CULTURAL MODELS AND FISHING KNOWLEDGE:

A CASE STUDY OF COMMERCIAL BLUE CRAB FISHERMEN IN GEORGIA, USA

by

DANA ROBERT COOLEY

(Under the Direction of Benjamin G. Blount)

ABSTRACT

This research, conducted in 1999-2000, demonstrates how the ecological knowledge of commercial blue crab fishermen in Georgia, USA, is characterized and structured by specific cultural models, identified through computer-aided text-based analysis of interview data. Three cultural models and their supporting sub-models are defined and described. The first model reveals how the crabbers characterize their knowledge, and how this definition misrepresents the true nature of their ecological knowledge. The second model indicates the core characterization of their ecological knowledge, and encompasses the sub-models relating to their understanding of the estuarine environment as pertaining to the harvest of blue crabs. The third model represents what the crabbers themselves believe is the central ecological change that has most significantly contributed to the decline in the blue crab population. Aside from contributing to a better understanding of how cultural models function to structure and facilitate the utilization of ecological knowledge among fishing populations, this research also illustrates certain domains where the ecological knowledge of the crabbers closely mirrors traditional "scientific" understandings of the crab and the coastal environment. Conversely, the research demonstrates that in other areas, their knowledge differs, which offers insight as to how future collaborative efforts between scientists and crabbers might better incorporate crabber knowledge into management, and provide ecological information from scientists to the crabbers in culturally appropriate ways.

INDEX WORDS: Cultural Models, Ecological/Environmental Anthropology, Ecological/Environmental Knowledge, Maritime/Fisheries/Coastal Anthropology, Fisheries Management, Blue Crab, *Callinectes sapidus*, Georgia Commercial Fisheries.

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CHAPTER 1

INTRODUCTION

Statement of Objectives

Within the past ten years, ecological, social, and economic changes have stressed the Georgia blue crab fishery and its participants, creating new challenges that resource managers have been obligated to address. Collaboration between the crab fishery and the Georgia Department of Natural Resources, Coastal Resource Division (DNR) produced the current limited entry and gear-restrictive fishery management plan that regulates the fishery today. This policy solved the basic problem of overcrowding due to open access along with the associated threats of continual gear and effort escalation. Despite this, the fishery's landings have continued to decline since the plan's implementation in 1999. Like all other US states, the investigation of the factors contributing to Georgia's blue crab fishery decline is the responsibility of scientists and resource managers, not the fishermen. However, the Georgia crabbers feel that they can and should contribute to the effort to restore the fishery. Their solutions, though, are not innovative harvest regulations and management protocols. Rather, their contributions come from their understanding of the fishery itself. The crabbers concede that the recently implemented fishery management plan adequately curtails the problem of unlimited gear and effort escalation. They also believe that the contribution of certain environmental phenomena to the crab population decline may be significantly underestimated.

The effort to investigate and explore the ecological knowledge of fishermen reveals a significant cultural division which segregates the ecological knowledge of fishermen from that derived from formal science in the Western world. Frequently this differentiation is denoted through the dichotomous terms "scientific" and "anecdotal" in reference to the knowledge of scientists and fishermen, respectively. While there is no substitute for empirical methodology and rigorous scientific research to produce definitive understandings of natural phenomena, increasing attention is being paid to the lessons that can be learned from the knowledge of fishermen. Accurately describing their knowledge systems demands an accurate representation of culture and culturally specific bodies of knowledge, which may be the most critical challenge facing anthropologists today (Blount 2002).

My research with the Georgia blue crab fishermen attempts to bridge this gap between knowledge systems. My purpose in this dissertation is to examine whether crabbers possess or use an organized system of environmental knowledge that is structured by cultural models. Cultural models are subconscious world representations, mental templates used to explain or organize cultural or physical environmental components (Holland and Quinn 1987, Keesing 1987). Understanding cultural models will help me better describe how the crabbers perceive their environment, and show how these perceptions may influence their fishing activities. This analysis can also reveal potential sources of conflict between the fishermen and managers about regulation and management. In this manner, I will be able to demonstrate how certain ecological, economic, or other fishery-specific topics are viewed by the fishermen in culturally specific ways that cannot be understood through external, etic perspectives.

Conducting this type of research is rewarding in that it provides a deep understanding of the fishery participants' knowledge of the resource, the local ecosystem, and their approaches to fishing. It provides more than just an understanding of the cognitive framework through which the study group views their world. The data from the cultural models analysis allows the development of quantitative approaches to assess patterns of agreement within the entire study population. Identifying and explaining patterns of variation in knowledge among the crabbers is important because it can help predict or explain why bitter, divisive conflict might erupt among the fishery participants themselves in response to a proposed management option. Learning the source of the conflict can help facilitators like anthropologists find shared ground between the fishermen and those involved in the policy process and devise a management solution that works for all.

To recapitulate, this research serves two purposes. First, it investigates, identifies, and describes the major cultural models that structure the knowledge system crabbers hold regarding their environment and the fishery in which they participate. This is a significant contribution to ecological anthropology because it will be an in depth investigation of how a particular group of commercial fishermen have come to perceive their environment and the resource they depend upon through their direct physical experiences. Second, it represents an example of how qualitative research exploring culturally based domains of ecological knowledge can potentially identify areas where quantitative assessments can be implemented to further explore patterns of agreement within the fishery on a particular ecological topic relevant to its management. Quantitative anthropological research based on qualitative research can help identify the

likely social or economic factors responsible for generating intra-group variation in opinion. This should interest resource managers because understanding such attitudinal patterns within key fishery participant groups may enhance managers' abilities to create management plans that are appropriate and helpful for the stakeholders involved.

Study Area, Target Species, and Fishery Description:

This section contains descriptive information to familiarize the reader with the Georgia coast, the blue crab's biology, and the boats and gear characteristic to this fishery. To provide adequate ecological background information, I give both a brief description of physical characteristics of the Georgia coast and a discussion of the biology and life cycle of the blue crab. This provides a scientific description of the blue crab and its habits, which helps contextualize some of the cultural models presented and discussed in Chapter 4. To conclude this section of Chapter 1, it is important to describe the boats and gear essential to the Georgia blue crab fishery to enable comparison with other blue crab fisheries. This is important because people pursuing the same marine species in different geographic areas can have different perceptions of its habits and behaviors due to regional habitat variations that influence the targeted species. Others who study blue crab fishermen might need to consider differences in habitat or gear characteristics, for example, in the Chesapeake or the Gulf Coast, which have significantly different ecological characteristics than the Georgia coast.

The Georgia Coast

The coast of Georgia is approximately 100 miles long from the South Carolina border in the north to its border with Florida to the south. When all the inlets, islands, rivers and sounds are included, Georgia has an estimated 2,344 linear miles of coastline. The saltwater marshlands in Georgia cover an area of approximately 378,000 acres, measuring between three to five miles wide in places (NOAA Office of Ocean and Coastal Resource Management 1997). Georgia's marshes cover an area of approximately one third of the remaining salt marsh of the Eastern United States (NOAA Office of Ocean and Coastal Resource Management 1997).

The eleven counties of coastal Georgia have a total population of 511,444 people, as determined by the 2000 US Census (US Census Bureau 2003). The total land area of the region is 3,611,661 acres, 494,080 of which is water (NOAA Office of Ocean and Coastal Resource Management 1997). Coastal residents contribute to a diverse economy based on natural resource use and extraction, primarily pine forests, fisheries, natural waterways (shipping), and groundwater (NOAA Office of Ocean and Coastal Resource Management 1997, Sullivan 1990, Blount et al. 2000). The primary economic activities in the coastal region include the timber industry with its paper producing facilities, and fisheries, including shrimp, blue crabs, whelks, clams and oysters (NOAA Office of Ocean and Coastal Resource Management 1997). Other sources of income in the Georgia coastal counties are agriculture and the manufacturing and processing of products like jet aircraft, truck trailers, titanium dioxide, or sugar refining. Additionally, income from tourism and recreational fishing has recently become a major economic component on the Georgia coast.

The Blue Crab

The blue crab, C*allinectes sapidus*, is a member of the family Portunidae, belonging to the class Crustacea, from the phylum Arthropoda. Over 75% of all animal species belong to this phylum. Also in this phylum are organisms like spiders, horseshoe crabs, scorpions, lobsters, crabs, centipedes, and insects (Pechenik 1991). In general, arthropods have a hard external protective covering, referred to as the exoskeleton, and three distinct body segments called tagmata- head, thorax, and abdomen. Unlike vertebrates, which rely on internal skeletal structures to give them strength, mobility, and shape, arthropods use their exoskeleton to perform this function.

The range of the blue crab is as far north as Nova Scotia and as far south as Uruguay, and can be as far offshore as up to 120 feet deep, but is most typically found in shallow estuaries, where it can move into freshwater areas (Gosner 1978). They are most common and abundant in the Atlantic waters south of Long Island, and all along the Gulf Coastline to the Mexican border (Gosner 1978). Optimal habitat for blue crabs is tidal salt marsh estuaries, typically with soft mud bottoms and moderate salinities. Blue crabs function both as predator and prey in these estuarine ecosystems. Their larvae and postlarvae are food to eels, drum, spot, croaker, striped bass, sea trout, and catfish (Orbach et al. 1997). Mature crabs prey on fish, mollusks, and other benthic invertebrates when available.

They are active swimmers, with the final pair of walking appendages modified into flattened swimmerets, or paddles that enable efficient lateral swimming movement (Pechenik 1991). Blue crabs have three pairs of walking legs and one pair of large

chelipeds, used as pinchers for grasping and tearing prey (Pechenik 1991). A charismatic element are eye stalks that allow for 360° vision which retract for protection, and pop up almost comically. Blue crabs are characterized by a greenish color on their backs, accented with blue, gray and brown hues on their legs and undersides. Males have blue claws, and females have orange/red claw tips, humorously referred to by some Georgia crabbers as their "lipstick." Aside from these differences in coloration, males and females differ morphologically in their abdominal area. The mature male abdominal plate is long, slender, and sword shaped. In contrast, mature females have a round, semicircular abdominal plate, differing significantly from the triangular plate typical of the immature female.

Males reach sexual maturity after one year, and females after two years, mating once during their lifetime in late summer (Orbach et al. 1997). Females reach maturity in their terminal molt, which occurs at approximately 18 months (Williams 1984), where their abdominal plate changes from triangular to a larger, rounder shape. Mating only occurs during the short window of time after the newly mature female has exited her old shell and is soft, beginning to harden her final, mature exoskeleton.

Females ready to molt are attracted to a pheromone released by mature males, and up to several hours before the females enter into the final phases of their molt, the males climb over them and cradle them underneath. Days before the females enter into this phase they exhibit visually detectable colorations on their shells that crabbers use to determine whether they are ready to molt or not. Female crabs ready to molt are referred to as "peelers," collected and kept for shedding in tanks for sale as softshell crabs, a valuable product. The male releases the female while she sheds the old shell.

Immediately after shedding, the female is now completely immobilized, soft, and vulnerable; the male protects her by picking her up again and holding her inverted underneath his body. The male begins copulation at this point, and fertilizes the female. Afterwards, he returns the female to an upright position, but cradles her until her new shell has hardened and she is fully able to protect herself (Williams 1984). Individual females can spawn multiple times, depending on the amount of sperm received during copulation. They may spawn successively during the same year, or a season apart, spanning a winter. The females that are in the process of maturing in mid summer tend to spawn in the fall, while females that are later in developing spawn the following spring (Maryland Department of Natural Resources 1997). The numbers of eggs released per spawn ranges between 700,000 to 8,000,000 (Maryland Department of Natural Resources 1997). Two months after fertilization, the eggs are produced and adhere to the female's underside on the apron. The female carries her eggs for approximately two weeks until they hatch, a phase known by crabbers as "sponge" crabs, because the egg mass looks like a bright orange kitchen sponge.

Blue crabs mate in the upper areas of the estuary, areas typically more brackish than lower regions in the estuary. The release of eggs from the females during spawning, however, takes place in the saltier areas of the estuary, closest to the open water of the ocean. This preference for different salinities at different stages of the life cycle produces a seasonal migration of male and female crabs as well as a basic differential regional pattern of preference between males and females that the crabbers follow. The main controlling factor that regulates mating and spawning is water temperature (Williams 1984). In Georgia and the surrounding regions, blue crabs typically begin mating in

April and continue through August, but can be ready to mate as early as March and as late as November (see also Archambault et al. 1990).

The eggs released by the females into the coastal ocean from the mouths of the estuaries hatch into zoea larvae, approximately 0.01 inches in length. Tides and currents carry them out over the continental shelf, in full ocean seawater, with salinities exceeding the 30 part per thousand level required for optimal development of the larvae (Orbach et al. 1997). During this phase, the zoea are planktonic, vulnerable to predation by filter feeders, fish, and other environmental threats. As an arthropod crustacean, the blue crab must molt and shed its outer shell in order to grow in size. Crab larvae passes through six zoeal stages during the first 30 days of life (Orbach et al. 1997). Successful completion of this zoeal phase allows them to enter the megalopal stage, where they use tidal and surface currents to carry them to the upper estuary where they settle out of the water column and begin to actively feed and grow into mature crabs. Crab recruitment is completely dependent on environmental conditions that create favorable tidal and current conditions to sweep these larvae back into the estuaries (Orbach et al. 1997).

Crabs do not remain in one location throughout their life cycle, or even month to month. Salinity seems to significantly influence crab movements within the estuary (Frizzelle 1993). Salinity changes can result from seasonal or immediate weather characteristics. Typically, though, males tend to remain in the upper estuary, lower salinity areas throughout the majority of their life. By contrast, mature females normally congregate near the mouths of larger rivers, closer to the sounds, where salinities tend to be higher. Females migrate in response to salinity largely because of reproductive demands; they move upriver to lower salinity to molt, mature, and reproduce, then move

back down to higher salinity to carry the eggs and release them into the high salinity water nearest the ocean.

In Georgia, crabbers observe this pattern and recognize that the females tend to spend their winters in the saltiest waters of the sounds near the ocean, while males remain in the deeper, brackish areas of the upper estuary (Williams 1984). Crabs are also cold-blooded creatures; consequently, they are most active between April and November, the warmest periods of the year in Georgia. During the coldest months, they resort to semi-hibernation, burying in the mud between December and February, waiting for warmer water to return. Winter dormancy is a typical behavior, well studied in the Chesapeake, but the longer warm period in the South reduces the length of this cycle (Frizzelle 1993).

The Georgia Blue Crab Fishery

My research included a quantitative element comprised of a survey administered to all crab license holders in Georgia. Due to distinct limitations in design and implementation, I describe it in Appendix E. Although the interview data used for the cultural models analysis comes from a group of crabbers selected for their years of experience in the fishery, the survey data provides a general characterization of the age, gender, and characteristics of the fishermen who participate in this fishery. This will be presented here to give the reader a better understanding of the characteristics of this fishery.

In 1999-2000, there were 166 licensed crabbers in the State of Georgia (Clark Evans, Georgia Department of Natural Resources, Coastal Resources Division, personal communication, December 16, 2000). The crabbers who participated in this study lived

in different areas along the entire Georgia coastline, and represented a variety of different approaches to crabbing. Some marketed their own crabs locally, some delivered their own harvests by truck to northern markets, some sold to seafood wholesalers. Forty-nine individual crabbers participated in the survey out of 166 registered license holders. All but one were male. Ethnicity was not investigated. The average age of the respondents was 52 years, with a minimum of 20 and a maximum of 79. The age at which they entered the fishery varied from 5 to 65, with an average of 30. The majority of respondents began crabbing in the 1970s: 1 in the 1940s, 3 in the 1950s, 4 in the 1960s, 14 in the 1970s, 12 in the 1980s, 10 in the 1990s, and 5 since 2000. This matches the documented (Orbach et al. 1997, McIntosh 1996, Blount 2002) overall industry increase between the 1970s and the 1990s, and was one of the strongest factors driving the need for regulation, a need that resulted in the establishment of limited entry in the late 1990s. Age at fishery entry varied such that a 60 year old could potentially have five years of experience or less. Consequently, the age of the individual crabber was not a useful variable for analysis for either the interviews or the survey.

The crabbers I interviewed tended to agree that crabbers with less than 10 years experience were relative neophytes, and those with more than 30 to be seasoned, knowledgeable experts. For descriptive purposes, therefore, I asked the survey respondent to indicate how many years he or she had in the crabbing business. For convenience in reporting the results, I have divided the respondents into four general subgroupings: 0-10, 11-20, 21-30, and 31+ years of experience. There were 12 individuals with up to 10 years of experience, 13 with up to 20 years, 13 with 21-30 years, and 11 individuals with more than 30 years of experience.

Also related to knowledge and relative levels of experience is whether the crabber's father was specifically a commercial crabber, or a commercial fisherman in general (e.g. a shrimper). The responses reflect the relative "youth" of this fishery, with only 11 of the 48 respondents indicating that their fathers were commercial crabbers. However, generalizing this category to "commercial fishing" increased this figure to 24 of the 48 respondents, exactly 50%, (this includes the 11 who indicated their fathers were crabbers). If they indicated that their father had been a commercial fisherman, they were requested to indicate what fisheries their father had fished. The categories provided for them were shad, shrimp, sturgeon, eel, and "other." Not everyone answered this question, or marked "other" but did not specify what "other" was, so the data from this question will be treated as descriptive information only: shad (11), shrimp (17), sturgeon (4), eel (3), and other (14), with species like kingfish, rockfish, oysters, clams, pogies, and catfish.

The economic and technological change elements in Part A of the survey generated data that could enable stratification of the fishery participants by economic variables, since ethnographic data suggested that levels of economic commitment to the fishery might influence attitudes regarding conservation, management, and the health of the resource. These economic variables were: the number of traps the respondent is registered for, whether or not he/she owns the boat he/she uses to crab, whether he/she owns extra facilities related to crabbing (cooler and/or freezer to store bait and crabs, a shedding facility), and whether he/she shares these facilities with other crabbers. Trap levels are specific numbers of trap permits that individuals purchase from the DNR in

addition to their license fee, which permits them to fish quantities of 50, 100, 150, and 200 crab traps.

From the interviews, it was apparent that the crabbers recognize an interesting ecological dichotomy. Those estuarine systems that are not directly influenced by freshwater rivers, and derive their freshwater from surrounding systems of forested wetlands and swamps are characterized as saltwater "deadheads" by many local crabbers. The areas that receive freshwater, or the fishing areas that "have freshwater" are those that are directly influenced by any freshwater outflow from one of the five major freshwater river systems that empty into the Atlantic from Georgia's coastline. Twenty crabbers classified their fishing area as "freshwater," 21 as "saltwater deadhead," and eight indicated both, neither, or did not respond. This is an interesting classification by the crabbers, showing that they observe differences in salinities between estuaries with different physical layouts. This distinction might be a useful variable for future studies looking at correlations between certain environmental attitudes and the type of fishing area in which the crabbers work.

Crabbing: Work, Boats, and Gear

The ethnographic essay in Appendix A provides an aesthetic, descriptive representation of the daily life and activities relating to crabbing. It provides specific details regarding the types of gear and daily realities of crabbing. Such detail is necessary because it gives the reader an understanding of the vast knowledge a crabber must master and be able to apply each day on the water and at home, "on the hill."

Most crabbers in Georgia begin their day before the sun rises to take advantage of the coolest part of the day, especially during the summer months. Crabs stored on deck in the wooden boxes are easily over stressed by the hot summer sun; for the sake of their product as well as their own comfort crabbers get out on the water as early as possible. Some even rig lights on their boats to enable work in the dark early morning hours. Some crabbers work their traps at 2:00, 3:00, or 4:00 A.M., returning to the dock or their homes by 8:00 A.M. Typically Georgia crabbers work alone, but some employ helpers called "strikers," deckhands who handle all heavy tasks on deck, and who also help or do all of the sorting and culling of the catch under the watchful eye of the crabber. The strikers can get paid up to 50 dollars a day, being paid a flat rate wage rather than a share in proportion to the catch. Once all the traps have been pulled, the crabber returns to the "hill," and once the boat has been tied up or put on the trailer, he unloads the crabs from the boat and takes them to the local market or seafood wholesaler. Mechanical maintenance of the boat, traps, and other gear usually take up a large portion of the afternoon, along with other typical household tasks, and the stage has been set for another day's work.

Boats

In general, the crabbers in Georgia use fairly small, open boats for their work, in comparison to the large workboats their Chesapeake counterparts operate. The typical Georgia crab boat is between 16 and 23 feet long, and is powered by outboard motors ranging in capacity from 40 to 225 horsepower. Georgia crabbers' boats are small in comparison to their peers in the Chesapeake because the majority of their time is spent

traversing small tidal creeks, channels, and rivers of the Georgia estuaries, all the while coping with the dramatic 8 to 10 foot rise and fall of the tide. Thus, small, shoal draft watercraft with outboards that can be raised and lowered depending on the depth are essential. Many of their boats have bows designed to cut the rough chop that is common out in the more open waters of the sounds. A design that is growing in popularity despite its poor handling and some perceived design weaknesses is the Carolina Skiff, pictured in Appendix B. It is a simple fiberglass, flat bottom, blunt bow design that is useful due to its completely open, rectangular internal layout, providing ample workspace for the fisherman. In general, the boats are made from fiberglass, with wood occasionally used to create work-related structures on deck.

Every boat I observed was characterized by maximizing available open deck space, essential for transporting quantities of traps, and also, in more productive times, for carrying ten or fifteen boxes of crabs, a hundred pounds apiece, back to the shore. All had some form of a console for towards the aft section for the operating controls, but some had a small "house" constructed to provide shelter for the captain and the boat's controls. Whether it was an open console or a "house," this structure typically contains a wheel or stick for steering and the engine controls, and a place to store lunch, a cell phone, wallet, truck keys, license, registration, and other essential items that need to stay dry. This is important to have because in an open boat, everything is bound to get wet eventually. Most crabbers now employ electronic depthfinders to help them determine the optimal depth for their traps, and this device is usually found in association with the controls in the house or at the console. Some crabbers also have incorporated other items

into their console like a compass, marine radio, sometimes even an F.M. radio to listen to the morning news or music as they pull their traps.

Each boat I observed also had an electric pot puller, an electric motor that reels in the traps mechanically between two stainless steel sheaves bolted together, resembling two dinner plates attached back to back. It pinches the pot line into its V between the sheaves, and deposits the line in a compact pile on the deck at the crabber's feet. It is operated with a switch typically located next to the puller, enabling the crabber to keep a close watch on the trap as it surfaces, making sure he does not leave the puller on too long and accidentally get the trap itself wrapped up around the sheaves on the puller. Most professional crabbers in Georgia rely heavily on their pullers; pulling 100 or more traps a day, each with over 40 feet of line attached and weighing up to 50 pounds can be exhausting, backbreaking work, especially in summer.

Crab Traps

Traps and trap pulling are the keystone element of crabbing. Unlike the Chesapeake, where crabbers still use trotlines and other non-trap methods to catch crabs, the only type of gear used in Georgia to catch crabs is the "Maryland style" wire trap. The traps are approximately 24 inches deep, 24 inches wide, and 18 inches tall, constructed from two U - shaped sections of vinyl coated wire mesh, connected together to form a cube. There is some variation in trap dimensions and design among crabbers because many make their own traps from materials bought in bulk from commercial fishing equipment suppliers. In general, though, the overall design and function of the traps remains uniform for the entire fishery. Typically, the traps are nearly geometric

cubes, weighted on the bottom with ten to twenty pound welded squares of rebar. These weights are essential to Georgia crabbers because the current in the creeks and rivers can be so strong that an unweighted trap will sail along up or downstream behind the float. The Chesapeake, Gulf Coast, and Delaware blue crab fisheries, where currents tend to be weaker, do not use such rebar weights, or use weights that are much lighter.

The crabbers install a baitwell at the center of the bottom of all their traps. It is made of a tougher, tighter mesh than the rest of the trap, and closed by a trap door secured by a section of bungee rope attached to the trap with stainless steel hog rings. The baitwell juts upwards vertically into the trap's bottom compartment. The crabs, attracted to the trap by the scent emanating from the bait in the baitwell, crawl to the trap, come into contact with its sides, and crawl around the sides until they come to the openings called funnels located approximately one to two inches above the bottom edge. There are two basic design layouts; two and four funnel plans. Depending on the crabber's preferences, two or all four of the sides of the trap can have an opening through which the crabs enter the trap. A funnel shaped piece of mesh is attached to the inside of the opening, making an opening that a crab can easily crawl into from the outside but from which it is extremely difficult to escape. Although it is largely a matter of personal preference, several crabbers interviewed pointed out that the two-funnel design requires less materials and construction time, which may be an important factor since many crabbers build their traps themselves.

The traps are divided into upper and lower compartments by a "baffle," a roughly V-shaped section of wire mesh that has a small slit cut in the center of the fold that splits the V. The crabs crawl into the trap and feed on the bait. Their natural tendency to crawl

backwards causes them to crawl up and onto the underside of the baffle, which collects them into its opening and allows them to creep into the upstairs section of the trap where they are stuck until the crabber pulls the trap to empty it. There are small "cull rings" (two and three-eighths inches in diameter) mandated by crabbing regulations that let undersized immature crabs out of the trap before they are trapped in the "upstairs" section of the trap. Many crabbers say cull rings are a labor saving device in addition to a conservation benefit, because they prevent them from having to take more time culling undersized crabs from their catch, reducing dead loss both from being trapped, handled, and released, and by minimizing the time that the catch sits on the deck in the hot sun. The top of the traps is attached on three sides, the fourth kept closed by a bungee that is pulled over and hooked onto the trap in a lower area. This allows the top to be quickly opened, and the crabs in the top area dumped quickly into a waiting box for culling and sorting. Many crabbers also hook their traps shut in specific ways that enable them to determine if they were the last person to open and shut their trap. If another crabber or recreational fisherman opened their trap to pilfer crabs, they would likely hook it shut in a different way, alerting the trap owner that a potential theft may have occurred. The crabbers also attach zinc bars to one or two corners of the trap to prevent corrosion from the saltwater. Then they attach the line to it, with a foam float at the end to mark the trap. The float is required by law to be visible at 100 feet in clear weather at slack tide, and is usually marked with the crabbers' license number and initials on it either in paint, magic marker, or branded in with a soldering iron. The crabbers interviewed said they could put together a complete trap, line, float, zinc and all, for 25 to 30 dollars, with each trap taking at least an hour of their time to assemble and rig.

Bait

All the crabbers I interviewed use "pogies," or menhaden (*Brevoortia tyrannus*) for bait. They buy the bait from fish houses or bait dealers in frozen 50 pound flat boxes, known as "flats," for around 10 to 12 dollars per flat. Some crabbers share refrigerator/freezer setups that allow them to buy bait in bulk (hundreds of pounds at a time), saving money and enabling them to guarantee the quality and freshness of their bait. Most of the "pogies" they buy are harvested commercially off North Carolina and Virginia and shipped by truck throughout the Southeast. According to the crabbers, totally fresh bait does not attract crabs well. At the same time, bait that has been thawed once and refrozen for another trip is ineffective also. They tend to agree that crabs will not be attracted to bait that is either too young or too old. Accordingly, many will dump out the old bait even when there is plenty left in the baitwell when they pull it after a day or two; the bait must be kept at its prime at all times to maximize productivity. This illustrates that something that seems as simple as "bait" is a complicated topic that requires daily consideration by the crabber.

Clothing:

Another important element requiring consideration by the crabbers is protective gear. The most commonly used item is a pair of heavy-duty "slicker pants," or in hot weather, a rubber apron, made by commercial fishermen's supply companies. "Slicker pants" are thick, resilient rubber pants held up by wide, elastic suspenders that keep the bait "juice," marsh mud, slime, jellyfish tentacles, and other detritus off the crabber while

he empties traps and throws them back overboard. Trap lines are usually coated with marine growth, and fling muddy droplets all over the place as they are reeled in over the sheaves of the puller. The slicker pants, or for some, a simple rubber coated apron make the job more comfortable by keeping the crabber dry. Gloves are probably the most important piece of equipment the crabber has, next to his boat, in that sorting and culling the catch is done manually, reaching into a box full of outstretched claws and snapping crabs and pulling them out by hand, one at a time. The gloves do not prevent the crabber from being pinched, but they prevent most crabs from cutting their hands to ribbons with their sharp claws. Most of the crabbers interviewed described how they try to grab the crab quickly and place it in the box as gently as possible which minimizes stress to the crab, but also minimizes being pinched. A pair of white, calf-high rubber boots is the other essential elements of a crabber's equipment. The boots keep their feet dry, and tuck up under the slicker pants. The work gloves help protect the crabber's hands against the crabs' sharp claws and shells. A matching rubber slicker jacket is stuffed in a box somewhere, or under the console in case the weather becomes windy and wet, but is usually saved for such conditions because wearing a rubber jacket (in addition to the pants) can be unbearably hot in the Georgia sun.

Harvest Regulations, Grading, Sorting, and Selling

Two major components are involved in grading and sorting the catch. Personal requirements and standards for the product the crabber harvests and presents to the buyer are foremost, then followed by state enforced size and sex regulations. Individual crabbers' standards for catch quality seem to exceed the state's limits, apparently because

buyers today will only buy the best, prettiest, heaviest crabs. If the quality of the product is inferior, the crabber risks losing that buyer, or at least losing the ability to demand a good price for the product. The market is so competitive today that crabbers must use these measures to ensure that their product is most desirable for buyers and that they have a continued future demand for their product.

The basic legal requirements are that all hard male crabs must be five inches point to point (measured across the back), and mature females may be harvested regardless of their size. Since 1955, Georgia law has required that all hard crabs caught must be a minimum of 5 inches wide from point to point across their carapace. In 1979, the law was relaxed to allow mature females smaller than five inches to be harvested since they will not molt or increase in size again in their lifetime. In 1976 a law was passed in Georgia regulating the harvest of peeler crabs to individuals no smaller than three inches spike to spike, and limiting commercially licensed fishermen to the possession of no more than two bushels per licensee. If the crabber himself does not market them, softshell crab dealers will purchase the peelers, shed them in holding tanks, and sell the final product to other wholesale buyers and retailers.

Crabbers use a variety of personal methods and tricks to judge the quality of their catch. The live market is picky; customers buying a dozen crabs for a backyard picnic at premium prices want meaty, satisfying crabs, not newly shed, light male crabs that are not worth the effort to pick and eat. The most obvious method is to grade size and sex. Mature males larger than five inches, mature females of any size, and peeler crabs larger than three inches are “keepers.” Using a notched piece of wood or metal kept close by the culling box, the crabber or striker whisks through each trap’s catch and sorts the crabs

by size and sex. "Number Ones" are the larger than five and a half or six-inch males, the catch that gets top dollar on the market. Number Twos are the five inch, average size males. Mature females are typically placed in the same box regardless of size.

However, depending on the crabber's personal preferences, some of these may be thrown back overboard because they do not meet his own personal standards for quality. Some of these methods include testing areas on the crab's underbody for firmness, or looking at the color of the abdomen to judge the meat content. If it is bright white, it has recently shed and has not yet been able to fill its shell with meat. If it is rusty brown and hard, it is old, and full of meat. Some also judge the crab on its liveliness; if it is listless, it will not make the trip to the market, and it is tossed overboard. Generally, light crabs are thrown back, along with undersized males and sponge females. Sponges are illegal to harvest and sell in South Carolina and Florida, so even though it is legal to harvest them in Georgia, there is no market for them so they typically are not kept. Peeler crabs, females that are on the verge of shedding their shell and becoming softshell crabs are valuable to some crabbers. Once peelers shed and become soft shell crabs, they are a specialized commodity in the crabbing business, but are also the most valuable product from the crabbing trade. Some people buy nothing but peeler crabs from crabbers, and have large scale systems to allow peelers to shed and become softshells which they then sell. Some crabbers participate in this in addition to harvesting the crabs.

In general, the crabs are sorted according to the gradations discussed above and placed right side up into rectangular wood boxes. The crabbers stated that this is important because if the crabs were allowed to flip upside down in the box, their gills will dry out, causing them to suffocate and die. Crabbers in Georgia once used bushel

baskets, but they have found that the rectangular boxes used in the shrimp trade are more convenient for storage and shipping. When full, these containers can contain approximately two bushels of crabs, and weigh between 80 and 110 pounds. Boxes pack better than bushel baskets, and stack well in trucks. This means that the crabs are less compacted and injured in transit, arriving at the market fresher, with reduced dead loss, which ultimately generates higher market prices.

Summary of Chapter Contents:

This chapter describes the main objectives of the research and presents important background information regarding the geographic characteristics of the Georgia coast, the biology of the blue crab, and the fishery's social and technological aspects. The following paragraphs describe the topics that will be discussed in the subsequent chapters of this dissertation.

Chapter Two provides the theoretical framework and literature supporting the research conducted for this dissertation. Since this is an effort to demonstrate the utility of anthropological research for commercial fisheries management in the United States, the discussion begins with a description of the components of the Magnuson-Stevens Fishery Management Act that specifically relate to and mandate that such work be completed. Chapter Two also provides a more in-depth perspective on the current views of the human dimensions of modern fisheries and their management, to illustrate the need and utility of such research. Third, this chapter discusses in detail the anthropological elements drawn from ethnoecology and cognitive anthropology combined in this research. In particular, the chapter demonstrates how the concepts of cultural models,

experience-based ecological knowledge, and traditional ecological knowledge, can be applied to the study of the ecological knowledge of commercial crab fishermen.

Chapter Three defines cultural models and the methods utilized to identify and analyze them. Specifically, it presents a discussion of the nature of cultural models and reviews how they can influence behavior with their intrinsic motivational force. The chapter then describes primary methods of data collection and analysis. Semistructured interviewing applied in conjunction with ethnographic data collection through participant observation was most significant for the qualitative component of this project. The interviews were then transcribed for analysis using qualitative analysis computer software. A survey designed for and administered to the entire population of commercial blue crab license holders addresses the exploratory quantitative element. This chapter discusses the design and development of the survey, and indicates that due to difficulties with the survey instrument, it was not formally analyzed in this dissertation. Basic details concerning the survey are presented in Appendix E.

Chapter Four presents the cultural models identified through extensive text analysis of interview transcripts using the qualitative data analysis package NVivo from QSR International (2001). Three basic models are discussed individually, each in association with its key sub-models. These models are named: “Trial and Error Knowledge,” “Essential Knowledge,” and “Environmental Change.” This is the first time cultural model research has been applied to this population; therefore, the models identified are upper level, generalized concept models that describe how the crabbers visualize and organize the elements of the world that surrounds them. Future research can break these models into their specific, basic behavior-shaping component sub-

schemas. Throughout the chapter a collection of schematic diagrams present visual maps for this detailed analysis that help represent the hierarchical nature of the organization of the models that the crabbers use. These representations help the reader visualize the location of each model or sub-model in the crabbers' cognitive system, and reflect both the specificity of the models but also their situational flexibility.

Chapter Five, the conclusion, summarizes the findings and general significance of the research for anthropology and fishery management. The appendices that follow are an important resource which provide greater perspective and information that substantiates the utility and need for this research. Appendix A is an ethnographic essay intended to give the reader a firsthand experience of the emotional, intellectual, physical, and environmental experiences a commercial crabber in Georgia has in a day's work, both on and off the water. Appendix B is a collection of selected photos I took that document the basic activities common to a day of crabbing. Appendix C contains pertinent excerpts from the Magnuson- Stevens Act that represent the components of the Act that lay out the federal mandates requiring the inclusion of social science input and the assessment of the human dimension of fisheries management. Appendix D is the interview schedule used for each of the semistructured, tape-recorded interviews with the individual crabbers. Appendix E summarizes the survey and its limitations; it provides the actual survey instrument administered. Appendices F, G, and H are the informational letters that preceded, accompanied, and followed the survey in accordance with the Survey Total Design Method (Dillman 1978) that encouraged participation, explained the nature of the survey, and subsequently, thanked the fishermen for their participation in the survey.

CHAPTER 2

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

Introduction

Boats don't fish, people do. (Miller and Van Maanen 1979)

This section discusses the anthropological literature and research that addresses the issues supporting my research with the Georgia blue crab fishermen. First, I document the relationship between social scientific research and the United States Magnuson-Stevens Fisheries Conservation and Management Act and demonstrate how this research adds to it. Second, I present a summary of the cognitive anthropological literature that supports my interpretation and application of ethnoecological theory. Finally, I discuss more specifically how cultural model theories were applied to the study of the ecological knowledge and attitudes of the Georgia blue crab fishermen, to demonstrate the contribution of this approach to fishery policy research and development.

US Fisheries Management and its Challenges

The Magnuson Fisheries Conservation and Management Act of 1976 is the United States' declaration of exclusive right to manage and harvest marine fishery resources (except tuna) within 200 miles offshore (the Exclusive Economic Zone, or EEZ), with exceptions for areas of overlap with other nations' territorial seas (Iversen

1996). This act ensures that US fish stocks are harvested only by US fishermen; it is intended to prevent situations like the 1970s when thousands of foreign fishing boats fished in US coastal waters, directly competing (usually outcompeting with more gear, bigger boats and more destructive fishing practices) with US fishermen (Iversen 1996). The Magnuson Act essentially establishes parameters for the management and conservation of all fishery resources within the US EEZ.

In 1996 the Magnuson Act was amended and became the Magnuson-Stevens Fishery Conservation and Management Act (MFCMA). This added a component to the original Act that mandated the addition of socioeconomic and community impact analyses to the standard biological, economic, and ecological data collection required for proposed fishery management plans. In Title III, Section 301 of the MFCMA, National Standard Eight supports social science by promoting the development of Fishery Management Plans (FMPs) that support sustainable use of marine resources with the ultimate goal of supporting sustainable maritime communities. (NOAA Fisheries, National Marine Fisheries Service 2003). This will help ensure that fishery management plans will both maintain the integrity of the resource, enable continued participation in the fishery, but also proactively seeking to minimize adverse economic impacts from the regulations themselves on these communities. The tasks involved, such as impact assessments of the anticipated effects of proposed policies on fishing communities, are ideally suited for anthropological research.

Appendix C contains significant excerpts from the Magnuson-Stevens Act, including National Standard Eight, to highlight the main components of the Act that

support the human dimension of US fishery management, and illustrate the social scientific contributions they demand.

Human Dimensions of US Fisheries Management

Incorporating social science into fisheries management is an ever-evolving endeavor; marine fisheries management in developed nations like the US is typically focused on the study of biological and economic dimensions of fisheries. A recent fisheries management textbook (Iversen 1996) defines traditional marine fishery management as identifying fish stocks and explicating their physical and biological characteristics with the intent to devise management plans which will promote effective harvesting. Traditional biological and economic data are the key components for this effort. Fishery professionals that this definition includes are biologists, ecologists, economists, engineers, managers and lawyers; however, anthropologists or sociologists are not represented. This definition is inadequate, because it does not incorporate the social factors that affect the decisions and needs of the fishers. These human factors conflict with numerically based regulatory policies; the fishers never seem to behave in ways that "make sense" to managers (Durrenberger 1997). In the US, it has become a legal requirement to use social science to assess the needs, values, and goals of fishermen effectively and to help them work collaboratively with managers toward sustainable policy development.

Serious, systematic social scientific inquiry into the human factors affecting marine resource utilization and management is new, beginning during the 1990s in response to the amendments made to the legal mandates of the MFCMA. Evidence has

been gathered that shows that fishermen do not always make economically rational decisions, and that biological data regarding stocks can be significantly flawed or subject to unforeseen random ecological fluctuations (Durrenberger 1997, Acheson and Wilson 1996, Acheson 1997, Smith 1995b). The MFCMA established Federal legal mandates that require a basic level of social scientific contribution to all fishery policy development research. Mandating community impact analysis, social impact assessments, and social scientific research in fisheries has generated new understandings of their human dimensions. Examples include studies concerning the manner in which fishermen view their environment, the fishery resource, descriptions of ethnoecological knowledge of fish and fish resources, or even identification and description of local level folk systems of fishery management (Paolisso 2001, Griffith 1999, Acheson 1997). Incorporating social science in fisheries research can demonstrate that fishers themselves have significant needs and have potential contributions to resource management that should be recognized.

Research that documents the importance of participatory, fishermen inclusive approaches to policy development and resource regulation as well as an understanding of traditional methods regulating fishery access and utilization is key to the design of good management plans (Acheson and Wilson 1996, Acheson 1997, 1998, Palmer 1990, McGoodwin 1990). Policies can have negative economic and social consequences, an outcome that needs to be avoided (Kearney 1989, McEvoy 1987). This can occur due to different or conflicting communication styles of fishers and managers, or their views of the marine environment and its appropriate uses (Cicin-Sain and Knecht 1998, Acheson 1997, Durrenberger 1997, 1988, Sylvia 1992). Another key management consideration is

the extent to which the fisheries are territorial, competitive, defensive, or individualized (Acheson 1988). These fishing groups have developed highly structured social frameworks for regulating access to the resource and the amount that is harvested, parameters that should preserve the resource for sustained use. The Georgia blue crab fishery fits into this category; Evans (1998), Frizzelle (1993), McIntosh (1995), Murray (1996), and Orbach (1996) collectively provide evidence that shows that this fishery is regulated to an extent by a social framework that recognizes informal ownership of fishing territories.

It is important to identify whether social mechanisms for regulating fishery resource allocation are present and functioning, because they will dramatically affect the compatibility and acceptability of new policies applied to the fishery by the regulating agency. James Acheson's work on the Maine lobster fishery (1979, 1988, 1997, 1998) is a central example of such work, and others, notably Durrenberger (1997), Palmer (1990, 1991), and Martin (1979) have contributed complementary perspectives, all showing that policy needs to be informed by good social scientific understandings of the fishermen involved.

The 1996 revisions to the Magnuson Act reflect a growing awareness of the need to understand the socioeconomic characteristics of the fishery's participants by requiring social science data collection and assessment goals. Obviously, biology and stock assessments are essential to understand the specific characteristics of the species targeted by fishermen, and provide the data that enables rational decision making regarding regulation of resource utilization. However, without understanding the socioeconomic and cultural principles surround and influence their harvesting behavior, policies

developed may not achieve desired regulatory effects and instead generate resentment and frustration. This only perpetuates the stereotype that regulators and managers are nothing more than "suits" or "fish-crats," as they are often characterized in the "Cap'n Sane" column in the industry's national monthly publication, *National Fisherman* ("Cap'n Perc Sane," 2002).

Certain human factors relatively unique to marine resources pose challenges for resource managers. First, social frameworks among fishing people can be difficult to understand from an etic perspective, and can provide invisible barriers to implementing effective policy. Ethnographic research can shed light on how these systems create self-regulating, managing behaviors, self-destructive consumptive extraction behaviors, or even barriers impeding external influences from fishery entry or regulation. Second, the common pool or common property dimension of marine resources can present unique challenges to management. Open access to a "public" resource can create conditions of effort/gear escalation that require specific approaches to management to eliminate overfishing; the individual needs assurance that the other fishermen will not go out and catch his or her share. Otherwise, he or she will fish as hard or as long as possible to make sure that he or she gets a "fair share." The problem is that everyone else will be acting the same way, and fishing effort will increase to the point where it exceeds the ability of the resource to support it and the fishery crashes. Policy in such situations needs to eliminate the perceived social threat that the individual's share of the resource could be caught by another person (McCay 1994, Hardin 1968, Berkes 1985).

A successful resource management policy must bridge gaps between competing stakeholder groups with different and potentially conflicting needs. By studying how

stakeholder groups believe things are supposed to work (socially, economically), conflicts or commonalities between them can be identified and addressed. The first step is to assemble enough information to substantiate the claims that the parties involved put forth (DeWalt et al. 1996). Then, practical, acceptable, and complementary roles can be identified for the stakeholders that will enable mutually acceptable resource allocation and use patterns to be created (Stonich 1995, Stanley 1998). This will improve resource management policy approaches by establishing meaningful relationships and dialogue among stakeholders. Consequently, the knowledge held by each group could inform designers efficiently and enable them to create policies specifically tailored to suit the ecological and human environments affected (Stonich 1992).

Overall, contemporary US fishery management embodies one of the most stakeholder-inclusive policy approaches of the developed nations of the world, with federally mandated requirements for public hearings, feedback periods, and open times for stakeholder input. However, within the past two decades, largely due to the Magnuson-Stevens amendments, the anthropological work demonstrating the value of local fishing knowledge has begun to influence US fishery policy development efforts. Maritime anthropological research is enhancing policy development in several ways. First, pioneering ethnographic studies on groups like the lobster gangs of Maine (Acheson 1988) and the tuna seiners of San Diego (Orbach 1977) have heightened awareness as to the richness and empirical nature of the ecological knowledge and skill that fishers need to have. Second, community-based conservation research (see Pinkerton 1987, Lynch and Alcorn 1994, Little 1994, Kleymeyer 1994, and especially Zerner 1994) has begun to emphasize the need for incorporating fisher knowledge into

management in northeastern fisheries (examples include Acheson & Wilson 1996, Amend 1989, Jentoft and McCay 1995, Kearney 1989, McCay and Jentoft 1996). This points again to the value and nature of local ecological knowledge as applied to management and conservation. Finally, in recent years anthropologists are proving that social science can contribute to fishery management at many levels. Examples include: the development of equitable fishery policies (Clay and McGoodwin 1995, Durrenberger 1988, Dyer 1994), the types of research anthropologists can perform (Maiolo et al. 1992), how to examine patterns of discourse and participation in policy development and its impacts on fishers (McCay and Jentoft 1996, Smith and Jepson 1993), and how anthropology can help explain the unique social and fishing behavior problems associated with open access resources (McCay 1987, 1989, 1994, McCay and Acheson 1987, Acheson 1975, 1987).

Local Knowledge and Marine Fisheries Research

The Magnuson-Stevens Act mandates that an ecosystem/habitat level approach be established for all managed species that incorporate a documentation of the status, health, and threats to the habitat deemed essential (Essential Fish Habitat, EFH) to the marine resource species managed (NOAA Fisheries, National Marine Fisheries Service 2003). This strengthens the need to add to the ecological data scientists gather by studying and understanding the ecological knowledge of the fishers who are intimately familiar with the fishery in question. Fisher knowledge needs to be considered to enhance scientific understanding of the subtle patterns of the system, because fishers are the people with the most expert understanding of the entire fishery. Appropriate anthropological research

will clarify how fishers, viewed as folk scientists or local experts, can contribute to the arenas of coastal ecological research and resource policy development. Although anthropologists have studied the ecological knowledge of many different groups over time, the study of the environmental knowledge of fishing groups, in particular the information they use to locate, harvest, and/or market their product, has only recently become "common" (for North American examples, see Orbach 1977, Gatewood 1983, Durrenberger 1993). These studies are good examples in that they assess what information the fisher has assimilated and utilizes to locate and harvest the target species.

For social scientists conducting research that contributes to fishery policies, an understanding of biological and ecological properties of the species and ecosystem in question is essential. Without an understanding of the organism and its habitat, the appropriate management goals cannot be identified or understood (especially in relation to habitat conservation, stock condition, the impact of management on the stock). This research on the Georgia blue crab fishery, for example, requires a thorough background in the biological and physical processes of estuaries, life history and ecology of the crabs, and knowledge of the characteristic species of southeastern estuaries. Social scientists need to be familiar with this information to be able to communicate with resource managers, policymakers, and in this case, the blue crab fishermen.

The key anthropological contribution is demonstrating that fishing knowledge is beyond anecdotal, by presenting it in ways that make it worthwhile, informative, and potentially useful for scientists and fishery managers. The importance of fisher knowledge and understanding of fishery processes are gaining recognition, due largely to expanding anthropological research on the topic. Much of this research has targeted the

question of how fishers know where and when to fish (Gladwin 1970, Durrenberger 1993, Gatewood 1983), what conservation measures they practice (Dyer 1994, Dyer and McGoodwin 1994, McGoodwin 1990, Palmer and Sinclair 1996, and Anderson 1994 for folk management of marine resources), and the assessment of the social impacts of fishery management plans (Sinclair 1983, Nance et al. 1994, Nielsen and Vedsmand 1997, McCay 1989, McCay and Jentoft 1996, Smith 1996, Pinkerton 1987).

A growing body of literature is also emerging that explores the potential for incorporating fisher knowledge into policy. Acheson and Wilson's 1996 paper challenges the empirical western scientific foundations of North American fishery management with the claim that mathematical models are incapable of accurately representing the effects of natural stochastic (chaotic) variations in stock recruitment and abundance of lobsters. They claim that parametric management, moving power to local levels, is ideal because fishers are closest to the resource and thus most able to assess fluctuations in stock abundance (see also Smith 1995a and 1995b for support of this position). This suggests that different regions of the fishery may have different management needs or stock abundance characteristics (overlooking larger scale issues of stock migration). Other studies have shown that single fisheries can be fragmented into smaller, isolated groups based on social or ecological characteristics (Smith and Hanna 1993, comparative study of Oregon coast trawler captains in two different ports). This lends support to the parametric approach because fisheries are typically ecologically variable, even at the local level.

Considering local knowledge as a source of valid, detailed, and useful ecological information is an established practice in international agricultural and economic

development projects as well as research in developing countries. It has been used successfully in helping tailor conservation and development projects to the specific ecological and economic needs of the local people and their ecosystem. Using local knowledge is so well established that designing research to document this knowledge in the forms of folk experts or expert systems (Guillet et al. 1995), ethnographic decisionmaking analysis (Zabawa and Gladwin 1995, Gladwin 1989), local experimentation (Rhoades 1995), and land tenure systems (Lynch and Alcorn 1994, also Price 1995 for application to fisheries) are all recognized, accepted approaches. (See Alcorn 1995, Croll and Parkin 1992, Fujisaka 1995, DeWalt 1994, Frechione et al. 1989, Gupta 1995, Kleymeyer 1994, Little 1994, and Stigter 1995 for examples involving local knowledge in management and conservation). Other research related to these projects demonstrates that local people have expert, extensive ecological knowledge that can contribute substantially to local, national, and international resource management efforts (Brush and Stabinsky 1996, Warren et al. 1995, Western et al. 1994, Dyer and McGoodwin 1994, McGoodwin 1990). Local knowledge is an important foundation for building resource management programs and can identify essential scientific research topics to enhance the effectiveness of policies generated (see Warren et al. 1995 and Western et al. 1994 for case studies on how indigenous knowledge and local participation enhances resource management, also Ruddle 1994).

Ethnoecology

Ethnoecology is considered to be the examination of the interactions between humans and all the ecological factors with which (physical, biological, social) they

interact (Gragson and Blount 1999). This study investigates how humans perceive natural divisions in the biological world, characterizations of plant-animal-human relationships and observations of relatedness among divisions. It also seeks to describe human resource utilization patterns in terms of ecosystem-individual interactions. Such inquiry is traditionally applied to the investigation of the knowledge and experience of indigenous hunter-gathering, horticultural, and agricultural peoples from around the world, people who derive subsistence predominantly from terrestrial resources. This research attempts to incorporate traditional elements of ethnoecological research into an applied approach by showing how the environmental knowledge of the crabbers can be influenced by socioeconomic and cultural factors. Therefore, this is an attempt to explore how ethnoecological anthropology can best facilitate the development of relationships among fishers and policymakers, resource managers, and scientists.

Examining ecological knowledge and the nature of fishing behavior enriches (adaptive/responsive) understanding of fisher decisionmaking in relation to ecological factors. The most important theoretical foundation for this research is the application of ethnoecological theory to the analysis of how maritime peoples perceive, cognitively organize, and interact with ecological elements in the marine environment. Perhaps the most significant component/contribution of maritime anthropological research concerning North American fishery management needs is the study of the social norms and institutions created by fishers to regulate marine resource access, harvest, and distribution as well as patterns of communication, and the effects of cultural values on fisher decisionmaking processes.

The fundamental element of ethnoecological research is the investigation of the traditional ecological knowledge (TEK) people derive from of the components of their surrounding environments (see research and case studies presented in Warren et al. 1995, in particular, Alcorn 1995, and Radcliffe et al. 1995). TEK is not learned from books, rather from experience, direct interaction, and purposeful, utilitarian activities within the environment. Much of the original ethnoecological research thus centers on the nature and characteristics of “folk” or traditional knowledge people have regarding the species and characteristics of their immediate environments (in particular: Berlin 1978, 1992, Clement 1995, Conklin 1962, Ellen 1993, Atran 1990, Hunn 1985, Posey 1984). The central component to such research traditionally depends on identification, description, and exploration of the classification systems people use to organize and compartmentalize ecological components. The concept of folk taxonomic classification systems, the salience (of morphological characteristics) versus utilitarian classification argument, and the term “traditional ecological knowledge” result from this effort (Atran 1990).

Typically, research concerning TEK or "folk" knowledge is conducted among indigenous groups who obtain their subsistence largely through direct physical interaction with their immediate ecological surroundings, as opposed to more Westernized, industrialized populations operating in more ecologically alienated economic conditions. Also, much of the classic ethnobiological research on folk taxonomic classification systems has been conducted among such indigenous groups (for example Atran 1990, Berlin 1992). Although TEK is the subject of this research, the combination of two major issues warrants a semantic adaptation of the concept. First, the blue crab fishermen

participate in a fishery that is entirely single-species oriented, unlike artisanal fisheries in developing nations where fishers generally handle a wide array of species with a potentially enormous and complex array of specific and significant social, economic, seasonal, and ecological parameters attached to them. Second, the Georgia blue crab fishermen, born, raised, and educated in the American, Western tradition, use the same language and basic taxonomic classification system as the researcher. These two characteristics render the term "traditional" inappropriate for the crabbers, since it relates more specifically to indigenous groups who utilize entirely non-Western approaches to understanding and interacting with the components of their environment. Consequently, Dr. Benjamin Blount and I have decided to apply the term "Experience-Based Knowledge" (EBK) to refer to the ecological knowledge North American fishermen have accumulated from their personal, physical experience in their environment over the course of the years they have spent on the water seeking to locate and extract the particular resource(s) they seek.

EBK, like folk knowledge, represents an individual's cultural heritage and identity, and for the larger community EBK includes social institutions and acceptable patterns for behavior (Ruddle 1994). The physical environment contains specific salient aspects which are integrated into the community's understanding of external phenomena (prototypes), providing ways to describe them (taxonomies), and helping establish ways to relate to them (schemas) (Ruddle 1994, D'Andrade 1995). Folk knowledge can therefore explain relationships between environmental phenomena and reactive behaviors to outsiders who otherwise would not understand the connection. In this light, patterns of

fisher marine resource use can be considered to be products of culturally formed perceptions of the environment and the users' needs (Ruddle 1994).

Why study the EBK of fishermen?

Despite the semantics that differentiate EBK from TEK for the purposes of this project, the basic issue underlying much established TEK and ethnoecological research remains: how do fishermen see and cognitively organize environmental information related to fishing? The classification and cognition aspects of environmental knowledge cover the most classic and debated elements of this field. The two theoretical areas involved are linguistic approaches to understanding how words are used to structure and describe the elements of the environment and how this information is cognitively structured. The processes of taxonomic differentiation of elements in the environment are critical foundation elements for this research; much ethnoecological research has been conducted among peoples who utilize entirely non-Western approaches to classification. The Georgia crabbers utilize a classification system that is highly similar to the system used by the scientists.

Although crabbers, ecologists, and resource managers may utilize the same taxonomic categorization criteria to differentiate the common species of Georgia's estuaries, their close interaction with the environment may enable them to create secondary classificatory domains derived from more subtle and specific properties. Unlike ethnobiological taxonomies of fungi, tropical forest species, or diseases, the domain here is more conceptual, involving subsets of knowledge related to an activity

that seeks to locate and extract a particular resource hidden from physical view by the surrounding environment.

A taxonomic focus may be inappropriate for assessing experience based ecological knowledge in this fishery because it is a single species fishery, bycatch is rare, and the target species is different morphologically and behaviorally from all the other species present in the ecosystem. Alternate fishery participation is also rare, so the fishermen are rarely faced with a situation where they have to differentiate between similar but different organisms. Focusing on taxonomies alone would be incomplete, since I am also interested in understanding how their knowledge affects fishing behaviors and decisions. Thus, while issues of categorization and prototypicality of physical environmental components are important foundational elements for this research, the knowledge of fishermen is approached from a more generalized point to identify the presence of higher level, generalized information structures and determine if or how they serve to organize and regulate the utilization of ecological information.

Cultural Models: Application for Fishery Management

The theoretical foundation for the research presented in this dissertation is largely based on ethnoecological and cognitive anthropological research concerning cultural knowledge and human behavior as structured and shaped by cultural models. The accurate representation of culture and cultural knowledge is well understood to be the most critical challenge anthropologists face (Blount 2002). Involvement in resource management requires anthropologists to do this as accurately as possible, since the

outcome of their research will shape a resource management policy that will directly impact the livelihood of a fishing people (Blount 2002).

Cognitive and linguistic approaches to the representation of cultural knowledge have evolved into a system modeling approach that seeks to reveal the characteristics, functionality, and utility of cultural ecological knowledge through discourse analysis (Blount 2002). The term "cultural models," a conceptual product of this modeling paradigm, especially within the context of this research, carries two meanings, both of which are fundamental to this research. First, cultural models are viewed as the constructed representations by researchers that describe the knowledge held, shared, and used by a group of people in their daily experiences and activities. Second, these models are seen also as cognitive devices the group of people studied actually use and believe in relation to their daily activities (Blount 2002).

The study of cultural models will enhance marine resource management efforts because it will more accurately document and evaluate the needs of affected constituent groups. It achieves this by investigating culturally based information internalized by the stakeholder group that is related to their utilization of the managed resource. Cultural models enable ecological anthropologists to demonstrate that ecological knowledge of fishermen and other resource user groups is an organized, systematic "folk science" (Keesing 1987, Ruddle 1994, Holland and Quinn 1987). This research uses cultural model theory to attempt to describe and analyze how Georgia blue crab fishermen understand and interact with their environment (in terms of knowledge relating to human behavior and understanding the marine environment), and whether these attitudes and patterns of knowledge are idiosyncratic or shared by the overall group. This second

component, investigating the degree of acceptance or shared-ness of certain aspects of crabber knowledge or environmental attitudes is an attempt to determine if at higher levels of generality, knowledge or attitudes seem shared among the group. It is also an effort to see if these attitudes vary at basic levels in relation to specific socioeconomic variables. If so, it could offer an explanation of how knowledge, attitudes, or beliefs regarding resources, environment, and the fishermen's self-perceived role within that system shape or direct their interaction with management policies and resource management officials.

Several key questions regarding cultural models are fundamental to this dissertation, as they are for all other research pertaining to stakeholders affected by any proposed fishery policy. First, what do crabbers know about the blue crab and its environment, and how is this knowledge structured (processes, phenomena, relationships connected with fishing)? Second, have they perceived any environmental changes over time that have related to crab productivity or estuary health? Third, how does this ecological information function to facilitate responses and/or stimulate goal oriented behaviors? Essentially, this asks how the crabbers' ecological knowledge functions to motivate or shape fishing behavior and attitudes towards conservation or regulation? Finally, in what ways can a better understanding of crabbers' ecological knowledge or attitudes regarding the environment and resources enhance management and policy decisionmaking or design? How can a body of knowledge be collectively held by a group of relatively independent fishermen, and how can this vast encyclopedic body of knowledge be compartmentalized and processed by individuals to produce the culturally appropriate behavioral response to the situation at hand? The research of cultural models,

based on schema theory from cognitive anthropology, represents the best available approach to find the answers.

Summary

The key question about cultural models is to understand how they motivate behavior if an understanding of resource-use conflicts among stakeholders is to be achieved. Environmental values are powerful; they are the manifestation of the people's reactions to environmental patterns and processes, as well as social or cultural constraints or conditions. The Georgia crabbers are no exception.

Management programs can maximize information flow if they operate from a thorough understanding of the community they serve. This facilitates establishing an equitable process that can promote learning through participatory inclusion (Olsen 1993). Management plans must empower, legitimize, and strengthen the voice of local community members to equalize them with larger entities that have historically ignored folk-based sources for information. Such requirements are as true for the fishing groups in the United States as it for marginalized coastal peoples in developing countries. A management scheme derived from folk knowledge should be based on an understanding of core community social processes and needs to empower the voice of the individual. It should also encourage establishing a social organization of resource users capable of preventing powerful interests from appropriating control of the folk system itself (Anderson 1994). “Personalizing" the policy process in this way could better engage the diverse interests represented, as well as connect the process with the resources of

applicable non-government organizations (NGOs) at national and international levels (see case studies in Warren et al. 1995 and Western et al. 1994).

Understanding patterns of experience-based knowledge is critical when generating specifically targeted management policies that address both human and resource needs (Palmer 1994). Management schemes can be developed that mesh with stakeholder/folk system values in order to provide an emotionally compelling public ideology of conservation (Anderson 1994). This could be referred to as a "social process of nature appropriation," structured by technical and economic characteristics of resource use, resource attributes (spatial, temporal, and abundance), and the social context of use strategies (political, legal, symbolic) (Bailly and Paquotte 1996:256).

Integrating the best possible knowledge of ecosystem processes with that of societal needs and values is imperative (Olsen 1993). Technology or management schedules must be created that are compatible with the target community, ecology, and economy (Pollnac 1982). This is easier said than done; if there are solutions, those which have easily appraised advantages will be successful (Pollnac 1982). Observable proof that the plan will fulfill a need and match existing beliefs, values, attitudes, and status and role relationships is imperative (Pollnac 1982).

Finding a personal, cultural level through which to connect a sense of ecological responsibility with individual behavior is not simple. Fishermen are facing plummeting catches, economic inflation, coastal environmental destruction by industries, and real estate development. Fishing today is becoming increasingly a hostile, competitive, and individualistic pursuit. Anthropological research can find the critical cultural, social, and personal avenues through which the needs and values of the fishermen, the key

stakeholders in a fishery regulation policy situation, can be evaluated, understood, and addressed.

CHAPTER 3

CULTURAL MODELS: IDENTIFICATION AND ANALYSIS

Introduction

The challenge representing the existence of cultural models and their sub-level components lies in the fact that they are a dynamic system that reside in the minds of living people, individuals who experience new and different conditions and experiences in each moment of their daily lives (Dailey 1999). The models function like building blocks, with the actor adding and subtracting components from the system at will to best suit the cognitive task at hand. The challenge this presents is that the researcher must be able to take a snapshot of the cognitive system that is both specific enough to be complete, but general enough to be flexible and represent the adaptive, pliable nature of the model system itself. This chapter presents first a detailed description of what cultural models are and how they can influence the behavior of fishermen, and then discusses how I collected and analyzed the qualitative data that contains the cultural models in question. The actual models identified are presented in detail in Chapter Four.

What are Cultural Models?

Cultural models are subconscious world representations that shape how members of a group understand their environment and regulate their behavior (Holland and Quinn 1987). Understanding culturally based patterns of human behavior can facilitate the

explication of relationships between physical and cognized entities in a particular group's surrounding environment. This can improve our understanding of how rules defining appropriate behaviors are related to relationships perceived between environmental elements significant in the daily activities of the group studied (Ruddle 1994). Cultural models reflect such relationships because they are shaped by the speaker's psychological and physical goals and needs, therefore producing discourse that invokes cultural understandings pertaining to the issue and event involved (Holland and Quinn 1987). There are two basic types of cultural models: common sense knowledge and understandings of the community, encoded in language; or partial versions of these models invoked and used by individuals in everyday perception, thought, and interaction (Keesing 1987).

Overall, identification and description of cultural models is an attempt to represent the manner in which people represent and conceptualize information and ideas based on the activities and events in their everyday world. Cultural models are a specific form of a cognitive schema, a mental framework that simplifies, clarifies, structures, and helps guide the individual to identify the appropriate pattern of response for a particular situation, event, phenomena, etc., encountered in daily life. Cultural models are essential elements that enable people to function in their daily lives, because whenever individuals engage the world around them, they cannot perceptually respond to every aspect of its complexity (Quinn and Holland 1987). Interaction with the world requires the ability to simultaneously simplify, make generalized abstractions, and be specific and focused during decisionmaking and response actions for each event (Blount 2002). Simultaneously perceiving, processing and reacting to external stimuli in the environment

requires that the event under attention be simplified to a cognitively manageable proportion. Thus cultural models are structured by community shared conceptual frameworks, and can be seen as mentally held templates that are utilized to explain or organize components of the cultural or physical environment (Keesing 1987). As such, cultural models function as behavioral operating strategies that represent the implementation of cultural knowledge in the everyday world, organizing information and enabling the actor to interpret sets of external conditions and choose the appropriate response (Holland and Quinn 1987).

The functional element that enables efficient perception and reaction to cultural and environmental information is the schema. People interacting with the world rely on schemas to enable them to perceive and react to situations. Schemas are situationally specific frameworks of information built from years of personal experience and communication with other group members that allow interaction in everyday activities in the environment in a basic, productive, and efficient manner (Blount 2002). Schemas contain common basic units of information, known as defaults, which create a reference point from which the person quickly sorts out the appropriate situational frame and subsequent behavioral response (Blount 2002). Schemas can be as basic as turning the key to start your car, or complex like a cross-country road trip, which includes the key turning schema and many others.

These schemas, according to Dailey (1999:10), are "…simplified and prototypic knowledge structures" that we hold in our minds that enable us to cope with the enormous amount of stimuli with which our external environment continually bombards us. Schemas are essential cognitive tools that function to generate rapid, useful, and

practical interpretations of daily experiences and events (Casson 1983). Schemas also provide the actor with cognitive informational structures that have slots into which they plug in information from the event or interaction, enabling objects or events to be more easily identified, explained, or analyzed to identify the appropriate behavioral response (D'Andrade 1992). Some highly specific behavior schemas can be idiosyncratic and personal, learned through unique individual experiences, as Dailey describes, like the feel of the clutch in your car, or imagining the opening bars of a song after one has ended, knowing it is next on the album (1999). These schemas are learned by the individual through that person's own unique daily experience and surroundings.

The building blocks of cultural models can be viewed as bundles of related schemas that are focused on fairly specific activities or phenomena learned from cultural activity and interaction with the environment (Blount 2002). Schemas are the working component of a cultural model, that is, as Blount (2002:12) states, "…most directly engaged with the external world, either in mental or physical terms." Bundles of schemas aggregate hierarchically to accommodate the encounter and the complexity of the required information, creating explanatory mechanisms that are as complex or abstract, or as basic and concrete as needed. (Blount 2002). Cultural models are, therefore, assemblages of schemas learned from cultural interaction and shared with many people within a particular cultural group (Strauss and Quinn 1997).

How is Behavior Influenced by Cultural Models?

The most important element of cultural models pertaining to fishery and other resource management issues is the relationship between them and the motivation and

regulation of behavior. How do cultural models motivate behavior? This is probably the most important question and most significant benefit learned from cultural models research. Since fishery management directly interacts with the regulation and control of resource harvesting behavior, it is critical to show how cultural model theory can put anthropological contributions at the center of resource management development. By understanding how cultural models act to motivate and shape fisher behavior regarding harvesting, economic goals, concerns for environmental management, and resource allocation, managers will be better able to understand the patterns of behavior in the fishery. Managers can then adjust management goals based on the best biological data to also best suit the fishers' needs.

There are five conceptual elements central to understanding how cultural models are organized and how they function. First, they are interpretative, flexible, and goal oriented. This is the most general but most influential element that affects their ability to shape and direct individual behavioral responses to situationally specific conditions. Much research demonstrates that cultural models serve as cognitive frameworks for interpretation and response to environmental stimuli or events, and also as structures that govern goal oriented behavioral responses (Casson 1983, Holland and Quinn 1993, Kempton 1993, Strauss 1992a, D'Andrade 1992, Holland 1992, Quinn 1992, Harkness et al. 1992, Lutz 1992, Dailey 1999). Cultural models apply motivational force in many facets of daily life, showing that cultural models influence, shape, and direct individual behavior choices. For example, things or concepts we interact with on a daily basis like marriage, thermostats, parenting, or the processes involved in intangible phenomena like global warming have been shown to be driven by cultural models (see Holland 1992,

Quinn 1992, Harkness et al. 1992, Kempton 1987, 1993, Strauss 1992a for such examples). These are all elements that require attitudes, behaviors, responses, and all have practical, immediate, and social or economic consequences that affect the perceived and real socioeconomic well being of the actor involved.

Cultural models do not all directly motivate behavior, but as Quinn and Holland state, these models strongly influence behavior in highly complex ways (Quinn 1987). Goal oriented, directive force which shapes behavior only occurs when models carry enough social or physical force to compel the actor to choose a specific course of action (Dailey 1999). This motivational force can be understood by asking the following questions. Is there historical memory of positive events related to the model? Is there a realistic chance of success in the scenario? Does a fit exist between the generalized model and the specific self-oriented schemas of the actor? Are the models associated with specialized expert or scientific models? (For more detailed treatment of the issues related to these questions, see Strauss 1992a, Strauss 1992b, D'Andrade 1992, Holland and Quinn 1987, and Dailey 1999)

Second, models are arranged in a hierarchical fashion that allows the individual actor to move cognitively up or down the scale from specific to general depending on the situationally specific parameters of the event at hand. According to Casson (1983), models are arranged in a nested hierarchy that can be seen as progressing from general to specific (see also Strauss 1992a, D'Andrade 1992a, Holland and Quinn 1987, and Dailey 1999). The upper level schemas, usually the more general, goal oriented elements, activate, invoke, or otherwise direct attention to the appropriate lower level schemas that are utilized to accomplish situationally specific tasks (Dailey 1999). D'Andrade

classifies this hierarchical arrangement concept by identifying three levels of schemas: master motives (like "love," instigate action with no ultimate goal in sight), middle motives (like "fly fishing," schemas that generally require the presence of other schemas to instigate action, but can instigate their own actions), and lower motives (direct action schemas like "tying wooly booger trout flies") (D'Andrade 1992). Cultural knowledge is situational, flexible and constantly faced with new permutations of situational constraints, and as such cannot be reduced to discrete, inflexible, elemental components; rather, it must be flexible, adaptive, and dynamic (Dailey 1999). Holland and Quinn support this by stating that knowledge is not a monolithic unit, but rather "…an array of different culturally shared schematizations formulated for the performance of particular cognitive tasks" (Holland and Quinn 1987:10).

Third, cultural models function as if linked in lateral, flexible, dynamic pathways (Casson 1983). This is a critical point because cultural knowledge, as life experience in the everyday world, requires an adaptive, flexible approach, and the ability to draw selectively on a mental database and toolkit to respond appropriately to each new situation. Rigid adherence to inflexible models that structure behavior could leave the individual actor without options for action in real-life situations. This is because "real life situations" can be influenced by countless factors that, when combined, can create unique situations with specific, unique behavioral strategies. As Dailey states, supported by research from Holland and Quinn (1987), and Blount (2002), the "subschematic parts upon which models are built automatically reconfigure to suit the pragmatic context at hand (Dailey 1999:299-300)."

Another perspective on the utility of the flexibility conferred onto models by their hierarchical nature is the unique individual experience and cognitive background each actor brings to bear on the situation based on his/her personal life experiences. Two individuals may experience the same event, but have two totally different, separate reactions to it based on the linkages they make within their schemas based on their life experiences. Dailey uses a good example, describing how "worms" might mean for one organic gardening and rich soil, where for another they might mean living in filth (Dailey 1999:300).

Finally, the fourth key element of cultural models is that culturally shaped cognition and the physical environment are completely interrelated, mutually dependent processes (Dailey 1999). Culture is the product of the interaction of the internal and external worlds, shaped by the constraints of culturally mediated cognition (Dailey 1999, also Strauss 1992a). Models are responsive to situational parameters, and thus are responsive to and can recognize change. If a particular class of models center around the continued integrity, productivity, and localized abundance of a particular natural resource, those models will be challenged when that resource becomes scarce or distribution changes as a result of numerous factors, including but not entirely dependent on human activities. The responsiveness and adaptability of cultural models makes sense at a very obvious level; environmental changes are physical, observable, and sometimes dramatic (Dailey 1999). The actor has no choice but to confront these changes and make a behavioral decision that weighs his/her needs in comparison to the environmental and/or social framework. Strauss (1992b) provides an example by showing how declining economic prosperity caused factory workers to alter their schema relating to

employment earnings from a concept of "American success" to a more simple "breadwinner" schema. Kempton's study of models of thermostat function (1993), Quinn's study of marriage models (1987), and Holland's study of romance (1992) also illustrate how models gain directive force with increasing informational feedback resulting from real experience within the parameters of the model.

Culturally acquired knowledge can provide sources of socialized motivation that underlie cultural models. As such, directive social force is experienced by the actor who then perceives a distinct urge to act or react (Holland and Quinn 1987). Cultural models, therefore, function as behavioral operating strategies which represent the implementation of cultural knowledge in the everyday world (Holland and Quinn 1987). Considering this, it is possible to see that cultural models classify information into categories where behavior is either justified by external authority and expertise (expert validation), or through intrinsic persuasiveness (Holland and Quinn 1987).

Do the cultural values that shape behaviors change over time? Generations come and go, and leave some sort of cultural informational legacy, instilled in their children at home, in school, and throughout all life experiences. Models are passed on from parent or knowledgeable colleague to the child or novice. However, as environmental constraints evolve or appear before the individual, or when the individual chooses an activity the parent has no experience in, he/she must make an independent decision. Over time, successes and failures are shared among peer groups, and new knowledge is added to the schematic domain. The behavioral adaptations the individual makes become internalized and integrated into the individual model, which is eventually passed on to subsequent generations (Dailey 1999). Another way change occurs is when the factors

affecting motivational force change, forcing actors to reassess their opinions on the unknown element. As Dailey (1999: 302-303) puts it, "…the view of trans-generational change fostered by this view is built not upon alterations in the cultural models of individuals, but in their cumulative cognitive drift over generational time."

Data Collection for Cultural Models Analysis:

The fieldwork for this project began in October 1999 and ended in December 2000. The first three months were occupied by establishing initial contacts, developing rapport with these and other members of the coastal commercial fishing community, beginning initial interviews, and assessing interview data to refine the research through identifying key questions and issues. Preliminary data coding and analysis began once several interviews were completed and transcribed. This process determined whether the interviews were functioning properly and producing appropriate data. Once the interviews were functioning smoothly, full scale semistructured interviews were conducted throughout the balance of the fieldwork (The interview schedule is provided in Appendix D). These interviews covered a range of topics that intended to represent the key components of crabber ecological knowledge and their environmental concerns.

Participant Observation

The fundamental tool I used for general data collection was participant observation (Bernard 1995). By spending most of my days with individual crabbers, doing things their way, and interacting in an unstructured informal social context, I became fluent in typical discussion topics, unique cultural mannerisms, and the activities

characteristic to crabbing life. This knowledge was not applied to formal analyses, but instead served as a benchmark that enabled better assessment of data gathering during interviews. It provided background for questions, and enabled me to converse with crabbers about crabbing activities in culturally appropriate ways. Like learning a foreign language, becoming familiar with the fundamental details of the crabbing life enabled me to determine what the appropriate questions were to ask and elicit detailed explanations about crabbing knowledge that move beyond unproductive responses like "I don't know, you just do it that way."

Semistructured Interviews

The primary formal data collection method utilized for this research was the standard semistructured interview technique (Bernard 1995, see also de Munck and Sobo 1998, Mason 1996, Pelto and Pelto 1970, and Spradley 1979). These are interviews structured by an interview guide, which is a list of questions, topics, and probes that must be covered during the interview. Typically, these questions are primarily derived from information gathered from participant observation (see Appendix D for the interview schedule used for this research). What makes this type of interview semistructured as opposed to structured is that the order in which the interview guide contents are covered is regulated only by what feels natural and flows with the evolving conversation with the interviewee. This type of interaction is not as flexible as a completely spontaneous interaction; rather, it strives to ensure a minimum of control over the informant's responses. The interviewer's main responsibility is to cover the issues listed in the interview guide and to keep the conversation focused on a topic, while allowing the

informant to define the content of the discussion. This allows the interview participant to feel comfortable and express their true feelings on a topic, rather than offering what they believe are the answers the interviewer seeks to elicit.

The interviewees were selected by starting with an initial contact and working from that contact outwards by personal recommendations, a “snowball” sample (Bernard 1995) that targeted the locally acknowledged "expert fishers" from each river-sound system along the entire length of the coast. I interviewed 25 members of the crabbing community during the course of this research. Seventeen of these crabbers permitted me to tape record their interview for transcription to facilitate analysis. Due to equipment malfunction during one interview, the recording was not usable, reducing the total number of interviewees used for analysis to 16. For two of these 16 crabbers, it required two separate visits to complete the interview. This produced two tapes for these two crabbers, artificially creating a total of 18 recorded interviews. To prevent this from skewing content analysis, these two pairs of interview tapes were transcribed so that each crabber was ultimately represented by a single transcript.

These interviewees were selected primarily because they were highly experienced fishermen, occasionally referred to as “old timers.” This distinction is made because the crabbers seem to emphasize it, defining someone who has crabbed since the 1970's as an "old timer," and someone younger (30 years of age or younger) who had fished since the late 1980's as a "new guy." It would be difficult to attempt to collect samples of interviewees differentiated according to other variables like market orientation and involvement, trap increments, etc. The interviews focused on highly experienced individuals in an attempt to collect data from equally knowledgeable crabbers (fishermen

with equal levels of skill and experience). Subsequent work could benefit greatly from a comparative study that targeted inexperienced, new crabbers.

The interviews targeted informational domains centered around topics determined to be important components of crabber knowledge through ethnographic interviewing, participant observation, and growing daily experience within the crabbing environment. In particular, the interview had two main thrusts. First, it elicited a description of the crabber's understanding of crab biology and the effects of seasonal environmental factors. Second, the interview was intended to identify what environmental changes the crabber felt had occurred during his career, and how these changes had affected the crab population.

In particular, the interviews targeted three main topics: the life cycle of the crab (reproduction, seasonal movements, growth) and the environmental factors that affect these patterns, the environmental changes that have occurred in the estuary since they began crabbing, and the causes of these changes. These questions sought to elucidate what explanatory models the crabbers hold regarding the ecology of the blue crab, what environmental factors affect its life stages and movements (like habitat preference), and what impacts, if any, humans have had on the estuarine habitat and health/productivity of the blue crab population. The interviews were structured to elicit a taxonomic representation of the informational hierarchy used by the informant; this enables data analysis to identify folk models (Ruddle 1994) of ecological relationships like, for example, a connection between hog farm runoff and decreased crab productivity.

Unlike the information gained from a series of individual and unique conversations, the interviews produced a range of individual responses that address

certain overarching topics, themes, and specific categories. Thus, by requiring each participant to answer the same questions and topics during the course of the interview, semistructured interviews can be seen to be methodologically rigorous and will produce a rich and analyzable body of information. These individual responses fit into a textual data set of transcribed interview tapes that can be collectively analyzed.

Each interviewee was asked in advance for permission to tape record the interview to ensure accurate reproduction of their responses. The taped interviews were subsequently transcribed into computer based word processed documents to enable computer-aided analysis using NVivo (QSR International 2001). This enabled systematic assessment and reconstruction of the environmental patterns and change collectively understood by the fishers by enabling specific analyses of word choice, context, descriptors, and other components of the informants' responses. The recordings also constitute an archive of the fishers' personal accounts, preserving firsthand this rich cultural resource for future analysis.

Data Analysis: Identification and Description of Cultural Models

Cultural models analysis is a developing and malleable theoretical basis for anthropological research. There are a variety of pathways to the identification and explication of cultural models that have been utilized; however, most have been based nearly entirely on qualitative data, small sample sizes, and the researcher's interpretation of cultural content and meaning (see Blount 2002, Holland and Quinn 1987, Quinn 1987). As Blount succinctly states, there are really no definitive methodologies established to define and identify a cultural model (2002). My approach has been to

conduct a qualitative analysis that identifies and describes the cultural models that the Georgia blue crabbers possess and utilize.

Keyword analysis (Blount 2002) is the most well developed approach to date that allows efficient evaluation of qualitative interview data to identify and describe cultural models. Keyword analysis is the process through which the terms or phrases central to the discourse offered by informants are identified (Blount 2002). These terms or phrases are used by informants to structure their discourse on the topics discussed during the interview. Most importantly, though, is the fact that these keywords are "… essentially what people talk with one another about, the topics around which and in relation to which the content and meaning of units of discourse pivot (Blount 2002)." They are the central terms, concepts, ideas, and issues that people talk about and use to share understandings of the larger environment which surrounds them. Keywords are indexical, according to Blount, functioning as labels that identify and locate clusters of information relating to specific topics (Blount 2002). As such, keywords can be general terms that reflect upper level, generalized models, or lower level, highly specific schema models. Also, for each group of people that share a specialized body of knowledge, there are unique, specific keywords and phrases that unite that knowledge through models, which serve to unify both discourse and action.

The study of cultural models is well suited for keyword analysis within the software environment of NVivo (QSR International 2001). NVivo is a data analysis program that enables coding and structuring of textual data through "nodes" which are essentially keywords that serve as compartments the researcher can use to organize his/her understanding of the subjective content of the textual data. After transcripts for

the tape recorded interviews were completed, they were imported into the NVivo project where they could be searched, coded, and investigated online. Once analyzed, the computerized coding and node structure enabled graphical models to be made to represent the flow of information and influence from one keyword and model to the next. This allows the hierarchical structure of models and concepts that are essential to crabbing knowledge to be represented in a fluid sequence.

The initial starting point for keyword analysis was fairly pedestrian; basic keywords and concepts (identified from ethnographic notes and observations) were explored using NVivo text search tools. The best starting point was to run simple text searches across all the transcripts to look for the presence, relative frequency, and context of keywords or concepts that I had noted as important during the actual interviews. If the search was successful, I looked at the relative frequency of occurrence of the term in the transcripts; was it present in only one of the 14 transcripts, or was it present in all 14? Frequency was used as a rough indicator of salience and importance, and/or centrality. If the majority of the interviewees mentioned a keyword included in a concept during the interview, that word was judged to be significant and likely a component of a cultural model (see Chapter Two for a detailed discussion of supporting theories).

The usage context was also scrutinized; if all mentions of the term "salinity" appeared in conjunction with "sea turtles," for example, the two terms were determined to be part of a larger concept or model. As Blount (2002) stated, keywords are not reducible to lexical semantics; they are the external representation of a generalized concept or model around which the individual can selectively invoke more specific informational elements as the situation warrants. Contextual investigation shows that

certain general models based on the same keyword gave way to dramatically different sub-models given different question sequences and discussion topics. This idea was uncovered largely through experience and increasing intimacy with the interview transcripts. As key word text searches were run, more keywords and usage elements became apparent; the searches became more structured and specific.

Keywords were useful as "nodes," to conduct automated text/pattern searches with the NVivo software to identify all the circumstances where the word or concept appeared within the interview transcript. These searches coded the transcripts automatically; searching for salinity would mark all the transcripts with the node "salinity" everywhere the word "salinity" occurred. Manual analysis of the coding determined whether it all was "correct" and did not include miscoded or use coding word fragments or the right word out of context. In many ways, one search led to another, and eventually contributed to the assembly of a tree diagram that linked general keywords like "salinity" or "environmental change" or "trial and error" with more specific keywords representing specialized areas of crabbing knowledge like crab growth, saving money, or trap placement. The modeling feature of NVivo enabled graphical representations of this hierarchical system to be generated, and are included throughout the models analyses presented in Chapter Four.

Much like Dailey's analysis of cultural models of Appalachian forests and ecological change in 18th century America (1999), I alternated between asking questions (searching for keywords) and exploring how the keywords functioned (looking at meaning/context) during this process of coding and analyzing interview transcript content. I used three basic criteria to determine whether a model was present or

functioning. First, the majority of interviewees had to have discussed or used the same key word or concept in the same context in their discourse. Second, discussion of the keyword or concept initiated discussion of the same or similar topics subsequently within the interview. Third, the discussion spawned by the use of the keyword/concept contained the same or similar thematic elements.

Summary

This chapter presents a detailed description of cultural models with the intent to demonstrate how these cognitive elements can influence the behavior of fishermen. It achieves this by first discussing in detail the literature supporting cultural models theory, and then discusses how the qualitative data that contains these cultural models was collected and analyzed.

Chapter Two laid the foundation for the discussion of cultural models presented in this chapter by discussing the key literature that defines and discusses the characteristics of traditional, experience-based bodies of ecological knowledge. Much research on this subject has been conducted among traditional, non-Western populations, but this chapter demonstrates its applicability to the ecological knowledge of Western commercial fishing groups like the Georgia crabbers. However, the challenge for fishery management is not to determine whether a particular fishery has its own unique experience-based ecological understanding. The challenge is to be able to determine to what extent the fishers' ecological knowledge will influence their fishing behavior. This is significant because good management must understand the basis for behavior so it can regulate fishing activities to ensure both ecological and social sustainability.

This is what necessitates cultural models analysis of the experience-based ecological knowledge of fishermen. As discussed in Chapter Two, the central issue is to investigate how crabbers' ecological knowledge functions to influence fishing behaviors and their attitudes regarding management or conservation. This chapter begins by defining cultural models, and then discusses the ways in which they can influence individual behavior. The key is that cultural models are subconscious world representations which shape people's environmental understandings and regulate their behavior (Holland and Quinn 1987). They function as behavioral operating strategies that structure and facilitate the implementation of cultural knowledge in everyday situations, organizing information and enabling the actor to interpret sets of external conditions and choose the appropriate response (Holland and Quinn 1987).

This chapter then moves on to present a discussion of how I collected and analyzed the data to identify the cultural models used by Georgia blue crab fishermen. It describes how participant observation, the "snowball sample," and semistructured one-on-one interviewing techniques were used to collect the majority of the data for the research. It also indicates that all the interviewees were "expert" commercial crabbers with comparatively equal and extensive experience-based fishing knowledge. The chapter concludes with a discussion of the process of data analysis.

For my research, the first phase of cultural models analysis began with key word analysis. Key words are the terms or phrases used by informants to structure their conversations surrounding daily topics of discussion. Keywords are the central elements of everyday discourse between people. These words represent the concepts, ideas, and issues central to people's understandings of their surrounding environment. Qualitative

data analysis software packages like NVivo enable large bodies of text to be searched and digitally coded to highlight specific content elements. This technology enabled me to examine specific keywords in terms of their usage frequency and their context in the discourse in relation to other keywords. Usage frequency is important because cultural models cannot be determined to exist if the majority of interviewees do not use or discuss same key word in the same manner within their discourse.

The second critical component of cultural models analysis is the examination of the context of the keyword's usage. If for the majority of the interviewees, mention of the keyword elicited discussions of the same or similar topics in their discourse, that keyword was determined to be a central cultural model component. Computerized coding of these keywords enabled me to generate graphical models that represent relationships between keywords, or more generally speaking, the models that the keywords instantiate. This permits assembly of a hierarchical framework of models and concepts from the analysis that reflects the essential models of the knowledge of the Georgia blue crab fishermen.

This chapter demonstrates how cultural models can help researchers learn about the intricacies of the experience-based ecological knowledge of commercial fishermen. It also shows that there are ways in which such experience-based ecological knowledge can influence patterns of fishing behavior in ways that may be interesting to resource managers. The chapter highlights the fundamental perspectives from current cultural models theory that support the research conducted for this dissertation. The final sections of this chapter present the reader with a discussion of the analytical methods used; the results follow in Chapter Four.

CHAPTER 4

GEORGIA BLUE CRAB FISHERMEN'S CULTURAL MODELS

Introduction

This chapter will document and describe the cultural models, identified through this research, that exist and function within the community of Georgia blue crab fishermen. Most are functionally generalized, higher level abstractions representing thematic conceptions of the environment or its processes. However, in almost all cases during the interviews, the discourse spawned by the models indicates that more specific, behavior shaping schemas may be present that warrant future research. In the following sections of this chapter, I will identify, describe, and demonstrate the relationships between the higher and lower level models identified in the discourse from transcribed semistructured interviews with 16 Georgia blue crab fishermen.

These models are manifestations of knowledge accumulated through lifetimes of experience in the Georgia coastal ecosystem; there are large scale models of "the way things are," but more focused models that represent specific understandings of certain components of complex coastal ecosystem processes are also included. The models are all complex, invoking numerous sub-level models which have their own unique subcomponents. Some reflect understandings of large scale ecosystem processes, while others marry ecological knowledge with economic planning, enabling them to optimize

harvest levels to protect the resource as well as maximizing their return and minimizing fishing effort.

The Cultural Models

There are three major cultural models that emerged from these interviews: *Trial and Error, Essential Knowledge,* and *Environmental Change*. The crabbers interviewed offered highly similar explanations of the general seasonal patterns and characteristics of the blue crab, its life cycle, and the fishery. For this research, the most productive discussions resulted from the crabbers' shared perceptions regarding the definition of crabbing knowledge, how it is learned, and their interpretations of the environment and its patterns. In many ways, looking at these elements of crabbing knowledge together reveals themes that collectively indicate a basic explanatory model. The model, in turn, represents their perceptions of why the crab population has declined so dramatically even though formal, legal, regulatory steps have been implemented to attempt to ensure sustained fishery harvest levels. As each section and model is presented, please refer to the flowcharts included throughout this chapter that graphically represent the flow of ideas, knowledge, and the relationship between the models. The figures help keep track of where the discussion in the text is located within the hierarchy of models. They also provide the frequency of each model, in the interview data, indicating how many of the 16 interviewees included the keyword or other terms relevant to the particular model in their discourse. These frequencies are presented in parentheses adjacent to the terms in the charts.

The extensive interview discussions about the blue crab's life cycle and its environment reveal, not surprisingly, that the crabbers indeed possess an extensive and detailed understanding of the blue crab. Their knowledge spans numerous domains, but in particular, is highly specific regarding crab habitat preferences and seasonal as well as long term environmental changes (anthropogenic and natural) affecting the crab and ultimately, crab harvest levels. However, during the interview, as the fisherman and I discussed seasonal components of the crab's life cycle and habitat preferences the conversations invariably followed "tangential" topics relating ecological, economic, even social elements to crab location, quality, or fishing effort decisions. Analysis of the interview transcripts revealed that these "tangents" appear to represent several sub-models. These result from crabbers drawing on their environmental knowledge related to the crab, specific ecological components of the blue crab's habitat preferences, and ultimately how anthropogenic and natural environmental perturbations contribute to the ever increasing crab population decline.

Cultural Model: Trial and Error

The most likely answer a Georgia crabber will give to the question "How do you learn what you need to know to be a successful crab fisherman" is a dismissive statement indicating that crabbing knowledge is simply "…common sense, common knowledge, uh, trial and error learning, experience (Crabber C)." In the interviews, the majority of crabbers offer responses like this, phrasing their explanations almost identical to one another. Please refer to Figure 4.1 below for a graphical representation of this model, the

number of times *trial and error* or related analogies appeared in the interviews, and the sub-models to which it relates.

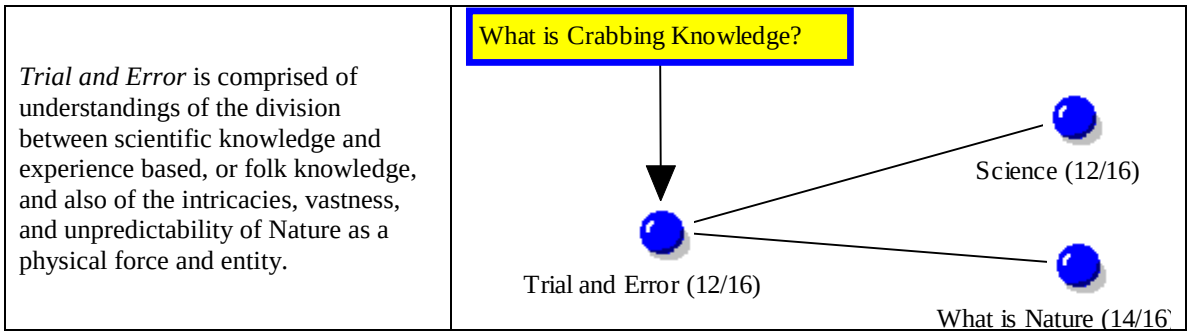


Figure 4.1: Crabbing Knowledge: Trial and Error

Although the crabbers may describe their knowledge as happenstance, experiential, common sense, or even accidental, analysis of the discourse pertaining to their learning process reveals that to them, "crabbing knowledge" is far more than just common sense, and *trial and error* is really a more systematic and empirical process than the speakers themselves may realize or care to admit. *Trial and error* seems to function as more of an identity marker, a cultural model that relates more to their identity as fishermen than to the content and nature of their knowledge. Analysis of the interview transcripts indicates that discussions of *trial and error* do not get into the specifics of crabbing knowledge. Rather, *trial and error* functions as the central, organizing cultural model that encompasses and orchestrates the access and utilization of all other information related to crabbing. Activating this model appears to be what enables them to describe their diverse knowledge quickly and efficiently, while simultaneously downplaying it by emphasizing its "nonscientific," individualized nature. Invoking *trial*

and error eliminates the need to explain how they acquired their knowledge, and prohibits the need to defend its validity, as is common in the scientific world. *Trial and error* is thus the metaphoric structure that connects and unifies the rest of the components of crabbing knowledge. This cultural model sits at the most general, upper level, describing the crabbers' understandings of seasonality, trap placement, salinity, life cycle reproductive patterns, habitat preferences, tidal effects and market influences as their personal, experience-proven view of how things work relating to the environment, crabs, and crab fishing.

Why do they call it *trial and error?* Crabbers may view their knowledge as "just" *trial and error* because they are as steeped in the Western cultural respect for science, the validity of scientific data, statistics, and formal education as are fishery scientists and managers. Many of the interviewees offered supporting statements that show that while they believe in their knowledge, trusting their livelihoods to their understanding of the ecosystem and the blue crab, they defer in some way to "science," "scientific knowledge," and "research." Apparently, scientific data is valued in certain ways by the crab fishermen, but at the same time, it is apparent from the following excerpts that they tend to defer to science perhaps at the expense of their own knowledge. The following four quotes demonstrate the crabbers' typical dismissive hedge: "I'm not a scientist, but…."

> CRABBER C: I'm not a biologist, but, the natural ingredients of that effect is getting depleted. …I don't know if it's been proven or not, [it's] just my personal theory.
>
> CRABBER E: We're talking the same thing, you just call it something different than I do, I'm just a plain simple person, you're a college person, ha ha.

> CRABBER M: I just think they just thinking about it, course there might be, you know, I ain't no scientist, I don't know, what, but I been seeing that for a long time. I thought it was just battle scars on 'em, you know, where they've hit stuff...

Other crabbers present a more collaborative perspective, noting that the scientific insights might help improve fishing productivity and/or help explain ecological phenomena that they have been unable to explain satisfactorily through their own experiences and observations. The passages still reinforce how they segregate their knowledge from scientific understandings of ecological systems, although the difference represents more of a perceived lack of formal expertise than one of relative inferiority. The following excerpts demonstrate this:

> CRABBER B: Crabbing has to evolve into a little bit smarter thinking, and the only way we're going to do it is, I guess, the university's going to have to help us show us how the crabs move in and out so we can learn to pick our crop when the season's ripe.
>
> CRABBER C: Usually see your sponges show up in February or March, depending on the water temperature and the warmth, and uh, they normally lay their eggs in the saltier water, and from what I understand, talking to some of the biologists and stuff, they say that the crab goes through larval stages before it even looks like a crab, and they have the best chance of surviving to maturity if they make it to the marsh. They kinda ride the tide in.
>
> CRABBER J: Well, and that's what I'm saying. Do I have the knowledge to tell you what made that change [increased salinity], no I don't. I've seen it. I know its there. Do I have the knowledge to tell you that I know what made it change, no I don't, but I know it did.
>
> CRABBER A: Uh, those are factors that you generally can't see with the naked eye, uh, it takes experts and professionals to find those.

Most crabbers in Georgia have not pursued extensive formal scientific training or academic education (McIntosh 1996, Murray 1996). However, their years on the water

provide them with a body of knowledge that is derived from extensive informal cause and effect experiments. By observing the daily, weekly, monthly, and seasonal environmental patterns and relating them to characteristics of crab behavior, the crabbers develop an ecological understanding that enables them to evaluate current conditions and produce a hypothesis that enables them to roughly anticipate crab behavior. They test the theory and adjust their fishing activities accordingly in response to what they observe in their traps. The scientific rigor of controlled laboratory conditions is not typically present in this process, since much crabbing data is recorded mentally on a per-experience basis rather than through standardized, systematic databases with repetitive measurements intended to make experimental results replicable and analyzable. Flexibility, understanding environmental patterns, and being able to adapt to Nature's stochasticity is important; if the crabber stays with a specific plan or approach to crabbing based on last year's data, he would soon be out of business. Naming the model *trial and error* thus reflects the model of their knowledge both as an experimental, information gathering approach, but also as an experience based and experience generating approach that is inherently observant and adaptive.

Trial and Error Sub-model: Experience

Crabbers view their knowledge in a culturally defined way that relates to their socially defined educational status *(science).* As such, their knowledge, to them, represents the logical by-product of *experience.* Such experience based knowledge gives them an understanding of the coastal ecosystem in which they fish that is far more than just happenstance, haphazard compilations of superficial information. Please see Figure

4.2 below for a graphical representation of this model and its frequency in the discourse among the interviewees. When questioned about how they acquired their knowledge, and what they felt they needed to know and how to use this knowledge to be a crabber, the typical response was to describe crabbing knowledge as "just" "…common sense, common knowledge, uh, trial and error learning, experience…" (Crabber C), emphasizing the common sense, experience element. Based on D'Andrade's definitions (1995), this model, *experience*, represents a statement or set of statements that asserts a state of affairs, or abstract, language based representation, in this case, the concept concerns the definition of knowledge and what that knowledge gives the fisherman.

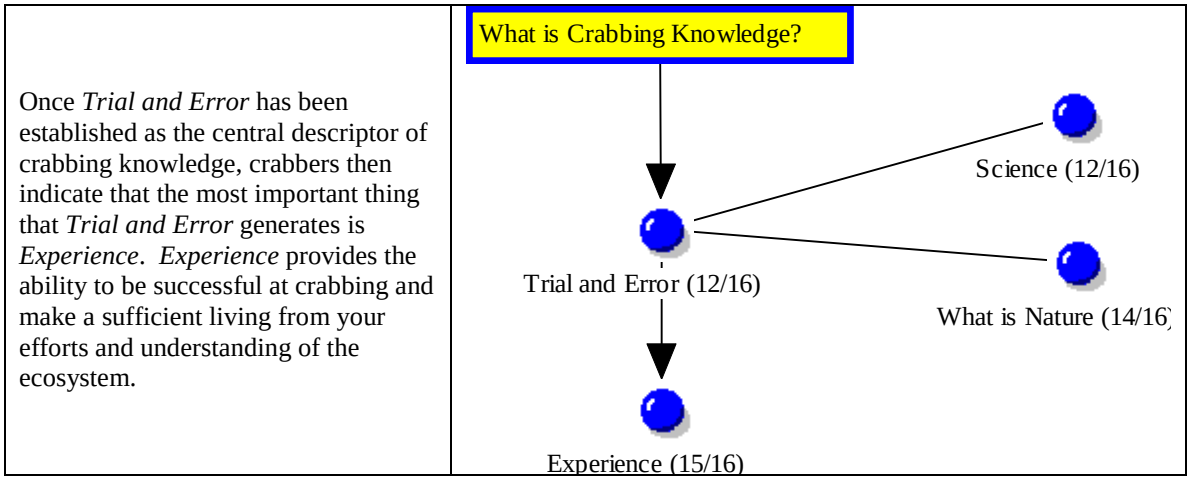


Figure 4.2: Trial and Error: Experience

Seeking to elaborate the components of this model, I asked the fishermen to explain how they actually accumulated such knowledge, and what it was that they acquired, in essence, what *experience* produced for them in terms of knowledge. It was clear to me from their descriptions that their knowledge was not learned from information

contained in books. Accordingly, the explanations this line of questioning elicited from all the interviewees incorporated some element of the "you just get out there and do it" experience based perspective, which emphasized their hands-on approach to knowledge accumulation.

The *experience* model indicates that the Georgia crabbers believe that without firsthand interaction and information from one's observations regarding the characteristics of their fishing environment and the crab resource, one will never learn anything. The concept of common sense may also be a by-product of cultural differentiation from "science" in that it has a practical component and basis to it. By trying things and seeing the results, the crabber gains knowledge, experience that narrows the choices for the next situation. This saves the crabber time, money, gear, and effort. Collecting experiential knowledge is the only true way to become an expert crabber, as there are no books on the subject, and no book knowledge will ever really help one learn to be a crabber. The following quotes demonstrate this concept, and represent typical examples of how the crabbers ordinarily describe their perceptions of how knowledge is traditionally accumulated.

> CRABBER M: Just by trial and error, being out there all the time, and you know, and by just exploring, just put a trap over there you know. Sometimes they be over on the left side of the sound, knee deep, there won't be none on the other side. … The only way you learn that, trial and error, you just got to hunt them.

Essentially, this fisherman is indicating that testing, experimenting, and putting in the hours on the water will bring knowledge in the form of *experience* over time. "Just put a trap over there you know…" shows that in his mind, simply throwing a trap over

the side and testing a spot is the best way to get knowledge. However, trap placement, regardless of experience level, requires evaluation of a wide assortment of ecological variables. These could include moon phase, tide stage, water current patterns in the area where the trap will be set, proximity to banks, guts, freshwater sources, bottom types, time of year, target crab type, and even considering trap production patterns from this spot, or similar spots in the past. Here again, *experience* is influenced by the larger model, *trial and error*, where experience gaining behaviors originate and gain motivational force, helping organize at an initial level the sub-categories of information that collectively impact the decision to "just put one over."

> CRABBER I: I tell you what, what usually happens is when like, I first started crabbing, no one told me nothing, I just had to learn on my own, and it took me many a year, to, keep knowledge up in [my] head, and the area you're fishing, you just have a hunch of what it is, just like a farmer, you know, um, he knows a certain time of month of the year when the soil chemistry is right, when to put down okra or corn or something, it's just knowledge, you know.

Explanations like this were typically offered in tandem with the *trial and error* response. Crabbing is a highly competitive, individualistic pursuit, and in Georgia it is mainly a first generation fishery; as a result, the contemporary experts are self taught. Most did not have the benefit of their fathers' teachings, or old-timer mentors; rather, they had "put in their time" out there, experimenting, learning, trying and evaluating new ideas and techniques on their own. As Crabber A states in the quote below, it takes years to accumulate the requisite knowledge and experience sufficient to sustain a crabber, and it is an extensive, complicated body of information. Several fishermen also offered analogies to farmers and farming knowledge like Crabber A does, indicating the

perception that nature is complex, subtle, and changing. Considering Crabber A's statement, it seems that the crabbers might also consider the knowledge gained from years of physical interaction with the environment as encyclopedic.

> CRABBER A: That'll come with it, if you're successful, it'll come with it. It'll grow upon you. And it will make you start remembering where crabs are at, you know, that's basically how most of us all have learned, is uh, like necessity is the mother of most inventions, you know.

This statement reinforces the concept that knowledge "grows" on the individual with experience. The longer you work at it, the more you will know, and the more you know, the more you remember where they were the previous year under similar conditions. If your knowledge and ideas do not produce a successful approach, then "necessity is the mother of invention," where you experiment and try something new. The innovation or technique then produces results, positive or negative, and knowledge is gained from the experience, to be referred to in the future in similar situations.

Trial and Error Sub-model: Nature

With experience, it seems a deeper, more complex appreciation for *Nature* grows within the receptive crabber, as *Nature* is the most significant force (potentially an adversary and/or a provider) the crabber faces on a daily basis. Figure 4.3 below provides a visual representation of this model and its frequency within the discourse. Knowing that *Nature* is unpredictable, mysterious, and something that humans will never be able to control or completely understand is a key element to being a successful crabber. This perspective seems to indicate that crabbers must be psychologically

prepared to cope with the constant variability of the environment in which he will work. Without the ability to view the ever changing characteristics of *Nature* as an intriguing, interesting challenge, it seems likely that a person could become frustrated and rapidly lose interest in the whole process of fishing and abandon it for a more predictable occupation.

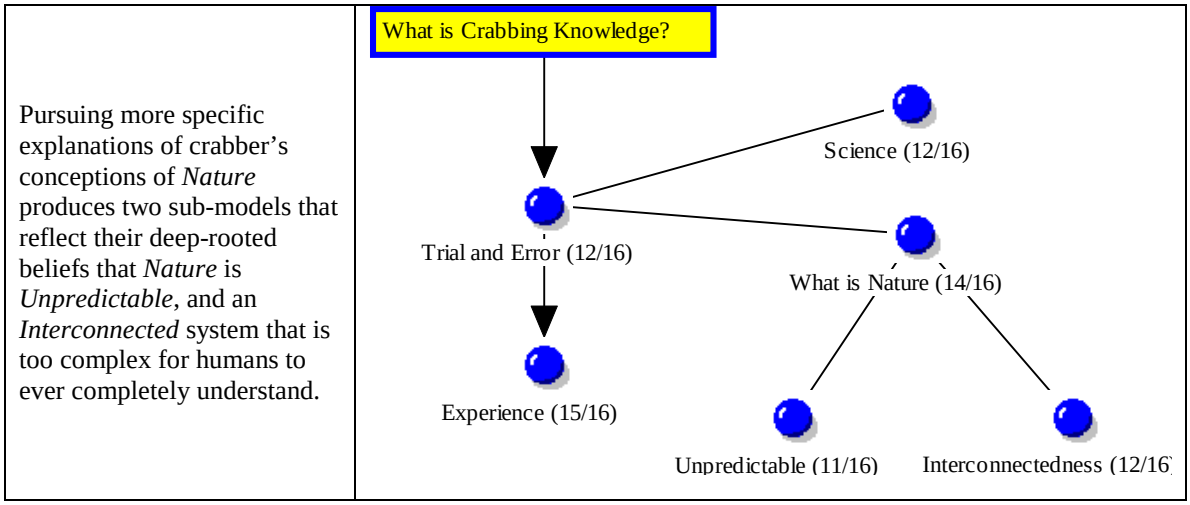


Figure 4.3: Nature: Unpredictable, Interconnected

Most experienced crabbers will freely admit that they continue to learn new things about crabbing every day spent on the water, and that *Nature* always throws "curveballs" and surprises at them. Some even admit that this variation is one of the most attractive components of crabbing, in that it provides a varying work experience, something that many of their peers who have business or industrial work do not have in their daily experience. From the interview transcript analysis, two models emerged that form the foundation for the crabber model of *Nature*. First, *Nature* tends to be described as mysterious, incredibly complex and wholly *unpredictable*. Second, *Nature* is an

interconnected (*interconnectedness*) set of systems that function collectively to affect crabs in one way or another. According to this model, if left alone by humans, *Nature* functions as a self-maintaining set of systems with an "ideal" balance or equilibrium point. This balance point is frequently referred to as the way things "used to be," before the crab population began to decline in abundance in recent years. This unpredictability and complexity puts *Nature* beyond human comprehension, adding support to the *trial and error* model. Accordingly, if one is unable to understand the environment completely, then all one's activities can be described as is just trying things to observe what the outcome may be.

Nature Sub-Model: Unpredictable

Nature is the biggest unknown and continually changing factor that crabbers must confront. This is the basis for their feeling that their knowledge of crabs and the environment is not a scientifically derived body of data that is testable and robust. The underlying model that seems to most influence the manner in which crabbers view and describe their knowledge is *unpredictability*; as the three crabbers below succinctly point out, a crabber, or any human being, regardless of education or profession, will never totally understand Nature, or be able to anticipate exactly what event or circumstance it will generate next. Please refer to Figure 4.3 above for the frequency and relationship of *unpredictability* to the larger model of *Nature* within the framework of crabbing knowledge.

> CRABBER C: You won't never figure it [Nature, the environment] out. Every year is different.

> CRABBER E: That's a strange game. And it's so variable I tell you what, I guess if I was 70 years old, I'll never really figure that out. It's a complicated ball game.
>
> CRABBER I: No, just recently because of the dry spell and um, the change of the weather pattern, you know, because of all these new types of weather they got, like El Nino, and La Nina, or whatever it is, they got names for everything, all I say its really excuses for certain things, they just end up calling it a name that make it really an excuse for what it is. What it is, you and me and scientists cannot predict Mother Nature. You can't predict it, you just don't know.

It is impossible to be a hunter, farmer, fisherman, or birdwatcher, for example, and ignore the inherent dynamism of *Nature*. Acknowledging the variability of natural processes shapes crabbing knowledge; one must always be flexible and ready to try something new when faced with a new combination of conditions in the estuary. Talk that invoked the *unpredictability* model in the interviews typically encompassed two main topics that are directly connected to the larger model of *experience*: environmental fluctuations and changes in crab behavior. These influence the general level model *trial and error* because understanding crab movements and environmental responses comes from experience. Reacting to crab responses and new, changing environmental conditions becomes the central process of *trial and error*. Paolisso's work (In press, 2002) substantiates this model as he describes how central the concept of weather and the randomness of nature affects beliefs of Chesapeake Bay watermen regarding the crab stock, and the impacts harvesting can have on it.

The *unpredictability* model manifests itself through several different concepts incorporated into crabber discussions of the environment, crab behavior, crab location and the approaches they use to locate crabs. Again feeding into the *trial and error* model, trap placement theories and approaches are frequently described in a manner that

indicates their belief that it is almost accidental at times, because *Nature* is always one step ahead of them, and they are always trying to figure out what she has in store for them next. So, in trying to adapt or anticipate environmental changes, attempting to "keep up" with fluctuations in crab abundance or location, trying a new trap design, implementing a fishing tactic learned from another fisherman, or using any other innovation can generate unexpected results, positive or negative, that may seem "accidental" indeed. As this fisherman describes,

> CRABBER C: A lot of that was accidental, finding it out, and a lot of it was knowing that they had to be somewhere, and you had to learn to be more aggressive and try and learn. It cost me to learn, some, lost some traps, bogged up, tore 'em up, but I learned when I could fish some areas and when I couldn't, but it was all trial and error.

Other crabbers describe *unpredictability* in terms of never knowing what is going to happen next, that Nature continually throws "curveballs" at them, and it is nearly impossible, in their belief, to be able to totally understand and predict the outcome of environmental patterns and events. Some crabbers may say you may be doing well and think you have it all thought out, then some unseen environmental change will make the crabs "leave." Suddenly the crabs are not as easily caught in the area where they were just recently abundant, perhaps even the previous day. The following passages emphasize this component of the *unpredictability* model.

> CRABBER C: Well you shoot your blanks too, you can get in areas, and it happens time after time after time after time, you can, uh, have say 20 traps in a line, the first four or five catch real good, the middle four or five won't catch nothing, and the last four or five will catch, you know, where the middle is dead.

(CRABBER C, continued) Same depth of water, but the middle of the line will be dead. It's unexplainable. And it changes, I'll bring in the line, and they catch good today, and the bottom line not do nothing, and it change back tomorrow. So they definitely moving, you know, this time of year, they just unpredictable.

CRABBER E: We keep, have actually kept notes you know almost in a diary like, you know, in once in a while, you'll get fooled and learn a new trick, ain't nothing wrong with that, you know, cause nature's a fickle creature.

CRABBER F: Yeah, I mean it's, Mother Nature, that's the whole key is Mother Nature, uh, rain and the pattern that they wanta go a lot of times, you just kinda you know you pretty much know about what he's supposed to do, but sometimes they will throw you a curve, you know, as to where you know when you got a long stretch of area, maybe you should catch him here, and maybe throw you a curve, you know where you caught him there for two springs, or five springs, it may be a little further up [this time, and you'll spend time and effort not catching crabs and wondering where they are].

CRABBER M: And one year won't be, it'll be completely different from the year before, you can't tell, you know, crabs is funny, you can't tell what they gonna do. I mean you might think you got him figured out, he'll fool you.

Each of the above statements highlights Nature's unpredictability as something a crabber must accept; it is reality. However, a less salient element of *unpredictability* is the fact that *unpredictability* creates a variable schedule of reinforcement (Kosslyn and Rosenberg, 2003) a lot like gambling. A crabber will never truly know exactly what is going to happen in a day on the water, how much or how little he will catch that day, or what interesting species he may find in his traps or see out on the water. This variability and element of surprise is a critical factor in keeping fishing challenging, interesting, and rewarding. It is also the reason why many crabbers remarked that they prefer it over corporate employment and other industrial, non-outdoor situations. The following quotes illustrate that this freedom, variability, and independence are very strong attractions to this way of life:

> CRABBER A: I like to roll the dice, I like to see what's going to come up in that next trap. And that's all it amounts to. It's like setting your hook in a fish, you can't wait 'til you get to see what it is. There ain't no fisherman that can deny that to be a fact. Hmm, ha ha ha.
>
> CRABBER A: The freedom, no clock punching. Um, I'm a loner, first of all, I never liked to work for anyone else, I don't want to work for nobody else, and won't work for nobody else. There, its uh, the freedom and doing what I want to do, being what I want to be, and I can, just like that commercial for the army, be the best I can be, and a crabber can be that if he really wants to.
>
> CRABBER N: Well I make a living out of it, you know, I make money you know, too, and like I say, I can be home, and I can go if I want to go, and if I don't want to go, I don't go. You know, flexible, lets me do what I want to do. I've never worked for anybody since I got out of school, one job, two jobs since I got out of school, and I just been, you know, self employed, and I just, basically, what I do, you know.

Nature Sub-Model: Interconnectedness

The second sub-model that completes the overall model of *Nature* is the model of "*interconnectedness.*" Like *unpredictability,* the relationship of this model to *Nature* and crabbing knowledge in general is contextualized in Figure 4. *Interconnectedness* is particularly interesting because it contains numerous conceptual parallels to scientific ecological research questions regarding estuaries and their ecological patterns and functions that are actively being researched at universities. The primary thematic component of this model is that of nature or the environment as the sum total of multiple different, but connected ecological systems. Not one crabber I spoke with viewed the estuary in which he harvested crabs as being a single, isolated unit immune to the effects of other ecological and anthropogenic activity and change elsewhere. They applied a regional, large scale perspective to their fishing area, noting that human activity hundreds of miles away, as well as that in the immediate vicinity had direct impacts on their fishing

area and thus on the crab population. The following quotes represent this thought process, illustrating differing, but similar perceptions of the *interconnectedness* of *Nature*, as pertaining to crabs and their habitat. First are three quotes that demonstrate conceptions of the large geographic and temporal scale with which crabbers envision ecological relationships involving coastal estuaries and their inhabitants.

> CRABBER C: And when you change the environment from 100 miles, 500 miles, 300 miles whatever it may be from the coast, it's got to be a fall down effect, its gotta be. It's all gravity fed, basically, I mean the water's gotta come from the mountains to the damn ocean. Got to. And when it does that, it comes too rapidly, it's not right.
>
> CRABBER A: It seems to be getting a little higher, as time goes on, I attribute that, you know, really a lot of that is just the population growth, nothing we can do about it. You know, there's more people up the river, they taking more water out of the ground, they take more surface water, you know, you know behind dams and lakes and stuff, and uh, just less coming down the river, and uh it's a cumulative effect of a great deal of many factors, and uh, with no one being the culprit. You know the problem's bigger than me and I know I can't do anything about it. Well, just hope the polar ice cap melts and puts plenty more freshwater in the ocean. Ha ha ha!
>
> CRABBER J: Well, I don't think the public realizes, or gives a damn, twenty years ago, twenty something years ago, when they done all that crap [ditching and draining upland wetlands and swamps], I don't think the public had any idea what the effect was gonna be twenty or thirty years down the road.

Although Crabber A's comment was somewhat in jest, together, these excerpts indicate that crabbers know that Georgia's coastal ecosystem is directly influenced by human activities affecting freshwater runoff not only in the immediate coastal zone, but also well inland, perhaps even globally. They also show that the crabbers understand the complexity of nature, that environmental phenomena are not just the product of

immediate cause and effect relationships, but also can be the indirect result of processes influenced by human activities in coastal and upland ecosystems.

Second, the following statements show that Georgia crabbers also believe that Nature's *interconnectedness* can be observed in terms of crab population growth and also overall ecosystem integrity and health, especially in relation to rainfall and estuarine salinity patterns.

> CRABBER A: Like I said, there is no one factor, but if you had to pick a major factor, that played a huge role in not just blue crab production, but fish, shrimp, and all of the above, it would be salinity, that plays a huge role in all of them. Uh, EPA says that 96 percent, or about 96 percent of the commercial species in the SE United States are saltmarsh and wetland, coastal wetland dependent. Well, we lost our coastal wetlands, so now we don't have anything but salt. Go right back down to that trickle down effect, from your blackwater wetlands, isolated cypress swamps, and what have you. …They may say " how in the hell is a wetland up on the hill habitat to a crab." Well, by god he needs that water from up there so he don't be in such salty water that it kills him when he molts.
>
> CRABBER F: Now it boils down to you know after you catch your wintertime crop, what you catch in winter from the middle of January to the middle of March, uh, you should be getting into springtime then, and there again for a normal year that's when you should start seeing some rain. You know you gotta have some, the salinity's gotta be right for the peelers to be right, you know it's all a chain reaction kinda thing.
>
> CRABBER J: You can play it back and forth any way you want to go, you know, you can say salinity, you can say temperature, I think its all of the above, but some of the parts that we don't understand and we don't know, and again have a big environmental effect on them, is what is if the herbicides …that's going in these woods and these freshwater, brackishwater creeks and running out here into your salt marsh, what is it doing to your juvenile stages early in the spring? We (CRABBER J, Continued) don't know. We know what we see on a normal year, but we don't know what, we can't see what we don't know.

These quotes illustrate that these fishermen have a large scale understanding of the influences that affect their estuarine ecosystems. They talk about interrelationships

between human activity up in Atlanta, as well as activities right in the immediate coastal vicinity. They invoke metaphors and descriptive models which describe how the cumulative effects of human activity even hundreds of miles away can still affect coastal ecosystems.

Perhaps most interesting, however, is the thread that unites the statements about the effects freshwater has on coastal estuarine systems and crabs, and how human and environmental changes affected these systems. The Georgia coast has experienced dramatic growth in timber plantations, commercial and residential real estate development, a severe, multi-year drought, and a dramatic decline in crab population as seen through diminished landings. All the crabbers interviewed were highly concerned that the decline in harvest levels would jeopardize their future as fishermen. Thus they appear to have spent much time thinking about the potential factors contributing to this phenomena. This thinking contributes to the larger model of nature as *interconnected*.

Trial and error is the uppermost model of knowledge, a metaphor-model of sorts that encompasses and enables access and activation of all the subcomponent models incorporated within the varied domains of knowledge relating to the pursuit of blue crabs. As the upper level model defining all things related to crabbing knowledge, the cultural model *trial and error* as a metaphor model can be dissected into its component lower level models (Casson 1983, Strauss 1992a, D'Andrade 1992). Considering *trial and error* in this way, it is plausible to claim that *trial and error* is rarely consciously considered as the process through which knowledge is gained by the crabbers. Crabbers merely define *trial and error* this way when questioned about it by an outsider. Most likely none of these models are consciously evaluated or referenced by individual

fishermen in their daily activities as discrete functional cognitive units, or even as concepts. Rather, they are more accurately described as conceptual domains activated and suppressed, enabling the crabber to navigate quickly through and access the critical information related to impending crab fishing decisions. As such, *trial and error* is the most generalized descriptive model that enables the crabbers to reflect etically on the nature and characteristics of their knowledge. However, with further questioning and self-reflection regarding the domains of knowledge, the discourse rapidly becomes more specific, revealing more discrete concepts that more directly influence behavior shaping models.

Cultural Model: Essential Knowledge

Trial and error and its component models of acquiring and applying knowledge indicate that at some level crabbers utilize these models to serve as conceptual structures that define their identity as fishermen. These models enable the crabbers to describe and legitimize their knowledge within the larger Western, United States cultural system (which tends to uphold science and education over experience based knowledge). There is much more to their knowledge, though, than just *trial and error,* or basic understandings that Nature is simply *unpredictable,* impossible for humans to understand, or just a big confusing set of ecological systems that are *interrelated* in one way or another. The interview transcript analysis reveals that at many levels, the knowledge of the Georgia crabbers is highly specific, detailed, empirical, predictive, and enables them to assess the characteristics of the estuarine environment at any time of year and be able to predict relatively accurately where the crabs will most likely be found in their fishing

territory. This is not to say that they can proceed to catch crabs with the first trap they throw overboard (although some fishermen would like you to believe that); instead, their knowledge gives them the reference point from which they employ a number of experimental mechanisms to pinpoint the location of the most productive bottom. These mechanisms are based on key domains of knowledge that are central to crabbing, categories that can be seen as *Essential Knowledge.* Please refer to Figure 4.4 below for a visual depiction of this model and related sub-models, and their associated discourse frequencies.

According to the crabbers, *trial and error* produces *experience* based knowledge.

This *experience* can be seen as enabling the fisherman to understand and apply certain "essential knowledge" domains.

Based on the frequency and content of the relevant discourse, two significant types of *essential knowledge* were identified as important models: *being strategic* (fishing behavior shaped by a future orientation) and *ecological knowledge* (knowing crabs, habitat, behavior, and other related environmental elements).

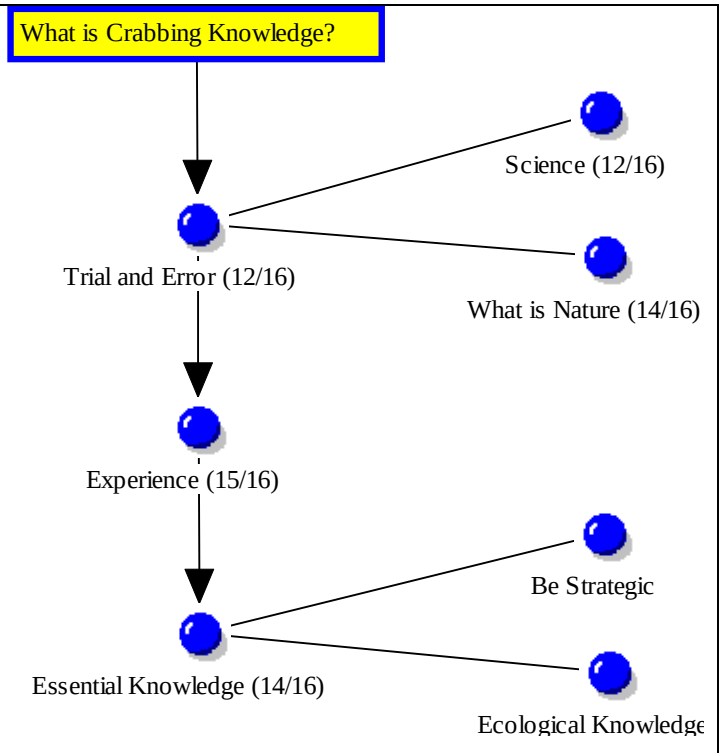


Figure 4.4: Trial and Error: Experience, Essential Knowledge

Thinking of models as simplifiers and organizers (Blount 2002) functions perfectly here; they structure knowledge for ease of access and retrieval, compressing and suppressing some areas while instantiating others, enabling quick and efficient access, retrieval, and analysis of stored information. There are so many domains that need to be assessed and examined in crabbing, such a structure is essential. The model of seasons is itself worthy of examination and identification of sub-structures. Crabbers appear to agree on the general characteristics of individual seasons, crab habits, and the effects of water temperature and salinity changes on the crabs in terms of their location and abundance at different times of the year.

During the course of the actual interviews I posed questions regarding the life cycle of the crab first, and followed with more general questions regarding what one needs to know to be a successful crabber. The life cycle section of the interview data presented here is derived from one large "long question probe" (Bernard 1995): "What do you need to know in order to be a successful crabber?" Several patterns emerged from the discourse to form models and their related supporting models, while other response topics appeared to be highly scattered and variable. In general, the most important domains that the crabbers discussed in relation to this question, directly or indirectly, were issues relating to crab biology specific to life cycle knowledge, and the economic aspect of knowledge relating to resource conservation and self-preservation.

In Georgia, and most likely anywhere else blue crabs are harvested commercially, successful crabbers need to understand how to locate crabs at any time of the year, under any environmental circumstances. This is probably the most fundamental concept for crabbers. In addition to being able to find crabs, a crabber must also be able to harvest

them efficiently in sufficient quantities to satisfy his economic needs while simultaneously being careful not to deplete the crab population in his fishing area. Obviously, this is easy to say but difficult to do. To understand how Georgia crabbers structure their knowledge of the crab's location and availability throughout the year, the interviews investigated where crabbers believe crabs are located in each of the four annual seasons and why they feel the crabs seek those specific conditions at each time of the year.

The pattern that emerged from the responses indicates that the Georgia crabbers apparently share a collective winter, spring, summer, and fall model of crab location and activity. Supporting this, the crabbers all offered highly similar explanations of crab location, habitat preference, environmental conditions as well as comparable responses in relation to water temperatures and salinities that explained differences in crab feeding activity, movements throughout the fishing area, and life cycle stages. However, once the interviews progressed beyond descriptions of general seasonal characteristics of crab location and habitat preference, specific explanations of mechanisms of causality displayed substantial variation. This is probably due to the potentially wide variation in the ecological characteristics of each crabber's fishing area, as well as their own unique individual life experiences with the environment. At the general level, the patterns of seasons, water temperature and salinity do seem to possess the sharedness and uniformity worthy of being defined as cultural models, and will be discussed in detail in the following sections of this chapter.

Essential Knowledge Sub-Model: Life Cycle

Many crabbers would agree that one needs to know the *life cycle* of the crab in order to be able to catch crabs. See Figure 4.5 below for a representation of this model and its related frequencies. Biologically, the life cycle is the physical progression the organism passes through as it moves from an egg to a mature adult. To the crabbers, the life cycle is more than this; the life stages are cognitively connected with characteristic seasons, salinity, depth, water temperature, rain, tide, moon phase, and bottom conditions. These are the key environmental factors a crabber needs to learn in order to understand the crab itself, and consequently, to become successful at crabbing. For example, Crabber A summarizes this point very succinctly:

> CRABBER A: You know what the crab's gonna do in the environmental circumstances, like when the rains come, or when it gets dry, or when do I need to be in the head of the creeks, when do I need to go to the creeks, when do I need the sound, how much longer should I stay in the sound, even though there's not much crabs here, you know. That factors into becoming successful.

It is essential for a crabber to be able to observe and understand the reactions of crabs at different times of the year, and their associated weather and environmental patterns. The interviews revealed very strong sharedness in the perceptions of the general environmental and climatic patterns of each season of the year and its effects on the blue crab's life cycle stages and behaviors. During these discussions, a model emerged relating salinity patterns to crab location, connecting an understanding of crab location with crab behavioral responses to ecological stimuli that will be discussed in the next section, crab location, "*Hunting that balance*."

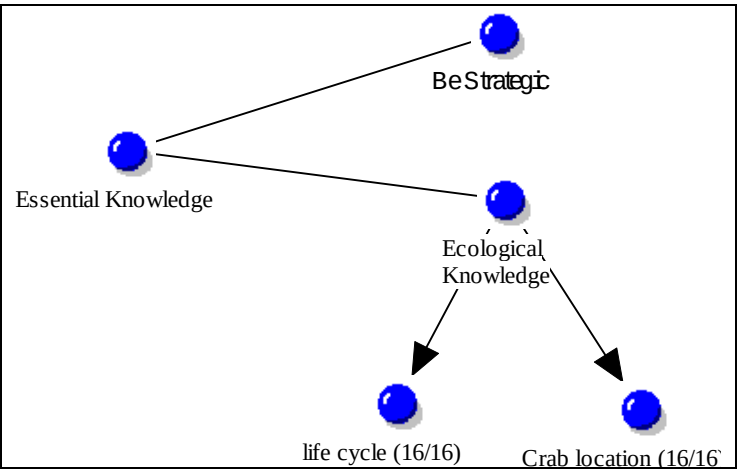
Focusing specifically on *Essential Ecological Knowledge* revealed that crabbers feel that one had to understand the *life cycle* of the crab so one could predict, roughly, where crabs might typically be found at any time of the year.	

Figure 4.5: Essential Knowledge: Life Cycle

This section will summarize the *life cycle* model crabbers share that helps them cognitively organize the basic components of weather, water conditions, habitat characteristics, life cycle stages, and habitat preferences of the crab over the course of the four annual seasons. This model seems to represent a hybridization of a temporal or script schema (Shore 1996), relating the passage of time and the specific characteristics related to each time period in relation to crabbing behavior. Simultaneously, it helps the fisherman choose what fishing actions need to be implemented based on the time of year.

During the winter season, crabbers generally indicate that the crabs are found in the deeper sections of their fishing areas, typically in the sounds, the deep channels near and in the sounds, or out as close to the beaches in deep water as the crabbers care to take their traps and boats. The crabbers feel that the decline in water temperatures in the mid to late fall is the signal that initiates the crabs' migration towards deeper water where they will bury in the sediments and lie dormant until the water warms in the spring.

During the winter, crabs will be fairly sluggish, neither eating or moving much. Crabbers tend to agree, however, that careful observation of tide and weather patterns can enable a crabber to anticipate and set traps to capitalize on the brief increase in feeding activity. Bright, sunshiny days in wintertime, especially a series of them with calm weather, will coax the crabs out of their muddy burrows and bring them up onto the muddy flats and entice them to feed actively. This is the only time in winter when crabs will increase their activity, and when the crabber should really try to catch as much as possible. At this time, market price is up because supply is low; therefore, this is when you should make your move to maximize income and save the extra both as insurance against future capital expenses, but also to help get through the winter, the season crabbers view as the leanest time of the year.

Crabs come out of their burrows in the spring when the water begins to warm up. This is also the time when juvenile crabs released by the sponge crabs in late winter or early spring begin to come into the estuary and mature. The young females molt and become peeler crabs, a critical time in the life cycle. Crabbers know that this is when the males fertilize the females and attract the females by means of a pheromone that broadcasts readiness to mate. The fishermen capitalize on this, knowing that peelers, females about ready to shed and get soft, are the most valuable crab product they can harvest; they attract peelers to traps baited not with fish, but with a prime male crab. A growing number of fishermen build saltwater holding systems that enable them to keep these females until they shed. Once the females have shed their old shells, they become softshell crabs, which the crabbers then sell to Northern markets at more than 100% profit. The crabbers know that spring is also the time when females who have not yet

mated move up from the deep channel areas and the beaches towards the creeks and guts where the males are waiting to mate with them. They describe that even the male crabs settled in deep areas for winter at this time are emerging from the mud and moving up the estuary towards sources of freshwater and food in the upper estuary for the summer months.

Most crabs are in the warm, shallow, productive areas of the estuarine systems of coastal Georgia during the summer months. As one crabber indicated, "…they're knee deep to a ten foot Indian…" and "…any jack___ can catch crabs in summer." Crabs are typically found as far up the creeks as the crabber can navigate his boat. According to the interviewees, crabs are especially abundant in areas where freshwater input into the estuary is consistent and available in just the right amount, not too much, and not too little. Crabs tend to congregate around freshwater guts and channels coming out of swamps and headwater areas. Males tend to be further up the estuary than females, which still prefer slightly saltier water and bigger water areas of the estuary. The difficulty for crabbers at this time of the year is culling out the low quality, young crabs that have little or no meat inside their shells, because they shed so recently they are too light and thus considered poor quality on the live crab market.

Finally, the crabbers describe the fall season as a time when the crabs separate out once again; the fertilized, mature females head to the deep beach areas, and the males settle in the deep areas of the rivers and sounds, seeking the warmest, most protected area they can find for them to ride out the winter. Males, still preferring fresher water, are described as not falling out as far as the females. Females are thought to prefer salty water, and go as far as the beaches to bury themselves for winter; they prefer to be close

to the ocean so that they will be in an optimal area to drop their eggs when they are ready. The crabbers feel that water temperature drops due to shorter day lengths and cooler winds cooling the water of the fall are the main factor behind the migration. Crabbers must bring their traps out of the creeks and follow the crabs as if they were walking down the sound on "steppingstones," always putting a few traps from the back of their line to the front, keeping ahead of the seasonal migration toward the beaches. This allows them to maintain their catch as crabs move out, and slow their feeding activity and shift into their winter mode of near hibernation.

Many other interesting topics in the discussions related specific aspects of the crab's *life cycle* to ecological phenomena. However, they tend to be somewhat variable, and do not seem to represent cohesive models. For example, crabs sometimes disappear for a day or two and show up again in the same traps almost instantaneously. The accepted theory among crabbers explaining this is that crabs bury in the mud to hide from some ecological change that is undesirable to them. However, the crabbers interpretations of such crab behavior vary greatly; they include a brief increase in fresh or salt water passing through the area, a storm front passing through, brief but dramatic air temperature changes (over a day or two), and other similar events. Other statements relate crab behavior to human analogs, almost anthropomorphizing the crab to explain the nature of its activities. Other highly variable discussions related moon phase to stages of maturity, shedding, maturation of the eggs on sponge crabs, and mating cycles.

Essential Knowledge Sub-Model: Crab location (Hunting that balance)

Discourse during the winter-spring-summer-fall discussions clarified the idea that although the Georgia crabbers share a schematic model relating seasons and life cycle stages to trends in crab location and activity, they attribute special emphasis to the effects of salinity levels on crabs. Please refer to Figure 4.6 below for a representation of the model relating to *crab location*, which reflects the concept that crabbers believe it is essential to understand where crabs will be in the estuary, since crabs are forever "hunting that balance" of ideal environmental conditions. Transcript analysis clearly shows that the crabbers place equal value on understanding salinity and its effects on crab location and movement as they do knowing what season it is, and how basic life cycle stages will also affect the crab and its location. In the *life cycle* model, it is clear that a widely shared model of the passage and characteristics of the seasons exists in relation to conceptualizations of the crab life cycle and its movements within the fishing area.

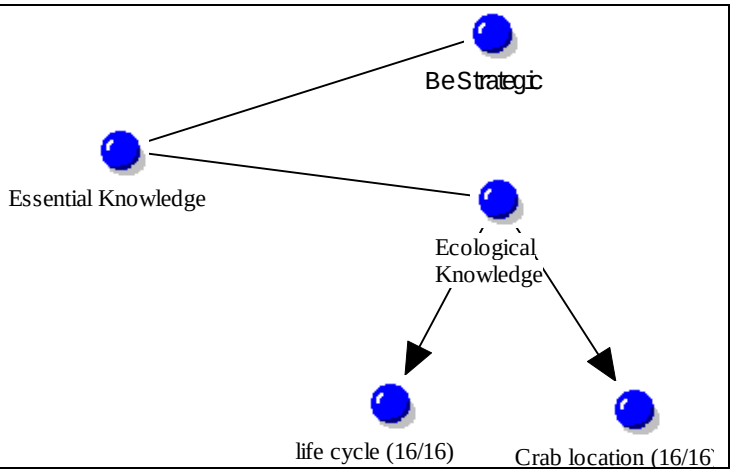
Focusing specifically on *Essential Ecological Knowledge*, revealed that they felt one had to understand the complex relationships present between specific environmental factors that influence *crab location*, especially regarding habitat preference, and behavior.	

Figure 4.6: Essential Knowledge: Crab Location

The major model that emerges from the transcribed discussions regarding crab life cycle and biology is the highly shared perception that in regard to salinity and temperature, *crab location* will frequently change, as crabs are always "hunting that balance." According to the crabbers interviewed, crabs move continuously year-round, seeking the ideal salinity balance, generally avoiding both the highest and lowest salinities. Concerning water temperature, crabs tend to behave in a more seasonal manner, avoiding the extremes, and migrating up or down the estuary in response to basic seasonal increases or decreases in water temperature. Overall, the crabbers note these changes in salinity and water temperature through physical observations that enable analysis of patterns of crab location, activity, and movement. Consequently, fishermen develop a high level of awareness of the characteristics of these two factors; they have many ways that enable them to observe events and both interpret current patterns of crab activity as well as anticipate where the crabs will be found (generally speaking) tomorrow or next week. The following quote is probably the most concise summary of this perspective from the interviews:

> CRABBER E: [Salinity] affects them in a lot of different ways. Depends on you know, In the springtime, or in the fall, or you know, the winter, in summer, you know, summer the water temperatures are pretty steady. Uh, summer, I guess your key in summer is salinity. Salinity will tell you more than anything. You know, in the fall of the year its uh, water temperature. In the wintertime it's salinity and water temperature. You know, in the spring of the year it's salinity and water temperature. And you know, when you combine those factors and you know you know what you're looking for and this that, and the other, you can determine, pretty well, with experience, where to go. Where to be.

This crabber's comment demonstrates that salinity continues to be a valid ecological variable affecting crab distribution throughout the seasons of the year, while water

temperature influences crab distribution only during the seasons where it changes (spring, fall). Below are several other excerpts from different interviewees that illustrate how they view salinity as a defining factor that is critical to the characteristics of the habitat where crabs will become established at different times of the year. Interestingly, they also reveal that perceptions of the unpredictability of nature manifested through patterns such as precipitation and freshwater outflows from local river systems are directly connected to the relative salinity of the area in which they crab, showing how this specific model of habitat characteristics is connected upwards to more general, conceptual models of the overall coastal ecosystem. Consider this statement:

> CRABBER D: A steady trickle [from the swamps is needed] to make the water the right salinity for a crab. Whatever the right salinity is. Must be about 18 [parts per thousand], I don't know what it is.

Here, the crabber is explaining that in Georgia, the outflow of freshwater from the swamps is critical to optimizing the salinity of crab habitat; this is a recurring theme in the interviews, that is woven into a variety of different models. For the purposes of the *Crab location* model, freshwater discharge from the swamps is repeatedly cited as an essential component to crab habitat, because it buffers the system with freshwater, keeping salinities at the right brackish level. However, expanding this line of reasoning to larger matters like shifts in geographic patterns of crab distribution, or the crab population decline, nearly all the crabbers expand their focus and indicate their belief that the threats the swamps have endured reduced their capacity to provide this ecological service. This will be discussed later in the section devoted to the model of *Environmental Change*. The following two quotes are included to give emphasis to the theme that

salinity is a critical factor influencing the distribution of crabs throughout the crabbers' fishing area, and that they understand distinctly the effect that freshwater has on the relative salinity of the system, whether it is from rainfall or outflow from inland wetlands.

> CRABBER A: The salinity can influence it all. Salinity influences the whole ballgame out there. If you got a lot of rainfall, they'll stay in the bottom of the sounds, or nearer the beaches or on the beach. Or on the beach. Or in the very deeper water too. The very deeper water, down on the far end of the sounds, you know, but it gets salty, they come in, and they'll come quick.
>
> CRABBER L: Not really, its where I've been at, like in the Darien river, I'm used to freshwater. Really I'm used to, always, this is the first year I haven't seen, but usually my upper traps are catching freshwater catfish. Always. And when I'm catching freshwater cats in the upper end I'm catching good crabs, good, big, pretty males. Right where your catfish stop at, right where they started is where I kinda stop crabbing. You'll catch 'em, you get a little rise, they come down, and your crabs will kinda fall off a little bit, but you'll have better crabs lower down there. But them, your bigger, prettier males, and I'm used to crabbing in freshwater, really, you know, its like, oh, here comes the river, back up, you know, and now its like I can't get far enough up the river, and I got them boys up above me, and I ain't going up on them, and it'll be just like I said, we'd have the river so loaded up you won't catch nothing anyhow.

Salinity is scientifically known to be a critical ecological factor for the blue crab (Williams 1984, Orbach et al. 1997, Frizzelle 1993). Female and male blue crabs have dramatically different life cycle habitat requirements, all related directly or indirectly to salinity patterns observable by the crabbers. In Georgia, females prefer larger rivers and the sounds, only coming up into the creeks to shed and mate, returning quickly to the deeper waters as soon as they can. Under normal circumstances, mature, fertilized females migrate to the mouth of the estuary where they release their eggs to float out to sea for their initial planktonic life cycle stage. As a result, females tend to gravitate towards higher salinity waters. In Georgia, these tend to be the deeper waters closer to

the Atlantic Ocean which are influenced by the tidal influx of saltwater. The inland inland marsh areas, however, are typically brackish because they receive freshwater runoff from the coastal land and swamps. These low salinity areas are the preferred habitat for males nearly year round.

Crabbers know that females prefer saltier water because they have observed the annual migration of egg bearing crabs (sponge crabs) towards the ocean. From this, they are able to evaluate changes in salinity, make comparisons between seasons, and theorize how these changes may be affecting the crab population. Crabbers know that male crabs, in contrast, tend to prefer brackish water, and consequently associate with runoff from swamps or creeks draining the inland areas. As a result, they are typically found farther up the estuary than females on average, all year long. For example, here are some typical views on what sponge crabs represent in terms of the salinity of the estuary where they are found:

> CRABBER A: Well, we never used to see sponge crabs all the way up to I -95 in the big river but they were up there last year, …I-95 I believe is river mile 18 or 19, and that's probably about 8 or 10 miles further up than normal.
>
> CRABBER B: You into the uh starting into the winter equinox, I guess, so you would uh you really seeing now all the female crabs are moving into your bigger bodies of water getting ready to make their seaward or salinity migration, we'll say seaward, but we're actually looking for salinity gradient.
>
> CRABBER D: But, like I say, the females they'll sponge up this time of year we're well on the end of it, I seen years where the sponges come in and be a bunch of ‘em, and they'll disappear like they went out to sea to lay their eggs. That's when we had you know more freshwater than we have now. With this extreme drought, they just pretty much came in and stayed in. Dropping their eggs in the upper mouths of the rivers and the edge of the sound, where normally they lay them out on the beaches. ‘Cause of the drought.

Perturbations in salinity have dramatic effects on crabs, especially male crabs. A few days of heavy rain will "flush" the crabs down towards the ocean, as they follow that salinity balance downriver. As the freshwater influx dissipates, they will then move back upriver again, all the while remaining in the salinity zone they prefer. Sometimes the crabs will mix up, that is, males and females will occupy the same area and salinity, especially during heavy rainfall events or big tides, but as conditions settle out, so will the crabs. The following quotes show that crabbers know male crabs prefer lower salinities to females, and their location indicates the presence of lower salinities, but also their movement to other areas downriver (or upriver) is indicative of salinity changes in progress.

> CRABBER D: Well where you normally catch crabs on a wet rainy season you catch good crabs now you don't. They just not there, they don't have the balance of fresh and salt water for the male crabs, that's what I'm talking about, catching male crabs back in these creeks, and stuff, one of the creeks that are closer to the saltier water just don't have the crabs in them like they used to when we had a lot of rain And uh, the males, they need as much freshwater as they can get, I mean, not too much freshwater, but I mean, they prefer a lot fresher water than the females.
>
> CRABBER N: Well like I say, in the summertime, the males stay up in the rivers. …Like if you got a dry summer like we've had the last two years, your sounds go completely dead [as far as catching male crabs is concerned]. I mean completely dead. You won't catch, you couldn't, you could put a hundred traps out there and you wouldn't catch enough to cover the bottom of a box.
>
> CRABBER I: Crabs are always down [river] lower, cause there's more crabs but uh, a lot of it is due to in my area, where I'm at, we depend on the Altamaha a lot, for brackish water to have male crabs come down, but the water's been so salty all the way up to, I know I talked to a few of the other crabbers that crab right up around ____ and stuff, they say they're catching females all the way up [there], and that's very unusual.
>
> CRABBER M: Specially on this end, you know, all the way up to the Geechee, the Geechee back down to you know, wherever the freshwater river run in there

(CRABBER M, Continued): at. Them boys caught some crabs up in that river, them big males go. And why do you think they go up in there? They go up there after freshwater. Only reason they go, is they can't find none out here. And I think every crab just about to shed, if he don't die before he can find it, hunt it, it goes that way, goes that way and that way.

CRABBER D: Well it seems to be like I say, the balance that where the males and females pretty much come together, more, it seems more like a line, an invisible line in the river, above it you gonna catch 90% males, below it you gonna catch 90% females. And because we've had this drought for the past couple years, that line has moved further up the river, so therefore these crabs are jammed up in a smaller and smaller area, so their environment has decreased.

CRABBER H: No uhuh, well, it will if you get the spot, if you hit the spots, where the salinity is what it supposed to be what 19 [ppt], well, I don't know, I don't even know what the, uh, but you'll find that the size and grade of crabs is the same thing, where you don't have the size and grade is where the salinity count is way up, like in the sound and big water. That's where you have the smaller crabs, the immature crabs and stuff, but you'll find out that they will, when, if they get 5,6,7 days of rain, straight rain, that the grade of crabs, the size of the crab will (CRABBER H, Continued) grow, grow, grow, and after about 5 or 6 days they'll be back up to normal like they're supposed to be. It's just the drop in that salinity, or whatever it is.

Not only can crabbers note the movement of high and low salinities up or down the estuary and estimate the areas of optimal salinity conditions by following the males and females with their traps up or downriver, but they can also evaluate the relative degree of salinity by other ecological indicators they observe in their traps as well. Additionally, some even use visual cues like the color of the water and types of growth that accumulates on the traps. The following quotes demonstrate the similarity among different crabbers in the signs of high salinity interpreted by the appearance of high salinity species other than crabs either in the traps, or just observed in the region, or being caught by other fishermen, commercial or recreational.

CRABBER C: I don't know, you see, a lot of like you say, no catch creatures. They get indications that you not going to catch. Like the angelfish, the toadfish, spider crabs, what we call beach crabs- little purple looking crabs. They real high salinity creatures, real high salinity. When you see those signs, those things in your traps, the blue crabs, move up, go somewhere different. What causes them to do it, there again, its salinity.

CRABBER A: Kinda, ha ha! And, we've got amphipods up there in the river, we never used to see those things in the river. Well, angelfish going up the river, one, (catch them in your traps) yeah, hermit crabs going up river, and like I said the amphipods, they're a good indicator, uh, last year and the year before, the Atlantic paper mussels showed up upriver, that's a clear indicator.

CRABBER D: Well, they wanting freshwater, right now the water's real salty, and uh, they catching stingrays at the marina …Yeah, they catching stingrays and whiting, …last year I saw jellyfish and sea turtles above Highway 17.

CRABBER D: Catfish, depends on the area you're in, and the amount of rainfall. If you all of a sudden get a lot of rainfall, you'll start catching freshwater catfish, and occasionally during the summer you catch a saltwater catfish, occasionally, (CRABBER D, Continued) but not very often. Usually in the spring we see a good many whiting, and then a little later on you start seeing flounder.

CRABBER I: Yeah, very unusual, I mean, that's because we've had such a dry year, the water's so salty, I mean, you're catching croakers, flounders, and spottail bass off Two-Way dock, stuff like that, that's unusual, you know.

CRABBER J: Now, other than that, my answer would have to be no, that pretty much, that everything that I see pretty much used to live in the same place, but now it don't. Your hermit crabs is coming in further inland, your angelfish, which is a very salty, high salinity animal, they're way inland from what they were.

CRABBER L: I bet they ain't no, I bet on low water there might be some fresh water, but I'm catching toadfish all the way up, you know, and them little angelfish, you don't catch them most of the time unless you're close to the ocean, they all the way up in Darien right now. You can catch different stuff, when the tide runs in and gets high, stuff comes in, and when it gets low and fresh it leaves.

CRABBER H: The whiting, had never, we still catch just as many whiting now as we ever did. That's the only one that, the only one fish other than catfish in our traps that we don't. As long as you are catching crabs you never catch catfish. Start catching catfish, you might as well move out, the crabs will go when the catfish show up, I've always found that the crabs move pretty quick. It's getting too salty for the crab, when the (saltwater) catfish usually show up. When the whiting, don't matter with him, I assume he don't matter about the salinity in the water, he just stays there like a catfish.

It is interesting to point out that in these passages, nearly all the crabbers cite the same species in the same manner. Clearly they view the presence of these species in the traps or in the surrounding area as a sign indicating that high salinity water is present in the fishing area, and through experience, they have all learned that catching these organisms is directly correlated to not catching any crabs. They believe this water is too salty for crabs to be present in commercially viable quantities. Also, some offered statements that reflect a perceived long term environmental change in salinity that is partly manifested in species loss or population shifts in abundance in their fishing area, claiming that certain species that were once abundant are now scarce or completely absent from the estuarine environment. For example,

> CRABBER A: We'd see those rockfish back in them creeks and rivers like they used to be, they used to be rockfish down here just like any other place. …Black drum, croaker, flounder, mullet, saltwater catfish, spot, hogchokers, you name it, …Not disappeared, completely, but have, they've done lost their way drastically. Menhaden, they're not even here anymore like they used to be. We used to major menhaden fishery down here. There was three pogie plants within a hundred miles of here. I've seen all, everything but a spottail bass in one, but I've seen croaker, flounder, spot, angelfish, mullet, lots of flounders, go in a crab trap, specially saltwater catfish, lots of them, freshwater catfish, there's a decline in freshwater catfish too, major decline.

Another fisherman benchmarks the change by the type and density of growth on his traps. Trap cleaning is essential; according to the crabbers, crabs are reluctant to enter a trap that is covered with too much growth. Conversely, they will not trap well in a brand new trap either, the common theory being that the new vinyl coating exudes noxious odors that repel crabs. So crabbers are concerned with the growth that fouls their traps, and most keep them relatively clean to maximize trap productivity, but also to

prevent too much growth from accumulating. Too much fouling contaminates the catch if it drops off the trap and gets into the boxes of crabs, where it will rot, smell, and contribute to dead loss. This fisherman describes his perception of how trap fouling organisms in his fishing area have changed in recent years:

> CRABBER N: Yeah less crabs, you know, and uh, I guess cause the water, like I say was so salty and, I tell you something else, there's less growth on your traps this year than I ever seen. I guess cause the freshwater causes that growth to grow, and I guess it's been so salty, but there's hardly any growth on my traps. Usually you leave a trap out there a month and a half, you gotta carry it back and put it on the dock. This year I got some traps that's been in there probably six months, and every now and then I take a wire brush and get the throats of 'em, and they just about as clean as a new one you can put out.

Overall, these comments also suggest that the crabbers believe that an unusual environmental condition is the reason why these species are present; for example, crabbers will say things like they have had such a dry year, they have never seen them up the river this far before. Many crabbers believe that if they observe an unusually high level of salinity farther upriver than would be expected under normal conditions, the causes for this salinity change were largely attributed to as drought or anthropogenic changes that were reducing freshwater discharge from upland areas and swamps into the estuaries. This will be discussed in the final section of this chapter in the cultural model *Environmental Change*.

Essential Knowledge Sub-model: Be Strategic

All of the crabbers I interviewed were lifetime career crabbers, individuals who had dedicated their efforts to crabbing as their sole source of employment and income.

These lifetime fishermen with decades of experience had succeeded in learning the essential elements of the blue crab and its habitat. They also had developed work patterns that enabled them to support themselves and their families (if, of course, the forces of Nature cooperated), and return each season with enough resources to support another year of fishing. During the discussions of crabbing knowledge, they offered statements that indicated a future orientation, while simultaneously qualifying their statements with acknowledgements of the *unpredictability* of nature. Please see Figure 4.7 below for a graphical representation of the relationships of these sub-models and their frequencies to the larger concept of crabbing knowledge. Obviously, these skillful crabbers were fully aware of the fickle nature of dedicating a career to harvesting a wild resource.

Being Strategic is an absolutely essential component of being a successful crabber.

This model reflects the philosophy of these interviewees that the crabber should be able to plan ahead and build up reserves, economic or otherwise, to survive the peaks and valleys of the fishery's cycles.

Being strategic embodies an understanding of *nature* as a fluctuating entity; the ability to save money and plan for market fluctuations enables the crabber to maximize economic returns and also ensure his ability to remain in the fishery in both good and bad years.

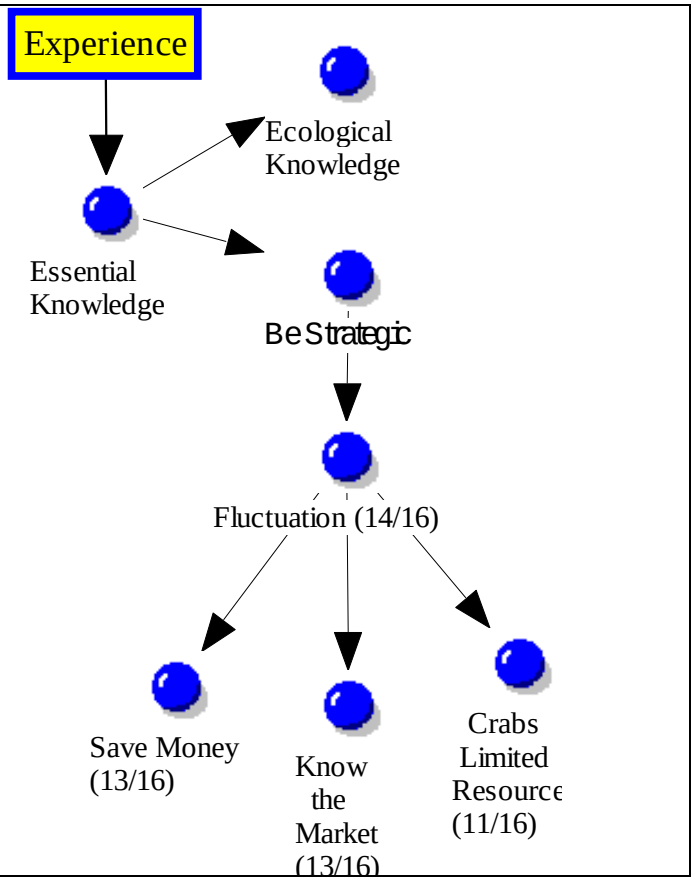


Figure 4.7: Essential Knowledge: Be Strategic

A theme emerges from this discussion regarding the essential knowledge one must have to be successful enough in the pursuit of crabs to be able to perpetuate your ability to stay in the fishery, year after year. This model is that of *being strategic*, or simply, being knowledgeable enough to plan ahead for the long and short term future. This model is a representation of a particular mindset in which crabbers frequently offer statements stating that one just has to be ready, having planned ahead for contingencies. But it is also a script because it structures certain behaviors that are appropriate when directly connected to abstract and current, real circumstances (See Shore 1996 for proposition/script definitions). The following paragraphs will demonstrate why.

Crabbing involves far more elements than just throwing traps out, catching what you can, and selling them to anyone who will buy them. As described in the *Essential Knowledge* model, crabbers are continually assessing environmental factors to determine where the crabs will be most abundant next. Since crabs peak in abundance just before the two periods of spring tides each month, many crabbers will look ahead to see when the tides will peak, and make sure they have the best available market options during that time to maximize their earnings.

Just like every other American, they have bills to pay and expenses to anticipate. Every two to three years, they are likely to find themselves needing a new outboard motor, which currently can cost as much as $12,000. For example, to buy an $8,000 motor outright, a crabber would have to have set aside $333 every month for 24 months. Obviously, loans, are commonly used, but large amounts of money are involved in the "invisible" expenses related to purchasing and maintaining one's fishing equipment. The day to day expenses are high as well; each crabbing trip can cost up to $100 in bait and gas alone (personal observations, but see also McIntosh 1996, Murray 1996). Crabbers have typical American expenses like mortgages, grocery bills, utilities, or car loans. The traps are not cheap either; on average, each costs a minimum of 25 dollars, and takes at least an hour of labor to build from scratch. However, crabbers do not receive a steady paycheck that they can count on like those working salaried or wage jobs; their pay is directly tied to their ability to find the crabs and sell them for the best price possible. Consequently, it seems that at least experienced, full time successful crabbers tend to have a long term perspective and regard crabbing as a business, contrary to some

stereotypes that depict fishermen as impulsive individuals who would rather party on payday than save their earnings in the bank.

Be Strategic Sub-Model: Seasonal/Environmental Fluctuations

The central model underlying *Being strategic* is *fluctuation*. Please refer to Figure 4.7 above for a visual representation of this model and its associated frequency in the discourse. All crabbers know that the abundance of crabs fluctuates, often dramatically, in response to a number of environmental factors. Some are fairly predictable, some are not. As a result, many crabbers offer explanations that reveal how they can anticipate periods of abundance and scarcity by understanding the environment; they know the only way to survive as a crabber is to make the most of productive times so you can eke out the lean times.

Many of these explanations reflect understandings of seasonal patterns, like the fact that there are more crabs that can be harvested in summertime than in the winter due to life cycle patterns. Others reflect fluctuations that occur more regularly, even year round, like changes in crab abundance in relation to tide heights. The general seasonal changes are fairly easy to anticipate, and depending on the crabbers' market orientation and/or arrangements, they adjust their seasonal effort levels to reflect their work and economic preferences. Supply and demand economic factors are also involved; any experienced crabber knows that the market offers the lowest price per pound for crabs in summertime when supplies are most abundant, but in wintertime offers the highest prices per pound due to scarcity of supply. Depending on his market options and personal preference for seasonal working conditions (does he prefer the summer's heat or winter's

cold), the crabber adjusts his effort level to match his desired outcome. However, discussion elicited enough variation in individual approaches to these fluctuations to conclude that a model does not exist here, except at a language-based representation level of "*being strategic,*" planning ahead for the future.

The tide constitutes a second environmental pattern of fluctuation that generates fairly regular and predictable patterns of scarcity and abundance. In Georgia, tidal currents are amplified, funneled in towards the land due to the geographic "bight" in which it lies, in comparison to other areas on the U.S. Atlantic coast whose tides reflect the actual tide heights of the open ocean (Schoettle 1993). The tide is a predictable natural force, however, and in Georgia, potentially the strongest environmental variable with which crabs and crabbers must contend. Experience gives crabbers a very uniform perspective on the tide and its effects on crab activity and trapping ability. In general, they believe that approaching the highest tides of the monthly moon cycle, crabs are most active, dropping off immediately at the highest tide stage, and remaining fairly inactive until things calm down. This is related to trap placement, also, in that crabbers know too well that the tide can easily drag a trap off to unknown locations, which can quickly become an expensive and frustrating situation. The following passages illustrate the shared perspective among crabbers that crabs pick up on the moons of each month, and drop off shortly after the moon, and that crabbers need to adjust their trap placement and numbers to capitalize on this abundance to maximize profits while they're available to help smooth over the other low spots during the month.

> CRABBER C: Well, … if the tides are too high, it drops off. It just runs too hard, or they bury up during those hard, hard tides, you can see a fluctuation and its not, …that before the moon or after the moon are the big tides, that you'll see a

(CRABBER C, Continued): major increase, but before or after you will see a change. In other words, you may do better before the moon and up to the moon, and right after the moon you drop off.

CRABBER J: That's when they seem to be a lot more dormant, why, I don't know. Unless its because they can see more and catch their own food without doing it, you know, I mean I don't know, but its damn sure there. And if a person in crabbing tells you it ain't, then they all, I gonna tell you he ain't no crabber, because I'll promise you, like I tell my son, and this shows you the young versus the old, more experienced versus nonexperienced, I tell him, I say ok son, these tides fixing to pick up now, you need to gear up, and catch these crabs. All right? He'll piddle around, piddle around, "well, I'll be gearing up." I'll be shuffling my traps around, he'll come in with two boxes, I'll come in with four boxes, or he'll come in with three boxes, and I'll come in with six boxes. That's where knowing what, when to move on that crab, to be ready, to be where he's at, to be, have your gear ready, to sock it to him when that tide gets to that phase, cause when that moon gets there, it ain't gonna last but a few days, so you better make the hay while the sun shines. Cause soon as the tides get to running hard, you can forget it. It's like turning it off with a damn switch.

CRABBER A: In between moons in neap tides the crabs won't be worth a damn, that's the one that just shed from the moon, and they don't generally have a lot of good quality, I'm talking from experience in the _____ river, I don't know what other people are doing, but your better and bigger crabs and fatter crabs normally come around moon time- full and new moon. And after that tide neaps and goes up, your amount of crabs goes up, your moon peaks, you'll catch pretty good for a day or two, and the moon starts neaping back down, then your crabs will start go neap back down with it. You know, and then flatten out, tide starts picking back up, your crabbing starts picking back up a little bit.

It is apparent from the above quotes that the tide is a predictable, and anticipated pattern of environmental change, which the crabbers, at least the seasoned, experienced ones, in Georgia are keenly aware. The crabbers who are successful for many years of crabbing know from experience that there will be lean times as well as times of abundance in the crab harvest, according to the ebb and flow of the seasons of the year, and the rhythmic patterns of the environment. However, they also know that unforeseen influences can exacerbate the effects of these patterns and make periods of scarcity more severe as well as periods of abundance more dramatic. They know that they need to

anticipate as best they can and capitalize on seasonal periods of abundance because they know a wild natural resource naturally *fluctuates* in abundance, and they can never exactly predict the time or duration of the next period of scarcity.

Be Strategic Sub-Model: Save Money

Deriving logically from the model of fluctuation above is the more utilitarian model of *saving money*. Please refer once again to Figure 4.7 above for a visual and the frequency of discourse pertaining to this model. As has been described in Chapter One, crabbing is a pursuit that has significant overhead expenses, and the profit margin is frequently very thin. Economically speaking, crabbers who have been able to survive for many years solely as crabbers have learned how to manage their expenses wisely, and proactively, planning ahead, *being strategic*, in such a way that they expect and are prepared for the unexpected. For example, consider the following quote, in which Crabber O touches on many of the surprises crabbers might face in their careers and some of the common strategies they employ to survive them.

> CRABBER O: A motor will go out, or somebody will say alright, you making too much money, one of the crabbers will say [you've] got too good of a market, [you're] cutting out my market, [you're] cutting out my throat, next day you go out you can't find a pot. You're cut. [You] ain't got no money to buy a pot. [You] don't have no money to fix the motor. Or your winch goes out. I'm not gonna pull by hand. Um, the gas prices are out of this world. Another thing is, January, February, March [lean months]. "What do I do?" There's no crabs, it's too cold, the weather, so uh, you should be like a squirrel, you pick up your nuts and put 'em aside, some, because you got three months you got to do something, if you don't get nothing but a 40 hour week somewhere, you just, they know,

> (CRABBER O, Continued) June, July, you gonna leave ‘em. A lot of people won't hire you, knowing you just going to be a few months, then you're gone. That's why a lot of the crabbers wives work, and uh, it makes a difference. But uh, if someone were starting out and come to me, you got to either have a truck, you got to have a boat and motor, and you also got to have a trailer, or if you lucky enough, you can find a dock to put it.

Again, it is clear that this passage is influenced by the *fluctuation* model, clearly identifying the numerous economic threats that the typical crabber will face, hopefully never all in the same year. It seems that the strongest model underlying *being strategic* is "*saving money,"* incorporating elements of economic planning, future orientation, and being a smart businessman. Much of the discourse surrounding *being strategic* comes in relation to saving money, looking at fishing through an economic lens, and constantly evaluating one's situation in market options, bills to pay, relative crab abundance and projected trip yields in relation to market price. This demonstrates a shared perspective among Georgia crabbers that crabbing is not just throwing traps overboard and hoping for the best. It shows that crabbing requires a systematic, forward thinking perspective that is rooted in experience based databases, and is keenly attuned to current patterns in the environment and in the market. Crabbers interviewed indicated they always seek to optimize their situation and maximize profit margins, both in an effort to make the best living possible, and also for insurance against that unpredictable "rainy day" that surely will come. The quote included above from Crabber O clearly demonstrates this perspective.

The central element of *saving money* is to make sure you do not waste what financial resources you already have in your pocket, and to set aside as much of your daily earnings to ensure that you are not caught short in the future. For example:

> CRABBER A: Number one, you need to learn how to control your expenses, and control your dollars, to become successful, and while you're doing that, equally important, would be to learn something about the critter you're wanting to catch, your quarry, your prey. Whatever, that you're trying to catch, you need to know its habits, you know, and once you learn those, you're controlling your money, you're saving your money, for hard times, you know what the crab's gonna do in the environmental circumstances, like when the rains come, or when it gets dry, or when do I need to be in the head of the creeks, when do I need to go to the creeks, when do I need the sound, how much longer should I stay in the sound, even though there's not much crabs here, you know. That's factors into becoming successful.
>
> CRABBER A: When we first started out we knew we had to be prepared come November to not make a penny until February at least, so we had to have saved our money.

Adding to saving money and controlling your expenses, the second key component of *saving money* is to understand the dynamics of the market and be able to anticipate where it is headed. This enables crabbers to adjust fishing tactics accordingly, both to catch the appropriate quantity, as well as the appropriate quality that the market will be demanding. This maximizes results and profits. In the days when crabs were routinely sold to picking plants, crabbers had to simply catch the maximum amount possible, due to the incredibly low price per pound they were offered for the catch. One crabber recalls:

> CRABBER A: I used to look at it as a certain number of dollars per trap, not so many pounds per trap, but I want to see dollars per trap. That's why I maximized by taking every damn little crab like everybody else did. So many dollars per trap. …they made you do it, the picking houses made you do it with those prices.

But, in the modern live market, most crabbers will agree that quality draws a better price per pound than quantity. As a result, this “X dollars per trap” approach still holds true, but covers many fewer crabs, and a different array of characteristics regarding the catch quality. As one crabber states:

> CRABBER C: So you learn to catch a better quality crab to maximize dollar for what you do and can catch. You know, if they can catch, that means if you can catch them if they're there, or, if you're allowed to catch them because you do have a market for them.

In other words, you learn to catch crabs that the market demands, fat, healthy, males or females, and spend more time being selective than slinging traps for poundage. This approach, when fishing for the live market, will bring more money in the long run than a substandard product. Crabber C reinforces the concept of crabbing responsively to the market demands by saying:

> CRABBER C: You know, I'm not gonna get rich, but you can uh, still get those little get ahead spurts because uh, not always do I got a consistent market here in town, but if there's another market like shipping to Maryland or Florida, or wherever, then that's where I can get my extra income boost, by the right time, right place, and then I can work a little harder, and get that little boost. That's get ahead money.

One of the realities, though, of being responsive to market and environmental conditions and striving to maximize your economic opportunities while they are available is that they may come at an inopportune time. Crabbing knows no sick days, comp time, or other days off. Crabs trap when Nature decides crabs should trap. This can be tough on a fisherman, but like Crabber E says, you have to go when the time is right whether you want to go or not.

> CRABBER E: You have to be able to, you have to, in no special order, cause its hard to line things up in an order, your greatest asset is the ability to hustle when it's there. If the money's there you got to go, cause its not there all the time, you know, and you got to, you know, you can wake up that morning with a migraine headache, but if you can go out there and knock out 500 bucks, you better get up and go, cause you know, come January, you'd die to make 500 dollars in two

(CRABBER E, Continued) weeks, so it's efficiency and time. Uh, you know, I think one of the biggest things that you could learn, would be how the, we just discussed it a little bit, the market, you know, where to get a fair price for your product, and at the same time, you have to learn to, you have to deal with these people openly and honestly, you know, uh. Or then you wind up getting your throat cut, you know.

There is a compromise, though, to *being strategic* in crabbing, for a crabber cannot spend all his time wildly searching for the right kind of crab; if he spends all his time running all over the river he will waste too much money and time and catch too little. He must still be systematic and keep an eye on the bottom line at all times.

CRABBER N: You got to make the money, in other words, you got to, if you don't catch no crabs, and don't make no money, you got to catch crabs, to keep going. I figure my expenses are like I say, run me say a hundred dollars a day! You know, I gotta at least make two hundred dollars a day. That's what I figure I want to make, you know, two hundred or better, you know, and I try to keep it at that, you know, try to gross maybe three and a half a day, or something like that.

It seems likely that Crabber N, if probed further on this topic, would agree with Crabber G's addition to this discussion:

CRABBER G: you spend half of your day running, say ok, tide's right for me to go here, tide's right for me to go there, you know, you spend all day long flip flopping around, you spend more time riding than you do working. Usually in the summertime, I start at point A and work to point B. I scatter so many traps all the way. This week there might not be none on this end, but that end catches real good. Well, next week, might be exactly the opposite. A lot of guys don't do that. They want to put all their traps right where them crabs are, right now. Well, in three or four days from now, they move, "oh, …I got 200 traps sitting here and I didn't get a box of crabs. What happened." Well, hell, dummy, they moved (CRABBER G, Continued): down the river a half a mile, you moved all your [stuff] away from there last week. On the law of averages, when I start working on a seven day basis, once crabs actually get here, I'll catch within a box of the same every day of the week. It might drop off here, but it will pick up here. Tomorrow they might drop off there but pick up back over here again.

The final point Crabber G makes in his statement is of central importance to *being systematic* and *saving money…* "on the law of averages." By looking at crabbing in terms of the whole year rather than just reacting to what happens today or yesterday, crabbers will waste less money and time out on the water and be more systematic, disciplined fishermen. Crabber N adds another statement that supports this:

> CRABBER N: Certain times are better than others, you gonna have them cycles you go through, you know, its gonna be slow, then it'll pick up, you know, but you just work through, it all equals out at the end of the year, you know.

However, none of the knowledge or reactions encapsulated in the *strategic* or *save money* models can be accessed or utilized without first becoming established and accumulating knowledge and wisdom in accordance to the *experience* model. Without experience, one cannot make wise, long term decisions. Crabber O's opinion about new, inexperienced crabbers in regard to their equipment handling skills and money management reflects this very clearly:

> CRABBER O: So a newcomer, if I were …a newcomer, I'd start off with a hundred [traps]. And then that way you could tell that you could [manage] a hundred a lot better than you can two hundred. And you start putting out 200 pots, and you're not familiar with what's gonna happen, you're not familiar with this dadgum pot's gonna drift, or whatever, it's all in practice, knowledge, uh, your time, your skills, the weather, I mean because there's another thing is, I mean because crabbers, there's a lot of crabbers that the older ones, new crabbers think (CRABBER O, Continued) "Alright, I got 500 dollars today." They go blow it. OK? Then tomorrow, they make 500 dollars again, they blow it.

Be Strategic Sub-Model: Market

The second component of the *essential knowledge, be strategic* model is a firm understanding of the workings of the market in which the crabber must sell his crabs, the propositional *market* model. Again, please refer to Figure 4.7 above for frequency and integration of this sub-model into the larger hierarchy. Without an understanding of how to sell crabs, a person could not succeed at crabbing in modern times.

In the early half of the twentieth century, being a crabber was a lot like being a sharecropper, or working in a coal mine and living in the "company town" and shopping at the "company store." One worked for the crab picking plants, rather than being a self-employed entrepreneur and marketer. Some of the older crabbers describe working for the crab plants as having your boat, bait, traps, fuel, and all other necessary supplies furnished to you on credit, deducted from the check you received at the end of each week. Of course, many also recall being cheated by the crab plants and overcharged for bait or equipment they never bought, etc. On the other hand, the crab plants were the only available buyer for their catch; sometimes it was better to accept the accounting "errors" (typically in the plant's favor) because alienating the plant usually meant losing the only local crab buyer. The picking plants also provided a nearly bottomless demand for crabs; they could process and store almost everything crabbers could catch at any time of the year. They would process it, and then, once canned, the meat had a long shelf life and could be distributed throughout the retail outlets as demand dictated. As a result, picking plant crabbers caught as much as they could, because the price per pound was very low from the plants and they would take as much as the crabber could catch. The quote

below describes this shift as perceived by Crabber C and how he feels it changed the way he fishes for crabs.

> CRABBER C: Yeah, you're limited by the market, and how many you can get rid of, but a lot of times too, you can't put but just so much effort forth, you burn yourself out. You can't burn yourself out, you gotta get a sweet point there where you can make a reasonable living, but don't get greedy, if you get greedy, it will hurt you. But don't be slack either, cause you'll starve. You have to find a mediocre amount that's comfortable for you, uh, I was a little too much aggressive when I was younger, and it hurt me, hurt my back, bothered my back now, ended up slacking back, and trying to uh, and to add to it, that's right along the time when the live market started, and I was able to change my tactics on fishing on better quality, and pull less traps, work less hours, cause standing out there was beating and banging that's what was killing my back, and uh, now I cut way back, I'm gonna say I cut back probably 30 percent, on the amount of traps, 30-40 percent, probably, and uh, course I've got, I hope, a little wiser and may be able to produce more per trap, and still maintain about the same amount of money, or you know. Course, the amount of money has grew through the years, but so has everything.

The crabbers interviewed all worked for picking plants in their early days (1950s-1970s) in the fishery, and remember well the approach for fishing for the plants. At the time, they used 55 gallon drums to hold the crabs they caught, and dumped practically every crab they caught in their traps into those drums. Little care was given to make sure the crabs were not damaged in the process, or that the crabs kept were mature, male, female, with or without eggs, or even if they were filled out inside with meat or if they were freshly shedded and empty inside. Everything went to the plant. Some stories surfaced during “off the record” (un-recorded) interviews of attempts to cheat the plants and get a better price for the catch by putting the best crabs on the top layer of crabs in the barrel to hide poorer quality crabs below, hoping buyers would not look down inside. Of course, the plant buyers knew this ruse, and negotiations between plant and crabber

were a constant game. But, since both sides were completely dependent on the existence of the other, neither could afford to "win" the competition all the time.

> CRABBER C: Oh yeah, sure, you fished more wire because you was catching quantity and the more traps you pull, the more quantity you can catch, and you uh, been after picking crabs, you wasn't selecting them, what went into the box and what went into the drum. Shake 'em into the box, s*** and git.

The market for crabs has changed over the years due to advances in transportation and packaging technology options, evolving to where today the primary market for crabs is the "live market" "up north" where people buy live crabs by the dozen to boil and eat, "Maryland style." This put the plants out of business in two major ways. First, retail seafood markets paid higher prices for crabs than the picking plants. Second, marketing the product was easier for crabbers because buyers working for the distant markets would bring a truck to the crabber to pick up his catch; the crabber did not have to work as hard to deliver his product to market anymore. The ability to market one's own product transformed the way crabbers did business. Now they could select the market arrangement they felt best met their needs, whether it was price, volume, transportation method, or seasonality. The final blow to the picking houses was the establishment of commercial fishing equipment supply houses in nearby cities and door-to-door vendors; crabbers were no longer dependent on the crab plants for such equipment.

The new live market changed the crab fishery into a quality before quantity fishery. Now, markets could become quickly glutted with product, as live crabs spoil rapidly, and retail outlets can only sell so many at a time (customers could only eat so many crabs in a given period of time). As a result, a new body of knowledge needed to

be mastered that helped the crabbers understand and navigate the fluctuations and options the market presented, the *market* model.

Not all crabbers today sell directly to the live market brokers; some sell to local wholesalers and distributors who then transport and distribute the crabs to distant markets. This arrangement is in many ways similar to the picking plant relationship. However, the difference remains that even here, the wholesaler is intent on providing a quality product to his customers, and has to ensure that his crabbers are providing him with product that meets the quality standards.

The first component of the *market* model reflects the importance quality has over quantity in the new live market crab fishery. Today, live markets, catering to the individual consumer who buys live crabs whole to be boiled and served to be eaten at parties, cookouts, and other get-togethers, are concerned with providing large, high quality crabs that are as full of meat as possible. Consumers will not return to a store if they find the crabs they bought there were "light" and without substance. As a result, the experienced long term crabbers who now serve the live market are focused on harvesting the highest quality crabs and taking care of the product to ensure that it not only satisfies the customer at the other end, but that the highest percentage of it reaches the market. Reducing "dead loss" and maximizing quality is the surest way, crabbers and wholesale distributors have found, to ensure that they get paid the highest, most consistent price for their product.

> CRABBER G: No, every one of them will ram them baitwells slam full just to see how many they can catch. Cause that's the difference between them getting their 30 cents for their crabs and me getting decent money. Mine will live to get

> (CRABBER G , Continued) up the road, and theirs won't. I'll be the first to tell you, I haven't found a way to sell a dead crab yet.
>
> CRABBER A: Today I throw a lot of crabs back, you know, uh, even though they may not be live market, some of ‘em, I still throw a lot of them back, especially if somebody will pay me for them. I'll throw the junk back.

This has changed the way crabs are harvested, sorted, handled, packaged, and transported, affecting the work of the crabber in numerous ways. Most significant, perhaps, is the attention to size, weight, gender and maturity that crabbers now incorporate into their daily fishing routine. The following quote incorporates references to nearly every one of the key areas a crabber must consider to maximize the quality of his product, and thus the price his product can command.

> CRABBER D: Yeah, well I've seen, if I find that the crabs have just shedded or still kinda soft, I try to return ‘em back to the water live, you know, try to protect them, if they're not real, not soft but not real firm, I put ‘em back because I know they're not gonna survive to the market, so might as well let them finish doing what they're gonna do, chances are I'll catch him again, make sure that they're uh, in good condition, like I say handling of the crab is the main thing, slapping them around is the main thing, even the immature ones, they're aggravating to handle, but I try to pick the larger ones out of ‘em and leave them in the pan and gently return the whole pan back over into the water, and let ‘em get away from the boat for a second or two and then I'll take off so as not to run over them.

There are occasional constraints or disadvantages to the modern live market system. The old crab picking plants usually could be counted upon to buy nearly all the crabs a crabber could catch, almost regardless of sex or size. However, the price per pound would vary according to season, demand, and abundance of crabs to be processed. Aside from volume, the live markets of 2002 are different from picking plants in several other ways. They are more product specific, usually demanding as many “Number One” (greater than 5.5 inches, point to point across the carapace) males, as the crabber can

produce in times of scarce supply (typically winter), and needing a fairly fixed amount compared to what the crabber can catch in abundant times (typically summer). They are also highly specific regarding the aesthetic quality of the crabs supplied, in that they must be full of meat, large, and attractive; no customer paying top dollar for fresh live crabs wants a disfigured, ugly crab. Crabber F highlights the challenges that the market can pose for a crabber, if they want nice male crabs (more good meat is found in them compared with females), and if in his area the opposite crab is available, it can be tricky to get what the market wants.

> CRABBER F: It will strongly depend on what type market you have, if you have a female market or male market, whatever market you have, that's what you have to adjust to at that time. That's usually when everybody's beginning to get a few crabs, and that's when it becomes a market issue, you got to have what the type market that you have you know, the type crab that you're selling, if you have a female market, you catch females, you know.

This statement may represent an attitudinal difference between younger, more inexperienced crabbers and experienced crabbers or those who sell to a wholesaler versus crabbers who self-market their product and deal directly with retailers. In order to maximize benefit from the resource, maintain a good market, and preserve the resource for the future, the concern is bringing in quality over quantity, being selective, responding to the signs they can observe that indicate the quality of the product**.** Many also express concern that crabbers who dump low quality crabs on the market contaminate the reputation of the crab product from Georgia, and drive the price down overall, making experienced crabbers who try to maximize their opportunity suffer depressed prices as well.

> CRABBER G: Well, [inexperienced crabbers]don't care. They fish, fish, fish, for, they not worried about quality, they worried about quantity. And they bring poor stuff in, half dead stuff in, all that does is kill the market. But, bottom line, they don't buy motors, boats, traps. If they make 200 dollars today, they get half of that, and they got no expenses coming out of that, so like the old saying goes, if you worked at McDonalds, and they fired you tomorrow, you'd go the next day and find you another job. Same with them. If crabbing ended tomorrow, they'd go the next day and find another job. You know, they don't look out for the future. And the way I see it, any poor crab or little crab that I put back over today, that's my future. I mean, any way you look at it.

The crabber above touches on a sensitive topic that relates both to the concept of understanding the market and maximizing one's return for one's effort out on the water, but also a related conservation concern. Experienced crabbers are concerned about the sustained production of the resource. They seem to be concerned that even though they feel they can selectively harvest the resource, there are many inexperienced crabbers out there who are less careful. If this is so, the experienced crabbers feel that the newcomers may be contributing to the decline of the resource.

Be Strategic Sub-Model: Crabs are a limited resource

Discussions about market elicited discourse relate to competition and scarcity. Consequently, it becomes apparent that the last of the major sub-models that form the core of *essential knowledge* is that all the crabbers interviewed view crabs as a *limited resource*. Once again, please refer back to Figure 4.7 for a visual representation of where this model fits in the hierarchical structure and its frequency in the discourse. It seems logical to conclude that if crabs are becoming increasingly scarce and valuable, those fishermen who actively seek to conserve the resource and optimize their catch through saving money and understanding the market will prosper the most. One of the

unfortunate misconceptions of commercial fishermen is that they tend to harvest as much as possible of the resource they pursue until that resource has been decimated. This may be true for heavily industrialized fisheries, but the crabbers interviewed avow that it certainly does not apply to them. After all, they point out that their ability to allocate their share of a limited resource on which they are dependent for their sole income is critical. Also, because there are social, economic, and geographic constraints that limit their ability to move and fish traps wherever the crabs are, they must make the most of the slice of the resource that they have available to them. A majority of the fishermen interviewed offer explanations or analogies that reflect a shared perspective that regard the fishery as a *limited resource*.

Most crabbers acknowledged that overfishing an area was very possible, and that it was up to the individual crabber to fish "intelligently" in order to maximize the productivity of good spots in their fishing area. Many equated experience with sustainability, in that they believed experienced fishermen knew how many traps to place in an area just by visually assessing the size and characteristics of the area. Frequently, they indicated that less experienced fishermen tend to load too many traps in an area and then find themselves surprised when catch levels decline, a scenario most crabbers described as "catching an area out." They believed inexperienced fishermen tended to be more prone to overfishing behaviors than experienced fishermen.

> CRABBER C: Yeah, its not too hard, you can definitely see a immediate decline when you put traps in there. Ha! I don't give a damn how many crabbers you put in the water, there's so many crabs to be caught.
>
> CRABBER N: I ain't gonna crab like that, I be honest with you, I quit. Now if I had to crab, two or three crabbers in one river and all that, there ain't no way you

(CRABBER N, Continued) can make it. You cannot make it. One person can't hardly make it, they overfishing the bottom, for one thing, I bet they taking everything they catch outta there. I mean there's just no way you can, you know, two or three crabbers can crab in one river, there's no way! And make a living. That's the reason they all starving to death.

CRABBER D: Right, they come in and totally overfish the area and then the wonder, hey, somebody's robbing my traps! Ain't nobody robbing your traps, you just overfished the area. You know, I've seen that in this river system before, new guys come in that's currently fishing, and he'll come in where I have my traps spaced out just where they'll support the trap, you know, and he'll come in and throw three around each one of mine in the general area, and overfish the area and make it not worth working that area very often.

CRABBER C: Nope, not in a day. You get the younger, more aggressive, oh, I gotta make a living, they don't understand that if they stay where they're at they going to make a living anyway, they're not going to make anymore, because if they come over here, they going to deplete it, and then when they go back over there, its not going to be ready yet, and they ain't going to make no damn more.

CRABBER L: You do a lot better when it ain't overfished. I can tell that. When I first started, there wasn't no, I never overfished that river, and you can tell when these boys [inexperienced newer crabbers] load up on each other, and they catch it out, but I can tell myself I'm putting too many traps in a spot, and I don't catch no more than if I thin ‘em down a bit, I catch more per trap. But really, the, lot of people say there's less crabs and this and that, and I've seen I don't know where crabs went, I think a lot of got dark up and are on peelers now, but they were there, a couple weeks ago, right on back, I told you before I was catching pretty good crabs right there. But nobody was, that river where I was fishing at, I wouldn't load it up with traps. But you go right down to the end where somebody else was crabbing, on each end, and they fall off. But right in the middle I was by myself and not fishing a lot of traps and I did good. Just overfished, like I say, you catch a crab out, before he even has time to fatten up, and then you catching junk and you catch it all out, and then if you sitting there and its empty, nothing but little crabs and as they shed you catch ‘em, you ain't catching nothing but white stuff.

These statements indicate that the concept of crabs as a *limited resource* is embedded within the element of competition and resource allocation. With the decline in fishery productivity, and the increase in number of fishermen in the past decade, competition among fishermen has increased and caused conflict in a variety of ways

(again, refer to McIntosh 1996, Murray 1996, Sortais 2000). Historically, a social system of territoriality allocates and regulates access to the crab resource. Social pressures and a system of "punishments" helps control the number of fishermen in any given area (Frizzelle 1993). Now, however, it seems that a combination of increased numbers of fishermen and an increasingly scarce resource is forcing more fishermen to fish more closely together. This combination of circumstances results in overfishing, conflict, and frustration for many fishermen; it brings different generations of fishermen with different views on fishing "manners" and resource allocation together, resulting more often than not in some form of conflict. The crabbers interviewed are all career crabbers; all basically acknowledge and try to follow the unwritten social rules of territoriality, just as they attempt to operate within the socially accepted rules of trap placement, fishing area, and mutual respect for other crabbers. This crabber describes the basic principle of territoriality:

> CRABBER N: Well, like I say, there ain't nobody gonna, …ain't nobody gonna mess with my area too much, I mean, you know, like I say the ones that's crabbing out there now has been there, and we kinda know where everybody crabs, and they don't mess with me, and I don't mess with them, and I can let that river sit there for three or four months if I want to and nobody's gonna put a trap in it, cause that's just the way it is, you know?

At one time, territories were so well defined and respected, that some crabbers, upon retirement, actually were paid sums of money by incoming fishermen for the rights to crab that area. This shows that the social rules delineating and regulating the concept of territory were so strong and embedded in behavior that fishing territory rights were valuable enough to be sold among fishermen, despite the fact that a legal title could never

be held for the fishing grounds, which are public property legally owned only by the state of Georgia.

> CRABBER E: Well, I bought it, I paid for it with cash money, and I don't think you have a right to come in there and take it for nothing. …The water is [public], but that bottom ain't, that bottom is mine, I bought it. …It's, you hear of written laws and unwritten laws? This is an unwritten law of the sea. Been like that forever.

Depending on how willing a fisherman was to endure confrontations, territories could also be taken over with force, too. This was not easy. According to the crabbers interviewed, if you were willing to endure trap loss, verbal and physical confrontations, as well as other conflict, you could establish the right to an area by fishing traps in that area, outcompeting other fishermen for a vacant area, or until the established crabber in that area gave up and moved on.

> CRABBER N: Somebody told me he had it up for sale, the territory and all, I said that's history now, bubba, ain't no taking that back. That's gone, me and another guy got that now.

The interviewees frequently combined elements of territoriality within their discussions of overfishing, self management, conservation, perceptions of an increasingly scarce resource, and feelings of too much competition between crabbers. However, several acknowledged that the old way might never be useful again, since there was no guarantee that one territory could provide enough crabs over the course of a year to support the individual fisherman. Crabber N, in the quote immediately above, is speaking from a perspective that may reflect that in his area, crabs are still abundant enough to maintain a

territory, or that the crabbers that are active in his area are all established fishermen who still uphold the principles of territoriality. Unfortunately, this is not the case for many of the crabbers interviewed. Many acknowledged a growing suspicion that it might not be possible to wait in one's own territory when it is not producing, knowing that adjacent areas "belonging" to other crabbers are. The conviction that eventually those crabs would move into your area and the neighboring crabbers would then endure their period of scarcity has begun to lose strength, even though most of the interviewees still tried to act according to the rules of the territory system with their fellow crabbers. The combination of scarce crabs and new patterns of fishing behavior due to "newcomers" not recognizing the established system of social rules has compromised the territorial system and engendered increased levels of competition and overfishing. The following quotes demonstrate several different aspects of this perception.

First, Crabber D reflects on the old system and how it worked to minimize pressure on the resource, and leave it up to the individual fisherman regarding effort level decisions.

> CRABBER D: It's always been an unspoken rule amongst crabbers that have been doing it for quite a period of time, not to come in the same little old creek as another man is, been pretty much an unspoken rule, respect for another person, more or less, not to get right there on top of him, don't throw your traps in between his and his line, and so forth like that. I try not to take something away from a man, but just try to get my fair share, but I don't want to take nothing away from this guy, cause he's out working hard too, just like I am. And some of these newtimers, you know, they "oh, he's catching crabs, you know, let's go load a bunch of traps in there, lets go catch them." And they come in there, do good for a day or two, and then all of a sudden they won't hardly catch nothing and think they getting robbed, and what it is its been totally overfished.

Crabber E contributes to Crabber D's comments by stating how certain long term crabbers in an area can work together in close proximity, knowing how much room to give each other, and what courtesies must be extended to make crabbing in close quarters profitable, peaceful, and rewarding for each other. The following excerpt from the interview with Crabber E shows both a long term perspective derived from the time when territoriality was the industry accepted social, informal regulatory system, and also complains that it only takes one fisherman to ignore the rules to "stir things up" and make it difficult for all involved.

> CRABBER E: You know, it's like if you want to come down there and crab by me, you come up to me with a decent attitude, like you just said, you know, I'd say look. I've got a few things I want you to do for me, and we'll get along just fine. First of all, in these little creeks I'm crabbing, don't even try it. You want instant war, that's gonna create instant war. That little teeny place over there, I got ten traps in it, that's all you can put in there and catch anything. If you go in there and put 50 traps, in two days, you ain't gonna catch anything anyway! That's rule number one. Rule number two is, if I'm crabbing this stretch of river, and I got twenty traps there, don't put 100. If you want to put 20 and give me some room, help yourself. It's a big river. I don't have no problem with that, but don't come in there and load me up. And three, don't touch my stuff. If I catch you with, if I think you're pulling my stuff, I'm gonna start cutting, I ain't gonna ask. All I gotta do is think its happening. Most of the time I can tell. There's all kinds of little tricks you can do to tell. You stay out of my little creeks, don't load me up, give me some room, and keep your hands to yourself, and I'll try to work with you. You violate any one of them three things, and we gonna fight. That's how I am. And that's how, you know, that's why we got 5 people down there instead of 2 anymore. But we got one gypsy down there that creates problems for anybody. And we all lose traps because of it. But I'm not gonna sit there and take it by myself. And I don't think that's asking too much. Common sense tells you you can't put fifty traps in a little ditch. …The funny thing is that the traditional crab fisherman, whether they gonna say it or not, I know down there in ___ County, you got, one, two, three, four, five, six, you got at least seven that crab, just in ___ County. That be ___ River on down, and up ___ River. There's seven guys right there that I would call professional crabbers. That, if it was just seven of us, we would never even have cross words. But there's about two or three gypsies [new crabbers with no qualms about fishing wherever the crabs seem to be abundant, regardless of who was already established fishing there] mixed in there that keeps everything in an uproar.

Similar to Crabber E, Crabber N adds support to the concept of territories in the past as a viable institution; territories either were bought outright, or earned through perseverance. However, Crabber E brings up another controversial point; since the time he went into crabbing, the crab resource has diminished dramatically in abundance. In some ways this has thinned out the population of crab fishermen in his area, reducing competition and opening up more area that can be fished without inciting more conflicts.

> CRABBER N: Well, back when I got started there was a bunch of people crabbing, …I mean, we was on top of each other, and you know, I just had to mainly crab in the sound, you know, the sound's kind of open area, and the rivers is kinda staked off areas, I guess, you know, would say, people respect you if you're crabbing in there and usually don't move in on you and all, but uh anyway, when I started like I say there was a good many crabs, and then as the years progressed I was able to hang in there and they were beginning to fall out [crabs declining, crabbers being weeded out].

In other fishing areas, crabbers have concentrated in number in their fervent effort to catch enough to get by, as crabber E describes:

> CRABBER E: I [have] heard about people setting traps all over each other in those places, on account of that's the only place you can catch any crabs, must be the only place you can catch any. …That's pitiful.
>
> CRABBER B: So lo and behold, we get this thing they call price cutting, and the crabbers all react and go crazy and instead of actually being smart enough to back off the crabs, Rob, and leave them alone till they develop into a good crab, they fish harder, to go make the same dollars they made last week. And then by the middle of the summer, we fished this stock down to nothing, cause they're too (CRABBER B, Continued): targeted now. We know where they go, we don't have territories. Well, you [had] unwritten territories between crabbers, but the way it works now with these females, if I'm not catching crabs, and I hear you had seven boxes, you're gonna have a line beside you in the morning. So, where you had one little old line of (CRABBER B, Continued) maybe ten traps setting here,

> (CRABBER B, Continued) wasn't catching anything, now there's 50 here. And two weeks later there might be a hundred here. It's... we call it pulse fishing, rodeo fishing. You come from nothing, but it's the way the market and the fishery has evolved and they're forced to fish this way. I don't say the answer is to eliminate a few more people out of the fishery, I don't think that is the answer, we have got to get smarter to harvest these crabs when the market's there.

There were other themes that became apparent during the interviews and during the transcript analysis that related to the essential things a crabber must know to be successful. Many of these topics were highly specific, and exhibited high variation between crabbers regarding their personal opinions on the mechanisms behind an observed ecological phenomena. These themes include discussions about specific influences of the moon, weather patterns, analogies comparing and explaining crab behaviors in human terms, the effects of wind, specific rainfall events, why crabs will bury up and disappear from the traps for short periods of time, individual theories regarding market behavior and buyer tactics and principles, and many more. None of these were as uniform and comprehensive as the models and models elaborated above, but at the same time, none were pursued systematically in the interviews as key discussion topics. However, they are all related in some way to the overall picture of what a crabber must know in order to be successful at crabbing. It would be interesting to pursue these as well for future interviews and better understandings of specific domains of crabber knowledge.

Cultural Model: Environmental Change (The Way Things Were)

> CRABBER H: …It's got a lot to do with Mother nature, she gets her cycles right together, it'll get back, they'll get back to where they'll grow back…

In their discussions about crabs as a limited resource the crabbers frequently indicated that they felt that fishing pressure was not the sole reason behind the continuing decline in catch levels in the crab fishery. Please see Figure 4.8 below for a visual representation of this model and its associated submodels. *Environmental changes*, both "natural" and anthropogenic, were considered to be the largest single component contributing to the fishery's decline. The discussion regarding *environmental changes* was strikingly uniform among the interviewees. It became apparent that environmental change was a highly important cultural model used by crabbers to explain the perplexing, frightening declining trend of the fishery in recent years. Typically, discussion of *environmental changes* began by invoking the generalized cultural model I refer to as "the way things were" as a cognitive device that organized, quantified, assessed and discussed the changes perceived by crabbers in their surroundings.

This figure represents an approximation of the flow between models and schemas that culminates in perceptions, evaluations, and understandings of environmental changes that have occurred in relation to the effects on the productivity of the crab population. Without *experience*, a crabber cannot understand anything about the environment and its effects on crabs. Without *experience*, they cannot understand the crab's *life cycle*. Without understanding the *life cycle*, they cannot have anything to base an opinion on the relative effects changes in the environment have on the crab, its life cycle stages, productivity, and so forth. Even though a crabber may speak of the *environmental changes* as a separate conceptual entity, the discussion always occurs in relation to its effects on crabs, using historical conditions as a baseline for comparison.

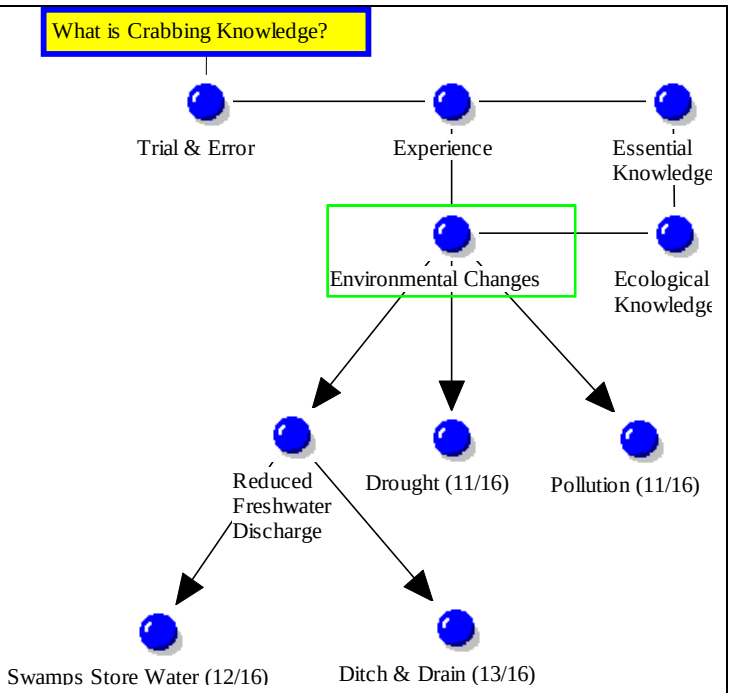


Figure 4.8: Environmental Change

At the most general level, *environmental changes*, as measured by "the way things were," represents a widely shared model that things have changed in the environment, and as a result, there are a lot less crabs out there now, as well as a host of other species. Three explanatory models emerge from the discourse that form the foundation of "the way things were" that serve as mechanisms that identify and explain the relationships behind the factors believed to contribute to the crab decline. They are, as depicted above in Figure 4.8, *Reduced Freshwater Discharge, Swamps Store Water, and Pollution.* The apparent starting point, or benchmark used to measure change is represented in the following quotes. They reveal a high degree of uniformity among the fishermen in their recollections of "the way things were," measuring *environmental*

changes through reduced harvest levels. They all cite the ability to fish similar trap quantities (which serve as indirect estimates of historic effort levels), associated daily catches, and contrast with expected catches for similar efforts today.

> CRABBER B: Back in 1971-72 when I first started, most people fished no more than 100, 110 traps. 1000, 1400, 1500 lbs. every day.
>
> CRABBER A: We don't run 100 traps anymore and catch two thousand pounds, don't catch a thousand neither, don't catch 800 very often, right now.
>
> CRABBER H: In 62, in the 60's, I'd say anything before 1977 June, the middle of June, we'd be anywhere from 1000 to 2000 pounds per day, seven days a week.
>
> CRABBER J: But that's all that I can tell you, that I've seen it go from this time of the year, I could be catching 15 to 20 boxes a day and I'm catching five. So, if you asking me if there's something definitely wrong, I can tell you right quick they's damn sure something wrong, whether it be environmental, or from the fishery itself.
>
> CRABBER M: I'm serious, for years and years, I usually catch 12, 1500 pounds, every day and it wasn't female crabs, it was male crabs, I mean beautiful male crabs, and then in the spring, you get that run of sponge crabs and regular you know, female crabs, just load the boat. Four traps, three traps fill a shrimp box full.
>
> CRABBER N: Yeah, but you don't do that anymore. That's what I'm saying. The crab population is not near the crabs there was. I mean common sense will tell you, When I first started crabbing, about, 13 years ago, when I started back, I was crabbing, …I could go in the mouth of that _____ river, up towards, _____, I had two lines in there, fishing about 150, 170 traps, I had to make two loads a day, I was catching, I had a flat bed truck, I'd leave here at three o clock in the morning, I had my boat rigged up with a light, I'd leave here at three o clock in the morning, I'd be in the river about three thirty, quarter to four, I'd pull to daylight, I didn't have nothing but a nineteen foot boat with a 120 [horsepower outboard motor] on it, I'd pull my creeks, and when daylight broke, I'd bring them back to their dock, and then I'd go in the sound. When I ended up the day, at about two o clock, I was back at the dock with thirty, thirty three or four boxes of crabs. That was every day!

Facing this bleak reality of seemingly continuously decreasing catch levels, crabbers utilize the cultural model *environmental change* to incorporate several related sub-models and explain the challenges the blue crab population faces. Essentially, when crabbers reflect upon *environmental change*, they are recalling "the way things were," comparing current ecological conditions to the environmental conditions characteristic of when they began crabbing 10, 20 or 30 (or more) years ago. Many achieve this comparison specifically by reflecting on characteristics relating to the location or quantity or behavior of the crabs.

Harvest levels are a logical starting point for explaining environmental change, because the ecological component the crabbers know and understand the best is the crab and its behavior. Anomalies are easily detected by the crabbers regarding crabs and crab behavior. As described in the *essential knowledge* model and sub-models, they know where crabs are supposed to be at different times of the year, and recall from their records or memories how much they caught from different areas at different times of the year. As a result, looking at current conditions in relation to *the way things were* in a sense enables us to look at what the crabbers are seeing and learn how they explain why the crabs or the crab population is experiencing its current challenges. We can see that the crabbers have extensive knowledge of how salinity, water temperature, and seasons affect crab location, behavior, and movement within the fishing area. It is also apparent that they understand how weather patterns, seasonal climatic patterns, and larger (geographic) scale issues like human land use affect salinities, water quality, and other habitat characteristics in their fishing areas. Bringing this knowledge to bear on the need to explain the observed phenomena of a declining crab population, the crabbers develop and

share three key explanatory models that, combined, form the basis of their response to the question of why things are different from *the way things were.* These models are: pollution, drought, and reduced freshwater discharge from the swamps.

Environmental Change Sub-Model: Pollution

The first and most generalized of the three explanatory proposition models is *pollution*. Please see Figure 4.9 below. *Pollution* encompasses an understanding of what pollution consists of, how much of it and what type is present in the interviewees' fishing area, and how it affects the crabs. Most of the crabbers interviewed believe that pollution exists in their water, but they also seem to believe that *pollution* is not the main reason contributing to the crab decline. In many of the discussions, the linkages between *pollution* and crabs are made by crabbers who have personally observed small point sources of pollution in their fishing area. These might include a paper mill, a golf course, or a tributary that enters the marsh or river from an area where human activities are suspected to be generating a discharge in the runoff water that is detectable by sight, smell, or taste.

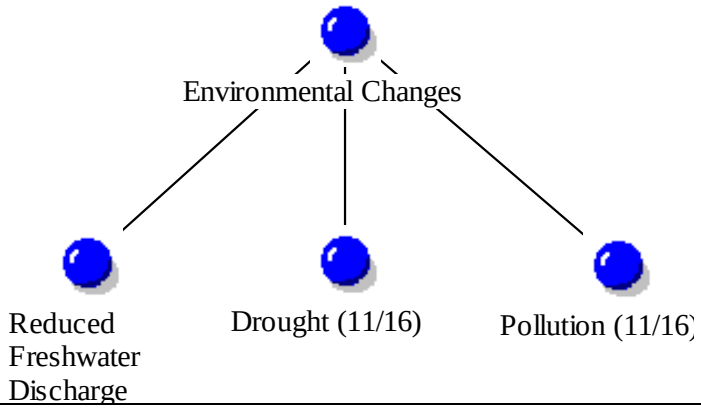
This depicts the relationship between the generic categorical model of *environmental changes* with the specific sub-model categories of *pollution*, as a significant environmental factor perceived by the crabbers to impinge on crab population health and production.	

Figure 4.9: Environmental Change: Pollution

According to these crabbers, *pollution* is any sort of chemical or toxic substance generated by human activities (residential, agricultural, or industrial), that runs off the land or is discharged from a pipe into the water of the estuaries where crabs live. Interestingly, their *pollution* model reflects the model Kempton has identified in his studies of American environmental values (Kempton et. al, 1995, Kempton 2001). According to this study, Americans typically view pollution as artificial chemicals that are toxic to living things, including humans; detectable signs of the effects of this pollution can be long in appearing, and it is predominantly from industrial and automotive sources that can be prevented with additional filtering equipment (Kempton 2001).

The following quotes illustrate the central themes in the crabbers' *pollution* model, identifying pollution as some sort of toxic industrial chemical by product, herbicide, fertilizer, or pesticide runoff from residential areas or timber plantations, or residue from municipal mosquito control programs. In all but the last quote, each crabber

describes pollution in relation to crab population impacts in terms of its direct or observed impacts on the marine environment.

> CRABBER D: I do think pollution in some areas created by man has affected them, not so much in my area because there's not really much man intrusion around the area, but I've heard tell of some crabbers that caught, one particular fellow said he crabbed a creek that run next to a golf course, and when it had a heavy rain, the fertilizers would run into the creek and kill everything in the creek. And take seven eight days you know for everything to return to normal again. Said every time they'd have a heavy rain it would kill, kill the fish, crabs, whatever. From fertilizer running off that green golf course. …I think land use has some effect on it, fertilizers, pesticides; sooner or later it's going to end up in the water, whether its in the groundwater or the runoff water, its eventually gonna (CRABBER D, Continued) go off somewhere. And like I say, with this extreme drought, what little bit of rain that we do get, put these pesticides, fertilizers, whatever into the river system, and with this extreme drought, its not going to get enough of more rain to flush it on out of the system in other words, it will just hang around and pollute the waters.
>
> CRABBER I: Its just they don't, they don't sift their stuff like they're supposed to, there's too much chemicals coming out of these mills, like ___, for instance, ___ Creek, remember how they used to tie up in ___ Creek and everything, Shrimp boats, used to tie up in ____ Creek, right there…, remember how that little dock used to be there I know a few boys that got crab pots up there right now, and they ain't catching no crabs. …Its like right …over there, ___ where they got the pretty golf course, and certain times of the year, where they spray the pesticide on the fields to make them greener, they have the fish dies…, where they have all the fish floating around and stuff, that's what it is, you know, whenever you um, put so much of that stuff on your grass to make ‘em turn green, and it hits the water, gets those fish and they lose oxygen, and they die, or whatever happens, you know, something in the stuff they use the um, keep the areas looking sharp, kills ‘em.
>
> CRABBER J: Well, the first hat he give me was "helicopter herbicide," Both of the hats are herbicide hats. But tell me what its doing on a windy day when they spray herbicide over them damn pine trees that's in between them wetlands?
>
> CRABBER L: I think that not only industry, but places like golf courses, places like, everybody I talk to says fecal counts in 90% of these blackwater creeks are way over the limit. Human waste, animal waste, whatever it may be. Over the limit is over the damn limit, don't make a damn what its from. And that's the same water that is dumping right out here in the estuaries, where all this [stuff] hatches and grows up.

> CRABBER N: I'll tell you what I believe has a lot of effect, and especially, uh, when you getting a lot of rain. That runoff? These power companies spraying and all, I believe that's got some effect on something, because I've seen it, I don't know so much on crabs, but I know on shrimp, I believe it's got a big effect on shrimp, I believe once you getting all that runoff in there I believe there's something in that water, I believe that poison getting in there is really doing something.
>
> CRABBER J: Like your industries, and your herbicides, and things of this nature. Same thing with the honeybees. We used to have a shitload of honeybees around here every spring. Now you hardly ever see 'em. Cat squirrels. Cat squirrels used to be very plentiful around here. Same thing with the crab. Where are they going? Two things have happened. Their environment has changed. The hardwoods is being cut. They're spraying. Who tells that deer? These people put (CRABBER J, Continued): up signs for their herbicides when they used to spray these clearcuts, Do not enter this area for 48 hours.
>
> CRABBER D: No, but when it runs off, not just the timber companies, as well as farmers up there whenever they're spraying their fields and stuff, you know, that have pesticide running into the rivers and it keeps on, it comes through Jesup, then it goes through McIntosh, and then it goes through Glynn County.

A second component of the model of *pollution* is the generally shared belief that although it may be a problem at an ecosystem level, and definitely a problem in very localized areas, overall, it is not the most important environmental change that has occurred in their fishing area to impact crabs negatively. Most crabbers in Georgia fish areas that are, in comparison to the rest of the East Coast of the United States, largely untouched by intensive residential or industrial coastal development. This comparatively low level of development may mean that overall, pollution in coastal Georgia is present at levels low enough that it is only occasionally detectable by sight, smell, or taste to the fishermen. The old cliché "dilution is the solution to pollution" may still be somewhat true in this case, disguising the effects of anthropogenic pollution with the absorptive capacity of the ecosystem. This may permit crabbers to cognitively distance themselves

from *pollution* as a significant factor behind the crab decline. Some, however, have begun to detect it, and are understandably concerned. Consider this crabber's statement:

> CRABBER L: You know that pulp mill smell. You could smell it riding down the river. It was so strong this year in ___, what they were doing was they were dumping a lot more stuff out that they weren't supposed to be dumping, and the river, there wasn't enough water to dilute it, it was low and and it was strong, and I could pull my farthest traps up the river, if I skipped a day and pulled 'em, the crabs were dead in them. Somebody said they tried to eat some, said they couldn't eat 'em, tasted like I forget what they said, but they had a bad taste to them. It had to be that mill. I could smell it in the water, I knew what it was. I could go down, my lower traps, close to the ocean, where those crabs would live good. Go (CRABBER L, Continued): a couple days and pull it, they were alive. But go up that river, and it was just killing them. Whether it was oxygen in the water, that stuff is real red looking, real brown looking.

All of these crabbers acknowledge that *pollution* is indeed a bad thing for crabs, but many were vague or indecisive when providing their self-assessment of the impacts it has on the crab population. Many feel that development, industrial and residential, had always been there, and the runoff from the industrial activity in addition to residential sources had always been an effect; since crabs were abundant at one time with this impact occurring simultaneously, then pollution was not the culprit. Consider the following quotes as representations of this theme:

> CRABBER C: I would say that pollution wise, like I've said, I've heard a lot of contradiction about that, but I still personally have not seen no pollution that has caused depletion in the crop. I do not see it, I would have to see something that proved it to me. Everything that I have seen or heard of, pollution wise, is something now that is buried under the mud, I mean in the deposits. So its' not affecting us in the last 10 years, maybe around the pulp mill or something they got a little runoff, and it may be affecting I guess you'd say the humanly consumption part of it, maybe it's not safe to consume, I don't know if it is or not. But it don't hurt the way they grew or the way they reproduce or... I don't see that. I don't see the pollution.

> CRABBER F: In my area we got the same stuff. We got the pulp mill, and the sewage treatment plant, they been there ever since I started crabbing, they're still dumping, you know, they were dumping before I got there and they'll probably be dumping when I leave.
>
> CRABBER G: I'm sure [pollution has an effect], but it's been there all along. …You got your tree companies still spraying, they're still putting fertilizer out, they're still got their drainage ditches, your pulp mill and ___ [company] have been there all these years, you know, the only thing that has grown is the town as far as the people, well that's not going in the river, that's in town. …The sewage has been there all along, the only difference now than back then now there's more regulation on it, stricter regulations, so basically if you stop and think, everything went into the river, now only a percentage goes in, so it kinda balances out.
>
> CRABBER M: Now Chesapeake Bay, I don't know, it might be pollution's done there, I don't know about that, but I know, down around this coast here, they ain't no pollution right here, you know, pollution will come down the ___, you got some right up there at ___, I reckon they dump a little bit in that ___ river, up there where them plants is.

So, *pollution* may be a factor, but its effects are hard to observe, and the sources of pollution in the fishing areas of the crabbers does not change much in their eyes since they began fishing. What else might be behind the crab decline? What else had changed?

<u>Environmental Change Sub-Model: Drought</u>

> CRABBER M: Yeah, and you ain't gonna catch all of 'em no way. Like I said, there'd be beaucoup more crabs if you had the right amount of rainwater to make 'em shed and mate and do like they supposed to. And it ain't all pollution, it ain't, its cause of your drought and the draining of all your wetlands and stuff, is what it is, that's what I think it is.

In the interviews, many of the crabbers discussed certain ecological conditions that are critical to crab health. The most prominent of these factors that they discussed

was salinity and the factors that influence it. The *essential knowledge* model reflects the crabbers' perception that blue crabs are forever *hunting that balance* of salinity they need for optimal completion of the different life cycle stages. The most significant factor that crabbers feel has been responsible for salinity changes is the *drought*. Please see Figure 4.10 below for a representation of how *drought* fits in relation to the overall model of *environmental change*.

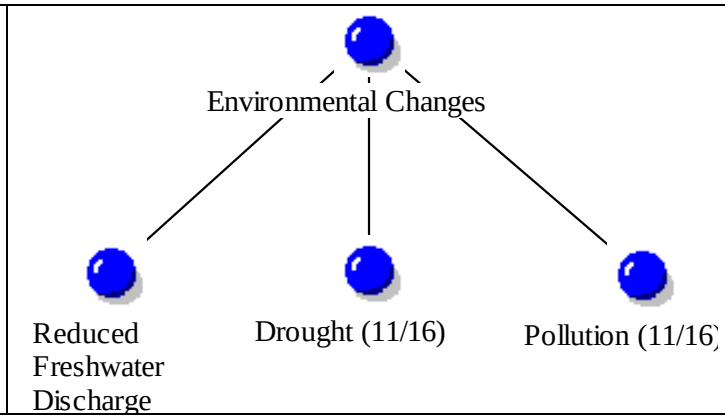
This shows the relationship between the generic categorical model of environmental changes with the specific sub-model of drought as a significant environmental factor that crabbers perceive to be affecting crab population health and production.	

Figure 4.10: Environmental Change: Drought

During the research, coastal Georgia was suffering the effects of a third year of severe drought. The crabbers had observed this change through observing meteorological information on television or from other sources, as well as their own ability to note that there had been dramatically less precipitation than there had been in the past. Interestingly, with these statements about the *drought* and its effects on the crab population, most offered insights that reflected their understanding of the estuarine ecosystem as a system susceptible to the influences of stochastic environmental variation as well as anthropogenic influences. Analysis of the interview transcripts determined that

the discourse related to how human impacts on the coastal environment have amplified the effects of the drought on salinity was uniform enough to represent its own discrete proposition model, *"reduced freshwater discharge,"* which will be discussed in detail in the next and final section of this chapter.

The first category of statements incorporated into the *drought* model are those that reflect perceived deviations from the "normal" rainfall patterns that once brought spring "freshets" and regular afternoon thundershowers. During the period of time spanned by the interviews, coastal Georgia was suffering from the third in a series of extremely dry years, with wildfires burning all over south Georgia and northern Florida, water restrictions in municipalities, and gradual, subtle, but significant changes in the estuarine ecosystems where the crabbers make their living. Most of the crabbers interviewed were native to the coast of Georgia, and had a lifetime of experience with the typical weather patterns in the area. They frequently explained the current drought situation in terms of crabbing and past weather experience, saying that if precipitation patterns and levels would return to normal, so would the crabbing. For example:

> CRABBER D: Uh, normally, when we're having normal weather patterns, we'd have afternoon thundershowers. During just about all summer, generally from around June to about around September, along in there, when we get those fronts coming out of the north, cool fronts coming in, they creating showers and thunderstorms too, in the late fall, but with this extreme drought, unless we get a passing hurricane, that passes close enough or a tropical system, we don't really get much rain at all. And that's really upset the balance that the crabs like. It's got them jammed way up in the river systems, pretty much as far as they can go, in our particular system, of course, we got a short system, it just dead ends up here in the swamp, you know, just a few miles up the river, I imagine if the river system that kept on going, I imagine the crabs would keep on going, hunting that balance they need.

> CRABBER J: Well to me, I don't think, you know, I'm going on years of it, normal, the only way we'll have much change in salinity anymore is to have a high river. Don't know if we're gonna have that. I'm going on years in the past that I've watched it been fairly normal years. You know, used to every spring, we'd have a freshwater rise, and the Altamaha be 10, 12, 14 feet out of the banks, and that killed that area down there where they're catching crabs at now, but not because the crab wasn't there, its because it gets too fresh for them to survive, and they have to move, and that runs them through us. You know, but on your normal year, that you didn't have a flood, and you hadn't had a drought.

Frequently, these evaluative statements relating *drought* to crab migration, or reduced crab abundance emphasized that the causes for the drought were complicated and not explainable, supporting the *unpredictable* model of *Nature*, with cycles and patterns that are not discernible to humans. Consider the following statements:

> CRABBER D: A few more, not many, we had a much better peeler run this spring than we did last year, and lot of times, you don't know why, was better than it was last year, cause we're still under extreme drought conditions. And we're not sure if its just a phase, that the cycle, the life cycle of the crab is going through over a period of years is changing, or what, but we know the landings have been extremely poor, one of the worst records on record was last year, and we think it was because of the drought, maybe some pollution, some shell disease, not shell disease, but some kinds of a blood disease that's been discovered in the crabs last year. May have some effect on it.

> CRABBER I: A lot of it is to do with Mother Nature, really, cause you just don't know, year by year, the way the year has been the past two or three years has just been unbelievable. They have been telling you there's El Nino, and then La Nina, and different types of weathers you know, changes that have been going on that they keep on blaming it on, but I don't know what exactly it could be, I know what a lot of it is this year, its because we ain't had no rain, and we've been getting a lot of rain, but like you said, a little bit of rain we had, the sun comes out and dries it up so quick. You know, the poor old trees and grass and stuff starving for water so much, its sucking it up so quick that it doesn't get a chance to get in the river like we need it to go, and wash out these basins, creeks and sloughs, with all this stuff that comes down from above the country, you know, that we know its draining off these farmlands and stuff, you know the farmer's gotta make a living just like we do, but if you have the rain like we're supposed to, it keeps ‘em washed down pretty good, where it don't mess up everything so bad, but that's what's hurting us a lot right now …No, just recently because of the dry spell and

(CRABBER I, Continued) um, the change of the weather pattern, you know, because of all these new types of weather they got, like El Nino, and La Nina, or whatever it is, they got names for everything, all I say its really excuses for certain things, they just end up calling it a name that make it really an excuse for what it is. What it is, you and me and scientists cannot predict Mother Nature. You can't predict it, you just don't know.

CRABBER O: Nature's our biggest threat, if nature works with us, we'll have a good crop, if nature works against us we won't have anything. Same way with nature this way- it's been a dry season this year, then the rains came, it didn't help us as much as it did the farmers, but then uh, we uh, just have to take it because its (CRABBER O, Continued) just like the farmers, the farmers say one out of five years I have a tremendously good season, but after that it dribbles back down then it comes back up again. Like a pecan tree, you have a real good season with pecans, then two to three years nothing to it. It's just a cycle, that's all it is, a cycle.

Assessments that the drought itself would not have had as significant an influence if it had not been coupled with the stresses humans have placed on the coastal ecosystem represent another element of the explanatory models of *drought* and its effects on salinity. The majority of the individuals interviewed believe that combining reduced inflow of precipitation into the estuarine aquatic system with the draining of the swamps and other coastal land use practices amplified the effects of the drought and made them longer lasting and more significant for the crab population.

CRABBER H: I think it would, I don't know how it affects them, I assume its got to, cause we get to catching less and less in June, July and August, on account of, I want to say, like going back to drought conditions but if the swamps were there, we might have water, standing water, June, July & August, where we don't anymore. But we can't say that that's all progress. It could have happened by itself.

CRABBER M: Uh, the drought, the drought mostly, and the when the rain we do get, it runs off out there too fast, cause of the ditches, you know what rain we get it rains a lot, it just whew, and its gone. Used to, the swamps used to hold it, hold a certain part of it, and it seeped in there, you know, even if it didn't, I don't know if it worked like this, but I think it goes underground to it someway sometimes,

> (CRABBER M, Continued) too. You know? Evidently, these swamps was a reservoir for it, you know? The swamp right back here starts at that highway when you go around this curve, and it runs all the way, near about that other road over yonder, and when I was a boy, well, all the way up to about the 70s, it had water in it up to my neck. We used to hunt ducks back there, I used to ride my horse back in there. And uh, but that thing's powder dry.

Five major freshwater rivers drain the interior areas of the state and empty into the Atlantic Ocean along the Georgia coastline. However, a large majority of the areas that crabbers actively utilize for traps are not directly or sometimes are even indirectly affected by the freshwater flow these rivers produce. Much area fished is classified as "saltwater deadhead" areas, estuarine systems that get their freshwater input from localized swamps and wetland systems, or small watershed creeks and rivers. These areas are highly dependent on rainfall to recharge the systems that produce freshwater to flow into them. Without that flow, saltwater from the ocean can move farther inland to replace what once pushed out from land as freshwater, effectively raising the salinity in these areas (Valiela 1995, Fitz and Wiegert 1991, Fitz and Wiegert 1992). This is significant for crabs because they need certain salinities at different stages of their life cycle. Only during specific phases of their life do they need full seawater, and usually this is only for the mature, fertilized females in wintertime.

As a result, crabbers find that crabs, if they are able, tend to migrate upriver farther inland in search of freshwater sources, "*hunting that balance.*" Reduced rainfall forces them to move upriver as higher salinities from ocean water moves inland, and they either cluster around freshwater outflows, or move up into the swamps or rivers in areas that are off limits to crabbers according to the fishery management plan. Many crabbers cluster during such periods around freshwater river discharge areas, causing

overcrowding and conflict. The past three seasons have been, according to the crabbers, the Georgia DNR, and other local residents, the most challenging seasons on record in terms of reduced catch levels and overcrowding and conflict due to shortages, leading in some cases to outright altercations between fishermen (Davis 2002). The following quotes from the interviews reflect how crabbers feel salinities have increased in areas further inland due to reduced precipitation:

> CRABBER D: Well it seems like its decreased the area that the crabs seem to be in because of that. In other words they had more of a wider range when we had regular afternoon showers than we do now. During the drought. Like I say, we had a wider range of more areas that were suitable for the crab's habitat, whereas now, there's only so much that they're seem to be at, seem to be in. and that's, like I say, every year, that seems like it moved a little further and further up the river system. And on average, when I first started crabbing, we catch good crabs during the summertime like just at the top of the sounds, or just the mouths of the rivers, we catch good female crabs, and now we catch ‘em near about up to the marina, which is seven, eight miles inland.
>
> CRABBER I: Yep, that's pretty bad, like now, its um, we need so much rain right now to help us out right now, and I don't know if it would help us right now because its so late in the season, but I believe it would help a little bit, because there's a lot of crabs up, above I-95 where we can't fish at, you know, and if you get the rain, it will push them down, and would help all of us, you know, cause the crabs, as long as the water's staying salty like it is, they're not gonna move, they're gonna stay right there in that one area, they live right there where they're at, they gonna stay there and they not gonna move around.
>
> CRABBER D: But, like I say, the females they'll sponge up this time of year we're well on the end of it, I seen years where the sponges come in and be a bunch of ‘em, and they'll disappear like they went out to sea to lay their eggs. That's when we had you know more freshwater than we have now. With this extreme drought, they just pretty much came in and stayed in. Dropping their eggs in the upper mouths of the rivers and the edge of the sound, where normally they lay them out on the beaches. Cause of the drought.

The statements listed above clearly indicate that the crabbers have a very distinct understanding of how drought conditions reduce freshwater inflow into the estuaries from

the rivers that flow down from the inland areas of the state, and that this inflow is critical to maintaining certain salinity levels in the estuaries. They all indicate that this reduced inflow of freshwater has influenced the preferred location for crabs, causing them to remain further inland, not moving down as far into the sound, and in some cases staying up in the rivers and swamps up above Interstate 95, where crabbers are not legally permitted to fish traps. At the same time, however, the crabbers did not stop at just blaming the drought as the sole culprit behind this reduced flow of freshwater into the estuaries. There is a larger, more difficult factor at work that magnified the effects of the drought.

Environmental Change Sub-Model: Reduced Freshwater Discharge

Indeed, *drought* is recognized by crabbers as a key factor that effectively increased salinities upriver. However, those interviewed also incorporate another explanatory model into their perspective on the impaired health of the estuary and the declining crab population. Although droughts have occurred in the past, they have not lasted as long, and have not been temporally associated with dramatic changes in crab or other fishery populations. The crabbers interviewed indicated that the although the drought reduced freshwater outflow into the estuaries, humans have also contributed to the problem. The anthropogenic role in the phenomenon, according to the crabbers, has been to ditch and drain coastal swamps and wetlands, which eliminated the natural ability of the coastal system to store and slowly release this freshwater into the estuaries. The interview transcript data indicates that the crabbers are well aware of the role of swamps and wetlands in regulating estuarine salinity. Their discussions frequently describe how

these wetlands, if intact, provide a critical ecological service that helps maintain freshwater outflows into tidal systems, which indirectly optimizes habitat conditions for blue crabs. This model is the subject for this final section, *reduced freshwater discharge*, and its two subcomponent models, *swamps store water*, and how this ecological process has been compromised through *ditching and draining*, and the perceived effects of this change on the estuaries and the crab population. These models are represented below in Figure 4.11.

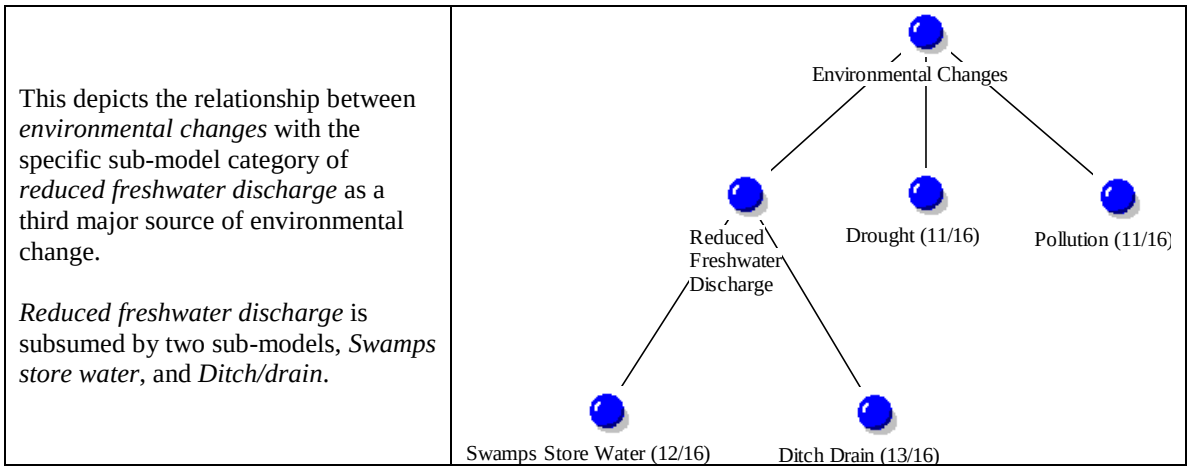


Figure 4.11: Environmental Change: Reduced Freshwater Discharge

Many of the crabbers who were interviewed were born and raised in the area where they live now, and have been active outdoorsmen their entire lives. Many hunt and fish for sport in addition to their commercial fishing activities. Growing up, they spent lots of time hunting in the expansive low lying woodlands in the areas surrounding their homes, learning the land, becoming familiar with the seasonal changes and patterns; they also became accustomed to the periodic flooding and saturation of the swampy

areas. It was a fact of life that the woods were wet, in some areas "waist deep" and deeper according to several interviewees.

> CRABBER F: Yeah, right up there at Crabber C's house, and my own wife will tell you, I've seen it waist deep in water, right there where his house is setting, I've hunted squirrels there, waist deep.

In their childhood, it was normal for large areas of the coastal wetlands and swamps to be flooded for at least part, if not the majority of the year. This was "normal," the way the world was, and unique ecological properties like this received little conscious attention. In many ways everyone can be guilty of this oversight; I grew up on the New Jersey coast, and always wondered why anyone from the mountains, for example, would pay vast sums of money to come vacation at the ocean. The mountains were foreign, fascinating, and intriguing for study and preservation. The beach, ecologically equally important, was a mundane place where one went to look at the ocean. This may be how many people perceive their immediate environment in the United States and other developed nations. In Georgia, the environment was slowly and steadily being modified by human activities, and the simple process of flooding of the wetlands quietly disappeared over the years. It changed slowly, and went relatively unnoticed, even by the people born and raised there, until now.

With growth in the paper industry, population growth, and land development, the crabbers note that the area covered by the original swamp systems has slowly shrunk over the years, being ditched and drained to "reclaim" the land and make it "productive" for pine tree growth and residential or commercial real estate development. Like scientific concern for global climate change, the crabbers feel that although the cumulative effects

of this development have been very slow to materialize and may be difficult to identify, the changes are too real to ignore. Born and raised in this environment, and with decades of perspective and experience, the crabbers have assembled an explanatory model of environmental change that appears to link estuarine salinity with land use changes and ultimately, crab population productivity. Their model is plausible at several levels, and mirrors many scientific paths of inquiry into estuarine ecosystem processes and functions. Like the proverbial "canary in the coal mine," the crabbers seem to be concerned that the decline in the crab population may be the visible ecological indicator pointing at ecosystem level changes due to historic patterns of land use in coastal Georgia, and many are afraid that it may be too late to "fix" the problem.

Reduced Freshwater Discharge Sub-Model: Swamps Store Water

> CRABBER A: Well, you don't have the trickle down effect of the waters coming out of the swamps all summer. You just have to have that water coming from somewhere, and if its not there anymore, the landscape of the surface of the southeastern GA no longer has the capability to withhold water. It rains, hits a ditch, and its gone. That's the problem. …Cause, getting rid of the wetlands eliminates that storage, that trickle, that ability to trickle out. …Its much more drastic now than it used to be, it hits all at one time, and the crabs all leave the river at one time. We used to could, like stepping stone the crabs right out to the sound, when the floodwaters come, but today it happens overnight. You can't stepping stone with 'em right on out to the sound, they gonna be gone all at once. And you have to go to, because most of the time, when the first big freshet comes, it kills the crabs in the traps now. It used to didn't do that.

The quote above is an excellent summary of the concept crabbers have that relates their understanding of the ecological benefits swamps have in relation to the estuaries, providing water storage and buffering estuarine salinity with a slow and steady year

round release of freshwater. Clearly this model derives some of its perspective from the interconnectedness model, and is represented in Figure 4.12 below. The first of the two major components of the *reduced freshwater discharge* model is that swamps are a critical ecosystem component that serve an absolutely pivotal role in managing and maintaining salinity levels amenable to estuarine creatures, including crabs, in the estuary. The first component of the *swamps store water* model is once again, concepts of the way things were. These recollections serve as a benchmark that enables the crabbers to evaluate the degree of anthropogenic environmental change, and then serve as a basis for their hypotheses regarding the estimated impact on the crab population. At the superficial level, these have an "anecdotal" characteristic, and it is obvious that these sorts of statements contribute to the concept of fishermen's knowledge as being memories and anecdotes.

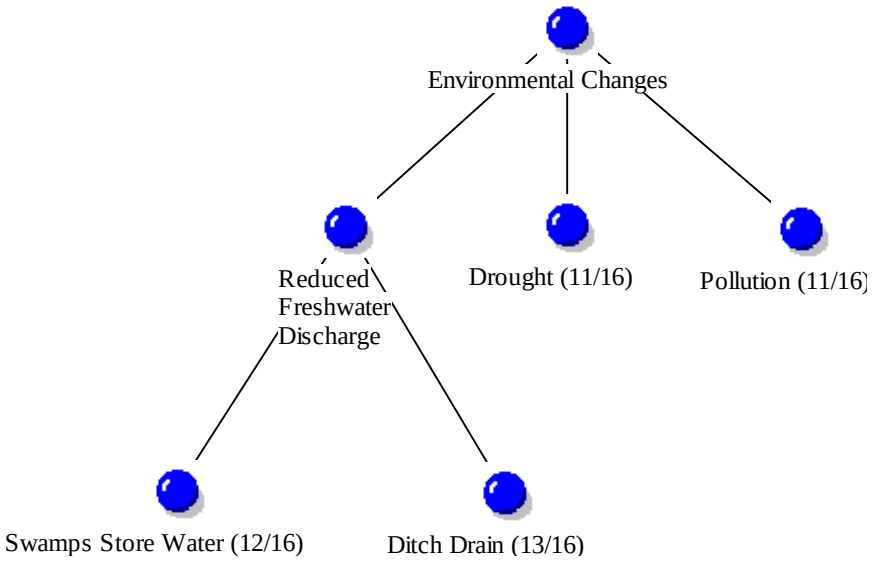
Swamps store water: the relationship between the model of swamps as a water storage system and the more general *reduced freshwater discharge* model is represented here.	

Figure 4.12: Reduced Freshwater Discharge: Swamps Store Water

Looking deeper, however, one can see elements of an empirical, deductive perspective that shows a complex understanding of ecosystem processes. Consider these selected excerpts:

> CRABBER C: Because of, my personal opinion is, like we've talked about before, probably forestry, is the main, maybe roads, whatever it takes to drain certain natural areas to make it more feasible to build roads or to uh make it more able for people to live in the area that normally would not or could not be inhabited because of a lot of the areas that are being drained are for nothing but draining swamps so they can get in there to cut the timber. A lot of the areas are being drained to get in there to build housing subdivisions, to make sewer systems work, there's no doubt its being done, there's no doubt. Uh, I feel sure that everybody that's ever been in an area where they've lived, where they had a drainage problem, they did what they could to get the relief, regardless of what it cost anybody else further down the road, or further down the ditch, or whatever. And, when you have that runoff, that rapid runoff, there's no doubt it's probably detrimental to the uh, the nature. It's gotta be. Cause it's not natural. In other words, when you go in and destroy a piece of property, basically, and you take the natural habitat away, it's got to change the environment, its got to. And when you change the environment from 100 miles, 500 miles, 300 miles whatever it may be from the coast, it's got to be a fall down effect, its gotta be. It's all gravity fed, basically, I mean the water's gotta come from the mountains to the damn ocean. Got to. And when it does that, it comes too rapidly, it's not right. And if it is draining because of a man made problem, then man is what made the problem. If he's in there cutting ditches to live, or in there cutting ditches to cut timber, or to grow timber, or whatever the case may be, the natural ingredients of the soil, I'm not a biologist, but, the natural ingredients of that effect is getting depleted.

This crabber is clearly cognizant of the connection between rainfall events that occur inland and the outflow of freshwater to the estuaries. He is concerned about how humans have modified the rate at which water from precipitation runs off the land and enters rivers and estuaries. This fisherman strongly believes that humans have accelerated runoff by ditching and draining the swamps, and as a result, have reduced the length of time that freshwater resides in the coastal ecosystem, amplifying the rates and levels of

salinity patterns within the estuary. Crabber J, in the following quote, echoes this sentiment, and backs up his concerns with empirical data that reflects the scale and implications of this change.

> CRABBER J: I can go and show you places where I was born and raised as a kid, Rob, that the cypress knees are 75 yards where what little creekbed is left in it. I can go and show you places where they just went and cut the whole damn swamp, cypress trees and all. So damn dry cause of these ditches that they don't have to wait for a dry year. These timber companies nowadays are building …wood roads out of pallets and go cut it. …The draining of the ditches, your herbicide spraying, or the draining of the wetlands, …and the cutting of the hardwood, so when you do get rain, there's nothing there to hold the water table no more. The water runs off in a few days, because there's nothing to suck it up. I never dreamed, I never knew none of this growing up, I never knew it, didn't think I had to know it. I thought what we had would be here for eternity.

He is worried about the transformation of the coastal wetland ecosystems into pine tree plantations by the timber companies. He is not just upset about the loss of species, but like the individual quoted previously, Crabber J is upset about the changes that this transformation have had on the coastal ecosystem in terms of freshwater storage and their effects on salinity. By demonstrating that the cypress knees are "75 yards" away from a water source now, he shows a concern that hydrologic changes from ditches dug to facilitate pine tree growth by the timber companies have had permanent changes on freshwater storage. Cypress trees are indisputably wetland dependent species, and evidence of their existence in a dry area growing pine trees is concrete proof to anyone familiar with these ecosystems that there once was an entirely different wetland ecosystem here. Crabbers M, F, and I in the next three quotes, support this with their recollections:

> CRABBER M: Not no more. The last time he done that, …the water was running, you know where Crabber B is, the water was running through the woods out there up to my door on that truck. Freshwater. That's what caused it. Now they wasn't catching nothing down yonder, its was too much freshwater, but out here? My son was catching 30 boxes a day. And it was not a thing in the world but freshwater that was doing it. It ain't pollution, they got pollution, you know, (CRABBER M, Continued) but it ain't pollution doing it. It's cause you ain't got the flow out the woods like you used to have. Seepage.
>
> CRABBER F: Yeah, you know yourself it don't rain like it used to? Between the rain and I guess you know the draining of the swamps and stuff like that, you used to get a lot of freshwater runoff from that.
>
> CRABBER I: This year and last year, the crabs ain't been up in the creeks, you know, its just been, I don't know if its been the environment's changing, or if its just pollution, or rain, not getting enough rain. I mean I know that's a lot to do with it, cause you're not getting the rain like you're supposed to, but since they drained a lot of these, um, timber companies have drained a lot of these swamps, and dug these ditches where they can't keep water in 'em no more, they just, seem like its changed the environment a lot, because constantly drains, either the water, when it rains real good, the swamp, you can't go in the swamp no more and walk through water up to your knees like you used to, and be able to jump a deer on a little mound, there's no water around them, the water constantly runs off cause they grow pine trees in the swamps now, you know, I dunno, all these hard bottoms is being drained off and everything, and it seems like its hurt the environment a lot, not just in the crabbing, but shrimping, oystering, and clamming, and everything.

All three crabbers acknowledge that pollution may exist, but it is not, in their opinions, the central factor affecting the crab decline. Rather, they believe that reduced freshwater storage and sustained release into the estuarine system are what reduce the quality and availability of suitable crab habitat, thus contributing to the crab decline. In Crabber M's statement, the scenario described reflects too much freshwater present in the system, but he acknowledges that overall, more is needed in the system to make things work "right," and to collectively create optimal conditions for the crab. Finally, consider another statement from Crabber J as an example of more evidence relating the

disappearance of certain freshwater dependent species upland that eventually translates to reduced productivity and salinity balance downstream in the estuary.

> CRABBER J: Well, I could carry you right out there to my hunting club, and show you what I call the blackwater clam or mussel, I don't know what he actually is, this swamp here that is on my hunting club used to maintain water year round, on a normal year or drought year, it would have some water all the way through the swamp. If you hunted in the fall, you'd have to wade through it up to your neck most of the time to get across it. Now you can walk across it and never get wet. They got mussels that are laid up on the ground by the thousands, dead. You got your little backwater fish we used to call a redfin pike. I mean he's still I think around the ____ [river] system some, but these blackwater creeks like where I was raised up, wasn't nothin, any of them, you could put a piece of cut bait or cotton on a bare-ass hook, and just cast out across, was very like a jack-fish, or something, very vicious fish, you know, he didn't get very big, but he looked a lot like a jack fish, or a chain pickerel, or whatever you want to call it, but he didn't have the spots, he was just a gray color with red fins. We never caught 'em much bigger than that long, shaped a lot like a jack fish, only a little more rounder to a point, a little more fatter and wider. I tell you all them things is gone, Redhorse sucker, or what we called a redhorse sucker, I don't know what the actual name of him was, he was a type of a carp, they're gone out of that same system.

Each of these statements reflects a clear understanding that the freshwater that once stood in these systems has been eliminated, largely due to anthropogenic influences. But the key element unifying these statements is the factual recollections of the scale of the water that once was held in these swamps. Also unifying them are the theories about how they believe the water stored in the swamps trickles out into the estuarine system slowly, and steadily, providing a constant buffer for salinity levels, maintaining as steadily as possible the optimal salinity levels for crabs and other estuarine species. In several of the statements above, the crabbers also indicate that the depth of the water held in the swamps was substantial, measuring the change through comparison to the relative depth today. Another empirical and insightful approach is to acknowledge the current

location of indicator species like wetlands dependent tree species, now found at great linear distances from wet areas, demonstrating concretely the change in the water levels of these systems over time. Overall, these statements show that at many levels, the crabbers are able to utilize their historical recollections to demonstrate factually that change has occurred, while simultaneously giving a benchmark that allows some degree of analysis of the magnitude of the change to be carried out. Hope does remain, though, deriving support from the model that nature is mysterious, complex, and interconnected, and if we were to give it a chance, it might be able to repair some of the damage, as this crabber suggests:

> CRABBER H: If they would do that more in swamps, if they would dam some of these swamps back up, so we got standing water in the wintertime, I mean even in the summertime, I believe it would help let it just filter out. But [right now], once you get a four five, six inch rain, three days later, its gone. It don't soak in, it runs right on into the water and its gone. It don't set inland in these swamps and stuff like it used to.
>
> CRABBER J: I'd say the answer to that is make ‘em close up all the ditches and put the beaver on the protected species list, and he'd be what, he can't put the trees back, matter of fact, he'll have helped restore what these trees is left, but, he'll put that water back in those swamps like its supposed to be. That's what I tell ‘em at these meetings. If y'all want to do something for our industry, make it a law that that's a protected animal.

Reduced Freshwater Discharge Sub-Model: Ditch/Drain

Georgia crabbers tend to agree that the presence of a freshwater source in the fishing area can significantly enhance the abundance, size, and general health of the crabs produced in that area. They also seem to agree that those who fish in areas directly influenced by the outflow of one of the five major freshwater rivers emptying into the ocean experience higher average levels of freshwater and different seasonal patterns of

abundance of crabs due to the flow patterns of those rivers. They believe that these patterns are tied to rainfall events and water use inland from the coast. Further, they concur that the freshwater from those rivers is a benefit for those fishing there in times of drought. Most of the interviewees felt that crabbers who fish areas not directly influenced by a major freshwater tributary face a distinct disadvantage in terms of increased salinity, unless they have a strong source of freshwater coming from swamps adjoining their fishing area. Crabber C summarizes this well:

> CRABBER C: Where I fish at is …a saltwater head where a lot, most of the [other] guys [fishing in other areas of the Georgia coast] are getting some freshets of some sort. Ours is nothing but a deadhead salt. A lot what you get out the woods or the roads, no swamps to talk about. No big state feedoff [river system] or you know, even, put it this way, I'm gonna say that the freshwater that runs into the creek where I'm at is probably within a 4-5 mile radius all the drainage I'll get. And you talking about like the Big Satilla freshwater, you talking bout hundreds of miles, the Altamaha, (huge watershed), the Savannah River, you talking about major, major swamps and rivers and stuff up there that's steadily, if the water's there, its coming.

Overall, as demonstrated above in the *swamps store water* model, Georgia crabbers realize that the swamps can be a critical source of freshwater that buffers high salinity water from the ocean and to maintain their area as good crab habitat.

There are two factors cited as the source of this problem: development for residential and commercial land use, and ditching and draining for paper company pine plantations. The first is not as heavily emphasized as the second, perhaps because it is a less visible, salient process. *Ditching and draining* has been a standard approach in the coastal zone of Georgia and countless other low lying, swampy coastal areas in the United States, as an attempt to reclaim land that is “unproductive” in its wild form as

wetlands and swamps, and render it into economically tangible products and services, much in accordance with the culturally encoded principles of "progress" Dailey identified in his dissertation research (1999). Until the last few decades, coastal Georgia had never received much economic investment from industrial, commercial, or private sources except for one: pulp paper and pine tree products. Throughout the 20th century, but most significantly within the past thirty years, the timber industry transformed Georgia's coastal ecosystem by ditching and draining the wet areas to dry them out and make the land productive for forestry. This process is a very visible activity, and its results are dramatic, visual, and far reaching. Over their lifetimes, the crabbers have all watched the coastal ecosystem be transformed from a wet, swampy, diverse ecosystem to a homogenous pine tree monoculture system. Figure 4.13 below represents the location this model occupies in the developing hierarchy.

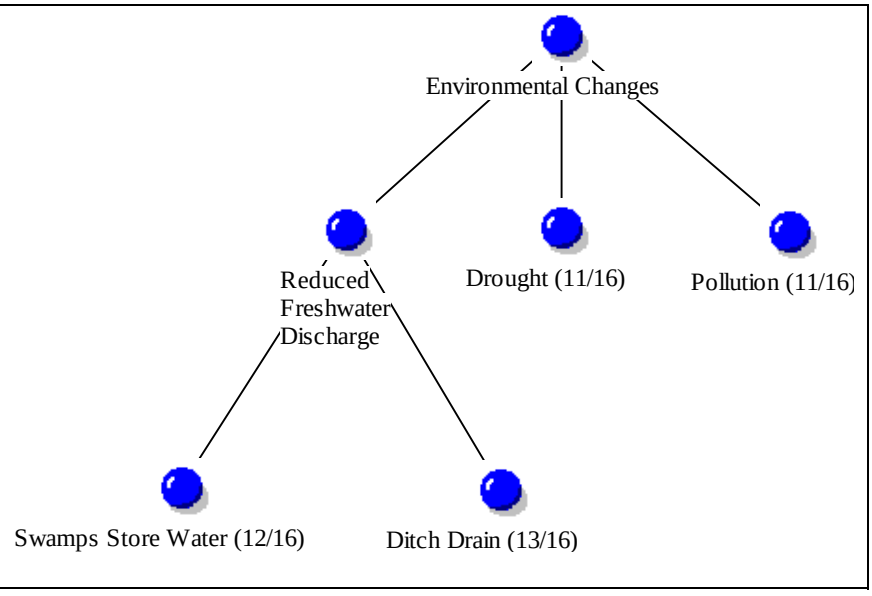
Ditch and Drain swamps is an anthropogenic environmental change that seems to be contributing to the overall decline of the estuaries, according to the crabbers. Their theory contends that draining the swamps is reducing the freshwater that is available for outflow into the estuaries to buffer salinities year round.	

Figure 4.13: Reduced Freshwater Discharge: Ditch and Drain

The first, and most obvious concern regarding *ditching and draining* the wetlands according to the crabbers interviewed is the increased rate at which rainwater runs off the land and into the rivers. The key theme within the statements offered by the interviewees related to the effects of *ditching and draining* is that it eliminated the swamps' ability to store water, accelerated runoff of rainwater, and sharpened and/or amplified fluctuations in salinity in the estuary following a rain event. Consider the insights of these crabbers; if ditches are built, they permanently eliminate and/or negatively modify the natural hydrologic patterns and runoff rates.

> CRABBER D: Its like you get a whole bunch and then its gone. And don't have what they call, more or less a trickle effect, where the swamps are holding water and that's slowly working its way out through the bushes and the woods and the trees, and now it where the timber companies got it ditched off where it rains, it hits the ditches, and its gone. It doesn't have that slow trickle effect.
>
> CRABBER I: I know …you're not getting the rain like you're supposed to, but since they drained a lot of these, um, timber companies have drained a lot of these swamps, and dug these ditches where they can't keep water in 'em no more, they just, seem like its changed the environment a lot, because constantly drains, either the water, when it rains real good, the swamp, you can't go in the swamp no more and walk through water up to your knees like you used to, …there's no water around them, the water constantly runs off cause they grow pine trees in the swamps now, you know, I dunno, all these hard bottoms is being drained off and everything, and it seems like its hurt the environment a lot.

Crabber C also is similarly concerned that *ditching and draining* changes the rate at which water and other materials pass through the system, thus interfering with temporal cycles and nutrient cycles within the ecosystem:

> CRABBER C: I would say that natural drainage is flushing food source or flushing the ingredients of whatever is there or what needs to be there to the

> (CRABBER C, Continued) marshland, (The natural system?) right, once we get that flush to that marshland, and it flush the marshland just like, uh, it would be just basically like uh, your toilet hanging up. It's flushing your sewer system too quick, not letting it act naturally like it should, or like we know it should, and, washing all the damn good stuff out. So what is depending on like, just like I said, like a toilet, if its flushing too darn much too quick, then instead of your grass getting the nutrients and ingredients like your sewer system, and where you see the grass growing real (CRABBER C, Continued): good, its flooding it and its not getting what it needs where it needs it, or like its thinks it needs it.

Although this is a somewhat circuitous quote, Crabber C's concern regarding interruptions of proper flows of nutrients and matter essential to the coastal system is clear. Crabber E elaborates on this topic:

> CRABBER E: The destruction of our hardwood bottoms and stuff, up on the hill that I've seen has a great impact, especially during heavy rain events, uh, on the systems in general, I think that's, you know, to me, cause I'm an outdoorsman, deer hunter, uh, I notice that, other people wouldn't, uh, your just your urban sprawl, you know, as you go in an area and blacktop a place and put a mall in there, you know, that rain, when it hits, runs right straight off into the rivers. Uh, you know, since I've been here twenty years.

He is saying that rapid runoff is bad for many reasons, primarily that destroying the hardwood bottoms (he implies that this occurs due to forestry activities including ditching and draining) reduces the land's ability to retain freshwater from rainfall in a similar manner to the effect of impervious surfaces in urban areas. His conclusion is simply that this must be a negative impact in that the rain never has a chance to percolate into the ground and recharge the system. Other crabbers believe that increased runoff rates change the time and duration that optimal habitat conditions will be available to crabs, interfering with specific stages of their life cycle, or overall levels of health and vigor, contributing further still to the crab population decline. Consider the following two

passages, clear examples of complex understandings of how ecological parameters can affect the progression through the normal sequence and duration of the stages of the crab's life cycle.

> CRABBER C: Well, they would theoretically be that way, because they hunting freshwater, now. Hotter times of the year, yeah, they'd be further toward the estuary, up in the estuaries, because they naturally, why I don't know, but naturally, from what I know, they do go toward the more freshet or brackish, less salinity water. The warmer water gets, the closer they want to get to freshwater, and in the spring of the year they want to get up there, there's something to do with their natural whatever they do that they got to have that low salinity water to shed properly, do what they gotta do, uh, with their reproduction. You gotta have runoff, but too quick, they don't have enough time to do what they need to do. That's what I think, they got a shorter period, and then that shorter period, the less that's gonna survive. That's in all reality, should have a detrimental effect tot he reproduction which is some people think its overfished, but its because all the natural stuff not there to make them fulfill their lifespan as quick or during the time period they need to. They don't have time period there because the water's running off too damn quick to do it.

> CRABBER J: Well, I think it does, because those diseases live in the higher salinity water. And when you catch these crabs now, that's light right now, they're so weak, there's no punch, no movement to 'em, you throw them in the box and they just kinda lay there. You get a good run, a shot of water, freshwater, and those same crabs, in the same rivers, are twice as spunky. So, yes, I have to say the salinity or the temperature, uh, I mean not the temperature necessarily, but the salinity, I think right now it has a big to do with what a crab's doing in the summertime. Because if you go to anybody's crabs, and take the freshwater crabs versus the saltwater crabs, the freshwater crab is more lively, he lives longer, you go right to one of these crab houses and markets, say I bought a box of this guys crabs (fishes more freshwater area) and a box of my crabs, and I held those two boxes for 48 hours and went through 'em, I promise you I'd have twice as many dead loss as he would have. Therefore, I'd have to throw it to the salinity causing it. Then the environment, what has caused that salinity to be there, and there's a lot of people don't want to hear it, it's the damn truth to me, is the major cutting of these hardwood wetlands and the swamp bottoms and the ditches. And how I can explain that to anybody, I don't know. But it's the damn, that's where the culprit's at. Cause we never had this problem 'til we seen the results, of all the hardwood gone, and all the swamps drained. Now we seeing the results.

This crabber is trying to describe that under normal circumstances, crabs seek freshwater and move up the estuary until they find the balance between fresh and salt water that they prefer, typically in the hotter times of the year. When they do find that optimal balance, they are most energetic, grow the biggest and the fastest, and have the most vigor, lasting longest in the shipment to market. Obviously, his conclusion is that without freshwater present in the system, crabs suffer in a variety of ways, not the least of which is their health, which affects their ability to survive, reproduce and maintain a good population, but also to generate good profit for the crabber in their ability to survive en route to market. In order for them to find that balance during the hotter months of the year and remain in their historically "normal" range, they need a source of freshwater runoff to maintain the salinity in that area. Otherwise, they will have to go further upriver into the swamps, out of reach of the crabbers, or if they are unsuccessful in finding that salinity balance, they may be unable to mate properly, shed properly, feed properly, and otherwise complete their life cycle stages within the natural, normal time frame.

The final component of the *ditching and draining* model is the understanding of the permanent and dramatic hydrologic changes the ditches have apparently wrought within the coastal systems on which the crabs and crabbers depend. Perhaps the fear that the system has been pushed beyond its ability to absorb diverse human impacts and that it will never be able to achieve its level of productivity and resilience is heightening their concern. Many of the crabbers interviewed are concerned about the effects of *ditching and draining* on the salinity of the estuaries, but in particular, Crabbers I and M are very vocal on this topic:

CRABBER I: That's right, everything's in draining, what they're doing now when they cut these swamps up, they're cleaning them up and planting pine trees, you know. Like the man says, you know, he told us, when we went up on our lease, for the hunting club, we used to pay 350, now it went up to 400 dollars, went up on our lease, it looks like a desert out there now, he says we're in the tree business, we're not in the raising of deer, hogs and turkeys business. They don't care about that, they're in the tree business. If we don't want to lease it, they got (CRABBER I, Continued): people that would come right in there and lease it from us, you know, they'll pay the money.

CRABBER M: Yeah, that's because of the ditching, and the destroying of the wetlands, cutting all the hardwoods out, and the gum, and the everything down where the cypresses is, and just going in there and clearcutting and then planting, draining it so it will dry up so they can plant a pine tree. You know, that's what its about.

CRABBER M: When the rain we do get, it runs off out there too fast, cause of the ditches, you know what rain we get it rains a lot, it just whew, and its gone. Used to, the swamps used to hold it, hold a certain part of it, and it seeped in there, you know, even if it didn't, I don't know if it worked like this, but I think it goes underground to it someway sometimes, too. You know? Evidently, these swamps was a reservoir for it, you know?

CRABBER M: Yeah, hundreds of acres of swamp that's just dry. Not just here, but all the way to Townsend like that. All that water from that way crossed the other side, west of I-95, Used to come in there at the Days Inn. All right, but they had to ditch, they ditched a big canal through yonder, over there at the Heron Bridge, canal, goes through that pasture over yonder, and it goes, all that goes to Darien now, if they any rain. It don't come back this way, to feed this river, this Sapelo river.

CRABBER M: And so the other side, they dug a ditch, on the other side of Briar Dam, and all that water goes to Darien. But all that, this whole north end of this county, has been drained. And that, and its killed the freshwater getting out here in these rivers… This river here used to turn red, right here at the boat ramp, used to turn red when you had a good rain. And the crabs, boy you could just catch crabs. Even over yonder on Blackbeard, uh, it was, enough water would come through from Riceboro and the Sapelo River, to make that water over there, uh, the salinity, good for a crab.

Reading these statements is like reading an ecology textbook of sorts; documentation is given to the functioning of the original system, then comments are

made on both how specific human activities changed those patterns, as well as on the hypothesized indirect impacts these changes have had on the crab population. The crabber model is essentially that swamps serve as freshwater storage areas that feed freshwater into the estuarine system slowly over long periods of time. Some link the increased rate of runoff with sharpened peaks and valleys in salinity fluctuations, and relate this to increased rates of crab migration in response to these changes. All link increased salinity to reduced water storage of the system, and that reduced storage is obviously caused by the "improvement" of the land for pine tree production. A crabber offered this response to a question relating to how should we move into the future and work to preserve the coastal crab fishery and its related ecosystem. His answer reflects the conservation dilemma faced in coastal Georgia, but also across our nation:

> CRABBER C: Probably the main thing that would make [the crab fishery] survive, I would say definitely have some more rules and regulations on import meat, there's no doubt on that, that's definitely hurt us, (leveled out the prices), you know, there's no doubt that more law enforcement on poaching, especially traps and all helps us some, harassment and uh ... on some of the law enforcement hasn't helped us, being harassed over particular stuff that really don't mean a hill of beans, there's no doubt that there needs to be more studies done on what effect the freshwater runoff has, we need to get more documentation to make sure that what I think is right is right, but damned if you do, damned if you don't. If you say yeah, we need to dam up all these runoffs, that all the paper companies are putting in, hell, my wife works for a paper company, you know, you gotta have toilet paper, what do we really want and what do we really need. Do we need crab meat or toilet paper. I don't know the answer that would make it better.

Summary

This chapter lays out the basic cultural models and their component sub-models that the crabbers maintain in order to define, organize, and allocate their knowledge about crabbing, being fishermen, and the species they pursue. The most general level model of

Trial and Error functions as an identity model, defining who crabbers are in terms of what they know and how they use their knowledge of the ecosystem they operate within. Second, the model of *Essential Knowledge* is the cognitive structure that functions to enable them to access, utilize, and allocate their knowledge efficiently; this enables them to be successful as crabbers. Third, the model of *Environmental Change* is the result of their need to explain the decline in the crab population relating to the vast storehouse of ecological knowledge that they have amassed during their lifetime on the water.

The crabbers interviewed clearly share a system of cultural models that structures their understanding of the blue crab and its estuarine environment. The models presented in this chapter present numerous individual models and their associated sub-domains that warrant individual exploration. Please see Appendix E for an example of how quantitative approaches can be applied to further explore findings generated from qualitative approaches to cultural models analysis like this to open new areas for analysis.

CHAPTER 5

SUMMARY AND CONCLUSIONS

Summary of Findings

Three major cultural models utilized by the Georgia blue crab fishermen are identified through this research: *Trial and Error, Essential Knowledge,* and *Environmental Change*. The most general model, *Trial and Error,* functions as an identity model, defining who crabbers are in terms of what they know and how they use their knowledge of the ecosystem within which they operate. Second, *Essential Knowledge* is the uppermost cognitive structure organizing the hierarchy of sub-models relating to their knowledge and ability to function efficiently as crabbers. Third, the model of *Environmental Change* results from their need to explain the decline in the crab population in relation to the vast storehouse of ecological knowledge that they have amassed during their lifetime on the water.

A number of lower level models are also identified in this dissertation that support these three upper level models. These sub-models are tied to specific components of crabbing behavior, like *being strategic*, the relationship of "crab location" to environmental patterns and processes, or the ability of a crabber to either anticipate or be able to adapt to market or environmental fluctuations and their impacts on crabs or the crabber. The documentation and description of these models is intended to contribute to

the growing anthropological and ethnoecological literature regarding fishing people and the characteristics of their experience-based ecological knowledge systems.

Understanding where fishermen feel they "fit" in terms of the cultural value of their knowledge through the division between science and "non-science" is important for two reasons. First, this concept shows that at one level they are at times intellectually marginalized; their years of observations and experience are, in some cases, diminished to simply "anecdotes." Second, it shows that their experience is based on predictive understandings based on observed causal relationships and a need to understand the workings of the ecosystem to maximize their economic opportunities when harvesting the resource. Their knowledge is not the least bit haphazard or anecdotal. My research seeks to give them credibility as knowledgeable stakeholders at the decision-making table, showing that as a whole, they do not approach their understanding of the environment "willy-nilly," but in a rational, methodical manner much like scientists. Perhaps, in a sense the only major difference between crabber knowledge and scientific understandings of the crabs and the estuarine ecosystems is that scientists use the scientific method to ensure the validity of their observations. Crabbers, however, rely on their memories, journals, and their collective ability to share and communicate knowledge. This, in the language of science, weakens the authority of their statements and explanations regarding environmental phenomena.

Every farmer, fisher, or participant in activities directly influenced by the environment knows that some knowledge about that activity may be learned from literature. However, they also are likely to point out that the ability to apply that knowledge usefully can be gained only from direct, hands-on experience. Understanding

what knowledge the crabbers have is key to evaluating etically what domains of knowledge are central to crabbing. This analysis demonstrates that certain models help the crabber know where to look to find crabs at different times of the year based on such things as life cycle patterns, salinity patterns, weather patterns, tide stages, moon phases, air and water temperature. Obviously these represent individual domains of knowledge; each its own model and associated hierarchy of sub-models and schemas. The models presented in this dissertation under this category are just scratching the surface; for example, a hierarchy of models and schemas could likely be identified and described which relate tide to crab location and/or habitat preference.

Perhaps the most important model and model hierarchy identified in this research is the overarching model of environmental change and its component sub-models. The question that weighs on both the fishermen and the managers involved with the Georgia blue crab fishery is the continued decline in landings, despite the implementation of the collaboratively designed limited-entry, gear-restrictive fishery management plan. Why, if the fishery is now being managed at a level that is more reflective of what managers and biologists feel is more sustainable, is the fishery continuing its downward trend in production? Chapter Four indicates that fishermen have their own theories, based on their experiential data, that enable them to explain the environmental changes they see. The research presented in this dissertation shows that fishermen and scientists, in some cases, hold similar theories in relation to the phenomena they consider to be contributing to the decline in crab production. The explanatory models offered by the crabbers are consistent enough and collectively coherent enough to represent their own cultural models, which were discussed in Chapter Four.

Again, the point of detailing these models is to show that they are substantially similar to the mechanisms and ecological phenomena that scientists are interested in investigating as potential sources for the decline in crab production. Scientists at the University of Georgia are interested in modeling residence time of nutrients in the estuaries, and are building complex numeric computer simulations of the tidal currents and flushing patterns of particular areas in the Georgia coast. Crabbers talk about specific areas being places where salinities are differentially influenced by physical factors like proximity to freshwater rivers, upland swamps, or specific physiographic characteristics that render certain areas prone to being inundated with fresh or saltwater at different times of the year. They may not be interested in contributing the highly specific forms of data required for the design and functioning of such computer models, but they could easily provide "ground-truthing" evidence to contribute to assessment of model results or predictions. There is even the possibility that they could function as field guides of sorts, identifying certain areas of their fishing territories where they feel they have observed evidence that supports the scientists' theories. Being native to the region, these fishermen have a vast knowledge of the ecosystem, and their historical knowledge of what it once was is very clear. Consequently, while they acknowledge that fishing mortality may be one of the reasons for the crab decline, they also recognize that a relationship exists between land transformations and the increasing decline of their estuarine fisheries. Hopefully, by demonstrating that there is a system and structure to their knowledge of the physical and ecological mechanisms of the ecosystem, both current as well as historically, this research will show that they need to be considered a

more significant source of knowledge and information that can enable them to contribute greatly to the research process.

Project Limitations

As with all research efforts, there are limitations inherent to this work which warrant discussion. Something that may have attracted attention with this project is the overall number of interviewees that collectively form the sample used for cultural models analysis. It is likely that in almost any research project involving human subjects the researcher would wish to have collected or interviewed more subjects during their fieldwork. However, the sample I collected was adequate for the purposes of this work because analysis revealed substantially high levels of within-group agreement among the responses offered by all interviewees. This high degree of intra-group consistency permits the conclusion that, as a whole, the crabbers interviewed represent an adequate sample of the fishery.

Qualitative assessment of cultural models, regardless of sample size, is one part of research that addresses the human dimension of fishery management plan development and design. Anthropologists should seek to balance such assessments, based on exhaustive hours with interviewees and collaborators, to ensure that their analyses are truly representative of the people they have studied. During the development and data gathering stages of this research, cultural consensus analysis of survey data appeared to be an appropriate methodology for substantiation of the qualitative cultural models analyses. To achieve this, an attitudes assessment survey was created from an array of

statements taken from interviews and ethnographic data and was distributed to every current licenseholder in the entire Georgia blue crab fishery.

Using ethnographic notes and interview data enabled the creation of a survey that attempted to represent the spectrum of issues relating to crabbing knowledge. This survey presented these culturally significant topics as questions and statements with a five point response option Likert scale. The intent was to apply consensus analysis (Romney et al. 1986) to evaluate the results and assess the nature and extent of intra-group agreement regarding these statements. Then, if appropriate, more specific statistical tests of variance could be applied to further explore patterns of variations in the agreement data. Quantitatively identifying and exploring the characteristics of intra-group agreement on a particular survey statement, positive or negative, was intended to provide support for the cultural models identified through the qualitative analysis of the interview transcripts.

However, one fundamental issue emerged during the final data analysis that prevented the full utilization of the survey data as originally intended to contribute to the cultural models analysis presented in this dissertation. It became apparent that cultural models are a constructed description of a cognitive framework that can only be identified and described within the context of native discourse. A crabber's statement like "high salinity makes a crab move upriver seeking areas of lower salinity" can be seen as representing the core of a cultural model only when it is identified in its native context. This means that the model can only be described as such when it is present in its original and entire contextual framework; this is only possible when working with recorded and transcribed native discourse. Furthermore, it is only a model when the contextual

relationship of the concept to other culture-based elements is present and repeated by the majority of the other interviewed members of the population.

When a statement that may be the core concept of a cultural model is isolated and presented as a statement in a survey to elicit an agree / disagree response, the context that once gave it "model" status is lost. This is because the cognitive context of a group member's response to the statement is inaccessible to the researcher during analysis, and the researcher cannot determine if each respondent's opinion is derived from the same cultural logic. The resultant data representing group level patterns of agreement on statements derived from cultural models cannot, therefore, contribute to the analysis of cultural models. However, even though quantitative assessment does not actually generate supporting evidence to substantiate the existence of a particular set of cultural models, it still holds promise as a technique that can be used to enhance the exploration of intra-group attitudinal variation related to key elements of crabbing knowledge identified and described during cultural models analysis.

Conclusion

Natural resources management in the United States as well as throughout the world is a truly interdisciplinary, multi-level effort. Fisheries have traditionally been a difficult resource management challenge due to several characteristics. Considering the biological component alone, fisheries are difficult to understand because the models are based on landings and estimated recruitment rates, which are estimates of what actually occurs within the population under the visual barrier of the water. One cannot truly count the fish or assess diversity in pelagic or coastal fisheries as a forester would trees in a

forest transect. Models of recruitment and reproduction rates are all based on estimated data, and subject to the enormous stochastic variability of the natural, marine environment. This is not to say that these fishery models are invalid- it is just to say that they are approximations, and the variables on which they are based are subject to continuous fluctuation.

While fishery management depends on good data to understand the ecological status of the stock being managed, controlling and shaping the activities of the people who harvest the resource is truly the ultimate goal of regulation. Understanding people is as difficult as understanding ecological and biological aspects of a resource. The central challenge is that marine resources are typically recognized to be open access, public resources. Traditionally, open access creates problems with allocation and distribution of a resource among its stakeholders.

There are two basic schools of thought influencing approaches to regulating human behavior in regard to harvesting a commonly held natural resource. Some schools of thought posit that individual rationality will ensure optimal use and management; the individual acts rationally, knowing that they need to manage the resource in such a way as to maximize their individual return, but also to sustain their activities over a certain period of time (Perman et al. 1996). Others argue that open access makes for a "Hardin-esque" tragedy of the commons situation, where the resource is quickly degraded or consumed by overuse due to the individual's fear that if they do not collect as much of the resource as they can, the next person will (Perman et al. 1996). In this scenario the fear is that other individuals will consume infinite amounts if allowed, so each individual tends to gather the largest share they can to maximize their return (see McCay and

Acheson 1987). Elements from both scenarios have elements that are present and significantly influence behavior of the participants in modern commercial fisheries in North America and around the world. However, a third element, a cultural component, including behavior regulating social systems, values, specific knowledge domains, also shapes individual decisions regarding harvesting the resource, rendering individual and group behavior very different from what the economic or business-based models might predict (Durrenberger 1997, Gatewood 1983). For fishery management, this third element may be the most difficult to assess; this dissertation is intended to contribute new approaches to addressing this challenge.

National Standard Eight of the Magnuson Stevens Act mandates human dimension research for marine fisheries management in the US, stating that all conservation and management efforts will evaluate and assess the importance of the fishery resource to the fishing community that depends on it. The goal is to ensure that policy enables these communities to continue to participate in the fishery, and to minimize adverse economic impacts on such communities. The research related to this is commonly referred to as the "human dimension" of the management issues. Research conducted to assess this has typically included extensive surveys designed to measure use values, attitudes, patterns of behavior, and reactions to proposed management options. The Georgia Blue crab fishery is no different, having been extensively researched by Orbach (1996), Orbach et al. (1997), and his students (McIntosh 1996, Murray 1996, Sortais 2000), but again, their studies are limited to what the crabbers do, how they utilize the resource, and their reactions to certain limited management options.

These studies lack an in depth exploration of the knowledge, attitudes and opinions of the crabbers. Without going beyond superficial economic, physical, and behavioral components of the user groups involved, the management plan is potentially flawed and less likely to work very effectively. The managers might wonder why, if the data so clearly show a decline in the resource, why do these fishermen, as rational human beings, continue to overfish it? This is especially true when managers learn that fishermen do believe that overfishing may be a factor contributing to their fishery's decline, and yet they continue to exhibit overfishing behaviors.

The application of cultural models research theory may be one of the best methodological contributions from anthropology toward the effort to satisfy the requirements established by National Standard Eight (NOAA Fisheries, National Marine Fisheries Service 2003). As discussed in the literature review presented in Chapter Two and the data analysis in Chapter Four, cultural models are defined as cognitive structures that provide flexible, adaptive frameworks for interpretation of external information. Dailey (1999) makes a key point by emphasizing that cultural models analysis is much more than analysis of culturally embodied meanings. Meanings are static, functionally isolated elements. Dailey agrees with D'Andrade's (1995) definition of cultural models as structures that hierarchically organize meanings and cognitive elements into a dynamic, hierarchical framework that at every level is directly linked to motivating the individual to action. These assemblages of cognitive structures are not fixed, discrete elements; rather, they are subjectively variable, flexible, and successively nested within other assemblages of models. They form a web of interrelated, flexible, adaptive interpretational structures that enable the individual to assess situations and react to them

efficiently and appropriately. Cultural models, in the context of this research, can therefore be seen as the cognitive devices the crabbers actually use and believe; they enable the fishermen to function effectively in their daily activities. Identifying the models helps understand why crabbers fish the way they do, how they understand the dynamics of the resource, and why they react the way they do to certain management alternatives, fulfilling to an extent the goals of National Standard Eight (NOAA Fisheries, National Marine Fisheries Service 2003).

The process of identifying cultural models is still evolving, consisting largely of of ethnographically based semistructured and structured interview techniques coupled with systematic analysis of the collected interview data using several manual and computer-aided automated methods. The goal of this analysis is to identify the presence of a shared, fairly uniform cognitive structure in the discourse collected during the interviews. This structure, the cultural model, may or may not be consciously acknowledged by the speaker, and may function at a high level of abstraction, organizing many sub-level, more action-oriented models, or it may itself be a very specific, task oriented model, also known as a schema. The methods used for analysis in this research were fairly simple; individual fishermen were interviewed separately using the same semistructured interview schedule, the interviews were tape recorded (with permission from the interviewee), the tapes were transcribed into a word processed document, and qualitative data analysis software was used to organize, code, and analyze the transcripts for content.

The first step in this analysis is to use the software to determine what central concepts are present in the interviews. Using ethnographic data as a starting point,

keywords are investigated in terms of the nature of their usage, context, and generally accepted definitions. Patterns emerge from keyword usage and give the first clues that a model is present. Since the interviewees were separate individuals giving their own independent responses and opinions, if the majority of them used the same key word in the same manner or context, and explained an ecological phenomenon or a concept in the same basic way, then a model was determined to be present. This is not to say that if they all say "the sun is yellow and bright," then a cultural model exists. Rather, the key words form the central core of a larger structure, and if the context that surrounds them is the same for all interviewees, then a cultural model is determined to exist that is defined or represented based on that central key word.

Consider this scenario: a cultural model exists in a fishery regarding stock recruitment and population growth that has produced lower-level action-oriented models that fundamentally shape fishing behaviors in relation to seasonal activity and gear or effort levels, and has done so for generations. New biological research has generated a need to revamp the seasonal restrictions and gear rules. Without understanding why the fishermen see the fishery the way they do, their fishing activity will not be understood as a product of their cultural models of fishery biology. Any rules put into place are less likely to be received as an attempt to incorporate better science into conservation, than as just another example of managers trying to interrupt the flow of the way they should be able to conduct their business of fishing. Fishermen do not act irrationally; they act in manners derived from their specific understandings of their environment, resource, and their daily and seasonal economic needs. Understanding this will help managers better

reach out to meet the needs of the fishermen, or more importantly, to help show that they are trying to protect the resource while keeping the fishermen in business.

In conclusion, the Georgia crabbers are not a group of individuals who possess a collection of anecdotal environmental data, an assemblage of stories and wild, untested theories about the blue crab and its environment. Rather, they are an assortment of resilient, resourceful, fiercely independent individuals who, through their ability to observe carefully the nuances of their environment, have become expert in reading ecological information to aid them in locating and extracting an externally invisible prey from the depths of the estuarine environment. Their years of experience on the water have provided them individually with a database of ecological information uniform enough to create a system of cultural models that is shared and used, adapted and applied to meet individual demands among the crabbers. Their knowledge is likely to be similar to that of blue crab fishermen in Maryland or Louisiana; however, the Georgia estuarine environment is different from those areas, so although they pursue the same species, fundamental differences in ecological knowledge are likely to exist that may differentiate Georgia crabbers from their peers in other US blue crab fisheries. Cultural models are essential components that must be studied, identified, and understood not only to contribute to anthropological understandings of ethnoecological knowledge and ecological knowledge systems, but also to aid in the facilitation of a productive, complimentary interactive relationship between managers, scientists and fishermen. The knowledge these fishermen have of their environment is incredibly deep and extensive, and although the Georgia crabbers present their information in essentially a different language than that spoken by scientists, using the tools of cultural models analysis and

consensus analysis can help translate and bridge some of those gaps, bringing the two stakeholder groups more close together.

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APPENDIX A

ETHNOGRAPHIC ESSAY

Going to Work

He opens his eyes to the darkness and glances at the clock, even though he doesn't need the clock to tell him it's 4:30. His wife murmurs something as he slides out of the bed, home from the graveyard shift at the hospital just a few hours ago. Pulling on a clean pair of bluejeans from the folded stack on the cane chair next to the bed, he shuffles into the kitchen. The sudden brilliance of fluorescent light fills the room, and squinting, he starts a pot of coffee. With a yawn, his wife's black cat opens one eye from her perch on the washing machine in the corner and watches the morning ritual through a sleepy haze.

While the coffeepot sputters and snorts, he brushes his teeth in the adjacent bathroom. The cat has lost interest, and is asleep again. Splashing some water on his face chases some of the sleep away, and he returns to the kitchen. With a slow yawn, he pours the coffee into a battered plastic mug and turns off the pot. He rummages through a drawer by the telephone and grabs his wallet, keys, and watch. Grabbing the Winn Dixie bag with his peanut butter and jelly sandwich lunch, he shoves his wallet into a back pocket, and steps out into the damp, cool night air. He knows he'd better enjoy it while he can, soon even the nights will be hot. The cool in fall and spring is his favorite time of year, mainly because the weather's nice, but also because crab prices are better

than they are in the heat of summer. A flash illuminates creases around his eyes, knowing lines that mark the days and years he has spent learning the water, and he lights a Camel, pausing for a few moments to listening to the quiet sounds of the dark Georgia spring morning.

The kitchen light pours from the front door, spreading out across the porch floorboards, dissolving quickly into the still inky dark. From the edge of the yard, an orange dot bobs suspended until his silhouette materializes from beneath the live oaks, as he walks out across the yard towards his truck. Before he even gets halfway there, his old yellow dog crawls out from under the toolshed and ambles over, grinning, huffing, and growling as usual. He reaches down and pats Winston on the chest, asking him if he wouldn't mind sticking around the house and keeping out the riffraff while he's out fishing. Winston's too old for crabbing now, and he'd rather have him here to keep an eye out for the shiftless individuals who tend to wander in off the highway. It's good to have a dog like Winston around the yard to keep people honest. Too much gear and tools lying around to let people wander through. Stuff goes missing. Can't ever afford to lose stuff, especially these days, catching only three or four boxes a trip, half of what it was last year.

Fumbling in the softening dark, he unlocks the door and slides into the cab. The starter wakes the V-8 into a low, steady rumble. He gets back out and walks around the rig and checks his equipment, like he does every day. Stepping over the trailer tongue he tugs on the hitch lock while checking the winch cable. He climbs aboard the boat and stuffs his sandwich under the steering console. With his toe, he nudges the waxed cardboard flats of pogies on deck in front of the console- the bottom boxes are still

frozen, but the fish on top have softened and will be perfect bait by the time he gets to the river. It's still cool enough to leave them out overnight; but pretty soon he knows he'll have to leave them in the freezer until morning or they'll spoil before he's done pulling traps in the brutal summer heat. Standing behind the controls of his boat in his yard, high atop the trailer, he pauses, listening to the mockingbird mingling its voice with the country music drifting out of the truck fading in and out over the thrumming engine.

He hops down from the boat but stops, peering back inside to see if there are enough boxes in the boat for his catch. He grabs another box full of old burlap coffee sacks from the shed. These sacks, which have been wet in brackish water and tucked atop countless full, squirming, bubbling boxes of crabs, have absorbed an essence of crab, which wafts into the cool air around the boat. The sharper scent of the pogies overpowers that of the sacks, but combined, they create the unmistakable smell of crabbing. He also unhooks his orange rubber coveralls from the hook in the shed and, stretching over the gunwale, stuffs them into the console next to his sandwich to keep them dry on the ride to the boat ramp. It's no fun to start out a cool morning with your slicker pants wet from the morning dew or yesterday's rough wave- got to have them dry. He tosses an extra gallon of two cycle oil in a box beside the console just in case.

One last look- he runs the list in his head almost unconsciously- slicker pants, boots (already in the truck warming under the heater floor vent), boxes, sacks, bait, gas (topped off the day before, like every day, after crabbing), extra oil, sandwich, and the boat FM radio on, tuned to the same station as in the truck. He slides back into the cab, drops it into gear, and sips his coffee as the rig slides out from under the live oaks and into the palest hints of dawn on the highway. It's not even 6:15 yet, but the traffic has

begun to pick up, the headlights coming across the highway snaking through the marsh, workers on their way to the pulp mill. He's glad to be heading the other way, always quick to assert his gratitude to be his own boss. He slows and pulls into the darkened parking lot of the convenience store on the way to the river. He's beaten the grumpy lady who opens the store in the morning to the store every day this week. He stands by the door, now empty coffee cup in hand. Not even a full minute passes before the lights within come on, and she shuffles over and opens the door, keys jangling in chorus with the bell inside. He pours a cup of coffee, dosing it liberally with cream and sugar, and grabs another pack of Camels at the counter. He tries to crack a joke with the cashier, but she's too tired for laughter. Walking out into the parking lot, passing a few bleary eyed commuters on their way in, he notes the faint puffs of a southwest breeze. Pausing before he gets into the truck, he looks at the plume out of the stacks from the pulp mill a mile off to the east. The telltale vapor trails ease upward a few hundred feet and then are topped off and pushed eastward by the west wind. This is a good sign, he knows. West winds, especially gentle ones, make for a smooth day. Northeast winds, blowing the pulp mill smoke straight down from the stacks and then south over the sound are rough, awful days. Today will be smooth, as far as weather goes. Too early to tell about what crabs will do or whether the price will stay good today.

An eighteen wheeler loaded with pine logs roars by on the highway, sending a tornado of pine bark and a Wal-Mart bag into the ditch at the edge of the parking lot. He shakes his head as he climbs into the cab, thinking of the waterlogged hardwood swamps of his childhood that have since been drained and cultivated with pine trees for the pulpwood industry. He believes in his heart that those freshwater swamps were an

important part of the estuaries, feeding them a steady trickle of freshwater year round, helping maintain the proper salinity balance that he knows blue crabs prefer. But, nobody seems to want to listen to his arguments that the lack of swamps is changing the salinity in the estuaries, and contributing to the crab population decline- pine trees are jobs, and the plants bring money. Yes, he knows that's true, but won't back down, asking the tough, unanswerable question- are jobs worth destroying the entire coastal ecosystem, not to mention the fishery that he and scores of other hard working men have made their living from?

He starts the engine once again and eases out back onto the highway, trailer wheels clanking the gas tank cover plates in the parking lot. The lights of the pulp mill glow in the distance, but are fading against the brightening dawn. Down the road he rides, listening to the local DJ's national news parody. Shania Twain comes on- the DJ always seems to play her this time of the morning to wake everybody up. Along the way, he passes by an old roadside store abandoned since I-95 took the traffic away from the old coastal highway years ago. Antique gas pumps rust quietly beneath the sagging tin roof, and torn remnants of screens hang languidly in front of broken windowpanes. A white lettered advertisement enticing prosperous Northern tourists with peanuts, a Coca-Cola or games of chance peeks from beneath subsequent identities, disintegrating themselves once again.

Another log truck rushes past just before he turns off the two lane onto a side road that immediately disappears between identical stands of pine trees, rows as geometric as individual stalks in a farmer's cornfield. A few wild hogs scurry startled across the road, vanishing quickly into the underbrush on the other side. His headlights cast only a faint

yellow splash across the pavement, as the morning sun has begun to gather its strength for another day. About a mile down this side road, the symmetry of the pine trees give way to a jumble of live oak trees, Spanish moss, and junk an old man collected around his bungalow. The road leads to a boat ramp adjacent to this house, perched by the headwaters of a muddy tidal creek. He turns around gently, the trailer springs creaking over a few wayward live oak roots. Straightening out, he backs up to the top of the ramp and stops for one last check. Everything's ok, the boat won't sink, he chuckles to himself, and proceeds to back the trailer down into the water.

The tide is in his favor today- it's coming in, and hasn't yet reached mid-flood; he'll have enough water out there while he works, and have until noon to get back and on the trailer without too much hassle. He usually can't get back to the ramp at low tide; there's not enough water in the creek. He times his trips with the tide so he can leave and come back without waiting for the water to come back into the creek. The last thing he wants is to have a full load of crabs and be forced to sit around out there waiting for the tide to return; the longer the crabs are out of the water and not refrigerated, the higher the dead loss will be, and the less desirable his product will be to crab buyers. Some fishermen pay someone with a hoist to lower their boats into the water, and that eliminates worrying about the tide and allows you to work on your own schedule, not the tide.

But, he likes the solitude of this place and knows he won't be aggravated by other fishermen or recreational boaters here. Boat hoist fees are getting more expensive every year. Plus, the places that have boat hoists are beginning to cater to recreational boaters more than the commercial fishermen. His trailer wheels begin to descend towards the

water, and he opens the door, peering out to watch. Once the trailer clearance light vanishes into the muddy water, he brings the rig to a slow, sliding stop on the muddy ramp, and sets the parking brake just in case. The water's a little higher today than usual, and is lapping at the rear tires of the truck. He decides to put his boots on now. He steps out of the cab, leaving the engine running and the door open behind him intentionally, in case he has to make a mad dash to save the whole rig from rolling into the river. Before hopping up onto the bulkhead alongside the ramp, he walks around the back of the truck and unclips the trailer winch strap from the bow eye, freeing the boat from the trailer.

He balances along the top of the slippery wooden bulkhead and walks the length of his boat, unconsciously scanning her for anything unusual, anything out of place. Reaching her stern, he casually steps across the watery gap between and lands squarely inside the low gunwale in the aft cockpit of his boat. The tight, dull thud of his foot is not noticeable, but to him is reassuring- the deck is stout and sound, encased in layer upon layer of fiberglass that he himself laid. He lowers the big outboard motor down into the soupy brine and fires it up. The engine sounds like a muffled hot rod, sputtering and coughing at first, but levels out to a mellow rhythm as the automatic choke settles out. It exhales a light gray smoke for a minute or so that disperses up the bank and into the trees with the light, shifting west wind. He smokes another Camel while he lets the motor ease into its day. After all, that motor is what makes his business operate- too expensive to abuse, better treat it right. In the meantime, he pulls on his orange slicker pants and gets situated. Cell phone goes up on the console wedged between the compass and the windshield, wallet and watch stashed a little to the left. Camels go on the right, near the control box.

He looks around- boxes and bags are arranged on the forward deck appropriately, and the bait is set up right, everything seems good. She's unhooked from the trailer, so he puts her in gear, and opens the throttle to break her loose from the carpeted bunks on the trailer. With a bubbling roar, she slides slowly backwards and he eases off the throttle. Once afloat, free from the trailer, he lets her drift back a few more feet, then shifts into forward to stop her and ease her over to the bulkhead. Putting her in neutral, he lets the current push him toward the wall, where he quickly hops off and ties her to a cleat. He strides back to the truck and trailer, pulls it out of the river, dragging marsh grass and drowned Spanish moss through the sand, dripping cascades of saltwater onto the sandy road, parched with months of drought. He parks under an ancient live oak, tosses the keys under the seat, and returns to the boat.

The sun is now just at the eastern treeline, and is beginning to glint off the water like a thousand diamonds. He loves that sight, and swears he'll never get tired of seeing that, it's half of what makes the job worth doing. He hops back into his boat, unties the bow line, and walks back to the console at the stern. He backs her out of the ramp area, puts her in gear, and spins her around, putting all 150 horses to work. She rises up out of the water and settles into a smooth plane as he runs her down the creek towards its mouth, where it joins the river at the upper reach of the sound. The smooth muddy water flies beneath the hull, leaving a hissing brown wake behind as it skims down the creek. The motor churns out a baritone howl, pushing the hull rapidly towards the first trap of the day down in the sound. He runs her just below wide open for twenty, twenty five minutes, moving from the little creek into the larger river, then from the river into the wide open sound, with nothing but the open ocean beyond. The purple-black treelines of

barrier islands frame his perspective to the southeast and northeast, lurking beneath the brightening gray morning sky, and to the west, the twinkling, shimmering lights of "civilization" speckle the dark tree-line beyond which lies the remains of the lingering night. Everywhere the view is framed by brownish expanses of marsh grass, beginning to awaken with the burgeoning spring.

He pulls on his heavy neoprene protective workgloves as the boat cruises the sound. He passes an old duck blind to starboard, zips past an Intracoastal Waterway daymark to port, and sees the mouth of a big creek that winds off the main body of the sound ahead to the east. This time of the year, the crabs are still awakening from winter hibernation, buried up in the deep mud bottom of the sounds. But, the past week has been pretty warm, and just like they always do, they're coming out of the mud, and spreading out over the now warm, shallow, muddy flats and trying to feed on what's available. Yesterday he placed a few traps up this creek to see if any were coming out of the sound and beginning to work their way up. If they were there, he promised himself that this year, he'd put some test traps a little further upriver and some of the creeks to make sure he kept up with them as they moved. Can't afford to waste even a single trip guessing wildly, taking inordinate risks- have to be systematic and observative, he knows. Wasting anything is risky when catches are down on average to only three to five boxes, compared to the typical ten box trip from only a year or two before. The scarcity has kept crab prices up, which he knows is why he is still making it on 3 boxes, but he knows that he has to make every crab count. Cutting the throttle, he coasts into the creek, his wake cresting and splashing into the marsh grass, slowly being inundated by the rising tide. There's only three traps in this creek, but when they're here, this creek

produces some good crabs, he knows, so he hopes they have begun to move in here. After all, spring is here, and they'll go in here eventually, he just wants make sure he's there when they do.

At a quarter throttle, he passes the first buoy, the second, then the third. The best way to approach the trap is against the current, it gives you the most boat control at slow speeds. He pulls a quick U-turn, cuts the throttle back to idle speed, and kicks her into neutral, to prevent tangling the prop in the trap line. He leans over the port gunwale and grabs the bullet shaped yellow foam float. He stands up, slinging the line through the sheaves of the puller, an electric winch that wedges the line between two dinner plate shaped metal discs, and trips the switch, commencing to lift the trap up to the surface. Checking the depthfinder, he notes the depth the trap was sitting at. He kicks her into forward at a slow idle, and lays the steering all the way to port. She carves a tight circle, all the while keeping the trap line inside her circle, keeping the line out of the prop, and approximately holding her position in the current. In one fluid motion, he flicks off the puller switch just as the trap breaks the surface, pulls the trap aboard, opens the baitwell, and drops it with a clang on the stainless steel reinforced gunwale, making sure the baitwell is poised over the water, not the boat. Most of the old bait flops overboard, fueling the raucous joy of the gathering flapping, swooping seagulls and pelicans. Another deliberate thunk and the rest of the chewed up baitfish is sent out for recycling. Got to make sure no residue from the rotting bait gets into the boxes that go to market- they stink up the product, and cause more crabs to die. Buyers hate that, and give you lower prices for your product. On the deck in front of him, he has a rectangular seafood box ready to catch the contents of the trap. He unhooks the bungee that holds the trap

sealed shut, and in one smooth motion upends the trap and shoots the mass of crabs into the box, spattering the deck with a light shower of black marsh mud, pieces of marsh grass, and small black snails. The skirmishing crabs crunch the slats of the box and occasionally each other with claws outstretched, struggling to find some cover.

The boat still circling, drifting slowly upstream on the tide, he grabs two pogies from the box in front of the console. Still cool, but thawed, one goes in the baitwell whole, the other torn in half to better chum the water for crabs. He flips the hatch to the well closed, flips the trap back right side up and bungees the trap closed in a particular way that he uses like a signature to prove to himself that he was the last person to open his trap. Sometimes other crabbers check your traps to see what you're doing, or recreational boaters pilfer from your traps, and it's good to be able to detect what's going on before problems arise. He grabs the line just beneath the buoy and holds it with the trap, balanced on the gunwale in front of the puller and with his right, he points the bow downstream, easing down a few yards to where the trap had been placed yesterday- two dozen crabs, half nice males isn't bad, so he'll try it again. When the depth gets just right, he knows he's there. With a flick of the wrist, the buoy sails overboard ahead of the puller, flinging green strings of slimy growth onto the deck and at a lingering seagull, and with a quick push, the trap drops over the port quarter. The remaining trap line coiled on deck zips over the gunwale. He glances around to make sure his feet aren't entangled with the escaping line. No need to hurry in here, the traps are close enough together, so he idles to the next one, and repeats the process again.

Finished with the creek traps, he idles out into the sound where he has some breathing room, and allows her to drift with the wind towards the east, knowing he has

room to drift while culling the crabs. He walks forward to the empty boxes in the bow, three abreast, lengthwise, side by side. He shoves three boxes aside to starboard, and sets the box of crabs on the remaining three boxes, straddling the middle one. With the confidence and speed of experience, he tosses undersized, weak, or newly shed crabs overboard, muttering "grow up, I'll see you again" under his breath. A quick squeeze between index finger and thumb tells him if the crab is strong enough and nourished enough to survive the trip to the northern markets, and a glance at the crab's color and underbelly tells him if the crab has enough meat to be worth keeping and selling. Occasionally he holds a crab up to a notched measuring stick to make sure it's not too small. Every once in a while his practiced eye is fooled and the crab's points don't fill the cutout in the stick, and he has to throw an otherwise perfect crab back over the side. He keeps the biggest, strongest males, "Number Ones" over five and a half inches in one box, those males between five and five and a half inches in another box, and the good fat females in a third box. There's still a market for females, since the northern crabbers haven't begun to fish yet, season's still closed, and the males haven't begun to really trap well yet down here. In another few weeks, the price will drop on females and the Baltimore market will want only nice number one males. Then the males will be moving and trapping better than the females anyway, so he'll switch to males. But he knows too, he can only catch what Mother Nature will let him, and if all of a sudden tomorrow he finds he's getting one or the other, that's what he'll catch. He knows he has to go with the flow and take what he's given by Mother Nature.

In only a minute or so he's done, dumping the box with its culled discards overboard, rinses it, and walks back to the console, dropping the box on the deck beside

the console where it will be ready to collect the next trap's contents. Can't waste time culling- it would take forever if he took his time here. But, at the same time, he knows if he were careless and rushed too much, he runs the risk of getting ticketed from the DNR for undersized crabs, or worse, keeping light, small crabs would cause his buyer to lose faith in him and quit buying from him or cut the price for his crabs.

He takes a moment to stretch his back and look around him. The wind has freshened somewhat from the west, corrugating the incoming tide with scattered standing waves, but the water is still comfortably smooth. The tide is coming in full bore now, making several knots over the bottom, swirling and scouring, creating eddies and waves at the mouths of creeks and over oyster shellbeds, filling the marsh with new water and new life. The sky has intensified from the gray dawn to a deeper blue, with scattered clouds easing out over the Atlantic. The water here is almost a pea green, still looking cold and wintry in the morning sun. In the distance, the ripples sparkle and mirror shifting mirages of the dark tree line of the islands to the north. The sun has revealed yellow and green highlights in the marsh grass, reaffirming that spring has gained the upper hand over winter. The sun disappears behind a cloud, and the western breeze gets chill, reminding him that spring is coming, but vestiges of winter still remain.

He puts the throttle forward, and his boat surges forward, pointed east to his next line of traps. Most of his traps are still in the open water of the sound, as the crabs are still waking up from their winter slumber, buried deep in the warm mud of the bottom of the sound. Targeting their movements upriver onto the shallow flats, he's spread his traps out to cover a few different depths. He has set some out like those he pulled first in that creek this morning as experimental test traps, but the majority of his traps are

targeting certain depths that have been producing well for the past few days. Because in the sound the bottom slopes gradually from the marsh to the center channel, his traps stretch out in long lines, one after the another, each line following a different, unique depth contour. In some ways, this pattern is reminiscent of the gracefully curving parallel furrows in a farmer's field. He has several lines of traps clustered in a few different areas of the sound right now, each area chosen for its own unique balance of current, bottom, depth, and proximity to the deeper areas where he knows the crabs gathered this winter to bury up and ride out the cold months.

Only two other crabbers work out here, and he's worked alongside them for years. They know how close they can get to each other with their traps before they "step on each other's toes." Getting too close makes it hard to fish traps without tangling other trap lines in propellers, and traps too close together spread the harvest out too thin. He stops and talks with these two crabbers on days when he sees them out fishing, but today neither are to be found, so until now the whole trip was spent in silent reflection, when his cell phone rings. It is his buyer, who says he'll be coming to the house around 4:00 this afternoon to pick up today's crabs. Bobby T., the buyer, said that he'd be coming up the coast from Fernandina Beach, so he wouldn't have too many stops along the way, so he should be on time, for once, he thought to himself as he ended the call.

He skims eastward around a grassy point, now facing the open ocean in the distance, and heads away from the shoreline to his right towards the center of the channel. He cuts the throttle and coasts down to the first trap in the line, the deepest traps he has going at the moment. The water here is clear, green, and crisp looking, coming in from the ocean, lacking the enormous load of organic matter and sediment it will collect

up the estuary before it returns to sea. He leans over the side once again, this time bracing himself against the gentle roll of the sound with his knees against the gunwale, grabs another float, wraps it over the puller, flips it on, puts the boat in gear, and hauls her over to port. The line winds, creaks, and groans through the churning puller, dropping green and brown organic encrustations onto the deck as it comes up from the bottom, 16 feet below.

The trap surfaces, and once again, he hauls it aboard, empties the bait, and empties its contents into the waiting box in an almost unconsciously choreographed motion. But this time, as the contents of the trap are shaken out, on top of a handful of crabs a half dozen brown spiral conch shells clack together loudly like castanets, and two hulking tan crustaceans come flying out like bowling balls, thudding loudly into the box below. One remains in the trap, crushing the wire mesh with its powerful claws. Darn stone crabs, he grumbles, always mashing my traps. He reaches in and pulls it free, but not before it crushes another mesh on the trap. He knows that even though these guys are slow, if they get a hold on your finger, it will be broken before they let go. Not like a blue crab that pinches hard but leaves your finger "just" sore or cut. With some pliers, he straightens out the damage to the trap, and checking the depthfinder and the shoreline to check his position, baits it, tosses the buoy overboard and sends it back down, straightening out and heading for the next trap at moderate speed. Returning to culling, he takes one big claw from each of the stone crabs and puts them in a small bucket. Tossed overboard, the stone crabs tuck their legs and claws in and hit the water like small cannonballs.

The blue crabs here are sluggish, slowed by the cold water, so they don't struggle as much in the box as the ones up the creek from earlier. He culls them into their respective boxes rapidly, and throws the remaining debris back overboard. Other traps out here occasionally produce small flounder, whiting, angelfish, and jellyfish, depending on the season and the tide. Sometimes hungry sea turtles chew up the traps in search of the crabs inside, out in the sounds, or way up to the heads of the tidal creeks. Their beaks are strong, and as they bite crab legs poking out through the trap, their beaks also catch the wire mesh and pinch it together. If they work at it enough, they can kill all the crabs inside and collapse a trap so badly it will cease to catch crabs. They can do this overnight, sometimes entire rows of traps are destroyed that rapidly. This is frustrating, since it kills the crabs, ruins the trap, and costs lots of money and time in replacement trap material and construction. All in all, though, he likes to see what surprises lie in the traps, because to him, finding different species in the traps is like clues as to how the different unseen animals down there move and do their thing. He likes to imagine and try to figure out the mysteries Mother Nature holds, that challenge and mystery is what keeps the work interesting to him. Sometimes, to his amusement, a dolphin follows him from trap to trap begging and squeaking for discarded bait, much like his dog Winston begs for leftovers from lunch.

It's late morning, about 11 AM when he's finished pulling his lines in the corners of the sound. He prefers fishing the sound to the tight creeks and guts he has to fish in the summertime, because there's room to work without fear of running into the bank, or tangling a crab pot around the prop, or getting stuck on sandbars, shellbeds, etc. He'll grumble with recreational boat traffic in the Intracoastal Waterway, or when shrimpers

accidentally tangle his pots in their nets, but feels that's a small price to pay for the freedom and wide open space of the sound. Sometimes the sound is harder to fish than the tidal creeks in the marshes, though, especially when the wind is blowing hard. The further it can move across the water, the more water it can stir up, and with the strong currents out there, a stiff wind from the north northeast can make the sound incredibly rough and difficult to work. Sometimes it's just too rough to be able to go out and pull traps safely. Just like on larger boats that go further out to sea, there's a point at which he knows he has to let Mother Nature have her way, and wait until she's through before it's his turn again. It's just the way it works. He believes wholeheartedly that he has to respect the water and know that it's far more powerful than him.

He's pulled about 95 traps today, and filled four boxes, two male, two female. Even though today's catch is a paltry fraction of what he would have caught in these same traps 10 years ago, it's not bad for the current conditions, especially with a solid 85 pounds of crabs to the box. He thinks it'll bring a good check today, especially if Bobby T., his buyer, is still getting a good price up north. He's also got a half-full bucket of stone crab claws that he gives to his brother and nephew and sometimes his neighbors just to see them smile- it makes him proud that his work produces something that makes people happy. He takes a burlap sack, leans over the side, and wets it in the cold water, sloshing it around to get it good and soaked. He swings it up over the deck, rivulets streaming off, glinting in the bright sun, and drapes it over the last box of females he packed, tucking it into the corners and along the sides to keep the crabs cool and moist, to help them survive the long trip from Georgia to their market up north. The brown sack undulates as the crabs on top squirm to find a protected spot to settle in. He knows that

covering the crabs carefully and taking care of them, even when putting the crabs into the box when culling, is critical to making his product top notch. Even though it is tempting to reach in and grab a handful of crabs, and toss them into their appropriate box to avoid getting pinched through the gloves all the time, it is important to make sure that all the crabs are treated fairly gently, and that as they go into their boxes, that none get flipped and packed upside down. Also, he takes care to make sure that crabs that are damaged or injured are thrown overboard. One dead crab will stink up a whole box, and can increase dead loss during shipment. If they are packed fairly gently, they'll fight less, and if they don't crunch each other with their claws, more will reach the market alive, and get a better price and reputation for the product. So, he takes pride in putting together a neatly packaged, well taken care of product. And his buyers know this, and their price and reliability to him reflect this.

With all the traps pulled, and boxes packed, it's time to head back. The crabs were fairly scattered across the traps, he'll wait a few more days to watch what they do before he moves any more traps. The sun is nearly directly overhead and has driven the chill from the air- it really feels like a spring day now. The gulls and pelicans have vanished, looking for another shrimper or crabber to pester. He's glad they're gone, the noise and commotion they produce can get annoying, especially when he reaches down to grab a trap float and instead winds up with his hand in a pelican's beak. They can get real pushy. Every once in a while an undersize crab flung overboard will latch on to a beak or a wing and cause great havoc among the birds, which always gives him a good laugh.

He grabs an empty five gallon bucket and fills it up over the side and splashes it up the deck towards the bow. In the sound, the water looks green and clear, but against the white deck it has a faint brownish tint. He lifts the rubber mat he stands on by the puller to let the water flow past unobstructed. He drags it over the side in the water for a minute to rinse it of debris. He heaves several more buckets of water vigorously across the deck and the front of the console, wiping off the bait juices and scales that have dried onto the white gelcoat with a rag. It's not a yacht, he'll admit, but his workboat, he feels, should be clean and well maintained. No reason to let it become a pigsty, covered in mud and stinking like rotting fish like some fishermen he knows might do. The water flows past his white rubber boots flecked brown with marsh mud, flushing marsh grass stems, bits of oyster shells, black pea-sized snails, and assorted crab body parts out the transom scupper holes he himself engineered. A few more bucketfuls, and the deck is clean, the floormat is free of debris, and everything is put away. He removes his gloves and tosses them in the box of tools and gear to the right of the console. He reaches under the console and grabs his sandwich, and eats it thoughtfully as the last puddles drain from the deck and the marsh slides slowly past. He idles along while he eats, enjoying the warm sun and the breeze, watching the light dance across the rippled surface, and looking out across the marsh, thinking about nothing in particular, just enjoying the moment.

He peels off his orange slicker pants and stuffs them under the console. It's not rough enough to get wet on the ride back to the ramp, so he takes them off out here. He knows that if he doesn't, he'll have to sit around fumbling with them at the boat ramp and be eaten alive by the gnats. Finished with his sandwich, he opens the throttle and speeds across the water back towards the ramp, waving to another crabber heading downriver.

The tide has changed now, and is ebbing fast, but he knows he'll have enough water to get out with ease. He follows close to the bank for a while, then eases off out into the channel to avoid the shoals near the bank on this bend. A blue heron swoops across his path, gliding slowly over the water, its shadow mirrored on the surface below. He watches it until it disappears into the grass on the other side of the river. Slowing, he bears right into the creek that leads back to the boat ramp. He cruises up the creek slowly, which has less water in it than he thought it would, being careful to avoid hitting the shellbed with his propeller. Replacing lower units and props are tough on the budget, so he is always very careful not to put his at risk.

The tide has flushed lots of debris out of the marsh- large rafts of brown marsh grass float past as he heads upstream. He shifts into neutral as he rounds the bend and approaches the bulkhead by the boat ramp, and waves to the old gentleman who lives there, out in his yard, swatting gnats and puttering with an old lawnmower. With a quick burst in reverse, he stops the boat and ties up. He hops out, leaving the motor idling, and walks up to get the truck. The old man hollers to inquire if he left any crabs in the sound today. He replies that if he's lucky, there might be a few more for him to catch tomorrow, but he's not sure. They laugh together, and he continues on to the truck. He pulls straight back, down the ramp, and buries the trailer in the swirling brown water. Again, leaving the door open, engine running, and parking brake on, he walks back along the bulkhead and flips the line back into the boat as he hops in. He puts it in gear and drives it straight up onto the trailer. The truck and trailer sag and bump as the hull settles into its bunks. He kills the engine and the hydraulic trim pump whines loudly in the sudden silence, raising the motor up out of the water. He turns off the radio, depthfinder

and running lights, and walks forward to the bow. He hops up on the deck and stretches over the Sampson post and fumbles for the winch strap. He hooks it to the bow eye and gives the winch a turn to lock it in place.

All set, he walks towards the stern a few feet, hops down between the boat and bulkhead, and walks up to the cab of his truck. Kicking the sand and saltwater off his boots on the door sill, he slides in, shuts the door, and slowly pulls the boat out of the water, the V8 churning, rear tires straining for grip on the slick concrete. The boat emerges, water cascading off both sides, rushing back down the ramp. Once on the level, he stops the rig and goes back to check the winch strap, tightening it for insurance, checks the tires, and makes sure nothing's loose in the boat that could blow out on the drive back home. Back by the puller, he notices that one of the nylon fenders on the side of the hull has come loose. Put it on the to do list, he thinks to himself. He stretches his back and yawns, and listens to the chatter of a clapper rail hiding in the marsh across the creek. Seeing nothing that warrants his immediate attention, he gets back in the truck and finishes off the cold dregs of his morning coffee.

He waves to the old man and eases down the road. The bright sun comes straight down between the tight clusters of pine trees at midday, casting no shadows across the road. It's a lot less mysterious than it was earlier this morning, looking more like the cornfield it really is, tree after identical tree in parallel rows, broken only by drainage ditches large enough to drive a full size truck through. He shakes his head and wishes there was a way to fix the damage these ditches have done. He wishes someone would listen.

The pinwheel air freshener on the dash vent spins lazily as he waits for another log truck to pass before he merges back onto the highway. Another small car zips by before he can proceed. He accelerates onto the highway and the wind begins to rush loudly past his open window. He's had more than twelve 100 pound boxes on that boat before, but even though he's only got about 425 pounds on there today, it seems like the truck feels it. Luckily, even though there are less crabs being caught now than ever before, prices are still high because people everywhere still seem to want to eat them, and will pay just about any price to get them. He can't imagine why people pay as much as they do for a bushel of live crabs. But, that is what pays the bills, so in his mind, he tips his hat to the people who can afford this luxury and hopes they keep on doing so.

He slows, turning left back into the convenience store he visited this morning and pulls up to the gas pump. He hates to waste time getting gas in the morning before crabbing, so he always refills his boat tank on the way home. Fifteen gallons later, he walks out of the store with a cold Mountain Dew and eases the rig back onto the highway. The paper plant and town in the distance are white against the blue sky and the greening expanse of marsh grass. They appear to shimmer in the air through the distance. A few more miles down the road, and he turns into his driveway. Everything quiets as the tires sink into the soft sand and grass under the live oak, and he pulls around and parks the boat in the shade next to the shed where he stores his crabs in a large refrigerator until his buyer comes by in the afternoon. Sometimes, if there is any bait left that is still good, he'll bring it back and re-freeze it to use again the next day. Like gasoline, bait's not cheap anymore either. These days, he estimates it costs him between 80 and a hundred dollars per trip, in bait, gas, oil, and indirect maintenance costs and gear

costs. He knows he has to try to save money whenever possible. He'd like to get one of those new four stroke motors because rumor has it they use a third the gas of a two stroke, and over a year or two would more than pay for themselves with gas savings, even if they're so expensive. Plus, they're quiet and nonpolluting, too, which he knows are significant benefits, for both him and the environment.

He climbs up into the boat and hefts the boxes out onto the concrete deck he built to match the height of the gunwale of the boat. It makes life so much easier, and easier on his back, too. All four boxes out, he weighs them on an industrial sized scale, tags them according to quality, sex and weight, and shoves them inside the refrigerator. He shuts the refrigerator door, and grabs the garden hose and hoses off the concrete deck, the scale, and then gives the boat a good thorough hosing, from stem to stern. He doesn't stop there, though, but he gets down and hoses off the trailer meticulously, not letting a single bit of muddy saltwater linger on that metal any longer than is necessary. It's hard enough as it is, going through a trailer every other season, maybe once every three seasons, if he's lucky. Got to do what he can to preserve the equipment. With all the equipment washed, the crabs put up, and everything shut off, he raises the trailer with its jack off the truck hitch, and heads out to grab some lunch.

He returns and parks the truck under the live oak, and rummages through a sackful of Krystal cheeseburgers. He picks off the pickles and tomatoes and throws them to Winston, who has ambled around the corner of the house to investigate. Winston digs the tomatoes out of the sand, but even he ignores the pickles and curls up with a sigh under the rear bumper, watching the cars whiz by on the road. His wife is not home, she must be out running errands or over at her mom's house, he doesn't know. She'll be

back later this afternoon for supper, and then she'll head out to work once again. Done eating, he leans back and thinks about what work needs to be done this afternoon.

Fishing traps is only half the battle- maintenance of the boat and gear is more than the other half. He knows he has to fix the bumper on the port side by the puller he noticed this morning, and that he needs to make at least twenty traps to replace some pretty ragged ones he has nursed along all winter. He also remembers that yesterday he noticed that a steering cable on the motor needs attention, and the gelcoat under the culling box is wearing thin. But, all of that will wait for an hour while he rests on the back porch. Hopefully Bobby T. will be right and will show up on time, maybe early, bringing the crab truck by before 4, so he might still have some time to go over to the dealer and look at one of those new four stroke engines. Lighting a cigarette, he walks slowly towards the house to rest in preparation for the afternoon's activities.

APPENDIX B:

SELECTED IMAGES OF CRABBING GEAR AND ACTIVITIES

	
Carolina Skiff, 19 ft.	More elaborate hull style with “house”

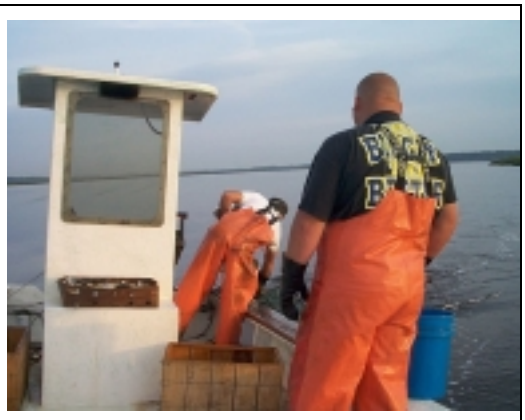
	
Welded Wire Traps under Live Oak	Simple console and puller

	
Typical wire crab trap.	Side profile reveals lower and upper compartments divided by V-shaped baffle.

	
Side view close-up shows round hole at center, bottom: this is the “funnel” where crabs enter trap.	When this bungee cord is unhooked, this opening allows the crabber to invert the trap and dump the crabs that collect in the top of the trap out into a box for culling.

	
The bottom view shows the square rebar weight and the door that closes the bait well, held shut by a section of bungee cord.	For comparison, this is an example of the “old fashioned” wooden crab trap. These were weighted by 40 pounds of concrete, and were typically pulled in to the boat by hand. Crabs entered through one opening in the top, here propped inside the trap in this photo.

	
Putting in at the boat ramp	Off to the first trap…

	
Baiting the first trap	Reaching over to grab a trap buoy
	
Start the puller and pull the trap up	Trap surfaces…
	
Open baitwell, drop the old bait overboard	Shake crabs into the culling box

	
Striker grades crabs	Bait: menhaden (pogies) in baitwell
	
Watching the depthfinder, placing the trap	At the right spot, throw trap over.
	
Conference in the river among friends…	Done fishing, going to the hill

	
Weighing the crabs, put them in the cooler	A pallet of crabs, roughly 1300 lbs.
	
Loading the crab truck,	Box by box…
	
Crabs enroute to MD from GA every week.	Nice number one male blue crab.

APPENDIX C:

SELECTED EXCERPTS FROM THE MAGNUSON-STEVENS ACT

These excerpts from the Magnuson- Stevens Act represent the federal mandate for inclusion of social science input and the assessment of the human dimension of fisheries management.

Fishery Conservation and Management Act
Public Law 94-265 , As amended through October 11, 1996

104-297

(9) One of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States.

***Fishermen understand the habitat- it is where they harvest the resource they seek. Their knowledge of habitat must be included; this dissertation should demonstrate one way that fishermen's ecological knowledge can be demonstrated as insightful and useful to fit the scope of this purpose.**

104-297

(4) to provide for the preparation and implementation, in accordance with national standards, of fishery management plans which will achieve and maintain, on a continuing basis, the optimum yield from each fishery;

*** Optimum Yield is considered to be the maximum economic benefit at minimum effort level, the ultimate situation for the resource and the harvester. To determine this point requires extensive research into the economic structure and patterns of the fishery and levels of capitalization, earning requirements and goals of the participants, and their economic behavior patterns. Again, a task for the anthropologist, in many ways.**

(8) Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

***Perhaps most important, this statement, commonly referred to as "National Standard Eight," is responsible for the mandatory social impact assessments of proposed policies and regulations. This standard essentially mandates the inclusion of sociological and anthropological research into fishery management development, and stands to substantially improve the overall quality and fit of management plans for the fishing communities they regulate.**

101-627

(5) to establish Regional Fishery Management Councils to exercise sound judgment in the stewardship of fishery resources through the preparation, monitoring, and revision of such plans under circumstances (A) which will enable the States, the fishing industry, consumer and environmental organizations, and other interested persons to participate in, and advise on, the establishment and administration of such plans, and (B) which take into account the social and economic needs of the States;

***The role of anthropologists in fulfilling this stipulation should be fairly clear- facilitating the development and establishment of management plans in accordance with the social and economic needs and goals of the states involved.**

SEC. 303. CONTENTS OF FISHERY MANAGEMENT PLANS 16 U.S.C. 1853

95-354, 99-659, 101-627, 104-297

(a) REQUIRED PROVISIONS.--Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, shall--

(9) include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and describe the likely effects, if any, of the conservation and management measures on--

(A) participants in the fisheries and fishing communities affected by the plan or amendment; and

(B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants;

(b) DISCRETIONARY PROVISIONS.--Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, may--

(6) establish a limited access system for the fishery in order to achieve optimum yield if, in developing such system, the Council and the Secretary take into account--

(A) present participation in the fishery,

(B) historical fishing practices in, and dependence on, the fishery,

(C) the economics of the fishery,

(D) the capability of fishing vessels used in the fishery to engage in other fisheries,

(E) the cultural and social framework relevant to the fishery and any affected fishing communities, and

(F) any other relevant considerations.

***Again, the above statements present a clear indication of the integral role anthropological research will play in the present and future activities of the National Marine Fisheries Service and its subsidiary branches and offices in terms of the design, development, and implementation of fishery management plans.**

APPENDIX D:

SEMISTRUCTURED INTERVIEW SCHEDULE

Historical Data

1. When did you begin crabbing? How old were you? Where did you live (if different from now)?

2. Why did you decide to become a crabber?

3. What do you need to know/learn to be successful? How did you learn this?

4. When you began, what was your major product and where did you sell it? Is that different than today? When did you change and why?

5. Did this change affect the way you fish? Is it easier or harder to make a satisfactory return?

6. What type of gear did you first use? What kind of boat? Is that different than what you use now? How much gear did you fish? Why did it change?

7. Where was your fishing area? How/why did you get established there? Were there any physical characteristics of that area that drew you there?

8. What parts of the year did you fish when you began? Was there ever a time when you put your gear on the hill and did not fish? Did this ever change? Why?

9. Did you fish the same area the entire year, or did you move with the seasons? Did you fish the sounds when you began? Did you alternate between the sound and the river? What time of the year did you go into the sound, when did you leave? Why?

10. Did you vary your effort level to maintain a certain production level? Was there a time when you had to increase your effort to maintain a basic level of profitability?

11. Has crabbing become a better or worse way to make a living since you began?

12. Why do you like being a crabber?

13. Do you want your kids to try crabbing? Is there a future in it? Why/why not?

Crab Biology

Lets talk about the life cycle and habitat of the blue crab through all four seasons. Let's start with winter.

Where are the crabs in _____?

Is this where you generally put your traps?

Are they more or less active than other times of the year? Why? What affects their level of activity?

What is the ideal habitat for crabs in _____ that you target to catch them?

What stage of the life cycle are the crabs that you catch? What are they doing at this time?

What's the climate and water like at this time of year?

What about salinity? Is the water more or less salty? How does this affect crabs?

Are there seasonal salinity patterns?

How does the moon affect crabs in _____?

How does the tide affect crab activity?

How do weather patterns affect crab activity at this time of year? What's normal weather for this time of year?

Environmental Changes

1. What ecological changes have you detected in your fishing area since you began crabbing? What was it like when you began crabbing? How was it different than it is today?

2. What caused these changes?

3. How have these changes affected crabs?

4. What is the most significant factor that negatively impacts crabs?

5. Does salinity affect crabs? What are the salinity patterns in your area? Have they changed since you began fishing there? More or less salty? Annually, seasonally, monthly, tidally, what? Why have they changed?

6. Do you catch other species than crabs in your traps? Has their abundance or diversity changed since you began? What does this indicate? Is there a pattern to it (seasonally, tidally, annually)

7. Are you concerned about these changes?

8. Have people affected the crab population at all? Is there more or less wire out there than when you began? Are there more or less crabbers in your area now than before? Why?

9. Does crabbing impact crab abundance?

10. Do you feel there is a need to better protect the resource? Do you do anything to conserve it?

11. Is the FMP working? Is it going to help preserve the fishery resource? Has it helped individual crabbers?

12. Are there other better ways to preserve the resource?

APPENDIX E:

BLUE CRAB FISHERY "KNOWLEDGE" SURVEY

This appendix presents the survey I created to assess intra-group patterns of agreement on topics that were central to the cultural models derived form the qualitative data analysis. Due to some limitations of the application of survey methodology to cultural models analysis as discussed in the Limitations section of Chapter Five, formal analysis of this data collected from the administration of this survey was not included in the body of this dissertation. This appendix is presented to document the work that I did, and to demonstrate that despite the structural limitations of this particular survey, this approach does have potential to contribute significantly to the identification and analysis of cultural models derived from ethnographic interviews and other qualitative data.

The survey statements were generated from statements made by blue crab fishermen during tape recorded one-on-one interviews. There were some statements included in the survey that were drawn from scientific explanations of certain specific aspects of blue crab biology and the life cycle to see what crabbers knew regarding "scientific" perspectives. Overall, the survey was intended to assess patterns of agreement or disagreement within the entire blue crab fishery relating to the statements made during interviews that were determined to represent cultural models. For cultural models analysis, therefore, the survey was intended to function as a ground-truthing device, to triangulate and reinforce the presence or absence of cultural models functioning within the general crabbing population, strengthening make conclusions and

descriptions of the patterns of knowledge and attitudes within the overall crabber population.

The survey was divided into two sections, referred to as Parts A and B. Part A contains questions intended to generate data that would enable stratification of the respondent group to facilitate consensus analysis of the data collected by Part B. Part A of the survey is comprised of an array of basic demographic questions, and also contains a number of "free-form" and ranking items relating to certain crabbing issues. This section of the survey contained items that aimed to elicit information from the respondents in three categories: demographic information, economic and technological changes in the fishery, and ecological/environmental topics related to crabbing. Overall, the information gathered in Part A enabled me to structure my analysis of Part B data according to the following variables: experience level (years in the fishery), ecological characteristics of their fishing area (saltwater deadhead, influenced by a freshwater river system), their commercial fishing heritage (was their father a commercial fisherman), and also, by other variables like effort levels, market involvement, or capitalization.

The data collected and represented by the statements and questions contained in Part B of the survey represent the culturally appropriate versions of critical concepts and topics in crabbing knowledge based on extensive semistructured interviews with 16 individual crabbers, in much the same manner as used by Kempton et al. (1995). Many of the survey questions look into the issues related to the decline in the crab population, addressing mechanisms for decline, ecological conditions that caused the decline, and human activities that may also be attributed to contributing to the decline, as perceived by the overall industry, a benchmark to validate ethnographic conclusions. Overall, there

were two basic goals for the survey's assessment of crabber knowledge. First, do all Georgia crabbers agree with the statements made by the small subset of interviewees? Second, if agreement or disagreement is identified from the survey results, is there a pattern to it? Does the pattern show that there are clusterings of agreement that relate to membership in particular crabbing subgroups?

These clusterings may function as indicators of agreement or disagreement at the level of the entire fishery, and indicate whether conclusions relating to cultural models based on statements made by a small core group of interviewees are representative of the larger group. The categories used to delineate these groups were assessed by Part A, and can be used to stratify consensus analysis of the data from Part B to answer these questions. In this way, surveys can provide more understanding about the target group being studied than just demographic or economic data. They can reveal overall group opinions on culturally specific statements made by informants during interviews, and show that what may appear to be strong and cohesive in the interviews may not necessarily be what the group believes, or not, understandings that are absolutely critical to finding the key issues that are central to successful policy development.
Future research will be able to build on this effort and attempt to better address these issues. The survey instrument begins on the next page.

Crab Survey Part A

For the statements and questions below, please fill in the blanks, circle yes or no, or place a check on the line next to the appropriate answer.

I appreciate your taking the time to complete this survey. Thanks!

When did you begin crabbing?

19_____

How old were you?

_____

Did your father crab before you did?

Yes No

Did your father commercial fish for other things?

___Shad
___Sturgeon
___Shrimp
___Eel
___Other _____

If your father fished commercially, which of the following best describes where he fished?

___In the same area/waters that I fish now.
___In another state, in totally different waters.
___In Georgia, but in different waters than I fish now (like he worked the Altamaha, you fish the Satilla, etc.)
___Don't know.

If there was one person who taught you a lot about how to crab, which of the following best expresses the relationship of that person to you?

___Grandfather
___Father
___Uncle
___Brother
___Friend
___Crabber you worked for as a striker
___An established fisherman in your area gave you tips and information.
___Other: _____

If you bought traps, who did you buy them from?

___Commercial fishing supply company
___Seafood processing plant (like Lewis Crab, etc.)
___Local manufacturer of traps
___Other crabbers who made traps

If you made your traps, why did you make them?

___It was cheaper to build them myself.
___I could make stronger, more durable traps than pre-made traps.
___I could make design changes to build traps that would catch better.
___Other: _____

Why did you pick the area where you first crabbed?

___Father/brother/friend fished there and invited you to work there.
___Bought rights to area from another crabber.
___Close to home/dock or boat ramp.
___Worked there as a striker for another crabber and learned that area from that work.
___Didn't want to crowd established fishermen, so worked where nobody was fishing.
___Wanted variety of features like creeks, guts, channels, flats, freshwater sources and deep holes.
___Other: _____

Do you still crab in the area where you first began crabbing?

Yes No

Is your fishing area affected significantly by the flow of a big freshwater river like the Altamaha, Ogeechee, Savannah, Satilla, or the St. Mary's?

Yes No

Is your fishing area a saltwater tidal river that dead-ends in the saltmarsh and small, localized swamps like Turtle River in Brunswick?

Yes No

How many traps do you fish each year, on average, since the trap limits went into effect?

___0-50
___50-100
___100-150
___150-200

If you crab in the sounds in winter, when did you begin crabbing in the sounds?

19_____

When you began, where did you sell your crabs?

___Live market
___Picking plant
___Other: _____

Where do you sell your crabs now?
(I don't have any interest in the money you earn. I'm just interested in how the fishermen of this industry sell their product, because it is an important part of being a successful crabber).

___Sell to a picking plant.
___Local wholesale seafood dealer/shipper buys the crabs.
___Have own shipping arrangements to get crabs to northern live crab markets
___Sell to Florida seafood dealers/retailers
___Have own retail business to sell live, cooked, or softshell crabs to local customers.
___Other: _____

If you don't sell to plants now, when did you quit selling to them?

In 19___

Do you own your own boat, or do you run someone else's boat?

___Own boat
___Run someone else's boat

Do you have your own cooler to store your crabs until you can sell them?

Yes No

Do you share this cooler with other crabbers?

Yes No

If you do share the cooler with other crabbers, how many do you share it with?

1 2 3 4 5+

Do you buy your bait in bulk and store it yourself?

Yes No

Do you have a shedding facility?

Yes No

In your opinion, what are the top five reasons why you like being a crabber?

1. _____
2. _____
3. _____
4. _____
5. _____

What is the most profitable time of the year to crab? In other words, when do you feel like you get the most return for your effort?

___Winter
___Spring
___Summer
___Fall

When was the best year you ever had, where your catch levels were the highest?

_____

When was the worst year, where your catch levels were the lowest?

_____

Have any of your sons or daughters become crabbers?

Yes No

If your children have not yet become crabbers, would you want them to?

Yes No

Please list in the blanks below the top five most important types of knowledge a person must learn in order to be a successful crabber. This can be environmental, biological, economic or other sorts of knowledge that you feel is essential to making your traps catch well and succeeding as a crab fisherman.

1. _____
2. _____
3. _____
4. _____
5. _____

Do you ever have problems with people who are not crabbers stealing your crabs from your traps, destroying your traps, cutting them off, etc.?

Yes No

If so, who are they? _____ (like castnetters, sport fishermen, etc)

Water pollution in your fishing area comes from (check all that apply):

___Golf courses
___Sewage plants
___Paper mills
___Timber Industry (pine plantations)
___Housing developments
___Other industry
___Other: _____
___The water is not polluted.

If pollution has affected your fishing area, what did it do?

_____

Have you seen signs of disease in the crabs you catch?

Yes No

What signs of disease were there?

_____

On average, the water where you fish is saltier now than it was when you began crabbing.

Yes No

If yes, is it due to the drought or had it been getting saltier before the drought occurred?

Drought Prior to drought

Are crabs less abundant this year than they were in the past?

Yes No

If yes, rate the factors below from most important (1) to least important that caused crabs to be so scarce.

___overfishing
___pollution
___low salinity
___habitat destruction
___High salinity
___Other (please describe)

Did you ever know of areas in the rivers, creeks, or sounds, where the water was always fresher than the rest, as if there was a freshwater spring flowing underwater there?

Yes No

There is a long term cycle between abundance and scarcity in the crab population.

Yes No

If there is a cycle of abundance and scarcity, what do you think is the approximate time period?

___0-2 years
___2-4 years
___4-6 years
___6-8 years
___8-10 years
___Other

Crab Survey Part B

For the questions and statements below, please indicate whether you agree or disagree by circling the number in the column at right that corresponds to the nature of your opinion.

Circling "1" indicates you strongly agree with the statement.
Circling "3" indicates you neither agree nor disagree.
Circling "5" indicates you strongly disagree with the statement.

Example:	**SA**		**N**		**SD**
The sun rises in the east.	**1**	**2**	**3**	**4**	**5**
The sun rises in the west.	**1**	**2**	**3**	**4**	**5**

1: Strongly Agree 2: Agree 3: Neutral 4: Disagree 5: Strongly Disagree

1. Crabbing was a good way to make a living when you began.	**1**	**2**	**3**	**4**	**5**
2. Crabbing is a good way to make a living now.	**1**	**2**	**3**	**4**	**5**
3. Although the live market makes it harder for a fisherman to sell his catch than to a picking plant, it has significantly increased the price per pound of crabs.	**1**	**2**	**3**	**4**	**5**
4. A crabber is not "just" a fisherman, but also a businessman.	**1**	**2**	**3**	**4**	**5**
5. Costs of engines, boats, fuel, and bait have all gone up significantly since you began. However, the live market has increased the price of crabs enough to maintain a satisfactory return for your work.	**1**	**2**	**3**	**4**	**5**
6. In mid to late summer when you're up to our ears in light new shed males and the market is glutted. It would be nice if people could quit crabbing for a little while to let the males grow big and fat. This would help thin the market out and raise the price, plus be better for the resource.	**1**	**2**	**3**	**4**	**5**
7. There is a future in crabbing.	**1**	**2**	**3**	**4**	**5**

8. The live market won't tolerate poor crabs, so the fishery is almost self regulating now, it forces you to throw back small and poor crabs.	**1**	**2**	**3**	**4**	**5**
9. There are no local plants to absorb large catch levels anymore; this causes the market price to fluctuate much more than it used to.	**1**	**2**	**3**	**4**	**5**
10. Imported crab meat from Asia and South America undercuts crab prices and makes it harder for you to get a decent price for your product.	**1**	**2**	**3**	**4**	**5**
11. Since you began crabbing, the general area where you catch the most crabs has moved inland to some extent.	**1**	**2**	**3**	**4**	**5**
12. You never used to see sponge crabs all the way up the river to I 95 until recently.	**1**	**2**	**3**	**4**	**5**
13. Runoff from development around the marshes- docks, houses, lawns, etc, is bad for the marsh and the runoff has hurt the crab population.	**1**	**2**	**3**	**4**	**5**
14. In the past, a substantial rainfall would trickle slowly into the marsh; the salinity in the estuaries would fluctuate slowly over long time periods- weeks, months, even entire seasons.	**1**	**2**	**3**	**4**	**5**
15. These days, a good shot of rain flows rapidly into the estuaries, and causes a sharp reduction in salinity, and the salinity bounces rapidly up and down because there are not enough swamps left to maintain that freshwater flow.	**1**	**2**	**3**	**4**	**5**
16. This year, females, especially sponge crabs, have been caught much further upriver than you can ever remember.	**1**	**2**	**3**	**4**	**5**
17. You see more saltwater species like sharks, stingrays, hermits, flounders, barnacles, etc further upriver this year in my traps than in the past.	**1**	**2**	**3**	**4**	**5**
18. It used to be possible to pull fifty traps twice a day and catch more than 1,000 pounds.	**1**	**2**	**3**	**4**	**5**
19. Although there may be some pollution out there, there hasn't been enough to hurt the crabs, since the bottom is alive with all sorts of grass, barnacles, etc.	**1**	**2**	**3**	**4**	**5**
20. Over the past several years, crabs have been further upriver in summertime and not fallen out as far into the sounds in wintertime as they once did.	**1**	**2**	**3**	**4**	**5**
21. The salinity balance that crabs prefer, especially nice number one males, has moved inland because of the drought.	**1**	**2**	**3**	**4**	**5**
22. Ditching and draining the swamps for pine tree plantations has eliminated the swamps' ability to hold rainwater and release it slowly into the tidal creeks and rivers.	**1**	**2**	**3**	**4**	**5**

23. Long ago, like when you began crabbing, salinity would rise and fall slowly according to the change in seasons, except during occasional unusual events like hurricanes.	**1**	**2**	**3**	**4**	**5**
24. The crabs were jammed upriver as far as they could go this summer because the lack of rain allowed saltwater to move much further upriver than during years with normal rainfall.	**1**	**2**	**3**	**4**	**5**
25. You see more small mature crabs now than you used to when you began crabbing.	**1**	**2**	**3**	**4**	**5**
26. The drought has stunted crabs growth, they put so much energy into surviving that they don't grow up like they normally do.	**1**	**2**	**3**	**4**	**5**
27. Sea turtles are a nuisance in your fishing area because they bite and mash the traps trying to get the crabs inside them.	**1**	**2**	**3**	**4**	**5**
28. The environment is a complex system; anything people do that affects the land or the water, even activities far up a river like the Altamaha, can have unintended impacts that might hurt the crab population down on the coast.	**1**	**2**	**3**	**4**	**5**
29. Years ago, there was a regular freshet of rain that happened in the spring that flushed the crabs out. It made for good catches in early spring, because the freshwater helps crabs grow big and strong.	**1**	**2**	**3**	**4**	**5**
30. Mother nature is mysterious and complex and will take care of itself.	**1**	**2**	**3**	**4**	**5**
31. It is a human right to use and conserve the natural resources of the environment as we see fit.	**1**	**2**	**3**	**4**	**5**
32. Humans have significantly altered the environment in many ways; we must manage our activities more carefully so the resources we use and enjoy today will be there for our children in the future.	**1**	**2**	**3**	**4**	**5**
33. If you get enough rain, it gives the river and sound a steady supply of freshwater, helping crabs grow bigger and fatter.	**1**	**2**	**3**	**4**	**5**
34. A warm winter is bad because crabs that would normally winter over by being buried up get caught up by the crabbers, making less crabs available during the summer months.	**1**	**2**	**3**	**4**	**5**
35. There should be no sponge crabs kept because their eggs represent next year's crop of young crabs.	**1**	**2**	**3**	**4**	**5**
36. It does not matter if we keep sponge crabs because its still legal to keep peelers, females that haven't even had a chance to breed yet.	**1**	**2**	**3**	**4**	**5**
37. Because males are targeted year round there are less males available to breed the females; this makes it important to leave sponge crabs alone.	**1**	**2**	**3**	**4**	**5**

38. There are so many eggs per sponge crab that catching sponge crabs doesn't impact the crab population because the sponge crabs that are not caught will release enough eggs to produce next year's crop.	**1**	**2**	**3**	**4**	**5**
39. In the heat of summer, crabs from high salinity water are weak and die more easily once caught than those caught from brackish or fresher water.	**1**	**2**	**3**	**4**	**5**
40. Brackish or fresher water crabs in summertime are as lively and strong as they can be- they come out of the trap crunching, biting each other, they even crawl out of the box sometimes.	**1**	**2**	**3**	**4**	**5**
41. In late spring and summer rainfall lessens and the air warms. This increases salinity and water temperature, causing crabs to migrate up the rivers from the sounds and deep holes they buried in over the winter.	**1**	**2**	**3**	**4**	**5**
42. If you get normal rainfall patterns during the year, then everything comes into order the way Mother Nature wants it to be for crabs.	**1**	**2**	**3**	**4**	**5**
43. Crabs are like a crop, if you take just enough and throw back the poor quality crabs, the crop as a whole will get bigger and fatter and produce more benefit for the fisherman.	**1**	**2**	**3**	**4**	**5**
44. Crabs are mysterious and hard to figure out- if they're abundant, even if there's a lot of light crabs, its time to catch as much as possible, to make hay while the sun shines, so to speak.	**1**	**2**	**3**	**4**	**5**
45. The depletion of the crab crop is due to large scale global changes like global warming or weather patterns like El Nino.	**1**	**2**	**3**	**4**	**5**
46. The depletion of the crab crop is due to increased salinity caused by reduced freshwater runoff caused by the ditching and draining of the swamps that the timber companies have done.	**1**	**2**	**3**	**4**	**5**
47. The depletion of the crab crop is due to overfishing. "Too many pickers picking the crop."	**1**	**2**	**3**	**4**	**5**
48. This year crabs are scarce because of the drought.	**1**	**2**	**3**	**4**	**5**
49. We should not take poor quality crabs from the population, and only harvest the best, highest grade crabs.	**1**	**2**	**3**	**4**	**5**
50. The biggest threats to the crab population are high power outboard motors, wire traps, and the electric puller.	**1**	**2**	**3**	**4**	**5**
51. If it were enforceable, it would make sense to limit the number of traps each river, creek, and spot can support, because it seems that each spot is always loaded up with too many traps and totally fished out.	**1**	**2**	**3**	**4**	**5**
52. Territorial respect, or fishermen giving each other enough space to work comfortably, is a thing of the past- it's dog eat dog now out there on the water.	**1**	**2**	**3**	**4**	**5**

53. Everybody fishing year round really hurts the abundance of the crab resource.	**1**	**2**	**3**	**4**	**5**
54. You have to be careful to not overfish a creek- put just so many traps in it so it will fish well for a long time.	**1**	**2**	**3**	**4**	**5**
55. If crabs are abundant in a particular spot, you put as many traps there as you can until they drop off, then move the traps to another spot where you think they'll be.	**1**	**2**	**3**	**4**	**5**
56. If crabs are abundant in a particular spot you concentrate some traps there, but keep the rest of your traps spread out to see where the crabs are going to move next.	**1**	**2**	**3**	**4**	**5**
57. If you see that people in an area are catching a lot, you get a little closer to them with your traps because that's where the crabs are.	**1**	**2**	**3**	**4**	**5**
58. You try to stay in your own area even if you're not catching as much as someone else you know because you'll have your turn later on, "every dog has his day," so to speak.	**1**	**2**	**3**	**4**	**5**
59. It's not the number of traps you have in the water, it's how efficiently you use them that determines how well you do.	**1**	**2**	**3**	**4**	**5**
60. You carefully manipulate your traps in the smaller creeks and guts, because there's not unlimited crabs in them; there are good crabs there, but they are a limited resource and you don't want fish them out.	**1**	**2**	**3**	**4**	**5**
61. The depletion of the crab crop is not due to pollution or environmental changes, but our ability to catch lots and lots of crabs with highly efficient wire traps and fast boats.	**1**	**2**	**3**	**4**	**5**
62. Below a 50 degree water temperature, crabs don't move much, and therefore, don't trap well.	**1**	**2**	**3**	**4**	**5**
63. Blue crabs bury up in winter for the same reasons that we put on a sweater- they're looking for warmth.	**1**	**2**	**3**	**4**	**5**
64. In late winter, and early spring, if you get a lot of rain, the crabs will stay down in and near the sounds.	**1**	**2**	**3**	**4**	**5**
65. High salinity this year has forced crabs to migrate well above the Route 17 / I-95 boundary for crab traps; crabbers should be able to fish this area.	**1**	**2**	**3**	**4**	**5**
66. The area above Rt. 17 / I-95 should be kept off limits as a sanctuary to protect crabs, especially in a bad year to ensure that there will be a crop for the next year.	**1**	**2**	**3**	**4**	**5**
67. In between moons, during neap tides, the crabs aren't worth much, having just shed on the moon.	**1**	**2**	**3**	**4**	**5**
68. Bigger and fatter crabs come around the moons, full and new.	**1**	**2**	**3**	**4**	**5**

69. Crabs are more active, and trap better, just before and at the peak of the biggest tides, just before the moon.	**1**	**2**	**3**	**4**	**5**
70. Crabs just don't harden up like they used to.	**1**	**2**	**3**	**4**	**5**
71. It takes higher salinity to make a crab harden up well.	**1**	**2**	**3**	**4**	**5**
72. It takes freshwater to make a crab harden up well.	**1**	**2**	**3**	**4**	**5**
73. Sponges mature on the moon- go from orange to black.	**1**	**2**	**3**	**4**	**5**
74. When the tide picks up, it will flush the crabs out of the smaller creeks and guts.	**1**	**2**	**3**	**4**	**5**
75. In winter, stretches of warm weather make crabs active and come out of the bottom to shallow flats to feed.	**1**	**2**	**3**	**4**	**5**
76. If you have cold water temperatures at the time of the spring peeler run, you'll catch more peelers because they're all wadded up in bunches- warm weather and water causes them to scatter and makes them harder to catch.	**1**	**2**	**3**	**4**	**5**
77. In the fall, the crab is going deep, and he won't stop until he finds that right salinity and temperature to bury up for winter.	**1**	**2**	**3**	**4**	**5**
78. Salinity is the most important factor influencing where a crab decides to stay put- high salinity, he goes upriver, low salinity, he goes downriver.	**1**	**2**	**3**	**4**	**5**
79. Sponge crabs lay their eggs in saltier water, a salinity level that is found under normal circumstances, in the sounds near the ocean.	**1**	**2**	**3**	**4**	**5**
80. Crab eggs are released by the sponge crabs and float out with the tide offshore where they develop into tiny larvae.	**1**	**2**	**3**	**4**	**5**
81. Tiny crab larvae ride the tide inshore into the marshy areas where they settle and develop into mature crabs.	**1**	**2**	**3**	**4**	**5**
82. The drought caused the female crabs to come into the rivers and creeks and stay in, dropping their eggs in the rivers and at the edges of the sounds instead of on the beaches like they normally would.	**1**	**2**	**3**	**4**	**5**
83. Prior to the drought, the females had not been going out as far out to the sound as they once did to sponge up and drop their eggs.	**1**	**2**	**3**	**4**	**5**
84. When the water's warm, the crabs are more active because they're a cold blooded creature.	**1**	**2**	**3**	**4**	**5**
85. Crabs shed better on the full moon and new moon.	**1**	**2**	**3**	**4**	**5**
86. Crabs like to be around the ditches and guts that run out of the marsh and the swamps because they know they'll get what freshwater and nutrients that washes out of them, especially after it rains.	**1**	**2**	**3**	**4**	**5**

87. In the fall, when the water temperature drops below 70, 75 degrees, the crabs begin to move out towards the deeper water in the sounds and rivers to get ready for winter.	**1**	**2**	**3**	**4**	**5**
88. Any rain during the warmer months (between May to August) helps the crab stocks a lot, helps them grow better because they need area, and when they're not all herded up hunting freshwater they can grow bigger and better.	**1**	**2**	**3**	**4**	**5**
89. Whenever you get a big shot of freshwater from a heavy rain, crabs will try to get away from the freshwater and move wherever they can find the right salinity balance.	**1**	**2**	**3**	**4**	**5**
90. When the weather changes, regardless of the season, you have to spread your traps out a little towards the areas where you think the crabs are going to go. This will allows you to follow their movements by seeing where the traps are that catch the best, and then adjust your trap locations accordingly.	**1**	**2**	**3**	**4**	**5**
91. You have your worst weather around the moons, full or new.	**1**	**2**	**3**	**4**	**5**
92. Right before or after the moon you catch more and prettier crabs.	**1**	**2**	**3**	**4**	**5**

APPENDIX F:

SURVEY INTRODUCTION LETTER:

September 23, 2000

Dear Commercial Crab Fisherman,

I am a graduate student at the University of Georgia. I believe that you, as a fisherman, have seen the fishery change dramatically, both ecologically and economically, during your career. Consequently, you deserve respect as an intelligent, knowledgeable participant in matters regarding the allocation and conservation of your fishery resource. I hope to illuminate this by conducting a survey that seeks to describe your knowledge and concerns about Georgia's crab fishery.

I have personally interviewed a dozen or more crabbers about these topics. Some have been generous enough to take me out on the water and show me how it is done. I do not work for the DNR, I am not an IRS agent, or anything else like that. I'm just a student working on a project that I believe will help the fishermen. I feel that if anybody knows what's going on out there in the river, it's you.

I believe experiential knowledge like yours, learned on the water through fishing, is too often ignored, stereotyped as "unscientific," "anecdotal," or worse, a collection of "superstitions and myths." I believe it is rich and informative, and would like to learn about your knowledge of the resource and its changes.

The only way I can accomplish this is if you complete and return the survey you will receive from me in about a week. The more responses I get from the members of the crab industry, the more accurate the results will be. All you will have to do is indicate whether you agree or disagree, circle yes/no, and fill in a few blanks. I will not ask for specifics regarding your landings, income, or anything like that- its' none of my business. This survey should be more interesting and relevant than previous ones you have completed.

All of the returned surveys are my property and will be kept strictly confidential. **No one will ever see your individual responses.** I will only release findings based on the data as a whole. Your individual responses will only be viewed by me.

Second, I would like to offer an incentive that I hope will encourage your participation. I will randomly select ten crabbers from all who have returned surveys to me by October 31, 2000, and I will send $25.00 to each of them. Your participation means that much to me.

Finally, I have enclosed an article from this month's National Fisherman that describes my project in a little more detail. I hope it helps show that I am on your side, and that your knowledge deserves greater respect when it comes to fishery management, policy development and scientific fishery research.

Thank you for your time and consideration. I sincerely hope you will contribute to this study by completing and returning the survey when you get it next week.

Sincerely,

Rob Cooley

APPENDIX G:

LETTER ACCOMPANYING SURVEY:

September 28, 2000

Dear Commercial Crab Fisherman:

I know you are very busy, and the demands of crabbing take up the majority of your time. However, I hope you will take some time to reflect on your experience as a crabber and fill out this survey. All of the Georgia crabbers I have spoken with feel that no-one out there really listens to what fishermen know about the fishery and its changes. I believe crabbers are in the best position to observe the system, being on the river every day.

The whole point of my study is to learn about your extensive knowledge of the blue crab fishery and the environment. I hope the results from this survey will help you gain respect as a knowledgeable fishery participant. So, please take the time to fill out this survey. The more people that fill it out, the more accurate and useful the results will be in reflecting what you all think and feel about the crab fishery.

Your answers will be kept confidential at all times. The survey ID# on the enclosed form is for mailing and data entry purposes only. Only I will see individual responses; all findings released will be based on group data. No person's identity will ever be revealed at any time for any reason. This study is sponsored by the University of Georgia Sea Grant program, and the UGA Marine Extension Office in Brunswick will have a copy of the results from this survey for all crabbers to read and use when they are published.

There are two parts to the survey. Part A covers historical topics regarding the crab fishery and how it has changed over time. Part B seeks to describe what you know about the habits of the blue crab and what environmental changes you have seen during your years on the water. All you need to do is circle yes or no, fill in the blanks, and circle the number that reflects your opinion on a series of agree/disagree questions. There's a blank page at the end of the survey for your comments, thoughts, etc. When you've completed the survey, put it in the enclosed envelope, and send it back to me.

And, as I promised in my letter to you last week, on October 31st I will hold a drawing and ten of the individuals who have returned to me completed surveys will be awarded $25.00 for their participation.

Sincerely,
Rob Cooley
University of Georgia
Department of Anthropology

Questions? Comments? Call me: 912-634-4669.

APPENDIX H:

LETTER OF REWARD AND THANKS FOR SURVEY COMPLETION.

November, 2000

(Commercial Crab Fisherman)
P.O. Box 0000
Anytown, GA 00000

Dear Mr. _____ ,

Thank you for participating in the survey I conducted among the blue crab fishermen in Georgia. As promised, I randomly selected ten crabbers from all of whom returned surveys to receive a reward of $25.00. Congratulations! You were one of the lucky ten. Please accept the enclosed check for $25.00 as a token of my appreciation and thanks for your participation in my study. If you are interested, the results of the survey will be available for your review at the University of Georgia Marine Extension Office in Brunswick by the end of summer 2001. Once again, thank you for your participation.

Sincerely,

Rob Cooley