3-18-2014

The Impacts of Fisheries Management on the Performance and Resiliency of the Commercial Fishing Industry and Fishing Communities in the Florida Keys (Monroe County, Florida) from 1950-2010

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DOI: 10.25148/etd.FI14040849

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THE IMPACTS OF FISHERIES MANAGEMENT ON THE PERFORMANCE AND RESILIENCY OF THE COMMERCIAL FISHING INDUSTRY AND FISHING COMMUNITIES IN THE FLORIDA KEYS (MONROE COUNTY, FLORIDA) FROM 1950-2010

A dissertation submitted in partial fulfillment of the

requirements for the degree of

DOCTOR OF PHILOSOPHY

in

INTERNATIONAL RELATIONS

By

Manoj Shivlani

2014

To: Dean Kenneth G. Furton
College of Arts and Sciences

This dissertation, written by Manoj Shivlani, and entitled The Impacts of Fisheries Management on the Performance and Resiliency of the Commercial Fishing Industry and Fishing Communities in the Florida Keys (Monroe County, Florida) from 1950-2010, having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Peter Craumer

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Gail Hollander

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Laura Ogden

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Roderick Neumann, Major Professor

Date of Defense: March 18, 2014

The dissertation of Manoj Shivlani is approved.

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Dean Kenneth G. Furton
College of Arts and Sciences

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Dean Lakshmi N. Reddi
University Graduate School

Florida International University, 2014

DEDICATION

I dedicate this dissertation to my entire family, and especially to my boys, Rahul and Somak, and my beloved wife, Mariella. Her infinite patience and tireless support led to the completion of this work, and she deserves as much credit for this dissertation as does her lesser half.

ACKNOWLEDGMENTS

I thank all the members of my committee for their guidance, from the start of my proposal to the end of the dissertation. I could have not have asked for a better set of engaged, knowledgeable, and helpful group of individuals who cared about my progress and directed the completion of this dissertation. Dr. Laura Ogden was very helpful in our discussions concerning the human side of fisheries management. Dr. Gail Hollander broadened my views on globalization, helping explain the connections between the local and the global. Dr. Peter Craumer gave me a better appreciation for demography, and why it matters. I can only hope that I learned as much as they were willing to impart, and that some of that is reflected in this effort.

I owe an immeasurable debt of gratitude to my major professor, Dr. Rod Neumann. His acumen and insights guided every part of my dissertation, and his patience and humor helped me during the times when I thought that I would never finish. Mostly though, it was Rod's selflessness and generosity for which I am most grateful; I can only hope to be as giving in my professional career as he was with me over this process.

So many other researchers have informed my research, but I am especially indebted to the insights provided by Tom Murray, Tom Matthews, Dr. Billy Causey, Maria Estevanez, Dr. Bob Leeworthy, Flavia Tonioli, and Rafael Araujo. Dr. Daniel Suman gave me my first opportunity to work in the Florida Keys, paving the way for the dissertation. Doug Gregory gave way too much of his time to help me understand changes in the region's fisheries. The late Ed Little was among the most

knowledgeable persons on the Florida Keys history, and our numerous discussions greatly informed my work.

I was aided with the unconditional support of my colleagues at work and am particularly thankful to Roger Peretti, who encouraged me throughout the dissertation. Roger championed my efforts, as did David Sampson, Roberto Koeneke, Bob Mohn, Pat Sullivan, Don Siniff, Steve Brown, Shelley Covington, and Carole Gaudette. A special thanks to my friends and colleagues, Dr. David Die and Bill Michaels, who were always available and accommodating as I made my way through the research and writing process.

I cannot end these acknowledgments without thanking all the Florida Keys fishers who have tolerated having an interloper, a social scientist at that, in their midst for the past two decades. These folks and their communities represent a way of life that I can best describe as authentic, and I am only too thankful that they have shared part of it with me.

ABSTRACT OF THE DISSERTATION

THE IMPACTS OF FISHERIES MANAGEMENT ON THE PERFORMANCE AND RESILIENCY OF THE COMMERCIAL FISHING INDUSTRY AND FISHING COMMUNITIES IN THE FLORIDA KEYS (MONROE COUNTY, FLORIDA) FROM 1950-2010

by

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Florida International University, 2014

Miami, Florida

Professor Roderick Neumann, Major Professor

Commercial fisheries in the Florida Keys have experienced a significant decline in participation and harvest over the past two decades, with over half of the fishers exiting the fishery since 1990 and a 50-70% decline in annual landings compared to previous decades. The conventional narrative of fisheries management identifies overfishing and overcapacity as the malaise endemic to open-access fisheries systems, for which the remedy offered is technocratic management. Technocratic management, which seeks to restore ecological integrity and economic efficiency, has been increasingly employed in the Florida Keys, in the form of limited access and property rights measures. I contend that the technocratic management approach is flawed and in a large part responsible for the decline of Florida Keys fisheries because the approach has ignored social sustainability, leading to a significant reduction in fisher participation, the fragmentation of fishing

communities, and erosion of social capital. Technocratic management has also underestimated the importance of non-fishery factors, unique to place, and these factors – including population, tourism, and globalization factors – have exacerbated the impacts of management measures. The net result has been the opening up of scarce and valuable coastal space, which was previously occupied by fishers, fish houses and processors, and other fisheries infrastructure, to conversion for non-working waterfront uses. While measures have been undertaken to foster fisher participation and slow down waterfront conversion, these have largely failed due to the measures' inability to address the core problem, which is the flawed management approach that undermines social sustainability. I provide a revised, comprehensive fisheries management framework that, if implemented, can at least address some of the technocratic management's shortcomings and prevent further decline in fisher participation and fisheries decline.

TABLE OF CONTENTS

LIST OF FIGURES

FIGURE PAGE

CHAPTER 1: INTRODUCTION

The Conventional Narrative in the Florida Keys

Walking down the historic waterfront in Key West, a visitor can often engage with the ghosts of the Keys' past, from turtle pens (called 'kraals') that once housed locally landed and then imported sea turtles ready for slaughter, slips that served one of the region's largest shrimp fleets, brick warehouses that stored varieties of dried sponges, and converted fish markets that sold the denizens of nearby and offshore waters. In their place exist simulacra that entice tourists with authentic (often restored) façades and faded signs, but not for the products of working waterfronts but for restaurants, souvenir shops, and excursions. The gentrification in areas like Old Town Key West is complete, while in other communities, such as Stock Island and Marathon, the transformation to condominiums and curio shops continues. As more of the archipelago is converted to non-working waterfront uses, its economy has perhaps reached yet another equilibrium. After five centuries of dependence on piracy, salvaging, sponging, bootlegging, drug smuggling, and fisheries, the Keys have been domesticated by tourism. Goodbye working waterfronts, hello vacation rentals.

The recent history of the Florida Keys (1950-2010) can in some ways be characterized as the inexorable growth of a tourism economy that over the past quarter century has dominated all other industries in the archipelago. The focus of my dissertation is the history of the Florida Keys' commercial fishing industry that, like other economies in the Florida Keys, underwent a number of changes over the

past 60 years. Starting mainly as a subsistence-based activity that supported local trade, the fishery grew over the 20th century into various sectors that supplied regional and national markets with fin fish and invertebrates. The fishery began a steady decline since reaching its peak in the late 1970s and has been reduced into a minor part in the Florida Key's tourism-dominated economy, both in terms of landings from and participation in the industry and as measured by economic output.

The conventional narrative that explains the decline of the fishing industry (both in the Florida Keys and elsewhere in the US) is one that largely places the blame on the industry and its participants, who are seen to have exploited a largely open access system with support from government incentives and subsidies. Under this narrative, the fishing industry, which expanded in the post World War II era, grew too large for the resource base that it harvested, and its inevitable crash occurred as a result of unsustainable fishery practices (the ecological explanation) and too many fishers and excess effort (the economic explanation) (Weber, 2002). Also as explained by this narrative, management reforms that emerged from the 1980s onwards, which I term as technocratic management, focused on addressing unsustainability and overcapacity (excess participation, gear, and/or effort) to discipline and save the fishing industry. While part of the policy solution involved eliminating excess capacity, in the form of gear and participants, the net result was the restoration of the resources and greater profits to the industry. Part of the technocratic management solution has been a tendency towards privatization of

fisheries, where market alternatives, such as individual transferable permits, quotas, and gear have been applied to reach equilibriums for fishery participants and effort. The narrative has implied that because fishers were competing in an open-access system, tragedies of overharvest and excess effort were inevitable; by addressing these tragedies, management has strengthened the industry for the long-term.

My argument in this dissertation is that this conventional narrative is flawed because it fails to take into account the social dimensions of fisheries and their importance in maintaining sustainable fisheries. My contention is that ecological integrity, economic efficiency, and social sustainability comprise three legs of a sustainable fisheries stool (Symes and Phillipson, 2009), and that each leg is essential for the overall success of a fishery. Technocratic management has largely assumed that by eliminating overfishing and maximizing profits in fisheries, the fishing communities and their participants will achieve a new equilibrium to the benefit of the industry and society. However, in doing so, the approach often weakens fishing communities, eroding the communities' underlying social capital. Fishers are homogenized into units of effort, and societal relations that engender trust, foster cooperation, and sustain networks are undermined. Also, by ignoring the importance of place and the attending non-fishery factors unique to place, technocratic management has exacerbated the impacts of non-fishery factors, which have further weakened these communities, leaving them vulnerable to larger economic forces that precipitated their decline.

The fishing communities that I evaluate in the dissertation are located in the Florida Keys, an archipelago that extends off the southeastern tip of south Florida in a southwesterly direction to Key West (Key West is the westernmost of the Florida Keys that has a permanent, resident population, but the Florida Keys extend in a discontinuous manner to the Dry Tortugas, a group of islands located 108 kilometers west of Key West). The Florida Keys fishing industry and its communities are spread across a large, heterogeneous set of islands, comprise of a diversity of fin fish and invertebrate fisheries, and are rich in fishing history and tradition. These factors make the Florida Keys as a region an excellent case study through which to examine the larger questions on technocratic management and its impacts, including the effects on the social dimensions of fisheries, and the long-term changes in fishery participation, effort, and landings. By using a variety of existing literature, extensive research experience, and an eclectic set of biophysical, biological, and socioeconomic databases, the dissertation weaves a narrative counter to the conventional one. It explains why the Florida Keys' fishing industry and fishing communities initially flourished but then later fragmented and faded over the past two decades. I use the Florida Keys spiny lobster fishery as a case study to evaluate the effects of technocratic management in the fishery and to draw lessons for improving the management focus. The lobster fishery is one of the archipelago's oldest and most lucrative fisheries and has been subject to a privatization scheme since the early 1990s. This fishery best exemplifies how technocratic management, implemented to improve economic efficiency and reduce

overcapacity, ignored the social dimensions of the fishery, resulting in a long-term decline in participation and deterioration of fishing communities and social networks.

Theories Underpinning the Arguments

The dissertation argues against the efficacy of technocratic management on two main fronts: One, technocratic management fails to account for the value of social dimensions, especially social capital, in maintaining vibrant and resilient fisheries; and, two, technocratic management ignores the long-term impacts of consolidation on fishing communities by increasing the communities' vulnerability to non-fishery factors. To best understand the effects of technocratic management, it is important to consider its underlying premise.

For the purposes of the dissertation, technocratic management is defined as a management approach that has ecological sustainability and economic efficiency as its primary goals. Technocratic management is implemented to address the biological problem of overexploitation, set at fishing beyond a sustainable yield (Weber, 2002), and the economic problem of overcapacity, determined by the number of participants, gear, or effort (Tietenberg and Lewis, 2012). Technocratic management seeks to 'solve' the tragedy of the commons conundrum (Hardin, 1968) by disciplining fisheries to levels of maximum sustainable yields (Finley, 2011) and economic efficiency (Tietenberg and Lewis, 2012). Fisheries science, which had developed in reaction to depleting fish stocks in the early 20th century,

gained momentum in the post World War II years, as management increasingly adopted biophysical models to establish sustainable fishing targets. Among the most important such targets was that established under the maximum sustainable yield (MSY) model, which is theoretically the largest yield that can be harvested over a sustained period (Finley, 2011). Economists built on the MSY model by developing a bioeconomic model (one that combined the economic and biological dimensions of fishery effort and harvest) that could predict the costs and benefits to a fishery based on levels of fish stock growth and effort (Anderson, 2004). Under bioeconomic modeling, the maximum economic yield (MEY) of a fishery, the landings total that represented the most efficient level of effort for the fishery, could be determined. Moreover, by understanding how benefits and costs in fisheries were configured, technocratic management could use the biological/ecological and economic dimensions of fisheries to solve the increasingly pervasive problem of overfishing.

A suboptimal solution in the fisheries bioeconomic model was that associated with open access, under which fishers would be incentivized to compete against each other until all economic rents would be exhausted. Simply put, effort would be shifted past maximum sustainable yield resulting in overfishing. Thus, management would be required to decrease effort towards ecological or economic sustainability, and that could be achieved by, among other measures, the creation of property rights in fisheries (Tietenberg and Lewis, 2012; Siejo et al., 1998).

Lost in this approach, however, were the social dimensions of fisheries and their importance in maintaining vibrant and resilient fishing communities. Despite a legislative requirement to focus on communities (National Standard 8 of the Magnuson Stevens Act (16 USC 1851(a)(8))), technocratic management solutions ignored or underestimated the social ramifications, expecting that fishing communities could withstand the consolidation (in terms of reducing participation in a fishery) that accompanied overcapacity and overfishing remedies (Jentoft, 2000). Even when fishing communities were acknowledged as requiring attention, actions taken generally favored consolidation over participation (Bromley, 2009), mainly because the management approach uses an impoverished view of society, in which fishers and their communities are perceived as interchangeable units or aggregations of effort. The lack of attention to the social dimensions of fisheries allowed the degradation in social capital, a decline in fishing communities, and increased distrust of management (Carothers and Chambers, 2012). The fragmented communities and remaining participants became increasingly vulnerable to non-fishery pressures, especially within uses that competed for the same resources and waterfront. Once technocratic management had set into motion the consolidation process, many fishers moved out due to the high prices of dock spaces and housing, higher costs of living, and cheaper seafood imports, among other factors.

Part of the problem, as I discuss in the dissertation, has been how fishing communities are perceived and have been defined under technocratic management. Under the system, fishing communities have been represented largely by a

concentration of unitized fishing interests (Jepson, 2007) that are economically dependent on the resource and which make up a sizable component of their larger communities. Lost in the technocratic management definition are fishing communities that occupy discontinuous space and which consist of spatially distant operators rather than as replicas of Herman Melville's *Moby Dick* New England fishing villages. Also lost in this antiquated definition are the dynamic communities that occupy space in the ocean and on the waterfront, where both areas are dependent on each other (St. Martin, 2001). The simplification of what fishing communities should look like makes it easier for the technocratic approach to ignore the social dimensions of fisheries, including the omission of the value of social dimensions, as exemplified by social capital.

Social capital is an essential but often underappreciated community value. Organized mainly as bonding social capital (Putnam, 2000) in fishing communities, where such capital is shared within a community and its members, social capital is represented by the trust, cooperation, and networks that fishers and their allies share and which makes their community resilient to impacts (Grafton, 2005; Pretty, 2003). Examples of social capital in fishing communities include social networks in which fishers engage to exchange confidential information on fishing grounds and conditions, fish prices and markets, and environmental and regulatory changes and impacts, among others (Grafton, 2005). Collective action, as it results in cooperation to adjust to regulatory changes, address environmental change, or to reach consensus on community decisions, is strengthened by social capital, where

increased levels of trust allow for consensus building and cooperation. Social networks, built on the foundation of trust and cooperation, also serve to recruit entrants into fisheries. The entrant/mate system[1] is built on captains and crews working together, and it results in both traditional ecological knowledge transfer and an informal education (tacit knowledge) on fishing practices (Davis and Ruddle, 2012; Shivlani and Milon, 2000).

Within communities, certain individuals may serve as key agents who help build consensus and increase trust, thereby maintaining social capital. These agents are undermined in technocratic management measures, which assign effort in terms of positionality, where all fishers are identified as units of effort that are interchangeable, like persons in position in a line (Jentoft, 2000). As such, a fisher no longer has more value than that of the effort that the fisher represent; the fisher, once removed from the fishery, can be replaced by another, such that the fishers themselves represent only positions in a line. However, in terms of social dimensions, the loss of fishers who are key agents erodes the social capital they provided and reduces trust and cooperation. Under the tenet of social capital, fisheries and fishing communities cannot be managed as the summation of individual units of effort, in which units can be eliminated and reconfigured. The erosion of social capital from exiting fishers and fragmented communities

[1] The entrant/mate system refers to the apprenticeship system that exists in many fisheries, via which individuals interested in a career in fishing join a fishing vessel as mates, building experience and knowledge to a point where they can 'graduate' into the fleet as captains.

commences a downward spiral, where cohesion and participation are replaced by intra-fishery distrust and wariness over management goals.

Methodology

Throughout the dissertation, I use the term, 'fisheries', to describe the system comprised of the target marine organisms, the coastal and marine environment, and the fishers and their infrastructure and communities that harvest the organisms and influence their abundance (Ross, 1997).

The design and conduct of the dissertation research was supported by a significant amount of personal experience with the fishing industry in the Florida Keys. I have been working with the commercial fishing industry in the Florida Keys since 1995, when I led a field effort in collecting fisher and other stakeholder group data on use patterns and attitudes, perceptions, and beliefs regarding the Florida Keys National Marine Sanctuary (FKNMS) (Suman et al., 1999; Milon et al., 1997). Since then, I have led or been involved in various fisheries' related studies in the region, including an economic assessment of the Florida Net Ban (Shivlani et al., 1998), data collection and spatial analysis of commercial fishery operations in the Dry Tortugas (Shivlani et al., 1999), a sociocultural analysis of the Spiny Lobster Trap Certificate Program (Shivlani and Milon, 2000), socioeconomic characterization of fisheries in Biscayne National Park (EDAW, 2006), a fisher-level analysis of the spiny lobster fishery (Shivlani et al., 2004), a medium-term assessment of the impacts of the Dry Tortugas Ecological Reserve on commercial

fisheries (Thomas J. Murray & Associates, 2006), a ten-year monitoring project on the performance of commercial fisheries in the Florida Keys (Thomas J. Murray & Associates, 2008), a follow-up study on commercial fisher uses of and perceptions concerning the FKNMS (Shivlani et al., 2009), and longitudinal analysis on the effects of non-fishery factors on the performance of Florida Keys' fisheries (Shivlani, 2009). I have also worked with commercial fishers and other stakeholders in the Florida Keys, Florida, Puerto Rico, the US Virgin Islands, and Panama. These experiences have provided me with important insights (especially as related to the complex inter-relationship between regulations and fishing communities) on commercial fisheries, fishing communities, and fishery social networks.

Interviews and participant observations

In addition to the fieldwork described above, I conducted in-depth interviews with 40 key informants with Southeast Florida commercial fishers and persons involved in and knowledgeable about the region's coastal and marine resources as part of my primary, dissertation fieldwork. The interview effort commenced during the last half of 2010 and was comprised of open-ended discussion on the respondents' views on the following issues: Changes in the region's fisheries and the reasons for the changes, the impacts of fishery management measures on landings, effort, participation, and fishing communities, the effects of non-fishery factors (e.g., population growth, tourism, development, etc.) on the performance of fisheries and on resource abundance and quality, and predicted, long-term shifts in the region's

coastal and marine economies and stakeholders. The 40 key informant interview effort targeted a variety of professions and not just commercial fishers. Apart from commercial fishers, fish house owners and operators, and mates/crew, I also interviewed resource managers, port agents, environmental group representatives, dive and charter operators, and marine scientists.

I selected the group from a larger list of persons with whom I had participated in my previous years of research in Southeast Florida. I selected only those key informants who I knew had experience working in and knowledge of the region, its fisheries, and fisheries management. Also, because I had worked with these individuals in the past and had a good working relationship with them, I knew that I would be able to conduct lengthy interviews that spanned a variety of topics and across several historical periods. Several of the interviews also spanned sensitive topics, including drug smuggling and its impacts on commercial fishing capacity development from the 1960s to 1980s, the level of under-reporting of harvests, poaching, and intra-fishery conflicts. I could obtain this information because I had built a high level of confidence with the informants after having worked together for over a decade in some cases, and the stakeholders were able to provide me with unaltered information.

I conducted the interviews in person and usually at the participants' primary locations, and the average interview lasted 1. 5 hours. I let every participant know that I would not use the person's name in any reporting and that I would aggregate answers as needed to avoid disclosure. In a few cases, I conducted an individual

interview over several days, especially where the participant wanted to continue providing information. While undertaking the interviews, I kept notes on personal observations, such as listed seafood prices, the status of vessels and gear, the interactions between the interviewees and other stakeholders, etc.

Whenever possible, I asked respondents to provide me with anecdotes on the issues we discussed. These anecdotes, whether these were related to the changes in fishing conditions, past and present seafood prices, or the problems between different fishery sectors, were all useful in providing the details for the large-scale changes and events that I identified via interview and other data. Also, these anecdotes helped greatly in promoting further discussion as they often disarmed otherwise guarded participants.

I always started each interview with asking the respondent on his or her background, in terms of how long the person had lived in and/or worked in the Florida Keys, and family history in the region. Then, the interview usually centered on changes that the person had observed in the biophysical conditions in the region. I made certain to ask why these changes had occurred, how the fishing industry may have influenced and been affected by these changes, and how the regulatory process had addressed the changes. I then asked the respondent about how the economy of the Florida Keys had changed over the respondent's tenure, focusing on industries that had grown and others that had declined, the cost of living conditions, and housing, dock space, and waterfront access. I followed up with questions related to the reasons for these changes and their overall impact on the fishing industry and

fishing conditions, especially whether these changes had influenced fishing communities and fisher participation. Depending on the stakeholder's occupation and expertise, I then tailored the remaining interview to learn about the person's views on, for example, the long-term shifts in resource conditions, the change in resource allocation across user groups, the effects of water quality and the decline of benthic resources (especially coral reefs) on fisheries, and the effects of seafood imports on effort and landings in Florida Keys fisheries.

I maintained all my interview notes and personal observations in journals that I referred to at the end of the interview session. Where I had questions or needed to follow up with the participant on a matter, I worked mainly via telephone calls or email exchanges to obtain the clarifications or supplementary information. I also made certain that any data provided by respondents, such as key dates, prices, and harvest totals, were all checked with other information sources (such as official landings and price datasets, ground truthing, etc.). I also corroborated information with other stakeholders, for example with gear costs and seafood prices that I checked with several fishers and fish house operators I interviewed. Where I could not obtain confirmation from another source, I generally did not use the information.

Analysis of secondary datasets

I analyzed eight secondary datasets. I stratified each dataset as per my analysis requirements, summarizing relevant data, developing data trends, and

organizing data tables and figures. Two of the datasets that I used contained fishery level information for the Florida Keys fishing industry and the Florida Keys spiny lobster fishery, respectively. I had led both research projects that led to the completion of these datasets. The first of these studies was the Florida Keys spiny lobster economics project, funded by the Florida Department of Environmental Protection (DEP), and which I led from 2002-05. The second study was the Florida Keys National Marine Sanctuary (FKNMS) re-study, funded by the National Oceanic and Atmospheric Administration (NOAA), which I led from 2005-08. The Florida Keys spiny lobster economic project dataset contained information on demography, economic investments and annual operating expenses, landings, effort, and costs data, fishing patterns, and views on management, use conflicts, and enforcement for 272 commercial lobster fisher surveys. The FKNMS re-study dataset contained demographic, economic, fishery, and perceptions data from 294 commercial fishery surveys.

I used four fishery specific datasets from the State of Florida and US National Marine Fisheries Service (NMFS). These were the Florida Fish and Wildlife Research Institute (FWRI) spiny lobster fishery dataset, the FWRI Florida Keys fishery landings and effort set, the FWRI commercial fishery statistics dataset, and NMFS fishery trade statistics dataset. Together, these four dataset provided most of the longitudinal data trends that I analyzed for the region.

The FWRI fishery landings and effort dataset provided information on landings and trip information on all Florida Keys fisheries from most of the study

period (1950-2010). For some species, landings were aggregated at the genus or species complex level (such as grouper or reef fish), but the data disaggregation improved over the last thirty years in the database. The FWRI spiny lobster fishery dataset provided information on landings, effort, and participation in the spiny lobster fishery over the past two decades. The dataset also contained information on landings by commercial sector (which is divided into a trap fishery and dive fishery), the amount of gear, and inter-annual landings in the commercial and recreational fisheries. The FWRI commercial fishery statistics dataset, which I created using annual landings summaries and commercial fishery license information available at the FWRI database, contained information on the number of commercial fishing permits (Saltwater Products Licenses), endorsements by species (which are special permits to fisheries that have a limited entry requirement), and wholesale permits. The dataset provided information on long-term trends in commercial fishery participation and participation in different fisheries. The NMFS fishery trade statistics dataset yielded trend information on trade in major species groups, such as shrimp, spiny lobster, and reef fish, among others. The trade statistics database also provided information on the nominal value of fishery products, which I then transformed to inflation-adjusted value using the Bureau of Labor Statistics (BLS) Consumer Price Index (CPI) Inflation Calendar. I also used the NMFS fishery landings dataset but I did so mainly to compare the FWRI landings that served as the main data source for landings and effort information.

I obtained socioeconomic data from the University of Florida's Bureau of Economic and Business Research (BEBR) data tables and dataset to determine trends in the cost of living index and key economic characteristics for Monroe County, Florida. Included in the data tables were data related to employment by sector, median home prices, and a cost of living index.

Finally, I obtained US Census data from the 1950 Census through the 2010 Census datasets for Monroe County, Florida. I used both the general population characteristics and social and economic characteristics, to determine changes in population by region (used to demonstrate how population centers affected fishing community growth in the Upper and Middle Keys from the 1950s onwards) and to determine the relative importance of the commercial fishery sector, as measured by the number of individuals who worked in the natural resources sector. I also utilized US Census datasets to determine median home values and other economic characteristics related to changes in the cost of living conditions.

Analysis of historical sources

Archival research included analyses of local news archives, historical journal articles, other gray literature (e.g., government documents, policy documents, agency reports, etc.). I worked with Tom Hambright, the Key West Public Library historian, to obtain archival material on fisheries and fisheries-related literature available from the library. I also accessed archival material from major newspapers covering the 1950-2010 period as it related to commercial fisheries, recreational

fisheries, fish abundance, environmental resources, and tourism. Specifically, I searched the digital archives of the Miami Herald and New York Times for the time period.

The journal search also consisted of keyword searches, but I expanded my query to include all Florida Keys articles. Once collected, I sorted the articles by relevance, topic, and date, referring to the articles as required during data analyses and writing. I also obtained reports from historical studies (extending back into the early 1950s) from the FWRI website. These included seminal studies conducted on the then emerging pink shrimp fishery, characterizations of the spiny lobster fishery, descriptions of gear types used in commercial fishing in the Florida Keys, and discussions on the recreational fishery sector, among others. I accessed the US Fish and Fisheries Commission reports, published between 1872 onwards, focusing mainly on the early reports for descriptions on the Havana snapper fishery, the Lower Keys sponge fishery, and the Key West spiny lobster fishery.

Organization of the dissertation

The dissertation, divided into seven chapters, uses a 'political ecological' approach (Neumann, 2005) to describe the performance of Florida Keys fisheries (here, performance roughly refers to the changes in ecological, economic, and social aspects of the fisheries) over the past 60 years (1950-2010). The political ecological approach is one that encompasses the interaction between the ecological trends in the various fisheries and the political and economic decisions taken at the

management level to address those trends. The approach also brings in social theory to explain how the human dimensions of fisheries have been mostly ignored in the political-economic framework, especially as the fisheries came under increasing management control from the 1980s onwards, and the long-term consequences on participation, networks, and the land and seascape.

Chapter 2 presents the technocratic management conventional narrative and describes the twin pillars of ecological sustainability and economic efficiency first as an emergent theoretical concern and then dominant paradigmatic approach to fisheries management. The chapter discusses the role of the Gordon-Schaefer bioeconomic model (Siejo et al., 1998) in the evolution of technocratic management, positioning fisheries' bioeconomics as the forerunner to Garret Hardin's more influential 1968 article on the tragedy of the commons (Hardin, 1968). Chapter 2 describes the development of the 1970s federal fisheries management act that followed in line with the modern environmental movement of the same decade (Kraft, 2011). The 1976 Fishery Conservation and Management Act (FCMA), presently reauthorized as the Magnuson Stevens Act (MSA), greatly increased federal oversight in fisheries by enclosing the waters beyond state limits up to 200 nautical miles as part of a fishery conservation zone (Weber, 2002). The MSA created a regional council system, via which stakeholders and state and federal agency officials deliberated policy concerning harvest limits and, over time, management approaches. The management approaches that gradually gained favor were those that addressed access and harvest limits, i.e., the institution of limited

entry and property rights. Technocratic management followed as part of the reforms of the federal fishery management program once overfishing – in part facilitated by the reapportionment of coastal fisheries to the domestic fishery sector via the MSA and subsequent subsidies to expand local fishing effort – became a major problem in the 1980s and 1990s (Weber, 2002).

Chapter 3 provides a counterpoint to the technocratic management discussed in Chapter 2, introducing the concept of social capital and its importance in fisheries and fishing communities. The chapter discusses theoretical tenets of social capital and the application of social capital in fisheries management. Whether considered as Bourdieu's re-formation of social relations as a means to reproduce class structure (Bourdieu, 1986), Coleman's determination of capital present in informal settings that improves social standing (Coleman, 1988), or Putnam's broad views on social capital (Putnam, 2000) as a means by which to sustain civic society, the definition of social capital at its core concerns the existence of a value that is shared across individuals and within society that facilitates trust, promotes cooperation, and develops networks (Field, 2011). Social capital in the context of fisheries and fishing communities is identified as an essential component of the operational and organizational aspects of the industry (Grafton, 2005). That is, the social capital in fishing communities is manifested in the fishery information networks as related to fishing grounds, fishery practices, and product and gear prices, the level and extent to participation in fishing organizations, and cooperation in strategic actions to project and protect fishery interests. The chapter

demonstrates that as communities decline, social capital erodes, reaching a point where there may no longer be viable communities to harvest fishery resources. In such areas, the productive capacity of the fishery – as measured by the economic metrics – may have been improved, but the social sustainability is permanently impaired.

Chapter 4 introduces the Florida Keys, its fishing industry and fishing communities, and non-fishery factors that have influenced participation in and performance of the region's fisheries. The chapter describes the changes in the Florida Keys' economy over the long-term, showing demographic, employment, and cost of living trends, and how these have influenced the development and performance of the fisheries sector. I describe how fisheries and fishing communities are organized in the Florida Keys. I also outline the major historical trends and events, especially over the past two centuries, that shaped the Florida Keys' political economy, culminating in the post World War II era on a path towards mass tourism (Shivlani, 2009). The chapter discusses the importance of changes in demography in the region and how these have affected fisheries. I also document how the tourism economy, especially water-based tourism sectors, increasingly competed with the commercial fishing economy for access to and rights over coastal and marine resources. Finally, the chapter demonstrates the importance of economic globalization in fishery imports, and how the imports have affected the profitability (and indeed the viability) of several Florida Keys fisheries.

Chapter 5 describes the evolution of the fisheries management and regulatory framework in the State of Florida and the Florida Keys, and its effects on fishery landings and participation. I show how access in the Florida Keys fishing industry was seldom fully unrestricted, and that many of the local fisheries were regulated by a series of local and state management measures. I also describe how the regulatory framework that developed in the advent of the federal fishery management system prompted the creation of a parallel state fishery management system. Together, these two systems increasingly disciplined effort to address the issues of ecological sustainability and economic efficiency, first by identifying who was allowed to participate in the fisheries and then by adding requirements that limited access and which often promoted consolidation, transferability, and other market-based measures.

Chapter 6 presents the Florida Keys spiny lobster fishery as a case study to demonstrate the effects of technocratic management on the region's most lucrative fishery. I describe the history of the fishery, how it developed from a mainly local fishery into an export-driven industry (Labisky et al., 1980). I also discuss how the fishery spread out across the Florida Keys and then into foreign waters as fisheries technology improved in the post World War II years, before retrenching into the Florida Keys in the 1970s. From here, the dissertation explores how the escalation in effort in the Florida Keys paved the way for the Spiny Lobster Trap Certificate Program, a market-based measure that sought to reduce traps and increase efficiency (Milon et al., 1999). The program, with its roots in technocratic

management, largely ignored the social dimensions of the fishery, assuming that lower rates of participation and effort would result in a new equilibrium. The owner-operator system, in which small and medium scale fishers could participate in a common property system, was replaced by ever-larger operators in a vertically oriented system. Entrants, who in the past had graduated via an apprenticeship system, now had to buy their way into the fishery (Shivlani and Milon, 2000). The social networks that thrived in fish houses and across communities eroded, marking an end of an egalitarian era in Florida Keys fisheries.

Chapter 7 summarizes the argument against technocratic management, presenting a comprehensive fisheries management framework that accounts for ecological integrity, economic efficiency, and social sustainability (Symes and Phillipson, 2009). Ecological integrity ensures that resources are managed conservatively, without which harvests are depleted, and the fishery's demise is inevitable. Ecological efficiency, which seeks to obtain the greatest benefit to society from a common pool resource, maximizes profits to the participants. Social sustainability, which has been overlooked in technocratic management, seeks to maximize social capital, which builds trust, cooperation, and networks that develop and maintain healthy and vibrant fishing communities. Social sustainability also ensures that fishers, their communities, and their networks are fully considered in fishery management decisions, that fishers are not viewed as interchangeable units of effort, and that fishing communities and fishing grounds are not relegated as only a physical space where fishers reside and where they work, respectively (St. Martin,

2001). I conclude by recommending a management agenda derived from the comprehensive fisheries management framework, one in which the fishers and their communities are accounted for and where social sustainability is utilized in creating robust and diverse fisheries.

CHAPTER 2: TECHNOCRATIC MANAGEMENT

Introduction

Technocratic management, defined here as management that follows the twin principles of ecological integrity and economic efficiency, first gained prominence in the post World War II era and attained pre-eminence in the decade following the establishment of the 1976 Fishery Management and Conservation Act (FCMA) (Weber, 2002). The federal fishery management program, reauthorized in 2007 as the Magnuson-Stevens Act (MSA) (16 USC 1801 et seq.), standardized technocratic management across a regional fishery management council process.

Having previously managed its many fisheries via an admixture of local and state ordinances, rules and regulations, and prohibitions, the State of Florida also embarked on a technocratic approach in1983, with the creation of the Marine Fisheries Commission (MFC)[2] (Miami Herald, 1983). The MFC ushered in the state management system which increasingly participated with the MSA in the development of technocratic management for the state and state-federal managed fisheries. By the end of the 20th century, most lucrative Florida fisheries had adopted technocratic measures such as closed participation via limited entry, transferable licenses, and, in the case of certain fisheries, individual transferable effort quotas. Individual, quasi-property rights measures increased in both the state and state-federal regulations, resulting in greater vertical orientation and lowered

[2] In 1998, Florida voters approved a constitutional amendment that merged the MFC and the Game and Fresh Water Fish Commission into a new commission titled the Florida Fish and Wildlife Conservation Commission (FWC), which entered into effect in 1999 (FWC, 2014a).

rates of participation. Fishing communities that once dotted the state's Atlantic and Gulf of Mexico coasts faded into enclaves and later into fragmented communities (Jepson, 2007).

The central question facing this chapter is how technocratic management, which coupled the biophysical concept of dynamic yield with the economic principle of competing fishery units, gained ascendancy as the preferred approach for fisheries management, especially from the 1980s onwards. How were fishers simplified into units of effort, devoid of any sense of common purpose or cooperation, and how did fishing communities change from centers of local ecological knowledge, cooperation, and networks into aggregates of fishing effort? Why were fishers and fishing communities largely absent in the decision-making structure of technocratic management? These are important questions to consider in the understanding the failure of technocratic management to address social sustainability in its march to achieve sustainable fisheries.

I track in this chapter the rise and proliferation of technocratic management in post World War II fisheries science, showing how biological and economic modeling led to the development of the twin concepts of maximum sustainable yield (Finley, 2011) and maximum economic yield, and how the marriage of the probabilistic science of fishery population dynamics and the prediction of profits (rents) via economics set the mathematical platform via which natural and social sciences could negotiate and plan fishery management together. I also discuss the importance of resource conservation ideology that emerged with the neo-

Malthusian movement. I demonstrate how when taken together, the two trends gradually became the sine qua non of identifying and remedying inefficiencies in fisheries. I also show that under this approach, the social dimensions were largely ignored not because they were considered insignificant but because fishery participation and fishing communities were considered almost as dependent variables. Thus, if fish stocks could be recovered and profits could be secured, then it was expected that fishing communities could equally rebound.

The Roots of Technocratic Management

While there is a long history of US fisheries management that extends into the colonial period (see Weber, 2002, and McGoodwin, 1990, among others), this chapter starts in the first third of the 20th century when fisheries science matured both as a discipline and as an approach to fisheries management. To understand how technocratic management developed, it is important to consider how the concepts of maximum sustainable yield (MSY) and maximum economic yield (MEY) were devised over this era. These concepts did not emerge in isolation of each other and indeed the economic side of the solution to sustainable fisheries (the MEY concept) was built on the ecological solution (the MSY concept). Later social objectives, in the form of optimum yield (OY), were introduced to the MSY-MEY framework, but as will be shown, that approach fell short of fully incorporating the social dimensions of fisheries in technocratic management.

As stated previously, local approaches to addressing fisheries landings and conflicts in the US existed well before the development of formalized fisheries research and (later) management, but such measures were related mainly to localized depletions (Weber, 2002). Due to the fishing industry's inability to exploit deeper waters (with the exception of whaling ships), fish stocks were largely intact and considered inexhaustible (Ross, 1997; Juda, 1996). Early agencies in the US, such as the US Fish and Fisheries Commission, did conduct a number of scientific surveys through the late 1800s, but these were directed mainly towards the characterization of fisheries (Ross, 1997).

Concerns over sustainability were first directed towards vulnerable and transboundary stocks. In 1911, the US negotiated a multi-lateral treaty that promulgated a sustainable harvest of fur seals with its Alaskan territorial waters (Barrett, 2003). The landmark Fur Seal Treaty was signed by the Japan, Russia, the UK, and the US, and it banned the take of fur seals (and sea otters) in international waters, and it gave signatory states the right to manage the stocks within their respective, territorial seas (i.e., within three nautical miles of the coast). In 1923, following a decade of decline in the transboundary stocks of Pacific halibut off the British Canada and US west coasts, the UK and the US signed the Convention for the Preservation of the Halibut Fishery of the Northern Pacific Ocean to create the International Pacific Halibut Commission (IPHC) that would investigate the causes of the lowered landings (IPHC, 2006). Similar attempts to jointly manage the

western North American salmon stocks led to the creation of the less successful International Pacific Salmon Fisheries Commission in 1937 (Juda, 1996).

Following the end of World War II, the US entered into a number of multilateral agreements, including the International Whaling Convention (1946), the Inter-American Tropical Tuna Commission (1949), International Commission for the Northwest Atlantic Fisheries (1950), and the International Convention for the Conservation of Atlantic Tunas (1969), among others (Ross, 1997). Within US territorial waters, fishery management was left mainly to the states, with the federal government overseeing fishing in US territories. The US Congress created interstate commissions, authorized with the coordination of fishery management for coastal species. The first of these interstate commissions was the Atlantic States Marine Fisheries Commission, established in 1942, to recommend and coordinate fishery management actions across its 15 member states. Similar compacts were approved for the three-member (later amended to include five members) Pacific States Marine Fisheries Commission (1947), and the Gulf States Marine Fisheries Commission (1949)[3] (Weber, 2002). These actions across interstate and international boundaries demonstrated that fishery management could not be addressed within state or national boundaries and thus required cooperation and, most importantly, that coastal and marine fisheries were vulnerable to overexploitation and thus required conservation measures.

[3] The State of Florida is the only state that belongs to two marine fisheries commissions: The Atlantic and Gulf Marine Fisheries Commissions.

Fisheries Science: The Concept of (and Quest for) Maximum Sustainable Yield

With a growing awareness that fish stocks were indeed exhaustible, scientific research increasingly focused on the underlying characteristics of fish stock recruitment, growth, and replacement rates, as well as the effects of removing fish from their respective populations (Payne et al., 2008; Ross, 1997; Juda, 1995). Basic research on natural history, fish identification, and fishery characterization, such as that conducted by US Fish and Fisheries Commission, was of great utility in understanding fisheries and their components, but it was the theoretical research in population dynamics that laid the groundwork for evaluating present and future fish stock size (and thus, availability to a fishery) (Angelini and Moloney, 2007).

In the last decade of the 19th century, E. W. Holt, an English biologist proposed the propagation theory (McGoodwin, 1990), which posited that fish populations need to be given an opportunity to spawn at least once to maintain sustainable fisheries. Holt also favored the policy of adding to natural populations with artificially fertilized eggs (much as the US Fish and Fisheries Commission policy on developing hatcheries). A colleague of Holt, C. G. J. Petersen proposed an alternate theory in 1895 (Angelini and Moloney, 2007). Known as the growth theory, Petersen's thesis was that fisheries were landing fish that were too young and too small, thereby leading to lower profitability from selling less weight per volume and declined landings as a consequence of the harvest of immature fish. Petersen effectively expanded his analysis to include the economic dimensions of

fisheries, which argued that sustainability in fisheries was related to both the ecological condition of the populations and their market value.

Advances in fisheries science occurred through the first two decades of the 20th century, with the so-called "Great Experiment" of World War I demonstrating how lowered effort led to larger fish and higher catches following the war (Angelini and Moloney, 2007). A similar experiment would take place over the six years of World War II in the eastern Atlantic and North Sea, where the decrease in fishing pressure would help groundfish stocks recover for a period of post-war overfishing (Finley, 2011).

Another important contribution in this period was by a Russian scientist, Fedor Baranov (McGoodwin, 1990). He published a paper in 1918 in which he determined that increased fishing effort leads to higher mortality rates in a population, which in turn reduces the proportion of an age class surviving to older ages. He also showed how reducing catches at younger ages (using a length-weight assumption) could positively impact landings over the lifespan of the age class. In setting the conditions for mortality, growth, and age, Baranov in part set the quantitative foundation for inquiries into how to determine the correct level of fishing effort.

The field of quantitative or theoretical ecology, buoyed in part on the advances of physics in the early 20th century, advanced mathematical explanations

of biological relationships[4] over the next two decades. In 1933, the Norwegian team Hjort, Ottestad, and Jahn discussed what they called the "optimum catch", an inflection point which they identified as the position at which growth in a fishery occurs at its fastest rate (Angelini and Moloney, 2007). In 1935, Michael Graham, who would go on to be Britain's chief fishery scientist, published a seminal paper on sustainable yield (Finley, 2011; Angelini and Moloney, 2007). He argued that reductions in yield would actually help a number of species. British researchers were at the vanguard of quantitative fisheries science research in the years leading up to and following World War II. Along with Graham, his predecessor E. S. Russell, H. R. Hulme, Raymond Beverton, and Sidney Holt, the cadre of UK scientists addressed the overfishing problem and how to assess fish population growth and replacement rates to develop sustainable and productive fisheries in the post-war era (Finley, 2011). By the late 1940s, the team of Hulme, Beverton, and Holt had taken the important step forward in deriving the yield function (curve) used in determining the sustainable yield for an exploited fish population. By the 1950s, Beverton and Holt combined the four major cornerstones in fishery science – recruitment, growth, harvest, and natural mortality – to develop the equation that incorporated recruitment and growth as positive factors that increased total weight in a fishery and harvest and mortality as negative factors that decreased total weight in a fishery (Finley, 2011).

[4] Angelini and Moloney (2007) argue that the progenitor to this modeling approach was Thomas Malthus, who developed the first formal, ecological model in 1759 describing the differences in population growth (geometric) and food availability (arithmetic).

In 1954, in a paper titled "Stock and Recruitment", William Ricker, a Canadian ecologist, coined the term maximum sustainable yield (MSY). Ricker stated that MSY is the stock density point at which reproduction potential is at its highest, such that "removal of part of the adult stock...(to MSY)...increases reproduction" (Ricker, 1954, pg. 559). With this and subsequent advances by Beverton and Holt and others in the 1950s, the field of fisheries science became an integral part of fisheries management and MSY became the benchmark of sustainable fisheries management (Finley, 2011). Disciplining the ecological dimensions of fisheries had been achieved, and the ecological half of technocratic management could be implemented.

Fisheries Bioeconomics: Maximum Economic Yield (MEY) and Efficiency

In 1954, Milner Schaefer, the director of the Inter-American Tropical Tuna Commission (IATTC), developed the Schaefer short-term growth equation to describe a fishery equilibrium model (also known as a surplus production model) (Schaefer, 1954). The Schaefer model states that there is an average relationship in (idealized) fish stocks between population growth and population size, such that at its natural equilibrium point, stock size reduction is countered by an increase in population growth rates and stock size expansion is countered by a decrease in population growth rates (see Figure 1 for the logistic curve). If a stock decreases to a point where growth in population is negative, the stock will collapse to extinction; this point is known as the minimum viable population. By contrast, if a stock

increases to a point where the stock size cannot be exceeded due to the capacity of the habitat, the stock size reaches to its maximum point; this point is known as the stock's carrying capacity. Where the growth rate is at its highest point is where it represents the highest yield that can be harvested sustainably; this point is known as the maximum sustainable yield (MSY).

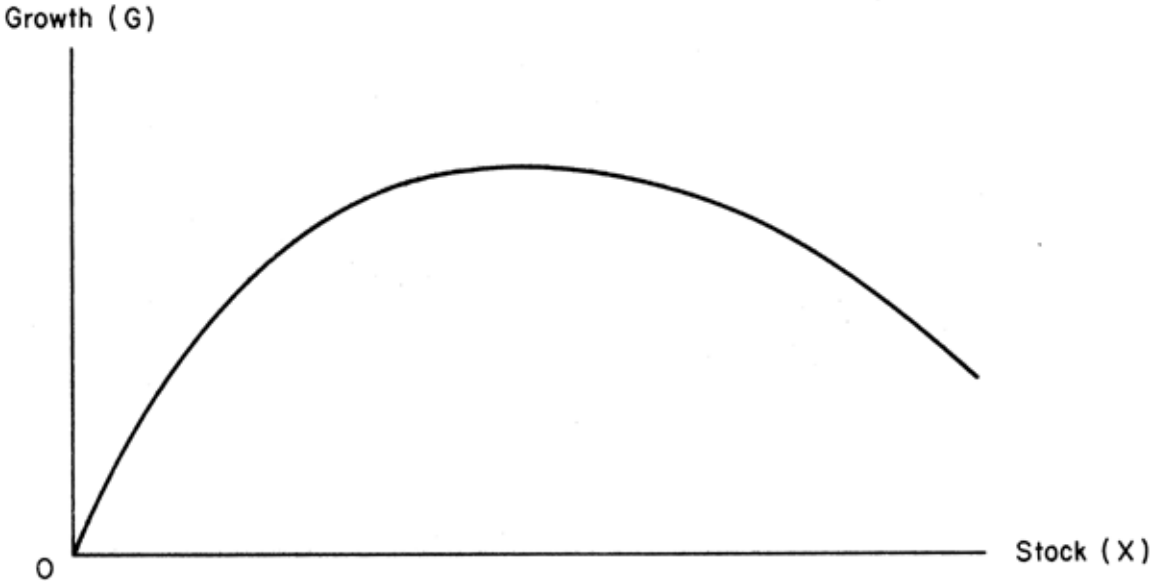

Figure 1: Growth-stock relationship (Panayotou, 1982)

This single stock-growth relationship and other previous work on fisheries quantitative ecology served as the basis for the development of fishery bioeconomics, where the economic dimensions of a fishery were combined with its ecological dimensions. The seminal work in the field built on Schaefer's growth equation (and on the work of other fisheries scientists) and was conducted by two Canadian researchers, Scott Gordon and Anthony Scott. Gordon, in his influential 1954 paper titled, "The Economic Theory of a Common-Property Resource: The Fishery", argued that biologists tended to ignore fishermen in their models, and that

the biological approach, while focused on MSY, did little to consider the economic inputs in fisheries:

> Focusing attention on the maximization of the catch neglects entirely the inputs of other factors of production which are used up in fishing and must be accounted for as costs. There are many references to such ultimate economic considerations in the biological literature but no analytical integration of the economic factors. In fact, the very conception of a *net economic yield* has scarcely made any appearance at all. On the whole, biologists tend to treat the fisherman as an exogenous element in their analytic model, and the behavior of fishermen is not made into an integrated element of a general and systematic "bionomic" theory (Gordon, 1954, p. 128).

In Gordon's view, overfishing was less related to the biological characteristics of a fishery and instead had "its roots in the economic organization of the industry" (Gordon, 1954, p. 128). His view was that because of the common property nature of most fisheries, effort extends in these fisheries until where total costs equal total revenue, or where the economic rents in the fisheries are exhausted. For a fishery to provide the maximum net economic yield, or to reach its "optimum degree of utilization" (Gordon, 1954, p. 129), fishing effort must set at the point which maximizes the positive difference between total revenue and total cost, known as maximum economic yield (MEY). As shown in Figure 2, fishery effort beyond MEY would result in a suboptimal situation, where resource rent would dissipate (eventually to negative rents or losses to the fishery were total costs exceeded total revenues).

Thus, from a bioeconomic perspective, overfishing was no longer solely an ecological problem that could be solved by addressing landings, growth, and mortality in fisheries; overfishing was now an economic problem that required

economic solutions that addressed capacity (the number of participants and/or gear a fishery) and effort. Under the Gordon-Schaefer model, the problem also stemmed from unfettered access to a common property resource, such that under prevailing conditions in the post-war era, where many fisheries were still relatively open to domestic and (past three nautical miles) foreign fleets, overfishing was an almost inevitable outcome. Bioeconomic solutions to the dissipation of rents and overfished resources would require disciplining the commons or common pool resources (CPR) access, a task taken on by the neo-Malthusian movement in the 1960s and 1970s and co-opted by fishery management two decades later.

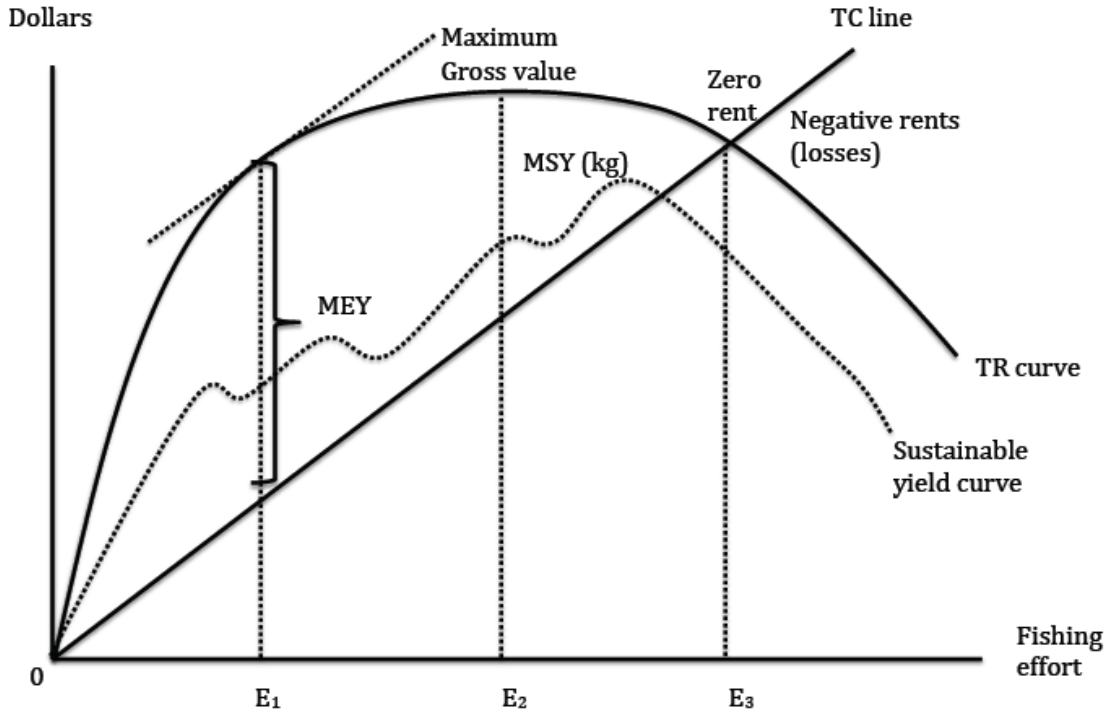

Figure 2: Fishery bioeconomic model (adapted from Panayotou, 1982)

Neo-Malthusianism and the Argument for Closing the Commons

While neo-Malthusianism likely reached its apogee in the early 1970s, at least as measured by its cultural resonance (e.g., the 1968 publications of Hardin's polemic "Tragedy of the Commons" and Erlich's and Erlich's "Population Bomb", and the Club of Rome's "Limits of Growth") (Conca and Dalbeko, 2010), the argument's views towards common property and open access were well represented among many of the ecologists and economists who developed their respective fields of quantitative ecology and bioeconomics. In the late 1930s and following World War II, Michael Graham lobbied for lower catch limits to solve the "overfishing problem", which he believed could be resolved by decreasing landings and increasing size limits (Finley, 2011). While his solution was derived from ecological principles, it nevertheless utilized access and limits as a means by which to achieve sustainable harvests. Similarly, other researchers argued in favor of harvest limits to control transboundary stocks and pointed to the success of the International Pacific Halibut Commission (IPHC), whose members recommended quota totals to US and Canadian fishing industries (Weber, 2002). However, economists such as Gordon were clearly the closest allies to the neo-Malthusianism.

In his 1954 paper in which he posited an economic theory of fisheries as a common property resource, Gordon stated that the main reason wealth cannot be accumulated in fisheries is because the "natural resource is not private property" (p. 131). He added that open access allows fishing effort to shift until all fishing grounds yield conditions where average productivity equals average costs (i.e., where rents

equal zero), and that this explained why "fishermen are not wealthy despite the fact that the fishery resources of the sea are the richest and most indestructible" (p. 132). Gordon felt that the "inefficiency of fisheries production stems from the common-property nature of the resources of the sea" (p. 134) and similar to other common property resource conditions. He pointed to other common property systems, arguing that even in "primitive cultures", land tenure is considered part of the commons only where farming and husbandry cannot be practiced. Finally, Gordon pointed to the case of the "common pasture in the medieval manorial economy" (p. 135), where he stated that the ownership of animals was private but the resources on which they fed was communal. In this case, he pointed out that grazing was regulated by the manor, which developed rules on the number of animals allowed, hours of pasturing, etc. In Gordon's view:

> the fish in the sea are valueless to the fisherman, because there is no assurance that the will be there for him tomorrow if they are left behind today…Common property natural resources are free goods for the individual and scarce good for society. Under unregulated private exploitation, they can yield no rent; that can be accomplished only by methods which make them private property or public (government) property, in either case subject to a unified directing power (Gordon, 1954, p. 135).

It should be noted that Gordon did not overtly favor a private property solution over common property resources. His concern was related to the maximization of rents, which could only occur when fishery participants were not driven to exhaust all rents in the fishery (i.e., the open access outcome). If this could be accomplished by governmental intervention, it was as acceptable as granting private property rights over the resource.

Decision-makers in the US decided in the post-war era to both develop US fisheries and to export the MSY concept to developing states as a means of increasing production (Finley, 2011). Estimates of potential harvest were over optimistic, with the Department of the Interior reporting in 1964 that the world's oceans could yield 500 million tons of seafood per year (Weber, 2002). The Department of the Interior exceeded that estimate, claiming that total landings cold range between 1-2 billion tons annually (as of 2010, total freshwater and marine food production did not exceed 150 million tons, which includes a significant aquaculture sector) (Weber, 2002). The concern in post-war US was that the fishery production had declined significantly and needed to be increased with the opening of new markets/fisheries, expanding production, and marketing seafood to increase domestic consumption (Weber, 2002). The Bureau of Commercial Fisheries was involved in conducting research in existing fisheries, conducting surveys for nascent fisheries, and promoting the consumption of seafood. Even with the governmental assistance, overall landings did not improve much through the 1950s and 1960s. Whereas world landings almost doubled from 1957 to 1967, US landings declined by 13% over the same period (Weber, 2002).

The US, which had been the world's largest fishery producer in previous years, now sought to develop its domestic fishing fleet to compete with increasing foreign fleets off its territorial sea, which as per customary law was recognized at three nautical miles from the shoreline (Juda, 1996). The neo-Malthusian narrative that developed was one that characterized foreign fishing vessels as taking

advantage of the commons located just off the US coastline, and these vessels were perceived as the culprits for the decline in several major stocks (Weber, 2002). The US also blamed the inadequacy of international agreements, such as the International Commission on Northwest Atlantic Fisheries (ICNAF), to eliminate foreign fishing pressure off its coasts (Weber, 2002). The US government sought to redress the overfishing that the fishing industry blamed on foreign fleets by assisting the growth of the domestic fleet (which was largely an unsuccessful enterprise in the pre-MSA period) and then by transforming the fishery regulatory and management framework by extending the geographical jurisdiction for US fisheries up to 200 nautical miles, effectively federalizing offshore fisheries management (Ross, 1997).

The Magnuson Stevens Act: The Federal Fishery Management Framework

The federal fishery management era commenced in 1976 with the establishment of the Fishery Conservation and Management Act, later reauthorized as the Magnuson-Stevens Sustainable Fisheries Act (MSA). The act accomplished two, related actions: The first was the expansion of federal jurisdiction over fishery resources up to 200 nautical miles (first called the fishery conservation zone and, from 1983 onwards, the exclusive economic zone); and the second was the replacement of foreign effort with that of a domestic fleet up to the aforementioned exclusive economic zone (Ross, 1997). In accomplishing the latter action, the MSA fostered the growth in capacity and proliferation in effort of the domestic fleet,

which would eventually lead to its over-capacity and decline in the third and subsequent decades following the legislation (Weber, 2002). Domestic effort, which had remained mostly confined to the territorial waters (three nautical miles) and restrained by low investment, expanded with private capital (often backed by governmental support) into offshore waters, untethering a previously cautious industry towards an explosion of uncontrolled effort. While it is partly correct to conclude that open access facilitated the unchecked growth in several fleets, it should be noted that the growth was neither opposed by the new management authority (instead, it was often supported with government subsidies for domestic expansion) and was considered as a means by which to increase domestic production and consumption. Moreover, several fishing grounds were discovered and promoted by research vessels directed to promote domestic production (Karp et al., 2001). The MSA's strategy eventually led to the failure in several fisheries, in that overcapacity developed because production was not inexhaustible and indeed was several orders of magnitude lower than projected in the 1960s and 1970s (Weber, 2002) and because fishing operations reacted to the market subsidies that initially supported increased capacity and development and later collapsed under the globalization of fishery production and localized overfishing. Finally, by creating a regionalized system that promoted single-species management under the authority of the vested interests of stakeholders (Okey, 2003), the MSA often privileged exploitation over conservation; under the council system, stakeholders

could petition for greater access, higher quotas, and increased effort, even as the corresponding fisheries declined in production (Weber, 2002; Hanna, 2000).

The MSA created a regionalized, federal fishery management process, nested within NOAA, and administered by the NMFS (Hanna, 2000). The act created fishery management councils that were to oversee fisheries across broad coastal regions. The councils include the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, the South Atlantic Fishery Management Council, the Gulf of Mexico Fishery Management Council, and the Caribbean Fishery Management Council across the eastern seaboard and Caribbean territories, and the Pacific Fishery Management Council, the North Pacific Fishery Management Council, and the Western Pacific Fishery Management Council across the western seaboard and Pacific territories (see Figure 3). The MSA also established a science-stakeholder collaborative process whereby the science could be gathered and presented to stakeholders for deliberation and action (Ross, 1997). The process, which is continuous, commences with data collection, analysis, and recommendations, all of which are fed through a hierarchical, decision-making system. Decisions reached on fishery stocks are reconsidered on a periodic basis, such that the process is to provide the best scientific information for management (MSA National Standard 2).

Under the MSA, NMFS was designated as the lead federal agency charged with fishery research and tasked with providing management advice. The latter represented a major shift in NMFS' duties that, prior to the passage of the MSA, had

focused mainly on research and seafood promotion activities (Weber, 2002). The new and expanded role of the federal agency created an inherent tension between providing scientific-based advice and supporting a stakeholder-driven (i.e. interest-driven) management process.

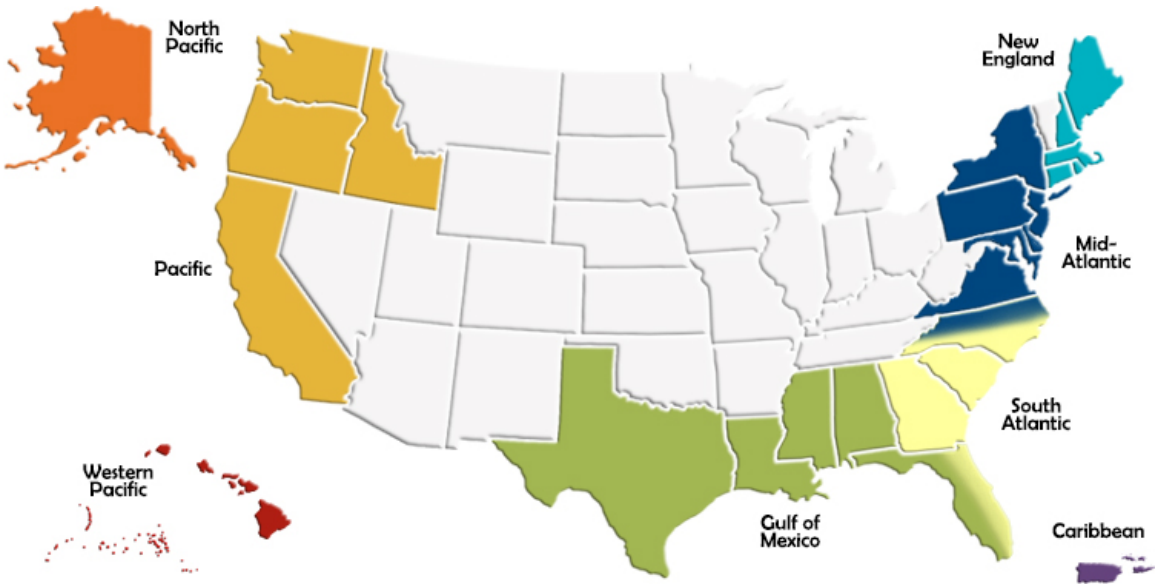

Figure 3: Regional fishery management council jurisdiction (NMFS, 2013)

The Regional Fishery Management Council Process

To best understand how fishery management councils were to implement fishery management measures, it is instructive to describe the MSA, the councils, and the council process in greater detail. It is also important to conduct a brief review of how that the councils performed and how the federal fishery management process has evolved through the most recent reauthorization of the MSA.

The MSA was passed to conserve and manage US (federal) fishery resources, support the implementation of international fishery agreements for the

conservation and management of highly migratory species, promote domestic commercial and recreational fishing under conservation and management principles, provide for the development of fishery management plans to maintain optimum yield, establish the regional fishery management councils to provide stewardship over fishery resources in collaboration with the states represented in the respective councils, encourage the development of underutilized fisheries, and protect essential fish habitat (Ross, 1997). The act also stated that all fishery regulations implemented as part of the MSA must be consistent with the following, ten national standards (16 USC 1851(a)):

1. Prevent overfishing while achieving optimum yield.
2. Be based upon the best scientific information available.
3. Manage individual stocks as a unit throughout their range, to the extent practicable; interrelated stocks shall be managed as a unit or in close coordination.
4. Not discriminate between residents of different states; any allocation of privileges must be fair and equitable.
5. Where practicable, promote efficiency, except that no such measure shall have economic allocation as its sole purpose.
6. Take into account and allow for variations among and contingencies in fisheries, fishery resources, and catches.
7. Minimize costs and avoid duplications, where practicable.
8. Take into account the importance of fishery resources to fishing communities to provide for the sustained participation of, and minimize adverse impacts to, such communities (consistent with conservation requirements).
9. Minimize bycatch or mortality from bycatch.
10. Promote safety of human life at sea.

The MSA established regional fishery management councils as hierarchical decision-making, regional bodies comprised of stakeholders and state and federal agencies' representatives, and the act charged these councils with developing fishery management plans, amendments, and other fishery regulations for the federal

fishery resources within their jurisdictions (Ross, 1997). Apart from various state and federal agency representatives who were required to serve on councils, the other council members would need to be nominated by their respective states' governors and approved by the Secretary of Commerce. Councils required technical expertise, and this was provided for by the requirement that each council needed to maintain a scientific and statistical committee whose members would assist the council by providing natural and social science information; councils could also obtain information and recommendations from a fishery industry advisory committee, which each council was to establish, advisory panels that councils could establish based on needs, and NMFS (Hanna, 2000). Each council developed slightly different hierarchies in the decision-making process, but all councils, in concert with the Secretary of Commerce, were charged with making the final fishery management decisions.

The initial passage of the MSA (then the FCMA) in 1976 accelerated the development of the fields of fisheries science and management (Weber, 2002). Fishery management councils were formed to address major stocks in each of the eight regions, although science and management processes progressed most rapidly in those regions that had an established tradition of fisheries science, especially New England. In other areas, such as the Gulf of Mexico, South Atlantic, and Caribbean, fisheries science had been less systematically implemented, and management was slower to implement, particularly in the case of the so-called 'data-poor' stocks. Nevertheless, as pointed by Weber (2002), the first few years into the federal

fishery management era represented an expansion in the domestic fleet, which was aided in part by governmental subsidies and with easier access to private capital. Up through the 1990s, the concept of optimum yield (OY), the National Standard 1 benchmark, included social and economic factors that could be used to change MSY in favor of the aforementioned factors, thereby facilitating overfishing. Kurlansky (1997), Finlayson (1994), and others have described in detail how sociopolitical and socioeconomic factors promoted and prolonged overfishing in the Northwest Atlantic groundfish fisheries; the authors demonstrated how subsidies and allowances increased effort and ignored calls for lowered limits even as the scientific evidence grew for reduced catches.

Similar collapses occurred along many of the major fisheries across the US over the first two decades of the MSA, such that by the turn of the 20th century, fish stocks and the fishing industry (with the exception of several Alaska stocks) were considered to be overfished or were subject to overfishing. The problem was likely more severe, but the status of hundreds of stocks was (and remains) unknown (Hanna, 2000). Starting with the groundfish collapse in the late 1980s and through the next two decades, NMFS adopted a precautionary approach to fishery management that the 2007 reauthorization of the MSA called for the end of overfishing by 2010 and the establishment of annual catch limits (ACL) at levels that prevent overfishing (Dell'Appa et al., 2012). National Standard 1, which had previously accommodated social and economic factors to exceed sustainable quotas, could no longer use these factors to fish above limits that led to overfishing.

Another significant shift that occurred over the MSA's history was the adoption of market-based measures to allocate the dwindling fishery resources across and within fishery sectors. Privatization as favored by Gordon and others in the mid-20th century finally gained momentum in the late 20th century, as management pivoted from earlier having promoted participation to now promoting exit from fisheries suffering from inefficiencies and overcapacity. Transferable quotas, units of effort, and permits had been utilized in Norway, New Zealand, and Australia, among other nations, as well as in certain fisheries in the US (e.g., the North Carolina wreckfish fishery) (Anderson and Holliday, 2007), but concerns over allocation and market share, among other political differences, led to the 1996 reauthorization of the MSA creating a moratorium on the creation of property rights for fishery stocks and participation (Weber, 2002). By the 2000s, however, there was greater support for a broader approach of dedicated access, based on market-based programs, traditional rights access, and community development quotas, such that NMFS released a catch shares policy in late 2010 that encouraged the adoption of catch shares and affirmed its support for such programs (NMFS, 2010).

Discussion

Technocratic management developed in the post World War II era, when fisheries science matured to a point where it could putatively provide management advice for sustainable fisheries. The MSY concept was recognized as a harvest benchmark, a type of gold standard that would yield a guaranteed supply of excess

fish production. After having purportedly solved the fisheries estimation conundrum, science next turned to the economic dimensions of fisheries and on how to make fisheries profitable to producers and society. Bioeconomics arrived as the solution, via which economists could marry the biological dimensions of a fishery resource with the effort and returns in the fishery to determine the equilibrium point for the maximum returns and corresponding harvest in the fishery. This point was identified as the maximum economic yield (MEY), which would provide the greatest benefits (in the form of rents) in the fishery. All that remained in the proliferation of this union of biological and economic objectives was the application of bioeconomic principles to existing and developing fisheries. Proponents of the approach viewed open access to common property resources as the problem, which could be resolved by closing the commons. But omitted in this approach was the social sustainability of fisheries. Why was this the case? Why were the ecological and economic dimensions of fisheries prioritized ahead of the social dimensions?

A response to the questions raised above may be that the social dimensions of fisheries were omitted because of disciplinary bias or an indifference towards social dimensions. A more accurate response is that the two disciplines were simply ill equipped to comprehend the heterogeneity and complexity of social dimensions. Biologists were interested in solving the issues relating to stock assessment and population dynamics, and they perceived fishing as a form of effort and mortality to be incorporated into their fishery models. Economists viewed fishers and their

respective communities as units and aggregations of effort, respectively, to be modeled to determine effects of effort on efficiencies and rents. The social dimensions did not comprise complex systems to either discipline, as each sought to simplify fishers and their communities for the basis for their research. However, from a reductionist standpoint, such an approach is to be expected and indeed may be allow for disciplinary progress (Blaikie (1985) raises many of the same issues concerning the causes of soil erosion in developing countries). Thus, determining the maximum sustainable yield for fisheries would require the simplification of well-established and complex social systems into aggregations of effort. Similarly, economic efficiencies may be best understood in terms of fishery units in competition with each other for the same resource. However, these disciplinary approaches did not remain in their ivory towers and were instead, especially in the neo-Malthusian era[5], applied as technocratic management to address overfishing problems. Taken together, the ecological –economic sustainable yield framework gained currency as the means by which to solve a larger problem, that of disciplining the fisheries commons.

[5] It should be noted that concepts of neo-Malthusianism and Hardin's Tragedy of the Commons are different. Neo-Malthusianism, as elaborated by Meadows et al., Ehrlich and Ehrlich, and Hardin, among others (Conca and Dalbeko, 2010), concerns the relationship between an increasing population base on finite resources and its impacts on future generations, whereas the Tragedy of the Commons (Hardin, 1968) is related to the impacts of unrestricted access to a commons resources. However, the rationale used to prioritize a technocratic solution to fisheries conflated the concepts of Neo-Malthusianism and the Tragedy of the Commons to argue that unchecked growth in the fisheries commons necessitated a technocratic solution.

The thesis that ripened, first during the neo-Malthusianism era in the 1970s and then under the 1980s neoliberalism movement, was that the fishers and by extension, their communities and relations, were the problem, and that technocratic management – with its focus on the biological resource and economic efficiency – was the solution. Furthermore, because technocratic management had already identified fishers as units of effort in competition with each other and a measure of fishing mortality, the fishers, their communities, and their contribution to social sustainability were all rendered irrelevant[6]. All that remained of the fishers was the effort that each operation expended, the landings it harvested, and its economic characteristics.

While it is clear that overfishing was a problem in the MSA era, in no small part due to the subsidies and other encouragement offered by the government (Weber, 2002) as means by which to boost production and strengthen the domestic fleet, the technocratic solution adopted to address the problem has to be contested. That is, if the issue were overfishing, then why did property rights need to be part of the solution? Why did consolidation of participation have to be the only way forward? As Bromley (2009) argued in his critique of the creation of property rights for fisheries:

> How does one prevent fishing? You do not allow fishing. How does one prevent overfishing? You constrain the quest for control over future value to the rate at which nature can yield up future value today—and

[6] This is not to state that fishers and fishing communities were completely marginalized from analysis. Indeed, Nietschmann's work (1972) with the Miskito Indians' fishing culture and effects of market on resource exploitation patterns was among the early studies that evaluated the social dimensions of fisheries.

> for evermore. If people are caught in the act of overfishing, penalties are imposed. Human societies, over a rather long history, have figured out how to prevent all manner of unwanted activities and outcomes—from child pornography to organized dog fighting. It is no great mystery, and ownership plays no part in the story. Only fisheries economists and ideologues—believe that property rights (or the lack thereof) explain overfishing (Bromley, 2009, pg. 281).

However, because technocratic management operated in the pursuit of economic efficiency and omitted social sustainability, the property rights and related solutions were not viewed as creating potential social disruptions. Instead, the approach would revive fisheries by promoting the survival of the fittest firms (the high-liner) while culling out the weaker competitors. The fisheries would then become more efficient while providing the maximum profits to the participants and society. In subsequent chapters, I will show how this management approach and its unintended consequences played out in the Florida Keys.

It should be noted that the success of technocratic management depended on the neo-Malthusian turn to gain traction from the 1970s onwards. Depletions after all were not uncommon, with the whaling industry having witnessed a near collapse by the mid-20th century (Juda, 1996). Neo-Malthusianism provided technocratic management with a widely accepted ideology that buttressed the promotion of economic efficiency as the dominant social prerogative in fisheries management, and neo-Malthusianism gave the approach its urgency in implementing the economic agenda in disciplining fisheries. Social sustainability, which was never part of the bioeconomic framework, was not completely eliminated and was instead given a ceremonial position in the management agenda. This is exemplified in

National Standard 8 of the MSA, which calls for fishery management plans to provide for the "sustained participation" of fishing communities and the minimization of "adverse impacts" to those communities; yet, the regulatory agency's actions have largely undermined the very communities (Olson, 2011; Bromley, 2009; McCay and Jentoft, 1998) that the act sought to protect.

To reiterate, most, if not all, of the actors involved in the engendering, maturation, and dissemination of technocratic management had the best intentions and sought to conserve fisheries and to maximize profits for the industry's participants. But, misguided policy is in part based on incomplete or inaccurate information (Kraft, 2009), and this is what occurred with the melding of technocratic management with neo-Malthusianism. The ideological, even dogmatic, approach came to perceive fishers as interchangeable units and each fishery as a competition. But, what the exponents and allies of technocratic management did not comprehend are the inextricable connections between the biological, economic, and social dimensions of fisheries. In having severed the social dimensions from the other two dimensions, the management approach crippled the overall system, leaving it susceptible to non-fishery factors and vulnerable to collapse. It is only by bringing back social sustainability that fisheries can become fully sustainable. But to build back towards social sustainability, it is important to shift from technocratic management and into an understanding of how fishers and their communities create social sustainability. In effect, it is essential to discuss social capital and its importance to fisheries.

CHAPTER 3: SOCIAL CAPITAL AND FISHERIES

Introduction

The previous chapter introduced technocratic management, showing how the approach had achieved dominance in the past three decades as a corrective to overfishing. The chapter also demonstrated how by omitting social sustainability, technocratic management has actually weakened fishers and fishing communities, concluding that a comprehensive approach would need to include social capital in the decision-making framework. But, before launching into a discussion on social capital in fisheries, it is important to define what is meant by the often-contested term, how it has developed as a concept and in practice, and how I utilize the concept in my discussion of its importance to fishers and fishing communities.

In this chapter, I describe the evolution of the concept of social capital, as it developed from what Bourdieu (1986) described primarily as an alternative form of capital, Coleman's (1988) work on expanding the rational choice model to include exchanges via social interactions, and Putnam's (1995) national level analysis that established social capital's features to encompass trust, cooperation, and networks. I also discuss how social capital has been evaluated in the performance of resource-based systems, utilizing Pretty's (2003) model of social capital in resource management and Grafton's (2005) application of social capital in fisheries performance and sustainability. Finally, I present my argument on why social capital is an essential component of social sustainability in fisheries, and how its exclusion from technocratic management has weakened fishing communities.

Social Capital

Social capital, as stated in the previous section, is a term that has been used in diverse disciplines and tends to vary considerably in its definition and application (Field, 2011; Adler and Kwon, 2002). This is not to state that social capital does not have a rigorous foundation, and to better understand the status of current usage in the social sciences in general and in fisheries in particular, it is instructive to review how social capital has evolved as a concept over the past three decades.

In economic terms, physical capital refers to a stock of assets that comprise a factor of production (Samuelson and Nordhaus, 2009). The characteristics of physical capital consist of its persistence over time, sacrifice required to obtain future benefits, and excludability (Arrow, 2000). The narrow definition of physical capital has been expanded in the 20th century to include capital in other stocks, including natural capital, human capital, and social capital, among others. Each of these types of capital refers to a specific type of capital stock that is different from physical capital and which confers different benefits to its constituents. Field (2011) defines the central thesis of social capital as "relationships matter" (pg. 1). It is therefore a stock similar to the stock present in other forms of capital, which provides benefits to the groups that engender, foster, and maintain social capital. Unlike physical capital, however, social capital is not depleted when used and in fact appreciates with use (Sobel, 2002). The fact that it is difficult to operationalize, measure, and monitor (Sobel, 2002; Arrow, 2000) does not take away from social

capital's value in explaining how social relations and networks confer advantages that cannot be accounted for by other forms of capital (Dasgupta, 2000).

Pierre Bourdieu is often credited as among the first social scientists to have characterized social capital as an asset that conveys benefits to the groups that cultivate social relations and connections (Field, 2011). Bourdieu identified social capital as a source of power via class relations that is in part responsible for maintaining class structure and reinforcing class differences. Bourdieu identified social capital as the main reason for the advantage that less affluent but high status classes possess in corporate society. Also, he identified social capital as the connections that provide access to jobs and resources, whereas cultural capital explained how certain groups use (high) culture to reproduce systems of inequality and hierarchy. These groups could accomplish this by imparting high culture to their children from an early age that the children could then apply in their schools and other social circles. Also, it is important to note that Bourdieu showed how social capital could be tapped to maintain social strata, demonstrating that while conveying benefits to the group and/or structure that it affects, this insular form of social capital can reinforce class differences and prevent upward mobility (Bourdieu, 1986). Thus, Bourdieu elucidated the dual nature of social capital, which serves to cohere groups and therefore promote social sustainability but can also result in insularity. While he was mainly interested in insularity as it related to social classes via the transference of culture, Bourdieu's analysis provided a

foundation for future research on both the positive and negative effects of social capital.

Unlike Bourdieu who used class as a frame to study social capital, James Coleman (1988) expanded on the rational choice model and exchange theory to evaluate the impacts of social capital in institutional settings, particularly education. In Coleman's formulation, an individual's behavior may include cooperation and yet be consistent with self-interest because cooperation will lead to a better outcome for the individual over the long-term. An individual can thus build social capital by engaging in a series of exchanges, which can later be used for the individual's benefit. Coleman's work evaluated how community norms influence educational attainment, when controlled for student socioeconomics and ethnic groups. His results suggested that even for students from the most underprivileged backgrounds, engaged communities played a significant role in minimizing the impacts of low income and other family disadvantages. For Coleman, social capital is linked to the development of human capital, in that social capital contributed to the development of human capital. Like Bourdieu, Coleman characterized the importance of social capital within social structures; for both scientists, structures such as social class or small groups played an important role in bounding the influence of social capital. Bourdieu claimed that cultural capital operates best in a structure of relationships and networks in which the culture-based training and erudition serve as totems of a shared worldview, a type of entry pass into the upper echelons of a class-stratified society. Similarly, Coleman's social capital works most

effectively when it is shared within a structure in which participants can be sanctioned.

Robert Putnam, often recognized alongside with Bourdieu and Coleman as the progenitor of social capital theory (Field, 2011), extended the limits of social capital beyond social structures and across society. He did so by developing an expansive definition of social capital that he used to explain changes in civic engagement and societal change. In Putnam's view, social capital grows via community interactions, exemplified by civic engagement. These interactions allow persons of very different backgrounds and interests to participate as a group, to exchange ideas, to cultivate relationships, and to establish networks. When repeated, the interactions increase intra-group trust and foster cooperation, effectively building social capital. The results of this iterative and engaged process create a connected society that can cooperate more efficiently to achieve societal objectives (i.e., the reduction of transaction costs). His definition of social capital therefore encapsulates the social interactions and relationships and their effects on behavior and connectivity.

Putnam defined social capital as "features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit" (Putnam, 1995, p. 67). Putnam and his colleagues showed that social capital can effectively determine how successful political systems are in his longitudinal study of Italian democracy (Putnam et al., 1994), the positive impacts of certain organizations on generating social capital (Putnam, 1995), and the

disintegration of civic engagement that results from the erosion of social capital (Putnam, 2000). In part, Putnam explained the expansion of social capital by adopting a categorization of social relations as separate but related types of social capital (Putnam, 2000). The first of these is bonding social capital, and it is generated within a group of individuals who share familial, kin, or other socio-demographic ties (also known as strong ties). The second type of social capital, called bridging social capital, exists between groups (which may be geographically separated) that share one or more purpose (also known as weak ties). A third category that has emerged in the literature since then is linking social capital, and it refers to the relations between groups and authority institutions (Woolcock, 1998).

Social Capital and Natural Resource Management

Although the use of social capital has now permeated various disciplines (Field, 2011), it is in natural resource management, and especially management of common pool resources (CPR), that the concept holds particular promise to show how trust, cooperation, and networks prevent tragedy of the commons related consequences. Importantly, social capital serves as a corrective to the neo-Malthusian ideology that has tended to remove any agency from stakeholders (beyond that of use maximization) in the CPR management process. The application of technocratic management has been insufficient to maintain social sustainability and has, in cases, led to the disintegration of the very communities and ways of life that the approach has been applied to sustain (Olson, 2011; Urquhart et al., 2011;

Dietz et al., 2003). Social ties that have been ignored by a singular focus on ecological integrity and economic efficiencies have been weakened, resulting in a weakening of the so-called, social 'glue' that promotes cooperation by reducing transactions costs (Pretty, 2003).

Conversely, studies have shown that local stakeholders can play a positive role in resource management where the stakeholders possess social capital (Gutiérrez et al., 2011; Dietz et al., 2003; Pretty, 2003). Social capital represents the "third way" (Pretty, 2003, pg. 1913) by which to conserve resources and communities that depend on those resources. Social capital reduces the transactions costs of cooperation and works best in systems where there is underlying trust, reciprocity, a structure that promotes common rules and enforces sanctions, and networks (Pretty, 2003). Because many natural resources are part of common property systems, trust reduces the need for monitoring efforts and costs. Common objectives derived from interactions in a social structure (e.g., a community, stakeholder organization, etc.) create the framework for strong sanctions, where noncompliance can be effectively punished. Formal and/or informal social networks reinforce connections (in the form of bonding, bridging, and linking social capital) and objectives, strengthening social sustainability.

Social Capital in Fisheries

Most fisheries have evolved and persist as common property systems, in which fishing communities access fishery resources in fishing grounds for their

livelihoods. The rules governing access to resources and grounds have changed in many fisheries, as a result of resource abundance, effort, profits, employment, and traditions, among a myriad of other factors. Depending on the rules adopted, fisheries have changed considerably, in terms of how much resource is extracted, the economic characteristics of the fleets, and the social dimensions of the communities. As discussed in the previous chapter, technocratic management, which emerged in tandem with neo-Malthusianism, has tended to favor property rights solutions for fisheries, but often without much attention given to the fisheries' social dimensions (Carothers and Chambers, 2012; Olson, 2011; Urquhart et al., 2011). A key impact in the implementation of technocratic management has been the erosion of social capital (Davis and Ruddle, 2012; Urquhart et al., 2011; McCay and Jentoft, 1998). The erosional process has already been described, but what needs to be considered is *how* social capital works in fisheries and *why* social capital is important for social sustainability.

How does Social Capital Work in Fisheries?

Apart from the fact that fisheries exploit common property resources, there are particular characteristics that many fisheries share which create the conditions necessary for the generation of robust social capital. Fishing, for instance, has been and remains one of the most dangerous professions in the world; in the US in 2012, fishing was ranked as the second deadliest occupation, at a rate of 117 fatalities per 100,000 individuals, and it accounted for 32 deaths (Smith, 2012). While the risks

vary across fisheries and regions, fishing is inherently risky as a consequence of the variety of weather conditions encountered and heavy gear used by fishers at sea. The occupation's hazards necessitate that its participants work closely together and watch out for each other, especially when out at sea. The need to work with and trust other crew members builds trust and can promote cooperation.

Another characteristic of fishing that builds cooperation is the need to fish together as a team. Crews in many fisheries (especially small to medium-scale, coastal fisheries) still work for shares instead of daily wages, and shares are determined by each trip's harvest. Because a participant's income is directly related to how the entire vessel will perform, this enhances the need for the crew to work together as a team to maximize earnings for each other. Also, there is trust between the crew members and the captains and ownership that they will be compensated fairly for their effort, as payments are usually provided at the end of trips.

As at sea, there are various arrangements on land that engender trust and cooperation. An important such arrangement is an informal loan system in many fisheries where ownership provides capital for those entering the fishery and others in need of repairs and maintenance. In the Florida Keys, the fish houses have traditionally provided this type of support to fishers who sell their catch exclusively to those fish houses (Shivlani et al., 2005). Another arrangement is the dock space that fishers share for their vessels, gear, and supplies. Often, fishers who compete for the same species using the same gear will share dock slips and gear storage areas. The proximity and vulnerability of vessels and gears to competitors builds a

sense of mutual responsibility, which in turns increases trust[7]. A final arrangement is the formation of fishery interest groups and organizations, which are often supported by fisher (member) dues. These groups may be related to seafood marketing, fishers' political interests at the local and national levels, or initiatives developed to support or oppose a proposed management action, among others. These groups are initially created as a result of cooperation between fishers within and across communities, and the groups often serve to increase cooperation, thereby deepening social capital.

A final, key characteristic in fisheries important to the generation of social capital is the existence of various social networks. These networks exist across fishing operations, within fishing communities, and across an entire fishery (which may include many communities and span a considerable geographical range). Within a particular dock, fish house, or processing plant, fishing operations may develop networks used to exchange information on daily fishing conditions, product prices, fuel and other variable costs, bait costs, gear and supply prices, and management changes and proposals; networks can also be used to identify the most dependable crew and fair captains, leading to a facility in labor recruitment. Such social networks tend to be isolated in space across a common area in which small groups of fishers discuss conditions and prices. Larger networks develop within

[7] It should be noted here that I use trust here as it applies to the fishers' profession and not as an all-encompassing trait. That is, the trust developed here is relevant to the fisheries themselves, which are the social structures in which the fishers operate and which comprise the aspect of their lives that are shared. Thus, social capital develops in relation to the fisheries and as part of a common objective, but it may not extend to other aspects of the fishers' lives.

fishing communities, and these extend across fishers and their families and professional and personal circles. Developed in part as a result of economic ties, the networks mature into a series of long-term relationships than bind the communities together with shared objectives. The most distant but equally important set of networks that exist are those related to an entire fishery. Fishers who target the same species or who identify themselves as being from the same region may develop these networks to compare market prices and fishing costs, exchange information on resource abundances, best management practices, and emerging technologies, and represent the fishery's political interests. As these distant networks mature, the networks can be used to lobby for or protect allocation and distributive benefits that a sufficiently large network can demand.

Trust is among the most important components of social capital in fisheries, as it is responsible for lowering monitoring and compliance costs (Grafton, 2005). Many fishing activities take place over large and often isolated expanses, and sea-based infractions are difficult to witness and prosecute. In the case of fixed gear, such as traps or nets that are set in the water column on seafloor, there is the added burden of leaving the gear in place for hours, days, or even an entire season with the expectation that the gear will not be tampered with, have the harvest robbed, or even have the gear stolen. In fisheries with high social capital, the monitoring costs are effectively lowered because fishers have a high degree of trust that each will comply with the regulations and will not affect the others' landings or gear. Trust also impacts the level of compliance such that if there is trust that fishers are not

harvesting more than is sustainable, then others will also comply with the catch limits. Grafton (2005) also identifies a form of trust between fishers and management agencies, where a high level of trust promotes information exchange between fishers and managers and yields positive results in management and allows for the incorporation of fisher local ecological knowledge in management decisions.

Cooperation is another key component of social capital in fisheries, and it is generally divided into cooperation between fishers and within fishing communities and cooperation between fishers and management authorities (Grafton, 2005). Cooperation between fishers and within fishing communities can lead to more informed fishery decisions that reduce trip costs, collaboration (as opposed to competition) in setting market prices, pooling resources to reduce individual expenses[8], and the capacity to reduce intra-group conflicts. Cooperation between participants and within communities also reinforces trust, which in turn improves the likelihood of further cooperation.

Cooperation between fishers and management authorities that incorporates fisher input and participation in decision-making, from a spectrum of advice to decision-making authority, is commonly referred to as 'co-management' (Gutiérrez et al., 2011; Sen and Raakjaer Nielsen, 1996). As shown in Figure 4, the level of

[8] Florida Keys trap fishers in certain communities and fish houses participate in "concrete pours", an event in which participants pool funds to purchase cement to add to their spiny lobster and stone crab traps. The fishers, their workers, and even family members apply the cement to newly constructed traps that are lined up in rows. By the end of the event, all traps are sufficiently weighted with cement such that they will sink when deployed.

fisher and fishing community management varies in the type of co-management approach adopted. Whether and what type of co-management system can be adopted depends on the regulatory framework, institutional capacity, and linking social capital, among other factors; however, the objectives in any co-management approach are to devolve management authority, increase cooperation, and reduce conflicts.

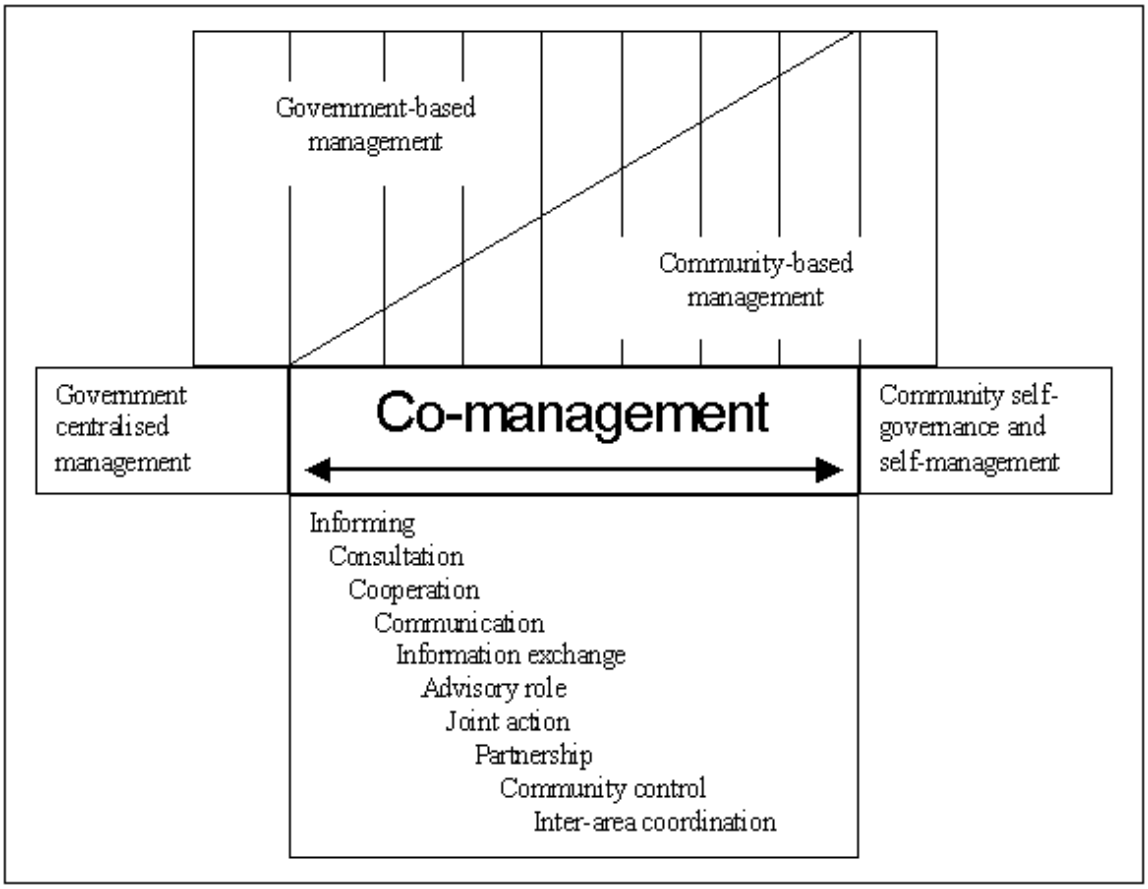

Figure 4: Co-management typology (Ninnes, 2003)

Co-management works to build social capital because it promotes cooperation (at any level within the spectrum as shown in Figure 4) between fishers and management authorities, and it does so under the auspices of the management framework. That is, consultations between industry and managements are not

uncommon, but if not sanctioned, management does not have to address the advice provided. In the case of co-management, especially when it is set up as part of a formal institution, management has to at some level consult with fishers. Under the US federal fishery management framework, fishers and fishery interest groups participate within the regional fishery management councils by either voting in the process (if there is a commercial fishery vote on a council) or by providing input and advice at the sub-council level (as members of advisory panels, members of the scientific and statistical committees, or as appointees of special groups as created by the councils). Participation at the state level varies as according to individual state legislation, and in the State of Florida, participation in the Florida Fish and Wildlife Conservation Commission (FWC) – the state's primary fishery agency – is determined by appointment by the governor and confirmed by the state legislature. Stakeholders, such as commercial fishers, can participate and provide input to the process, but their role is limited to providing information (FWC, 2014b). In both the federal and State of Florida level fisheries approaches, fisher participation in a co-management type format is severely limited. This is in part a result of how the US system of laws is organized, such that administrative law developed as part of a statutory framework which does not allow for more public participation than at discrete stages of the law formation process.

The final aspect of social capital that is essential to fisheries consists of social networks. While networks have already been introduced in this chapter, it is important to differentiate between the types of social capital that networks provide.

Social networks generate three types of social capital, based on the ties that exist between fishers, their communities, their regional and professional affiliations, and with management authorities (Grafton, 2005). Within local fishery groups and individual fishing communities, the most important form of social capital is bonding social capital (Bodin and Crona, 2009). It is the social capital that exists within groups and which denotes local networks. Social relations between individuals in a fishery operation, within kin, and across tightly knit fishing communities can generate bonding social capital. Bonding social capital is important in developing trust within local groups and communities, and it is affiliated with strong ties that promote sanctioned behavior and best management practices (Grafton, 2005).

Another form of social capital generated by fishery networks, bridging social capital, extends across communities and includes similar interests. This type of social capital may consist of a fishery across various communities along the range of the fishery, where the ties are not determined by proximity, family, or familiarity, but are instead related to common interests. Bridging social capital plays an important role in the social dimensions of fisheries as it helps to connect disparate fishing communities with a common interest. In fisheries across large areas, such as the Florida Keys archipelago, networks serve multiple purposes, including gear and fishery product price information, fishery conditions, and organization and advocacy. Fishers across a region may share price information as this relates to vessel and gear costs, market prices, and – in the case of privatized fisheries – the cost of individual transferable quotas and gear. MacLauchlin's (2011) work with

Florida Keys spiny lobster trap fishers determined that the social connections and networks play an important role in the trade of trap certificates. Other work in ITQ fisheries, such as the Gulf of Mexico red snapper fishery (Ropicki, 2013), have reached similar conclusions, in that bridging social capital in the form of fishery social networks assist in benchmarking quota prices, locating buyers and sellers, and lowering transactions costs (Gutiérrez et al., 2011; van Putten et al., 2011). However, as a note of caution[9], bridging social capital in a property rights system can also reinforce quota concentrations and reduce participation from small and medium-sized operations (Pinkerton and Edwards, 2009; Shivlani et al., 2005).

The third form of social capital created by interactions between fishers and fishing communities and management authorities is referred to as linking social capital. As discussed previously with respect to co-management, greater levels of substantive interactions can engender trust and promote cooperation between the fishing industry and management, allowing for bilateral exchange. The relations that evolve can result in the conveyance of local ecological knowledge for management to identify and address environmental problems, better harvest and effort reporting that reduces monitoring costs, and a shared understanding of policy actions. Fishers may not be satisfied with resource management or other fishery related decisions, but in a network with high linking social capital, fishers are more likely to accept

[9] Field (2011), in his criticism of Putnam, relates that social capital does not always create social benefits, and types of social capital that promote strong ties can be responsible for negative outcomes for outsiders. Indeed, Bourdieu acknowledged the negative aspect of social capital in his analysis of social class entrenchment as facilitated by social relations and networks (Bourdieu, 1986).

such decisions as legitimate. In the Florida Keys, fishers generally accepted a closure of the Dry Tortugas Ecological Reserve (DTER) as a legitimate action because industry representatives participated in the zone creation process as a larger, multiple stakeholder working group (Delaney and Haskell, 2003; Shivlani et al., 1999); this is to be contrasted with an earlier zoning process which involved no fisher participation and which was rejected by the Florida Keys' voters in a non-binding referendum (Suman et al., 1999).

Why is Social Capital Important to Fisheries?

Fisheries require social capital to achieve an undervalued objective in fisheries policy: Social sustainability. Management approaches, such as technocratic management, that ignore or undervalue the social dimensions of fisheries and their importance in maintaining sustainable fishing communities are likely to promulgate incomplete management actions that erode social capital and weaken the communities. By doing so, such actions often actually do harm to the fisheries that the actions have been crafted to sustain. Social capital in fisheries is the glue generated from social relations between fishers, across communities and groups, and between fishers and management authorities. Social capital is important because fishers can draw from it to establish harvest and effort rules that can prevent overfishing, minimize overcapacity, and reduce transactions cost. Social capital is also important because it reduces the costs associated with governance factors (Grafton, 2005). Finally, social capital can play a significant role in

strengthening fisheries against inter-seasonal harvest fluctuations, proposal management actions, and non-fishery factors.

Common pool resources (CPR) face the challenge of being non-excludable by nature, and in fisheries resources the expected long-term result without intervention is the dissipation of economic rents and commercial extinction of stocks (Anderson, 2004; Hardin, 1968). However, social capital can provide the trust and cooperation necessary to establish communal rules within a fishery's social structure to prevent overfishing and to control overcapacity. Fishers operating within the social structure will be constrained from breaking the rules as the structure ensures sanctions. Also, as negative behavior is minimized by sanctions, the fishery will experience lower monitoring and enforcement costs, thereby reducing overall transactions costs. Hardin's mutual coercion does not need to be a choice between governmental oversight and property rights; it can also be derived from social structures that exhibit high degrees of trust and cooperation.

Social capital's importance in improving governance factors is related to the ability of fishers and fishing communities to assume part of the responsibility for fisheries governance (Grafton, 2005). The governance refers to rules established to determine who enters a fishery, the rates of resource extraction and effort, and support for enforcement and management. Because social capital facilitates cooperation and increases trust, governance factors related to the rate of resource extraction and effort can be shared with fishers, who can persuade their cohorts. Also, social networks generate bonding, bridging, and linking social capital, which

can be used to enforce restrictions within communities and across a fishery and develop ties with management authorities in harmonizing management efforts.

Because it enhances cooperation, social capital can strengthen intra-fishery communication and information exchange as related to fishery harvest conditions. In seasons when landings are depressed, fishers can exchange information on harvest and effort rates, thereby preventing excess effort and associated costs. Also, in fisheries where there exist robust networks, bridging social capital can be used to mobilize a fishery-level response to proposed management actions. In the Florida Keys, fishers organized against the 1995 Florida Keys National Marine Sanctuary (FKNMS) zoning action plan through a statewide fishery organization (Organized Fishermen of Florida) and a local fishery organization (Monroe County Commercial Fishermen, Inc.), as well as with a multi-stakeholder opposition group (Conch Coalition) (Suman et al., 1999; Milon et al., 1997). Fishers from different fishing communities in the Upper, Middle, and Lower Florida Keys banded together to oppose the FKNMS no-take zones, which the fishers perceived as having been designated without full participation (Suman et al., 1997). Finally, robust social capital, especially bonding social capital, has the ability to withstand non-fishery factors. Non-fishery factors, such as demand for commercial waterfront space by competing waterfront activities, high land values in coastal communities, and gentrification, all exert considerable economic pressure on fishers and fishing communities to exit the region. Social capital in the form of cooperation provides opportunities for fishers to maintain dock space by working for fish houses and with

other fishers and exerting pressure via their organizations for sustained access to working waterfronts.

Discussion

This chapter has shown that social capital is an essential component and part of the ecological-economic framework required to maintain sustainable fisheries. But, social capital has been undermined because technocratic management has largely ignored the social dimensions of fisheries. While it could be argued fisheries that adopted catch shares, individual transferable quotas, and other property rights systems have succeeded (Costello et al., 2008), it is worth considering whether property rights rather than strict harvest and other control limits are required to discipline fisheries (Bromley, 2009). I do not suggest that there is not a place for property rights in fisheries, but as I argued in the previous chapter, technocratic management cannot be proffered as the only remedy to declining fisheries. That is, without the inclusion of social sustainability, technocratic management endangers the fishing communities that it seeks to sustain. This is best understood in the context of how social capital is affected by technocratic management.

Among the most pernicious impacts of technocratic management on social capital in fisheries is technocratic management's view on cooperation. Under technocratic management, the emphasis is on ecological integrity (i.e., sustainable harvests) and economic efficiency. While ecological integrity concerns how many units of fishery product can be removed to achieve a sustainable harvest, the

concept does not in any way address how a fishery should be organized, in terms of its economic and social dimensions. The economic component of technocratic management concerns how a fishery can provide the highest benefits to society while maintaining a sustainable harvest; therefore, the concept straddles both the ecological and economic (and, as we shall see, the social) dimensions of a fishery. Because there is no social component embedded in technocratic management, for example as economics is embedded in a biological model to create a bioeconomic model, technocratic management relies almost exclusively on economic principles to organize fisheries management strategies (Bromley, 2009). These strategies adopt the neo-Malthusian narrative of Hardin's tragedy, favoring a property rights approach to addressing the tragedy in rationalizing fisheries. The accepted view of fisheries developed under these strategies is that as rational actors, fishers represent measures of effort that compete with each other for access to a non-excludable, commons-based resource. There is no space for cooperation in these strategies because cooperation does not fit the accepted view. After all, how can there be cooperation if the argument is that it is competition that leads to the tragedy?

The fisheries management strategies, stripped of all social relations and cooperation, develop participant, harvest, and effort-based models that can 'talk' to the ecological models. The population of fishers – comprised of fishery leaders who influence their respective fisheries and communities, fishers who represent generations of tradition and experience, and fishers who transfer local ecological

knowledge, among others – are represented as the sum of undifferentiated units of effort. Since each unit is undifferentiated, the only (or at least, most significant) interaction is of competition. Also because each unit is undifferentiated, fishers by themselves do not have the capability in this system to cooperate or otherwise participate in activities that engender social capital. Each fisher has standing due to his or her participation in the fishery but is otherwise interchangeable (Jentoft, 2000); in fact, the expectation under property rights systems such as individual transferable quota, effort, or permit systems is often that excess effort will be shed from a fishery as the so-called high-liners (or most efficient fishers) out-compete the less efficient ones (Anderson, 2004).

Because competition is prioritized over other social relations, trust within the fishery, which is engendered through continuous interactions, is replaced by reliance in the management authority. Fishers no longer gain as much as they would have in the past by interacting and building trust, as management now favors that each fisher competes with all others. No longer is there a need to rely on norms and community-based sanctions (Grafton, 2005), as the management authority now establishes rules and metes out penalties. I do not suggest that trust is eroded across all segments of the fishery, as it may occur that bonding social capital actually increases among different classes of fishers. For instance, membership in local fishery organizations actually increased in the Florida Keys spiny lobster fishery after the State of Florida implemented a property rights system; but, most organization members owned large percentages of the overall gear (Shivlani et al.,

2005). Such an insular form of bonding social capital therefore is characterized by cliques (closed groups) that may be beneficial to the groups themselves (Field, 2011) but which may decrease trust in their respective communities and fisheries.

Another impact of technocratic management, related to its effects on cooperation, is its weakening of fishing communities and social networks. As stated above, under the technocratic management framework, competition is the main type of interaction between fishers, and each fisher is represented as an undifferentiated unit of effort. There is no place for a community in the framework, as a community is simply an aggregation of effort in a given location. Also, because all the fishers are ostensibly the same (and are only differentiated by how efficient each is), even if a community could be conceptualized in this framework, members of the community would largely be differentiated in terms of their economic characteristics and capacities.

While it is clear that communities are an important consideration in US federal fisheries management, technocratic management undercuts that consideration. Communities thus become objects upon which action needs to be taken, rather than participants in a project to conserve resources. Social capital and its benefits are not goals to be considered in line with economic efficiency because the communities that engender and nurture such capital are perceived as the objects that technocratic management will attempt to salvage as it disciplines fisheries. Thus, whether communities provide the basis for social relations resulting in trust, cooperation, and networks is not even a concern because these relations are

not given much standing in fisheries management. Consequently, fundamental issues such as the initial allocation of quotas or effort, allowance for new entrants, and quota concentrations and oligopolistic behaviors, among others, are downplayed as technical problems that need to be surmounted to achieve effective property rights rather than the social crises they represent (Olson, 2011). Overall, under the competition framework, communities are expected to be disrupted certainly, but that disruption, which may result in fleet consolidation, changes in social relations between fishers and within communities, and the erosion of social capital, is expected to remake the communities on the 'other side' (when technocratic management has been fully implemented).

Technocratic management impacts the three types of social capital in different ways. As discussed above, bonding social capital may actually increase with technocratic management, dividing up fishers into classes, fragmenting communities into familial and kin groups, and increasing competition between classes of fishers. Bridging social capital can be eroded considerably with increased competition, as participants across a fishery may have fewer reasons to cooperate and communities may be further isolated from each other. Finally, linking social capital can be seriously impacted due to decreased trust between fishing communities and management authorities.

Bonding social capital may actually increase in communities in the aftermath of a technocratic management action. As stated above, the competition framework prevents cooperation and decreases trust. Growth in bonding capital is more likely

among groups that have less in common, such as the lack of family or other kinship ties, common processors or shared fishing docks, or similar views. Described by Field (2011) and others as the 'dark side' of social capital, inclusive forms of bonding social capital have the likelihood of increasing transactions costs, thereby increasing monitoring and compliance costs. Bonding social capital, if not supplemented by bridging social capital, may also result in lower trust across a fishery and communities, making it more difficult for fishers to be able to organize any form of collective action or to exchange information on fishery conditions. Finally, because entrants (fishers entering a fishery) and crew rely on broad social networks (formed via bridging social capital) to be able to find operations, bonding social capital that is strengthened via management action may result in the severance of such connections and the diminishment of employment and apprenticeship networks.

Bridging social capital is negatively impacted with the erosion of trust and cooperation across fisheries and between communities. Also, bridging social capital declines in the cases where technocratic management favors a particular group over another. Social networks function best when a group of individuals or communities connected by a common interest can conduct transactions based on trust and a shared understanding. The trust develops through an iteration of interactions, each of which is responsible for increasing connectedness and increasing bridging social capital. However, with the imposition of technocratic management, fishery participants and communities are now put in direct competition with each other

and have fewer incentives to interact. That is, under conditions of high social capital, participants and communities know that information exchange, cooperation, and collective action could assist each of them. Under technocratic management, it is competition for the scarce resources that dictate how well the fishers and communities will fare in the future. For those that are willing to share information, they run the risk of having lower profits in the long-term. Therefore, the terms for information sharing change from working within a social structure characterized by norms and sanctions to a legal structure defined by dedicated access and penalties. This is not to state that certain aspects of bridging social capital do not fare well in a property rights system. Indeed, social networks do emerge in response to the trade that occurs under transferable quota and effort fisheries (Ropicki, 2013).

Linking social capital is negatively affected by the erosion in social relations between fishers and management authorities. Fishers who may have participated in the conservation of resources may now be less willing to do so, because the management authority takes on the new responsibility of establishing quotas (determining winners) and dictating who has rights of access. As explained by Grafton (2005), social capital lowers the transactions costs associated with fisheries governance, which includes setting quotas, allowing access, and determining changes in the fisheries effort and harvest conditions. With the implementation of technocratic management, co-management options become more restrained, especially as these relate to community-controlled decision-making. As this occurs, fishers have less incentive to participate with a management authority on fisheries

management issues and thus would tend to share less information. Also, because the sanction power is shifted from the communities to the management authority, fishers no longer have to mete out community-based penalties. Thus, the relationship between the fishers and their communities and the management authority changes, where the latter gains power which it can wield to obtain information (e.g., mandatory reporting programs, data collection systems, etc.) that was previously provided via information exchange. The relationship that matures is one based on coercion than a shared responsibility, further eroding linking social capital.

Another significant effect that technocratic management has on social capital results from the former's view on participation, especially as this relates to overcapacity. Fisheries that are considered over-extended need to be disciplined by reducing effort, and this often results in strategies that promote the exit of smaller and medium-sized fishing operations from their respective fisheries and communities. While property rights programs, such as ITQs, often to have restrictions on the concentration of quotas, evidence from various programs (Pinkerton and Edwards, 2009; Shivlani and Milon, 2000) have shown that small and medium-sized operations are among the segments that are most likely to exit. The irony in such cases is that the many of the smaller operations are the least responsible for effort escalation, yet because they have historically lower landings or effort, they are the ones that are given the smallest shares. These smaller shares

leave them the most vulnerable to exit, especially as they cannot increase effort in poor seasons without buying more shares

As operations exit fisheries, the operations take with them both the expertise and experience of the fishers who may decide that they no longer want to remain in the fishery. The flight reduces the number of fishers and affects the persons and businesses that rely on the operations. Communities that may have relied on fishers in terms of their economic and employment contributions now have to rely increasingly on non-fisher contributions. Also, among the fishers who exit a fishery may be fishery leaders and other influential fishers who are responsible for establishing and maintaining networks, who serve to strengthen social relations, and who may be reservoirs of local ecological knowledge. As communities lose their participant base, there is an opening of the working waterfront.

As more fishers exit a fishery, a vicious circle develops in their respective fishing communities. Exiting fishers reduce the total number of participants and community members, making it more difficult for communities to maintain social capital, which may otherwise have been used for collective action and other forms of political organization. Fishers who do not exit the fishery create small units strengthened by bonding social capital, which further fragments the communities, opening up even more space. Fish houses and processors either ally themselves with the small units of fishers or exit the fishery, creating yet more space.

A final aspect of technocratic management and its effects on social capital worth evaluating is how, by its very approach, technocratic management makes

invisible the concept and value of social capital. As stated above, US federal fishery regulatory language describes fishers and their respective communities as the objects of policy actions. The fishers and fishing communities have no agency in this ideology, as both can only be acted upon; policymakers must take into accounts these objects and allow for their sustainability by the actions prescribed. Sustainability in this case represents almost a coastal tableau, populated by fishing boats against an idyllic waterfront and small waterfront shops and residences. The objectification is made possible because the ideology does not accept that fishers and their community have agency and should have their interests considered in the decision-making process. That is, fishers should be part of a process that includes the ecological, economic, and social dimensions of fisheries management. Proponents of technocratic management may argue that fishers and their communities are included in the decision-making process, and that fishers serve on panels and councils, and public participation is afforded at each stage for input and consideration. This is certainly the case, but the boundaries of the alternatives in the decision-making process have already been determined, and these do not include social capital; by reducing fisheries into almost a bioeconomic complex, social factors have no place in the construction of policy and work only to ameliorate the overall impacts. Until the ideology itself is modified to include social factors in the construction of sustainable fisheries policy, fishers, their communities, and their underlying social capital will not be fully represented in the management framework.

CHAPTER 4: PLACE MATTERS IN THE FLORIDA KEYS

Introduction

The narrative developed in the past two chapters has focused on the evolution of technocratic management and its general failure in incorporating the social dimensions of fisheries, and especially fishing communities, in the decision-making process. However, the effects of the management approach have not been uniformly felt across all fishing communities and thus cannot be simplified into a simple input-output/causal model; that is, not all fisheries have been made more robust but clearly neither have the fisheries all failed (NOAA, 2012; Milazzo, 2010). The mixed record is largely due to the fact that technocratic management is not the only factor that affects fisheries. Fishing communities –complex and dynamic configurations – are in fact continually subject to a variety of non-fishery factors that shape the communities and their responses to fishery management. In short, while the larger institutional forces such as technocratic management certainly affect the fisheries' social sustainability, place matters.

In the Florida Keys, place is of utmost importance. As an archipelago that could be reached only by boat from the Florida mainland until the second decade of the 20th century, the islands and their communities developed largely in isolation from the mainland US culture, often maintaining strong ties with the islands of the Bahamas and especially the island of Cuba (Ogle, 2003; Viele, 1996). Fisheries were a mainstay of the local economy, which otherwise relied on a number of activities over the islands' recent history (Viele, 1996). Over the territorial and statehood

eras, the Florida Keys adopted a number of different economic ambitions, most of which were suited for external (non-Florida Keys) demand. From the wrecking economy of the 19th century, cigar rolling in the late 19th and early 20th centuries, sponging in the early 1900s, and tourism following the post-World War II period, the archipelago reinvented its economic identify several times (Viele, 1999; Viele, 1996). Commercial fishing never gained prominence in the Florida Keys as it did in other fishing ports and communities in New England, for example, and fishery products always remained part of an export economy (Labisky et al., 1980). Thus, fisheries and their underlying fishing communities relied on external demand for their vitality and were vulnerable to macroeconomic conditions. Moreover, because fisheries were never as important as (and sometimes in competition with) other economies, fishing communities were often relegated as a minor sector of the islands' overall, economic well-being.

I posit in this chapter that three main, non-fishery factors have affected fishery performance in the Florida Keys, and that these factors have to some degree exacerbated the effects of technocratic management to make the region's fishers and their communities more vulnerable to flight and decline, respectively. I coin the term, 'non-fishery factor', to separate the factor from technocratic management. Non-fishery factors are related to demographic and macroeconomic trends and while they may intersect with technocratic management in how they affect fisheries, they are otherwise unrelated. The first of these non-fishery factors has been the changing population and demographic structure of the Florida Keys, which reflects

the transformation of a primarily resource-based, export economy to a diversified economy consisting of military, services, and retiree sectors. The growth and affluence that has been associated with a higher population have increased the cost of living conditions and, as the population's interests have shifted from resource extraction, so have their views on and support for fisheries. The second non-fishery factor has been the rise of tourism and its impact on fisheries, both in terms of competition for resources and in demand for waterfront access. Tourism has become a type of economic monoculture in the years of this study, dominating all other economic interests, including commercial fishing. The third, non-fishery factor has been the globalization of fisheries trade, exemplified by the importation of fishery products that has had a dampening effect on local seafood prices. I show in this chapter how these non-fishery factors have interacted with Florida Keys fisheries, and why because fisheries were never a dominant economic sector and relied mainly on external demand, the factors exacerbated the impacts of technocratic management on fishers and their communities[10].

[10] Elsewhere, I have explored the importance of ecological factors in determining fishery performance (Shivlani, 2009), and in certain fisheries such as pink shrimp and spiny lobster, ecological change has played a role in shaping short-term performance (Behringer et al, 2012; Ehrhardt and Fitchett, 2010; Ehrhardt and Legault, 1999), especially as this relates to interannual harvests due to environmental perturbations. However, non-fishery factors other than ecological factors have had a greater influence on overall, long-term performance, especially over the period during which technocratic management was implemented in the Florida Keys.

The Florida Keys and its fishing communities

To better understand the significance of place and the changes that occurred in the Florida Keys' recent economic history, it is important to characterize the fisheries and fishing communities. The islands of the Florida Keys archipelago are located at a subtropical latitude, bounded by the South Atlantic Ocean to the east, Florida Bay to the north, the Florida Straits to the south, and the Gulf of Mexico to the west (Lott et al., 1996) (see Figure 5). Heated by the warm ocean currents that converge in the straits to create the Gulf Stream, the region contains the largest barrier reef system located in the continental US and is rich in a variety of tropical and subtropical fish and invertebrates and tropic ecosystems (coral reefs, sea grasses, mangroves, and hardwood hammocks). Only a few of these species comprise a majority of the Florida Keys' fisheries, which have been dominated by spiny lobster, stone crab, shrimp, coastal pelagic finfish, reef fish, and offshore pelagic finfish. The Florida Keys also hosts a marine life industry, which targets on tropical fish and invertebrates for the aquarium industry.

In part because of how the island chain developed over the past two centuries (as will be discussed later in this chapter), its fishing communities are varied depending on which part of the Florida Keys these are located (Shivlani et al., 2008). Communities in the Upper Keys (from Key Largo to Islamorada) tend to be spread across large areas (even across several islands), primarily fish the South Atlantic (or south side) of the Florida Keys, and are dominated by 'independent' fishers who sell their catch to several fish houses. Communities in the Middle Keys

(Long Key to Marathon) are more concentrated, even within their respective islands, fish both the north and south sides of the Florida Keys, and have a mix of independent fishers and those who are affiliated with fish houses. Communities in the Lower Keys (Big Pine Key to Key West), like those in the Middle Keys, are concentrated in particular areas and fish both sides of the Florida Keys. However, the fishers from these communities, especially those in the Key West area, have the highest rates of fish house affiliation.

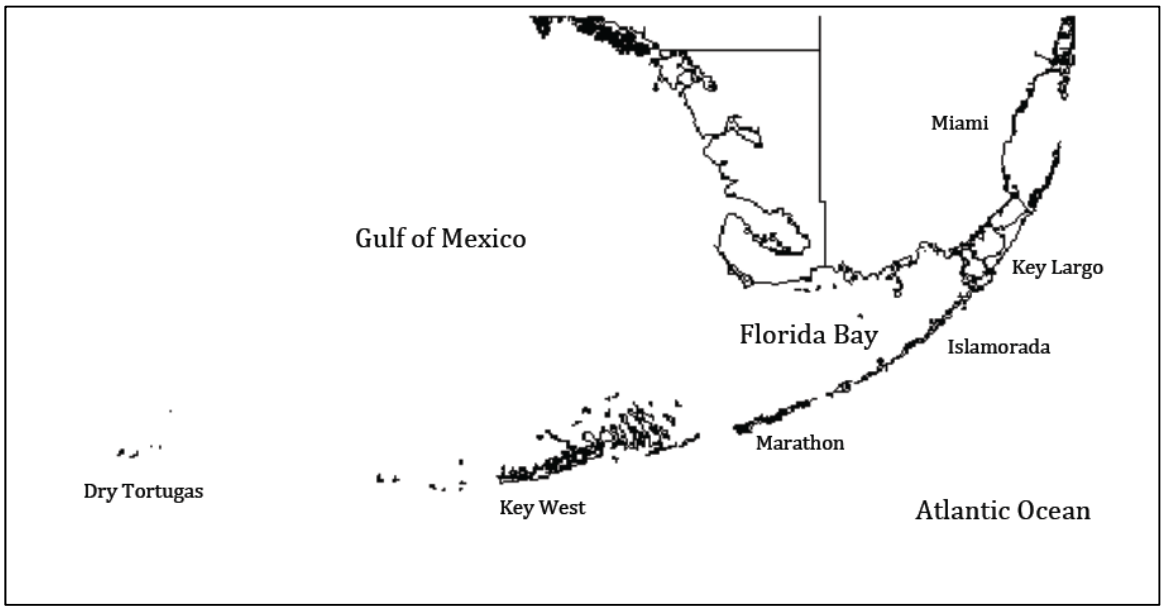

Figure 5: Florida Keys and South Florida

Fishing communities in the Upper Keys are comprised of fishers living in larger, diverse communities comprised of a variety of commercial interests. There are no traditional fishing villages or enclaves from Key Largo to Islamorada, but there are areas on various islands where there are high densities of fisher domiciles. Fishers in the Upper Keys tend to be independent, in that they are not affiliated with a single fish house and are thus not required to sell their landings to that fish house.

The independence is partly because of the wide availability of residential water access (via canals), which was created during the dredge and spoil operations that dominated the post World War II building boom in the Florida Keys (Gallagher, 1997). Fish houses, retail markets, and restaurants are the main seafood purveyors, and the region's few fish houses purchase a majority of the landings. Upper Keys' fishers are ethnically the most homogenous group in the Florida Keys. In a recent study, only less than 3% identified themselves as Hispanic/Latino; by contrast, in the same study, Hispanic/Latino fishers comprised 18.2% of the Florida Keys fishing industry (Shivlani et al., 2008). Rates of group affiliation are also low among Upper Keys fishers, and in 2005, only 16.2% and 24.3% belonged to a local commercial fishery organization or statewide fishery organization, respectively. Finally, Upper Keys fishers tend to rely less on commercial fishing for income than do Florida Keys fishers in general; in 2005, commercial fishing accounted for an average of 70.1% of the Upper Keys fishers' total income compared to 80.3% for all Florida Keys' fishers.

Some Middle Keys fishing communities are different than the ones in the Upper Keys in that these communities, such as Conch Key, have high concentrations of fishers and could be considered traditional fishing villages. However, there are other parts of the Middle Keys in which fishers are spread out as in the Upper Keys. Fish house affiliation is highest in the Middle Keys; almost 71% of Middle Keys fishers belonged to a fish house in the mid-2000s, compared to 47.3% in the Florida Keys. Differences in participation are in part a result of the strong tradition of fish house affiliation and high levels of bonding and bridging capital in the region's

fishing communities (Milon et al., 1997), as exemplified by the Middle Keys fishing industry's history of collective action against protected area and other fishery management measures (Suman et al., 1999; Shivlani et al., 1998). Over a quarter of Middle Keys' fishers are Hispanic/Latino, of which most are of Cuban descent or are first generation Cuban Americans. Dependency on commercial fishing is very high among Middle Keys fishers, and in 2005, 86.5% of average household income was derived from fishing operations.

Lower Keys fishing communities can be divided into two segments: There is the eastern Big Pine to Sugarloaf Key segment in which the fishing communities strongly resemble those in the Middle Keys; and there is the western Key West-Stock Island segment, which has a commercial fishing tradition (since the US annexation of Florida) dating back to the Key West live snapper/reef fish fishery of mid to late 19th century. There are small fishing enclaves on Big Pine Key, Summerland Key, Boca Chica Key, and Sugarloaf Key, and fishers in these areas are largely independent in part as a result of demise of fish houses in the Florida Keys. Key West-Stock Island, by contrast, is the region's largest port. In 2011, Key West (as it is officially identified) was ranked 49th in US fishing ports in terms of landings and 15th in terms of dollar value of the landings (NMFS, 2012). A majority of the commercial fishing that is attributed to Key West actually occurs on the adjacent Stock Island, which took over as the main commercial fishing port after the fishing operations were pushed out in favor of the tourism industry from the Key West waterfront (Schittone, 2001). The Stock Island fishing community thus is split, in

that a percentage of the fishers and their families still live in Key West but dock their vessels in Stock Island, and a larger percentage (including crew) live in and around Stock Island. Fish houses are disproportionately important to the Key West-Stock Island fishing community because their waterfront locations provide the only dedicated access that fishers have in the region. That access has declined over the past two decades, as over 80% of the Stock Island fish houses operating in 1995 have shut down and sold to non-commercial operations (such as recreational marinas, restaurants, etc.) (Shivlani, 2009). However, as demonstrated by the landings and value, Key West-Stock Island hosts among the most influential fishing communities in the Florida Keys.

A brief history of the Florida Keys

The political, economic, and social histories of the archipelago provide important insights on how the Florida Keys' fisheries and fishing communities evolved. The islands underwent a number of significant shifts since their European discovery in the early 16th century, through statehood in the mid-19th century, and the ascendency of the tourism economy monoculture from the 1980s onwards.

The Florida Keys: Spanish possession to the end of the 19th century

Ponce de Leon staked claim over the Florida peninsula for the Spanish realm in the early 16th century, and a mixture of Spanish and other European migrants claimed an uneasy peace with the native tribes settled the northern parts of the

territory (Viele, 1996). Over the next two centuries along the southern archipelago, the Spanish developed a small settlement in Cayo Hueso (Key West), which was the southernmost key with a freshwater source. The island, located 90 miles north off La Habana, a populous settlement in northern Cuba, housed a Spanish garrison and had a fishery trade with Cuba (Viele, 1996). When England gained possession over Florida in 1763, the garrison and other Spanish interests were relocated to Cuba (Viele, 1996). Twenty years later, the Spanish regained Florida at the end of the US Revolutionary War but did not recolonize the Florida Keys; instead, they allowed all settlers to homestead the peninsula. Settlement did not occur in the Florida Keys however, which were left largely uninhabited during the second Spanish occupation. In 1819, Spain sold Florida to the US for land assurances in western North America and for a total of $5 million. Included in the acquisition was the southern archipelago off the Florida Keys (Ogle, 2003).

Much of the Florida peninsula was effectively uninhabitable because of a variety of mosquito-borne diseases, including malaria, dengue fever, and yellow fever. The temperature conditions rendered the region intolerable for much of the year (Viele, 1996). Only the northern ports of Pensacola in the Gulf of Mexico and Jacksonville in the South Atlantic represented major population centers prior to and during the first decades of US acquisition (Ogle, 2003). Settlers in the northern and central parts of Florida imported the slave cotton plantation economy from other southern states, but migration and economic development patterns differed considerably in southern Florida and the Florida Keys (Bretos, 1991).

In South Florida, apart from a military presence and a handful of homesteaded farms on the mainland, the most extensive settlement occurred on Key West. John Simonton, a US businessman interested in developing Key West for its deep harbor and strategic location, purchased the island from Juan Pablo Salas, a Royal Spanish Navy officer, in early 1822 (Ogle, 2003). A few months later, Lieutenant Commander Matthew Perry of the US Navy claimed the island as US property. Both private developers such as Simonton (and his colleagues, including Pardon Greene, John Whitehead, and John Fleeming) and the US military acknowledged the commercial and strategic value of the island, which was located at the intersection of the Gulf of Mexico, South Atlantic, and Straits of Florida, and which provided excellent anchorage (Ogle, 2003).

Following its establishment, Key West quickly gained notoriety as an important wrecking center (Viele, 1999). The offshore reefs presented a treacherous challenge for the many vessels that traversed between the Florida Straits and Gulf of Mexico, and Key West wrecking operations profited from those ships that were grounded in the shallows. The industry grew considerably through the mid-19th century such that by 1860, Key West was both the richest town in the US on a per capita basis and the most populous city in the State of Florida (Viele, 1999). While other parts of the Florida Keys were under threat of Native American raids (most notably Indian Key), Key West enjoyed protection from both the US military presence and its relative distance from the Florida mainland (from where the raids emanated) (Ogle, 2003). As such, the island developed in considerable isolation not

only from the mainland but also from the rest of the archipelago; in fact, Key West remained the most significant population center in the Florida Keys through the 1950s, when other islands along the chain were settled (Ogle, 2003).

Wrecking, the first and arguably most profitable economy in the Florida Keys until the advent of mass tourism a century later, ebbed after the end of US Civil War (Viele, 1999). Vessels were more frequently equipped with better maps, aided by an increasing number of lighthouses, and motored by steam that prevented wind-related groundings. While one of the last major wrecking operation involved the steamer Alicia that grounded off Ajax Reef in what is presently Biscayne National Park off southern Miami-Dade County in 1905 (Barnette, 2008), the profession had by then dwindled to a minor part of the Florida Keys economy.

Key West developed a significant cigar rolling industry as wrecking started its decline in the post Civil War era (Bretos, 1991). Supplied almost exclusively by raw material from Cuba, cigar rolling expanded in Key West over the struggle for independence in Cuba, starting with the 1868-1878 Ten Year War. The industry was important both for its output, which peaked in 1890 at 130 factories that rolled 100 million cigars, and its role in cultural assimilation (Bretos, 1991). Cubans migrated to Key West throughout the cigar rolling era, increasing the county's population to over 18,000 in 1890 (Bretos, 1991). The Cuban population, which had been part of the Florida Keys following the Spanish claim over the archipelago in the early 16th century, also sustained the fishing culture on the island (Viele, 1996). Indeed, records demonstrate that reef fish harvest represented an important export

commodity from the Florida Keys to Havana (the closest and most populous port) throughout the 19th century (Viele, 1996). With the advent of rolling machines and the migration of the industry to Tampa, cigar rolling declined considerably after the end of World War I and the last operation in Key West closed in 1931 (Bretos, 1991).

Related to fishing, sponging became an important industry in Key West and parts of the Lower Keys (although the activity was practiced along much of South Florida and the Florida Keys) from the mid to late 19th century (Shubow, 1969). Fishermen worked off hook boats to work sponge beds, where they used long poles with hooks to pry loose and harvest sponges. Key West sponges reached the New York market by 1849 and over the next 50 years, the island chain exported sponges to the rest of the US. Production peaked in the late 19th century, by which time Key West employed an estimated 1,200 spongers who worked off 350 hook boats producing 2,000 tons per year. Key West was also an important auction market (and remained as such even after the sponge harvest shifted up north) which attracted product from the rest of South Florida, including Biscayne Bay (Shubow, 1969). However, a combination of overfishing, blights, and competition from spongers from Tarpon Springs, Florida, and environs, led to the slow but inevitable decline of the Key West sponge fishery (Shubow, 1969). While it recovered somewhat to accommodate a small sponge fishery in the late 20th century, the industry never regained its 19th century prominence.

The other, mainstay economy in Key West from the time of its establishment in 1822 was the US military (Ogle, 2003). As previously stated, the US Navy claimed the island as a US possession in April 1822 and continued an uninterrupted presence on the archipelago until the present day. The US Navy, in particular, occupied the islands for a variety of purposes, in the 19th century most notably for the development of a naval base in 1823 to counter piracy, Fort Zachary Taylor (completed in 1850), and Fort Jefferson on the Dry Tortugas (commenced in 1846 but never completed) (Windhorn and Langley, 1974). Although the archipelago's military importance decreased considerably with the waning of piracy in the region over the 19th century (which resulted in the abandonment of the Fort Jefferson construction), the US Navy nevertheless maintained a physical presence in Key West and contributed to the Florida Keys' economy. The US military also occupied Key West during the US Civil War, and the island remained a Union outpost for the duration of the conflict (Ogle, 2003). By the late 19th century, Key West gained military importance due to its proximity to Cuba, which was by then undergoing a struggle for independence from Spain. When the 1898 Spanish American War erupted, Key West served as a prominent port and military installation (Bretos, 1991). The subsequent occupation of Cuba only reinforced the Florida Keys' strategic importance and sustained the military presence on Key West throughout the 20th century.

The Florida Keys in the 20th century

While the various economic endeavors re-created the Florida Keys identity, from that of pioneers to wreckers to cigar rollers, it was not until Henry Flagler connected most of the islands that the archipelago was physically and, more importantly, economically connected to the mainland (Labisky et al., 1980). An endeavor that commenced farther north, the Florida East Coast (FEC) railroad developed further south through the late 19th century (Corliss, 1953). By 1904, Flagler's trains reached Homestead, one of the southernmost cities along the east coast of Florida. His next goal was to connect Key West with the rest of Florida by rail, thereby facilitating the import of Cuban produce to northern markets and providing access for US goods to the deepwater port of Key West.

Construction on the FEC extension, more commonly known as the Overseas Railroad, commenced in 1905 (Zeiller, 2006; Corliss, 1953). Mired by cost overruns, engineering challenges, and hurricanes, the extension was completed in 1912, when the first locomotive brought an elderly and fragile Flagler to Key West. However, the FEC extension never fully lived to its economic potential. That is, it did not result in the trade volume that Flagler had anticipated between Cuba and Florida by train freight, and the schedule, delays, and gaps that required ferry transport led to an incomplete and thus unreliable service (Zeiller, 2006). However, the railroad represented the first successful attempt at connecting the Florida Keys with the rest of Florida, and in doing so, it directly connected the economy of the archipelago with that of its increasingly important northern mainland.

By contrast, the southern peninsula, where settlement was discouraged by the Seminole Wars in the first half of the 19th century, started from its modest beginnings as a military outpost called Fort Dallas (established in 1836) to fruit and vegetable farms that eventually formed the city of Miami and greater Dade County (Shappee, 1961). Population growth from the late 19th century onwards, which centered on the mouth of the Miami River and then along the barrier islands and coastal ridge and fringe, outpaced the once most populous city in Florida, Key West (Ogle, 2003). The Florida Keys, which had developed separately from the mainland, became increasingly dependent on the physical resources, infrastructure, and tourism provided by the mainland, and thus the islands slowly but more fully integrated into the macroeconomic fabric of South Florida.

Tourism, which Flagler had promoted in his various commercial endeavors along Florida's east coast, became an increasing important sector of the Florida Keys' economy. The winter months represented the important tourism months, when visitors came down to visit the island of Key West while on their way to Havana, and others who set up fishing excursions in one of the several fishing lodges dotting the Florida Keys. The tourism economy, as well as the aforementioned cigar rolling and developing fishery sectors (for mackerel and lobster fisheries, see next chapter for more details), swelled the population of the Florida Keys to 20,000 residents by 1920 (Ogle, 2003; Labisky et al., 1980). Most of the residents lived on the island of Key West, with only a few hundred inhabitants passing a hardscrabble existence in the other mosquito-infested keys. These other Keys residents eked out

their living by usually selling produce to the mainland or Key West, depending on their location, or by tending small (usually pineapple) plantations (Viele, 1996).

All economic sectors in the Florida Keys collapsed in the following decade, however, with the advent of the Great Depression. As demand declined for tourism, cigars, fisheries, and other Keys products, the archipelago experienced a severe decline in income, followed by a mass exodus of residents. As had occurred previously in the Florida Keys' history, with the removal of Native Americans and the migration of Spanish settlers, the population of the islands plummeted in the 1930s. The 1930 Census determined that the population of Monroe County declined from just under 20,000 residents in the previous decade to 13,600 residents, representing a decrease of 30.3% (Ogle, 2003). The population remained at less than 15,000 inhabitants through the 1940 Census, even with the federal government's efforts via the Federal Emergency Relief Administration (FERA) in the mid-1930s to rehabilitate Key West into a year-round tourist destination (Ogle, 2003). The Keys' economic nadir arrived in the mid-1930s, best exemplified by the infamous Labor Day Hurricane of 1935 that destroyed sections of the Overseas Railroad, which by then was already in receivership and which was abandoned after the storm damage (Drye, 2002). The hurricane, still the most powerful storm to make landfall in the continental US, also flooded parts of the Upper Keys, resulting in the deaths of dozens of Windley Key residents.

The economic renaissance in the Florida Keys commenced in the post-World War II era, spurred on by coastal development and tourism, and supported by

military spending and fisheries. The Overseas Highway, having been completed in 1938, highlighted a series of infrastructure upgrades that 'opened' up the county to development and population growth (Stuart, 2008). By 1950, the population of Monroe County had increased to 30,000 inhabitants, and it would grow in each Census measure until it peaked at almost 80,000 residents in 2000 (US Census, 2000). In the post war era, development patterns shifted such that the rest of the Florida Keys, previously only sparsely populated, grew as the island of Key West was more or less built out. Thus, while in 1950, 88.3% of the Keys population resided in Key West, the rest of islands (in particular, the Upper and Middle Keys) grew at a faster rate and added more population from the 1950s onward. By the end of the 20th century, a majority of the Keys' residents lived on the rest of Keys rather than Key West (US Census, 2000).

Coastal development and tourism often worked in tandem in the post war era. That is, the increasing demand for lodging and activities spurred on tourism infrastructure development. Also, tourism exposed visitors who elected to settle in the region, thereby promoting coastal development. By the 1950s, large scale dredge and spoil projects had commenced in the Middle Keys, creating the communities of Duck Key and Key Colony Beach (Gallagher, 1997). As with the Overseas Railroad construction in the early 1900s, these projects made wholesale changes to the coastal and nearshore benthic communities, destroying mangroves and burying benthic organisms in the process (Garrett, 1997).

By the 1980s, many of the larger keys accessible by the highway and not designated as protected areas, had been developed. Tourism, which had spurred development since the 1950s, gained primacy as the region's economic driver, especially after the decline in the Florida Keys' military presence (Leeworthy and Wiley, 1996). Over the much of the 20th century, the military had maintained a strong presence in the Lower Keys, from the Spanish American War onwards. Key West served as a Navy base and gained increasing importance following the Cuban Revolution in 1959 and the 1962 Cuban Missile Crisis (Ogle, 2003). However, as the Cold War receded in the 1970s, the Navy decided to close its submarine base in 1974 (Swift, 1997). With that decision, the Florida Keys lost part of the military's economic contribution to the region, eventually hitching the county to tourism as its dominant economy. In 1988, the county government approved the establishment of the Tourism Development Council (TDC), an advisory board related to the promotion of the tourism economy (Swift, 1997).

Tourism expanded significantly under the TDC, such that by the mid-1990s, the Florida Keys were hosting an average of 2.5 million visitors who contributed $1.3 billion to the county's economy (Leeworthy and Wiley, 1996). Tourism and tourism-related activities accounted for over two thirds of the county's labor force and 61% of its overall economy, respectively. The Florida Keys, which had once represented an outpost, bookended by the Last Chance Saloon at their entrance in Florida City and southernmost city in Key West, were by the end of the 20th century

a prime tourist destination, serviced by cruise terminals, airports, and the Overseas Highway.

Non-fishing factors influencing fisheries

Fisheries have been a way of life in coastal Florida and have represented an important economy in the Florida Keys (and indeed in the State of Florida) over their history under US jurisdiction (Cato and Sweat, 2000). However, while Native Americans relied on coastal and marine resources, as did the Spanish who displaced the tribes and established the first European settlements in the Florida Keys, the islands never developed a fishery-dominated economy. That is not to state that fisheries were not an important part of the archipelago, both in terms of traditions and identity. For example, Key West was at one point the second largest fishing port in the US (Cato and Sweat, 2000), and settlements dotting the Florida Keys were very much resource-dependent communities that relied on fishing for subsistence and sold fishery products in the local economy (Zeiller, 2006; Viele, 1996). However, unlike in New England, where ground fish fisheries dominated the economy and defined the culture of the coastal communities (Kurlansky, 1997), fisheries developed mainly alongside other Florida Keys' economies. Also, because of their relatively small population during the period over which many fisheries were developed, local demand was insufficient to consume the enormous harvests of reef fish, coastal pelagic finfish, sponges, turtles, and spiny lobster, among other species (Little, 2000; Labisky et al., 1980). Thus, the markets that developed for most of

these species from the mid-19th century onwards catered to external demand; once these markets had been established, much of the fisheries sector formed an export economy.

Also, as the tourism economy developed after World War II, it did so in a way that competed with commercial fisheries and fishing communities, such that restaurants were as likely to sell imported fishery products (especially over recent years as globalized seafood trade increased) as they were to buy locally landed products and where the burgeoning tourist (recreational) fishery sector competed directly with the commercial fishing sector. The increase in population and demand for the islands' space and resources, competition associated with coastal and marine tourism, and a globalized seafood trade market all matured as powerful, non-fishing factors[11].

Finally, as technocratic management began to dominate fishery management in the Florida Keys, it exposed the vulnerability of the archipelago's fishing communities. Unlike other coastal communities that were more dependent on commercial fishing (as a share of the overall economy, percentage of the total labor force, etc.), the Florida Keys fishing communities existed in an uneasy peace with the tourism sector, which was increasingly important as a share of the regional economy and which relied on many of the same resources as did commercial

[11] Other fishing communities across the US have experienced similar impacts from the proliferation of non-fishery factors, and while the impacts of factors have been similar (competition for resources, loss in social capital, and even fisher job dissatisfaction), the factors themselves have varied in terms of type and scope of each factor (Colburn and Jepson, 2012).

fisheries. Factors that weakened the viability of commercial fishing in the county acted synergistically with technocratic management in further weakening the resilience of fishing communities. While it has been shown that the economy of the Florida Keys did reinvent itself several times over its recent history (Ogle, 2003; Viele, 1999; Viele, 1996), the main difference in the decline in commercial fisheries under technocratic management was that it led to an opening of the waterfront that was taken up by gentrification, as I describe in the next section. Thus, fishers and fishing communities were now left with nowhere to return.

Population growth and socioeconomic characteristics[12]

The post-World War II era witnessed the highest population growth in the Florida Keys, due in a large part to the infrastructure developments over the 1930s and 1940s (Shivlani, 2009). The population growth and demand for housing and services at first assisted the development of the fishery sector, by increasing local consumption and providing a source of labor. However, over time, as the state and county adopted measures to curtail that growth, fishing communities were among the most impacted by increased demand (and higher costs of living).

Figure 6 shows the population growth in the Florida Keys from 1920 to 2012. The population stood at 14,078 in 1940 and had increased more than fivefold by 2000. The period from 1940 to 1990 represented the greatest population growth

[12] All population information in this section, unless otherwise cited, is obtained from the US Census Bureau's 1950-2010 Census statistics on general population characteristics, available via: www.census.gov.

and the most inhabitants added to the county. However, population growth was not evenly spread across the islands, with Key West increasing as a share of total population from 1920 to 1960 and then the rest of the keys increasing from less than 1,533 residents in 1950 to almost 46,000 residents in 2000. The Key West population peaked in 1960, at 33,956 residents, and it only reached a similar total (33,730 residents) in 2000. This was in part due to the decline in military activities in the Lower Keys from the 1970s onward, high housing costs (especially relative to adjacent islands), and a depressed local economy in the 1970s.

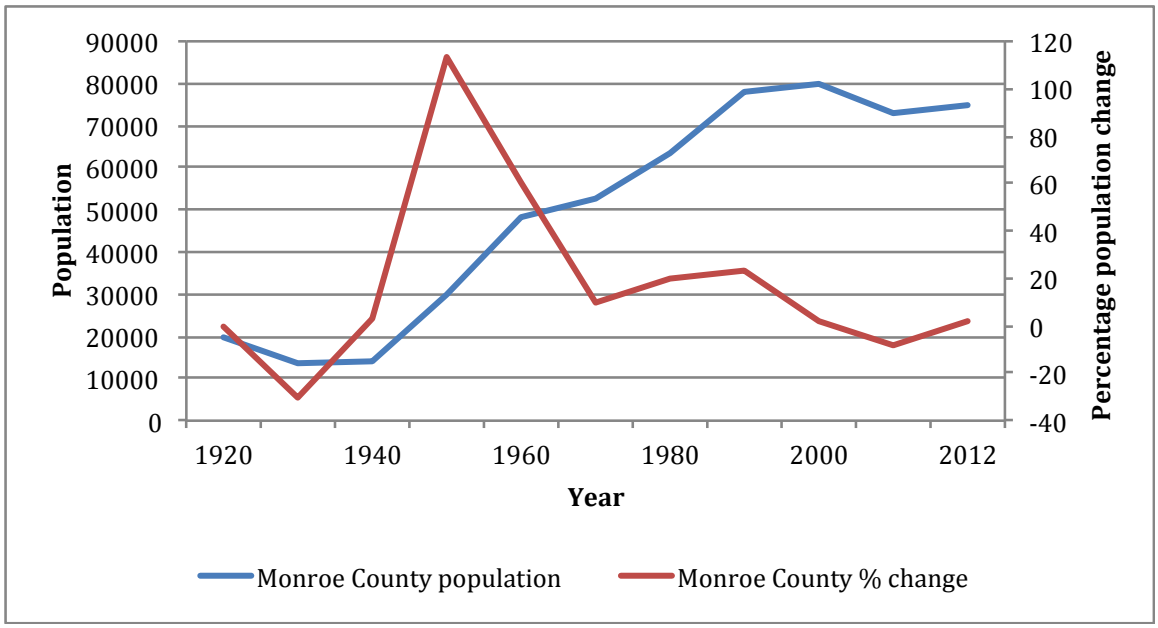

Figure 6: Population growth in the State of Florida and Monroe County, 1920-2012

Population growth benefited certain economic sectors more than others. Most of the 1,533 residents living on islands other than Key West in 1950, for instance, relied on resource dependent activities, including farms, fishing, and sponging operations (Viele, 1996). But, within a decade, while the total population of the county increased by 60% and the labor force nearly doubled from 6,500 to 12,300 workers,

the percentage of the labor force involved in fisheries declined from 6.2% to 4.0%; in fact, the percentage of the labor force involved in fishing activities never exceeded 6.2% in the post war era and declined. By 2010, the percentage of the labor force involved in fisheries had declined to 2.7% (although the actual number of participants in the fishery were likely much lower[13]). The sector to gain most in the post war era, in terms of jobs and economic activity, was the tourism economy. In both the 1980 and 1990 Censuses, the labor force in eating and drinking establishments comprised 10% of all employment in the Florida Keys. The 2012 US Census American Community Survey, which included information on tourism services, reported that 21.5% of the county's employees were involved in tourism services, such as the arts, entertainment, recreation, accommodation, and food (US Census, 2014).

As the Florida Keys' economy adopted greater dependence on tourism, the region experienced greater immigration, from both domestic and foreign (mainly Cuban) migrants. In 1950, only 4.4% of the population was foreign born, which increased only slightly to 5.5% by 1960. The influx of foreign-born residents was largely a result of Cuban immigration, especially following the 1959 Cuban Revolution (Masud-Piloto, 1996). By 1970, however, immigration was increasingly fueled by domestic immigration. The 1970 Census determined that almost 80% of

[13] The 2010 US Census estimated 1,430 participants in a natural resource industry in Monroe County, but the Florida Fish and Wildlife Conservation Commission recorded 1,365 Saltwater Products Licenses (SPL) sold in Monroe County in 2009. Studies conducted in the region (e.g., see Shivlani et al., 2008) have found that the actual number of participants, including those who are full-time commercial fishermen, is much lower than those estimated by other sources.

Key Largo and Marathon residents were born outside the state, although only 4% of the county's population was foreign-born. By 1990, the foreign born population of the Florida Keys had increased to 10.1% of the population, with islands other than Key West hosting the highest percentages of mainly Cuban immigrants. Also by 1990, most of the residents across the county were not born in the Florida Keys. Almost two thirds of Key West residents (63.4%) and three quarters of Key Largo (73.5%) and Marathon (76.5%) were born outside the State of Florida.

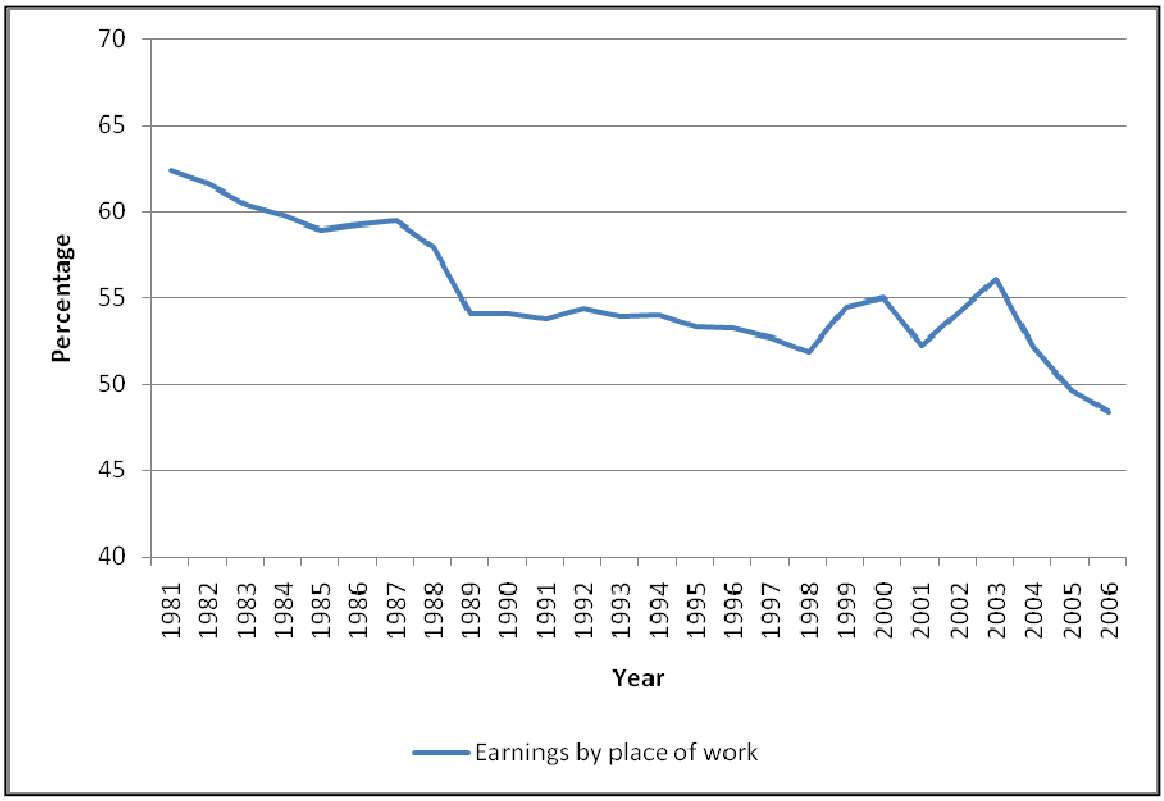

Figure 7: Monroe County earnings by place of work, 1981-2006 (BEBR, 2009)

Immigration in the latter part of the 20th century included many new residents who moved to the Florida Keys as retirees or those who owned second residences on one of the islands (Clarke, 2002). These residents were more likely to be more recent immigrants who were not part of the region's history and not tied to

the local economy; these residents did not form what is defined as communities of interest and were less likely to identify themselves with the extractive industries, especially those associated with commercial fishing. In fact, as measured by income from place of work (Figure 7), the percentage of residents who earned their living by work in Monroe County declined from 62% in 1981 to less than 50% in 2006. Thus, by the mid-2000s, less than half of the residents living in the Florida Keys were employed in the county (BEBR, 2009). These residents, many of whom joined local and national environmental groups, were more likely to favor resource preservation, such as coastal and marine protected areas, land conservation, and species protection than were the residents involved in resource extraction (Suman et al., 1999). The other aspect of population growth, fueled mainly by immigration, was the higher demand for housing and related services. While the Florida Keys were being developed in the 1950s, there was sufficient, inexpensive land to accommodate migration. However, as land became less available, and regulations became stricter for development, both competition for land use and real estate in general increased. The State of Florida Legislature decided in 1975 that Monroe County required state supervision to oversee development within the archipelago and designated the county as an Area of Critical State Concern (Clarke, 2002). The designation required the county government to balance development with environmental protection via the establishment of a comprehensive development plan (Garrett, 1997). The plan was to consider issues related to quality of life, environmental protection, and hurricane evacuation time. The county adopted its

comprehensive plan in 1986 and commenced a rate of growth ordinance (ROGO), which limited growth to 255 housing units/year in 1992. Coupled with the controls on housing development, over 60% of the county's lands were under public ownership, of which most were protected as conservation areas (URS Corporation Inc., 2001) The result of these controls and protected areas was an explosion in home prices (Figures 8 and 9). In 1990, the median home price of a Monroe County home was just under $150,000, which was almost twice the Florida median home price. The prices increased substantially over the next two decades, especially during the housing price boom of the mid-2000s. By 2007, the median price of a single-family home in Key West peaked at almost $750,000.

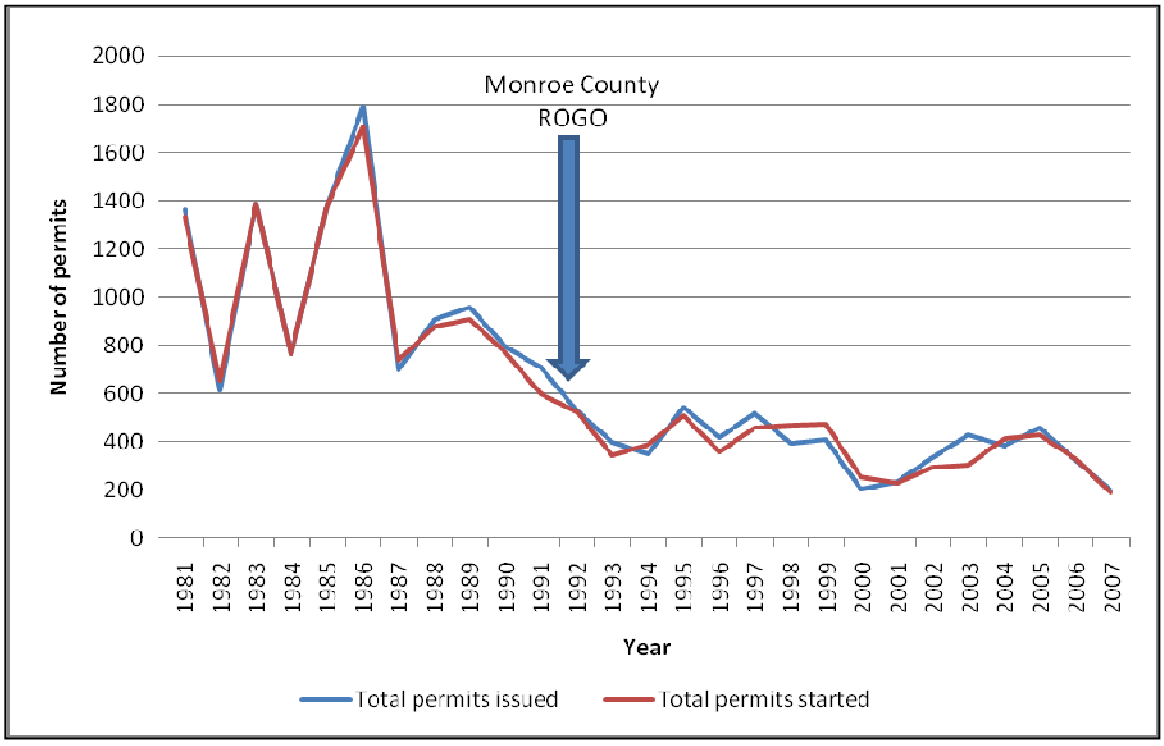

Figure 8: Monroe County building permits, 1981-2007 (Shivlani, 2009)

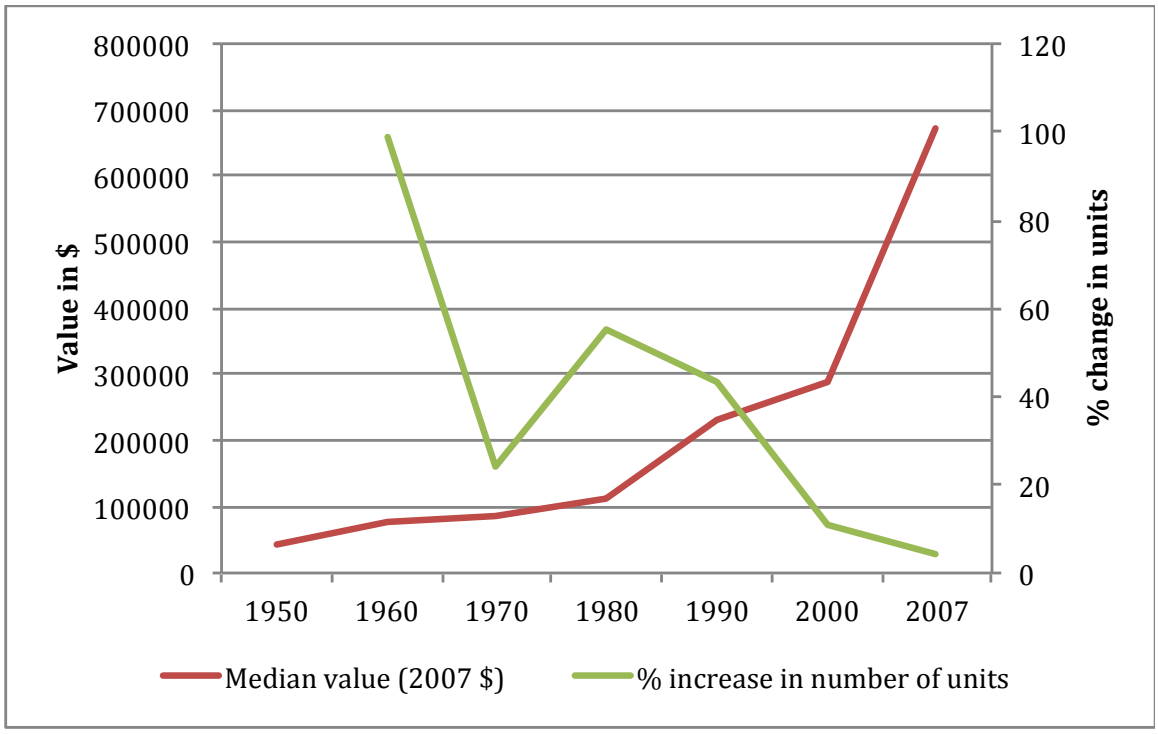

Figure 9: Monroe County median home value and increase in housing units, 1950-2007 (Shivlani, 2009)

Along with the housing demand and prices that reflected on the cost of living in the Florida Keys, utilities and commodities and material prices increased significantly over the past three decades in the region. The utilities, especially the cost of water (Ball, 2005; AP, 1982), largely affected the standard of living, but commodities and material prices directly impacted the variable costs of fishing trips (Shivlani, 2009; Shivlani et al., 2005). Additionally, fuel costs, which had been stable over the 1980s and 1990s, commenced an upward trend in the first decade of the 2000s, culminating in the July 2008 peak of $145/barrel. The Florida Price of Living Index, based on "data on wages, occupational location, and the prices of goods and services "(BEBR, 2009; p. 2) to compare cost of living across counties, provides an annual index that can be compared across period to evaluate changes in cost of

living conditions relative to the Florida average (average = 100). Over the last half of the 2000s that the index was calculated, the cost of living in Monroe County was the highest among all Florida counties.

The cost of living increases, experienced most profoundly in the early 1980s and mid-2000s among the less affluent segments of the Florida Keys communities (including commercial fishing communities), led to the outmigration of mostly working class Keys residents. In the early 1980s, water and other utility prices were the leading reason for the outmigration of the so-called Conchs (multi-generational Keys' residents) (AP, 1982); in the mid-2000s, the Keynoter newspaper published out of Marathon labeled emigrants as Horse Conchs because of their proclivity to re-settle in Ocala (horse country in Central Florida) (Ball, 2005). In both cases, residents who could no longer afford to live in the Florida Keys needed to move out to accommodate more affluent residents. Several conchs who I had known for over a decade or longer left the fishing industry and the Florida Keys. One of the fishers who remained told me that the "Keys are now for rich folk, and we are just in their way"[14]. This large exit of fishers and their families took with them the local ecological knowledge, rendered social bonds that existed within their communities, and removed present and future generations of fishers who would have otherwise sustained their respective fishing communities.

[14] Bobby, commercial fisher. Personal interview conducted in Stock Island, Florida. January 14, 2011.

Tourism and ocean-based recreation

Since the 1980s, when Monroe County and its tourism industry groups began a concerted effort to improve tourism quality and promote tourism, the Florida Keys have moved steadily towards a diversified tourism economy (Swift, 1997). That economy now consists of an average of three million visitors (or person-trips) that arrive via road, air, and sea and participate in a number of different land and ocean-based activities (Leeworthy et al., 2010). Tourism contributed $2.23 billion to the Monroe County economy in 2007-08, employing 32,000 workers (Leeworthy, 2010). Over half (53.0%) of the Florida Keys visitors in 2007-08 participated in one or more ocean-based activities, including swimming, snorkeling and diving, and fishing (Leeworthy et al., 2010). The popularity of ocean-based activities has led to a competition for coastal and marine resources between tourism and fisheries and other coastal and marine resources. As tourism has attained economic dominance, it has increasingly gained in preferential access to both fisheries and coastal and marine resources and waterfront space.

Recreational fishing

Among the ocean-based activities, recreational fishing has competed most directly with commercial fisheries over the Florida Keys' recent history. Recreational anglers, spear fishers, and lobster divers compete for the same resources that commercial fishers do, often in the identical habitats and across the same seasons. Always popular as an economic activity in the region, recreational

fishing has remained a mainstay of tourism and attracts visitors whose primary purpose is to fish in the Florida Keys. In 2007-08, 13% of visitors participated in recreational fishing on a trip to Monroe County (Leeworthy, 2010).

Recreational fishing effort in the State of Florida and especially the Florida Keys has increased considerably over the past few decades, both as the state and county have grown in population and as a tourist destination. An estimated 27% of all saltwater fishing through 2008 in the US occurred in the State of Florida, and the numbers of recreational fishing licenses (RFL) grew significantly since the licenses were first issued in 1989 (Hanson and Sauls, 2011). Over the ten-year period between 1990-2000, Stephan and Adams (2001) determined that Monroe County led the state in the sale of RFL to both residents (33,487 licenses) and non-residents (45,543 licenses). Figure 10 shows the change in fishing trips (effort) and anglers (participation) in Florida, as measured by the Marine Recreational Fisheries Statistical Survey (MRFSS) time series for 1981-2012. Over the 32-year period, the number of participants increased by over two-thirds and the fishing trip days increased by almost 90%, with anglers spending an estimated $16.7 billion in Florida in 2006 (Hanson and Sauls, 2011).

Coupled with this increase in recreational fishing participation and effort has been a higher demand for for-hire fishing services, such as charterboats, headboats, and flats fishing boats. Marinas across the Florida Keys have for-hire fishing operations that promise visitors successful flats, reef, and offshore fishing trips (Brinson et al., 2005). Fishing lodges that once catered to an exclusive clientele in

the first half of the 20th century have been replaced by large recreational marinas such as Holiday Isle in Windley Key and Charterboat Row in Key West (Gallagher, 1997; Viele, 1996). Islamorada, the so-called "sportfishing capital of the world", boasts numerous for-hire fishing operations in its many recreational marinas. By the late 1990s, there were over 240 charter fishing operations in the Florida Keys (Brinson et al., 2005), offering visitors half and full-day fishing trips from nearshore to offshore waters.

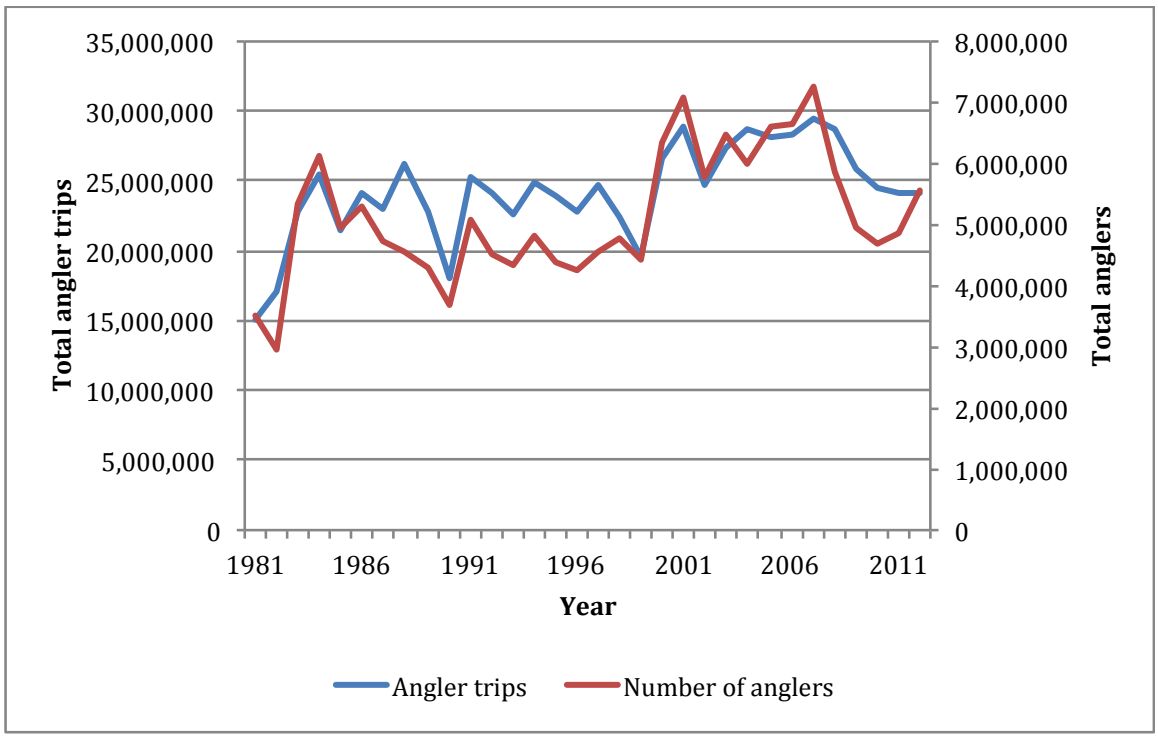

Figure 10: Total recreational anglers and recreational fishing trips in Florida, 1981-2012 (NMFS/FSD, personal communication, January 6, 2014)

As the recreational fishing effort has increased in certain fisheries, the recreational share of the species has overtaken and, in some cases, completely eclipsed commercial landings. Commercial landings of net-caught fish in the Florida Keys mostly declined after the Florida Net Ban was implemented in 1995 (Shivlani

et al., 1998; Barnes, 1995), and commercial effort in species such as pompano effectively ended, allocating the species to the recreational fishing sector (Shivlani et al., 1998). Other fin fish that are managed via annual quotas have their quotas divided among commercial and recreational sectors, but there are economic pressures to increase the recreational share in certain fisheries. For example, the Gulf of Mexico Fishery Management Council, the federal fishery body charged with Gulf of Mexico living marine resource management, allocates 49% of the Gulf red snapper annual quota to the recreational fishing sector; recent economic analyses have suggested that the recreational quota is too low and should be increased relative to the commercial quota (Agar and Carter, 2012). In the Florida Keys' spiny lobster fishery, competition between the commercial and recreational sectors has resulted considerable conflict, especially as the recreational fishery has grown in the past few decades (Eggleston et al., 2008; Sharp et al., 2005). As early as 1975, the Florida Legislature established the two-day, recreational season to allow the recreational sector to access the spiny lobster resource prior to the opening of the commercial fishery (Labisky et al., 1980). The recreational sector remains a concern to commercial fishers, who argue that recreational fishers overharvest the resource, poach from commercial lobster traps, and are not subject to annual quotas (Shivlani et al., 2005; Shivlani and Milon, 2000).

Diving and snorkeling

Apart from the demand for fish and invertebrates from greater fishing pressure, tourism has also increased the demand for these species and their habitats for nonconsumptive purposes, namely recreational diving and snorkeling. In a recent tourism survey, 21.8% and 4.9% of the visitors reported taking a snorkel trip or diving trip, respectively (Leeworthy, 2010). Unlike in other parts of South Florida where spearfishing and lobster diving comprise a large percentage of dive operator led dive and snorkel trips (Shivlani and Villanueva, 2008), Florida Keys dive operators seldom take such consumptive trips (Shivlani et al., 2008). Instead, a study conducted with divers determined that the most important activities on Florida Keys dive trips are marine identification and underwater photography (Letson, 2006). Competition for these resources has led to direct conflicts between fishers and divers and snorkelers, where the former have blamed the latter for scaring away fish, and where divers and snorkelers have blamed fishers for endangering them with their vessels and fishing gear and for degrading the marine environment (NOAA, 1996). In part because of these conflicts, the Florida Keys National Marine Sanctuary established small, no-fishing zones in popular dive and snorkel sites called Sanctuary Preservation Areas (SPAs) to separate extractive and non-consumptive activities within the Sanctuary's most visited areas (NOAA, 1996). The Sanctuary also closed other, larger areas called Ecological Reserves (ERs) to provide ecosystem protection across a variety of habitats (NOAA, 2000; NOAA,

1996). Altogether, the Sanctuary closed 5.1% of its almost 3,000 square nautical miles to commercial fishing by the early 2000s.

Globalization in fisheries trade and its effects of Florida Keys fisheries[15]

As a consequence of the fact that a majority of fisheries markets that developed for the Florida Keys seafood were located outside the archipelago, the seafood often has had to compete in regional and national (and even international) markets with the same or similar species that are harvested or, increasingly, grown in captivity elsewhere. Also, because of the facility of transportation and availability of large networks, the sustained quality of imported seafood, and the low cost of international trade, locally landed seafood in the Florida Keys has had to compete with imported seafood. With other non-fishery factors increasing the costs of living, trip costs, and competition for a scarce resource, fishers have been largely unable to pass on the higher costs of management and non-fishery factors on the consumer, who has been willing to accept cheaper, imported seafood. Thus, several, previously profitable and healthy fisheries have declined or even (in the case of pink shrimp) collapsed, further exacerbating non-fishery factors' impacts.

[15] All fishery imports information in this section used to calculate import totals and to generate figures was obtained from the Fisheries Statistics Division of the National Marine Fisheries Service (NMFS), which can be accessed at: http://www.st.nmfs.noaa.gov/st1/trade/index.html.

Shrimp fishery imports

Among the fisheries most affected by imports is the pink shrimp fishery. Pink shrimp is landed primarily in Florida, and from 1950 through the mid-1980s, Key West was among the top pink shrimp ports in the state (Ehrhardt and Legault, 1999; DeMaria, 1996). Pink shrimp production (both in the Florida Keys and the State of Florida) steadily declined from the mid-1980s through the early 1990s (Figure 11). While the fishery enjoyed a resurgence with several strong production years (20 million or more pounds) from 1995 to 1998, the industry did not produce more than 20 million pounds from 1999 onwards. Price per pound for pink shrimp peaked in 1979, when it sold for $6.00/pound (in 2010 dollars). In the 1990s, the price averaged $3.22, dipping to under $3.00 in 1999 (in 2010 dollars). The price further decreased from 2000 through 2010, when the average ex-vessel value per pound was $2.27. In 2010, the price reached its lowest point, when pink shrimp sold for an average of $1.77/pound.

In contrast to pink shrimp production, shrimp imports exploded in the US from the 1970s onwards. In 1975, the US imported 200 million pounds of shrimp (including fresh, frozen, breaded, and canned shrimp), which increased to over half a billion pounds in 1990 and increased again to an average of over 1.1 billion pounds in the first decade of the 2000s (Figure 12). The price of shrimp in part reflected the importance of imports in setting the price in the US market. The price of imported shrimp in 1975 averaged $6.96 per pound (in 2010 dollars); by 2005, the price of imported shrimp had decreased to $3.51 per pound (in 2010 dollars).

Effectively, the price of imported shrimp halved as the imported shrimp supply increased fivefold.

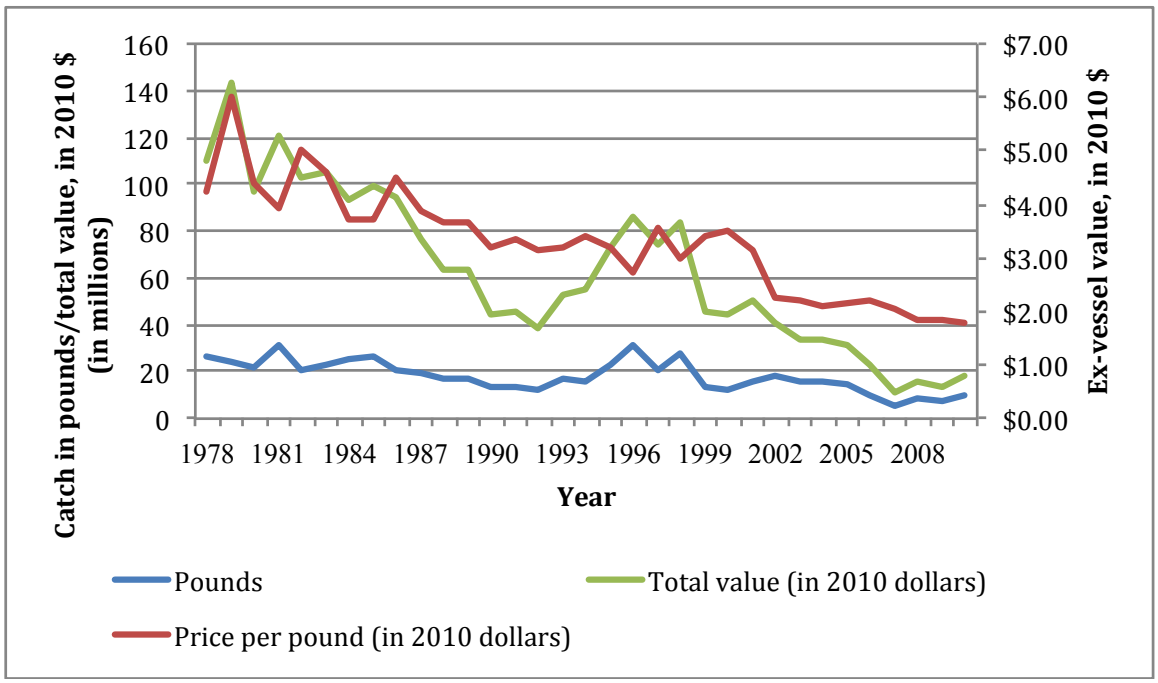

Figure 11: Pink shrimp landings, value, and ex-vessel prices, 1978-2010 (Stephen Brown, FWC, personal communication)

Factors other than imports influenced the decline of the pink shrimp fishery in general, including poor production years during the mid-1980s, land-based prices, and increased fishing operation costs. Exceptionally dry conditions, lack of hurricanes, and algal blooms are proposed as the main reasons for the decline in shrimp production over this period (Browder and Robblee, 2009; Ehrhardt and Legault, 1999). While landings recovered following this environmental perturbation, the Key West shrimp fleet did not, mainly because these factors combined with imports decimated the fleet, facilitating the extirpation of shrimp fishing first from Key West (Schittone, 2001) and then from the neighboring port, Stock Island. Shrimp fishers had to internalize costs related to regulatory

compliance (permits, licenses, safety equipment) and resource protection (turtle excluder devices, trawling area restrictions, and marine protected areas) that foreign fleets did not. Adams et al. (2004) point out that increasing import volume from the 1970s onwards placed a "downward pressure on domestic ex-vessel values" (p. 233), so fishers in the Florida Keys (and elsewhere) were unable to pass on the higher costs of operation to the consumer.

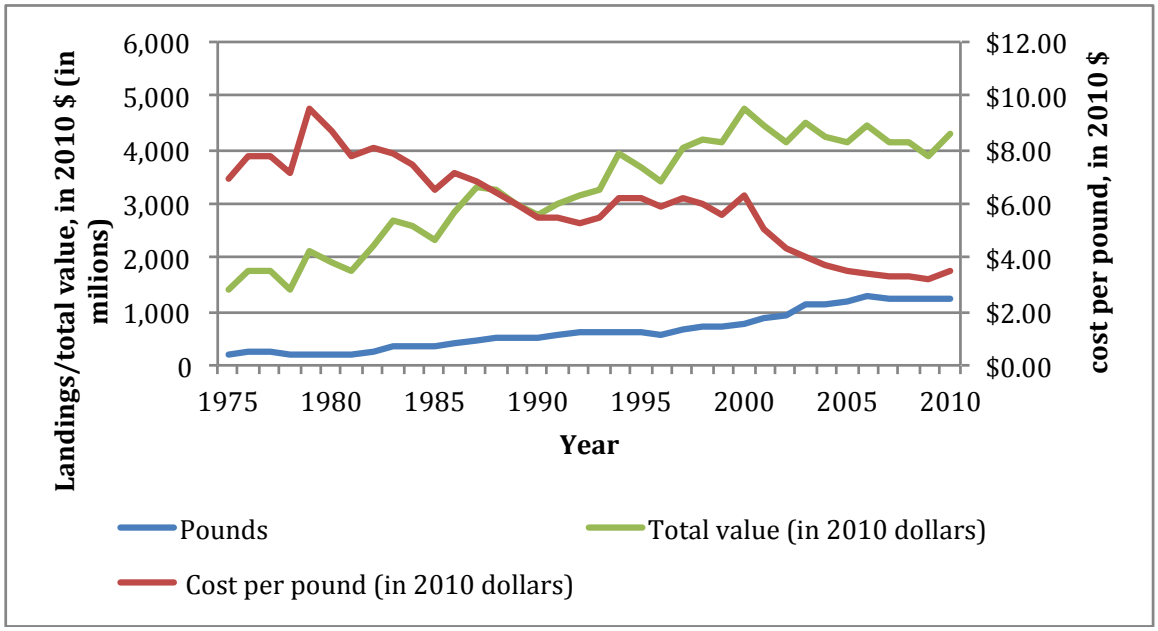

Figure 12: Total US shrimp imports, value, and cost per pound, 1975-2010 (NMFS O/ST, personal communication)

Spiny and rock lobster imports

As with shrimp, spiny and rock lobster imports have dominated the US market. From as early as 1960, Prochaska and Keithly (1983) reported that the US imported over 30 million pounds of spiny and rock lobster; this was almost ten times the amount produced by the US fisheries in Florida and California that year. United States imports peaked in 1976, when imports reached 49.2 million pounds in

product weight (Vondruska, 2010); since the early 1970s through 2010, whole weights of spiny and rock lobster imports in the US have averaged over 76 million pounds. By contrast, Florida landings from 1975 through 2009 have averaged less than 5.8 million pounds (whole weight). Thus, the import supply has been significantly greater than domestic production.

The price signal in the domestic market has been partly derived from external demand; that is, Florida lobster prices have been influenced at least from the late 1980s onwards by demand from Japan, China, and the EU. Some fish processors in the Florida Keys reported that they export up to 80% of the landings purchased. Since the domestic market has been saturated with imports over the past few decades, locally landed lobster has not competed with imported rock and spiny lobster, which are sold mainly as tails, and has instead focused on selling whole lobster (Vondruska, 2010). Notwithstanding this market separation, Florida lobster prices have remained flat in the last two decades.

As shown in Figure 13, price per pound for Florida caught spiny lobster showed an increase over six decades of landings, from just over an average of $1.50 per pound in the 1950s to $6.27 per pound in the first decade of the 2000s. Prices increased by over 400% in that period. However, oil prices also increased considerably over that period, averaging less than $25 per barrel in the 1950s to just over under $53 per barrel in the first decade of the 2000s. Also, other variable costs in the Florida Keys fisheries rose considerably, with fishing trip costs and dockside costs both increasing the overall fishing costs (Shivlani, 2009). The spiny

lobster fishery in the Florida Keys also suffered from periods of lower demand resulting from recessions, manifested as flattened ex-vessel values for one or more years (see flattened prices from 1979-86, 1988-90, 2002-05, and 2008-09). The fishery largely experienced boom and bust years while imports continued to dominate the overall US market.

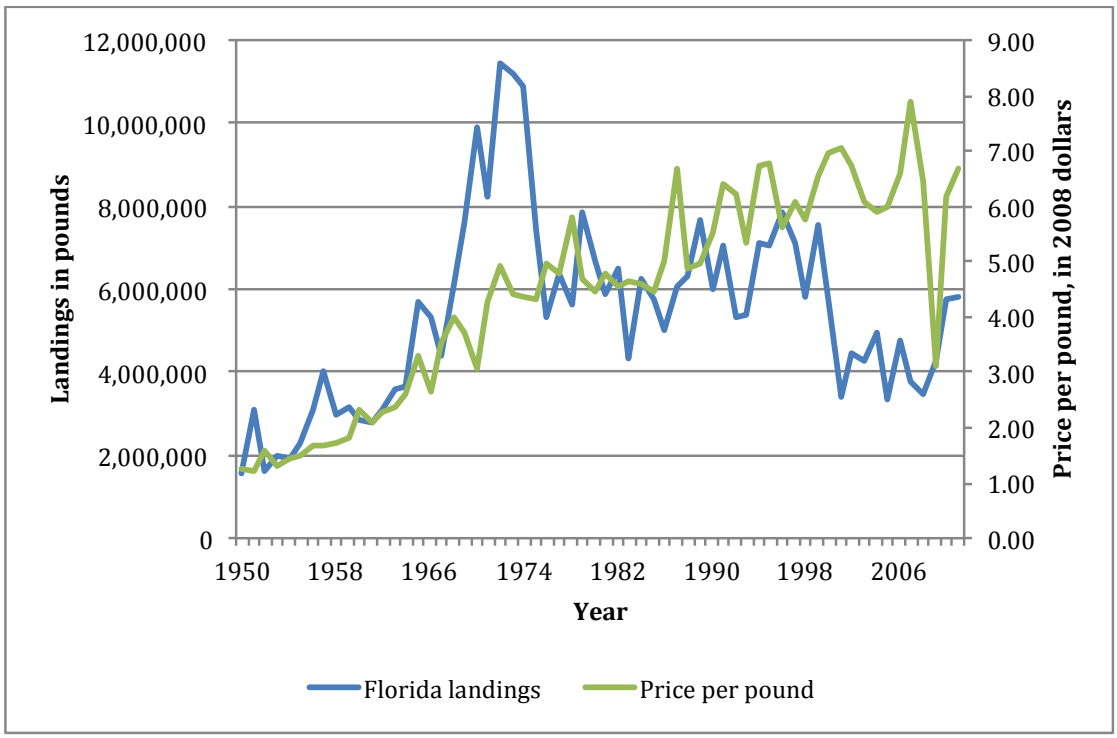

Figure 13: Florida spiny lobster landings and price per pound, 1950-2010 (Vondruska, 2010)

In terms of imported rock and spiny lobster, the quantity imported peaked in the early 1970s and has since averaged less than 80 million pounds per decade (Figure 14). Much of the rock and spiny lobster sold in the US is in the form of frozen tails, as demand for whole lobster is limited to niche markets and locations. Prices for imported lobster have largely followed the trend exhibited by the domestic spiny lobster prices, where recession years have witnessed a flattening in price because of

reduced demand; however, prices for imported lobster have been less variable than those for domestic lobster. Also, prices for imported lobster have been consistently lower than those for domestic lobster, which may in part reflect the different markets for the products.

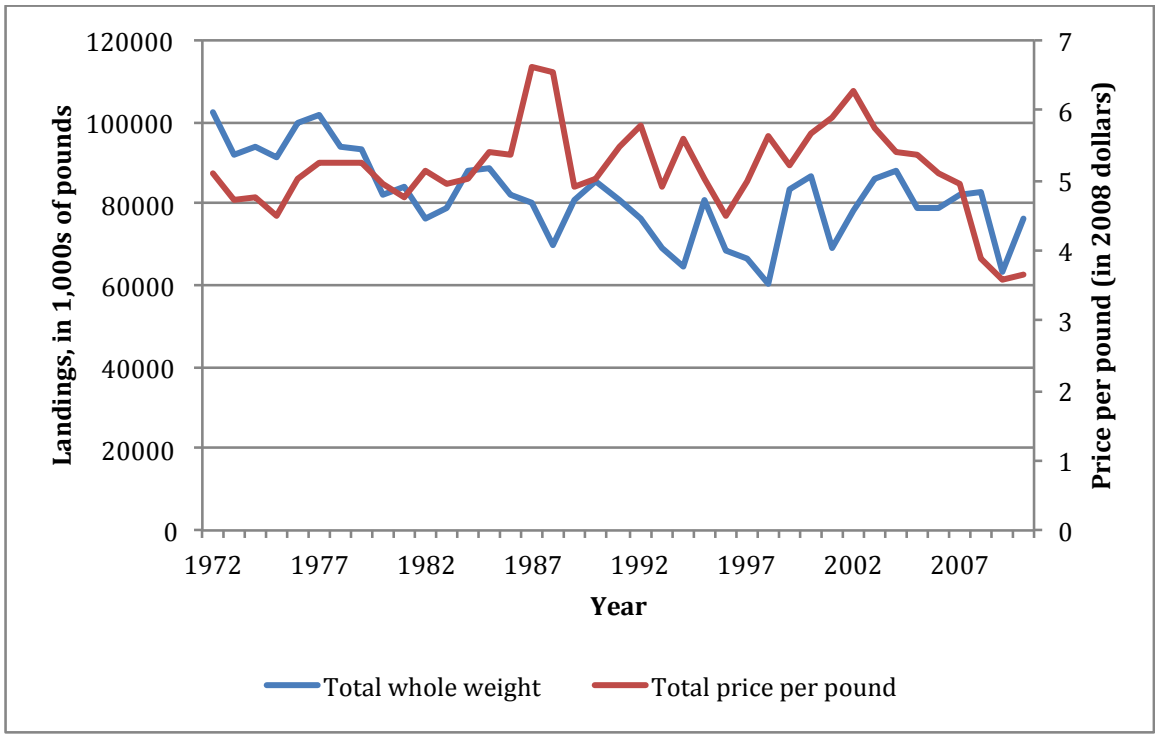

Figure 14: Imported rock and spiny lobster pounds and price per pound, 1972-2010 (Vandruska, 2010)

In comparing the average price per pound, it is interesting to note that as with shrimp import prices, the imported lobster prices were usually lower than those for domestic lobster. However, the prices have tended to rise and fall in tandem, such that the world market appears to have influenced average prices for both imports and domestic lobster. World average prices suggest that while domestic lobster may serve a niche market that relies on fresh, whole lobster, that market is tied in terms of price to the frozen tail market; this is shown by the fact

that prices tended to fluctuate in both markets according to similar demand conditions. Overall, domestic lobster prices were set in part by the larger world market, of which imported lobsters are a component.

Reef fish imports

Reef fish imports – as measured by the pounds of snappers and groupers imported –accounted for a majority of the US total reef fish supply over the past two decades. Snapper imports averaged 18.4 million pounds in the 1990s and increased to an average of just less than 35 million pounds in the first decade of the 2000s (Figure 15). Grouper imports were more stable over the 20-year period, averaging almost 10 million pounds in the 1990s and 9.2 millions pounds in the following decade.

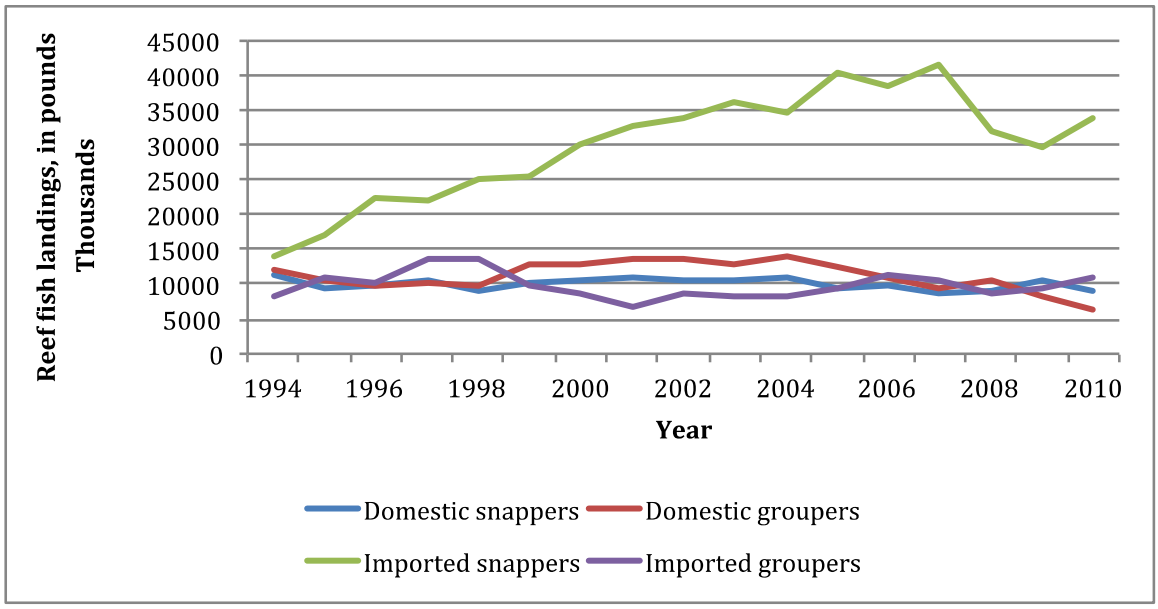

Figure 15: Reef fish landings and imports, 1994-2010

Mexico accounted for a majority of the species from each group of reef fish, and three quarters of the total grouper landings and 20% of the total snapper imports over the reporting period originated from Mexico, respectively. Mexico, Central America, and the Caribbean and South America (particularly Colombia, Venezuela, and Brazil) accounted for 94% of all grouper exported to the US for the last two decades. The same regions represented 86% of the total US import of snapper over the same time period. Domestic production of reef fish was stable over the past two decades, with snappers accounting for 10.1 million pounds and groupers accounting for 11.0 million pounds over 1994-2010 period. While grouper imports remained comparable to domestic production over the same period, snapper imports increased, especially from 1996 onwards when imports exceeded 20 million pounds (or twice the average domestic production). In 2007, snapper imports (41.5 million pounds) were almost five times greater than domestic production (8.7 million pounds).

As with other species discussed in this section, imports may have affected the price that domestic producers (including Florida Keys commercial fishers) could demand in the marketplace. The import effect is reflected by the flattening of domestic snapper and grouper prices from 1994-2010 (Figure 16). Over this period, prices of domestically harvested snapper and grouper averaged $2.82/pound and $2.87/pound, respectively. While these prices were on average higher than the prices for the respective imports (where prices for imported snapper averaged $2.08/pound and prices for imported grouper averaged $2.27/pound), prices for

grouper imports did show an increase over the period. Importantly, domestic prices for reef fish did not demonstrate a steady increase from 1994 through 2010, even while other variable costs (especially fuel) rose in the domestic fisheries (Shivlani, 2009).

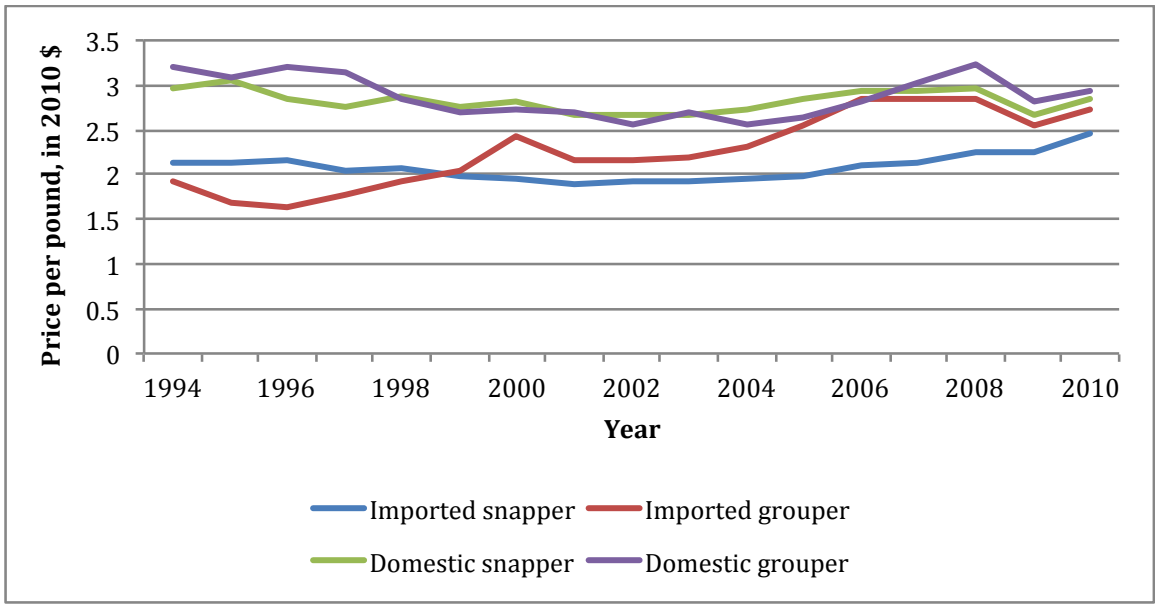

Figure 16: Domestic and imported reef fish price per pound, 1994-2010

Globalization, realized as the increased volume of imported fishery products, has played a significant role in dictating the values that Florida Keys fisheries products could demand, even as the overall costs in these fisheries have increased (both as a result of non-fishery factors and technocratic management). In the case of transboundary stocks and far-ranging species, imports have had a significant impact in controlling market prices. In species landed in the Florida Keys that were subject to world market conditions, such as shrimp and spiny lobster, ex-vessel values remained flat for much of the past two decades. For reef fish, domestic production

did fetch a slightly higher price than did imports, but the prices themselves were flat for the past 15 years.

As previously stated, part of the problem facing the Florida Keys fisheries has been the improved quality and consistent supply of imported species. As lowered transportation costs, improved handling techniques, and refrigeration technology have been standardized in the harvest and exporting of fishery products, Florida Keys and other domestic fishery products have lost much of their previous advantage of being perceived as having a higher quality. In the case of species that the domestic fishery shares with other states in the region, such as reef fish and spiny lobster, imports have often influenced market prices due to lower harvest costs (e.g., lower labor costs, fewer regulatory restrictions or expenses, etc.) for the same species. In the case of species that enjoy a generic branding, such as shrimp or rock lobster, the volume of cultured and wild caught imports has increased to dwarf domestic production and, effectively, set market prices.

The branding problem has been especially acute for most of the Florida Keys fisheries, which increasingly compete with regional and global imports mainly based mainly on price. Spiny lobster, often the archipelago's most lucrative fishery, competes with both spiny lobster landed across the Caribbean, Gulf of Mexico, and southwest Atlantic Ocean. Spiny lobster also competes with other rock lobster species imported from the Pacific and Indian Oceans. Because the US (Florida) spiny lobster fishery comprises only a small percentage of the overall spiny lobster supply (dominated by Brazil, the Bahamas, and Cuba), the domestic fishery has had to

either compete directly with imports or diversify into niche markets. The latter has occurred on several occasions, with a live, whole lobster market having developed in the 1990s for the Japanese market and a similar market for the Chinese market from the end of the first decade of the 2000s onwards[16]. Similarly, the Florida Keys shrimp fishery, which was the islands' most important fishery (in terms of participation and landings) from the 1950s to the 1980s, has been almost extirpated due to, among other non-fishery factors, its inability to compete with imported shrimp prices. Because the industry in the Florida Keys was unable to brand its pink shrimp product effectively, it could not pass on the higher costs that the fishery experienced as a result of higher operating costs, landside expenses, and regulatory pressures.

The only major species in the Florida Keys that avoided flattened returns and major fluctuations has been the stone crab fishery (Figure 17). Prices for stone crab claws held between $6.26/pound and $11.08/pound from 1986 through 2010, averaging $8.97/pound over the 25 years. By contrast, pink shrimp prices declined through much of the same period, peaking at $5.23/pound in 1989 and then declining to an average of $2.39/pound for the first decade of the 2000s. Spiny lobster, which enjoyed periods of high prices, fetched an average of $5.80 over the past 25 years; prices reached their lowest level over the catastrophic year of 2009, when the average price dropped to $3.18. All fisheries were subject to lower prices during recession years, but the species that most held its value was the stone crab

[16] Bill, fish house owner. Personal interview conducted in Key Largo, Florida. January 16, 2011.

fishery, which experienced the lowest decline in terms of average price and which rebounded to higher prices following each economic downturn.

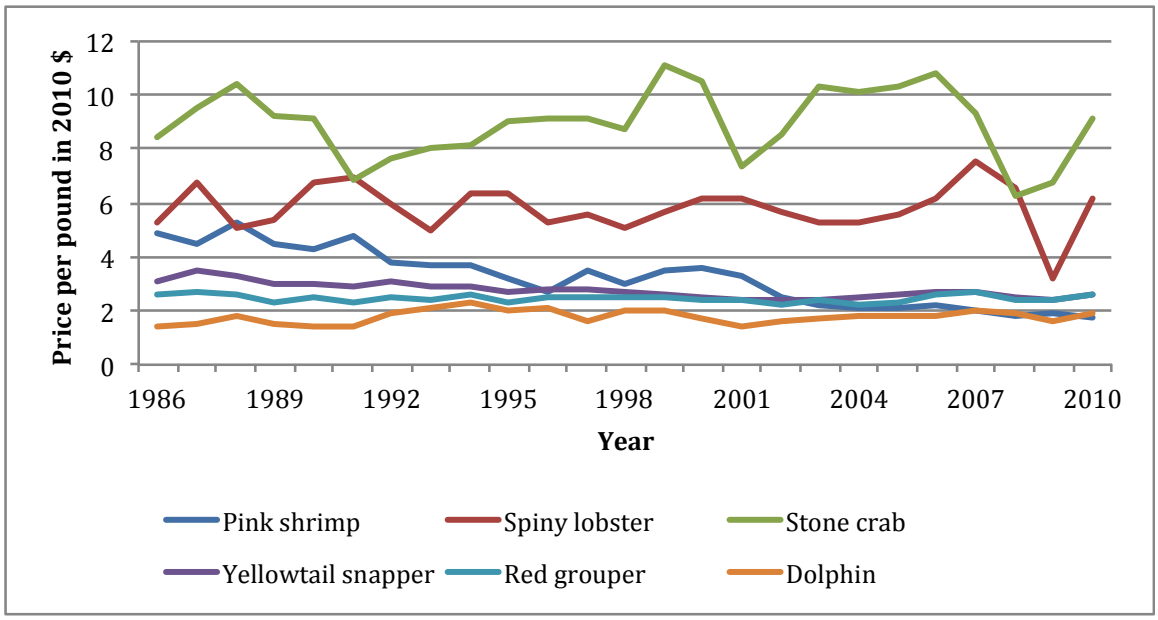

Figure 17: Florida Keys fisheries by species, price per pound, 1986-2010 (FWRI, 2012)

The reason why the stone crab fishery has fared better than its counterparts, both in terms of receiving a high price per pound and in maintaining its overall value, is most likely due to the unique nature of the fishery. The stone crab fishery enjoys a 'natural' branding because the fishery is largely restricted to the State of Florida; that is, stone crabs do not have a comparable competitor from imported species as do the spiny lobster, shrimp, or fin fish fisheries. Thus, the industry has been able to brand the product without significant competition and likely been able to pass on more of its fishery costs to consumers. It should be noted that the fishery has not been invulnerable to demand conditions, as shown by the depressed prices over the recession years of 1990-91, 2000-01, and 2008-09; however, by avoiding

direct competition with imports, the stone crab fishery has rebounded to its previous or better market prices after each economic downturn.

Gentrification

The combined effects of non-fishery factors and technocratic management have created a vicious circle promoting the exit of fishers from previously lucrative and healthy fisheries, leading to the dissolution of fisheries groups, fragmentation of fishing communities, and the loss of social capital. As a result of the relative dearth of buildable space and the attraction of the coastal landscape, the vacated fish houses, commercial fishing docks, and fishing communities have been replaced by non-waterfront development and uses in a process known as gentrification. Tenants of gentrified areas, many of whom are affluent, do not earn their income from work in the Florida Keys, and share a conservation ethic, have increased the demand for marine protection, limits on resource extraction, and greater access to coastal and marine resources. This, coupled with a more rigorous technocratic management approach over the past two decades, has accelerated the exit of fishers and degradation of their communities and opened up additional space for gentrification. Gentrification is an important, re-restructuring phenomenon via which under-utilized, mainly developed spaces can be revitalized by new capital, a more affluent population, and alternate economies. The way that I discuss gentrification is based on what Bourne (1993) describes as an inclusive definition and therefore focuses on the redevelopment of working waterfront areas; that is, I do not focus on social rank or class in what Bourne describes is a restrictive definition of gentrification. While

the process has these and many other salutary effects on the areas that it often revives (Bryne, 2003), gentrification also serves as a barrier for the revival of traditional economies. Waterfront space is particularly important for coastal economies such as commercial fishing, which rely not only on waterfront access but also on coastal industries (boatyards, commercial marinas, dock storage areas, fish houses) and communities (Gale, 1991).

Waterfront change has occurred consistently in the Florida Keys over the past two centuries, abetted by the numerous changeovers in the region's economy that have brought with them new immigrant populations who have transformed the coastal landscape of the islands (Ogle, 2003; Viele, 1999; Viele, 1996; Bretos, 1991). However, post World War II tourism (and the associated non-fishery factors) has been a major driver for waterfront changes, and this is best exemplified in the waterfront transformation of Key West in the 1980s (Schittone, 2001). As previously discussed, Key West was and remains the main population center in the Florida Keys since the island was developed in the 1820s; however, the combined population of the other keys increased steadily from the 1950s onwards, aided by the completion of the Overseas Highway, development, and mosquito control (Shivlani, 2009). By the late 1970s, although fisheries peaked in production and value, the Key West waterfront became a major target for revitalization. It should be noted that the waterfront was then occupied by fleets from the major fishery sectors, including shrimp trawlers, trap fishing boats, and hook-and-line boats (Schittone, 2001; Little, 2000). From the 1920s to the late 1960s, Thompson

Enterprises, Inc. owned much of the fishery infrastructure on Key West Bight (the main commercial waterfront located in the northwest corner of the island); but, by 1981, the bight's waterfront property had changed ownership several times. ConAgra, a national agricultural conglomerate, took over the bight's lease in 1981 but began divesting its holdings over the decade. Waterfront prices increased as tourism-related businesses moved to the bight, and these prices forced fishers to move their gear and then their entire operations off the waterfront. Dock slip rentals increased considerably, with some slips costing as much as $1,200 per month in the mid-1980s. By the early 1990s, fishing operations and ancillary businesses had relocated to neighboring Stock Island, and the City of Key West assumed ownership of the bight in 1993. Today, the bight is populated by bars, restaurants, and souvenir stores, some of which have adopted names from now defunct fish houses, and others of which have re-created a working waterfront motif of turtle pens (kraals), fishing nets, and other gear. However, the names and motifs are part of the tourism experience, as the bight is no longer a working waterfront.

Another major driver in waterfront conversion was the growth of cruise ship tourism, which occurred exclusively in the historic part of Key West, often referred to as Old Town. Cruise ship tourism, which had been a niche industry in the 1980s, exploded in the first decade of the 2000s, reaching to over a million passengers (Thomas J. Murray & Associates, 2005). Old Town Key West and environs transformed from a sleepy, eclectic coastal business district to a homogenized set of shops that one could experience in every major, Caribbean cruise port (see Klein,

2011, for example). While certain, venerable establishments survived the transitions, others were replaced by the likes of franchise jewelry stores, souvenir shops, and fast food restaurants. Notwithstanding the impacts that the sudden and significant visitor loads had on the quality of life in the area, other significant, medium to long term effects included an escalation of waterfront prices that further expelled working waterfront activities (Thomas J. Murray & Associates, 2005).

The changes to Key West Bight were in many ways a forerunner to the gentrification that would take hold in the rest of the Florida Keys from the 1990s onwards. Tourism surged over across the county over the past two decades, claiming its position as the region's pre-eminent economy (Leeworthy et al., 2010). Increasing demand for waterfront space for residential and tourism-related space accelerated the transformation of working waterfronts all over the Florida Keys. The affected infrastructure that had the greatest impact on fishers and fishing communities was fish houses. In 1995, when I first started working in the Florida Keys, there were 32 fish houses on the archipelago, of which 11 were located in Stock Island (Milon et al., 1997). By 2005, when I led a re-study of the Florida Keys commercial fisheries, there were only 14 fish houses left (Shivlani et al., 2008), representing a decline of 56%. In Stock Island only two out of the 11 fish houses remained by the end of the first decade of the 2000s. As has been discussed previously, the loss of these fish houses reduced the ability of fishers to be able to work together, exchange ideas, and engender trust, i.e., build social capital. Moreover, in terms of gentrification, the loss of these fish houses also opened up

space for re-development, as fishers now could no longer work together to repel such initiatives and did not have enough participants to justify the space. Fish house owners, concerned about the decline in fisher participation and the resulting effects on fishery product supply, were increasingly willing to cash out on the windfalls offered by enthusiastic developers (Shivlani et al., 2005).

As more fish houses, commercial boatyards, and commercial gear storage facilities sold out to developers interested in building waterfront residences, tourism establishments, and recreational marinas, both Monroe County and the State of Florida made legislative efforts to address waterfront gentrification (Monroe County, 2011). The Florida Legislature passed the Florida Waterway and Waterfront Act of 2005 (FS 342.07), which required that all county comprehensive plans should encourage public access, that local governments should include waterfront preservation strategies as part of their coastal management plans, and that business owners should be incentivized to maintain working waterfront via property tax deferrals. The act also established the Waterfronts Florida Program (WFP) to provide financial and technical assistance to local governments in developing waterfront preservation strategies. Monroe County developed its own Working Waterfront Preservation Master Plan in 2007 (Monroe County, 2011), after the county had implemented a short-term moratorium on the conversion of working waterfronts (SPRC, 2005). The plan sought to inventory all marine facilities in the Florida Keys, finalize a marina siting plan, and to address working waterfronts. In

2010, Monroe County released its updated comprehensive plan, which highlighted the importance to protect commercial waterfronts (Monroe County, 2011). Notwithstanding these and other efforts to maintain working waterfronts, the Florida Keys – like many other regions in the US (Colburn and Jepson, 2012)– have continued to experience a decline in fisher participation and a degradation in fishing communities. Fisher participation in the five years following the Monroe County's efforts to preserve working waterfronts (2005-2009) declined by over a quarter (26.5%). Several fish houses closed over this period as well, leaving islands such as Key Largo with only a single operation each and others like Big Pine Key and Summerland Key without any fish houses. Fishers with whom I discussed waterfront availability all had a common insight, which was that gentrification had not taken hold because of any single factor; instead, they described gentrification as an end stage of a series of synergistic factors, all of which had been abetted by technocratic management. While some fishers described this confluence of factors as a "conspiracy" (Suman et al., 1999), others saw it as a long-term shift in what the region wanted with its waterfront and coastal resources. One fisher from the Lower Keys told me that while he continued to fight against anti-fishing regulations and waterfront changes (he had in fact purchased a dock and adjacent storage space), he understood that gentrification forces would end up eliminating fishing altogether from the Florida Keys[17]. Another fisher from Key West agreed with this sentiment,

[17] Richard, commercial fisher. Personal interview conducted in Stock Island, Florida. October 23, 2010.

pointing to the changes in Key West Bight, where his family had fished for three generations and from where they had been evicted in the 1980s[18]. For this and many other fishers across the Florida Keys, gentrification represents an inevitable outcome that they continue to oppose but which they know will prevail; the proof, as they so often related, is in what has happened to their infrastructure and communities

Discussion

This chapter demonstrates the importance of place, and how non-fishery factors can often play a disproportionately important (and often unanticipated) role in exacerbating the impacts of technocratic management. Impacts, in a way, are unavoidable because technocratic management assumes a uniform, or 'one size fits all', approach to fisheries management. The social dimensions of a fishery, which are intricately tied to place, are not part of the technocratic management paradigm. Thus, when impacts do occur, there are very few remedies that technocratic management can offer to ameliorate the impacts. Also, technocratic management has a static view on fishers and fishing communities, assuming that both will achieve the expected ecological and economic equilibriums over a period of adjustment. However, the view has no place for non-fishery factors and how these may influence the effects of technocratic management. Finally, technocratic management in many

[18] Bobby, commercial fisher. Personal interview conducted in Stock Island, Florida. January 14, 2011.

ways exacerbates the impacts of non-fishery factors by undermining the social capital that is essential to moderate the impacts.

There is an implicit assumption in technocratic management that place in fact does not matter, mainly because technocratic management considers its ecological and economic theories as inviolate and therefore applicable in all situations. After all, the maximum sustainable yield (MSY) is based on ecological theory that, when correctly operationalized, provides an accurate estimate on the amount of sustainable harvest. Similarly, maximum economic yield (MEY) and related economic parameters are derived from economic theory, and these too can be operationalized to provide the highest benefits to society. While it is certain that the approach may require modifications based on the species and their characteristics and the fishery and its economic characteristics, it has no other reason to accommodate the social dimensions of the fishery (other than to minimize impacts, for instance) or to consider the place, its history, and the prevalence and importance of non-fishery factors. As the fishery achieves ecological sustainability and economic efficiency, technocratic management assumes that it will surmount challenges presented by non-fishery factors. What is completely overlooked in this highly ideological view is that technocratic management may actually influence non-fishery factors and in some cases even exacerbate the impacts of those factors on social sustainability. Thus, what technocratic management may otherwise shrug off as unexpected impacts resulting from non-fishery factors may in fact be related directly to the changes caused by such management actions. Also, these impacts are

not always unexpected and could in many cases be predicted, but only if all aspects of a fishery – including the social dimensions – are considered in the decision-making process.

As shown by Colburn and Jepson (2012) in the social impact assessment of fifteen fishing communities, fishery performance and vulnerability to gentrification is affected by a variety of non-fishery factors that vary across location, fisheries, and fishing communities. In that study, variables such as fishery dependency, fisher engagement, retiree migration, urban sprawl, and resource amenities all played different roles in impacting fishery performance in the various communities. Other studies on gentrification and fishing communities (Jacob et al., 2010; Shivlani, 2009; Clay and Olson, 2008) have found similar results, yielding two, main conclusions: The first is that non-fishery factors comprise an important variable that can determine (either by itself or in concert with technocratic management) social sustainability; and the second is that non-fishery factors may vary across locations and therefore need to be considered in context (i.e., in place).

Technocratic management also fails to address non-fishery factors by ignoring the importance of social capital in promoting fisher participation and sustaining fishing communities. Thus, even if technocratic management were to accept the importance of non-fishery factors in influencing social sustainability, it could not take meaningful measures to ameliorate non-fishery factor impacts. Mitigating such impacts requires trust and cooperation among fishers that can be used to mobilize opposition and develop collection action strategies. If however

fisheries are decimated to achieve, for example, economic efficiency, then lower rates of participation, increased competition, and community fragmentation all reduce the amount of social capital available in fishing communities to resist non-fishery factor impacts. In the Florida Keys, fishers and their respective communities were able to resist many regulatory measures, including the siting of marine protected areas, because they were able to mobilize and build a united opposition to the measures (Suman et al., 1999). But, as technocratic management reduced capacity by promoting competition and forcing lower rates of participation in several fisheries, the remaining fishers were no longer able to generate the trust and cooperation necessary to mobilize collective action. Added to this diminution was the closure of a majority of the region's fish houses, which increased the isolation of fishers and further prevented their ability to resist both technocratic management and non-fishery factor impacts. I do not suggest that fishing communities rich in social capital can always resist non-fishery factors. Fishing communities are dynamic, complex systems that are characterized by changes and turnovers, much as the ecological systems that fishers target and the economic markets in which they participate. But, technocratic management weakens fishing communities by stripping them of any agency, i.e., the ability to act towards their own sustainability, and this renders them more vulnerable to non-fishery factors than they would have been with robust social capital.

Overall, the ideological inflexibility and narrowness of scope inherent in technocratic management demonstrate the approach's inability to fully incorporate

place in its deliberation process. Place, however, is what most needs to be considered in the formulation of sustainable fishery policies, especially as coastal gentrification takes hold in vulnerable fishing communities. After all, even if the most effective technocratic management measures were implemented, these would not necessarily ensure the survival of a fishery under threat from non-fishery factors; in fact, the fishery may be weakened to the point of extinction if the management measures abetted the effects of the non-fishery factors. In the Florida Keys (and elsewhere), these non-fishery factors have been largely omitted from consideration in developing fishery policy; affordable housing, working waterfronts, coastal business incentives, and other community measures have been promoted as solutions, but these are at best stop-gap measures that may delay the decline of the fishery sector, while technocratic management undermines the social capital needed to maintain robust and vibrant fishing communities. In the next chapter, it is essential therefore to turn to how technocratic management has been implemented in the Florida Keys and how it has affected fisher participation.

CHAPTER 5: STATE AND FEDERAL FISHERIES MANAGEMENT

Introduction

This chapter reviews the formation and development of the state-federal fishery management approach that superseded the patchwork of local, regional, state, inter-state, and federal laws that regulated Florida Keys fisheries prior to the enactment of the 1976 Fishery Conservation and Management Act (MSA). The era of technocratic management in the state commenced from the 1980s onward, as both state and federal regulations sought to centralize management and to discipline effort in terms of ecological integrity and economic efficiency. The state-federal partnership coalesced via the establishment of two fishery management councils and the development of fishery management plans, the latter of which laid the framework for individual species (and later, multispecies) management. I show how this complex framework fundamentally changed what it meant to be a Florida Keys fisher, as an increasing set of access, harvest control, and effort limitation programs compartmentalized fishers and their communities based on fishers' levels of effort, harvest totals, and target species.

The development of the state-federal management approach consisted of two distinct phases, both in the Florida Keys and elsewhere in the US (Weber, 2002). The initial phase, which commenced with the passage of the MSA, promoted the expansion of US fisheries. As many species became overfished, the second phase – dominated by technocratic management – called for the consolidation of effort, reduction of overcapacity, and, in several cases, the implementation of property

rights (Weber, 2002; Hanna, 2000). I explore in this chapter how Florida Keys fisheries were increasingly controlled using the technocratic management approach and especially how fishing operations were encouraged/forced to undergo a process of 'professionalization', and how that restricted the ability of fishers and their respective communities to withstand the effects of technocratic management and non-fishery factors.

The chapter presents a history of fisheries management in Florida, showing how the state took an increasingly centralized role in regulating harvest and effort in its waters from the 1980s onwards, and how its approach fundamentally re-defined what it meant to be a commercial fisher in the State of Florida. The chapter also discusses the federal fishery management era, which commenced in Florida in the early 1980s and how it developed to address most of the region's major fisheries, implementing technocratic management measures to address participation, harvest, and effort. Finally, the chapter discusses how fisheries and participation fared over the past two decades, or from when both the state and federal fishery management systems coordinated their efforts to professionalize the Florida Keys fisheries.

History of fisheries management in Florida

Fisheries management in the territorial and statehood history of Florida consisted mainly of a patchwork of local, state, and federal government regulations until the passage of the federal Magnuson Act and the establishment of the state

Marine Fisheries Commission (Cato and Sweat, 2000). The reasons for the paucity in management oversight were the relatively low effort, the local nature (i.e., markets) of most fisheries, and the economic importance of recreational fishing to the state's economy. As effort increased, markets developed, and several stocks declined, greater state and federal management oversight emerged.

Florida hosted considerable fishery effort in a few fisheries along key ports, including a thriving reef fish trade with the Spanish colony of Cuba from Key West from the late 19th century onwards (US Commission of Fish and Fisheries, 1897). Other important ports included Pensacola in the Florida Panhandle and Jacksonville in the Florida northeastern coast. Regulations within each fishery were established at the county or port level, and there was little state oversight over most species throughout much of Florida's history (Cato and Sweat, 2000).

As fisheries developed in South Florida, local and county ordinances dictated fishery effort and regulations (see, for instance, Labisky et al., 1980, for a description of early regulations in the spiny lobster fishery). This was mostly due to the insular nature of the local fisheries, where only a few species were sold beyond county boundaries. For example, the Biscayne Bay fishery consisted of only 20 boats in the early 1950s, and the primary target species was mullet (Siebelaner, 1953). These were regulated via a net mesh size. Other species landed in the Florida Keys had fewer restrictions (see Viele, 1996, for a description of the fishery activities in the region in the late 19th and early 20th centuries), with the exception of spiny lobster (Labisky et al., 198). The state regulated the spiny lobster fishery via seasons and

size limits through much of the 20th century, starting in the 1920s, as the fishery expanded to supply national markets. However, because of the relative laxity of statewide regulations and low effort in most fisheries, fisheries in South Florida and the Florida Keys avoided much regulatory oversight until the federal Magnuson and state Marine Fisheries Commission eras.

The demographic history illuminates aspects of the history of fishing in South Florida and the Florida Keys (as discussed in Chapter 4). Only Key West was established much earlier than the rest of the archipelago and southern peninsula, when pioneers on the western island recognized its value as a deepwater port (Ogle, 2003). The island enjoyed considerable prosperity, first as a wrecker capital and later as a sponging and cigar rolling center. Fisheries were always integral to Key West's local economy, but it was only after the completion of the Overseas Railroad in 1912 that fisheries trade became a viable option. From the 1910s onward, spiny lobster (*Panulirus argus*) became an export commodity to the northern markets. Landings increased from a few thousand pounds to one million pounds in the late 1910s onwards (Labisky et al., 1980). By the end of the 1920s, the spiny lobster fishery, along with king mackerel fishery, was among the most lucrative fisheries in the region (Little, 2000). The Great Depression and the 1935 Labor Day Hurricane, the latter of which destroyed the Overseas Railroad, affected demand and the transport route (Zeiller, 2006), respectively, but fisheries production increased greatly in the post World War II years (especially after the discovery of pink shrimp fishing grounds in the Dry Tortugas in 1949) (Idyll, 1950).

The Florida State Board of Conservation, established in 1933, was the first state body to address fishery regulations; however, most regulations were directed at the state's major fisheries and, within these, towards the development of the fisheries. Much like the US Fisheries Commission, the board was established with the goals of "supervision, conservation, and development" of the industry (Siebelaner, 1953). Importantly, the board acknowledged the growth of the sport fishery, as a means of growth in the tourism sector of the state's economy. By the late 1950s, studies funded by the board had found that sport fishing contributed to the private and charter fishing industries of South Florida. Under these conditions, development was preferred over conservation, and indeed, the State of Florida did not impose licensing provisions or many regulatory restrictions through much of the 20th century.

Gear, size, and seasonal restrictions were implemented throughout the growth of various fisheries, such that spiny lobster traps (first introduced in 1940 (Moe, 1991)) had to meet size standards, gill and other entangling nets had to be meet mesh requirements, and (over time) corals and other organisms were protected from harvest. In 1953, the State of Florida passed a unified measure to identify and regulate commercial fisheries in the state. Under Florida Law Chapter 28145, persons who landed marine fisheries products for sale were required to hold a commercial fishing license (Jones, 2009).

Notwithstanding incremental measures designed to monitor commercial fisheries and to regulate the most profitable fisheries, a combination of population

and tourism growth in the post World War II decades led to concerns over the decline in multiple fisheries across the state and finally forced the state's full entry into fishery management. Certain fisheries, including previously abundant stocks of reef fish and coastal migratory pelagics (especially king mackerel) were certainly experiencing a decline, and greater effort in the state's increasingly lucrative trap fisheries increased intra and inter-group use conflicts. Conflicts in the spiny lobster fishery between commercial fishermen and sport divers had reached critical levels by the early 1970s, leading the state to pass a 1975 bill which established a special, two-day recreational season scheduled one week prior to the opening of the commercial season (Labisky et al., 1980). But, a mixture of local, county, and state ordinances largely still governed fisheries, and apart from the aforementioned and other regulations in the most lucrative fisheries, both access and effort were left largely unchecked.

The centralized management era

Although various fisheries were already centralized at the state and federal levels, both levels of government took additional steps to gain control of fishery management from the 1970s onwards. As previously discussed, the State of Florida had commenced on an incremental approach from the 1920s onwards to centralize some of its most important fisheries, especially those that crossed local boundaries. Florida joined the Atlantic States Marine Fisheries Commission and the Gulf States Marine Fisheries Commission in 1942 and 1949, respectively, to coordinate

migratory fish management (Weber, 2002). While the Florida Legislature took steps to address certain fisheries (such as the aforementioned, establishment of the spiny lobster, two-day, recreational season in 1975, among others), the state did not embrace centralized management until the legislature created a fisheries commission in 1983.

At the federal level, impetus for a centralized, marine fisheries agency gained momentum in the 1970s after concerns grew over the impacts of foreign fishing off US territorial waters and the continued decline in the domestic fleet (Weber, 2002; Ross, 1997). The Nixon administration created the National Oceanic and Atmospheric Administration (NOAA) by executive order in 1970, and NOAA combined parts of the Bureau of Commercial Fisheries and the Bureau of Sports Fisheries and Wildlife to create the National Marine Fisheries Service (NMFS) (Cicin-Sain and Knecht, 2000). NMFS held mainly an advisory and research role until the passage of the 1976 Fisheries Conservation and Management Act (FCMA), which ushered in the federal fishery management era. With the passage of the FCMA, NMFS gained management responsibilities with the newly established regional councils for commercial and recreational fisheries in the newly created fishery conservation zones that extended from either three or nine nautical miles to 200 nautical miles off the US coasts. By effectively expelling foreign fishing in the fishery conservation zones, the FCMA fostered the expansion of the domestic fleet, thereby "Americanizing" landings in federal waters (Weber, 2002).

The Fisheries Commission era in Florida: 1983 to the present

On July 1, 1983, the Florida Marine Fisheries Commission (MFC), a seven-member group approved by the Florida Legislature, began its tenure (Miami Herald, 1983). The MFC (to be replaced by the FWC in 1999) took over the 220 state laws previously passed to manage Florida's various fisheries and it established a deliberative process consisting of expert testimony and public input to reach management decisions to be recommended for approval by the Florida Governor and Cabinet (Miami Herald, 1983). Among its first acts, the MFC recommended a requirement for all commercial fishing operations to purchase and hold a Saltwater Products License (SPL) at an annual cost of $25. Another requirement that followed, called the Florida Marine Fisheries Trip Ticket Program, standardized fishery trip data collection by requiring commercial fishing operations to provide trip-related data, including the date of a trip, time fished, landings by pounds of each species harvested, port information, and area fished, among other information) (FMRI, 2004).

In 1984, the MFC recommended a rule that would lead to greater restrictions on participation in the state's commercial fisheries, by implementing a "Restricted Species" (RS) provision that required all SPL holders seeking the provision to demonstrate that a significant percentage of their income was derived from commercial fishing, thus qualifying them for specific RS fisheries (FWC, 2014c). To qualify to target RS, SPL holders had to demonstrate that 25% or $5,000 of their total annual income was derived through the sales of non-restricted species to a

wholesale operation in the State of Florida. Fisheries under the RS provision were those that comprised the most economically important species, and over time most Florida Keys fisheries were designated under the RS provision. Altogether, the State of Florida designated a total of 16 fisheries as RS, including valuable Florida Keys fisheries such as king mackerel (1988), reef fish (1990), marine life comprising tropical fish and invertebrates (1991), spiny lobster (1993), stone crab (2000), shrimp (2001), and dolphin and wahoo (2005) (Shivlani, 2009).

The RS provision and subsequent measures to restrict participation that followed in the 1990s and 2000s represented a path towards the state-led technocratic control of commercial fisheries. That is, by requiring participants to demonstrate a financial stake in their respective fisheries, the state created an economic identity for commercial fishers that could be used to differentiate them between full-time participants and part-time fishers. The move towards "professionalization" in many ways was the first, significant step towards the commodification of fishers and their communities as centers of economic activity. These centers could now be compared on a quantifiable basis (e.g., the number of full-time fishers), where fishing operations were characterized by self interests (i.e., the rational fisher), and in which cooperation, inter-generational knowledge, social networks, and entry and apprentice systems were undermined (or at least undervalued).

The move towards professionalization was solidified in the 1990s with the introduction of limited entry endorsements for several species, which required that

fishers to obtain endorsements as an additional licensing tier to qualify to participate in the respective fisheries, and the establishment of transferable effort programs, market-based schemes developed to reduce over-capacity in the spiny lobster (and later, stone crab and other) trap fishery. Fishers would now be required to obtain several tiers of licenses (SPL, RS, species endorsements, and gear certificates) to be able to participate in commercial fisheries. Unlike in previous decades when fishers (in the Florida Keys in particular) were able to switch gears and fisheries, the move towards professionalization forced fishers to invest in and focus on fewer fisheries.

As has been discussed in Chapter 3, what was often missing from the decisions to professionalize fisheries and reduce participation was the role that fishers and their respective communities played in maintaining social sustainability, especially by generating social capital. Management at the state level, abetted by federal management measures, anticipated that by applying the principles of ecological sustainability and economic efficiency, fisheries would reach a new equilibrium consisting of sustainable, albeit smaller fishing communities. But, the move towards professionalization in particular and technocratic management in general often weakened fishing communities through measures aimed towards reducing participation.

The overall impact of the MFC/FWC era on Florida Keys fishers and fishing communities was a large-scale consolidation in participation, as measured by the decline in the total number of fishers. This was accomplished by implementing

regulatory barriers to participation, by increasing the cost to enter the most lucrative fisheries, and by compartmentalizing a traditionally, multi-species fisheries system. Regulatory barriers to participation were erected deliberately, as a means by which to remove excess effort and to increase dedicated, full-time participation in the industry. The economic effect of downsizing was accompanied by lower rates of participation and considerable diminution in fleet size, fishers, and fishing communities (Shivlani, 2009). By increasing the cost for entry, the state made entry cost prohibitive for the next generation of fishers by curtailing the apprenticeship system via which younger fishers often joined the corps of established fishers (an issue that I discuss in more detail in Chapter 6). Since the most lucrative fisheries, such as spiny lobster and stone crab, now required considerable capital, only fishers with access to the capital or those were had familial ties (and thus inherited access) could expect to participate. Apprenticeship represented an important social feature that facilitated the transfer of ecological knowledge across generations, provided a means by which mates could graduate into the role of captains, and attracted committed labor to a working waterfront (Shivlani and Milon, 2000). Finally, the compartmentalization of the traditional, multi-species fishery system forced fishers who had historically fished different fisheries both during and across seasons to commit to fewer fisheries. It left the overall system less resilient by making it vulnerable to failures in single fisheries (e.g., as occurred in the decline in spiny lobster landings from 2001 onwards). Thus, whereas prior to the spiny lobster and stone crab certificate programs, which

required fishers to purchase licenses, endorsements, trap certificates, and annual tags (see chapter 6 for a description of the spiny lobster trap certificate program), fishers often limited their risk by investing in a single fishery; following the advent of the limited entry and effort transfers, fishers were forced to conform to and depend on fewer fisheries.

The federal role in fisheries management in Florida

The federal fisheries management era commenced in Florida with the passage of the Fishery Conservation and Management Act (MSA) in 1976 (although, as has been noted previously, existing federal fishery management addressed highly migratory species, fisheries research, etc., prior to the passage of the MSA). As part of management framework, the MSA regionalized the fishery management process by establishing eight fishery management councils for fisheries that occur in the US Exclusive Economic Zone (EEZ) (Weber, 2002; Ross, 1997). Due to the fact that the Atlantic Ocean and Gulf of Mexico border the Florida Keys archipelago to the south and to the north and west, respectively, both the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council (Figure 18) were tasked to regulate federal fishery management in the Florida Keys, giving the county the unique distinction of being the only region in the US that is governed by two fishery management councils. Federal jurisdictional boundaries also varied due to how Florida entered the union, such that the Gulf of Mexico Fishery Management Council jurisdiction commenced at nine nautical miles, and the South

Atlantic Fishery Management Council jurisdiction commenced at three nautical miles (Fitzgerald, 2002). Also, because of the differences in the biophysical and ecological characteristics in the fisheries and the political configuration of council members and stakeholders, the two councils evolved somewhat differently in terms of their regulatory approaches (Okey, 2003). This led to the Florida Keys fishers having to obey one set of regulations when fishing in federal waters north of the islands and another set of regulations when fishing south of the islands. Finally, it must be emphasized that the federal management era greatly expanded federal oversight over what in the past were largely high seas fisheries. The US claimed a narrow territorial belt, or sea, until the 1980s (Juda, 1995), but the MSA created a 200 nautical mile zone fishery conservation zone (FCZ). This zone expanded federal jurisdiction to cover almost all Florida Keys fisheries.

It should be noted that while the MSA federalized fisheries across the US, states such as Florida often took the lead in managing most fisheries, thereby developing a cohesive (albeit complex) state-federal partnership. For example, the State of Florida's fishery management agency enacted most fishery regulations for major Florida Keys fisheries over the MSA era such that the two management councils largely deferred to the state's management decisions and made their decisions consistent with those of the state. This consistency has allowed for a spatially consistent set of rules across state and federal jurisdictions, although not necessarily across the waters pertaining to the two management councils. Fishery management councils also on several occasions made region-wide decisions that

had profound effects on the Florida Keys fishing industry, including decisions related to the use of gear, moratoria on federal fishing licenses, seasonal closures, and no-take reserves. Like the state's approach to fishery management, the federal approach across both management councils changed over time considerably to adopt measures related to consolidation (e.g., limited entry, permits) and privatization (e.g., transferable permits).

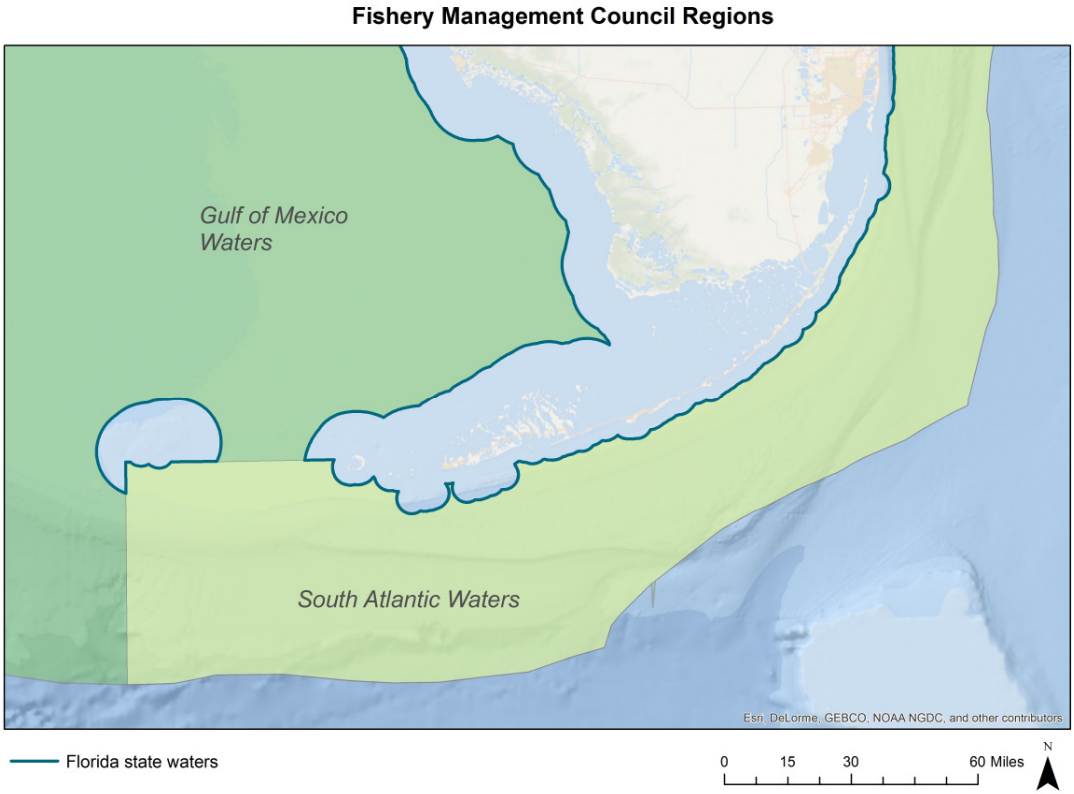

Figure 18: Florida state and federal fishery management council waters (Angela Orthmeyer, NOAA, personal communication, 2014)

The Gulf of Mexico Fishery Management Council

The Gulf of Mexico Fishery Management Council (hereafter Gulf Council) was the first of the two councils to implement fishery management plans (FMP) in the

State of Florida and the Florida Keys, and from 1979 to 1987 the Gulf Council passed a total of seven FMP to manage stone crab, shrimp, corals, reef fish, spiny lobster, and red drum within its jurisdictional boundary. Linked to these FMP was a 2005 generic amendment that the council passed as a means by which improvement management science, identify essential fish habitats (EFH), and protect EFH and habitats of particular concern (HAPC) from fishery and gear impacts (GOMFMC, 2005c).

On September 30, 1979, the Gulf Council passed the Stone Crab FMP (GOMFMC, 1979)[19]. The council followed most of the existing state stone crab fishery regulations but did establish a crab-shrimp line that prohibited shrimp trawling inside the line from January and May each year as a means by which to reduce gear conflict. Subsequent amendments to the Stone Crab FMP matched state rules to impose a 1990s moratorium on stone crab licenses/endorsements (GOMFMC, 1994) and to extend a 2001 trap certificate for fishing in federal waters (GOMFMC, 2001b). Similarly, on July 2, 1982, the Gulf Council (in partnership with the South Atlantic Fishery Management Council and hereafter Atlantic Council) passed the Spiny Lobster FMP extending the state regulations into federal waters (GOMFMC/SAFMC, 1982a), while subsequent amendments matched the state management approach, including measures to limit access and to develop a market-based, trap reduction program (GOMFMC/SAFMC, 1992).

[19] The stone crab FMP was repealed on October 24, 2011, because the Gulf Council and NMFS agreed that the fishery was being adequately managed by the State of Florida, which could extend its regulations into adjacent federal waters (NMFS, 2011).

In 1981, the Gulf Council's Shrimp FMP enlarged an existing, state-based shrimp sanctuary into federal waters to designate the Tortugas Shrimp Sanctuary. As par to a spatial approach to fisheries regulations, the sanctuary prohibited shrimp trawling within its boundaries (GOMFMC, 1981). The council expanded the boundaries in later FMP amendments (Amendments 2, 4, and 6), closing off most the State of Florida and Gulf of Mexico federal waters west from Key West to southwest Florida, including Florida Bay (GOMFMC, 1992). The purpose of the sanctuary was to protect juvenile shrimp, but in terms of management implications, the sanctuary represented amongst the first and most significant federal fishery closures in the region. Moreover, the sanctuary, of which the boundaries were extended since it was first designated, in a way normalized similar designations in the future, including the implementation of other no-fishing zones. What the sanctuary and other spatial management measures also did was to limit the amount of fishing grounds available to Florida Keys fishers, which served as an important factor in promoting fisher exit and exacerbating the effects of technocratic management. Finally, the precedent that closures such as the Tortugas Shrimp Sanctuary (and especially later closures, such as Everglades National Park in 1986 (Browder, 2007) and the Florida Keys National Marine Sanctuary no fishing zones in 1997 (NOAA, 1996)) set led to a growing perception among the commercial fishing industry that there existed a management-NGO conspiracy to eliminate commercial fishing from the Florida Keys (Suman et al., 1999).

Subsequent regulations to the Shrimp FMP related to participants followed the technocratic management approach. Starting in 2002, Amendment 11 required all shrimp trawling vessels operating in Gulf of Mexico federal waters to purchase a federal commercial shrimp vessel permit (GOMFMC, 2001a). Three years later, the council passed Amendment 13, which established a limited entry system for the Gulf of Mexico shrimp fishing industry by passing a moratorium on new permits. Under the amendment, only those vessels that were active on or before the end of 2003 could trawl in federal waters. The other regulation passed as part of Amendment 13 was that permits were made wholly transferable and could be sold by exiting participants, thereby creating a market for permits (GOMFMC, 2005a). Thus, by 2005, entry into the Florida Keys shrimp fishery was effectively closed, and entrants would heretofore need to purchase their way into the industry.

The Gulf Council passed the first of its two finfish FMP, the coastal migratory pelagics FMP, which was approved in 1982 and implemented in 1983; this FMP, like that for spiny lobster, was completed in partnership with the Atlantic Council (GOMFMC/SAFMC, 1982b). The coastal migratory pelagics FMP set up king and Spanish mackerel quotas, divided between the commercial and recreational fishing sectors. The FMP also divided the commercial quota into gillnet and hook-and-line sectors. By 1998, the council determined that it would allow no more entrants into the coastal migratory pelagics fishery, passing Amendment 8 that established a moratorium, which was later extended under Amendment 12 (GOMFMC/SAFMC, 1999). Amendment 9, passed in 1998, established a similar moratorium on the

gillnet fishery, requiring participants to show a fishing history dating back to 1995 and allowing only the transfer of gillnet endorsements (or permits) to immediate family members (GOMFMC/SAFMC, 1998). Finally, in 2004, the council closed entry into the fishery for an indefinite period, capping participation at the then current level (GOMFMC/SAFMC, 2004). While participation in the federal fishery had declined from 2,182 permits during the first year of the moratorium (1998) to 1,683 permits in 2004, the council argued that the indefinite cap on participation would provide for the "long-term social and economic stability" (GOMFMC/SAFMC, 2004) of the fishery.

The last of the FMP passed by the Gulf Council that affected Florida Keys fisheries in the Gulf of Mexico was the 1984 reef fish FMP (GOMFMC, 1984). The FMP restricted specific types of gear use within certain areas, and it established a size limit for red snapper. In 1990, the council passed Amendment 1 to the reef fish FMP, which set a 20% spawning stock biomass per recruit (SBBR) target for January 2000 to ensure the survival rate of many depressed reef fish populations (GOMFMC, 1989). To achieve the target, the amendment set up annual quotas for reef fish, increased minimum size limits for several species, and established the first, significant restriction on the use of fish traps in the Gulf of Mexico. The amendment required that participants in the fish trap fishery obtain permits, and it capped the maximum number of fish traps to 100 per permit holder; the South Atlantic Council, as will be discussed in the next section, had already taken action on the fish trap gear, and the Gulf Council's action shows one of the several differences between

management measures on either side of the Florida Keys. As with the other fisheries, subsequent amendments passed under the reef fish FMP limited access, restricted gear use, and established marine protected areas. Amendment 4, passed in 1992, set up a reef fish permit moratorium, preventing further entry into the fishery (GOMFMC, 1991). Amendments 9, 11, and 17 extended the moratorium until Amendment 24 in 2005 established a permanent limited entry system under which it was finalized that no new permits would be issued and all existing permits would be made fully transferable (GOMFMC, 2005b). Fish traps were phased out from the 1990s onwards, with Amendment 14 in 1997 setting up a ten-year phase out on all fish traps in the Gulf of Mexico (GOMFMC, 1996). Amendment 5 set up a seasonal closure of Riley's Hump, located in the western Florida Keys, as a mutton snapper spawning aggregation site during May and June of each year (GOMFMC, 1993). In 2001, the Gulf Council agreed with the Florida Keys National Marine Sanctuary in its identification of Riley's Hump as part of a much larger closure in the same region, creating the then largest no-take zone in the US. Commercial fishers, who had relied on this region for a variety of crustaceans and fin fish, including reef fish, were disallowed from fishing in 151 nautical square miles protected as the discontinuous Tortugas Ecological Reserves (GOMFMC, 2001c; NOAA, 2000)

The South Atlantic Fishery Management Council

Like the Gulf Council to its north and west, the South Atlantic Fishery Management Council (Atlantic Council) passed a number of FMP to manage regional

(transboundary) stocks but acceded to the State of Florida as the lead in the management of local fisheries. The spiny lobster FMP, for example, was passed in 1982 and extended the state regulations into the South Atlantic federal waters (GOMFMC/SAFMC, 1982). However, the FMP for the other major crustacean fishery, the shrimp FMP, did involve new, federal regulations (SAFMC, 1993). Under Amendment 2, that Atlantic Council required that all shrimp trawls (the nets used to haul the seafloor for shrimp) include a bycatch reduction device (SAFMC, 1996). As discussed by Adams et al. (2004), such capital investments greatly increased US shrimp operations' costs, putting them at a competitive disadvantage with foreign shrimpers who did not have similar regulations and whose catch competed directly with US caught shrimp. Amendment 6 to the shrimp FMP established a federal shrimp permit in 2005, but it did not limit entry into the fishery (SAFMC, 2004). However, since most shrimp in the Florida Keys is landed from state and Gulf of Mexico federal waters, it was the 2001 State of Florida restricted species designation and 2005 Gulf Council shrimp permit moratorium that had the greatest regulatory impacts on shrimp fishing in the region.

The Atlantic Council passed three fin fish FMP: The coastal migratory pelagics FMP (1982), the snapper grouper FMP (1983), and dolphin wahoo FMP (2009). The coastal migratory pelagics FMP established a joint management program with the Atlantic and Gulf Councils to manage the king and Spanish mackerels in the southeastern US as a single stock each to be divided between commercial and recreational fishing sectors (GOMFMC/SAFMC, 1982b). The Atlantic

Council also worked with its Gulf of Mexico counterpart in establishing a moratorium on king mackerel federal fishing permits in 2000 and setting up a limited entry program in 2004 (GOMFMC/SAFMC, 2004). The State of Florida worked in concert with both councils by listing king mackerel as a restricted species in 2005 (Shivlani, 2009).

The snapper grouper FMP followed two tracks. Under the earlier track, commencing with the 1983 FMP, the Atlantic Council established size limits, gear limitations, and marine protected areas to reverse declining stocks (SAFMC, 1983). The FMP established minimum size limits for several reef fish species, set up gear limitations, and implemented Special Management Zones (SMZ). Starting in 1991, under the later track, the council commenced on reducing participation and limiting entry. Starting with Amendment 4, the Atlantic Council passed a ban on the use of fish traps in South Atlantic federal waters (SAFMC, 1991). This was one of the major differences in management decisions that the Atlantic Council enacted compared to the Gulf Council, which decided to phase out fish traps through 2007. Also, Amendment 4 set up income requirements similar to the State of Florida RS provision to qualify to fish in the South Atlantic reef fish fishery, such that only those operations that could demonstrate $20,000 or more or 50% of total revenues over the past three years from the sales of seafood, whichever was lower, could qualify. Amendment 8, which was passed in 1997, created a limited entry system under which only those operations that could demonstrate past landings would qualify for either an unlimited permit or a 225-pound per trip permit (SAFMC, 1997). The

council modified the former permit system, creating the 'two for one' program. Under the program, fishers who wanted to enter the South Atlantic reef fish fishery with an unlimited permit would be required to buy two permits, of which one would be retired. The program required that either an entrant find two permits to retire one or that an exiting fisher find two permits to sell one. Further amendments led to additional size and trip limit adjustments, closed seasons, and marine protected areas. In 2007 under Amendment 14, the Atlantic Council established a series of no-fishing zones, including the 50 nautical square mile East Hump/Un-named Hump located in the South Atlantic Ocean off Islamorada in the Upper Florida Keys (SAFMC, 2007). In amendments passed from 2008 through 2010, the council closed the South Atlantic red snapper fishery indefinitely Amendment 17A) (SAFMC, 2010a), established lower quotas for several species (Amendment 17B) (SAFMC, 2010b), and set up closed seasons for all gag grouper harvest and recreational vermillion snapper harvest in South Atlantic waters (Amendment 16) (SAFMC, 2008). By the end of the first decade of the 21st century, the South Atlantic snapper grouper fishery was effectively closed to entry and subject to an intensive rebuilding program to restore the heavily depleted stocks, as required under the rebuilding plan provisions of the MSA.

The Atlantic Council approved its dolphin wahoo FMP, which was passed in 2004 (SAFMC, 2003). Dolphin and wahoo are offshore pelagics and are caught predominantly by hook-and-line gear by commercial and recreational fishers. The council acknowledged in passing the FMP that neither species was overfished, but

the council took a "precautionary and risk-averse approach" to managing the fishery (SAFMC, 2014a). The goal of the approach was to ensure that no new fisheries are developed for either dolphin or wahoo, especially from shifts in commercial longline fishery effort that may result in an imbalance between the present allocation between the commercial and recreational fishing sectors. The FMP set up a permit requirement, requiring all entrants to obtain a transferable commercial fishing permit, and it established an earning threshold via which entrants would need to demonstrate 25% of their income or at least $10,000 of income from commercial fishing. (SAFMC, 2014b). Also, the FMP closed entry to new fishers who could not buy their way into the fishery by requiring that fishers demonstrate a landings history of 250 or more pound of dolphin and/or wahoo on or before the 1999 season or prove that they held valid permits in another fin fish sector. Finally, the FMP established a 1.5 million pound quota for commercial landings in the South Atlantic, set up trip limits for wahoo, restricted allowable gear types, and set up size limits for dolphin along part of its range.

Overall trends in the federal fishery management process

While there were clear differences in how the Gulf and Atlantic Councils approached species management, especially in terms of the more proactive approach of the Atlantic Council towards gear restrictions and species protection, the overall trends in both councils showed a gradual embrace of technocratic management. Both councils increasingly favored restrictions in participation as a

means by which to limit effort, and each showed a willingness to adopt property rights measures. The other approach adopted early on in the council process and which gained greater acceptance was the use of spatial management, first as time-area closures and then as permanent, no-take zones.

The MSA enshrined spatial management in part via the need to protect essential fish habitat (EFH), which the 1996 reauthorization identified as those "waters and substrate necessary for fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802(10)). Both councils had previously prioritized coral protection with the 1982 passage of a joint FMP for coral and coral reefs (GOMFMC/SAFMC, 1982c), but it was the Atlantic Council that passed the first comprehensive EFH FMP in the US. Approved in 1998, the EFP FMP served as a guiding document for the protection of EFH via the establishment of marine protected areas and the restriction of particular gear types and uses (SAFMC, 1998). The Gulf Council, by contrast, implemented its EFH measures as an amendment applicable to its seven, existing FMP, which it finalized in 2005 (GOMFMC, 2005c). Both councils undertook significant steps to establishing permanent, no-take zones within their jurisdictional boundaries following the EFH amendment. In the case of the Atlantic Council, it protected the Pourtales Terrace located in deep water off the central part of the Florida Keys as part of a five-year initiative to establish five, deep water Habitat Areas of Particular Concern (HAPC), an EFH subset (SAFMC, 2009). As part of the designation, the council prohibited the use of mainly bottom fishing gear, anchoring, and possession of deep-water corals in the 23,000 square miles

encompassing the five coral HAPC. As stated previously, the Atlantic Council had already established a deep-water, no fishing zone off Islamorada. The Gulf Council also protected various HAPC, including the aforementioned Tortugas Ecological Reserve in the western Florida Keys in 2001 (GOMFMC, 2001) and Pulley Ridge (GOMFMC, 2005c), located northwest off the western Florida Keys. The area was of particular importance to Lower Keys trap fishers who fished the region and who were dislocated with its closure as an HAPC (Gentile, 2005). Overall, however, in the studies that I have led, other studies conducted in the region, and the conclusions derived by the councils, it is clear that most of the marine protected areas had minor impacts on commercial fishing activities in the Florida Keys, with the notable exception of the Dry Tortugas Ecological Reserve (Thomas J. Murray & Associates, 2006). It has not been the closures themselves that have created the most concern within the region's fishers and fishing communities; instead, it is the larger trend that marine protected areas are part of that has generated a new source of a sense of uncertainty and increased the potential for fisher exit.

Taken together as a series of management actions to address fisheries sustainability, the state-federal approach can be viewed in two stages. The first stage, which commenced shortly after the 1976 passage of the federal MSA and 1983 creation of the state MFC/FWC, was characterized by actions taken to address rates of harvest, fishery stocks, and, to a less degree, habitat protection. The councils and state recognized that certain fisheries were in decline, and both took steps over the first stage to reverse the trend. The second stage, which commenced from the

1990s onwards, focused more on effort, adopting the technocratic management principle of economic efficiency. Management actions now considered the fishery participants in need for rationalization, or most aptly, consolidation. This followed the overall trend set by the spiny lobster fishery, the focus of Chapter 6, in which the State of Florida implemented a market-based, effort reduction program in 1990 (FS 370.142). Both councils adopted the state's program by extending its regulations into federal waters. This was followed by a series of federal management measures that limited access by capping the number of permits and/or established control years that were used to determine whether fishers would be allowed into the fisheries. The final step in achieving economic efficiency was the marketization of permits. Under this step, fishers were now allowed to transfer their permits (two for one, in the case of the unlimited snapper grouper permit in the South Atlantic fishery), with the expectation that the most efficient fishers would remain in their respective fisheries. Also, reflective of the changing attitudes towards resource conservation and fisheries science, the councils increasingly embraced the marine protected areas concept by establishing no-fishing zones, seasonal, and gear-based closures. Missing in the latter stage of the management approach were the social dimensions of fisheries. FMPs and amendments did in fact describe fishers, their livelihoods, and their communities, but these descriptions followed the technocratic management paradigm – one in which fishers and their communities were the objects of management rather than agents involved in shaping and sustaining fisheries.

Discussion

Fishers and their respective fisheries in the Florida Keys were profoundly affected by the state-federal technocratic management measures. Although it should be noted that non-fishery factors played a significant role in exacerbating the impacts of technocratic management, it is nevertheless instructive to discuss how the various fisheries fared since when they were subjected to consolidation and, in some cases, property rights.

Participation in commercial fisheries in the Florida Keys under the MFC/FWC declined steadily from 1990 to 2009. The total number of Saltwater Products License (SPL) holders (commercial fishers) decreased from under 3,200 in 1990 to 1,365 in 2009, representing a decline of 57.2% (Figure 19). Also, it should be noted that the total number of active fishers was likely considerably lower than the 1,365, as the total referred to the number of individuals who purchased or renewed an SPL (i.e., the total does not refer to fishers who reported landings)[20]. Participation in the two major trap fisheries also decreased considerably, with a decline in 74.2% in stone crab endorsements and 62.8% in spiny lobster endorsements. Over the same period, the number of fishers who qualified for the restricted species (RS) provision did not decline as much as did overall participation, showing the increasing importance of the RS provision in the industry. In 1990, only 40.8% of Florida Keys' SPL holders qualified for the RS provision; by 2008, almost 86% of the SPL holders

[20] In a study that I conducted in the mid-2000s, I determined that 10.2% of the fishers on the 2005 Monroe County (Florida Keys) SPL list were not active (Shivlani et al., 2008).

qualified for the provision. This shows that there was an increase in the level of "professionalization", in that the fishers who remained in the industry were mostly full-time fishers who participated in fewer fisheries than in the past and who gained a majority of their household income from commercial fishing.

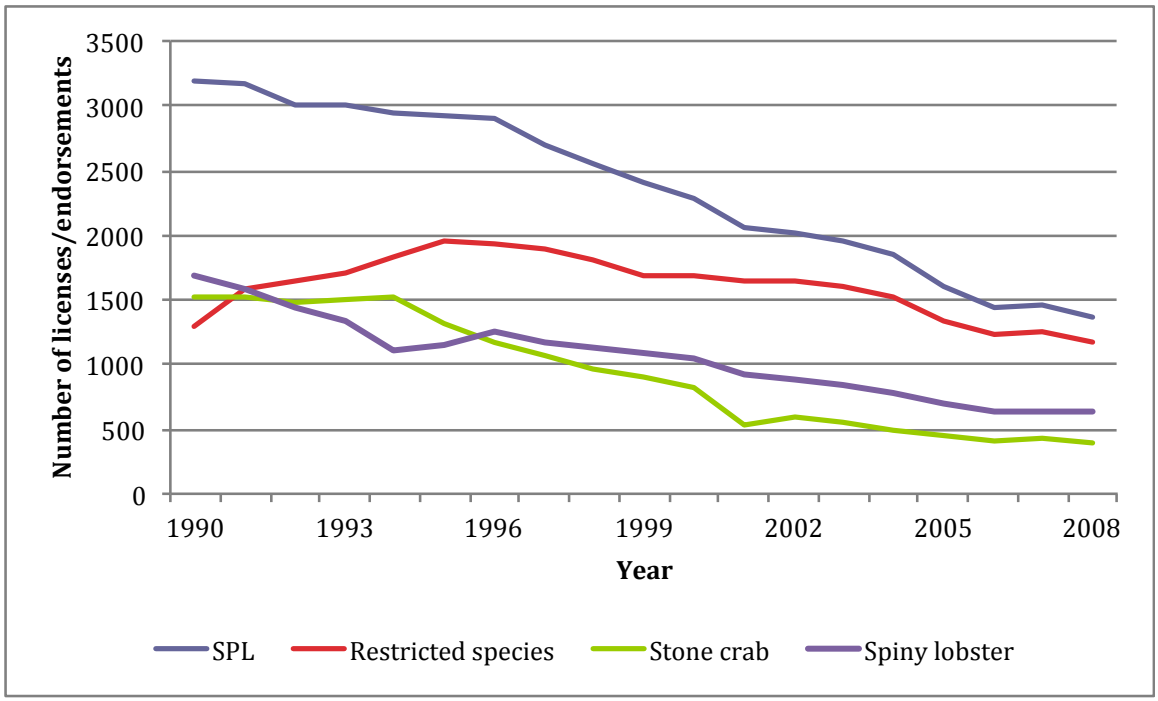

Figure 19: Participation in Florida Keys fisheries, 1990-2009 (FWRI, 2013)

A comparison between two studies conducted within a decade of each other (Milon et al., (1997) was conducted in 1995-96 and Shivlani et al. (2008) was conducted in 2006-07) demonstrates the profound shift in the Florida Keys commercial fishing industry over the decade and the "professionalization" of the fishery. Shivlani et al. (2008) reported a decline of 53% in the number of active fishers over the decade. However, the decline also coincided with a significant increase in the average household income earned by fishers; fishers from the 1995-96 sample reported earning an average of 61% from commercial fishing, compared

to the 85% average household income from commercial fishing earned by fishers form the 2006-07 sample. Milon et al. (1997) also determined that over half of the reef fish fishers (54%) they interviewed in the Florida Keys in the mid-1990s participated in at least one crustacean trap fishery (i.e., spiny lobster and stone crab), and 27% participated in both crustacean trap fisheries. Ten years later, just over a third (35%) of reef fish fishers participated in at least one crustacean trap fishery, and only 13.3% participated in both crustacean trap fisheries (Shivlani et al., 2008).

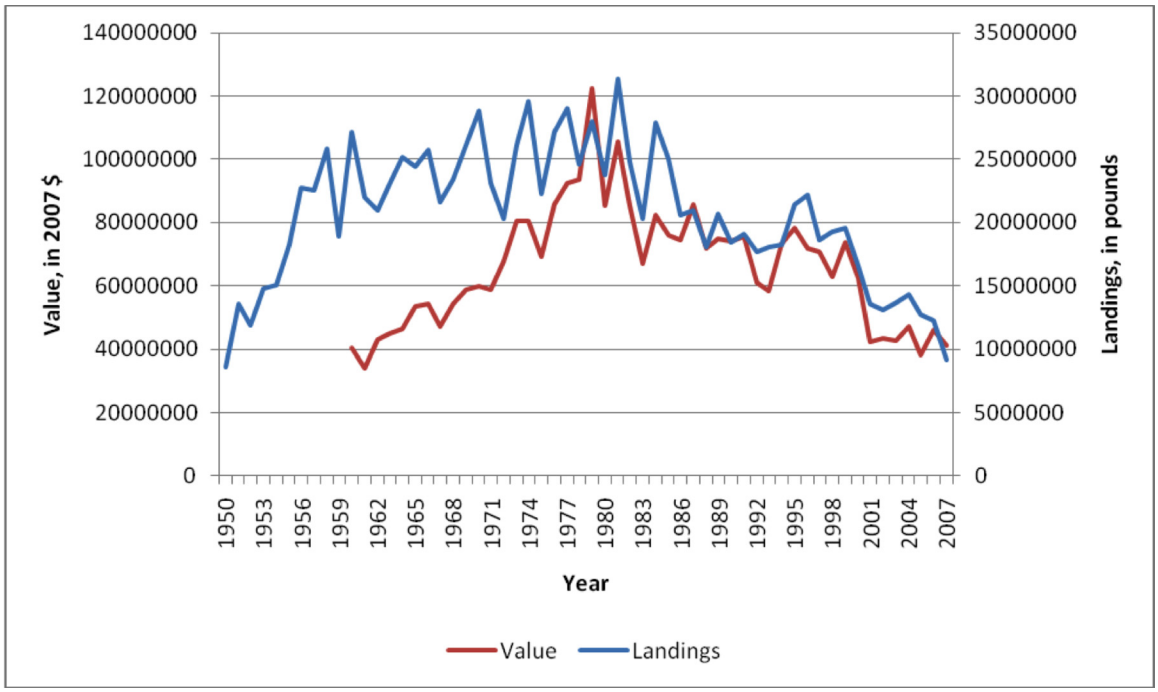

Figure 20: Value and landings of Florida Keys fisheries, 1950-2008 (Stephen Brown, FWC, personal communication, 2009)[21]

In terms of total production, the Florida Keys commercial fishery peaked towards the end of the 1970s and start of the 1980s (Figure 20). In 1978, the

[21] Stephen Brown, Florida Fish and Wildlife Conservation Commission (FWC), provided the Florida Keys landings, effort, and price database for the 1950-2008 period upon request in 2009.

combined total of all Florida Keys fisheries exceeded 30 million pounds, with pink and other food shrimp species leading all landings. Three years later, in 1981, the fishery reached its highest value, when ex-vessel price totals amounted to $120 million (in 2007 dollars). By 1983, the state-federal management approach was implemented, followed by a series of state regulations and federal FMP and related amendments; however, landings and value both dropped steadily throughout the state-federal management era and commenced on a steeper decline throughout the 1990s as a majority of the region's most productive fishery (in terms of landings and value), the pink shrimp fishery, relocated to southwest Florida, with only a few vessels migrating to Stock Island (Schittone, 2001). By the end of the first decade of the 2000s, total landings averaged only 10 million pounds, although several of the fisheries (shrimp, spiny lobster, stone crab, coastal migratory pelagics, and reef fish) had undergone some level of consolidation. The decrease in landings, simply put, was not a result of a long-term decline, with the exception of most of the reef fish complex. Instead, most of the decline in the major fisheries occurred **after** the implementation of technocratic management. It is not suggested here that the decline was a direct result of technocratic management; I have shown in an earlier chapter how a complex of non-fishery factors interacted with technocratic management measures to exacerbate impacts to fishers and their communities. However, it is also clear that technocratic management did little, if anything, to improve landings and – as the decline in participation shows – stabilize the fisheries and the fishing communities.

Participation in fisheries was affected by confidence in management and concerns over the long-term viability of the fisheries as it related to whether commercial fishing would be allowed in the future (Shivlani et al., 2005; Suman et al., 1999). Fishers were particularly concerned over management decisions that they perceived as unending and which they argued were part of a larger effort to eradicate commercial fishing from the region (Shivlani and Milon, 2000). Their concerns were hardly allayed as more species were put under limited entry and transferable permits. Without security, fishers were more likely to exit the fishery, and that trend accelerated over the period when technocratic management reached its ascendency. In some fisheries, such as spiny lobster, which is the focus of my case study in Chapter 6, technocratic management that was implemented to stabilize the fishery ended up decimating participation, as two out of three lobster endorsement holders left the industry from when the State of Florida commenced an effort reduction program in 1990 to 2009.

CHAPTER 6: THE FLORIDA KEYS SPINY LOBSTER FISHERY

Introduction

The history of management in the spiny lobster fishery is an appropriate case study to evaluate the effects of technocratic management as it demonstrates how a complex social system consisting of fishers, their social configurations and networks, and fishing communities were transformed with the implementation of a technocratic approach. The approach sought to reduce effort while retaining the "high liners" (most efficient fishers) but did not fully anticipate the multifold effects of its measures on the social, cultural, and economic landscapes of the Florida Keys (Shivlani and Milon, 2000). While it may be hyperbolic to suggest that the effort reduction program was a form of social engineering, the chapter will demonstrate that the program did end up picking winners. The question is whether this was the best or even the only way to address overcapacity and whether technocratic management is the best approach to discipline fisheries; by refocusing the narrative on the community, the chapter privileges the role of social capital in maintaining sustainable fishing communities, without which, as Jentoft (2000) has so clearly concluded, there are no fisheries.

Creating an effort reduction program

To understand the need for and results of the technocratic approach that the State of Florida implemented in 1990 to address excess effort, it is important to review the biological aspects of the species, the historical conditions and

performance of the spiny lobster fishery, and the evolution of the management framework.

Spiny lobster life history

The Caribbean spiny lobster, *Panulirus argus*, is a decapod, or ten-legged, crustacean (of the Order Decapoda) (Moe, 1991). Unlike the iconic American lobster (*Homarus americanus*) and its relatives, the spiny lobsters lacks claws and instead are characterized by two pairs of antennae, of which the longer ones are covered in spines and exceed the length of the adult animal. *P. argus* is distributed across the subtropical and tropical western Atlantic Ocean and is found from Bermuda to central Brazil, and there exist major fisheries for the species along much of its range (Ehrhardt, 2005). In the mainland US, spiny lobster are mostly commonly found off the Florida Keys and south Florida, but individuals can range into the northern Gulf of Mexico and northeastern Florida (Moe, 1991).

The spiny lobster's life history plays a major role in its abundance and distribution and indeed on the range and health of its fisheries. Gravid females release their fertilized eggs usually in peak summer months, after which the eggs enter the plankton. Hatched lobster, called phyllosomes, spend between 9-12 months drifting in the water column after which they settle in algae and sea grasses (Moe, 1991). Called plueruli at this stage, these juvenile lobsters molt several times after which they mature and migrate to deeper, often coral reef habitats. Due to the extensive time that the species spends in the water column, recruitment (the

process by which young are 'recruited' or added to the adult population) is often at least partly dependent on distant spawning grounds; that is, areas located away from the fishing grounds often contribute to the fishery by providing the phyllosomes that are hatched there but which spend almost a year in the water column. For the Florida Keys fishery, it is estimated that the local population is seeded from both local areas (e.g., eastern Gulf of Mexico) (Yeung and Lee, 2002) and distant areas (e.g., western Caribbean, especially off the Yucatan Peninsula) (Moe, 1991). This recruitment feature in part affects inter-annual abundances and has influenced fishery management measures, although it should be noted that recent work suggests that recent depletions may have resulted from local fishing pressure (see Ehrhardt and Fitchett, 2010)).

Major spiny lobster fisheries in the US are located off Puerto Rico and associated islands, the US Virgin Islands, and Florida. The Florida fishery extends from the eastern Gulf of Mexico (especially around the western Florida Keys and Dry Tortugas), the length of the Florida Keys, Biscayne Bay, and the Atlantic Ocean off southeast Florida (Moe, 1991). While spiny lobster landings do occur north of these areas, the Florida Keys and southeast Florida comprise the main fishing grounds, and the Florida Keys usually account for 90% of the fishery's inter-annual landings.

Setting the platform for the spiny lobster fishery and markets

Spiny lobsters have been harvested in the Florida Keys since pre-Columbian times, when the resident Native Americans targeted the crustaceans in nearshore

habitats (Viele, 1996; Moe, 1991). Spaniards, who briefly occupied the islands (using them mainly as a transit point in the shipping route between Cuba and their North American possessions), likely also fished for spiny lobster (Viele, 1996). Although the US acquired the Florida Keys in 1821 and Key West was settled in 1823, there was not much demand for spiny lobster throughout the 19th century (Labisky et al., 1980). It was instead a local delicacy and served also as bait for the more lucrative snapper/reef fish fishery (Moe, 1991). The snapper/reef fish fishery was the region's dominant fishery sector, serving the Havana market. Small fishing vessels, called "smackees", contained live wells to provide fresh catch to markets, and fishers also salted pelagic fin fish (especially king and Spanish mackerel) that could not be maintained in live wells (Little, 2000).

Two other fisheries developed in the Florida Keys in the 19th century, slowly integrating the Florida Keys with the US mainland markets and ushering the way for 20th century spiny lobster production and trade. The sponge fishery, which likely existed during the Spanish possession era, expanded considerably from the 1820s onwards. Key West commenced a sponge trade with New York in 1849, and the region exercised a monopoly on the US sponge trade for most of the 19th century (Shubow, 1969). By the start of the 20th century, there were 500 vessels employing 1,800 spongers who worked the Biscayne Bay and Florida Keys nearshore waters. The rise of Tarpon Springs in western Florida as a rival market in the early 1900s and the depletion of South Florida sponge beds led to a steady decline in the Florida Keys sponge trade production and trade, which was reduced to a minor fishery by

the late 1940s. The other fishery that developed in the Florida Keys over the 19th century was the sea turtle fishery, both for sea turtle meat and eggs. As with the sponge fishery, the sea turtle fishery developed mainly to supply northern markets. To prevent spoilage, turtles were caught and maintained in "kraals", which were shore-based corrals that housed captive individuals that were shipped live (on their backs) to northern ports; a small cannery operation opened in the Florida Keys in 1896, but the local fishery declined in subsequent decades and was supplemented by imports from Central America and Caribbean (Witzell, 1994).

The sponge and sea turtle fisheries, as well as the salted fin fish sector, demonstrate that markets already existed for Florida Keys fishery products prior to the rise of the spiny lobster fishery (and other major fisheries) in the early 20th century. In fact, it is likely that the economic ties between northern ports and Key West facilitated the export of spiny lobster, such that the completion of the Overseas Railroad in 1912, coupled with the completion of the first ice plant in Key West, accelerated the fishery trade that had developed across several fisheries over the previous century. It is also likely because of these existing markets that spiny lobster production could grow so rapidly in the 1910s.

The Florida Keys spiny lobster fishery in the 20th century

As previously stated, while locals in the Florida Keys consumed spiny lobster, the crustacean was used mainly as bait for snapper/reef fish fishery throughout the 19th century (Labisky et al., 1980). In 1868, however, Cuba placed a high duty on

fresh imported fish, leading to a long-term decline in the Florida Keys' fishing industry and the ancillary spiny lobster bait fishery (Little, 2008). The situation remained stagnant, although fishers did sell spiny lobster to local markets, earning as much as $0.53/pound (in 2011 dollars) by the end of the 19th century.

The fortunes of the spiny lobster fishery changed with the completion of the Overseas Railroad in 1912. The railroad, built over a period of eight years (1905-12), connected the Florida mainland with Key West. Henry Flagler who funded the construction of the railroad, expected that the deepwater of Key West would benefit from the recent construction of the Panama Canal, by serving as the transshipment point for the eastern United States and the preferred US port for Latin American trade (Zeiller, 2006). Flagler's vision was never fully realized as the railroad was not successful over the long-term and indeed went into receivership before the 1935 Labor Day Hurricane destroyed part of its Upper Keys section. However, the railroad did promote spiny lobster production by providing a rapid and (largely) dependable transportation option to regional and northern markets.

By the late 1910s, Labisky et al. (1980) report that 40% of 350,000 pounds of spiny lobster landed in the Florida Keys were exported (mainly as cooked tails) to northern markets; of the remaining 60%, 40% were consumed locally and 20% were used as bait. Landings fluctuated considerably over the 1920s, due in part to the changing economic situation in Key West over the decade but also a result of likely underreporting (Dawson and Idyll, 1951). Landings exceeded a million pounds in the 1931-32 season, when over 1.3 million pounds were reported for the

Florida Keys. For the rest of the decade, however, landings remained a million pounds, ebbing to 266,000 pounds in 1933-34; that year, the average price per pound dropped by 35%, from $1.30 in 1931-32 to $0.86 in 1933-34 (in 2011 dollars). The Great Depression flattened demand, and the fishery declined to an average of 700,000 pounds per year in the 1930s. The 1935 Labor Day Hurricane effectively ended the railroad era, and while the Overseas Highway was completed only three years later, the disruption in a direct route likely reduced landings (Labisky et al., 1980). The fishery only recovered in the early 1940s, when the US recovered from the Great Depression and entered in World War II.

The spiny lobster fishery mostly grew over the 1940s with the notable exception of a sharp decline in 1945. That year, landings dropped to less than 800,000 pounds, and it was the only sub-million pound year in the decade. This decline was in the same year that the US suffered a recession, resulting from lowered demand following the end of the war in the European theater. But, as the economy recovered, landings quickly increased, reaching almost five million pounds in 1947. Aiding the growth of the fishery were advances in fishing vessels and, especially, gear. Prior to 1940, the main gears or approaches in the fishery were bully nets, fish traps, and free or hookah diving. Fishers targeting the shallow Florida Bay and nearshore waters used bully nets to harvest spiny lobsters. Bully nets are an active gear, in that they require fishers to locate and fish spiny lobster. Bully nets are contrasted with fish and other traps that fishers also used, in deeper Atlantic waters located south of the Florida Keys. Traps are a passive gear, and they

attract spiny lobster (and other species, depending on the trap configuration) while sitting on the ocean bottom; fishers can deploy the traps and check them periodically. The third approach to spiny lobster fishing in the Florida Keys was free or hookah diving, where fishers would free dive or use a pipe that provided air to harvest spiny lobsters by hand; this approach would be greatly enhanced with the widespread introduction of the aqualung, which was developed during World War II and gained popularity in the subsequent decades as SCUBA. By the end of the 1940s, the Florida Keys and its spiny lobster fishery were poised for a sustained expansion that would lead to the development of the then lightly populated islands outside of Key West and the increase in fishing power, effort, and participation in the fishing industry.

Spiny lobster landings averaged 2.6 million pounds in the 1950s (1950-59), and the price per pound averaged $1.51 (in 2008 dollars)[22]. Landings oscillated between 1.5 million pounds (1950) and over four million pounds (1957), whereas price per pound increased almost each year. Price per pound had increased from $1.25 in 1950 to $1.80 in 1959 (in 2008 dollars). Thus, the price signal suggested increased demand, and fishers responded by ramping up effort. Related to the increased landings was a continued investment in vessels and gear, the development of small ports across the Florida Keys (that could be used to access fishing grounds further away from the main fishing port of Key West), and more labor availability due to a population boom. Also, with the aforementioned

[22] All spiny lobster landings and price data adapted from Vondruska (2010).

investments in vessels and gear, especially wooden-slat traps, fishers now targeted deeper waters off the Florida Keys and more intensely fished Bahamian fishing grounds. Over the decade, trap totals increased from 12,000 traps in 1950 to 52,000 traps in 1959.

Technology advances increased in the 1960s, such that vessels could increasingly target offshore and international waters, and gear totals increased to cover the wider fishing grounds (Labisky et al., 1980). Landings averaged 4.5 million pounds for the 1960-69 period, with harvest increasing from 2.8 million pounds in 1960 to 7.6 million pounds in 1969. Trap totals more than doubled over the 1960-69 period, from 74,000 traps in 1960 to 165,000 traps in 1969. Price continued to increase over the decade, with the inflation adjusted price per pound increasing from $2.31 in 1960 to $3.69 in 1969, representing an increase of 60%. Population and development also increased, but for the first time in the islands' history, population growth in settlements outside of Key West contributed to the population increase while Key West's population declined. By the end of the 1960s, almost half of the county's 50,000 residents lived outside of Key West. Another major demographic shift that occurred over the 1960s was the influx of Cuban exiles to the Florida Keys following the 1959 Cuban Revolution. Most of the incoming Cubans settled in adjacent Miami-Dade County[23], and a segment of these immigrants took up commercial fishing and fished areas around Miami-Dade County and into the

[23] The 1970 US Census data demonstrate that population growth in the Florida Keys (Monroe County) over the 1960s was due most likely to domestic, or US born, immigrants. While there was an influx of Cuban migrants over the 1960s, only a minority of these new residents moved to the Florida Keys.

Bahamas; also, as Labisky et al. (1980) explain, Cubans were exempt from restrictions on foreign-owned fishing vessels, facilitating their entry into the commercial fishing industry.

An often underreported development that likely expanded over the 1960s and which would have profound effects on the Florida Keys commercial fishing industry was the illicit drug trade (Brown, 1993)[24]. The illicit drug trade can be best understood as a continuation of previous, quasi-legal and illegal Florida Keys' economies, especially wrecking (early to mid-19th century) and bootlegging over the Prohibition era (1919-1933) (Zimmerman, 2006). This significance of the drug trade economy for the spiny lobster fishery was that it provided capital for investment in technology and gear, both of which would have significant impacts on overcapacity in the 1980s.

Another significant development in the fishery throughout the 1960s was the rise of the recreational lobster fishery (Labisky et al., 1980). Exponents mainly used the increasingly popular SCUBA gear to "hunt" for lobsters underwater in the Florida Keys and South Florida, competing with commercial lobster divers and trap fishers. As the population of the county and especially the South Florida metropolitan areas grew, recreational fishing pressure intensified, creating greater use conflicts. Commercial lobster trap fishers complained that recreational lobster divers were responsible for theft (of lobsters from traps), presented navigational

[24] Douglas Gregory, NOAA/Florida Sea Grant Agent and UF/Monroe County Extension Director. Personal interview in Key West, Florida, November 17, 2010. Edward Little, NMFS fishery port agent. Personal interview in Key West, Florida. October 30, 2010.

hazards in their increasing numbers, and were responsible for habitat destruction due to poor fishing etiquette. By the start of the 1970s, the conflict between commercial and recreational lobster fishers worsened, precipitating the need for a regulation remedies.

The spiny lobster fishery continued its expansion into distant waters in the early 1970s, and landings averaged over 10 million pounds in the 1970-74 period; however, landings dropped to an average of 6.5 million pounds for the remainder of the decade even as the price per pound increased by an average of 17% from 1970-74 to 1975-79 (Milon et al., 1998; Labisky et al., 1980). The primary reason for the decline in landings was the closure of the Bahamian fishery grounds in 1975 to foreign fleets; the government of the Bahamas increased its territorial claim from 3 nautical miles to 12 nautical miles, effectively curtailing all foreign fleet fishing in its most productive fishing banks (Labisky et al., 1980). The gear and effort that had been used in Bahamian waters now had to be relocated in US waters, namely the Florida Keys and southeast Florida. Trap totals had increased to 520,000 traps in the mid-1970s, from 219,000 traps in 1970, and fishers added more traps to the fishery through the decade and through the 1980s (Milon et al., 1998). One reason why fishers may have increased effort may have been due to reduced landings resulting from the closure of the Bahamian fishing grounds. However, this reason does not completely explain how fishers were able to make large investments in traps (which are an expensive gear type, and of which the wooden variety needs to be replaced every 3-4 years) if their profits were dropping from lower catches per

trap; that is, how did these fishers obtain capital to increase gear if with each additional unit of gear, they were actually making less per unit?[25] An alternate explanation that Labisky et al. (1980) and Brown (1993) have proposed for the capitalization in the spiny lobster and other fisheries is the illicit drug trade. Fishers who gained illegal funds from smuggling drugs into the Florida Keys needed to launder their profits and frequently did so by purchasing and upgrading vessels and by investing in gear[26]. Whether gear such as traps were able to provide a suitable return on investment was less important than the laundering operations, as these fishers relied on profits from their smuggling activities. The result of an expansion in effort, regardless of the reasons for the expansion, was that by the 1980s, there were almost one million traps in the spiny lobster fishery, and that the State of Florida's Marine Fisheries Commission (MFC) considered this as an overcapacity problem that needed to be remedied by technocratic management measures.

The "War on Drugs" effort effectively curtailed the booming drug trade in the Florida Keys, and the archipelago began a protracted process towards re-

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[25] Several fishers interviewed for this section, including two who were imprisoned for illicit drug smuggling, stated that they knew that increased effort would not result in greater profits. Two of the interviewees added that they did not even haul their traps on a regular basis, as there was so much profit to be made by transporting drugs. They also stated that many of the vessel upgrades were in the form of larger, faster engines, and these were done to expedite drug runs and to outrun officials; however, the increase in fishing power was misinterpreted as the fishers' response to expand domestic fishing grounds.

[26] Douglas Gregory, NOAA/Florida Sea Grant Agent and UF/Monroe County Extension Director. Personal interview in Key West, Florida, November 17, 2010. Edward Little, NMFS fishery port agent. Personal interview in Key West, Florida. October 30, 2010.

establishing itself into a tourism destination. The fisheries sector, which had often competed with tourism for waterfront space, became increasingly marginalized as tourism totals increased and demand for waterfront and water-based activities decreased. By the early 1980s, the City of Key West decided that it would accelerate its transformation as a tourism center by effectively removing commercial fishing from its waterfront. Higher rents resulted in a flight of the commercial fishers, their vessels, and associated waterfront establishments from the port that commercial fishing had occupied since the first half of the 19th century. Spiny lobster and other fishers, including the iconic Key West shrimp fishing fleet, relocated to adjacent Stock Island, and the City of Key West gentrified its port into a series of marinas, restaurants, and waterfront shops (Schittone, 2001). Similar approaches were adopted by other county governments that required that fishing gear be stowed away from public view and the commercial fishing operations be located in special zones (Johnson and Orbach, 1990).

Spiny lobster landings in the 1980s were consistent, averaging almost six million pounds each year. Average prices per pound increased from $4.56 in the 1970s to $4.90 in the 1980s, representing an increase of 7.5% (in 2008 dollars); however, although the price per pound did increase over the decade, the 7.5% increase was much lower than the increase in previous decades. For example, prices per pound rose by 90% from the 1950s to 1960s and by 59% from the 1960s to 1970s. Part of the reason for the decline in the price may have been due to the maximum that a mature market (i.e., where demand and supply were in relative

equilibrium) could bear, but another reason may have been because of the cost of imported spiny and rock lobster. In the 1980s, the US imported an average of 27 million pounds of spiny and rock lobster and 10.8 million pounds of warm-water lobster. The average price of the warm-water species was $4.52 over the 1980s, which may have checked the price of domestic spiny lobster. Trap totals, which had exceeded half a million traps by the end of the 1970s, increased in the 1980s. The industry fished an average of 597,000 traps over the 1980s, and the number of traps fluctuated from a low of 542,000 traps in 1982 to a high of 675,000 traps in 1984. The traps per vessel, which had remained at or near 1,100 traps, increased to over 1,300 traps per vessel in 1989 and 1990, representing an increase of 18%.

Increases in trap totals, both in vessels and across the industry, can be understood in two, conflicting narratives. The technocratic narrative explained that the fishery, whose participants had historically enjoyed an open access status, had been forced to increase effort (i.e., dissipate rents) in the domestic fishing grounds once foreign nations had closed off their fisheries. The lack of a barrier to entry attracted new entrants who further increased effort, leading the fishery into its then overcapacity state. An alternate narrative suggested that the fishery had expanded first because of a large resource base but then had grown due to a mixture of demand (i.e., price signal) and increased effort resulting from the illicit drug trade, and that the fishery largely controlled entry and effort due to profit conditions rather than open access. Fishers who had participated in the spiny lobster fishery during the 1970s and 1980s stated that while effort did increase over the 1980s,

profits largely determined how much effort was feasible in the fishery; this was largely because traps represented an expensive capital investment which needed to be replaced every 3-4 years, and fishers were unwilling to invest in traps if the gear did not pay for itself and provide a profit over its lifetime. Another economic aspect of the fishery, often overlooked in the technocratic explanation, was the price of crude oil over the 1980s, when effort increased considerably. Oil prices plummeted following the early 1980s recession such that gas and diesel prices were low enough to support larger fishing operations.

My research in this and previous studies demonstrated that fuel prices dominated all variable fishing costs for several fisheries in the Florida Keys over the 2000s, and that oil prices – more than other variable costs – best explained changes in fishing effort. Fishers I spoke with argued that low variable costs, especially gas prices, led to a growth in the fishery. One of these fishers, Bobby[27], a lobster trapper who had worked the Lower Keys and Dry Tortugas fishing grounds for several decades, stated that gas was always cheap for fishing operations, but that it became a lot cheaper in the 1980s. Lonnie[28], whose fish house handled shrimp in the Key West area until it closed down in the mid 2000s, told me in an earlier interview that gas was among the least expensive item on any fishing trip except for shrimp trips,

[27] Bobby, commercial fisher. Personal interview conducted in Stock Island, Florida. January 14, 2011.

[28] Lonnie, fish house operator and owner. Personal interview conducted in Stock Island, Florida. October 9, 2010.

which burnt a lot of gas per day. But even those trips got cheaper in the 1980s as gas prices plummeted.

Another aspect that many fishers stated occurred towards the end of the 1980s was the deliberate inflation by fleet members on the number of traps that they held and the number that they fished. This is because fishers recognized that the industry would need to address overcapacity, and that it was likely that past effort would determine future allocations. Bobby explained that many fishers did not actively fish more than 1,000 traps in a season, especially down in the Lower Keys; for him and others interviewed as part of the study, the increase in effort was a deliberate act to get as many trap certificates as they could. A Conch Key fisher, Thomas[29], added that he had always fished a number suitable to be able to fish his traps in 1-2 days. That total was exactly what he needed based on his vessel size and his expectations. He is a third generation fisher and did not want to get rich from fishing. But, he was among those who were given fewer trap certificates than those who increased their effort; to Thomas and others like him, this showed that the system was set up to benefit those who were most responsible for increasing effort. Thus, participants had an incentive to inflate the amount of gear that they utilized. Participants reported a similar inflation almost a decade later when the State of Florida initiated an overcapacity initiative in the stone crab trap fishery.

Finally, by stating the need for reining in excess effort, the technocratic narrative largely ignored the fact that the spiny lobster fishery was managed by a

[29] Thomas, commercial fisher. Personal interview conducted in Marathon, Florida. October 20, 2006. Unpublished data from Shivlani et al. (2008).

series of gear, size, seasonal, and temporal restrictions since its growth as a commercial industry; that is, the fishery as it existed in the 1980s was already regulated, via licensing, standardized gear, size limits, a closed season, and closed areas. Bobby, the Key West trapper, pointed out that he needed a license, then a restricted species permit, and then an endorsement just to land lobster. These regulations were only part of the requirements and restrictions, including when the government told him that he could no longer dip his traps in oil (with which Bobby agreed, although a lot of old-time fishers did not) to make them last longer, when he was told that the divers would be allowed to get lobster before the commercial fishery started, and when he had to accept closed areas like Everglades National Park, Dry Tortugas National Park, and then the Sanctuary no-take zones. Bobby felt that there were already too many regulations and that these regulations changed according to the agency and the area, and that fishers didn't need "another layer of bureaucracy"[30].

The process to address overcapacity in the spiny lobster trap fishery commenced in the late 1980s, culminating in the Florida State Legislature's passage of the 1991 Spiny Lobster Trap Certificate Program (TCP) (Milon et al., 1999). The MFC led the process in which industry participants and others provided input on

[30] The phrase, "another layer of bureaucracy", was popularized by Edward Swift, an opponent of the establishment of the Florida Keys National Marine Sanctuary (FKNMS) in the mid-1990s (Suman et al., 1999). Swift wrote and self-published a book that itemized the potential impacts of the FKNMS, which he and others against the Sanctuary's establishment felt would undermine the region's economy. Commercial fishers picked up on this refrain and used it to voice their opposition against subsequent regulatory measures.

how best to control effort and maintain a sustainable fishery. The TCP, described in more detail in the following section, represented the culmination of a series of regulatory approaches developed over the 20th century to address participation, effort, and landings in the spiny lobster fishery. The TCP also represented the State of Florida's first, major measure that applied market mechanisms to discipline effort, and in doing so, the TCP was a significant departure from previous top-down control measures implemented for the state's fisheries. Finally, the TCP in many aspects was a vanguard for the future of fishery management in the US, where fisheries would increasingly be disciplined via market mechanisms, most notably via transferable quotas, gear, and permits.

Spiny lobster fishery regulations prior to transferable effort quotas

The spiny lobster fishery had developed in a way where, by the 1980s, the State of Florida determined that it had reached a point of overcapacity, but this was not because of a lack of management (Milon et al., 1999). In fact, as will be shown in this section, the fishery was managed by series of regulatory approaches throughout much of its history in the Florida Keys. That is, the TCP was not implemented to discipline an otherwise open access fishery with no regulations; instead, the TCP was the culmination of a series of regulations used since the early 1900s to manage the fishery.

In 1919, the State of Florida enacted the first law concerning spiny lobster, when it created a closed season between March and June (Moe, 1991). The closed

season was modified three times through the mid-century, when in 1955, it was set to April 1st to August 1st of each year (the present closed season). Size restrictions were also introduced early in the fishery's history, when in 1929, lobsters weighing under one pound were considered illegal. This weight restriction was changed to a size restriction in 1953, when the State of Florida established a six-inch minimum size limit (tail length). The minimum tail length was reduced to 5.5 inches and a carapace (shell) length of three inches in 1965. Also in 1965, egg-bearing females were prohibited from harvest.

Gear restrictions arrived later than size and seasonal restrictions in the industry, as fishers were allowed to use a variety of fish and other traps, entangling and bully nets (scoop nets attached to the end of long poles that fishers used to harvest spiny lobster), and spears (Moe, 1991). As technology improved in the 1920s, more gasoline engine vessels entered the fleet, and fishers commenced using wire mesh traps. These precursors to the wooden-slat trap, today's standard trap gear, presented an advantage over other, active gear in that traps could be fished deeper than bully nets or spears, and traps could be hauled after being deployed for a few hours or even days (known as soak time). The first significant gear restriction was the 1965 standardization of the wooden-slat trap dimensions, which were set at 1.5 by 2 by 4 feet (Moe, 1991). The same regulations also required that fishers now mark their traps and buoys (floats) with the owner's lobster license number, which fishers were now required to obtain. Other gear types, such as ice-can traps made of steel tanks previously used to making ice, and other non-standard traps, were

prohibited from use in the fishery. Then, in 1987, the Marine Fisheries Commission (MFC) capped gear totals per vessel, mandating that a maximum of 2,000 lobster traps be allowed by vessel (Milon et al., 1998).

Entry into the fishery was mostly unrestricted through much of the early history of the spiny lobster industry. In 1953, the State of Florida passed a law requiring a fishery license for all operations that landed marine products (Labisky et al., 1980). The license remained the only, major entry requirement for commercial fisheries until the establishment of a 1971 rule that required spiny lobster fishers to pay a fee of $50 to harvest spiny lobster in "commercial quantities" (Labisky et al., 1980). The MFC in 1983 required that all commercial fishing operations hold a Saltwater Products License (SPL) to be able to sell marine products. Towards the end of the 1980s, the MFC introduced the Restricted Species (RS) requirement, under which commercial fishing operations had to qualify for so-called restricted species (as designated by the MFC) by demonstrating a minimum income derived from commercial fishing. In 1988, the MFC designated spiny lobster as a restricted species, effective in 1994 (Milon et al., 1998).

Closed areas represented another type of management measure that affected the spiny lobster fishery for much of its history. Fort Jefferson National Monument, established in 1935 and expanded and re-designated as Dry Tortugas National Park in 1992, did not allow commercial fishing within its boundaries in the western Florida Keys (National Park Service, 2000). Everglades National Park also disallowed commercial lobster fishing within its boundaries before prohibiting all

commercial fishing in 1986 (Browder, 2007). Similarly, John Pennekamp Coral Reef State Park, the first underwater state park in the US, banned lobster fishing around coral reefs within its boundaries. North of the Florida Keys, the State of Florida and the National Park Service collaborated on the creation of the Biscayne Bay-Card Sound Lobster Sanctuary, which disallowed lobster fishing in much of the inner bay and sounds north of Key Largo (National Park Service, 2011). These closures created a mosaic of protected areas for spiny lobster that prevented capture and curbed effort.

The commercial fishery experienced increasing competition from the recreational fishery sector, especially after the popularity of SCUBA gear from the 1950s onwards, leading to temporal regulatory approaches. By the early 1970s, use conflicts between the commercial and recreational sectors had worsened, leading the State of Florida to adopt a bill that created a two-day recreational season that would take place a week prior to the opening of the commercial season (Labisky et al., 1980). The intent of this so-called "mini-season" was to sufficiently separate the two uses such that recreational divers could access the resource earlier than commercial fishers (mainly trap fishers).

Despite these regulations, restrictions, and prohibitions, the MFC concluded that there was overcapacity in the fishery, which undermined the economic welfare for the industry and which posed an ecological threat to undersized lobster (Milon et al., 1998). Thus, the commission determined in 1990 that the spiny lobster fishery would be prohibited from using undersized lobsters as attractants and that escape

gaps would be required for traps effective for the 1993-94 season unless “an effort reduction program for spiny lobster is adopted by the Legislature and implemented by the Commission prior to this date" (Florida Administrative Code, Chapter 46-24). The MFC sponsored workshops at which commercial fishers were invited to provide their input on the best way to manage the fishery, especially as related to controlling the growth of the number of traps in the fishery. The management objectives, guided by expert advice and industry input, led to the development of the TCP (Milon et al., 1998).

Several fishers who I interviewed argued that they accepted the program because the alternative would have been to accept escape gaps, which most of the industry vehemently opposed. Bill[31], a fish house owner in the Upper Keys, felt that the program had been set up to benefit only the biggest operators. Another fisher in the Lower Keys, Bobby, blamed many of the biggest fishing operations in the Middle Keys, which he labeled as the ‘Marathon mafia’. Smaller fishers across the Florida Keys, including Jeanette and her husband in the Lower Keys, stated that their input didn’t matter, as the program was not interested in helping out small fishing operations. They, like others, worked with their fish houses and fishing organization representatives to get the best arrangement.

[31] Bill, fish house owner. Personal interview conducted in Key Largo, Florida. January 16, 2011.

The Spiny Lobster Trap Certificate Program[32]

The Spiny Lobster Trap Certificate Program (TCP), passed by the Florida Legislature in 1991, was created to "stabilize the lobster fishery by reducing the total number of traps" (FS 370.142 (1)). The legislation recognized that the fishery was experiencing congestion and conflict, increased sublegal lobster mortality, declining catch per trap, and concern over oil-related and debris pollution. Thus, the stated goal of the program was to increase the yield per trap by reducing a proportionally equal number of traps among participants. This would be achieved by apportioning traps across fishing operations based on previous landings and reducing trap totals until it was determined that the fishery had been stabilized. Specifically, the legislation elaborated that the "objective of the overall trap certificate program is to reduce the number of traps used in the spiny lobster fishery to the lowest number that will maintain or increase overall catch levels, promote economic efficiency in the fishery, and conserve natural resources" (FS 370.142 (3)). The legislation did not identify the total number of traps that it considered would achieve this objective and instead delegated the responsibility of trap reduction to the MFC.

The allocation framework adopted under the TCP was based on reported landings over a three-year period, from the 1989-90 season to the 1990-91 season. Fishers who participated in the spiny lobster fishery over that three-year period were eligible for the trap certificate program and could receive a number of

[32] All information in this section, unless otherwise noted, is from the Florida Statutes section 370.142, which describes the Florida Spiny Lobster Trap Certificate Program.

certificates (where each certificate applied to a trap) based on prior landings. The sum of the highest single-year landings for each licenseholder over the three-year period (up to a maximum of 30,000 pounds) was divided by 700,000, yielding a trap/catch coefficient; then, the total of number of trap certificates allocated to each licenseholder was determined by dividing the highest single-year landings (up to a maximum of 30,000 pounds) for each licenseholder by the trap/catch coefficient. The maximum number of trap certificates allocated under the framework was capped at 2,743 trap certificates per licenseholder, and no licenseholder would be allowed to own more 1.5 percent of the total number of trap certificates in the fishery.

To achieve its objective of maintaining or increase overall catch levels and the promotion of economic efficiency and conservation, the legislation authorized the MFC to set up an annual trap certificate reduction schedule which was not to exceed 10 per year and which could continue until the aforementioned objective had been achieved. The MFC could also "resume, terminate, or reverse the schedule" to protect the resource or fishery participants (FS 370.142 (3)). But, the program did not identify a minimum number of traps that would be considered as the optimum number of traps for the fishery (i.e., where trap reductions would be discontinued).

Unlike most other fishery management measures that the State of Florida has enacted until then, the TCP legislation allowed the market-based transfer of trap certificates across participants. Fishers were allowed to sell a portion or all of their

trap certificates by paying a $2 transfer fee per trap and a first time surcharge of $5 or 25% of the sale price of the trap, whichever was greater. Certificates that had not been previously sold and were thus subject to this first time surcharge were designated as 'A' certificates, and those that were sold for the second and subsequent times were designated as 'B' certificates.

The program also required that fishers affix a tag to each trap, thereby showing that the trap was tied to a certificate, and that fishers pay a tag fee. When the program started, fishers had to pay $1 per tag, a fee that increased to $2 per tag over the program's history. Another cost identified in the legislation which was not implemented in the program was that of equitable rent per trap certificate. Under this provision, the State of Florida retained the right to establish a rule on the amount it could cover per trap as compensation for the fishers' access to the spiny lobster resource.

Finally, the program established an advisory and appeals board that was to provide the MFC with information on the TCP and issues related to allocation and implementation. The board, which was created in 1992, was comprised of nine certificate holders and the Department of Environmental Protection (DEP) Secretary, and it was charged with settling disputes related to allocation, cases of hardship, and other implementation issues.

The TCP was implemented in 1992, which was the first year when spiny lobster fishers were required to deploy the amount of traps that they were allocated under the program. While the program was designed to allocate a total of 700,000

traps in the fishery, DEP allocated 727,313 certificates for the first year of the TCP. The advisory and appeals board was allowed to allocate a further 125,000 certificates, and it ended up allocating 108,178 certificates. Thus, DEP and the board allocated between 835,471 certificates in the first three years of the program. Trap certificates were reduced by 10% at the end of each season for the 1992-93 season, the 1993-94 season, and the 1994-95 season, reducing the total number of traps in the fishery to 606,190 traps at the start of the 1995-96 season. The next season in which trap certificates were reduced by 10% was in the 1998-99 season, when trap totals were reduced to 544,056 traps in the fishery. By the end of the decade, the program had reduced effort by 34.9% (Milon et al., 1999). The reduction schedule from the 2001-02 season forward, where a total of 4% reduction was required per year; however, passive reduction, which resulted from a 25% reduction/retirement of certificates sold outside the immediate family of certificate holders, would be used in calculating total reduction. If passive reductions did not total 4% of the certificates available in that season, then active reduction across the fishery would be applied to achieve the 4% reduction. This modification slowed down the reduction trend, such that certificate totals declined by 10.3% from the 2001-02 season to the 2011-12 season, representing a decrease of 56,189 certificates. There were 486,515 certificates in the 2011-12 season, representing an overall decline of 41.8% of certificates over the program's history[33].

[33] Personal communication, Thomas Matthews, Florida Fish and Wildlife Research Institute, November 6, 2012. State of Florida spiny lobster landing and effort statistics database.

The number of spiny lobster fishers, identified as those operations that held spiny lobster permits, declined over the TCP tenure. Overall, the Florida Keys fishery, as measured by licensed fishers, declined from 3,171 in 1991 to 1,365 in 2008, representing a decline of 57% in the commercial fishing industry. In terms of spiny lobster fishers, a total of 1,584 permits were issued in Monroe County in 1991, and 625 permits were issued in 2008; this represented an overall decline of 61% of permits in the fishery (FWRI, 2013). It should be noted that there were 131 commercial dive permits issued in Monroe County in 2008, showing that the total number of lobster fishers was higher than those that fished using traps (FWRI, 2013). The trap reduction program led to a significant decrease in participation, resulting from both an overall decline due to fewer traps available in the fishery and also because of a shift in effort to the commercial dive sector.

Many of the fishers interviewed in this study represent the "survivors" of the program, as one respondent put it. Jeanette from the Lower Keys[34] related how her family had been forced to buy back into the trap fishery just to be able to survive. Her view, echoed by others, was that the reductions affected those fishers who were among the most conscientious in the industry. She, for instance, had fished a small number of traps for several years. She had not increased her effort over that time. It was only after the program forced her to buy back into the fishery that she tried to increase her effort. Similarly, Thomas from Conch Key had been fishing 800 traps for

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[34] Jeanette, commercial fisher. Personal interview conducted in Key West, Florida. January 14, 2011.

all his life and could not make up for the reductions. He ended up needing to take a third, part-time job, with his wife also entering the labor force. These were not part-timers or less efficient fishers; instead, such fishers were among the most industrious participants who had elected not to increase effort deliberately. Such fishers were also important members of their respective communities, who worked with other, small to medium-scale operators in maintaining their way of life. Jeanette, her husband, and son represented a two-generation fishing family which fished in multiple fisheries, held a small business, employed mates and other workers from the Lower Keys, and who participated actively with management and research personnel for the benefit of the fisheries.

A related decline over the TCP period was the decline in the number of fish processors/fish houses in the Florida Keys. In a study conducted with the commercial fishing industry in 1995, it was estimated that there were 32 fish houses in the Florida Keys that sold two or more fishery products (Milon et al., 1997). ,My research shows that by the mid-2000s the number of fish houses had declined to 14 across the region. This problem was especially acute in the Key West/Stock Island area, where 70% of the lobster fishers interviewed in a 2002-03 study (Shivlani et al., 2005) stated that they docked their vessels in fish houses. As the number of fishers decreased, fish house operators could not rely on a steady source of spiny lobster and other fishery products; this was coupled with an increase in real estate prices, which tempted fish houses to change their waterfront

locations into commercial marinas or residential units and forced fishers to higher cost of living expenses.

Many of the fish house operators I interviewed felt that they were in a bind. These fish houses were losing their best fishers, and the fishers were often not being replaced. One of these owners, Paul from Stock Island[35], told me, "Come and take a look at the empty lots I have. The fishermen are gone, and I still have to pay taxes on the lot. How long can I stay in business?" Another owner, from the Middle Keys, commended the owners who had closed their fish houses, stating that at least the owners had been able to get something for their waterfront space. Overall, the fish house owners had little confidence that the county or state could protect their interests and were thus less willing to state that they would remain in the industry in the near future. The problem that they identified was the inconsistency in supply that resulted from having fewer, dedicated fishers. I found a similar situation develop after the Florida Net Ban (Shivlani et al., 1998). The net ban was implemented in 1995 following a constitutional amendment (Barnes, 1995). In the Florida Keys, supplies of pompano – a fish that was caught using nets in state waters – declined to the point where fish houses stopped buying the product. This was because the fish houses could not guarantee supply to their clients, and the clients

[35] Paul, fish house owner. Personal interview conducted in Stock Island, Florida. December 15, 2011.

found different suppliers. Leo Cooper[36], the manager of the now defunct National Fisheries, a Middle Keys fish house that relied on net caught fish, told me in the aftermath of the ban that this was part of a systematic approach to eliminate fishing in the Florida Keys. A similar sentiment was echoed by fish house owners and operators who I interviewed for this effort, who felt that by reducing the networks of fishers, fishery agencies had weakened the fishing industry to a point of near extinction. A refrain both fish house owners and fishers used was that there would be no more commercial fishing in the Florida Keys in a generation.

Some fish houses that sold out were perceived to have cashed in on time. Fishers like Hernando who used to fish in Gulf Seafood[37], a Stock Island fish house that closed in the second half of the past decade, was not upset that he had been displaced. Instead, he felt that the family that owned the fish house acted correctly. In his view, there was not going to be much of a fishing industry anyway, so why not make the most from the land now? Richard[38], a Lower Keys trapper, bought some commercial waterfront space in anticipation of this decline. He related that he would take care of his crew and work off his own lot, selling lobster with a wholesaler's license. Larger operators across the Florida Keys and especially in the

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[36] Leo Cooper, National Fisheries fish house manager. Personal interview conducted in Marathon, Florida. June 24, 1997. Unpublished data from Shivlani and Milon (2000).

[37] Hernando, commercial fisher. Personal interview conducted in Stock Island, Florida. October 22, 2006. Unpublished data from Shivlani et al. (2008).

[38] Richard, commercial fisher. Personal interview conducted in Stock Island, Florida. October 23, 2010.

land-scarce Lower Keys saw the loss of waterfront space by the first few years of the 2000s, and those who could afford to purchased waterfront lots where they stored their gear and docked their vessels. As gentrification started to take hold, fishers who held property were enticed to sell their homes and to leave the industry. Bobby told me that at the height of building boom, tiny single-family homes along Flagler Avenue (a non-waterfront location in Key West) were selling for $500,000 or more. At the height of the gentrification period in 2006-07, the median single-family house price in Key West exceeded $700,000 (US Census, 2013). As fishers moved out, of whom many represented second or older generations of fishing families, they tear the social fabric of their respective fishing communities and depleted their fish houses of member fishers. Thus, the spiral continued until the fish houses had to make the difficult decision as to whether to remain in business or to sell the properties to non-commercial fishery uses.

Performance under the TCP: Climbing back up the yield per trap ladder

Among the primary management concerns in relation to overcapacity was that yield per trap had decreased over the spiny lobster fishery's history. The remedy, as espoused in the TCP, was to reduce the total number of traps, and that would increase yield per trap. This approach, sometimes called 'climbing back up the ladder', would presumably allow the fishery to regain its previous efficiency by shedding excess effort. As will be discussed later in this chapter, the social benefits associated with higher rates of participation (both within communities and across

the Florida Keys) and a historical analysis on the expansion in the trap fishery were both largely absent from this approach, which focused mainly on economic efficiency.

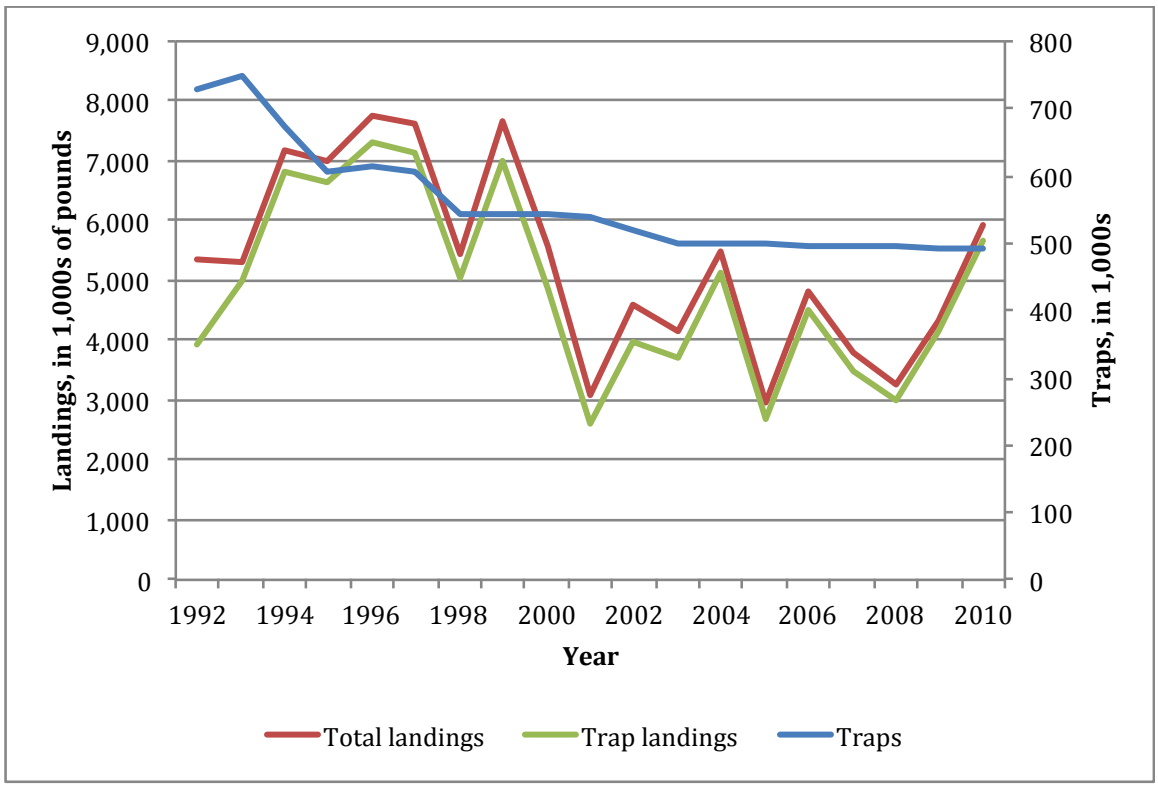

Figure 21: Florida spiny lobster landings, trap landings, and traps (Vondruska, 2010)

Figure 21 demonstrates that landings fluctuated considerably in the spiny lobster fishery since the implementation of the TCP. In particular, landings dropped considerably for both the entire fishery and for the trap sector from the 2001-02 through much of the rest of the decade. Landings in the 1990s for the trap fishery averaged over 6.1 million pounds whereas landings in the first decade of the 2000s averaged 3.8 million pounds (Vondruska, 2010). The reason for the decline remains unclear, with hypotheses claiming that it was the result of hurricanes, overfishing in the source areas for the Florida Keys spiny lobster fishery, habitat degradation,

climate change, and the proliferation of a herpes-like virus, among others (Behringer et al., 2012; Ehrhardt and Fitchett, 2010).

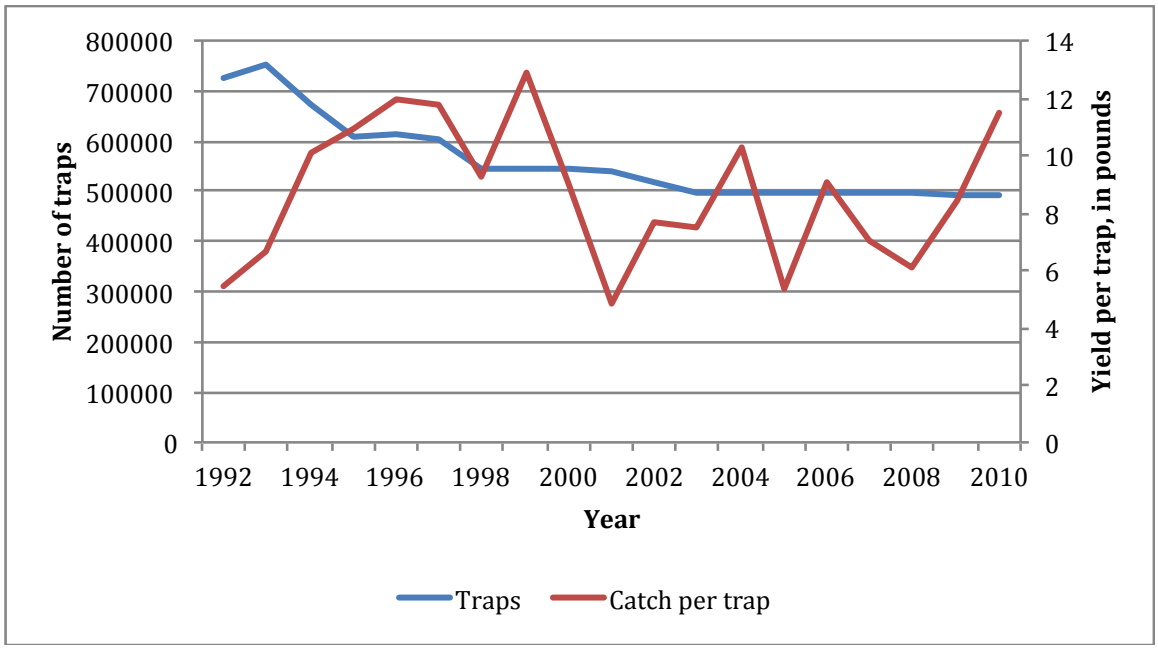

Figure 22: Spiny lobster catch per trap (Vondruska, 2010)

As shown in Figure 22, yield per trap fluctuated considerably following the establishment of the TCP. While trap yields increased to over 10 pounds per trap in the first few years of the program, yields decreased to half that amount in the 2001-02 season and 2005-06 season. On average, yields in the 1990s were 9.9 pounds per trap, compared to yields of 7.5 pounds per trap in the first decade of the 2000s (Vondruska, 2010). Yield per trap consistently followed the trends in landings, such that yields were lowest in poor fishing seasons, and that there was no consistent increase in yields following several years of trap reduction. By contrast, traps were more effective from the mid-1970s and earlier, when the yield per trap was over 26 pounds per trap (Harper, 1995). While this was likely related to the lower number of traps in the fishery (less than 400,000 traps), the higher yield per trap also

reflected the harvest from the rich Bahamian fishing grounds. In fact, the yield per effort did not exceed 15.6 pounds per trap since the closure of foreign fishing grounds in 1975 through 2010 (Vondruska, 2010).

Factors affecting yield per trap other than the natural variability of spiny lobsters in the fishing area consisted of competition from other sectors of the fishery, namely the commercial and recreational dive sectors, which were not subject to effort quotas or reduction. The commercial dive sector expanded in the years following the establishment of the TCP, as entrants sought to compete for spiny lobster with trap fishers. However, as there were no limits placed on effort in the commercial dive sector, the sector began to expand quickly. Landings by the commercial dive sector increased from less than 3% in the first year of the TCP to 14.5% in the 2001-02 season[39]. The Florida Fish and Wildlife Commission (FWC) recognized the allocation problem the sector represented, and the rules were changed to limit entry in the commercial dive industry. Only those divers who could document landings from July 1, 2000 through June 30, 2003 were eligible to purchase a commercial dive permit, which could not be transferred outside the immediate family. The FWC also prohibited active trap fishers from obtaining commercial dive permits. Permits were only issued through the end of 2004, and the FWC implemented a ten-year ban (through 2015) on issuing new permits. Also beginning in the 2004-05, the FWC determined that divers would be only allowed to

[39] Personal communication, Thomas Matthews, Florida Fish and Wildlife Research Institute, November 6, 2012. State of Florida spiny lobster landing and effort statistics database.

harvest a maximum of 250 spiny lobsters per day. A total of 177 commercial dive permits were issued for Monroe County for the 2004-05 season, and the permits declined each season thereafter, decreasing to 131 commercial dive permits issued for the 2008-09 season. The permitting system also affected the dive sector's share of landings, which declined to an average of 5.9% from the 2004-05 season to the 2010-11 season.

The dive sector that emerged after the TCP was both reviled and celebrated in the commercial fishing industry, depending on the primary gear of the fisher. Fish house owners such as Gerald in the Middle Keys[40] believed that the dive sector was largely a set of illegal operations, which relied on placing disallowed items (such as car tires, washing machines, etc.) on the ocean floor to attract lobsters. Gerald, whose fish house represented large trap fishing operations, felt that the dive sector should be severely restricted or altogether eliminated. Smaller operators who had been allocated few or no traps or were recent entrants held the opposite view, in that they argued for increased access to the trap fishery. Dan, a long-time diver in the Lower Keys, stated that he had been fishing with dive gear for several decades and that he should not be discriminated against or removed from the fishery. These divisions, which were always present among gear lines, deepened as the TCP reduced effort and restricted entry. The low level of trust, or camaraderie, within the industry declined such that fishers were now less willing to fight for a common cause than in the past. This fragmentation had significant impacts on the social

[40] Gerald, fish house owner. Personal interview conducted in Marathon, Florida. March 12, 2011.

capital. Richard, who had worked in loose affiliation with fishers in the Key West and Stock Island area in the past, reported that he had withdrawn from all organizations and that he was working using a wholesale permit, which allowed him to sell his product directly to wholesalers. While in Richard's case, his decision was motivated by the fewer number of fish houses in the region to which to sell his catch, other fishers, especially divers like Dan, were simply distrustful of trap fishers, who they believed were in cahoots with government to limit divers.

The recreational share of the overall spiny lobster fishery is usually harvested in the mini-season through the first few months of the season. Since the inception of the TCP through the 2009-10 season, the recreational sector captured an average of 23.6% of the fishery (an average of 1.61 million pounds) (T. Matthews, personal communication). The average percentage increased from 21.6% in the 1990s to 25.0% in the first decade of the 2000s. While the total amount harvested by the recreational sector declined from the 1990s to 2000s, the percentage share slightly increased. Thus, a slightly larger percentage was de facto allocated to the recreational fishery since the passage of the TCP.

A breakdown in social capital: Unintended impacts of the TCP

The TCP was designed to reduce fishing effort via trap reduction, which it was able to accomplish via a series of active and then active-passive reduction measures. The TCP also accomplished a reduction in effort by promoting exit among those fishers who felt that the program would reduce traps to levels that would

hinder commercial fishing or those who argued that the program was designed to eliminate commercial fishing from the Florida Keys altogether. Finally, the TCP was able to reduce effort due to what can be best described as unintended (or at least, unanticipated) impacts, resulting from a diminution in the fleet size and participants, and the social feedback loop that eroded social capital. Collectively, these impacts transformed the landscape of commercial fishing in the Florida Keys, weakening the resilience of fishing communities and abetting the rise of gentrification.

Fishing communities in the Florida Keys are very different than fishing communities in traditional maritime ports, such as those in New England, and industrial ports, such as those in Alaska (Jacob et al., 2001). Also, while based on largely small-scale owner-operator units, Florida Keys operations are not akin to artisanal or subsistence-based fleets prevalent in developing countries. Instead, Florida Keys fishing operators and their communities are best described as what Jepson (2007) defined as the "virtual" fishing communities of Florida. These communities are almost invisible as fishing communities, if the definition were extended from what traditional communities look like, such as those found in New England coastal communities. Instead, commercial fishery operations and interests are often embedded within larger, diverse communities such that for the casual onlooker, there is no semblance of a fishing community within these population centers.

Fishers who settled in the Florida Keys outside of Key West largely did not do so in clusters of commercial fishing ports, with exceptions such as Marathon and Conch Key in the Middle Keys (Jacob et al., 2005; Milon et al., 1997); instead, in other areas, such as the Upper Keys, fishers operated from their homes, departing from canals and selling landings to one or more fish house retailers or wholesalers. Thus, affiliation with fish houses and with fishery organizations was often lowest in these areas, which nevertheless could be considered as comprising fishing communities (Milon et al., 1997). Fish houses thus gained importance as areas where fishers could recruit help (i.e., mates), exchange information on fishing areas, landings, and regulations, and where fishers could organize to address regulatory proposals. Jentoft (2000), in his description of fishing communities, likened removing participants as weakening links on a chain. In the case of the Florida Keys spiny lobster fishery, the TCP effectively weakened the links by reducing effort and facilitating consolidation. However, because the fishery did not provide an overwhelming or iconic, physical presence, the diminution of the fleet and its impacts on the integrity of the virtual fishing communities was not readily identified.

Under the TCP, the Florida Keys lost over 60% of the spiny lobster licenses issued over a 20-year period (FWRI, 2013). While the consolidation was in part due to forces other than the TCP (as has been discussed under non-fishery factors in Chapter 4), the program nevertheless had significant and, indeed, intended impacts on participation. Using economic efficiency as its lodestar, the State of Florida

expected that by reducing effort on a proportional basis across the entire fishery, the industry would climb back up the yield per trap ladder and transfer reduced effort to the most efficient operators (FS 370.142). By including provisions on recovering equitable rent, the statutory language ensured that the program would use the rules of economics to reach a sustainable solution. The decline in effort and participants was hailed as a positive metric that demonstrated that the program was achieving its objective of reducing the number of traps (Milon et al., 1998). Even in years when the fishery underperformed, analyses undertaken to assess the economic condition of the fishery concluded that reduced effort had in fact prevented an early season collapse (Ehrhardt and Deleveaux, 2009). Thus, the conventional wisdom was set towards explaining that effort reduction was beneficial to the fishery in both good and poor years; after all, higher yields in good years promoted greater profits and lower yields in bad years were mitigated by fewer participants and reduced effort (leading to fewer losses). What were lost in this approach were the fishing communities, which became less robust as the program's dedicated effort and reduction components took hold and whose disintegration affected overall fishery resilience (Shivlani and Milon, 2000). To best understand the TCP's long-term impacts, it is instructive to review the conditions that the statutory language set for operationalizing the program and its effects on fisher behavior and fishing community resilience.

In its framework, the TCP presented an almost intractable problem: allocation. The program's objective was to reduce effort while promoting

sustainability. But, how would it allocate certificates? The decision made was to allocate certificates based on the best of the previous three years' landings. In effect, fishers who were high-liners and who fished the greatest number of traps were, in many of their cohorts' views, rewarded for having created the problem of overcapacity in the first place (Shivlani and Milon, 2000). Also under the allocation scheme, the TCP did not account for regional differences across the Florida Keys; that is, fishers using less gear were presumed to be small operators and were thus consigned to a lower share of the quota. In an earlier study which I led (Shivlani et al., 2005), it was determined that on average, fishers reported receiving 27% fewer traps than they had fished prior to the TCP. Fishers from the Middle Keys fished an average of 2,100 traps, compared to fishers from the rest of the Florida Keys who fished 1,235 traps or fewer, before the allocation scheme. The study also determined that the 67% initial allocation made a significant difference in the subsequent costs for fishers. Fishers who were allocated more than 1,500 certificates were likely to reduce the number of traps that they fished over the ten-year TCP period. By contrast, fishers who were allocated less than 1,500 certificates were likely to buy certificates. Thus, the allocation affected fishers' purchasing behavior, and it disproportionately benefited those fishers who received the most certificates. Unlike as could be expected under the tenets of economic efficiency, results demonstrated that where one started in the fishery would largely dictate how well one would perform in the long-term. Related to this result was the finding that fishers who fished at lower tiers (i.e., those who held less than 2,000

certificates) were most likely to lease certificates from others (a practice that was disallowed from 2003 onwards).

Another challenge that the TCP presented to the Florida Keys fishing community was its indefinite language on when the program would stop reducing traps. The statute stated that the MFC (now FWC) would set a reduction goal to maintain or maximize annual harvests, but it never identified a minimum trap total for the fishery. Without knowing how many traps they would require to buffer against future reductions, fishers could not plan for the long-term. In my earlier work (Shivlani et al., 2005), it was determined that 80% of the fishers who were interviewed on the TCP agreed that trap reductions should be stopped, and 69% and 67% disagreed that there were too many traps in the fishery (there were 540,000 traps in the fishery at the time of the study) and that trap reductions were an effective way to reduce effort, respectively. Also in the same study, a significant percentage of fishers reported that they would increase effort if trap reductions were stopped, and almost 40% stated that they would leave the fishery altogether if reductions continued over the next decade. Uncertainty over trap reductions was in effect a major impediment to stability, and it may have, in conjunction with other fishery and non-fishery factors, promoted the exit of both part-time fishers and high-liners (Shivlani, 2009).

A third impact that the TCP generated in the fishery was the increased reliance among spiny lobster fishers on a single fishery. Historically, Florida Keys fishers participated in multi-species fisheries, where the fall and winter months

were taken to fishing traps and summer months were spent line fishing for reef fish and coastal pelagics[41]. The TCP sought to "professionalize" the fishery by eliminating part-time effort and by increasing the financial stake that participants had in the spiny lobster fishery. By monetizing traps in the form of transferable certificates, requiring fishers to purchase seasonal tags to be affixed on gear, and having fishers pay for licenses and endorsements, the program made fishers increasingly expend more of their revenues to participate in the spiny lobster fishery. Where in the past fishers may have been able to switch to other fisheries in poor seasons, they were now increasingly reliant on the spiny lobster fishery. In comparing two studies that characterized the Florida Keys commercial fisheries, the earlier study (Milon et al., 1997) determined that the 54% of the 120 reef fish fishers who were interviewed participated in spiny lobster and/or stone crab trip fisheries, and the overall participation rate for reef fish fishers was 2.59 fisheries. By 2005, my colleagues and I (Shivlani et al., 2008) found that only 35% of 45 reef fish fishers who were interviewed participated in one or both trap fisheries, and the overall participation rate had dropped to 2.18 fisheries. The specialization, or professionalization, had occurred not only in the spiny lobster fishery but also in most other lucrative fisheries in the region, such that fishers were now expected to dedicate most of their effort in one or two fisheries.

A fourth impact that the program facilitated by not addressing it until the early 2000s was that of increased effort from other sectors in the spiny lobster

[41] Edward Little, NMFS fishery port agent. Personal interview in Key West, Florida. October 30, 2010.

fishery. The intent of the TCP was to control effort by reducing trap totals, but it did not address effort emanating from the commercial dive industry (or, for that matter, the recreational dive industry). Trap fishers interviewed in 2002 felt that the program was unsustainable as long as it allowed unchecked effort in other sectors while controlling trap fishing (Shivlani et al., 2005). By the time the commercial dive sector had been controlled via a separate licensing program, it accounted for over 10% of the total fishery. The recreational dive fishery was another sector that competed with the trap fishery, and effort in that fishery was not addressed by the TCP (or other regulations). While the recreational sector's share only grew by an average of 3% (from 21.6% to 25% from the 1990s to the first decade of the 2000s), the fact that the recreational sector was not limited to a set allocation remained a concern for the commercial trap industry. Trap fishers felt that they were made to reduce their effort and agree to trap reductions, while the recreational sector was not similarly restricted and was instead even allowed to get continued, preferential access to the resource. This perceived lack of equity greatly affected the fishers' views towards the TCP and, in certain cases, their willingness to remain in the fishery (Shivlani et al., 2005).

The TCP impacts did not occur in isolation and instead were of part of a large set of regulatory and management changes that occurred in the Florida Keys from the 1990s onwards that facilitated the decline of the region's commercial fishing industry. In 1994, the State of Florida passed the Florida Net Ban, approved by popular vote in favor of a constitutional amendment, which banned the use of

gillnets and other entangling nets in nearshore waters (Barnes, 1995). The ban affected Florida Keys fishers who used such nets to target pompano, mackerel, and bait fish, and several of those affected also participated in the spiny lobster trap fishery (Shivlani et al., 1998). In 1997, the Florida Keys National Marine Sanctuary (FKNMS) implemented its zoning action plan, closing off 3.1% of its 2,800 square nautical mile area to all forms of consumptive activities, including commercial fishing (NOAA, 1996).

The FKNMS closed another 151 square nautical miles in 2001 along the western Florida Keys, including important lobster fishing grounds off the Dry Tortugas (NOAA, 2000). Along with these closures, the State of Florida and the two federal fishery management councils increased their efforts in enacting technocratic management, in the form of transferable quotas and permits for other Florida Keys fisheries. Over the 1990s, several of the most lucrative fisheries in South Florida were listed as restricted species, and others were closed to entry altogether. The federal fishery management councils followed the state's lead by making their rules consistent in federal waters. As more fisheries required that participants buy their way into the fishery, multispecies fisheries participation declined (see above), and fishers were increasingly forced to target fewer species. This effectively reduced the fishers' resilience, in that they were no longer able to switch fisheries as they had in the past.

Finally, macroeconomic conditions shifted to increase both fishing costs and cost of living expenses. Spiny lobster fishers were subject to increasing fuel costs

over the first decade of the 2000s, and they made up for this by reducing their other variable costs (Shivlani, 2009). But because the fishers were increasingly tied to the spiny lobster fishery, in terms of investments and annual operating expenses, they could not readily switch to other fisheries (which restricted entry in any case). Over much of the TCP era, spiny lobster prices were flat, such that fishers could not pass on increasing costs to the consumers. On the landside, however, the cost of living in Monroe County peaked by the middle of the first decade of the 2000s, making the county the most expensive county in the State of Florida (BEBR, 2009). Real estate and rental prices exploded in the housing boom, providing lucrative incentives for many fishing families to cash out their investments and leaving the fishing industry and county altogether (known as the so-called "Conch Migration") (Ball, 2005).

The result of the TCP, its impacts, and the prevailing macroeconomic and fishery factors was a collapse in Florida Keys fishing communities from the late 1990s onwards. Proximately, this was in part due to conditions and events that were unrelated to the TCP but which worked synergistically to weaken the fisher and fishing community resilience. Structurally, however, the collapse was a result of the TCP's inability to consider fishers more than units of effort and communities as more than concentrations of fishers; by not anticipating what lowered participation would do to the larger landscape, the program ignored the social dimensions of fisheries and their importance in maintaining functional communities. Jentoft (2000), in his analysis of fishing communities, stated that too often fishery

management atomizes fishers into "positional" units that can be replaced or downsized:

> …vessels can on the fishing ground can be seen in this way (as positional units), likewise communities, especially if one adopts the perspectives of methodological individualism and rational choice that are underpinning the Garrett Hardin argument. (Jentoft, 2000, p. 56).

In doing so, however, the management system undervalues the community, which serves as a learning system, a center for employment, and a center for social networks. As Jentoft put it, "communities are more than simply aggregates of individuals that are driven by self-centered utilitarian motives, but well connected systems rooted in kinship, culture, and history" (p. 56). Also, Jentoft pointed out that in their communities, fishers play more than the rational actor role that management assigns them, and that communities disintegrate as more fishers are taken out of them and the fishing population declines. Jentoft argued that management systems must identify and invest in communities such that communities are not weakened by management actions.

Unfortunately, fishing communities were not identified in the TCP; instead, the technocratic approach considered what was socially and culturally a mosaic of regional fisheries as a single entity, which was experiencing economic inefficiencies and could be disciplined by reducing overcapacity. The impacts that allocation, reductions, and inter-sectoral competition would have across the Florida Keys were largely ignored, as the prime objective of reducing effort was expected to resolve the fishery's (economic-ecological) problems. Fishers, under this approach, would gain

a share of the fishery as their certificates gained value, and the fishery would return to the profitability it had enjoyed in the past.

In the first decade following the program's implementation, yield per trap increased to over 10 pounds per trap, landings reached record levels, and certificate prices[42]. Nevertheless, studies showed that fishers were dissatisfied with the program (Shivlani et al., 2005; Shivlani and Milon, 2000). There was general concern among fishery participants that the program's benefits were ephemeral, that the TCP had increased operating costs, and that the reduction schedule needed to end. Also, at this time, several fishers I interviewed complained that entry into the fishery had been curtailed such that fishers could no longer apprentice as mates and expect to enter the fishery as they had in the past. This, they argued, cut off the transfer of local knowledge and culture, and it truncated the entry of new fishers. The cessation of the apprentice system also transformed the fishing culture, where mates were no longer had a future in which they could replace the captains and were consigned to support positions. In ports like Stock Island, this meant that the availability of mates dropped off considerably, even more so as the cost of living increased in the region.

Also, as the program progressed and more fishers left the industry, fish houses that the fishers supplied were left with stark options. One option was to downscale the operation, another was to diversify in other seafood products, and

[42] Personal communication, Thomas Matthews, Florida Fish and Wildlife Research Institute, November 6, 2012. State of Florida spiny lobster landing and effort statistics database.

the final one was to sell the operation. Among 18 fish houses surveyed in South Florida (Miami to Key West) in 2002-03, spiny lobster was ranked at the top ranked species, in terms of its importance to the operation (Shivlani et al., 2005). The fish houses had lost on average half of their spiny lobster fishers, and 72% of the fish houses reported having problems with spiny lobster supply. The fish houses served more than as just wholesalers, as 72% of them provided loans to fishers for purchasing gear to build and maintain traps and for purchasing certificates, 28% leased certificates to their fishers, and 72% provided slip and trap storage for their fishers. Over half, or 56%, also kept their fishers informed on fishery regulations and regulatory proposals, serving as clearinghouses of such information.

Several fish houses, especially from the end of the 1990s onwards, commenced downscaling and then closing altogether. Whereas there were 32 major fish houses in the Florida Keys in 1995, these had been reduced by 56% to 14 fish houses in 2005. While this did not affect fishers in certain parts of the county where they docked their vessels at home (e.g., Key Largo and the Upper Keys, the Lower Keys), it had a major impact on fishers in Stock Island and Marathon, who required docking slips and trap storage space. Those fishers who could afford to purchase private docking space did so, but others were forced either to relocate to another fish house or to change primary ports. Also, fishers started to obtain wholesale licenses, which allowed them to sell their landings directly to distributors rather than having to work through a fish house. The number of wholesale licenses in the

Florida Keys increased from 80 in 1990 to 106 in 2008, representing an increase of over 32%.

The breakdown in fishing communities, depletion of fish houses, and diminution of the commercial fishery fleet ushered the way towards gentrification. Waterfront space has historically been a scarce commodity in the Florida Keys, and more so following the 1992 Rate of Growth Ordinance (ROGO) that limited development in the county and the proliferation of coastal protected areas, which make up much of the 60% of public lands. The City of Key West had already acquired all the commercial fishing docks within the city's boundaries and transformed these into a mixed development of commercial waterfront businesses and marinas for tourism interests (Schittone, 2001). By the early 1990s, the main fishing port in the Lower Keys was Stock Island, located next to Key West. But, as the 2000s housing bubble expanded in Florida, the Florida Keys became the center for speculation and re-development. By 2006, the county was ranked highest in the state in terms of the Florida Price of Living Index, and in 2008, only two out of 11 fish houses from the 1990s remained in Stock Island (Shivlani, 2009).

Paul, the Stock Island fish house owner, explained how the situation had changed his fish house. The efficiency resulting from reduced participation was only a number and didn't mean anything to him. What mattered was having fishermen at his dock, fishermen out at sea, fishermen bringing in lobster. His family had been in the business in Key West for several generations and in Cuba before then. He saw the fishing industry as a network of fishermen and fish houses. If the fishermen left,

the fish houses would have to be sold. He had barely hung on to his fish house and only so to give his son a chance to become a fisherman. “My son”, he said, “wants to be a fisherman, and I want to give him the chance”. But, he added, the regulations have made that continuity difficult if not impossible. Where would his son be able to find a dock, storage, and other facilities? Where can fishermen, who are now supposedly better off than before, find places that are affordable? The system was set up without thinking about how fewer fishermen would affect the entire region. Fishermen, Paul emphasized, built the Keys. Fishermen built these communities and gave their families a good living. But, the certificate program and other restrictions come along with the promise of making things better for the fishing communities. The regulations had done the exact opposite and now have the fishermen at a point that most don’t want to be part of the industry and certainly don’t want their children to follow in their occupation.

Elsewhere along the Florida Keys, including Summerland Key, Marathon, Islamorada, and Plantation Key, fish houses either consolidated or went out of business. In their place, commercial marinas, private boating slips, and even a super yacht basin were planned and/or developed (Shivlani, 2009). The county and the state both attempted to control the transformation of the waterfront by passing working waterfront legislation and ordinances, but the measures could not address the change that had been set in motion with technocratic management and which had ultimately weakened fishing communities and left them vulnerable to collapse and gentrification.

Ed Little[43], the president of the Key West Maritime History Society and National Marine Fisheries Service (NMFS) scientist and port agent, felt that the commercial fisheries could never return to where they once were. This is because fisheries rely on waterfront space, and that waterfront space had now been transformed for the foreseeable future. He stated that he had seen the same transformation occur, first in Key West, then in parts of the Lower Keys, and now across the entire archipelago. Ed also believed that by replacing commercial fishing with a services economy, the Florida Keys were losing their history, culture, and traditions. While he did not identify the changes as a loss in social capital, Ed was nevertheless adamant that recent regulatory approaches had weakened fishing communities. In his view, there were just fewer fishers out there, fewer fishers to work the waters, fewer fishers to congregate to discuss fishing patterns and changes, and fewer fishers to mobilize and fight against proposed changes.

Social capital and technocratic management: The lessons of the TCP

The State of Florida established the TCP to address the very serious problem of overcapacity in one of the state's most valuable fisheries, and it sought to reduce effort to render the fishery ecologically sustainable and economically profitable. However, missing in this calculus, as has been the case often for technocratic management, was the social dimension. Neither the state nor the MFC (later the FWC) considered how a decline in fishing effort and participation rates would affect

[43] Edward Little, NMFS fishery port agent. Personal interview in Key West, Florida. October 30, 2010.

the fishery – the fishery as defined as a set of fishers, their respective fishing communities, the social interactions between fishers and across communities, and the resource. The TCP accepted the premise that each fisher in the fishery was a positional unit, which would be changed (e.g., reduced or eliminated), and that change would leave the social dimension unaffected or, at least, not significantly altered. The community has often been omitted from this type of approach, where individual fishers are depicted as rational actors in competition with other rational actors. The role of the community as a means by which to promote cooperation and create normative rules and boundaries has either completely ignored or given nominal attention. The value provided by the community in the form of social capital is considered as an afterthought, where the social sciences are often "tacked on" to the more important technocratic requirements. As such, the TCP assumed that by correcting the economic efficiencies and forestalling an ecological collapse, the social dimension would be left intact (or at least not significantly affected). But the question to ask is why does this matter, especially if the intervention has led to lower effort and a more sustainable fishery?

The answer to the question is best obtained by first clarifying that the decision to incorporate the social dimension of the spiny lobster fishery in a technocratic approach was not a choice between the ecological and economic health of the fishery and the social welfare of its participants. The TCP could and should have considered the social dimension to improve the management approach. If, for instance, the program would have contained as one of its metrics the integrity and

sustainability of fishing communities, then it could have modified its reduction schedule or mode of reduction to promote participation. As explained to me by several, small scale fishers at one of the now defunct fish houses in Stock Island, the TCP was established with only the larger operators in mind. Why were the smaller operators not considered? Did they not mean anything to the fishery? Why was it, as Giuseppe [44]– one of the older fishers - asked, that his years of fishing the waters off Key West not count for anything? He had been fishing in the region for over half a century but was given only enough trap certificates to survive in the fishery. Giuseppe felt that his knowledge, ties to the fish house, and ties to the community were completely ignored in favor of making rich fishers even richer.

Similarly, if the program would have identified the continuation of the apprenticeship system as an objective, the program could have been established to sustain that system. No trap certificates were set aside to be given to aspiring entrants, mates who had been working in the fishery with established captains, or others who had experience in the fishery but who lacked the capital to enter the fishery. A system which in the past at least afforded industrious mates to slowly make their way up to captain and become operators had ossified into a class system, characterized by the wealthy operators and the penurious helpers and mates. Billy in Stock Island complained that he could no longer find reliable mates for his fish house captains. His concern was that all the mates that were left after the more

[44] Giuseppe, commercial fisher. Personal interview in Stock Island, Florida. October 29, 2010.

competent ones left had substance abuse problems. This, in Billy's view[45], was directly a result of the TCP, which had made it a futile exercise for competent mates to participate in the fishery. Another aspect of the curtailment of the apprenticeship program was the reduction in cooperation and inter-personal relationships. As pointed out by Billy, the new mates are increasingly more like day laborers, and many are no longer part of a long-term unit. He had seen a decline in the shares system, under which the vessel and captain took the largest shares and mates took equal shares, and it had been replaced more frequently by the daily rate system. In the daily rate system, mates were paid a base rate (usually under $100/trip) for a day's work. Because the latter system relied on day laborers rather than committed crew members, the fishery had migrated from one in which the same crew worked together for one or more seasons to one where crew were replaced, based on availability and, increasingly, sobriety. It is not suggested that this is a widespread phenomenon, but my interviews and long-term research in the region found that there had been a profound shift in captain-crew relations in several operations.

The other consequence of the failure of the TCP to create an apprenticeship program or to promote small and medium size operations, or to even generate a perception of fairness among smaller operators, was distrust in the industry. As previously stated, several respondents who I interviewed identified the Marathon fleet out of one fish house, as the "Marathon mafia". Social capital relies on trust within a group, and while my results do not suggest that there may have been a

[45] Billy, commercial fisher. Personal interview in Stock Island, Florida, October 29, 2010.

great amount of trust across participants in the industry, the fishers interviewed unequivocally stated that the program had degraded much of the underlying trust. This is demonstrated not only by the views on different operators provided by respondents but also by the declining rates of participation in fishery interest organizations over the years that I researched fisheries in the region. Total participation in the Organized Fishermen of Florida (OFF) and Monroe County Commercial Fishermen (MCCF) (now the Florida Keys Commercial Fishing Association (FKCFA)) dropped from the 1990s to the late 2000s (Shivlani et al., 2009), and several of the small scale fishers I interviewed reported dropping out because they felt that the organizations no longer represented their interests. They felt that they paid their dues into these organizations only to support the demands of the larger operators, who had been responsible in part for the changes in management over the past two decades. Even some of the larger operators, such as Bobby in the Lower Keys, felt that the organizations had impacted his operation by working with management to implement measures that had undermined the fishing community.

Other aspects that the program could also have identified as key parameters for gauging the success of the program include the level of participation in relation to the availability of fish houses and the facilities they offer, the regional distribution of effort and vulnerability of fishing communities, and the synergistic effects of non-fishery factors (such as affordable housing and housing demand, fuel costs, cost of living), among others. The incorporation of these social measures would not need to

have been done at the cost of reducing the efficacy of the program and may in fact have improved fishers' views on the program, its objectives, and its effectiveness.

Fish house owners across the Florida Keys were irate over how little the program had considered their contribution to the region's fishing communities. As Bill, the Upper Keys fish house owner, explained it, fish houses and fishers enjoyed a mutual relationship prior to the TCP. Many of the fishers in the Upper Keys only fished lobster part time and otherwise provided a regular supply of fin fish to the region's fish houses. But, the program somehow presumed that these fishers would somehow just intensify their efforts in fisheries that were already at capacity? Bill was especially upset at the fact that these changes had affected some of his best and most trusted fishers, who were by then either exiting the fishery or planning to exit the fishery. He felt that the reorganization of effort away from the Upper Keys had occurred not because there were fewer lobster in the region but because larger operators had been able to buy a lot of the certificates. The resulting mismatch of traps and fishers had resulted in many of his fishers exiting and reducing the supply to his fish house. Bill wanted to know why the government had not considered his community, comprised of his fish house, his fishers, and their families, in the decision making and why traps had been allowed to be transferred across what are very different fisheries. This is an important point, as it demonstrates that while the lobster stock may be a single stock across the Florida Keys and South Florida, it is not fished the same way across the archipelago.

National Standard 8 of the MSA states that US federal fishery conservation and management measures "shall be consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to **fishing communities** in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities" (16 USC 1851 (a) (8)). The federal fishery approach mandates the need to consider fishing communities in fishery management decision-making and calls for the "sustained participation". The TCP, in its statutory language and via its implementation, did not fully consider fishing communities in managing the spiny lobster fishery, relying instead on the expected gains via economic efficiency to restructure sustainable fishing communities. However, as Jentoft noted in his discussion of fishing communities, "viable fish stocks require fishing communities" (Jentoft, 2000, p. 53); until the social dimension is incorporated into management, instead of being added after management decisions have been made, its absence will continue to undermine the resilience of fishing communities.

The rise, consolidation, and decline of the Florida Keys spiny lobster fishery elucidates the failure of technocratic management in failing to consider the importance of the social dimensions of fisheries. The commercial fishing sector, which had enjoyed a reef fish bilateral trade with Cuba in the 19th century, expanded into northern US markets following the completion of the Overseas Railroad in

1912. The spiny lobster fishery that developed as a result of demand was subject to a variety of local regulatory measures, as early as the second decade of the 20th century. Thus, the notion that the fishery was somehow unregulated until the imposition of technocratic measures in the federal fishery management era is incorrect.

Local and state regulations developed in line with the growth in effort and landings in the spiny lobster fishery, and gear and size restrictions followed technological improvements in the industry (e.g., the standardization of trap dimensions following the introduction of the wooden slat-trap in the 1940s (Moe, 1991)). When a significant recreational sector added to the effort and led to use conflicts, the Florida Legislature passed a special recreational fishing season (Labisky et al., 1980). Additional measures on participation in the commercial sector, via licensing, income dependency, and endorsements, followed. This brief summary demonstrates that the fishery-regulations system was a dynamic one, where changes in gear, effort, and participation were regularly countered with adjustments in the regulatory approach. In other words, management had an opportunity to build on this regulatory structure when it identified the problem of overcapacity in the 1980s.

The roots of overcapacity were partly misinterpreted by management, which pushed the narrative of unfettered growth in a commons environment leading to excess effort and inefficiencies resulting from overcapacity (see for instance Milon et al., 1998). The narrative assumed that excess effort resulted from a combination

of the closure of foreign fishing areas to the US fishing fleet (and the resulting displacement into domestic waters) and the incentive to overcapitalize in an open access system; however, the narrative did not consider in detail how increased capacity, realized as greater investments in capital intensive gear such as traps (of which the wooden variety lasts an average of four years) and larger vessels, could have been made in a fishery that was presumably returning lower returns. The narrative surmised that participants in the fishery were either ignorant of this long-term trend or were caught in a competition spiral with other participants. In doing so, the narrative concluded that effort increased because of the open access nature of the problem, thereby necessitating the need for technocratic management.

A reasonable argument concerning the narrative may be it should not matter how the fishery arrived at overcapacity, and that the most important result was the need to reduce that overcapacity via technocratic measures. But, it does matter how and *why* effort increased to the level that it did. This is as important as the measures taken to remedy that situation. If, for instance, as my research has shown, overcapacity developed in tandem with the drug trade, and increased gear investment among part of the fishery was a result of money laundering, then it changes the reason why fishers were capitalizing in a fishery that would yield a low to even negative return on investment. McCay and Jentoft (1998), Buck (1985), and others have made a similar argument against Hardin's definition of the commons, arguing that narratives do matter as they influence our decision making on current problems. In the case of the spiny lobster fishery, the narrative was incomplete and

led to solutions that largely omitted the reasons for the transformation in the fishery. Also, by largely ignoring the social dimensions of the fishery, these very solutions undermined the resilience of the fishing communities that developed in line with a series of regulatory measures over the past 70 years.

Without a considered approach to the social dimensions of the fishery, the technocratic management effectively adopted an agnostic view on the importance of fishing communities on the long-term health of the commercial fishing industry in the Florida Keys. Fishers were considered interchangeable under technocratic management, and putative high liners were expected to end up reaping the benefits of the effort reduction program. Fishers in this system did not have any value except that which was associated with the effort they represented. Since overcapacity was a problem anyway, removing excess effort, i.e., reducing the number of participants, was seen as part of the overall goal to bringing the region's fisheries towards a sustainable path. Social relations within communities were considered to be outside the purview of the program (Shivlani and Milon, 2000), and the expectation was that the "equal basis" (FS 370.142 (1)) of reductions would assure some level of fairness. Research that I conducted in the mid-2000s found that fishers who were awarded higher totals were more likely to accept reductions whereas those who were awarded lower totals faced a steep challenge to maintain their position in the fishery (Shivlani et al., 2005). Even if the program's intention to use fairness is accepted, the fact remains that via its trap reduction, the TCP did not result in a fair

outcome for fishers who were least responsible for overcapacity, i.e., those fishers who had elected to fish fewer traps.

Social relations that emerged over the program's early history involved trap certificate leasing, which I evaluated in an earlier study (Shivlani and Milon, 2000). Because there are minimal restrictions on who can purchase certificates, non-fishers could and did buy their way into the fishery only to lease certificates. Several fishers I interviewed back in the late 1990s called this a return to a feudal system, where they were no longer able to earn enough to purchase trap certificates because they had to pay high rates to lease certificates for the season. The State of Florida ended leasing in 2003, but the activity had severe consequences in the communities, including an increase in mistrust between fishers, and increase in unequal economic and social relations, and an overall frustration with the management strategy. Even after leasing had ended in the fishery, field research that I conducted with trap fishers would often lead to their views on how leasing had damaged the fishery for the long-term.

A central aspect of participation that the program mostly ignored was the importance of having a threshold of fishing and fishing-related operations to build and maintain social capital. Fish houses often took the place of fishing villages and towns that exist in more traditional fishing communities. As discussed in Chapter 3, it was around the fish house docks and outside the fish house office that fishers congregated to exchange ideas on fishing techniques, compare notes on landings, complain about existing and proposed regulations, and strategize on how to

respond to proposals that may affect their livelihoods. The TCP, as many fish house owners told me in the mid-2000s, had affected supply to the point where several fish houses (especially the smaller ones) would be closing down. Supply was negatively impacted because fishers whose trap totals were reduced were forced to exit the fishery, others who sold their operations because they saw no future in the fishery, and others who left to become independent wholesalers. The spiral was thus set in place. As fewer fishers were left in fish houses, fish houses no longer had a steady supply of fisheries products. Such fish houses closed down and were often taken over by other waterfront concerns (e.g., recreational marinas) or gentrified, leaving the remaining fishers to find dock spaces in the few remaining fish houses. Over time, the dozens of fish houses and thousands of fishers, mates, and helpers dwindled into a handful of fish house and a few hundred fishing operations. The TCP had ostensibly achieved its objectives, of reducing effort and participation, but at what cost? Could not have participation been maintained in a way as to allow the social configuration to change on its own, rather than by being fragmented? Could the program not have reduced trap totals without decimating fish houses and fishing communities? Could the program not have worked more closely with the communities to adopt an adaptive approach that could have identified and ameliorated some of the dampening effects that reductions had on cooperation, trust, and confidence?

These questions become relevant only when the social dimensions of fisheries are acknowledged as having an equal place with economic and ecological

imperatives. Otherwise, as has been discussed in Chapter 3, social dimensions are relegated to a post hoc analysis, where fishing communities and their social benefits are described in a post-mortem as a lamentable yet necessary sacrifice to the benefits of privatization and sustainability. The fishery is memorialized in a tableau of sorts, in the form of monikers given to gated communities, tourist-friendly docks that preserve the rickety paths that once transported seafood and supplies in a working waterfront, and the inevitable row of restaurants and bars often occupying refurbished fish houses that now advertise fresh caught seafood imported from foreign shores.

CHAPTER 7: A NEW FISHERIES MANAGEMENT AGENDA

Introduction

Before engaging with the dissertation's findings and my recommendations for a new management agenda, I revisit the Florida Keys vis-à-vis the lens of the conventional narrative. I briefly presented the conventional narrative in the introduction, demonstrating its fallacies in fully accounting for what occurred to the Florida Keys fisheries, fishers, and their communities over the span of technocratic management, especially as the management approach eroded social capital and exacerbated the effects of non-fishery factors. In doing so, I have also presented a revised narrative that more fully captures the complex of resource abundance, economic conditions, social relations, place, and the macroeconomic forces that interacted with the preferred management actions in determining the performance of region's fisheries, the strength of its fishing industry, and the sustainability of its fishing communities.

Also, as I described in the introduction, the conventional narrative for the Florida Keys and elsewhere has been shaped by the twin ideologies of economic integrity and economic efficiency. By combining the ideologies, technocratic management has been elevated as the best approach by which to stop overfishing and improve efficiency. Furthermore, under the conventional narrative, fishers and their communities have no agency and cannot self-organize to manage their resources (Jentoft, 2000; McCay and Jentoft, 1998). Hardin's (1968) tragedy looms over these fisheries, unless measures are taken to solve the open access conundrum.

Difficult, rationalization measures are taken to reduce effort and to professionalize the fleet, and while participation declines and fishing communities fragment, the end results under the conventional narrative are ecologically robust and economically profitable fisheries. Fisheries effectively are transformed from an unstable equilibrium state characterized by open access and unlimited entry to a stable equilibrium state with strong property rights and very limited entry.

My revised narrative shows that technocratic management has had devastating impacts on fisher participation, fishing communities, and fishery networks specifically because of its exclusion of social sustainability in its ideological framework and its inability to account for the effects of place and its attending, non-fishery factors on fishery performance. In the Florida Keys, the various rationalization programs have reduced participation in all fisheries by over 50% in the last two decades and by two-thirds or more in the lucrative trap fisheries (FWRI, 2013). Whereas in previous decades, such as after the depressed 1930s or after debilitating tropical storms, when displaced fishing effort could return to the region after demand had been restored or infrastructure had been rebuilt, this is not the case under the technocratic management era (Shivlani, 2009). Fishing communities decimated by the effort reduction and entry measures have left open spaces in the working waterfront subject to gentrification pressures; once gentrification has taken hold, the waterfront has been changed permanently, allowing little to no opportunity for the return of commercial fishing activities and infrastructure. Much of the working waterfront, once characterized by fish houses,

gear storage facilities, fishing-related businesses, and boatyards, has been transformed into recreational marinas, waterfront housing developments, and tourist districts. Measures taken at the local and state level have attempted to slow down some of this transformation, but these have been largely unsuccessful in preventing declining fisher participation.

Technocratic management in the Florida Keys has effectively created a vicious circle, via which rates of fisher participation and levels of waterfront transformation have worked in a positive feedback loop. By reducing participation, technocratic management has, on one side, eroded social capital and, on the other, exacerbated the effects of non-fishery factors. As fishing communities and networks have dwindled due to lower participation rates, fishers have been less able to mobilize or exercise collective action to counter gentrification pressures. Gentrification pressures on the working waterfront, once established, have increased waterfront-associated costs, increasing uncertainty and promoting fisher exit. The remaining fishers have retreated into the fewer remaining fish houses and other enclaves, opening up even more waterfront. This phenomenon has been well described for Key West Bight, which changed from a historical, working waterfront to a tourism destination in the 1980s (Schittone, 2001; Little, 2000). But since then, the phenomenon has been occurring all across the Florida Keys (SFPRC, 2005), as measured by fisher participation, fishery production, and the number of fish houses, among other metrics, demonstrating the region-wide impacts of technocratic management. Under the revised narrative, as in the conventional one, the new

equilibrium is one of fewer, professionalized fishers working in discrete parts of a largely gentrified waterfront, exporting a majority of their landings to regional, national, and even world markets. However, what the revised narrative shows is that this new equilibrium has been one of choice and not of necessity. As Bromley (2009) has argued, disciplining fishery effort does not require a technocratic management approach. Well-planned, traditional management measures can yield similar resource results as property rights (Dietz et al., 2003). Also, as shown in the revised narrative, the choice of elevating economic efficiency over social sustainability has profound and lasting impacts on the waterfront, resource allocation, and fishing communities – in the case of the Florida Keys, the identity of the region. Before developing a management agenda that can challenge this approach, it is important to revisit fishery performance in the context of social capital and place and its complex of non-fishery factors.

The undermining of social capital

Technocratic management failed to account for social capital in two main ways in the Florida Keys: First, from an ideological standpoint, fishers and communities were relegated as objects upon which technocratic management worked and which it reshaped; second, because technocratic management emphasized competition as a major organizing principle, it effectively undermined trust and competitions, factors that engender and enhance social capital. Thus, the technocratic management framework adopted to address Florida Keys fisheries was

fundamentally flawed, in that it could not incorporate social sustainability, as it did ecological integrity and economic efficiency, in the calculus of sustainable fisheries policy. Furthermore, by elevating competition as the organizing principle for achieving sustainable fisheries, the framework had no 'room' for accommodating trust and cooperation (other than a result achieved by rational actors promoting their self-interests).

As described by Pretty (2003), social capital has often been described as the 'third way' to achieve the sustainable, common pool resource (CPR) management. While there is no guarantee that social capital may lead to sustainability, the other two ways, governmental regulation and property rights, also have a mixed record (Dietz et al., 2003). From a neo-Malthusian perspective taken to its extreme, individuals within a Hardin commons are simply incapable to achieving a sustainable outcome; this tautology assures that no solution other than that which assures state oversight or property rights can ever succeed. Therefore, technocratic management – which draws ideological support from Hardin's tragedy – cannot accept social capital as a means by which to achieve sustainability, as there is simply no room for social arrangements or assets within technocratic management. While critics (Urquhart et al., 2009; Symes and Phillipson, 2009) call for reforming the approach by adding the metaphoric 'third leg' of social sustainability to balance the other two legs representing ecological integrity and economic efficiency, it should be clear that this would require a new, integrated framework. That is, the addition of the social sustainability leg to technocratic management would likely resemble

present-day fisheries management, in which social factors are evaluated in the context of impacts and not inputs, where the fishers and their communities are objects and not agents. This is particularly the case in federal fisheries management considerations for community sustainability.

The MSA's National Standard 8 states that federal fisheries management actions, such as Fishery Management Plans (FMP), must take fishing communities into account to provide for the communities' "sustained participation" and to minimize "adverse impacts" (500 CFR 600.345(a)). The MSA guidelines require that communities and their participation in fisheries should be balanced within the "constraints of conservation and management goals of the FMP, other national standards, and other applicable law" (500 CFR 600.345(c)(5)). The 2010 US National Catch Shares Policy, which adopted property rights as a tenet of US fisheries management policy, also acknowledges the importance of communities and calls for their sustained participation to the extent possible to achieve sustainable fisheries (NOAA, 2010). However, these and other laws designed to protect fishing communities and other social dimensions of fisheries have a simplified view of communities. A fishing community under the MSA guidelines is one that is "substantially dependent on or substantially engaged in the harvest or processing of fishery resources" and "a social or economic group whose members reside in a specific location and share a common dependency" (500 CFR 600.345(b)(3)). Also, as exemplified under the US National Catch Shares Policy, the intent is to "achieve the long-term ecological and economic sustainability of the

Nation's fishery resources and fishing communities" (NOAA, 2010, p. ii) when implementing property rights. Communities thus remain as objects upon which action needs to be taken, rather than participants in a project to conserve resources. Social capital and its benefits are not goals to be considered in line with economic efficiency because the communities that engender and nurture such capital are the very objects that technocratic management will attempt to salvage as it disciplines fisheries. Thus, whether communities provide the basis for social relations resulting in trust, cooperation, and networks is not even a concern because these relations are not given much standing in fisheries management. This is why fundamental issues such as the initial allocation of quotas or effort, allowance for new entrants, and quota concentrations and oligopolistic behaviors, among others, are downplayed as technical problems that need to surmounted to achieve effective property rights rather than the social crises they represent (Olson, 2011).

The asset base of social capital is enhanced by repeated interactions that via their iterations create exchanges, ties, and obligations (Pretty, 2003). These interactions generate trust between users, that lowers the transactions costs of enforcement and monitoring, and enhance cooperation by harmonizing individual and group objectives. Technocratic management views such arrangements as sub-optimal (see above), and it re-organizes fishers into units of effort (i.e., firms) that compete against each other in a market. Self-restraint that is a result of long-standing, community rules and norms is misidentified under technocratic management as a fool's errand, or what Hardin described as "psychologically

pathogenic" (Hardin, 1968, p. 1247). Fisheries rationalized around the competition principle are effectively encouraged to reduce cooperation (as that leads to a competitive disadvantage), promote individual over group welfare and benefits (as there is no longer a harmonization of individual and group objectives), and reconfigure existing social networks (as there is a greater need of in-group bonding than across-group bonding).

Under technocratic management in the Florida Keys, fisheries suffered two main impacts resulting from increased competition and reduced cooperation. Bonding social capital actually increased within certain groups and communities but at the expense of bridging social capital across the region. Groups that gained market share in the wake of the property rights programs implemented for various fisheries were often vilified by fishers with smaller operations who argued that the larger operators were only in favor of their interests and not those of the greater fishing industry. Conversely, participation in fishery organizations increased as the number of participants declined, and the average size of each operation increased. The inclusive nature of fishery organizations showed that the remaining fishers increasingly relied on bonding social capital to promote their interests. Also, as property rights programs went into effect, the fisheries' apprenticeship system effectively collapsed and was replaced in part by more of a day labor system. The cooperative venture, via which entrants into a fishery were afforded experience to gain expertise while working on fishing boats, allowed for the apprentices to 'graduate' into the fishery as captains. This system facilitated long-term

relationships between captains and crew, with the latter gaining important, local ecological knowledge and learning social norms and rules concerning the fisheries. Unlike transient mates who are not tied to a particular vessel and earn a fixed wage per day worked, apprentices were involved in most aspects of fishery operations and earned shares for each trip. But, with this imposition of property rights, the prohibitive costs of entry into many fisheries meant that most apprentices would now no longer be able to start their own operations; it also meant that captains had less incentive to pass on knowledge or help prepare apprentices, as both actions would increase future competition and affect the value of their operations.

The untethering of place

As with its omission of social factors, technocratic management does not accommodate place and its attending non-fishery factors in its ideological framework. I do not suggest that no framework should be bounded, as that can greatly dilute any prescriptive benefits that a framework can offer; I do however fault the technocratic management framework as being too limited in scope and unimaginative in options to be able provide effective policy advice. The reductive nature of the solutions that technocratic management proposes, i.e., limited access, property rights, etc., often interact with non-fishery factors that are endemic to place. Thus, this 'one size fits all' approach can and does exacerbate the effects of non-fishery factors, while assuming that the new equilibrium will resolve such transitory problems. What has been learned from the Florida Keys experience with

technocratic management is that the there might instead be a threshold (Jentoft, 2000), beyond which non-fishery factors gain in impact and from where fishers and their communities cannot be restored. Thus, technocratic management cannot afford its agnosticism concerning place and non-fishing factors, as these greatly influence the success of any program, regardless of ideology.

Fishing communities in the Florida Keys are very unlike those in New England coastal communities, both in terms of how they are organized and their relationship to the region's overall economy. Fishing operations and infrastructure developed in coastal landscape characterized by multiple uses, and fishing communities for the most part likewise grew in larger, diverse communities. The fishery aspect of these communities was never dominant (Jacob et al., 2005), and even by other measures (such as local markets, labor force involvement, and percentage of overall economy), fisheries were never the region's primary economic driver. Also, the fisheries developed mainly to serve outside markets, and thus the economic health of each sector has depended on external demand. Finally, due to its competition with other economies for the scarce waterfront resource, the fishing industry has had to secure dedicated (and often tenuous) waterfront access to maintain production. This description is important because it places the Florida Keys fisheries in context, as being located in a region characterized by outside influences, scarce resources, and competing economies.

Technocratic management was implemented in the Florida Keys with almost no consideration for place, as if the archipelago were an undifferentiated set of

fishing ports which were readily interchangeable and where fishing effort were motivated solely by profit maximization. In crafting the effort reduction program for the spiny lobster fishery, the State of Florida did not consider, for example, the differences in effort profiles among Upper, Middle, and Lower Keys fishers, the relative dependency on the fishery across the region, intra-sector and inter-sector competition, and program effects on participation in other fisheries. This is not to state that these issues were not known or were not discussed as the program was being drafted; my contention rather is that the final regulations did not account for these issues, mainly because the expectation was that by implementing property rights, the fishery would be left to Adam Smith's invisible hand to reach a market equilibrium. Added to this expectation was the assumption that the program would increase the value of fishery by marketizing traps as remaining traps would rise in price as the trap totals were reduced over time, and that this would increase industry support for the program. I spoke to Richard, a fourth-generation and highly prolific fisher in Stock Island, in 1997[46], when the program had completed several rounds of trap reductions, and trap prices had reached their highest point to date. He owned more than 3,000 traps at the time, and his traps alone would have garnered him more than $240,000 if he were to have sold his shares (certificates) that year. I asked him whether he felt that the program had been a success and had provided fishers like him security. He explained that the program had perverted the industry, asking, "Are you (the State of Florida) trying to give people money or

[46] Richard, commercial fisher. Personal interview conducted in Stock Island, Florida. June 30, 1997. Unpublished data from Shivlani and Milon (2000).

allowing them to make a living?". He added that he was not in the fishery because he wanted to sell out when the prices reached their maximum or to fish only for the money. For him (and so many others I interviewed over my fieldwork in the Florida Keys, from 1995 to the present), fishing was a way of life; it represented an identity with which he had been raised and was part of his heritage, and it was now under threat. Having seen his friends being forced to exit the fishery because of the effort reduction program devastated him, and despite the value that the program provided, he wanted it "removed from the Florida Keys".

Due in a large part to the Florida Keys' dependence on outside markets, non-fishery factors have historically dominated the region's fishery production (Shivlani, 2009). As early as 1898, the US Commission on Fish and Fisheries reported the abandonment of the prolific live snapper fishery in which Florida Keys fishing vessels harvested reef fish that they transported in live wells to the Havana market (Henshall, 1897). The collapse in the reef fish fishery, as well as the king mackerel fishery, was a result of political factors, emanating from the Spanish government's decision to impose a "prohibitory import duty" (Henshall, 1897, p. 253) on US fishers. Also, over the same period, the commission described the local crawfish (spiny lobster) fishery, concluding that it was a minor branch of the other, major fisheries that accounted for 31,500 pounds of local sales in 1895 (US Commission on Fish and Fisheries, 1897). Production in that minor branch would exceed a million pounds, as spiny lobster became the Florida Keys' pre-eminent export seafood product from the 1920s onwards, after the Florida Keys were connected by railroad

to the mainland and to northern markets (Labisky et al., 1980). Growth from the 1950s to the early 1980s in most of the archipelago's fisheries were a result of a combination of various non-fishery factors, including urban development, drug smuggling, technology, and favorable macroeconomic conditions, all in support of increasing demand for Florida Keys seafood. From the 1980s onwards, a different set of non-fishery factors dampened production, including the increasing cost of living, higher variable fishing expenses (especially in terms of fuel prices), and the advent of fisheries globalization. Globalization in particular affected fishery production and, in turn, participation, as imported seafood prices for most identical or similar species were lower than Florida Keys seafood prices. Thus, fishers had a limited ability to pass on higher costs, resulting from the various non-fishery factors and regulatory requirements, to the consumer. In the case of fisheries such as pink shrimp, this led to a wholesale exodus of the fleet from Key West and environs to other Florida Gulf coast ports (Schittone, 2001). In other fisheries, the effects of non-fishery factors, exacerbated by technocratic management measures, led to reduced fisher participation and accelerated community fragmentation.

I do not claim that in the absence of technocratic management, fisheries would have been able to withstand the effects of non-fishery factors. I do suggest that technocratic management is at fault for not accounting for how the consolidation and property rights approach that it espoused would interact with non-fishery factors in affecting fishers and their communities. This is because place, like social capital, does not matter to technocratic management. The 'one size fits all'

approach is tailored to address the boundaries of a fishery policy issue, and it has no adaptive mechanisms that are so important to calibrate management. The boundaries in this case are the fishery conditions at the equilibrium at which management is implemented and the fishery conditions when the fishery reaches a new equilibrium. The intermediate period, during which fisheries are downsized, fishing operations are eliminated, communities are fragmented, and waterfronts are gentrified, is presumably just a messy but necessary transition to sustainability. But the intermediate period does matter, and changes to ameliorate unintended impacts can best be addressed if place remains fully tethered to policy. As the rock musician Sting once sang in his response to then UK Prime Minister Margaret Thatcher's 1980s program to consolidate Britain's coal mining industry:

This place has changed for good
Your economic theory said it would
It's hard for us to understand
We can't give up our jobs the way we should
Our blood has stained the coal
We tunneled deep inside the nation's soul
We matter more than pounds and pence
Your economic theory makes no sense

We Work the Black Seam, Sting (1985)

A new management agenda for fisheries policy

Having conducted almost two decades of fisheries research in the Florida Keys over the period when technocratic management was in its ascendency, I have had a unique perspective to observe the dramatic changes that have occurred in the region's fisheries, to its fishers, and in its fishing communities. Florida Keys'

residents often consider themselves as the ultimate refugees, seeking an escape from the rest of the country along the archipelago. The islands have welcomed waves of immigrants, including the Conchs who moved from the Bahamas in the 1800s, the Cubans who arrived over various periods to find employment, organize their independence, and escape communism, and other US-based transplants (Ogle, 2003). Many such residents, especially fishers, display a strong sense of individualism and independence. That independent streak was most vividly on display when in April 1982, the City of Key West seceded from the US and formed the Conch Republic, as a form of protest for the US Border Patrol's checkpoint set up at the entrance of the Florida Keys for drug and illegal alien interdiction purposes (King, 1997).

Making a living off the ocean in the Florida Keys in many ways exemplifies the region's individualism and independence, and the fishers and their communities who participate in this way of life are more than just producers and centers of production, respectively. They represent the lineage of fishers who were among the first settlers following US acquisition of the islands, and their activities comprise the continuation of one of the most durable occupations in the Florida Keys. This history, which mirrors the history of the Florida Keys over the past two centuries, imbues the area with a sense of identity, one which is inextricably tied to the ocean, its resources, and its users. As a society, we have a choice as to whether we want to rationalize fisheries, divesting the fishers and their communities of any agency, elevating competition as the main organizing principle, and promoting an

equilibrium based on efficiency, catch shares, and property rights. These are all reasonable objectives and in fact should be pursued if there is a consensus in favor of them. However, technocratic management cannot be promoted as the *only* choice to address overfishing, as there are ways other than access controls and property rights by which to protect fisheries (Bromley, 2009; Dietz et al., 2003). That is, there is no reason to elevate economic objectives over social objectives – this is, again, a choice. But, I argue that it is false choice to select, rank, or emphasize any set of objectives over another in a management framework, as that creates a dogma. In the case of technocratic management, the dogma is that ecological and economic principles will achieve fisheries sustainability. A better approach is to (a) include ecological, economic, and social principles and to (b) consider the unique circumstance of each fishery, in terms of its place, non-fishery factors, and its historical roots and development, in the development of a fisheries management framework. Much like ecosystem management frameworks, any fisheries management framework must also be adaptive, rather than dogmatic, such that if major considerations have been overlooked, these can be entered into the framework. Regardless of how the framework is developed, the following factors must be given careful consideration in the generation of sustainable fisheries policy.

Developing a comprehensive fisheries management framework

The technocratic management framework is flawed and needs to be replaced by a comprehensive framework that takes into account the ecological health of a

given fishery, the economic condition of the fishing industry, and the social dimensions of the participants and their communities. By the latter, I do not refer to a characterization or description that is commonly found in many planning documents; I instead refer to analyses of well-being, dependency, and vulnerability, etc., that can be used in comprehensive decision-making (see, for instance, Jacob et al., for a description on fishery social indicators). Also within the social factors, the approach must account for social capital, developing meaningful indicators for the levels of trust and cooperation, types of social capital, and levels of connectedness (e.g., social networks). Finally, a comprehensive framework must account for place and its attending non-fishery factors. These can often be readily selected from a wide variety of existing sources, but these need to be prioritized in a way (e.g., risk analysis) to yield some predictive power. Not all factors can or will be identified or accounted for, and that is the reason why any such framework must be adaptive.

Accounting for social capital

Social capital is an asset to fishing communities that leads to intra-fishery trust, greater cooperation, and lower transactions costs (Grafton, 2005; Pretty, 2003). Social networks that develop as a result of high social capital can be robust modes of information exchange (Ropicki, 2013; MacLauchlin, 2011), harmonizing fisheries interests and disseminating key data within and across fishing communities. Linking social capital creates a vertical pathway for communication and trust between management agencies and fishers. These benefits should be

harnessed to increase agency trust, lower monitoring and compliance costs, and provide information (Grafton, 2005). However, this can only be accomplished if management objectives reward cooperation, rather than competition. Whether this means that a particular fishery should be managed with an emphasis on continued participation over consolidation, the prevention of community fragmentation, etc., the goal should be to maintain social capital as the fishers and fishing communities undergo the transition to sustainable fisheries. As such, measuring connectivity, trust, and cooperation should be part of a comprehensive fisheries management framework; these social metrics (however they are parameterized) need to be part of the decision-making matrix (and not vestiges to technocratic management) to provide meaningful advice.

Bringing back place

Planning at an abstract level that incorporates ecological, economic, and social factors is insufficient if place (and non-fishery factors) is left undifferentiated. Fishing communities are very much grounded in place, and where one approach may have worked in one location, that same approach may fail altogether in another location.

A useful example from the Florida Keys that explains the shortcomings of an undifferentiated approach is related to marine zoning in the mid to late 1990s. In 1995, the Florida Keys National Marine Sanctuary (FKNMS) proposed a series of no-fishing zones, including one that was located in the Dry Tortugas, along the western

Florida Keys (NOAA, 1996; NOAA, 1995). This zone was developed using a closed process that paid little attention to local ecological knowledge, fisher and other stakeholder concerns over the zone's impacts, the logistics of establishing and monitoring the zone, etc. Following strong criticism from a variety of sources, and especially the fishing industry, the FKNMS eliminated the zone with the expressed condition that it would restart the zoning process for a Dry Tortugas zone in the future (NOAA, 1996). That process commenced in 1998, and it took a completely different approach than that used in 1995. This process collected biophysical, economic, and social information specific to the western Florida Keys. It also established a working group consisting of representatives from the commercial, for-hire, and recreational fishing industries, environmental groups, and local, state, and federal agencies, among others. The working group, over a series of workshops, obtained input about the location, its uses, its importance to different stakeholders, etc., and in 1999, the members voted unanimously to establish a 151 nautical square mile, no-take zone that the group drafted (Delaney, 2003). Why did the first process fail where the second succeeded? It is because the second process took into account the place, its biophysical, economic, and social characteristics, and local concerns and support.

Thus, a comprehensive fisheries management framework must account for place and its non-fishery factors. This can be done by collecting information relevant to the location, especially as it relates to dependency of the community on fishing activities, other economies and their interactions with the fisheries, the presence

and types of waterfront gentrification activities and pressures, and cost of living trends, among others. Social indicators selected can be used to establish a baseline, which can then be tracked to account for the direction and intensity of change, triggering adaptive strategies, as needed.

Adaptive management

The final factor recommended is adaptive management (Maguire, 2012). It does not need to be formally enshrined in a framework as a periodic re-assessment and could instead be triggered by threshold changes in key indicators. Also, although it would be developed into the management framework, changes (social or otherwise) would not need to be addressed unless these represent an unintended, management consequence.

Adaptive management requires updated and accurate information that can be used to assess changes to a baseline, and these can be best obtained from the fishing communities themselves. Management would be served by linking social capital, which would ensure trust and communication between fishers and managers, allowing the latter to identify changes. Also, managers can use the trust and cooperation with the fishing communities to allow for communities to act as partners in implementing adaptive management. Ad hoc or dedicated fishery panels that bring together managers, fishers, and other stakeholders can serve as excellent forums for identifying such changes, and, based on the authority vested in such panels, provide guidance for management alternatives. There are several examples

of such consultative groups at both the state and federal levels (Crosson, 2013; Gopnick et al., 2012; Helvey, 2004), but there is a need to give these groups more input in the decision-making process, to better represent the different fisher classes and fishing regions, and to keep the groups active, even if they were to convene infrequently.

A good example of an advisory group that was able to gather useful information on fishery conditions, participation, markets, and management issues was the Ad hoc Spiny Lobster Advisory Board, which was active from 2005 to 2007 (Florida Legislature, 2007). The Florida Fish and Wildlife Conservation Commission (FWC) established advisory boards for several fisheries, including the one for spiny lobster, and the role of the board was to provide the FWC with management recommendations over a three-year evaluation period. The board was comprised of lobster trappers, divers, and fish house owners, a nongovernmental organization representative, and management agencies' representatives. The board worked from 2005-07 to assess the condition of the fishery and to develop recommendations to sustain participation, reduce theft, and improve landings, among several others. The Florida Legislature dissolved the board in 2007, arguing that it had met its objectives. While this may have been the case, having perhaps maintained the board while spacing out meetings over longer period could have provided other useful information in this dynamic fishery.

Conclusions

I return to the argument that technocratic management is a management based on choice. I agree that resource sustainability is and should remain the primary objective; otherwise, there would be no industries, no uses, and no communities organized around the resource. But, after management has addressed resource sustainability, and the resource (in this case, fisheries) is not under threat of over-exploitation, then how we choose to organize effort is a matter of choice. Thus, when technocratic management omits social sustainability as an objective, the choice is to elevate economic efficiency as the main social benefit. This choice however has ramifications, in terms of the number and diversity of participants, the health of fishing communities, the robustness of social capital and networks, and the impacts of non-fishery factors.

In some areas, the choice may not be obvious, as social sustainability may not be affected. In the Florida Keys, where place matters very much, the choice is stark. The depletion of the region's fishers and disintegration of their communities, depressed participation and lower production in most fisheries, and a rapidly gentrifying waterfront show the effects of the choice: A once vibrant, working waterfront is transformed into high end residences, tourist attractions, and recreational marinas. If we consider this the right choice, then we are on the right track; however, if we find this transformation unacceptable, then we need to reconsider how we manage our fisheries.

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