Private Fish, Public Resource:

Socioeconomic Impacts of the Grouper-Tilefish Individual Fishery Quota (IFQ) program on Gulf of Mexico Communities

Volume I:
Executive Summary, Overview, Literature Review, and Social Indicators

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Table of Contents

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Executive Summary

David Griffith, David Halmo, Steven Jacob, Mary Margaret Overbey, and Priscilla Weeks

The Gulf of Mexico Grouper-Tilefish Individual Fishery Quota (IFQ) Program has been in effect since 2010, established by the National Oceanographic and Atmospheric Association (NOAA) National Marine Fisheries Service (NMFS) in cooperation with the Gulf of Mexico Fishery Management Council (GMFMC) to address three principal perceived problems with the fishery: overcapitalization of the fleet, fishing inefficiency, and derby fishing. A limited entry strategy, the Program initially allotted shares in the fishery (percentages of the overall quota of grouper, tilefish species that may be accessed) and distributed annual allocation (pounds of grouper, tilefish species that may be landed) to over 700 individuals with a reef permit and proven history of participation in the fishery using data from commercial fishing vessels. Those who did not receive shares from this initial allotment could only access the fishery by purchasing shares or leasing allocation from existing shareholders. While shares continue ad infinitum, the annual allocation if not used in the calendar year, does not roll over to the next year. Allocation is determined at the beginning of the year after the Total Allowable Catch (TAC) is set. Shareholders receive shares, their allotted percentage of the TAC for the grouper-tilefish species categories, and allocation for the year.

Put into effect shortly after the Gulf of Mexico Red Snapper IFQ Program was established in 2007, the Grouper-Tilefish IFQ Program has had a variety of real and perceived socioeconomic impacts. The Program has created some anxiety over future management initiatives that may force fishermen used to participating in diverse, multi-species fisheries to specialize. As such, fishery managers and Council members and staff require feedback on how the Program has affected commercial fishing families and communities during its first five years of operation.

This report constitutes an evaluation of the Grouper-Tilefish IFQ Program five years after its inception using rapid ethnographic procedures in four regions of the Gulf of Mexico: Central and Southwest Florida, the Florida Panhandle, Louisiana's Bayou Lafouche Corridor, and Texas's Galveston Bay area. In each of the regions, multiple commercial fishing families, neighborhoods, organizations, and enterprises comprise the "fishing community," and in no region did researchers find a homogeneous, monolithic fishing community representing the entire region. Instead, the grouper-tilefish fishery like other fisheries of the Gulf generally is a diverse, multi-gear, and multi-species fishery. Participants in the fishery view the fishing community as both an association with a geographical area and an affiliation with people who make some or all of their living from the sea.

The goal of this research was to assess the socioeconomic impacts of the Grouper-Tilefish IFQ Program on the fishing communities in the four regions and, by extension, in the Gulf in general. Specifically, the researchers were tasked with collecting and analyzing data about the Program, compiling a review of relevant literature about catch shares, IFQ, and similar programs, and

assessing the program's impacts with social indicators. Research began in the late fall of 2014 and lasted into the summer of 2016.

The research methods included: windshield surveys; direct observations; taking photographs; in-depth and shorter-term interviews with participants in the IFQ program (e.g. commercial fishermen, captains and crew, seafood dealers and processors, fisheries scientists, and others associated with the fishery); background reading and a comprehensive review of the literature; visiting local archives and collections; and reviewing census, landings, and other official data sources. Analysis varied across regional studies, but generally involved a qualitative assessment of the data collected, with attention to how views of the IFQ program varied among participants based on factors such as the shares allocated to them, history of participation in the fishery, and other factors.

Findings

1. The grouper-tilefish fishery and red snapper fishery are historically interrelated and overlap. Reef fishermen harvested grouper, red snapper, and tilefish in the past. Today, the Grouper-Tilefish and Red Snapper IFQ Programs separate and regulate these fisheries, although many, if not most, commercial reef fish fishermen participate in both programs. While fishermen recognize a general predominance of grouper in the eastern Gulf and red snapper in the western Gulf, the recent influx of red snapper into the eastern Gulf complicates the harvesting and management of these fisheries.
2. In all regions, the initial allotment of shares in the Grouper-Tilefish IFQ Program has become a point of for contention among fishermen. Among other aspects of the initial allocation, some individuals objected to: a) NOAA's presumed right to allocate a public natural resource among private citizens; b) perceived problems with how one's history in the fishery was established; and, especially; and c) individuals with no direct participation in the fishery owning and leasing their shares without assuming any of the physical or economic risks of commercial fishing.
3. The program has achieved its goal of addressing overcapitalization of the fleet, reducing the numbers of participants in the fishery and moving toward increased consolidation of fishing effort. While this may have been a desirable outcome of the program, it contradicts the history of Gulf fisheries, which tend to be diverse, multispecies, and multi-gear fisheries. Some fishermen believe that the program rewarded those who practiced less ecologically sound fishing practices, giving shares to those who had specialized in grouper rather than fishing over the full range of Gulf of Mexico fin fish.
4. Those who have to lease allocation to participate in the fishery, including captains and crew who received no shares, must add this expense to the other costs associated with commercial fishing (e.g., vessel maintenance, servicing loans, fuel, ice, bait, tackle). Quite often, the lease expense is passed on to the captains and crew by deducting this from their share of the catch, even in cases where the shareholder either owns the vessel or is the seafood dealer where the captain and crew will sell their catch.
5. Captains and crew often have to pay the 3% recovery fee that is passed on to the government to administer the program. Some captains and crew have little to no idea

what this fee pays for, believing that it is an additional unjust tax that has cut into their annual income. In other cases, shareholders and dealers alone pay the recovery fee, sometimes noting the high cost and not fully understanding the purposes of the fee.

6. The impacts of the Grouper-Tilefish IFQ program have not been as pronounced in the western regions (Texas and Louisiana) as in the two Florida regions, in part due to the more recent historical distribution of the stock, with red snapper and red snapper IFQ shareholders being more prevalent in the western Gulf and Grouper-Tilefish species being more prevalent in the eastern and southern Gulf. The rough boundary between the two regions, according to local ecological knowledge, is Apalachicola Bay. Most fishermen interviewed reported that the red snapper stock, however, has expanded its territory, returning to the eastern Gulf and becoming a nuisance to grouper fishing.
7. The program has altered labor relations in the fishery. Some captains and crew with long histories of participation were not allotted shares in the fishery because the shares went to boat owners with reef permits rather than to fishermen on the vessels. Because the cost of leasing allocation and often the recovery fee are taken out of the captain's and crew's share of the catch value, some fishermen believe the IFQ Program has turned captains and crew into workers similar to sharecroppers, providing all of the labor of fishing for less than 50% of the share of the catch. This has created a disincentive to entering the fishery.
8. The program has changed relations between fishermen and fish dealers in a few ways. On the one hand, fishermen who own enough shares to fish year-round, and who are neither obligated nor reliant on dealers for dock space, ice, fuel, credit, etc. are now free to market their catch in multiple venues. These independent fishermen may market their catch to the highest paying dealer or directly to seafood restaurants or retail markets. On the other hand, captains and crew who rely on shareholders and dealers to lease them allocation and provide dock space, ice, fuel, credit, etc. have fewer options and become even more dependent on dealers.
9. The program allows fishermen flexibility to decide when and how long to fish, and the majority of fishermen recognize this as a benefit of the IFQ Program. Fishermen may "choose their weather" and land fish throughout the year. In other words, fishermen who own shares can now decide to fish their shares all year round instead of during the first few months of the year, as usually occurred prior to the IFQ Program. This has reduced derby fishing and also means that fishermen need not fish in bad weather, when they are ill, or when their boats require maintenance, thus improving safety in the fishery. Other fishermen have stated that derby fishing did not occur in the grouper fishery, only in the red snapper fishery, and that they fish when the fish are out there regardless of the weather.
10. Some boat owners and fishermen reported that the ability to fish throughout the year has also resulted in increased stability of work and higher quality captains and crew in the fishery. Prior to the IFQ, during derby fishing, these participants state that vessel owners were forced to hire as many crew as they could to fish the resource as hard as possible, resulting in having to hire crew who were less high quality and less reliable. With a longer season, they argue, vessel owners can now keep captains and crew employed all

year round. Although fewer individuals are hired into the fishery, those that are hired are of higher quality. Conversely, other boat owners, fishermen, and dealers reported difficulty in finding good captains and crew. These participants state that the caliber of captains and crew has declined as a result of the Grouper-Tilefish IFQ Program. This, they believe, is because there is no future or economic gain for captains and crew who do not hold shares and must lease allocation.

11. The IFQ program has enabled some fishermen to engage in more detailed, year-round planning as to when and where they will fish, including switching from IFQ species to those, such as vermillion snapper, that are not covered by an IFQ. The increased opportunity to plan out their fishing year has allowed them to spend more time with family.
12. Nearly all grouper fishermen on the eastern Gulf Coast, and several on the Texas coast, reported an invasion of red snapper and having to "fish through the red snapper." Without holding red snapper IFQ program shares or allocation, these fishermen complained about the resulting bycatch, regulatory discards of red snapper. Although reasons for the increase in the red snapper population ranged from red snapper following an oil pipeline from Alabama to Tampa Bay to a year of closure, fishermen reported that red snapper, a voracious feeder, are congregating in, above, and around grouper territories. As such, they have to fish through the snapper to reach the grouper. In the process, red snapper are caught among the grouper, forcing fishermen to secure allocation, and if unable, to discard or "high grade" the red snapper (keep only the best they are allowed to land). All of those who experienced inordinate bycatch and resulting regulatory discard of red snapper considered this a morally reprehensible waste of the resource.
13. Some fishermen object to the advanced nature of state surveillance that has accompanied the IFQ program (i.e. Video Monitoring Systems), complaining about the cost of the system, but others expressed the belief that the heightened surveillance would result in better landings data and improve the image of commercial fishermen in the eyes of the state. These fishermen saw this as helping them politically, particularly in relation to what they considered poor data collected by recreational fishermen.
14. Those who have few to no shares in the program, as well as some of those who lease all or the majority of their allocation, have had to target other high value species in the Gulf of Mexico. The most commonly mentioned species in the Florida Panhandle and in Texas was Vermillion Snapper (*Rhomboplites aurorubens*) and the most commonly mentioned species in Central and Southwest Florida was Amberjack (*Seriola dumerili*). Others targeted King Mackerel (*Scomberomorus cavalla*). Because many believe that each of these species will eventually be placed under an IFQ management program, part of their incentive for targeting these species is to establish a history of participation so that they will receive future shares in the fishery.
15. The vast majority of those interviewed expressed concern about the future of the fishery. While many fishermen said that the IFQ program had assured the sustainability of grouper-tilefish fisheries, they were unsure about the longevity of commercial fishing. The majority recognized an aging population of fishermen and a dearth of younger fishers in the fishery. The majority said that the barriers to entry into the fishery,

particularly the costs of leasing allocation, high share prices, the inability to purchase shares, the costs of purchasing a boat, reef permit, VMS equipment, and recovery fees relative to ex-vessel prices, among others, would prevent younger fishers from entering the fishery.

Recommendations

In addition to these findings, those interviewed made many recommendations concerning how to improve the Grouper-Tilefish IFQ Program. The research team concurred with some of their recommendations, but were less inclined to agree with others. Those with which the research team concurred are presented below.

1. Steps should be taken to curb the practice among some of passing the recovery fee and leasing costs onto captains and crew. Shareholders are the principal beneficiaries of state oversight of the program, which the recovery fee pays for, and also benefit from the leasing allocation, yet assume little to no risk of catching fish. As such, it is unjust to pass recovery fees and leasing costs onto captains and crew and feeds the idea that the IFQ program has turned captains and crew into sharecroppers.
2. A mechanism should be in place for captains and crew without shares or owned vessel to establish history in the fisheries, so that they may benefit from the allotment of future shares and allocation.
3. Allowing people with no direct physical participation in the fishery to purchase shares in the fishery should be reconsidered. Nearly all IFQ participants interviewed believe that shareholders need to have, in their words, "skin in the game." By this they refer to people who actually assume the risks of searching for, catching, landing, processing, and otherwise handling the catch, or those who have spent lifetimes in these pursuits and now have retired from the fishery.
4. There needs to be some mechanism to bring new fishermen into the fishery, allowing some way for shares to be allotted as they become available. This will address, in part, the issue of the longevity of the fishery, or the fishery's ability to reproduce itself and continue providing high quality fish to the public.
5. The issue of bycatch and regulatory discards of red snapper needs to be addressed in a way that reduces the bycatch, discards of bycatch, and incentives for "high-grading." Before the Grouper-Tilefish and Red Snapper IFQ Programs, much of the bycatch in the past was given away to people in the community who could not afford such high quality protein otherwise.
6. Fisheries managers need to rethink the wisdom of putting every species under an IFQ program. This contradicts both other management measures that focus on ecosystems rather than individual species or species groups (e.g. Marine Protected Areas) and the realities that many Gulf of Mexico fisheries participate in multiple fisheries over the course of a year.

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Socioeconomic Impacts of the Grouper-Tilefish Individual Fishery Quota (IFQ) program on Gulf of Mexico Communities

Chapter 1: Introduction

David Griffith

Individual Fishery Quotas (IFQs) have been utilized in several locations around the world to encourage fisheries management to adopt the principles of private property, embracing the assumptions of the tragedy of the commons, or the idea that open-access fisheries are subject to overfishing because no single resource user has an economic incentive against catching as many fish as possible. Because the state maintains the right to set quotas for species, reallocate the quotas, abolish the system entirely, or make other changes to the program that affect the fishing capability of shareholders, IFQs cannot be considered private property like land, livestock, or other material wealth (McCay, et al. 1990). Under IFQ programs, the federal government assigns shares of the resource to individuals, allowing them to catch a designated number of pounds of a specific species while monitoring the state of each commercially important fishery, setting and revising annual quotas, surveilling fishing fleets, and working with state and local enforcement agencies to assure compliance with the program. This level of access to the fishery and monitoring of its users, regulators and other believe, will assure that the fishery will remain sustainable over the long term, satisfying the reauthorized Magnusson-Stevens Act's mandate that fisheries susceptible to overfishing, due to high consumer demand and consequent high value, will not be overfished.

The government's continued presence in the fishery, further, not only prevents one from considering the fishery fully privatized but also discourages the entry of entities in the fishery who might wish to monopolize fishery resources for profit or other motives. In the Grouper-Tilefish IFQ, for example, as in other IFQ-managed fisheries, rumors that Walmart might buy up all the shares for sale through its retail outlets, or that the NGO Environmental Defense might do the same to prevent fishing altogether and preserve, rather than conserve, grouper and tilefish species, have not materialized. This is very likely due to the NOAA retaining the right to alter, at any time, the terms of possessing shares in the nation's fisheries—a right similar in spirit to eminent domain.

Nevertheless, IFQ programs, in the Grouper-Tilefish fishery and other fisheries, do restrict access to the fishery in ways that create classes of haves and have-nots with regard to natural resources that many people consider public rather than private property. Because participants in IFQ programs are allocated different sized shares of the quota, IFQ programs are inherently unequal and, as such, inevitably lead to conflict, creating additional demand for state intervention. Any evaluation of the program must consider how shares in the fishery were initially allocated, why some fishermen seem to have benefited tremendously while others received few or no shares, and what mechanisms are available to adjust the distribution of shares across vessels, permits, and fishing folk.

This report evaluates the Gulf of Mexico Grouper-Tilefish IFQ program in two regions of Florida, one region in Louisiana, and one region of Texas. The grouper-tilefish fishery is less

important than the red snapper fishery as one moves further west in the Gulf of Mexico, with more grouper-tilefish being concentrated in central and southwest Florida and the Florida panhandle than in either Louisiana or Texas. Within the fishery, too, different species of grouper and tilefish are more highly valued and targeted more heavily than others, and fishermen vary by how much they fish for species outside of the grouper-tilefish complex, by whether they fish commercially full time or operate charter boats part of the year, by whether they occupy positions in the fishery as captains, crew, dealers, shareholders, or others, and along other dimensions. The reports that follow each focus on several communities in the study regions, although ultimately we are interested in individuals' reactions to the Grouper-Tilefish IFQ program and how it may have impacted, and may continue to impact, fishing communities. Although the Magnusson-Stevens Act considers fishing communities as attached to specific geographical locations, in each of the regions the fishing community is made up of several families and individuals scattered across the region, many of whom have network ties across the entire Gulf of Mexico and beyond. They are, in short, more of an imagined community, to borrow Benedict Anderson's concept, than a community occupying a specific place and time.

Methods

The research underlying this report began in early 2015 and lasted into the summer of 2016, overlapping with a period of analysis and writing from the spring though the summer of 2016. The research was ethnographic in nature, although more in line with rapid ethnographic assessment procedures than long-term ethnography that entails full-time residence in a community. Initially, in consultation with NOAA personnel and with the benefit of landings data, several Gulf of Mexico communities were identified for reporting high levels of grouper-tilefish landings, as exemplified in chart 1 below; in each region, we selected one primary and one secondary community for study. The primary and secondary communities are listed in table 1 below, although in each region researchers expanded the list of communities due to the geographical distribution of grouper-tilefish fishermen. Researchers also had access to names, addresses, and other information about grouper-tilefish shareholder information, which is public information available on NOAA's Southeast Regional Office's website (www.sero.noaa.gov), which facilitated locating additional communities in which to work.

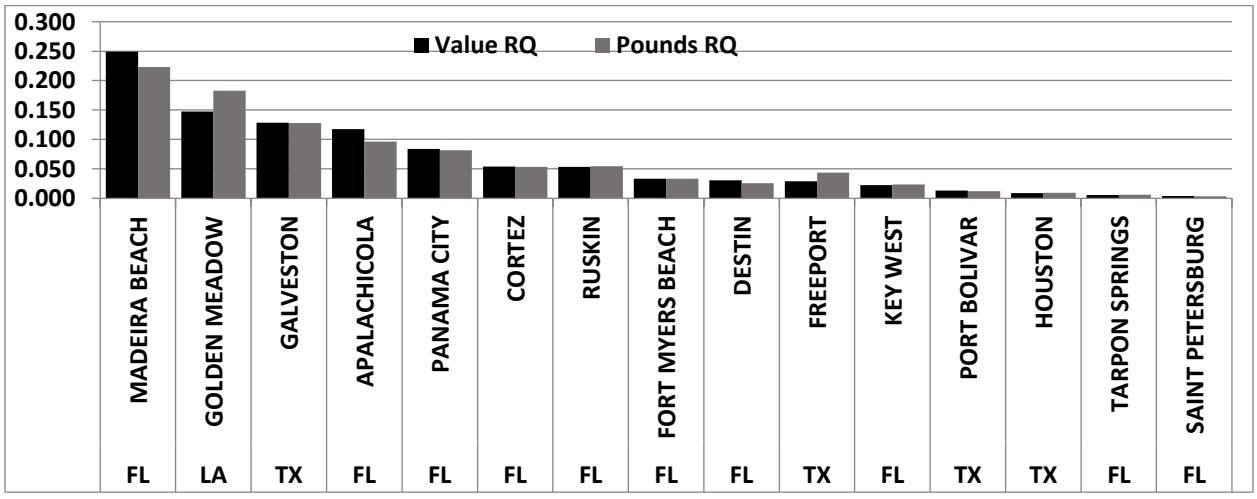

Chart 1: Deep Water Grouper Landings

Each region was the responsibility of a single researcher, although in some cases that person was assisted by a research assistant. They project team coordinated work by jointly developing interviewing protocols, check-lists, and other data gathering instruments, as well as conducting research in similar phases. The work began with windshield surveys; these are general observations, assisted by marine inventory check-lists, of the community's fishing infrastructure, support services, and fleets. Researchers visited landing centers, commercial and recreational marinas, Sea Grant offices, port agents' offices, and other locations tied to the commercial fishing industry, as well as consulting local sources of information such as libraries and newspapers. During this phase, researchers conducted brief interviews with individuals at some of the sites, primarily to determine the locations of docks, landing center, seafood houses, etc. associated with the grouper-tilefish fleet.

Map 1 shows the locations of the areas that researchers covered in the research. While each researcher began with the two communities listed in table 1, none of the researchers found that they could restrict their interviews, observations, and other work solely to those communities. In other words, the grouper-tilefish fleets were spread out over multiple communities in each region, again driving home the idea that contemporary fishing communities are less likely to be place-based than network-based.

Map 1: Grouper-Tilefish IFQ Study Communities

Table 1: Regions, Communities, and Researchers Responsible for Research

Regions	**Communities selected**	**Researcher**
Central & Southwest Florida	Madeira Beach Cortez	Mary Margaret Overbey
Florida Panhandle	Panama City Apalachicola	David Griffith
Bayou La Fouche Corridor, Louisiana	Golden Meadow Grand Isle	David Halmo
Galveston Region, Texas	Galveston, Freeport	Priscilla Weeks

	Port Bolivar	

Following the windshield surveys, with the assistance of the lists of shareholders' accounts, researchers began contacting participants in the IFQ program to interview, including fishermen, dealers, captains, crew, and shareholders who no longer participate directly in the fishery. The vast majority of those interviewed, however, were directly and physically participating in the fishery—in short, they were catching, handling, packaging, buying, selling, shipping, or otherwise coming into physical contact with the fish. These interviews were guided by the interview protocol mentioned above; many were digitally recorded and many were in-depth, lasting one to two hours. The interviews opened by probing about the respondent's experience with the IFQ program, including the number of shares or pounds of fish he or she received from the initial allocation. We then probed about a variety of issues related directly to the fishing experience: relations between captains and crew, relations with dealers, changes in the market for grouper-tilefish, local knowledge of the impacts of the program on fish stocks (if any) and other feature of the coastal and marine environment, relations with the state, and so forth. We paid particular attention to respondents' reports of how the fishery has changed since the beginning of the IFQ program, as well as their opinions about how the program had reorganized the fishery and whether they considered changes to the fishery as positive or negative.

During the course of fieldwork, in each region, we collected background information from census materials and in local bookstores, libraries, newspapers, and other archival venues. For an understanding of IFQ programs in general, we developed a comprehensive literature review about IFQ programs in other parts of the United States and world. This information allowed us to place what we were observing and hearing about in a broader context, comparing the experiences of individuals in our regions to others' experiences with IFQ programs elsewhere.

Finally, analysis of the information consisted of reading through notes, interview transcripts, background information, and other texts to pull out themes that were raised multiple times. After writing about these themes in draft reports, we shared them with other members of the research team for feedback and comparative reflection. We then discussed them in person in a day-long meeting in Tampa, Florida, on August 17, 2016.

The Gulf of Mexico Grouper-Tilefish IFQ Program

The Grouper-Tilefish IFQ Program began in 2010, specifically to address three perceived problems in the fishery: overcapitalization, inefficiency, and derby fishing or "the race to fish." It initially assigned shares to 766 shareholders in the Gulf of Mexico; four years later the number of shareholders had dropped by around 18%, to 628, with most of the loss occurring from smaller shareholders selling shares to larger shareholders (NMFS 2015). New participants, however, do continue to enter the fishery every year.

People who own shares in the program have the right to utilize those shares to catch a percentage of the annual quota, which is established by NOAA in consultation with the Gulf Council and which, every year, can be converted into actual pounds of the different species included in the IFQ. Those with too few shares to make a living, or no shares, can lease allocation from shareholders for a price that often fluctuates over the course of the year. Allocation not fished at

the end of the year does not carry over into future years; instead, on January 1, all shareholder accounts are replenished with the same shares they had at the beginning of the previous year.

While fishermen interviewed tend to refer to shares as those portions of the quota that are owned by specific individuals or entities, and tend to refer to allocation as the portion of the quota that is leased every year, shares and allocation are the same, both capable of being measured in pounds of fish. In their annual reports, the Council and NOAA personnel use the words shares and allocation more or less interchangeably, although they do differentiate between shares and allocation in the following way: "Shares are a percentage of the commercial quota, while allocation refers to the poundage that is possessed, landed, or sold during a given calendar year" (NMFS 2014: 7). A shareholder's percentage of the commercial quota remains the same from year to year, in other words, but the amount allocated (the actual pounds) can change based on changes to the Total Allowable Catch (TAC) or other factors influencing the quota. In this report, in line with the way that fishermen seem to perceive them, we use the word share to refer to the percentage of the quota that an individual or entity owns and use the word allocation to refer to both the pounds of grouper-tilefish allocated annually and the exchange of percentages of the quota among shareholders' accounts.

Currently, as shown in the figure below, the program includes gag grouper, red grouper, four species of deep-water grouper, four species of shallow-water grouper, and three species of tilefish. Some of these species are more valuable than others, commanding higher ex-vessel prices, and this translates into higher leasing fees and prices to buy shares for those species that are more valuable. Most fishermen target gag, black, and red grouper, but other grouper species are targeted less frequently and very few fishermen reported fishing specifically for tilefish.

Shares in the IFQ program were initially distributed in 2010 to individuals who held reef permits, based on the number of pounds landed in the fishery in five years prior to the distribution. As noted in the executive summary, the way the shares were initially distributed has been a point of contention in the fishery. Some fishermen complained of a lack of flexibility in the years selected, saying that in some years sickness, financial problems, deaths in the family, and other issues prevented them from fishing as much as they had historically. Others complained that the history tied to vessels and reef permits that sold immediately prior to 2010 unjustly benefited fishermen who purchased those vessels and permits to the detriment of their previous owners, who had acquired the history.

Figure 1: Grouper-Tilefish IFQ Complex

In 2015, the purchase of shares no longer required possession of a reef fish permit. While this has not led to large businesses like Walmart or the NGO Environmental Defense buying up shares, this has led to the accumulation of shares by individuals who have "no skin in the game" (i.e. those who have no direct, physical participation in the fishery) as well as the accumulation of shares among seafood dealers. Current work by Gabriel Stocks and Ava Lasseter (2016) suggests a slight trend toward increased concentration of shares in the hands of fewer individuals, or, in other words, the emergence of so-called "Sea Lords."

Organization of the Report

This report is organized into eight chapters, including the present chapter. Chapter 2 discusses IFQ and similar "catch share" programs across the United States and around the world, considering them in terms of theory and practice. Using primarily census and other secondary source data, chapter 3 discusses the eight communities initially selected in terms of dimensions such as reliance on fishing, resilience, and engagement in fishing.

With Chapter 4, the regional studies begin. Moving north and west from South-Central Florida to the Texas, Chapters 4 through 7 detail how commercial fishermen have experienced the IFQ program in Florida, Louisiana, and Texas. These regional studies follow more or less the same format, although because local and regional factors make each of them unique, each of the authors presents his or her information slightly differently. Because of this, the final chapter, 8, considers the similarities and differences among the regional studies, drawing out some of the principal points covered in the studies and relating them back to the main findings and recommendations outlined in the executive summary. Final appendices that include the research instruments used, along with references, complete the report.

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Chapter 2:

Theory and Practice in U.S. Individual Fishing Quota programs

Steve Jacob

In many cases, IFQ programs represent moves by the U.S. and other federal governments to privatize open-access fisheries by issuing shares of the quota of specific fish or shellfish to individuals based on their historical participation in the fishery. In the process, IFQs can initiate a process of class formation and economic differentiation within specific fisheries by forcing those with few to no shares in the fishery either to leave the fishery altogether, depriving them of a source of income, or to work for those with sufficient shares or the means to lease the allocation of others. In the surf clam fisheries of the Atlantic, for example, Individual Transferable Quotas (ITQs) were implemented in 1990, although management mechanisms limiting participation in the fishery had been occurring prior to implementing ITQs (McCay, et al. 1995). As such, the ITQ program did not constitute a complete transformation from open access to privatization, but rather a gradual process of reducing the size of the fleet. McCay, et al. (1995) report similar fleet reductions in the Canadian groundfish ITQ program.

In light of the fact that both programs were implemented due to perceptions of overcapacity, reducing the fleets suggests that the programs have achieved at least one of their goals. Presumably, fleet reduction will result not only in fewer vessels chasing the same amount of fish, but increased fishing incomes for vessel owners, captains, and crew, increased stability in the fishery, and increased efficiency.

IFQ programs and economic impacts

Most economists consider Individual Fishing Quota (IFQ) programs the most economically efficient way to manage fisheries (Trondsen 2001). IFQ programs create a market-based solution to what is termed the "common-pool externality" (Nøstbakken 2012). The "common-pool externality" is the "tragedy of the commons" and from this perspective, primarily stems from a lack of property rights (Nøstbakken 2012). In the commons, an individual fisher does not have an incentive to account for the impact of their catch on other fishers' catches and the fish stocks (Walden et al, 2012, Hansen et al. 2008). The logic follows that if they do not harvest the resource someone else will. This can lead to overexploitation of the resource and corresponding increases in "command and control" type regulations (McEvoy et al. 2009; Brandt 2005). These include things like restricting vessel size, length of season, and gear, which may in turn establish derby fishing conditions and economic inefficiencies such as over-capitalization, suppressed resource prices, and fishing in less productive areas to avoid crowding (Bond 2009). In addition, there are personal costs such as dangerous and burdensome work shifts as some seasons only lasted 24-48 hours and the incentive to fish in any weather, which has resulted in loss of lives (Bond 2009). Of course, all of these impacts are unintended consequences of regulations (Bond 2009). In addition, fishers have proven to be very resourceful in circumventing the intent of these "command and control" regulations, as Levy (2010: 781) states:

> Before the move to catch shares, US regulators tried all sorts of strategies to control fishing pressure, limiting the seasons and days on which fishers could go to sea, the gear that could be used, and the amount of fish that could be caught. Fishers found creative ways to work around such limits: If boats of a certain length were excluded, fishers used wider boats to hold more catch. If managers then limited boat width, fishers installed bigger motors to allow them to make more trips to the fishing grounds faster. The end result of the accelerating race to fish was that both fish populations and fishing profits shrank.

A race to fish allegory is fitting because it also includes an incentive for overinvesting in boats, equipment, and gear to help out compete other fishers (Costello and Deacon 2007).

Individual fishing quotas solve the common pool problem by providing a fisher a right to a certain portion of the resource, usually a biologically and process established Total Allowable Catch (TAC) (Crosson 2012; Da Rocha, Villasante, and Gonzalez 2013; Adelaja, McCay, and Menzon 1998). TACs in US federal waters come from stock assessments in conjunction with scientific advisory committees within fishery management councils (Crosson 2012; Adelaja, McCay, and Menzon 1998). This is a relatively recent development and is a complex process of biological science with imperfect data, risk tolerance, and buffers for margins of error and unforeseen factors that act upon the stock (Crosson 2012). The whole process requires a great deal of dialogue and compromise, often in the face of criticism and attempts at influence (Crosson 2012; Adelaja, McCay, and Menzon 1998).

Adelaja, McCay, and Menzon (1998) point out that shareholders do not own a right to the stock, but rather a portion of the TAC. The quota holder has no real control over the stock, just the privilege to harvest a given amount of fish (van Hoof 2013). The value of owning a share is not just for that year but future years as well (Ropicki and Larkin 2014). The value of leasing a pound of quota is derived from the profit of the dockside price minus the cost of the lease plus the cost of fishing (Ropicki and Larkin 2014). IFQ programs vary in whether a share represents "an absolute quantity of fish, or a percentage of the share (van Hoof 2013: p. 469)."

IFQ programs are sometimes called "incentive-based" management, fishers are willing to accept short-term limits on catch if they know they will benefit in the future when stocks recover (Bond 2009; Adelaja, McCay, and Menzon 1998). Some other immediate benefits to the fisher include the elimination of derby fishing conditions, increased fisher safety, increased income predictability, and less need for temporary crew (Sigler and Lunsford 2001). Fishing communities may benefit from the regular use of fishing infrastructure and reduce the probability of fish house and processing facility closures or the loss of fishing capital (Jamison, Heiles, and Griffith 2011). Society also benefits from the increased availability of fresh seafood through a longer portion of the year (Sigler and Lunsford 2001).

As a market-based solution, IFQ programs can be evaluated on some reasonably straightforward economic indicators (McCay, and Menzon 1998). It can be established whether or not the value of the resource has increased over time (McCay, and Menzon 1998). This is a likely outcome as derby fishing flooded the market in-season and suppressed prices. In IFQ programs, fishers can choose to use their shares when the price of the resource is highest or inputs are the lowest. Economic efficiencies can also be monitored (Eythorsson 1996b). Things like catch per unit effort (CPUE) increase as fishers do not have to compete for space in crowded fishing grounds or work less productive areas. The efficiency of exiting fishers can be monitored with the

expectation that the most efficient fishers will remain in the fishery and substantial cost of harvesting savings will be accrued across the fishery (Lian, Singh, and Weninger 2010; McCay, and Menzon 1998). Consolidation of quota can be monitored to ensure no single fisher is accumulating too much share (Eythorsson 1996b). It should be noted that the rebuilding status of the fish stock is very important consequence of the IFQ program too.

The Gulf of Mexico red snapper IFQ program provides good examples of some standardized economic indicators of reducing overcapacity that are monitored (shareholder consolidation, accounts with allocation, dealers, vessels, trips, days away, concentration, market power, technical efficiency, quota overages, and unused allocation) (Gulf of Mexico Fishery Management Council (GMFMC) 2013; Agar et al. 2014). There are also measures of reduction of "race to fish" or derby conditions such as increases in season length, ex-vessel price changes, and price volatility (GMFMC 2013; Agar et al. 2014). There are biological indicators that are monitored to insure that the conditions the IFQ program creates do not negatively impact the resource (fishing mortality, dead discards, stock abundance, and catch rates) (GMFMC 2013; Agar et al. 2014). There are also social impact indices such as changes in geographic allocation distribution, new entries, safety-at-sea, and number of crew (GMFMC 2013; Agar et al. 2014). In general, the economic indices are the strongest and best developed, as IFQ programs are a market-based solution and the outputs of the program, which are mandatorily collected, are well suited to economic analyses (Agar et al. 2014).

Although there are some fairly consistent positive economic results from existing IFQ programs, some concerns and cautions remain. Without a doubt, the most controversial issue in IFQ programs relates to how shares are initially distributed (Kaufmann and Geen 1998). Quota allocations tend to be the most litigious issue in IFQ programs in part because they create obvious winners and losers and the property conferral is valuable (Kaufmann and Geen 1998). It is generally the second-generation of fishers after the IFQ program is implemented that pay the real costs in significant barriers to entry and lost flexibility (Van Putten et al. 2013; Orebech 2005). This in turn puts overfishing pressure on other less regulated species (Orebech 2005). Orebech (2005) maintains this is an unjust redistribution and that it is also not as sustainable for the whole ecosystem. Orebech (2005) points out that neither the direct or the indirect social costs have been reviewed in IFQ programs, especially for those excluded from the fishery. This is turn may offset any benefits that are documented as IFQ program efficiency (Orebech 2005). Kaufmann and Geen (1998) ask if it is reasonable to ask a fisheries management agency to allocate resources on the basis of social objectives like wealth redistribution and fairness, rather than economic efficiency and biological sustainability, which is easier to measure and achieve. They answer their own question -- of course social objectives are fine if they are legislated objectives that are guiding the agency (Kaufmann and Geen 1998).

Trondsen (2001) feels that distributing the initial quota allocation for free is a mistake because it produces a windfall for recipients and allows them to lease without adding any value or innovation to the process. He goes on to say innovative markets where value is added and innovation is common typically have low entry barriers, which are not the conditions that free quota produces (Trondsen 2001). He suggests having an annual quota auction instead of permanently gifting quota will produce more efficiency (Trondsen 2001).

For the Gulf of Mexico (GOM) red snapper program, initial share allocations were granted on the basis of prior landings history. Some have argued that this amounts to taking a public

resource available to all for free and making it the private property of a restricted few (Alsharif and Miller 2012; OECD 2011; Bond 2009; Orebech 2004). Some have gone further and argued that this has favored those fishers with a longer history of over-exploitation of the resource as opposed to those who engage in more sustainable fishing practices (Orebech 2004). Others note that it disadvantages those who wish to move into the fishery as their occupation begins or as a livelihood strategy (GAO 2004). In addition, catch shares tend to be held by their initial holders and leased rather than sold, creating what some have called tenants or "virtual sharecroppers" in the fishing industry and raising additional social justice questions about IFQ programs (Levy 2010; Bond 2009p.25).

Alsharif and Miller (2013) point out that the largest gap in evaluating the GOM red snapper IFQ program is excluding people who no longer have open access to the fishery because they were not awarded adequate (or any) quota at the beginning of the program. Now the cost of leasing quota has made it difficult to produce adequate profit, while avoiding red snapper catches is very difficult in a complex reef fishery (Alshariff and Miller 2013). In addition, there are substantial community impacts that have not been determined (Alshariff and Miller 2013).

Some have pointed out that basing IFQs on historical landings ignores the cyclical abundance changes that may take place over time. Boen and Keithly (2012) noted that red snapper abundance is shifting west in the Gulf of Mexico. When the red snapper IFQ program was implemented in the Gulf, fishers in Florida had higher landings and were assigned the majority of catch share. Now there is a geographic mismatch between the resource and fishers holding catch shares. Though the catch shares could be sold or leased, their value has increased and it is seen as cost prohibitive by many fishers in the western Gulf who would like to target the increasingly common red snapper (Boen and Keithly 2012).

In addition to cyclical changes in resource abundance, Kaplan et al. (2010) point out that resources will also migrate and abundance will be impacted as a result of global climate change. McCay, Brandt, and Creed (2011) describe how climate change may necessitate closures within specific territories of the surf clam IFQ program, which will substantially disrupt the status quo, but may be a looming reality. Kaplan et al. (2010) indicate that these changes must be factored into the initial geographic distribution of catch shares and changed accordingly to reflect shifting resources. Holland (2004) suggested that IFQ programs may not achieve efficient outcomes because of this territorial shifting and that programs should consider using territorial stock use rights in specific regions. Little et al. (2009) suggested there are many ways to use incentives to enhance fisheries other than IFQs and by using no take zones (marine preserves) along with territorially based quotas, so fisheries can become more productive. Toft, Punt, and Little (2011) constructed a spatially explicit model for use of IFQ planning to account for where the stock is located which can increase efficiency in the fleet and help avoid non-target species. Waitt and Hartig (2000) have pointed out that the IFQ programs do produce uneven social and spatial impacts and disproportionally impact rural remote places with few other economic opportunities.

The Government Accountability Office (GAO) has responded to congressional concerns about IFQ programs. One of the observations is that IFQ programs unintentionally function to limit the ability for new entry into the fishery (GAO 2004). GAO research shows that planning for new entries needs to be part of the IFQ program plan and that these programs should be monitored to meet this objective (GAO 2004). When entry is limited, it can disproportionately impact younger fishers and those who live in more rural and fishery-dependent places that have little

economic opportunity (GAO 2004). This is particularly detrimental to communities where fishing is critical to community identity, yet which are having difficulty reproducing fishing livelihoods.

In addition, there is little effort in these existing programs to protect fishing-dependent communities or to monitor the impact upon them (GAO 2004). GAO also notes that some of the economic goals of IFQ programs have been met, such as consolidation and efficiencies, but that more information was needed to better manage the program, especially concerning a single entity holding multiple catch shares under different records. Further, specifics about what constitutes excessive share-holding has to be empirically defined (2002). Finally, GAO was concerned that increased management costs were not recovered as required by the regulations (2005). The GAO (2005) notes that some fishery management costs are actually lowered by IFQ programs, but in most cases the costs increase as enforcement efforts have to be implemented such as vessel monitoring, reporting systems, and official-staffed landing sites. Also, there are sometimes increased law-enforcement activities conducted by special agents, wildlife officers, and game wardens (GAO 2005). Many managers have directly addressed the above issues in their IFQ programs after these GAO reports were published. However, some still have not been fully resolved. For example, the red snapper IFQ program in the Gulf of Mexico does recover costs, but not enough to fully cover the program's expenses (GMFMC 2013).

The economic impacts of IFQ programs have been largely determined by using input-output models that produce multipliers of total economic impact (Seung 2014). Seung (2014) points out that this does not establish how individual communities experience the changes of the path or flow of money throughout a region. Seung (2014: p.331) says this is a "black box" that does not meet the requirements of National Standard 8 to consider community level impacts. This is especially important for fishery reliant communities that have many forward and backward linkages in the economy related to the fishery.

There are some economically motivated behaviors stemming from IFQ programs that impact fish stocks. One potentially damaging behavior is referred to as "highgrading." Kristofersson and Rickertson (2009: 335) describe highgrading as a profit maximizing strategy where less valuable sized fish are discarded at sea. This in turn can impact mortality, recruitment, and sustainability (Kristofersson and Rickertson 2009; Campbell et al. 2014). Discards may account for up to 25% of worldwide catch (Garner and Patterson 2014). Aside from the obvious ethical issues of wasting such a large portion of the resource, such behavior has a negative impact on fishery stocks (Garner and Patterson 2014). National Standard 9 indicates that mortality from discards be lowered to the greatest extent that is practical (Garner and Patterson 2014).

Bans on discards in Icelandic cod fisheries have done little to mitigate the issue and Kristofersson and Rickertson (2009) recommend increased monitoring to increase compliance. Non-compliance is an important problem in fishery management (Hansen et al. 2008). In a review of studies, Hansen et al. (2008: 1131) estimate that illegal landings account for 11% to 22% of the total catch. According to Hansen et al. (2008) when the costs of allocation share equal or exceed market price, there is an incentive to cheat (Villasante et al. 2011). Their advice is to consider "compliance uncertainty" when choosing a regulatory strategy (Hansen et al. 2008: 1140).

There has been less economic research on how IFQ programs impact processors, crew, and communities (GAO 2002). Some studies have claimed "stranded capital" (or capital returning

less in a new policy context) has resulted among the processors in certain fisheries while in other fisheries it does not seem to be an issue (GAO 2002; Wilen 2009). Matulich (2009) documented that processors were greatly disadvantaged by the Red King Crab IFQ program. Matulich and Clark (2003) documented that the two largest IFQ programs in the United States for Pacific Halibut and Sablefish made processors significantly worse off. Wilen (2009) points out that most of the capital involved in fish processing can transition to other fisheries without any devaluation. Some have observed reductions in crew as derby conditions are mitigated, but it is highly dependent on gear type (Levy 2009; GMFMC 2013). In general, crew sizes have decreased along with fishing trips, but the average trip length has increased, resulting in more crew days (GMFMC 2013). The impact on communities has been the least explored. Although much of the economic data shows little change in economic impacts, consolidation does influence how money circulates in communities. There have been no studies following how the consolidation of allocation has impacted places. In addition, there has been no research on the well-being of fishers who sold their allocation or who are unable to move into the fishery.

Ultimately, any IFQ program in the U.S. must be compliant with the MSA national standards for fishery conservation and management (GAO 2004). The relevant standards for socioeconomic assessment include National Standard 1 which requires the prevention of overfishing while achieving optimum yield. National Standard 5 requires management measures that consider efficiency in the use of fishery resources. National Standard 8 which requires fisheries managers to consider the importance of the resource to the community and where practical minimize adverse economic and social impacts on these fishing-dependent places. Although economic analysis is particularly well-suited to analyze compliance with standards 1 and 5 there are surprisingly few measures of community-level economic impacts of IFQ programs.

Along with a reduction of overcapacity, an increase in efficiency, and mitigating race to fish problems, IFQ programs are credited greatly with increasing the quality and availability of fresh rather than frozen fish (Anderson and Sutinen, 2005; Waitt and Hartig 2000). This ability to fish throughout a larger portion of the year, rather than a brief derby fishery allows fishers the ability to use their quota when prices are higher, which in turn increases profitability (Anderson and Sutinen, 2005; Waitt and Hartig 2000). In general, Waitt and Hartig (2000) have observed an increase in professionalism, with fishing decisions being made in a business-like manner. Catch planning is now a daily activity, factoring in costs, likely catch, and prices (Waitt and Hartig 2000). However this impacts processors who very often over-invested in equipment to handle the derby fishery glut that would occur annually. In addition, fishers also benefit from greater security in their retirement as they can sell their quota to help provide for their later years fish (Anderson and Sutinen, 2005).

IFQ programs have a period of price discovery for shares where there is significant inefficiency in the system (Anderson and Sutinen 2005; Holm and Nielsen 2007). The immaturity of the new IFQ market often retards transferability, which is a key to making efficiency gains (Gibbs 2009; Holm and Nielsen 2007). This immature market problem for trade can be addressed by program managers by framing the value of the quota and helping identify potential buyers/leasers (Anderson and Sutinen 2005; Gibbs 2009; Holm and Nielsen 2007). Still there is a dearth of literature on the mechanics of market trading (Ropicki and Larkin 2014). Ropicki and Larkin (2014) used network analysis to shed light on quota lease markets and found market inefficiencies such as information asymmetries that favored some leasers who had many network connections, which translates into bargaining power. The second inefficiency they identified

was regional average lease price differences across the eastern and western Gulf of Mexico, which is supposed to be one market (Ropicki and Larkin 2014).

IFQ programs are not value neutral as implied by dispassionate economic analysis (Waitt and Hartig 2000; Yandle and Crosson 2015; Orebech 2005). The rationalization process creates real winners and losers and changes the very nature of community economic and social structures (Hilborn 2007 Kaufman and Geen 1998; Orebech 2005). The emphasis on efficiency and maximizing revenue ignores the existence of "social and cultural values" around the fishery (Waitt and Hartig 2000; Orebech 2005). One implicit assumption of IFQs is that all fishers will overexploit fisheries to extinction without state intervention (Waitt and Hartig 2000). There are numerous examples of inshore fisheries and co-management schemes where this is certainly not the case (Waitt and Hartig 2000; Orebech 2005). In addition, privatization is favored as a management scheme because it is compatible philosophically with current governments (Waitt and Hartig 2000). Rationalization is the combination of privatizing public resources while simultaneously creating a market for that resource through direct state intervention (van Hoof 2013). Assignment of wealth to a class of people because of a history of resource harvesting at one particular point of time is in no way equitable to future fishers and likely limits value adding and innovation in the fishery (Trondsen 2001; Orebech 2005). Allocation will always be part of this discussion, and government allocation could and is sometimes used instead of market allocation (Orebech 2005).

Fisher Behavior in IFQ programs

Hilborn (2007: p.285) "Understanding the behavior of fishermen is a key ingredient to successful fisheries management." Fishers are operating under a new set of incentives in IFQ programs and the impacts on them, the fishery, communities, and the region are not well understood. The key is that fishers do respond to incentives, but the incentives redistribute winners and losers in the fishery, dependent of the objectives of the program (Hilborn 2007; Waitt and Hartig 2000). The thing that complicates this is that ecologists, economists, and social scientists all have differing objectives and the behavior of fishers is not always rational, destructive, or compliant (Hilborn 2007; Waitt and Hartig 2000).

Dunn et al. (2013) point out that most successful IFQ programs in rebuilding stocks also incorporate a system to count discards against the overall quota to protect both target and non-target species. This is critical especially in complex multispecies fisheries such as a reef complex (Burgess 2014; Branch 2008; Macdonald et al. 2014; Toft, Punt, and Little 2011). Part of the complexity that faces fishers is that healthy species are often intermingled with those that are depleted (Burgess 2014; Dunn et al. 2013; Branch 2008; Garner and Patterson 2014; Hoff et al. 2010; Ono, Holland, and Hilborn 2013). With an IFQ in place fishers are expected to develop "move on" rules so that when the discards grow too large and decrease their marketable quota, they move to a different area where the target species is not mingled with depleted stocks (Dunn et al. 2013; Toft, Punt, and Little 2011). This scenario helps in rebuilding stocks more quickly. Fishing pressure can increase on non-target species as a result of IFQ programs (Branch 2008; Agar et al. 2014; Hutniczak 2014). However, Hatcher and Cemare (2005) found little difference in the economic incentive to discard or high grade more between ITQ program and TAC only fisheries. Hoff et al. (2010) and Ono, Holland, and Hilborn (2013) suggest it might be more effective to allocate both effort of fleet and individual quotas in specific circumstances in multispecies fisheries. ***

Kaplan, Holland, and Fulton (2014) and Poos et al (2009) describe catch balancing mechanisms for fishers, such as paying deemed value (fine), discarding, surrendering, and borrowing against next year's quota. These are important strategies in a multi-species environment though relatively few exist at the implementation of an IFQ program (Kaplan, Holland, and Fulton 2014; Poos et al. 2009). They also found that these penalties also help lead to reduction in over-capacity compared to programs where they don't exist (Kaplan, Holland, and Fulton 2014). Lee and Gates (2007) proposed a carry-over system where some defined portion of unused quota can be used next season.

It is important to establish TACs for all species and anticipate added pressure on less regulated species (Burgess 2014; Branch 2008; Agar et al. 2014). Though IFQ programs seem to have a great deal of success addressing both biological and economic issues in a fishery, there is still a great deal of concern about unintended consequences or externalities in the ecosystem and in communities (Gibbs and Thebaud 2012). In addition, it is not clear how IFQ programs can be useful in the transition into more ecosystems based fisheries management schemes (Gibbs and Thebaud 2012). To be most effective in ecosystems based management TAC will need to be established for all species in a fishery and discards will need to be accounted for as part of the quota system (Gibbs and Thebaud 2012). In addition, differing sectors, such as recreational fishers have a substantial impact on stocks but are not part of IFQ programs (Gillig, Ozuna Jr., and Griffin 2000).

Illegal fishing within an IFQ system directly undermines the conservation efforts of the program (Da Rocha, Villasante, and Gonzalez 2013; Cinner and Huchery 2013). Jensen and Lindroos (2008) point out that without strict enforcement of the property rights of quota holders, IFQ programs are essentially open access fisheries. IFQ programs work by establishing a TAC and then assigning a portion to a fisher, group, vessel, or community (Emery et al. 2013). If proper enforcement is not in place, fishers return to a race to fish or "tragedy of the commons" set of incentives (Emery et al. 2013, Da Rocha, Villasante, and Gonzalez 2013; Branch 2008; Villasane et al. 2011; Parslow 2010). This can lead directly to overfishing and undermine the IFQ program incentives (Branch 2008; Villasane et al. 2011; Parslow 2010). If agencies cannot limit illegal fishing within an ITQ system it is better to use other management schemes that are more effective in those circumstances, such as community co-management where social norms might create more compliance (Cinner and Huchery 2013; Branch 2008; Orebech 2005; Van Putten et al. 2013). Social norms can be as or even more effective as rationalization, but have only been implemented on small spatial scales with fisheries that are easily identifiable with a community (Jackson 2007; Van Putten et al. 2013). Parslow (2010) indicated that allocation of community quotas might be a more equitable and socially responsible way to sustain fishing communities. This however, will push the decision of determining who are the individuals that will receive the quota benefit to a smaller scale (Parslow 2010). Jackson (2007) indicates that IFQ programs will be an essential part of preventing the collapse of global fish stocks because of the scope and scale of the global fish market. There is also the issue of overfishing in sectors that are not rationalized, such as recreational fishers (Gillig, Ozuna Jr., and Griffin 2000).

Compliance to fisher regulations decreases as regulations increase in complexity. As the number of rules increase compliance decreases (Cinner and Huchery 2013). However, where co-management institutions are in place for community input, social norms help keep compliance higher (Cinner and Huchery 2013). This may be exclusively due to a direct link to more beneficial livelihood outcomes that are directly observable to the co-management arrangement

that do not seem to exist in more centralized management situations (Cinner and Huchery 2013). Programs dependent on on-board observers for enforcement report a significant "observer" effect, with landings varying greatly with an observer and without (Faunce and Barbeaux 2011). This indicates observed fishers' activities differ from unobserved activities (Kindt-Larsen, Kirkegaard, and Dalskov 2011). This "observer" effect is especially likely to influence discarding and where fishing takes place (Faunce and Barbeaux 2011). As flawed as observer programs are, most discard rates are established by self-reporting and may substantially underestimate mortality (Garner and Patterson 2014). Kindt-Larsen, Kirkegaard, and Dalskov (2011) propose a video monitoring system that becomes part of a total reporting system to protect the fisher from quota overages, discarding, and high grading.

Ultimately, to meet the efficiency goals of an IFQ program fishers have to behave in rational but often counter-intuitive ways. Costello and Deacon (2007) show that IFQ programs often do not meet efficiency goals for the fleet because there is a collective action problem. To maximize efficiency fleets need to minimize costly searches and share the highest valued stocks (Costello and Deacon 2007). This requires cooperation and planning instead of competition and is not typical fisher behavior (Costello and Deacon 2007). Such cooperation can eliminate congestion in fishing areas, flooding the market, and expensive searches for stocks but requires the development of a new set of norms and values. Felthoven, Lee, and Schnier (2014: p.135) describe from the literature that fishers have essentially two types of information that they share "course-grained" and "fine-grained." Course-grained information is general and about the fish species behavior and broad location (Felthoven, Lee, and Schnier 2014). Fine-grained information is about exact hot spots for fishing (Felthoven, Lee, and Schnier 2014). There is some indication within cooperatives that fishers share both forms of information in an ITQ program, but whether this sharing is a direct effect of rationalization is unable to be conclusively established (Felthoven, Lee, and Schnier 2014).

In many fleets ITQ programs do not eliminate overcapacity as much as anticipated (Aranson 1993; Agar et al. 2014; Hannesson 2007; Hoff and Frost 2007; Matthiasson 1997). This may be due to sunk historical costs and the possibility that even inefficient vessels provide some flexibility in other fisheries (Aranson 1993; Agar et al. 2014; Hannessson 2007; Hoff and Frost 2007; Matthiasson 1997). One of the reasons over-investment in vessels occurs is the pay system for crew which is based on a percentage of catch. This reintroduces an incentive to wastefully overinvest in capacity in spite of the rationalization of the fishery (Hannesson 2007). Agar et al. (2014) point out that in multispecies fisheries in IFQ programs should be integrated because displaced fishers may just move to another fishery stock rather than retiring the vessel. Therefore, any gains in reducing overcapacity may be overstated unless all species are managed in the program (Agar et al. 2014). In some circumstances to truly achieve fleet reduction a decommissioning program may be the only real incentive that will be effective (Hoff and Frost 2007).

IFQ programs and social impacts

Anderson and Uchida (2014) and Gibbs (2009) noted that the majority of IFQ research focuses on the highest levels of catch in order to maximize the greatest sustainable benefits. Gibbs (2009) points out that biologists primarily see IFQ programs as threatened by illegal, unregulated and unreported fishing. However, sociologists, anthropologists, and political scientist often focus on achieving community well-being, norms, and institutions that are related and/or

dependent upon the fishery (Anderson and Uchida, 2014; Gibbs 20009). The majority of economic research has a clear unit of analysis, primarily money. The fisheries related sociologists do not have well established and easily observable outcome variables. Arnason (1993: p.201) puts it succinctly:

> These analytical models, however, represent at best an approximation of the economics of the actual fisheries. In addition, they generally ignore the social environment in which fisheries operate. It is therefore of great scientific as well as practical importance to study the socio-economic conditions that allow the actual introduction of an ITQ system and to monitor the subsequent course of the fishery.

IFQs are designed to fix economic problems in fisheries and they also have a positive impact on rebuilding stocks (Gibbs 2009: Branch 2008). While the economic benefits are obvious and well-enumerated, there has been less concern on the social impacts (Branch 2008). There are issues of fairness and equity and the impact of concentrating the resource in the hands of relatively few fishers, who sometimes turn into sea lords, who themselves do not fish, but lease their quota (Branch 2008). These windfall gains accrue primarily to the generation who are fishing when the program is implemented, while later fishers must pay for their quota, which is inherently unfair (Van Putten et al. 2013; Branch 2008). Additionally, IFQ programs generally reduce overall employment in the fishery, while increasing the average income and stability for those who remain (Branch 2008; Toft, Punt, and Little 2011; van Hoof 2013).

IFQ program also shift the balance of power from processors to fishers or just the opposite depending on how quota accrues to beneficiaries in the program (Branch 2008). Two unknowns for IFQ programs are how they change social relationships throughout the fishery and in fishery reliant communities; and how IFQ programs can fit into ecosystems based approaches (Branch 2008; Hara 2013; Toft, Punt, and Little 2011). Hara (2013) points out that an ecosystems based approach is necessary in an IFQ system and allocation issues because there is little balance between the economic models and the overall impact on the interdependent relationships in the ecosystem. For example, fishers do not believe marine mammals and birds should be part of the allocation process (Hara 2013 p.315). What is complicated in this approach is how to value non-consumptive and ecosystem services uses of the resource in an inherently economically rational framework (Hara 2013). Kaplan, Holland, and Fulton (2014) explicitly say ecosystems must incorporate community well-being as part of the model, something IFQ programs do not. Macdonald et al. (2014) and Poos et al. (2009) call for ecosystems approach in complicated multispecies fisheries where discarding and high grading are substantially underreported and have a large impact on the fishery.

Crosson (2011) completed a study of North Carolina commercial fishers and found that there was significant concern over IFQs and that they mostly preferred other management strategies. Knapp (1996) found a similar set of findings in the Alaska halibut fishery. The primary reason for this resistance to IFQ programs is that fishers would substantially lose the flexibility to move from different fisheries both seasonally and as stock abundance changes (Crosson 2011; Knapp 1996). If an IFQ is established based on landings history, there is deep concern that the biggest exploiters of certain species would benefit while others would end up penalized for not

overfishing (Crosson 2011). Ultimately, the ability to move into a fishery if the need arises is the main concern of respondents in this study (Crosson 2011). Allison et al. (2011) found that IFQ programs that establish fishing rights have little meaning in areas where there are poorly established human rights such as adequate food, access to economic opportunity, and general relief from crushing poverty.

Fishing for catch history is also an unintended impact of anticipated future IFQ programs (Crosson 2011; Brach 2008). This speculative behavior is a logical outcome of the rationalization of fisheries management. This also keeps fishers from exiting fisheries that are being over-exploited so they do not lose their chance at being granted free quota at a later time (Branch 2008).

Holland (2000) and Mansfield (2007) noted that an alternative to IFQ programs which assign individual rights to a resource, is group assignment of rights. In Alaska the Community Development Quota (CDQ) assigns 10% of the TAC fish quota to those under-represented in the fishery indigenous communities (Holland 2000; Mansfield 2007). All of the CDQ is leased to non-indigenous fishers, but the proceeds are used to fund economic development efforts in these typically struggling communities (Holland 2000; Mansfield 2007). CDQs function identically to IFQs except rather than benefitting individuals by the creation of property rights, this program promotes social objectives and social justice (Holland 2000; Mansfield 2007).

Because little research has been conducted on the social impacts of IFQ programs in the Gulf of Mexico, there is little to review. We noted above that the five-year evaluation of the Gulf of Mexico Red Snapper IFQ program did take steps toward complying with NS8. The primary data collection by Boen and Keithly (2012) offer a comprehensive overview of allocation holders' behaviors, attitudes, attributes and satisfaction level with the red snapper IFQ program. This important study provides valuable information but by design does not look at the impacts on other important stakeholders, such as fishers who lease shares, fishers prohibited from entry, crew, fishers who exit the program, processors, and communities. In addition, the study is cross-sectional where it should be part of a longitudinal data information system. This is not a criticism of the study but an assessment of need for a research framework that is compliant with National Standard 8.

Fleet consolidation has had variable impacts on community members' ability to find employment in the fishing industry (Copes and Charles 2004). Employment reductions have been noted in the surf clam fishery in the northeast U.S. (Brandt and Ding 2008) and halibut fisheries in the northwest U.S. In Norway, factory trawlers replaced land based processing workers, leading to greater community unemployment (Eythórsson, 1996). In contrast, New Zealand saw employment increases in both the harvesting and processing sectors despite consolidation. Olson (2011) points out that in the latter case, significant government intervention provided the context for the increases.

In some communities, consolidation of quota has also resulted in the geographic redistribution of quota from local residents to outside interests because local, small scale fishermen are not able to pay market price for quota (Carothers 2010; Olson 2011). Large quota holders concentrate their fleets, moving to larger ports and leaving smaller communities with idle infrastructure and lost job opportunities (Copes and Charles 2004). Reducing fishery related employment is felt throughout the community due to the multiplier effect. In Alaska, one result has been the migration of non-quota holders to urban areas (Carothers 2012). The loss of fishermen from a

community impacts shore based businesses, further impacting employment opportunities (Olson 2011).

IFQs have resulted in new class dynamics based on the control of access to fishing resources (Wingard 2000). Quota holders allocate access to fishing by leasing/selling quota, hiring crew and providing loans to fishers (Copes and Charles 2004). This new class is considered by fishery managers to be the prime stakeholder vis-à-vis fishing regulation and its needs are put first (McCay 2004). Related to changes in class dynamics are changes in how social status is conferred (Carothers 2008; McCay et al. 1995). Individualized competition is valued over "collective measures of success" (Olson 2011:360; Carothers 2008) weakening older norms related to succeeding through hard work (McCay et al.,1995).

There is built-in inequity in IFQ programs due to the way that quota was initially allocated. The first generation of quota holders is 'gifted' with quota but future generations of quota holders must either purchase or lease it (Copes and Charles 2004). The wealth effects from the initial allocation continue as quota and lease prices rise (Pinkerton and Edwards 2009). Additionally, crew members have been excluded from quota allocation in most programs even though they contributed to the catch history on which the owner's quota is based (Copes and Charles 2004).

In the five-year evaluation of the Gulf of Mexico red snapper IFQ program evaluation report (GMFMC 2013p.45) under the "Research Needs, Social and Community" section the following passage outlines some specific issues:

> A comprehensive study of the social impacts resulting from implementation of the RS-IFQ program has not been conducted due to limitations of time and personnel. Potential questions to examine, should the resources become available, include:
>
> - How have fishing communities and fish houses been affected by the RS-IFQ program?
> - Develop finer measures of IFQ dependency and change with regard to red snapper and other species managed under IFQ programs and fisheries not under IFQ. Has the RS-IFQ program affected the quality of captain and crew jobs and how? Has there been a change in well-being, compensation, or availability of work?
> - Collect data on crew and hired captains that will allow measures of social and economic well-being. How have roles of participation changed?
> - Evidence suggests that there are now entities whose role as "brokers" entails only buying and selling shares and allocations. What impact has this had on fishermen and access to allocation?
> - Examine data on share and allocation ownership and trades over time to measure trends in activity and possible impacts on participation both within and outside the Gulf IFQ programs.

The above questions represent significant gaps in research and a solid initial call for further research. New research must look beyond just program participants and include fishers who have exited the program, lease catch shares, want to purchase catch shares, and who are fishing other species because they do not have catch shares. In addition, there must be a focus on

community-level impacts, including in the study the experiences of crew, fish processors and fish house owners, and others attached to local fisheries indirectly.

Socioeconomic Impacts of the Grouper-Tilefish Individual Fishery Quota (IFQ) program on Gulf of Mexico Communities

Chapter 3: Indicators of Fishery Reliance, Vulnerability, and other Dimensions of the Target Community

Steve Jacob

Part I: Indices

Social Indicator Indices Components and Internal Reliability

The indices used in this research have been validated by scientific peer review in research reports and journal articles (Jacob and Jepson, 2009; Jacob et al., 2010; Jacob et al., 2012; Jacob et al., 2013) as well as have been used in additional NMFS research. A project to duplicate these indicators was undertaken by the NOAA Fisheries Southeast Regional (SERO) and Northeast Regional (NERO) Offices. Social indicators of vulnerability and resilience were developed for coastal communities in the North Atlantic, South Atlantic, and Gulf of Mexico. The index development process relied upon updated data and produced indicators that were nearly identical to this study and often with similar levels of reliability. These results have encouraged further development of social indicators on a national level which is now a functional informational website. Much has been written on the development of these indicators and for a more in-depth description we refer you to the above references.

To establish internal reliability of the social indicators used in this study, multiple indicators for each concept are necessary. At a minimum it is necessary to include enough variables to fully cover the range of the concept, while maintaining unidimensionality (only measuring one central concept). In general, multiple measures are preferred and do increase internal validity when the items are significantly intercorrelated. However as more variables are added to the index it is harder to maintain unidimensionality. Unidimensionality, in part is established by principal components analysis. In a principal components analysis a single factor solution provides evidence that the various index items only measure a single concept. The indices in this study range from a low of three items to a high of seven items. Indices with three or fewer items are generally thought to be insufficient to establish internal validity through Cronbach's Alpha or Armor's Theta. Factor loadings below .350 are generally considered to be inadequate and fail to contribute to the index in a meaningful way. Below you will find a description of the components of each index, the principal components analysis and factor loadings, and measures of internal validity including the percentage explained variation, and Armor's Theta Reliability.

Latent Constructs and Index Development

The appropriate tool to analyze the underlying concepts is structural equation modeling, of which factor analysis is the most used technique. In this sense exploratory factor analysis is used to reveal items that do not share an underlying structure of covariance and these items are usually eliminated from the index. In that sense the factor analysis is similar in function to how many

researchers use Chronbach's Alpha in constructing indices, however in this instance factor analysis is preferable because the items are also checked for unidimensionality, a key factor in producing strong indices. In addition, the factor analysis can standardize the variables and produce a factor score that weights the specific items in their relationship to the underlying construct. Factor indices are standardized and weighted for their effects in the model. Factor scores are similar to composite scores, with the exception that the items are standardized and weighted in regard to their factor loadings. The factor loadings are a rough indication of correlation of the domain concept's latent structure to the single variable. Therefore items that are most important in an index receive a higher weighting than a less important item.

Index Development Strategy

Three steps were taken to develop the indices. First, correlation coefficients were examined to find underlying patterns of variation. Second, the variables that were most highly intercorrelated and reflected the range of ideas of interest were placed in a principal components analysis, where these variables were determined to be reliable indices. Last, the variables were standardized and weighted for their effects in the model. Index factor scores were used. In principal components, factor loadings less that 0.350 are generally not considered to be significant and in most cases should be removed from a factor scale. One advantage of factor scaling is that negative relationships do not have to be reverse coded before scaling. This means that negative factor loadings work to reduce the overall score and the absolute number conveys the strength of relationship regardless of being negative or positive. The interpretation of a negative factor loading is similar to a negative Pearson's r bivariate correlation. The factor scores were standardized with a mean of zero and the scores reflecting standard deviations from that mean. Scales were subsequently tested for internal consistency by using Armor's (1974) theta reliability for factor scales. The theta coefficient is interpreted similarly to Cronbach's Alpha, and is used for factor scales because it does not assume that all items are weighted equally in the scale. Theta is calculated as: $\theta = [p/(p-1)]*[1-(1/\lambda)]$, where p = the number of items in the scale and where λ denotes the largest eigenvalue from the principal component analysis.

Community Selection and Inclusion in the Data Set

Communities in this study were selected around four clusters of dense grouper/tilefish landings in the states of Florida (2 locations), Louisiana, and Texas. Initially four communities were identified but it soon became clear that surrounding communities were also substantively engaged in the fishery too. As such a total of 18 communities were included in the social indicators reporting. However, all Gulf Coast communities were included in the data set, and total of 19 communities. This allowed sufficient variation to conduct the analyses for index development. Results of the indices are reported in standardized z-scores (standard deviations) with a mean of zero. Therefore, an index score of 1.500 for a community indicates that the place is 1.5 standard deviations above the mean for that variable (for all Gulf-Coast communities). If an index score is -1.500 then it is 1.5 standard deviations below the mean for that variable (for all Gulf-Coast communities). The first grouping of communities were in Texas and included: 1) Freeport, 2) Galveston, and 3) Port Bolivar. The second cluster was in Louisiana and included: 4) Leeville, 5) Golden Meadow, 6) Galliano, 7) Cut Off, 8) LaRose, 9) Port Fourchon, and 10) Grand Isle. The third grouping was in Florida and included: 11) Pensacola, 12) Destin, 13)

Panama City, 14) Carrabelle, 15) Panacea, and 16) Steinhatchee. The last group of communities was also in Florida and included: 17) Madeira Beach, and 18) Cortez.

Data Set Characteristics and Sources

The main source for information about fishery landings, permits, and value was provided as a custom database by NOAA Fisheries personnel. Very current demographic, housing, and occupational data were retrieved from the U.S. Census Bureau's "American FactFinder" web page. The data source and variable manipulation will be detailed below in each index description.

Issues with Confidentiality and Data Availability

An important issue in using community-level landings data revolves around federal confidentiality rules. NMFS does not allow reporting landings data when there are less than three fishers, processors, or distributors in a given community (Impact Assessment, 2005b). The "rule of three" protects confidentiality by prohibiting the reporting of information that might be attributed to a single business or individual. This keeps potential competitors from gaining inside information about the activities of that business or individual (Impact Assessment, 2005b). There are many small rural communities that have only one or two fish processors that contribute a relatively large amount of jobs and income to the local economy (Impact Assessment, 2005b). Nonetheless the data cannot be reported because of the rule of three. In many cases this essentially makes community-level landings data unavailable to researchers outside of NMFS because of the sensitive and confidential nature of the information. This is the case for the majority of the Louisiana communities in this study. Some of the communities in Louisiana also do not have census data available because of their very small population makes inter-decennial estimates too unreliable.

Fishing Reliance and Engagement

Table 1. presents the fishing and reliance and engagement indices. The reliance indices have been divided by the total population to derive a per capita rate. This means that smaller communities might have higher reliance scores because the impact on the economy is greater overall. Therefore this is a relative measure to the population size. Engagement indices are absolute numbers and reflects the overall size of fishing regardless of population of portion of the overall economy. Reliance and engagement is presented for recreational fishing, commercial fishing, and the grouper/tilefish fishery. In general, the results are very consistent with previous indices that have been established as reliable in many studies. In fact, in most cases the indices display higher factor loadings, explained variation, and Armor's Theta scores than in other studies. The indices can be consistently interpreted such that a higher score reflects community vulnerability.

Recreational Fishing Reliance Index

The recreational fishing reliance index (Table 1) consists of three variables: 1) charter permits per 1,000 population in 2013, 2) recreational fishing mode private per capita, and 3) recreational

fishing mode shore per capita. Principal components analysis revealed a single factor solution with an explained variation of 47.3% and an Armor's Theta of .637 reflecting an acceptable level of internal reliability among the variables. All factor loadings are well above .350.

Recreational Fishing Engagement Index

The recreational fishing engagement index (Table 1) consists of three variables: 1) charter permits, 2) recreational fishing mode, and 3) recreational fishing mode shore. Principal components analysis revealed a single factor solution with an explained variation of 60.9% and an Armor's Theta of .638 reflecting an acceptable level of internal reliability among the variables. All factor loadings are well above .350.

Table 1. Fishing Reliance and Engagement.

Index Variable	**Factor Loadings**	**Explained Variation and Armor's Theta**
a. Recreational Fishing Reliance Index		
Recreational fishing mode charter per capita	.683	R^2 = 47.3%
Recreational fishing mode private per capita	.632	
Recreational fishing mode shore per capita	.744	Θ = .637
b. Recreational Fishing Engagement Index		
Recreational fishing charter pressure	.732	R^2 = 60.9%
Recreational fishing private pressure	.797	
Recreational fishing shore pressure	.810	Θ = .638
c. Commercial Fishing Reliance Index		
Values of landings per capita	.811	R^2 = 64.0%
Number of commercial fishing permits per capita	.869	
Dealers with landings per capita	.712	Θ = .639
d. Commercial Fishing Engagement Index		
Values of landings	.815	R^2 = 68.4%
Number of commercial fishing permits	.832	
Dealers with landings	.834	Θ = .684
e. Grouper/Tile Fish Reliance Index		
Value of GTF landings per capita	.953	
Number of GTF permits per capita	.961	R^2 = 91.6%
Dealers with GTF landings per capita	.949	
Pounds of GTF landed per capita	.965	Θ = .909
f. Grouper/Tile Fish Engagement Index		
Value of GTF landings	.971	
Number of GTF permits	.681	R^2 = 72.7%
Dealers with GTF landings	.878	
Pounds of GTF landed	.960	Θ = .820

Commercial Fishing Reliance Index

The commercial fishing reliance index (Table 1) consists of three variables: 1) values of landings per capita, 2) number of commercial permits per capita, and 3) dealers with landings per capita. Principal components analysis revealed a single factor solution with an explained variation of 64.0% and an Armor's Theta of .637 reflecting an acceptable level of internal reliability among the variables. All factor loadings are well above .350.

Commercial Fishing Engagement Index

The commercial fishing reliance index (Table 1) consists of three variables: 1) values of landings, 2) number of commercial permits, and 3) dealers with landings. Principal components analysis revealed a single factor solution with an explained variation of 68.4% and an Armor's Theta of .684 reflecting an acceptable level of internal reliability among the variables. All factor loadings are well above .350.

Grouper/Tilefish (GTF) Reliance Index

The grouper/tilefish reliance index (Table 1) consists of four variables: 1) values of GTF landings per capita, 2) number of GTF permits per capita, 3) dealers with GTF landings per capita, and 4) Pounds of GTF landed per capita. Principal components analysis revealed a single factor solution with an explained variation of 91.6% and an Armor's Theta of .909 reflecting a very high level of internal reliability among the variables. All factor loadings are well above .350.

Grouper/Tilefish (GTF) Engagement Index

The grouper/tilefish reliance index (Table 1) consists of four variables: 1) values of GTF landings, 2) number of GTF permits, 3) dealers with GTF landings, and 4) Pounds of GTF landed. Principal components analysis revealed a single factor solution with an explained variation of 72.7% and an Armor's Theta of .820 reflecting a high level of internal reliability among the variables. All factor loadings are well above .350.

Social Vulnerability

Table 2. presents the five social vulnerability indices developed in previous research. These variables measure community well-being and help set the context for the quality of life in each place on five factors: 1) personal disruptions, 2) population composition, 3) poverty, 4) labor force structure, and 5) housing characteristics. The indices can be consistently interpreted such that a higher score reflects potential community vulnerability.

Personal Disruption Index

The personal disruption index (Table 2) consists of five variables: 1) percent unemployed, 2) percent receiving disability, 3) percent with no high school diploma, 4) percent in poverty, and 5) percent receiving public assistance. Principal components analysis revealed a single factor solution with an explained variation of 44.7% and an Armor's Theta of .868 reflecting a high level of internal reliability among the variables. All factor loadings are well above .350.

Population Composition Index

The population composition index (Table 2) consists of four variables: 1) percent white alone, 2) percent female single-headed households, 3) percent population aged 0-5, and 4) percent speak English less than well. Principal components analysis revealed a single factor solution with an explained variation of 42.2% and an Armor's Theta of .550 reflecting an adequate level of internal reliability among the variables. All factor loadings are well above .350.

Table 2. Social Vulnerability Indices

Index Variable	Factor Loadings	Explained Variation and Armor's Theta
a. Personal Disruption Index		
Percent unemployed	.569	
Percent receiving disability	.712	$R^2 = 44.7\%$
Percent with no diploma	.774	
Percent in poverty	.759	$\Theta = .868$
Percent receiving public assistance	.478	
b. Population Composition Index		
Percent white alone	-.637	
Percent female single households	.821	$R^2 = 42.2\%$
Percent population age 0-5	.699	
Percent that speak English less than well	.350	$\Theta = .550$
c. Poverty Index		
Percent in poverty	.971	
Percent over 65 in poverty	.681	$R^2 = 77.5\%$
Percent under 18 in poverty	.878	
Percent females in poverty	.960	$\Theta = .903$
d. Labor Force Structure Index*		
Percent females employed	.879	
Percent population in labor force	.940	$R^2 = 59.7\%$
Percent of class of worker self-employed	-.384	
Percent of population receiving social security	-.804	$\Theta = .774$
e. Housing Characteristics Index*		
Median rent in dollars	.840	
Median mortgage in dollars	.845	$R^2 = 54.3\%$
Median number of rooms	.579	
Percent mobile homes	-.644	$\Theta = .719$

Poverty Index

The poverty index (Table 2) consists of four variables: 1) percent in poverty, 2) percent 65 or over in poverty, 3) percent 18 and under in poverty, and 4) percent females in poverty. Principal components analysis revealed a single factor solution with an explained variation of 77.5% and

an Armor's Theta of .903 reflecting a very high level of internal reliability among the variables. All factor loadings are well above .350

Labor Force Structure Index (Reverse Coded)

The labor force structure index (Table 2) consists of four variables: 1) percent females employed, 2) percent population in labor force, 3) percent class of worker self-employed, and 4) percent population receiving social security. Principal components analysis revealed a single factor solution with an explained variation of 59.7% and an Armor's Theta of .774 reflecting a high level of internal reliability among the variables. All factor loadings are well above .350. The variables were reverse coded so a high score reflects vulnerability in the community labor force.

Housing Characteristics Index (Reverse Coded)

The housing characteristics index (Table 2) consists of four variables: 1) median rent in dollars, 2) median mortgage in dollars, 3) median number of house rooms, and 4) percent mobile homes. Principal components analysis revealed a single factor solution with an explained variation of 54.3% and an Armor's Theta of .719 reflecting a very high level of internal reliability among the variables. All factor loadings are well above .350. The variables were reverse coded so a high score reflects vulnerability in the community housing market.

Retiree Migration and Urban Sprawl Indices

Table 3 presents the retiree migration and urban sprawl indices. These indices are designed to capture community change by two major migration forces. They are codes so that higher scores reflect community vulnerability.

Retiree Migration Index

The retiree migration index (Table 3) consists of four variables: 1) percent households with at least one member over 65, 2) percent population receiving social security, 3) percent receiving retirement income, and 4) percent in labor force. Principal components analysis revealed a single factor solution with an explained variation of 71.5% and an Armor's Theta of .868 reflecting a very high level of internal reliability among the variables. All factor loadings are well above .350. The variables were reverse coded so a high score reflects vulnerability in the community housing market.

Table 3.3. Retiree Migration and Urban Sprawl Indices

Index Variable	**Factor Loadings**	**Explained Variation and Armor's Theta**
a. Retiree Migration Index		
Households with one or more over 65	.924	
Percent population receiving social security	.933	$R^2 = 71.5\%$
Percent receiving retirement income	.700	
Percent in labor force	-.804	$\Theta = .868$

b. Urban Sprawl Index		
Population density	.618	
Cost of living	.891	$R^2 = 49.3\%$
Median home value	.712	
Percent of income of mortgage costs	.538	$\Theta = .656$

Urban Sprawl Index

The urban sprawl index (Table 3) consists of four variables: 1) population density, 2) cost of living, 3) median home value, and 4) percent income of mortgage costs. Principal components analysis revealed a single factor solution with an explained variation of 49.3% and an Armor's Theta of .656 reflecting an acceptable level of internal reliability among the variables. All factor loadings are well above .350. The variables were reverse coded so a high score reflects vulnerability in the community housing market.

Factor and Category Scores for the Indices

After the creation of the indices tables were created to present the factor score for each index for the community study sites. The factor scores can be understood as standard deviations from the mean, where the mean is standardized to zero. The index score was put into an ordinal category based on previous research. For communities with missing or withheld data the category score is 0. Negative scores through to the mean of zero were assigned a value of 1. Scores of zero to .499 were assigned a value of 2. Scores between .500 and .999 were assigned a three. Scores of 1 or greater were assigned a value of 4. These categories will be used later in the evaluation section. In addition the index scores will be presented in graphs to visually display risks to the study communities.

Table 4. presents the factor scores and categories for the fishing engagement indices and the study sites. Because the community sites were selected for their participation in the grouper/tilefish fishery most of the places are above the average for the various measures of engagement. The exceptions are for communities adjacent to other engaged communities. Landings data for grouper/tilefish were withheld for most the Louisiana study sites due to confidentiality issues. There is no standardized recreational data available for Texas communities. These sites were assigned a score of zero and are excluded from the evaluation analysis. Table 5. presents the factor scores and categories for the fishing reliance indices and the study sites. Since these indices are constructed identically to the engagement variables, with the exception of being reported per capita, the data limitations are identical to the above.

Table 6. presents the social vulnerability, retirement migration, and urban sprawl indices factor scores and categories by study sites. There are two sites in Louisiana that have significant grouper/tilefish landings but are so small in population that the census does not report estimates on demographics, housing, and occupation variables. These sites were assigned a score of zero and are excluded from the evaluation analysis

Table 3.4. Factor Scores and Categories for the Fishing Engagement Indices and by the Study Sites

		Grouper/Tilefish Engagement		Commercial Fish Engagement		Recreational Engagement	
Communities	**State**	**2013**	**Cat**	**2013**	**Cat**	**2013**	**Cat**
Freeport	TX	0.668	3	-0.045	1	No Data	0
Galveston		3.901	4	4.025	4	No Data	0
Port Bolivar		0.463	2	2.352	4	No Data	0
Leeville	LA	1.157	4	No Data	0	No Data	0
Golden Meadow		No Data	0	2.145	4	0.301	2
Galliano		No Data	0	1.021	4	-0.327	1
Cut Off		No Data	0	1.725	4	-0.327	1
LaRose		No Data	0	0.405	2	-0.139	1
Port Fourchon		No Data	0	No Data	0	No Data	0
Grand Isle		0.339	2	2.309	4	2.607	4
Pensacola	FL	2.431	4	1.986	4	4.537	4
Destin		4.688	4	2.091	4	5.441	4
Panama City		8.321	4	4.981	4	0.734	3
Apalachicola		4.039	4	2.267	4	0.495	2
Carrabelle		-0.159	1	0.096	2	-0.265	1
Panacea		1.789	4	0.726	3	-0.327	1
Steinhatchee		1.897	4	0.928	3	1.159	4
Madeira Beach	FL	18.731	4	1.649	4	2.391	4
Cortez		4.991	4	1.387	4	-0.198	1

Factor Scores -> Categorical Scores	
Factor Scores	**Cat**
N/A-Missing values	0
lowest thru 0	1
0-0.499	2
0.500-0.999	3
1.000 and above	4

Table 3.5. Factor Scores and Category for the Fishing Reliance Indices by Study Sites

		Grouper/Tilefish Reliance		Commercial Fish Reliance		Recreational Reliance	
Communities	**State**	**2013**	**Cat**	**2013**	**Cat**	**2013**	**Cat**
Freeport	TX	0.034	2	0.022	2	No Data	0
Galveston		0.087	2	4.121	4	No Data	0
Port Bolivar		0.467	2	1.466	4	No Data	0
Leeville	LA	1.485	4	No Data	0	No Data	0
Golden Meadow		No Data	0	1.612	4	0.108	2
Galliano		No Data	0	1.454	4	-0.236	1
Cut Off		No Data	0	1.878	4	-0.236	1
LaRose		No Data	0	0.536	3	-0.21	1
Port Fourchon		No Data	0	No Data	0	No Data	0
Grand Isle		0.467	2	1.912	4	6.084	4
Pensacola	FL	2.433	4	2.541	4	-0.107	1
Destin		5.288	4	2.171	4	1.494	4
Panama City		9.444	4	5.881	4	-0.188	1
Apalachicola		4.107	4	2.555	4	0.48	2
Carrabelle		-0.616	1	0.261	2	-0.214	1
Panacea		1.418	4	0.953	3	-0.236	1
Steinhatchee		1.188	4	1.230	4	1.566	4
Madeira Beach	FL	18.958	4	1.845	4	1.458	4
Cortez		4.337	4	1.609	4	-0.091	1

Factor Scores -> Categorical Scores	
Factor Scores	**Cat**
N/A-Missing values	0
lowest thru 0	1
0-0.499	2
0.500-0.999	3
1.000 and above	4

		Personal Disruptions		Populaton Composition		Poverty		Labor Force		Housing Characteristics		Retirement Migration		Urban Sprawl	
Communities	**State**	**2015**	**Cat**	**2015**	**Cat**	**2015**	**Cat**	**2015**	**Cat**	**2015**	**Cat**	**2015**	**Cat**	**2015**	**Cat**
Freeport	TX	0.722	3	0.896	3	0.844	3	-0.543	1	0.721	3	-0.689	1	-0.855	1
Galveston		0.126	2	0.279	2	0.341	2	-0.516	1	0.112	2	-0.112	1	0.998	3
Port Bolivar		0.359	2	-0.216	1	0.041	2	0.289	2	0.46	2	-0.054	1	-0.766	1
Leeville	LA	No Data	0	No Data	0	No Data	0	No Data	0	No Data	0	No Data	0	No Data	0
Golden Meadow		-0.043	1	-0.116	1	-0.203	1	-0.568	1	0.998	3	-0.222	1	-1.038	1
Galliano		0.151	2	0.099	2	-0.372	1	0.136	2	0.694	3	-0.339	1	-0.809	1
Cut Off		0.098	2	-0.152	1	-0.511	1	-0.088	1	0.255	2	-0.471	1	-0.621	1
LaRose		-0.193	1	-0.027	1	-0.343	1	0.328	2	0.506	3	-0.067	1	-0.83	1
Port Fourchon		No Data	0	No Data	0	No Data	0	No Data	0	No Data	0	No Data	0	No Data	0
Grand Isle		-0.325	1	-0.682	1	-0.241	1	-0.521	1	0.114	2	-0.079	1	-0.262	1
Pensacola	FL	-0.181	1	0.247	2	-0.097	1	-0.527	1	-0.132	1	-0.187	1	-0.091	1
Destin		-0.757	1	-0.528	1	-0.638	1	-0.787	1	-0.655	1	-0.691	1	0.531	1
Panama City		0.209	2	0.215	2	0.179	2	-0.303	1	0.099	2	-0.269	1	-0.217	1
Apalachicola		0.347	2	0.377	2	0.479	2	-0.084	1	0.581	3	0.045	2	-0.148	1
Carrabelle		0.98	3	0.009	1	1.455	4	1.046	4	0.938	3	0.571	3	-0.703	1
Panacea		0.384	2	-1.573	1	1.201	4	0.609	3	No Data	0	-0.428	1	-1.231	1
Steinhatchee		-0.624	1	-1.115	1	-0.701	1	2.248	4	1.0512	4	2.235	4	-0.863	1
Madeira Beach	FL	-0.398	1	-1.249	1	-0.433	1	-0.174	1	-0.569	1	-0.029	1	2.091	4
Cortez		-0.852	1	-1.037	1	-0.824	1	1.707	4	0.294	2	2.143	4	-0.198	1

Factor Scores -> Categorical Scores	
Factor Scores	**Cat**
N/A-Missing values	0
lowest thru 0	1
0-0.499	2
0.500-0.999	3
1.000 and above	4

Part II: Analysis of the Secondary Data Indices

Fishing Engagement Indices

Table 7 presents fishing engagement factor scores for the study communities. For the Texas Communities Galveston is the most engaged in the grouper/tilefish fishery (GTF), nearly four standard deviations greater than the average. Both Freeport and Port Bolivar were above average on engagement. For commercial fishing engagement, Galveston is highly engaged along with Port Bolivar. Port Bolivar clearly more engaged with other species rather than grouper/tilefish. Freeport is below average on commercial fishing engagement, while above average on GFT for gulf coast communities.

Table 7. Fishing Engagement Factor Scores for the Study Communities.

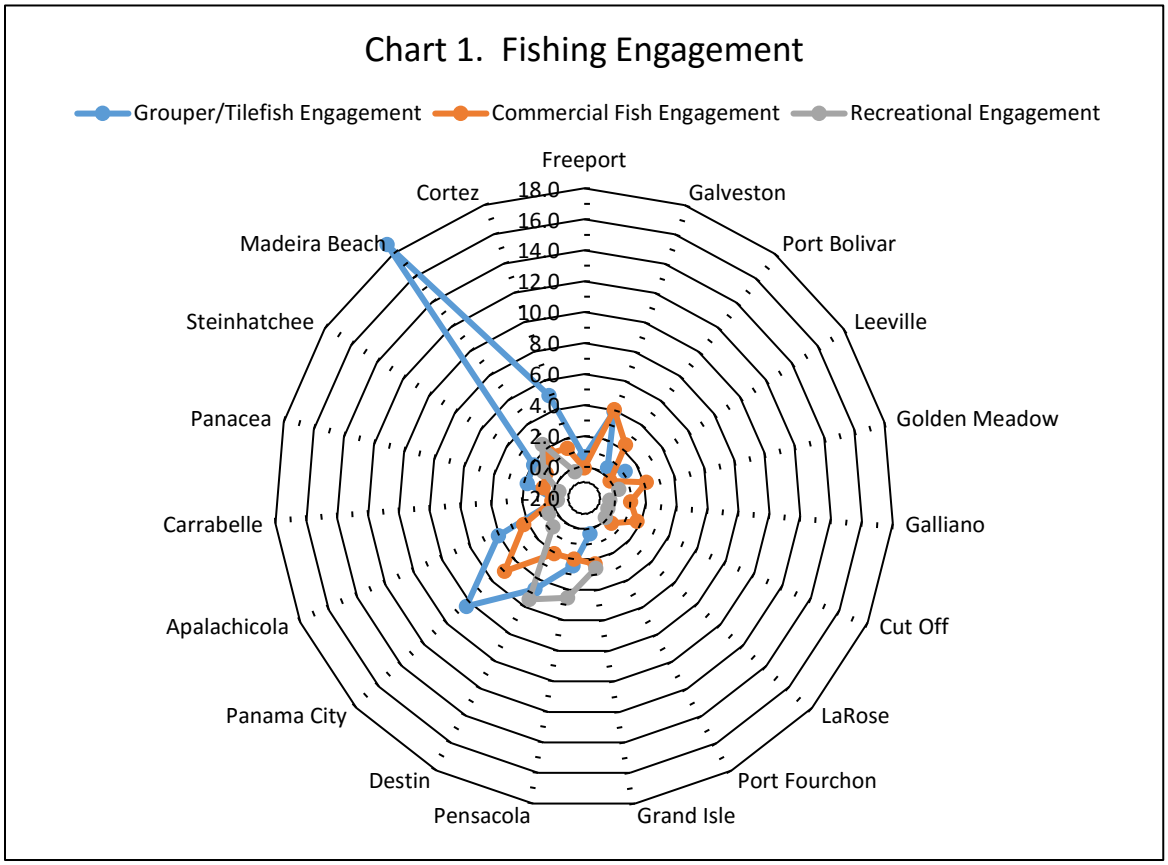
Communities	Grouper/Tilefish Engagement	Commercial Fish Engagement	Recreational Engagement
Freeport	0.668	-0.045	
Galveston	3.901	4.025	
Port Bolivar	0.463	2.352	
Leeville	1.157	0.000	
Golden Meadow		2.145	0.301
Galliano		1.021	-0.327
Cut Off		1.725	-0.327
LaRose		0.405	-0.139
Grand Isle	0.339	2.309	2.607
Pensacola	2.431	1.986	4.537
Destin	4.688	2.091	5.441
Panama City	8.321	4.981	0.734
Apalachicola	4.039	2.267	0.495
Carrabelle	-0.159	0.096	-0.265
Panacea	1.789	0.726	-0.327
Steinhatchee	1.897	0.928	1.159
Madeira Beach	18.731	1.649	2.391
Cortez	4.991	1.387	-0.198

For the Louisiana communities, GTF data were largely unavailable due to confidentiality restrictions. This significantly curtailed the available analysis to only two communities for GTF engagement. Both Leeville and Grand Isle were above average for GTF, with Leeville being a standard deviation above average. Leeville is at the mean for commercial fishing engagement, while Grand Isle is two standard deviations above the mean, suggesting the GTF is less important than other fisheries. Among the Louisiana communities, Grand Isle was most engaged in recreational fishing.

The Florida Panhandle communities were all well above average level of engagement for GTF with the exception of Carrabelle. Panama City was eight deviations above average and Destin and Apalachicola were four deviations above the mean. The remaining communities (excluding Carrabelle) were approximately two standard deviations above the mean. Panama City was highly engaged in commercial fishing (five deviations above the mean), while Pensacola, Destin, and Apalachicola were very engaged (two standard deviations above the mean). Pensacola and Destin were also very engaged in recreational fishing.

The mid-state gulf coast Florida communities were very highly engaged in the GTF fishery. Madeira beach is the most-engaged in the state, 18 standard deviations above the mean. Cortez was five standard deviations above the mean for GTF engagement. Both communities were moderately engaged in commercial fishing between one and two standard deviations. Madeira Beach is two standard deviations above the mean for recreational engagement while Cortez is below average.

Chart 1. presents a visual representation of the above data. Here it is possible to see all three variables simultaneously and communities that are highly engaged in different indices.



Fishing Reliance Indices

Table 8. presents the fishing reliance factor scores for the study communities. These indices use the same variables as the engagement indices but they are modified to use the per capita variable in the community. This weights fishing activity in its importance considering the relative population size.

Table 8. Fishing Reliance Factor Scores for the Study Communities

Community	Grouper/Tilefish Reliance	Commercial Fish Reliance	Recreational Reliance
Freeport	0.034	0.022	
Galveston	0.087	4.121	
Port Bolivar	0.467	1.466	
Leeville	1.485		
Golden Meadow		1.612	0.108
Galliano		1.454	-0.236
Cut Off		1.878	-0.236
LaRose		0.536	-0.21
Grand Isle	0.467	1.912	6.084
Pensacola	2.433	2.541	-0.107
Destin	5.288	2.171	1.494
Panama City	9.444	5.881	-0.188
Apalachicola	4.107	2.555	0.48
Carrabelle	-0.616	0.261	-0.214
Panacea	1.418	0.953	-0.236
Steinhatchee	1.188	1.230	1.566
Madeira Beach	18.958	1.845	1.458
Cortez	4.337	1.609	-0.091

Though all of the Texas communities were above average on GTF reliance all were well below a standard deviation of the mean. However, both Galveston and Port Bolivar were well above average on commercial fishing reliance (4.121 and 1.466 respectively). There was no comparable recreational data available for the Texas communities.

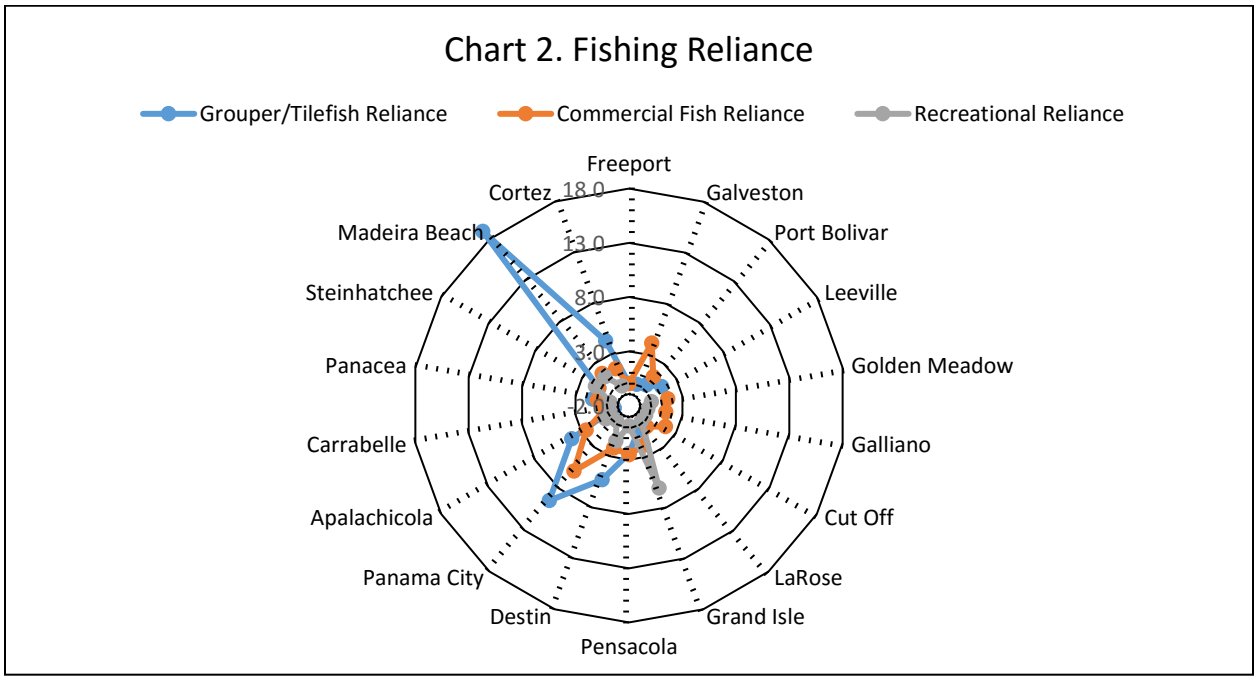
For the GTF fishery, both Leeville and Grand Isle were above average for reliance, with Leeville about 1.5 deviations above the mean and Grand Isle about a half of a deviation above. All of the Louisiana communities were above average on commercial fishing reliance, with most (except La Rose) being between one and half and two standard deviations above the mean. Grand Isle was the only community in Louisiana that was heavily recreational reliant.

For the Florida Panhandle communities, all were above average on GTF reliance, excluding Carrabelle. Panama City, Destin, Apalachicola were well above four standard deviations above

the mean for GTF reliance. Though lower on the index score, Pensacola was still two standard deviations above the mean on GTF reliance. Even Panacea and Steinhatchee were over a full standard deviation above the mean. This corridor of communities is reliant on the GTF fishery. There are also high levels of commercial fishing reliance in Panama City, Apalachicola, Pensacola and Destin. All these communities were over two standard deviations above the mean for commercial fishing. Recreational fishing reliance was above average in Steinhatchee and Destin, about 1.5 standard deviations above the mean.

In Madeira Beach GTF reliance was very high, the highest in this study. Reliance was also very high in Cortez. Commercial fishing reliance was in between one and two standard deviations above the mean. Recreation reliance was seen in Madeira Beach as well, but below average in Cortez.

Chart 2. presents visually the fishing reliance indices. Here it is easy to see the communities that are highest on one or two the reliance indices.



Social Vulnerability Indices

Table 9. presents the five indices of social vulnerability. Here the data are less dramatic because we have not selected the communities based on any of these indices, unlike the fishery variables.

Personal Disruptions Index

The Texas communities were all above average on personal disruptions, however, none were more than a standard deviation above the mean. Freeport has the highest factor score among the

community study sites. The Louisiana communities are clustered closely to the mean of zero. The Panhandle and the mid-Gulf Coast Florida communities were also clustered near the mean,

Table 9. Social Vulnerability Indices.

Communities	Personal Disruptions	Population Composition	Poverty	Labor Force	Housing Characteristics
Freeport	0.722	0.896	0.844	-0.543	0.721
Galveston	0.126	0.279	0.341	-0.516	0.112
Port Bolivar	0.359	-0.216	0.041	0.289	0.46
Golden Meadow	-0.043	-0.116	-0.203	-0.568	0.998
Galliano	0.151	0.099	-0.372	0.136	0.694
Cut Off	0.098	-0.152	-0.511	-0.088	0.255
LaRose	-0.193	-0.027	-0.343	0.328	0.506
Grand Isle	-0.325	-0.682	-0.241	-0.521	0.114
Pensacola	-0.181	0.247	-0.097	-0.527	-0.132
Destin	-0.757	-0.528	-0.638	-0.787	-0.655
Panama City	0.209	0.215	0.179	-0.303	0.099
Apalachicola	0.347	0.377	0.479	-0.084	0.581
Carrabelle	0.98	0.009	1.455	1.046	0.938
Panacea	0.384	-1.573	1.201	0.609	
Steinhatchee	-0.624	-1.115	-0.701	2.248	1.0512
Madeira Beach	-0.398	-1.249	-0.433	-0.174	-0.569
Cortez	-0.852	-1.037	-0.824	1.707	0.294

with most places below the mean. Panacea had the highest factor score in this group, about a third of a standard deviation above the mean.

Population Composition Index

Freeport had the highest population composition index score among all study communities, just under one standard deviation above the mean. Galveston and Port Bolivar were near the mean. The Louisiana study sites were all below the mean or very near the mean. Similarly the Florida communities were also very near the mean, or below the mean. Among the Florida study sites, Apalachicola had the highest factor score (.377).

Poverty Index

All of the Texas communities were above average on Poverty with Freeport having the highest score, just under one standard deviation above the mean. All of the Louisiana communities were below average on poverty. Poverty was more of an issue in the Florida Panhandle communities. Carrabelle and Panacea were both 1.5 standard deviations above the mean for poverty and Apalachicola about one half standard deviation above the mean. Other Florida communities

were slightly above the mean or below, and sometimes significantly below, the mean for poverty.

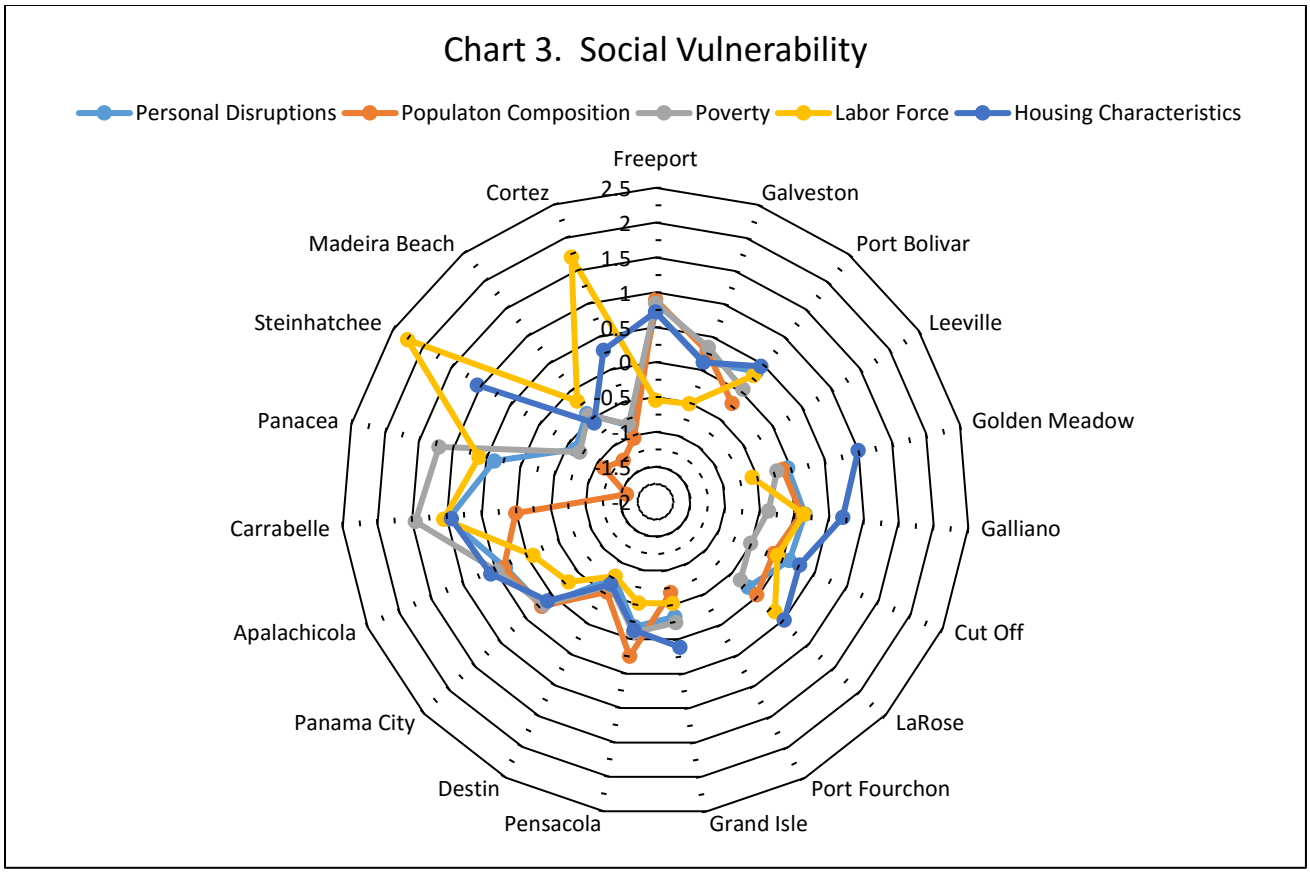
Labor Force Index

The Texas, Louisiana, and mid-Gulf Coast Florida communities labor force index scores are closely arrayed around the mean. However, in the Panhandle of Florida Panacea and Steinhatchee were above average in labor force vulnerabilities, with both being between one and one and a half deviations above the mean.

Housing Characteristics Index

All the Texas communities were above average on the housing characteristics vulnerability index. Freeport had the highest factor score, just below one standard deviation. The Louisiana study sites were also all above average. Golden Meadow and Galiano were below a standard deviation above the mean, while the remaining communities were around or below half a standard deviation above the mean. In the Panhandle of Florida communities there were no data available for Panacea on housing. Steinhatchee, Carrabelle, and Apalachicola all were above the mean, about one half to one standard deviation above the mean. The remaining communities were near or below the mean.

Chart 3. visually presents the social vulnerability indices. This shows some communities patterning at higher vulnerability, especially Freeport, Steinhatchee, Panacea, Carrabelle and Apalachicola.



The Retirement Migration and Urban Sprawl Indices

All of the Texas and Louisiana communities were below average on the retirement migration index. For the Florida Panhandle communities, Steinhatchee was well above the mean (2.235 standard deviations), and Carrabelle was about half a deviation above the mean. Cortez, in the mid-Gulf Coast was also about two standard deviations above the mean.

The Urban Sprawl Index

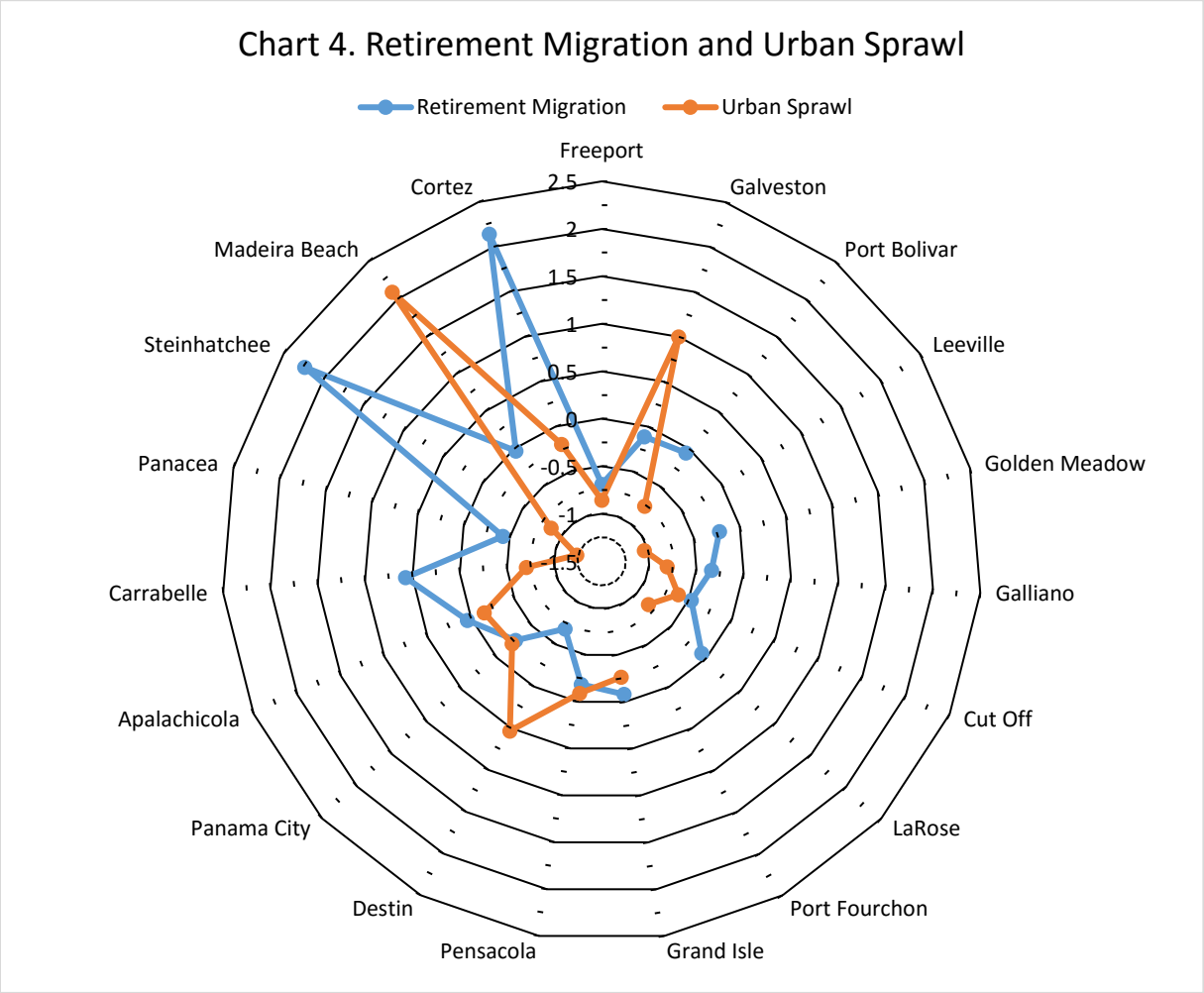
Galveston was about one standard deviation above the mean for urban sprawl, while all of the remaining Texas, Louisiana, and Florida Panhandle communities were below the mean. Madeira Beach had the highest urban sprawl factor score among the study sites, fully two standard deviations above the mean.

Table 10. The Retirement Migration and Urban Sprawl Indices by Study Community Sites.

Communities	Retirement Migration	Urban Sprawl
Freeport	-0.689	-0.855
Galveston	-0.112	0.998
Port Bolivar	-0.054	-0.766
Golden Meadow	-0.222	-1.038

Galliano	-0.339	-0.809
Cut Off	-0.471	-0.621
LaRose	-0.067	-0.83
Grand Isle	-0.079	-0.262
Pensacola	-0.187	-0.091
Destin	-0.691	0.531
Panama City	-0.269	-0.217
Apalachicola	0.045	-0.148
Carrabelle	0.571	-0.703
Panacea	-0.428	-1.231
Steinhatchee	2.235	-0.863
Madeira Beach	-0.029	2.091
Cortez	2.143	-0.198

Chart 4. visually represents the retirement migration and urban sprawl indices. Steinhatchee and Cortez are high on retiree migration index while Madeira Beach and Cortez are both high on the urban sprawl index.



Part III: Evaluation

Interrater Reliability

Interrater reliability is the degree to which independent observers evaluate the characteristics of a subject and reach the same conclusion (Lombard et al., 2002). High level of agreement in ratings generally reflects the reliability of the standards and process. This is true especially if two or three different raters are applying the same criteria and reaching the same results. However, in this case there are three completely differing sets of criteria and processes. Here a high level of agreement reflects convergence of a construct with reality. In other words, rather than being a reflection reliability (receiving the same results from repeated measures using the same criteria) it is a reflection of both construct and external validity (the link between a construct and observed reality). For this use we agree with Lombard et al. (2002) who have argued convincingly that a more accurate term would be interrater agreement.

There are some widely reported measures of agreement used to assess interrater reliability or agreement. They are percentage agreement, Spearman's rho, and Interclass Correlation Coefficient. Each of these measures has some significant advantages and drawbacks but taken together they allow for a more complete assessment of interrater agreement. Percentage agreement is easily understood and has a straight forward interpretation but can be misleading. For example, when matching only three rating categories, a significant level of agreement would be expected to be to random chance (11.1%). However, in this current research raters have four categories to match. Thus reducing the random risk by about half (6.25%). Correlational techniques measure covariation but not the extent in which there is identical agreement in the categories. Bivariate correlations are generally interpreted in analysis to be substantial above 0.600. In this case, we use a non-parametric correlation technique called Spearman's Rho because the N size is relatively small and we cannot assume normal distribution.

To assess the overall consistency of the reviewers an Interclass Correlation Coefficient (ICC) analysis was employed. ICC is a measure of the reliability of the raters' agreement, in other words, both raters assigned the same similar score to secondary data indices. The ICC is a coefficient that ranges from 0, which means no agreement to 1, which means perfect agreement. It is used when there are more than two raters and a single measure is needed to assess the overall reliability of the rating process. The ICC interpreted similar to Chronbach's Alpha and bivariate correlations, with .600 generally seen as the beginning of substantial agreement. It is also similar in relation and interpretation to a multiple *r*.

Coding Issues for the Secondary Data Indicators

To evaluate the agreement of the social indicators with the ethnographic research it was necessary to code the indices into ordinal categories so the quantitative analyses (social indicators) could be compared with the descriptive qualitative research (ethnography). These categories were: 1) low (bottom half of all coastal communities) 2) average (near the mean for all coastal communities), and 3) moderate high (above average for all coastal communities), and 4) very high (top 10% for all coastal communities). Each separate community (N=827) was coded into one of the categories based on the index factor score, so the response categories within the

study communities are not evenly distributed. In addition, the ethnographic researchers were asked to rate the community study sites on fishing engagement and fishing reliance using the above categories.

Interrater Agreement Results Fishing Engagement

Table 11. presents the interrater reliability results for fishing engagement the study sites. For GTF engagement the index matched the ethnographic raters 43% of the time. A high level of agreement for a four category rating system. In addition, Spearman's Rho (bivariate correlation) was .626 and was statistically significant. The Spearman's Rho is a conservative estimate of the correlation so .626 is a substantial correlation. In short there is a good amount of evidence that both data collection efforts are in agreement.

For commercial fishing engagement the raters matched 41% of the time, but the Spearman's Rho was .698 and also was statistically significant. This also reflects a very good level of agreement reality between the research methods.

Recreational engagement matched 73% of the cases but Spearman's Rho was only .564. This is still statistically significant. The correlation was reduced greatly over the previous analysis because the loss of three communities in the analysis because of limited recreational data in Texas. Still, matching 73% of the cases is very impressive and indicates an underlying high level of agreement.

The ICC for the three engagement variables is .778 which is moderately high. All of the raters were regularly responding in a consistent pattern with the social indicators, even if not matching identically. This ICC indicates a moderately high degree of consistency among the reviewers and the indicators.

Interrater Agreement Results Fishing Reliance

Table 11. presents the interrater reliability results for fishing reliance for the study sites. For GTF reliance the index matched the ethnographic raters 29% of the time. In addition, Spearman's Rho (bivariate correlation) was .588 and was statistically significant. There is an acceptable level of evidence that both data collection efforts are in agreement.

For commercial fishing reliance the raters matched 18% of the time, but the Spearman's Rho was .709 and also was statistically significant. This reflects a good level of agreement reality between the research methods.

Recreational reliance matched 14% of the cases but Spearman's Rho was only .248. This was not statistically significant. The correlation was reduced greatly over the previous analysis because the loss of three communities in the analysis because of limited recreational data in Texas. There was not a sufficient amount of agreement for this index.

The ICC for the three reliance variables is .762 which is moderately high. All of the raters were regularly responding in a consistent pattern with the social indicators, even if not matching

identically. This ICC indicates a moderately high degree of consistency among the reviewers and the indicators.

In general, both the qualitative ethnographic data and the quantitative social indicator data have reinforced a common agreement on the state of fishing engagement and reliance in these study sites. Five of the six indicators were statistically significant and had strong evidence of similar results. In the case of recreation fishing reliance, the analysis was hindered by the loss of the Texas study site data, coupled with the difficulty of assessing the relative impact of recreation fishing give the communities size. Since recreational fishing was not a focus of this research, we feel this mixed result does not impact any of the findings.

Table 11. Interrater Reliability Results for Fishing Engagement and Reliance.

		GTF Engagement		Commercial Engagement		Rec Engagement		GTF Reliance		Commercial Reliance		Rec Reliance	
		Observer	Indicator	Observer	Indicator	Observer	Indicator	Observer	Indicator	Observer	Indicator	Observer	Indicator
Communities	**State**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**	**Rate**
Freeport	TX	3	3	2	1			1	2	1	2		
Galveston		4	4	4	4			1	2	2	4		
Port Bolivar		1	2	2	4			1	2	3	4		
Leeville	LA	2	4					2	4				
Golden Meadow				3	4	1	2			3	4	4	2
Galliano				3	4	1	1			3	4	3	1
Cut Off				3	4	1	1			3	4	2	1
LaRose				1	2	1	1			1	3	1	1
Grand Isle		2	2	4	4	2	4	2	2	4	4	2	4
Pensacola	FL	3	4	3	4	4	4	2	4	2	4	3	1
Destin		3	4	3	4	4	4	2	4	2	4	3	4
Panama City		3	4	3	4	3	3	2	4	2	4	3	1
Apalachicola		4	4	4	4	2	2	4	4	3	4	2	2
Carrabelle		2	1	2	2	3	1	1	1	1	2	2	1
Panacea		2	4	2	3	2	1	1	4	1	3	2	1
Steinhatchee		3	4	3	3	3	4	2	4	2	4	3	4
Madeira Beach	FL	4	4	4	4	4	4	4	4	4	4	4	4
Cortez		4	4	4	4	4	1	4	4	4	4	4	1

	Matched	Matched	Matched	Matched	Matched	Matched
	43%	41%	73%	29%	18%	14%
*p<.05	Spearman's Rho	Spearman's Rho	Spearman's Rho	Spearman's Rho	Spearman's Rho	Spearman's Rho
**p<.01	.626**	.698**	.564*	.588*	.709***	0.248
***p<.001	For Engagement Variables			For Reliance Variables		

Interclass Correlation Coefficient (ICC)

0.778

Interclass Correlation Coefficient (ICC)

0.762