in Paraty (Hanazaki et al. 2013), kinship ties and food-sharing appeared to have a role in maintaining food security across households. More generally, basic needs such as shelter, health care, and safe drinking water were also reportedly accessible for the great majority of participants. Nonexistent in the past, children and youth also have access to relatively good public school and daycare facilities within the community.

However, differences in the capacity of households for taking advantage of tourism-related opportunities increased social stratification, weakened social capital, and ultimately decreased community resilience in terms of the ability to mobilize community resources toward meeting shocks and stresses. Indeed, resilience was low for the broader fishing community, illustrated by the lack of active fishing organizations to give a voice and agency at the community level. Lack of community collective action, such as poor participation in fisheries management, has also been observed by others working with the Caiçara (Leite and Gasalla 2013, Trimble 2013, Trimble et al. 2014, Bockstael et al. 2016). The absence of formal community-level institutions, known to be important for adaptation elsewhere (e.g., Blythe et al. 2014), as well as the disappearance of community-level informal support networks (such as *multirões*) indicate the absence of strong community cohesion in the study area. Low community cohesion, i.e., low social capital, means a missed opportunity for community resilience: "Social capital is a resource for action [that] lie[s] with 'relations' and the benefits that arise from these relations" (Trimble 2013:30); organizing with others in order to become an agent of one's own life is ultimately an act of empowerment (Jentoft 2007). Magis (2010) and Berkes and Ross (2013) similarly emphasized the roles of community agency, self-organizing, and drawing on community resources. Figure 2 attempts to organize and summarize the central findings regarding resilience features for the three levels.

A further finding of the present study is that persistence, adaptation, and transformation were related phenomena (and not alternatives) occurring simultaneously as fishers and their families responded to changes. Through the rapid conversion process from a resource-based and subsistence-oriented economy to a tourism-orientated one, fishers, their households, and the broader community persisted, adapted, and were partially transformed. For example, many men persisted in fisheries by adapting their skills to include tourism as a part-time income source. At the same time, women began engaging in wage labor, e.g., working as housekeepers, adding up to a transformation. Many fishers themselves partially transformed their ways to accommodate the new lifestyle. As hired captains, the fishers had to accept the loss of being their own bosses, a defining characteristic of being a fisher (Johnson et al. 2018, Leite 2018). Even though some of the resilience literature tends to consider adaptability and transformability as distinct concepts (Walker et al. 2004), the

results indicate a melding of persistence, adaptation, and transformation processes allowing resilience. Consistent with Béné et al. (2014) and Brown (2016), all three phenomena were taking place simultaneously among the fishing-dependent people in Ubatuba.

CONCLUSIONS

We argue the need for a more nuanced understanding of the relationships between different features of resilience at multiple levels of organization (individual, household, community). The nature of these interactions has represented a knowledge gap in the literature. This study of a coastal fishing community in Brazil offers three conclusions in furthering our understanding of multilevel resilience.

First, interactions among resilience features at individual, household, and community levels were not always consistent. Importantly, they included disjunctions, or negative connections, between features in one level and another. Further, lack of individual resilience did not necessarily translate into overall lower household resilience. Similarly, high household resilience did not translate into increased community resilience, and the lack of community resilience did not affect all households in the community equally.

Second, the higher resilience of certain groups within the fishing community contributed to increased social differentiation, ultimately undermining community resilience. Approaching resilience at multiple social levels revealed the complexities of dealing with social-ecological system resilience more broadly because resilience was not homogeneous within levels, nor among levels.

Third, understanding resilience at multiple levels highlighted the consideration of persistence, adaptation, and transformation processes as potentially complementary, rather than as conflicting or alternate processes. In this study all three processes frequently occurred simultaneously, as fishers, their families, and the broader fishing community responded to shocks, stresses, and new opportunities brought about by changes. Here transformation was an emergent process and incomplete, rather than a managed process as in Gelcich et al. (2010).

These findings together underline the risks of approaching social-ecological system resilience without unraveling the particularities of specific social levels and actors, and the importance of unpacking resilience processes at various levels and exploring how they relate to one another. A multilevel approach allows insights into important aspects of resilience (or lack thereof) that would not be apparent if only one level were explored.

Last, resilience is always changing over time depending on the particular social, ecological, and political context. Shocks, stresses, and new opportunities, life and its adversities, as well as natural resources management policies and user-rights are all dynamic processes; as these change, resilience within and across social levels, and their interactions, is also likely to change.

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