

# Ethnoarchaeology Can Be Used for Ecological Conservation Because It Can Detect Shifting Baselines

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## Abstract

*“Shifting baselines” describes the human difficulty with perceiving long-term change across overly short timeframes. This is due to humans having lifespans that are too short to accurately perceive long-term change, as well as the difficulty of developing continuous perceptions across successive generations. The bigger picture is obscured by focusing on short-term fluctuations. Fortunately, archaeology allows us to gain greater perspective because of its profound time depth, which is especially important because no realistic definition of “sustainability” is possible without time depth. However, trying to apply archaeology to modern “shifting baseline” problems will be of limited use until combined with high-resolution ethnographic methods. While cultural anthropologists and archaeologists have increasingly come to utilize one another’s work for their own purposes, applied fusions of the two are still unpopular. Ethnoarchaeology has great potential for connecting modern ethnographic data with archaeological data because both disciplines can interface across a common data source – physical, preservable artifacts. Additionally, ethnoarchaeology can be used to detect potentially dangerous shifting baselines in modern perceptions of ecosystems health. This paper demonstrates what shifting baselines can look like in an anthropological context through a case study of a subsistence fishing community in northeastern Brazil. Future research directions for fusing ethnoarchaeology and archaeology are suggested for expanding today’s baselines of ecological health.*

Here, ethnoarchaeology will take Carol Kramer’s textbook definition as “ethnographic fieldwork carried out with the ex-

press purpose of enhancing archaeological research by documenting *aspects of sociocultural behavior likely to leave identifiable residues in the archaeological record*" (David & Kramer 2001, 12; emphasis added). However, ethnoarchaeology can not only enhance archaeology—it can also help make archaeology useful to living people. Humans already communicate within and across generations, but ethnoarchaeology can further empower the communication of ecological information from beyond the limits of a single lifetime. In this way, ethnoarchaeology can create standards for sustainability policy, as well as empower communities with an understanding of the environment which they co-create locally. This paper explores how ethnoarchaeology can detect shifting baselines and briefly suggests what would be necessary to create grand ecological baselines using both archaeological and ethnographic data. Due to space limitations, this work will primarily focus on demonstrating what shifting baselines can look like in an anthropological context using a case study concerning subsistence fishing in northeastern Brazil.

### **What Are Shifting Baselines?**

In 1995 Daniel Pauly introduced the concept of "shifting baselines" in fisheries science to describe how perceptions of change across overly short timeframes can give an unrealistic understanding of an ecosystem's health (Pauly 1995, 430). For example, a scientist or fisherman basing their assessment of a fishery's health on a few decades of fish stock observation might conclude the population has been relatively stable and therefore healthy. However, a study of the same fishery using data gathered over the past century or more could indicate that the fishery actually experienced a catastrophic population crash before reaching its current "healthy" state. In order to avoid this type of error and gain a holistic perspective of ecosystem health, research must utilize long time series. Because humans live for short time periods relative to multi-decadal or multi-centennial ecological shifts, the shifting baselines phenomenon creates an amnesia in which oral history can fail to

convey a fluid perception of ecological change across generations. However, archaeology and history can help communities overcome generational myopia when it is made relevant to their lives now.

Below, I provide an example of shifting baselines observed in Brazilian subsistence fishing communities. However, mine is only one of several such ethnographic studies (Sáenz-Arroyo et al. 2005, Bender 2013, Papworth et al. 2009). Several historical (Sáenz-Arroyo et al. 2006) and archaeological efforts are also being made to develop longer-term ecological baselines (Carder & Crock 2012), reaching even a 4500-year time stretch (Maschner 2008). In the future, efforts similar to mine and those above would be better at creating additional time depth by interfacing in an interdisciplinary manner, rather than existing in isolation.

### **Pilot Data on Subsistence Fishing in Northeastern Brazil**

As part of a pilot study, I conducted 21 semi-structured interviews with subsistence fishermen in the Atins and Queimada dos Britos area in the state of Maranhão of northeastern Brazil over a 30-day period in July and August, 2013. My interviews indicated significant fishery degradation over the course of a 78-year period. Informants were divided into nearly equally sized groups by age (10-24, 25-39, 40-54, 55-69, 70 and older). Only one participant, however, was in the 70+ age group because informants of this age were difficult to locate. Only two of the twenty-one informants were female, which reflects the male-dominated nature of the area's subsistence fishing economy. All of my informants are described as subsistence fishermen because their catches usually only feed immediate family or are sold within the village. In addition, their methods include line-fishing, net fishing by hand in the surf, and operating small wind- or oar-propelled boats. This is in contrast with the area's industrial scale fishing complex that uses motorboats, long-lining, and shrimp trawling. Seven of the twenty-one informants occasionally also sold their fish in the nearest city, Barreirinhas.

Informants were asked to name species they commonly caught as well as their size and quantity, both in the present as well as at the time they first began fishing. The same questions were posed in regards to the memories they had of the catches of their parents or grandparents. Informants then described the changes in fishing technology, weekly frequency, and the distance from shore where they typically fished. Other questions included species of bycatch, the amount of time they had lived in the area, if and where they sold their fish, where the informants learned to fish, and what threats (if any) they perceived to their fishing livelihood or the fishery itself. Informants were asked to rate on a scale of 1-10 the health of their fishery today, as well as to estimate from 1-10 that fishery's health one hundred years ago. Lastly, the informants described whether or not they thought their children or grandchildren would continue to be fishermen and why.

### Changes in Species Diversity

According to informants, species diversity in fish being caught has dropped significantly within their lifespans when over the age of 24. This was a pattern that was most pronounced in the oldest age group, who experienced a loss in species diversity three times that of the youngest group (Figures 1 and 2). In fact, no difference in species diversity was reported in the 10-24 age group (Figures 1 and 2). In the informants' collective past 12 species dominated their catches, while today only 7 species were named.

Species that are no longer frequently caught by the interviewed subsistence fishermen include sharks, bonito, mero, dolphins, *camurupim*, and shrimp. *Camurupim* (tarpon) in particular was repeatedly brought up as a species that was once common enough to be spear-fished, but now can only very rarely be caught with even multiple passes of a net. Instead, the majority of fishermen now catch almost entirely *tainha* (mullet fish), a small R-selected (i.e. fast-reproducing) species (Abou-Seedo and Dadzie 2004, 97). This species appears to have been the most resistant to overfishing by humans. The

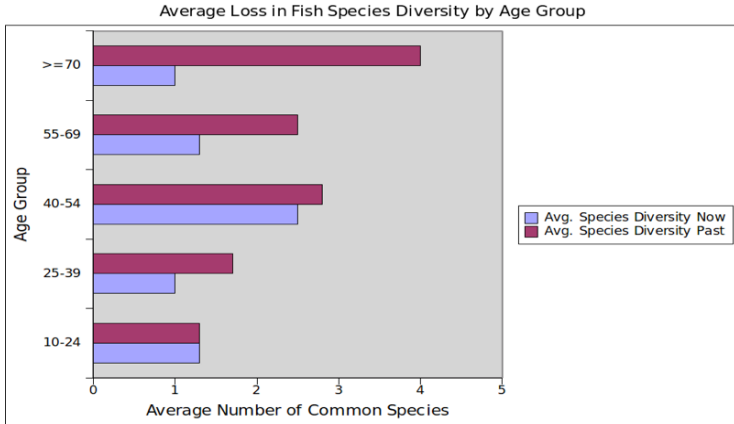


Figure 1

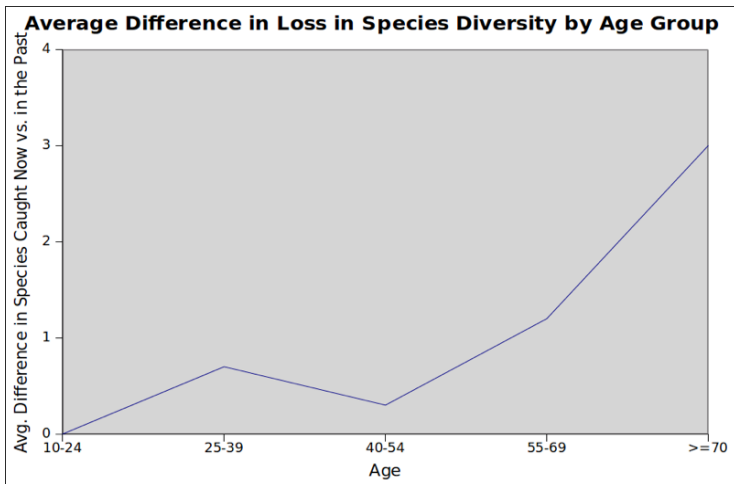


Figure 2

near complete loss of large, slow-reproducing fish such as *camurupim*, sharks, and local *peixe-serra* is a symptom of degradation in this fishery. Figure 3 demonstrates that all generations commonly find mullet to be the only species of fish caught today, while this was the case less and less in past generations as one looks farther back in time. In fact, the two oldest generations never used to catch solely *tainha* in the past.

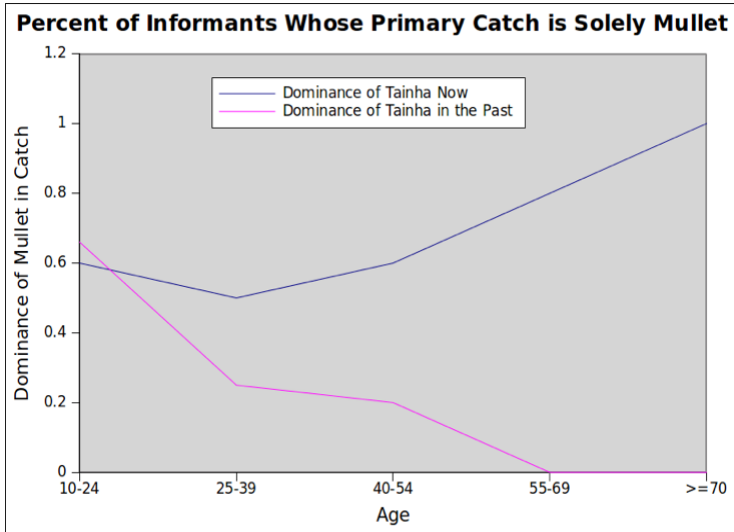


Figure 3

### Changes in Catch Size, Quantity, and Labor

Among middle-age and elderly fishermen complaints were ubiquitous about the decrease in catch size and quantity of fish obtained over their lifetimes. More labor became necessary in order to catch the same quantities of fish; for example, while one swift pass of a net was once sufficient to catch 30-50 kg. of fish, a fisherman can now spend hours at sea trying to obtain the same amount.

As shown in Figure 4, at the beginning of each fisherman's career (typically at the age of 10), the lowest value quoted for average catch per day was 6kg., whereas today that number is 0.66kg. The highest value for average catch per day was 400kg. in the past, which has reached 67kg. today. This suggests that fish resources may have been 510% more than what they are today in the average collective past of this area's fishermen. Notably, the numbers quoted for average catch per day were low for the 10-24 and 25-39 age groups but shot up radically after the 40-54 age group. This may suggest that shifts in fish population occurred suddenly within the last thir-

ty years because the 40-54 age group began their careers, at the latest, 30 years ago. This is particularly interesting because as the age groups get younger from 70+ until the 40-54-year limit group, reported fish acquisition increases dramatically. This may indicate that, starting about 70 or so years ago, as each younger generation began to fish, individual fish acquisition increased until fish populations may have crashed in the last 30 years.

Changes in technology, number of dependents per household, or economic demand in general each may have had a role in this increase in fishery exploitation until the crash happened. Many older informants explained that declines in their fish stocks were the result of illegal industrial fishing that went on unpoliced, especially in the case of long-lining trawlers. Informants reported decreases in catch size unanimously, indicating an unquestionable perception of crashing fish stocks.

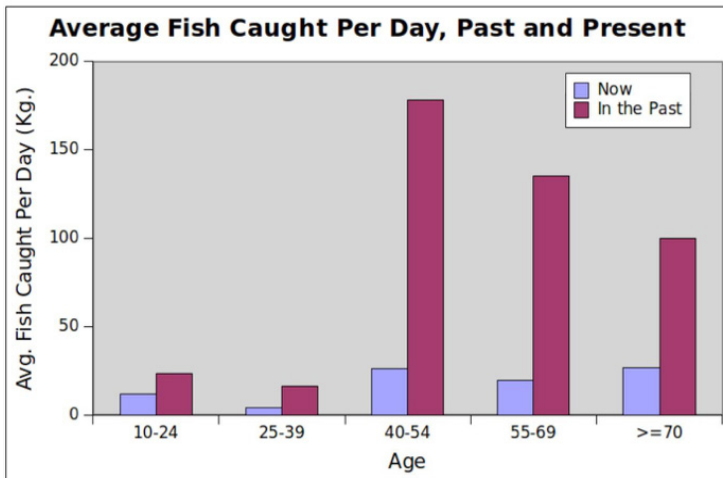


Figure 4

### Changes in Method and Skill Lineage

The oldest informants were the only ones who reported having learned their trade alone or by observing local fishermen, rather than by learning from family. That includes all informants between 60-78 years old (N=6), with one exception that claimed “brother-in-law”. All other informants learned from family members, almost always from their fathers (although one 54-year-old reported having learned from family early in life and then local fishermen later on). This suggests that as of about 50-60 years ago people moving into the area or being born there did not generally have a family tradition of fishing, while subsequent generations followed in the footsteps of hereditary lineage.

In the past, line-fishing and spear-fishing were more common; however, in recent times competition from motorboats has made sustainable, low-impact methods unattractive. Also, as a result of the wave of industrial fishermen deploying long-lining and shrimp-trawlers, many fishermen have been forced out of traditional paddle or sail boat net fishing—forced instead to fish by hand nets in the shore’s surf. This is because it is more difficult and less lucrative for motorboats to fish near the shore. Today, wooden boats lay abandoned across the landscape, artifacts of long-lost easy fishing. Parents discourage their children from becoming fishermen because they believe with fewer fish, fishing will become prohibitively difficult.

### Rating of Ecosystem Health: Past, Present, and Future

Informants were asked to rate the health of their local fishery today on a scale from one to ten. They were also asked to do this again in estimation of fishery health around one hundred years ago. I also asked them whether or not they thought their children or grandchildren would be fishermen and why. Unfortunately, these questions were implemented several days into the research schedule, and many informants were no longer available to answer the question, so the sample size is regrettably lower (N=8) than with the other answers collected due to travel constraints. However, it provides an example of how



to gauge perceptions of fisheries health to be correlated with the data above. These ratings are based at least partly on their own experiences, and display a shifting baseline.

The two groups most optimistic about how their fishery today compared to that fishery one hundred years ago are, not surprisingly, the two youngest groups. That is, the two groups with the shortest baseline perceive the least degradation in the fishery (Figure 5). The 40-54-year age group, which experienced by far the most extreme change from high-yield fishing in the past to low yields today in Figures 4 and 6, is also the most pessimistic by far about the fishery’s health. The 55-69-year age group was the second most pessimistic as well, having had experienced the second most extreme change in fish yield (Figure 6).

The one member of the 70+ group was unable to answer the second half of the rating question and was therefore left out of this data. As a result, it appears the two oldest groups experienced the greatest changes over the course of their lives in terms of changes in the quantity of fish caught. Referring back to Figure 2, we can see this is the case for two oldest groups in terms of species diversity as well. As a result, the older generations have not only longer baselines than the younger groups, but they also have more pessimistic opinions about the state of the fishery as a result of having witnessed the longest periods of the fishery’s degradation.

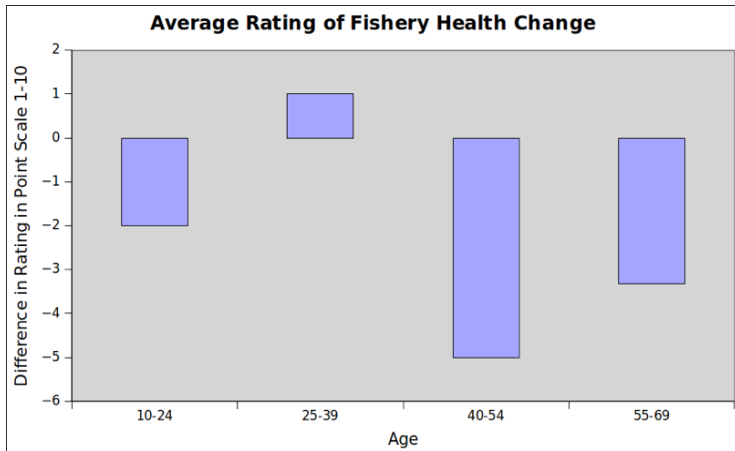


Figure 5

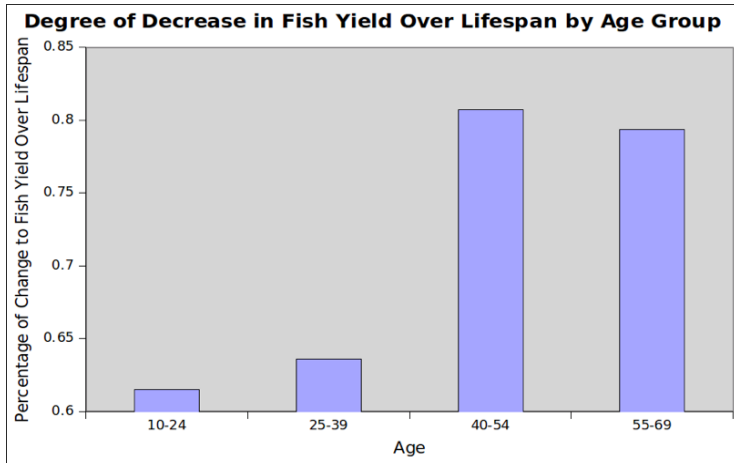


Figure 6

### Expectation of Future Fishing

Similar to Figure 5, Figure 7 shows that the oldest groups had the bleakest outlook on whether or not their grandchildren or children would become fishermen. The age group of 40-54-year-olds who fished during the worst of the fishery crash, similar to the 70+ group, unanimously believed their future progeny would not become fishermen. Additionally, older age groups more unanimously believe future fish stock populations will dramatically decline (Figure 8). No one suggested that fish populations in the future would increase very much.

These data together demonstrate a shifting baseline wherein age (and therefore experience levels) coincide with different perceptions of ecosystem health. Lacking an older group, however, our understanding of the degree of this fishery's degradation could be enhanced in the future by combining these results with the results of archaeological and historical materials.

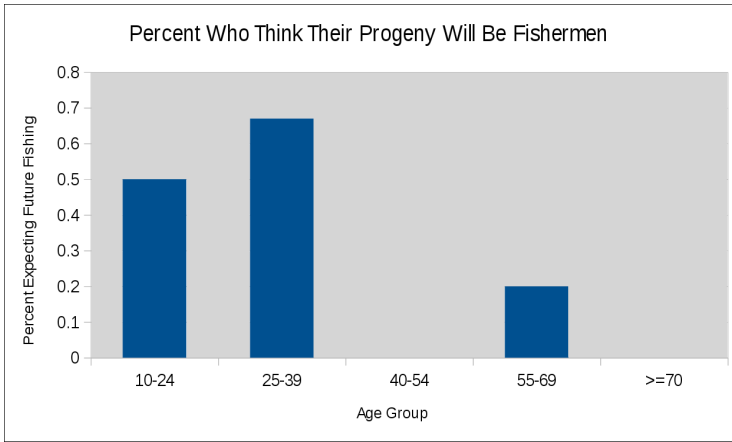


Figure 7

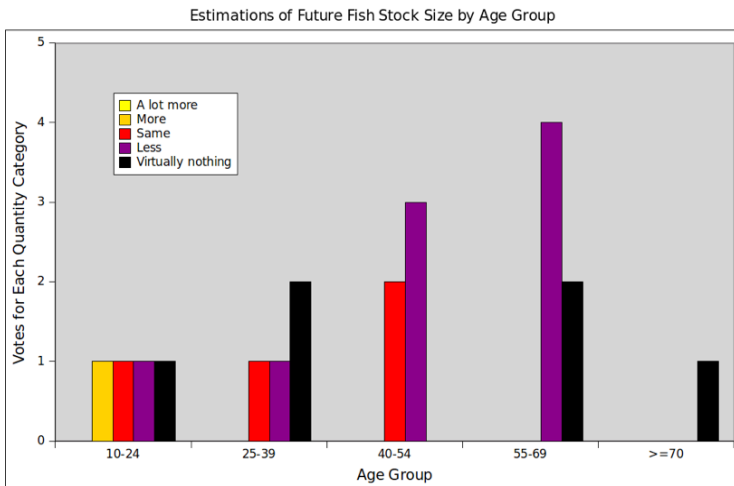


Figure 8

The interviewed subsistence fishermen live in and around a dune park where mangroves naturally occur. However, over the course of decades of deforesting the mangrove area and degrading other turf-maintaining local vegetation with roaming domesticated animals, people have eroded the shoreline by several kilometers. That is, the sands of the coastline have been progressively sweeping out to sea, causing buildings such as resorts to be submerged and destroyed under the waves. Because the shoreline has been receding in this way, it is difficult to understand how much of the decrease in fish stock quantity and species diversity is a result of these environmental forces rather than directly from overexploitation of the fish themselves; therefore, further study is required.

This pilot study also unfortunately has the small maximum sample size of 21 people, and more data is required to support the preliminary results reported here. Also lacking is data on actual, rather than reported, quantities of fish taken. More precise and elaborate data is also needed about the amount of time spent at sea in the past and present, as well as the impacts of seasonality. The data used in this study are based on estimates of annual averages. Lastly, better data should be collected on changes in fishing technology and their relation to the phenomena described above.

### **Future Directions and Conclusion**

The Atins/Queimada dos Britos fishery appears from this initial ethnographic data to be severely degraded, although the extent of that degradation cannot be reliably grasped without the formation of a grander interdisciplinary baseline. While long-lining and shrimp-trawling are officially prohibited, enforcement is so lax that these practices can be observed from shore daily. Better enforcement of industrial fishing is necessary to prevent the disappearance of subsistence fishing as a livelihood in this and similar areas.

My results demonstrate a shifting baseline across generations of fishermen. In the future, these or similar ethnographic results could be incorporated into the production of a grand fisheries baseline for the area, utilizing data from local sambaqui shell mounds, historical accounts of species variety and quantity, and historical representations of technological change. From these data sources, one could investigate changes in species diversity, relative quantity of marine resources, changes in technique (e.g. nets, boats, spear-fishing platforms), and estimated population densities of both humans and marine resources. More interviews could be conducted, as well as participant-observation and quantitative evaluation of marine resources (e.g. by weighing catches and estimating the amount and dynamics of ecological impact).

Ethnoarchaeology is especially well-positioned to fuse ethnographic, historical, and archaeological data for the creation of baselines with deeper time depth because ethnoarchaeology centers on material culture. Material culture and biofacts can serve as a common frame of reference between both the past and the present. For example, we can explore declines in species diversity by examining zooarchaeological shell mound remains, as well as through historical and ethnographic evidence of fishing practices.

Similar to biofacts, changes in fishing technologies are explorable through ethnographic, historical, and archaeological sources alike. This is important because changes in technology may represent changes in resource availability, possibly providing another line of evidence for changes in an ecosystem's health. For example, in my Brazilian case study, industrial overexploitation of a fishery forced many subsistence fishermen to abandon the use of small wind- or oar-propelled boats in favor of collection with nets by hand in shallow water.

The creation of larger ecological baselines, however, is not solely a task for anthropologists. Rather, communities should be empowered by this process by being informed co-creators of their area's environmental narrative, rather than remaining

ignorant of a process secreted away within academic spheres. While parenting and oral history already communicate within and across generations, creating longer baselines through applied anthropology can further empower the communication of ecological information from beyond the limits of individual lifetimes.

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