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A Picture Is Worth A Thousand Words: Using Anecdotal Data and Photographic Evidence to Obtain Baseline Data for Southeast Florida Reefs

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HALMOS COLLEGE OF NATURAL SCIENCES AND OCEANOGRAPHY

A Picture Is Worth A Thousand Words:

Using Anecdotal Data and Photographic Evidence to Obtain Baseline Data for Southeast Florida Reefs

By

Catherine E. Brady

Submitted to the Faculty of
Halmos College of Natural Sciences and Oceanography
in partial fulfillment of the requirements for
the degree of Master of Science with a specialty in:
Coastal Zone Management
And
Marine Biology

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Submitted in Partial Fulfillment of the Requirements for the Degree of

Masters of Science:

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And

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Capstone Committee Approval

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Dr. Kenneth Banks, Major Professor

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Dr. Manoj Shivlani, Committee Member

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To my family for their constant and unwavering support

My friends for all the memories and all of the laughs

For Keiko, who inspired me to be a marine biologist

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Abstract

By using first-hand accounts, interviews, and photographs from fishermen throughout the region (Martin, Palm Beach and Broward counties), this paper will provide evidence of changes in recreational fish catches. It will also identify a shift in commonly caught fish species, factors that affect the head boat business, environmental changes and suggestions for management. Head boat fishing is a favorable activity for tourists and regular anglers in the state as well as the region. Upon returning from their day trip, companies often provide photo opportunities to display the day's catch, as part of the fishing experience. Companies that have been around for generations have unknowingly created an archive of a "good day's catch" which documents the ecological changes that have occurred below the water. This photographic evidence, combined with the results of a survey designed to obtain a firsthand perspective on the changes in past and present trips, illustrates what fishing was like several decades ago, what changes have occurred, where fishing is occurring, and, more importantly, what should be done to protect and restore the local environment. The local reef fisheries are important to the operation of the for-hire industry in southeast Florida however, limited historical data exist for the both the reefs and drift boats in Southeast Florida. By documenting the history of head boat fishing and the various changes and pressures that have occurred, an assessment can be made to identify a shifting baseline for the region. From this, inferences can also be made as to what kind of management and protection the reefs need in order to promote increased productivity and return reef fish populations to a healthier state.

Key Words: South Florida, reefs, fishing, head boats, charter boats, king mackerel, grouper, snapper, shifting baseline, anecdotal, ethnographic and photographs

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In 1945 they cleaned up the boat and started business and my mother use to work; they had two trips a day and I think it was $3 per head and we use to cut up bonita for bait and they used hand lines and fishing back then was wonderful, full of nice fish. [*sic*]

Interviewee 12

Introduction

Beginning in the late 1800's, tourists from the northern states began to visit Florida for its beauty and climate (A Brief History of Florida, n.d.). The state and its resources were still in a nearly natural state until development began in the 20th century (Devries, 2008; Gillis and Hobby, 1999). Marine resources were bountiful and an essential part of sustaining life along the coast (Devries, 2008). As communities developed so did the newspapers and journals that highlighted the adventures of local anglers and hunters (Kelly, 2011). In the early 1920's tourism increased, shifting coastal communities like West Palm Beach, Boynton Beach, Fort Lauderdale and Miami from agriculture areas to entertainment centers (Gillis and Hobby, 1999). This shift to tourism, combined with the prospects of landing trophy-worthy fish, created a demand for guides who knew the local waters well and where the best catches could be found (Kelly, 2011). Boats were chartered to take anglers on a journey to find the best catch. As time went on, some of these charters switched to boats that could carry larger numbers of people. These were called head boats, drift boats, or party boats, and the charters provided full or half day trips to local reefs (Devries, 2008; Ditton *et al.*, 1991). As defined by Johnson et al. (2007), "Head boats are large fishing vessels that carry multiple recreational anglers who pay "by the head" to fish" (page 6). The vessel is larger than a charter boat (which is limited to six passengers) and can accommodate up to 100 passengers (Dougherty, 2007). As the industry developed, the head boat sector still provided a profit for captains and crew but was now able to accommodate a different clientele and more people (Ditton *et al.*, 1991).

Occasionally, for-hire fishing becomes a family business; some of these companies have changed their focus but still remain in the marine industry. Captains have had to adjust to competition, advancement in technologies, ecological deterioration and fluctuating economies. How these factors have affected business and fishing has not been well documented. Fishermen are notorious for boasting about their catches, and this may

be done for personal or competitive reasons. Because of this very aspect of fishing, there are plenty of documents preserving the history of the best anglers, guides, and record catches in Florida. Studies have also been done on the economics, logistics, and methods of head boat fishing (Ditton *et al.*, 1991). What has not been thoroughly documented is the history of the head boat companies that have been around for decades and have been passed down from previous generations. Little is known about the companies that have survived despite economic changes over the years. Additionally, ecological changes have been occurring for some time (Ferro *et.al*, 2005, Banks *et.al*, 2008 and Kilfoyle *et.al* 2014), and members of the fishing community have witnessed first-hand the decline in stocks and change in species as various factors have affected local fisheries. What remains of these once bountiful and diverse stocks are firsthand accounts and photographs, dug up by historians, to tell the story of what once existed in this region (Devries, 2008). Gaining insight into what once inhabited the waters in South Florida not only helps to document history but also helps scientists and conservationists by providing a baseline for management and conservation goals (Pauly, 1995). With multiple factors affecting regional ecosystems, having a historical base is valuable when creating management areas, environmental regulations and conservation objectives, especially in a region with multiple users, all of who have different ideas when it comes to protecting the local marine environment. Without a baseline, we end up trying to preserve a degraded state. John Jolley, a well-respected member of the fishing community, said in Devries' *Sport Fishing in Palm Beach County*, "New generations, representing a shifting baseline, will never see it as it once was." (Devries, 2008, page 8).

A baseline can be defined as "information that is used as a starting point by which to compare other information" (Merriam-Webster). Baselines are essential because they provide a starting point to document change. Trying to understand the ecology [*sic*] of a system without first knowing how the system originally worked would be useless when attempting to restore it for the future (Knowlton and Jackson, 2008). Coral reefs, which have been referred to as "rainforests of the sea" because of their great diversity (Knowlton and Jackson, 2008), lack the essential baseline data needed to understand pre-human states.

In 1995 Daniel Pauly coined the phrase "shifting baselines". Pauly explains this phenomenon by saying:

> …each generation of fisheries scientists accepts as a baseline the stock size and species composition that occurred at the beginning of their careers, and uses this to evaluate changes. When the next generation starts its career, the stocks have further declined, but it is the stocks at that time that serves as a new baseline. The result is a gradual shift of the baseline, a gradual accommodation of the creeping disappearance of resource species, and inappropriate reference points for evaluating economic losses resulting from overfishing, or for identifying targets for rehabilitation measures.
>
> (Page, 430)

Simply put, the conditions continue to degrade as time progresses and the worst condition is accepted as the standard by the present generation. Unfortunately, underwater exploration is much "newer" than terrestrial data collection (Knowlton and Jackson, 2008), and due to limited accessibility and limited time underwater, observations are more difficult to obtain, creating gaps in data. Additionally, marine ecology is a younger science with few extensive long term studies (Al-Abdulrazzak *et al.*, 2012). Fisheries science does not have scientific data that represent long term or historic trends in fish catches (Pauly, 1995). However the use of anecdotal information and personal accounts can provide insight which can be translated into evidence that represents historical fish catches. In addition to personal accounts and anecdotes, historical documents can provide quantitative and qualitative data for historical ecosystem health.

Botanical and zoological museum collections have been used to document the changes in coral reef ecosystems, and historical photographs have also been used in baseline assessments (Hoeksema *et al.*, 2011, Lotze *et al.*, 2009 and McClenachan, 2008). By using a combination of first-hand accounts and historical photographs, this paper will attempt to collect information that can be used as baseline data for Southeast Florida and examine changes in the local reef fisheries.

Statement of Significance

It is understood in the scientific community that the coral reefs off the Florida coast are deteriorating (Pandolfi et al., 2004). By using first-hand accounts, interviews, and photographs from fishermen throughout the region, this paper will provide photographic evidence of changes in recreational fish populations. It will also identify a shift in commonly caught fish species, factors that affect the head boat business, environmental changes and suggestions for management. Having all of this information creates a detailed understanding of the environmental and economic challenges in South Florida.

Drift fishing is a favorable activity for tourists and regular anglers in the state as well as the region. In 2009 a study found that in a calendar year a total of 4,521 head boat trips were taken on the east coast of Florida (Holland *et al.,* 2012). Another, earlier study found that in Palm Beach, Broward and Miami-Dade counties, a total of 12.11 million people (residents and visitors) participated in a for-hire fishing (charter and head boats) over the period of a year (Johns *et al.,*2001). Between the four counties there are fourteen companies that operate a total of 23 head boats.

Upon returning from their day trip, companies often provide photo opportunities to display the day's catch, as part of the fishing experience. Companies that have been around for generations have unknowingly created an archive of a "good day's catch" which documents the ecological changes that have occurred below the water.

This photographic evidence, combined with the results of a survey designed to obtain a firsthand perspective on the changes in past and present trips, illustrates what fishing was like several decades ago, what changes have occurred, where fishing is occurring, and, more importantly, what should be done to protect and restore the local environment.

The local reef fisheries are important to the operation of the for-hire industry in southeast Florida. Limited historical data exist for the both the reefs and drift boats in Southeast Florida. By documenting the history of head boat fishing and the various changes and pressures that have occurred, an assessment can be made for changes in

species composition, individual size, etc., for fish in local waters. What once thrived in the local waters can be compared to what is now commonly seen in the Southeast Florida. From this, inferences can also be made as to what kind of management and protection the reefs need in order to promote increased productivity and return reef fish populations to a healthier state.

Methodology

Drift boat captains were identified through a list compiled by the National Oceanic and Atmospheric Administration (NOAA) Southeast Regional Office (Southeast Regional Office, 2014).. This list provided the names and address for all charter and head boats registered to catch grouper and snapper in the Southeast United States. In order to keep snappers and groupers, the vessel must have an Open Access Permit for the species they intend to keep. The names of all boats registered in the Southeast Florida region (Martin, Palm Beach, Broward and Miami-Dade counties) were extracted from this list. Each company was searched through an online search engine to identify whether the boat was a head boat or a charter boat. The original list from NOAA's database had 1,428 boats registered in the Atlantic and Gulf to catch and keep snappers and groupers, as of October 10th 2014. This list was narrowed down to twelve different companies. Operations were eliminated for one or both of the following, two reasons: 1) they were outside of the study area and/or 2) because they were not head boats. Some companies had more than one boat that qualified as a head boat, resulting in a total of 23 head boats in the South Florida Region. The number of companies providing this service varied by county. Across the region there were two companies in Martin and Miami-Dade Counties while Palm Beach and Broward had four each. A total of eight individuals who were currently active in the head boat industry as well as four individuals who have retired or moved on from the head boat industry were interviewed, resulting in a total of twelve interviewees with a cumulative experience of 407 years. The average number of years spent in the industry was 33.9 years, and the average age was 51.9 years, making a majority of these participants "lifers". The breakdown of their ages, location and years active is presented below. Years active refers to years in fishing industry. Some individuals worked on charter boats and commercial vessels but many started in head

boats. An identification number was assigned to each individual to insure confidentiality, and many participants agreed to participate in the survey as long as their identification was anonymous. These numbers will be used to associate quotations with individuals.

Table 1. Interviewee Identification

Interviewee ID	Age	Years Active	County
1	60	47	Broward
2	28	15	Broward
3	43	30	Broward
4	54	10	Martin
5	34	20	Broward
6	39	30	Palm Beach
7	70	62	Palm Beach
8	61	40	Broward
9	56	33	Palm Beach
10	59	35	Broward
11	88	40	Broward
12	88	45	Broward

The small number of available interviewees is due to limited responses from individuals and companies who were contacted; consequently, the reply rate was lower than expected, and responses do not reflect all of the counties in Southeast Florida. In an effort to get the maximum number of responses, companies and individuals where contacted by phone three times at one month intervals. Additionally, companies that had email addresses were e-mailed on three different occasions. All counties have representation with the exception of Miami-Dade County, where operations provided either no response or refused to participate. Those that refused to participate declined the interview because they felt they were too busy or because they did not want to talk to a scientist.

After captains and owners were identified, a formal letter (Appendix 1) was sent out to notify the individuals about the project and to let them know that they were going to be contacted to participate. Companies were contacted via e-mail and telephone to set up an appointment at the convenience of the captain. Interviews were conducted in person at the dock or at a location chosen by the interviewee. Interviews were conducted from November 2014 through June 2015.

The questionnaire (Appendix 2) was based on a semi-structured model, which allows for an open ended conversation where the interviewer can improvise as needed (Wengraf, 2001). Additionally, this method provides flexibility in the conversation and allows for probing as needed by the interviewer. The interviewee is allowed to speak and recall events instead of providing simple short answers (Tesfamichael *et al.*, 2014). The questionnaire (Appendix 2) contained general demographic questions and fisheries-related questions. Demographic data included age, location of business and level of education. Fisheries questions focused on historical or past information regarding business practices, changes in catch, and threats to business and fisheries. It also provided an opportunity for the interviewee to provide opinions on fisheries management options.

Photographs were obtained from personal collections and through social media sources. While past and present photographs were not available for all counties, they did provide insight into the biodiversity and size of fish that were once targeted and those that are targeted today.

The information gathered was broken down into several categories describing the changes of business, fishing, fishing location and fishing grounds.

Results

The information gathered was broken down into several categories describing the change in the following: business, fishing, fishing location, and fishing grounds. Each category contained the responses of fishermen to questions asked, as well some direct quotes supporting the information provided. The responses are presented in table form, where the numeric value in the tables is the total number of individuals who supported a given response. Even though twelve individuals were interviewed, there were multiple

factors that affected each category. In addition to quotations, photographs were used to support claims made about changes in the species of fish caught.

Business

Change in business was described by individuals as the number of customers that went fishing as well as the number of trips taken by the boats. In most cases vessels required a minimum of ten customers to take a fishing trip. Causes of changes in business varied, with multiple factors causing a positive or negative change in business. Table 2 lists various causes from most common to least common responses, where rows highlighted in blue indicate factors causing a negative change in business.

Table 2. Causes for positive and negative changes in business

Causes for Change in Business	
Giving better service/ improved quality of trip	4
Use of internet and social media has improved business	3
Ownership has improved the name of the company	3
Decline in economy causes a decline in business	3
Increased tourism increase in business	2
Decline in economy causes increase in customers	2
Increased population decreases dependency on tourists	1
Decreased tourism causes a decrease in business	1

Factors that increased or decreased business for a company. Rows in blue indicate a negative change in business.

Overall, stakeholders felt that providing better service and improving the quality of the trip helped increase business. One fisher with over fifty years of experience in the industry stated:

I started running the drift boat that was known to be the partiest [sic] boat in the world. I got mad because people where smoking weed on there, people were coming drunk so I started cleanin' it up. I put it on the radio, the religious radio… I said; bring your children, bring your kid, bring your wife. Don't bring 'em today because it's going to be too rough. Well from only 10-12 people on the average trip I was running 35 people, 40 people and so many of them were girls because women love to fish because they wanna know what their husbands were doing and go with them and they became very good fisherman. That's what happened here we were getting families here, but it was really great to see these tourist coming down and ask 'Can my kid go fishing?' Now he's a little bit too young to hold a rod but he can go fishing and fish with you there's no problem with that… [*sic*]

Interviewee 7

Another fisher was quoted with saying;

> …by getting rid of everything that was old and vintage about this business it actually pulled in a lot of new customers… The whole thing now is to entertain those people that go on that boat, explain to them the truth, the fishing's not that good today, fishing's good catching's not but enjoy yourself, they can live with that, sit back relax and unwind on the boat.
>
> *Interviewee 6*

It is evident that by removing the "party" from party boat has helped businesses maintain and improve under various economic and ecological conditions. Additionally, the use of social media and the internet helped to increase business. This has been done by providing real time updates regarding weather and fishing or promotional deals to help generate business and create repeat customers.

Not all factors caused a positive change in business; for example, the larger economy played a role. Several individuals felt that the decline in the economy leads to a decline in business. Some said, people spent their money smarter or used it more wisely. Overall business has improved for these companies; one stated;

> Business has gotten better, there's a lot more hotels, big hotels so there's a lot more people so in my eyes business has gotten better, fishing has gotten a lot worse…
>
> *Interviewee 2*

This view was felt by many that while business has improved or fluctuated, fishing is on the decline.

Factors Effecting Fishing and Condition of Fishing Grounds

Before examining how fishing has changed, identifying factors that have caused a decline in fishing should be noted. Fisheries managers are aware of the linkage between decline in fish stocks and the factors listed below. It is interesting to see that the individuals interviewed for this study, with no scientific background, yet years of experience, identified the same issues science is addressing. In addition to discussing factors affecting business, changes in catch and influence on fishing stocks, fishers also commented on the condition of the fishing grounds. Because all of these factors are connected, the opinion of fishers on all aspects of the industry may yield unique insights into environmental decline.

Table 3. Factors identified by individuals that affect fishing in order of most frequent response

Factors affecting fishing	
Pollution	7
Commercial Fishing/ Gillnetting	6
Runoff	5
Increased Population	5
Increased Fishing Pressure	5
B.P. Oil Spill	5
Decrease in bait	4
Over Fishing	4
Economy	4
Water Quality	3
Size Limits	2
Commercial Dredging	2
Fishing Closures	2
Recreational Divers	2
Catch and Release negatively affecting fish	2
Climate Change	2
Lack of enforcement catching undersize	1

Table 4. Fishers' opinions of fishing grounds

Condition of fishing grounds	Yes	No
Crowded fishing grounds	5	2
Reefs and wrecks are declining	4	1
Artificial reefs have been beneficial	4	0
No difference	1	0

The majority view on the fishing grounds was that they had become more crowded in recent years than in the past. But this perception was not unanimous, and it was dependent on location. Fishers in less populated areas or areas with less tourism did not feel as much pressure as those in tourist destinations. Johnson *et al*., (2007) found a correlation between increased population and an increase in recreational boaters (Figure 1).

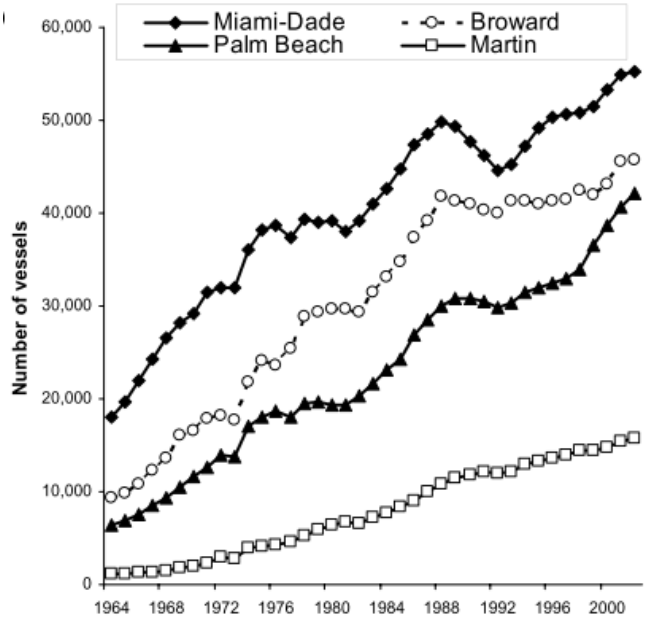

Figure 1. The number of recreational boaters by county from 1964-2000 (Johnson et al., 2007). As of 2005 there were over 87,000 recreational boats registered in the SEFCRI region (Shivlani and Villanueva, 2007).

The graph supports the claims made by captains. In Broward County, where water-based tourism is very popular, there has been some of the largest population growth over the past three decades. Two fishermen from Broward stated the following about the fishing grounds in this region:

> There's certainly a lot more pressure now than there was in the 70's and 80's everyone has faster boats bigger boats better crews more information there are no secrets.
>
> *Interviewee 1*

> The industry has grown to full saturation just on a competition level so basically there are more boats doing the same thing.
>
> *Interviewee 5*

In Martin County where population growth has not been as significant, an individual claimed the grounds were less crowded due to the economic state:

> If anything it's gotten lighter, because the economy is in the tank people aren't buying boats like they use to be
>
> *Interviewee 5*

Another factor that affects how dense these locations are is the offshore distance to neighboring reefs. The continental shelf, where the reef lies, is 4 km (2.5 mi) offshore at its widest point (Banks *et al.*, 2008). This short distance makes it easily accessible to boaters. In Palm Beach county, where the shelf is at its narrowest (3 km or 1.9 mi) (Banks *et al.*, 2008), an individual made this comment regarding how accessible the reef is:

> Definitely more crowded fishing spots, a lot more small boats out there… There's a ton more people living in Florida so there's a lot more boaters, the areas are getting a lot more pressure than they use to... We're so narrow here we don't have a long run, here you're fishing out of our inlet within five, ten minutes if you go out here out the inlet you're right on the reef everything is close… [*sic*]
>
> *Interviewee 9*

The reefs offshore of southeast Florida are highly utilized because they are close to shore and navigational inlets. The price of fuel and time allotted for a trip becomes a major factor when choosing a fishing location. The use of these locations was explained by one of the respondents:

> Fuel is more expensive now we don't have the range so the fishing grounds are getting pounded closer and closer to the inlet that's all you do you try to stay as close to the inlet as you can and still get enough people fish. You're hitting more localized areas harder and harder
>
> *Interviewee 6*

Increased numbers of reef users and increased fishing pressure were among the top five responses for factors affecting fishing. The top response was increased pollution, where having more boaters in the water increases the likelihood for littering, illegal dumping, and fuel spills (Association, 2015), all of which will have a negative impact on the health of the reef. Pollution from boaters is not the only source of pollution. Non-point sources of pollution, such as treated wastewater outfalls and agricultural runoff, bring pollutants from other sources and alters the water composition.

> One of the things that has really had influence is when they moved Port Everglades and opened up all that other water to come out verses the natural flow of the New River, you could see the change it created a lot more fresh water coming out… we seemed to get a lot more dirty water coming out…
>
> *Interviewee 10*

With pollution being described as a driving force for the decline of fishing by fishermen, it can be assumed that the health of the reef is declining as well. When asked about the health of the reef, four individuals said it was declining, and the one individual who disagreed was newer to the head boat industry. The success of a fishing trip is dependent on the proximity and health of the reefs and fish, utilized by fishermen and the fish themselves.

> …Our indigenous catch is showing the biggest decrease and that definitely relates to the reef but the pelagics when they pass through they have to have something to eat so the reef would be... like the refrigerator, there's not refrigerator anymore so the bait are gone they've got nowhere to hang out… if it weren't for the pelagics we wouldn't have much to do out here except take people for boat rides
>
> *Interviewee 5*

In an effort to help reduce resource user conflict, improve reef fish habitat, and increase private and recreational fishing and diving, artificial reefs have been installed throughout the region (Commission, 2015a). Several fishers claimed that artificial reefs were beneficial and had been helping fishing conditions. In some cases it is the sole source for fish:

> If it weren't for artificial wrecks we'd have no reason for the bait fish to be here. A lot of the success of our trips is solely dependent on those wrecks, we'll position the boat near that… here the reef is pretty much dead or dying so we'll set up near a wreck
>
> *Interviewee 5*

Fishing

This section aims to identify the changes in species composition. There is a strong feeling throughout the region that fishing is on the decline. This is supported by changes in species, change in catch frequency of certain species and various environmental and anthropogenic factors.

The table below shows what fishers were catching when they entered the head boat industry, ranked in order of most frequent response to least frequent. It is important to remember that the average time in the industry is 32.9 years, which translates to three decades of in-field observations.

Table 5. Fish targeted when fisher entered head boat industry in order of most frequent response

Fish	
King Mackerel (locally, kingfish, Scombridae)	9
Snapper (Lutjanidae)	5
Grouper (Serranidae)	4
Triggerfish (Balistidae)	3
"Anything we could catch"	3
Other mackerel (Spanish and cero, Scombridae)	2
Dolphin (Coryphaenidae)	2
Amberjacks (Carangidae)	1
Shark (Elasmobranchii class)	1
Sailfish (Istiophoridae)	1

As displayed above king mackerel was an important fish for these vessels. Later in this paper the importance of kingfish will be covered. Snappers were mentioned as a family (Lutjanidae), followed by groupers (Serranidae). Over the years fishers noticed a decline in the species they were catching. The table below identifies specific and nonspecific fish which have declined in frequency of being caught over the years.

Table 6. Species showing a decline in frequency of catch from fishers' perspective

Species	
King Mackerel	7
Bait Fish	4
Grouper (species)	3
Gag Grouper	2
Black Grouper	2
Amberjack	2
Bonita	2

One of the more important questions individuals were asked was, "What are you catching now?" By asking individuals what they caught in previous years versus today's catch, a shift in species can be detected. Additionally, it supports the shifting baseline theory (Pauly, 1995), i.e., individuals entering the fishery today will have a lower standard than the fishers who entered before them.

Table 7. Species targeted today by headboat fishermen, in order of most popular response

Species	
Snapper (Lutjanidae family)	6
Amberjack	5
Cobia	5
Kingfish	4
"Anything that will bite"	4
Grouper (Serranidae family)	3
Triggerfish	3
Mutton Snapper	3
Yellowtail Snapper	3
Porgies	3
Dolphin	3
Vermillion Snapper	1
Blue Runner	1
Shark	1
Tilefish	1
Black Fin Tuna	1

Present day catches included a larger variety of fish species then past years. This can be attributed to factors above, i.e., more resource users, declining ecosystems and increased pollution which may cause a decline in target species populations. (U.S. Fish and Wildlife Service, 1999).It can be assumed that in an effort to ensure a catch for customers fishermen are more inclined to keep what they would not traditionally keep. This change in catch is supported by photographic evidence when comparing catches from the mid-1900's to present day there is a variation in the size of the fish as well as species present.

Changes in Catch

When interviewed, nine out of eleven individuals declared that Kingfish or King Mackerel (*S. cavalla*) was their most coveted catch. The species has two distinct stocks, the Gulf of Mexico and the Atlantic. The species is targeted by both recreational and commercial fisheries. *S. cavalla* migrates to southeast Florida during the winter to spawn (DeVries, Grimes, and Prager, 2002). This seasonality has been imperative to fishers over the years, who fish for the species as it migrates through the region. Multiple interviewees claim that the species seemed infinitely abundant. So much so that one individual exclaimed:

> Back in the 70's in the spring run you could ask the people how many they wanted to catch…
>
> *Interviewee 9*

The photos below are of kingfish catches from the 1940's and 50's. These provide an idea of what fishing was like before commercial fishing for *S. cavalla* began. Additionally, it supports the previous claim and the following statement on how abundant these fish were during their migrations. Figure 2 supports the abundance of this species in the past.

> In the winter we would have a full boat probably 1970... and the boats would be full, 65 on one boat 77 on the big boat…and we would go down to the south off of Dania and we would catch in the morning, 100 Kingfish per boat go out on the afternoon with half as many people catch half as many fish, go out the night trip and they'd catch 'em [*sic*] again and this would go on for days and days and then the crowd would dwindle down…. and then over the years a good catch was 30 kings in the morning so you could see it dwindling over time and now they hardly get a run at all. They catch a dozen they think it's a big trip.
>
> *Interviewee 10*

Figure 2. a) A photo of a kingfish catch from Ft. Lauderdale in 1941 (IGFA Archives) b) Kingfish catch from Miami's Pier 5 in 1952 (IGFA Archives). c) A kingfish catch caught in Palm Beach from the early 1950's (West Palm Beach Fishing Club). d) and e) Images of what is considered a "good" kingfish catch now from Palm Beach County. f) Another example of today's "good catch" from Broward County.

It is clear from these images that there has been a change in the abundance of kingfish in the region. For many individuals this fish guaranteed business. Throughout the years there have been several factors proposed by the interviewees for the causes of decline. They include the lack of baitfish; the BP oil spill; and, most commonly, commercial fishing.

The Deepwater Horizon Spill of 2011 is believed by some interviewees to have caused a decline in many species. Some individuals in southeast Florida believe it is one of the reasons for the lack of *S.cavalla* migrating through the coastal waters.

> …the fishing has gotten [*sic*] horrible, starting about 5 years ago. We stopped getting our kingfish runs. Our kingfish runs would bring groups and literally busloads of people from Lake Okeechobee … we don't get kingfish anymore. If we get three kingfish a night we're lucky, if you want to blame that on the oil spill … because it's coincidental or it's right in line with it as far as the kingfish runs stop.
>
> *Interviewee 6*

The short and long term effects from the Deepwater Horizon explosion are not entirely known. However, based on the life history of these fish, it is possible this caused a decline in populations. It is known that oil spills, in general, effect fish larvae, decreasing their survival success rate. (Carls *et al.*, 1999). This could contribute to a decrease in the *S.cavalla* population as well as a decrease in their prey, which would inevitably effect the population. Without prey there is no reason for the fish to stay in regional waters.

> Well, if the bait's there then the migratory fish are going to eat the bait ya [*sic*] know, without the bait, the fishing's terrible so the bait fish do have a big reflection on the fishing…about 15 years ago we used to catch as much bait as we wanted in the port before we went out fishing, we haven't done that in 15 years
>
> *Interviewee 2*

The leading factor the interviewees believed to cause a decline in fishing is commercial fishing and commercial gillnetting. Kingfish, in particular, have been a commercial target since before the 1980's. Aerial surveys were often used to find the schools during migration. Once spotted, the fishermen would move to the identified location and set their nets. This allowed them to produce large catches (NOAA, 2015), potentially removing the entire school. The commercial landings in Southeast Florida for king mackerel have increased over the last thirty years (Data on commercial landings began in 1984). The landings peaked in 2010 with a regional total of 2.4 million pounds of king fish. Since then the total landings have declined to 634,000 pounds in 2014 (Commission, 2015b). A fisheries management plan for king mackerel was established in 1983, creating allocations and regulations for the recreational and commercial fisheries. Since then, there have been several amendments limiting gear use, catch size and seasonality of harvest (Council, 2015).

We had a period there I want to say it was the middle to late 80's that they were still commercial netting the kingfish, and you couldn't catch a king fish at all hardly…and that's when we went … from king fish boats to really targeting yellowtails and mutton; more grouper fishing and things like that because before that we fished all wire we'd just go out there and drift and we'd catch kingfish. People would catch yellow tails, muttons and groupers but pretty much by accident and then when they put the moratorium on kingfish and the kingfish weren't around we had to change our ways…

Interviewee 3

This change in availability shift catches from looking like Figures 4 and 5 to a much more diverse and smaller catch.

Figure 3. A photo from the 1920's of a large kingfish catch. (International Game Fish Association Archives).

Figure 4. A present day catch consisting of some kingfish but mostly yellowtail snapper from Palm Beach County (Southern Comfort Charters, Hypoluxo, Florida, Facebook)

Snappers and groupers have always been a part of the head boat catch. King mackerel and yellowtail snappers made up a majority of South Florida's head boat catch in the early 1980's (Dixon and Huntsman, 1983). Snappers were the second most commonly targeted fish for most fishers when they entered the industry. Snappers have now become the leading fish for most companies. Two interviewees confirmed that snappers are their most targeted fish in recent years.

> I don't want to say we don't target the kingfish, but we fish more for yellowtails and muttons and things like that.… our main goal now is snappers, yellowtail and mutton …And like I said, you get your mix so that's like your add-on now, and they don't expect it… Yesterday they had 50/60 yellowtail, 10 muttons, and that's a beautiful catch… they caught 3 dolphins and 4 kings, so in the mix of things that was a phenomenal catch but, we don't go out with intention of catching dolphin and kingfish ever were in the years past we go out to target king fish ya know now we don't

> really target 'em…but our snapper fishing has been our life line, we're still strong, we're still catching great numbers …[*sic*]
>
> *Interviewee 9*

Today's catch is more diverse than it was several decades ago. The industry is now heavily relying on members of the Lutjanidae family to promise a catch for customers. In a few instances captains confirmed they are no longer targeting fish, they'll go out and take whatever is biting;

> We don't target fish, we fish over reefs; whatever's biting that's what we'll catch. We try to catch edible fish, snapper, seabass and trigger fish
>
> *Interviewee 4*

When examining catches that consist of "whatever's biting", it is evident that decades ago biodiversity was higher regionally. Additionally, these fish were of noteworthy size compared to what would be considered a good size fish today. The photo in Figure 5 is from 1939, the catch consisted of jacks, snappers and groupers. This haul consisted of species not commonly seen in local waters today, including a Nassau grouper and black grouper (Ferro *et al.,* 2005). In a reef fish survey including over 600 individual counts that was conducted in Broward County between 1998 and 2002, by contrast, no black grouper were observed (Ferro *et al.,* 2005). The photograph in Figure 6 (1950s) is from the Hillsboro Inlet area and gives an additional idea of the size of the fish being caught. Figure 8 reflects the current abundance of these fish.

Figure 5. A large catch from 1939 in Ft. Lauderdale. This pictures shows a variety of fish including jacks, snappers and groupers. Some of these species are rarely found in Southeast Florida. Note: the Nassau grouper on the top row (5th from left) and 2 black groupers (3rd from right on top and 3rd from left on second).) (Riverside Market, Personal Collection).

Figure 6. A diverse and impressive catch from the Hillsboro Inlet in 1950's (International Game Fish Association Archives).

Figure 7. A large warsaw grouper (sp.) catch from Fort Lauderdale, estimated to be in the1950's (International Game Fish Association Archives).

Today's catches that are composed of "whatever's biting" look more like the photographs below (Figure 8 and Figure 9). Some may consider these landings less than impressive, especially when comparing it to the past. Large catches and fish do exist; however these are less common than before.

Figure 8. An example of today's "good" catch from Hypoluxo Florida. Composed of vermillion snappers, porgies and triggerfish, (2012) (Southern Comfort Charters, Facebook)

Figure 9. An additional example of today's "good" catch from Stuart, Florida, with a variety of fishes of small size. This catch includes mangrove snappers, porgies, dolphin, almaco jack, and the uncommon black grouper, (Lady Stuart Deep Sea Fishing, Facebook, 2014).

The evidence is not only in the photographs. Seven out of the eight interviewees who were still in the head boat business agreed that fishing had gotten worse.

Interviewees made statements that, in fact, support Pauly's shifting baseline theory (Pauly, 1995). These statements included:

> That's probably the biggest difference as far as great catches were back in the day you could be a total novice and probably do good. Now if you start as a novice, good luck… [sic]
>
> *Interviewee 7*

> …what he's saying is you could take anybody, it doesn't matter what year they were born, and pick the year you want to end it, they'll talk about how great it was when they were a kid and how bad it is now. When he's saying it started to decline is when my brother and I started getting into fishing, I look like back like wow that was great fishing, and I look at it now like wow it's horrible
>
> *Interviewee 6*

> Compared to now, it's night and day the average catch back then was what we would consider out of this world today, that's kind of a sad thing
>
> *Interviewee 5*

Management Recommendations

It is important to the interviewees to have the opportunity to make management recommendations. The livelihood of these individuals rests on the health of the reefs and the management actions that are implemented.

Table 8. Management recommendations from fishers, in order of most common response

Management Recommendations	Number of interviewees
Improved studies and regulations	4
Less regulations for recreational fishers, increase commercial regulations	3
Improve communication between fishers and policy makers	2
Regulate land-based pollution	2
Improve enforcement and implementation of regulations	1
Improve dredging of Port Everglades	1
Improve Education	1

Overall, the most frequently stated recommendation was that studies are needed to improve regulations (Table 8). Interviewees felt the information collected in studies, as well as the length of certain studies, were not good indicators of what was occurring in

the fishery. Additionally, several interviewees also felt that commercial fishing (non-hook and line) should face stricter regulations than the recreational sector.

> Hook and line fishing will never, ever deplete a resource because there are so many other variables, whether the fish don't bite, they're on the move, they're migrating... There's so many variables that come in to play that a hook and line fisherman, whether it be commercial or recreational, will never, ever deplete the species of any fish.
>
> *Interviewee 9*

An example that supports this claim is King Mackerel. For the period from 1982-2013 (Figure 10), there were fluctuations in overall landings due to quotas and bag limits, but overall commercial landings for kingfish greatly exceeded recreational landings (Florida Fish and Wildlife Conservation Commission, FWRI, 2014). This is due to the commercial vessels ability to harvest larger quantities of fish at one time, something the recreational sector is not capable of. It can also be attributed to the lack of regulation in the fishery prior to the establishment of a fisheries management plan.

Although not listed as a common response, two respondents cited the need for improved communications between fisheries scientists, fishermen and policy makers. This idea supports the purpose of this paper. Utilizing stakeholders who are heavily dependent on the resource can provide valuable insight and information that may be overlooked my scientist

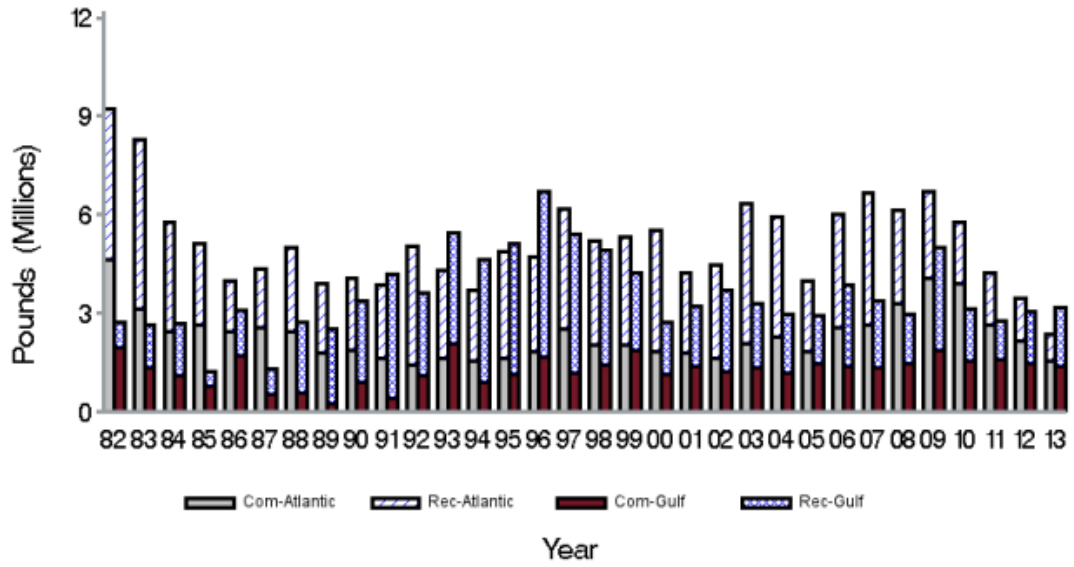

Figure 10. The total annual landings, in pounds of king mackerel, on the Atlantic and Gulf coasts of Florida. The landings are broken up into recreational and commercial catches for king mackerel. Representation goes as follows; grey, commercial catches Atlantic, white, recreational catches Atlantic, red, commercial catches Gulf of Mexico and blue, recreational Gulf. (Addis et al., 2014).

Discussion

The information collected as part of this study shows a strong correlation between what fishermen have experienced and the trends in fisheries data (Kilfoyle *et.al* 2014 and Gregg, 2013). Over the course of their careers, the interviewees have witnessed a decline in the size of fish catches, a shift in species caught, overcrowded fishing locations and deterioration of local reefs. Additionally, interviewees appear to be willing to work with the scientific community to help gain a better understanding of what kind of research is being done and what information still needs to be collected.

Collecting fisheries data can be a difficult task due to time constraints, location of operation, and man power. Head boats can provide an understanding into what is being caught in local waters, additionally they are easily accessible, because these boats return to the same dock or marina every day. In 1972 the National Marine Fisheries Service (NMFS) began the Southeast Headboat Survey (SRHS). This survey is the longest continuous series of recreational fisheries data on the east coast (Brennan, 2010). The SRHS conducts surveys from Cape Hatteras, North Carolina to South Texas covering both the Atlantic and the Gulf of Mexico (Brenna, 2010). Sampling for this survey is

conducted in two ways: dockside sampling and self-reported logbook. Dockside sampling uses scientists to intercept the vessel and collect data including; species, size and biological data (otoliths, gonads etc.) (Brennan, 2010). The logbook requires captains or crew to fill out catch reports for each trip, this reporting is mandatory as it is directly related to the renewal of the necessary permits needed to operate. Reporting for Southeast Florida began in 1978, and this data is collect in a confidential manner, where the landing county is not recorded. Instead counties belong to numbered area, the counties examined for this paper belong to Area 11, which consists of Sebastian through Miami. Because of the confidentiality of reporting data could only be provided at the family level. Figure 11, shows families of caught in pounds from 1978-2014. The families selected for this graph where the most common species mentioned by the interviewees. Families included; Lutjanidae (snappers), Rachycentridae (Cobia), Scombridae (King Mackerel, Bonita etc.), Serranidae (groupers) and Carangidae (Jacks).

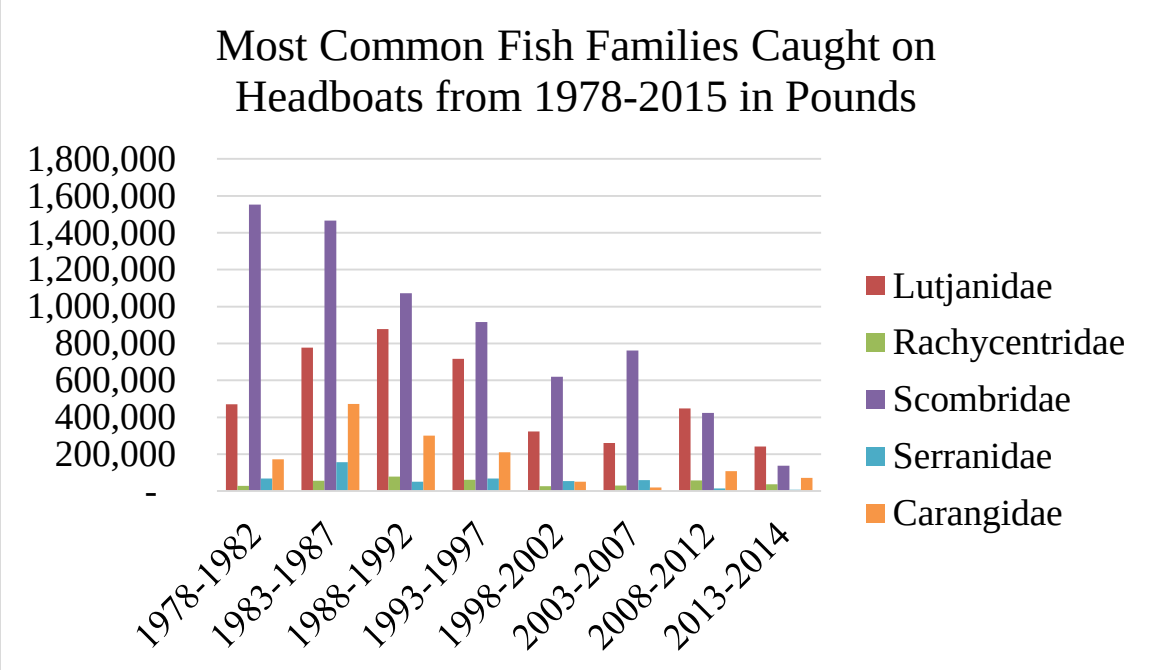

Figure 11. Most common fish families caught from 1978-2015.

Although this information includes data collected outside of the study area, the overall trend for the region is obvious. There has been a decline in the pounds of fish caught on head boats. This decline can be attributed to the fore mentioned factors as well

as; a decline in the total headboats and regulations. Another trend seen here is that a family of fish may have an overall decline but there is an increase in frequency of being caught, this is obvious with a shift in Scombridae to Lutjanidae. This shift in family was supported by claims made by fishermen that they are now targeting more snappers and that there has been a decline in King Mackerel as well as Bonita.

Discrepancies in the data may be due to self-reporting. One could argue that the number of pounds may be greater than actually caught in order to boasts about ones catch. It could also be that the data are partially invalid because the numbers may be misreported. But, it is difficult to argue that there has been a region-wide decline in poundage as shown by the long-term trends. There has also been a change in species caught, which could be due to a number of factors such as; food availability, pollution, change in customer preference or overharvesting.

From a fisheries management perspective, the headboat survey data provide important insights. Fishers are on the water every day, and their livelihoods depend on their ability to make astute observations and correlations on population trends of fishes. The use of historical anecdotes and photographic collections is imperative to the conservation and protection of coastal ecosystems (Al-Abdulrazzak *et al.,* 2012). These insights give a better understanding to the past ecological state of the ecosystems off of Southeast Florida. Without historical data, the perception of change may appear to be less dramatic than it actually is. The reliability and accuracy of opinions of fishers may be questioned, however, Al-Abdulrazzak *et al.,* (2012) found that peoples' perceptions of historical anecdotes are generally consistent (Al-Abdulrazzak *et al.,* 2012).

Using anecdotal data or historical collections for research methods is not new. This method has been used in several cases as a means of obtaining a baseline or examining ecosystems in a historical setting. It has also been used to obtain basic fisheries science information, such as gear use and catch per unit effort.

In McClenachan's (2008) *"Documenting Loss of Large Trophy Fish from the Florida Keys with Historical Photographs"*, a shift in catch targets from groupers (*Epinephelus spp.*) to snappers (*Lutjanus spp.*) was found, and there was a decline in the size of the fish being targeted (McClenachan, 2008). This discovery was found by using

photographs collected from for-hire companies throughout the Florida Keys. The size of fish was determined by scaling to the size of the board on which they were hung in the photographs. The results showed a major change in the local ecosystem over the last half century. The photographs also showed that at one time there was an abundance of both large and small reef fish (McClenachan, 2008). Because fisheries science is a relatively new science, this information plays a valuable role in aiding management decisions.

In a study very similar to this one, a case study was conducted on catch rates from the Red Sea (Tesfamichael *et al.,* 2014). The researchers there conducted 472 interviews, which were then standardized to assess a change in catch rate. The fishermen interviewed were asked to recall their best catch in the regional fisheries. Researchers used an open ended method which required the interviewees to retell a story providing accurate details of certain instances. Researchers found that fishers who had been fishing longer had seen a greater decline in the average catch rate than those who more recently started fishing (Tesfamichael *et al.,* 2014). They also found that the decline in certain fisheries aligned with preexisting fisheries data as well as times of political stability. The method used in this research is useful to complete data gaps for resource assessments as well as prioritizing necessary fisheries management actions.

The approach used to collect fisheries data in this case is unconventional and relatively new compared to traditional collection of fisheries data. Because of this, there were unforeseen difficulties which could be approved upon in the future. The first is the lower than expected response rate, even after head boat operations were notified via letter, telephone, and e-mail on multiple occasions. There was a fine line between persistence and pestering, as the latter can further dampen response rates; additionally it was found that there remains a deep resistance to discussing fisheries with scientists. Fishers feared that any information they provided would come back to hurt them. This is evident in the case of Miami-Dade, because this part of the South Florida was not represented the findings do not fully reflect the SEFCRI region. Had Miami-Dade participated in this study responses from individuals may have been different than those from the northern counties. Additionally, the difference in offshore ecosystem would have presented different target species. In order to remedy the lack of response,

strengthening the bonds between scientists and fishers (ex., by building better relations and bridging social capital) in the future will be beneficial. This could be remedied in the future by strengthening bonds between scientists and fishers For this study a trust was gained with those interviewed by reassuring them their identities would remain anonymous. With their anonymity assured, interviewees discussed issues more freely, some still remained reserved.

A second issue that arose was scheduling and location. These individuals are on a tight schedule and at the end of the day, many of them did not want to participate. Most interviews were conducted over lunch when fishers had a moment to spare; this however put a time constraint on the length of an interview which lasted anywhere between forty-five minutes to an hour.

Although this approach is ethnographic in nature and relies on key informants rather than using traditional fisheries data, it is beneficial because the region possesses only a limited amount of long term fisheries data. Discussing changes that have occurred in the local fisheries opens the door for the kinds of management needed to protect and restore local ecosystems. Additionally, looking at photographs taken from decades ago can be used to compare the kinds of species that are commonly being seen today, which can create a baseline for more effective management. With an overall consensus supporting the claim that fishing and the regional ecosystem are in decline, the information collected give additional support to the shifting baseline theory (Pauly, 1995) for the region.

The health of the ecosystem which these fish rely on is also being impacted by both local and global events. With further research and cooperation from stakeholders, an effective protection plan can be established to ensure the future of the fishing grounds and to promote measures for the successful re-establishment of the local fish populations.

Appendix 1. Letter to Fishing Captains

Catherine Brady
E-mail: cb1999@nova.edu
Phone: 631-804-2446

To Captain or Company,

My name is Catherine Brady, I am a graduate student at Nova Southeastern University in Dania Beach. I am starting work on my research project which is titled "Documenting the history of head boat fishing and catches in Southeast Florida through historical photographs and firsthand accounts." I am reaching out to you because I believe your experience and expertise will greatly help my project.

I will be conducting personal interviews with head boat captains, owners and operators to document the history of head boat fishing in our region. I would also like collect photographs as a way to assess changes in target species.

I will be contacting you in the near future to set up an appointment to conduct the interview if you are willing to participate. I plan to undertake an in-person interview, set up at your convenience, which will take no more than an hour. The interview will be composed of questions regarding the history of your fishing operation, the condition of fisheries, and the reasons for change in fishing over your time in the region.

If you have any questions I can be reached at the e-mail or phone number provided. Thank you for taking the time to read this letter and I look forward to meeting you in the very near future.

Best Regards,

Catherine Brady

M.S. Marine Biology and Coastal Zone Management

Appendix 2. Questionnaire for head boat fishermen

DEMOGRAPHIC DATA

Name: _____ Date: _____

1. Age/ D.O.B._____ Gender: M / F
2. County/City_____
3. Occupation: Owner Captain Crew Other
    a. Companies Owned/Employed by:_____
    b. Years in Business: _____
    c. Occupations other than fishing:_____
    d. Do you presently have another job:_____
4. Highest Level of Education:_____
5. How long have you been fishing (recreationally & commercially)?
6. How long have you been in the head boat industry?
7. Was your family involved in the head boat/charter industry?
    a. If yes, please elaborate on (time period, company, business etc.)
    b. For how long/ how many generations?
8. When did you start your first company?
    a. Are you still in business?
    b. How long were you in business?
    c. Why did business end?
9. For Non-owners
    a. When did you start in the head boat industry?
    b. How many companies have you worked for?

i. Did any of these companies go out of business?

ii. Are you still in the head boat industry, why or why not?

FISHING DATA

1. Can you describe daily business operations from when you first started compared to now/when business ended; number of trips per day/week, number of people participating, how the fish were caught, and fishing locations?
    a. Have you personally seen a change in business over the years such as a decrease/increase in customers, fewer trips, more crowded fishing spots?
    b. What do you believe are some factors that may have caused these changes?
2. When you first began in the head boat industry what fish were you targeting?
    a. Did you ever notice a change in the size of the fish?
    b. Did you ever notice a change in the frequency of catching your target species?
    c. What do you believe may have caused this change in size/frequency?
        i. More fishermen?
        ii. Harvesting fish that were too small?
        iii. Harvesting too many fish?
    d. As time went on, how did your target species change? (number/size)
3. Are there any events that specifically stand out that caused a change in your catch/business?
4. When you first began, how would "a good days catch" have been described?
5. What do you consider "a good day's catch" now?
6. As a head boat captain, owner, operator etc, can you describe your best day fishing?
    a. Number of fish caught
    b. Species caught

c. Number within species

d. Weight

e. How were the fish caught

f. Where was this catch caught

7. Describe your best catch recently.
8. How would you describe the conditions of fishing grounds today?
    a. Have they improved since you entered the industry, if so how?
    b. Have they declined since you entered the industry, if so how?
    c. Do you think others agree with your opinion?
9. Do you think these changes need to be managed, to improve conditions or prevent them from declining?
    a. What kind of action do you recommend?
        i. Limited usage, designated areas for usage, seasonality, improved enforcement.

ADDITIONAL INFORMATION

Interviewees' comments, questions and concerns

Interviewer remarks

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