

Human Organization, Vol. 69, No. 2, 2010
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0018-7259/10/020180-12\$1.70/1

The Political Ecology of Small-Scale Commercial Fishermen in Carteret County, North Carolina

Susan Andreatta and Anne Parlier

Fishing communities along North Carolina's coastline struggle to maintain a viable fishing industry. No one points to any one thing contributing to the decline of the fishing industry, but to a collection of events and conditions that make it impossible for local commercial fishermen to sustain a livelihood. Drawing on the theoretical orientation of political ecology, we engaged in ethnographic research during the summer of 2006 in Carteret County. We interviewed fishermen, fish dealers, consumers, and restaurant owners to learn more about the political economy of the environment and the shared waters and fish. We learned from the research that regulations are in place that protect the waters and impose limits on who can fish when and the catch limits, but less protection is available for the fishermen and their families, who for many generations made their living by working in the fishing industry.

Key words: participatory action research, political ecology, local commercial fisheries, North Carolina

Introduction

Commercial fishing is a central part of North Carolina's coastal heritage. For centuries, fishermen and their families have worked the waters, built boats and nets, and sold seafood along the coast. Descendants of European families who established fishing communities in Carteret County several hundred years ago remain in the area. Although these families began working the water, few have been able to sustain the legacy of full-time fishermen by earning their livelihood from the sea. Until the late 1990s, a commercial fisherman could take care of his family and maintain his boat from the income derived from full-time fishing, but today's fishing communities along Carteret County's coastline struggle to maintain a viable fishing industry. No single thing has caused the decline of the fishing industry, but a collection of events and conditions make it impossible for local commercial fishermen to sustain a livelihood.

Much of the consuming public is unaware of the challenges local fishermen face in their daily operations. Though

there is widespread reporting of the poor state of the oceans, there is limited coverage the effects of international trade has had on a local fishing industry. In stark contrast, people in the coastal regions such as Carteret County North Carolina, where the research for this paper was undertaken, are quite aware of the effects international trade has had on their local economy and the local seafood supply in their region. Drawing on the theoretical framework of political ecology, this study used participatory action research to examine the lives of commercial fishermen in Carteret County and to offer suggestions for direct marketing of fresh local seafood.

A Political Ecology Perspective

Political ecology embraces the cultural, economic, political, and environmental systems at local, national, regional, and international contexts. The emphases are on access and control over resources, interactions of production, policy, and decision making power as they relate to environmental adaptations. Eric Wolf (1972) used the terminology of political ecology to discuss ownership of land and natural resources as it connects with the greater ecosystem, with society, and, specifically, with power systems of the elite. Blaikie and Brookfield (1987) expanded on political ecology, focusing on issues of land management and degradation in non-industrial countries. They state, "The phrase 'political ecology' combines the concerns of ecology and a broadly defined political economy, and together they encompass the constantly shifting dialectic between society and land-based resource use and also within classes and groups within society itself" (Blaikie and Brookfield

Susan Andreatta is an Associate Professor at the University of North Carolina at Greensboro in the Department of Anthropology. Anne Parlier was an undergraduate research assistant in the same department when this research was undertaken. We wish to thank all of the fishermen, fish house dealers, and members of the Carteret Catch board for their assistance, without which we would not have been able to carry out this research. We also want to thank Patrick Wood and Michael Parris for their assistance in this project. The research was funded by a Sea Grant FRG grant 06-ST-02.

1987:17). Their approach, like Wolf's, characterizes local adaptation and management of resources as inextricably linked to global processes through power, production, and economic hierarchy.

This interpretation of political ecology is easily applied to the complexities of the commercial fishing industry and its relationships with natural resources and with local, state, and international policies and power systems within a socioeconomic framework. Although there has been an attempt to consider the social and economic impacts upon fishermen and their communities, it is clear that the complex and multifaceted perspectives involved in legislation reach far beyond the local political arena. The power dynamic involved in this single arena of access and sustainability requires daily interactions or connections between multiple social, economic, and political levels, reflecting a primary concept of political ecology.

The commercial fishing industry depends, of course, upon the natural resources available in the coastal waters just as it depends upon the proper maintenance and stewardship of those waters. Federal legislation regulates control of and access to these waters through the Magnuson Stevens Fishery Conservation and Management Act (USFWS 2004). Fisheries and other resources of the sea are among the most regulated resources in the United States, yet recent research by biologists and fisheries experts alarmed the public with warnings of possible global collapse of fisheries by 2048 (Worm et al. 2006). The World Watch Institute places the responsibility for preventing this global collapse at the local level by recommending that we eat lower on the seafood chain, support small-scale, inshore fishing methods, and reduce global transport of seafood (Halweil 2006).

Local and federal environmental legislation is designed to prevent harm to "at risk" species, such as sea turtles, manatee, and porpoises, and to protect commercially viable fish from becoming unintended catch, often referred to as "by-catch." These regulations, combined with weak trade protections from foreign competitors who do not comply with their regional regulations or operate with fewer restrictions, give foreign competitors an advantage in the market (Wilson 2006). In some coastal states, commercial fisheries have already been forced out of business. States such as Florida, Texas, South Carolina, and Georgia have placed bans on the use of most commercial fishing nets, and numerous fisheries are regulated by quota and size limits. In North Carolina, commercial fishermen can fish only from Sunday through Friday, sundown to sundown, to avoid interference with weekend recreational fishing.

Examining international interests and the role of the state, Stonich (1998) pointed out that tourism development affected shrimp production in Honduras. Employing a political ecology analysis in her research, Stonich revealed the impact such development activities were having on local resource users vis-à-vis the state and their control of resource access. Similar examples have been found in Malawi by Derman and Ferguson (1995) in their research on the displacement of local

fishermen because of increased tourism and hotel development. Beehler, McGuinness, and Vena's (2001) work among African-American anglers and their right to know "is the fish safe?" is another study in which issues of power, control, and access to natural resources—the fish—is challenged by those not necessarily living with its direct use.

In the days before ice and other means of refrigeration were available, fresh seafood was for the most part available only to those located near where the seafood landed, while others had to consume theirs in dried, smoked, or pickled form. The consumption radius was only as far as fresh seafood could travel without spoiling. When technologies became available for longer-term storage, longer travel distances were possible, enabling seafood that was chilled or frozen to travel to more distant markets and be stored longer, changing who eats seafood, when they eat it, and the species that are available to eat. This allowed coastal fishermen to transport wild-caught seafood for longer distances or store it frozen for sale during the off-season. However, these same technologies have led to increased competition from fish farmers and foreign fishermen who are also making their products available in the same markets (Bonanno and Constance 1996).

Changes in world trade policies have opened United States ports to an influx of farm raised seafood imported from Asian and South American countries. Although the increased supply of shrimp, crab, tilapia, and other species has made it possible for families of all income levels to enjoy seafood, the competition of lower prices has had an enormous impact on the United States fishing industry. For many years, the development of international agro-food regimes has hinged on the production of food crops and the globalization of markets for cultivated food and foodstuffs (Bonanno 1994). However, as trade agreements between the United States and other countries have expanded to include seafood, both wild and farmed, the power of the food regimes is being felt. According to Friedmann (1993), dumping of United States surplus food crops in developing nations is inherent in the political economy of food and the global food regimes, the United States has accused exporters from a number of nations of dumping low-cost shrimp in the United States in 2003 (Globefish 2007). For example, in Thailand, one of the world's major aquaculture shrimp producers, production grew from 15,000 tons to 260,000 tons of shrimp from the early 1980s to 1995, making Thailand the world's leading producer of shrimp. As early as 1995, Thailand was producing about 25 percent of the world supply (Bluffstone, Anantanasuwong, and Ruzicka 2006).

It is not that difficult to see how using political ecology provides a useful framework to understand the interconnectedness of local arenas and their linkages to national and international ones. The previous examples illustrate various permutations of how one might use political ecology to show these connections. Sometimes they are linked through policies that regulate the product, while in others they may regulate the distribution system influencing who fishes, who sells fish, and

who eats fish and how many of what fish. Therefore, whether the point of departure is the local, national, or international level, political ecology combines environmental, political, economic, and cultural factors that influence those involved in the fishing industry. The coastal areas of North Carolina serve as a useful case study that reflects the concepts of the environment, scale and local-global links encompassed in the harvesting of seafood, local economies and heritage preservation, and could possibly be extended to other coastal communities.

Carteret County Commercial Fishing Industry

Carteret County, located in southeastern North Carolina, was selected as the research site because of the number of commercial fishermen in the county; it had the highest number of active fishermen of all of the coastal regions in North Carolina (Bianchi and Burgess 2003). This part of the County has 81 miles of coastline where a number of fishing families are descendants of the early settlers of the area, dating back nearly 400 years ago. The county population is approximately 65,000; however, coastal villages are not densely populated. The tourist areas known as the Crystal Coast swells to over 100,000 people in the summer months and includes Atlantic beach to Emerald Isle. The area in which the majority of commercial fishermen reside or dock their boats is known as "Down East"—a nickname for areas located east of the North River. The history of commercial fishing in the coastal area has led to a way of life in which boat builders, net makers and menders, seafood handlers, fishermen, and their families depend on each other as well as on the sea for their survival.

The beaches of Carteret County, like the entire North Carolina coast, have undergone many tourism development projects, with scores of condos, hotels, and large vacation homes built on the Outer Banks directly facing the ocean. The villages along the Core and Pamlico Sounds and the North River are experiencing increased population growth and new construction to accommodate the numbers of vacationers and retirees who are courted by the Economic Development Council and Chamber of Commerce. Many of these areas border the estuaries that serve as fish nurseries. New building and residence construction coupled with population growth have added pressure to the fragile ecosystem, including septic systems and storm water runoff throughout the county. The political and economic interests that affect access to and control of these resources highlight the role of class and social status, specifically those who have capital and not local heritage. For example, in 1989 home prices averaged \$73,100; by 2006 home prices averaged \$257,786 (Hettinger 2006). This increase in property values has raised the local property taxes that fishermen must pay, putting them under additional financial pressure.

Fishermen see the development issue and the tensions between recreational and commercial fishermen as "all about allocation"—who gets the land, who gets water access, and

who is allowed to catch what fish. Commercial fishermen, those living by the trade, recognize they are being marginalized from several standpoints, through increasing regulations on commercial fishing, increased wooing of recreational fishermen and other tourists, and with limited restrictions on development. Unless the fishermen are able to strengthen their own position, they will remain at the weak end of an unequal power dynamic.

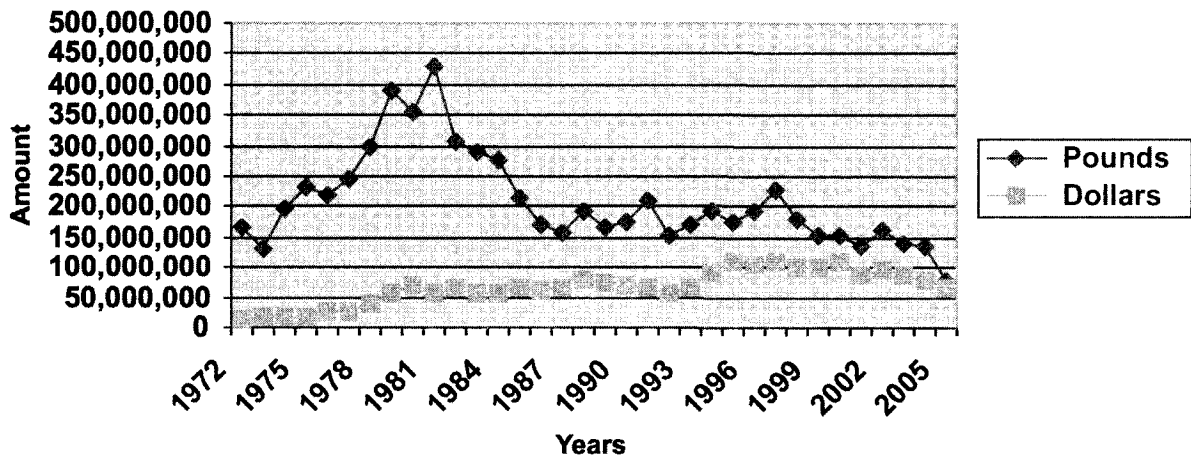
In Carteret County, as well as throughout most coastal fishing communities, recreational fishermen often join conservationists to cast aspersions upon local commercial fishermen for harming the environment through over-fishing and "ruining the ocean floor" or "nature raping." Pollution caused by fertilizer, pesticide, and other chemical runoff originating with individual homeowners as well as with powerful industrial and agriculture interests is also known to be harmful to fisheries, yet blame is most frequently laid at the feet of the commercial fishermen, reflecting a disproportionate power dynamic (Beehler, McGuinness, and Vena 2001; Griffith 1999; Maiolo 2004; Stick 1958; Stonich 1998; West and Garrity-Blake 2003).

Data from the North Carolina Division of Marine Fisheries (NCDMF) indicate that fishing has been declining in both total landings and dollar value of seafood. In 1981, commercial fishermen brought in 432 million pounds, and in 2005 they brought in 79 million pounds, a decrease of 63 percent (see Figure 1). Between 2000-2005 there was a 40 percent decline in dollar value of seafood landed, from \$108 million to \$64 million. In contrast, the increase in demand for seafood in this country has reached record levels. In 2004, Americans consumed 16.6 lbs of seafood per person, almost 9 percent more than in 1999 with a trend that is forecast to increase (NCDMF 2006a).

Fishermen in Carteret County were feeling the impact of aquaculture and imports. In 2001, the fishermen landed 5,254,214 pounds of shrimp valued at \$11,911,070. However, in 2006 they landed slightly more shrimp, estimated about 5,736,305 pounds, which was valued at \$9,141,172. Although there was an increase in weight caught, the negative change in market value was due to the decrease in price per pound (Division of Marine Fisheries Commercial Landing Totals 2006).

Most fishermen are aware that their livelihood is dependent upon the careful maintenance of the environment. Local compliance with regulations is not a serious problem; the problem is remaining competitive while doing so (Anderson 2006). Among the Southern Shrimp Alliance members, North Carolina was the most profitable of United States fisheries in 1999 and in 2000, but since then, the picture has changed drastically. Shrimp prices began a steady decline in 2002 and by 2003 had dropped by as much as 50 percent (Anderson 2006). Shrimp processing workers in the United States suffered job losses and shrimp fisherman lost billions in net profits. Moreover, the growing supply of imported shrimp has led to a decline in total value of shrimp landings in North Carolina (see Figure 2).

Figure 1. North Carolina Total Landings 1972-2005 (North Carolina Division of Marine Fisheries Commercial Statistics 2007)

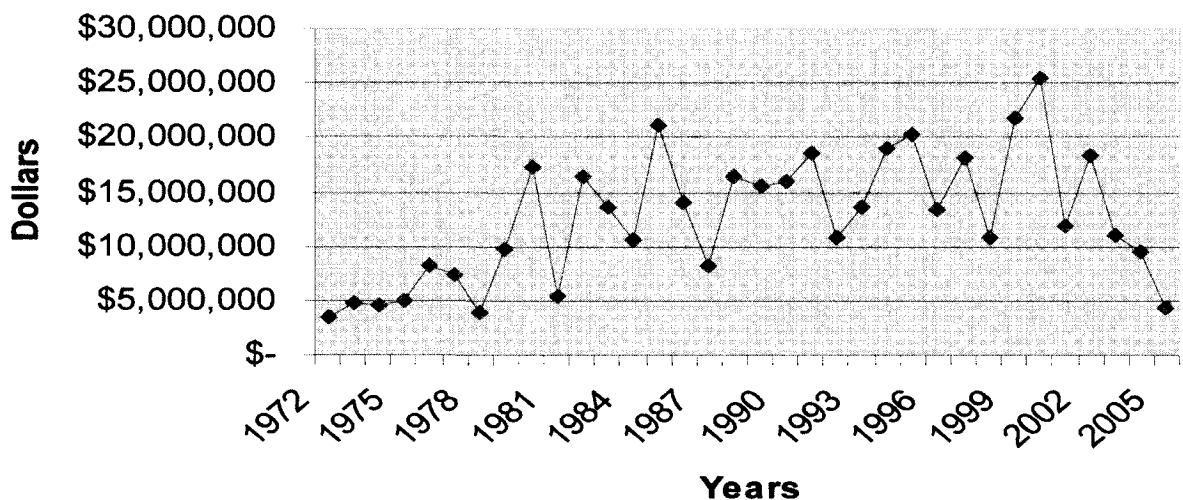


The downturn in shrimp prices was largely attributed to the illegal dumping of shrimp into our nation's food economy. These practices led to the filing of a lawsuit by the Texas Southern Shrimp Alliance on behalf of eight states, including North Carolina. Six nations were found guilty of violating current United States antidumping regulations: Thailand, China, Vietnam, India, Brazil, and Ecuador (Anderson 2006). These lawsuits led to a \$35 million aid package to compensate losses on the part of the southern shrimp industry, including some compensation to fishermen and a labeling campaign featuring a "Wild American Shrimp" label on packaged shrimp caught in United States waters and processed in this country (Hedlund 2004). However, continued dumping has led to a

surge in world shrimp supply, and imports account for nearly 90 percent of the shrimp found in the United States market. The growing supply of imported shrimp has led to a dramatic decline in shrimp prices in the United States; wholesale prices fell roughly 40 percent between 1997 and 2002 (Fritsch 2004). The policies in place are having a negative impact on local economies and local fishermen. When fishermen have product to sell and no place to sell it, they are at risk because of the increased presence of farm raised imports.

Commercial fishermen in Carteret County used to sell most of their catch to fish houses, wholesalers who in turn sell it to restaurants, retail outlets, and distributors who transport it to other markets. Fishermen and fish house dealers have

Figure 2. Total Value of Shrimp Landings (Shrimp with Heads Still On) 1972-2005 (North Carolina Division of Marine Fisheries Commercial Statistics 2007)



worked together for nearly a century. Over time, fish houses had become a center for major wholesale distribution of seafood. The wholesale fish houses located along the Sounds enabled fish laden boats to dock and unload their catch. They also had ice machines, coolers, freezers etc. making it easy for the fishermen to leave with ice to chill their catch. Some fish houses also made fuel available. The many services, which often included having mechanics, welders, and painters on hand, made it attractive for fishermen to have good relationships with the fish house dealers. The dealer processed the seafood and took on the responsibility for selling it to restaurants or exporting it to other regions. Traditional wholesale markets that received seafood from Carteret County included Washington, D.C., Baltimore, Md., and Fulton Fish Market in New York City (West and Garrity-Blake 2003).

Today, relationships between fishermen and fish house dealers are strained. They both struggle with the policies and economics from imported seafood, and neither are making it. Fishermen want a fair price for their catch, and dealers want a good catch for their services. However, because of seafood imports, fewer trucks line up at the fish houses and fewer fishermen are fishing and landing their harvests at the fish houses. Fishermen and fish house dealers, who for more than a century worked together to make seafood available, are on their way to becoming historical artifacts. In Carteret County, the number of licensed commercial fishermen has declined. From 1999 to 2006, more than a thousand fishermen have stopped working as active commercial fishermen, a decrease of more than 50 percent, and a great many boats were for sale (NCDMF 2006b). In the 1980s, there were more than 20 fish houses operating from Beaufort to Cedar Island which dotted the coastal shores of the county; by 2006, less than half of these were in operation with others considering closing their doors. Without an improved outlook for the local industry, retention of the existing infrastructure is not likely. The loss of fishermen and fish houses in addition to others who support the industry such as net menders, boat builders, and painters will most likely be the continued pattern for fishing communities.

Methods

Incorporating participatory action research as an approach to understanding the fishing industry was central to the methods used in the fieldwork. Advocates of the participatory approach emphasize the need for involvement of local people in the process, for through their participation they can identify key elements of the problem as well as the possible solutions. "The foundation of this thought is the fact that the local people know the complexity, diversity, and dynamism of their environment better than outsiders" (van Willigen 2002:68).

Therefore, we had the good fortune of working with a group of concerned citizens in Carteret County comprising of commercial fishermen, fish distributors, marine specialists, restaurant owners, chefs, and others. In 2004, they organized

around the issues of losing fishermen and markets for local seafood in the area. They evolved into a committee with an advisory board whose objective was to create a branding program that included a logo for seafood landed in Carteret County, and in 2005 launched Carteret Catch, a branding program which represents wild-caught seafood that is landed on the shores of Carteret County by local fishermen.

Members of the Carteret Catch advisory board were extremely helpful during the planning process of this research. We needed to be able to understand the fishing industry from the perspective of those involved in it, and these connections led to many others in the community and in the industry. We were guided on the questions, the flow, where to go, and who to meet. In fact, quite a few people contributed to the questionnaires used for fishermen and consumers.

Several general questions guided the research, and as we became more involved, the list of questions grew. The research questions included: What was the public's interest in eating seafood? Was the public interested in knowing where their seafood came from? Was there an interest in connecting fishermen and fish house dealers with the public? What were the fishermen's and fish house dealers' perception of the local commercial fishing industry?

Data were gathered during the months of May through August 2006 and in October for the Annual Seafood Festival. We engaged in casual and participant observation by going shrimping with fishermen, listening to stories told by community members, attending community social gatherings, and observing what was going on in the coastal area and commercial fishing industry.

Fishermen considered for this project were those who fish and sell from their own catch locally. They were selected based on recommendations from other fishermen, fish house dealers, restaurant chefs, and fisheries resource extension personnel. Purposive and snowball sampling techniques were used to select the participants in the study (Bernard 1995). We interviewed 15 fishermen, five of the eight dealers operating fish houses, two retail seafood markets, and six local independent restaurant owners. We tried to interview more fishermen, but many that we called were working land jobs, driving trucks, or working on dredges, thus, unavailable for an interview.

Consumers included residents and visitors to the area and were a major part of the research. Convenience sampling techniques were used to survey 295 consumers at neutral locations (Bernard 1995). We interviewed at local museums, an aquarium, at roadside stands, on public streets, and at the annual Seafood Festival. Data from consumers were collected over a period of several months to ensure seasonal coverage of tourists and residents. We were interested in establishing consumers' interests in eating, cooking, and purchasing local seafood to gain an understanding of seafood consumption behavior for the area. Results of interviews with fishermen and surveys with consumers are reported in this paper. Additional data from the other participants will be reported in a later publication.

Data Analysis and Results

Learning about consumers' and fishermen's perspectives on the local seafood industry was a necessary first step. First, we wanted to learn who was eating seafood and whether they knew or cared if it was local seafood. From residents as well as those visiting the area for any amount of time, we were interested in learning whether eating local seafood is part of their coastal experience. We were also interested in their perceptions of the fishing industry—be they policy or economically related. Second, we were interested in learning from the fishermen, learning how the industry has been changing for them, both politically and economically.

Consumers

The average age of the consumers we interviewed was 51 years and the average household size was three. Of those interviewed, 27 percent resided in Carteret County year-round, with the majority owning their own home be it a house, condo, or trailer. The majority, however, were visitors and predominantly from other counties in North Carolina. Visitors coming considerable distances were more likely to spend a longer time in the area, anywhere from a long weekend to a two-week stay. The average distance traveled was 241 miles. It is important to point out that 90 percent of those interviewed were not making their first visit to coastal Carteret County. The average number of years for being in the area was 20 years, ranging from first timers to those residing in the area 80 years. Consumers, be they visitors or residents, have a relationship with the coastal area as well as a connection to the sea, for 65 percent fish the local waters.

The majority of the consumers (86%) had a kitchen where they stayed. This was an important question to have asked. If people are interested in cooking fresh local seafood, having facilities to cook where they are staying is critical to expanding the use of local seafood. Those who are familiar with Carteret County are also coming to eat seafood. The majority (98%) said they would eat seafood at least once during their stay. For many, eating seafood is part of their definition of a coastal or "beach" experience, and 82 percent said it is important that the seafood be local. Among those visitors arriving and staying only for the day, 51 percent ate at least one seafood meal during their visit. Visitors staying for a long weekend stated that they ate at least one seafood meal out during their stay. Of those visitors staying a week, 33 percent ate one seafood meal out during their stay, while 30 percent ate at least two seafood meals at a restaurant. An interesting find was that 40 percent of those who reside in the area ate seafood at a restaurant at least once a week. However, not everyone who eats seafood was eating it at a restaurant; rather they cook it themselves. In fact, 9 percent reported only cooking seafood for themselves and would not eat it at a restaurant. For those cooking their own seafood, we learned they purchased their seafood at retail seafood markets and purchased it directly from fishermen or at roadside stands.

The majority of respondents said they wanted local seafood because of freshness or taste. When consumers were asked how they know the seafood is local they reported "I ask" meaning they thought it necessary to ask although some simply asked if it is fresh, assuming that means local (however we've all heard of "fresh frozen.") We had other replies such as "they say it is" or "I only go to local restaurants" or "because we're at the beach." These consumers assumed since they were at the coast of course their seafood would be local. There were others who said they "don't know" or "don't care" if it is or isn't local seafood, while others recognized that only a small percentage is local in the area and one needed to know where to go to obtain it. Some knew it was local because they buy from or know the fishermen; some of those were residents, although some were visitors who have made a connection to someone local. However, there were consumers who were shocked to have us ask the question because it had not occurred to them that they might not be served local seafood.

We asked and received a broad range of answers to the question how consumers define local seafood. A total of 24 different responses were offered, some of which were more easily grouped together than others. Some could be grouped to "place" defining it in some way to being "caught in the waters of Carteret County by local fishermen." For others that addressed the category of "place," local was considered in broader terms. Local for these respondents included all fish landed in North Carolina while others were more specific to say "seafood that traveled less than 45 minutes" or "anything on the side of the road." Others considered local to be where they purchased their seafood, such as at local retail fish markets or at local restaurants they would go out for a meal.

Those who did not identify where the fish was landed or purchased chose to describe the quality of the seafood they consumed while in the area; essentially they offered a description of food. To these respondents, local seafood was "yummy," "delicious," "fair," "good," "wonderful," and being in the south, "fried" also came up. Others defined local by the fish type, looking for "local varieties." Some respondents commented on how it "was harder to catch [the fish]" or they want the seafood they consumed not to be farm raised.

The average amount spent by consumers on seafood was between \$16 and \$20 each time they purchase fresh seafood at a retail location, commenting that it depends on the fish they are buying. Other consumers reported they buy in larger quantities, spending anywhere from \$30 to over \$100 when buying shrimp at a roadside stand to freeze for later use.

We asked consumers to identify their five favorite seafood items from a list that contained 14 items including finfish and shellfish. Consumers listed a total of 52 different varieties of seafood they enjoyed eating. Shrimp, flounder, and scallops were the favorite, significantly above the others mentioned. Ironically, it is shrimp and scallops that are most likely to be imported when served at local restaurants. A few individuals knew more local varieties of finfish, mentioning croaker, mullet, spot, and trigger fish as their favorite seafood

items to eat. And then there were others who listed halibut and salmon as their favorite fish, but only a few noted that these were not local species. The list does reflect the few individuals who knew their deep sea fish and listed black sea bass, mackerel, mahi-mahi, pompano, and red drum as some of their favorite seafood. Still others mentioned catfish and tilapia, not knowing these might be farm raised and not wild-caught or local.

Lastly, we asked if having local seafood was important to the consumers. We learned that for 84 percent it was important that the seafood they were eating in the area be local. A small percentage commented they did not want their seafood to be farm raised, for they wanted to eat local seafood; it was one of the attractions for being on the coast. Several individuals were quite emphatic about making sure that they ate local seafood, for they had life-threatening food allergies and were concerned that imported seafood did not carry the same standards and might cause them to have an allergic reaction. From their personalized accounts, we learned they already experienced some unpleasant seafood experiences and were not interested in living through any more.

We asked consumers which restaurants they went to eat for a seafood meal. Consumers provided the names of 73 restaurants, with no real favorite standing out among them. One fish house dealer mentioned, "We only have one restaurant that uses local shrimp. They peel their own shrimp every day." Few others use it; they say it is "too hard" to deal with. We learned from restaurant owners and managers that the problem with shrimp is the processing. They say that peeling and deveining takes additional time and may cause injuries to their employees. Another manager stated they do not use shrimp because the prices for local seafood are "exorbitant" compared to imports. (Shrimp at the time we were interviewing sold between \$1.50 to \$3 per pound from May through August at roadside stands, and local retail outlets were several dollars more per pound.) Another restaurant manager noted that consistency in size was important to their customers, believing that consumers expect shrimp to be all the same size. However, shrimp or fish size served was never mentioned by consumers during the interviews. We learned from some restaurant owners, "They can't always get fresh local seafood even if they pay in cash and not on credit." We mention shrimp specifically because it was the most sought after by consumers at local restaurants. However, what consumers do not realize is that most of the shrimp available in local restaurants is farm raised imported shrimp.

To confirm that consumers were not necessarily looking for an inexpensive meal and to see if "local" seafood was important to them, we asked them if they were at a restaurant and had a choice between a \$21 local seafood entrée and a \$15 imported seafood entrée which would they select. Accordingly, 83 percent responded they would prefer to pay for the \$21 local entrée, while 9 percent stated they would pay for the less expensive imported fish, and nearly the same percentage, 8 percent, said it really depends on the fish, how it was prepared, and what they were in the mood to eat.

Towards the end of the questionnaire, we asked consumers if they were interested in eating more local seafood and asked them to rank their reasons for eating more local seafood. From this sequence of questions, we learned that 89 percent were interested in eating more local seafood and specifically for "taste" (31%), followed by supporting a local economy (30%), personal health and supporting the local environment tied at 15 percent. The remaining reasons mentioned for wanting to eat more local were all less than 1 percent.

We further explored the importance of local seafood. To do so, we asked consumers (both residents and visitors) whether they would still come to the area if there were no local fishermen and 84 percent said they would while 6 percent said they would not. This response demonstrates that the connection between the fishermen, place, and local seafood is either not completely clear or not very strong. There were those who commented if there were no local fishermen it would definitely change the area and others who were unsure if they would come back. Again, we followed up with a question asking what the public could do to support local fishermen and 66 percent said to "buy their seafood." Others stated, "eat at places that support local fishermen," "talk to politicians," "talk to friends about it," and "keep the waters clean" as additional ways to support local fishermen. Lastly, consumers were asked if they would be interested in a seafood delivery program. Among those we spoke with, 23 percent responded that they would be interested if such a program existed.

While conducting these interviews one evening not far from local restaurants, we encountered people who believe the commercial fishermen are over fishing and not leaving anything for the recreational fishermen to catch. A husband and wife waiting to get into a seafood restaurant left an impression on us; they were angry about spending \$200 each on an afternoon fishing trip where they did not catch anything. They truly believed it was because the commercial fishermen caught all the fish that day. We encountered others who were conflicted about commercial fishing because of conservation stories they had heard—over fishing, wasted by-catch, and killing the ocean floor.

Fishermen in Carteret County

Although we spoke with a limited number of fishermen, we interviewed fishermen who were experienced in harvesting multiple species for a number of years. Most of the fishermen had experience in harvesting shrimp, clams, crabs, and a wide variety of finfish. The average age of fishermen was 45, ranging from 22 to 60, and all of the fishermen/women interviewed expressed a love for their jobs. Nearly all of them were introduced to fishing as young children and had their fishing license by the time they were 10-12 years of age. They have been fishing nearly all their lives, stating they were "raised in it" and averaged 35 years in the fishing industry. Most of them were descendants in some way of the European settlers and fishermen of the area from 400 years earlier and

see that this heritage is important to their coastal way of life. Many of the fishermen said that fishing and the sea is in their blood and fishing is how they want to spend their time. One fisherman shared a story of when he and his wife had taken a little vacation and decided to go to the mountains for a week. They didn't last but a few days; he was back on his boat by the fourth day.

Fishermen understand that the resource—the water and the fish—does not belong to them. One fisherman said he was taught as a child that the founding fathers held the water in trust for the public and that no one owns any of it; for him this was a concept “new waterfront land owners didn't seem to get.”

Fishing for multiple species keeps fishermen in the water year-round. Even during the winter months, they are able to fish or hunt ducks. The versatility of their boat riggings with many types of gear provides them with flexibility in what they are able to catch (hunt) and provide for their families year-round. They know what they can fish, what they like to fish, and what they are good at landing. For example, one fisherman told us he has his boats rigged up for multiple species. He can go out for sea bass, but he can have his crab pots on deck and a gill net on a reel. If the weather is too bad for being out at sea, he can come into the Sound and do something else. Fishermen struggle with sharks biting their nets and turtles squashing their crab pots. Fishermen respond with continued maintenance of their nets while others have left their pots on land, discontinuing their quest for crab. In their eyes, there is always something they must contend with to keep fishing.

Today, however, fishermen are struggling to fish either as a full-time or part-time occupation. The cost of production, that of landing their harvest, is greater than what they are able to sell it for once they bring it ashore. Fishermen and fish house dealers tell us there have been other times that have been difficult because of hurricanes or in adjusting to new regulations or poor markets. Strategies they and their families had “for making it” depended upon fishing for what is available and for what is in demand. Rigging up for several things whenever they have gone out has helped them to be prepared while out on the water. However, “scrappin,” which is driving the boat around looking for what is plentiful, was no longer possible because of the increase in the price for fuel.

Collectively, fuel prices and equipment costs and the increase in labor wages have made it difficult for the fishermen to cover their cost of harvesting wild-caught from local waters. “Hope for better next time” was a pat answer to the question “What do you do if the income from the trip doesn't cover the cost?” They have learned that one trip may not do well, but the next one probably will. However, because of increased expenses and the decrease in sales and, in some cases, decrease in catch the next time and even the time after that has not offered better. To help make ends meet, many of the fishermen's wives have taken land jobs, although some wives have always been employed outside of the home. Fishermen have worked in construction or at welding or similar jobs for extra income.

We happened to be conducting our interviews with fishermen when shrimp were in season, May through October. Fishermen were told on several occasions not to bring shrimp to the fish houses because dealers could not sell them. There were fewer fishermen landing shrimp, and as a result, there was fewer shrimp landed during the summer. Dealers decided that because of the price and volume brought in it was not worth contacting the “breader” to come to the area to purchase the shrimp to take back to Louisiana for bread-ing. Increasingly with less volume of seafood landed at the fish houses, dealers were scaling back on management costs and were turning off freezers and operating smaller cooling units (see Figure 2).

Past marketing strategies have relied heavily on the fish house dealers and their connections with the wholesale and retail markets often located in distant big cities. Although dealers will continue to play a role in the fishing industry, they need to consider modifying their marketing strategies. However, the fact that only few active fish houses remain poses other problems for the fishing industry. For example, if the remaining fish houses close, where will the fishermen land their harvest, put their boats on the rails to be painted, get ice, dock their boats, chill their product, and market it? Some of the fishermen were adamant that the fish house dealers were essential to selling their catch. All of them understood the place the dealers had played in the history of commercial fishing, but as one fisherman put it, “You gotta do what you gotta do” to survive in the industry.

Lower prices for their product, higher fuel costs, and increased availability of imported seafood have collectively created a Catch-22 for fishermen and fish house dealers. Fishermen commented that the first hundred pounds went to the boat to pay for the fuel. Fishermen were more calculating in how they fish, taking into account how long they were out at sea, how much they were bringing in, and of what type of fish they were carrying. After each interview, we asked if the fisherman would recommend another person for us to speak to about the fishing industry. We also asked how many people in their area were fishing full-time. In most cases, we would get a name or two of someone to help us continue with our interviews. However, few fishermen could think of five people that were fishing full-time. They recognize that their numbers are dwindling and not necessarily because of poor health or aging out. In their minds, it was a result of the high fuel prices to operate their boats, the low cost paid per pound for the local catch, and the competing lower priced-imported processed product.

What becomes clear from the interviews is that fewer fishermen are “making it” as fishermen. Recall that there was more than a 50 percent decline in number of active fishermen in Carteret County between 1999 and 2006. All the fishermen we interviewed knew others who had taken a land job and were wondering how long it would be before they would be forced into taking one. However, some creative fishermen were trying to figure out ways in which they could modify their marketing practices, and a number of the fishermen we

interviewed signed up for a membership in Carteret Catch.² Being part of the branding and traceability program offered the fishermen, as well as participating fish house dealers and restaurants, flags and stickers to display at their business or on their boats along with advertising on websites and newspapers. Membership in Carteret Catch was a way to clearly denote a locally landed product.

When the fishermen were asked the question “Do you see yourself fishing in five years?,” we heard varying answers. We learned from fishermen of all ages that being a full-time fisherman and raising a family is a financial struggle, forcing many of them to leave the industry. Older fishermen, 60 years and over, who have been fishing all of their lives are less encouraging of their own children and grandchildren getting into the industry. In fact, one fisherman stated, “I got a grandson, he’s crazy over it. I hope he don’t follow it.” When fishermen were asked if they see themselves fishing five years from now, we got a mixed response. Typically, we heard, “I don’t think it’ll be here; [fishermen] can’t raise a family on it.” However, young people were being introduced to fishing. One young man told us, “Well, I was encouraged not to do it, but at the same time I was taken and shown how to do it.” In general, not many saw themselves fishing if they were depending on it for their livelihood.

Fishermen lamented the fact that the industry was changing right before their eyes. They see the industry changing and fishing becoming something to do part-time while working at another place of employment such as on a dredge, a ferry, or a land job. Some fishermen remained hopeful and believed they could be the “survivors” of the industry, and should the industry turn around, they plan to be there to harvest and sell their locally landed seafood products. Others were getting out because they could no longer support their families and maintain their boats. They leave behind a smaller group of fishermen to supply the local communities and tourist markets with wild-caught seafood. An outsider might see that those fishermen “hanging in there” are more efficient with their operation. Downsizing in boat size or in number of boats to maintain was making it possible for some commercial fishermen to keep fishing for a living. Most of the fishermen we spoke to had boats no larger than 42 feet and skiffs around 19 feet. Also, depending on the fishery, they did not need to hire a crew, enabling them to cover their expenses and keep more of the money earned within the family.

Community Supported Fisheries—A New Direct Marketing Strategy for Seafood

If fishermen cannot support themselves with a traditional strategy of selling to fish houses, are there other market strategies that might be more successful? One of the new strategies being considered for a future project is borrowed directly from the United States farming industry that caters to small-scale farmers. United States farmers have been facing similar trends with cheaper imported products, high fuel, and labor costs interfering with their traditional way of producing and

distributing fruits and vegetables. Farmers have been facing a significant decline in numbers, and frequently wives work off-farm to help meet household and farm expenses. However, small farmers have turned to direct marketing strategies to bring them closer to local consumers (Andreatta 2000, 2002; Andreatta and Wickliffe 2002; Goland 2002; Henderson and van En 1998). Marketing directly to the public and bypassing the middlemen has helped to sustain primarily small-scale farmers. Examples of direct marketing strategies include roadside stands, U-picks, farmers markets, and Community Supported Agriculture (CSA) arrangements.

In these last 20 years, small farmers have developed marketing skills and gained a loyal clientele through direct marketing. Today there are over 4,385 farmers markets in the United States, an increase of 111 percent from 2000 (USDA Agricultural Marketing Services 2006). Direct marketing works for small-scale farmers because of their smaller scale of production. For example, small-scale farmers may produce 100-foot rows over a couple of acres, sometimes growing as many as 20 or 30 different items on only a few acres. Large-scale industrial farmers produce acres of a single commodity, making it challenging to sell their harvest at a farmers market, and, therefore, tend to rely on wholesale markets for the sale of their fresh harvest.

Diversifying marketing plans complements the diversity that is found in the field. A number of small family farms in North Carolina have been able to stay in farming by selling directly to restaurant chefs, selling at farmers markets, establishing CSA arrangements, or by a combination of these methods. A CSA arrangement functions as a buy-in club where consumers or “shareholders” pay the farmer for a share of the harvest in advance, which in turn serves to cover seasonal start-up production costs. The farmer, in return, provides the shareholders with a share of the harvest during the growing season. The arrangement provides financial support to the farmer (and decreases the time “selling”) and shareholders receive local, fresh products that are harvested in season (Andreatta 2000; Goland 2002; Henderson and van En 1998). These farmers have taken attributes that are detriments in the commodity marketplace (i.e., seasonality, availability, locality, and identity of harvester) and positioned them as desirable attributes for local consumers. “Buying locally” and “knowing one’s farmer” have been key slogans in developing and maintaining this form of niche marketing for farmers and their supporters.

Modifying a CSA arrangement with a fisherman’s catch to form a Community Supported Fisheries (CSF) arrangement would help to connect fishermen directly to their customers. A critical aspect of direct marketing used in a CSF would be to understand the needs of consumers (local residents and visitors) and the expectations they have for such an arrangement. As found among farmers, direct marketing within a local seafood industry would require consumer support. If local seafood is to find its way onto consumers’ plates, fishermen must be able to provide it, someone must distribute it to the various venues where it is sold, and consumers must demand

it with their dollars. Having a Carteret Catch membership was one way fishermen, fish house dealers, and the seafood consuming public could ensure a locally landed product, and the CSF would provide another means to connect the public to their "seafood provider."

Consumer responses to our questionnaires for this research provided us with information on their favorite seafood, length of stays in Carteret County, willingness to cook seafood, frequency of seafood consumption and restaurants frequented during their stays. As consumers told us, they come to the coastal area for recreation and to consume seafood. Residents may want a different form of a CSF arrangement; they may want to purchase fresh seafood on a weekly basis from a fisherman or fish house dealer, much like the way a traditional CSA works—the prepaid arrangement. In an ideal CSF, an arrangement would be worked out between a fisherman and a resident, where the resident would become a member of the fisherman's CSF by prepaying for a specified amount and/or type of fish for a specified amount of time. The prepayment is the resident's contribution to investing in "their" fisherman, enabling the fisherman to make repairs on his boat or gear without dipping into savings or going into debt. This CSF arrangement between fishermen and members would work similarly to a CSA where variety of fish species could be provided on a seasonal basis, much like a farmer provides seasonal produce when available.

We have learned consumers are traveling great distances for their coastal experience, over 200 hundred miles. They were looking for good, quality fresh seafood for a fair price and want to be supporters of commercial fishermen much like they might have been supporters of the small-scale farmers. Restaurants and retail outlets could make a point of serving a "fresh local catch" and advertise on their menus "a real catch of the day" caught by an artisan fisherman. It is hoped that in time CSF arrangements will emerge and take on various configurations to increase the sale of local seafood and enable consumers to know their seafood provider. A desirable outcome is to get consumers hooked on fresh local seafood so they taste the difference and seek it out each time they are eating seafood in a coastal area.

A number of presentations and workshops have been given in North Carolina and Maine on Community Supported Fisheries. Since this direct marketing model was first conceptualized, several fishing families have been working together to create a CSF in Port Clyde, Maine (Canefield 2009; Leschin-Hoar 2009; Smith 2008; and West 2006). Their success has encouraged other fishing communities to consider this alternative marketing strategy. Fishermen from Canada, Massachusetts, Georgia, and other regions in North Carolina have also expressed their interest in getting started. Although only a couple of CFS have been organized in Maine and Massachusetts, there is an opportunity for other small-scale fishermen to consider starting a CFS in their community. It will take the cooperation of local, national, and international policymakers to ensure some level of local seafood that is caught by local fishermen is available.

Conclusion

A political ecology perspective was used to frame the research undertaken to learn about the fishing industry and the collective factors that contribute to its present state before recommending any further modification. Political ecology and participatory action research enabled us to work with and learn from community members involved in the fishing community. By identifying the actors, primarily the fishermen, fish house dealers, restaurant owners, and consumers, and their involvement in the fishing industry, differing perspectives of the industry emerge. Collectively integrating culture, policies, economics, and the environment provided the context in which they operate. Connecting these various groups that worked together to bring local seafood to the market place painted an interesting waterscape. Had we not had the participation from the members of Carteret Catch, and had we not been made welcome in the local fishing community, we would not have obtained all the information we did. It is a complex scenario with no silver bullet solution for all those involved.

As was pointed out, fishermen and fish house dealers face a range of challenges that are converging on the industry simultaneously and are leading to the decline of local commercial fishing economies and the loss of commercial fishermen. Inherent in commercial fishing is the changing demand for a product, the addition of new regulations, adverse weather conditions (hurricanes and nor'easters), and much more.

International markets and local commercial fishing communities are clearly at odds with each other. The disturbing aspect about job losses among the local fishermen is that there is public interest in local wild-caught seafood, but importers are dominating the market to the extent that local harvesters are losing out. If local producers cannot gain ground in influencing international commerce laws to more fairly reflect the cost in resources of seafood production, then the decline of sustainable fisheries will only continue. Therefore, to prevent a global collapse of the world's fisheries and fishing industry, policies need to be in place at the local level, which include supporting small scale inshore fishing and reducing the transport of seafood.

The question remains how states and counties with coastal communities can protect a fishery, the environment, and the fisher families. What policies are needed to ensure survivability and sustainability of those who fish as a way of life and who are the keepers of the cultural knowledge necessary for managing a mobile natural resource? What role can consumers play in this process of fishery and fisher sustainability? Are new direct marketing strategies a way to connect consumers with fishermen and fish dealers, and could a relationship be forged to help sustain the industry and to avoid depending on imported or farm raised seafood? In looking to the future, new policies need to be in place to protect the environment, the natural resources, and fishermen and their families through establishing local markets for a limited amount of wild-caught seafood and balanced with that of imported farm raised seafood products. Clearly, labeling

the seafood Carteret Catch or something else is insufficient to protect the fishermen from competing products and producers.

A goal for this research was to determine if there was an interest among participants in the local fishery industry for alternative marketing strategies for local seafood in Carteret County and offer suggestions for how one might go about developing such a strategy for small-scale commercial fishermen, fish house dealers, and the public. This research revealed that the rising cost of the production of wild-caught seafood coupled with the lower price paid per pound caused by competition with imported processed seafood was putting fishermen and fish house dealers out of business. Members of the fishing community indicated that they are paying more for the fuel they use to fish, the costs to maintain their boats and gear (cages, nets, turtle and fish excluders, etc.), and the taxes to continue to reside in the area, especially as bigger homes and condos are being constructed. It is not that fishermen cannot fish or that there are no fish; rather, there are fewer distributors and restaurants willing to pay for the fresh locally landed product. "Buying local" and "connecting sea to plate" is a way the public can have an active role in sustaining the fishing heritage of coastal communities, fishermen, and fish house dealers. Participants in this research suggested the public could play an important role in sustaining local fisheries by where they spend their seafood money and what seafood they purchase.

Notes

¹Diesel fuel was \$1.50 in the 2005 and rose to \$2.50 in 2006.

²*Carteret Catch* is a branding and traceability program that is membership driven. Fishermen, fish house dealers, restaurant owners, and the public can participate by purchasing a membership. Those who have joined see *Carteret Catch* as a way to advertise fresh, local seafood – but also to advertise that not everyone sells fresh, local seafood. Fishermen, fish house dealers, and restaurant owners receive a flag and sticker to display on their boat or business.

References

Anderson, Wilma

2006 Statement Presented on Behalf of the Southern Shrimp Alliance Before the Committee on Resources, United States House of Representatives, Washington, D.C., May 3

Andreatta, Susan

2000 Marketing Strategies and Challenges of Small-Scale Organic Producers in Central North Carolina. *Culture and Agriculture* 22(3):40-50.

Andreatta, Susan, and William Wickliffe, II

2002 Managing Farmer and Consumer Expectations: A Study of a North Carolina Farmers Market. *Human Organization* 60:167-176.

Beehler, Gregory, Bridget McGuinness, and John Vena

2001 Polluted Fish, Sources of Knowledge, and the Perception of Risk Contextualizing African American Anglers' Sport Fishing Practices. *Human Organization* 60:288-297.

Bernard, H. Russell

1995 *Research Methods in Anthropology. Qualitative and Quantitative Approaches*. Walnut Creek, Calif.: Altamira Press.

Bianchi, Alan J., and Christine C. Burgess

2003 *An Economic Profile Analysis of the Commercial Fishing Industry of North Carolina Including Profiles for Coastal Fishing Counties*. Morehead City: North Carolina Division of Marine Fisheries.

Blaikie, Piers, and Harold Brookfield

1987 *Land Degradation and Society*. New York: Methuen Publishers.

Bluffstone, Randell, Anantanasuwong, Darratt, and Ruzicka, Ivan.

2006 Mixing economic and administrative instruments: the case of shrimp aquaculture in Thailand. *Environment and Development Economics*. 11:5:651-667.

Bonanno, Alessandro

1994 Introduction In *Columbus to ConAgra: The Globalization of Agriculture and Food*. Alessandro Bonnano, Lawrence Busch, William H. Friedland, Lourdes Gouvela, and Enzo Mingione, eds. Pp.1-25. Lawrence: University Press of Kansas.

Bonanno, Alessandro, and Douglas Constance

1996 *Caught in the Net: The Global Tuna Industry, Environmentalism, and the State*. Lawrence: University Press of Kansas.

Canefield, Clarke

2009 Maine Fishermen Pre-sell Cuts of Their Catch. URL:<http://www.boston.com/news/local/massachusetts/articles/2009/06/21/maine_fishermen_cuts_of/> (June 29, 2009).

Derman, Bill, and Anne Ferguson

1995 Human Rights, Environment, and Development: The Dispossession of Fishing Communities on Lake Malawi. *Human Ecology* 23(2):125-142.

Friedmann, Harriet

1993 The Political Economy of Food: A Global Crisis. *The New Left Review* 197 (1):29-57.

Fritsch, Peter

2004 As Shrimp Industry Thrives in Vietnam, Trade Fight Looms Tariffs Send Contrary Signal As United States Seeks Closer Ties With an Old Adversary A Billion-Pound Appetite. *The Wall Street Journal* (New York), October 21. URL:<http://www.americaneconomicalert.org/view_art.asp?Prod_ID=1226> (March 10, 2010).

Globefish

2007 Shrimp Market Report. February—China. URL:<<http://www.globefish.org/dynamisk.php?id=3560>> (February 2, 2007).

Goland, Carol

2002 Community Supported Agriculture, Food Consumption Patterns, and Member Commitment. *Culture and Agriculture* 24(1):14-25.

Griffith, David

1999 *The Estuary's Gift: An Atlantic Coast Cultural Biography*. University Park: The Pennsylvania State University Press.

Halweil, Brian

2006 Catch of the Day: Choosing Seafood for Healthier Oceans. *World Watch Paper* 172. Washington, D.C.: World Watch Institute.

- Hedlund, Steve
2004 Shrimp buyers' enigma. *Seafood Business*. September 1.
- Henderson, Elizabeth, and Robyn van En
1998 *Sharing the Harvest: A Guide to Community-Supported Agriculture*. White River Junction, Vt.: Chelsea Green Publishing Company.
- Hettinger, William S.
2006 *Living and Working in Paradise*, Carteret County, NC. The Wyndham Financial Group. October 20.
- Leschin-Hoar, Clare
2009 Taking Stock in Fish. URL:<<http://online.wsj.com/article/SB124421534407589317.html#articleTabs%3Darticle>> (June 29, 2009).
- Maiolo, John R.
2004 *Hard Times and a Nickel a Bucket: Struggle and Survival in North Carolina's Shrimp Industry*. Chapel Hill, N.C.: Chapel Hill Press
- North Carolina Division of Marine Fisheries (NCDMF)
2006a North Carolina License and Statistics Section. Summary Statistics. URL:<http://www.ncfisheries.net/download/2005BigBookofData_1sted.pdf> (April 2, 2006).
2006b Fish Dealer Report. License and Statistics Section. URL:<<http://www.ncfisheries.net/download/JanJun06FishDealerReport.pdf>> (March 13, 2007).
- Smith, Peter
2008 How the Fishing Industry is Trying to Stay Alive By Acting Like Small Farmers. *The Christian Science Monitor* (Boston, Mass.). March 10.
- Stick, David
1958 *The Outer Banks of North Carolina 1584-1958*. Chapel Hill: The University of North Carolina Press.
- Stonich, Susan C.
1998 Political Ecology of Tourism. *Annals of Tourism Research* 25(1):25-54.
- United States Department of Agriculture
2006 USDA Releases Survey of Farmers Markets. AMS No. 114-09. URA:<<http://www.ams.usda.gov/AMSV1>> (March 8, 2010).
- United States Fish and Wildlife Service (USFWS)
2004 Digest of Federal Resource Laws of Interest to the United States Fish and Wildlife Service. URL:<<http://www.fws.gov/laws/lawsdigest/fishcon.html>> (April 2, 2006).
- van Willigen, John
2002 *Applied Anthropology. An Introduction*. 3rd ed. Westport, Conn.: Bergin and Garvey Publishers.
- West, Susan
2007 Jones Tells National Marine Fisheries Service to Pull Amendment. *Outer Banks Sentinel* (Nags Head, N.C.), September 15. URA:<http://ahabsjournal.typepad.com/ahabs_journal> (January 5, 2007).
- West, Susan, and Barbara J. Garrity-Blake
2003 *Fish House Opera*. Mystic, Conn.: Mystic Seaport.
- Wilson, Jim
2006 Coastal Tension. *Wildlife in North Carolina* November:4-11
- Wolf, Eric
1972 Ownership and Political Ecology. *Anthropological Quarterly* 45(3):201-205.
- Worm, Boris, Edward B. Barbier, Nicola Beaumont, J. Emmett Duffy, Carl Folke, Benjamin S. Halpern, Jeremy B. C. Jackson, Heike K. Lotze, Fiorenza Micheli, Stephen R. Palumbi, Enric Sala, Kimberley A. Selkoe, John J. Stachowicz, and Reg Watson
2006 Impacts of Biodiversity Loss On Ocean Ecosystem Services. *Science* 314(3):787-790.