Development of a Buyout Business Plan for the Southeast U.S. Commercial Shark Fishery

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FINAL REPORT

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I.

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II. Abstract

Funds were provided to the Gulf & South Atlantic Fisheries Foundation, Inc. to assess the feasibility of a buyout program within the commercial shark fishery of the Atlantic United States. Four individual contracts were awarded to assess the necessary components of the buyout, including: (1) socio-economic impacts to shark-dependent communities, (2) management, policy and resource analysis, (3) calculation of fair-market value for a shark permit and/or vessel, and (4) the development of the Buyout Business Plan. Each component of the Business Plan was successfully completed.

Using primary (industry survey) and secondary data, fishing dependent communities were described and an index of vulnerability computed to assess if these communities would be negatively impacted by a buyout. For most of the selected communities, it was found that an adverse impact would result from a buyback within the shark fishery. This impact would also have a geographic/regional effect since Florida accounts for the majority of shark landings.

Several methods were used to assess the fair market value of a shark vessel and/or permit. Underlying weaknesses precluded the use of any one method, but recent buyback scenarios within other fisheries favored an assessment at a range of annual gross revenues for all species landed by a vessel. Analysis of primary and secondary data allowed for a range of annual gross revenues to be calculated for participants within the shark fishery. The resulting analysis method was found to be the most appropriate and endorsed the use of a production-normalized value assignment/bid submission approach.

An industry survey allow for the collection of a variety of social and economic data; an estimated value for a vessel and permit was also calculated and included in the survey. Survey data indicated that ~70% of fishermen supported the buyback of shark permits and/or permits and vessels, that there was some

willingness from a majority of fishermen to accept the estimated value of a vessels (ranging from $10,000 to over $450,000), and that most (70%) fishermen rejected the estimated value of a permit (ranging from $500 to $20,000).

To estimate the number of full-time shark fishing vessels necessary to harvest the total allowable catch of the shark resource in one calendar year, an assessment of the current fishing fleet was conducted. An analysis of fleet characteristics (catch and fishing effort) indicated that approximately 21 directed shark fishing vessels (standardized by length and fishing power) and 96 indirect vessels could harvest a 2.25 million pound total allowable catch in about 270 days.

The Business Plan developed during this project included a variety of options that would reduce fishing effort within the shark fishery. Because the total allowable catch of the fishery is low, the fishery cannot generate sufficient funds for a significant removal of effort (assuming an industry financed buyback program). Hence, the options included in the Business Plan focused predominately on the removal of shark fishing permits (both incidental and directed). One option was included in the Business Plan that would allow for the removal of vessels and permits. Many assumptions were associated with the development of the Business Plan and should be thoroughly considered prior to implementing a buyout scenario.

To gain insight from industry about the acceptance of options included in the Business Plan, a direct mail survey was conducted. Incidental and directed shark permit holder received a package that included: an overview of the project, the options included in the buyout, a comment sheet, a postage-paid return envelope, and a copy of the Draft Buyout Business Plan. Of the 541 mailings that were sent, 74 comment sheets were returned. The majority of respondents did not support the options listed within the Buyout Business Plan ("None of the above" option). We believe that the majority of negative responses were based on the options included in the Plan.

An evaluation of industry comments (either written or verbal) received on the Draft Buyout Business Plan indicated that the options included in the plan were perceived as non-feasible. To increase the effectiveness of the buyback (from both a perceived and realistic standpoint), a more comprehensive buyback should be considered, one that includes increased payment for a shark permit or a vessel and all fishing permits (including shark). Because many participants (almost all) in the shark fishery are dependent upon other fisheries for revenue, a comprehensive buyback targeting a vessel and all associated fishing permits would eliminate substantial capitalization within many commercial fisheries of the Atlantic United States. If other fisheries were included in the buyback, it would increase the total funds available for an industry financed buyback. However, funding from public (appropriation from U.S. Congress) or private programs would increase the overall effectiveness of a buyout.

III. Executive Summary

To increase profits, allow for a year-round directed shark fishery, and to conserve the shark resource, commercial shark fishermen approached the Gulf & South Atlantic Fisheries Foundation, Inc. (Foundation) to assist in the development of a feasible plan to reduce effort through a buyback program. After a series of planning meetings, the Foundation prepared a Request for Proposals (RFP) to solicit outside expertise in the development of a Buyout Business Plan. The RFP was distributed to a variety of individuals and institutions throughout the Southeastern United States. From responses received, four contracts were executed, each focusing on a different objective of the Buyout Business Plan – (1) socio-economic impacts to shark-dependent communities (Independent Contractor; M. Jepson), (2) management, policy and resource analysis (Hanan and Associates, Inc.; F. Hester, R. Hudson, D. Hanan), (3) calculation of fair-market value for a shark permit and/or vessel (University of Florida; S. Larkin and C. Adams), and (4) the development of the Buyout Business Plan (Louisiana State University; W. Keithly). All contractors were successful in completing their individual projects.

To assess the socio-economic impact of a buyout, primary (industry survey – see below) and secondary (permit, landings and U.S.Census) data were utilized. Baseline community profiles, derived through secondary data, were created for each of the major communities where shark is landed. These profiles were used to assess the context for considering a buyout of the shark fishing industry. Using an index of vulnerability comprised of various measures of socio-economic well-being, the selected communities were rated in terms of their ability to withstand adverse impacts from a buyout. Most of the selected communities would be considered vulnerable to adverse impacts that might accrue from a buyout. Although permitted vessels are scattered throughout both the Gulf and Atlantic coasts (Maine to Texas), most landings are reported from the state of Florida. Therefore, a buyback within the shark fishery would have a disproportionate effect on Florida fishing communities.

Insured value, comparable sales value, future income stream value, 1-year of gross revenue, and an assigned value per linear foot of total vessel length were all methods used to assess fair market values of shark fishing vessels. However, none of these methods were used to compute fair market value based on weaknesses inherent with each method. Utilizing information derived from similar buyout scenarios in the northwest U.S., acceptable bid values were computed for vessels using a multiple-range of annual gross revenues for all species landed by the vessel. To compute this value for the shark fishery, a list of federal shark permit holders in the U.S. Gulf of Mexico and Atlantic regions were obtained, along with specific catch histories (all species) for each permit holder. Values were developed for each permit holder utilizing the bid-to-annual gross revenue ratios (the value for shark permit ranged from $500-$20,000; the value for a vessel and all fishing permits ranged from $10,000 to about $450,000). These values were incorporated into a industry survey to allow for an assessment of willingness to accept an estimated bid.

An industry survey was conducted by Jepson and Larkin and Adams to collect primary data from shark fishermen. The survey instrument collected a variety of social and economic data, but was also meant to collect data related to the buyback and any knowledge or willingness to participate. 605 federal shark permit holders were mailed surveys. A 58% response rate was achieved. Approximately 70% of respondents were in favor of a buyout of either vessels and/or permits but were unwilling to pay a tax to fund such a program . However, 70% rejected the estimated permit value as an acceptable buyout payment while approximately 60% of respondents indicated at least some level of willingness to consider the estimated amount as an acceptable buyout payment for the vessel and all permits.

An analysis of the commercial shark fishing fleet was conducted to estimate the number of vessels required to harvest the total allowable catch of the large coastal shark resource for most of a calendar year. Of the total universe of shark permit holders, 126 vessels caught 85% of the annual quota in only a few weeks of fishing. Within the group of 126 vessels, 47 were identified as core vessels that depend on large coastal shark for at least half their total landings and landed 50,000 lb whole weight large coastal shark during the period of study. Through an analysis of the fishing fleet, vessels were standardized by length and fishing power. If the total number of shark fishing vessels were reduced through an industry buyout, about 21 standard Class III shark boats (longline vessels 42-54 ft in length) could take the current quota (2.2 million pounds dressed weight) in about 270 days.

Because of issues surrounding latent effort, coupled with the small government loan the fishery could support during an industry financed buyback, the options included in the Buyout Business Plan focused primarily on the removal of shark fishing permits. These options included: (1) receive $500 for an incidental shark permit and give up future rights to fish for shark, (2) receive $2,500 for a directed shark permit and give up future rights to fish for shark, and (3) Receive $2,000 for a directed shark permit and “buy down” to an incidental shark permit. However, to allow for a more inclusive option that would allow for the buyback of permits and vessels, a forth option was included (4) a “blind, silent reverse auction”. The development of the Business Plan was based on many underlying assumptions. Prior to implementing a final option for capacity reduction within the fishery, these assumptions must be critically assessed to maximize the effectiveness of the program.

To gain insight from industry about the acceptance of options included in the Business Plan, a direct mail survey was conducted. The NMFS-SERO was petitioned for a list of active shark fishery permit holders (both incidental and directed). The resulting query of the available permits database returned 541 shark permits. Survey packages were mailed to each permit holder. Survey packages included: an overview of the project, the options included in the buyout, a comment sheet, a postage-paid return envelope, and a copy of the Draft Buyout Business Plan. Industry members were instructed to choose one of the options included in the Business Plan or a “None of the above” option and return the comment sheet by January 10, 2006; comment sheets were accepted up to May 2006. Of the 541 mailings that were sent, 24 were undeliverable (4%) and 74 comment sheets were returned (13.9% response rate). Industry supported each of the options included in the Buyout Business Plan, except the option to receive $2,000 for a directed shark permit and “buy down” to an incidental shark permit. However, the majority of industry members supported the “None of the above” option (87.8% of respondents). From written comments and telephone conversations with industry, it is thought that the response rate is correlated with the perceived “feasibility” of the options included in the Buyout Business Plan, e.g., response rate was low because options were either not fully understood or perceived as “unfeasible”. Another factor thought to impact response rate was the timing of the survey and the number of surveys targeting shark fishermen.

Survey data and policy documents (Magnuson-Stevens act and NOAA publications) suggest that a buyback within the shark fishery is feasible. However, issues surrounding latent effort, financing, and continued research identifying how commercial fishing businesses fit into their communities need to be addressed. Of significance to fisheries managers and shark fishermen, is the apparent lack of funds generated by the commercial shark fishery to finance a buyback that would substantially reduce capacity. This would indicate that either a more comprehensive buyout is necessary, one that included other fisheries in which shark fishermen participate, and/or an alternative source of funding would need to be secured (U.S. Congressional Appropriation or public financing). Latent effort within the fishery is a significant concern. Of the directed shark permits that were active during the study period, approximately half reported limited or no landings. This suggests that if a buyback were to be effective, latent effort would need to be eliminated or restricted to decrease the likelihood of vessels becoming active after a buyback is implemented.

Results of the most recent large coastal shark stock assessment could further complicate a buyback within the shark fishery. The final SEDAR-11 Stock Assessment Report and Consensus Summary Report indicate that sandbar sharks are overfished and that overfishing is occurring. Sandbar sharks account for

~50% of the large coastal shark landings. Although implementation of revised management measurers will likely not occur until 2008, the total allowable catch for large coastal sharks will likely be reduced, thereby decreasing the funds that could be used to implement an industry financed buyback within the shark fishery.

IV. Purpose

The commercial exploitation of the U.S. shark resource has a long history. The commercial fishery was established in the early 1900's to supply leather, fins, oil, and meat to a variety of user groups (NMFS 2005). When commercial quantities of vitamin A were found within shark liver oil (ca. late 1930's), the fishery expanded considerably (NMFS 2005). The fishery remained strong until the early 1950's when post-World War II technology allowed for the development of synthetic vitamin A through laboratory techniques (Otwell *et al.* 1985; NMFS 2005). The mass manufacturing of vitamin A quickly reduced the demand for sharks and landings declined (Otwell *et al.* 1985; NMFS 2005). It is assumed that the ex-vessel value of shark meat, leather, and fins remained low and that fishing for shark was economically unproductive when compared to revenues generated in other fisheries (NMFS 2005). It wasn't until 1964-1968 that shark landings began to rise (NMFS 2005). Although instigated by an increase in the price paid for leather, the shark fishery also expanded to act as a "nuisance" control to reduce attacks on mackerel fishing operations in and around the Florida Keys (Otwell *et al.* 1985). Shark landings again declined and corresponded with a reduction in ex-vessel value paid for shark leather (Otwell *et al.* 1985).

Conflicting reports in literature suggest that the fishery "developed rapidly" or "accounted for less than 25 full-time jobs in the state of Florida" in the late 1970's (Otwell *et al.* 1985; NMFS 2005). Whichever is true, the fishery did expand significantly by the mid 1980's. Much of this expansion was based on market factors, namely the increased demand and ex-vessel value paid for shark meat, fins, and cartilage. Because the shark resource was perceived to be underutilized, the federal government actively promoted the exploitation of the shark resource and greatly assisted in the development of new markets (e.g., funding of marketing and food development programs) (Personal communication, Mr. Robert Spaeth, Southern Offshore Fishing Association, Inc., Madeira Beach, FL, and Mr. Russell Hudson, Directed Shark Fisheries, Inc., Daytona Beach, FL; Otwell et al. 1985). During this time, U.S. fishermen increased capacity within the fishery to become more efficient at harvesting the resource; this included upgrades to vessels and gear. On-board handling techniques, were also developed during this time to increase the price paid for meat (Otwell *et al.* 1985).

Shark landings peaked in 1989 (NMFS 2005). Based on the life-history strategies of many shark species (low fecundity, long maturation period, and slow growth), five of the regional Fishery Management Councils solicited the Secretary of Commerce to develop a Shark fishery management plan (FMP) that would impose a variety of regulations limiting effort and reducing landings (Brewster-Geisz 2005). The FMP was finalized in 1993 and allowed NOAA Fisheries, Highly Migratory Species (HMS) Office, to manage all shark fishery resources under the auspice of the Secretary of Commerce (NMFS 2005).

The Gulf and South Atlantic commercial shark fishery is a unique fishery that encompasses all local shark species into one of four aggregate groupings, large coastal sharks, small coastal sharks, pelagic sharks and prohibited (no take) species. Each grouping, with the exception of the prohibited species, is regularly assessed through stock assessments; some species are assessed individually. Although exploitation rates differ for each of the aggregate groupings, large coastal sharks have consistently dominated commercial shark landings. Sandbar and blacktip sharks constitute the majority of landings for large coastal sharks (NMFS 2005).

Large coastal shark stocks were assessed in 1990, 1992, 1994, 1996, 1998, 2002, and 2006. The entire large coastal shark stock, and/or individual species contained within the group, have been classified as overfished or overfishing was occurring at some date, either historic or present. These results, lead to increased regulations aimed at limiting landings and effort within the fishery. Brewster-Geisz (2005) provides a detailed timeline of regulatory actions within the shark fishery (from 1993 until present) and the reader is directed to this publication for further information. Generally, restrictions have included catch quotas (often referred to as a "hard Total Allowable Catch"), trip limits, prohibited species, prohibited gears, time-area closures, reporting requirements, minimum size limits, limited access, vessel monitoring systems, fishery observer coverage, and permit restrictions.

As regulatory restrictions increased, many fishermen that historically participated in the shark fishery refocused their efforts to other, more profitable fisheries while retaining their directed or incidental shark fishing permits (personal communication, Mr. Russell Hudson, Directed Shark Fisheries, Inc.), creating substantial latent effort within the fishery. While latent effort is a concern (e.g., inactive shark fishing permits), the shark fishery is still an established and prevalent fishery within the Atlantic United States.

To increase profits, allow for a year-round directed shark fishery, and to conserve the shark resource, industry members approached the Gulf & South Atlantic Fisheries Foundation, Inc. (Foundation) to assist in the development of a feasible plan to reduce effort through a buyback program. The objectives of this project were to:

1. Achieve the southeast region's shark fishery stock rebuilding goals by substantial reductions in fishing effort;

2. Formulate a mutually acceptable, fair, operationally sound and financially viable vessel buyout program; and

3. Minimize or mitigate the negative impacts of the vessel buyout program on dependent fishing communities of the region.

V. Approach

To facilitate the development of the Buyout Business Plan, Foundation staff convened a series of planning meetings with industry cooperators Mr. Robert Spaeth and Mr. Russell Hudson. The purpose of these meetings was to discuss project objectives and develop a Request for Proposals to solicit the assistance of outside expertise in the development of the Buyout Business Plan. The Request for Proposals (RFP) outlined four priority projects, including: (1) socio-economic impacts to shark-dependent communities, (2) management, policy and resource analysis, (3) calculation of fair-market value for a shark permit and/or vessel, and (4) the development of the Buyout Business Plan.

Prior to the start of contractor projects, industry cooperators sampled a limited number of fishermen (both directed and incidental shark fishermen) to gather comments relative to the development of the Buyout Business Plan and the formulation of options that would be accepted by a majority of fishermen. Comments were received through telephone interviews, person-to-person contact, and small group meetings. Because industry cooperators were based in Madeira Beach and Daytona Beach, FL, efforts focused disproportionately on soliciting comments from industry members in these areas. Although concerns may be raised as to how well these samples might represent the entire shark fishery (non-random sampling, limited in time and space), Madeira Beach is considered the center of directed shark fishing efforts and the state of Florida accounts for the majority of shark landings within the United States (Jepson 2005). As such, it was regarded that the diversity of comments received by those industry members solicited would represent the variety of views of the shark fishing fleet. Industry comments indicated there was interest in having both vessels and permits included in the buyback program.

The RFP was disseminated to a variety of groups and institutions throughout the southeastern United States. From received responses, the Foundation executed four contracts, each pertaining to one of the listed priorities.. Listed below are the contractors, the Principle Investigator(s), project objectives and a description of work methodologies:

Calculation of Fair Market Value -

University of Florida. Larkin, S.L. and C.M. Adams. *Assessing the fair market value of commercial shark permits and vessels in the Gulf of Mexico and Atlantic Regions.*

The objective of this project was to determine the "fair market" value of a commercial shark permit and/or vessel as perceived by its owner(s). This was achieved through the conduct of a literature review of past buyout programs, collection of vessel-level data, and the computation of a fair market value for representative shark permits and/or vessels. To gain further insight into the fair market values that a shark fisherman might accept during a buyback scenario, an industry survey was conducted in cooperation with Jepson (2005).

Several sources of information were sought to allow for a thorough review of literature surrounding buyback scenarios, including: peer-reviewed journal articles (e.g., Marine Resource Economics, Review of Agricultural Economics, American Journal of Agricultural Economics), regulatory reports (from nations worldwide, such as the National Marine Fisheries Service in the United States), publications by organizations (e.g., Food and Agriculture Organization of the United Nations, Pew Charitable Trust), and white papers from individuals with in-depth knowledge of specific buyout programs.

To determine "fair market value" of a vessel, historical landings were obtained for each shark fishing license holder. Staff at the NMFS-Southeast Regional Office (SERO) queried the database containing information from the Federal Permit Application for Vessels Fishing in the Exclusive Economic Zone. The query searched for "active" directed and incidental commercial shark permits (i.e., permits codes SKD, SKI, TSKD, TSKI; the latter correspond to 'transfer' permits). An active permit is one in which the annual license fee has been paid; it is not associated with whether or not the vessel is fishing. Each permit is associated with a unique vessel. For each vessel, all of the active permits for other federal fisheries were identified. Two separate searches (one on March 30 and the other on April20, 2004) identified 605 vessels. A review of the associated owners revealed that 41 operations consisted of multiple (2-5) vessels.

The permit information discussed thus far corresponded to "active" directed and incidental shark permits only as recorded in the database on those two dates. It is possible that some other permit codes may correspond to fishing operations that would be eligible for a buyback program. For example, "expired" permits can be re-activated within a year; if these permits are associated with vessels that have been active in the fishery and only expired recently; they would need to be included in the evaluation of the fishery. Discussions with SERO staff indicated that the number of such permits is approximately 1% of the total on any given date. Similarly, "inactive" vessels can become active (those with valid permits can begin fishing) and thereby increase the amount of actual or potential effort in the fishery that needs to be determined for the purpose of examining commercial shark fishing capacity. Thus, any official preliminary analysis of this fishery for the purpose of devising an effort buyback program would need to include expired, renewal, inactive, transfer and active permits on the date the query is conducted.

Estimating the revenues generated by each permit for each vessel was the first step in the fair market value assessment. Prior studies suggested that, in some cases, fair market value for a vessel was roughly approximated by the average annual gross revenue. This value would provide a "starting point" for fair market assessment. In order to determine the annual revenues associated with each federal fishing permit, total annual revenues were needed by species for the most recent historical period that covered multiple years. Multiple years are considered important due to the variability that can characterize fishing stocks and socio-economic conditions that can affect participation. A three-year period was used in this study because it corresponds with the number of years used in recent buyout programs.

Calculation of total revenues by vessel and species required use of multiple NMFS data sources, namely from the Southeast and Northeast Science Centers. This is because landings of species harvested in federal waters are reported in three distinct logbooks for the fisheries with permits. These logbook programs include: the pelagic longline data program for highly migratory species (HMS); the coastal fisheries data program for snapper/groupers, coastal sharks, and mackerel; and the Northeast groundfish logbook.

Ideally, the annual revenues would be calculated using intra-annual (monthly or quarterly) and regional data (to the extent possible) in order to account for seasonal and regional fish prices and individual fish weights (and yields) that can affect revenue estimates. Given that such precision is beyond the scope of this project, current local fish prices and weights are used in this analysis. All references to total revenue, gross revenue, and income in this paper refer to the dockside value of landings calculated with the numbers of fish landed or pounds landed, conversion factors as necessary, and prices reported on the logbooks. The annual landings and dockside values used in this report were obtained from NMFS, the value estimates were generated by NMFS staff. In doing so, the official NMFS landings conversion factors were utilized to ensure the appropriate prices (per pound of whole weight) were applied to the appropriate landings units (i.e., whole weight basis). This was done for all species reported across the suite of permits held by each vessel. As a result, a data set was created that contained landings and gross revenues associated with all species for all vessels that possessed an active directed or incidental shark permit.

A profile of the shark fishery was created by summarizing information on landings and associated total revenues for all vessels that landed any species in 2003. The sample was composed of 474 vessels that are holders of shark permits. Shark permits are classified as directed and incidental. The sample contained 197 directed shark permits and 317 incidental shark permits. Since the 605 total active shark permit holders collectively held an additional 3,080 federal permits, the shark fishery can be characterized as a multi-species fishery.

To further assess "fair market value", all license holders were invited to participate in a survey by responding to a mailed questionnaire. The mail survey was sent to all fishermen who held a shark permit during April 2004 regardless of type of shark permit and whether or not they targeted shark. The survey questionnaire was developed in consultation with representatives of the commercial shark industry (i.e., the Directed Shark Fisheries, Inc. and the Southern Offshore Fishing Association, DSF and SOFA respectively) and was pre-tested by fishermen in the Daytona Beach and Madeira Beach areas.

The implementation of the survey followed a modified-Dillman Approach. In the case of surveys that were returned as undeliverable following the first mailing, internet searches were conducted to confirm the validity of addresses and obtain revised addresses from the U.S. Coast Guard Vessel title database. The survey protocol was submitted to, and approved by, the Institutional Review Board at the University of Florida.

To help explain survey responses with respect to valuation of their permits and/or vessels, data from the Southeast Regional Office (SERO) of NMFS were obtained on transfers of all shark permits and transfers of all permits maintained by SERO for all vessels with an active shark permit in April 2004. Some of these files contained a reported sale price for the permit. The data with this price information covers a five-year period beginning early 2000.

The SERO maintains hard copies of all permit applications by vessel and has an electronic list of vessels involved in transfers for different permit types; the electronic list is continually updated such that historic permit information cannot be easily obtained. From the hard copies it is possible to obtain information on the vessels involved in the transaction, the date the transfer was official, and the reported transaction price. Aside from information on shark permit transactions, the files were also queried to obtain information on transfers of any permits maintained by SERO for all vessels that held shark permits in April 2004.

Data on prices for commercial fishing vessels and permits from two different sources were also collected and summarized. These values provided some indication of the current values for vessels and permits in the market; however, they are not transaction prices. Data was gathered from East Coast Marine Brokers, a private broker site, and from National Fisherman, a commercial fisheries periodical (vessel and permit prices were taken from the May 2004 issues and the August 2004 issues).

To compute fair market values, information generated from the previous objectives and activities described above are used to draw conclusions about what vessel owners perceive is the "fair market value" of their assets. For example, the pros and cons of seven alternative approaches for estimating values of fishing assets are summarized. The preferred approach, and approaches that could be analyzed with available data (e.g., preferences of permit owners, historical landings, transfer information), are used to estimate asset values. The effectiveness of two specific buyout programs (i.e., purchase of shark permits only versus purchase of the vessel and all permits) are then discussed in light of the valuation results and the likely characteristics of such programs as dictated by current NMFS regulations as summarized under the first objective.

Fishing Community Socio-Economic Impact Analysis -

Jepson, M. (Independent Contractor). *Socio-economic and community profile for Atlantic and Gulf of Mexico shark buyout program.*

The purpose of this project was to aggregate and compile socio-economic data to provide a baseline for fishing communities having been identified as being dependent upon shark resources. This was achieved through an overview and description of the current fishery utilizing both primary and secondary data. An industry survey, conducted in cooperation with Larkin *et al.*, was conducted to collect primary data relative to individual social indicators and perceptions of the buyback. U.S. Census and shark permit and landings data were used to assess populations at the community level. An index of vulnerability was also computed to evaluate the impact that a buyout would have on shark dependent communities.

Secondary data were obtained from both the U.S. Census Bureau and National Marine Fisheries Service Southeast Region. Census data for selected communities were obtained from the U.S. Census Bureau American Factfinder website. Data for the years 1990 and 2000 were assembled and placed into tables to comprise a demographic profile of each community. Data were also collected at the county level to use in the creation of a vulnerability index which consisted of select variables for each community compared to the county and then scaled accordingly. Permit data were acquired for the year 2004 from the National Marine Fisheries Service, Southeast Region. Permit data were then assembled into tables by state and for the selected communities. HMS permit data were also acquired from their website to contribute to state profiles.

A mail survey was conducted with a list of 2004 permit owners acquired by Dr. Charles Adams and assembled by Dr. Sherry Larkin. The mail survey was constructed by Drs. Larkin, Jepson, and Adams. Returned surveys were entered into a spreadsheet and the data were distributed to the researchers. Data analysis for this research was primarily descriptive in order to outline concerns of fishermen regarding the potential buyout. Several other questions on the survey provided a profile of the shark fishing industry and are detailed in the report.

Using both secondary and primary data, community profiles were created which provided a context for the buyout process and the potential impact to fishing dependent communities.

The community profiles from the most recent amendment to the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (HMS 2003) was used as a basis for selecting communities, although other communities were added based upon assessment by those knowledgeable with the industry at the time of this research. Profiles from documents describing fishing communities previously were reviewed for communities located in the Mid-Atlantic (McCay and Cieri, 2000) and from research conducted previously on HMS vessels (Wilson and McCay, 1998).

The profiles described here expand on previous descriptions to include data that were considered important social indicators and have been updated with the most recent census data. Permit data for vessels and dealers were also collected and assembled to profile participation in the industry.

Data at the census designated place level (CDP) are used for describing the demographic character of most communities. Where zip code level data only are available (NAIC employment figures), data are compiled for the all zip codes associated with each CDP. When using census data it is important to understand that certain qualification must be made; certain groups of people who have been difficult to contact are often underreported in census data. Commercial fishermen are part of that group as outlined in recent research by Kitner (2001). For that reason, it must be assumed that census data as it relates to fishing communities is suspect. As was pointed out in earlier research (Jacob et al., 2001) any attempt at quantifying employment or income from commercial or recreational fishing becomes problematic. Data may be suppressed or grossly underreported and therefore any description will miss important economic and social contributions of fishing related businesses.

At the same time, census data is the only demographic data that can be applied over large geographic areas, population ranges and timeframes. It is easily available and represents the most affordable alternative for describing any community at this time. Although these data are problematic, it can only be assumed that any underreporting is consistent across geographic area, population range and time. Although this situation is not ideal, by combining several different data from various sources, a general description of community and the fishing activity associated with it may be attained. Until more detailed ethnographic research that can examine the social and economic networks that exist in fishing communities can be undertaken, this general and often broad description of community will have to suffice.

Employment data collected by the Census Bureau were also used at the zip code level for these community descriptions. These data are taken from the County Business Patterns data that are collected on a different timeframe from the decennial census. Data for this description were collected in 1998 and 2001 representing the most up-to-date at the time. Again, it must be assumed for reasons stated earlier that these data are likely to underreport actual fishing employment. In addition, the category of fishing that is reported in the economic census does not include those individuals who report themselves as self-employed, which most commercial fishermen consider themselves to be. Therefore, employment figures from the Census Bureau again grossly distort the actual employment from commercial and recreational fishing. However, these data do point to employment that is related to both commercial and recreational fishing and give some indication of their importance to the community when compared to the same data for other communities. It must therefore be assumed that employment is being underestimated evenly across communities.

Permit data for vessels and dealers was received from the NMFS SERO office in St. Petersburg and used to calculate the number of vessels with directed and incidental shark permits in July of 2004. The query was to identify active shark permits and produced a total of 590 records. These numbers vary from other datasets used by other contractors involved in the buyout program as the data change according to the date of the inquiry. These were the only permit files used for the community profiles.

Landings data in the form of a table listing total landings by community were provided by Larkin and Adams using the dataset compiled for them by NMFS SERO. Landings were for the year 2003 and were calculated by using vessel landings for that year and summed using the variable homeport as the community. Homeport was chosen as community because it was assumed that this is where most shark were landed; according to questions in the analysis of the survey this is the case for most permit holders. For those communities with less than 3 vessels, data are withheld due to confidentiality.

A vulnerability index table was created for each community which consists of selected quality of life variables from the census data. Those variables include: percent minority population; percent below poverty level; percent unemployed; percent high school graduate or higher; Median household income (dollars); percent owner-occupied housing units. These variables were compared to the same variables in their respective county for each community. If the percentage (within 0.5% either way) was greater than that for the county, the index scale score was -1, if the percentage was the same the scale score was 0 and if it was lower the scale score was +1 for the variables poverty level, minority population, unemployment. For the other variables the scale was reversed. The total of the scale scores represents the overall index score of vulnerability with a possible range from +6 to -6. Positive scores suggest less vulnerability while negative scores suggest more vulnerability to adverse impacts. A high vulnerability score for a community would indicate that residents may have difficulty adjusting to disruptions in their social or economic stability as their community may be economically depressed or not capable of offering a better quality of life.

Stock Assessment and Fishery Management Policy Analysis -

Hanan and Associates, Inc. Hester, F., R. Hudson, and D. Hannan. *Southeastern U.S. commercial shark fishery stock assessment and fishery management policy analysis.*

This project aimed to assess the current shark fishing industry and shark resource to determine the size of a fishing fleet that would harvest the total allowable catch over a one year period. This was accomplished through an analysis of the current shark fishing fleet including direct and indirect permits, the distribution of catch and effort, and the composition of catch.

Catch information for the study period came from the two logbook sets: Coastal Fishery and Pelagic Longline. The logbook data were valuable in providing information on vessel performance and catch rates. Quality control and quality assurance measures were implemented to assure that any obvious errors were identified and corrected.

The bottom longline fishery accounted for the majority of large coastal shark landings. To adequately assess an average shark fishing vessel, the analysis focused on this segment of the overall shark fisheries. To decipher which bottom longline trips were directed at sharks, they examined the distribution of shark trips, and how trips might be separated from trips that target other species. Approximately 190 different vessels that used bottom longline gear made at least one trip in the three-year study period (2001-2003). Of the vessels using bottom longline gear, 137 held directed shark permits. Only 126 of the 137 vessels landed more than 100 lbs (whole weight) of large coastal sharks. They considered trips landing more than 100 lbs (whole weight) to be directed shark trips.

When examining the length of trips landing more than 100 lbs of large coastal sharks, it was assumed that short trip duration would be a directed shark trip because of the perishable nature of the product. Approximately 85% of bottom longline trips landing 100 lbs or more of shark had trips that lasted four days or less. For this analysis, a shark trip was defined as being a trip of four days or less with at least 100 lbs of large coastal shark landed.

Representative vessels were then identified. Of the 137 vessels that hold directed shark permits, 54 vessels land less than 50% large coastal sharks (as compared to other species landed). Of the remaining 83 vessels, those that landed 50,000 lbs or more large coastal sharks during the three-year period were selected (two additional vessels were included with slightly less landings to increase sample size). Thus, forty-seven vessels remained and were selected to establish individual vessel classes and compare their fishing power with that of the whole fleet. The 47 vessels included in the analysis account for 71% of the total large coastal sharks landed during the study period.

Three measures were then identified as potential proxies for fishing performance, length, engine horse power, and hold capacity. When regressing these variables against landings per trip, length was the only parameter that showed a significant relationship to landings. Vessels were then divided into four possible classes of directed shark bottom longline vessels based on landings and length: Class I = <32ft, Class II = 32-41ft, Class III = 42-54ft, Class IV = >55.

Class III vessels are the most numerous and about equally distributed geographically and therefore were selected to represent the standard large coastal shark bottom longline vessel. All other vessel classes were standardized to Class III vessels. The catch capacity of the fleet was then computed using standardized Class III vessels (e.g., computing how many Class III vessels and trips it would take to harvest the large coastal shark Total Allowable Catch).

Development of the Buyout Business Plan -

Louisiana State University. Keithly, W.R.. *Business Plan for the Atlantic Shark Fishery.*

The primary goal of this project was to develop a buyback scheme compatible to the nuances associated with the shark fishery. This included a review of relevant literature, including, but not limited to, historical and ongoing buyback programs, project sub-contractor reports, federal regulations and guidelines, and compatibility of these regulations and guidelines with alternative buyback scenarios. Industry and NMFS personnel were also consulted to formulate a 'preferred' program and method for implementation of such a buyback program.

Although a variety of databases were requested for use during analyses (under the Freedom of Information Act), delays were encountered by contractors in the acquisition of data. These delays likely stemmed from the legality of releasing information that could be traced to individuals or corporations. To keep data confidential, all contractors had to individually request data for use and follow necessary procedures (signature of confidentiality agreements that outlined the constraints of who could view data and how data could be presented; this action precluded data sharing among contractors). Data were not received by contractors until late 2004. All data were kept confidential during the duration of this program, and Foundation staff and industry cooperators were barred from viewing raw data or any data outputs that would link individuals/corporations to income revenues and/or catch histories.

Industry Mailings -

To disseminate the Buyout Business Plan to fishermen, the original project proposal outlined a series of public presentations and meetings to discuss proposed options with commercial shark fishermen and interested members of the fishing community. Comments and suggestions on how to improve the plan were to be compiled and used by the project cooperators to aid in the final revision of the Buyout Business Plan. Time limitations and the seasonal variability in fishing effort limited the ability of the Foundation and project cooperators to convene industry meetings. To facilitate input from industry and allow adequate time for a response to options included in the Buyout Business Plan, a survey was mailed to all shark fishermen (this survey was in addition to that conducted by Jepson and Larkin and Adams).

The NMFS-SERO was petitioned for a list of all active shark fishery permit holders, both incidental and directed. Staff from the NMFS-SERO queried the available permits database on November 30, 2005. The query returned 541 shark permits, and 20 lessees. Because the focus of this project was to receive comment from the owners of shark permits, lessees were not included in the mailing. Each shark permit holder received one complete survey package via U.S. Postal mail. Survey packages included: (1) a one-page overview of the project, (2) a synopsis of the options included in the Buyout Business Plan, (3) a copy of the Draft Buyout Business Plan, (4) a comment sheet, and (5) a self-addressed, postage-paid return envelope. Mailings were postmarked to permit holders on December 6-7, 2005.

The comment sheet included in the survey allowed fishermen to individually mark options included in the Business Plan which they supported. Options included: (1) receive \$500 for an incidental permit and give up future rights to fish for shark, (2) receive \$2,500 for a directed permit and give up future rights to fish for shark, (3) receive \$2,000 and be permitted to "buy down" to an incidental shark permit, (4) "Blind, silent reverse auction", and (5) "None of the above". Additional space was included on the comment sheet to provide for additional, handwritten comments. All comments were to be received by January 10, 2006. However, comments were accepted up to May 2006. All comments remained anonymous.

As outlined in the survey package, the Foundation's Program Director, Mr. David Medici, was available to answer questions regarding the Buyout Business Plan. Six (6) industry members contacted the Foundation's office directly. All conversations revolved around the history of the Buyback program and why the options included in the Buyout Business Plan were incorporated.

Project Management –

Principal Investigators:

Ms. Judy L. Jamison	Executive Director, overall administrative supervision
Mr. David Medici	Program Director, technical supervision

Foundation Staff:

Ms. Gwen P. Hughes	Program Specialist, contract administration
Ms. Charlotte L. Irsch	Grants/Contracts Specialist, contract administration

The Foundation's Executive Director, Ms. Judy Jamison, had ultimate responsibility for all administrative and programmatic Foundation activities, with oversight by the Foundation's Board of Trustees. She ensured progress of activities to meet project objectives and confirmed compliance of all activities with NOAA/NMFS guidelines. The Program Director, Mr. David Medici, was responsible for all technical aspects of Foundation projects and coordinated the performance activities of project personnel, including contractors. He also coordinate the survey package mailing, and prepared all operational reports concerning project performance.

The Grant/Contracts Specialist was responsible for maintaining general financial accounting of all Foundation funds including all Cooperative Agreements/Grants and contracts, as well as communicating with NOAA Grant Management personnel, and assisting auditors in their reviews. She conducted/documented internal and program (single and desk) audits, prepared backup documentation for fiscal audits, and drafted award extension requests. Ms. Irsch provided the Executive and Program Directors with projected budgets concerning program performance and ensured that these budgets adhered to the proposed budget. Finally, she prepared the annual administrative budget, NOAA Financial Reports, and confirmed compliance of all activities with NOAA/NMFS and OMB guidelines.

The Program Specialist was responsible for tracking programmatic activities, generating supporting documentation to assist in any and all programmatic audits, and coordinating program related workshops (Planning Meetings). She was also responsible for auditing and paying program related invoices. She processed requests for reimbursement to conform with federal guidelines and prepared and maintained all contracts and amendments.

VI. Findings

Each component of this project was successfully completed and culminated in the drafting of a Buyout Business Plan for the Atlantic United States commercial shark fishery. Listed below is the Executive Summary or Conclusion of each project with supplemental information on major findings. For additional information, contractor Final Reports are attached as appendices.

Calculation of Fair Market Value -

> University of Florida. Larkin, S.L. and C.M. Adams. *Assessing the fair market value of commercial shark permits and vessels in the Gulf of Mexico and Atlantic Regions.*
>
> The commercial shark fishery within the Gulf of Mexico and Atlantic region is recognized by fishery managers as being overfished and overcapitalized. The implementation of traditional management measures to address this issue have created significant uncertainty within the commercial fleet and appear not to have corrected the problems. Representatives of the

commercial shark fleet within the region have requested that federal fishery managers consider the development of a permit and/or vessel buyout program for the commercial shark fleet. It is hoped that this non-traditional approach to shark fishery management will allow latent effort to leave the fishery and provide for a more economically efficient commercial fleet to harvest shark in a long term, sustainable manner within the biological constraints (i.e., harvest quotas) imposed by management. Such a buyout program would likely require the issuance of a federal loan, to be paid back by those vessels remaining in the fishery. The loan amount would be determined, in large part, by the expected dockside value for shark throughout the duration of the loan. Once the number of permits and/or vessels to be removed from the fleet is determined, the question remains: is the loan amount enough to buy back those permits and/or vessels? The answer to that question would be linked directly to the perceived fair market value of commercial shark permits and/or vessels, and the owners' willingness to accept that value and leave the fishery.

The overall objective of this study was to estimate the fair market value of a commercial shark permit and vessel. This information would be necessary to ascertain the financial feasibility of a proposed buyout program. The specific sub-objectives of the study were to (1) conduct a literature review of past and present buyout programs to determine the role that fair market value assessment has played in buyout program design and development, (2) obtain the appropriate vessel-level data from industry and federal management sources that would allow the determination of landings and gross revenue profiles associated with commercial shark permits and/or vessels, and (3) compute the fair market value for commercial shark permits and/or vessels.

A list of all vessels with a federal shark permit of any type was obtained from the SERO of the NMFS. Landings and value data were obtained for these vessels from the NMFS Southeast Fisheries Center and NMFS Northeast Fisheries Science Center. These data allowed the development of landings and revenue profiles for commercial shark vessels within the region. The list of permits also provided the mailing list for a mail-out survey that was sent to all federally permitted shark vessel owners within the region.

Of the 605 active shark permits owners in April 2004, 249 were directed permits. These 605 permit owners collectively held 3,585 commercial fishing permits, indicating a high degree of participation in other fisheries. The majority of other permits were swordfish, Atlantic tunas, king mackerel, and Spanish mackerel. Thus, a permit only buyout program is likely to only have limited success (especially since some of these other permits are required in order to fish shark) and a vessel buyout program would need more funding that could be supported by the shark fishery (assuming the other species contributed sufficiently to total revenues). There is also an issue of latent effort to be addressed since only 517 of the 605 vessels reported any landings during the 2001-2003 period.

Of the 605 potential respondents, only 551 had valid addresses, which could be related to permit sales between the list date and the survey date. One key component of the mail survey asked respondents (commercial shark permit owners) to indicate their willingness to consider (a) helping to fund a buyout program through a subsequent long-run tax on landings, (b) selling their shark permit and their vessel with all permits, and (c) likelihood of accepting a given value (i.e., bid) for their shark permit and their vessel with all permits. The likelihood was solicited in quarter increments from 0% to 100% (i.e., would definitely accept the bid and retire assets).

Landings-based value offers were computed using the average of the two highest years shark revenues and total revenues across all species during the 2001-2003 time period for each vessel. If vessels only reported landings for one of three years, the value for that single year was assumed to be the average. Total revenues were converted to expected bids using a model based on results of the recent Pacific Northwest groundfish buyback program (Larkin and Adams 2005; personal communication, Dr. Mike Grable, NMFS). The model explains 91% of the variation in bid ratios (e.g., $R^2 = 0.91$).

The model produced corresponding bids for the combined annual total revenues for all species ranging from just over $15,000 to nearly $456,500. Vessel owners with an average annual total revenue for all species below $5,000 were assigned a bid value of $10,000 (137 of 605 total vessel). Owners of vessels with total average annual revenues above $456,500 (were assigned bid values equal to that average (values reached nearly $1.6 million). These values would be paid for a vessel, any associated permits, and the price to scrap the vessel.

The shark revenues were converted to expected bids for surrender of their shark permit using the same formula for average annual shark revenues (based on the highest two of three years in this study period) ranging from $1,000 to $8,500. For permits with shark revenues below $1,000, permit owners were assigned a bid value of $1,000 if they had reported any shark landings during the three-year period (197 permit holders), or $500 if they had not (207 permit holders). In some instances, the bid generated for shark permits exceeded the bid for all permits and the vessel. In such cases, the shark permit value was reduced to half the value presented for all permits and the vessel. For average annual revenues in excess of $8,500, permit owners were assigned bid values (split equally across each value) of $15,000, $17,500, or $20,000; higher values were presented to those with higher reported landings. The values were capped into these three groups to prevent the use of unrealistic values.

A total of 321 permits owners (58.3% of available population) responded to the survey. Among the respondents, 75% and 66% were willing to sell their shark permit and/or their vessel with all permits, respectively. When asked about their likelihood of accepting the landings-based offer presented to them, less then 30%, but more than 60%, were at least somewhat likely (i.e., indicated a 25% or higher percentage) to accept the bids for the shark permits and/or vessel and permits. Assuming an individual would accept the offered bid with a likelihood of at least 50%, a program to purchase only shark permits would cost $414,500 (approximately 15% of the annual value of the fishery) and would eliminate 9.3% of the value of the fishery. A program to purchase vessels and all permits would cost $50.3 million (approximately 60% of the annual value of all fisheries) but would eliminate 45.2% of the value of shark landings as reported annually from 2001-2003.

Fishing Community Socio-Economic Impact Analysis -

Jepson, M. (Independent Contractor). *Socio-economic and community profile for Atlantic and Gulf of Mexico shark buyout program.*

The report consists of a socio-economic profile of the Gulf and South Atlantic shark fishery and selected communities. Using both primary data, a mail survey, and secondary data (e.g., permit data, landings information and census data), baseline profiles of both the industry and selected communities are used to determine the context for considering a buyout of the shark fishing industry.

Using an index of vulnerability comprised of various measures of socio-economic well-being, selected communities are rated in terms of their ability to withstand adverse impacts from a buyout. Most of the selected communities would be considered vulnerable to adverse impacts that might accrue from a buyout and that these communities might not fare as well as the county, overall, in terms of quality of life. Although shark fishing is only one resource that is available to fishermen, an increasing number of fisheries are being regulated through limited entry and other management actions. Hence, the ultimate methodology for the buyback might have a disproportionate effect on fishermen. If a buyback of permits is the only considered option, then a fisher might be able to reduce the impact to the community by focusing efforts on another marine resource and stay active within fisheries. If the buyout were to focus on a buyout of permits and vessels, fishers would be permanently retired as a result; this would likely increase the negative impact to the community. Whatever the final method used to remove capital from the fishery, it is recommended that other measures of social impact assessment be used to understand how communities will be affected (the age of shark fishermen and the ability to enter into/increase efforts in new fisheries).

Primary data were collected through a mail survey of vessel owners in 2004. These data were analyzed to understand concerns over a proposed buyout. Although permitted vessels are scattered throughout both the Gulf and Atlantic coasts (from Maine to Texas), most landings are reported from Florida. Permitted vessels are found in concentrated number in only a few communities on either coast including Port Salerno, Pompano Beach, Fort Pierce, Madeira Beach and Panama City.

The response rate to the survey was over 50% and the geographic distribution of responses was closely aligned to the actual distribution of vessel owners overall. In terms of their demographic profile, respondents to the survey were on average around 50 years old and most had fished commercially for a good part of their adult lives with an average of 28 years. Of those that fished shark routinely, they had done so on average for about 16 years. The majority of respondents had a high school degree or higher in terms of their education level. Almost 75% of respondents were married and most were likely to have households with dependents. With regard to ownership of their homes, nearly 85% of those who answered this question owned their homes and about 10% rent. Just over 72% of respondents had health insurance for themselves and slightly less had health insurance for their family. With regard to opinions toward different management, the majority of respondents did not support revoking unused permits. This may reflect the large number of permitted individuals who do not have shark landings. Over 70% support either buying back permits or both permits and vessels. Approximately that same percentage do not want to see existing regulations tightened.

The majority of shark vessel owners surveyed were in support of a buyout, but indicated they were unwilling to pay a tax to fund such a program. Because the revenues from the shark fishery are relatively low, there would be little money to buy vessels and therefore would have little impact on reducing capacity. Although there is support for a buyout of permits and vessels, some alternative source of funding would be needed to have the desired impact of reducing over-capacity within the fishery if it were based solely on shark revenues.

Stock Assessment and Fishery Management Policy Analysis -

Hanan and Associates, Inc. Hester, F., R. Hudson, and D. Hannan. *Southeastern U.S. commercial shark fishery stock assessment and fishery management policy analysis.*

Nearly 600 boats ranging in size from a 14 ft skiff to a 146 ft motor vessel hold federal Limited Access Permits for landing sharks taken from the U.S. Exclusive Economic Zone in the Atlantic, Caribbean and Gulf of Mexico. These fishing vessels are estimated by NMFS to take the current annual Total Allowable Catch of large coastal sharks in a few weeks of fishing during each trimester (four-month) open period. This report estimates the number of active boats needed to match fleet size and therefore effort (expressed as fishing time) required to catch the Total Allowable Catch.

There are two types of shark Limited Access Permits: Directed and Incidental. Under current regulations, the directed permit holders are allowed to land up to 4000 pounds dressed weight of large coastal sharks per trip (some species in the complex are protected and not allowed to be landed). Incidental permit holders are allowed to land up to five large coastal sharks per trip.

In 2003, there were approximately 245 directed shark permits and 349 incidental shark permits extant. Most of the permitted vessels held federal permits to fish for other species as well as shark. This made it necessary to identify a "directed shark boat" and a "directed shark trip". A directed shark boat was defined as holding an incidental shark permit, using bottom longline gear and having made at least one directed shark trip (a trip lasting 4 days or less and landing at least 100lbs whole weight of large coastal sharks) during the three year period (2001-2003) for which logbook data was available. The 4-day time limit was used to separate trips believed to target large coastal sharks from trips that targeted other species and then finished off the trip with one or more sets for large coastal sharks. Using these criteria, 126 directed shark boats that produce 85% of the large coastal landings were identified.

Within the group of 126 vessels, they identify 47 core vessels that depend on large coastal sharks for at least half their total landings and landed 50,000lb whole weight large coastal sharks during the three-year period. These cores vessels were used to standardize fishing power (defined as catch per set and catch per trip). Four classes of directed shark vessel were identified: Class I = <32ft, Class II = 32-41ft, Class III = 42-54ft, and Class IV = >54ft. 116 of the 126 boats were standardized to Class III (ten of the 126 lacked length information in the database), and estimated a large coastal shark catch-per-trip for a Class III vessel at 2270 pounds dressed weight.

During the three years covered by the database, 175 directed shark permitted vessels and 96 incidental shark permitted vessels reported landing some large or small coastal sharks. These landings included catches by gillnet and handline as well as bottom longline and pelagic longline. Seventy directed shark permitted vessels and 253 incidental permitted vessels made no shark landings, and represented latent effort that could participate in the fishery unless their permits are removed. Assuming this were done, and these boats cannot fish large coastal sharks, they estimated that a fleet size of about 20 Class III directed shark permitted vessels and 96 incidental shark permitted vessels would match available effort to catch the current TAC of 2.25 million pounds (the actual number of boats would need to be adjusted according to length during the buyout process). Fleet size could increased to about 50 boats under an increased TAC of 5 million pounds. The effect of increasing the trip limit could not be quantified, but the distribution of landings suggested that a 25% increase to 5000 pounds was unlikely to have a major impact.

Development of the Buyout Business Plan -

Louisiana State University. Keithly, W.R. *Business Plan for the Atlantic Shark Fishery.*

Commercial shark activities represent a single component of a multi-species, geographically disperse fishing industry. It is plagued by many of the same problems facing numerous fisheries throughout the world. Many of the problems, such as overfished stocks and overfishing conditions, emanate from a severe mismatch between the available capital and amount of stock that can be taken in an efficient and sustainable basis.

As a result of this mismatch, some participants of the Atlantic shark fishery have asked that a buyback program be considered for the fishery. The Buyout Business Plan, based on available information, considers the viability of such a program and develops a “draft” plan for the purchasing of shark permits.

Buyouts within fisheries have historically been funded by one of two methods: industry financed loans or direct appropriations from the U.S. Congress. An appropriation does not require repayment, but policy documents from the NMFS suggests that the U.S. Congress is unlikely to fund future buybacks. The amount of an industry financed loan is based on the value of landings from the fishery and must be repaid (with interest) over a 20 year period. This suggests that if the total value of the fishery were to increase, the amount available for a buyback would also increase proportionately. Unfortunately, the current TAC of the shark fishery is estimated at a value of ~$5,000,000; a value that represents a small loan amount for an industry funded buyback. If vessels were to be included in the buyback options, the effectiveness of the program would be reduced (only a few vessels would be removed from the fishery). Hence, the Buyout Business Plan focused on the removal of permits.

While there appears to be a myriad of problems associated with development of a viable buyback program, the largest obstacle by far reflects the exceedingly large amount of latent and underutilized capacity in the fishery. While this capacity can, in theory, be removed via a buyback program, such efforts would be a wasteful use of funds and not reduce the size of the active fishing fleet (those actively fishing for shark on an annual basis). An option, therefore, is to make a direct request to the Secretary of Commerce that he take whatever actions are required to revoke unused or (substantially) underutilized capital (i.e., shark permits that are idle or rarely used).

Other concerns also exist regarding the viability of a buyback of shark permits. As discussed in this report, some states have regulations that are not completely compatible with federal regulations regarding the harvest and sale of shark. Likewise, the recreational component of the shark industry, which is sizeable, is not subject to a limited access system. Incompatibility of regulations and lack of a recreational limited access program suggest that some benefits that might otherwise be forthcoming from a buyback program, may well be eroded.

The issues of capital stuffing by post-buyback participants is also well recognized problem which can, over time, erode benefits initially gained from a buyback program. The Atlantic shark industry needs to carefully examine whether this issue is problematic before undertaking a program which it will be taxed for up to twenty years.

Finally, while this report focused almost exclusively on a buyback of permits, the industry may wish to consider a more “all inclusive” buyback program. Without going into detail, it is obvious that the amount of capital removed is directly related to the inclusiveness of the program. While an “all inclusive” program would, of course, require considerable coordination among many management councils and other agencies, such coordination may yield significant long-term benefits. However, these benefits must be weighed against a potentially long delay in implementing such a program.

Industry Mailings –

Of the 541 survey packages mailed, 74 comment sheets were returned (13.9% return rate). Twenty-four (24) of the survey packages were undelivered and subsequently returned to the Foundation’s office (4.4% undeliverable). Returned packages were from the states of Louisiana (13), Florida (7), South Carolina

(2), New York (1) and New Jersey (1). Of the returned packages from Louisiana, many were from or near the New Orleans area. Considering the impact of hurricanes Katrina and Rita, responses from Louisiana fishermen could be under represented.

Comments received by industry members supported each option included in the Business Plan with the exception of the option that would compensate fishermen $2,000 for a directed permit and "buy down" to an incidental shark permit. Overwhelmingly, the majority of industry comments supported the "None of the above" (e.g., "no action") alternative (Table 1).

Option	No. of Industry Responses	% of Total Responses
Receive $500 for an incidental permit and give up future rights to fish for shark.	4	5.4%
Receive $2,500 for a directed permit and give up future rights to fish for shark	1	1.4%
Receive $2,000 and be permitted to "buy down" to an incidental shark permit	0	0.0%
"Blind, silent reverse auction"	4	5.4%
None of the above	65	87.8%

Table 1: Options included in the Business Buyout Plan and industry responses. Total number of responses equal 74.

Of those that preferred the "None of the above" alternative, some provided additional hand written comments. Generally, fishermen expanded on their attitudes surrounding the buyback, options included in the Buyout Business Plan, and alternatives that were not considered. Most respondents were critical of the project and the amount of compensation being proposed for a shark permit. In addition to written responses from the survey package, the Foundation's Program Director fielded 6 calls from industry members inquiring about the buyback program. From these telephone conversations, it was apparent that industry members were confused about the development of the Buyout Business Plan and why specific options were included.

VII. Evaluation

All objectives for this award were completed. Contractors performed a series of research projects that provided detailed analyses of the Atlantic United States commercial shark fishery. These analyses allowed for the development of a Buyout Business Plan aimed at reducing capitalization within the fishery, while increasing profits to those individuals who stay in the fishery (assuming no significant regulatory changes).

While the proposed focus of the project shifted away from a buyout of vessels and permits, to a buyout of permits only, a "Blind, silent reverse auction" option was included in the Buyout Business Plan to allow for more options in the types of capitalization that could be removed during a buyback process (e.g., shark permits, all fishing permits, vessel, and/or vessel and permits).

Shark fishermen did not significantly support any of the options included in the Draft Buyout Business Plan, and most survey respondents supported the “None of the above” (“no action”) alternative (87.8%). These results were expected. Prior to mailing the Buyout Business Plan survey packages, industry cooperators hypothesized that the Buyout Business Plan would be rejected due to low compensation rates being offered for shark permits. Industry cooperators asserted that directed shark fishing permits sold for $7,500-$12,000 on the open market with no history of landings. This claim was substantiated by Larkin and Adams (2005) and their summary of past transactions by currently active directed and incidental shark permits. Analyses indicated that the average transfer price for a directed shark permit was $5,950, while a permit owner’s willing-to-accept price (as reflected in published personal advertisements) for a directed shark permit was $9,500-$15,000. When comparing these rates to the compensation being offered in the Buyout Business Plan ($500-$2,500), it is obvious why fishermen rejected these options; hand written comments from fishermen on survey sheets also reflected this point.

It is interesting to note that in the survey conducted by Larkin and Adams (2005) price ranges for permits ranged from $500 for permits that had not been associated with landing any species (not just sharks) during 2001-2003 up to $20,000 for permits that reported the highest average landings of shark during that period. A positive response was received across all categories, but was highest for those with higher landings. This suggests a speculative behavior on the part of latent permit holders and that a buyout for permits restricted to those that have landed shark could lure some to relinquish their fishing rights.

If it was expected that fishermen would reject the options included in the Buyout Business Plan, then why put those options in the Plan at all? Keithly (2005) and Larkin and Adams (2005) provide a detailed explanation. Briefly, the revenues generated by the total allowable catch of the shark fishery are too low to support an industry financed government buyback loan that would remove a significant amount of capitalization. In an example used by Larkin and Adams (2005) utilizing 2001 catch statistics, the total ex-vessel gross revenues of Atlantic shark fisheries were valued at approximately $3 million. These landings would only support a loan of about $1.87 million assuming a 4% U.S. Treasury annual interest rate. Utilizing a proposed vessel value assumed by the commercial shark fishing industry of $5,000 per linear foot, a $1.87 million industry financed loan would only remove 7 vessels during a buyback (assuming a vessel of 40 to 60ft). While there are many underlying assumptions associated with this example, when taking into account the total number of participants in the shark fishery (both incidental and directed fishing permits), clearly, an industry financed buyback focusing on the removal of vessels would be an exercise in futility.

Response rates to the options included in the Buyout Business Plan were markedly different (13.9%) than response rates attained by Jepson (2005) and Larkin and Adams (2005) (58.3%) during this project. Although a comparison of these surveys is impractical, the pool of respondents for each survey was approximately the same (541 vs. 551). Why the difference in response rates? Upon dissemination of the Buyout Business Plan survey package, industry cooperators conveyed that some fishermen discarded the survey package after a brief review of the options included in the Buyout Business Plan. From this information, it is thought that response rate could be correlated with the perceived “feasibility” of the options included in the Buyout Business Plan. For example, if more fishermen perceived the options in the Buyout Business Plan to be a financial benefit, then one would expect an increased response rate. Building on this idea, one is lead to believe that the options were not fully understood (e.g., “Blind, silent reverse auction”) or perceived as “unfeasible”.

Another factor that could have affected survey response rate is the number of surveys targeting the same sample population and the timing of surveys. Within one twelve month period, three surveys were conducted that focused on commercial shark fishermen: two for this project and one through Duke University. The surveys conducted by Duke University and Jepson (2005), Larkin and Adams (2005) were conducted within a relatively short period of time (several months). The industry survey soliciting comments on the Buyout Business Plan was conducted about 12 months later. It is possible that fishermen became disinterested in replying on the options included in the Buyout Business Plan.

While fishermen did not accept the options included in the Buyout Business Plan, data suggests that the majority of shark fishermen are interested in a buyout (Jepson 2005; Larkin and Adams 2005). Considering the National goal of a 25% reduction in fishing capacity by 2009 for all federally managed fisheries (NMFS 2004), a buyout within the shark fishery is still likely, but several significant impediments must first be addressed (regulations, reduction or elimination of latent effort, identification of alternative funding sources for a buyout, and the inclusion of more feasible options in the Buyout Business Plan).

Of significance to fisheries managers and shark fishermen, is the apparent lack of funds generated by the commercial shark fishery to finance a buyback that would substantially reduce capacity. This would indicate that either a more comprehensive buyout is necessary, one that includes other fisheries in which shark fishermen participate, and/or latent effort would need to be severely restricted or eliminated to increase the effectiveness of the buyback.

No recommendations are presented on how to mitigate the adverse impacts of a buyout within the commercial shark fishery. This can be attributed largely to the underlying assumptions that were implicit with each of the contractor's projects. While this overall program did describe and highlight the nuances of the fishery and willingness of fishermen to participate in a buyout, specific research highlighting how commercial fishing economies and enterprises incorporate into larger community economies and cultures (Jepson 2005) is necessary (this was not an objective included in this program). This insightful socio-economic research would then need to be reviewed by regulators to address concerns revolving around latent effort. Without these issues resolved, a formal buyback structure cannot be defined, hence adverse socio-economic impacts cannot be mitigated.

Data from the SEDAR-11 workshops (Large Coastal Sharks) might further complicate problems associated with a buyout. The final SEDAR-11 LCS Stock Assessment Report (NMFS 2006) and the Consensus Summary Report (Payne 2006) indicate that sandbar sharks are overfished and that overfishing is occurring. Sandbar sharks account for roughly one-half of large coastal shark landings on an annual basis (Hester *et al.* 2005; NMFS 2006; personal communication, Russell Hudson, Directed Shark Fisheries, Inc.). Although implementation of revised management measures will likely not occur until 2008 (personal communication, Karyl Brewster-Geisz, HMS Office, NMFS), the Magnuson-Steven Act requires NMFS to prevent overfishing and rebuild overfished stocks. This mandate is expected to result in a lowered TAC for large coastal sharks.

When quota adjustments are implemented, fishermen will continue to target shark stocks during the open season. However, the shark stock will be harvested in a shorter duration during the open season (i.e., the season will be reduced). Two possible scenarios are likely to result, each with a corresponding effect on the commercial fishery. Once the trimester shark fishing quota is filled, fishermen will be forced to shift their fishing effort to other fisheries, not normally targeted by shark fishermen, to remain profitable. This places a potentially undue burden on the newly fished stock. If fishermen cannot successfully transition to a new fishery and remain profitable, the second scenario could be encountered, the creation of a part-time fisher or early retirement of a fisher. Data from Hester *et al.* (2005) and Larkin and Adams (2005) suggests that vessels with smaller gross revenues will be most affected by a lowered TAC due to the increased dependence of these entities on shark stocks as a source of income.

If the TAC for the shark fishery is further reduced, the potential of an industry financed buyback within the shark fishery can be considered a financially impractical possibility unless a more comprehensive buyout program was considered. Increasing the number of fisheries involved in a buyback increases the complexity of the program and places more burden on other fisheries, besides that of shark, to pay back the industry financed loan. To be effective at reducing capital within the fishery, shark fishermen and fishery managers should explore financing alternatives outside of an industry financed program. This would include government (Congressional Appropriation) or private/public (charitable trusts, foundations, philanthropists) finance programs.

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Appendix

Appendix A

Business Plan for the Atlantic Shark Fishery

BUSINESS PLAN FOR THE ATLANTIC SHARK FISHERY

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TABLE OF CONTENTS

LIST OF COMMONLY USED ABBREVIATIONS AND ACRONYMS

Avg.	**Average**
DW	**Dressed weight**
FMP	**Fishery Management Plan**
LBS	**Pounds**
LCS	**Large coastal sharks**
MT	**Metric tons**
NMFS	**National Marine Fisheries Service**
QMS	**Quota Monitoring System**
SCS	**Small coastal sharks**
TAC	**Total Allowable Catch**

“DRAFT” BUSINESS PLAN FOR THE ATLANTIC SHARK FISHERY

I. BACKGROUND

A. Justification[1]

The Sustainable Fisheries Act (SFA) amended the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to provide for voluntary reduction of excess fishing capacity through fishing capacity reduction (buyback) programs. Excess fishing capacity decreases fisheries earnings, complicates fishery management and imperils fishery conservation. Congress acknowledged this by providing buyback program authority.

The statutory objective of a buyback program is “to obtain the maximum sustained reduction in fishing capacity at the least cost and in a minimum period of time.” Buyback programs pay fishermen either to (1) surrender their fishing permits or (2) both surrender their fishing permits and either scrap their fishing vessels or restrict vessel title to prevent fishing. Buybacks can involve a Federal or State fishery. Buybacks can be funded via a long-term loan from the Federal government to the fishery (called industry-funded buybacks), to be repaid by the industry by post-buyback landing fees, or funded from appropriations (non-industry funded) or other loan sources of funds.

Some participants of the Atlantic shark fishery have expressed interest in a buyback program and have requested that a “business plan” be developed. This report is in response to industry request. Specifically, the primary goals of this report are to: (a) ascertain the feasibility of such a program and (b) develop a “working document” that can be used by the industry as it further considers whether to pursue a buyback program. The report should not be considered the final word regarding a buyback program for the shark fishery but, rather, a starting point to generate additional discussion and ideas.

While the program is detailed in subsequent sections of this report, in some cases it is useful to start with some of the conclusions. This is one of those cases. Economists have long recognized that buyback programs, while possibly reducing the short-term severity of many of the problems facing fishermen, are not, in general, a lasting solution to the problem. As suggested by Weninger and McConnell (2000), “[b]uyback programs may achieve alternative management objectives, such as stock conservation or income transfers. They may also reduce administrative costs by simply reducing the number of vessels that are managed. However, the technological and capital-market conditions under which buyback programs lead to sustainable and efficient resource exploitation are exceptional. As such, buyback programs should not be viewed as a viable long-term

[1] The introduction to the Justification section is taken verbatim from the document “Supporting Statement: Fishing Capacity Reduction Program Buyback Requests, OMB Control No.: 0648-0376.”

solution to the economic problems of commercial fisheries exploitation (p. 412)." As examined in greater detail later in the report, these "technological and capital-market conditions under which buyback programs lead to sustainable and efficient resource exploitation" may be lacking in the Atlantic shark fishery.[2] In addition, a suite of other factors, generally considered as a prerequisite, for any buyback program, at least to some extent, also tend to be lacking. All of these issues "call into question" the long-run economic and financial viability of a buyback program for the Atlantic shark fishery.

These issues are "brought to the surface' throughout the report, not in an attempt to dissuade participants of the industry from pursuing a buyback program, but instead to (a) caution them regarding some of the weaknesses of a buyback program under current conditions and (b) highlight issues that the industry may wish to address prior to establishing a buyback program. It is, after all, the industry that will have to make a final decision regarding whether a buyback program is appropriate in the current setting and/or whether certain actions can be taken to enhance the viability of any buyback program.

B. Goal

To align fleet harvesting capacity in the Atlantic shark fishery with the sustainable harvesting capacity in that fishery.

Rationale: We all know the problem, or at least have heard the problem as explained to us by fishery managers. Simply stated, there are too many fishermen with too much equipment (referred to as capital) chasing too few fish (sharks). And, since the amount of fish (generally referred to as the fish stock) is, at least over time, related to the number of fishermen and the amount of capital used by these fishermen, excessive numbers of fishermen and/or capital can result in reductions in fish stocks and, more importantly, at least to each participant in the fishery, a concomitant reduction in his individual harvest. Since profits tend to be, at least indirectly, related to the amount harvested, an increasing number of fishermen or capital can result in a reduction in profitability to many of the participants.

Economists, recognizing the problem of open-access fisheries, more than 50 years ago recommended limited entry as a means of controlling expansion of capital, thereby, as envisioned, enhancing profits in the fishery as well as preserving/enhancing the fish stock. Empirical evidence over the past 30-plus years suggests that limited entry, by itself, is not the panacea that many of the economists had predicted. Why? Simply stated, limited entry does little or nothing to control the amount of capital employed by

[2] For example, buyback programs can, in the short run, generate positive profits among post-buyback participants. These profits reinforce investment incentives. As investment increases, profits are once again dissipated. Hence, while the buyback may reduce the number of vessels, the long-run post buyback level of capital in the fishery may approach that level which existed prior to the buyback. Hence, a strong prerequisite for a "successful" buyback program is the ability of the management agency to control the amount of capital employed by the post-buyback participants. Doing so has been shown to be exceedingly complicated,

participants permitted in the fishery. Hence, when, say, industry profits are increasing, participants (which are limited in number) respond by increasing the amount of capital exerted on the fish stock. This is frequently referred to as "capital stuffing." In short, empirical evidence now suggests that limited entry often does little, by itself, to enhance long-run industry profitability or preserve/enhance the stock of fish.[3]

Recognizing that benefits (measured on the basis of profitability and/or stock preservation) from limited entry were, in fact, quite limited, fishery managers then turned to combination of limited entry and input controls among participants in the fishery (say, on the horsepower of engines or days at sea). While found to be more successful at enhancing long-term profits and protecting fish stocks than a "stand alone" limited access program, the success associated with combined limited access and input restriction programs have, in general, found to be less than originally envisioned. The reason for this reflects the fact that fishermen are innovative at substituting non-restricted inputs for those that are restricted. As such, input restrictions tend to be effective only in those limited instances where substitutes are few or prohibitively expensive.

Over time, increasing recognition has been given to the fact that managing fisheries in an "optimal" manner would necessitate significant capital reductions in those fisheries already considered to be overcapitalized and curtailment of capital expansion in those fisheries not yet considered to be overcapitalized.[4] Recently, the U.S. developed it own national action plan for the management of fishing capacity with a goal "…to eliminate or substantially reduce overcapacity in 25 percent of the U.S. federally managed fisheries by 2009 and in a substantial majority, including fisheries that most seriously exhibit this problem, by 2015 (U.S. Department of Commerce, 2003)."[5]

The U.S. plan identified three major approaches for management of capacity: (1) permit management programs, (2) exclusive quota programs, and (3) buybacks of permits and/or vessels. The purpose of a buyback program, which is to reduce capacity in a given fishery (fisheries) by permanently retiring permits and/or vessels, is the primary focus of this report.[6] This focus emanates from the fact that the Atlantic shark fishery is recognized as being overfished and overcapitalized and industry, concerned about potential reductions in TAC as well as declining financial conditions, is interested in developing a plan to permanently reduce capital in the fishery.

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[3] There are some limited examples wherein limited-access programs have generated long-run profitability in the fishery. These examples, and underlying conditions that might enhance a limited entry program, are discussed by Wilen (1988). In a review of Wilen's critique, Hannesson (1988) suggests that "[their] success is, however, much less than one might have expected, and the economic potential of the fisheries he (Wilen) mentions has not been fully realized (p. 264)."

[4] In general, "overcapacity" is said to exist in a fishery if the harvest capacity exceeds the management target (e.g., TAC) or the sustainable productivity of the resource.

[5] The focus on capacity reduction was highlighted in Food and Agricultural Organization's (FAO) Code of Conduct for Responsible Fisheries and the subsequent FAO 1999 International Plan for the Management of Fishing Capacity. The U.S. national action plan was in response to the FAO Plan.

[6] Permit management systems represent limited-access programs which have already been briefly considered. Exclusive quota systems, such as an IFQ program, assign ownership shares to individuals, industry groups, and/or fishing cooperatives.

To examine the feasibility of a buyback program for the Atlantic shark fishery as well as to propose a specific buyback program, the report first briefly examines the history of the Atlantic shark fishery.[7] Then, the current situation is reviewed. Following the review of the current situation, the report moves into evaluating some of the strengths and/or weaknesses that might be associated with an Atlantic shark buyback program. Then, the report delves into the specific mechanisms of the proposed program including – the business plan's components, the projection of gross revenues derived from the Atlantic shark fishery during the post buyback period, the buyback's loan principal and repayment schedule, determination of the likely amount of capital to be bought back**,** and other miscellaneous items. Some general conclusions are presented in the final section of the report.

C. History of the Atlantic Shark Fishery[8]

The Atlantic shark fishery, which is primarily a southern coastal fishery extending from North Carolina to Texas, developed rapidly during the late 1980's and early 1990's. Given the rapid increase in landings, in conjunction with an understanding of the life history of the different species within the shark complex, concern regarding overfishing was heightened. In response to this concern, the National Marine Fisheries Service developed a Fishery Management Plan (FMP) for sharks which was implemented by the Secretary of Commerce in 1993.[9] Via this Plan, the Atlantic shark was divided into three management units: (a) large coastal sharks, (b) small coastal sharks, and (c) pelagic sharks. Large coastal sharks (LCS) were identified as being overfished and quota for the complex was set at 2,570 metric tons (mt) dressed weight (dw). No quota was established on small coastal sharks (SCS) The quota for pelagic sharks was set at 1,560 mt dw.[10] Among other things, the FMP also: (a) established calendar year commercial quotas for the LCS and pelagic sharks and dividing the annual quota into two equal half-year quotas; (b) established a recreational trip limit of four sharks per vessel for LCS or pelagic shark species groups and a daily bag limit of five sharks per person for sharks in the SCS species group; (c) prohibited finning by requiring that the ratio between wet fins/dressed carcass weight not exceed five percent; (d) prohibiting the sale by recreational fishermen of shark or shark products caught in the Exclusive Economic Zone, (e) requiring annual commercial permits for fishermen who harvest and sell shark (meat products and fins) and establishing permit eligibility requirements, and (f) requiring trip reports by permitted fishermen. At the time the FMP was developed, NMFS identified LCS as overfished and SCS as fully fished.

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[7] Unless otherwise stated, the Atlantic shark fishery will refer only to the commercial component of the fishery. There is also a large recreational component that is briefly considered where appropriate.
[8] This section draws heavily on the report by Cortes (2005) and the draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan* is, in instances, verbatim.
[9] The request for development of an FMP emanated from the five Atlantic Fishery Management Councils in 1989. This request was based on concern "…about the late maturity and low fecundity of sharks, the increase in fishing mortality, and the possibility of the resource being overfished (draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan*, p. 1-12).
[10] A listing of all species in these three categories can be found in Table 1.

Numerous changes have been adopted since the initial FMP was implemented. These include various changes in quotas, requirement that dealers obtain a permit to purchase sharks, the establishment of a recreational bag limit, and expansion of the list of prohibited species. Of particular relevance to the current study, limited access in commercial fisheries was implemented in 1999 along with upgrading restrictions.

Currently, there are retention limits, fishing seasons, fishing regions, and annual quotas in the Atlantic shark fishery. The retention limit on LCS during the open seasons is 4,000 pounds (lbs) dw for directed shark permit holders and 5 large LCS per vessel per trip and 16 pelagic or small coastal sharks per vessel per trip for incidental shark permits. Furthermore, quotas for LCS species and SCS species are split by region with three separate seasons, implemented January 1, 2005.

D. Current Harvests

Recent commercial landings of LCS species, SCS species, and pelagic species are presented in Tables 1.a through 1.c. Momentarily focusing on LCS species, it is apparent that two species, blacktip and sandbar, account for the majority of the landings. Both of these species tend to be overwhelmingly harvested in the Southeast.[11] Landings from 1999 through 2003 ranged from 3.44 million lbs dw (1,560 mt dw) to 4.45 million lbs dw (2,017 mt dw) and averaged 3.95 million lbs dw (1,792 mt dw).[12] These figures exceed LCS quotas during the respective years by a significant margin. For example, the LCS quota for the years 1999 through 2002 did not change and was set at 2.8 million lbs dw. Yet, landings of LCS during these years averaged 3.8 million lbs dw. Hence, reported landings exceed quota by about 35%, on average, during 1999-2002. In 2003, the LCS quota was set at 3.5 million lbs dw and reported landings totaled 4.45 million lbs dw. In short, reported LCS landings have historically exceeded the specified quota by a large fraction.

[11] According to Cortes (2005), from 92-98% of the LCS come from the Southeastern (Gulf and South Atlantic) region during the 1997-2003 period.
[12] These figures are based on canvass data which can differ substantially from the logbook or QMS figures.

Table 1.a Commercial landings of large coastal sharks in lb dw: 1999-2003.
Sources: Data from 1999-2001, Cortés pers. Comm.; data from 2002-2003, Cortés, 2005.

Large Coastal Sharks	1999	2000	2001	2002	2003
Basking**	0	0	0	0	0
Bignose*	9,050	672	1,442	0	318
Bigeye sand tiger**	0	0	0	0	0
Blacktip	1,259,016	1,633,919	1,135,199	1,099,194	1,487,604
Bull	28,603	24,980	27,037	40,463	93,816
Caribbean Reef*	0	0	1	0	0
Dusky*	110,942	205,746	1,973	8,779	23,288
Galapagos*	0	0	0	0	0
Hammerhead, Great	0	0	0	0	0
Hammerhead, Scalloped	0	0	0	0	0
Hammerhead, Smooth	0	0	0	0	0
Hammerhead, Unclassified	53,393	35,060	69,356	108,160	153,548
Large Coastal, Unclassified	67,197	16,575	172,494	147,359	51,433
Lemon	25,298	45,269	24,453	56,921	80,688
Narrowtooth*	0	0	0	0	0
Night*	4,287	0	0	0	20
Nurse	1,176	429	387	69	70
Sandbar	1,320,239	1,491,908	1,407,550	1,863,420	1,436,838
Sand Tiger**	6,401	6,554	1,248	409	975
Silky	9,961	31,959	14,197	30,731	51,588
Spinner	629	14,473	6,970	8,447	12,133
Tiger	30,779	24,443	26,973	16,115	18,536
Whale**	0	0	0	0	0
White**	82	1,201	26	0	1,454
Unclassified, assigned to large coastal	821,648	92,117	525,661	771,450	853,564
Unclassified, fins	116,570	87,820	23,988	142,565	181,431
Total (mt dw)	**3,865,271 (1,753)**	**3,713,125 (1,684)**	**3,438,955 (1,560)**	**4,294,082 (1,948)**	**4,447,304 (2,017)**

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.
** indicates species that were prohibited as of April 1997.
*** Preliminary data, species not yet available.

Table 1.b Commercial landings of small coastal sharks in lb dw: 1999-2003.
Sources: Cortés and Neer, 2002; Cortés, 2003.

Small Coastal Sharks	1999	2000	2001	2002	2003
Atlantic Angel*	0	97	0	495	0
Blacknose	137,619	178,083	160,990	144,615	131,511
Bonnethead	58,150	69,411	63,461	36,553	38,614
Finetooth	285,230	202,572	303,184	185,120	163,407
Sharpnose, Atlantic	244,356	142,511	196,650	213,301	190,960
Sharpnose, Atlantic, fins	0	0	209	10	0
Sharpnose, Caribbean*	2,039	353	205	0	0
Unclassified Small coastal	336	0	51	35,831	25,307
Total	**727,730 (330 mt dw)**	**593,027 (269 mt dw)**	**724,541 (329 mt dw)**	**615,915 (279 mt dw)**	**549,799 (249 mt dw)**

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.

Table 1.c Commercial landings of pelagic sharks in lb dw: 1999-2003.

Sources: Data from 1999-2001, Cortés pers. comm.; and data from 2002-2003, Cortés, 2005.

Pelagic Sharks	1999	2000	2001	2002	2003
Bigeye thresher*	18,683	4,376	330	0	0
Bigeye sixgill*	0	0	0	0	0
Blue shark	886	3,508	65	137	6,324
Mako, longfin*	3,394	6,560	9,453	3,008	1,831
Mako, shortfin	150,073	129,088	171,888	159,840	150,076
Mako, Unclassified	56,625	74,690	73,556	58,392	33,203
Oceanic whitetip	1,480	657	922	1,590	2,559
Porbeagle	5,650	5,272	1,152	2,690	1,738
Sevengill*	0	0	0	0	0
Sixgill*	0	0	0	0	0
Thresher	96,266	81,624	56,893	53,077	46,502
Unclassified, pelagic	0	233	0	5,965	79,439
Unclassified, assigned to pelagic	41,006	40,951	31,636	182,983	297,126
Unclassified, pelagic, fins	2,408	3,746	12,239	0	0
Total	**376,471 (171 mt dw)**	**350,705 (159 mt dw)**	**358,134 (162 mt dw)**	**467,682 (212 mt dw)**	**618,798 (281 mt dw)**

* indicates species that were prohibited in the commercial fishery as of June 21, 2000.

Source: draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan (August, 2005).*

Cortes (2005) suggests that the observed differences between total commercial landings and quota during 1999-2003 can be "attributed to state landings occurring after each of the two federal semi-annual season closures (p. 4)." In fully explaining the difference, however, one must also consider the fact that state regulations are not always compatible with federal regulations. In Louisiana, for example, a federal permit is not required for fishermen harvesting sharks exclusively from state waters though a state permit is required for all commercial shark fishing in state waters (i.e., even those who maintain a federal permit).[13] Harvests of shark by non-federally permitted fishermen are not required to be sold to permitted dealers and, hence, may bypass both the logbook tracking system and the Quota Monitoring System (QMS) tracking system. Assuming all LCS catch by federally permitted fishermen is reported in the respective logbooks, one can estimate catch by non-federally permitted fishermen, presumably all of which occurs in state waters and which may or may not be sold to federally-permitted dealers. In 2003, this estimate was approximately eight percent.[14]

[13] The issued number of permits has increased from 136 in 2001, the first year that the permit was issued, to 315 in 2004. The number equaled 253 in 2003. The number of state issued permits exceeds the number of federal permits issued to Louisiana fishermen by more than 200. Specifically, according to Jepson (2005), the number of Federal shark permits reported for Louisiana totaled 49 as of October, 2003. Forty-five of these were incidental permits.

[14] This estimate is based on the information presented in Table 3.44 of the draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan* (2005). If one looks at the Table, however, he should be aware of a mistake in labeling. Specifically, figures are stated to represent metric tons dressed weight. Numbers for the canvass data, however, clearly represent metric tons whole weight.

In addition to the commercial harvest of LCS, there is a significant recreational take. During 1999-2003, the number (not pounds) of LCS landed by the recreational sector averaged 102 thousand annually and ranged from a low of 77.9 thousand in 2002 to a high of 131.5 thousand in 2000 (draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan*, 2005).[15] This compares to an average annual take of 114 thousand by the commercial sector during the same period. Finally, it should be noted that catches by fishermen in other countries likely add to LCS mortality and may compete directly with the domestic fishery (in 2001, the last year for which data are available, the Mexican catch of LCS species was estimated to equal 52.1 thousand fish).

Turning now to SCS and pelagic sharks (Tables 1.b and 1.c), one can observe that commercial landings of SCS averaged 642,202 pounds dw (291.3 mt dw) annually during 1999-2003 with a range from a high of 727 thousand pounds in 1999 to a low of 550 thousand pounds in 2003. Commercial landings are dominated by three species- Atlantic sharptooth, finetooth, and blacknose. In general, commercial harvest of SCS has been but a fraction of the historical quota of 1,760 mt dw until the past year when the quota was reduced to 454 mt dw. Like the LCS fishery, there also exists a large recreational take of SCS species. In 2002, an estimated 154 thousand SCS sharks were caught by recreational fishermen with the estimated number falling marginally to 135 thousand in 2003 (draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan,* 2005).

Finally, commercial landings of pelagic sharks are presented in Table 1.c. As indicated, commercial landings during 1999-2003 averaged 434 thousand lb dw (197 mt dw) annually during 1999-2003. Among identified pelagic sharks, mako (shortfin and unclassified) is the dominant species though considerable landings of thresher are also reported. Recreational harvests of pelagic sharks are very limited.

E. Profile of the Fleet

A detailed profile of the fleet is given in various supporting documents (Larkin et al 2005; Hester et al 2005; Jepson 2005) and, as such, only a cursory overview is presented here. The Atlantic shark fleet is described by Hester et al (2005) as “a collection of vessels that depend on a variety of species of fish and sharks for their annual production (p.7).” This is substantiated by Larkin et al (2005) who, for the 2003 calendar year, examined shark revenues among directed and incidental shark permit holders in relation to total revenues (see Appendix A). For purposes of analysis, the authors considered nine revenue groups ranging from vessels with reported total revenues of less than $5,000 to vessels with 2003 reported revenues from $1.0 million to $1.6 million. In general, the authors found a decline in the contribution to total revenues derived from shark in relation to total revenues generated by the vessel. This is true for both the directed shark

[15] In general, the recreational take has fallen sharply since the introduction of the FMP. Much of the reduction in recent years undoubtedly reflects the reduction in recreational bag limit to one shark per vessel per day from the previously established two sharks per vessel per day. In many years, more than one-half of the recreational LCS catch represents blacktip.

permit holders and the incidental shark permit holders. For example, for the lowest category (total revenues less than $5,000 in 2003), shark revenues contributed an estimated 34% to total revenues among the directed shark permit holders and 8% among the incidental shark permit holders. By comparison, among vessels generating $500 thousand to $749 thousand in total revenues, shark revenues contributed an estimated 4.5% of total revenues among directed shark permit holders and 0.3% among incidental permit holders. In the top category (i.e., $1.0 million to $1.6 million), the contribution of shark to total revenues equaled just $0.5% among directed shark permit holders.

Both Larkin et al (2005) and Hester et al (2005) indicate that many of the shark permits are utilized infrequently, if at all. For example, Hester et al (2005) report that there were approximately 245 directed shark permits during 2001-03 and an additional 349 incidental shark permits. However, 70 of the directed shark permits (29%) and 253 of the incidental shark permits (72%) reported no shark landings in completed logbooks during that period. Furthermore, reported landings among directed shark permits are extremely limited for a substantial portion of the fleet. This can be seen with the aid of Figure 1. As indicated, in addition to the 70 directed shark permits that recorded no landings during 2001-03, another 50 reported extremely limited harvests.[16]

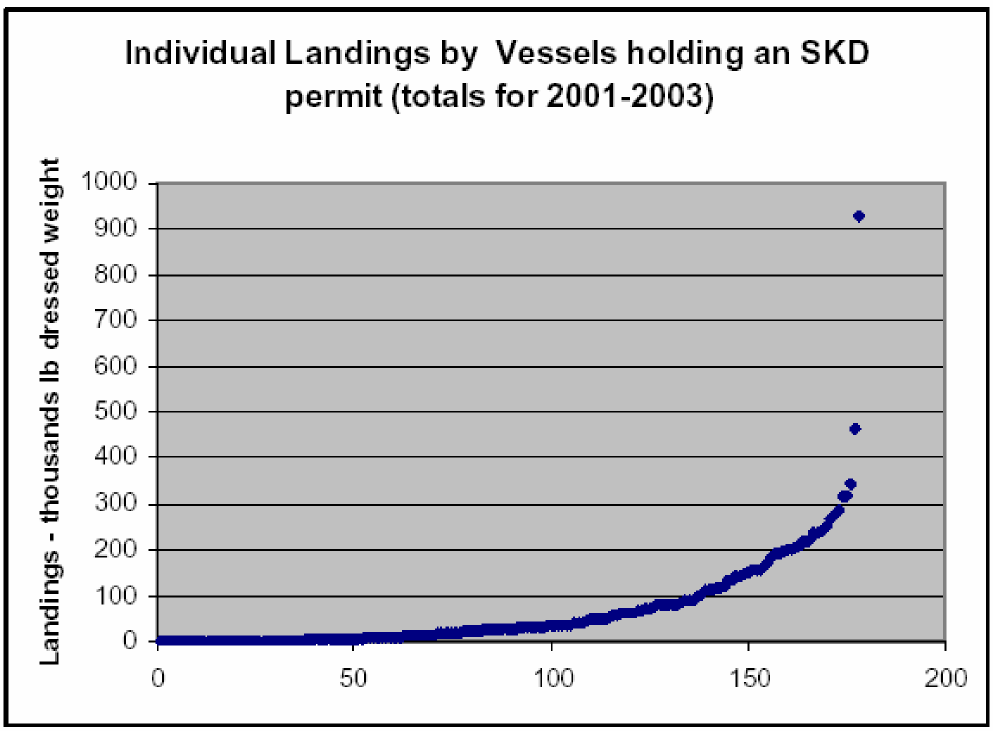


Figure 1. Distribution of total landings over a three year period LCS and SCS Combined (note SKD refers to directed shark permit).

Source: Hester et al (2005)

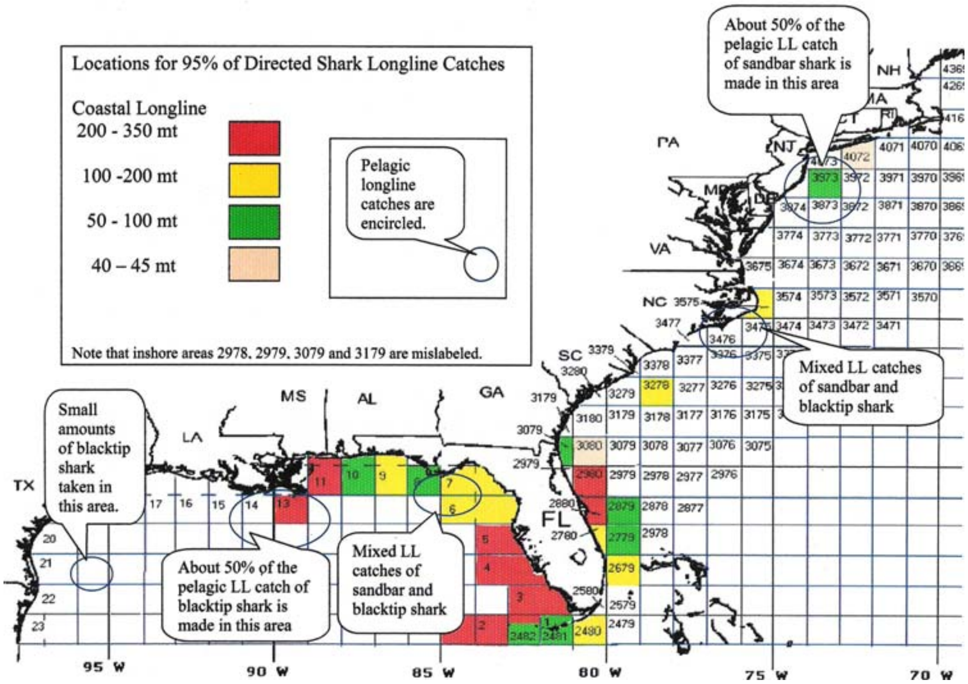
[16] Vessels reporting no shark harvest during 2001-03 are not included in the Figure.

Bottom longline is by far the dominant gear, accounting for about 85% of total harvest of LCS and SCS during 2001-2003. The only other gear of any significance, gillnets, represented all but a small fraction of the remaining harvest (Hester et al 2005).

Analysis of permit holders by state suggests that the majority of actual and/or potential shark fishermen reside in Florida (Jepson 2005).[17] Specifically, the author reports that Florida accounts for 60% of the directed shark permits and about 45% of the incidental shark permits (as of October, 2003). New Jersey and North Carolina account for an additional 21% of the issued directed shark permits while Louisiana and New Jersey account for an additional 20% of the incidental shark permits issued as of October 2003.

Hester et al (2005) reports that most vessels operate only in their home port region. As with the concentration of permit holders, catch is also concentrated in a few primary areas. With respect to bottom long line gear reported in the Coastal Fisheries Logbooks, areas of concentration for the harvest of LCS include the west coast of Florida, the northeast coast of Florida, around the mouth of the Mississippi, and New Jersey (Figure 2). The LCS gillnet fishery is primarily concentrated off the east coast of Florida with some additional catch occurring off North Carolina's coast (Figure 2).

[17] The word "potential" is included because, as noted, many of the permits are currently inactive. Under more suitable economic conditions, however, these permits could quickly become active.



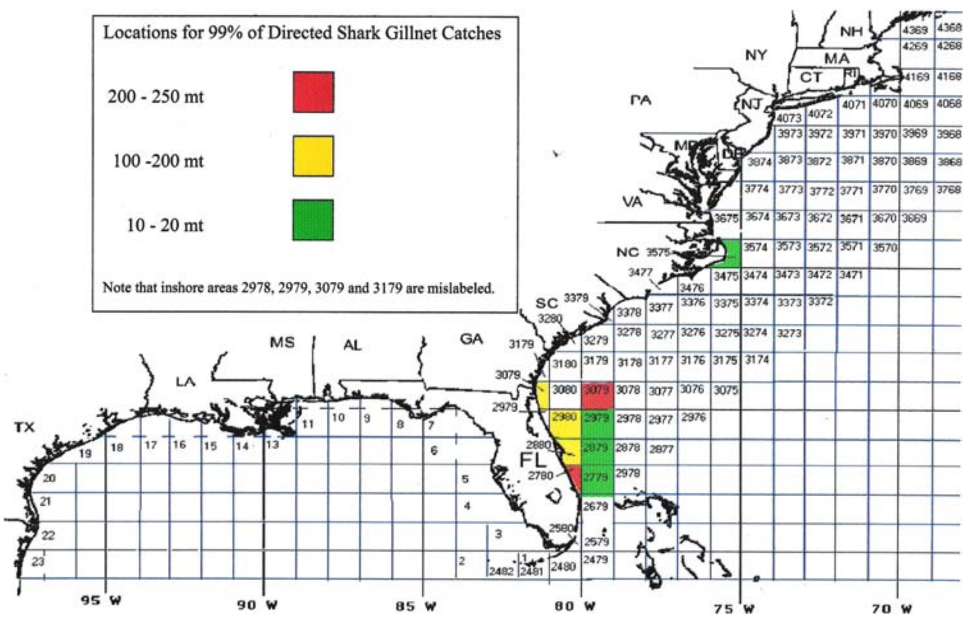


Figure 2. Areas of origin for about 95% of shark catches reported by directed permits using longline gear reported in the Coastal Fishery logbooks and pelagic or bottom longline gear reported in the Pelagic Longline Fishery logbooks (top figure) and shark catches reported by the directed shark permit vessels using gillnet gear reported in the Coastal fishery logbooks (bottom figure).

Source: Hester et al (2005)

II. CONSIDERATIONS REGARDING FEASIBILITY (STRENGTHS AND WEAKNESSESS)

Many fisheries throughout the world are considered to be overfished, resulting in dwindling stocks. In response, government intervention is increasingly turning to buybacks as a means of taking capital out of production; thereby reducing pressure on fish stocks and allowing stocks to recover over time. Buybacks, however, are not without their own set of problems. To fully understand some of the strengths and weaknesses of buybacks, one must first have an understanding of why buybacks are implemented. This is given in the next section. Then, attention is turned to examining some of the strengths and weaknesses of buyback programs.

A. Buybacks as a Policy Instrument

From an economic perspective, any type of buyback program- whether agriculture, financial markets, of fisheries- belongs to a broad class of policy instruments aimed at regulating or controlling supply to the market. Supply control can take one of two general forms; direct control, where goods are produced but prevented from reaching the market via direct purchases, or indirect, where attempts are made to reduce the ability of producers to generate goods in the first place by raising the costs of production. Buyback programs, with their emphasis on removing assets from the production process, clearly fall into the latter category. As a result, buyback programs generate the same economic problems common to all indirect supply controls (Alston and Hurd, 1990). This suggests that supply control comes at a rather steep price in terms of economic welfare and market efficiency.

One answer to why policy makers might consider buyback programs starts with the compelling premises that government (a) has some objective other than the maximization of economic welfare, and (b) faces heterogeneous producers that it would like to distinguish in order to advance some of its objectives, but cannot do so absent revealing producer behavior (Innes 2003). Under premise (a), supply control is a method of price manipulation for the purposes of increasing producer income, reducing the variability in producer income, or both. Of course, this form of policy control can be a method by which direct government payments can be transferred to producers regardless of whether there is any long-lasting effect on market supply. The long-run protection of productive resources can also fall under premise (a), particularly when market failure or attenuated property rights prevents private producers from making decisions that optimally use the resource from a social perspective. Questions about how efficient buyback programs might be in achieving resource protection goals hinge on a number of factors, including the actual efficacy of specific asset removal schemes (Sun 1998; Holland et al 1999) and the degree of capital malleability (Greboval and Munro 1999; Clark and Munro 2002; Weninger and McConnell 2000). Under premise (b) would fall a wide range of equity objectives and issues, including government's desire to transfer income to producers, its affinity for maintaining or reducing high-cost (Hueth 2000) or low-cost (Chambers 1992) producers, and the ability of producers to effectively misrepresent their entitlements to government transfers (Giannakas and Fulton 2000).

Other answers to why policymakers might consider buyback programs are identified in the *Federal Fisheries Investment Report* (1999). The panel addressed whether there was any compelling role for the government in providing funds (subsidies) for buybacks, and suggested that buybacks as a form of disaster relief can be viewed as a social insurance program. Rather than requiring universal insurance and protection against all possible hazards, it may be in the best interest of society to provide assistance after the fact.

The panel also suggested that as a defacto trustee of many of the nation's natural resources, the government has a fundamental responsibility to protect those resources. When there is excessive degradation of a resource stock and the cause of this mismatch between resource use and availability is outside the sector (e.g., institutional failure resulting in inadequate protection of the resource base), the government has a fiduciary responsibility to rectify the failure. In the context of fisheries, buybacks may represent a rectifying mechanism.

B. Strengths and Weaknesses Related to Buybacks

Various researchers have examined some of the strengths and weaknesses associated with buybacks. One of the first, and still one of the most detailed examinations, was that by Holland et al (1999). Analysis by Holland et al (1999) and others have generally identified three major concerns regarding buyback programs. The first concern relates to that of latent capacity. The second concern is that of "spill-over." The final concern relates to the issue as to whether such programs offer any long-term reduction in effort, and, hence growth in fish stocks and/or profits among the portion of the fleet remaining after the buyback program is implemented.

Latent effort refers to the situation where a given percentage of the vessels (often a large percentage) contribute nothing or marginally to harvest. Hence, if it is these vessels that are removed in a buyback program, effective effort in the fishery remains, for all intents and purposes, unchanged.[18]

Spill-over, as noted, is a second issue frequently addressed in the literature. Simply stated, most buyback programs do not prevent fishermen from entering other fisheries. This may be particularly relevant if only the license, which gives one the right to harvest

[18] Of course, an argument can be made that the lack of latent effort removed from a fishery during a buyback reflects not on buybacks as a concept, but primarily on the level of expenditures committed to the programs and the specific mechanisms established for the buyback process. Many buyback programs operate more at the margin and do not make any significant contribution to the reduction in capacity.

a given species or group of species, is retired rather than the vessel. Such situations may only exacerbate overcapitalization problems in fisheries that are not part of the buyback program.

Finally, the question as to whether buyback programs effectively reduce long-run effort is frequently addressed. The answer to this question (not considering latent capacity) depends upon whether the mechanisms are in place to curtail effort expansion among the post-buyback vessels in the fishery.

Since the primary purpose of this report is to examine a buyback for the Atlantic shark fishery, let's focus on latent capacity in that fishery. Without going into considerable detail, suffice it to say that it is large.[19] As just one indication, Hester et al (2005) reports that seventy vessels with a directed shark permit (approximately 28%) and 253 vessels with incidental shark permits (approximately 70%) reported no shark landings (based on logbook data) during the 2001-03 period. On top of this, another large share of vessels reported very low landings. Much of the explanation for low activity in the shark fishery reflects the multi-purpose nature of the shark fleet. This is highlighted in the analysis conducted by Larkin et al (2005) based on 2003 data. With the sharp reduction in LCS quota after 2003, one would expect even higher latent capacity than observed in analysis from 2003 and prior. Regardless of the reasons for the significant amount of latent capacity, it certainly serves as an obstacle to development of any meaningful shark buyback program.

Leakage, as noted, is also frequently considered to be problematic when developing a buyback program. Since most of the major species targeted by shark permit holders are under some form of limited access, this potential problem is likely not be significant in the development of a buyback program for shark.

As noted, there is also a question as to whether long-term effort is, in fact, curtailed via implementation of a buyback program. Given the difficulties of effectively measuring effort (along with the costs of such measurement), most work which examines this issue is theoretical in nature.[20] One of the most detailed analyses, because it looks at post-buyback activities at the firm level, is that by Weninger and McConnell (2000). Generally speaking, the authors found that long-term benefits associated with a buyback program depend critically on post-buyback remaining vessels ability to replace capital (i.e., that capital removed via the buyback program), the speed of capital replacement, and capital specificity. The authors suggest that each of these issues should be seriously considered prior to implementing a buyback program.[21]

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[19] Latent capacity is, of course, related to the commercial quota under TAC. If this quota is binding, increases (decreases) in it are likely to result in a decrease (increase) in latent capacity.

[20] Empirical evidence that effort expansion negates any long-term benefits associated with a buyback program is very limited. This partially reflects the relatively short history of most programs in relation to the timeframe required to observe and assess long-term technological changes, such as input (capital) stuffing in response to changing economic conditions.

[21] In the extreme, the authors found that net (long term) benefits to society can be negative with the implementation of a buyback program if capital is highly irreversible. These benefits, however, are those to society rather than to participating fishermen. However, the authors also note that any post-buyback

The Atlantic Highly Migratory Species (HMS) FMP does include vessel upgrading restrictions. In general, the regulations permit one vessel upgrade provided that upgrades do not exceed 20% of horsepower, and 10% of overall length, gross tonnage, and net tonnage of the vessel's baseline. While this restriction may curtail effort expansion to some extent, it is likely to be somewhat limited. Why is this? As aptly stated by Hannesson "[i]t is difficult to control all dimensions of fishing power; restrictions on vessel size can be compensated for by more powerful engines or better fish-finding equipment; it is like pressing a balloon in one place, it just expands in all other places. More seriously, this is a question of the degree of substitutability between different components of fishing power and how easily they can be monitored and controlled. The experience seems to be that fishermen and boat designers tend to beat fisheries regulators at the game of getting more fishing power out of a vessel while still satisfying a given set of regulations (p. 264)."

While Weninger and McConnell (2000) recommend that certain issues be seriously considered prior to implementation of a buyback program, analysis of these issues often tend to be beyond the ability of the analyst (or fishery manager).[22] Hence, it is left to the industry to determine whether the established mechanisms to control effort expansion are sufficient to generate long-term benefits from a buyback program.[23] As noted by the authors, conditions tend to be stringent and generally require the inability to substitute one input for another.[24]

What happens if these conditions are not met? In an analysis of five buyback programs conducted in the British Columbia salmon fishery, Grafton and Nelson (2005) note that "[t]he problem in the BC salmon fisheries is that the same incentives remain for fishers to upgrade vessels and gear so as to compete for the limited number of salmon that can be caught in salmon openings…Thus although the recent buybacks are beneficial to fishermen who remain, it is by no means clear whether there (sic) have been sufficient to maintain a financially viable industry. The possibility also remains that further buybacks may be required in the future if fishers continue in 'capital stuffing' to out compete their fellow harvesters, or if currently inactive license holders return to the salmon fishery."[25]

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increases in profits to fishermen may well be dissipated over time if expansion in capital cannot be rigorously constrained.

[22] Factors considered to be relevant by Weninger and McConnell (2000) include: (a) the ability of post-harvest participants to increase capital in response to enhanced profits, (b) the rate at which capital can reenter the post-buyback fishery, and (c) capital specificity (i.e., irreversibility of the additional capital drawn to the fishery in response to the initial generation of resource rents).

[23] It is worth noting that vessel performance is size related and is also distorted by the current trip limit with the larger boats being disproportionately disadvantaged (see Hester et al, 2005, for details). If the trip limit were to be increased, or removed, once the fleet was reduced in size, "capital stuffing" could further distort the class differences because the larger boats could regain some of the size advantage that they lost when the trip limit was implemented.

[24] As one concrete example of input substitution, crew size can be increased to negate restrictions placed on vessel size or horsepower.

[25] While Grafton and Nelson (2005) state that "recent buybacks are beneficial to fishermen who remain," the perspective is short run in nature. Indeed, the authors, in their concluding remarks, state that "[t]he history of the BC salmon fisheries suggests that the benefits associated with buybacks, without a change in

While discussion to this point has tended to focus on latent effort and expansion of post-buyback capital (capital stuffing), there are some issues specific to the shark fishery that may also warrant consideration prior to implementation of a buyback program. At the top of this is list is the fact that many states do not have regulations that are completely compatible to federal regulations.[26] In Louisiana, for example, fishermen who harvest sharks entirely in state waters are not required to have a federal shark permit and are not required to sell the harvested product to federally licensed dealers. In Virginia, some fishermen, reportedly, have voluntarily given up federal shark permits because restrictions pertaining to fishing in state waters are more lenient.[27]

While shark harvests in state waters tend to be limited, at least in part due to prohibition of longlining, state regulations that are not compatible to federal regulations could undermine some of the benefits that might otherwise be forthcoming from a buyback program. For example, if stocks do increase as a result of conservation practices (brought about, at least in part, from a buyback), one might anticipate increases in effort in state waters. Increased harvests by these non-federally permitted shark fishermen will, theory suggests, detract from catches by federally-permitted fishermen.

Along a similar line of reasoning, while there are recreational bag limits for shark and a required permit, there is no limited access system in the recreational component of the shark industry. Expansion in shark stocks may result in increased recreational fishing activities on sharks and a reduction in the stock available for harvest by commercial fishers.

Given the fact that some shark species migrate long distances and cross country boundaries, actions taken by the U.S. to conserve the stocks (e.g., a buyback program) may have only limited value if other countries do not adopt appropriate regulations to protect the same stocks. This highlights the importance of common goals in the management process.

While these issues need to be seriously considered by the participants of any shark buyback program, they are provided more as a cautionary note than any attempt to "undermine" the program. Some changes to help a buyback program achieve maximum success can be implemented through Plan Amendment (e.g., establishing a limited access system for the recreational sector and/or restricting capital stuffing). Other changes, such

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the economic incentives faced by fishers, will be short-lived as capacity and fishing effort creep back up over time." In contrast, Hannesson (2005) provides evidence that a long-run buyback in Norway, implemented in 1979 and still ongoing, has been successful at increasing profitability among remaining vessels. However, part of the success of this program, as explained by Hannesson (2005) is the result of a quota regime, whereby quotas can be bought and sold with the vessel. The buying and selling of unit quotas, argues Hannesson (2005) "…has led to a considerable rationalization of the fleet (p. 2)."

[26] While an exhaustive survey of regulations in all states was not conducted, it appears that among Gulf states, only Florida maintains regulations that are completely compatible with Federal regulations.

[27] Personal communication with Lewis Gillingham. Mr. Gillingham also indicated, however, that the Virginia Fishery Commission would be meeting in late November to consider altering state regulations to make them compatible with federal regulations.

as compatibility between state and federal regulations, will require the fishers and NMFS to work closely with the various state regulatory agencies.

Finally, while many possible "pitfalls" have been discussed, there exist some significant benefits if the buyback achieves the primary goal of significantly reducing capital in the shark fishery. Specifically, if capital stuffing can be adequately controlled, post-buyback participants will enjoy a reduction in costs per unit harvest. On top of this, it is likely that the price of the harvested product will increase as seasons are extended. The current situation is one of market gluts when the season is open and loss of markets when the season is closed (which results in lower prices when the fishery reopens). If a sufficient amount of capital is permanently removed from the fishery, one can anticipate extended seasons and a concomitant increase in the harvested price.

III. BUYBACK MECHNISMS AND AN ATLANTIC SHARK BUYBACK PROPOSAL[28]

A. Buyback Mechanisms

Before a fishery buyback program can be seriously considered, three important questions need to be addressed. What exactly is the program buying out, and why? How can the buyback program be structured so that it can achieve its buyback goals? How is the program going to be funded so that the buyback goals are achieved?

In general, there are three options regarding what is to be purchased in any given fishery buyback program: vessels, permits, or both vessels and permits together. The preferred option depends, of course, on management goals (presumably effort reduction, but other objectives may also exist) and as such, one must view any limitations associated with any option in context to the goals.

Buying back vessels without permits, while affording the immediate removal of more capital from the fishery then if permits were simultaneously purchased (assuming a fixed program budget), results in an imbalance between the number of available permits and the number of vessels attached to those permits. These "excess" permits may provide incentives for additional vessels to enter the post-buyback fishery. Hence, over time, capacity in the fishery may return to or exceed pre-buyback levels. Buying back permits or licenses without vessels can also lead to an imbalance where there is an excess supply of "available" vessels in relation to "allowable" vessels in the fishery. Vessels no longer

[28] In all cases, the only sharks to be included in any buyback assessment are those identified as LCS, SCS, or pelagic in the FMP and amendments.

able to fish the permitted fishery are likely to gravitate to other, potentially already overcapitalized, fisheries. The simultaneous purchase of both vessels and permits somewhat negates the limitations associated with the other two options. For a given funding level, however, simultaneous purchase of vessels and permits may result in less capacity being removed from the fishery than the severed purchase of either vessels or permits.

Once buyback program goals have been clearly defined, it is essential that the specific buyback mechanism be structured so as to achieve the goals, and to do so in a least-cost manner. Least-cost considerations are particularly relevant if capacity reduction is the primary purpose of the program. The two most common buyback mechanisms have been fixed rate payments and auctions. In the fixed rate buyout, the government offers a fixed price per unit of effort that it wishes to purchase. In an auction buyout, the government structures a bidding process whereby fishermen can “suggest” a price per unit of effort that they would accept in return for relinquishing their vessel and/or permit. The most suitable approach is situation dependent, and the best choice appears to hinge on both the number of potential participants and the amount of information asymmetry between the government and vessel owners (Latacz-Lohmann 2001). Economic theory may suggest that auctions will be more efficient then fixed rate payments in all but the omniscient government case, but it also suggests that efficient auctions occur only if they are carefully designed (Klemperer 1999).

Regardless of whether fixed rate payments or auctions are used, experience suggests that buyback programs need to carefully consider the measures that are used to both attract participants and to prioritize buyout offers. Ise and Sunding (1998) examined the variables that affect buyout bids for water rights in the U.S. and found that, in addition to the present value of future net earnings, personal characteristics (including financial condition and access to credit markets) were significant in participation and bid price. This situation would presumably hold for fishery buyouts as well. In addition, the impact of the buyout program on effort may depend on whether it is anticipated enough in advance for potential participants to capital stuff prior to the control date, thereby increasing the biological and economic damage to the fishery and negating potential benefits from the buyout (Clark et al 2003). Indicators of vessel effort, and the price offered per unit of effort, also need to be carefully considered, and at least in the case of auctions may influence both the cost efficacy of a buyout program and the ultimate level of effort reduction that can be achieved given a fixed budget (Walden et al 2003).

B. Atlantic Shark Buyback Proposal

This section of the report develops the mechanisms associated with an Atlantic shark buyback proposal. Specifics associated with the proposed program are based on the authors knowledge of the structure of different buyback programs and his knowledge of the shark fishery. In general, the suggested specifics should be considered as a “starting point” for additional discussion and insight into a more comprehensive buyback program.

1. Mechanisms of the Atlantic shark buyback proposal

How will the program be funded?: The program will be funded via a loan from the federal government that the industry will pay back over a specified period of time.[29]

Discussion: Buybacks can be funded through several sources. First, the federal government can pay for the buyback. Second, public and/or private organizations can pay for the buyback. Third, industry, itself, can pay for the program. Finally, some amalgam of the different funding sources can be used to pay for a buyback.[30]

In general, the federal government has funded the earlier U.S. buyback programs. With the passage of the Sustainable Fisheries Act, and the amendment to Title XI[31], the government has shown an increased reluctance to directly fund such programs. A possible reason for this increased reluctance is provided by NMFS[32] As stated, "[e]quity suggests that those who will benefit the most from buyback should pay most of the cost. Post-buyback producers will benefit most. Buyback should increase post-buyback production and/or decrease its variable costs. It should enable a more stable industrial future for post-buyback producers, free of excessive competition."[33] The report goes on to state that "[a] Fee System (i.e., tax on landings) may be the best means of encouraging producers to identify more with their collective long-term interests. If all producers are collectively serving a common buyback debt that finances their collective will to manage a fishery's capacity future, all may act more like fisheries stockholders with a common investment."

Regardless of the exact reason for increased government reluctance to fund buybacks, the assumption used in the consideration of an Atlantic shark buyback program is that direct government funds for the buyback will not be forthcoming. Since other funding sources (e.g. funding from an NGO) is also, at best, a remote possibility, this funding source will also not be considered. This now brings us back to the original position, i.e., that the program will be funded by a loan from the federal government that will be paid back by the industry over a specified period of time.

While details of Title XI financing are beyond the scope of this report, a few key provisions are noteworthy. First, a Fee System (i.e., tax on landings) can exist only if producers vote to fund a buyback this way and approval requires a two-thirds majority of those voting in the referendum. Hence, there is a "high hurdle to jump" to be eligible for

[29] The timeframe of the loan is discussed in a subsequent section.
[30] Larkin et al (2005) provide a succinct summary of financing sources associated with U.S. buybacks to date.
[31] The amended Title XI allows NMFS to provide loans for buyback programs.
[32] http.www.nmfs.gov/sfa/buyback.htm.
[33] As previously noted, an alternative view was expressed by the panel who prepared the Federal Fisheries Investment Report.

an industry funded buyback program. As one might expect, this ‘hurdle’ is heightened in relation to the amount of diversity (gears used, geographic areas, etc) in the considered fishery. Given the nature of the Atlantic shark fishery, one can envision that this ‘hurdle’ is relatively high.

If approved by producers, NMFS will borrow money from the Treasury and deposit it in a buyback fund. NMFS then uses this fund to buy back permits or vessels and permits. The loan’s maturity may not exceed 20 years and fee system revenue is the only statutory means by which post-buyback producers repay the loan.

Whether permit holders are willing to pay a tax on landings to support a buyback program appears to be highly questionable. In a survey conducted by Larkin et al (2005) 48% of the respondents indicated an unwillingness to pay for a buyback program via a tax. Twenty-eight percent, however, were undecided.

Who will be eligible to participate? All directed and incidental shark permit holders at the time of the buyback will be eligible to participate in this program.

Discussion: All permit holders will be invited to participate in the buyback program. The rationale for this “all inclusive” provision reflects the landings fee mechanism to be established should an Atlantic shark buyback referendum be adopted. Specifically, if some component of the industry was not included in the buyback program, that component would also not be included in the referendum nor would their landings be subject to a tax.

Alternatives to this option are several. First, the program could be structured such that only directed shark permit holders are eligible. Given the relatively small proportion of shark landings accounted for by incidental permit holders (approximately 11% of total revenues derived from shark fishing in 2003), exclusion of this group would alter the stream of funds available for a buyback program by only about 10%. While potentially contributing only marginally to the available pool of funds that would be available for a buyback program, exclusion of incidental permit holders would complicate collection of fees by permitted dealers (as well as payments to fishermen since one would have a differentiated price system) and transfer of these fees to the federal government.

A specific gear(s) could also be excluded from eligibility. For example, bottom long line and gillnet gear accounted for more than 97% of combined LCS and SCS landings during 2001-03 and, hence, the impact of exclusion of other gears on revenues for a buyback program would be negligible. Like, incidental permit holders, however, exclusion of specific gears would unduly complicate fee collections and payments to the fishermen.

Indeed, “all inclusive” eligibility in the buyback program appears to be the preferred option unless there is a compelling interest for excluding some component. The only compelling reason may be that of the referendum. As noted, a Fee System (i.e., tax on landings) can exist only if producers vote to fund a buyback this way and approval requires a two-thirds majority of those voting in the referendum. The vote is not weighted and, as such, a given component of the industry that is large in number can effectively cause the process to cease even if the production by the group is small in relation to the total.

What will be purchased in the buyback? Only directed and incidental shark permits will be purchased under the mechanism established for the Atlantic shark buyback program. No consideration will be given for vessels or other permits.

Discussion: As suggested by NMFS[34], "[i]t is easier and cheaper to buy back permits alone, rather than both permits and vessels. Buying back permits effectively removes from the buyback fishery the capacity associated with the previously permitted vessels." NMFS also cautions, however, that those previously permitted vessels "may then cause capacity problems in other fisheries." Finally, though, as noted by NMFS, "[i]f all other suitable fisheries were limited access, this would not be a problem."

As noted in the profile section of this report, revenues from shark fishing among shark permit holders tend to comprise but a small share of gross income derived from all fishing activities (see Appendix A for more details). Furthermore, the total revenues derived from shark fishing are limited.[35] The limited total revenues suggest that buying back vessels with shark permits (but not buying back other permits) would quickly exhaust any funds that would potentially be available for a shark buyback program (limited to five percent of potential gross revenues); thus significantly limiting any benefits of the program as measured by capacity reduction.[36] Alternatively, funds for a buyback program could be enhanced by including other fisheries (e.g., swordfish and tuna) in the buyback program. Including other species would greatly increase the complexity of the program and including non-shark species in the buyback would necessitate that permit holders in these other fisheries be included in any referendum.[37] For these reasons, the focus of this proposed buyback relates only to shark permits.

The National Marine Fisheries Service, as mentioned, has expressed concerns regarding previously permitted vessels causing capacity problems in other fisheries. While this concern is certainly valid, the applicability to the current proposed buyback is relatively limited for a number of reasons. First, limited access conditions are in place for many of

[34] National Marine Fisheries Service, "Supporting Statement: Fishing Capacity Reduction Program Buyback Requests, OMB Control No: 0648-0376" which can be found at "http://www.nmfs.noaa.gov/sfa/buyback.htm."
[35] For details regarding revenues derived from shark fishing, the reader is referred to the section of the report titled "Projections of buyback fishery's annual gross ex-vessel income during the buyback loan's term."
[36] For example, Larkin et al (2005), in an analysis of shark permit transfers registered with NMFS Southeast Regional Office, identified two instances where a shark permit and vessel were transferred (no other permits were transferred in these two instances). The sales prices in these two instances equaled $31,000 and $107,000 respectively.
[37] All permit holders in these other fisheries would be included in the referendum even if a sizeable proportion of permit holders in the other fisheries did not also have shark permits.

other fisheries that previously permitted vessels may consider entering (e.g., swordfish and tuna). Second, based on the analysis by Larkin et al (2005), it is estimated that revenues derived from the harvest of shark comprise less than three percent of the 2003 total dockside gross income derived by the population of shark permit holders.[38] This leads one to conclude that any additional capacity problems in other fisheries that might be forthcoming as a result of a buyback program targeting only shark permits will likely be limited. Finally, entry into many of the fisheries that do not have a limited access program, such as grouper, is constrained at a larger scale. Specifically, in the case of both snapper and grouper (for the Gulf), a reef-fish permit is required to commercially harvest these species.

How the buyback will work? The buyback, which is voluntary, will be comprised of two components.

(a) The first component relates specifically to the incidental shark permits. Any incidental shark permit holder may relinquish his incidental shark permit and will receive $500 compensation. Any person accepting this compensation gives up all future rights to fish for shark with either an incidental or directed shark permit.[39]

(b) The second component relates specifically to holders of directed shark permits. Eligible persons in this category who wish to be considered in the voluntary buyback program have several options. For any specified directed shark permit, the permit holder may select only one of the following specified options:

  i. *Option 1:* Under this option, any directed shark permit holder is invited to relinquish his permit and receive $2,500 compensation. Any person accepting this compensation gives up all future rights to fish for Atlantic shark with either an incidental or directed shark permit.
  ii. *Option 2*: Under this option, any directed shark permit holder is invited to relinquish his directed permit and in return will receive $2,000 as compensation and will be permitted to "buy down" to an incidental shark permit (i.e., buy an incidental permit from another owner).[40] Any person accepting this compensation gives up all future rights to fish for Atlantic shark with a directed shark permit.

[38] Analysis by Hester (2005) also indicates that the number of vessels targeting shark is probably fewer then 50.
[39] This amount is considerably lower than the average transfer price reported by Larkin et al (2005) in Table IV.3. However, the goal of the buyback is targeted more at reducing directed permits rather than incidental permits. Hence, the fixed price for the incidental permit is set low on purpose.
[40] In allowing a person to "buy down" to an incidental permit, an implicit assumption is being made that behavior of these persons will not change over time. Specifically, it is assumed that the incidental permits will be used primarily for the purpose of retaining shark that is a byproduct of the directed fishing activities.

iii. *Option 3*: Under this option, any person holding a directed shark permit is invited to submit a bid in a "blind, silent reverse auction." Since funds for this auction will be limited, interested sellers will not be able to ask for a "blind check." Each bid will be evaluated to examine the costs of removal in relation to benefits; measured in terms of pounds of sharks harvested during the 2001-03 period.[41] Bids that are submitted will be scored by dividing the bid amount associated with that permit by the pounds of shark landed during 2001-03 (as reported in the coastal and pelagic logbooks). The scores will then be ranked from lowest to highest with the lower bids receiving preferential treatment (i.e., bids will be accepted beginning with the lowest score and working upwards until funds are exhausted). For the bids accepted, the permit holder will receive the requested bid amount as compensation and will be allowed to "buy down" to an incidental shark permit. Any person accepting this compensation gives up all future rights to fish for Atlantic shark with a directed shark permit.

Given that limited funds will be available for the Atlantic shark buyback program, compensation will proceed as follows. The first persons to be compensated are the directed shark permit holders who select *Option 1* or *Option 2*. Incidental shark permit holders will then be compensated. All remaining funds will then be used to compensate those directed shark permit holders who select *Option 3*.

Discussion: As indicated, the proposed buyback program consists of two components: one which addresses incidental permits and one which addresses directed permits. Shark harvests by incidental permits are, by definition, highly constrained and add very little to capacity. For reasons previously discussed, however, holders of incidental permits are eligible in the buyback program. One might expect that the main purpose of holding (or acquiring) an incidental permit is to allow one to retain incidental shark harvests. One does not want to discourage retention of shark harvest (if dead when brought on board vessel). It is believed that the $500 compensation for incidental permits will not encourage persons catching significant shark bycatch to relinquish his permit.

Directed shark permit holders are provided with several options in this program. Option 1 is most likely to be selected by directed shark permit holders that had no or very low shark landings during 2001-2003. Though current harvest by this group is low, it represents considerable latent capacity which could easily be employed to significantly increase harvest. As such, it needs to be removed from the fishery for the buyback to

[41] The 2001-03 period is selected because it predates much of the buyback discussion. Specifically, shark fishermen may have changed fishing patterns in more recent years in anticipation that this change in fishing patterns would benefit them in a given buyback.

generate any lasting benefits. Analysis by Larkin and Adams (2005) indicates that significant proportion of the “low” shark producers would be willing to relinquish their permits for $2,500 or less.

Option 2 is similar to Option 1 with the exception that monetary compensation is less, but in return for lower monetary compensation, the person can buy an incidental permit. This would allow the person to retain small amounts of shark that tend to be harvested in conjunction with primary harvesting activities (e.g., swordfish).

Large producers of shark, if they care to relinquish their permit, would likely select Option 3. The other two options limit compensation to $2,500 or less and the expected discounted net returns from “large” shark producers, while unknown, certainly exceeds this $2,500 by a considerable margin.[42]

This proposed buyback scheme, one will note, involves a combination of fixed rate buyout and an auction buyout. There are a couple of reasons for proposing such a program. First, under a pure auction program (where fishermen “suggest” a price per unit of catch), directed shark permit holders with no catch records during 2001-03 would not be able to successfully compete in the auction process.[43] Hence, none of this latent effort (70 vessels in 2003) would be removed from the fishery via the bid process. The second reason for proposing a “mixed” program reflects the fact that many of the “smaller” producers (with shark landings in excess of zero pounds) would likely not submit a bid (or submit an unrealistically high bid), but instead would hold the permit for speculative purposes. This group, like the group that produces no shark, could easily expand their individual fishing activities. With a “take it or leave it situation,” it is thought that many of these low producers will take the $2,500 compensation.

The program, as specified, would prohibit a person from relinquishing his directed permit via the buyback process and, subsequently, obtaining another directed permit through any of the normal processes (e.g., buy, lease, etc.). The rationale for this restriction reflects the fact that other buyback programs have found that larger producers have, in some instances, relinquished permits/vessels and have used the compensation to reenter the fishery by buying another person’s permit/vessel (and often upgrading the vessel if the vessel is purchased). This type of “behavior” has been found to limit some of the benefits that would otherwise be forthcoming. The envisioned shark buyback program would prohibit this type of behavior.

As a concrete example, consider the information in Table 2. In the first scenario, it is assumed that 50 directed permit holders select Option 1 while an additional 50 direct shark permit holders select Option 2.[44] Finally, assume that 100 directed shark permits are “bought out” under Option 3 at an average price of $10,000 per permit. The total cost

[42] In theory, the discounted stream of net returns from the harvest of shark would equal the permit value and, hence, the compensation required for an individual to relinquish that permit.
[43] Dividing any “bid request” by zero would result in an infinite number.
[44] Incidental permits are not included in this example since the cost of purchasing even a large percentage of these will be relatively small.

of this program would be $2.45 million.[45] In the context of this scenario, approximately 80% of the directed shark permits will be "bought out" As indicated in a later section of the report, annual gross income in the fishery is approximately $5.1 million annually. Hence, one can expect income from shark fishing to average about $120 thousand annually, per permit, among post-buyback participants.

As a second example, assume that only 25 of the directed shark permit holders select Option 1 while another 25 select Option 2. Finally, assume that 80 directed shark permits are "bought out" at an average of $20,000 per permit. Under this scenario (Scenario 2) total cost of the program would be just under $2.3 million and a total of 130 directed permits will be relinquished. This would leave 120 post-buyback participants. Hence, one can expect income from shark fishing to average about $50 thousand annually, per permit, among post-buyback participants.

As one would expect, the number of permits that could be "bought back" depends heavily on the amount of funding that would be available and the average cost of buying back each permit under Option 3. Higher average accepted bids would result in fewer permits being taken out of the fishery.

Table 2: Hypothetical Shark Permit Buyback Scenarios

Option	*Number of Relinquished Permits*	*Average Cost / permit*	**Total Cost**
-- Scenario 1 --			
Option 1	50	$2,500	$250,000
Option 2	50	$2,000	$200,000
Option 3	100	$10,000	$2,000,000
TOTAL	200		$2,450,000
--------------------------------------- Scenario 2 --			
Option 1	25	$2,500	$62,500
Option 2	25	$2,000	$50,000
Option 3	80	$20,000	$1,600,000
TOTAL	130		$2,275,000

There are several alternatives to this proposed buyback procedure. As stressed throughout the report, one of the major obstacles to developing a "viable" buyback relates the removal of a significant amount of latent capacity. Rather than attempting to remove it via a buyback mechanism, industry could make the request to the Secretary of Commerce that inactive and low producing directed permits be removed directly.[46] As

[45] As indicated in a later section of the report, $2.45 million approximates the amount of funds that would be available for a buyback program assuming a 20-year loan and a five percent tax on shark landings.
[46] Of course, incidental permits could be provided to any person who has a directed permit revoked. This would allow him to retain small amounts of shark that are caught as a "byproduct" of the targeted species.

one might expect, this is certain to be met with a great deal of resistance by the inactive and low producing permit holders. Larkin et al (2005), in a survey of permit holders, found that 55% of the respondents opposed revoking unused permits. Opposition would only increase if one were to initiate discussion of removal of low producing permits.

A natural question arises should the industry decide to go this route. What should be the level of landings less than which would result in the permit being revoked? This, of course, is a subjective question for which there is no definitive answer. Certainly, inactive boats should be removed. How far should you proceed beyond the inactive vessels, however? Figure 1 though helps to shed some light on the issue. As indicated approximately 50 vessels (with a directed shark permit) reported virtually no shark landings during 2001-03 (though some minimum amount of landings are reported). These permits, at a minimum, should be removed. The next fifty boats each landed less than an average of about 15,000 pounds [equaling $15,000-$30,000 that could represent a substantive part of an annual income for a small 30-40 feet long vessel, which would be met with loud opposition from owners] per year and, as such, likely represent a significant amount of additional latent capacity. Removing these 100 vessels through revocation of permits in addition to the approximately 70 inactive vessels would result in a significantly smaller fleet (approximately 70 vessels) upon which a buyback program could be based.

Finally, it should be noted that there are several alternative ways of reducing capital via a buyback program that could also be considered by the industry. For example, the buyback could be conducted over multiple rounds. Doing so has been shown to reduce strategic behavior in terms of offers provided by fishermen but it increases administration costs. Given the increased complexity and amount of time needed to bring such a program to fruition, however, it is not considered here.

Alternatively, a fixed price per permit (differentiated by directed and incidental) could be offered. This would undoubtedly be the simplest method for retiring permits but it is not likely to be cost effective.

2. Projection of the buyback fishery's annual gross ex-vessel income during the buyback loan's term;

Projection of any fishery's annual gross ex-vessel revenues over any length of time entails a considerable amount of uncertainty that, undoubtedly, increases exponentially in relation to the timeframe being considered. Projections for the

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Without delving into details, the industry has tried to get NMFS to choose this option in the draft consolidated HMS FMP, but they chose not to, electing to wait until after the Highly Migratory Species FMP goes final which is estimated to occur about September 2006 and then another year or two after that, completing the overhaul of the permit system about 2007-2008]

Atlantic shark fishery are particularly difficult for a number of reasons. First, there are a large number of species in the Atlantic shark complex and prices for many of the species appear not to move in tandem. Second, price can vary significantly, depending upon the gear being employed and/or region harvested (see Tables 3.63 and 3.64 of the draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan*, 2005). Third, commercial quotas have changed frequently since implementation of the FMP and there is certainly a high likelihood that they would be changed during any extended buyback period.[47] Fourth, the harvested shark yields two distinct products, meats and fins. These two products receive highly differentiated prices and tend to be sold in separate markets. The meat tends to be sold domestically and the fins, to a large extent, are destined for the export market.[48] Fifth, some determination needs to be made regarding what gross ex-vessel income to include when considering a buyback. Specifically, annual harvests of LCS, as noted, have historically exceeded commercial quota by a significant amount. Certainly, however, inclusion of this excess in the potential amount of funds available for a buyback would be questionable. Finally, the price received by the fishermen does not appear to be "well established" and in some cases appears to be of dubious nature.[49]

Based upon the above considerations, it was decided to take a conservative approach in the estimation process. Specifically, the following assumptions were made. First, ex-vessel prices (both meat and fins) observed during 2001-03 are assumed to carry forward into the future and serve as the basis for calculating dockside price. The implications of this are that prices are not expected to significantly change over time as the result of either changes in demand/supply or inflation. Second, it is assumed that the commercial quotas under TAC will not change during the post-buyback period. Third, it is assumed that the weight of wet fins is equal to five percent of the landed carcass weight. Finally, it is assumed that the product weight of LCS landings available for a post-buyback tax is equal to the current commercial quota under TAC (i.e., 1,017 mt dw) while the product weight of SCS and pelagic shark landings available for the post-buyback tax is equal to their respective 2001-03 average landings (i.e., 286 mt dw and 218 mt dw, respectively).

Based on these assumptions, annual gross income from the fishery that would be available post buyback would be $5.051 million annually comprised of the following products:

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[47] Of course, the change in commercial quota could be either increased or decreased.

[48] According to data gathered by the Census Bureau, exports of dried shark fins fell from 365 metric tons in 2000 to 45 metric tons in 2003 (draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan*, 2005). The decrease in trade was explained as being the result of the Shark Finning Prohibition Act, implemented by final rule in February 2002. This would apply primarily to west coast harvested product.

[49] As just one example, based on value estimates [that] were generated by NMFS staff (p.6)," Larkin et al (2005) report total 2003 Atlantic shark landings had a dockside value of $2.44 million. By comparison, the draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan (2005)* reports total ex-vessel revenues in excess of eight million dollars (see Table 6.1 of the draft FMP)

LCS meats	2,129,395 lbs @	$0.50[50]	= $1,064,698
SCS meats	598,581 lbs @	$0.60	= $ 359,148
Pelagic meats	457,461 lbs @	$1.04	= $ 475,760
Fins	167,655 lbs @	$18.80	= $3,151,705
TOTAL			$5,051,311

This number is likely to be somewhat conservative for a number of reasons. First, as noted, current prices (2001-03 avg.) are used to estimate expected future revenues that would be generated from Atlantic shark commercial activities. While meat prices have been stable in recent years, limited information on fin prices suggest an increasing trend.[51] However, since it is unknown whether this increasing trend will continue, a conservative estimate (i.e., current price) was employed in the analysis.

Second, the analysis is premised on the assumption that the LCS quota will not change during the post-buyback period. To the extent that the LCS is managed effectively, one might anticipate stocks to grow which would allow for an increased commercial quota. Given the slow growth rate of most shark species, however, one might anticipate any increases in TAC to be relatively far into the future.

To the extent that the numbers are conservative, however, taxes on post-buyback harvest in relation to gross income will decline over time. Hence, a smaller proportion of gross income would be required to finance debt payments.[52]

3. The buyback loan's principal and repayment schedule;

The principal associated with a buyback in the Atlantic shark fishery depends on three factors (1) the treasury's cost of borrowing, (2) amount borrowed which is limited to five percent of projected gross income, and (3) number of years covered by the loan (limited to a maximum of twenty).

For purposes of analysis, the rate of borrowing was assumed to equal 7.2% annually.[53] Given a five percent tax on post-buyback harvested product valued at $5.051 million, this would generate a loan principal of $2.63 million, based on a 20 year repayment schedule. This constitutes a maximum principal that the industry could request for the purpose of buying excess capital. If a 10 year repayment schedule is selected, the loan principal would be $1.76 million. Finally, a 3.0% tax on post-buyback harvested product was also

[50] This price is significantly lower than the price reported in Table 3.65 of the draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan* (2005). However, comparison of Tables 3.63 and 3.65 indicates some significant discrepancies in terms of dockside prices.
[51] This increasing trend likely reflects a rebound in the Asian market where the majority of the fins are sent.
[52] As an aside, lack of detailed information on dockside prices may hinder the collection of the "true" amount of taxes that could be generated for a buyback program.
[53] This is the approximate rate which would be charged if the buyback was to be implemented in the near future. With increasing interest rates, one might hypothesize that the rate will be higher than 7.2% at the time any buyback is implemented.

considered. This tax rate would generate a loan principal of $1.58 million based on a 20 repayment schedule and $1.05 million based on a 10 year repayment schedule.

While considered in more detail in subsequent sections, it is clear that excess capacity in the shark fishery is so great that only a 20 year loan (and five percent tax) will be sufficient to remove enough capital to make a buyback program viable. Hence, the focus will be on a loan principal of $2.63 million.

4. Minimum amount of reduced capacity for the buyback to be cost-effective;

In order for the buyback to be cost-effective, a substantial reduction in capacity would be required. While an exact percentage is not quantifiable, analysis by Hester et al (2005) can shed some light on the issue. Currently, the fleet (i.e., all permits) is capable of harvesting the total TAC in an estimated 26 days.[54] This is based on 349 incidental permits and 232 directed permits. The fleet trip capacity (i.e., if each vessel were to make one trip targeting sharks) is an estimated 596 thousand pounds. Of the 349 incidental permits, 253 are inactive. Similarly, of the 232 directed permits, 74 are inactive. Removing the inactive permits would reduce the fleet size to 254 vessels. These 254 vessels represent less than one-half the current fleet size and if inactive permits are removed the remaining fleet would be capable of harvesting the TAC in 42 days.

Is it cost effective to remove these inactive permits? The answer is 'absolutely not' if these are the only permits to be removed. Why? Because while they represent latent capacity they are not active and thus do not contribute to current shark catch. Removing them would cost an estimated $311,500 under the proposed buyback scheme (253*$500 + 74*$2,500) yet catch per trip among the remaining portion of the fleet would remain constant. This represents about 12% of the loan principal but, by itself, provides no benefits. However, they would certainly need to be removed under a more comprehensive reduction program.

As noted elsewhere in the report (see Figure 1), an additional 50 vessels harvest only an extremely limited amount of shark. It seems likely that these directed permit holders will also relinquish their permits for $2,500. This brings the cost of the program up to $436,500 ($311,500 + 50*$2,500) and a total of 124 directed permits and 253 incidental permits are now removed. Thus, we are now left with 108 directed permits. It is roughly at this point that one would expect to see an increasing catch per trip among the remainder of the fleet. At this point, furthermore, approximately 17% of the loan

[54] This TAC refers only to LCS species. Since LCS species generally represent more than 70% of the Atlantic shark harvest, including SCS and pelagic species in the analysis would likely not appreciably change the results.

principal has been expended. Annual costs to the remaining fleet averages $411 per directed permit.

The remainder of the fleet, it is assumed, would enter into the reverse auction if interested in surrendering the permit for compensation. These would all be holders of directed shark permits. According to Hester et al (2005), a fleet size of about 40 active directed permits would meet "the objective of achieving a stable, self-regulating shark fishery." Hence, an additional 68 vessels would need to be 'bought out' to meet this goal. Revenues per vessel at this point would be roughly $148 thousand, on average, of which five percent would be given up in taxes. Hence, each of the 40 remaining directed shark permitted vessels would be paying $7,405 per year to the post-buyback Fee System.

Evaluating the costs associated with removal of additional permits becomes more complicated when one moves to the reverse auction. Bids submitted by license holders should reflect the loss in discounted net returns associated with relinquishing the permit. The more efficient producers would be harvesting at a lower cost and, hence, profits per unit of output would be higher. As such, their submitted bids should be higher than the bids submitted by less efficient producers. Beyond this point, however, little can be said regarding costs of buying out additional directed permits.

5. Analysis of the buyback cost-effectiveness at the minimum level and at additional incremental levels;

To the extent possible, this is addressed in the previous section.

6. Specified or target total allowable catch that will trigger post-buyback closures or other measures to reduce catch;

Detailed quotas, seasons, and quota monitoring are already in place for the Atlantic shark fishery. Hence, there is no need to specify a target total allowable catch that would trigger post-buyback closures to reduce catch.

7. Names and addresses of all likely post buyback fish buyers;

Commercial sale of Atlantic sharks (and other HMS species) can only be made to NMFS permitted dealers and fishermen caught selling to any person without the requisite permit are subject to enforcement action (draft *Consolidated Atlantic Highly Migratory Species Fishery Management Plan, Volume 1*, 2005). The number of Atlantic shark dealer permits issued as of April 20, 2005 totaled 230. Of these permits, 40% reported a Florida address while no other state represented more than about eight percent of the total.[55] There is no limited entry program for permitted dealers. The number, however, has fallen about 15% since 2002 when permitted dealers totaled 267.

Since the sale of Atlantic sharks can only be made to permitted dealers, the universe of likely post buyback fish buyers is maintained by NMFS.[56] This universe, as discussed in the next section, represents the group from which fees would be collected in association with a buyback program.

8. Fee collection and reporting procedures.

Federally permitted dealers will deduct the appropriate tax when making the first purchase from fishermen at the time of unloading. These receipts will be sent to the appropriate authority on a monthly basis.

9. Potential impact of the buyback on other fisheries, including the general economic impact and possible steps to mitigate undesirable impacts.

There exists a distinct possibility that a buyback in the shark fishery, as outlined in previous sections of this report, may result in a marginal increase in effort in many other fisheries and no steps are being taken to mitigate undesirable impacts. The potential increase in effort results from the fact that the Atlantic shark buyback program makes no direct attempt to either remove vessels or non-shark permits from the "collection of vessels that depend on a variety of species of fish and sharks for their annual production." Given the fact that shark harvest comprises a relatively small proportion of gross income of most shark permit holders, any increase in other fisheries is expected to be small.

While the Atlantic shark buyback makes no attempt to directly remove vessels and/non-shark permits, there may be some small reduction in the number of vessels who land small quantities of shark but are not engaged significantly in other fishing activities.

IV. CONCLUSIONS

[55] Six of the 230 permitted dealers reported addresses outside of the United States, including four in Canada, one in Chile, and one in Ecuador.
[56] As previously noted, many states do not have regulations compatible with the Federal regulations. Hence, some small proportion of shark harvest is likely to be moved through dealers who are not federally permitted.

Commercial shark activities represent a single component of a multi-species, geographically disperse fishing industry. It is plagued by many of the same problems facing numerous fisheries throughout the world. Many of the problems, such as overfished stocks and overfishing conditions, emanate from a severe mismatch between the available capital and amount of stock that can be taken in an efficient and sustainable basis.

As a result of this mismatch, some participants of the Atlantic shark fishery have asked that a buyback program be considered for the fishery. This report, based on available information, considers the viability of such a program and develops a "draft" buyback business plan for purchasing of shark permits.

While there appears to be a myriad of problems associated with development of a viable buyback program, the largest obstacle by far reflects the exceedingly large amount of latent and underutilized capacity in the fishery. While this capacity can, in theory, be removed via a buyback program, such removal will be difficult. An option, therefore, is to make a direct request to the Secretary of Commerce that he take whatever actions are required to revoke unused or (substantially) underutilized capital (i.e., shark permits that are idle or rarely used).

Other concerns also exist regarding the viability of a buyback of shark permits. As discussed in the report, some states have regulations that are not completely compatible with federal regulations regarding the harvest and sale of shark. Likewise, the recreational component of the shark industry, which is sizeable, is not subject to a limited access system. Incompatibility of regulations and lack of a recreational limited access program suggest that some benefits that might otherwise be forthcoming from a buyback program, may well be eroded.

The issue of capital stuffing by post-buyback participants is also a well recognized problem which can, over time, erode benefits initially gained from a buyback program. The Atlantic shark industry needs to carefully examine whether this issue be problematic before undertaking a program which it will be taxed for up to twenty years.

Finally, while this report focused almost exclusively on a buyback of permits, the industry may wish to consider a more "all inclusive" buyback program. Without going into detail, it is obvious that the amount of capital removed is directly related to the inclusiveness of the program. While an "all inclusive" program would, of course, require considerable coordination among many management councils and other agencies, such coordination may yield significant long-term benefits. However, these benefits must be weighed against a potentially long delay in implementing such a program.

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APPENDIX A: SPECIES LANDINGS COMPOSITION BY REVENUE

(Source: Larkin et al, 2005)

Table 1a. Species composition of revenue by shark permit type for group 1 revenue level $1 million to $1.6 million.(V = 11 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	945,376	945,376	0.0%	10.6%
Angler	41,553	126,697	0.0%	1.4%
Bluefin	1,960	41,553	1.6%	0.5%
Bluefish	3,687	1,960	0.0%	0.0%
BSBass	9,322	3,687	0.0%	0.0%
Croaker	82,120	9,322	0.0%	0.1%
Dolphin	176,959	82,120	1.0%	0.9%
Flounder	484,142	484,142	0.0%	5.4%
Grouper	0	0	0.0%	0.0%
Haddock	1,029,837	176,959	0.0%	2.0%
Hake	1,272,309	1,029,837	0.0%	11.6%
Herring	749	1,272,309	0.0%	14.3%
KMackerel	30,897	749	0.0%	0.0%
Lobster	7,008	30,897	0.0%	0.3%
Other	223,091	223,091	0.2%	2.5%
Pollock	0	7,008	0.0%	0.1%
RedCrab	721,506	0	0.0%	0.0%
Scallop	1,251,587	721,506	0.0%	8.1%
Shark	0	14,921	0.5%	0.2%
SMackerel	9,331	0	0.0%	0.0%
Snapper	14,921	0	0.0%	0.0%
Squid	0	1,251,587	0.0%	14.0%
Swordfish	2,201,179	2,201,179	72.7%	24.7%
Tilefish	126,697	9,331	0.0%	0.1%
Tuna	275,948	275,948	23.8%	3.1%
Total Revenue	*8,910,180*	*8,910,180*	*100.0%*	*100.0%*

Table 1b. Composition of total revenue by key species for group 1 revenue level $1 million to $1.6 million.(N = 11 vessels)

Fishery	Directed	Incidental
All other	2.9%	72.0%
Grouper	0.0%	0.0%
Shark	0.5%	0.2%
Snapper	0.0%	0.0%
Swordfish	72.7%	24.7%
Tuna	23.8%	3.1%
Total Revenue	*100.0%*	*100.0%*

Table 2a. Species composition of revenue by shark permit type for group 2 revenue level $750,000 to $999,999 (N = 9 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	534	477,493	0.0%	9.9%
Angler	212,809	66,772	8.4%	1.4%
Bluefin	34,284	1,725	1.4%	0.0%
Bluefish	0	3,407	0.0%	0.1%
BSBass	0	108,803	0.0%	2.3%
Croaker	0	320,703	0.0%	6.7%
Dolphin	6,260	6,005	0.2%	0.1%
Flounder	410	608,659	0.0%	12.7%
Grouper	0	0	0.0%	0.0%
Haddock	0	173,977	0.0%	3.6%
Hake	49	25,729	0.0%	0.5%
Herring	0	108,842	0.0%	2.3%
KMackerel	0	0	0.0%	0.0%
Lobster	0	22,393	0.0%	0.5%
Other	3,980	295,272	0.2%	6.1%
Pollock	0	2,800	0.0%	0.1%
RedCrab	0	0	0.0%	0.0%
Scallop	0	1,223,896	0.0%	25.5%
Shark	14,934	2,976	0.6%	0.1%
SMackerel	0	0	0.0%	0.0%
Snapper	0	0	0.0%	0.0%
Squid	0	584,705	0.0%	12.2%
Swordfish	2,048,893	130,993	81.3%	2.7%
Tilefish	41,454	505,149	1.6%	10.5%
Tuna	157,710	132,905	6.3%	2.8%
Total Revenue	*2,521,317*	*4,803,204*	*100.0%*	*100.0%*

Table 2b. Composition of total revenue by key species for group 2 revenue level $750,000 to $999,999 (N= 9 vessels)

Fishery	Directed	Incidental
All other	11.9%	94.4%
Grouper	0.0%	0.0%
Shark	0.6%	0.1%
Snapper	0.0%	0.0%
Swordfish	81.3%	2.7%
Tuna	6.3%	2.8%
Total revenue	*100.0%*	*100.0%*

Table 3a. Species composition of revenue by shark permit type for group 3 revenue level $500,000 to $749,00. (N = 23 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	451	538,368	0.0%	8.0%
Angler	204,293	315,223	2.7%	4.7%
Bluefin	57,158	20,975	0.7%	0.3%
Bluefish	74	2,553	0.0%	0.0%
BSBass	304	6,434	0.0%	0.1%
Croaker	0	0	0.0%	0.0%
Dolphin	322,485	76,708	4.2%	1.1%
Flounder	644	1,460,372	0.0%	21.7%
Grouper	787,882	348,752	10.3%	5.2%
Haddock	0	440,691	0.0%	6.6%
Hake	1,367	269,051	0.0%	4.0%
Herring	0	0	0.0%	0.0%
KMackerel	0	0	0.0%	0.0%
Lobster	0	75,207	0.0%	1.1%
Other	37,781	452,205	0.5%	6.7%
Pollock	0	89,438	0.0%	1.3%
RedCrab	646,978	646,978	8.4%	9.6%
Scallop	0	2,696	0.0%	0.0%
Shark	348,686	19,468	4.5%	0.3%
SMackerel	0	0	0.0%	0.0%
Snapper	219,527	158,993	2.9%	2.4%
Squid	343	597,456	0.0%	8.9%
Swordfish	2,887,368	823,066	37.6%	12.2%
Tilefish	1,055,089	65,260	13.8%	1.0%
Tuna	1,099,726	314,690	14.3%	4.7%
Total Revenue	*7,670,156*	*6,724,585*	*100.0%*	*100.0%*

Table 3b. Composition of total revenue by key species for group 3 revenue level $500,000 to $749,00. (N = 23 vessels)

Fishery	Directed	Incidental
All Other	30.3%	75.2%
Grouper	10.3%	5.2%
Shark	4.5%	0.3%
Snapper	2.9%	2.4%
Swordfish	37.6%	12.2%
Tuna	14.3%	4.7%
Total Revenue	*100.0%*	*100.0%*

Table 4a. Species composition of revenue by shark permit type for group 4 revenue level $250,000 to $499,000 (N = 68 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	0	49,485	0.0%	0.3%
Angler	120,614	465,272	2.3%	2.8%
Bluefin	36,363	297,108	0.7%	1.8%
Bluefish	19	63,821	0.0%	0.4%
BSBass	4	72,427	0.0%	0.4%
Croaker	106	148,975	0.0%	0.9%
Dolphin	221,007	154,191	4.3%	0.9%
Flounder	327	1,033,809	0.0%	6.3%
Grouper	1,748,111	748,968	33.7%	4.5%
Haddock	0	89,985	0.0%	0.5%
Hake	200.	273,829	0.0%	1.7%
Herring	0	94	0.0%	0.0%
KMackerel	15,371	33,940	0.3%	0.2%
Lobster	0	70,837	0.0%	0.4%
Other	72,815	877,035	1.4%	5.3%
Pollock	0	153,194	0.0%	0.9%
RedCrab	0	0	0.0%	0.0%
Scallop	0	61,803	0.0%	0.4%
Shark	202,370	57,667	3.9%	0.3%
SMackerel	0	15,465	0.0%	0.1%
Snapper	713,621	850,221	13.8%	5.1%
Squid	12	480,694	0.0%	2.9%
Swordfish	1,143,648	2,595,245	22.0%	15.7%
Tilefish	206,681	69,861	4.0%	0.4%
Tuna	708,677	7,856,914	13.7%	47.6%
Total Revenue	*5,189,947*	*16,520,840*	*100.0%*	*100.0%*

Table 4b. Composition of total revenue by key species for group 4 revenue level $250,000 to $499,000 (N = 68 vessels)

Fishery	Directed	Incidental
All other	13.0%	26.7%
Grouper	33.7%	4.5%
Shark	3.9%	0.3%
Snapper	13.8%	5.1%
Swordfish	22.0%	15.7%
Tuna	13.7%	47.6%
Total Revenue	*100.0%*	*100.0%*

Table 5a. Species composition of revenue by shark permit type for group 5 revenue level $150,000 to $249,999 (N = 82 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	0	49,485	0.2%	0.0%
Angler	120,614	465,272	11.1%	6.7%
Bluefin	36,363	297,108	0.1%	0.9%
Bluefish	19	63,821	3.5%	0.4%
BSBass	4	72,427	0.0%	1.5%
Croaker	106	148,975	1.3%	0.6%
Dolphin	221,007	154,191	0.7%	1.0%
Flounder	327	1,033,809	2.8%	3.1%
Grouper	1,748,111	748,968	31.3%	21.0%
Haddock	0	89,985	0.6%	0.1%
Hake	200	273,829	2.6%	0.4%
Herring	0	94	0.0%	0.0%
KMackerel	15,371	33,940	0.6%	0.6%
Lobster	0	70,837	0.0%	0.9%
Other	72,815	877,035	3.7%	5.1%
Pollock	0	153,194	0.7%	0.8%
RedCrab	0	0	0.0%	0.0%
Scallop	0	61,803	7.5%	1.2%
Shark	202,370	57,667	8.1%	0.7%
SMackerel	0	15,465	0.6%	0.0%
Snapper	713,621	850,221	4.9%	11.6%
Squid	12	480,694	0.0%	1.4%
Swordfish	1,143,648	2,595,245	5.5%	14.8%
Tilefish	206,681	69,861	2.4%	1.4%
Tuna	708,677	7,856,914	11.8%	25.7%
Total Revenue	*5,189,947*	*16,520,840*	*100.0%*	*100.0%*

Table 5b. Composition of total revenue by key species for group 5 revenue level $150,000 to $249,999 (N = 82 vessels)

Fishery	Directed	Incidental
All Other	38.4%	26.1%
Grouper	31.3%	21.0%
Shark	8.1%	0.7%
Snapper	4.9%	11.6%
Swordfish	5.5%	14.8%
Tuna	11.8%	25.7%
Total Revenue	*100.0%*	*100.0%*

Table 6a. Species composition of revenue by shark permit type for group 6 revenue level $75,000 to $149,999. (N = 74 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	1,785	102	0.0%	0.0%
Angler	361,864	217,199	8.0%	6.0%
Bluefin	2,767	8,676	0.1%	0.2%
Bluefish	69,020	2,701	1.5%	0.1%
BSBass	44,414	208,222	1.0%	5.7%
Croaker	67,526	38,311	1.5%	1.1%
Dolphin	31,853	41,779	0.7%	1.2%
Flounder	10,067	2,855	0.2%	0.1%
Grouper	1,761,185	1,317,497	38.7%	36.3%
Haddock	0	117	0.0%	0.0%
Hake	1,059	4,467	0.0%	0.1%
Herring	343	61	0.0%	0.0%
KMackerel	362,811	106,454	8.0%	2.9%
Lobster	26,902	19,967	0.6%	0.6%
Other	160,460	269,714	3.5%	7.4%
Pollock	0	5,399	0.0%	0.1%
RedCrab	0	0	0.0%	0.0%
Scallop	218,662	31,527	4.8%	0.9%
Shark	659,060	76,796	14.5%	2.1%
SMackerel	42,724	28,243	0.9%	0.8%
Snapper	201,477	489,440	4.4%	13.5%
Squid	0	0	0.0%	0.0%
Swordfish	312,055	125,687	6.9%	3.5%
Tilefish	99,354	111,085	2.2%	3.1%
Tuna	114,949	523,402	2.5%	14.4%
Total Revenue	*4,550,336*	*3,629,700*	*100.0%*	*100.0%*

Table 6b. Species share of total revenue by key species for group 6 revenue level $75,000 to $149,999 (N = 74 vessels)

Fishery	Directed	Incidental
All Other	33.0%	30.2%
Grouper	38.7%	36.3%
Shark	14.5%	2.1%
Snapper	4.4%	13.5%
Swordfish	6.9%	3.5%
Tuna	2.5%	14.4%
Total Revenue	*100.0%*	*100.0%*

Table 7a. Species composition of revenue by shark permit type for group 7 revenue level $25,000 to $74, 999 (N = 82 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	1,888	260	0.1%	0.0%
Angler	24,535	31,229	1.3%	1.5%
Bluefin	0	0	0.0%	0.0%
Bluefish	4,835	22,689	0.3%	1.1%
BSBass	28,515	137,995	1.5%	6.5%
Croaker	1,913	14,684	0.1%	0.7%
Dolphin	9,562	6,046	0.5%	0.3%
Flounder	160	22,179	0.0%	1.0%
Grouper	512,330	482,470	27.2%	22.7%
Haddock	0	1,623	0.0%	0.1%
Hake	593	12,959	0.0%	0.6%
Herring	0	9,817	0.0%	0.5%
KMackerel	121,173	175,239	6.4%	8.3%
Lobster	0	52,889	0.0%	2.5%
Other	118,610	251,550	6.3%	11.9%
Pollock	0	20,499	0.0%	1.0%
RedCrab	0	0	0.0%	0.0%
Scallop	31,764	116,144	1.7%	5.5%
Shark	578,883	4,491	30.7%	0.2%
SMackerel	107,273	187,061	5.7%	8.8%
Snapper	53,411	278,838	2.8%	13.1%
Squid	0	84	0.0%	0.0%
Swordfish	42,949	126,296	2.3%	5.9%
Tilefish	228,683	24,038	12.1%	1.1%
Tuna	18,777	143,627	1.0%	6.8%
Total Revenue	*1,885,854*	*2,122,707*	*100.0%*	*100.0%*

Table 7b. Composition of total revenue by key species for group 7 revenue level $25,000 to $74, 999 (N = 82 vessels)

Fishery	Directed	Incidental
All Other	36.0%	51.2%
Grouper	27.2%	22.7%
Shark	30.7%	0.2%
Snapper	2.8%	13.1%
Swordfish	2.3%	5.9%
Tuna	1.0%	6.8%
Total Revenue	*100.0%*	*100.0%*

Table 8a. Species composition of revenue by shark permit type for group 8 revenue level $5,000 to $24,999 (N = 66 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	6	0	0.0%	0.0%
Angler	1,990	0	0.5%	0.0%
Bluefin	0	0	0.0%	0.0%
Bluefish	5,640	54	1.4%	0.0%
BSBass	53	25,149	0.0%	5.7%
Croaker	13,219	9	3.3%	0.0%
Dolphin	3,095	2,461	0.8%	0.6%
Flounder	377	12	0.1%	0.0%
Grouper	19,592	157,092	4.9%	35.3%
Haddock	0	0	0.0%	0.0%
Hake	11	2	0.0%	0.0%
Herring	18	0	0.0%	0.0%
KMackerel	71,893	45,303	17.9%	10.2%
Lobster	0	1,796	0.0%	0.4%
Other	36,820	46,068	9.2%	10.4%
Pollock	0	0	0.0%	0.0%
RedCrab	0	0	0.0%	0.0%
Scallop	1,546	0	0.4%	0.0%
Shark	151,441	37,689	37.8%	8.5%
SMackerel	47,757	17,570	11.9%	3.9%
Snapper	35,493	91,408	8.9%	20.5%
Squid	0	0	0.0%	0.0%
Swordfish	482	10,673	0.1%	2.4%
Tilefish	14	41	0.0%	0.0%
Tuna	11,156	9,640	2.8%	2.2%
Total Revenue	*400,603*	*444,967*	*100.0%*	*100.0%*

Table 8b. Composition of total revenue by key species for group 8 revenue level $5,000 to $24,999 (N = 66 vessels)

Fishery	Directed	Incidental
All Other	45.5%	31.1%
Grouper	4.9%	35.3%
Shark	37.8%	8.5%
Snapper	8.9%	20.5%
Swordfish	0.1%	2.4%
Tuna	2.8%	2.2%
Total Revenue	*100.0%*	*100.0%*

Table 9a. Species composition of revenue by shark permit type for group 9 revenue level $1 to $4,999 (N = 59 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	0	303	0.0%	0.3%
Angler	0	675	0.0%	0.7%
Bluefin	0	0	0.0%	0.0%
Bluefish	730	1,122	2.1%	1.2%
BSBass	2,549	7,581	7.3%	8.2%
Croaker	0	0	0.0%	0.0%
Dolphin	87	2,783	0.2%	3.0%
Flounder	190	2,282	0.5%	2.5%
Grouper	3,807	14,446	10.9%	15.6%
Haddock	0	0	0.0%	0.0%
Hake	0	0	0.0%	0.0%
Herring	0	0	0.0%	0.0%
KMackerel	4,812	6,907	13.7%	7.5%
Lobster	0	55	0.0%	0.1%
Other	2,196	13,061	6.3%	14.1%
Pollock	0	0	0.0%	0.0%
RedCrab	0	0	0.0%	0.0%
Scallop	0	0	0.0%	0.0%
Shark	12,061	7,416	34.4%	8.0%
SMackerel	7,099	12,985	20.3%	14.0%
Snapper	4	17,459	0.0%	18.9%
Squid	0	0	0.0%	0.0%
Swordfish	0	3,075	0.0%	3.3%
Tilefish	1,473	1	4.2%	0.0%
Tuna	47	2,379	0.1%	2.6%
Total Revenue	*35,055*	*92,530*	*100.0%*	*100.0%*

Table 9b. Composition of total revenue by key species for group 9 revenue level $1 to $4,999 (N = 59 vessels)

Fishery	Directed	Incidental
All Other	54.6%	51.6%
Grouper	10.9%	15.6%
Shark	34.4%	8.0%
Snapper	0.0%	18.9%
Swordfish	0.0%	3.3%
Tuna	0.1%	2.6%
Total Revenue	*100.0%*	*100.0%*

Appendix B

Assessing the Fair Market Value of Commercial Shark Permits and Vessels in the Gulf of Mexico and Atlantic Regions

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FINAL REPORT

I. TITLE: **"Assessing the Fair Market Value of Commercial Shark Permits and Vessels in the Gulf of Mexico and Atlantic Regions"**

AUTHORS: **Sherry L. Larkin,** Assistant Professor
Charles M. Adams, Professor & Florida Sea Grant Marine Economics Specialist

ORGANIZATION: **University of Florida**

GRANT NUMBER: **00034722**

DATE: **December 15, 2005**

Errata

Page	Sentence begins	New sentence (bold text indicates change from original, brackets identify deleted words)
iii	First para., 2nd line	There is also an issue of latent effort to be addressed since only 517 of the 605 vessel**s** reported landing any species during the 2001 to 2003 period.
4	Last para., 4th line	The sample contained 197 directed shark permits and **27**7 incidental shark permits.
5	First para., 2nd line	The mail survey was sent **to** all fishermen who held a shark permit during April 2004 regardless of **the** type of shark permit and whether or not they targeted shark.
30	Last para., 2nd line	In 2003, 81% of all shark revenues [in] were associated with directed permits and the remaining 19% with incidental permits.
31	Last para., 4th line	Those in the $5,000 to $24,**999** category had the largest share of shark revenue (38%) followed closely by those with revenues below $5,000 (34%) and those within the $25,000 to $74,999 category (31%).
31	Last para., 12th line	Shark's share of total annual gross revenue was larger for **directed** shark permit holders than for **incidental** shark permit holders.

Continued

Page	Sentence(s) begins	New sentence (bold text indicates change from original, brackets identify deleted words)
41	First para., 4th line	The majority (74%) of the 300 respondents had household incomes of less **than** $100,000.
45	Last para., 1st line	A cross tabulation of responses for vessel debt and vessel insurance showed that those vessels with**out** debt were the largest proportion of those insured. Responses showed that 70% of vessels **were without** debt and, when considering insured status, this percentage can be divided into 41% insured and 29% uninsured (59% of vessels without debt were uninsured).
46	First para., 1st line	Respondents were asked to identify and rank statement**s** that best described their goals and perceptions pertaining to their shark fishing business.
59	Table 11, note	**SWKD and SWK refer to a directed swordfish permit and a swordfish permit (type unknown), respectively.**
68	Third para., last line	A true market price may be extremely difficult to find for specific vessel configurations that lay outside the realm of **what the** industry would recognize as a "typical" vessel.
70	3rd bulleted point	Reported landings of all species from federal waters were obtained for each vessel for the 3-year[d] period of 2001-2003. The majority of vessels had 2003 total dockside revenues ranging from $5,000 to $500,000.

Note: Pages 6-27 contain the text of a manuscript that was published in August of 2004, thus, no changes were made to the text within the final report.

Disclaimers: *Any opinions expressed in the final report are those of the authors and should not be associated with the funding agency in any regard. Remaining errors, if any, are the fault of the authors. Any subsequent use of the content of this report is cautioned; only those conclusions that are stated in the report are endorsed by the authors.*

FINAL REPORT

I. **TITLE:** **"Assessing the Fair Market Value of Commercial Shark Permits and Vessels in the Gulf of Mexico and Atlantic Regions"**

AUTHORS: **Sherry L. Larkin,** Assistant Professor
Charles M. Adams, Professor & Florida Sea Grant Marine Economics Specialist

ORGANIZATION: **University of Florida**

GRANT NUMBER: **00034722**

DATE: **November 2005**

II. ABSTRACT

Increased demand for seafood products, increasing fishing effort, and declining fishery stocks have created complex challenges for fisheries resource managers in the US. Several high-valued fisheries are currently considered overcapitalized, including most species of commercially important shark. Efforts to reduce fishing capacity within the U.S. Atlantic commercial shark fleet have been suggested as a viable management measure by industry representatives. The purchase and permanent retirement of shark fishing vessels and/or federal shark permits under a federally sponsored buyout (buyback) program is an approach that has been suggested for reducing shark fishing capacity. Recent evidence from similar programs in other fisheries, however, suggests that buyouts are not a panacea for solving overcapacity problems. Whether such programs can help improve the financial condition of fleets in any specific fishery depends on a multitude of factors. This project addressed one factor within a hypothetical buyout program for the U.S. Atlantic shark fishery: the fair market value of a shark fishing vessel and/or permit. Several methods for assessing fair market value of a commercial shark vessel were addressed. These methods included insured value, comparable sales value, future income stream value, 1-year of gross revenue, and assigning a value per linear foot of total vessel length. Each method was found to have weaknesses that precluded their use as a proxy for fair market value. The most appropriate method identified was derived from recent buyout programs held within the northwest U.S. region. These programs found that acceptable bid values for vessel buyout programs were within a multiple-range of annual gross revenue for all species landed by the vessel.

A list of federal shark permit holders in the U.S. Gulf of Mexico and Atlantic regions were obtained, along with specific catch histories (all species) for each. This information was utilized to develop predicted vessel and permit bid values for each permit holder. The values developed for each permit holder were derived utilizing the bid-to-annual gross revenue ratios which characterized the successful bidders in recent northwest U.S. buyout programs. A survey soliciting awareness level and perceptions regarding buyout programs was sent to all (605) federal shark permit holders in the Gulf and Atlantic region. Each survey recipient was also provided an estimated (a) vessel and (b) permit value for which they were asked to indicate their willingness to accept each as a buyout payment. A 58% response rate was achieved. Approximately 70% rejected the (b) value as an acceptable buyout payment for the permit. However, approximately 60% of the respondents indicated at least some level of willingness to consider the amount (a) as an acceptable buyout payment for the vessel and all permits. As such, this method appears to provide an appropriate alternative for determining the acceptable market value for a vessel and all the associated federal permits (including shark). This method basically endorses the use of a production-normalized value assignment / bid submission approach as the most appropriate method for determining fair market value in this fishery among the suite of methods considered.

III. EXECUTIVE SUMMARY

The commercial shark fishery within the Gulf of Mexico and Atlantic region is recognized by fishery managers as being overfished and overcapatilized. The implementation of traditional management measures to address this issue have created significant uncertainty within the commercial fleet and appear to not have corrected the problems. Representatives of the commercial shark fleet within the region have requested that federal fishery managers consider the development of a permit and/or vessel buyout program for the commercial shark fleet. It is hoped that this non-traditional approach to shark fishery management will allow latent effort to leave the fishery and provide for a more economically efficient commercial fleet to harvest shark in a long-term, sustainable manner within the biological constraints (i.e., harvest quotas) imposed by management. Such a buyout program would likely require the issuance of a federal loan, to be paid back by those vessels remaining in the fishery. The loan amount would be determined, in large part, by the expected dockside value for shark throughout the duration of the loan. Once the number of permits and/or vessels to be removed from the fleet is determined, the question remains … is the loan amount enough to buy back those permits and/or vessels? The answer to that question would be linked directly to the perceived fair market value for commercial shark permits and/or vessels, and the owners' willingness to accept that value and leave the fishery.

The overall objective of this study was to estimate the fair market value of a commercial shark permit and vessel. This information would be necessary to ascertain the financial feasibility of a proposed buyout program. The specific sub-objectives of the study were to (1) conduct a literature review of past and present buyout programs to determine the role that fair market value assessment has played in buyout program design and development, (2) obtain the appropriate vessel-level data from industry and federal management sources that would allow the determination of landings and gross revenue profiles associated with commercial shark permits and/or vessels, and (3) compute the fair market value for commercial shark permits and/or vessels.

A list of all vessels with a federal shark permit of any type was obtained from the Southeast Regional Office of the National Marine Fisheries Service (NMFS). Landings and value data were obtained for these vessels from the NMFS Southeast Fisheries Center and NMFS Northeast Fisheries Center. These data allowed the development of landings and revenue profiles for commercial shark vessels within the region. The list of permits also provided the mailing list for a mail-out survey that was sent to all federally permitted shark vessel owners within the region.

Of the 605 active shark permit owners in April 2004, 249 were directed permits. These 605 permit owners collectively held 3,585 commercial fishing permits, indicating a high degree of participation in other fisheries. The majority of other permits were swordfish, Atlantic tunas, king mackerel, and Spanish mackerel. Thus, a permit only buyout program is likely to only have limited success (especially since some of these other permits are required in order to fish for shark) and a vessel buyout program would need more funding that could be supported by the shark fishery (assuming the other species contributed sufficiently to total revenues). There is also an issue of latent effort to be addressed since only 517 of the 605 vessel reported any landings during the 2001 to 2003 period.

Of the 605 potential respondents, only 551 had valid addresses, which could be due to permit sales between the list date and the survey date. One key component of the mail survey asked respondents (commercial shark permit owners) to indicate their willingness to consider (a) helping to fund a buyout program through a subsequent long-run tax on landings, (b) selling their shark permit and their vessel with all permits, and (c) likelihood of accepting a given value (i.e., bid) for their shark permit and their vessel with all permits. The likelihood was solicited in quarter increments from 0% (i.e., would definitely reject the bid and continue fishing) to 100% (i.e., would definitely accept the bid and retire assets).

A total of 321 permit owners (58.3% of available population) responded to the survey. Among the respondents, 75% and 66% were willing to sell their shark permit and/or their vessel with all permits, respectively. When asked about their likelihood of accepting the landings-based offer presented to them, less than 30% but more than 60% were at least somewhat likely (i.e., indicating a 25% or higher percentage) to accept the bids for the shark permit and/or vessel and permits. Assuming an individual would accept the offered bid with a likelihood of at least 50%, a program to purchase only shark permits would cost $414,500 (approximately 15% of the annual value of the fishery) and would eliminate 9.3% of the *value* of the fishery.[1] A program to purchase vessels and all permits would cost $50.3 million (approximately 60% of the annual value of all fisheries) but would eliminate 45.2% of the value of shark landings as reported annually from 2001-2003.

[1] Recall that the value of shark landings reported annually from 2001-2003 totaled $2.8 million. The 9.3% in terms of value (and corresponding 45.2% of total values) are likely proportional to volume since unit prices of shark species have not fluctuated significantly during recent years.

IV. PURPOSE

A. Detailed Description of Problem

The commercial fisheries targeting sharks stocks located in the Gulf of Mexico and Atlantic region have been found to be characterized by over-capacity. A fishery is defined as being in a state of overcapacity if the harvest capacity exceeds the management target or the sustainable productivity of the resource. With respect to shark in the Gulf of Mexico and Atlantic region, those fisheries targeting large coastal shark species are of particular concern. Given that the large coastal shark stocks in the region are also considered to be overfished, the aforementioned management target, or total allowable catch, has been increasingly difficult to measure or anticipate. This is due to a diverse mix of management measures, including catch quotas, allowable gear, fishing seasons, and restricted harvest regions, having been imposed and periodically modified over the last several years. As a result, the development of efficient management schemes to overcome existing overcapacity and overfishing have evaded managers. Of particular interest to the vessel owners, however, is the issue of overcapacity, which represents a problem that is rooted in their own individual and collective decisions regarding capital investment, fishing power, and operational behavior.

A recent U.S. action plan identified three primary means by which to control overcapacity in fisheries including permit management programs, exclusive quota programs, and buyouts of permits and/or vessels. Each of these methods possesses a set of inherent strengths and weaknesses. The commercial shark industry within the Gulf of Mexico and South Atlantic region has recently proposed that overcapacity within the fleet currently targeting shark could be reduced through a permit and/or vessel buyout program. Such a program would provide for the permanent removal of permits and/or vessels through a process by which willingness-to-accept bids are submitted by interested owners. Such bid-based programs have a history of application globally, but have also been utilized recently in U.S. commercial fleets participating in the Northeast groundfish fishery, the Texas bay shrimp fishery, the Pacific Northwest groundfish fishery and the Bering Sea crab fishery. These programs were designed to permanently reduce the effective capacity of the fleet. In each case, fishery participants were attempting to achieve an improvement in overall economic efficiency of the fleet through the removal of potential effort (i.e., latent permits and/or vessels). Primary incentives for the remaining participants (i.e., those not willing to sell) would be that their individual catch revenues would exceed the individual costs associated with implementing the buyout and that uncertainty associated with future management changes (i.e., unanticipated changes in catch limits, gear restrictions, season and/or regional closures, etc.) would fall.

Historically, many buyout programs were funded through a federal appropriation that would fund the actual purchase of permits or vessels. Though such funding strategies are not totally outside the realm of possibility, a more plausible funding strategy for the commercial Atlantic shark fishery may be limited to a federal loan, which the remaining vessels must pay back. The amount of the loan is determined by a number of provisions delineated within the Merchant Marine Act and the Magnuson-Stevens Act. These provisions, such as the annual reported dockside value of the fishery being considered for a buyout, provide the basis by which the total loan amount and the payback schedule is determined. This information is obviously crucial to providing the fleet with an estimate of the upper limit of funds that can be generated to buyout permits or vessels. In addition, the loan amount provides the expected cost of the proposed buyout since the loan amount (with interest) must be paid back by the remaining vessels via some form of landings tax.

Crucial to designing the features of a buyout plan for shark permits and/or vessels is an understanding of the fair market value of a permit or vessel. This information, coupled with an estimate of the amount of capacity (e.g., number of vessels and/or permits) that would need to be removed from the fleet, is necessary to determine the financial feasibility of a proposed buyout program. For example, knowing the perceived fair market value for a representative vessel and/or permit, and then applying that value to the number of permits or vessels to be purchased, would provide an *a priori* estimate of the loan amount required to effectively address overcapacity. With the likelihood that most future buyout programs will be funded by a loan, which must be paid back by the remaining vessels, prior knowledge of the fleet’s willingness to pay back a loan is vital to assessing the feasibility of a buyout program.

B. Objectives

The general purpose of this study was to determine the “fair market” value of a commercial shark permit and/or vessels as currently perceived by owners. The specific objectives include:
1) to conduct a literature review of past buyout programs,
2) to collect vessel-level data for a determination of “fair market value,” and
3) to compute fair market values for representative shark permits and/or vessels.

Though market value can be assessed by a number of techniques, such a recent comparable sales, discounted net income stream, insured value, replacement value, and others, this study sought to poll existing shark permit and vessel owners regarding their perceived fair market value, regardless of the manner in which those values were individually determined. Such information may help anticipate the bid values submitted by buyout participants. In fact, the perceived fair market value may not equal the value submitted as a willingness-to-accept bid. This disparity may arise through strategic bidding behavior that could be motivated and influenced by the factors such as the total buyout funds available, logistical features of the of buyout program, expectations of future catch, etc. However, this study sought to measure perceived fair market values as a first step in assisting in the design of an effective buyout program that would have the greatest likelihood of being endorsed by existing commercial shark permit and vessel owners in the Gulf of Mexico and Atlantic region.

V. APPROACH

A. Description of Completed Work

To address the first objective (literature review) several sources of information were sought, including: peer-reviewed journal articles (e.g., *Marine Resource Economics*, *Review of Agricultural Economics*, *American Journal of Agricultural Economics*), regulatory reports (from nations worldwide, such as the National Marine Fisheries Service in the United States), publications by organizations (e.g., Food and Agriculture Organization of the United Nations, Pew Charitable Trust), and white papers from individuals with in-depth knowledge of specific buyout programs.

To address the second objective (obtain vessel-level data), historical landings were obtained for each license holder. In order to determine the vessels that were currently licensed in both the directed and incidental commercial shark fisheries in the Atlantic and Gulf regions, staff at the NMFS-SERO queried the database containing information from the Federal Permit Application for Vessels Fishing in the Exclusive Economic Zone (i.e., Form OMB No. 0648-0205). The information on these forms is maintained by the NMFS Permits Team, F/SER22, 9721 Executive Center Drive N., St. Petersburg, FL.

The query searched for "active" directed and incidental commercial shark permits (i.e., permits codes SKD, SKI, TSKD and TSKI; the latter correspond to 'transfer' permits). An active permit is one in which the annual license fee has been paid; it is not associated with whether or not the vessel is fishing. Each permit is associated with a unique vessel. For each vessel, all of the active permits for other federal fisheries were identified.

Two separate searches (one on March 30 and the other on 20 April 2004) identified 605 vessels. A review of the associated owners reveals that 41 operations consisted of multiple (2-5) vessels. Fifty-one percent of owners provided Florida addresses (New Jersey was second with 10%), although 21 states were listed in total.

The permit information discussed thus far corresponded to "active" directed and incidental shark permits only as recorded in the database on those two dates. It is possible that some other permit codes may correspond to fishing operations that would be eligible for a buy back program. For example, "expired" permits can be re-activated within a year; if these permits are associated with vessels that have been active in the fishery and only expired recently, they would need to be included in the evaluation of the fishery. Similarly, "inactive" vessels can become active and thereby increase the amount of actual or potential effort in the fishery that needs to be determined for the purpose of examining commercial shark fishing capacity. Thus, any official preliminary analysis of this fishery for the purpose of devising an effort buyout program would need to include expired, renewal, inactive, transfer and active permits on the date the query is conducted.

Estimating the revenues generated by each permit for each vessel was the first step in the fair market value assessment. Prior studies as summarized in VI.A. Objective 1 (Literature Review of

Buyout Programs) suggested that, in some cases, fair market value for a vessel was roughly approximated by the average annual gross revenue. This value would provide a “starting point” for the fair market assessment. The landings and revenue data would be necessary to describe the landings and earnings profiles of each vessel. This data can also be used to determine the extent of, and variability in, economic dependence on the other fisheries in which the vessel participates. In addition, the revenue data were necessary for the proposed bid amounts to be included in the permit/vessel owner survey.

In order to determine the annual revenues associated with each federal fishing permit, total annual revenues were needed by species for the most recent historical period that covered multiple years. Multiple years are considered important due to the variability that can characterize fishing stocks and socio-economic conditions that can affect participation. A three-year period was used in this study since it corresponds with the number of years used in recent buyout programs.

Calculation of total revenues by vessel and species requires use of multiple NMFS data sources, namely from the Southeast and Northeast Science Centers. This is because landings of species harvested in federal waters are reported in three distinct logbooks for the fisheries with permits. These logbook programs include: the pelagic longline data program for highly migratory species (HMS); the coastal fisheries data program for snapper/groupers, coastal sharks, and mackerel; and the Northeast groundfish logbook.

Ideally, the annual revenues would be calculated using intra-annual (monthly or quarterly) and regional data (to the extent possible) in order to account for seasonal and regional fish prices and individual fish weights (and yields) that can affect revenue estimates. Given that such precision is beyond the scope of this project, common fish prices and weights are used in this analysis. All references to total revenue, gross revenue, and income in this paper refer to the dockside value of landings calculated with the numbers of fish landed or pounds landed, conversion factors if necessary, and prices reported on the logbooks.

Though annual landings and dockside value were obtained from NMFS, the value estimates were generated by NMFS staff. In doing so, the official NMFS landings conversion factors were utilized to ensure the appropriate prices (per pound of whole weight) were applied to the appropriate landings units (i.e., whole weight basis). This was done for all species reported across the suite of permits held by each vessel. As a result, a data set was created that contained landings and gross revenues associated with all species for all vessels that possessed a current directed or incidental shark permit.

A profile of the shark fishery was created by summarizing information on landings and associated total revenues for all vessels that landed any species in 2003. The sample was composed of 474 vessels that are holders of shark permits. Shark permits are classified as directed and incidental. The sample contained 197 directed shark permits and 317 incidental shark permits. Holders of shark permits also hold permits for a variety of different species. Thus, the shark fishery can be characterized as a multi-species fishery.

To further address the second objective, all license holders were invited to participate in a survey by responding to a mailed questionnaire. The mail survey was sent all fishermen who held a shark permit during April 2004 regardless of type of shark permit and whether or not they targeted shark. The survey questionnaire was developed in consultation with representatives of the commercial shark industry (i.e., the Directed Shark Fisheries, Inc. and the Southern Offshore Fishing Association, DSF and SOFA, respectively) and was pre-tested by fishermen in the Daytona Beach and Madeira Beach areas.

The implementation of the survey followed a modified-Dillman Approach. The first mailing consisted of a cover letter, questionnaire, and a stamped and self-addressed return envelope. Approximately five days after the first mailing, a postcard with a reminder and encouragement to complete the survey was mailed. Approximately two weeks after the reminder postcard, a revised cover letter, a second copy of the questionnaire, and another self-addressed and stamped envelope was sent to non-respondents. In the case of surveys that were returned as undeliverable following the first mailing, Internet searches were conducted to confirm the validity of addresses and to obtain revised addresses from the U.S. Coast Guard Vessel title database (for those non-state licensed vessels). The survey protocol was submitted to, and approved by, the Institutional Review Board at the University of Florida and is included in Appendix A. A copy of the questionnaire is provided in Appendix B.

To help explain survey responses with respect to valuation of their permits and/or vessels, data from the Southeast Regional Office (SERO) of NMFS were obtained on (a) transfers of all shark permits and (b) transfers of all permits maintained by SERO for all vessels with an active shark permit in April 2004. Some of these files contain a reported sale price for the permit. The data with this price information covers a five-year period beginning early 2000.

The SERO maintains hard copies of all permit applications by vessel and has an electronic list of vessels involved in transfers for different permit types. Beginning with a list of all vessels that have been involved in a shark permit transfer, it is possible to obtain information on the vessels involved in the transaction, the date the transfer was official, and the price that represents the reported transaction price. In addition, the data also provide a variety of information on the new ownership (is it the same owner? is it a different owner but same person? was the permit purchased with other permits or with the vessel?). This information can help to explain whether or not a price was reported. Aside from information on shark permit transactions, our list of vessels that held shark permits in April 2004 was also used to obtain information on transfers of any permits maintained by SERO.

Data on prices for commercial fishing vessels and permits from two different sources were also collected and summarized. These values provide some indication of the current values for vessels and permits in the market; however, they are not transactions prices.[2] Data was gathered from East Coast Marine Brokers, a private broker site, and from *National Fisherman*, a commercial fisheries periodical.

[2] These prices are those at which the seller is willing to sell; they are equivalent to the owners' willingness-to-accept. Thus, these prices are likely biased upwards since they are prior to negotiation.

National Fisherman is an industry periodical that is published every month. Each issue contains a classified section that lists commercial vessels and permits for sale. Vessels are listed according to vessel size. Vessels and permit prices were taken from the May 2004 issues and the August 2004 issues.

East Coast Marine Brokers are a commercial ship and boat brokerage based in Cape Canaveral, Florida. Data from the private broker site were collected at intervals over a period of two months. Price information was collected for longline vessels under 70 feet in length. Data were collected from this site for both commercial vessels and permits.

To address the third objective (computing fair market values), information generated from the previous objectives and activities described above are used to draw conclusions about what owners perceive is the "fair market value" of their assets. For example, the pros and cons of seven alternative approaches for estimating values of fishing assets are summarized. The preferred approach, and approaches that could be analyzed with available data (e.g., preferences of permit owners, historical landings, transfer information), are used to estimate asset values. The effectiveness of two specific buyout programs (i.e., purchase of shark permits only versus purchase of the vessel and all permits) are then discussed in light of the valuation results and the likely characteristics of such programs as dictated by current NMFS regulations as summarized under the first objective.

B. Project Management

The individuals performing the work described in the previous section are listed below by objective. A brief summary of their specific contributions follow.

Objective 1 involving the literature review of past buyout programs was performed by Charles Adams and Sherry Larkin (PI and Co-PI) in collaboration with Walter Keithly and Richard Kazmierczak (PI's for another component of the project being conducted out of Louisiana State University). The material was synthesized into an Invited Paper for the Southern Agricultural Economics Association 2004 annual meeting, which was published in the August 2004 issue of the *Journal of Agricultural and Applied Economics*.

Objective 2 involving the collection and summary of vessel-level data was performed by both PI's (C. Adams and S. Larkin) with the help of two students: Jessica Musengezi, a Master's of Science student, and Venesa DeVeau, a Bachelor's of Science student, in the department of Food and Resource Economics at the University of Florida. The PI's were responsible for acquiring the permit ownership information and merging the landings data. They also developed the survey questionnaire, obtained IRB approval and pre-tested the questionnaire. Ms. Musengezi was primarily responsible for summarizing the historical landings data and searching for information from private brokers on Atlantic shark permit and vessel assets offered for sale. Ms. DeVeau was primarily responsible for researching, data basing, and summarizing permit transfers.

Objective 3 involving the assessment and determination of fair market values was performed by both PI's using information generated from Objectives 1 and 2. The PI's also assembled the final report.

VI. FINDINGS

A. Actual Accomplishments and Findings

Objective 1: Literature Review on Buyout Programs[3]

Governments throughout the world are implementing programs that seek to reduce capacity (effort) in fisheries in order to reverse the excessive harvesting conditions associated with many economically important fishery stocks. The focus on capacity reduction programs was initiated by adoption of the Food and Agricultural Organization (FAO) Code of Conduct for Responsible Fisheries (FAO 1995) and the subsequent FAO 1999 International Plan of Action for the Management of Fishing Capacity, which called for countries to

> "… develop, adopt and make public, by the end of 2002, national plans for the management of fishing capacity and, if required, reduce fishing capacity in order to balance fishing capacity with available resources on a sustainable basis. These should be based on an assessment of fish stocks and giving particular attention to cases requiring urgent measures and taking immediate steps to address the management of fishing capacity for stocks recognized as significantly overfished" (FAO 1999, Part III, Section II, Item 21).

As a signatory to these agreements, the U.S. developed its own national action plan for the management of fishing capacity with a goal

> "… to eliminate or substantially reduce overcapacity in 25 percent of the U.S. federally managed fisheries by 2009 and in a substantial majority, including fisheries that most seriously exhibit this problem, by 2015, the latter deadline corresponding to the target date for recovering overfished stocks agreed at the recent World Summit for Sustainable Development" (U.S. Department of Commerce, 2003a, p. 1).

As redefined in the 1996 reauthorization of the Magnuson Act, a fishery is considered "overfished" if fish are being taken faster than the stock can replenish itself or if the stock size is too small to be sustainable at current fishing levels. "Overcapacity" is said to exist in a fishery if the harvest capacity exceeds the management target (e.g., total allowable catch, or TAC) or the sustainable productivity of the resource. The U.S. action plan identified three major approaches to managing capacity, including permit management programs, exclusive quota programs, and buybacks of permits and/or vessels. Permit management programs, such as establishing a maximum number of permits assigned to a fishery, can be used to restrict entry and participation. Programs that restrict access, however, have met with only limited success as a means of controlling fishing effort because of the pervasive effects of "capital stuffing" and input substitution (Wilen; European Parliament). But, a simultaneous effort to reduce capital stuffing by incorporating restrictions on the allowable characteristics of vessels often creates technical inefficiencies. As aptly stated by Hannesson:

[3] This section contains the text of an article published in: *Journal of Agricultural and Applied Economics* 36,2(August 2004):317-332.

> "It is difficult to control all dimensions of fishing power; restrictions on vessel size can be compensated for by more powerful engines or better fish-finding equipment; it is like pressing a balloon in one place, it just expands in other places. More seriously, this is a question of the degree of substitutability between different components of fishing power and how easily they can be monitored and controlled. The experience seems to be that fishermen and boat designers tend to beat fisheries regulators at the game of getting more fishing power out of a vessel while still satisfying a given set of regulations" (Hannesson, p. 264).

In contrast to permit management, exclusive quota programs directly address the issue of individual incentives by allowing ownership of quota shares. The most effective of these programs are based on output shares because the management target in the fishery is usually output based.[4] As implemented in the United States, exclusive output quota programs assign ownership shares to individuals, industry groups (e.g., communities, processors), and fishing cooperatives. A key element of these programs is that quota users know in advance how much they will be harvesting and are no longer in competition with other fishermen. Long-run economic efficiency can occur in the fishery if the quota shares are transferable and the transfer market is perfectly competitive. Under such conditions, the harvest sector will go through a "rationalization," or restructuring, process due to the changes in fishing incentives. Several exclusive output quota programs have demonstrated a potential for reducing overcapacity and increasing efficiency (National Research Council), but they have been the subject of considerable debate due to equity issues surrounding shares allocations.

The third and final program identified for managing fishing capacity involves the purchase of permits and/or vessels for the purpose of permanently retiring them from the fishery. As stated in the U.S. action plan, "… the most direct and explicit response to overcapacity is to remove it through a buyout program" (U.S. Department of Commerce 2003a, p. 22). In addition to the potential conservation benefits from the removal of fishing capacity, buyback programs can also improve the economic efficiency of the fleet through removal of inefficient effort and improve equity in the fishery by making transfer payments to industry participants (Holland, Gudmundsson, and Gates).

Whether or not a buyback program can achieve its goal hinges on a number of factors, including the actual efficacy of the asset removal scheme (Sun; Holland, Gudmundsson, and Gates) and the degree of capital malleability in the fishery (Gréboval and Munro; Clark and Munro). Perhaps more fundamental is whether there is an agreed upon goal. This issue is particularly relevant for buyback programs that include migratory stocks or multiple species that are managed by different entities that are not required to collaborate. Given the recent international attention to managing fishing capacity raised by the FAO, and the relatively large budgets associated with some programs, previous buyback programs have been subjected to intense scrutiny (U.S. Department of Commerce 2003a; U.S. General Accounting Office). The conclusions and suggestions from these reviews will be instrumental in the development of effective buyout programs for overcapitalized fisheries.

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[4] Quota programs can also be based on input shares (e.g., a share of the maximum number of traps allowed in a lobster or crab fishery), but this approach allows for unrestricted use of other inputs and often results in technical inefficiency.

In order to review the potential impacts of a buyback program for the U.S. shark fishery, this paper first briefly describes the overall fishery and then reviews U.S. experiences with buyback programs in other fisheries. Next, the development of a buyback program for the fishery is discussed. The discussion will focus on how the characteristics of the fishery, available data, and program objectives affect a buyback program's design and potential effectiveness. The paper concludes with some remarks on the usefulness of buyback programs as a policy instrument.

The Southeast U.S. Shark Fishery

The recent U.S. action plan identified 75 fisheries over which the National Marine Fisheries Service (NMFS) has primary responsibility for developing management plans (U.S. Department of Commerce 2003a). Of the 42 U.S. fisheries identified as satisfying at least one of seven qualitative indicators of overcapacity, four are Atlantic shark complexes (large coastal, pelagic, small coastal, and deepwater) encompassing nearly 70 species. While fishermen have harvested sharks sustainably in coastal waters for centuries, recent advances in harvesting technology and access to distant markets have increased effort and catch (FAO 1999). Aside from being overcapitalized, the Atlantic shark fishery is of interest in the U.S. action plan because sharks have a low reproduction rate, which places their stocks at a higher risk of biological depletion. Most notably, the large coastal shark group (the primary shark group in terms of landings and value) has continually been overfished.

Commercial quotas for 2004 were expected to be 1,017 metric tons dressed weight (mt dw) for the large coastal sharks (LCS), 853 mt dw for the pelagic sharks with separate quotas for two of the five species, and 454 mt dw for the small coastal sharks (SCS) (Table 1). For comparison, LCS landings totaled 2,080 mt dw and 1,866 mt dw in 1998 and 2002, respectively (U.S. Department of Commerce 2001, 2004).

Commercial landings in the shark fishery are monitored by permit type, which can be either "directed" or "incidental." Fishermen that specifically target sharks are required to have a directed permit. Both the directed and incidental fisheries are considered limited access, as permits are limited in number and are required for participation in the fishery. A moratorium was established on the issuance of new permits in 1999, at which time 2,200 total permits were outstanding. As of September 2003, 607 total permits (256 directed and 351 incidental) were outstanding (U.S. Department of Commerce 2003b). This reduction in permits was thought to be a major step towards reducing overcapacity, but less than 100 directed permit holders have reported shark landings in recent years (e.g., just 85 in 2001). The current financial condition of the fleet has resulted in a significant amount of idle fishing capacity, especially in Florida where relatively large shares of directed and incidental permits are located (57 and 39%, respectively). Thus, even with the success in reducing the overall number of permits, overcapacity is still thought to exist, especially for the directed fishery that targets large coastal sharks with bottom longline gear (Kirkley et al.).

Table 1. Overview of Changes to Shark Regulations from Final Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks

Management Unit	Species	Limits for 2004	Allowable Gears
Prohibited	Whale, basking, sand tiger, white, dusky, night, bignose, Galapagos, Caribbean reef, narrowtooth, longfin mako, bigeye thresher, sevengill, sixgill, bigeye sixgill, Caribbean sharpnose, smalltail, Atlantic angel	Cannot be kept	None
Commercial			
Large Coastal (LCS)	Sandbar, silky, tiger, blacktip, bull, spinner, lemon, nurse, smooth hammerhead, scalloped hammerhead, great hammerhead	Quota: 1,017 mt dw (SA 54%; GM 42%) Directed: 4,000 pound dw/trip Incidental: 5/trip	Longline;[a] gillnet; rod and reel; handline; bandit
Pelagic	Shortfin mako, thresher, oceanic whitetip	Quota: 488 mt dw	Incidental: 16/trip
	Porbeagle	Quota: 92 mt dw	
	Blue	Quota: 273 mt dw	
Small Coastal (SCS)	Atlantic sharpnose, blacknose, finetooth, bonnethead	Quota: 454 mt dw	
Recreational			
LCS, Pelagic, SCS	Same as commercial	1 shark/trip	Rod and reel; handline

[a] Bottom longline gear is subject to time/area closures, specifications regarding on-board equipment, and movement requirements following interactions with protected species. See the source for complete details.

Source: U.S. Department of Commerce (2003b, p. viii). Note that deepwater/other sharks species (33 in total including catsharks, lanternsharks, and dogfish) were removed from the management unit under this amendment.

One potential method to reduce overcapacity in the shark fishery is a vessel buyback program. Similar capacity reduction programs have been utilized to reduce capacity in other fisheries, and a buyback program for the entire Gulf of Mexico and Atlantic shark fishery had been proposed by some sectors of the commercial shark fishery. Funding to examine this capacity reduction option was provided by NMFS and will be used to examine the target capacity reduction level for the Atlantic shark fishery, identify the various types of buyback programs, develop an implementation plan for the most appropriate buyback program, assess the fair market value for a vessel (and all associated permits), and provide insight into the potential effects to the local communities which have a degree of dependence on the commercial shark fishery.

Characteristics of Recent Buyback Programs

The general objective of any buyback program is to permanently reduce fishing capacity. Each specific program, however, has different characteristics with respect to how it was implemented, the buyback target (e.g., vessels and/or permits), participant selection, and funding. While these topics are discussed in turn, decisions involving each are interconnected and will affect the ability of buyback programs to contribute to stock conservation and/or profit enhancement objectives (Holland, Gudmundsson, and Gates; U.S. GAO; U.S. Department of Commerce 1999).

Impetus:

There are several reasons why buyback programs are implemented. First, buyback programs, in general, can satisfy a wide range of equity objectives and issues, including a desire to transfer income to producers, an objective that can reflect a government's affinity for maintaining or reducing high-cost (Hueth) or low-cost (Chambers) producers. One of the Washington state salmon buybacks, for example, was implemented following an unforeseen change in quota allocation that reduced the share to current participants by 50%. Programs in the United Kingdom have targeted the removal of the oldest and largest vessels (Department of Agriculture and Rural Development). Secondly, buyback programs can be one means to distribute disaster funds that are allocated when unforeseen environmental conditions (e.g., poor weather conditions) adversely affect stocks and cause severe financial hardships. When buyback programs are used as a form of disaster relief, however, they need to be viewed as a social insurance program. Rather than requiring universal insurance and protection against all possible hazards, providing assistance after the fact may be in the best interest of society (U.S. Department of Commerce 1999). From this perspective, buybacks can be beneficial to society if the disasters are truly unforeseen events and if the impacts from the disaster are expected to continue over an extended period of time. When buybacks are funded as a part of a comprehensive economic aid package, they are essentially focused on short-run effects. In contrast, buyback programs that are enacted out of concern for the long-run sustainability of a fishery and the associated fishing-dependent communities are focused on long-run effects. The distinction between short- and long-run effects has important implications for program development and evaluation.

Reduction Targets:

The target of most buyback programs has been either fishing licenses/permits (which are used interchangeably in this paper) and/or fishing vessels. Of course, the decision of which reduction target to select is directly associated with the amount of funding available. If the funding level is sufficient, both vessels and permits could be purchased. Buying back vessels without permits, while affording the immediate removal of capital from the fishery and potential revenue from resale, results in an imbalance between the number of available permits and the number of vessels attached to those permits. These “excess” permits may provide incentives for additional vessels to enter the buyback fishery, particularly if the fishing history is associated with the permit. Hence, over time, capacity in the fishery may return to or exceed pre-buyback levels. Buying back permits or licenses without the vessels can also lead to an imbalance where there is an excess supply of “available” vessels in relation to “allowable” vessels in the fishery. Vessels no longer able to fish the permitted fishery are likely to gravitate to other, potentially already overcapitalized, fisheries (although recent buyback programs have included titling restrictions on future vessel use in fisheries).

The simultaneous purchase of both vessels and permits somewhat negates the negative effects associated with leakage of capital to non-buyback fisheries. For a given funding level, however, simultaneous purchase of both vessels and permits may result in less capacity being removed from the fishery than the purchase of either vessels or permits. In addition, even in cases where both permits and vessels are bought out, leakage can occur if fishermen reinvest buyout funds into other fisheries. A survey of participants in the Northeast groundfish buyback, for example, found that 9 of 54 respondents shifted fishing activity to the overfished Atlantic lobster fishery after voluntarily surrendering licenses/vessels associated with groundfish activities.

Note that the undifferentiated buyout of permits and vessels results in the potential elimination of effort, but is less likely to reflect subsequent effects on stocks than buyouts that account for vessel size and power. Thus, some European programs measure capacity by accounting for vessel length, breadth, gross tonnage, and engine power (e.g., vessel capacity units or VCUs) and develop buyback programs by targeting reductions in specified fishing capacity units. An alternative method to target specific parts of the fleet is through the participant selection process.

Participant Selection:

The actual participants in the buyback program, either the specific vessels and/or permits, are determined by the eligibility conditions and selection mechanism. In the past, eligibility requirements often have been based on location of homeport, primary gear used, minimum age and/or size of the vessel, and minimum landings. The first two factors are primarily for equity considerations, but may also be used to focus in on sectors of the fleet affected by a natural disaster. Minimum age and size requirements of vessels have been used, for example, in UK decommissioning schemes that targeted the removal of older and larger vessels (i.e., over 10 years of age and 10 meters in length) (Department of Agriculture and Rural Development).

The specification of minimum landings (or analogously the number of days fished) is critically important to the development and outcome of a buyback program if latent (unused) capacity exists. This is because a minimum landings or days fished requirement eliminates latent effort from the program. The concern is that latent effort can easily become active if economic conditions are even temporarily enhanced, such as can occur the season immediately following the buyback when fewer participants are fishing the same level of quota. One extreme example of this is detailed in the U.S. General Accounting Office report that evaluated the effectiveness of the Northeast groundfish buyback program:

> "The 79 boats sold in the New England buyback caught a combined total of about 15 million pounds of groundfish in the 1996 fishing year. This total represented about 19 percent of all groundfish caught in that fishery. However, because of the number of unused fishing permits in the fishery, 62 previously inactive vessels have begun catching groundfish since 1996" (U.S. GAO, p. 7).

The lack of latent effort removal from a fishery during a buyback reflects not on buybacks as a concept, but primarily on the eligibility restrictions and level of expenditures committed to the programs. Eligibility restrictions are often indirectly specified in the development of the selection mechanisms. Although there are various buyout methods (Holland, Gudmundsson, and Gates), fixed rate payments and auctions appear to be the most common and practical in buyouts with many potential participants. In a fixed rate buyout, the government offers a non-negotiable fixed price (per permit, vessel, or other unit of effort) at which it is willing to purchase the permit and/or vessel. The prices can be based on the observed market price (such as the value of recently traded permits or recent vessel sales), appraisals, or insurance/book values (cost less depreciation and salvage value). Under this approach, participants are selected in the order the acceptance offers are received or by lottery.

In an auction-based buyout, the government structures a bidding process whereby the fishermen can specify a price that they would accept in return for relinquishing their vessel and/or permit (i.e., tendering a sealed bid). The bids are then ordered or used to create a bid score for ordering and selection. Selecting the lowest bids results in the maximum removal of vessels/permits per dollar of program funding. Selecting the lowest bid scores maximizes the removal of an effort-adjusted measure per dollar of program funding (i.e., a "blind, silent, reverse auction"). Typically, bid scores are derived by expressing the bid as a share of total landings or revenues over a specified period of time. Thus, vessels/permits associated with higher landings (which is assumed to proxy fishing capacity) will have lower scores (ceteris paribus to bid amounts) and will be selected first. In certain programs, acceptance of the bid by the agency results in a binding contract. In other programs, the tenderer of the bid has the right to refuse the acceptance. Programs that allow for refusal, and possible resubmission, are more akin to actual auction markets. Alternative bid prioritization measures are likely to have diverse capacity reduction effects for the same program expenditures (Walden, Kirkley, and Kitts).

The most suitable approach to selecting participants is situation dependent, and the best choice appears to hinge on both the number of potential participants and the amount of information asymmetry between the government and vessel owners (Latacz-Lohmann). Economic theory may suggest that auctions will be more efficient than fixed rate payments in all but the omniscient government case, but it also suggests that efficient auctions only occur if they are carefully designed (Klemperer). The previous discussion of "auctions" involved programs where eligible participants stated their willingness-to-accept (WTA) compensation for the forfeiture of fishing privileges (identified with permits and/or vessels). Generally, past research has shown that WTA values are greater than willingness-to-pay (WTP) values. If so, a cost minimization requirement might favor a “buy-in” system whereby eligible participants (e.g., those with active limited entry permits) would state their WTP for a permit to remain in the fishery for a specified duration of time (e.g., 10 years or forever). The funds raised from the payments would then be used to compensate those without permits that were eligible to bid. In addition, a double auction format could be considered whereby both permit sellers and buyers submit bids which are then ranked highest to lowest to generate demand and supply profiles. From the profiles, the maximum quantity exchanged can be determined by matching selling offers (starting with lowest price and moving up) with demand bids (starting with highest price and moving down). The decision as to which format to use, noting there are many types of auctions, would depend on whether latent permit holders would be eligible to accept payment and/or sell their permit.

Regardless of whether fixed rate payments or auctions are used, experience suggests that buyback programs need to carefully consider the measures that are used to both attract participants and to prioritize buyout offers. Isé and Sunding examined the variables that affect buyout bids for water rights in the U.S. and found that, in addition to the present value of future net earnings, personal characteristics (including financial condition and access to credit markets) were significant in participation and bid price. This situation would presumably hold for fishery buyouts as well. Anecdotal evidence from the West Coast groundfish buyout (R. Young, pers. comm.), suggests that (1) beliefs regarding the future effects of the reductions, and (2) demographics of the bidder (especially age) are the two most important factors affecting bids. In addition, a recent study by Kitts, Thunberg, and Robertson found that total annual revenues, vessel power, and fishing days all positively affect bid amounts, which were assumed to equal the net present value of future net earnings plus the difference between the cost to scrap the vessel and its salvage value.

Buyout Funding:

Financing of buyback programs can take the form of federal or state appropriations, private funds, or some amalgam. Most previous U.S. buyback programs have relied principally on public expenditures because they were simply a component of a larger assistance program (e.g., Interjurisdictional Fisheries Act). However, increased emphasis was given to privately funded buyback programs with the passage of the 1996 Sustainable Fisheries Act amendments to the Magnuson-Stevens Act, and the creation of the Fishing Capacity Reduction Program. Private funding sources include loans and donations. Statutory loans for buybacks are paid with assessments on landings of the post-buyback fishery participants. These loans involve no promissory notes, mortgages, or other conventional loan documentation, and beyond repayment fees no one has any other liability for loan repayment.

To date, loans have been used to fund the most expensive vessel-based programs and donations have been used to purchase permits. Conservation-based donations can, however, play a significant role in effort reduction. For example, the Texas Parks and Recreation Department has received donations from the National Fish and Wildlife Foundation and the Coastal Conservation Association to purchase shrimp permits. The National Fish and Wildlife Foundation also supported the purchase of latent permits in the New England groundfish fishery (Read and Buck). Also, an independent non-profit organization supported by the sport angling industry (i.e., the North Atlantic Salmon Fund) purchased all of the permits associated with the salmon fishery around the Faroe Islands and all quotas from fishermen in Greenland (Read and Buck).

If a loan is the sole source of funding of the program, the total amount of money available for the program can be determined a priori and used to assess whether an alternative program would be able to remove the fishing capacity necessary to improve the fishery. To convey the importance of this factor, consider that the 79 permits purchased in the New England groundfish buyback program represented less than 5% of the 1,763 permits that were issued in 1996 and 62 previously inactive permits were reactivated with larger-capacity vessels after the program (U.S. GAO). While this program clearly did little to reduce fishing capacity and effort, it did provide economic aid.

Summary statistics associated with U.S. government-sponsored vessel and permit buybacks, including the total level of funding, from 1995 to 2004 are presented in Table 2. The cost of the buyback programs totaled about $285 million by 2004, with the federal share equaling $74 million. The two most recent buyout programs are the largest in terms of dollars and both are industry financed through assessments on future landings.

Buyback Program Development for the U.S. Atlantic Shark Fishery

U.S. Regulatory Environment:

The 1996 Sustainable Fisheries Act amendments to the Magnuson-Stevens Act added a Fishing Capacity Reduction Program (FCRP), section 312(b)-(e), authorizing buybacks of vessels and permits funded from several sources (Public Law 104-297). In addition, amendments to the Capacity Reduction and Financing Authority (Title XI of the Merchant Marine Act, 1936), section 303(a), dictated specific requirements related to the amount, duration, and interest rate of the loan if privately funded. The key provisions of the laws, as summarized in Table 3, are used to discuss each aspect of the development of a potential buyback program for the shark fishery in the Atlantic Ocean and Gulf of Mexico.

Objectives and Analysis:

Provisions I-IV in Table 3 specify the conditions under which a FCRP can be conducted and the objectives and guidelines for developing the program. Provision I requires that the program helps conserve the resource in a measurable way. Given that the shark fishery includes approximately 70 species, specific management units (i.e., large coastal, pelagic, and small coastal sharks) would have to be addressed. It is likely that this provision could be satisfied by focusing on the three primary management units because each has been subject to a recent stock assessment and each has been considered as overcapitalized using at least one of seven qualitative measures (U.S. Department of Commerce 2003b). Furthermore, since specific gears have been shown to target specific shark management units (U.S. Department of Commerce 2001), this information can be used to link fishing capacity with the stock condition of each management unit.

Table 2. Characteristics of Vessel/Permit "Buyback" Programs for U.S. Fisheries, 1995-2004

	Value	Vessels	Permits	Avg price	Funding ($ mil)			
Year: Fishery (No.)[a]	($ mil)	(No.)	(No.)	($ thous)	States	Industry[c]	Federal	Total
1995: TX Inshore shrimp	?	0	310	4.5	0	0	1.4	1.4
1995-98: WA salmon	9.6	0	829	16.8	1.2	0	12.7	13.9
1995-99: NE multispecies (13)	101.0	79	787	43.0	0	0	34.5	34.5
1999: AK pollock[b]	175.7	9	17	10,000.0	0	75.0	15.0	90.0
2003: WC groundfish (7)[d]	50.0	92	240	497.3	0	35.8	10.0	45.8
2004: AK BSAI crab (7)[e]	240.0	?	?/335	?	0	100.0	0	100.0
Total (if known)	N/A	180	2,183	N/A	1.2	210.8	73.6	285.6

[a] Only the Alaska crab and West Coast groundfish are pure buyback programs. The remainder, those primarily federally funded, were not directed buyback programs. Instead, the fisheries received federal funds for disaster assistance that were later used for buybacks.
[b] Bering Sea. The 9 vessels were large factory trawler/processors (250-300 feet).
[c] Loan proceeds are dispersed as buyback payments. Post-buyback harvesters repay the loans with assessments on landings.
[d] In addition to federal groundfish trawl permits, the program removed state-licensed Dungeness crab and/or pink shrimp permits held by the same owner. The 30-year loan referendum passed with 86% of the votes weighted by permitted fishery.
[e] Bidding under this program is complete, but the loan repayment referendum is ongoing. This table assumes the referendum will pass.
Sources: U.S. Department of Commerce (1999, 2003a); Leipzig; U.S. GAO.

Table 3. Key Buyback-Related Provisions in the 1996 Sustainable Fisheries Act Amendments

No.	Section	Description
I.	312(b)(1)(A)	A FCRP may be conducted in a fishery if the program "is necessary to prevent or end overfishing, rebuild stocks of fish, or achieve measurable and significant improvements in the conservation and management of the fishery";
II.	312(b)(2)	"The objective of the program shall be to obtain the maximum sustained reduction in fishing capacity at the least cost and in a minimum period of time";
III.	312(e)(1)(A)	The buyback program implementation plan shall "define criteria for determining types and numbers of vessels which are eligible for participation in the program taking into account characteristics of the fishery, the requirements of applicable fishery management plans, the needs of fishing communities, and the need to minimize program costs";
IV.	312(e)(1)(B)	The buyback program implementation plan shall "establish procedures for program participation (such as submission of owner bid under an auction system or fair market value assessment)";
V.	312(b)(1)(B)(i)	A FCRP may be conducted in a fishery if the program is consistent with the relevant FMP and the FMP "will prevent the replacement of fishing capacity removed by the program through a moratorium on new entrants, restrictions on vessel upgrades, and other effort control measures, taking into account the full potential fishing capacity of the fleet";
VI.	312(b)(1)(B)(ii)	A FCRP may be conducted in a fishery if the program is consistent with the relevant FMP and the FMP "establishes a specified or target total allowable catch or other measures that trigger closure of the fishery or adjustments to reduce catch";
VII.	312(b)(1)(C)	A FCRP may be conducted in a fishery if the program "is cost-effective and capable of repaying any debt obligation";
VIII.	312(d)(2)(B)	The fees for a program shall "not exceed 5 percent of the ex-vessel value of all fish harvested from the fishery for which the program is established";
IX.	303(a)Sec.1111(b)(3)	Any debt obligation shall "not exceed $100,000,000 in an unpaid principal amount outstanding at any one time for a program";
X.	303(a)Sec.1111(b)(4)	Any debt obligation shall "have such maturity (not to exceed 20 years)";
XI.	303(a)Sec.1112(b)	"the annual rate of interest ….shall be fixed at two percent of the principal amount … plus …the interest cost of borrowing from the United States Treasury";
XII.	312(d)(1)(B)	"The industry fee system shall be considered approved if the referendum votes which are cast in favor of the proposed system constitute a two-thirds majority."

Provision II identifies the FCRP objective as obtaining the maximum sustained reduction in fishing capacity at the least cost and in the shortest time period. A sustained reduction requires restrictions on "leakages," which could apply to both the vessel and vessel owner (and other human capital such as the captain and crew). Previous programs have restricted the title of the vessel such that it can never fish again and other programs have required that the vessel be scrapped. The European decommissioning programs detail the salvaging process and costs that owners should factor into their bids. Other programs have accepted title to the vessel for the purpose of auctioning to raise funds to offset administrative costs. In the case of the shark fishery, the age and condition of the fleet would determine the most appropriate approach.

Least cost considerations, in terms of administration, would point to the use of fixed price accept/reject programs. This is because the research needed to determine the appropriate fixed price would only involve an aggregate analysis of permit value as revealed in past transactions prices, average vessel gross revenue, or average vessel value. This is in contrast to auction-based programs that require NMFS to summarize data on each vessel/permit over time, which is complicated in the case of sharks because landings entail a portfolio of species. In terms of the total payments to be made, the purchase of vessels would be the most costly approach. The cost issue in terms of program payments, however, would depend on the funding mechanism. If privately (industry) funded, then the payments by the government are zero, which would be the least cost (excluding recurring costs to monitor loan payments). For the shark fishery, a reasonable approach would be to conduct the buyback in multiple phases. First, offering a fixed price to reduce latent permits, then proceeding with a bid score system for vessels.

In terms of minimizing time, the use of a fixed valuation approach avoids the need to examine individual effort and landings levels, and their comparison with the actual bids received (Hogarth). In addition, if privately funded by the industry with a loan, then an 'auction' would involve numerous steps, including the creation of individual bid scores, selection, calculation of individual capacity by fishery, release of results for referendum, then the referendum and weighting of results. Studies of the Texas shrimp fishery suggest, however, that simple fixed-price permit buybacks may take a long time to reduce effort to target levels, primarily because of the large amounts of latent effort in the fishery (Funk et al.). This is true of all passive-reduction approaches whereby permits are revoked via a voluntary forfeiture.

Provisions III and IV state that participant selection must account for the characteristics of the fishery, while the program goals, objectives, and selection procedures must be outlined. These provisions require a significant amount of analysis, although some of this has already been conducted at the aggregate level for the shark fishery. The numbers of active and latent directed permits are known and the landings by management unit are controlled by quota. This information can be used to determine the annual average revenue associated with each permitted vessel. This approach has been used as a rule-of-thumb in previous analyses and has been found to correspond with the bid levels observed in buyback programs (Kirkley et al.). The critical element in the shark fishery case would be defining the scope of species to include in the revenue calculation and, thus, the relevant permits. Other than directed shark permits, there are also incidental shark permits that would be held by other vessels. The primary gear used for certain management units, namely the LCS and SCS, will differ by geographic region and species mix. This is important because gear is often nonselective. As a result, all pelagic longline vessels must have permits for swordfish, tunas, and sharks. If vessels own directed shark permits, they will also have swordfish and tuna permits, which could substantially increase the scope of the program. Congressional testimony in 2001 regarding a capacity reduction program contained in the Atlantic Highly Migratory Species (HMS) Conservation Act stated that "NOAA Fisheries also recommends that the legislation clarify that pelagic longline fishing for HMS is authorized only for vessels with all three permits (swordfish/shark/tuna) and that the permits be surrendered as a package."

When considering the implementation plan, participant eligibility will be crucial. For example, if a landings-dependent bid score is used, latent permits/vessels will not be eligible for participation. Instead, the fair market value of these permits should be determined, perhaps by examining the characteristics of the associated vessel and whether the owner holds other permits. Because latent effort can become active and undermine program objectives, this segment must also be considered.[5] Provision IV specifically provides for an auction system, and such an approach could result in the lowest payments if repeat bidding were allowed and bidding information was made available. Of course, the initiation of any of the required preliminary analyses could trigger potential participants to capital stuff, thereby increasing the biological and economic damage to the fishery and negating potential benefits from an anticipated buyout program (Clark, Munro, and Sumaila).

FMP Requirements:

Provisions V and VI pertain to elements of the corresponding FMPs. In the case of sharks, a limited access system for the commercial fishery (directed and incidental) was established in 1999. The FMP also contains biannual quotas on each of the three management units. Additional information on the "full potential fishing capacity of the fleet" would have to be investigated. The primary decision involves defining what the fleet is, which could be determined by examining the gear types for each fishery. One definition could be bottom longliners with directed shark permits. This would require identifying all vessels utilizing bottom longline gear and their landings portfolio.

[5] Note that the recreational sector remains an open-access fishery. Although the commercial shark fishery began a permit management program in 1999, recreational permits were not required until March 2003. As of September 30, 2003, a total of 22,290 permits have been issued with the majority (82%) going to recreational anglers and the remainder to charter boats. Since recreational effort has grown substantially and this effort contributes to total fishing mortality, any program aimed to reduce fishing capacity to improve the sustainability of the stock should consider the recreational sector.

Funding:

The last six provisions, VII-XII, concern loan funding for a buyback program. The first provision (VII) addresses the need for the fishery to be capable of repaying the debt. In order to assess this capability, the total cost of the buyback program must be estimated in advance. This implies that within the preliminary fishery analysis, the total effort reduction needed to cause a measurable improvement in stock size (and, thus, support, a sustainable stock, fishery, and fishing-dependent community) must be estimated and then valued. Once the FCRP target is established and individual units are valued, the total cost of the program can be determined. Whether a 5% assessment on ex-vessel landings over 20 years, discounted at the Treasury rate plus 2% will be large enough to cover the estimated costs will determine whether the fishery is capable of paying the debt. Given that the total ex-vessel gross revenues of Atlantic shark fisheries was valued at approximately $3 million in 2001 (U.S. Department of Commerce 2003b),[6] an assessment on shark-only landings alone would support a loan of just $1.87 million assuming a 4% U.S. Treasury annual interest rate. Thus, a buyback based on this level of funding is likely to be only capable of targeting permits. The fishery may not be able to generate the funds necessary to purchase enough vessels.

There are several methods for assessing permit/vessel value. One such approach is to use the insurance/book value. It is unlikely that this approach would be favored by the industry since the majority of vessels are old and are relatively low-valued. The industry has proposed that $5,000 per linear foot be paid for each vessel. Given that these vessels are from 40 to 60 feet in length, the average cost per boat would be $250,000. At that valuation, the industry could afford to buyback just 7 vessels (8% of active vessels) with the $1.87 million generated from the loan scenario described previously. Note also that such a valuation greatly exceeds a reasonable estimate of one year's gross shark revenue for active directed shark permit holders, which equals just $32,000 (i.e., total dockside value for sharks divided by the number of active permits, which is 85) (U.S. Department of Commerce 2003b, p. 6-2). Assuming that owners of directed shark permits receive 50% of their gross revenues from shark, which is a conservative effort for targeting behavior, the rule-of-thumb value would equal $64,000. This higher annual gross revenue estimate would in turn double the loan amount and the effort that could be bought out, but it would require that the other fisheries be included in the program. Based on a previous analysis of the Atlantic commercial shark fishery (U.S. Department of Commerce 2003b), assembling data on all shark permit owners would require use of the federal permit database and logbooks for the Northeast multispecies, longline, and reef fish fisheries. In addition, these data would be needed for multiple years, usually two to five.

[6] This data was obtained from Table 6.3, however, Table 9.1 lists total landings by state and reports a total commercial value of nearly $5.0 million (U.S. Department of Commerce 2003b). Since Table 9.1 does not identify whether the values are at the ex-vessel level, this paper uses the data from Table 6.3, which contains more conservative estimates. The $3.0 million valuation was based on average prices of $0.91, $1.11, and $0.79 per pound dw for LCS, pelagic sharks, and SCS, respectively. In addition, the value of shark fins was calculated assuming the fins weighed 5% of landings and received a price of $19.67 per pound. In sum, landings totaled 1.58 million pound dw for an average price of $1.90 per pound dw.

Using more comprehensive valuation methods, such as those defined in Kitts, Thunberg, and Robertson, could result in higher calculated fair market values based on net present value of annual net returns (i.e., annual net revenue from multiple years discounted back to current dollars) and the salvage costs less scrap value of the vessel. Another way of determining vessel value would be to hire independent appraisers. The Washington salmon buyback program in the late 1970s determined fixed price buyback offers based on two independent appraisals and the market price of the permits.

If a buyback is funded by an industry loan, fishermen vote on whether to proceed in a final referendum that identifies the buyback participants and their past harvest levels. For example, fishermen would vote on whether they would be willing to pay a 5% assessment on their landings for the next 20 years. Using the aggregate average shark price of $1.90 pound dw (note 3), The “garnishment” would total approximately $0.095 pound dw, which would reduce the net price to fishermen to $1.80 pound dw. By comparison, the pollock fishers are assessed a fee of just $0.006 per pound landed. The relatively-low level of the pollock fee brings out two important points. First, the level of fee assessment is directly related to the loan amount and indirectly related to the total value of the fishery. Second, the provisions of the Magnuson-Stevens Act may be too constraining. In the case of the Alaska pollock buyback, the loan is over 30 years, not the MSA’s mandated 20 years. And, in the case of the two most recent buybacks (West Coast groundfish and Alaska crab), the buyback covers multiple fisheries (defined as the number of distinct permits included). These revisions are possible if the loan program is created with special legislation that supercedes provisions in the MSA. If directed shark permit holders are required to have swordfish and tuna permits, or if a majority do, the program would have to be funded under special legislation. Although not addressed in the legislation, subsequent monitoring and assessment of the success of the program in terms of meeting the specified objectives is necessary (U.S. GAO). This would also include management of the fee collection mechanism.

Discussion

Declining fishery stocks, increasing fishing effort, and poor market conditions have produced difficult financial situations for fishermen worldwide. In several high-value fisheries, especially those that are considered overcapitalized, the total value of landings averaged across the current fleet suggests that revenues are insufficient to cover production costs. This overcapitalization is becoming a fisheries pandemic.

Although allowing the market to solve overcapacity problems would be the simplest policy to adopt, there are several reasons why continuing government intervention may be needed. First, many stocks need to begin rebuilding immediately and may not be able to withstand the transitory increases in fishing pressure that might result from a rapid transition to market-based policies. Second, coastal communities are heavily dependent on an active fishing fleet, and rapid movements to a market-rationalized fleet would certainly cause economic dislocations. Third, entry and exit from the fishing industry is not unhindered given that vessels are a significant capital investment and that there are moratoriums on the issuance of new permits in many fisheries. Lastly, there is much evidence to suggest that fishermen are optimistic regarding stock rebuilding, financial assistance, and potential changes in fisheries regulations and management – all factors that dissuade fishermen from exiting the industry.

The purchase and permanent retirement of fishing vessels and/or permits in a buyback program is one of the approaches for managing capacity that was identified in the recent U.S. National Plan of Action for the Management of Fishing Capacity. Evidence from previous programs, however, suggests that buybacks are not a panacea for solving overcapacity problems in fisheries. "Although the issue is complex, NOAA Fisheries believes that overcapacity is linked to overfishing, and we have a legal mandate to remedy the latter" (Fishing Capacity Reduction Program Fact Sheet, NOAA Fisheries, National Marine Fisheries Service). In addition, as the defacto trustee of many of the nation's natural resources, the government may have a responsibility to protect those resources. According to the recent Federal Fisheries Investment Task Force Report to Congress, when there is a mismatch between stock abundance and fishing capacity and the cause of this mismatch is outside the fishery (e.g., institutional failure resulting in inadequate protection of the resource base), "the government has a fundamental governance responsibility to assist people in an industry reshape the fishery in the public interest" (U.S. Department of Commerce, 1999, p. 119). Thus,

> "[a]lthough not every fishery will profit from a buyback program, arguments in favor of such programs are sufficiently strong that the industry should be encouraged to explore the full potential of this mechanism as set forth in the Sustainable Fisheries Act" (U.S. Department of Commerce, 1999, p. 105).

The recent emphasis on fishing capacity management affords the opportunity to address the problem in an efficient and effective manner. This is particularly the case for loan-financed buybacks where the benefactors of the reduced capacity (fishermen) compensate those who voluntary elect to give up their fishing privileges. If, however, there are additional benefits from the capacity reduction (such as bycatch reduction and improved habitat from the use of less gear, which are issues pertaining to bottom longline gear that targets sharks; Morgan and Chuenpagdee), then the program provides a positive externality. In such cases, government funding could be pursued to alleviate some of the repayment burden. Alternatively, donations could be solicited from conservation groups that value the improvements.

The concern as to whether buyback programs lead to any long-term reduction in effort extends well beyond the issue of latent capacity becoming active after the initial buyback. Specifically, it has been argued that pre-buyback active participants will increase effort after the buyback program in response to increasing industry profits. As stated by Holland, Gudmundsson, and Gates:

> "[for a] buyback program to improve long-run resource stability and profitability, the growth in effort must be constrained (or the reduction in effort must be very large). This requires restricting not only new entry, but increases in effective fishing effort due to various forms of input stuffing by existing fishermen. Otherwise, an ever-widening gap between real and nominal effort will develop, and the ratio of fishing mortality to nominal

> effort will drift up over time. Conservation goals will be frustrated and the economic cost of fish will increase needlessly." (Holland, Gudmundsson, and Gates, p. 68).

While such a conclusion is supported by economic theory in those instances where the buyback is government funded, empirical evidence of such findings is relatively limited. This partially reflects the short history of most programs in relation to the timeframe required to observe and assess long-term technical changes in response to changing economic conditions. Furthermore, industry funding of a buyback program through assessments would tend to suppress the generation of profits associated with post-buyback stock improvements and reduce the incentive to capital stuff.

Finally, concern regarding "moral hazard" tends to arise in most economic reviews of buyback programs. For example, anticipation of compensation via an expected buyback program (or a higher level of compensation if delay participation provided a control date is not established) has resulted in some participants, who would otherwise exit a fishery due to low economic returns, remaining active in the fishery while buyback discussions are ongoing (U.S. Department of Commerce 2003a). Holland, Gudmundsson, and Gates express concern that buyback compensation tied to historical catches can lead to the perverse incentives of accelerating overfishing of stocks already declining and, in anticipation of additional public intervention, capital stuffing in less regulated fisheries. Actions of this type can have strong negative impacts, both in terms of economic efficiency and stock conservation.

The Magnuson-Stevens Act requires that a limited entry permit system be in place before a buyback can be conducted. However, removal of effort does not remove the capital-stuffing incentive. Remaining vessels still must compete at sea for landings. Transferable exclusive output quota schemes, on the other hand, can provide the "rationalization" necessary to increase efficiency and profitability of the fleet. For example, the Bering Sea pollock buyback removed 9 of the 30 vessels, but the subsequent creation of a fishing cooperative resulted in the voluntary withdrawal of an additional 4 vessels. Thus, additional efficiency was achieved at no additional cost to the remaining fleet, while benefits will accrue to those 21 vessels that are members of the cooperative.

To date, the management of commercial fishing capacity in the United States has been predicated on an institutional structure that has considered previous participation (permit ownership and/or past landings) tantamount to partial rights to the underlying resource. Buyback programs have solicited willingness-to-accept bids for the relinquishment of rights to participate in a given fishery with specific assets (e.g., permit and/or vessel numbers). Exclusive quota programs have allocated shares based on previous landings. An alternative is to consider "buy-in" programs that would solicit willingness-to-pay bids for continued participation and auction programs that would allow participants to bid for quota shares (Macinko and Bromley). In either case, funds raised could be used to offset losses of those no longer allowed to fish. Although these solutions are outside the current provisions of the Magnuson Act, they raise important issues regarding property rights that can affect the degree of rent capture associated with sustainable fisheries management.

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Objective 2: Vessel-Level Data

To accomplish this objective, four types of data are analyzed: (1) historic landings and permit ownership portfolio; (2) characteristics and opinions of the fisherman; (3) permit transactions information and (4) advertised sales prices of vessels and/or permits.

(1) Description of Fleet: Historic Landings and Permit Ownership Portfolio

Permit Ownership:

In April 2004, there was a total of 605 active shark permits. These shark permit holders also held permits to fish commercially for a variety of other species. The species with the largest number of permits being for Atlantic tunas (304), swordfish (302), king mackerel (244) and Spanish mackerel (243). Other species accounted for fewer than 200 permits each. The total number of permits held by shark permit holders for each fishery is shown by shark permit type in Table 4. Collectively, the 605 shark permit holders hold 3,685 permits or an average of 6.1 permits per vessel. The average number of permits held by directed and incidental permit holders was 5.6 and 6.4, respectively.

Table 4. Number of Commercial Federal Fishing Permits held by Active Commercial Shark Permit Owners by Shark Permit Type (parentheses disaggregate the totals above by gear, limits, and/or species)

Fishery	Directed	Incidental	Total
SERO Permits (April 2004):a			
Shark	249	356	605
Swordfish	118	186	304
Directed	(89)	(109)	(198)
Incidental	(27)	(66)	(93)
Handline	(2)	(11)	(13)
King Mackerel	108	136	244
Spanish Mackerel	110	133	243
G.O.M. Reef Fish (with, without traps)	81	104	185
S.A. Snapper/Grouper (with, without pots)	64	64	128
Unlimited Grouper	(57)	(54)	(111)
Trip Limit Grouper	(7)	(10)	(17)
Red Snapper	48	65	113
Lobster (commercial and tailing)	20	31	51
Rock Shrimp (open access)	1	9	10
Charter/Headboat	36	82	118
S.A. Snapper/Grouper	(15)	(25)	(40)
Spanish Mackerel	(13)	(25)	(38)
G.O.M. Reef Fish	(6)	(15)	(21)
Coastal Migratory Pelagic	(2)	(17)	(19)

Table 4. continued

Fishery	Directed	Incidental	Total
NERO Permits (July 2004):			
Atlantic Tunas	122	179	302
Longline	(87)	(129)	(216)
General	(34)	(44)	(78)
Charter	(1)	(6)	(7)
Bluefish	56	94	150
Spiny Dogfish	45	79	124
Scallop (open, limited access)	38	71	109
Monkfish (open, limited access)	35	73	108
Skates	34	68	102
Tilefish (open, limited access)	38	64	102
Groundfish (open, limited access)	26	69	95
Squid, Mackerel, Butterfish (open, ltd. access)	36	55	91
Herring	28	62	90
Black Sea Bass	20	54	74
American Lobster	12	47	59
Surfclam	16	35	51
Scup	10	39	49
Ocean Quahog	16	30	46
Red Crab (open, limited access)	13	33	46
Summer Flounder	5	38	43
Charter/Party	12	32	44
Squid, Mackerel, Butterfish	(3)	(7)	(10)
Scup	(1)	(5)	(6)
Groundfish	(1)	(3)	(4)
Bluefish	(2)	(7)	(9)
Black Sea Bass	(2)	(4)	(6)
Flounder	(3)	(6)	(9)
Total	1,397	2,288	3,685

[a] The sample of permit holders included those with active directed or incidental permits obtained on two days approximately one month apart in March and April 2004. The first and second lists contained 594 and 599 permits.

[b] Information on 24 of the 605 was missing such that the number of permits may be underestimated.

Location of Vessels:

Vessels landing shark in 2003 were located in a region extending from Texas ports on the Gulf through both coasts of Florida and then along the Atlantic coast as far north as Maine. The distribution of vessel locations by state (as available from the permit application) is shown in Figure 1.

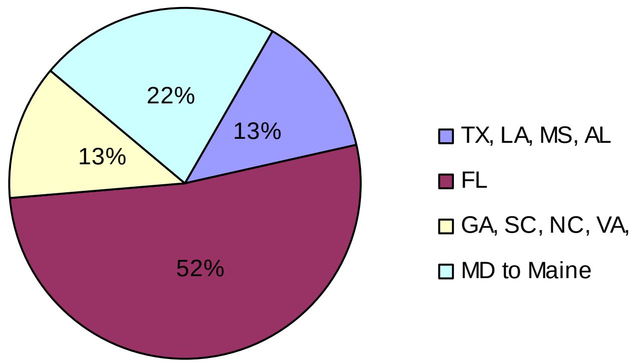

Figure 1. Location of Commercial Shark Fishing Vessels, 2003

Figure 1 and the vessel revenue discussion below are restricted to the most recent year (i.e., 2003) for simplicity. Given that this analysis is not aimed at describing fleet dynamics, this assumption is valid for this discussion. In the survey that follows, however, three-year averages are employed for the estimation of fair market values.

Vessel Revenues:

The data were sorted by gross total revenues (across all species landed, not just shark) and divided into nine groups. These revenues ranged from $0 to $1.6 million. Revenue levels of $25,000 to $74,000 and $150,000 to $250,000 had the largest number of vessels with 82 vessels in each group. Revenue levels of $750,000 to $999,999 had the smallest number of vessels with just nine. The frequency distribution of revenues between the nine groups and by type of shark permit are shown in Figure 2.

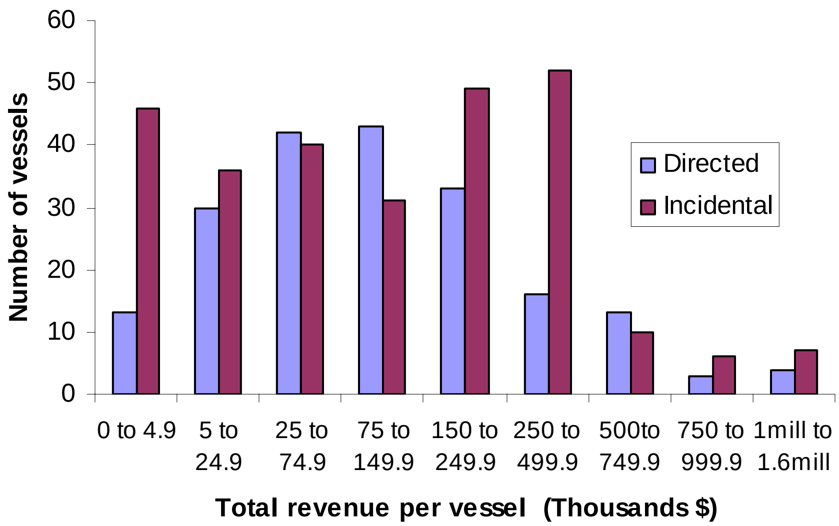

Figure 2. Frequency of Revenues per Vessel by Type of Shark Permit and Revenue Category, 2003

Commercial fishing vessels in the sample ranged from 35 ft to 98 ft in average length. The average length was longest for vessels in the higher level of revenue and those with lower revenues typically had shorter vessel lengths (Figure 3).

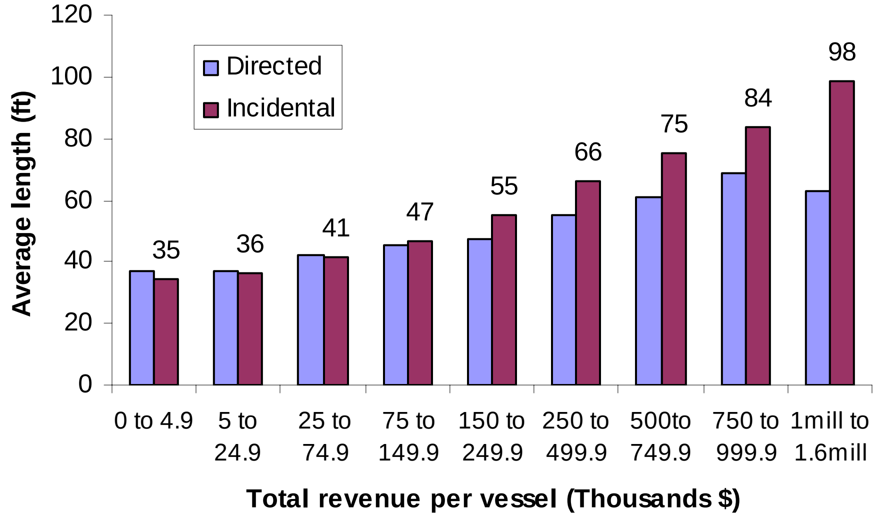

Figure 3. Average Vessel Length by Permit Type and Revenue Category, 2003

Average revenues from shark for 2003 ranged from $236 to $4,867 per vessel for incidental permits and $2,412 to $29,057 per vessel for directed permits (Figure 4). Average shark revenues were higher for directed permit across all income groups.

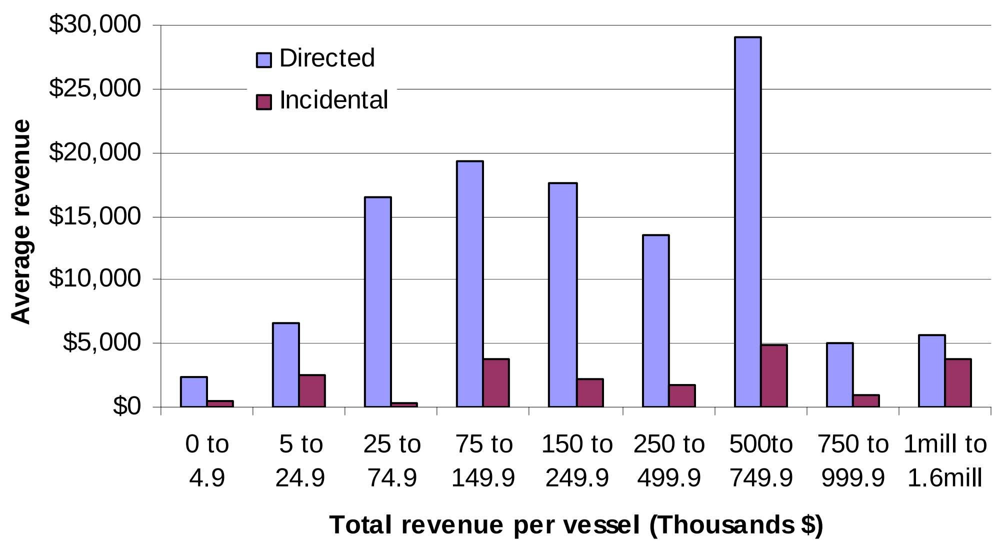

Figure 4. Average Shark Revenues per Vessel by Type of Shark Permit and Revenue Category, 2003

The majority of shark revenues are associated with directed shark permits. In 2003, 81% of all shark revenues in were associated with directed permits and the remaining 19%

with incidental permits. However, shark forms a small share of total annual commercial fishing revenue across all species. In 2003 shark comprised only 1% of fishing revenues across all species. Shark contributes a greater share to total revenues for those operators in the lower revenue categories (Figure 5). Those in the $5,000 to $24,000 category had the largest share of shark revenue (38%) followed closely by those with revenues below $5,000 (34%) and those within the $25,000 to $74,999 category (31%).

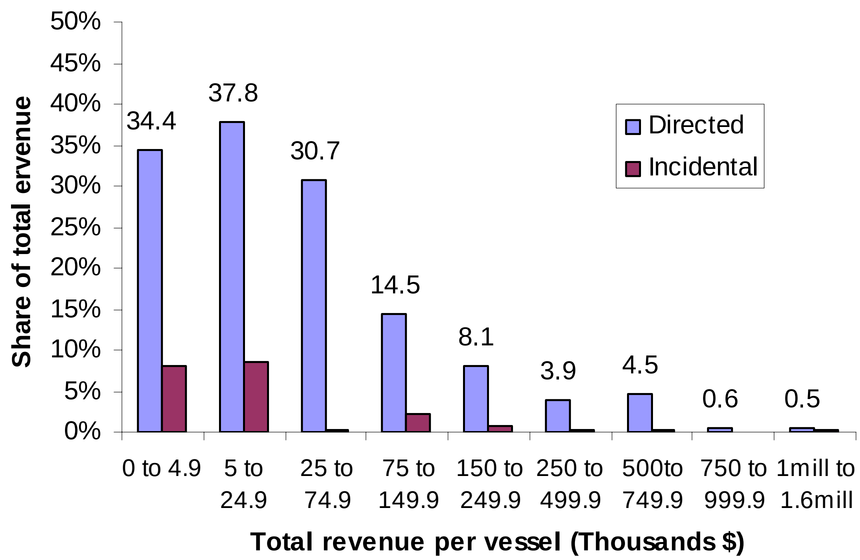

Figure 5. Shark Share of Total Revenue by Shark Permit Type and Revenue Category, 2003

The distribution of total revenue by species showed that there are a large number of species landed, which is to be expected given the number of different fishery permits held by the fleet (Table 4). Swordfish, tuna and grouper had the largest shares of revenue in 2003 for the combined fleet of 605 vessels that collectively landed approximately $85 million worth of marine species (Figure 6). Shares of total landings by species are sorted in descending order for the directed and incidental category (Dir & In). Swordfish, tunas, and groupers are the top three revenue groups, shark is tenth overall. The incidental sector of the fleet consists of more vessels than the directed sector, which accounts in part for the higher total value of landings across all species for the incidental sector. At higher revenue levels, tuna and swordfish are the main revenue generators, while at the lower revenue levels grouper and mackerel species become more important. Shark's share of total annual gross revenue was larger for incidental shark permit holders than for directed shark permit holders. However, shark comprised a relatively low share of overall annual revenue regardless of the permit type.

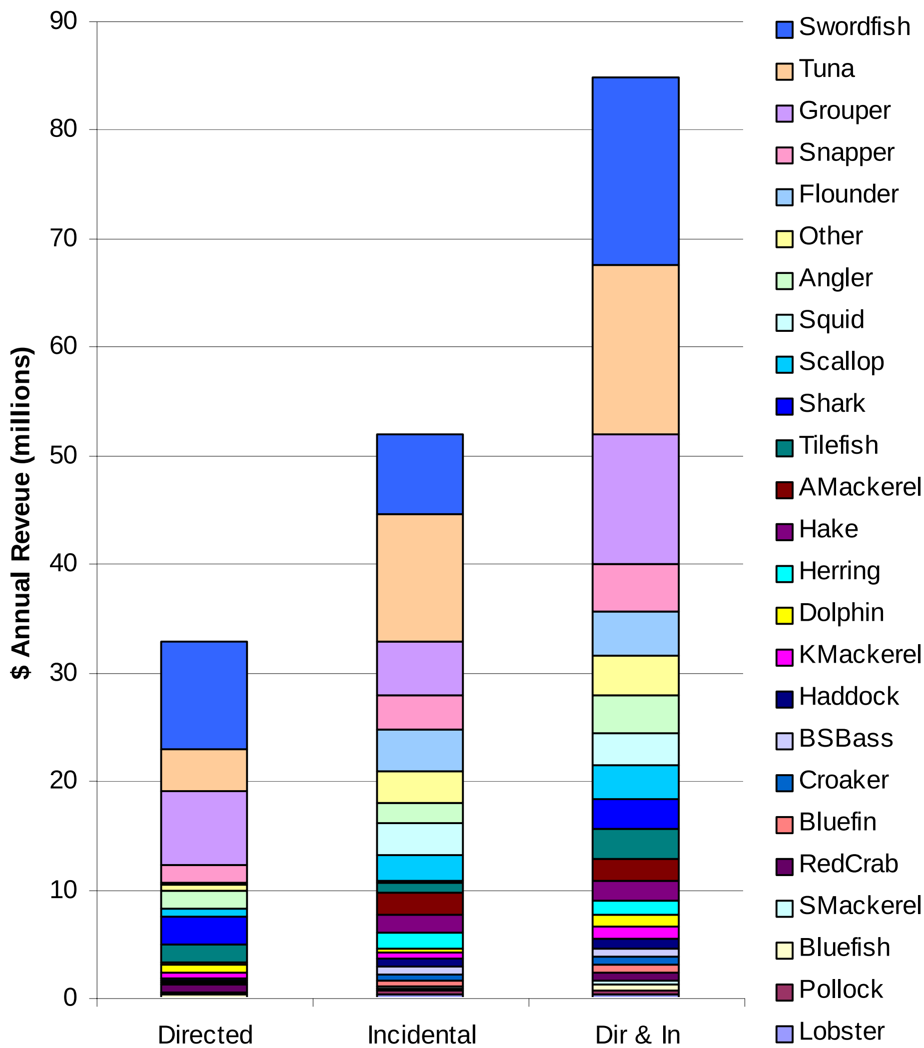

Figure 6. Species Composition of Total Revenue by Shark Permit Type for all Vessels with Landings, 2003

Vessel Revenues in 2003 by Income and Species:

Initial data analysis revealed that a large number of species comprise total revenue as just discussed (Figure 6). The shares that each species contributed to the reported total revenues by vessel in 2003 are shown for each of the nine revenue groups and by shark permit type in Appendix C. For ease of analysis, only five species groups are considered in comparing landings portfolios by revenue group. The remaining species are aggregated into an "all other" group. The following four species groups were selected since they comprised the largest share of landings overall: swordfish, tuna, grouper, and snapper. Shark was included as the remaining species groups since it was the focus of this study. These five species groups are collective referred to as the "key" species below.

Revenue group 1 ($1 million to $1.6 million in 2003)

Shark comprises a small proportion of catch for both incidental and directed permits with 0.5% and 0.2%, respectively. The major key species for this group for directed permit holders are swordfish (72%) and tuna (24%). The major key species for incidental shark permit holders are swordfish (25%) and tuna (3%), however, the majority of landings in terms of value for this species consisted of "other" species. The species composition of catch is shown in the Figure 7 below:

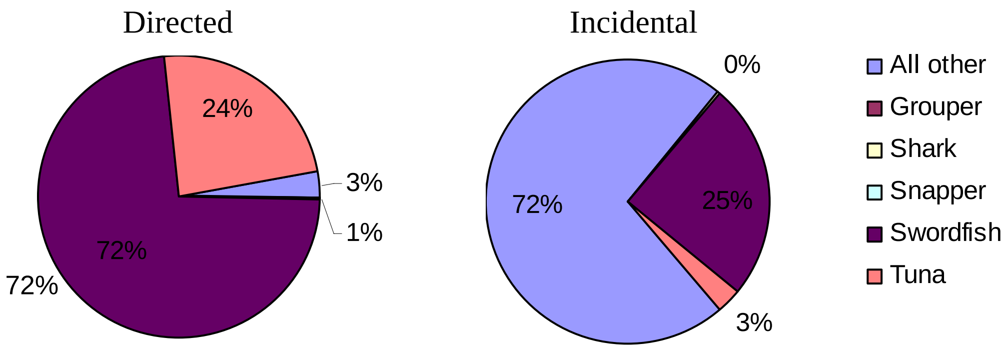

Figure 7. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $1 million to $1.6 million (N= 11)

Revenue group 2 ($750,000 to $999,999 in 2003)

Shark comprises a small proportion of catch for both incidental and directed shark permit holders (i.e., 0.6% and 0.1%, respectively) with revenues of $750,000 and $999,999. The key species for the directed permit holders in this group is swordfish (81%). The most important species in terms of contributing to total revenues for incidental shark permit holders, on the other hand, were none of the key species. The species composition of revenues are shown in Figure 8.

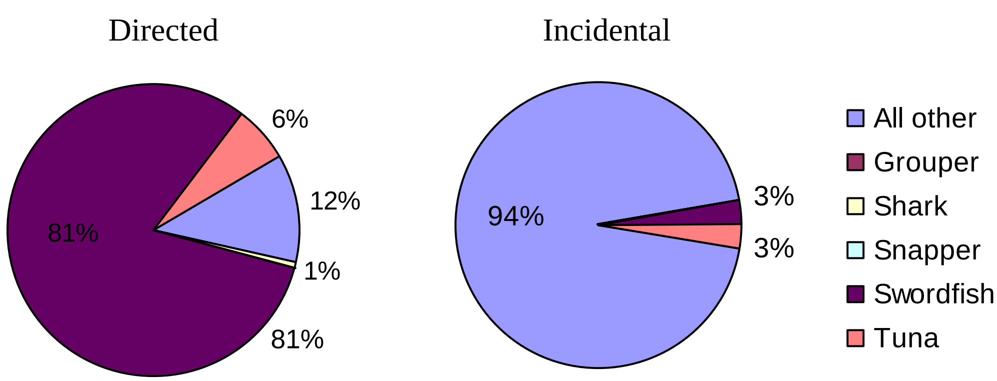

Figure 8. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $750,000 to $999,999 (N= 9)

Revenue group 3 ($500,000 to $749,999 in 2003)

Shark comprises 5% of total revenues for directed permit holders with landings ranging from $500,000 to $749,999 in 2003 (Figure 9). The remaining key species with the exception of the all other category in this revenue group for directed permit holders collectively accounted for 65% of total revenues; namely, swordfish accounted for 38%, tuna for 14%, grouper for 10% and snapper for 3%. These same key species for incidental shark permit holders accounted for just 24% of total revenues.

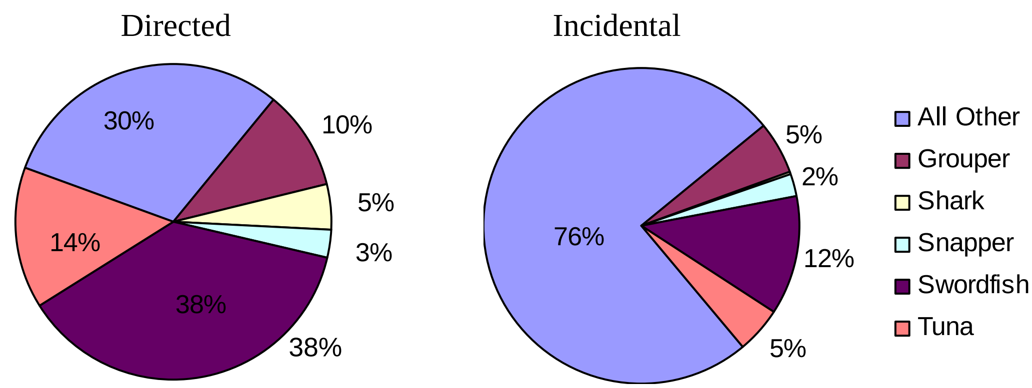

Figure 9. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $500,000 to $749,999 (N= 23)

Revenue group 4 ($250,000 to $499,999 in 2003)

Shark comprises similar shares of total revenue as with the previous (next higher) income group. Also, the shares of total 2003 revenues comprised by the key species for the directed and incidental permit holders is high as well, with a total of 85% and 73%, respectively, associated with grouper, snapper, swordfish and tunas. The dependence on any one key species group does, however, differ by permit type. The majority of landings for directed shark permit holders is attributed to grouper and swordfish versus tunas and groupers for the incidental permit holders (Figure 10).

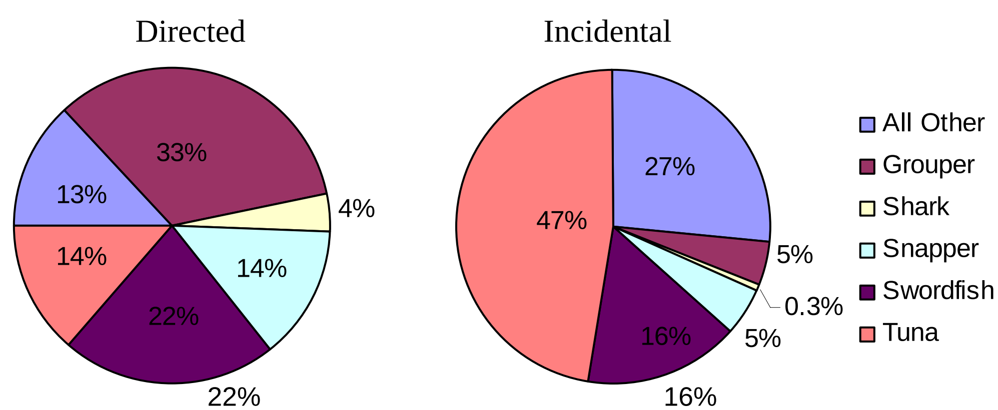

Figure 10. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $250,000 to $499,999 (N= 82)

Revenue group 5 ($150,000 to $249,999 in 2003)

With this lower revenue group the "all other" group of species comprised the single largest share (39%) for directed shark permit holders, which was followed closely by groupers (31%) Grouper is also an important species for incidental shark permit holders, by accounted for 21% of the portfolio (Figure 11). In general, the portfolios associated with vessels landing $150,000 and $249,999 in 2003 are relatively diversified, regardless of shark permit type. That said, shark comprised 8% of the directed sector's landings compared to just 1% for the incidental sector.

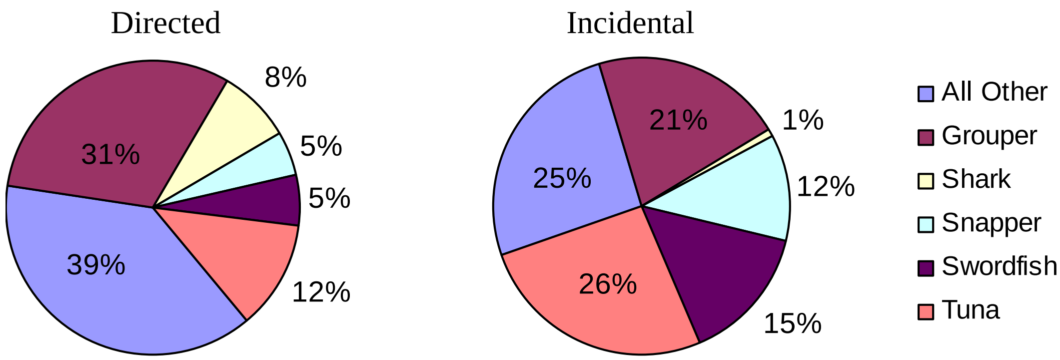

Figure 11. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $150,000 to $249,999 (N= 82)

Revenue group 6 ($75,000 to $149,999 in 2003)

The share of shark landings increased from 8% to 14% when moving to this lower revenue group (Figure 12). The key species for this group for both the directed and incidental shark permit holders is grouper, which accounted for 39% and 37%, respectively. Other species also counted for nearly equal shares between permit type categories. Overall, these portfolios are very similar only the directed targets a bit more shark and the incidental permit holder target a bit more tuna and snapper.

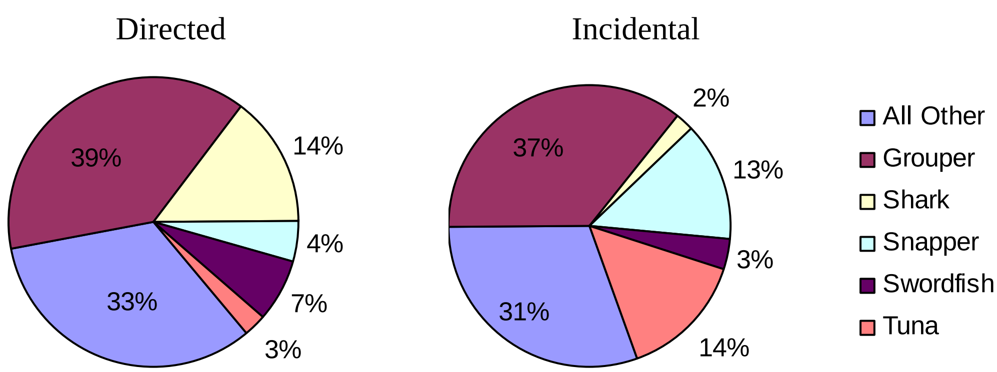

Figure 12. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $75,000 to $149,999 (N= 74)

Revenue group 7 ($25,000 to $74, 999 in 2003)

Within this revenue group, shark comprises a relatively large share of total revenues (31%) but the share of shark for incidental permit holders remains negligible (as expected due to landings constraints). Grouper remains the single most valuable additional species groups with 27% and 23% of landings for the directed and incidental shark permit holders, respectively (Figure 13).

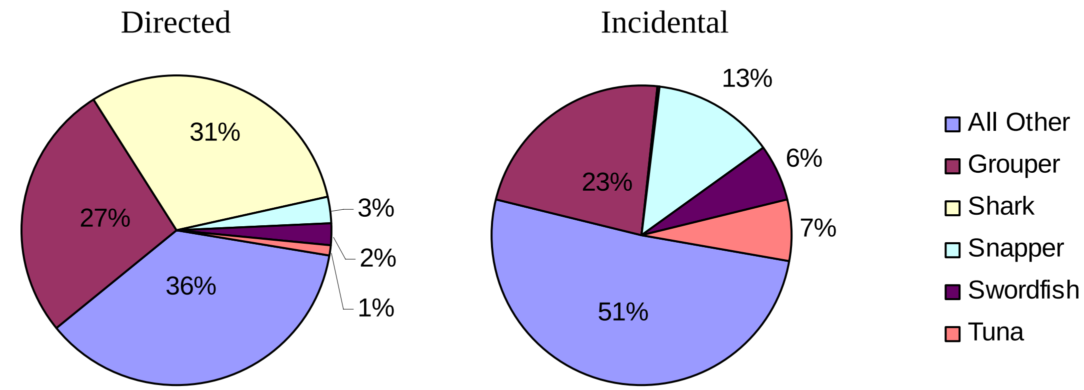

Figure 13. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $25,000 to $74,999 (N= 82)

Revenue group 8 ($5,000 to $24,999 in 2003)

This lower revenue group had the largest shark share of revenue with 38% and 8% for the directed and incidental permit holders, respectively (Figure II.14). For this relatively low revenue category grouper continues to play an important role for incidental shark permit holders by accounting for the largest single share of the portfolio (36%).

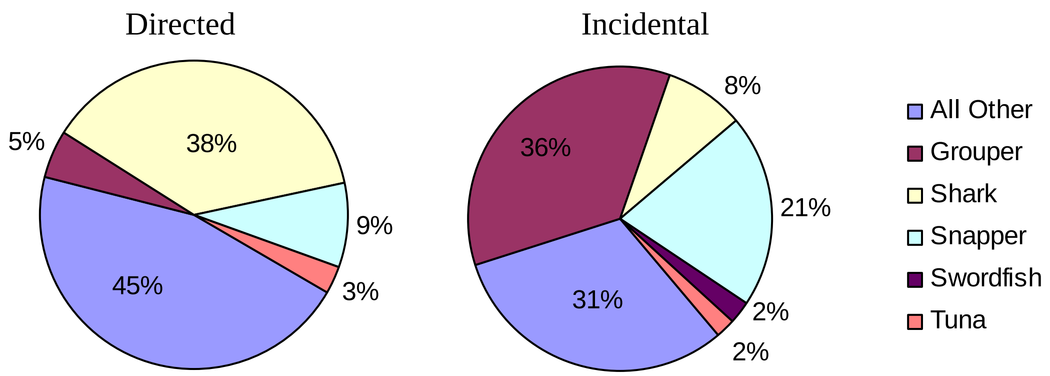

Figure 14. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $5,000 to $24,999 (N= 66)

Revenue group 9 ($1 to $4,999 in 2003)

With this lowest category, landings compositions are similar to the previous group. For the directed shark permit holders, shark and groupers accounted for 45% collectively. The remaining majority share is comprised primarily of mackerels. The incidental shark permit holders also have a portfolio dominated by other species, however, the remaining portfolio relies more heavily on snappers as opposed to sharks (Figure 15).

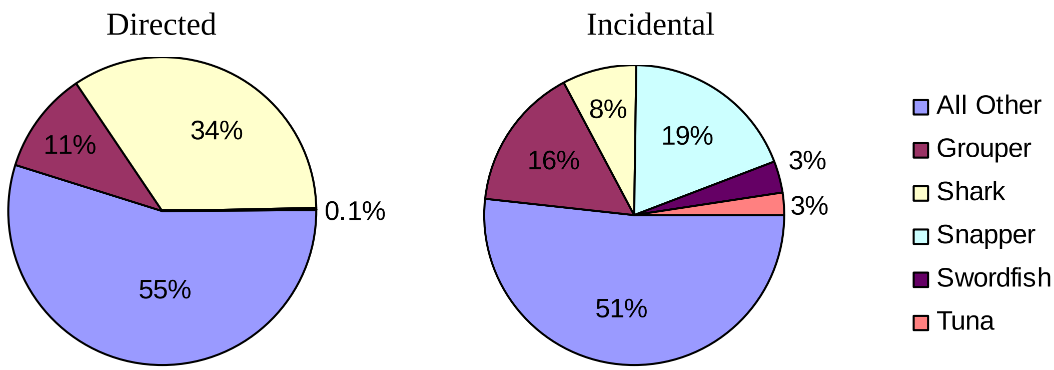

Figure 15. Key Species Composition of 2003 Total Revenue by Shark Permit Type for Vessels Earning $1 to $4,999 (N= 59)

(2) Survey Results: Characteristics and Opinions of Fishermen

Response Rate:

The objective of the survey was to determine the willingness to accept of bids for shark permits individually and vessels with all permits collectively. The survey questionnaire was also designed to collect general demographic information to better understand the factors motivating decisions regarding the value of a shark permit and the associated vessel. The questionnaire was divided into the following five sections:

1) Permit owner goals and perceptions,
2) Shark fishery questions,
3) Shark vessel and buyback questions,
4) Permit owner information, and
5) Household information.

The first mailing included the permit owners of the total population of 605 active permit owners as of April 2004. The effective population, however, was reduced by a number of factors. The number of potential respondents was lowered by incorrect addresses for permit holders, which resulted in some of the questionnaires being undelivered. The number of potential respondents was further reduced because some of the permit holders on the original list no longer owned the vessels and/or permits as indicated in the permit transfer files maintained by the NMFS' SERO. From the population of 605 potential respondents, 551 comprised the effective population for the survey. From the effective population a total of 321 responses were received. Thus, the overall response rate for the survey was 58.2%.

The following discussion, which focuses on groups of questions within the survey, often refers to the question number. The reader may refer to the questionnaire in Appendix B to find the question (Q) being discussed if necessary. Also, respondents are alternatively referred to as vessel and/or permit owners. While the questionnaire was mailed to the owner, and some questions were specific to the permit owner, the individual that actually completed the questionnaire is unknown.

Socio-Demographic Information:

The survey yielded information that provides insight into the social and economic characteristics of the commercial shark fishery. For example, a large number of shark permit holders are over 50 years of age and have been fishing commercially for all species an average of 28 years, while targeting shark for about 16 years. In addition, a large proportion of shark permit holders are heavily dependent on commercial fishing as their main source of income, primarily engaging in harvesting activities to generate household income. Most respondents were married with high school educations and living in households with dependents.

A total of 317 people provided age details (Q18). The average age of permit owners was 51.6 years. The age of permit owners ranged from 28 years to 82 years. Over half (50.8%) of vessel owners were over the age of 50 years.

Respondents were asked how long they had been fishing commercially for any species (Q19). The responding permit owners (N = 225) indicated that they have been fishing commercially for all species for an average of 28 years. The maximum number of years fishing all species was 65.

Respondents were also asked how long they had been fishing commercially for shark (Q20). A total of 72 people responded to this question from the second mailing. The number of responses to this question was lower since the question in the first mailing was poorly worded; it did not specifically pertain to shark so it was similar to question 19. Respondents to Q19 from the second mailing indicated that, on average, they have been commercial shark fishing for 16 years, but responses were as high as 45 years. This average figure may be biased if first responders to the survey (perhaps those most interested in a potential buyback program) differ from responders to the second mailing.

A large proportion of the respondents use a personal computer for their fishing business. A total of 316 people responded when asked whether they used a personal computer for their fishing business (Q21). Of those respondents, 60% use computers for their business while 40% did not use computers.

A total of 273 people responded when asked whether they had health insurance for their families (Q22). Of those respondents, 69% had health insurance for their families while 31% did not. A total of 313 people responded when asked whether they had health insurance for themselves (Q22). Of these, 72% of had health insurance for themselves and 28% did not.

Most of respondents characterized themselves as being in ‘good’ to ‘very good’ general health when asked about their general health (Q23). A total of 318 people responded to the question. Of these respondents (99% of the total), 43% characterized themselves as being in ‘good’ health, 32% in ‘very good’ health, 18% in ‘excellent’ health, 7% in ‘not very good’ health and 1% in ‘poor’ health (Figure 16).

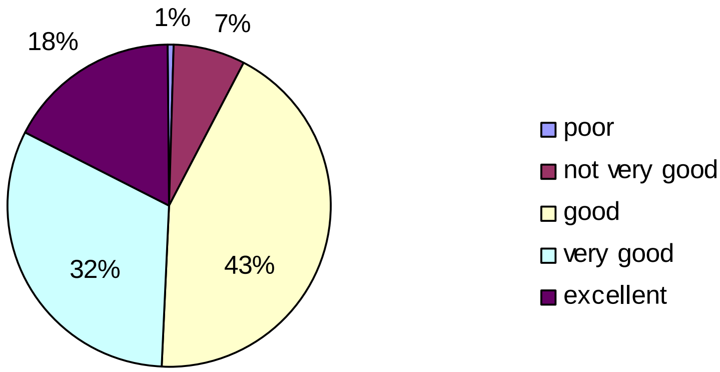

Figure 16. General Health of the Permit Owner as Reported by Respondents

A total 316 people responded when asked about their marital status (Q24), of which 75% of respondents were married, 11% were divorced and 7% never married (Figure 17).

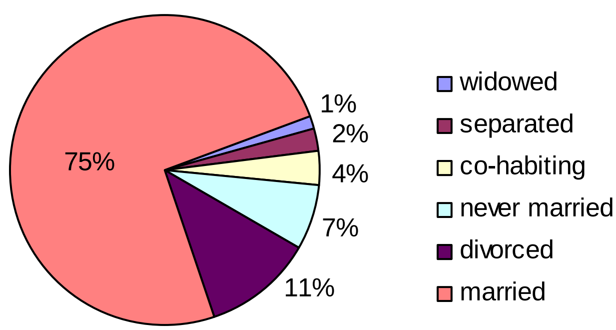

Figure 17. Marital Status of Respondents

A total of 319 people responded when asked of the highest degree level they had achieved (Q25). A high school degree was the highest degree level achieved for just over half of respondents, followed by bachelor’s degree (Figure 18). Of the respondents, the majority (86%) had earned at least a high school diploma. While 56% just graduated from high school, an additional 29% had at least some college experience.

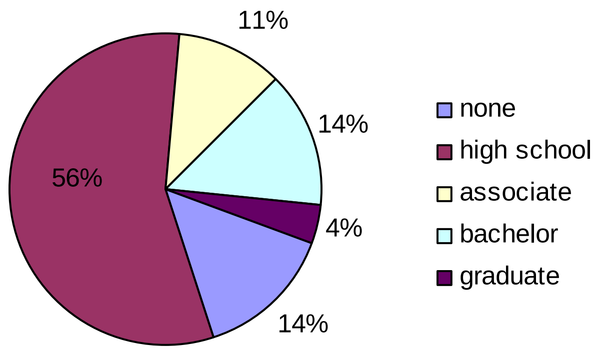

Figure 18. Highest Degree Level Achieved by Respondent

A total of 317 people responded when asked about their current living arrangement (Q26). Of those respondents, 86% are home owners and 32% rent housing; the remaining 4% had other living arrangements (Figure 19).

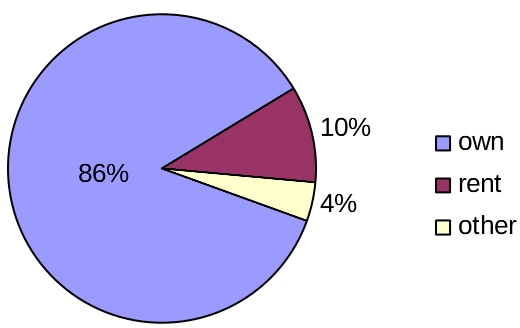

Figure 19. Household Living Arrangement

To gain a better understanding of the number of dependents per household, respondents were asked about the number of adults and children living in the household (Q27). A total 313 people (97% of respondents) answered the question regarding adults. Of these, the majority (76%) had just one or two adults living in the household (Table 5).

Table 5 also shows that a total of 153 people (48% of respondents) indicated the number of children in the household. Of the nearly half responding to the question, the majority (67%) had one or two children, which were defined as individuals less than 18 years of age, living in the household. The relatively low response rate to this question could be due to either the lack of children in the home or the fact that approximately half of permits (to be discussed later) are not owned by individuals. Thus, certain questions may not have been considered relevant to the respondent.

Table 5. Number of Adults (including the respondent) and Children per Household

Household Members	Frequency	Percentage
Adults (individuals at least 18 years):		
0	3	1%
1	41	13%
2	196	63%
3	43	14%
4	18	6%
5	10	3%
6	2	1%
Total (N)	*313*	*100%*
Children (individuals less than 18 years):		
0	22	14%
1	55	36%
2	47	31%
3	22	14%
4	7	5%
Total (N)	*153*	*100%*

Respondents were asked about their total household income in 2004 (Q28). In this study income was defined to include the total taxable earnings from all members of the household generated from both fishing and non-fishing sources. The majority (74%) of the 300 respondents had household incomes of less $100,000. Only 1% had an income of at least $500,000 (Figure 20).

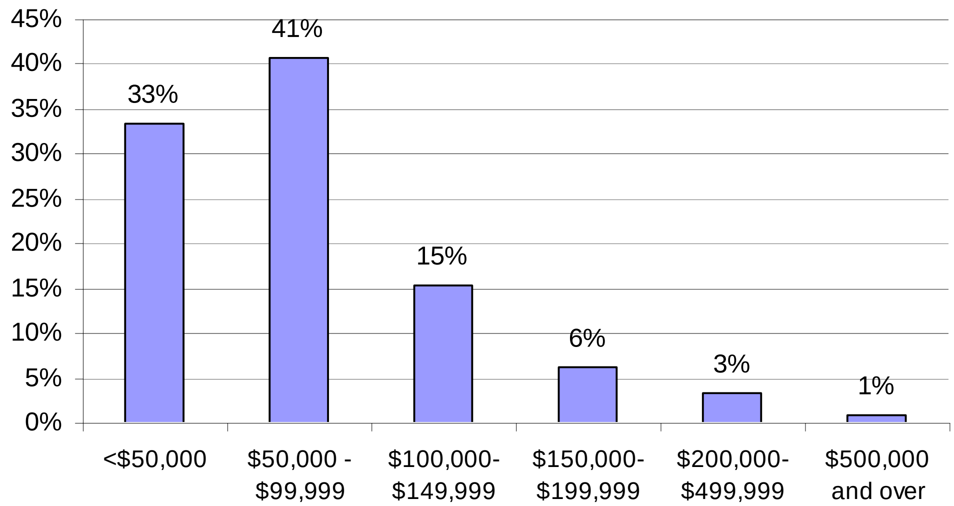

Figure 20. Distribution of Reported 2004 Taxable Household Income

When asked what percentage of household income is derived from the commercial fishing industry (Q29), on average across the 294 respondents, 77% of taxable household income was derived from commercial fishing. When considering the frequency of response by quartile, 68% of the respondents derived at least 75% of their total household income from fishing in 2004, while just 8% derived less than 25% of their household income from commercial fishing (Figure 21).

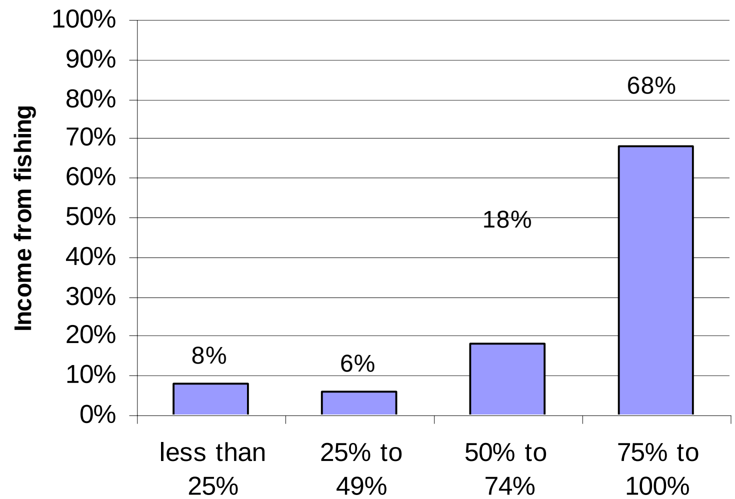

Figure 21. Distribution of the percentage of 2004 Taxable Household Income Derived from Commercial Fishing (N = 294)

As a follow-up question, respondents were asked about the source of their commercial fishing income (Q29). Harvesting is the main fishery/seafood activity in which they are involved. Of the 268 respondents (over 83% of the total respondents) 91% are engaged in harvesting. Less than one-third reported being engaged in any downstream seafood-based business activities (Figure 22).

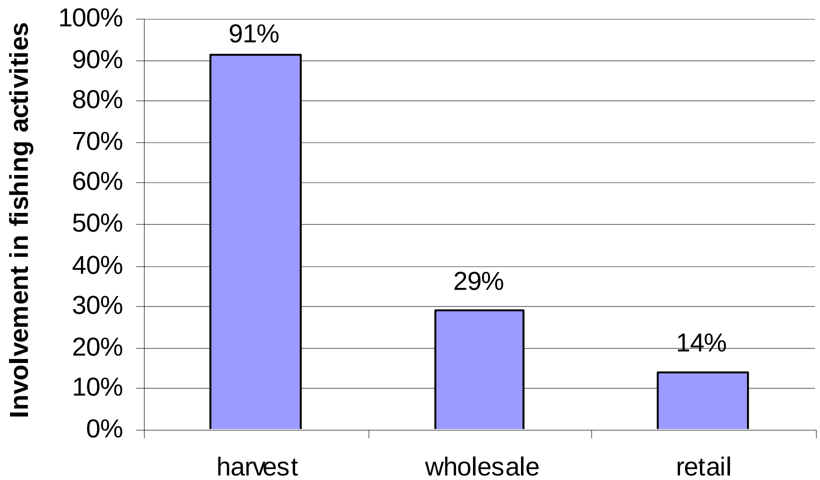

Figure 22. Percentage Participation in Key Fishing Activities (N = 268)

In order to determine income streams for the households, the survey respondents were asked how many jobs had generated their reported total household income (Q30). Across all respondents, an average of 2.3 full-time and 1.5 part-time jobs generated the reported total income for 2004 (Table 6). While the minimum number of jobs generating the income was zero for both types of jobs, the maximum number of reported part- and full-time jobs reached 10 and 53, respectively. The latter figure is reflective of corporate employees. Ideally the respondents would have included their own labor in these reported figures such that the reported minimum would be one, thus, these average numbers are likely biased downward (the figures increase to 2.4 and 1.7 for full- and part-time, respectively). To account for partnership and corporate ownership arrangements, Table 6 also includes the statistics on full- and part-time jobs by ownership. Overall, the average number of full-time jobs continues to exceed the number of part-time jobs despite the type of ownership. However, the average number of jobs of either type is higher for the vessels managed within a partnership or corporation.

Table 6. Full- and Part-time Job Statistics

Statistic	Full time job	Part time job
As Reported:		
Average	2.3	1.5
Minimum	0	0
Maximum	53	10
N	251	249
Excluding Zero Responses:		
Average	2.4	1.7
Minimum	1	1
Maximum	53	10
N	244	64
Excluding Zero Responses, Sole Proprietorships		
Average	1.9	1.5
Minimum	1	1
Maximum	12	5
N	110	28
Excluding Zero Responses, Partnerships or Corporations		
Average	2.9	1.8
Minimum	1	1
Maximum	53	10
N	125	30

Vessel Information:

The questionnaire solicited information needed to describe the physical characteristics of vessels that comprise the commercial shark fleet. The study hypothesized that the fleet was composed largely of older vessels. Size information was obtained on 321 vessels (Q8). A large range of vessel sizes were reported, namely from 9 ft to 122 ft. The average vessel length for the sample was 47.1 ft (Table 7). Vessels age ranged from one to 77 years. The average vessel age was 23.5 years.

Table 7. Basic Statistics on Commercial Fishing Vessel Characteristics

Statistic	Length (ft)	Year built	Age (years)
Mean	47.3	1982	23.5
Median	44	1981	24
Mode	42	1978	27
Standard Deviation	15.7	9.9	9.9
Minimum	16	1928	1
Maximum	122	2004	77
N	319	304	304

The survey also solicited information on the locations where shark are being landed. A total of 286 respondents provided information regarding where they land the majority of their shark (Q10). Over half (58%) of respondents reported landing most of their shark harvest in Florida (Table 8). New Jersey and North Carolina follow with 9% and 8%, respectively. Overall, over three-fourths (77%) land shark within the southeast region.

Table 8. Summary of Indicated Primary Landing States

Port State	N	Percentage
Alabama	2	1%
California	1	0%
Delaware	1	0%
Florida	166	58%
Georgia	3	1%
Louisiana	13	5%
Maine	11	4%
Maryland	8	2%
North Carolina	24	8%
New Hampshire	1	0%
New Jersey	26	9%
New York	8	3%
Rhode Island	6	2%
South Carolina	10	3%
Texas	3	1%
Virginia	3	1%
Total	*286*	*100%*

The survey also solicited information regarding vessel ownership.[7] Most vessels were owned by sole proprietor or as a corporation (Q11). Of the 311 respondents to this question, 50% of vessels were owned as sole proprietorships, 46% as corporations and 4% as partnerships (Figure 23).

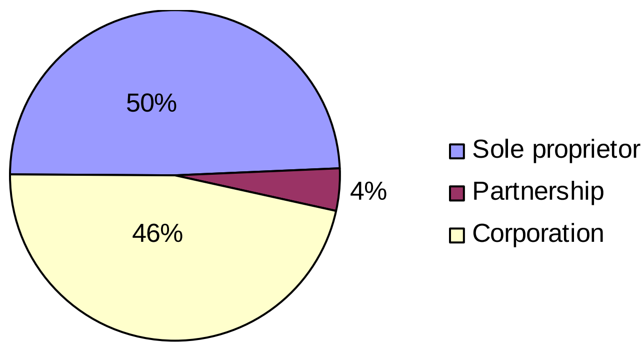

Figure 23. Distribution of Commercial Fishing Vessel Ownership (N= 311)

The study hypothesized that the fleet was composed of largely older vessels and, as a result, would not have much outstanding debt associated with the capital investment. Most of the 310 responses indicated that the vessel was free from debt (Q12). Specifically, 70% of the vessels did not have any debt on the vessel, while 30% had debt on the vessel debt.

Information solicited by the survey allowed for an examination of the relationship between a vessels debt level and whether it was insured. The working hypothesis was that vessels with debt were likely to also carry insurance, due to the increased liability. Insurance status was reported for 310 vessels (Q13). The response was split. Slightly over half of the vessels were not insured (51%).

A cross tabulation of responses for vessel debt and vessel insurance showed that those vessels with debt were the largest proportion of those insured. Responses showed that 70% of vessels had debt and, when considering insured status, this percentage can be divided into 41% insured and 29% uninsured (59% of vessels without debt were uninsured). The remaining 30% of vessels that do have debt repayment obligations, were likewise grouped by insurance status; approximately two-thirds (68%) of these vessels were insured (Table 9).

[7] While this information is included in the permit file, the decision was made to include the question in the survey for the purpose of having the respondent answer the subsequent questions about willingness-to-sell the permit and/or vessel with their share of ownership in mind.

Table 9. Cross Tabulation of Incidence of Vessel Debt and Insurance

	Vessel Insured?		
Vessel Debt?	No	Yes	Total
No			
frequency	128	90	218
percent	41.3	29.0	70.3
row percent	58.7	41.3	
column percent	81.5	58.8	
Yes			
frequency	29	63	92
percent	9.4	20.3	29.7
row percent	31.5	68.5	
column percent	18.5	41.2	
Total			
frequency	157	153	310
percent	50.6	49.4	100

Fishermen Goals and Perceptions:

Respondents were asked to identify and rank statement that best described their goals and perceptions pertaining to their shark fishing business. Respondents were asked to consider a list of five statements, then select the three most relevant and rank those three in order of importance or relevance (Q1). The responses to this question are summarized in Figure 24. A total of 231 respondents identified their first and primary goal, 219 identified their second goal and 176 identified their third. Responses were low, in part, due to goals not being applicable to the respondents and/or incorrect responses (i.e., several respondents checked goals instead of ranking).

For the majority of respondents, their primary and secondary goals were to generate income to support the household and supplementing household income, respectively. This suggests that for many respondents, commercial fishing for all species is done with the primary intent of obtaining household income. A total of 231 people identified one of the five goals as the “most important”. Of those respondents, 60% want to generate enough income to support the entire household, but nearly 30% identified their primary goal as expanding the fishing business. Of the 219 that identified a second goal, just over a third wanted to generate sufficient income to support their entire household, but nearly an equal share reported wanting to expand their fishing business. A total of 176 listed a third goal. Of these, 45% indicated that generating some additional income to help with the household expenses ranked third as the goal that best describes their overall commercial fishing strategy while nearly 40% said they were either considering a different career or wanted to expand their fishing business, which represents a completely opposite approach.

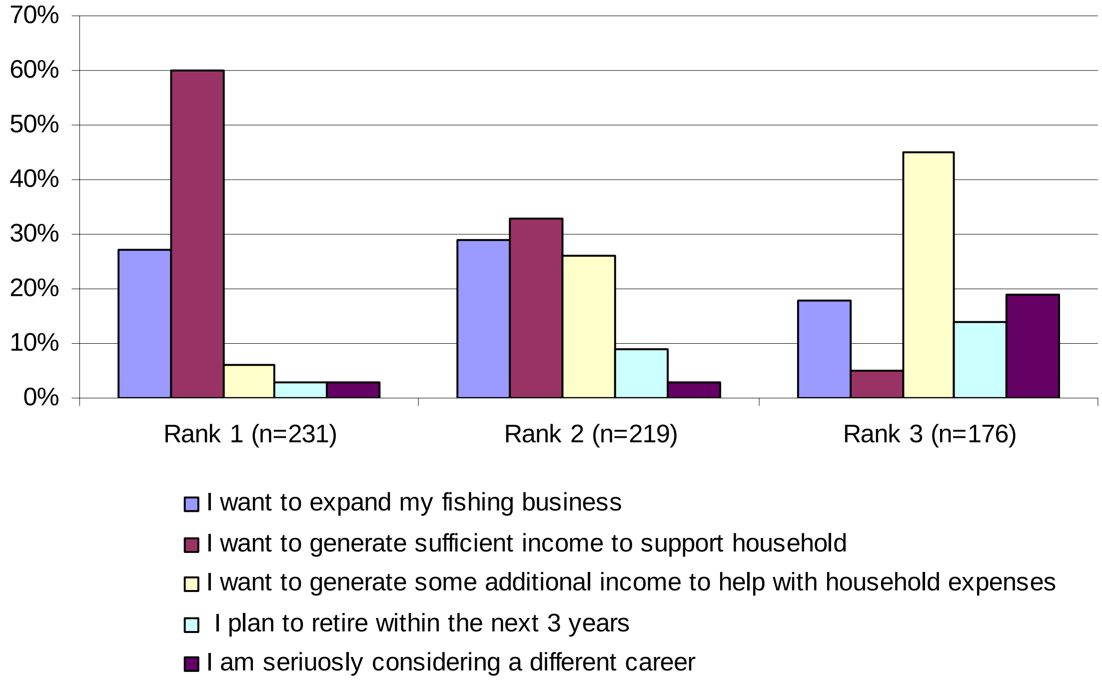

Figure 24. Distribution of Responses to the Question: "For the five goals listed, please identify the 3 that best apply to you for commercial fishing of all species. Rank those 3 goals (1-2-3) beginning with a "1" for the choice that best describes your goals" (Q1)

Respondents were asked how important they considered a number of different fish species to be to their fishing business (Q2). Respondents considered five specific species or species groups including shark, swordfish, tuna, snapper and grouper. Given the species composition of total revenues (Section II), we hypothesized that fishermen who land shark would also land a wide range of other species that provide a significant contribution to their total dockside revenues.

A total of 308 people responded to the importance of shark as a source of revenue. Of these respondents, 45% indicated shark was "very important," while 5% said it was of no importance (Figure 25). With regard to the other key species, 48%, 43%, and 56% indicated that swordfish, tuna, and grouper, respectively, were also "very important" to their business revenue generation.

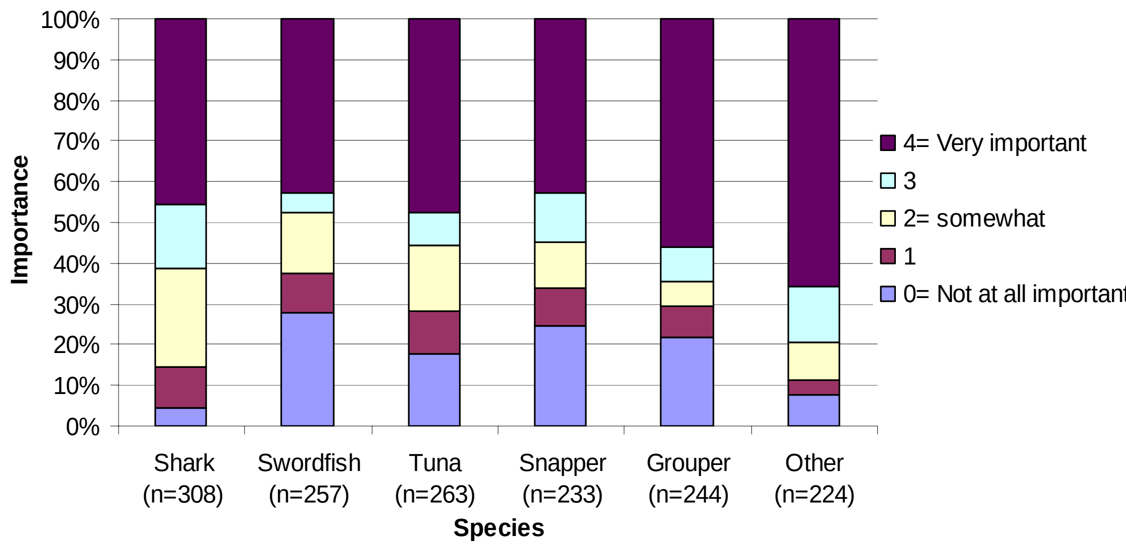

Figure 25. Distribution of Responses Regarding the Importance of Each to their Fishing Enterprise

The survey attempted to determine the primary source(s) that fishermen get their information about shark fishery management issues (Q5). Specifically, respondents were asked to indicate whether they have received sources of information on the shark fishery from each of six different sources. A total of 317 people responded to the question. Of the respondents, 88% said they receive information on the shark fishery from NMFS, 67% received information from other fishermen, 20% receive information from public meetings, and 15% received information from the local newspaper (Figure 26). In addition, 14% and 8% receive information from the Southern Offshore Fishery Association (SOFA) and the Directed Shark Fisheries (DSF) industry groups.

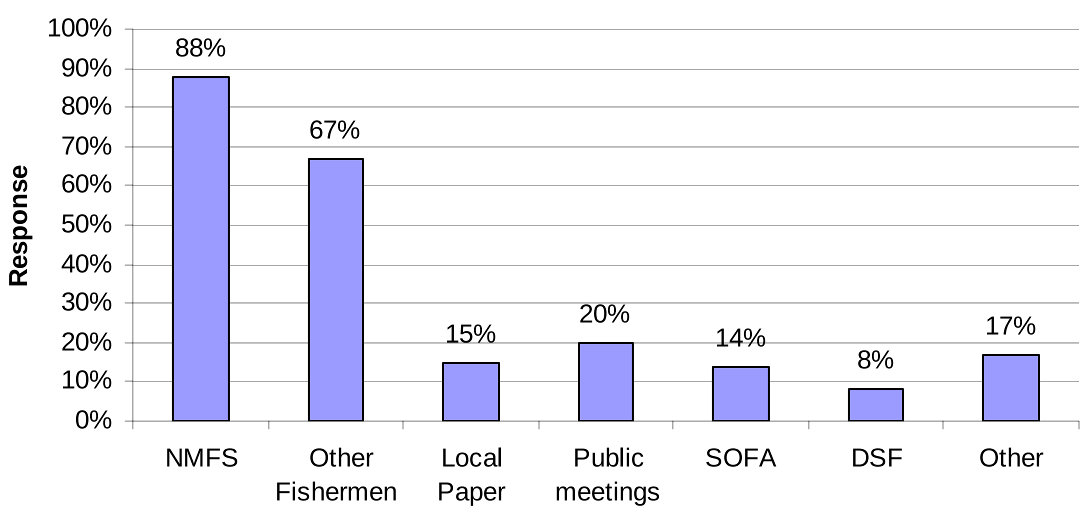

Figure 26. Percentage of Responses Reliance on Various Sources of Information on the Shark Fishery

Opinions Regarding a Potential Buyback Program:

Respondents were asked about their support for a number of regulations that can be used to reduce fishing effort (Q3). The majority of the respondents (55%) opposed revoking unused permits, while they supported buyback of permits only (71%) and buyback of both permits and vessels (72%). Concerning other options, 73% were opposed to tightening existing regulations while 39% (33%) supported (opposed) the allocation of transferable quotas (Figure 27).

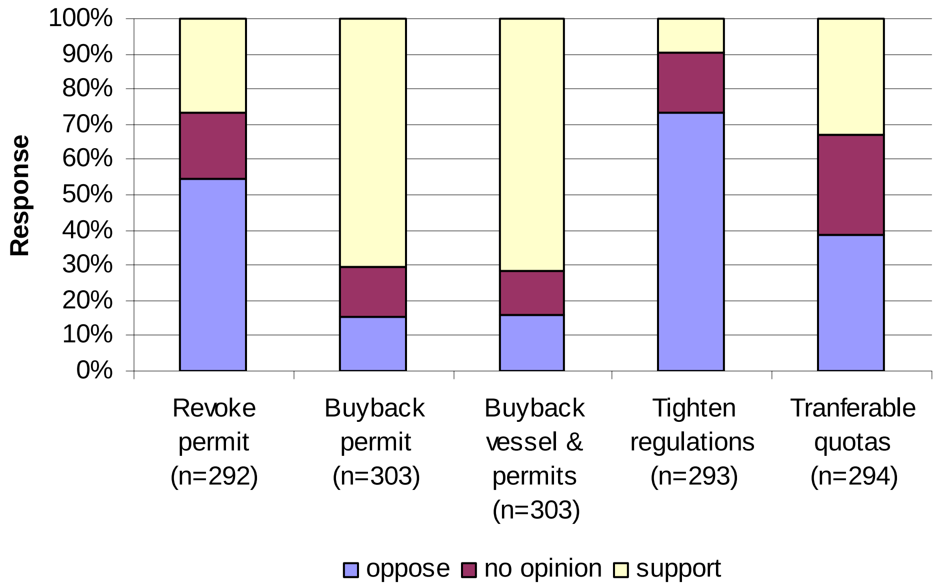

Figure 27. Distribution of Responses to: "Do you support or oppose (regardless of the fishery) each of the following measures that are designed to reduce fishing effort?"

In order to determine whether fishermen had any idea of what their vessels and permits were worth, respondents were asked whether they had ever tried to estimate the market value of their vessel and/or permits (Q4). Awareness of these values was expected to play a role in the respondent's reaction to the bid values presented later in the questionnaire for the respondent's permits and vessels (Q16 and Q17). Of the 304 people that responded to the question (i.e., 95% of total respondents), most (60%) had previously attempted to value their vessels and permits. The remaining 40% indicated that they had never attempted to value their vessels and permits. The larger proportion of respondents who had previously tried to value their vessels and permits suggests that most have some appreciation of the values associated with their permits and vessels, and may more carefully consider the fair market value of a vessel or permit when making the decision of whether or not to participate in a buyback program.

To determine the respondents' awareness of a potential buyback program for the shark fishery, respondents were asked if they were at all aware of such a program (Q6). Responses indicated there was roughly an even split, with over half (53%) having heard of the potential shark buyback program, while 42% of all 321 respondents indicated the survey as being the first they had heard of it (Figure 28).

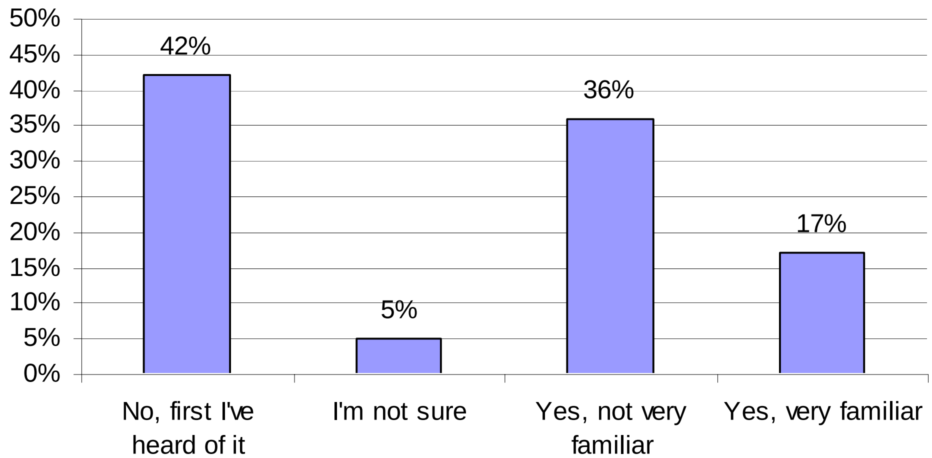

Figure 28. Summary of Responses to the Question: "Are you aware of the potential for a program to buyback shark vessels and/or permits in the Atlantic and Gulf of Mexico region?"

Implementing a buyback program in the shark fishery would necessitate a tax on landings as a means of generating the funds to cover the cost of buying back vessels and permits. The survey sought to first determine whether fishermen were receptive to the possibility of paying taxes on landings, since the willingness to pay such a tax would greatly influence the feasibility of a buyback. Respondents where asked whether they would be willing to pay a tax on their shark landings for up to twenty years (Q7). A total of 320 people responded to the question. Of these respondents, 48% of respondents were unwilling to pay tax on future landings to fund the program. Only 24 % of respondents were willing to pay a tax on shark landings, while the remaining 28% were undecided (Figure 29).

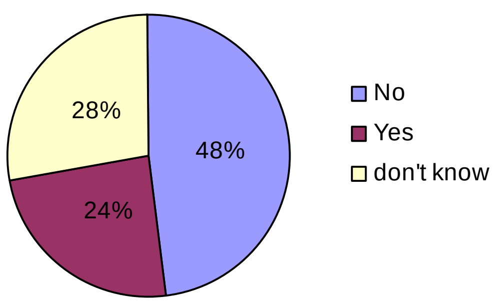

Figure 29. Distribution of Responses to the Question: "Would you be willing to pay a tax on your shark landings for up to 20 years to fund a program that would buyback vessels and/or shark permits?" (N = 320)

Willingness to Sell:

Fisherman were asked whether they would be willing to sell their permits (Q14). A total of 310 people responded to the question. Of these respondents, 75% were willing to sell their shark permit and 25% were not. When asked about whether they would consider selling their vessel with all the associated permits (Q15), 313 people responded to the question and, of these, 66% were willing to sell while 34% were not (Figure 30).

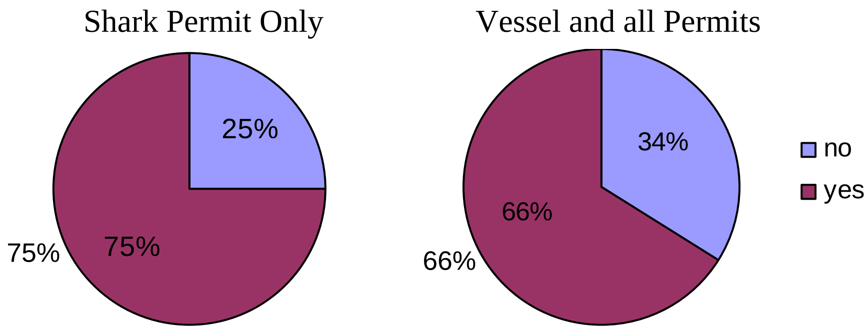

Figure 30. Willingness-to- Sell the Shark Permit Only and the Vessel with All Permits

A total of 25% and 35% of respondents indicated an unwillingness to sell their shark permit only and their vessel with all permits, respectively. A respondent was hypothesized to be unwilling to sell their shark permit only if they were required to have such a permit in order to participate in other fisheries (e.g., swordfish and/or tuna). Thus, the incidence of response to this question is likely correlated with the incidence of swordfish and/or tuna permits and the share of these species in the landings portfolios. Other reasons for the unwillingness to sell the shark permit pertain to the vessel and all other permits as well, including the identified fishing goals from question 1 in the survey, the level of education (that can reflect employment alternatives), and the type of permit ownership (since corporate or partnerships may require group decisions).

Creation of and Reaction to Projected Bid Values:

The average of the two highest years shark revenues and total revenues across all species during the 2001-2003 period were calculated for each vessel (i.e., shark permit number). For vessels reporting landings in only one of the three years, the value for that single year was assumed to be the average. These values were assumed to represent one factor in the determination of the future annual earnings potential for continued commercial fishing and, thus, were used as the basis for developing “bids”. The bids are intended to represent the value the permit owner would be willing to accept in exchange for forfeiting their permit and/or all permits and their vessel by means of submitting the bid for payment during a buyback program.

The total revenues were converted to expected bids for surrender of their vessel and all permits using a formula based on results of the recent Pacific Northwest groundfish buyback program[8] The estimated equation

$$\text{Bid-to-Landings Ratio} = \underset{(8.84)}{2.935} - \underset{(3.23)}{0.0000043}*\text{Landings} \qquad (R^2 = 0.91)$$

uses an average of the highest annual value of landings over a qualifying period (e.g., the highest three of five years) to predict successful bid ratios for the permanent retirement of the vessel from commercial fishing anywhere in the world (e.g., through titling restrictions) and all the associated fishing permits. The ratio can be multiplied by the average annual landings to approximate the successful bid. The parentheses under the equation contain the t-values from the ordinary least squares regression and they indicate that the individual parameter estimates are statistically significant. The R^2 value indicates that the model explains 91% of the variation in the bid ratios.

The equation predicts, for example, that a vessel with an average landed value of $5,000 annually would have bid-to-landings ratio of 2.9135 and, thus, a bid of $14,568. In other words, that particular vessel and all associated permits would have been bought out of the industry for a payment of $14,568. This payment would cover any costs needed to permanently retire the vessel (e.g., scrapping) since bidders were instructed to include such expenses in their bids. Since higher landed values reduce the bid ratios, it is possible that fishermen establish a minimum or threshold buyout value (i.e., the vessel, no matter how productive in the past, has at least some value) such that additional landings do not contribute proportionately more to bid values (at least those that were accepted). By comparison, a vessel averaging $500,000 in annual landings revenue would have a bid ratio of just 0.7967 and a total bid of $398,325.

Note that landings are measured by dollar values to account for variations in unit prices among the various species landed. In addition, the above equation was based on successful bids, which were those with the lowest ratios. This approach eliminates any bids that were too high on a dollar-per-landed value basis. Thus, vessels with relatively low landings would be more likely to have higher ratios and, given the funds available for the program, a lower likelihood of being selected for purchase. Vessels without landings during the qualifying period would be automatically eliminated from the buyback program since the average value of their landings is zero.

The formula (which predicts a declining bid to total earnings ratio as total earnings increases) produced corresponding bids ranging from just over $15,000 to nearly $456,500. Owners of vessels with average annual total revenue for all species below $5,000 (from their best two years in all fisheries) were assigned a bid value of $10,000; a

[8] This program was the only multispecies program that had been fully implemented at the time of this survey. As such, it was the only source of quantitative information available that links bids to historical landings. The data are confidential and were obtained from Mike Grable (NMFS, personal communication). The circumstances in both fisheries are similar due to the multispecies nature, declining quotas, and program being one that would buy the vessel and all permits.

total of 137 of the 605 total vessels were in this category. Owners of vessels with total average annual revenues above $456,500 were assigned bid values equal to that average (values reached nearly $1.6 million). The modifications to the extreme values were necessary since the bid values and corresponding ratios in the Pacific Northwest Groundfish Fishery buyback program ranged from approximately $5,000 to $450,000.

The shark revenues were converted to expected bids for surrender of their shark permit using the same formula for average annual shark revenues (based on the highest two of the three years in the study period) ranging from $1,000 to $8,500. For permits with shark revenues below $1,000, permit owners were assigned a bid value of $1,000 if they had reported any shark landings during the three-year period, or $500 if they had not (197 and 207 permit owners were asked to react to these values, respectively). In some instances the bid generated for shark permits exceeded the bid for all permits and the vessel (e.g., if shark was the primary species landed and landings were near the thresholds). In such cases, the shark permit value was reduced to half the value presented for all permits and the vessel. For average annual shark revenues in excess of $8,500, permit owners were assigned bid values of $15,000, $17,500, or $20,000; higher values were presented to those with higher reported landings.[9] The values were capped into these three groups to prevent the use of unrealistic values. While these three values were arbitrarily selected, the values correspond with anecdotal evidence of recent permit sales as discussed in the following section *(3) Permit Transaction Information*.

Respondents were asked to react to two unique values specific to their questionnaire to provide insight into their willingness to sell. These values were based on their individual landings history. Each permit holder was presented with two values based on their landings from the period 2001 to 2003, one value for shark permit only and another for vessel and all associated permits. The permit value was just for shark landings, while the vessel value was for all species (including shark). This latter value included all species because if the individual was willing to accept a value for the vessel, that value would include landings for all species.

The incidence (frequency) of bids was such that 187 permit holders were presented a bid amount of $1,000, while 168 were presented a bid amount of $500 for shark permits only. As the bid amount increased fewer people were presented with these values (Figure 31).

[9] The vessels to which this rule applied were divided into three roughly equal sized groups and those with the lowest and highest shark revenues were presented with values of $15,000 and $20,000, respectively.

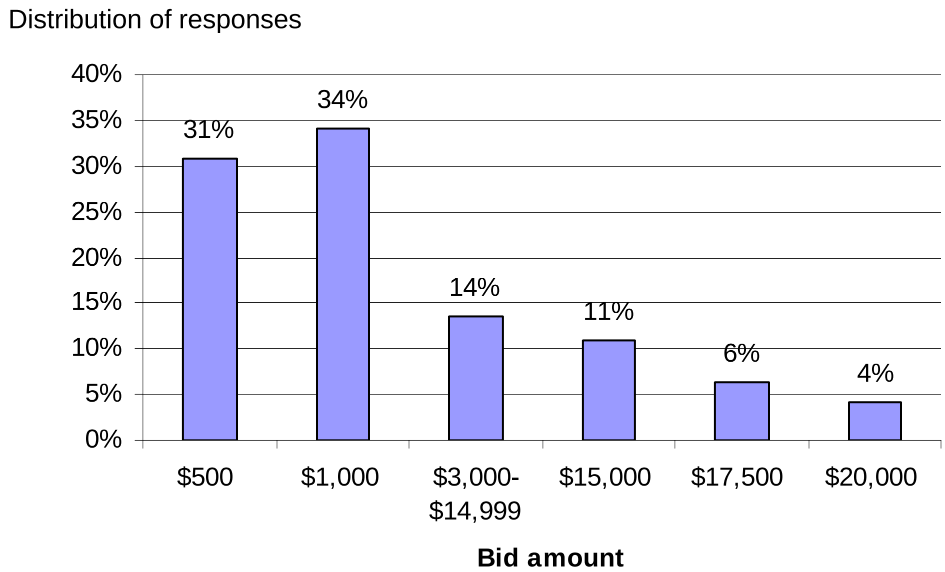

Figure 31. Incidence of Bids Generated for the Shark Permit Only

The incidence of bids for vessels and all permits was more variable (Figure 32).

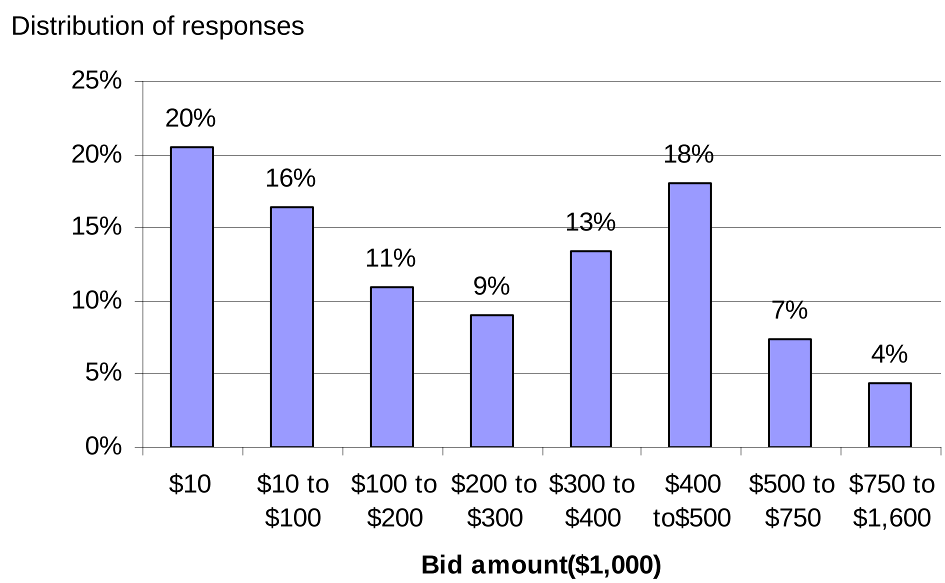

Figure 32. Incidence of Bids for the Vessel and All Permits

The distribution of the willingness-to-sell responses by bid amount indicated that the bulk of those willing to sell their shark permits (47%) were those that were presented with bids in the $500 and $1,000 categories (Figure 33).

Figure 33. Distribution of the Willingness-to-Sell Responses by Bid Amount for the Shark Permit Only

Recall that $500 bid amounts were offered for those permits that were associated with zero shark landings during the 2001-2003 period. These permits represent latent (unused) fishing effort. The $1,000 bids were presented to those with average shark landings below $1,000, which represent part-time effort (participation) in the shark fishery.

When considering the responses for those willing to sell their vessel and all permits, positive responses were more varied between bid amounts (Figure 34). However, 15% of all those willing to sell were in the $400,000 to $500,000 bid category, 13% were in the $300,000 to $400,000 bid category, while 10% were in the $10,000 bid category. The highest bid category of $750,000 to $1,600,000 represented 2% of all those willing to sell.

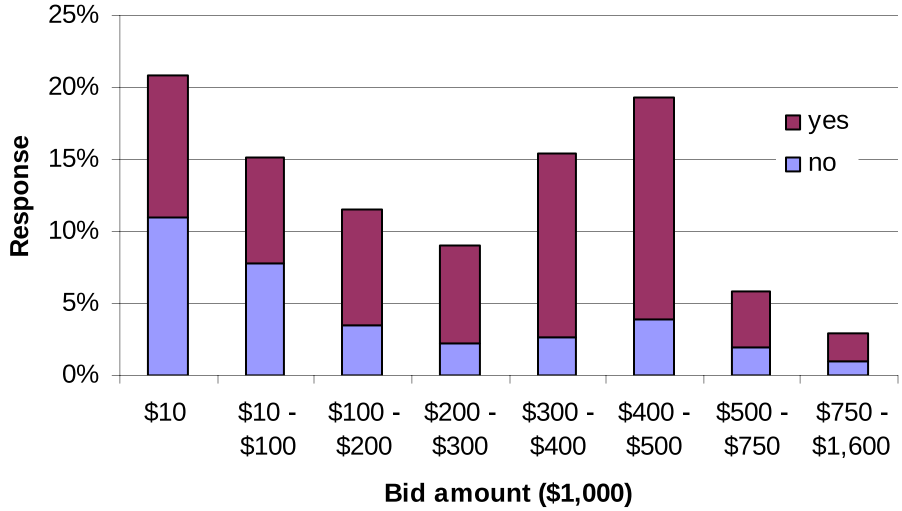

Figure 34. Distribution of the Willingness-to-Sell Responses by Bid Amount for the Vessel and All Permits

Those who were willing to sell were then asked if they were willing to accept the bid amount offered to them for the permit (Q16) and vessel with all permits (Q17). Respondents were presented with a dollar value based on their average revenue for the previous three years as discussed earlier. Specifically, they were asked how likely they would be to accept this value to surrender their permits. The "likeliness" was presented in the form of a closed ended question with five response levels. The distribution of these responses for (a) the permit and (b) vessel and all permits is summarized in Figure 35.

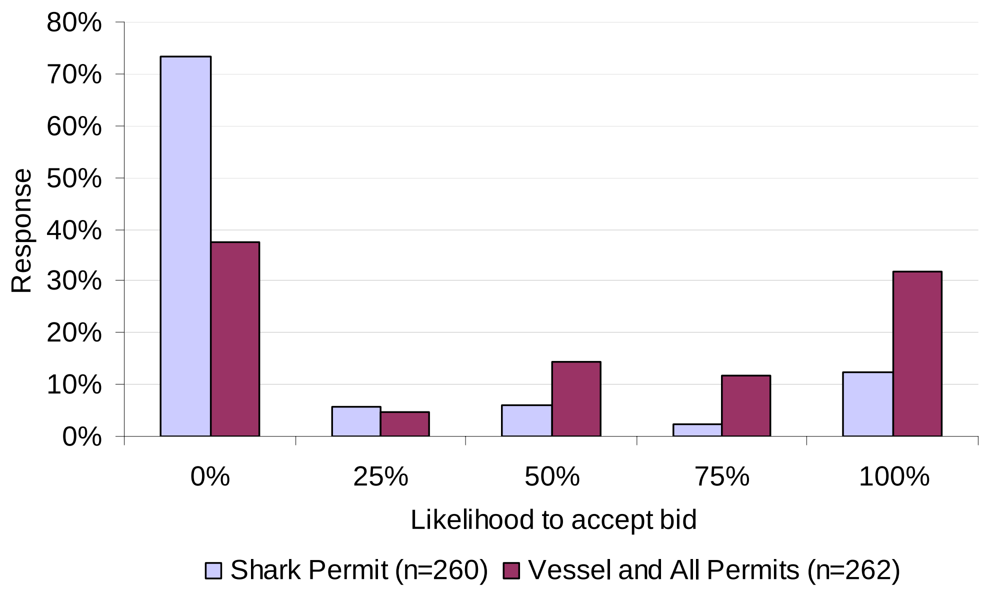

Figure 35. Distribution of Responses Regarding the Likeliness of Accepting the Bid Amount for Shark Permits Only and for the Vessel with All Permits

The majority (over 70%) of bids presented for the shark permit were rejected compared to less than 40% outright rejection of the bid for the vessel and all permits. The higher likelihood of acceptance categories where characterized by higher shares for selling the vessel and all permits. Over 30% of respondents were 100% willing to accept their bid for the vessel and all permits compared to just over 10% for the shark permits only.

It should be noted that the sample size of the willingness to accept responses summarized in Figure 35 (Q16 and Q17) exceeds the percentage that would be expected given the rate of willingness-to sell responses (Q14 and Q15). The expected number of observations for Figure 35 were 241 for the shark permit only and 212 for the vessel and all permits. These higher number of responses imply that the rates of willingness-to-sell in Figure 32 are biased downward (i.e., that respondents reconsidered when they saw the bids) or that respondents answering no to Q14 or Q15 incorrectly proceeded to answer the likeliness they would sell (Q16 and Q17). In any case, any subsequent empirical analysis of likelihood of accepting specific bids should exclude those that indicating in the previous question that they are not willing to sell (due to the uncertainty associated with the nature of the response).

The survey showed that 75% of respondents were willing to sell their shark permits (Figure 32). With this information we examine the potential quantity of landings that would be bought out under these conditions. Assuming that shark permits for those who indicated a 50% or higher willingness (likelihood) to accept the proposed bid are bought out, then such a program would have removed 10.5% of total Atlantic commercial shark landings in 2003.

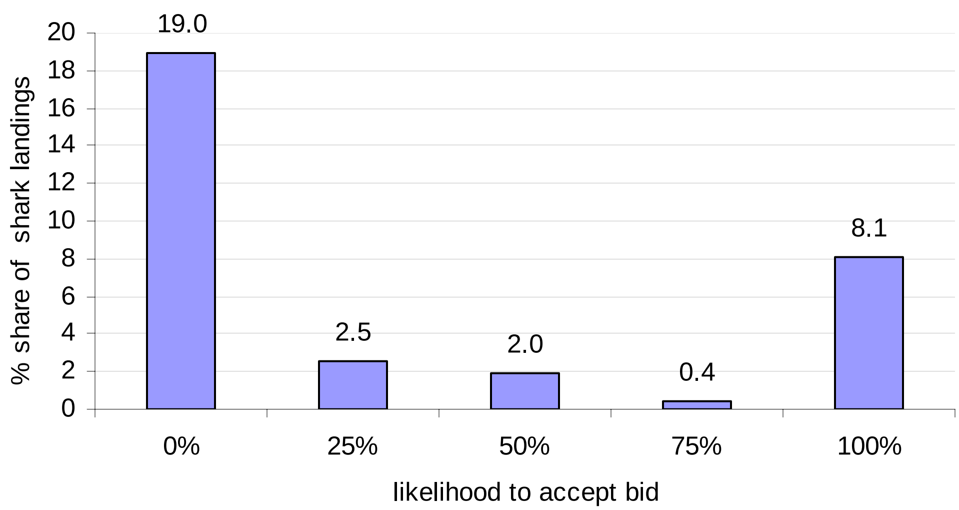

Figure 36. Share of Total 2003 Shark Landings Accounted for by Survey Respondents and their Stated Likelihood to Accept the Proposed Bid for their Shark Permit Only

The survey showed that 66% of respondents were willing to sell their vessels and associated permits (Figure 32). Assuming that vessels and associated permits for those who indicated a 50% or higher willingness (likelihood) to accept the proposed bid are bought out, then such a program would have removed 26.3% of total Atlantic commercial shark landings in 2003.

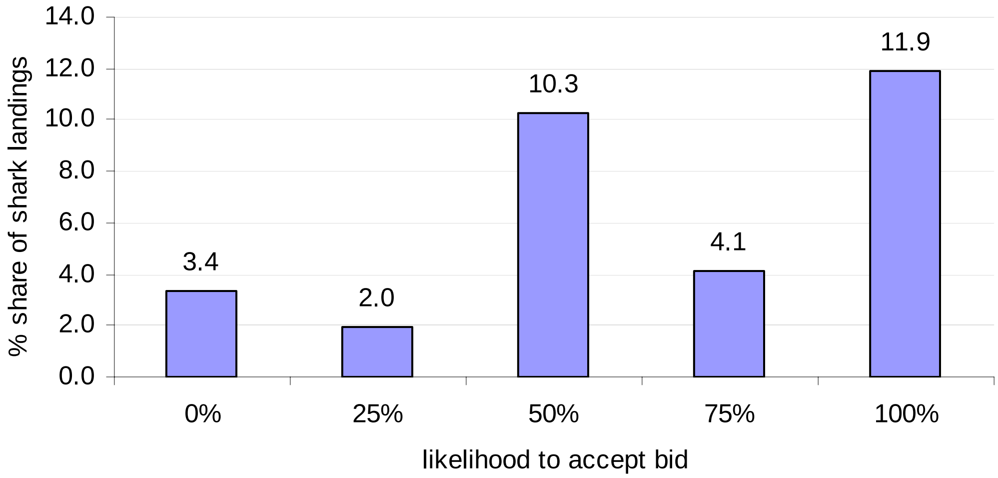

Figure 37. Share of Total 2003 Shark Landings Accounted for by Survey Respondents and their Stated Likelihood to Accept the Proposed Bid for their Vessel with all Permits

Table 10 below combines information from the previous two tables with the associated total bids. The summary indicates that a purchase from the willing shark permit sellers and from those willing to sell their vessel and all permits (defined as those with at least a 50% willingness to sell) would cost approximately $414.5 thousand and $50.3 million for a removal of 10.5% and 26.3% of 2003 shark landings, respectively.

Table 10. The Number of Individuals Willing to Accept the Proposed Bid and the Corresponding Total Value Required by their Stated Likelihood of Acceptance

Likelihood of Accepting the Proposed Bid	Total of Bids		Total Number of Individuals	
	Only shark permit	Vessel and all permits	Only shark permit	Vessel and all permits
0%	$614,544	$ 3,798,709	151	40
25%	127,464	3,161,722	14	11
50%	134,280	11,236,275	16	38
75%	26,913	9,701,457	6	30
100%	253,304	29,345,891	32	82
Total of 50-100%	$414,497	$50,283,623	54	150

Notes: The table summarizes the information for survey respondents who indicated a willingness to sell their permit and/or vessel and all permits (i.e., answered Q16 or Q17).

If the responses of the 59% of the population respondents are representative of the entire population, then both the value and effectiveness (in terms of landings removed) of a program based on the proposed bids estimated in this study would be higher.

Since this project is primarily concerned with the shark fishery, we should consider the impact to the shark fishery under each program. If only shark permits were purchased from those with at least a 50% likelihood of accepting the bid, then an average of $259,940 (9.3% of the $2.8 million reported annual landing from 2001-2003) in annual shark landings would be retired. If the vessels and all permits were purchased from those with at least a 50% likelihood of accepting the bid, then an average of $1.265 million (45.2% of the $2.8 million reported annual landing from 2001-2003) in annual shark landings would be retired.

(3) Permit Transactions Information

Permit transfer information was obtained from the NMFS SERO. The permit transfer information also contained any special circumstances that were involved in the transfer. The codes assigned to describe these circumstances are summarized in Table 11.

Table 11. List of Codes Used to Describe the Circumstances Surrounding Permit Transfers

Code	With regard to the Owner	With regard to the Price
1	person to company	also bought SWKD
2	company to person	transaction at cost
3	became incorporated	includes catch history
4	changed name of company	sold with vessel
5	transferred companies, same person	exchange of permits only
6	same lease owner	bulk sale
7	lease	includes one SWK
8	switched permits	plus further considerations
9	within family transfer	for multiple permits
10	same company, different person	given
11	two people to one	transfer
12	same Red Snapper license holder	NA
13	one person to two	exchange of vessel only

The federal limited entry shark permits were established in July 1999 via the Highly Migratory Species Management Plan (U.S. Department of Commerce, 2003b). Each cost $40 annually. The cost of additional permits in other fisheries were $10 each. The current costs are $50 for the first fishery and $20 for each additional fishery.

The limited entry shark permits could be transferred to a new owner or to another vessel owned by the original owner. The original permit form that was needed to complete the transfer did not ask for the selling price; this question was likely added in early 2000 (J.

Miller, SERO, personal communication, 1 June 1999). Thus, transfers conducted during the initial six to eight month period do not contain price information.

Permits are transferred by signing the back of the permit. When the seller signs the permit, the date and selling price are also requested although the latter information is essentially voluntary and, thus, not frequently reported. The date corresponds to when the permit was signed, not the actual transfer date. The transfer is not official until the Permits Office receives the signed permit, transfer application, and any necessary documentation. The processing date, at which time the transfer is official, is almost always later than the signature date on the permit (C. Sramek, SERO, personal communication, 19 May 2005). The processing date is also referred to as the transfer transaction date or the date of status. This date is readily available and is the one contained in the data sets described in this report.

A total of 325 shark permit transfers have been recorded from 19 July 1999 through 21 June 2005. On average, 59 transactions have occurred each year from 2000-2004. Nearly half (46.8%) involved transfers of "directed" permits. The annual number of permits transacted by permit type is shown in the following table.

Table 12. Number of Shark Permits Transferred through 21 June 2005 by Type

	Permit Type		
Year	Directed	Incidental	Total[a]
1999[b]	5	3	8
2000	33	16	49
2001	18	26	44
2002	37	38	75
2003	25	34	59
2004	34	28	62
2005[b]	20	6	26
Total	*152*	*171*	*323*

[a] Two transactions did not include the date of the transaction.

[b] Data does not correspond to a 12-month year.

A total of 408 unique vessels, of the possible number of vessels (650; number of transfers times two) involved in the 325 transfers. Of the 408, 109 only bought a shark permit, 115 only sold a shark permit, and the remaining 184 were involved in both purchases and sales.

Approximately one-third (30.8%) of the 325 transfers did not involve a change in ownership. This is important for explaining the response rate associated with the reported transfer prices. Prices that were at least equal to the initial cost of an additional permit (i.e., $10) were used as a lower bound in summarizing the price data. A total of 104 transactions, which is 32.0% or approximately one-third of the total number of transactions and 46.2% of those between different owners, were recorded with prices at least equal to $10. The incidence of reported prices are categorized in Figure 38.

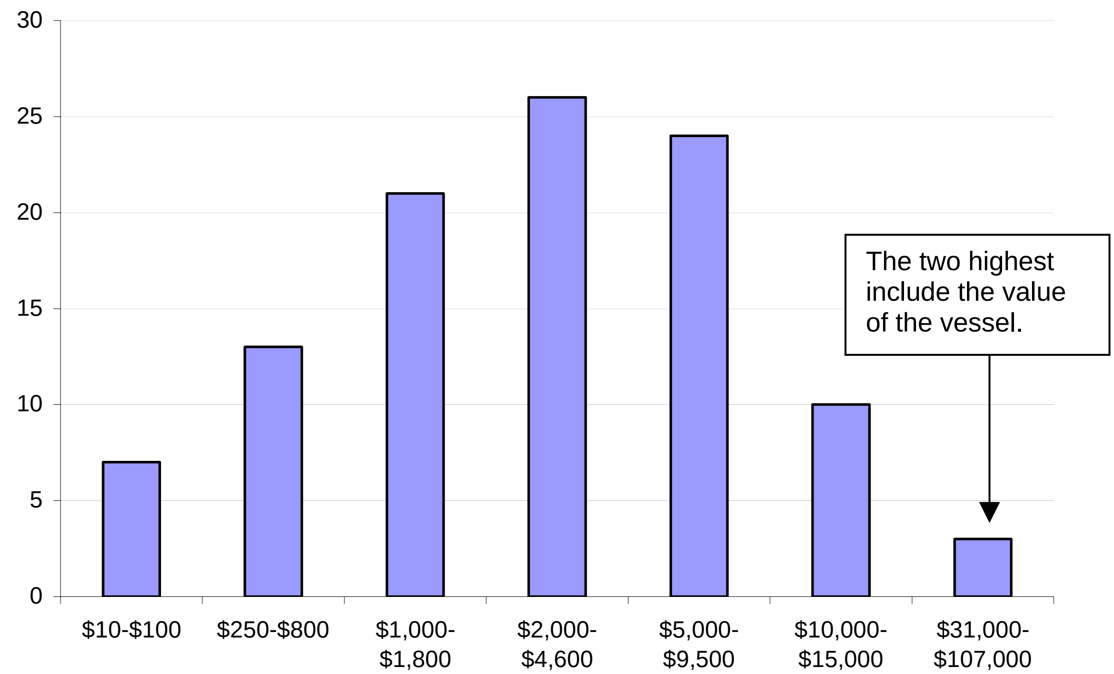

Figure 38. Incidence of reported shark permit transfer prices (N = 104)

The majority of permits were bought/sold at prices ranging from $1,000 to $9,500. While the transfer information on the two highest priced permits revealed that the prices also included the value of the vessel and other permits, little other information was available to explain the remaining prices. Most of the codes summarized in Table 11 were associated with the 221 transactions without price information (e.g., 100 involved the same owner).

Table 13 summarizes statistics on the prices, including statistics by permit type. Of the 102 transactions with prices that exclude other assets (to the extent this information was voluntarily provided by the parties), 58 were associated with sales of directed permits and 44 were associated with incidental permits.

Prices for directed and incidental shark permits averaged $5,950 and $1,397, respectively. The highest permit transfer price reported reached $31,000 for a directed and $8,000 for an incidental. While both figures may be associated with transactions that included additional assets, this information was not reported. Similarly, the lowest reported price for both permit types equaled the original price of an additional permit, or $10. While this price may seem low for privileges to commercial harvest shark species in Federal waters of the Atlantic Ocean and Gulf of Mexico, shark quotas have been severely reduced in recent years (lowering expected earnings) and a substantial number of vessels have not been reporting any shark landings (implying they have no current value to the owner since they are not being used and of reduced value to the buyer due to excess supply of permits)[10].

Table 13. Basic Statistics on the Prices of Shark Permit Transfers by Permit Type

		Permit Type	
Statistic	All	Directed	Incidental
N	102	58	44
Minimum	$10	$10	$10
Maximum	$31,000	$31,000	$8,000
Mean	$3,986	$5,950	$1,397
Standard Deviation	$4,413	$4,876	$1,467
Median	$2,500	$5,000	$1,000
Mode	$1,000	$5,000	$500

The 102 transactions could have occurred between as many as 204 vessels, but 163 were identified. Of those 163, 65 sold a permit, 62 bought a permit, and the remaining 36 bought and sold.

There are 86 current directed shark permit holders (of the 249 total active vessels described earlier) who have not participated in transfers of any other commercial fishing permits maintained by the SERO, though they could be involved in shark permit transfers. There was a total of 339 transfers of other permits by the 102 directed shark vessels. This makes an average of 3.3 non-shark permit transfers per directed shark vessel.

Overall, there were 302 vessels involved in the transfers either as a buyer or seller; of those, 168 (56%) were just involved in one transfer. All but one of the remaining 134 were involved in multiple transfers (i.e., 2 to 14) and one was involved in 29 transfers during the period.

In total there were 85 king mackerel (KM) transfers, 32 directed swordfish (SFD) transfers, 64 reef fish renewal (RR) transfers, 42 red snapper (L2) transfers, 44 snapper-grouper unlimited (SG1) transfers, 16 incidental swordfish (SFI) transfers, 27 class 1 red snapper (L1) transfers, 9 reef fish (RRE) transfers, 4 snapper-grouper (SG2) transfers, 3 Spanish mackerel (SM) transfers, and 3 swordfish handline (SFH) transfers.

[10] See previous section for further details. In 2003, for example, only 303 of the total 605 vessels (approximately half) with active permits (i.e., permits whose annual fee has been paid) reported landing any shark species.

Prices were explicitly stated for 146 (43.1%) of transfers. The sum of all the prices stated was $638,320, for a simple average of $4,372 per transfer. The average vessel was associated with $14,532 of transfers. Table 14 summarizes the average reported prices by permit type (other than shark) for directed shark permit holders. Average prices ranged from $2,464 for a commercial king mackerel permit to $33,750 for a Class 1 red snapper permit.

Table 14. Summary of Transfers by Directed Shark Permit Holders for Permits Maintained by the SERO Office, 7 February 2000 - 4 May 2005

Code	Type of Permit/License	N	Mean Price
KM	Commercial King Mackerel	32	$ 2,464
L1	Red Snapper: Class 1	4	33,750
L2	Red Snapper: Class 2	21	2,771
RR	Renewal Commercial GOM Reef Fish	24	5,600
SFD	Swordfish Directed	10	5,600
SGI	Commercial SA Snapper-Grouper Unlmt.	14	6,775

Notes: For transfers not indicating they included other assets, those with prices of at least $10, and including at least three transfers (the latter due to confidentiality).

There were 162 incidental shark permit holders (approximately 46% of the total number of permits) with reported shark landings in 2003. Of this 162, 86 (53.1%) have not participated in transfers of any other commercial fishing permits maintained by the SERO, though they could be involved in shark permit transfers. There was a total of 164 transfers.

Overall, there were 156 of a possible 328 vessels involved in the transfers either as a buyer or seller; of those, 79 (50.6%) were just involved in one transfer and the remainder were involved in multiple transfers (i.e., 2 to 11).

In total there were 164 transfers distributed primarily as follows: 38 king mackerel (KM) transfers, 20 directed swordfish (SFD) transfers, 28 reef fish renewal (RR) transfers transfers, 12 red snapper class 2 (L2) transfers, 11 snapper-grouper (SG1) transfers, 14 swordfish incidental (SFI) transfers, and 34 red snapper class 1 (L1) transfers.

Prices were explicitly stated for 44 (26.8%) transfers. These are prices that are at least equal to the initial annual fee for an additional permit (i.e., $10). The sum of all the prices stated was $184,346, for a simple average of $4,190 per transfer. The average vessel buying permits spent $6,145 (30 vessels accounted for the 44 transfers with price information). Average prices by specific permit types are summarized in Table 15.

Table 15. Summary of Transfers by Incidental Shark Permit Holders with Shark Landings in 2003 for Permits Maintained by the SERO Office, 18 January 2000 - 17 June 2005

Code	Type of Permit/License	N	Mean Price
KM	Commercial King Mackerel	13	$ 2,319
L2	Red Snapper: Class 2	4	1,650
RR	Renewal Commercial GOM Reef Fish	8	5,201
SFD	Swordfish Directed	7	3,094
SFI	Swordfish Incidental	6	3,306

Notes: For transfers not indicating they included other assets, those with prices of at least $10, and including at least three transfers.

(4) Advertised Sale Prices of Permits and/or Vessels

Permits:

Sale prices for shark permits alone were difficult to obtain largely because fishing permits are generally sold bundled with permits for other species (i.e., directed permits are identified if indicated in the advertisement). In most cases prices listed were for a bundle of permits corresponding to a mix of species. This is in accordance with the multi-species nature of the shark fishery. Fishermen sell combinations of permits and seldom sell single permits. The prices of a single shark permit ranged from $9,500 to $15,000. Prices of multiple permits, including shark, were $40,000 and $45,000. This information is summarized in Table 16.

Table 16. Selected Sale Prices Offered for Commercial Fishing Permits

Date	Region	Permits	Price ($)
Aug-05[a]	South & Gulf	Shark (Directed)	9,500
	South & Gulf	Shark (Directed)	14,500
	South & Gulf	Shark (Directed), King Mackerel	45,000
Mar-05[b]	-	Shark	15,000
	-	Shark, Swordfish, Tuna	40,000

[a] *National Fisherman* May 2004 and August 2004.
[b] East Coast Marine Brokers April- August 2005.

As shown in Table 17, sale prices for vessels with permits ranged from $31,500 to $400,000. Higher prices were generally associated with larger vessels that target relatively high value species such as swordfish and tuna. The sale prices listed in these sources were comparable to over 50% of the bid prices (including the relatively large share corresponding to zero landings) with which fishermen were presented in the survey questionnaire (Figure 31). This suggests fishermen do not simply consider the replacement value of their vessels but also they may take into consideration the potential revenue generated by the vessels.

Table 17. Selected Sale Prices Offered for a Commercial Fishing Vessel with Permit(s)

Date	Year built	Vessel length (ft)	Permits	Price ($)
May-04[a]	1982	30	Shark, Spanish mackerel, blue fish	31,500
	1986	30	Shark, king mackerel, tilefish, tuna	42,000
	NA	45	Shark, reef	115,000
	1978	46	Shark, swordfish	125,000
	NA	64	Shark, swordfish, tuna	95,000
Aug-04[a]	1986	30	Shark, swordfish, king mackerel, tilefish, tuna	42,000
	1982	46	Shark, swordfish	125,000
	NA	45	Shark, reef	115,000
	NA	64	Shark, swordfish, tuna	95,000
	1988	74	Shark, swordfish, tuna	400,000
Apr-05[b]	1986	-	Shark, snapper, grouper	120,000
	1984	60	Sword, reef, tuna	275,000
	NA	68	Sword, tuna	220,000
	NA	50	Shark, grouper	165,000
Jul-05[b]	1999	65	Sword, snapper, reef, tuna	300,000
	1987	45	Snapper, king mackerel, reef	195,000
	1978	45	Snapper, grouper, king mackerel	179,000
	1999	65	Tuna, swordfish, snapper, reef	300,000
	1987	45	Snapper, reef, king mackerel	195,000
	1978	45	Snapper, grouper, king mackerel	179,000
	1977	45	Snapper, reef	220,000
	1986	NA	Shark, snapper, grouper	120,000
	1980	45	Snapper, lobster	100,000
	NA	68	Swordfish, tuna,	220,000
	NA	50	Shark, grouper	165,000
Aug-05[b]	1977	45	Snapper, reef	220,000
	1986	NA	Shark, snapper, grouper	120,000
	NA	55	Shark, grouper	165,000

NA indicates that the information was not available.

[a] East Coast Marine Brokers April- August

[b] National Fisherman, May 2004 and August 2004

It is notable that none of the packages listed for sale as summarized in Table 17 is comprised of only just a shark permit. However, it is interesting to note that the prices in Table 17 fall well within the range of bid offerings provided to the survey recipients as discussed earlier.

Objective 3: Fair Market Values

The "fair market value" of a capital asset is likely composed of a variety of tangible and intangible values. These values are inherent in the overall perceived value associated with the capital asset by the owner. The tangible values may be observable in the market, while the intangible values may be linked to past history, personal association, and predicted future earnings. An objective of the study was to recognize the various methods by which the "fair market value" of a capital asset such as a commercial fishing vessel could be determined. Several different methods and approaches to deriving the fair market value were determined. Each method was considered within the context of using that valuation method to derive a defensible value for a commercial shark permit and/or vessel. And the pros and cons associated with each valuation method were addressed. The various methods, with the associated pros and cons, are discussed below and summarized in Table 18.

Insured Value:

Pros – It is a value that is determined by a marine surveyor or appraiser. The value is associated with the physical attributes of the vessel. The value is on record and can be reproduced. The valuation process incorporates and reflects values associated with similar vessels in the fleet. These values are often utilized for loss compensation and maybe, therefore, available through public records.

Cons – Many vessels currently operating in the fleet do not carry insurance. In fact, this study found that approximately 60% of the current fleet does not carry any insurance on the vessel. The values that do exist are not public record and are available only with the permission of the vessel owner. The insured value assigned by the appraiser may not reflect the owner's assessment of the vessel value.

Replacement Value:

Pros – This value reflects the current cost of replacing the vessel, deck gear, etc. at the current cost of those components if new. The value provides an assessment of what the vessel would cost in an un-depreciated state, with all components reflecting current market prices. The value can be easily reproduced given that the vessel, engines, gear, etc are itemized.

Table 18. Pros and Cons of Alternative Approaches for Determining the "Fair Market Value" of Fishing Assets

Method	Two Pro	Con
Insured Value	- Determined by professional surveyor - Used for capital loss compensation	- Many vessels do not carry insurance - Information may be proprietary
Replacement Value	- Reflects the current cost to replace - Easily reproduced given current prices	- Does not reflect actual depreciated value - Does not incorporate earnings potential
Comparable Sales Value	- Reflects the actual sales price from market - If available, will provide information on continuum of vessel sizes and configurations	- Only willingness to accept values are available, not price following negotiation - Actual sales prices are proprietary
Discounted Income Stream Value	- Reflects past earnings and fishing history - Commonly used method for businesses	- Future earnings are uncertain due to quota shifts and price changes - Does not account for potential changes in fishery participation
Unit Length Value	- Easily understood by vessel owners - Value can be derived for continuum of vessel lengths	- Implies that true value is directly proportional to vessel length - Does not recognize a latent vessel
One-Year Gross Fishing Revenue	- Would constitute a standardized method that could be administered to all vessels - Relies on actual, reported landings history	- Could provide conservative estimates if under-reporting is an issue - Does not consider variation in annual earnings, trip costs, true profit
Accepted Bid-to-Landings Ratio from Recent Buyback Programs	- Available for a number of different fisheries - Relies on actual historical earnings	- Ratios generated from other fisheries may not apply due to different technologies - Dependent on available data from other buyback programs

Cons – The value does not reflect the depreciated value of the asset given its current age, use history, and salvage value. The value does not reflect the earnings potential of the vessel. The value may be significantly higher than the selling price that could actually be received for the vessel on the open market. The values are not collected or reported by any private or public agency.

Comparable Sales Value:

Pros – The values reflect the current market selling prices for vessels and permits. A comparable sales value reflects the “fair market value” agreed upon by arbitrage in the current market. As such, these values reflect the buyers’ willingness to accept for a vessel or permit. A requisite number of these values should provide insight into what buyers and sellers recognize as a fair market value for the asset.

Cons – Though the asking prices for vessels and permit are commonly found in popular journals and industry trade publications, the actual transaction prices are often not reported. As a general rule, these selling prices are not public information. An exception is the price reportedly accepted in a permit sales transaction, which is maintained in a data-file by the National Marine Fisheries Service. However, this value may or may not reflect the actual sales value. The study found that many of these records grossly under-report the likely actual value, evidenced by the wide range of reported selling prices. A true market price may be extremely difficult to find for specific vessel configurations that lay outside the realm of industry would recognize as a “typical” vessel.

Discounted Income Stream Value:

Pros – This method would provide a value that would reflect the past fishing history of the vessel or permit. The value would therefore be based on actual fishing history of the owner. The method is commonly utilized in helping value other types of businesses. It is a commonly accepted method of developing a value that estimates the future earnings potential of a business by incorporating past earnings history, adjusted by an accepted discount factor. The method could focus on gross earnings or profit.

Cons – The value developed may not accurately reflect future earnings. This may be particularly the case if future quota levels are unknown or future participation in the fishery is uncertain. The past landings/effort levels may significantly over-estimate future landings/effort levels. Future price fluctuations may also contribute to the uncertainty associated with predicting future income streams.

Unit Length Value:

Pros – This method of assigning a value to vessel is easily understood and simple to compute, once an agreed upon per unit value is obtained. The value derived can be defined as pertaining to the hull only, or the hull, deck gear, electronics, etc.

Cons – Disagreement may exist over the per unit value to be assigned. Vessel owners may feel a unique value should be applied to their specific value. This approach will complicate the process and make value comparisons between vessels difficult. Values estimated as a fleet average would assign a value based on vessel length, without any contribution from vessel-specific fishing history. Thus, high values could be assigned to vessels that have been inactive, thus ignoring and overestimating the true earnings history associated with the vessel. Also, the values derived from this process could sum to a total far exceeding the amount of funds available for a fleet buyback program.

One-Year Gross Fishing Revenue:

Pros – The approach would employ a standardized method that would be common to each vessel … the vessel is worth the "annual" gross revenue generated by the vessel. This measure could be derived from the highest valued year, the most recent year, or some average of previous year's landings value. This measure is easy to develop and would provide an estimate that is easily comparable between vessels.

Cons – This approach could significantly under-estimate the true gross revenue if under-reporting is an issue and logbook/trip ticket data are utilized. The approach also does not consider the potential income stream associated with multiple years in the vessel's future. It may over estimate the gross revenue associated with a future year if significant downward quota adjustments occur. The method totally ignores the capital valuation associated with the vessel hull, gear, electronics, etc. And the method ignores the costs associated with landings. Although, an alternative approach would be to utilize one-year's profit as a measure of market value. An alternative approach would be to utilize one-year's profit as a measure of market value.

Value Derived from Landings History and Accepted Bid-to-Landings Ratios from Past Buyback Programs:

Pros – This methodology recognizes recent buyback programs, and reveals the range of bid to landings history ratios that characterizes successful bids. The range of ratios can be computed with respect to a variety of vessel characteristics. However, the most defensible would be to compute the ratio comprised of the submitted bid amount and an average of recent annual landings values. This ratio would express the predicted bid amount as a function of past landings history. The ratio used would thus define the actual dollar amount that recent buyback program participants felt were indicative of the fair market value for their vessel and/or permit. The landings history value used could be a single year, or some combination of years in the landings history of the vessel or permit. This value could be available for single species or multi-species fisheries.

Cons – The historical ratios utilized may have come from fisheries that utilize a totally different production technology than the fishery with the proposed buyback program. Thus, the bid to landings history ratio in the proposed buyback program may be fundamentally different from that seen in a recent buyback program for a fishery with a different production technology. If so, deriving the current bid values directly from the historical bid ratios may not be applicable. However, convergence of bid to landings value ratio amounts from several different fisheries would suggest the method to be robust across different types of fisheries.

The latter method discussed above is the method chosen for the fair market valuation estimation process. Although each of the alternative methods (including the latter) are characterized by problematic issues, the latter method seemed to be the most promising in terms of defensibility, theoretical appeal, and usefulness to a proposed buyback program for shark. Thus, the latter method was chosen for the purposes of the project. The following section discusses the general findings associated with the project efforts to estimate a fair market value for a shark permit and a shark vessel with all associated permits.

Summary of Findings Concerning "Fair Market Values"

The findings resulting from Objective 3 are best addressed by summarizing the key findings of this study, including results from the permit ownership information, logbook data analysis, secondary data on transactions (sales of shark permits and vessels with shark and other permits), and survey results, which are each summarized in turn.

Permit Ownership:

- There were 605 vessels with "active" shark permits (249 "directed" and 356 "incidental" in April 2004. These are permits with valid licenses, meaning the owner has paid the annual fee.
- The total number of permits owned by the population of 605 vessels with a commercial shark permit was 3,585 (38% were held by directed shark permit holders). The largest number of permit types held by shark permit holders were swordfish (304 of the 605 or 50%), Atlantic tunas (50%), king mackerel (40%), and Spanish mackerel (40%).

Landings and Revenue Data:

- Reported landings of all species from federal waters were obtained for each vessel for the 3-yeard period of 2001-2003. The majority of vessels had 2003 total dockside revenues ranging from $5,000 to $500,000.
- Average annual shark revenue in 2003 was substantially higher for directed permit holders, especially for vessels landing $5,000 to $750,000. Average shark revenues for incidental permit owners did not exceed $6,000 for any level of total vessel revenue.
- The shares of total vessel revenue attributable to shark exceeded 30% for only those vessels with annual total vessel revenues less than $75,000 in 2003.
- The landings compositions of directed and incidental permit holders varied by total vessel revenue level. In general, vessels with higher total revenues relied less on shark landings and are more dependent on swordfish and tunas. By comparison, the

vessels with the lower total landings value tended to depend more on shark, grouper and snapper, in addition to swordfish and tuna.

- Only 517 of the 605 shark permit holders reported landings of any species during 2001-2003. Total annual revenue across all vessels was $2.8 million for shark landings and ranged from $84.8 million to $86.9 million for all species.

Secondary Transactions Data:

- Both market and non-market data were summarized for the purpose of obtaining an indication of “fair market value” of a shark permit and a vessel with a shark permit (and perhaps other permits).
- The market data consisted of voluntarily reported transaction prices of permits recorded on the permit transfer application. The price for directed and incidental shark permits averaged $5,950 and $1,397, respectively (although the maximum prices were $31,000 and $8,000, respectively).
- The non-market data consisted of sale prices offered in trade magazine and broker websites. The prices that owners were willing-to-accept for their direct shark permit ranged from $9,500 to $15,000. The price for a vessel with a shark permit (and selected other permits) ranged from $31,500 to $400,000.

Survey Results:

- The effective population of the survey was 551 vessels (information could not be obtained on 54 vessels in the original list of 605 due to incorrect address or because the license was sold before the questionnaire was mailed).
- The overall survey response rate was 58%, which included information on 321 permit owners. In terms of the share of owners represented, the response rate was even higher due to multiple ownership of permits. Thus, the results reflect the majority of the fleet such that the results are representative of the population.
- A total of 55% of respondents opposed revoking unused shark permits; 71% supported buying back permits, while 72% supported buying back vessels and permits for the purpose of reducing overcapacity, overfishing, and latent effort.
- A total of 42% of respondents had not heard of the potential for a shark buyback program before receiving the questionnaire.
- A total of 48% of respondents indicated they would be unwilling to pay a tax on future landings to fund a buyback program.
- Only 14% and 8% of respondents reported receiving information on the management of the shark fishery from the SOFA and DSF industry group, respectively. This compares to 88% that rely on the NMFS and 20% that rely on public meetings. The relatively high rate of reliance on information from NMFS suggests that this form of communication is crucial and should be continued, especially for gathering information representative of the entire fleet. Industry groups may be an effective means of reaching additional fishermen, especially in a short time frame.
- A total of 40% of respondents indicated that they had never attempted to value their commercial fishing assets (i.e., vessels with gear and permits). These respondents may be less likely to develop an accurate and meaningful estimate of fair market value for their assets and, thus, improperly assess an offer to purchase their assets.

- Vessel ownership is divided equally among sole proprietors (50%) and multiple interests (50% are partnerships or corporations).
- A total of 70% of the vessels had outstanding debt associated with the vessels and 59% of those are uninsured, which could affect their estimate of the fair market value of the vessel.
- A total of 75% and 66% of respondents were willing to consider selling their shark permit or their vessel with all permits, respectively, prior to being presented a value for each.
- The average total revenue from the top two of the three years was used to develop "bids" reflective of the fair market value. The bids were based on an estimated linear equation that explained accepted bids from the recent Pacific Northwest groundfish buyback program with the associated average annual revenue of the vessel. In general, higher landings would result in higher bids and vice verse.
- Since several vessels did not report landings during the 2001-2003 period, 31% of shark bids and 20% of bids for the vessel and all permits were at the minimum threshold levels of $500 and $10,000, respectively.
- In general, the willingness-to-sell their shark permit decreased with the bid amount and the willingness-to-sell their vessel with all permits increased with the bid amount.
- The majority (over 70%) of bids presented for the shark permit were rejected outright (i.e., respondents reported a 0% likelihood they would be willing-to-sell at that price), compared to a less than 40% rejection rate for bid associated with the vessel and all permits. Conversely, over 30% and 10% of respondents were 100% willing-to-accept the bids to sell their vessel with all permits and just their shark permit, respectively.
- Assuming that a stated likelihood of 50% or greater for accepting the proposed bid amounts would translate into actual acceptance and participation in a buyback program, such programs would eliminate 9.3% and 45.2% of annual shark dockside value for a shark permit only and vessel and all permit buyback program, respectively, at a total cost of $414,500 and $50.3 million. While these figures are based on dollar values as opposed to volumes, the shares will be representative if prices have remained stable.
- The findings suggest that a shark permit buyback or vessel and all permit buyback program would remove 49 and 149, respectively, for an average buyback payment of $8,459 per shark permit and $337,584 per vessel and all permits. Both of these latter values were within the reported ranges of transfer values.
- For comparison, the estimated total program costs (which are based on proposed bid of up to three times the annual gross revenues) are approximately 15% and 60% of the lowest reported annual dockside values of landed shark and all species, respectively, during the 2001-2003 period.

B. Significant Problems

No problems were significant to the extent that they compromised the completion of the original objectives of the study. While there were delays in obtaining the data, and some of the data anticipated was not available, the work was completed and other substitute sources of information were found.

C. Description of the Need for Additional Work

The historical landings, permit transfer information, and the corresponding survey results contains a wealth of information that can be generated and further assessed. Given the difficulty with obtaining representative survey information in an increasingly tight regulatory environment, this information affords a unique opportunity to explore additional questions with regard to the Atlantic commercial shark fishery. This represents an opportunity that the investigators hope will be pursued.

VII. EVALUATION

A. Description of the Extent to which the Project Objectives were Attained

1. Were the goals and objectives attained? How? If not, why?

The project objectives were attained in full. The degree to which each Objective was addressed is briefly discussed below.

Objective 1 tasked the project participants with conducting a literature search that would assist them in establishing a methodology for fair market value assessment. This objective was completed in full. This is briefly discussed in Section V.A of this report, but a full literature list is provided at the end of the article published in the *Journal of Agricultural and Applied Economics*, which is presented in Section VI.A, Objective 1 of the Final Report.

Objective 2 tasked the project participants with assembling vessel cost and earnings data, recent market sales data, and vessel characteristic data (to the extent available) that would allow development of a method for fair market value assessment. This task was completed in full. Data on individual shark vessel landings and dockside value data were obtained from NMFS. These data are presented in detail within Section VI.A, Objective 2 of the Final Report. Vessel characteristic data were also obtained. Recent market sales data were compiled both from popular journal sources and from the NMFS. These data were crucial in the formulation and development of the fair market value assessment methodology.

Objective 3 tasked the project participants with computing fair market values for shark vessels utilizing a range of market value assessment techniques. This task was completed in full and the findings are presented in Section VI.A, Objective 3 of the Final Report. Several methods for determining fair market value were examined. However, the most appropriate method was determined to be that derived from past fishing history and accepted bid-to-landings ratios from recent buyback programs. However, values associated with other methods are also presented.

2. Were modifications made to the goals and objectives? If so, explain.

No changes or modifications were made to the original goals and objectives of the project.

B. Dissemination of Project Results

The project results have been disseminated through several papers, published articles, and formal presentations. These are listed below. In addition, one graduate student will focus on this topic for a Masters Thesis in the Food and Resource Economics Department at the University of Florida. This Masters Thesis will be forthcoming in Spring 2006 and will eventually yield additional publications. Formal presentations derived from the project findings have been delivered in Vancouver, B.C.; Tokyo, Japan; Corvallis, OR; and Tulsa, OK. A presentation on project findings will be delivered at the Southern Agricultural Economics Meetings in Orlando, Florida during 2006. In addition, the findings will be presented directly to industry via the industry workshops that will be held by the Gulf and South Atlantic Fishery Foundation staff as a part of this overall project.

Publications:

Musengezi, J. "Efficient and Effective Capacity Reduction in the Atlantic Shark Fishery," Master's of Science thesis, University of Florida, Spring 2006.

Adams, C.M. and S.L. Larkin. 2005. "Preferences for a Buyout Program: Survey Results from U.S. Atlantic Shark Fishermen," pp. 8. *North American Association of Fisheries Economists Forum, Future Benefits to all Generations: The Role of Economics*. Fisheries Centre Research Reports, University of British Columbia, Vancouver, B.C.

Larkin, S.L., W. Keithly, C.M. Adams, and R.F. Kazmierczak, Jr. 2004. "Buyback Programs for Capacity Reduction in the U.S. Atlantic Shark Fishery." *Journal of Agricultural and Applied Economics* 36(2): 317-332. (Invited Paper; FAES Journal Series No. R-02490).

Adams, C. and S. Larkin. 2004. "Valuation of Directed and Incidental Shark Permits for a Proposed Buyback Program for the U.S. Atlantic Shark Fishery," pp. 97. *IIFET 2004 Japan: What are Responsible Fisheries? Book of Abstracts.* IIFET Secretariat, Corvallis, OR.

Presentations:

Musengezi, J., F. Rossi, and S. Larkin. February 2006 (tentative). "A Double-Hurdle Model of Preferences for a Proposed Capacity Reduction Program in the Atlantic Shark Fishery," Southern Agricultural Economics Association Annual Meeting, Orlando, FL.

Musengezi, J. and F. Rossi. November 2005. "Preferences for a Proposed Capacity Reduction Program in the Atlantic Shark Fishery," Food and Resource Economics Department Annual Graduate Student Symposium, University of Florida, Gainesville, FL.

Larkin, S. May 2005. "Economic Contributions from Multi-species Fisheries Research." Florida Sea Grant College Program, Program Assessment Team, Gainesville, FL.

Adams, C.M. and S.L. Larkin. May 2005. "Preferences for a Buyout Program: Survey Results from U.S. Atlantic Shark Fishermen." North American Association of Fisheries Economists Forum. Vancouver, B.C., Canada.

Adams, C., and S. Larkin. July 2004. "Valuation of Directed and Incidental Shark Permits for a Proposed Buyback Program for the U.S. Atlantic Shark Fishery." International Institute of Fisheries Economics and Trade. Tokyo, Japan.

Larkin, S., W. Keithly, C. Adams, and R. Kazmierczak, Jr. February 2004. "Buyback Programs for Capacity Reduction in the U.S. Atlantic Shark Fishery." Southern Agricultural Economics Association Annual Meeting, Tulsa, OK.

APPENDICES

APPENDIX A: COPY OF THE APPROVED UNIVERSITY OF FLORIDA IRB PROTOCAL FOR PROJECT SURVEY

1. TITLE OF PROTOCOL:
Shark Asset Buyback Program

2. PRINCIPAL INVESTIGATOR:
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3. SUPERVISOR: N/A

4. DATES OF PROPOSED PROTOCOL: March 7, 2005 to May 31, 2005

5. SOURCE OF FUNDING FOR THE PROTOCOL: Gulf and South Atlantic Fisheries Foundation

6. SCIENTIFIC PURPOSE OF THE INVESTIGATION:
The main objective of study under this protocol is to determine the opinions and preferences of shark fishermen. Specific objectives are three-fold:

(1) To determine whether the fishermen support or oppose various types of regulatory measures designed to reduce fishing effort;
(2) To determine preferences for a buyback program including the associated level of compensation; and
(3) To determine the extent to which demographic characteristics affect the responses to (1) and (2).

7. DESCRIBE THE RESEARCH METHODOLOGY IN *NON-TECHNICAL* LANGUAGE.
Completion of the objectives will require collection of primary data from fishermen that will be analyzed in aggregate with various econometric techniques and statistical measures. Using the publicly available permit information, we have obtained a list of 605 vessels with active shark permits as of April 2004. The owners of these permits constitute our target population and sampling frame. Due to the relatively small size of the sample frame (in statistical terms), the entire population will be surveyed. Due to the geographic dispersion of permit holders, the survey will be conducted by mail. The mail survey protocol will follow standard procedures that include a first mailing (cover letter with consent information, questionnaire, pre-paid return envelope), post card reminder, and second mailing. Before the first mailing, the questionnaire will be pre-

tested at least twice with two different groups of willing volunteers that will be identified by the industry consultants on this project (i.e., R. Hudson and B. Spaeth).

Confidentiality will be maintained through keeping the vessel identification number in only one file. One file will contain the permit owner's mailing address and permit number. The other file contains only the information on the permits (i.e., there is no information on the owner). These two files will never be merged because the first file will be deleted after the survey is completed (it is needed during the survey process only to keep track of which individuals need to be sent a second copy of the survey). Removing names of those who have completed the survey from the mailing list will reduce survey costs through a reduction in expenses associated with the printing and mailing of the reminder postcard and second mailing.

8. POTENTIAL BENEFITS AND ANTICIPATED RISK:

There is no individual direct benefit associated with completing the questionnaire. The expected benefit for respondents has to do with the information/feedback that can be offered to them, as well as to other members of the industry.

There is no more than minimal risk (i.e., the risks of harm to a participant are no greater than those ordinarily encountered in daily life). There is no risk of breach of confidentiality since we will not be recording names on the survey instrument. That is, we are not interested in individual responses, only aggregated totals and averages.

9. DESCRIBE HOW PARTICIPANT(S) WILL BE RECRUITED, THE NUMBER AND AGE OF THE PARTICIPANTS, AND PROPOSED COMPENSATION:

Participants are identified through the permit ownership records maintained by the National Marine Fisheries Service. Holders of both directed and incidental licenses will be surveyed. Participation, as evidenced by completion and return of the questionnaire, is voluntary. Currently, there are approximately 605 directed and incidental federal commercial shark permits outstanding. Questionnaires will be sent by mail to the address of record.

10. DESCRIBE THE INFORMED CONSENT PROCESS. INCLUDE A COPY OF THE INFORMED CONSENT DOCUMENT.

There will be two types of informed consent; one is associated with the pre-test volunteers and the other that will be included in the cover letter that accompanies the questionnaire. The content of the consent will state that participation is voluntary, only for those over the age of 18, and is implied through attendance (in the case of the focus group) or by completion of the questionnaire (in the case of the mail survey). It will also state the benefits and costs associated with participation (similar to that in section 8 above), no compensation will be provided, a brief statement that all information will be used in aggregate, and give contact information for the IRB (including the protocol number assigned after approval of this protocol).

APPENDIX B: INDUSTRY SURVEY QUESTIONNAIRE

2005 Shark Fishermen Survey

Fishermen Goals and Perceptions (All fishing activities)

1. For the 5 goals listed below, please identify the 3 that best apply to you for commercial fishing of <u>all</u> species. Rank those 3 goals (1-2-3) beginning with a "1" for the choice that *best* describes your goals:
   ___ I want to expand my fishing business.
   ___ I want to generate sufficient income to support my entire household.
   ___ I want to generate some additional income to help with household expenses.
   ___ I plan to retire within the next three years.
   ___ I am seriously considering a different career.

2. For the fisheries listed below, please circle the response that best indicates how *important* each will be to your business (all vessels included) 3 years from now.

	Not at all		Somewhat		Very
Shark	0	1	2	3	4
Swordfish	0	1	2	3	4
Tunas	0	1	2	3	4
Snapper	0	1	2	3	4
Grouper	0	1	2	3	4
Other	0	1	2	3	4

3. Do you support or oppose (regardless of the fishery) each of the following measures that are designed to reduce fishing effort? Please circle a response for each.

Regulatory change	Oppose	No Opinion	Support
Revoke unused permits	-1	0	1
Buyback permits	-1	0	1
Buyback vessels and permits	-1	0	1
Tighten existing regulations	-1	0	1
Allocate individual transferable quotas	-1	0	1

4. Have you ever tried to calculate what your vessel and/or permits are worth? Yes No

Shark Fishery Questions

5. Where do you get your information about the shark fishery? Circle all sources.

   NMFS   Other fishermen   Local paper   Public meetings   SOFA   DSF   Other

6. Are you aware, if at all, of the potential for a program to buyback shark vessels and/or permits in the Atlantic and Gulf of Mexico region? Circle one.

   Yes, I am very aware   Yes, I've heard of it, but not very familiar   I'm not sure   No, this is the first I've heard of it

7. If you plan to continue fishing for sharks, would you be willing to pay a tax on <u>your</u> shark landings for up to 20 years to fund a program that would buyback vessels and/or shark permits now?   Yes   No   Don't know

Shark Vessel and Buyback Questions

	Permit #
8. How long is this vessel?	_____ feet
9. When was this vessel built?	_____ year
10. Location information: a. Where do you land most of your shark catch from this vessel?	(City, State)
b. Where is the homeport?	
c. What percentage of provisions are purchased near the homeport?	_____ %
11. How is this vessel owned? Please circle one.	Sole proprietor Partnership Corporation
12. Is there debt on this vessel?	Yes No
13. Is this vessel insured?	Yes No
For the next set of questions, assume that a buyback program for shark permits and/or vessels is being developed.	
14. Are you willing to sell this *shark permit* for a reasonable price?	Yes No
15. Are you willing to sell this *vessel and all permits* for a reasonable price?	Yes No
If you responded "Yes" to either question 14 or 15 for any vessel, please answer the next questions for that vessel (consider the depreciated, insured, replacement, and/or comparable sales value).	
16. How likely are you (on a scale from 0% to 100%) to accept this amount to give up your shark permit only? * Please circle this %	$ VALUE1 0% 25% 50% 75% 100%
17. How likely are you (on a scale from 0% to 100%) to accept this amount to give up your shark permit, all other permits, and the vessel? *****	$ VALUE2 0% 25% 50% 75% 100%

**** These responses do NOT guarantee and/or commit you in any way if a buyback program is to occur and they will not be associated with you personally; they will be used only by us (not NMFS or FWC) and analyzed statistically with all other responses.***

Please answer the following questions about the permit owner.

18. In what year were you born? _________

19. In what year did you begin fishing commercially (for any species)? _______

20. How many years have you fished commercially for shark? _______ years

21. Do you use a personal computer for your fishing business? Yes No

22. Do you have health insurance for yourself? Yes No For your family? Yes No

23. How would you characterize your general health?
    a. Excellent b. Very good c. Good d. Not very good e. Poor

24. What is your marital status?
    a. Never married b. Married c. Co-habitate d. Separated e. Widowed f. Divorced

25. What is the highest degree you have received?
    a. None b. High school c. Associates d. Bachelors (of Arts or Science) f. Graduate

To help us determine impacts on your <u>community</u> that could result from a buyback, please answer the following questions about your household.

26. What is your current housing arrangement?
    a. I own a home, apartment or condominium (with or without a mortgage).
    b. I rent a home, apartment or condominium
    c. Other.

27. How many are in your household, including yourself? ____ adults (over 18 yrs)
    ____ children (0-17 yrs)

28. Which category best reflects the taxable income from all members of your household (both fishing and non-fishing sources) in 2004? Please check the box before the category.

	Less than $50,000
	$ 50,000 to $ 99,999
	$100,000 to $149,999

	$150,000 to $199,999
	$200,000 to $499,999
	$500,000 or greater

29. About what percentage of that income is derived from commercial fishing? ____%
    What fishing activities are you involved in? a. harvest b. wholesale c. retail

30. How many paying jobs generated that income: ____ full-time ____ part-time

Please enclose your completed questionnaire in the self-addressed, pre-paid return envelope and <u>mail immediately</u> (remember to tear off and keep your cover letter).

APPENDIX C: REVENUE COMPOSITION BY INCOME GROUP, SPECIES, AND SHARK PERMIT TYPE

Table C-1a. Species composition of revenue by shark permit type for group 1 revenue level $1 million to $1.6 million (V = 11 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	945,376	945,376	0.0%	10.6%
Angler	41,553	126,697	0.0%	1.4%
Bluefin	1,960	41,553	1.6%	0.5%
Bluefish	3,687	1,960	0.0%	0.0%
BSBass	9,322	3,687	0.0%	0.0%
Croaker	82,120	9,322	0.0%	0.1%
Dolphin	176,959	82,120	1.0%	0.9%
Flounder	484,142	484,142	0.0%	5.4%
Grouper	0	0	0.0%	0.0%
Haddock	1,029,837	176,959	0.0%	2.0%
Hake	1,272,309	1,029,837	0.0%	11.6%
Herring	749	1,272,309	0.0%	14.3%
KMackerel	30,897	749	0.0%	0.0%
Lobster	7,008	30,897	0.0%	0.3%
Other	223,091	223,091	0.2%	2.5%
Pollock	0	7,008	0.0%	0.1%
RedCrab	721,506	0	0.0%	0.0%
Scallop	1,251,587	721,506	0.0%	8.1%
Shark	0	14,921	0.5%	0.2%
SMackerel	9,331	0	0.0%	0.0%
Snapper	14,921	0	0.0%	0.0%
Squid	0	1,251,587	0.0%	14.0%
Swordfish	2,201,179	2,201,179	72.7%	24.7%
Tilefish	126,697	9,331	0.0%	0.1%
Tuna	275,948	275,948	23.8%	3.1%
Total Revenue	*8,910,180*	*8,910,180*	*100.0%*	*100.0%*

Table C-1b. Composition of total revenue by key species for group 1 revenue level $1 million to $1.6 million (N = 11 vessels)

Fishery	Directed	Incidental
All other	2.9%	72.0%
Grouper	0.0%	0.0%
Shark	0.5%	0.2%
Snapper	0.0%	0.0%
Swordfish	72.7%	24.7%
Tuna	23.8%	3.1%
Total Revenue	*100.0%*	*100.0%*

Table C-2a. Species composition of revenue by shark permit type for group 2 revenue level $750,000 to $999,999 (N = 9 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	534	477,493	0.0%	9.9%
Angler	212,809	66,772	8.4%	1.4%
Bluefin	34,284	1,725	1.4%	0.0%
Bluefish	0	3,407	0.0%	0.1%
BSBass	0	108,803	0.0%	2.3%
Croaker	0	320,703	0.0%	6.7%
Dolphin	6,260	6,005	0.2%	0.1%
Flounder	410	608,659	0.0%	12.7%
Grouper	0	0	0.0%	0.0%
Haddock	0	173,977	0.0%	3.6%
Hake	49	25,729	0.0%	0.5%
Herring	0	108,842	0.0%	2.3%
KMackerel	0	0	0.0%	0.0%
Lobster	0	22,393	0.0%	0.5%
Other	3,980	295,272	0.2%	6.1%
Pollock	0	2,800	0.0%	0.1%
RedCrab	0	0	0.0%	0.0%
Scallop	0	1,223,896	0.0%	25.5%
Shark	14,934	2,976	0.6%	0.1%
SMackerel	0	0	0.0%	0.0%
Snapper	0	0	0.0%	0.0%
Squid	0	584,705	0.0%	12.2%
Swordfish	2,048,893	130,993	81.3%	2.7%
Tilefish	41,454	505,149	1.6%	10.5%
Tuna	157,710	132,905	6.3%	2.8%
Total Revenue	*2,521,317*	*4,803,204*	*100.0%*	*100.0%*

Table C-2b. Composition of total revenue by key species for group 2 revenue level $750,000 to $999,999 (N= 9 vessels)

Fishery	Directed	Incidental
All other	11.9%	94.4%
Grouper	0.0%	0.0%
Shark	0.6%	0.1%
Snapper	0.0%	0.0%
Swordfish	81.3%	2.7%
Tuna	6.3%	2.8%
Total revenue	*100.0%*	*100.0%*

Table C-3a. Species composition of revenue by shark permit type for group 3 revenue level $500,000 to $749,000 (N = 23 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	451	538,368	0.0%	8.0%
Angler	204,293	315,223	2.7%	4.7%
Bluefin	57,158	20,975	0.7%	0.3%
Bluefish	74	2,553	0.0%	0.0%
BSBass	304	6,434	0.0%	0.1%
Croaker	0	0	0.0%	0.0%
Dolphin	322,485	76,708	4.2%	1.1%
Flounder	644	1,460,372	0.0%	21.7%
Grouper	787,882	348,752	10.3%	5.2%
Haddock	0	440,691	0.0%	6.6%
Hake	1,367	269,051	0.0%	4.0%
Herring	0	0	0.0%	0.0%
KMackerel	0	0	0.0%	0.0%
Lobster	0	75,207	0.0%	1.1%
Other	37,781	452,205	0.5%	6.7%
Pollock	0	89,438	0.0%	1.3%
RedCrab	646,978	646,978	8.4%	9.6%
Scallop	0	2,696	0.0%	0.0%
Shark	348,686	19,468	4.5%	0.3%
SMackerel	0	0	0.0%	0.0%
Snapper	219,527	158,993	2.9%	2.4%
Squid	343	597,456	0.0%	8.9%
Swordfish	2,887,368	823,066	37.6%	12.2%
Tilefish	1,055,089	65,260	13.8%	1.0%
Tuna	1,099,726	314,690	14.3%	4.7%
Total Revenue	*7,670,156*	*6,724,585*	*100.0%*	*100.0%*

Table C-3b. Composition of total revenue by key species for group 3 revenue level $500,000 to $749,000 (N = 23 vessels)

Fishery	Directed	Incidental
All Other	30.3%	75.2%
Grouper	10.3%	5.2%
Shark	4.5%	0.3%
Snapper	2.9%	2.4%
Swordfish	37.6%	12.2%
Tuna	14.3%	4.7%
Total Revenue	*100.0%*	*100.0%*

Table C-4a. Species composition of revenue by shark permit type for group 4 revenue level $250,000 to $499,000 (N = 68 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	0	49,485	0.0%	0.3%
Angler	120,614	465,272	2.3%	2.8%
Bluefin	36,363	297,108	0.7%	1.8%
Bluefish	19	63,821	0.0%	0.4%
BSBass	4	72,427	0.0%	0.4%
Croaker	106	148,975	0.0%	0.9%
Dolphin	221,007	154,191	4.3%	0.9%
Flounder	327	1,033,809	0.0%	6.3%
Grouper	1,748,111	748,968	33.7%	4.5%
Haddock	0	89,985	0.0%	0.5%
Hake	200.	273,829	0.0%	1.7%
Herring	0	94	0.0%	0.0%
KMackerel	15,371	33,940	0.3%	0.2%
Lobster	0	70,837	0.0%	0.4%
Other	72,815	877,035	1.4%	5.3%
Pollock	0	153,194	0.0%	0.9%
RedCrab	0	0	0.0%	0.0%
Scallop	0	61,803	0.0%	0.4%
Shark	202,370	57,667	3.9%	0.3%
SMackerel	0	15,465	0.0%	0.1%
Snapper	713,621	850,221	13.8%	5.1%
Squid	12	480,694	0.0%	2.9%
Swordfish	1,143,648	2,595,245	22.0%	15.7%
Tilefish	206,681	69,861	4.0%	0.4%
Tuna	708,677	7,856,914	13.7%	47.6%
Total Revenue	*5,189,947*	*16,520,840*	*100.0%*	*100.0%*

Table C-4b. Composition of total revenue by key species for group 4 revenue level $250,000 to $499,000 (N = 68 vessels)

Fishery	Directed	Incidental
All other	13.0%	26.7%
Grouper	33.7%	4.5%
Shark	3.9%	0.3%
Snapper	13.8%	5.1%
Swordfish	22.0%	15.7%
Tuna	13.7%	47.6%
Total Revenue	*100.0%*	*100.0%*

Table C-5a. Species composition of revenue by shark permit type for group 5 revenue level $150,000 to $249,999 (N = 82 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	0	49,485	0.2%	0.0%
Angler	120,614	465,272	11.1%	6.7%
Bluefin	36,363	297,108	0.1%	0.9%
Bluefish	19	63,821	3.5%	0.4%
BSBass	4	72,427	0.0%	1.5%
Croaker	106	148,975	1.3%	0.6%
Dolphin	221,007	154,191	0.7%	1.0%
Flounder	327	1,033,809	2.8%	3.1%
Grouper	1,748,111	748,968	31.3%	21.0%
Haddock	0	89,985	0.6%	0.1%
Hake	200	273,829	2.6%	0.4%
Herring	0	94	0.0%	0.0%
KMackerel	15,371	33,940	0.6%	0.6%
Lobster	0	70,837	0.0%	0.9%
Other	72,815	877,035	3.7%	5.1%
Pollock	0	153,194	0.7%	0.8%
RedCrab	0	0	0.0%	0.0%
Scallop	0	61,803	7.5%	1.2%
Shark	202,370	57,667	8.1%	0.7%
SMackerel	0	15,465	0.6%	0.0%
Snapper	713,621	850,221	4.9%	11.6%
Squid	12	480,694	0.0%	1.4%
Swordfish	1,143,648	2,595,245	5.5%	14.8%
Tilefish	206,681	69,861	2.4%	1.4%
Tuna	708,677	7,856,914	11.8%	25.7%
Total Revenue	*5,189,947*	*16,520,840*	*100.0%*	*100.0%*

Table C-5b. Composition of total revenue by key species for group 5 revenue level $150,000 to $249,999 (N = 82 vessels)

Fishery	Directed	Incidental
All Other	38.4%	26.1%
Grouper	31.3%	21.0%
Shark	8.1%	0.7%
Snapper	4.9%	11.6%
Swordfish	5.5%	14.8%
Tuna	11.8%	25.7%
Total Revenue	*100.0%*	*100.0%*

Table C-6a. Species composition of revenue by shark permit type for group 6 revenue level $75,000 to $149,999 (N = 74 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	1,785	102	0.0%	0.0%
Angler	361,864	217,199	8.0%	6.0%
Bluefin	2,767	8,676	0.1%	0.2%
Bluefish	69,020	2,701	1.5%	0.1%
BSBass	44,414	208,222	1.0%	5.7%
Croaker	67,526	38,311	1.5%	1.1%
Dolphin	31,853	41,779	0.7%	1.2%
Flounder	10,067	2,855	0.2%	0.1%
Grouper	1,761,185	1,317,497	38.7%	36.3%
Haddock	0	117	0.0%	0.0%
Hake	1,059	4,467	0.0%	0.1%
Herring	343	61	0.0%	0.0%
KMackerel	362,811	106,454	8.0%	2.9%
Lobster	26,902	19,967	0.6%	0.6%
Other	160,460	269,714	3.5%	7.4%
Pollock	0	5,399	0.0%	0.1%
RedCrab	0	0	0.0%	0.0%
Scallop	218,662	31,527	4.8%	0.9%
Shark	659,060	76,796	14.5%	2.1%
SMackerel	42,724	28,243	0.9%	0.8%
Snapper	201,477	489,440	4.4%	13.5%
Squid	0	0	0.0%	0.0%
Swordfish	312,055	125,687	6.9%	3.5%
Tilefish	99,354	111,085	2.2%	3.1%
Tuna	114,949	523,402	2.5%	14.4%
Total Revenue	*4,550,336*	*3,629,700*	*100.0%*	*100.0%*

Table C-6b. Species share of total revenue by key species for group 6 revenue level $75,000 to $149,999 (N = 74 vessels)

Fishery	Directed	Incidental
All Other	33.0%	30.2%
Grouper	38.7%	36.3%
Shark	14.5%	2.1%
Snapper	4.4%	13.5%
Swordfish	6.9%	3.5%
Tuna	2.5%	14.4%
Total Revenue	*100.0%*	*100.0%*

Table C-7a. Species composition of revenue by shark permit type for group 7 revenue level $25,000 to $74, 999 (N = 82 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	1,888	260	0.1%	0.0%
Angler	24,535	31,229	1.3%	1.5%
Bluefin	0	0	0.0%	0.0%
Bluefish	4,835	22,689	0.3%	1.1%
BSBass	28,515	137,995	1.5%	6.5%
Croaker	1,913	14,684	0.1%	0.7%
Dolphin	9,562	6,046	0.5%	0.3%
Flounder	160	22,179	0.0%	1.0%
Grouper	512,330	482,470	27.2%	22.7%
Haddock	0	1,623	0.0%	0.1%
Hake	593	12,959	0.0%	0.6%
Herring	0	9,817	0.0%	0.5%
KMackerel	121,173	175,239	6.4%	8.3%
Lobster	0	52,889	0.0%	2.5%
Other	118,610	251,550	6.3%	11.9%
Pollock	0	20,499	0.0%	1.0%
RedCrab	0	0	0.0%	0.0%
Scallop	31,764	116,144	1.7%	5.5%
Shark	578,883	4,491	30.7%	0.2%
SMackerel	107,273	187,061	5.7%	8.8%
Snapper	53,411	278,838	2.8%	13.1%
Squid	0	84	0.0%	0.0%
Swordfish	42,949	126,296	2.3%	5.9%
Tilefish	228,683	24,038	12.1%	1.1%
Tuna	18,777	143,627	1.0%	6.8%
Total Revenue	*1,885,854*	*2,122,707*	*100.0%*	*100.0%*

Table C-7b. Composition of total revenue by key species for group 7 revenue level $25,000 to $74, 999 (N = 82 vessels)

Fishery	Directed	Incidental
All Other	36.0%	51.2%
Grouper	27.2%	22.7%
Shark	30.7%	0.2%
Snapper	2.8%	13.1%
Swordfish	2.3%	5.9%
Tuna	1.0%	6.8%
Total Revenue	*100.0%*	*100.0%*

Table C-8a. Species composition of revenue by shark permit type for group 8 revenue level $5,000 to $24,999 (N = 66 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	6	0	0.0%	0.0%
Angler	1,990	0	0.5%	0.0%
Bluefin	0	0	0.0%	0.0%
Bluefish	5,640	54	1.4%	0.0%
BSBass	53	25,149	0.0%	5.7%
Croaker	13,219	9	3.3%	0.0%
Dolphin	3,095	2,461	0.8%	0.6%
Flounder	377	12	0.1%	0.0%
Grouper	19,592	157,092	4.9%	35.3%
Haddock	0	0	0.0%	0.0%
Hake	11	2	0.0%	0.0%
Herring	18	0	0.0%	0.0%
KMackerel	71,893	45,303	17.9%	10.2%
Lobster	0	1,796	0.0%	0.4%
Other	36,820	46,068	9.2%	10.4%
Pollock	0	0	0.0%	0.0%
RedCrab	0	0	0.0%	0.0%
Scallop	1,546	0	0.4%	0.0%
Shark	151,441	37,689	37.8%	8.5%
SMackerel	47,757	17,570	11.9%	3.9%
Snapper	35,493	91,408	8.9%	20.5%
Squid	0	0	0.0%	0.0%
Swordfish	482	10,673	0.1%	2.4%
Tilefish	14	41	0.0%	0.0%
Tuna	11,156	9,640	2.8%	2.2%
Total Revenue	*400,603*	*444,967*	*100.0%*	*100.0%*

Table C-8b. Composition of total revenue by key species for group 8 revenue level $5,000 to $24,999 (N = 66 vessels)

Fishery	Directed	Incidental
All Other	45.5%	31.1%
Grouper	4.9%	35.3%
Shark	37.8%	8.5%
Snapper	8.9%	20.5%
Swordfish	0.1%	2.4%
Tuna	2.8%	2.2%
Total Revenue	*100.0%*	*100.0%*

Table C-9a. Species composition of revenue by shark permit type for group 9 revenue level $1 to $4,999 (N = 59 vessels)

Fishery	Directed $	Incidental $	Directed %	Incidental %
AMackerel	0	303	0.0%	0.3%
Angler	0	675	0.0%	0.7%
Bluefin	0	0	0.0%	0.0%
Bluefish	730	1,122	2.1%	1.2%
BSBass	2,549	7,581	7.3%	8.2%
Croaker	0	0	0.0%	0.0%
Dolphin	87	2,783	0.2%	3.0%
Flounder	190	2,282	0.5%	2.5%
Grouper	3,807	14,446	10.9%	15.6%
Haddock	0	0	0.0%	0.0%
Hake	0	0	0.0%	0.0%
Herring	0	0	0.0%	0.0%
KMackerel	4,812	6,907	13.7%	7.5%
Lobster	0	55	0.0%	0.1%
Other	2,196	13,061	6.3%	14.1%
Pollock	0	0	0.0%	0.0%
RedCrab	0	0	0.0%	0.0%
Scallop	0	0	0.0%	0.0%
Shark	12,061	7,416	34.4%	8.0%
SMackerel	7,099	12,985	20.3%	14.0%
Snapper	4	17,459	0.0%	18.9%
Squid	0	0	0.0%	0.0%
Swordfish	0	3,075	0.0%	3.3%
Tilefish	1,473	1	4.2%	0.0%
Tuna	47	2,379	0.1%	2.6%
Total Revenue	*35,055*	*92,530*	*100.0%*	*100.0%*

Table C-9b. Composition of total revenue by key species for group 9 revenue level $1 to $4,999 (N = 59 vessels)

Fishery	Directed	Incidental
All Other	54.6%	51.6%
Grouper	10.9%	15.6%
Shark	34.4%	8.0%
Snapper	0.0%	18.9%
Swordfish	0.0%	3.3%
Tuna	0.1%	2.6%
Total Revenue	*100.0%*	*100.0%*

Appendix C

Socio-Economic and Community Profile for Atlantic and Gulf of Mexico Shark Buyout Program

Final Report

Socio-economic and Community Profile for Atlantic and Gulf of Mexico Shark Buyout Program

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Abstract

The report offers a socio-economic profile of the Gulf and South Atlantic shark fishery and selected communities. Through the use of secondary data, e.g., permit data, landings information and census data, baseline profiles are used to assess the context for considering a buyout of the shark fishing industry. In addition, primary data about the present day industry are collected through a mail survey and analyzed to understand vessel owners concerns over a proposed buyout. Although permitted vessels are scattered throughout both the Gulf and Atlantic coasts, most landings are found in Florida. Permitted vessels are found concentrated in only a few communities on either coasts. Using an index of vulnerability comprised of various measure of socio-economic well-being, selected communities are rated in terms of their ability to withstand adverse impacts from a buyout using a scale of vulnerability. Most of the selected communities would be considered vulnerable to adverse impacts that might accrue from a buyout. Furthermore, the majority of shark vessel owners surveyed were in support of a buyout, but were unwilling to pay a tax to fund such a program. Because the revenues from the shark fishery are low there is little opportunity to buy many vessels and therefore would have little impact on reducing capacity. Although there is support for a buyout of permits and vessels, some alternative source of funding would be needed to implement the desired impact of reducing over-capacity within the fishery.

Executive Summary

The report consists of a socio-economic profile of the Gulf and South Atlantic shark fishery and selected communities. Using both primary data, through a mail survey, and secondary data, e.g., permit data, landings information and census data, baseline profiles of both the industry and selected communities are used to determine the context for considering a buyout of the shark fishing industry.

Using an index of vulnerability comprised of various measure of socio-economic well-being, selected communities are rated in terms of their ability to withstand adverse impacts from a buyout using a scale of vulnerability. Most of the selected communities would be considered vulnerable to adverse impacts that might accrue from a buyout. However, it is recommended that other measures of social impact assessment be used to understand how communities will be affected if a proposed buyout were to be implemented.

Primary data were collected through a mail survey of vessel owners in 2004. These data were analyzed to understand concerns over a proposed buyout. Although permitted vessels are scattered throughout both the Gulf and Atlantic coasts, most landings are found in Florida. Permitted vessels are found in concentrated numbers in only a few communities on either coast. The response rate to the survey was over 50% and the geographic distribution of responses was closely aligned to the actual distribution of vessel owners overall.

In terms of their demographic profile, respondents to the survey were on average around 50 years old and most had fished commercially for a good part of their adult lives with an average of 28 years. Of those that fish shark routinely, they have done so on average for about 16 years. The majority of respondents had a high school degree or greater in terms of their education level. Almost 75 % of respondents were married and most were likely to have households with dependents. With regard to ownership of their homes, nearly 85% of those who answered this question owned their homes and about 10% rent. Just over 72% of respondents had health insurance for themselves and slightly less had health insurance for their family. With regard to opinions toward different management, the majority of respondents did not support revoking unused permits. This may reflect the large number of individuals who do not have shark landings. Over 70% support either buying back permits or both permits and vessels and approximately that same percentage do not want to see existing regulations tightened.

The majority of shark vessel owners surveyed were in support of a buyout, but indicated they were unwilling to pay a tax to fund such a program. Because the revenues from the shark fishery are relatively low there would be little money to buy vessels and therefore would have little impact on reducing capacity. Although there is support for a buyout of permits and vessels, some alternative source of funding would be needed to have the desired impact of reducing over-capacity within the fishery if it were based solely on shark revenues.

Table of Contents

1.0 Purpose and Introduction

This report is segmented into three primary sections: first a general introduction describing the shark fishery; second, profiles of selected communities identified as having substantial fishing activity in the shark fishery; and third, an analysis of a survey conducted with shark permit holders. For more indepth discussion of survey methodology see the report by Larkin et al. (2005) included in this business plan.

Commercial shark fishing effort is generally concentrated in the southeastern United States and Gulf of Mexico with approximately 84-91 percent of Large Coastal Shark (LCS), 56-64 percent of pelagic sharks, and nearly all of Small Coastal Shark (SCS) landings from the southeast region (HMS 2004). In their 1997 survey of shark fishery participants, McHugh and Murray found the largest concentration of bottom longline fishing vessels along the central Gulf coast of Florida, with Madeira Beach area considered the center of directed shark fishing activities (HMS 2004). The primary gears that are employed in the South Atlantic and Gulf of Mexico directed LCS and SCS fisheries are bottom longline, gillnet and pelagic longline. Although many HMS vessels migrate from home ports to other fishing areas as seasons change and fish stocks move, it seems that bottom longline vessels are not as migratory as pelagic longline vessels (HMS 2004).

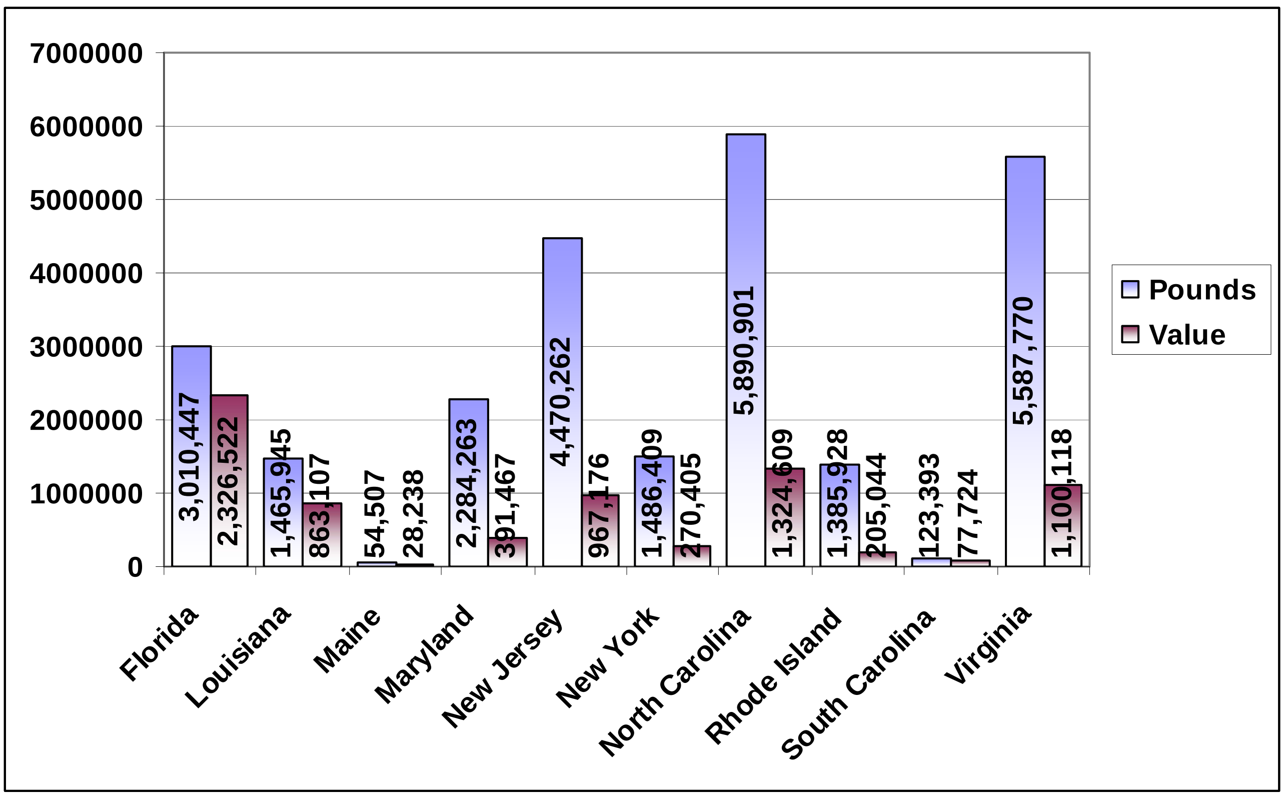

Figure 1.1. Shark Landings and Dollar Value by State for 1999. (Source NMFS 2005)

Although the shark fishery of the Atlantic and Gulf coasts covers a wide geographic area, from Maine to Texas, including Puerto Rico and the U.S. Virgin Islands, it is concentrated primarily in the waters off three states: Florida which lands somewhere near 50 percent of landings annually by weight; and Louisiana and North Carolina which both landed over 16 percent of the catch in 2001. Four other states, Virginia, New Jersey, South Carolina and Mississippi contributed a further combined 13 percent in 2001. The remaining fourteen states contributed less than 2% percent of the landings with none reporting over 30,000 pounds (HMS 2004). With over 60% of the fleet holding incidental shark permits, it is clear that most permitted vessels target shark on a supplementary basis and not as part of their annual fishing round. Even those with directed permits fish shark on a seasonal basis and spend a significant part of their fishing year targeting other species (HMS 2004).

Landings have shifted over the years (1999-2003) with changes in regulation and other factors, with states like New Jersey, Virginia and North Carolina having reduced landings, while other states in the southeast have relatively comparable landings between the two time periods as seen in Figures 1.1 and 1.2.

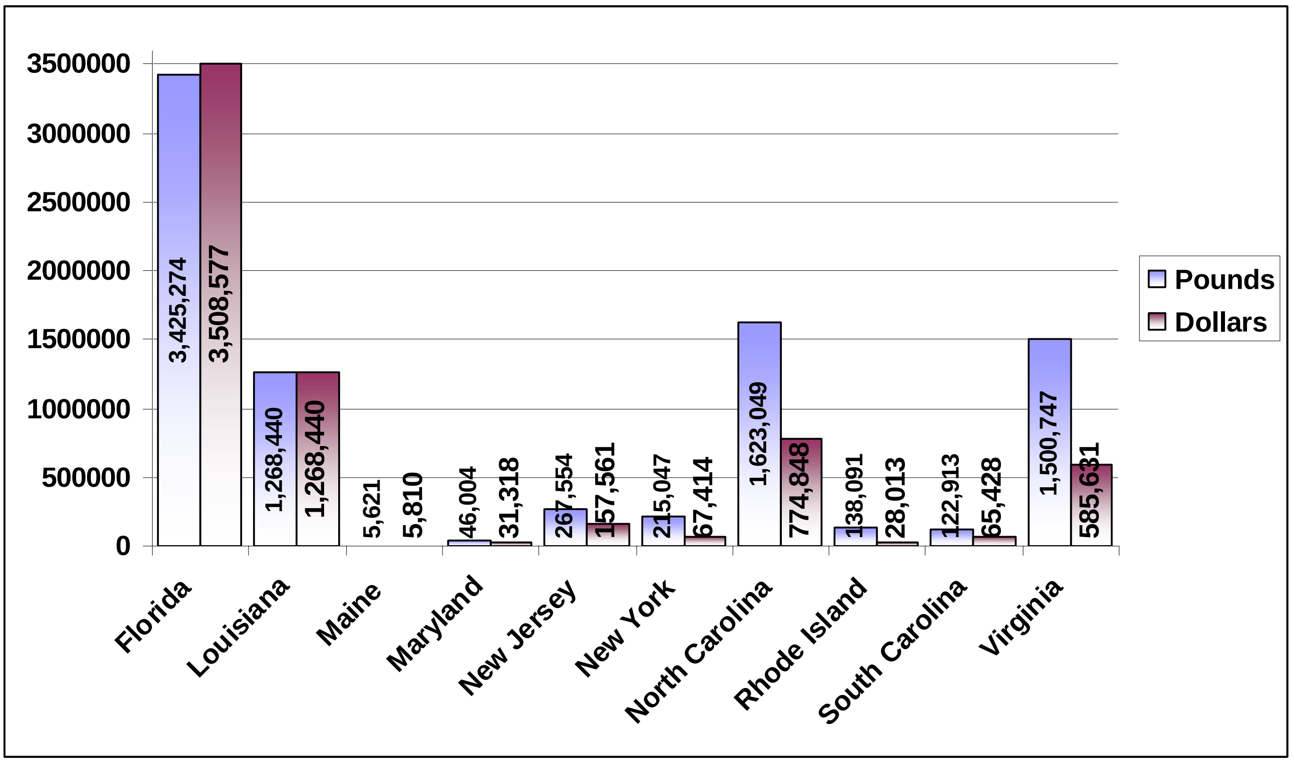

Figure 1.2. Shark Landings and Dollar Value by State for 2003. (Source: NMFS 2005)

As stated earlier, the majority of vessels with shark permits have incidental permits, which means that most fish other species which are likely more important economically to the fishing operation. Table 1.1 indicates that vessels with HMS permits often have numerous other permits and these do not include permits offered by regional offices of the NMFS. Even for many vessels with directed permits, it has been suggested that shark is most likely a seasonal catch and part of an annual species mix that includes reef fish and coastal pelagics along with others. Florida leads all states with the most shark permits, both directed and incidental. Louisiana is next, followed by New Jersey and North Carolina.

Shark fishermen can be very mobile as mentioned earlier, as many fishermen in the Northeast and the Western Gulf will travel to Florida as part of their annual fishing round. Permit holders listed addresses as far away as California and Indiana.

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Table 1.1. Federal HMS Permits by State and Total Type of Permit as of October 2003. (Source: HMS/NMFS)

State	Number Directed Swordfish	Number Incidental Swordfish	Number Swordfish Handgear	Number Directed Shark	Number Incidental Shark	Number Tuna Longline	Number Permit Holders/#Permits
ME	1	1	6	1	5	1	12/15
NH	-	-	1	1	2	-	4/4
MA	11	3	19	3	14	8	35/58
RI	6	3	25	1	12	6	34/53
CT	-	-	1	-	1	-	2/2
NY	16	5	10	9	13	17	31/70
NJ	35	14	10	31	30	37	69/157
DE	1	-	-	1	1	2	2/5
MD	8	1	-	4	8	8	12/29
VA	1	5	-	5	3	3	8/17
NC	8	11	3	22	19	10	43/73
SC	4	1	-	8	14	5	22/32
GA	1	-	-	3	3	1	6/8
FL	71	34	20	152	159	81	329/517
AL	1	2	-	3	2	2	6/10
MS	-	2	-	0	8	1	8/11
LA	33	9	-	4	45	43	51/134
TX	5	8	-	3	16	9	19/41
CA	2	-	-	-	2	1	2/5
IN	1	-	-	-	1	-	1/2
VI	1	-	-	-	1	-	1/2
October 2003	206	99	95	251	359	235	696/1,245
October 2002	205	110	94	251	376	226	713/1,262
October 2001	208	112	100	252	390	213	752/1,275
October 2000	240	203	125	287	585	292	982/1,732
December 1999	243	208	114	279	599	451	976/1,892

Florida also leads in the number of shark dealer permits which is no surprise, with Massachusetts next followed by North Carolina, Louisiana and South Carolina respectively. As stated in Amendment 1 (HMS 2004) many shark dealers are licensed in more than one state and therefore the total number of dealer permits may not represent an accurate count of dealers overall, with that number being far less than the total number of dealer permits reported for the various years. It should also be mentioned that many dealers buy shark through incidental permit holders and may deal in very small amounts of shark throughout the year, therefore, shark may be only a small portion of their annual sales and receipts.

Table 1.2 Number of Dealer Permits Issued in each State as of December 2003. (Source: HMS/NMFS)

State	Atlantic tunas	Atlantic swordfish	Atlantic sharks	# of permits
AL	1	2	4	7
CA	36	29	8	73
CT	5	-	-	5
DE	4	1	-	5
FL	22	107	96	225
GA	1	2	1	4
GU	1	-	-	1
HI	6	10	5	21
IL	-	-	-	0
KY	-	-	-	0
LA	18	16	17	51
MA	114	34	22	170
MD	10	4	4	18
ME	38	4	3	45
MO	-	-	1	1
MS	-	-	2	2
NC	43	13	18	74
NH	6	-	-	6
NJ	40	12	11	63
NY	72	29	14	115
OR	1	-	-	1
OH	-	1	1	2
PA	2	3	1	6
PR	4	-	-	4
RI	39	11	9	59
SC	13	11	18	42
TX	3	6	7	16
VA	26	5	6	37
VI	10	1	1	12
WA	1	7	1	9
Canada	-	7	2	9
Chile	-	1	1	2
Zealand	-	1	-	1
Uruguay	-	1	-	1
Ecuador	-	1	1	2
Nova Scotia	-	6	3	9
December 2003	**516**	**319**	**254**	**1,089**
October 2002	**479**	**321**	**267**	**1,067**
October 2001	**522**	**302**	**249**	**1,073**
October 2000	**544**	**312**	**251**	**1,107**

Figures 1.3 and 1.4 depict the concentration of directed and incidental permits along the Atlantic and Gulf coasts. Florida, as expected shows the largest concentration of both, with North Carolina and New Jersey having the next largest concentration of directed permits. Incidental permits are spread out among several Gulf and Atlantic States with less concentration in a few states than directed permits.

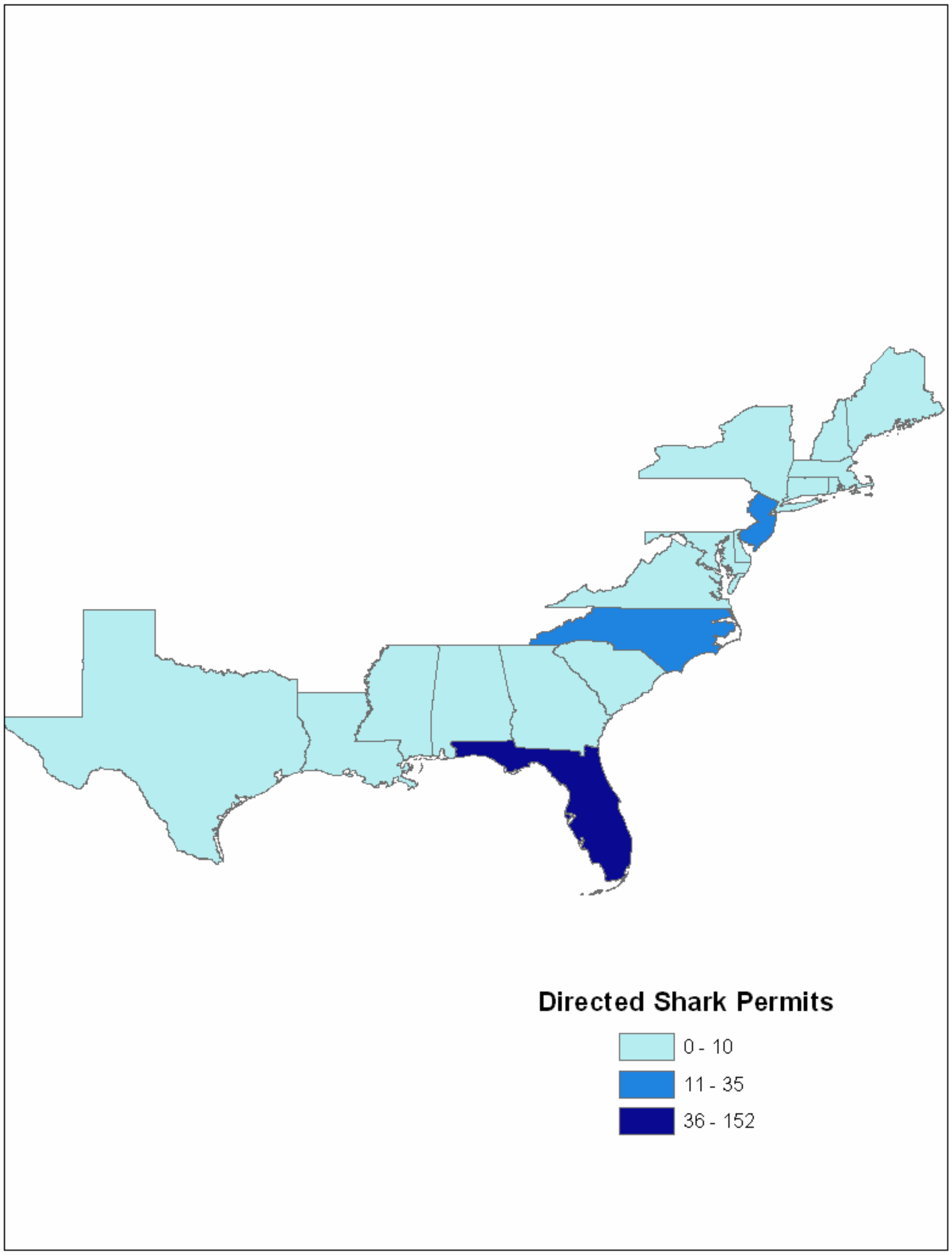

Figure 1.3. Total Number of Directed Shark Permits by State. (Source HMS/NMFS)

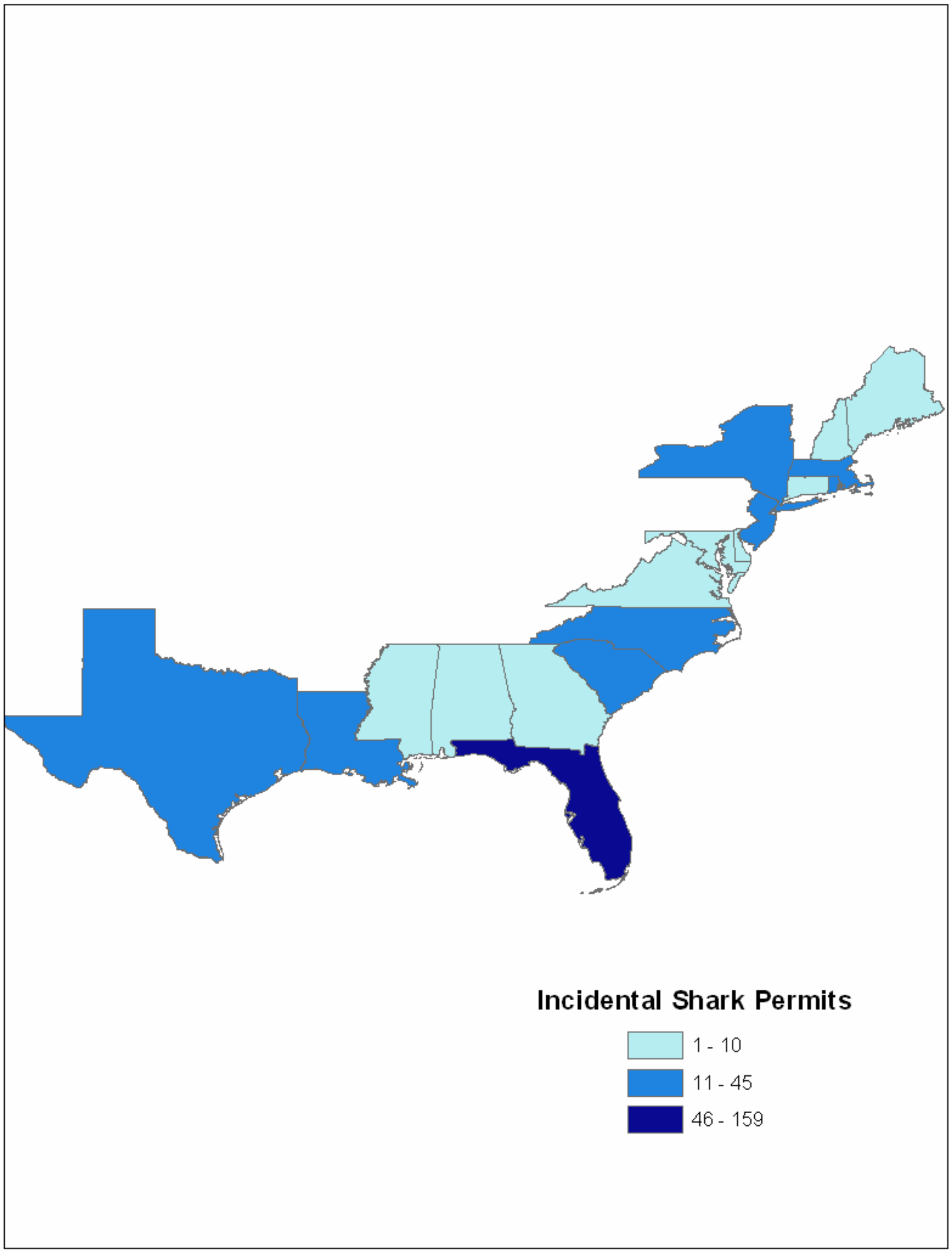

Figure 1.4. Total Number of Incidental Shark Permits by State. (Source HMS/NMFS)

1.1 Approach

The principal investigator for this research was Dr. Michael Jepson who is responsible for all data acquisition, analysis and reports. Secondary data were obtained from both the U.S. Census Bureau and National Marine Fisheries Service Southeast Region. Census data for selected communities were obtained from the U.S. Census Bureau American Factfinder website. Data for the years 1990 and 2000 were assembled and placed into tables to comprise a demographic profile of each community. Data were also collected at the county level to use in the creation of a vulnerability index which consisted of select variables for each community compared to the county and then scaled accordingly. Permit data were acquired for the year 2004 from the National Marine Fisheries Service, Southeast Region. Permit data were then assembled into tables by state and for the selected communities. HMS permit data were also acquired from their website to contribute to state profiles.

A mail survey was conducted with a list of 2004 permit owners acquired by Dr. Charles Adams and assembled by Dr. Sherry Larkin. The mail survey was constructed by Drs. Larkin, Jepson, and Adams. Returned surveys were entered into a spreadsheet and the data were distributed to the researchers. Data analysis for this research was primarily descriptive in order to outline concerns of fishermen toward the buyout. Several other questions on the survey provided a profile of the shark fishing industry and are detailed in the report.

Using both secondary and primary data community profiles were created which provided a context for the buyout process. The primary data collected indicated that while there was support for the buyout, there was little support for a tax to fund the buyout. The vulnerability index indicated that most of the communities profiled were vulnerable to adverse impacts as a result of the buyout.

2.0 Findings: Profiles of Communities with Substantial Shark Fishing Activity

The community profiles from the most recent amendment to the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (HMS 2003) was used as a basis for selecting communities here, although other communities were added based upon assessment by those knowledgeable with the industry at the time of this research. Profiles from documents describing fishing communities previously were reviewed for communities located in the Mid-Atlantic (McCay and Cieri, 2000) and from research conducted previously on HMS vessels (Wilson and McCay, 1998).

The profiles described here expand on previous descriptions to include data that were considered important social indicators and have been updated with the most recent census data. Permit data for vessels and dealers were also collected and assembled to profile participation in the industry.

Data at the census designated place level (CDP) are used for describing the demographic character of most communities. Where zip code level data only are available (NAIC employment figures), data are compiled for the all zip codes associated with each CDP. When using census data it is important to understand that certain qualification must be made; certain groups of people who have been difficult to contact are often underreported in census data. Commercial fishermen are part of that group as outlined in recent research by Kitner (2001). For that reason, it must be assumed that census data as it relates to fishing communities is suspect. As was pointed out in earlier research (Jacob et al., 2001) any attempt at quantifying employment or income from commercial or recreational fishing becomes problematic. Data may be suppressed or grossly underreported and therefore any description will miss important economic and social contributions of fishing related businesses.

At the same time, census data is the only demographic data that can be applied over large geographic areas, population ranges and timeframes. It is easily available and represents the most affordable alternative for describing any community at this time. Although these data are problematic, it can only be assumed that any underreporting is consistent across geographic area, population range and time. Although this situation is not ideal, by combining several different data from various sources, a general description of community and the fishing activity associated with it may be attained. Until more detailed ethnographic research that can examine the social and economic networks that exist in fishing communities can be undertaken, this general and often broad description of community will have to suffice.

Employment data collected by the Census Bureau were also used at the zip code level for these community descriptions. These data are taken from the County Business Patterns data that are collected on a different timeframe from the decennial census. Data for this description were collected in 1998 and 2001 representing the most up-to-date at the time. Again, it must be assumed for reasons stated earlier that these data are likely to underreport actual fishing employment. In addition, the category of fishing that is reported in the economic census does not include those individuals who report themselves as self-employed, which most commercial fishermen consider themselves to be. Therefore, employment figures from the Census Bureau again grossly distort the actual employment from commercial and recreational fishing. However, these data do point to employment that is related to both commercial and recreational fishing and give some indication of their importance to the community when compared to the same data for other communities. It must therefore be assumed that employment is being underestimated evenly across communities.

Permit data for vessels and dealers was received from the NMFS SERO office in St. Petersburg and used to calculate the number of vessels with directed and incidental shark permits in July of 2004. The query was to identify active shark permits and produced a total of 590 records. These numbers vary from other datasets used by other contractors involved in the buyout program as the data change according to the date of the inquiry. These were the only permit files used for the community profiles.

Landings data in the form of a table listing total landings by community were provided by Larkin and Adams using the dataset compiled for them by NMFS SERO and is included in Appendix 1. Landings were for the year 2003 and were calculated by using vessel landings for that year and summed using the variable homeport as the community. Homeport was chosen as community because it was assumed that this is where most shark were landed; according to questions in the analysis of the survey this is the case for most permit holders. For those communities with less than 3 vessels, data are withheld due to confidentiality.

A vulnerability index table was created for each community which consists of selected quality of life variables from the census data. Those variables include: percent minority population; percent below poverty level; percent unemployed; percent high school graduate or higher; Median household income (dollars); percent owner-occupied housing units. These variables were compared to the same variables in their respective county for each community. If the percentage (within 0.5% either way) was greater than that for the county, the index scale score was -1, if the percentage was the same the scale score was 0 and if it was lower the scale score was +1 for the variables poverty level, minority population, unemployment. For the other variables the scale was reversed. The total of the scale scores represents the overall index score of vulnerability with a possible range from +6 to -6. Positive scores suggest less vulnerability while negative scores suggest more vulnerability to adverse impacts. A high vulnerability score for a community would indicate that residents may have difficulty adjusting to disruptions in their social or economic stability as their community may be economically depressed or not capable of offering a better quality of life.

2.1 New Jersey

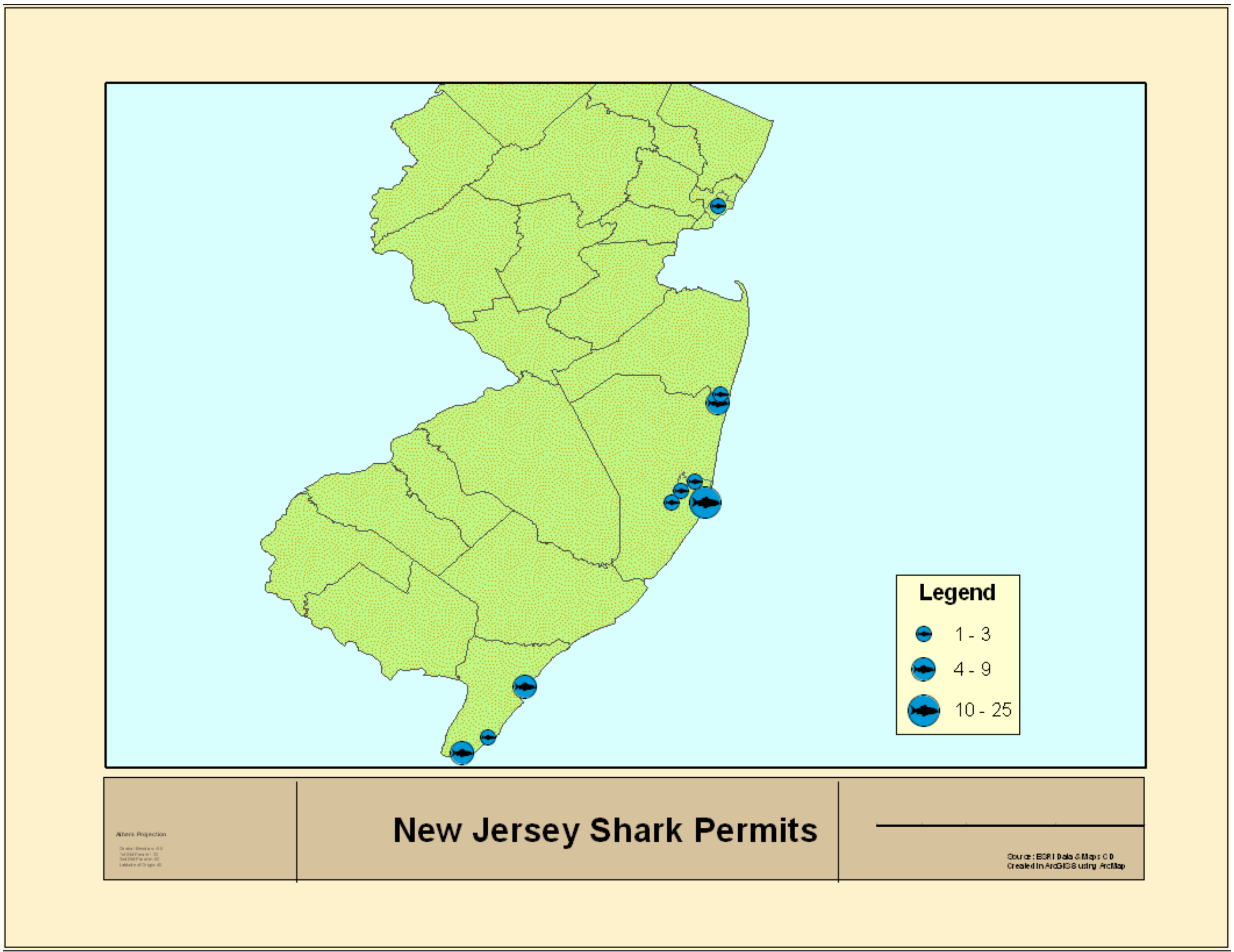

Figure 2.1. New Jersey Shark Permit Holder. (NMFS 2004)

Table 2.1. Number of Directed and Incidedntal Permits for Communities in New Jersey (NMFS 2004)

City	Directed Permits	Incidental Permits
Barnegat	0	1
Barnegat Light	17	8
Bricktown	1	0
Brielle	1	1
Cape May	2	7
Forked River	1	0
Galloway Township	0	1
Jersey City	0	1
Point Pleasant	3	1
Pt Pleasant Beach	0	1
Sea Isle City	2	2
Waretown	1	1
Wildwood	1	1
Total	29	25

New Jersey has a total of 29 directed shark permits and 25 incidental permits with the large majority of permits being held by vessels homeported in Barnegat Light. Cape May has the next largest concentration of shark permits with most of those being incidental harvest permits, whereas most permits in Barnegat Light are directed harvest permits.

2.1.1 Barnegat Light

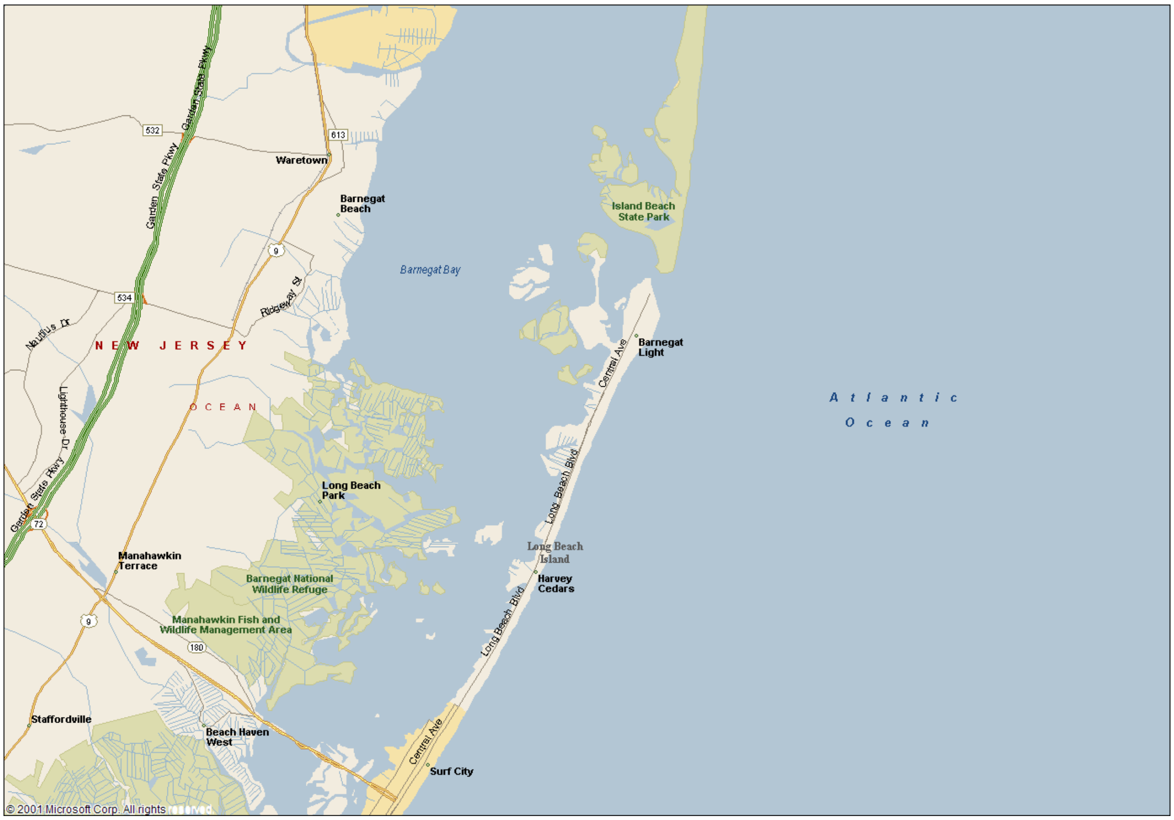

Figure 2.2. The Community of Barnegat Light, New Jersey.

The community of Barnegat Light has been profiled in several documents in the past few years including the most recent amendment to the Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (HMS 2003). Other profiles were included in Wilson and McCay (1998) and McCay and Cieri (2000). The following profile is created using information from all three previous profiles, in addition to census and permit data that has been updated and expanded since the previous profiles were written.

Barnegat Light is an important fishing port in New Jersey as it harbors one of the Northeast's more important long line fleets, in addition to scallop vessels and inshore gill-netters. Recreational and charter boats are also important component of this port (McCay and Cieri, 2000). The community has been an important seaport and fishing village since the 1800s. Today an economic mix of both tourism and fishing continues to exist with an estimate of fishing employment being over 50 percent for those within the civilian labor force (HMS 2003). This estimate is substantially larger than the percentage shown in Table 2.1 as census data often underestimates employment in this sector because most fishermen are self-employed. Furthermore, commercial fishermen are often missed in the census as they are sometimes difficult to locate (Kitner 2001).

There are five marinas in Barnegat Light with the two largest having at least 36 full-time resident commercial boats, roughly 40 recreational and charter boats, and some transient vessels. Commercial fishing boats work out of these docks year round. The three remaining docks can each have room for approximately 30-35 boats, the majority of which are recreational boats and charter/ party boats, with a few headboats. Most of the recreational fishing boats are here for a portion of the year, from May or June through early October (McCay and Cieri, 2000).

Table 2.2. Number of Federal Permits by Type for Barnegat Light, New Jersey Shark Permit Holders (Source: NMFS SERO 2004)

Type of Permit	Number
Total shark permitted vessels	25
Commercial King Mackerel	12
Commercial Spanish Mackerel	11
Commercial Spiny Lobster	0
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	1
Snapper Grouper Class 2	0
Snapper Grouper Trap	1
Swordfish	24
Rock Shrimp	0
Federal Dealers	2

Barnegat Light has 25 permitted shark vessels according to Table 2.2 and all but one of those hold a swordfish permit also (Table does not include NERO or HMS permits). The next most commonly held permit is king mackerel followed by Spanish mackerel, most likely for incidental catch of those coastal pelagics. There are two federally permitted shark dealers in the community. Vessels which indicated Barnegat Light as homeport landed 24,818 lbs of shark in 2003 according to NMFS landings data in Appendix 1. It is likely that many of these vessels migrate south during their annual round and some shark landings may be listed under different homeports.

The long line fishery and scallop are economically the most important fisheries according to McCay and Cieri (2000). There are fishing related businesses in Barnegat Light, according to the zip code business patterns reported in Table 2.3. Most of that employment is in the Fish and Seafood sector with 22 persons employed and another 18 reported as being employed in fishing for 2001. There was a slight increase in employment for the sectors of fishing and marinas from 1998 to 2001 overall.

Table 2.3. Employment in Fishing Related Industry for Barnegat Light, New Jersey (Zip code Business Patterns, U.S. Census Bureau 2004)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	6	18
Seafood Canning	311711	0	0
Seafood Processing	311712	3	3
Boat Building	336612	0	0
Fish and Seafoods	422460	22	22
Fish and Seafood Markets	445220	0	0
Marinas	713930	9	12
Total Fishing Employment		40	55

Barnegat Light saw a slight increase in population from 1990 to 2000. The percent of the population below the poverty line decreased from 7.2 percent in 1990 to 4.7 percent in 2000. The percent of owner occupied housing increased slightly while both the median value of owner occupied housing and median contract rent both increased substantially and well as median household income. All are well above the average for the state. Unemployment rose slightly to 2.7 percent in 2000 which is still well below the state average. According to Wilson and McCay (1998), there is a strong tourist economy during the summer months and many homes in Barnegat Light are seasonally occupied.

Table 2.4 Barnegat Light Vulnerability Scale Score

Index Variable	Ocean County	Barnegat Light	Score
Percent minority population	10.1	2.0	+1
Percent below poverty level	7.0	4.7	+1
Percent unemployed	2.9	2.7	0
Percent high school graduate or higher	83.0	92.0	+1
Median household income (dollars)	46,443	52,361	+1
Percent owner-occupied housing units	83.2	87.9	+1
Total scale score			+5

When compared to rates for the county, Barnegat Light's vulnerability index variables score higher. This high vulnerability scale score suggests that the community is doing better than other parts of the county in terms of its ability to endure displacement or other impacts from the shark fishery buyout and other fishery management. This measure does not assess whether fishermen's households share the same vulnerability level, but only the community as a whole may be better off with a prosperous economy. How that economy is integrated into the fishing enterprise is unknown and vulnerability is a general measure of the community's ability to cope with adverse change.

Table 2. 5 Barnegat Light Census Demographics

Factor	1990	2000
Total population	681	764
Gender Ratio M/F (Percent)	51.1/48.9	50.9/49.1
Age (Percent of total population)		
Under 18 years of age	13.2	14.4
18 to 64 years of age	56.1	46.1
65 years and over	30.7	34.3
Ethnicity or Race (Number)		
White	678	751
Black or African American	3	4
American Indian and Alaskan Native	0	-
Asian	0	2
Native Hawaiian and other Pacific Islander	0	2
Some other race	0	3
Two or more races	-	2
Hispanic or Latino (any race)	6	6
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	4.6	2.0
Percent high school graduate or higher	84.9	92.0
Percent with a Bachelor’s degree or higher	29.9	38.9
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	2.7	7.3
And Percent who speak English less than very well	2.0	1.5
Household income (Median $)	37955	52361
Poverty Status (Percent of population with income below poverty line)	7.2	4.7
Percent female headed household	5.8	3.2
Home Ownership (Percent)		
Owner occupied	82.1	87.9
Renter occupied	17.9	12.1
Value Owner-occupied Housing (Median $)	258900	299400
Monthly Contract Rent (Median $)	550	672
Employment Status (Population 16 yrs and over)		
Percent in the labor force	51.0	46.9
Percent of civilian labor force unemployed	1.0	2.7
Occupation (Percent)		
Management, professional, and related occupations	-	40.8
Service occupations	-	13.0
Sales and office occupations	-	23.3
Farming, fishing, and forestry occupations	10.2	6.5
Construction, extraction, and maintenance occupations	-	11.3
Production, transportation, and material moving occupations	-	5.1
Industry (Percent)		
Agriculture, forestry, fishing and hunting	12.6	8.2
Manufacturing	7.4	4.8
Percent government workers	8.7	17.5
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	6.0	4.2
Percent using public transportation	0	0.0
Mean travel time to work (minutes)	-	34.8
Percent worked outside of county of residence	=	28.7

2.2 North Carolina

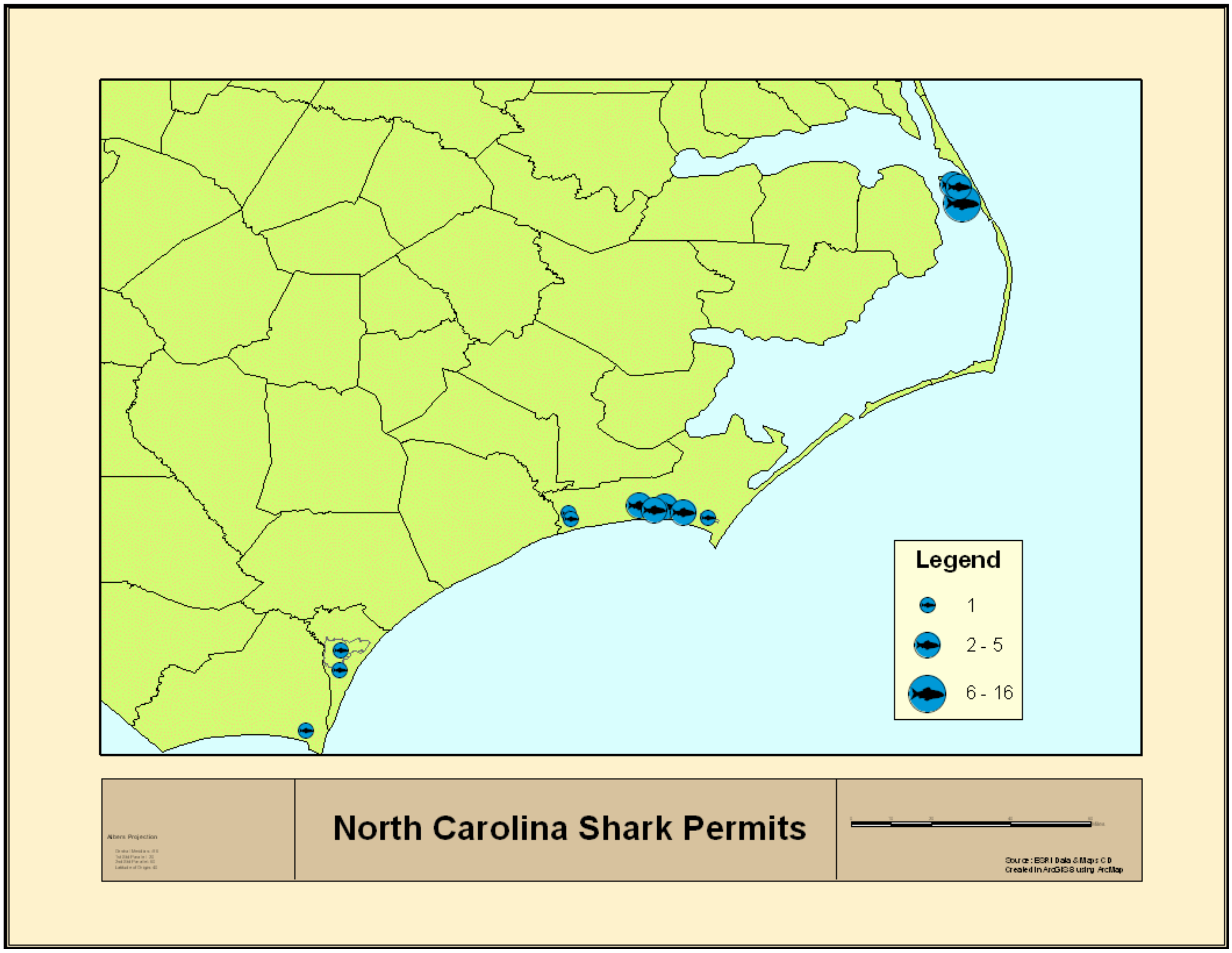

Figure 2.3 North Carolina Shark Permit Holders by City (NMFS 2004)

Table 2.6. Number of Directed and Incidental Permits for Communities in North Carolina (NMFS 2004)

City	Directed Permits	Incidental Permits
Beaufort	0	3
Cape Carteret	0	1
Engelhard	0	1
Harkers Island	0	1
Hatteras	3	1
Manns Harbor	0	1
Manteo	2	1
Morehead City	0	3
Rodanthe	0	1
Southport	0	1
Wanchese	14	2
Wilmington	1	0
Total	20	16

The majority of North Carolina's shark permits are held by vessels homeported in Wanchese, with 14 directed permits and 2 incidental permits. Hatteras is next, but only four vessels hold shark permits with three of them being incidental. The remaining permit holders are either in the Morehead City area or near Wilmington.

2.2.1 Wanchese

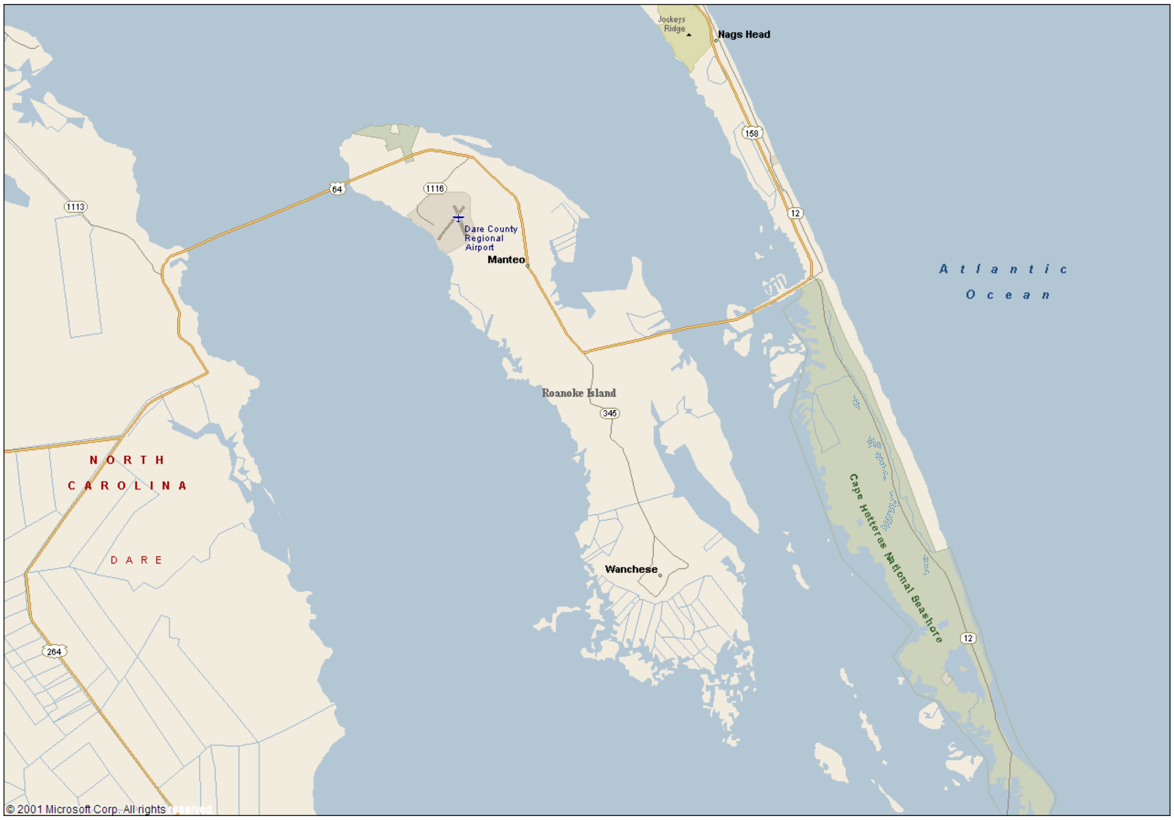

Figure 2.4. The Community of Wanchese, North Carolina

Wanchese is located on the southern part of Roanoke Island, on the northern part of North Carolina's coast. According to Wilson and McCay (1998), commercial fishing is vital to the economy of Wanchese. Unlike the many other coastal communities, Wanchese experiences very little seasonal variation in employment from tourism. The seasonal fluctuations that do exist are due to the availability of fisheries resources. In fact, in 1990 almost twenty percent of the labor force was employed in 'agriculture, forestry and fishing' according to census employment data. That number has dropped significantly in the most recent census (Table 2.9)

Fishing in Wanchese is a more mixed fishery than that in the north, where people can fish the same species year round. Wanchese fishermen fish a large number of commercially important species according to the time of the year. According to Wilson and McCay (1998), fishermen have to be versatile to survive, facing rapid changes in water temperatures and other conditions affecting fish availability. Tunas and swordfish are accessible to medium sized boats that utilize both gillnets and long line in the early to mid-summer. All fishing slows considerably during late summer. One respondent of the Wilson and McCay study said that "he would prefer to stick with shark fishing year round because of the danger of going for tuna and swordfish farther off shore" (1998:91). Fishermen gillnet for dogfish, bluefish, Spanish mackerel, trout, and croakers. Trout and croakers are important in the winter, while Spanish mackerel is important in the spring and fall. The major shark months are April to June, however their quota is in January and July, and so medium sized boats go north to fish for shark (Wilson and McCay, 1998). The larger longliners fish for swordfish, tuna and dolphin. Because of market changes, they fish for swordfish and mainly tuna until the fall. If the shark season were open at that time, they would then fish shark September and October, but they are only allowed to fish during January and July. The shark trip limits have made shark fishing less cost-effective for larger boats, therefore, many go north to fish shark off New York (Wilson and McCay, 1998).

Table 2.7. Federal Permits by Type for Wanchese, North Carolina Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	16
Commercial King Mackerel	10
Commercial Spanish Mackerel	10
Commercial Spiny Lobster	0
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	2
Snapper Grouper Class 1	5
Snapper Grouper Class 2	0
Snapper Grouper Trap	3
Swordfish	13
Rock Shrimp	0
Federal Shark Dealers	3

For most shark permitted vessels, swordfish is also an important fishery as all but 3 hold such permits (Table 2.7). Coastal pelagics are also important as 10 hold permits for both king and Spanish mackerel. There are three federal dealers in Wanches and according to landings data in Appendix 1, vessels homeported in Wanchese landed 29,783 lbs of shark. Fishing related employment is a significant part of the economy for Wanchese as Table 2.8 indicates over 200 individuals employed in some type of fishing related employment and over 100 in boat building.

Table 2.8. Employment in Fishing Related Industry for Wanchese, North Carolina (Zip code Business Patterns, U.S. Census Bureau 2004)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	16	12
Seafood Canning	311711	0	0
Seafood Processing	311712	8	0
Boat Building	336612	40	117
Fish and Seafoods	422460	56	211
Fish and Seafood Markets	445220	0	0
Marinas	713930	0	0
Total Fishing Employment		120	340

Table 2.9. Wanchese Census Demographics

Factor	1990	2000
Total population	1380	1527
Gender Ratio M/F (Number)	50.4/49.6	50.6/49.4
Age (Percent of total population)		
Under 18 years of age	23.4	23.4
18 to 64 years of age	58.8	64.5
65 years and over	12.0	12.0
Ethnicity or Race (Number)		
White	1366	1477
Black or African American	1	5
American Indian and Alaskan Native	4	9
Asian	5	2
Native Hawaiian and other Pacific Islander	0	0
Some other race	4	7
Two or more races	-	6
Hispanic or Latino (any race)	15	28
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	10.8	4.5
Percent high school graduate or higher	67.3	76.5
Percent with a Bachelor’s degree or higher	7.8	16.2
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	2.1	1.2
And Percent who speak English less than very well	0.0	0.0
Household income (Median $)	25,977	39,250
Poverty Status (Percent of population with income below poverty line)	9.3	8.1
Percent female headed household	9.4	9.8
Home Ownership (Percent)		
Owner occupied	71.2	72.3
Renter occupied	28.8	27.7
Value Owner-occupied Housing (Median $)	75,200	104,900
Monthly Contract Rent (Median $)	326	423
Employment Status (Population 16 yrs and over)		
Percent in the labor force	78.1	66.6
Percent of civilian labor force unemployed	8.9	2.8
Occupation (Percent)		
Management, professional, and related occupations	-	24.3
Service occupations	-	18.3
Sales and office occupations	-	21.9
Farming, fishing, and forestry occupations	18.8	9.5
Construction, extraction, and maintenance occupations	-	15.8
Production, transportation, and material moving occupations	-	10.2
Industry (Percent)		
Agriculture, forestry, fishing and hunting	19.7	8.2
Manufacturing	9.5	13.1
Percent government workers	16.5	23.9
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	21.3	12.6
Percent using public transportation	0.0	0.0
Mean travel time to work (minutes)	-	14.8
Percent worked outside of county of residence	-	2.0

Table 2.10. Wanchese Vulnerability Scale Score

Index Variable	Dare County	Wanchese	Score
Percent minority population	6.5	3.3	+1
Percent below poverty level	8.0	8.1	0
Percent unemployed	3.3	2.8	0
Percent high school graduate or higher	88.6	76.5	-1
Median household income (dollars)	42,411	39,250	-1
Percent owner-occupied housing units	74.5	72.3	-1
Total scale score			**-2**

In terms of vulnerability, Wanchese's index variables score relatively close to the rest of Dare County. This suggests that the community would be somewhat vulnerable in terms of its ability to endure adverse impacts from the shark buyout or other fishery management because its total scale score is -2. This score does not measure how fishermen's households would be able to withstand adverse impacts, but overall the community might have some difficulty.

2.2.2 Hatteras

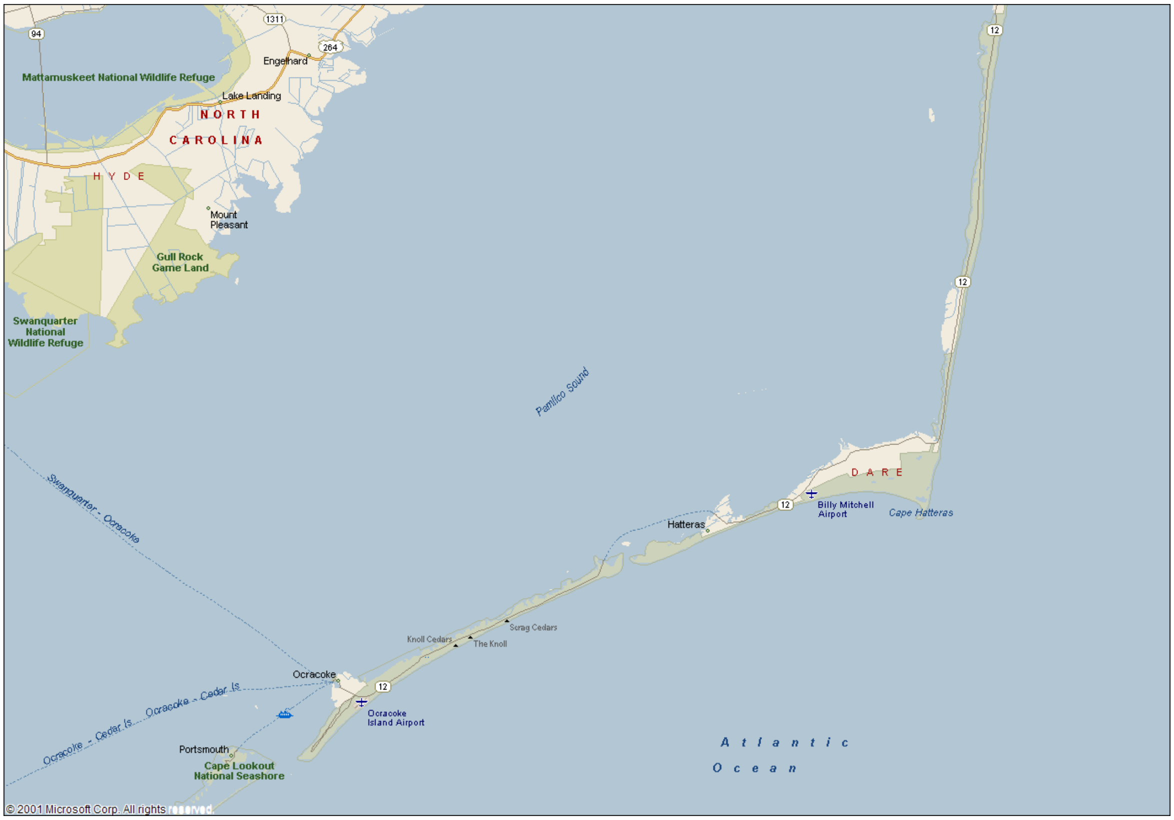

Figure 2.5. The Community of Hatteras, North Carolina.

Hatteras is located on the southern end of Hatteras Island on North Carolina's Outer Banks. The isolation of the community adds to the local character. Hatteras has historically been a seaport community with whaling an important part of the economy in its early history. Since World War II, the economy of the Hatteras community has depended on charter and commercial fishing. More recently, tourism has become an increasingly important economic activity (McCay and Cieri 2000).

There is some seasonal variation to the local economy; during the spring tourist season from April to May, weekend and holiday tourists are more prevalent. It is during this time that about 30 commercial vessels become active in charter fishing. Family vacationers are more frequent during the second season, which runs from June through August after school is out for the year. The third “season” is during the fall, when fishing, surfing and windsurfing are the dominant activities. A winter fishery for bluefin tuna has been a recent development and provides income for many locals who previously had little choice for work during the slack time.

According to Wilson and McCay (1998) and McCay and Cieri (2000) there are approximately 500 to 600 part and full time commercial fishermen in Hatteras and the surrounding townships. This has been considered to be accurate for the most recent community profiles compiled in the Amendment to the HMS fishery management plan (HMS 2003). There were five seafood wholesalers, one retail market, and three marinas at the time of the earlier studies and Hatteras Village was considered totally dependent on fishing.

Table 2.11. Federal Permits by Type for Hatteras Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	4
Commercial King Mackerel	4
Commercial Spanish Mackerel	4
Commercial Spiny Lobster	0
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	2
Snapper Grouper Class 2	0
Snapper Grouper Trap	1
Swordfish	2
Rock Shrimp	0
Federal Dealers	1

There are 4 permitted shark vessels that call Hatteras homeport and one permitted shark dealer as of 2004. All permitted shark vessels have coastal pelagic permits for king and Spanish mackerel and two have swordfish permits (Table 2.11). Although employment estimates from previous community profiles estimate fishing related employment at 5-600 persons, census data report only 20 (Table 2.12), which underscores the misrepresentation of census data.

Table 2.12. Employment in Fishing Related Industry for Hatteras, North Carolina (Zip code Business Patterns, U.S. Census Bureau 1998)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	0	3
Seafood Canning	311711	0	0
Seafood Processing	311712	0	0
Boat Building	336612	0	0
Fish and Seafoods	422460	0	0
Fish and Seafood Markets	445220	4	0
Marinas	713930	16	17
Total Fishing Employment		20	20

Table 2.13. Hatteras Census Demographics

Factor	1990	2000
Total population	2675	2797
Gender Ratio M/F (Percent)	51.6/48.4	50.5/49.5
Age (Percent of total population)		
Under 18 years of age	23.9	20.0
18 to 64 years of age	65.0	64.2
65 years and over	11.1	15.1
Ethnicity or Race (Number)		
White	2644	2705
Black or African American	10	0
American Indian and Alaskan Native	0	0
Asian	21	0
Native Hawaiian and other Pacific Islander	0	0
Some other race	0	38
Two or more races	-	54
Hispanic or Latino (any race)	18	98
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	7.1	6.6
Percent high school graduate or higher	74.4	80.2
Percent with a Bachelor's degree or higher	20.6	17.2
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	1.6	5.1
And Percent who speak English less than very well	0.0	2.6
Household income (Median $)	N/A[1]	N/A[1]
Poverty Status (Percent of population with income below poverty line)	6.0	10.0
Percent female headed household	9.0	6.2
Home Ownership (Percent)		
Owner occupied	72.3	78.1
Renter occupied	27.7	21.9
Value Owner-occupied Housing (Median $)	N/A[2]	N/A[2]
Monthly Contract Rent (Median $)	N/A[3]	N/A[3]
Employment Status (Population 16 yrs and over)		
Percent in the labor force	67.3	68.2
Percent of civilian labor force unemployed	4.2	8.9
Occupation (Percent)		
Management, professional, and related occupations	23.7	24.6
Service occupations	15.4	16.8
Sales and office occupations	17.3	20.4
Farming, fishing, and forestry occupations	6.4	7.8
Construction, extraction, and maintenance occupations	16.4	20.0
Production, transportation, and material moving occupations	13.9	10.5
Industry (Percent)		
Agriculture, forestry, fishing and hunting	11.3	8.4
Manufacturing	3.4	4.4
Percent government workers	21.0	19.3
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	-	-
Percent using public transportation	-	.05
Mean travel time to work (minutes)	-	-
Percent worked outside of county of residence	0.9	2.6

1 Median Household Income is between $16,799-29,900 for 1990; $33,456-40,718 for 2000
2 Median Value Owner-occupied Housing is between $51,900-127,600 for 1990; $111,300-155,100 for 2000
3 Median Contract Rent is between $325-338 for 1990; $335-421 for 2000

Table 2.14. HatterasVulnerability Scale Score

Index Variable	Dare County	Hatteras	Score
Percent minority population	6.5	5.4	0
Percent below poverty level	8.0	10.0	-1
Percent unemployed	3.3	8.9	-1
Percent high school graduate or higher	88.6	80.2	-1
Median household income (dollars)	42,411	40,718[1]	-1
Percent owner-occupied housing units	74.5	78.1	+1
Total scale score			**-3**

In terms of vulnerability, Hatteras falls into the vulnerable category as many of the index variables for the community score below those for the county. With a higher rate of poverty and unemployment, the community also has a lower median household income and lower percent of residents who are high school graduates. The community is like the county in terms of its minority population with slightly less than one percent difference and has a higher percent of owner occupied housing. Overall, the community may have difficulty adjusting to adverse impacts from fishery regulation or the buyback program. With a seasonal tourist economy, it may be difficult for some fishermen to find suitable employment if needed during slow times of the year.

[1] Median household income was calculated as a range because census blocks were combined to form community and medians cannot be averaged, therefore, the highest value in the range is provided here.

2.3 Florida

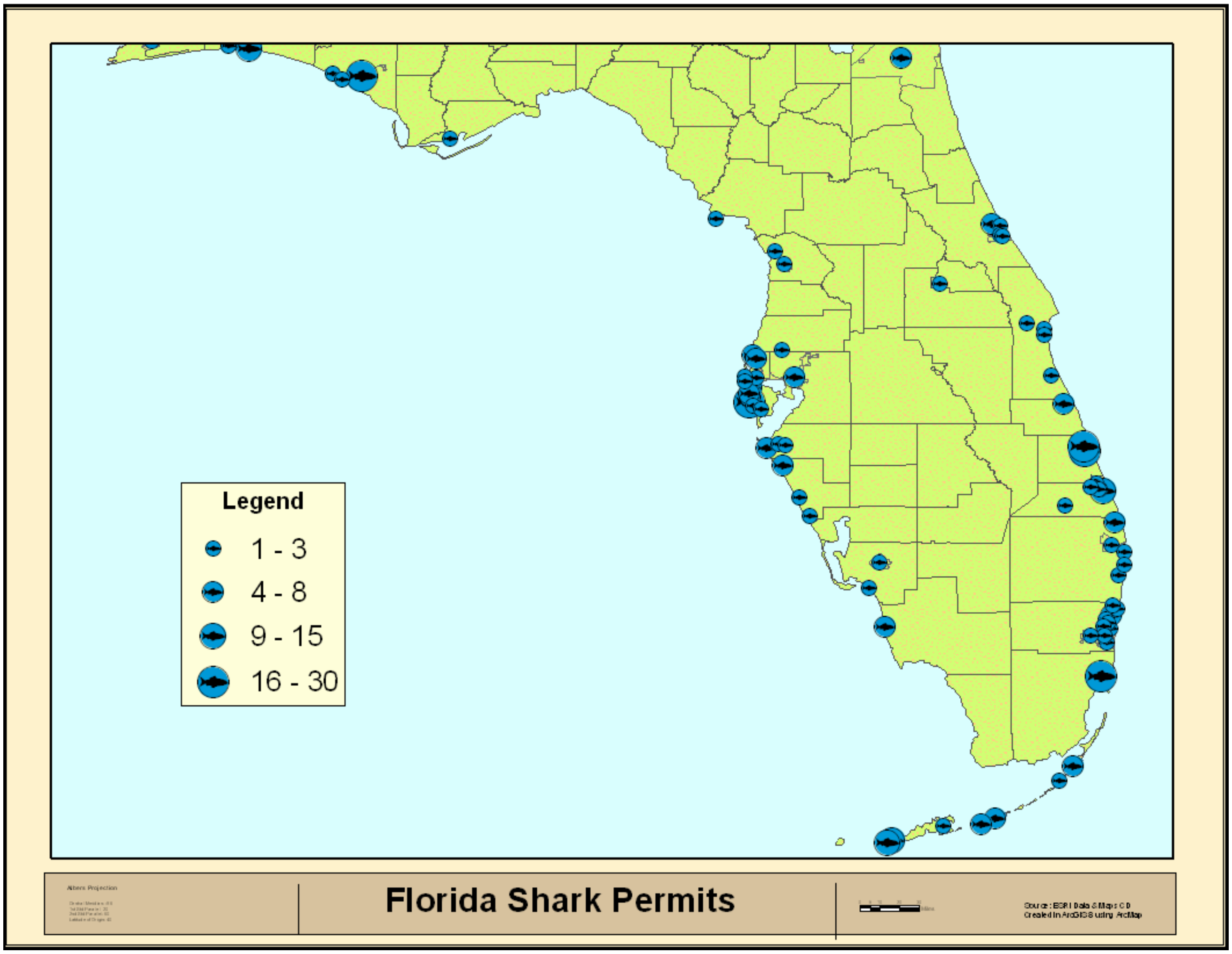

Figure 2.6 Florida Shark Permit Holders (NMFS 2004)

Florida's shark permits are most heavily concentrated on both the central Gulf and East Coast, with Madeira Beach on the Gulf coast and Ft. Pierce on the East coast having the most permitted vessels and the majority with directed permits. Miami ranks second on the East coast split evenly between directed and incidental permits and Panama City following on the Gulf coast with primarily incidental permits. The Florida Keys also have a substantial number of permitted shark vessels with mostly incidental permits spread throughout several communities.

Table 2.15. Directed and Nondirected Shark Permits for Florida's Atlantic and Gulf Coast. (NMFS 2002)

Atlantic Permits		Gulf Permits	
Directed Permits	**Number**	**Directed Permits**	**Number**
Boyton Beach	3	Clearwater	1
Cape Canaveral	2	Crystal River	1
Cocoa	1	Destin	4
Fort Pierce	11	Dunedin	1
Hobe Sound	1	Edgewater	1
Jacksonville	1	Englewood	1
Malabar	1	Fort Myers	1
Miami	9	Fort Walton Beach	1
New Smyrna Beach	2	Gulfport	1
Palm Beach	1	Islamorada	1
Palm City	1	Key Largo	3
Pompano Beach	1	Key West	3
Ponce Inlet	2	Madeira Beach	15
Port Canaveral	5	Naples	2
Port Orange	5	Panama City	3
Port Salerno	7	Panama City Beach	1
St. Lucie	1	Perdido Key	1
Salerno	1	Saint Marks	1
Sebastian	2	St. Petersburg	1
Stuart	4	Tavernier	2
		Venice	1
Incidental Permits	**Number**	**Incidental Permits**	**Number**
Boyton Beach	1	Apalachicola	2
Cape Canaveral	1	Bellair Beach	1
Cocoa Beach	2	Big Pine Key	1
Fort Pierce	8	Big Torch Key	1
Jacksonville	4	Bradenton	3
Jupiter	2	Cedar Key	1
Mayport	2	Chokoloskee	1
Miami	9	Cortez	1
Palm Bay	2	Davie	1
Palm Beach Inlet	1	Destin	5
Ponce Inlet	4	Englewood	2
Port Salerno	5	Goodland	1
Sebastian	4	Homosassa Springs	1
West Palm Beach	1	Key Largo	3
		Key West	11
		Madeira Beach	4
		Marathon	3
		Naples	2
		Odessa	1
		Ozona	1
		Panama City	11
		Parrish	1
		Pensacola	3
		Sarasota	4
		Southport	2
		Stock Island	1
		Summerland Key	1
		Tarpon Springs	5
		Tavernier	1
		Venice	1
		Wewahitcha	1

2.3.1 Port Salerno

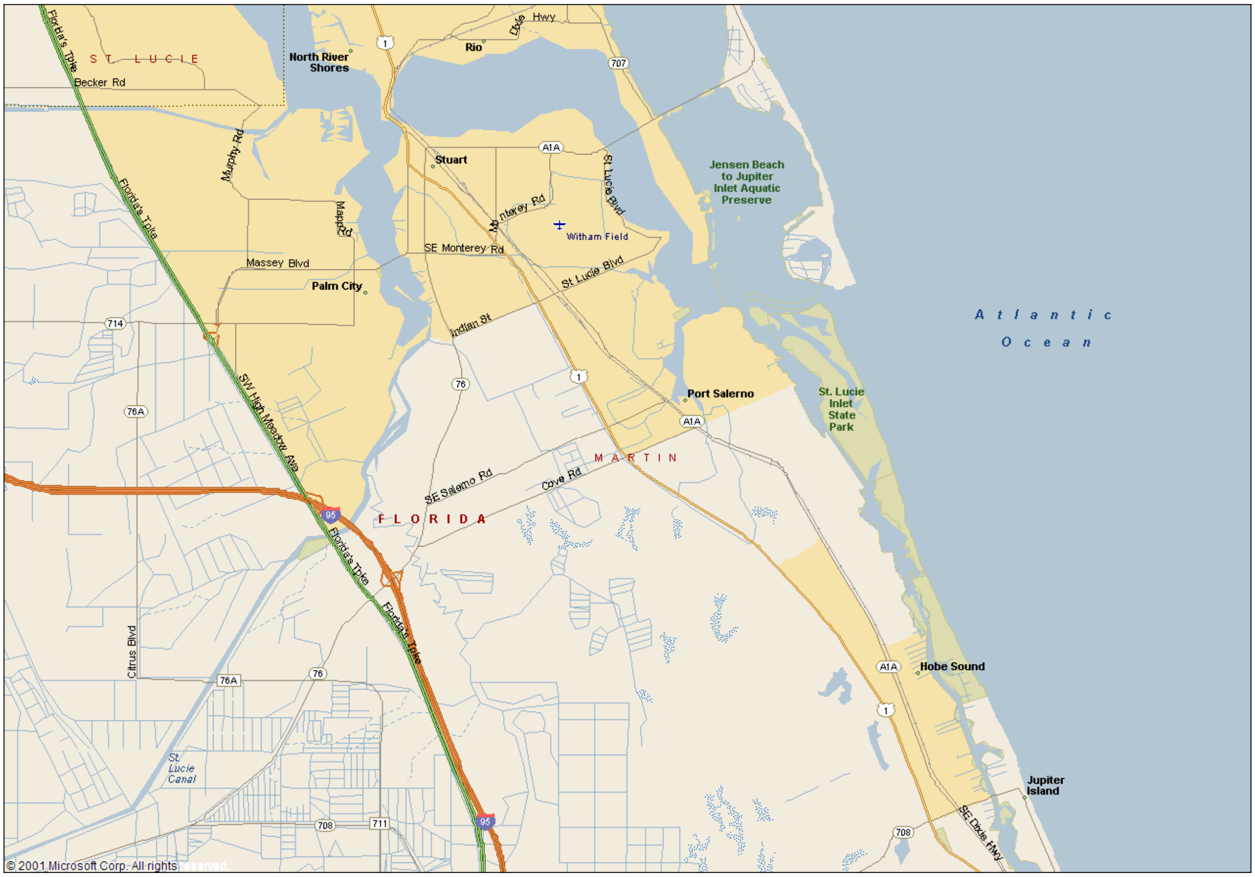

Figure 2.7. The Community of Port Salerno, Florida.

There is little description of Port Salerno as a fishing community as it does not appear in previous profiles. Port Salerno is the situated in Martin County between Stuart and Hobe Sound less than two nautical miles from where the waters of the Atlantic Ocean meet the Indian River and the St. Lucie River. The community has a growing reputation as a boating and fishing center and has major sport fishing tournaments held there each year. It is also home to the internationally known Chapman School of Seamanship. The community is incorporated and is located in an area that is one of the fastest- growing in the county.

There are 11 permitted shark vessels homeported in Port Salerno, almost all holding coastal pelagic permits for king and Spanish mackerel (Table 2.16). There is also one permitted shark dealer in the community. Port Salerno was included in this profile as several shark fishing vessels had moved from other homeports to Port Salerno since the earlier profiles in Amendment 1 (HMS 2004). Vessels homeported in Port Salerno landed 11,653 lbs of shark in 2003 according to landings information in Appendix 1.

Regarding fishing related employment (Table 2.17), there was a dramatic decrease in the number of persons involved in fish and seafood dropping to zero in 2001 from 35 in1998. With little or no ethnographic information on the community, the reason for such a decline is unknown.

Table 2.16. Federal Permits by Type for Port Salerno, Florida Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	11
Commercial King Mackerel	9
Commercial Spanish Mackerel	11
Commercial Spiny Lobster	1
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	0
Snapper Grouper Class 2	0
Snapper Grouper Trap	0
Swordfish	1
Rock Shrimp	0
Federal Dealers	1

Table 2.17. Employment in Fishing Related Industry for Port Salerno, Florida (Zip code Business Patterns, U.S. Census Bureau 2004)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	0	0
Seafood Canning	311711	0	0
Seafood Processing	311712	0	0
Boat Building	336612	0	0
Fish and Seafoods	422460	35	0
Fish and Seafood Markets	445220	0	0
Marinas	713930	15	0
Total Fishing Employment		50	0

Compared to Martin County, most of Port Salerno's index variables score negatively when evaluated with the county averages (Table 2.18). This would make the community vulnerable to any adverse impacts that might accrue from the shark buyout or changes in fishery management. It may be hard to judge how the community might be impacted without knowing more about the fishing related activities now located in the community.

Table 2.18. Port Salerno Vulnerability Scale Score

Index Variable	Martin County	Port Salerno	Score
Percent minority population	14.2	16.8	-1
Percent below poverty level	8.8	9.6	-1
Percent unemployed	2.1	5.2	-1
Percent high school graduate or higher	85.3	85.4	0
Median household income (dollars)	43,083	39,839	-1
Percent owner-occupied housing units	79.8	73.0	-1
Total scale score			**-5**

Table 2.19. Port Salerno Census Demographics

Factor	1990	2000
Total population	7786	10104
Gender Ratio M/F (Number)	48.1/51.9	49.3/50.7
Age (Percent of total population)		
Under 18 years of age	19.2	19.9
18 to 64 years of age	56.8	55.4
65 years and over	23.9	24.7
Ethnicity or Race (Number)		
White	6855	8975
Black or African American	536	705
American Indian and Alaskan Native	13	14
Asian	31	69
Native Hawaiian and other Pacific Islander	-	12
Some other race	6	230
Two or more races	-	136
Hispanic or Latino (any race)	345	827
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	6.3	3.2
Percent high school graduate or higher	81.2	85.4
Percent with a Bachelor's degree or higher	17.9	21.5
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	10.0	9.5
And Percent who speak English less than very well	3.2	4.5
Household income (Median $)	31687	39839
Poverty Status (Percent of population with income below poverty line)	6.9	9.6
Percent female headed household	7.7	9.3
Home Ownership (Number)		
Owner occupied	67.6	73.0
Renter occupied	32.4	27.0
Value Owner-occupied Housing (Median $)	99600	116900
Monthly Contract Rent (Median $)	459	559
Employment Status (Population 16 yrs and over)		
Percent in the labor force	57.1	54.3
Percent of civilian labor force unemployed	5.5	5.2
Occupation (Percent)		
Management, professional, and related occupations	-	28.5
Service occupations	-	19.3
Sales and office occupations	-	27.6
Farming, fishing, and forestry occupations	3.6	0.8
Construction, extraction, and maintenance occupations	-	13.9
Production, transportation, and material moving occupations	-	10.0
Industry (Percent)		
Agriculture, forestry, fishing and hunting	3.1	0.9
Manufacturing	12.0	8.8
Percent government workers	9.8	10.4
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	16.9	12.9
Percent using public transportation	0.0	0.6
Mean travel time to work (minutes)	-	23.8
Percent worked outside of county of residence	-	29.3

2.3.2 Pompano Beach

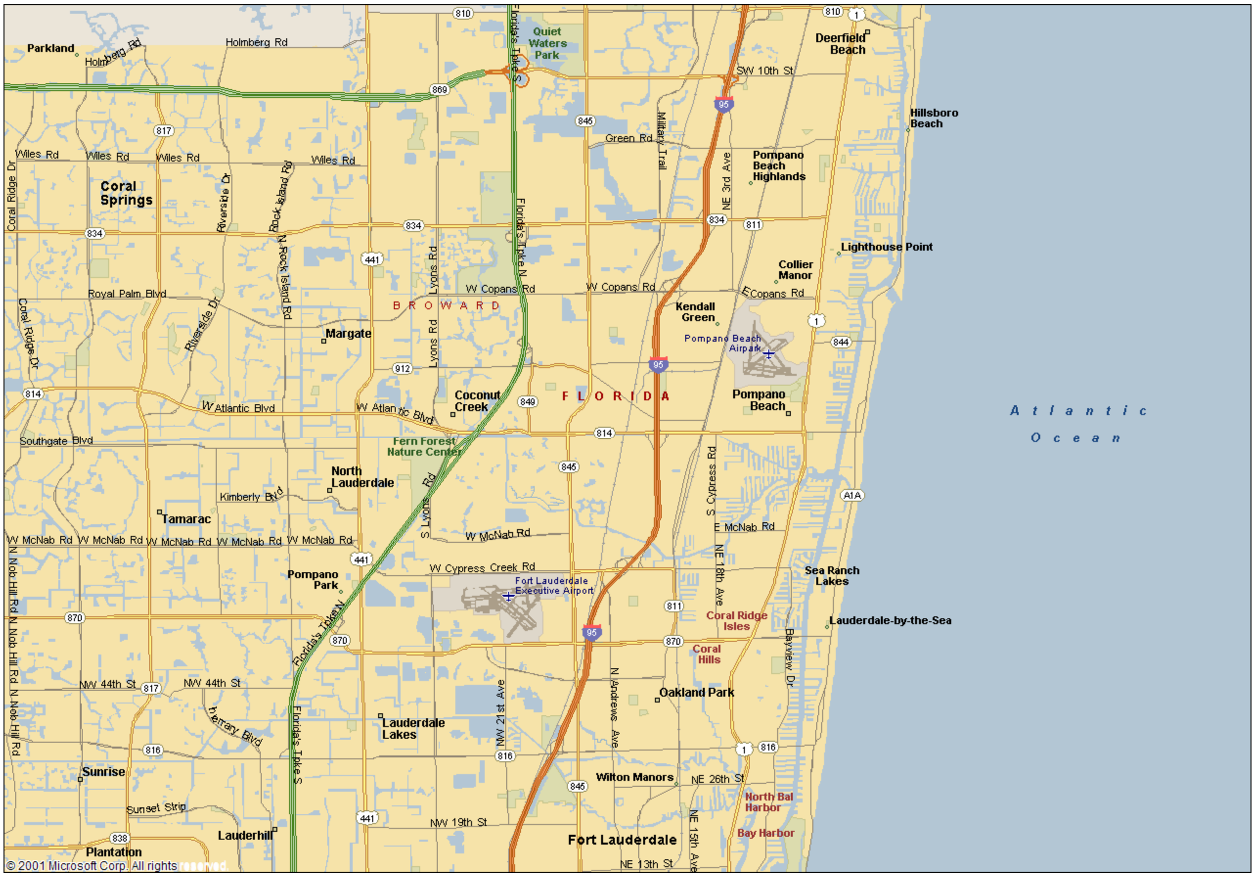

Figure 2.8. The Community of Pompano Beach, Florida.

Pompano Beach has a small longline fleet that targets tuna and swordfish primarily, but does also target shark along the northern coast. Wilson reported five small (40-50'), short trip year round longline boats that dock in Pompano Beach and six or seven seasonal longline boats. There are some larger boats in nearby Dania. Those numbers may have diminished since earlier reports according to some associated with the industry. It was stated in Wilson & McCay (1998) that December through April is the most intensive fishing timeframe for local fishermen. The resident fleet is joined by boats from the north that come to fish for the winter. The larger vessels fish the South Atlantic Bight from April to June, landing the majority of their catch with dealers in Charleston SC. The smaller vessels spend their yearly round fishing the Gulf of Florida (Wilson & McCay 1998). It was also reported that the longline fleet primarily lands their product with two fish houses in Pompano Beach and one in Dania.

All but one of the 8 permitted shark vessels in Pompano Beach hold swordfish permits (Table 2.20). Half of these vessels also hold coastal pelagic permits for king and Spanish mackerel. There is one registered shark dealer in the community. With regard to fishing employment, there seems to have been a steady drop from 1998 to 2001 with a subsequent jump in marina employment (Table 2.21). This is often the case as formerly commercial working waterfronts are transformed by an economy fueled by recreational or leisure enterprises.

Table 2.20. Federal Permits by Type for Pompano Beach, Florida Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	8
Commercial King Mackerel	2
Commercial Spanish Mackerel	2
Commercial Spiny Lobster	0
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	1
Charter/Headboat for Coastal Pelagics	1
Charter/Headboat for Snapper Grouper	1
Snapper Grouper Class 1	0
Snapper Grouper Class 2	0
Snapper Grouper Trap	0
Swordfish	7
Rock Shrimp	0
Federal Dealers	1

Table 2.21. Employment in Fishing Related Industry for Pompano Beach, Florida (Zip code Business Patterns, U.S. Census Bureau 2004)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	16	13
Seafood Canning	311711	0	0
Seafood Processing	311712	0	0
Boat Building	336612	33	0
Fish and Seafoods	422460	78	0
Fish and Seafood Markets	445220	6	0
Marinas	713930	94	229
Total Fishing Employment		227	242

The community of Pompano Beach scores lower than the county on several index variables making the community vulnerable to adverse impacts from fishery regulation or the buyout process with a total scale score of -4 (Table 2.22). Because Pompano Beach is in an urban environment it is difficult to isolate the community and understand the social impacts from any adverse events. These communities are often closely tied to the larger economy that drives the metropolitan area.

Table 2.22. Pompano Beach Vulnerability Scale Score

Index Variable	Broward County	Pompano Beach	Score
Percent minority population	42.0	39.2	+1
Percent below poverty level	12.6	17.0	-1
Percent unemployed	3.3	4.9	-1
Percent high school graduate or higher	82.0	77.2	-1
Median household income (dollars)	41,691	36,073	-1
Percent owner-occupied housing units	69.5	62.8	-1
Total scale score			**-4**

Table 2.23. Pompano Beach Census Demographics

Factor	1990	2000
Total population	72411	78301
Gender Ratio M/F (Percent)	48.2/51.8	49.3/50.7
Age (Percent of total population)		
Under 18 years of age	17.1	17.7
18 to 64 years of age	57.7	59.0
65 years and over	25.2	23.4
Ethnicity or Race (Number)		
White	48128	52989
Black or African American	19874	19897
American Indian and Alaskan Native	95	186
Asian	397	636
Native Hawaiian and other Pacific Islander	-	22
Some other race	39	1602
Two or more races	-	2859
Hispanic or Latino (any race)	3878	7770
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	9.8	6.9
Percent high school graduate or higher	73.7	77.2
Percent with a Bachelor's degree or higher	18.4	21.6
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	16.4	24.3
And Percent who speak English less than very well	7.8	10.8
Household income (Median $)	29683	36073
Poverty Status (Percent of population with income below poverty line)	16.0	17.0
Percent female headed household	10.5	10.9
Home Ownership (Percent)		
Owner occupied	63.3	62.8
Renter occupied	36.7	37.2
Value Owner-occupied Housing (Median $)		135700
Monthly Contract Rent (Median $)		630
Employment Status (Population 16 yrs and over)		
Percent in the labor force	55.7	64.5
Percent of civilian labor force unemployed	6.3	4.9
Occupation (Percent)		
Management, professional, and related occupations	-	34.0
Service occupations	-	16.3
Sales and office occupations	-	30.1
Farming, fishing, and forestry occupations	3.2	0.2
Construction, extraction, and maintenance occupations	-	8.6
Production, transportation, and material moving occupations	-	10.9
Industry (Percent)		
Agriculture, forestry, fishing and hunting	3.0	0.2
Manufacturing	8.5	6.8
Percent government workers	10.8	12.9
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	13.9	15.5
Percent using public transportation	3.5	0.0
Mean travel time to work (minutes)	-	24.4
Percent worked outside of county of residence	-	6.2

2.3.3 Fort Pierce

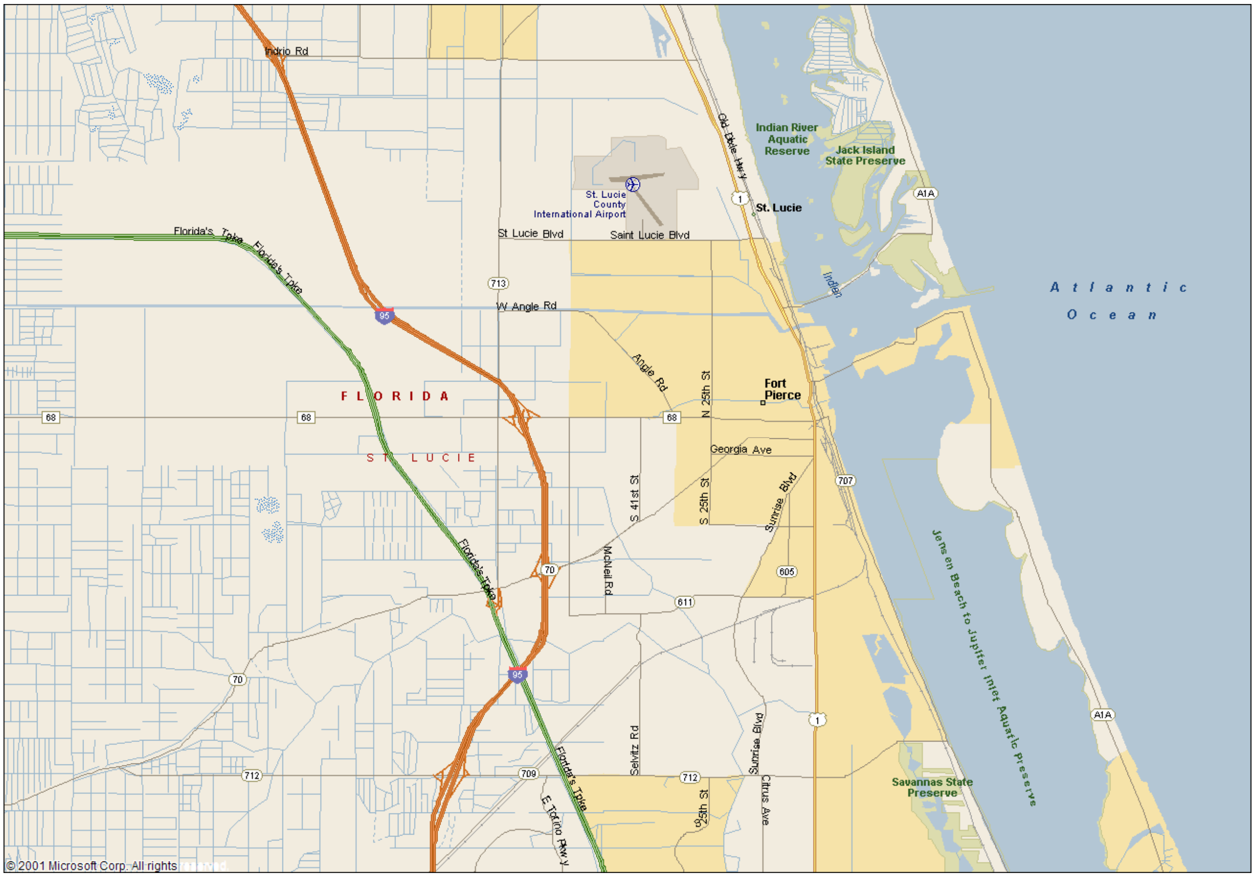

Figure 2.9. The Community of Fort Pierce, Florida.

Ft. Pierce's commercial fishing industry has been particularly hurt by the 1994 Florida Net Ban, and the impact has been worsened by newer, more stringent regulations implemented for the longline and shark fisheries according Kitner (SAFMC 2003). There has also been speculation about developing the waterfront for more tourist-oriented businesses. While there were five federally permitted dealers in Ft. Pierce at the time of the profile included in the Amendment to the Snapper-Grouper Plan, two of the larger fish houses indicated they may be leaving the business, and one recently stopped unloading commercial catches. Although some residents still see themselves as part of a fishing community, others believe that those days are gone (SAFMC 2003).

The species fished for the year 2001, according to SAFMC 2003, are bluefish, crevalle jack, king mackerel, Spanish mackerel, mojarras, striped mullet, white mullet, fine-toothed shark, small coastal sharks, swordfish, tilefish, and tuna comprised the majority of the catch.

The community profile for Ft. Pierce included in Amendment 13a to the Snapper Grouper Fishery Management Plan does indicate that the community has a high percentage of minorities and other important social indicators might suggest that this community could be adversely impacted by future fishery management actions.

Table 2.24. Federal Permits by Type for Ft. Pierce, Florida Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	21
Commercial King Mackerel	15
Commercial Spanish Mackerel	17
Commercial Spiny Lobster	3
Red Snapper Class 1	0
Red Snapper Class 2	1
Reef Fish	2
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	6
Snapper Grouper Class 2	1
Snapper Grouper Trap	0
Swordfish	9
Rock Shrimp	0
Federal Dealers	2

There were 21 permitted shark vessels located in Ft. Pierce in 2004 according to Table 2.24. The majority of those vessels also held coastal pelagic permits for king and Spanish mackerel. Slightly less than half held swordfish permits. There were 2 federally permitted shark dealers in the community at the time. In terms of fishing related employment there were few persons employed with 3 reported in fish and seafood for 2001. However, it is highly likely that these census data are underreporting employment as the profile in Snapper Grouper Amendment 13a suggests much more employment than that reflected in Table 2.25.

Table 2.25. Employment in Fishing Related Industry for Fort Pierce, Florida (Zip code Business Patterns, U.S. Census Bureau 1998)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	12	0
Seafood Canning	311711	0	0
Seafood Processing	311712	0	0
Boat Building	336612	265	175
Fish and Seafoods	422460	7	3
Fish and Seafood Markets	445220	3	0
Marinas	713930	21	0
Total Fishing Employment		308	178

With regard to Ft. Pierce and its vulnerability scale score, as mentioned earlier from Amendment 13a, this community could be very susceptible to adverse social impacts, which is reflected by a vulnerability index scale score of -6, the lowest possible score. With a high percentage of minorities and poverty and unemployment levels much higher than the county average, this community seems to be at risk if there are cumulative impacts from the shark buyout or other types of social disruptions.

Table 2.26. Ft. Pierce Vulnerability Scale Score

Index Variable	St. Lucie County	Ft. Pierce	Score
Percent minority population	25.9	58.6	-1
Percent below poverty level	9.6	30.9	-1
Percent unemployed	2.7	8.8	-1
Percent high school graduate or higher	77.7	59.7	-1
Median household income (dollars)	36,363	25,121	-1
Percent owner-occupied housing units	78.0	53.2	-1
Total scale score			-6

Table 2.27. Fort Pierce Census Demographics

Factor	1990	2000
Total population	36830	37489
Gender Ratio M/F (Percent)	47.1/52.9	49.2/50.8
Age (Percent of total population)		
Under 18 years of age	26.3	27.2
18 to 64 years of age	54.6	55.4
65 years and over	19.2	17.5
Ethnicity or Race (Number)		
White	18850	18585
Black or African American	15323	15326
American Indian and Alaskan Native	93	122
Asian	178	298
Native Hawaiian and other Pacific Islander	-	30
Some other race	16	2011
Two or more races	-	1144
Hispanic or Latino (any race)	2370	5629
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	18.3	17.8
Percent high school graduate or higher	56.9	59.7
Percent with a Bachelor's degree or higher	11.3	12.7
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	11.6	24.8
And Percent who speak English less than very well	5.8	14.8
Household income (Median $)	18913	25121
Poverty Status (Percent of population with income below poverty line)	29.2	30.9
Percent female headed household	18.6	19.3
Home Ownership (Percent)		
Owner occupied	51.8	53.2
Renter occupied	48.2	46.8
Value Owner-occupied Housing (Median $)	56100	62800
Monthly Contract Rent (Median $)	324	413
Employment Status (Population 16 yrs and over)		
Percent in the labor force	55.0	55.1
Percent of civilian labor force unemployed	12.4	8.8
Occupation (Percent)		
Management, professional, and related occupations	-	19.9
Service occupations	-	19.3
Sales and office occupations	-	20.5
Farming, fishing, and forestry occupations	9.7	9.0
Construction, extraction, and maintenance occupations	-	15.8
Production, transportation, and material moving occupations	-	15.5
Industry (Percent)		
Agriculture, forestry, fishing and hunting	9.8	7.8
Manufacturing	7.1	8.0
Percent government workers	17.7	11.4
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	19.4	22.4
Percent using public transportation	3.1	4.0
Mean travel time to work (minutes)	-	24.6
Percent worked outside of county of residence	-	15.2

2.3.4 Madeira Beach

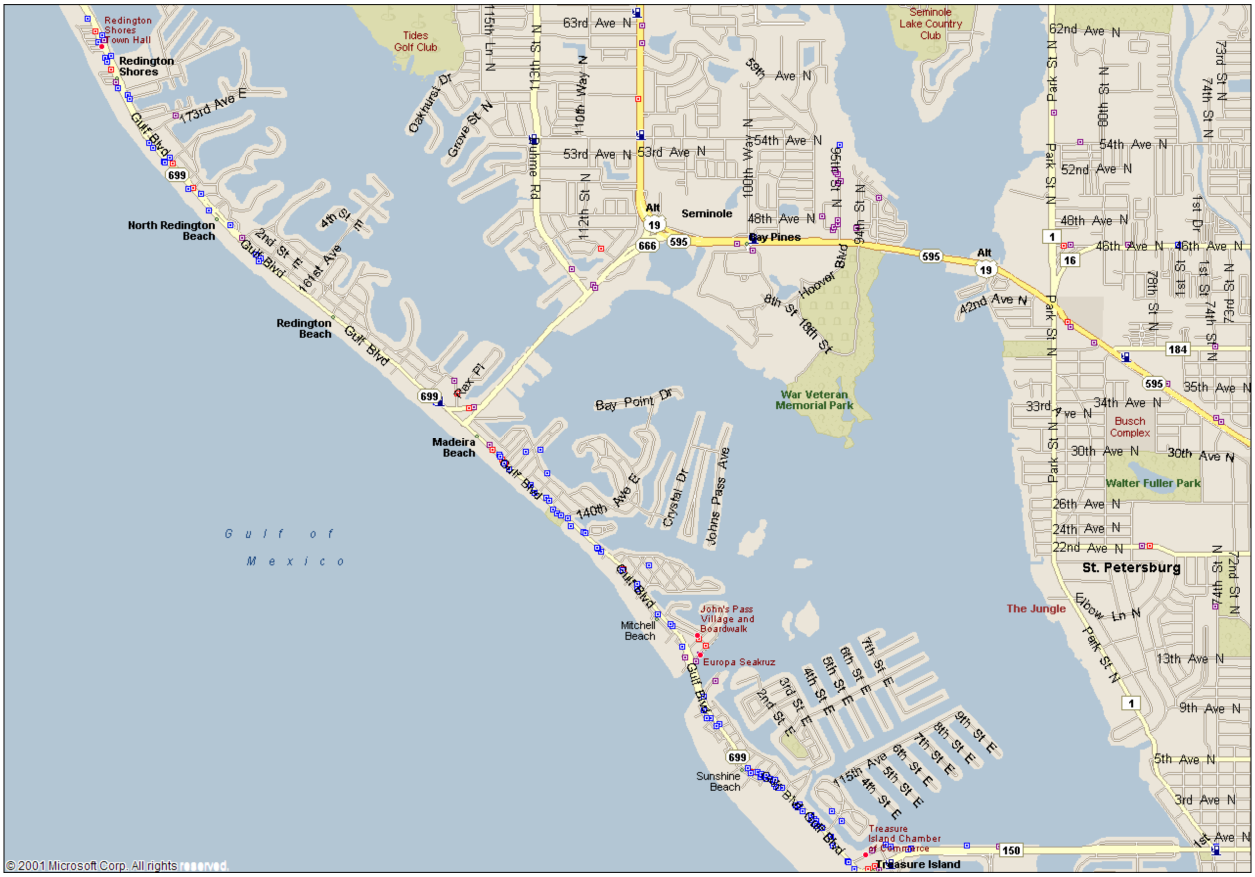

Figure 2.10. The Community of Madeira Beach, Florida.

Madeira Beach sits on the barrier island just west of the large urban complex of St. Petersburg and north of John's Pass on Florida's central west coast in Pinellas County, the most densely populated county in Florida. Madeira Beach is one of several beachfront communities on the island that cater to tourists and seasonal residents and has a population of 4,500 as of the 2000 census. Unemployment, poverty status and the percent of female headed households have all increased slightly since 1990 (see Table 2.30).

According to Wilson and McCay (1998), offshore fishing in Madeira Beach began as bandit reel fishing for grouper in the 1960's. There were two fish houses supported primarily by charter fishing and a small commercial operation. It was during the early 1970's that two vessels began experimenting with long line fishing, but were initially unsuccessful. Later, several vessels began using longlines for swordfish and did well, but as swordfish stocks began to diminish in the Gulf they were forced to expand their fishing territory to the eastern seaboard. It was on return trips that these vessels began to experiment with longlines in deeper water and discovered an abundance of tilefish and yellow edge grouper. As of their report (Wilson & McCay 1998), 95 percent of the fishing fleet in Madeira Beach was using longlines. There were four fish houses in Madeira Beach at the time dealing in primarily grouper but also swordfish, shark and other species. Approximately 100 vessels were working out of the community then.

Madeira Beach still retains many of the trappings of a fishing community. The community continues to hold a Seafood Festival in October, although the Chamber of Commerce is the primary organizer. There are three fish houses in Madeira Beach and approximately 70 vessels that homeport in the community. The community is referred to as the “Grouper capital of the World,” with a majority of the grouper in the U.S. being landed here and an important recreational catch. Lucas (2001) found an estimated 87 long line and 48 bandit reel vessels homeported in the community. In addition, she found that most captains and crew lived nearby with over 40 of the captains living in Madeira Beach. The rest lived within 30 minutes of the community. Overall, direct employment related to vessels and fish houses was approximately 441 (Lucas 2001).

Most shark fishermen have multiple permits and the majority fish grouper primarily. One dealer estimated that before restrictions on shark fishing his business used to be 45 percent grouper, 45 percent shark, and 10 percent sword and tuna, now it is 75 percent grouper, 10 percent shark and 15 percent sword and tuna (Wilson & McCay 1998). Different gear is used for grouper, shark, and swordfish and tuna. Longline fishermen use a wire cable for grouper, while for shark they use monofilament mainline. Some fish grouper with a monofilament mainline using weights to sink it. The maximum number of trips they can make is about 15 trips a year, as a grouper trip lasts 18-20 days (Wilson & McCay 1998).

Some fishermen keep both grouper and shark gear on board. When shark fishing began, it was easy to catch shark according to some, but has become marginal because of restrictions and the distances they now have to travel. Shark trips are kept as short as possible to maintain the meat at good quality. Fishermen from Madeira Beach and elsewhere go to Louisiana and Texas to fish and land their fish in Venice, Louisiana and Galveston, Texas, often doing a double trip in 22-23 days. These trips are long and can be costly. The meat is not valuable, getting only 50-60 cents a pound. The low price does reduce competition from imports that can't compete because of the shipping costs. The real value is in the fins that are sold mainly in Asia (Wilson & McCay 1998).

Respondents in the Wilson and McCay study (1998) have suggested that regulations, particularly the 4000 pound shark trip limit, have turned the fishery into a small boat fishery; even boats as small as 50' can have difficulty making a profit. One boat owner reported that he had been making $75-100,000 year fishing for shark with a 62' foot boat before the 4000 pound trip limit put an end to it. The problem with longline trip limits, their respondents argued, is the number of trips made that the boat does not reach the limit. This owner used to count on getting two or three trips in the 11,000 pound range and four of five trips in the 5,000 pound to balance the other trips that got less than 4000 pounds. Because the trip limit made fishing for shark on a 62' boat impractical he sold his boat and bought a smaller one (Wilson & McCay 1998).

Fish houses use several strategies to try to respond to the changing industry. One has a close business relationship with a restaurant chain that gives them the funds they need to compete price-wise. Fifteen percent of the business now goes to the restaurant chain and they would like this percentage to go to 100% because this is how they can stay competitive. They have also started to buy fish from Florida's east coast. Another fish house has tried to keep supplies up by running a boat in Nicaragua. It has been difficult and time consuming to continue this operation because of distance, infrastructure, and a lack of facilities (Wilson & McCay 1998).

There are 31 shark permitted vessels that list their home port as Madeira Beach according to the permit data and of those 27 hold reef fish permits (Table 2.28). Most of those (21) also hold red snapper class 2 permits. Twelve have Spanish mackerel permits while two hold king mackerel permits.

Table 2.28. Federal Permits by Type for Madeira Beach, Florida Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	31
Commercial King Mackerel	2
Commercial Spanish Mackerel	12
Commercial Spiny Lobster	5
Red Snapper Class 1	0
Red Snapper Class 2	21
Reef Fish	27
Charter/Headboat Reef Fish	5
Charter/Headboat for Coastal Pelagics	4
Charter/Headboat for Snapper Grouper	4
Snapper Grouper Class 1	2
Snapper Grouper Class 2	2
Snapper Grouper Trap	0
Swordfish	12
Rock Shrimp	0
Federal Shark Dealers	2

A special study on the impacts of a one to two month closure of the grouper fishery on Madeira Beach was conducted by Lucas (2001). In that study, Lucas estimates approximately 135 vessels are home ported and off load grouper in Madeira Beach on a regular basis. She also stated that there are 87 bottom longline vessels and at least 48 bandit rig vessels that call Madeira Beach homeport. While the estimates here are much lower, it may be an artifact of self reporting of homeport. There may be many other vessels that dock in Madeira Beach that may have listed another location as their homeport.

According to zip code business patterns (Table 2.29) there are 13 persons listed as employed in the marinas sector with another 19 in fish and seafood as of 2001. Six more in fishing brings the total to 41 in fishing sectors combined.

Table 2.29. Employment in Fishing Related Industry for Madeira Beach, Florida (Zip code Business Patterns, U.S. Census Bureau 1998 & 2001)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	3	6
Seafood Canning	311711	0	0
Seafood Processing	311712	0	3
Boat Building	336612	0	0
Fish and Seafood	422460	21	19
Fish and Seafood Markets	445220	0	0
Marinas	713930	28	13
Total Fishing Employment		52	41

Table 2.30. Madeira Beach Census Demographics

Factor	1990	2000
Total population	4225	4500
Gender Ratio M/F (Percent)	50.9/49.1	52.7/47.3
Age (Percent of total population)		
Under 18 years of age	8.7	8.2
18 to 64 years of age	65.7	69.8
65 years and over	25.6	22.0
Ethnicity or Race (Number)		
White	4,160	4,378
Black or African American	10	12
American Indian and Alaskan Native	7	14
Asian	32	26
Native Hawaiian and other Pacific Islander	-	2
Some other race	16	30
Two or more races	-	49
Hispanic or Latino (any race)	105	107
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	4.2	2.6
Percent high school graduate or higher	83.8	87.3
Percent with a Bachelor's degree or higher	19.5	22.2
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	4.6	6.8
And Percent who speak English less than very well	1.5	2.0
Household income (Median $)	$24,748	$36,671
Poverty Status (Percent of population with income below poverty line)	8.4	9.8
Percent female headed household	5.3	5.6
Home Ownership (Percent)		
Owner occupied	57.8	57.5
Renter occupied	42.2	42.5
Value Owner-occupied Housing (Median $)	$114,000	$171,000
Monthly Contract Rent (Median $)	$392	$486
Employment Status (Population 16 yrs and over)		
Percent in the labor force	58.5	61.5
Percent of civilian labor force unemployed	2.8	4.4
Occupation (Percent)		
Management, professional, and related occupations	-	30.4
Service occupations	-	22.1
Sales and office occupations	-	28.9
Farming, fishing, and forestry occupations	1.4	0.7
Construction, extraction, and maintenance occupations	-	10.6
Production, transportation, and material moving occupations	-	7.2
Industry (Percent)		
Agriculture, forestry, fishing and hunting	1.4	0.0
Manufacturing	7.5	11.3
Percent government workers	8.2	4.5
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	8.7	14.7
Percent using public transportation	2.2	1.6
Mean travel time to work (minutes)	-	23.1
Percent worked outside of county of residence	-	16.0

Table 2.31. Madeira Beach Vulnerability Scale Score

Index Variable	Pinellas County	Madeira Beach	Score
Percent minority population	17.2	4.6	+1
Percent below poverty level	11.2	9.8	+1
Percent unemployed	2.5	4.4	-1
Percent high school graduate or higher	84.0	87.4	+1
Median household income (dollars)	37,111	36,671	+1
Percent owner-occupied housing units	70.8	57.5	-1
Total scale score			2

In terms of vulnerability, Madeira Beach appears to be not vulnerable as it scores better than the county on many of the social index variables. It has a low percentage of minorities and poverty level, but does have a slightly higher level of unemployment and lower percentage of owner occupied housing. Overall, it seems that any adverse impacts from the shark buyout may be absorbed better here than in other communities. Being close to the metropolitan area of St. Petersburg and Tampa and a beachfront community may offer more opportunities and therefore make the community less vulnerable.

2.3.5 Panama City

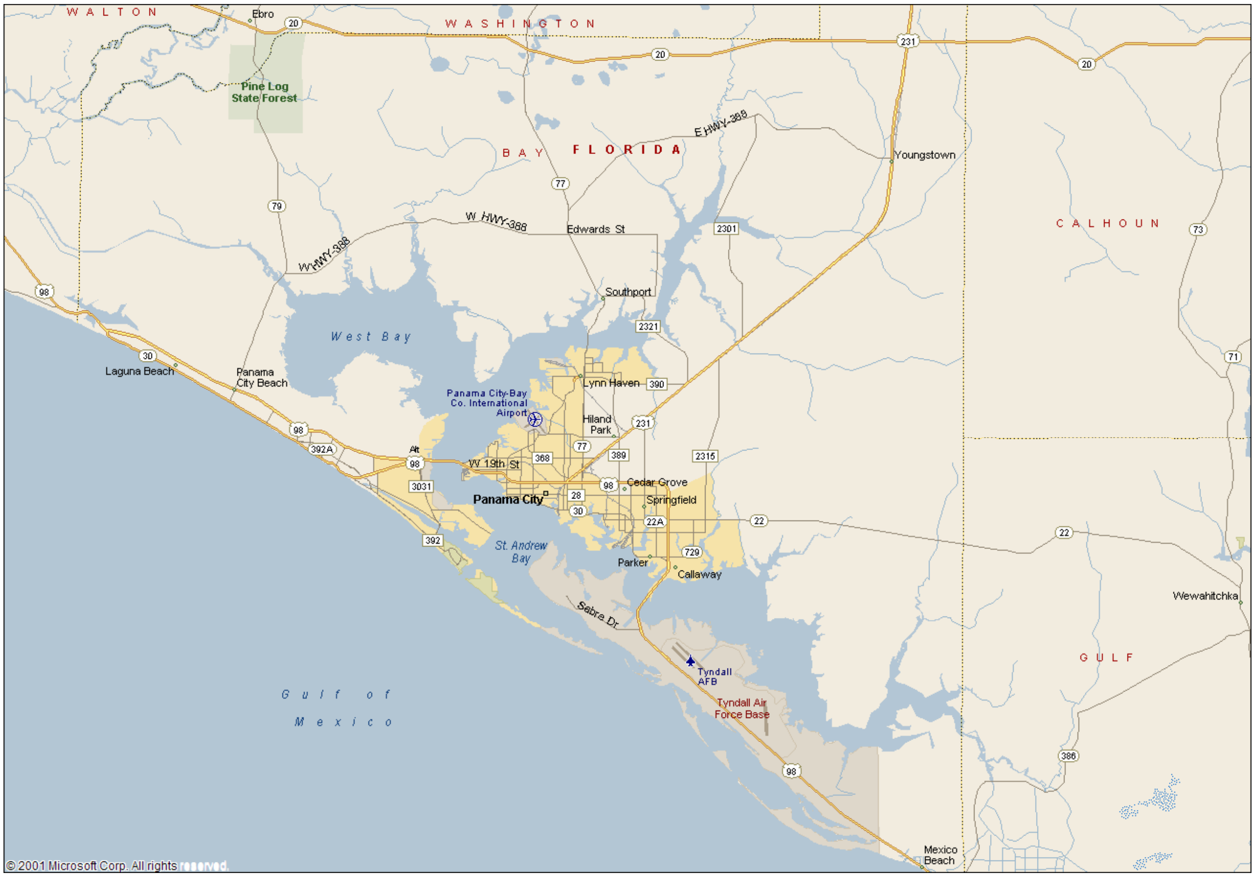

Figure 2.11. The Community of Panama City, Florida.

Panama City sits along the Bay County coast at the center of St. Andrew Bay. It is home of the Tyndall Air Force Base. Panama City had nine offshore longline boats that target yellowfin tuna during most of the year according to Wilson and McCay (1998). A few of these vessels targeted shark when that fishery was open; some targeted dolphin in the summer and swordfish more rarely. Some boats carry gear for both yellowfin tuna and shark. Two of these boats were owner operated, two are owned by a fish house, three are each owned by a single person who hires a captain, and two others are owned by the same person who hires captains. There were also 16-19 grouper boats and one distant water swordfish boat operating out of Panama City (Wilson & McCay 1998).

Several individuals interviewed by Wilson and McCay felt that the more skilled fishermen either left or are leaving the fishery. One owner said that the last time he had to recruit a captain it took him two months to find one; owners are competing hard for good captains. Most Panama City longliners did not see themselves as having an organization; however, some are members of Blue Water Fishermen's Association. One long time fishermen said that people see Blue Water as oriented toward the north because that is where most of the membership is (Wilson & McCay 1998).

Panama City is homeport to over 20 federally permitted shark vessels with some of those vessels (8) holding king mackerel permits (Table 2.32). There were 16 vessels that held reef fish permits and 11 held swordfish permits. The community had 3 federally permitted shark dealers.

Table 2.32. Federal Permits by Type for Panama City, Florida Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	20
Commercial King Mackerel	8
Commercial Spanish Mackerel	8
Commercial Spiny Lobster	0
Red Snapper Class 1	8
Red Snapper Class 2	2
Reef Fish	16
Charter/Headboat Reef Fish	2
Charter/Headboat for Coastal Pelagics	2
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	0
Snapper Grouper Class 2	0
Snapper Grouper Trap	0
Swordfish	11
Rock Shrimp	0
Federal Shark Dealers	3

Employment in fishing related businesses is predominately in the marina sector with 130 employed as shown in Table 2.33. Other important sectors include boat building, seafood processing and fish and seafood, each employing 40 or more. Both fishing and fish and seafood markets report having 12 employed in those businesses.

Table 2.33. Employment in Fishing Related Industry for Panama City, Florida (Zip code Business Patterns, U.S. Census Bureau 1998)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	12	12
Seafood Canning	311711	0	0
Seafood Processing	311712	70	70
Boat Building	336612	76	45
Fish and Seafood	422460	53	52
Fish and Seafood Markets	445220	12	12
Marinas	713930	123	130
Total Fishing Employment		346	321

Table 2.34. Panama City Census Demographics

Factor	1990	2000
Total population	34378	36371
Gender Ratio M/F (Percent)	46.7/53.3	48.6/51.4
Age (Percent of total population)		
Under 18 years of age	24.5	23.0
18 to 64 years of age	58.5	61.0
65 years and over	17.0	15.9
Ethnicity or Race (Number)		
White	25643	26819
Black or African American	7477	7813
American Indian and Alaskan Native	204	231
Asian	581	564
Native Hawaiian and other Pacific Islander	-	28
Some other race	19	274
Two or more races	-	688
Hispanic or Latino (any race)	460	1060
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	12.1	6.7
Percent high school graduate or higher	70.3	79.2
Percent with a Bachelor's degree or higher	16.7	18.9
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	5.3	7.2
Percent who speak English less than very well	1.9	2.0
Household income (Median $)	21881	31572
Poverty Status (Percent of population with income below poverty line)	19.6	17.2
Percent female headed household	15.0	15.4
Home Ownership (Percent)		
Owner occupied	58.3	57.8
Renter occupied	41.7	42.2
Value Owner-occupied Housing (Median $)	49800	75800
Monthly Contract Rent (Median $)	279	435
Employment Status (Population 16 yrs and over)		
Percent in the labor force	58.6	56.4
Percent of civilian labor force unemployed	8.1	5.8
Occupation (Percent)		
Management, professional, and related occupations	-	32.2
Service occupations	-	20.8
Sales and office occupations	-	27.7
Farming, fishing, and forestry occupations	1.5	0.4
Construction, extraction, and maintenance occupations	-	8.6
Production, transportation, and material moving occupations	-	10.4
Industry (Percent)		
Agriculture, forestry, fishing and hunting	1.5	0.3
Manufacturing	7.7	7.0
Percent government workers	20.4	18.6
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	12.5	13.7
Percent using public transportation	0.2	0.7
Mean travel time to work (minutes)	-	18.6
Percent worked outside of county of residence	-	3.3

In terms of vulnerability, Panama City has a rather low score with a -5. It has higher percentage of minority population than the county and higher levels of poverty and unemployment. With lower median income and lower percent of owner occupied housing the community appears to be susceptible to adverse impacts that might accrue from the shark buyout or other fishery management. Without indepth knowledge of the fishing culture and how it is integrated into the community, it is difficult to estimate what those impacts might be.

Table 2.35. Panama City Vulnerability Scale Score

Index Variable	**Bay County**	**Panama City**	**Score**
Percent Minority population	17.2	27.7	-1
Percent below poverty level	15.9	17.2	-1
Percent unemployed	2.9	5.8	-1
Percent high school graduate or higher	30.6	29.7	0
Median household income (dollars)	36,092	31,572	-1
Percent owner-occupied housing units	68.6	57.8	-1
Total scale score			-5

2.4 Louisiana

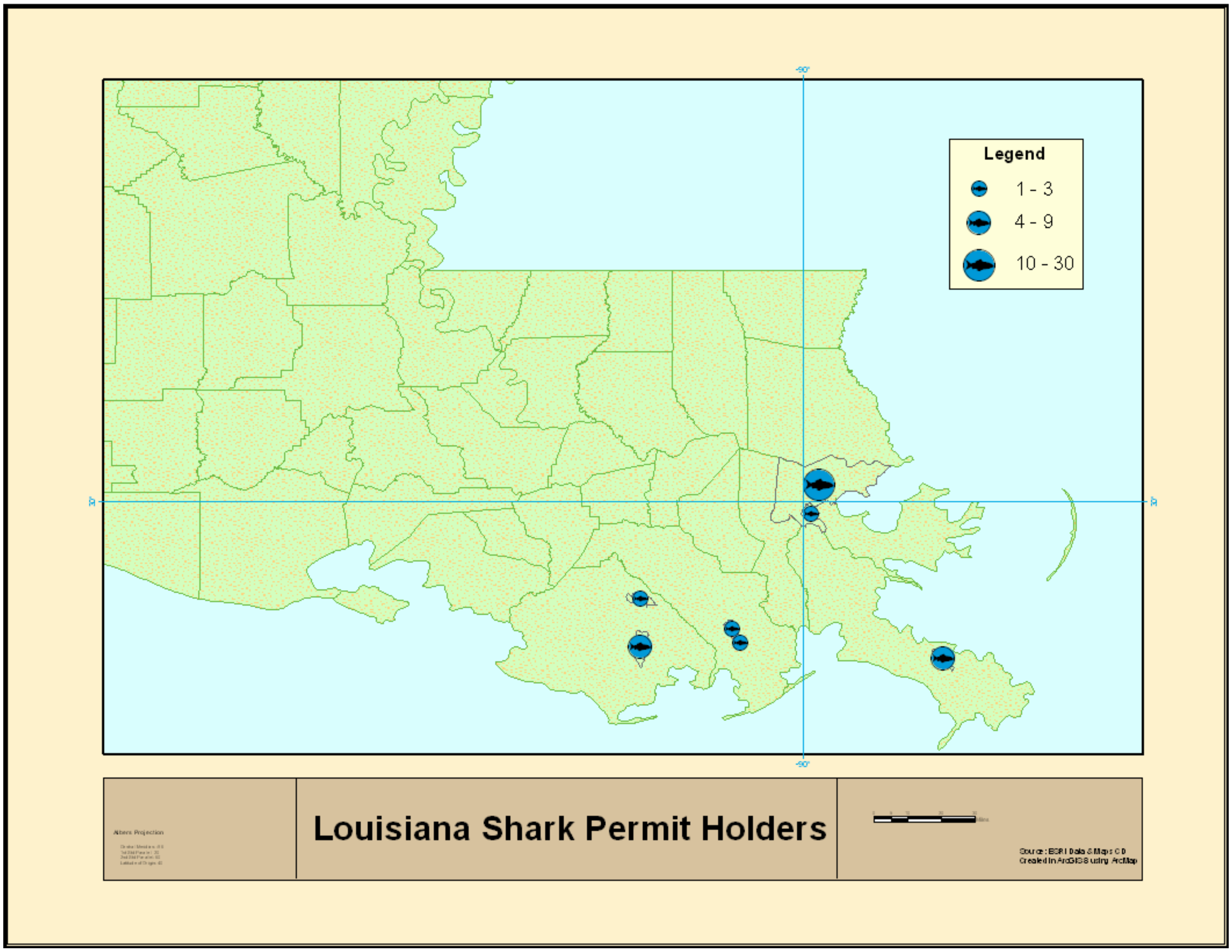

Figure 2.12. Louisiana Shark Permit Holders (NMFS 2004)

Table 2.36. Number of Directed and Incidental Permits for Louisiana Communities

City	Directed Permits	Incidental Permits
Cameron	0	1
Chalmette	0	1
Dulac	0	9
Galliano	0	3
Golden Meadow	0	1
Houma	0	1
Leeville	0	1
New Orleans	5	25
Venice	1	5
Total	6	47

Louisiana fishermen hold only a few directed permits with all but one of those residing in New Orleans. The majority of permits held are incidental and are in New Orleans also.

2.4.1 Dulac

Figure 2.12. The Community of Dulac, Louisiana.

While local residents of Dulac have long harvested marine resources for both income and nutrition, Wilson and McCay found no evidence that local residents extracted the highly migratory species in question for this study. With the exception of Mexican migrant workers, one dock owner and several employees, those involved in the commercial tuna, swordfish and shark industry live elsewhere. (Wilson & McCay 1998).

Dulac lies in the center of Terrebonne Parish, about 15 miles south of Houma, the parish seat. Terrebonne Parish government is a consolidated government so most data is gathered on a parish-wide basis. Landings of tuna, swordfish and shark indicate that Dulac is among the most important ports in the state and even along the Gulf of Mexico coast for those species (Wilson & McCay 1998).

Of the three docks that purchased fish from long line vessels, two were owned and operated by first generation Vietnamese immigrants. One dock owner estimated that 40 percent of his business came from long line purchases, and the other owner buys only pelagic long line fish. The third dock was at the time run by a white New Orleans native whose father operated a large tuna wholesale company in Venice. Of the three docks in Dulac, the one run by the “American” purchased the most tuna, swordfish and shark from the largest number of boats (Wilson & McCay 1998).

Small blacktip shark is the main catch in the shark fishery. Shark dressed weight was going for between 30 and 50 cents a pound at the time of their study. Shark fishermen don't fish much during the winter because the boats tend to be smaller. Sharks are caught at five to 20 miles from shore, and tuna are caught 100-300 miles out. Tuna fishermen generally cut the line when they hook a shark. Swordfish is not targeted by Dulac longliners. A typical trip is two weeks and boats range in size from 60 to 100 feet and set between 35 and 40 miles of longline rigging. Most fish for live bait during two or three days at the start of a trip. They prefer live bait as they target yellowfin tuna, instead of using frozen squid or light sticks that they would use if they wanted to target swordfish (Wilson & McCay 1998).

Regulations prior to the Wilson and McCay study seemed to have had an impact on shark operations as some shark long line fishermen said shifting the start of the year to June 1 would help smaller boats that can't fish in the Gulf during the winter. Fishermen and dock owners at that time called the 3 million pound Louisiana quota for shark the year "devastating" (Wilson & McCay 1998).

Table 2.37. Federal Permits by Type for Dulac, Louisiana Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	9
Commercial King Mackerel	0
Commercial Spanish Mackerel	0
Commercial Spiny Lobster	0
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	0
Snapper Grouper Class 2	0
Snapper Grouper Trap	0
Swordfish	8
Rock Shrimp	0
Federal Dealers	2

Table 2.38. Employment in Fishing Related Industry for Dulac, Louisiana (Zip code Business Patterns, U.S. Census Bureau 1998)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	20	20
Seafood Canning	311711	0	0
Seafood Processing	311712	65	53
Boat Building	336612	0	0
Fish and Seafood	422460	16	13
Fish and Seafood Markets	445220	0	0
Marinas	713930	0	6
Total Fishing Employment		101	92

There were 9 vessels with shark permits homeported in Dulac. All but one of those vessels held a swordfish permit, even though according to Wilson and McCay vessels here do not target swordfish it is the only other permit held by shark permitted vessels homeported in Dulac. There were 2 shark permitted dealers in Dulac according to NMFS data in 2004.

Table 2.39. Dulac Vulnerability Scale Score

Index Variable	Terrebonne Parish	Dulac	Score
Percent minority population	26.8	47.0	-1
Percent below poverty level	19.1	30.9	-1
Percent unemployed	3.3	6.7	-1
Percent high school graduate or higher	67.1	39.9	-1
Median household income (dollars)	35,235	22,900	-1
Percent owner-occupied housing units	75.6	79.3	+1
Total scale score			-4

Dulac has a rather low vulnerability scale score with a -4. It has a higher percentage of minorities and percentage of persons below the poverty level. In fact the index variable that scores better for Dulac than the county is owner occupied housing. Because Wilson and McCay suggest that fishermen who fish highly migratory species live elsewhere, it is not clear how the community would be affected by adverse social impacts that might accrue from the shark buyout or other fishery management. Fishing seems to be an important part of the local economy, yet how that sector is incorporated into the larger community and its economic dependence is unknown. Overall, it should be noted that this community is vulnerable to adverse social and economic impacts.

Table 2.40. Dulac Census Demographics

Factor	1990	2000
Total population	3273	2458
Gender Ratio M/F (Percent)	51.1/48.9	50.0/50.0
Age (Percent of total population)		
Under 18 years of age	36.9	31.4
18 to 64 years of age	56.0	58.8
65 years and over	7.1	9.8
Ethnicity or Race (Number)		
White	1603	1327
Black or African American	77	61
American Indian and Alaskan Native	1568	969
Asian	14	12
Native Hawaiian and other Pacific Islander	0	0
Some other race	11	12
Two or more races	-	77
Hispanic or Latino (any race)	66	42
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	55.5	38.1
Percent high school graduate or higher	27.1	39.9
Percent with a Bachelor's degree or higher	1.9	3.9
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	50.1	37.4
And Percent who speak English less than very well	14.5	10.8
Household income (Median $)	12653	22900
Poverty Status (Percent of population with income below poverty line)	49.3	30.9
Percent female headed household	12.2	14.2
Home Ownership (Percent)		
Owner occupied	80.1	79.3
Renter occupied	19.9	20.7
Value Owner-occupied Housing (Median $)	28700	54700
Monthly Contract Rent (Median $)	179	407
Employment Status (Population 16 yrs and over)		
Percent in the labor force	45.9	44.9
Percent of civilian labor force unemployed	17.5	6.7
Occupation		
Management, professional, and related occupations	-	12.4
Service occupations	-	12.7
Sales and office occupations	-	17.7
Farming, fishing, and forestry occupations	17.2	15.9
Construction, extraction, and maintenance occupations	-	12.0
Production, transportation, and material moving occupations	-	29.4
Industry		
Agriculture, forestry, fishing and hunting	19.6	19.8
Manufacturing	14.0	10.0
Percent government workers		6.0
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	25.7	19.4
Percent using public transportation	2.6	1.1
Mean travel time to work (minutes)	-	37.4
Percent worked outside of county of residence	-	6.1

2.4.2 Venice

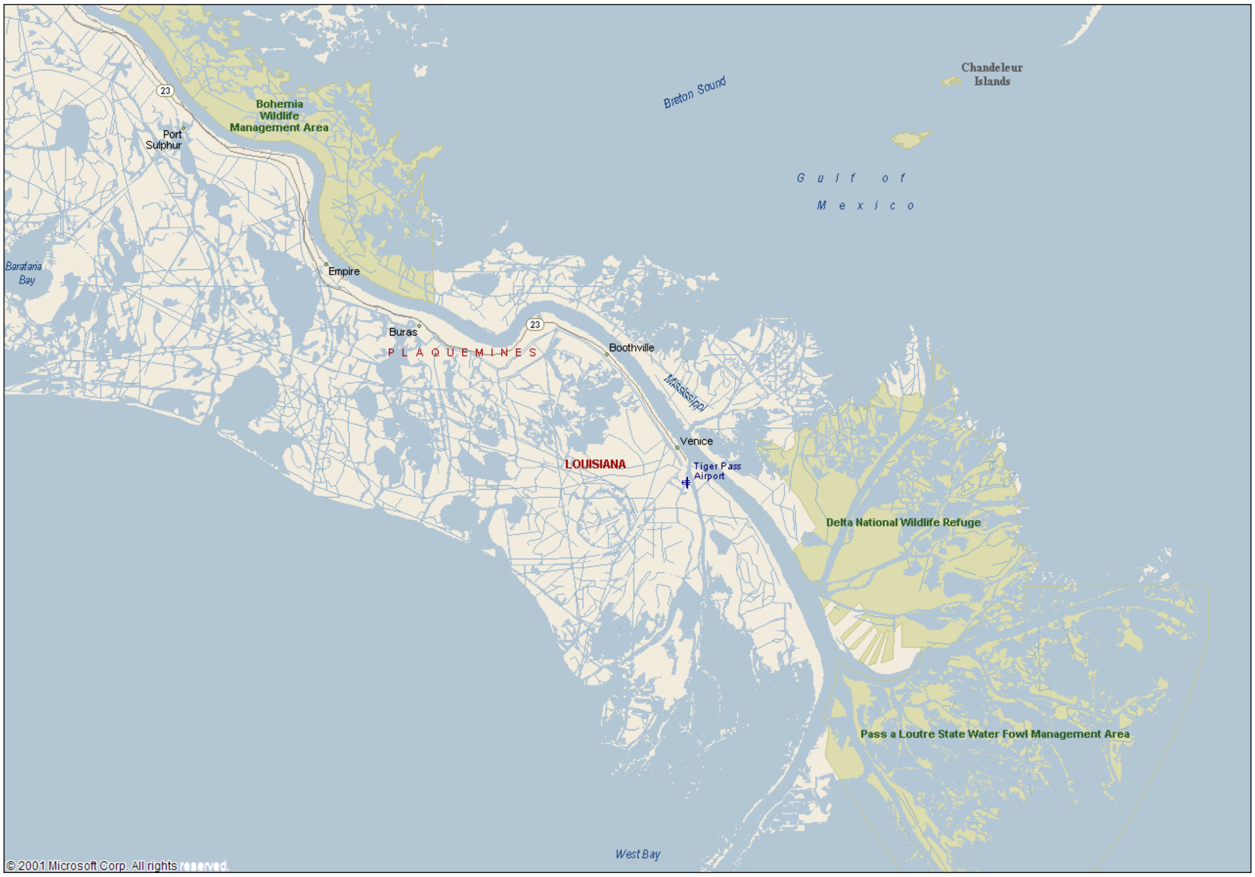

Figure 2.13. The Community of Venice, Louisiana.

Venice is located at the end of the Mississippi Delta in Plaquemine Parrish, on the southern most tip of Louisiana accessible by car. It lies about 30 miles south of Point a la Hache. The major industries are oil, seafood and, increasingly, recreational fishing.

While local residents of Venice have long harvested marine resources for both income and subsistence, Wilson and McCay found that Venice residents themselves do not participate in the highly migratory species fishery. Most pelagic long liners who sustain the commercial tuna industry in Venice are Vietnamese and live in New Orleans or a suburb of the city. Even Louisiana natives who fish for shark with nets in state waters live in neighboring towns, not in Venice. (Wilson & McCay 1998).

At the time of their study, Wilson and McCay found four docks in Venice where longline boats unload. One wholesaler purchases catches at three of these docks for a 25 cent docking fee. The fourth dock sells to a different New Orleans-based wholesaler. Like Dulac, the docks and fishermen who target the highly migratory species of interest in this report are largely a commuter population.

Of the 6 shark permitted vessels that call Venice homeport 4 have a swordfish permit (Table 2.41). A couple of vessels do have king mackerel permits and one has a Spanish mackerel permit. There were three federally permitted shark dealers in Dulac during 2004.

Table 2.41. Federal Permits by Type for Venice, Louisiana Shark Permit Holders (Source: NMFS 2004)

Type of Permit	Number
Total shark permitted vessels	6
Commercial King Mackerel	2
Commercial Spanish Mackerel	1
Commercial Spiny Lobster	0
Red Snapper Class 1	0
Red Snapper Class 2	0
Reef Fish	0
Charter/Headboat Reef Fish	0
Charter/Headboat for Coastal Pelagics	0
Charter/Headboat for Snapper Grouper	0
Snapper Grouper Class 1	0
Snapper Grouper Class 2	0
Snapper Grouper Trap	0
Swordfish	4
Rock Shrimp	0
Federal Dealers	3

In terms of fishing related employment, there were 48 persons involved in either fish and seafood and markets which grew from 1998 (Table 2.42). There were also 15 persons employed in marinas that also increased from the previous time period.

Table 2.42. Employment in Fishing Related Industry for Venice, Louisiana (Zip code Business Patterns, U.S. Census Bureau 1998)

Category	NAIC Code	Number Employed	
		1998	2001
Fishing	114100	0	0
Seafood Canning	311711	0	0
Seafood Processing	311712	0	0
Boat Building	336612	0	0
Fish and Seafood	422460	25	41
Fish and Seafood Markets	445220	3	7
Marinas	713930	7	15
Total Fishing Employment		35	63

Venice is not as vulnerable as Dulac, yet still registers a scale score of -3 (Table 2.43), which means it is still likely vulnerable to any adverse social or economic impacts that might accrue. In many instances, the community is like the parrish overall, in terms of the index variables chosen; yet scores sufficiently lower overall on vulnerability.

Table 2.43. Vulnerability Scale Score

Index Variable	Plaquemine Parrish	Venice	Score
Percent minority population	31.2	38.7	-1
Percent below poverty level	18.0	17.3	0
Percent unemployed	3.6	3.8	0
Percent high school graduate or higher	68.7	48.4	-1
Median household income (dollars)	38,173	33,812	-1
Percent owner-occupied housing units	78.9	80.0	0
Total scale score			-3

Table 2.44. Boothville-Venice Census Demographics

Factor	1990	2000
Total population	2743	2220
Gender Ratio M/F (Number)	50.1/49.9	51.0/49.0
Age (Percent of total population)		
Under 18 years of age	36.1	31.7
18 to 64 years of age	57.6	60.8
65 years and over	6.3	7.5
Ethnicity or Race (Number)		
White	1810	1375
Black or African American	783	638
American Indian and Alaskan Native	80	75
Asian	62	89
Native Hawaiian and other Pacific Islander	-	0
Some other race	8	6
Two or more races	-	37
Hispanic or Latino (any race)	50	27
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	28.0	27.3
Percent high school graduate or higher	43.5	48.4
Percent with a Bachelor's degree or higher	3.8	3.0
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	7.4	10.2
And Percent who speak English less than very well	1.7	3.8
Household income (Median $)	16250	33812
Poverty Status (Percent of population with income below poverty line)	36.2	17.3
Percent female headed household	12.1	14.2
Home Ownership (Percent)		
Owner occupied	82.8	80.0
Renter occupied	17.2	20.0
Value Owner-occupied Housing (Median $)	47900	73600
Monthly Contract Rent (Median $)	223	276
Employment Status (Population 16 yrs and over)		
Percent in the labor force	51.4	53.0
Percent of civilian labor force unemployed	6.4	3.8
Occupation (Percent)		
Management, professional, and related occupations	-	18.1
Service occupations	-	10.6
Sales and office occupations	-	19.5
Farming, fishing, and forestry occupations	12.1	11.0
Construction, extraction, and maintenance occupations	-	11.4
Production, transportation, and material moving occupations	-	29.4
Industry (Percent)		
Agriculture, forestry, fishing and hunting	14,5	22.7
Manufacturing	7.1	4.8
Percent government workers	11.4	16.1
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	22.3	13.4
Percent using public transportation	0.0	1.2
Mean travel time to work (minutes)	-	16.3
Percent worked outside of county of residence	-	

3.0 Findings: Shark Permit Holder Survey

To better understand shark permit holders attitudes toward the buyout process, a mail-out survey was conducted with the universe of shark permit holders in April 2005. Using a modified Dillman technique, questionnaires were mailed to 605 shark permit holders using a permit database provided by the National Marine Fisheries Service Southeast Regional Office. Questions covered a broad spectrum of topics including: goals for and perceptions of all fishing activity; description of shark fishing activity; attitudes and perception of shark buyout procedures; permit owner and household demographics. Questionnaires were modified for those cases where several permits were held by one individual or corporation to avoid duplicate responses. In those cases where multiple vessels were owned, respondents were asked to repeat answers for the vessels only and general questions once. For more detail on the survey makeup and sampling, see Larkin et al. 2005 in this business plan.

The response rate to the survey was over 50%, although due to the timeframe for when the permit database was generated (2004) and the time the survey was mailed out (2005), there were many permits that were sold and vessels no longer in the fishery. Given those changes and the remaining permits, the response rate may have reached close to 60% (See Larkin et al. 2005). The geographic distribution of respondents was very similar to the population as a whole with the majority of responses from Florida (58%) which is where just over 50% of the permit population resides.

In terms of their demographic profile, respondents to the survey were on average around 50 years old (Table 3.1). The youngest respondent was 28 and the oldest 82. Most had fished commercially for a good part of their adult lives with an average of 28 years. However, with only 72 responding to how many years they have fished shark, there seems to be few of the total number of respondents who actually fish shark as a routine part of their annual fishing round. Of those that do fish shark they have done so on average for about 16 years.

Table 3.1 Means for responses to demographic questions

Question	N	Minimum	Maximum	Mean	Std. Deviation
Age	317	28	82	51.60	10.096
Number of years fished commercially	252	0	65	27.55	10.788
Number of years fished shark	72	0	45	15.79	9.558
Percentage of income from fishing	322	0	100	71.33	33.694

Table 3.2 What is the highest degree you have received? (n=316)

Response	Frequency	Percent
None	46	14.6
High school	180	57.0
Associates	35	11.1
Bachelors	46	14.6
Graduate	9	2.8

The majority of respondents had a high school degree or greater in terms of their education level. There was a small percentage that did not have a degree at all and that same percentage had at least a bachelors degree.

Almost 75 % of respondents were married, with the next largest category being divorced. Only a small percentage were never married, so most respondents are likely to have households dependent, in some fashion, upon their fishing operation.

Table 3.3 What is your current marital status? (n=316)

Response	Frequency	Percent
Never married	21	6.6
Married	236	74.7
Co-habiting	12	3.8
Separated	7	2.2
Widowed	4	1.3
Divorced	36	11.4

With regard to ownership of their homes, nearly 85% of those who answered this question owned their homes and about 10% rent. It is likely that many of those who do own their homes have some type of mortgage associated with their residence, although we did not ask that question.

Table 3.4 What is your current housing arrangement with regard to ownership? (n=316)

Response	Frequency	Percent
Own	272	84.5
Rent	32	9.9
Other	12	4.0

Just over 72% of respondents had health insurance for themselves and slightly less had health insurance for their family. That is slightly lower (27.8% no insurance) than the average for the nation as a whole as it has been reported that in 2002 about 17% of adults under 65 reported as having no health insurance according to recent statistics by the Center for Disease Control.

Table 3.5 Do you have health insurance for your self and your family?

	Insurance for self (n=313)		Insurance for family (n=273)	
Response	Frequency	Percent	Frequency	Percent
No	87	27.8	84	30.8
Yes	226	72.2	189	69.2

With or without health insurance, the majority of respondents indicated that their health was good, very good or excellent. There was a small percentage that indicated their health was not good.

Table 3.6 How would you characterize your general health? (n=318)

Response	Frequency	Percent
Poor	2	.6
Not very good	22	6.9
Good	136	42.8
Very Good	102	32.1
Excellent	56	17.6

Although, most respondents did report good health, fishing is often a dangerous occupation and it should be noted that having health insurance with good health is vitally important when engaged in such a dangerous occupation.

Table 3.7 What type of ownership is there for this vessel? (n=311)

Type of vessel ownership	Frequency	Percent
Sole proprietor	154	49.5
Partnership	13	4.2
Corporation	144	46.3

Ownership of the vessel was just about even with almost half being sole owners of their vessel and just over 50% of the vessels being either corporate owned or in a partnership (Table 3.7). Just over 70% of the vessels had no debt associated with it and just fewer than 50% were insured (Tabe 3.8).

Table 3.8 Is there debt on the vessel and is it insured? (n=315)

	Is there debt		Vessel Insured	
Response	Frequency	Percent	Frequency	Percent
No	223	70.8	159	50.5
Yes	92	29.2	156	49.5

For the majority of vessels the species listed in Table 3.9 were either important or very important, with grouper being reported very important the most. Swordfish and snapper are rated less important more often than other species.

Table 3.9 How important are the following species to your fishing business?

Response	Shark (n=308) (%)	Tuna (n=263) (%)	Swordfish (n=257) (%)	Snapper (n=234) (%)	Grouper (n=244) (%)
Not at all	4.5	17.9	28.0	24.4	21.7
Slightly important	10.1	10.3	9.3	9.4	7.8
Somewhat important	24.0	16.3	15.2	11.1	6.1
Important	15.9	8.0	4.7	12.0	8.2
Very important	45.5	47.5	42.8	43.2	56.1

With regard to opinions toward different management, the majority of respondents did not support revoking unused permits. This may reflect the large number of individuals who do not have shark landings. Over 70% support either buying back permits or both permits and vessel and approximately that same percentage do not want to see existing regulations tightened (Table 3.10).

Table 3.10 Do you support the following management?

Response	Revoke unused permits (n=292) (%)	Buyback permit (n=303) (%)	Buyback vessel and permit (n=303) (%)	Tighten existing regulations (n=293) (%)	Allocate IFQs (n=294) (%)
Oppose	54.8	15.5	15.8	73.0	38.8
No Opinion	18.5	13.9	12.5	17.4	28.2
Support	26.7	70.6	71.6	9.6	33.0

Respondents are evenly split regarding support for IFQs with about a third opposing, with no opinion and supporting such management.

Table 3.11 Are you aware of the shark buyback proposal? (n=321)

Response	Frequency	Percent
No	135	42.1
Not sure	17	5.3
Heard of it	116	36.1
Very aware	53	16.5

Just over half of respondents said they were aware of the buyback proposal (Table 3.11) and a large majority is willing to sell either their permit or their vessel and permit (Table 3.12).

Table 3.12 Are you willing to sell your permit or permit and vessel at a reasonable price?

	Permit alone (n=310)		Permit and vessel (n=313)	
Response	Frequency	Percent	Frequency	Percent
No	78	25.2	105	33.5
Yes	232	74.8	208	66.5

However, almost half are not willing to pay a tax to fund a buyback of permits or vessels. This may also reflect the large percentage of permit holders that do not have shark landings.

Table 3.13 Are you willing to pay a tax for the buyback? (n=320)

Response	Frequency	Percent
No	153	47.8
Yes	78	24.4
Don't know	89	27.8

When asked where they get most of their information about the shark fishery, by far the most often cited was the National Marine Fisheries Service. The next most often selected was other fishermen.

Table 3.14 Where do you get your information about the shark fishery? (n=317)

Response	NMFS (%)	Other fishermen (%)	Local paper (%)	Public meetings (%)	SOFA (%)
No	12.3	33.1	84.9	79.8	85.8
Yes	87.7	66.9	15.1	20.2	14.2

For a more detailed analysis of respondent's choices with regard to the buyback program and the bids they were willing to accept, see Larkin et al. (2005) in this business plan. A discussion of the survey responses and community profiles follows in the next section.

4.0 Findings: Overall

It is difficult to know how each community might be affected if there were adverse social impacts from the buyout process without a better understanding of the communities themselves and how the fishing economy and enterprise is incorporated into the larger economy and community culture. The development of the vulnerability index offers one manner of assessing the possibility of adverse impacts and their consequences. Most of those communities profiled did fall into the vulnerable category which means that they did not fare as well as the county overall in terms of quality of life indicators. This most likely indicates that for those fishermen who do live in those communities, it may be more difficult for them to transition into other businesses if necessary.

Overall, the shark fishery seems to be a small part of the annual round of fishing; however, it may be an important part of an individual's fishing operations and may have even greater seasonal importance to them. Because it is becoming more difficult to enter other fisheries as limited entry and increased regulation become common, the choices for fishermen are also becoming limited. Work outside of fisheries becomes more likely if suitable jobs are available. That is why vulnerability measures become important, as these social indicators offer a glimpse of employment and other opportunities outside of the local fishing economy. Unfortunately, for most of the communities included in the profile, they do not seem capable of absorbing any large social or economic disruptions well. In fact, dislocation from the shark fishery may mean dislocation from their community for those included in the profile.

Given that most respondents would like to sell their permits and vessels, yet would not support a tax to fund such a buyout, it seems that the only alternative would be to seek funding elsewhere. Additionally, the revenues from the shark fishery alone would provide only enough money for a very limited buyout (Larkin et al. 2005). The structure of a buyout with this fishery would need to be considered carefully before the process was to begin, giving special consideration to where the most adverse impacts might occur. Removal of vessels in some communities may have secondary impacts on other types of fishing infrastructure, i.e., fish houses, local seafood retailers, fuel providers. While the vulnerability index is one measure of where significant impacts might be, it would be wise to consider other types of impact assessment once the number and location of vessels/permits being removed from the fishery is known.

The shark fleet is an aging fleet with an aging group of owners. Most shark fishermen fish other species that are likely more important to the annual round than shark is overall. Yet, the shark fishery may be an important source of income during the season and the removal of that income could have substantial impacts if there is no compensation. Fishermen like most businessmen, have configured their business operation on current opportunities and must make their decisions based upon what future they can perceive. A buyout of shark permits and/or vessels may offer one alternative, but is difficult to assess the impacts without knowing all the risks. Some fishermen who hold shark permits are willing to take some risks as seen through their willingness to not insure their vessels or have no life insurance. Overall, most shark permit holder's perception is that selling their permit or vessel is a good risk, but not if they have to pay a tax. With little support for tightening present regulations, alternative management might be needed. However, there was limited support for an IFQ system, although with proper outreach, more support may be engendered given the narrow range of options for other management. Because NMFS is the primary source of information about the shark fishery, it would be the most likely source of outreach information for alternative management in the fishery.

5.0 Evaluation

The goals and objectives of this research were to provide a socio-economic profile of the shark fishery of the Florida Gulf and Atlantic coast. To a large extent those goals were met with profiles of selected communities using permit and census data and an overall profile of the industry provided through the use of secondary data and primary data in the form of a survey conducted with 2004 permit owners. The profiles of communities and industry provide a context for the buyout proposal and the survey gave a current view of industry concerns with regard to a buyout scheme.

Although these goals and objectives were met to a large degree, delays in obtaining permit data created obstacles to this research which prevented certain aspects of this research from being completed. One task was to hold a series of meetings with shark vessel owners to go over their concerns prior to the survey which would have assisted in developing pertinent questions and may have increased the response rate. Visits to selected areas and discussions with shark vessel owners would have offered an opportunity to gather more detailed information on the present status of the industry and more insight into some of the dynamics of the fishery and its connection with the larger community.

In the end, because of time commitments to other work and the inability to hire an assistant due to delays, some tasks were not included in this research or were handled by the principal investigator. While these modifications did not hamper the attainment of goals and objectives, it did encumber the amount of detail and depth that was included in the profiles.

The results of this project, along with the other components of the buyout plan will be disseminated to the industry and made available on the Foundations website.

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Appendix

Case Summaries of Landings by Homeport City

State	Homeport City	Shark Landings (lbs)*
FL	Clearwater	2500.21
	Cortez	7.94
	Crystal River	-
	Dania	-
	Destin	13137.29
	Fort Pierce	6831.93
	Gulfport	-
	Jacksonville	1684.56
	Jupiter	-
	Key Largo	4523.02
	Key West	11382.85
	Largo	4062.25
	Madeira Beach	21463.32
	Malabar	-
	Marathon	-
	Mayport	-
	Miami	9568.21
	Naples	7794.47
	New Smyrna Beach	-
	Odessa	-
	Palm Beach	-
	Palm Beach Inlet	-
	Panama City	2137.46
	Parrish	-
	Pompano Beach	792.79
	Ponce Inlet	-
	Port Canaveral	-
	Port Orange	9325.54
	Port Salerno	11652.55
	Sarasota	2950.23
	Sebastian	98.19
	Seminole	-
	St. Augustine	-
	St. James City	-
	St. Lucie	-
	St. Marks	-
	St. Petersburg	-
	Stuart	-
	Tampa	7940.30
	Tarpon Springs	9.41
	Tavernier	-
	Treasure Island	-
	West Palm Beach	-
	Total	224309.17
GA	Darien	-
	Townsend	-
	Total	668.41
LA	Dulac	391.46
	Galliano	-

	Houma	-
	Leeville	-
	New Orleans	35919.71
	Venice	-
	Total	38750.51
MA	Boston	2785.37
	Scituate	-
	Total	2956.46
MD	Berlin	-
	Ocean City	7763.21
	Total	7952.62
ME	Portland	-
	Saco	-
	Total	597.79
MS	Biloxi	-
	Pascagoula	-
	Total	49512.69
NC	Beaufort	-
	Engelhard	-
	Hatteras	20543.31
	Manns Harbor	-
	Manteo	-
	Rodanthe	-
	Southport	-
	Wanchese	29782.68
	Total	66831.43
NH	Portsmouth	-
	Total	83.50
NJ	Barnegat	-
	Barnegat Light	24817.52
	Bricktown	-
	Brielle	-
	Cape May	4102.45
	Forked River	-
	Point Pleasant	-
	Pt Pleasant Beach	-
	Sea Isle City	1392.89
	Waretown	-
	Wildwood	-
	Total	53229.95
NY	Bayshore	-
	East Islip	-
	Islip	-
	Montauk	3638.89
	New York	3061.34
	Shinnecock	-
	Total	14577.87
PA	Philadelphia	3075.91
	Total	3075.91
RI	Little Compton	-
	Wakefield	-
	Total	144.50
SC	Charleston	925.08

	Hampton	-
	Little River	-
	Mt Pleasant	-
	Murrels Inlet	-
	Total	3700.54
TX	Channelview	-
	Galveston	-
	Port Isabel	-
	Total	771.38
VA	Chincoteague	-
	Norfolk	167.42
	Onancock	-
	Tangier	-
	Total	9608.86

* Those communities with no landings (-) had less than three permitted vessels and could not be presented due to confidentiality concerns.

Appendix D

Southeastern U.S. Commercial Shark Fishery Stock Assessment and Fishery Management Policy Analysis

I.

Southeastern U.S. Commercial Shark Fishery

Stock Assessment and Fishery Management Policy Analysis

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In Partial fulfillment of
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August 5, 2005

II. Abstract: The project addresses the question of how much of a reduction in number of boats presently involved in the fishery for US Atlantic Large Coastal Sharks (LCS) would be required to allow the remaining boats to fish shark for most of the year. The present fleet size of approximately 125 active boats is catching the quota in a few weeks. If this number were reduced through an industry buyout, the study calculates that a fleet of about 21 standard Class III shark boats would take the current quota (2.2-million pounds dressed weight) in about 270 days. The present stock assessment of the resource suggests that this quota might safely be increased to about 5-million pounds, in which case a remaining fleet of 45 to 50 boats might be a reasonable target for the buyout.

Stock Assessment and Fishery Management Policy Analysis

III. SUMMARY

Nearly 600 boats ranging in size from a 14-ft skiff to a 146-ft motor vessel hold federal Limited Access Permits (LAP's) for landing sharks taken in the US EEZ in the Atlantic, Caribbean and Gulf of Mexico. These boats are estimated by NMFS to take the current annual TAC of large coastal sharks (LCS) in a few weeks of fishing in each trimester (four month) open period. This Report estimates the number of active boats needed to better match fleet size to the resource; that is to extend the time needed to take the Total Allowable Catch (TAC).

There are two types of shark LAP's: Directed (SKD) and Incidental (SKI). Under current regulations, the directed permit holders are allowed to land up to 4000 pounds dressed weight of large coastal sharks per trip (some species in the complex are protected and not allowed to be landed). Incidental permit holders are allowed to land up to five LCS per trip.

In 2003, there were approximately 245 SKD and 349 SKI permits extant. Most of the permitted vessels held federal permits to fish for other species as well as shark. This made it necessary to identify a "directed shark boat" and a "directed shark trip." We define a directed shark boat as holding an SKD permit, using bottom longline gear and having made at least one directed shark trip (a trip lasting 4 days or less and landing at least 100 lb whole weight LCS) during the three year period (2001-2003) for which we had logbook data. The 4-day time limit was used to separate trips believed to target LCS from trips that targeted other species and then finished off the trip with one or more sets for LCS. These criteria identify 126 directed shark boats that produce 85-percent of the LCS landings.

Within the group of 126 vessels, we identify 47 core vessels that depend on LCS for at least half their total landings and landed 50,000 lb whole weight LCS during the three-year period. We use these core vessels to standardize fishing power (defined as catch per set and catch per trip). We establish four Classes of Directed Shark Vessel: Class I< 32 ft, Class II 32-41 ft, Class III 42-54 ft, and Class IV >54 ft. We standardize 116 of the 126 boats to Class III (ten of the 126 lacked length information in the data base), and estimate a LCS catch-per-trip for a Class III vessel at 2270 pounds dressed weight.

During the three years covered by our data base, 175 SKD boats and 96 SKI boats report landing some LCS and SCS. These landings include catches by gillnet and handline as well as bottom longline and pelagic longline. Seventy SKD boats and 253 SKI boats made no shark landings, and represent latent effort that could participate in the fishery unless their permits are removed. Assuming this were done, and these boats cannot fish LCS, we estimate that a fleet size of about 20 Class III SKD shark boats and 96 SKI shark boats would match available effort to the current TAC of 2.25-million pounds (the actual number of boats would need to be adjusted according to length during the buyout process). Fleet size could increase to about 50 boats under an increased TAC of 5-million pounds. We could not quantify the effect of increasing the trip limit, but the distribution of landings suggests that a 25% increase to 5000 pounds is unlikely to have a major impact.

TABLE OF CONTENTS

List of Tables

List of Figures

Stock Assessment and Fishery Management Policy Analysis

"…the moot point is, whether Leviathan can long endure so wide a chase, and so remorseless a havoc; whether he must not at last be exterminated from the waters, and the last whale, like the last man, smoke his last pipe, and then himself evaporate in the final puff."

- Herman Melville, *Moby Dick*

SOME BASICS

Section Summary. Being a simple introduction to fishery management in which managers consider sustainable use in terms of controlling the catch or controlling the effort.

Some 150 years have passed since Melville wrote this passage. Both he and his message were ignored in his lifetime. Today, it might have got him a PEW Fellowship if he had ended his chapter at this point. But he did not quit while he was ahead, and went on to argue that, in essence, that though land animals can be hunted to extinction, the same can not happen in the oceans. Meanwhile Pew and the petroleum industry went on to save the whale by substituting kerosene lamp oil for whale oil, and relegating the Starbucks to selling coffee instead of chasing leviathan.

Of course, in Melville's time the total population living on Earth was about 1.5 billion people, most of whom lacked the technology to exploit ocean resources very effectively. Today the number is over 6 billion, and mechanized fishing is widespread, and the demand for fish is manifold what it was in the 1850's.

Even though most scientists at the turn of the 20^{th} century were of the opinion that fishing was unlikely to result in extinctions, there was acceptance of the fact that fishing could cause the decline in abundance of stocks of fish. A considerable amount of effort went into developing ways to describe in mathematical terms the effect of fish catches on the abundance of fish stocks. The concept itself is simple enough. Baranov described it in 1918 as:

Eq. 1 $$C = F\,\bar{N}, \text{ where:}$$

C is the total catch in numbers killed,

F is the instantaneous fishing mortality rate, (the number of fish caught in any instant divided by the number of fish in the population alive at that same instant) and

$\bar{N}$ is the average number of fish in a population during the year.

Because most commercial fisheries buy by weight and not by the piece, Baranov's formula is often modified so that catch and biomass are in weight rather than numbers of fish. The expression becomes:

Eq. 2 $$C = F\,\bar{B}, \text{ where:}$$

C is the yield in weight[1], which may not be equivalent to total catch if it represents landed weight and does not reflect catch discarded at sea.
F is the instantaneous fishing mortality rate, (the number of fish caught in any instant divided by the number of fish in the population alive at that same instant) and
$\bar{B}$ is the average biomass by weight of fish in a population during the year.

Baranov's formulas form the basis for all the subsequent modeling that underlies even the most complex assessments made possible today by high-speed computing.

The desired goal in fishery management is to allow the largest catch C (MSY or OY)[2] that can be sustained over time while taking into account any other factors that seem necessary for consideration in the management policy. This means that the managers, with the advice of their technical people, have to decide upon an optimum stock size N or B for the fishery, and determine the F that can be allowed and still maintain the desired stock size. The process of determining these values, the assessment, is quite complex and uncertain, but once these have been provided by the technical side, the managers take on the political problem of satisfying, as best they can, the demands for catch (or no catch) from their constituents.

A common option taken by managers is to limit catch to Total Allowable Catch or TAC and to divide the TAC up among whatever entities convince the managers that they deserve a piece of the pie. Each piece of the pie will be a piece of the total fishing mortality proportional to the share they are awarded of the TAC. For example, if the TAC is to be divided evenly between say recreational and commercial fishermen, then each would be allowed to impose on the stock half the fishing mortality associated with the TAC.

There are two ways managers control TAC:

a) Control Catch: close fishing once the TAC has been reached.
b) Control Fishing Mortality: limit effort by limiting the number of fishing units involved in the fishery.

Managers may choose to develop a combination of the two – a quota and a limit on effort - in an attempt to "fairly" divide a limited resource among many constituents. In the present exercise, the idea is to limit the number of units in the directed commercial fishery for sharks by removal of excess existing capacity – Vessel Buy Out.

IV. PURPOSE - THE CONCEPT OF REMOVING EFFORT

Section Summary. A look at the relation between catch and effort and how the latter determines the former.

In the case of the Directed Shark Fishery, the overall management framework, which includes a TAC and other regulations, is already in place. The framework recognizes that because of a low TAC made necessary to meet the rebuilding plan of the assessment model, the share allocated to the Directed Shark fishermen is much less than in the past. The Directed Shark fleet now has more than enough units to catch the quota, and several measures have been implemented to prolong the duration of the fishery and to allow greater access to the resource for all the permit holders. These measures are a freeze on new entries, split seasons, area quotas and trip limits. A new measure under consideration is to remove a portion of the vessels holding permits so that the remaining vessels can more efficiently utilize the resource.

In general, here is how it is supposed to work. A number of boats (or fishing units: traps, set nets, etc.) are involved in a fishery on a stock (or group of stocks and/or species). They compose the fleet. The fleet works, expends effort (f), to catch the fish. Depending on the fishery the unit of effort may be expressed in units of gear, *e.g.* number of hooks, sections of gill net, *etc.*, or units of time, *e.g.* days at sea, days fishing, hook-hours trolled, hours trawled, *etc.*. If the fleet maintains some adequate degree of records, such as a fishing logbook, it is possible to calculate the catch per unit effort or CPUE for boats in the fleet by dividing the catch of each unit by the effort need to take that catch:

Eq. 3 Catch per unit effort: $CPUE = C/f$

Then, if all boats fish equally well, or if there is a way to standardize the CPUE for each vessel to estimate CPUE for a standard vessel, dividing catch by the standardized CPUE will give an estimate of the total amount of effort by the fleet that is needed to make that catch. If the catch is a TAC for the fleet, this calculation will give the amount of effort needed to reach TAC for that fleet.

Eq. 4 $f_{TAC} = TAC/CPUE_{STD}$

In the case where the fleet is able to generate much more effort than is necessary to take the TAC, and if there is some indication of how many days on the average a boat would participate in the fishery if the fishery were open for some predetermined time period and not restricted by running out of quota, it is then a simple matter to calculate how many boats *on the average* it would take to catch the TAC.

For example, if the TAC was set at 2-million lbs for the year and the boats had a standardized CPUE of 2500 lbs per day of fishing (the average CPUE for this example, it could be the number of hooks set per year fished, *etc.*). Then: Days of fishing to catch TAC = 2,000,000 lbs/2500 lbs per day = 800 days fished. If, on an average, a boat needed to fish 120 days per year to be a viable operation in the fishery, then the number of boats to catch TAC = 800 days/120 days per boat = 6.67 boats. And it becomes a political decision as to whether more than seven (6.67) boats should be allowed permits, and if so how many, and what provisions should be made to allow the TAC (and number of permits) to increase as the stock recovers, if the stock is below MSY.

Because for most managed fisheries the assessment work has been done and a management program put in place, the main technical difficulty in trying to tailor effort to fleet size is estimating a standardized catch rate for the fleet. This rate might be either in the form of CPUE or, in another form that is better suited to modeling, an estimate of q the catchability coefficient, where:

Eq.5 $$q = F/f$$

This is the same as Eq. 3 except that we divide the fishing mortality by the effort to get mortality per unit effort. This is handy for computations and, since F is a given in most assessments, we can find the effort needed to catch the portion of the TAC allocated to the fleet by dividing F by q.[3]

STANDARDIZING EFFORT.

Section Summary. A look at how catch and fishing effort are related and how one can estimate the amount of effort needed to yield a preset catch limit.

This simple approach assumes that all the boats are equal in fishing power, and that there is a good measure of CPUE and of *q* for the fleet at any time. However, all boats and all captains are not equal producers, and the fleet may comprise boats with different types of fishing gear fishing in different areas at different times. Also, stock size is not necessarily constant from year to year, and may fluctuate randomly, or exhibit some trend[4]. The unit of effort has to be standardized in order to account for these differences, and re-estimated at intervals to account for changing trends. To do this, the fleet needs to be disaggregated into individual boats and fishing power for each boat calculated. This is not too big a task for a small fleet all using the same gear and fishing the same area, but it quickly becomes a problem for a large fleet fishing over a wide area.

The way to simplify this task is to group the boats into a few different classes of vessel and develop a standard CPUE for each class. Often the length or horsepower of the vessel serves as useful determiner of class interval as bigger boats generally can stay out longer, travel farther afield, fish in worse weather and carry more per trip. A more powerful engine also may make a boat more effective, particularly in trawl fisheries.

The standardization process starts with a study of the fishery and the fishing behavior, the gear type(s) and characteristics of the vessels such as size and horse power of the engine. Sometimes this type of familiarization process results in insights that may suggest two or more classes of vessels compose the fleet, and that they can be standardized to a single "standard vessel." More often, the performance of the vessels must be examined statistically to determine the effect of several factors such as size, horsepower, gear, and equipment (electronics, helicopter, sonar, etc.), area fished, etc. From this, it may be possible to model performance for vessels in the fleet to a standard vessel. The process, however, usually reveals that little variability in catching (CPUE) can be explained by the vessel characteristics. Most seems to be attributable to individual captain's ability.

Standardizing the vessels is a several part problem that varies in complexity depending on the fishery. It is particularly troublesome in multi-species fisheries where the decision to fish a particular species may depend on the captain's decision rather than the demands of the market or seasonal availability of a species. Standardization may be simple for a purse seine fleet that is contracted to a particular cannery and fish as the cannery directs for all the fleet, but even here, performance often is better explained by the ability of the captain, than by any other factor. Standardization is more difficult for a fleet in a multi-species fishery where the boats can choose to follow migrating species or remain in home waters and fish other species. The decision as to what to do in any period is made either by the owner or by captain, and there is little coordination in the fleet over which vessels will engage in a specific activity at any time or in any area.

V. APPROACH - AN ANALYSIS OF THE CATCHING IN THE DIRECTED SHARK FISHERY.

Section Summary. We summarize the available data. Next, we examine the structure of the fleet and some operational characteristics, followed by a description of the fishery. We move then to Section IV. where we attempt devising a satisfactory means of standardizing fishing effort.

Data Supplied by NMFS. The National Marine Fisheries Service, Highly Migratory Species Office in Silver Spring, MD, And the Southeast Regional Office in St. Petersburg, FL, supplied the data for this project. The data files we have contain information for the vessels holding Directed or Incidental Shark Permits valid for 2004.

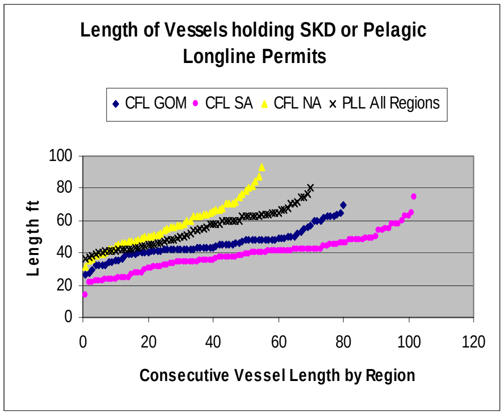
Appendix I lists the file names and size, followed by a brief description of the content. **Appendix II** list notations on some data errors and omissions we found when working with the files.

- Owner, operator, home port, permits held, vessel size, horsepower and hold capacity. Some of the records contain obvious errors in entry, and some omit entries for vessel size and/or capacity and/or horsepower.
- Coastal Fishery Logbook catch data of species taken, landed weight, area fished, trip duration, gear used and effort. Some entries are incomplete, and some effort entries appear to be incorrect.
- Pelagic Longline Logbook data with catch by species, by set with location.
- Auxiliary information on codes used in reporting, and a statistical area map.

The fleet

The data base contains entries for 594 boats that hold Atlantic shark permits issued for the year 2004[5]. Of these, 349 are Incidental Shark Permits (SKI) and 245 are Directed Shark Permits (SKD). The file also provides information on vessel length for 239 vessels. The distribution based by number and vessel length[6] for **directed shark vessels** for the three 2005 Coastal Shark Fishing Regions and the Pelagic Longline fishery is shown below. Assignment to region for CFL vessels is based on the home port listed in the permit data file. Of interest is the difference in the distribution of sizes for vessels among the three regions (Fig.1).

Eleven of the CFL boats hold only a Directed Shark Permit. The other boats hold at least one other type of permit in addition to their Directed Shark Permit. The majority of the CFL vessels hold two to five permits (Fig.2). Most of the boats holding a Directed Shark Permit can divide their annual effort among several fisheries that are under federal management.



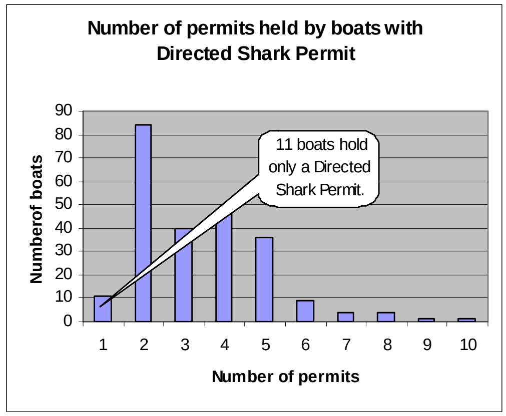
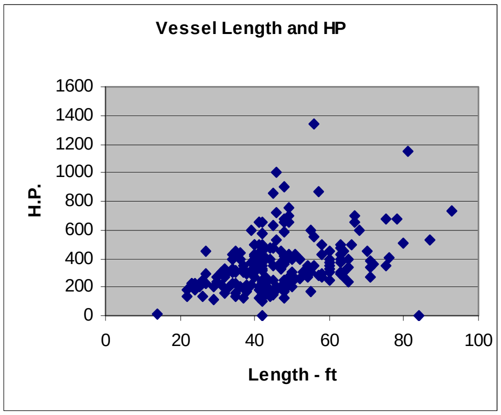


Figure 1. Vessel length **Figure 2. Number of permits held**

The permit file also lists engine horsepower and hold capacity for most of the CFL Directed Shark vessels (Figs 3 and 4).



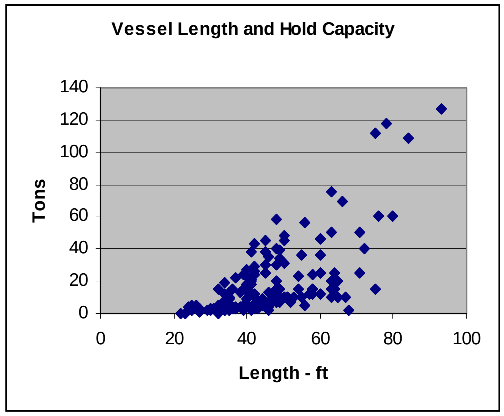


Figure 3. Length vs. H.P **Figure 4. Length vs. Capacity**

There is some indication that there are two groups of vessels: one group with a smaller engine size and greater hold capacity for a given length, and a second group of lighter displacement, faster boats with less hold capacity. The heavier displacement vessels have higher hold capacity for their length and are more likely adversely affected by low trip limit regulations than are the lighter displacement boats. We will explore these possible groupings later as we attempt to establish classes of vessels and fishing power, and in the discussion of trip limits.

The fishing - permits

The Directed Shark Fishery is an important segment of the coastal fisheries, particularly in the South Atlantic Region and the Gulf of Mexico Region. In addition, some pelagic longline vessels take coastal sharks, either as a directed take, or as an incidental take in pursuit of tunas and swordfish. The Shark Fleet (defined as vessels with Federal Permits that allow them to land shark) is really a collection of vessels that depend on a variety of species of fish and sharks for their annual production.

The “fleet” comprises 594 boats with Federal Shark Permits.

- 349 are Incidental Shark Permits
- 245 are Directed Shark Permits

The fleet reports the landings or catches with one or the other of two sets of logbooks.

- the Coastal Fisheries Logbook and
- The Pelagic Longline Logbook.

3032 vessels reported landings in Coastal Fishery Logbooks for the three Regions.

- 341 of those reporting hold shark permits.
- 167 are Directed Shark Permits
- 174 are Incidental Shark Permits

228 vessels reported catches in Pelagic Longline Logbooks.

- 168 of those reporting hold Shark permits
- 70 are Directed Shark Permits
- 98 are Incidental Shark Permits

48 vessels holding Federal Shark Permits reported in both logbook systems.

- 30 are Directed Shark permits
- 18 are Incidental Shark permits

133 vessels that hold Federal Shark Permits have not fished their permit for any species during the study period.

- 38 have Directed Shark permits
- 95 hold Incidental Shark permits
- 4 of the 11 vessels that hold only a Directed Shark permit and no other Coastal Fishing permit did not report catches during the study period

Of the CFL Directed Shark permits not fished

- 4 are from the North Atlantic Region
- 7 are from the South Atlantic Region
- 10 are from the Gulf of Mexico Region

<u>The fishing - distribution of catches and effort</u>

The way the fleet distributes its catches (and presumably its effort) can be seen in a general way on the following Statistical Grid Maps for the South Atlantic and Gulf of Mexico (Figs. 5 and 6).[7]

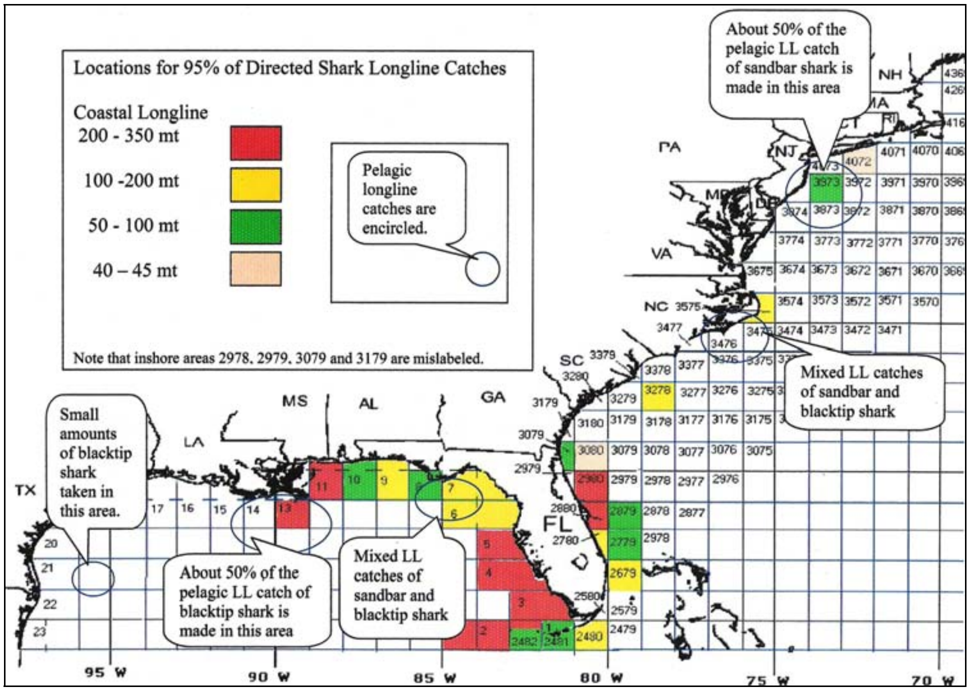


Figure 5. Areas of origin for most of the shark catches reported by the SKD Permit vessels using bottom longline gear reported in the Coastal Fishery logbooks and pelagic or bottom longline gear reported in the Pelagic Longline Fishery logbooks. Catches shown account for 95% of the landings.

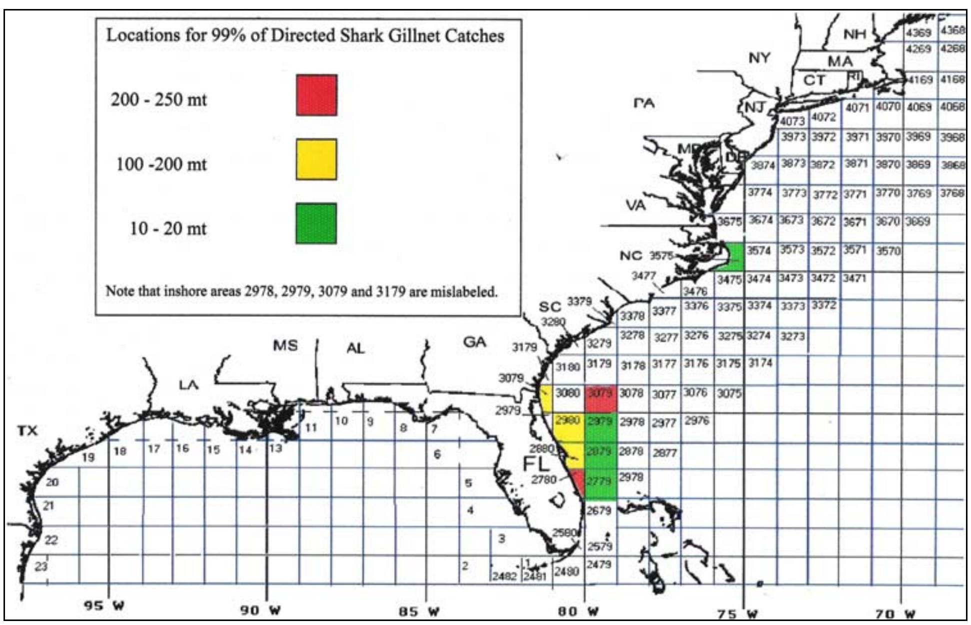


Figure 6. Areas of origin for most of the shark catches reported by the SKD Permit vessels using gillnet gear reported in the Coastal fishery logbooks. Catches shown account for 99% of the landings.

The majority of vessels operate exclusively in their home port Region. The Virginia/North Carolina border separates the North from the South Atlantic Region. There are a few tons reported caught in the southern portion of the North Atlantic Region by vessels from home ports in the South Atlantic Region. There is also a minor amount of movement both ways by vessels between the Gulf of Mexico Region and the South Atlantic Region. Most of this exchange involves fishing in south Florida, particularly in crossing the boundary along the Florida Keys. This latter is an administrative boundary separating the South Atlantic Region from the Gulf of Mexico Region and is unlikely of biological importance.

Origin and number of vessels fishing more than one region			
GOM	Keys	SA	NA
9 SA	4 SA 5 GOM	8 GOM 3 NA	17 SA

Table1. Origin and number of vessels fishing more than one region

The fishing – composition of the catch

The Coastal Atlantic shark fishery is a mixed species fishery. As expected, vessels holding Directed Shark permits land more sharks than do vessels holding Incidental Shark permits. The relative importance of the shark component of the catch varies from region to region. Sharks are of minor importance in the offshore pelagic fisheries where swordfish and tuna are the principal species of importance. **Only Large Coastal Sharks** are landed by vessels holding a Directed Permit (Fig. 7). Essentially no sharks are landed by the vessels holding Incidental Permits (Fig. 8).

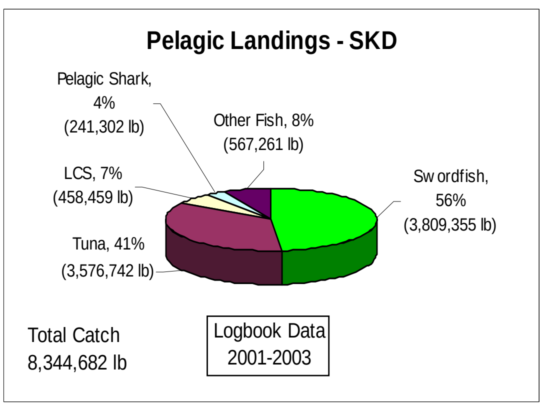


Figure 7. Catches by PLL with SKD permit

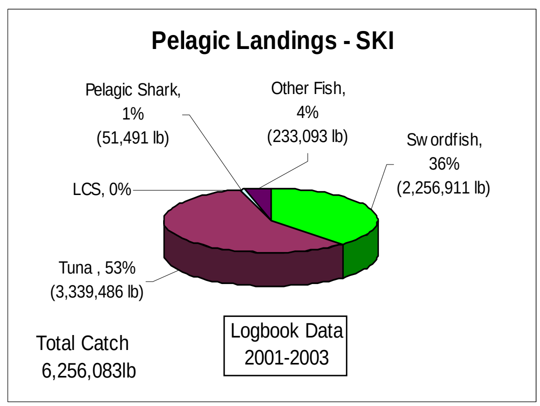


Figure 8. Catches by PLL with SKI permit

Catches of all species reported in the Coastal Fishery logbooks for the North Atlantic Region are low in comparison with the South Atlantic Region and Gulf of Mexico Region. Whereas sharks make up a large percent of the catch, the actual pounds caught are small and seasonal. It is in the South Atlantic Region and Gulf of Mexico Region where the major directed shark fisheries for both **Small and Large Coastal Sharks** occur. (The small coastal shark catch is about 14% of the total coastal shark catch.)

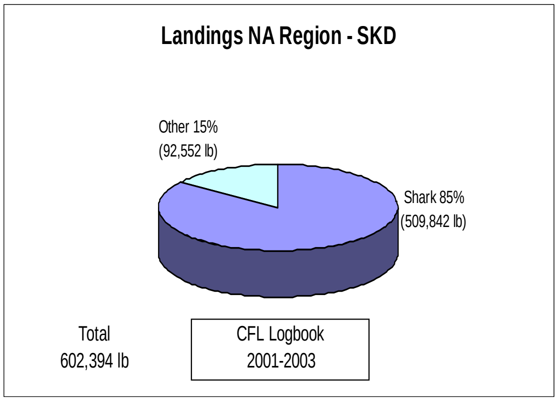


Figure 9. Landings in NA by boats with SKI permit

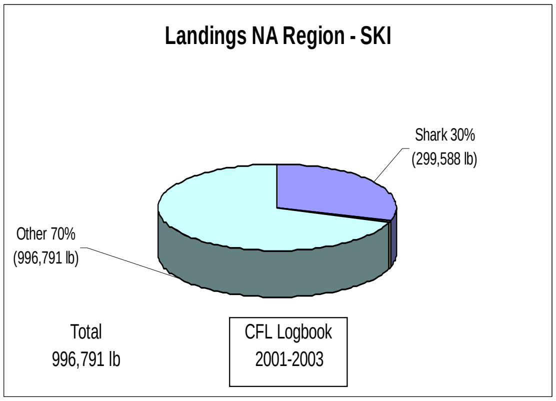


Figure 10. Landings in NA by boats with SKD permit

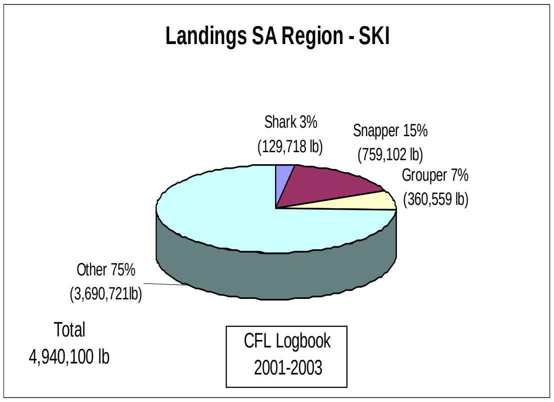


Figure 11. Landings in SA by boats with SKI permit

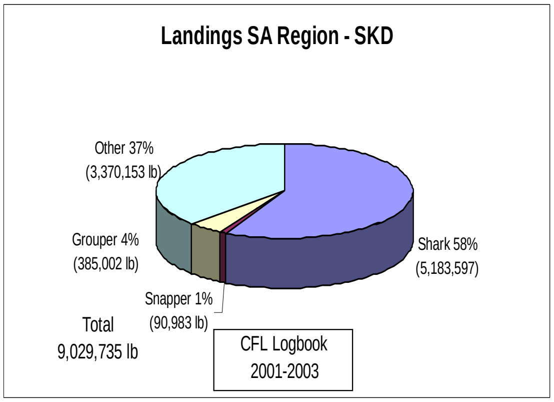


Figure 12. Landings in SA by boats with SKD permit

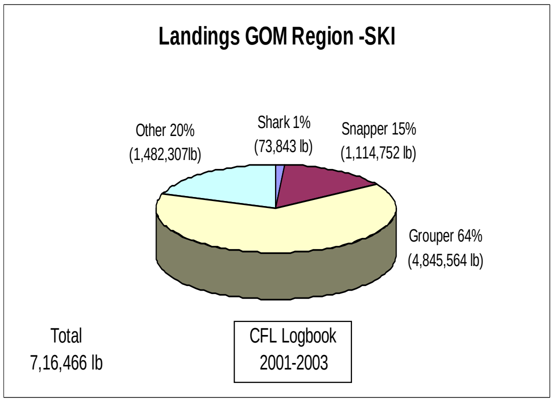


Figure 13. Landings in GOM by boats with SKI permit

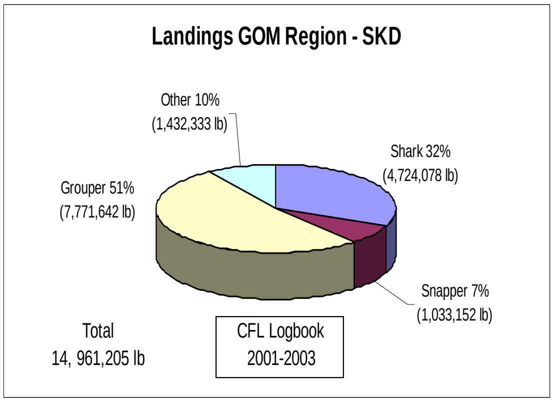


Figure 14. Landings in GOM by boats with SKD permit

CALCULATING CPUE AND FISHING POWER FOR LCS VESSELS

Section Summary. We analyze the data from the Coastal Fishery Logbooks, separate the fleet into four Classes of vessels, and develop a standardized measure for Catch per Trip for each Class and Three Regions.

For this task, we have:

- The Permit Register and the two sets of logbook data: Coastal Fishery Logbooks, and Pelagic Logbooks covering three years of fishing, 2001-2003.

- Three gear types that are the main contributors to the directed shark catch: pelagic longline, bottom longline and gillnet. Of these, the logbooks show bottom longline is by far the most important. The gillnet fishery involves 41 boats holding federal shark permits. Of these only five boats working out of central Florida's east coast produced over 5 tons of LCS in the 3-year period. One of these boats produces about half the total catch. A minor amount of LCS is produced seasonally by the pelagic longline fleet targeting with bottom longline gear and a few boats targeting with pelagic gear.

- Three areas: North Atlantic, South Atlantic and Gulf of Mexico. The Coastal logbooks report by one degree square boxes for the Atlantic and by one degree wide, indeterminate length areas originating and running normal to the coast line in the Gulf of Mexico.

- The permit data file providing information on vessel characteristics: length, engine horsepower and hold capacity.

All are factors that enter into calculating fishing power. The problem is deciding on which sets of vessels to use in estimating fishing power.

This is a mixed fishery. The Coastal Logbooks contain most of the shark catch data. Catch weight is recorded for each species taken on a trip, as is the total number of sets and number of hooks set. The logbooks do not provide individual set data, which restricts the detail of the analysis.

The data base shows that bottom longline boats may target fish such as snappers and groupers, may target sharks, or may do both on a single trip. We need to separate sets directed at shark from those directed at other species. Since most shark is delivered fresh, and since the product has a limited storage time on the vessel and shark is not a good companion on ice with table fish, targeting shark probably is done on the last set or two to finish off a bottom fish trip. Because individual set data are not reported, the amount of effort for shark within a trip cannot be determined from the logbook data file, nor can the amount of shark taken incidental to the bottom fish that may be the main target on multi-day trips. On the other hand, some trips target shark and last only a few days owing to the more perishable nature of shark. Therefore, we decide to use trip length to separate directed shark trips from bottom fish trips that finish off with one or two directed shark sets.

We used a three step process to select the data that is used in the final analyses:

1. Edit the records for apparent errors and omissions.

2. Select only trips that land at least 100 pounds of Large Coastal Shark.

3. Use only trips of four or less days away.

Trip data for vessels in the Coastal Fishery provide trip estimates of catch per trip, catch-per-set (but not catch per individual sets), and pounds caught per hook or length of net. Catch-per set data are available for the Pelagic Longline boats, and could be analyzed in the disaggregate, but we believe the small amount of the total shark landings in the pelagic fishery does not make such an extensive exercise worthwhile.

The analysis was planned in four steps:

1. A preliminary examination of all the data to obtain a general picture of the fishery during the three-year data window in the data base. This allows us to weed out those permits that were not fished, check for regional differences, and establish a protocol (see above) for selecting directed trips that minimize the interaction with trips that were not primary shark trips.

2. Establish groups of core vessels – the top producers - for each Region.

3. Examine vessel performance by year and Region to estimate fishing power.

4. Calculate standardized CPUE (Eq. 3).

The data

Catch information for catches during the study period comes from the two logbook sets: Coastal Fishery and Pelagic Longline. The logbook data are valuable in providing information on vessel performance and catch rates. They are not used to monitor the quota to determine closure dates for the fishery. Dealer reports, and not the logbooks, are used. These two data sets may differ in some respects and information on catches from the vessel logbooks may not exactly agree with landings reported in dealer reports.

The logbook data sets contain some obvious errors in data entry, which we corrected. We retained many entries that were possible, even when the numbers were unlikely. Table 2 and Fig. 15 summarize the shark catch.

Fishery	Permit	Species Group	Gear	Total Catch
Pelagic	SKI	LCS	Pelagic and Bottom Longline*	2,929**
Pelagic	SKD	LCS	Longline	469,116**
Coastal	SKI	SCS	All	170,822
Coastal	SKD	SCS	All	1,672,852
Coastal	SKI	LCS	All	517,209
Coastal	SKD	LCS	All	10,395,136
Coastal	SKD	LCS	Bottom Longline	9,256,842

*Note. Some trips by pelagic boats report using bottom longline gear. **We do not include Pelagic Shark species** in the summary because Pelagic Sharks have a separate quota that does not affect the LCS closure and, therefore, are not a consideration for the buyout plan.

**We are not certain how the weight for pelagic catches is reported in the PLL series.[8]

Table 2.Catch by species group and permit type and fishing gear.

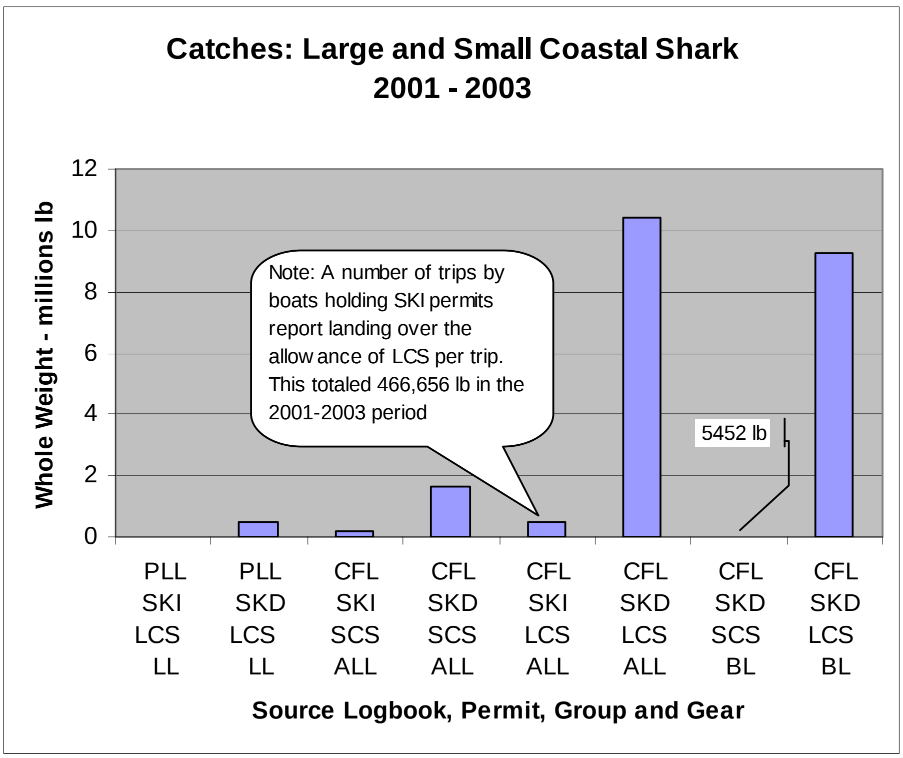


Figure 15. The X axis labels reading down show: Logbook Series (PLL = Pelagic Longline Logbook, CFL = Coastal Fishery Logbook), Permit Type (SKI = Incidental Shark, SKD = Directed Shark), Species Group (LCS = Large Coastal Sharks, SCS = Small Coastal Sharks), and Gear Type (LL = Pelagic Longline, may include some bottom sets , ALL = All Gear: electric reel, nets, handline, etc. and also includes bottom longline, and BL = Bottom Longline only). **Of note is the importance of bottom longline gear, which by itself accounts for about 90% of the total LCS landings.**

The species group of interest is the large coastal shark complex. Because the majority of the catch of large coastal sharks in the three regional fisheries is by bottom longline gear, most of our analysis focuses on that segment of the fishery.

During the years 2001 – 2003 covered by the data base, 3163 bottom longline trips landed a bit more than nine million pounds whole weight of large coastal shark. The individual landings are summarized in Fig. 16. Note that the pattern of landings is distorted on the right by the 4000 lb dressed weight (5560 lb whole weight) trip limit.

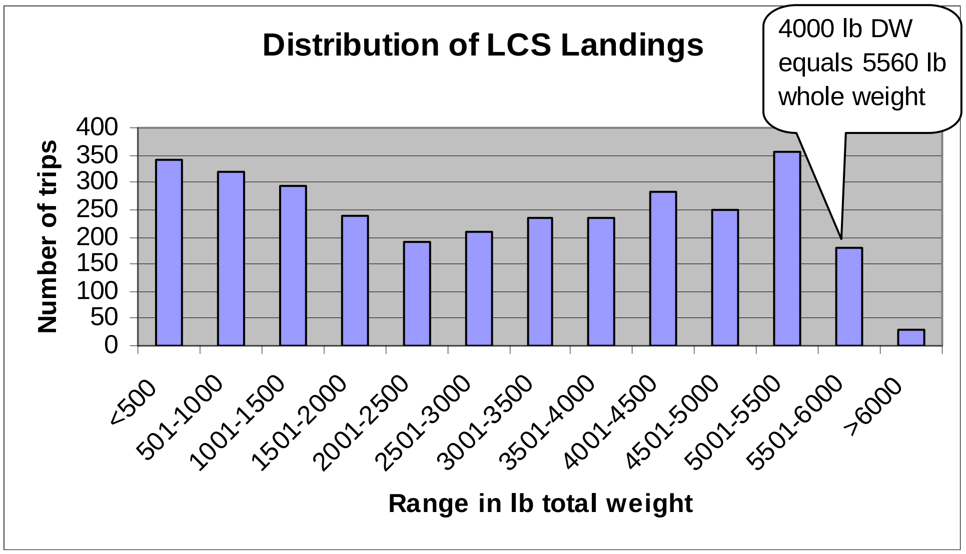


Figure 16. Number of trips reporting landings grouped by 500 lb (whole weight) intervals

The pattern of landings also is distorted over the course of the season (Figs. 17 and 18) by the TAC, which is reached before the end of the semester open periods. With the new "trimester" opening that goes in place in 2005, the pattern will change for the South Atlantic and Gulf of Mexico Regions. The North Atlantic Region has a biological seasonality as a summer fishery, and that pattern should remain about the same.

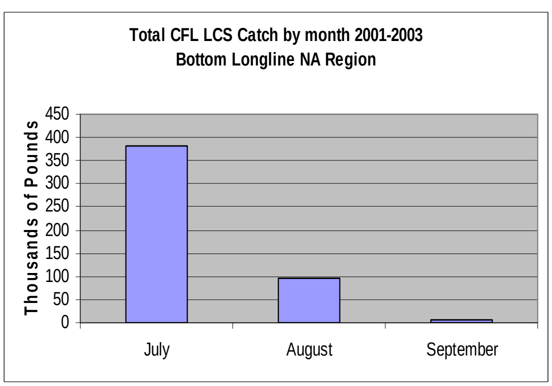


Figure 17. Monthly landings NA Region

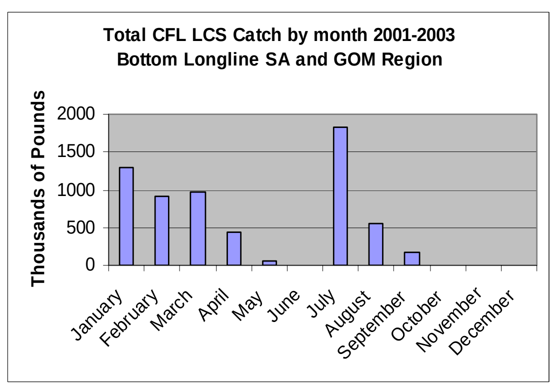


Figure 18. Monthly landings SA and GOM Regions

The regional distribution of catches for LCS and SCS is shown Table 3. The table also reports catches of the principal LCS species in the ridgeback and non-ridgeback groups.

SUMMARY CATCH - TOTAL WEIGHT LB	
All Gear Types	**All Regions**
Large Coastal Shark - all sp.	10,395,136
Small Coastal Shark - all sp.	1,672,852
Sandbar, dusky, blacktip, bull	9,665,940
Ridgeback - sandbar and dusky	5,830,465
Sandbar	5,793,653
Non-ridgeback - blacktip and bull	3,835,474
Blacktip	3,308,128

		Region	
All Gear Types	**Gulf of Mexico**	**South Atlantic**	**North Atlantic**
Ridgeback - sandbar and silky	2,750,475	2,671,311	408,680
Non-ridgeback - blacktip and bull	2,335,303	1,376,365	123,342
Small Coastal Shark - all sp.	412,488	1,253,691	6,674
Total with all gear types	**5,498,265**	**5,301,367**	**538,695**
Gear - Bottom Longline			
Ridgeback - sandbar and silky	2,747,104	2,648,994	399,019
Non-ridgeback - blacktip and bull	2,313,550	753,533	121,641
Small Coastal Shark - all sp.	291,653	181,162	6,660
Total Bottom Longline	**5,352,306**	**3,583,689**	**527,320**
Gear – Gillnet			
Ridgeback - sandbar and silky	0	101	
Non-ridgeback - blacktip and bull	0	577,370	1,567
Small Coastal Shark - all sp.	0	1,017,517	0
Total Gillnet	**0**	**1,594,988**	**1,567**
Total Bottom Longline + Gillnet	**5,352,306**	**5,178,677**	**528,887**
Total with other gear	**145,959**	**122,690**	**0**

Table 3. Landings by Region, Species Group and Gear Type

Next, we needed a way to decide on which trips were directed at shark. First, we examined the distribution of trips to how shark trips might be separated from trips that target other species. Figure 19 examines how the number of trips made by each boat holding a LAP for sharks varies with gear and targeting. The figure shows that about 190 boats (blue diamonds) using bottom longline gear made at least one trip in the three-year period, compared to about 50 boats (pink squares) using other gear. (One longline boat made about 900 trips in that interval.) Of the boats using bottom longline gear, 137 hold SKD Permits (yellow triangles). What is of interest is that only 126 of these made trips that landed more than 100 whole weight pounds of LCS (orange X's. **These are the trips we consider directed shark trips.**

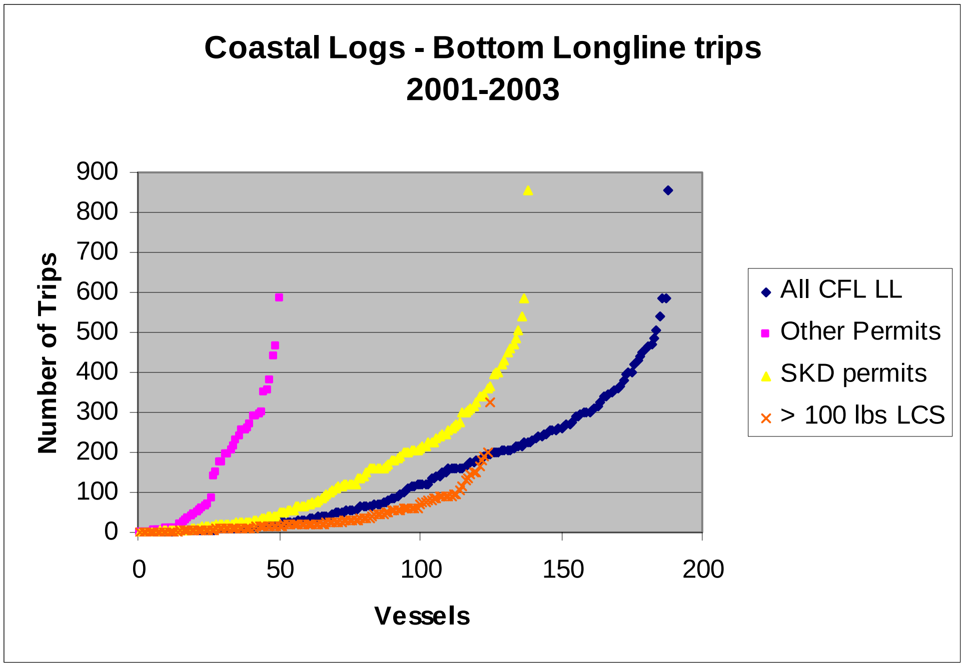


Figure 19. Number of trips made by each individual vessel in the Coastal Fishery Logbook system using bottom longline gear under permit and landings conditions noted in legend.

We then looked at the length of trips landing more than 100 lb LCS (Fig. 20) with the idea that directed shark trips, in the main, would be of short duration owing to the perishable nature of the product. And, as shown by Figure 20, most trips landing LCS were of only a few days absence. About 85-percent of these Large Coastal Shark trips lasted four or less days

.

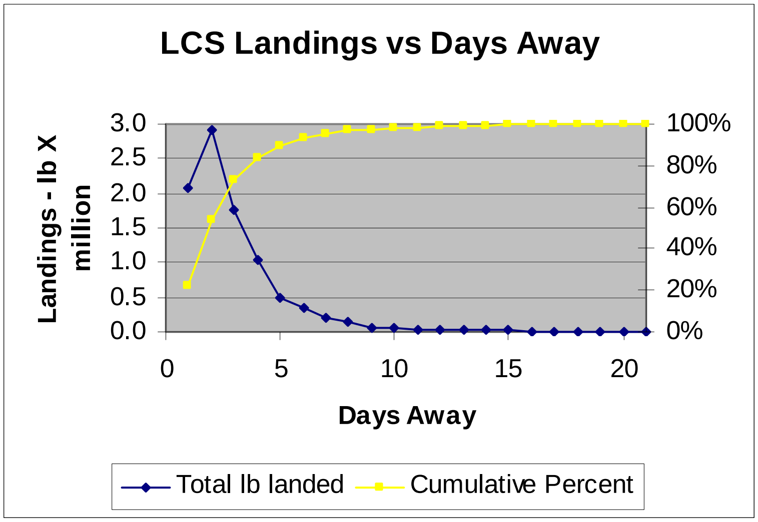


Figure 20. Trip duration vs. landings of LCS and cumulative percent of LCS landings

For the analysis, **we defined a shark trip as being a trip of four days or less with at least 100 lb of LC landed**. This definition accounts for 85-percent of the total SKD bottom longline landings.

LCS vessels and core vessels

Below are two plots (Figs. 21 and 22) of the landings data. Figure 21 shows the percent of the landings of each of these boats that was LCS. There is an interesting gap between 40- and 60-pecent LCS shown in Figure 21 that we consider can serve to separate core shark boats from the rest of the fleet. Note, however, that a high percent LCS in the landings does not necessarily mean that these boats landed a large quantity of LCS.

Figure 22 compares landings for boats taking at least 100 lb LCS during the three-year study period with their landings of all species including sharks. Some boats produced relatively small amounts of both LCS and other federally permitted species during the study period. Either the boats were operated by part-time fishermen who spent few days at sea during the year, or they fished mainly in state waters for species not covered by federal management regulations.

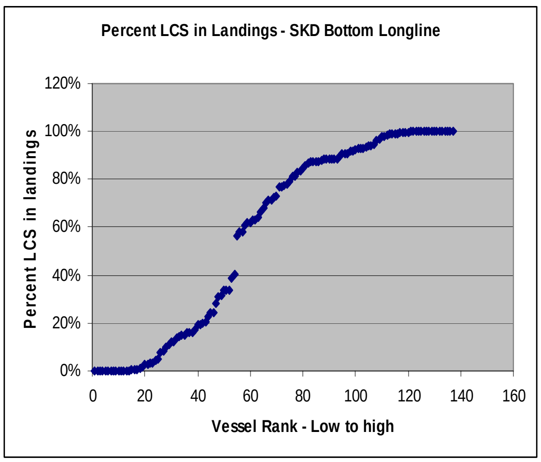


Figure 21. Proportion LCS in landings

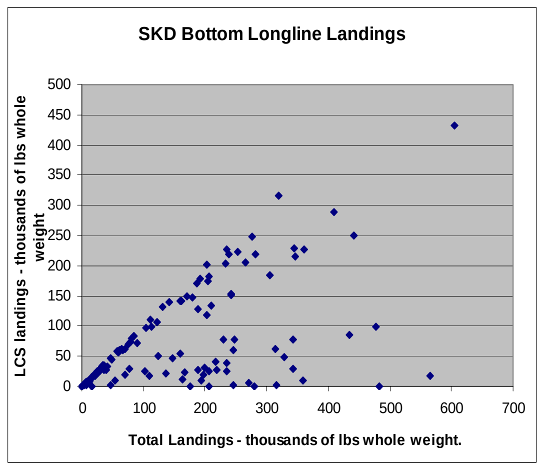


Figure 22. LCS landings vs. total landings

Of the boats represented above, we made two cuts. First, we removed 54 boats that had landings containing less than 50-percent LCS. Second, of the remaining 83 boats, we selected those that landed about 50,000 lb[9] (We included two boats that landed slightly less: 48,600 and 49,500 lb to increase the sample) or more LCS during the three-year period. These 47 boats are to be the core vessels we will use to establish vessel classes and compare their fishing power (CPUE) with that of the whole fleet. These boats account for 71-percent of the total LCS landed during the study period.

Next, we look at how vessel performance (CPUE, *Eq. 3* – here Catch/Trip) is related to vessel characteristics. We had three measures that could be used singly, or in combination. These were length overall, engine horse power and hold capacity.

Hold capacity was lacking for about 20-percent of the data base and, and horse power for about 7-percent. Neither, however, related well to catch per trip. Figure 23 compares horsepower to catch per trip, and shows little correlation. (A similar poor relationship exists with hold capacity and the combination that did not include length.)

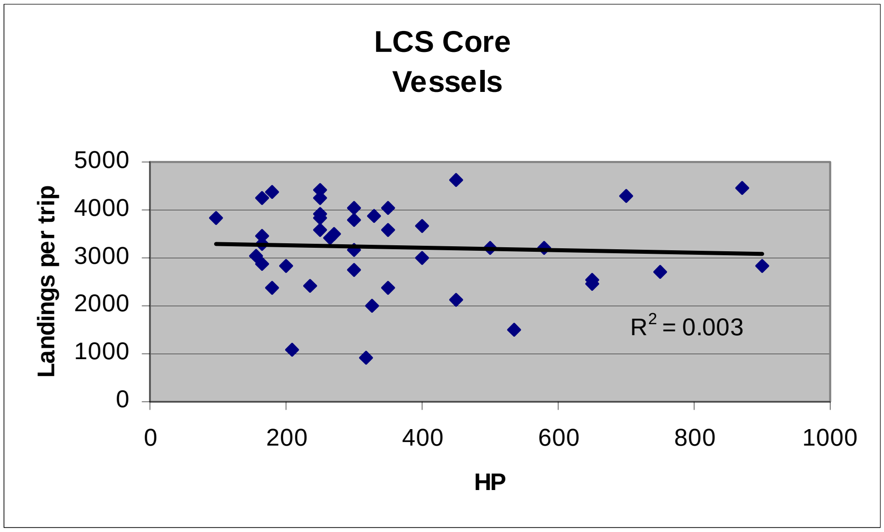


Figure 23. Relation between vessel horse power and fishing performance.

There is, however, good correlation (significant at the 0.01 level) between vessel length and fishing performance. This relation is shown in Figure 24.

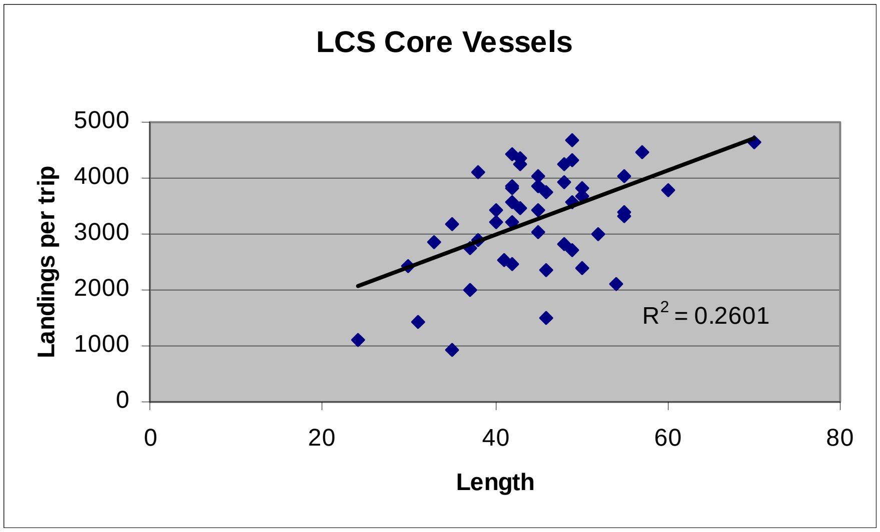


Figure 24. Relation between vessel length and fishing performance

This relationship is examined in detail in Figure 25, below. This is a scatter plot that shows the boats statistics for the 47 Core Vessels. It plots catch (landings) per trip and boat length. Each dot represents a separate trip. There are several boats represented in each length group. The line is a smoothing function connecting the average or mean for each length group of boats. The smoothing line flattens out in the center of the plot, suggesting that boats 42 to 55 feet in length are a group apart from smaller and bigger craft.

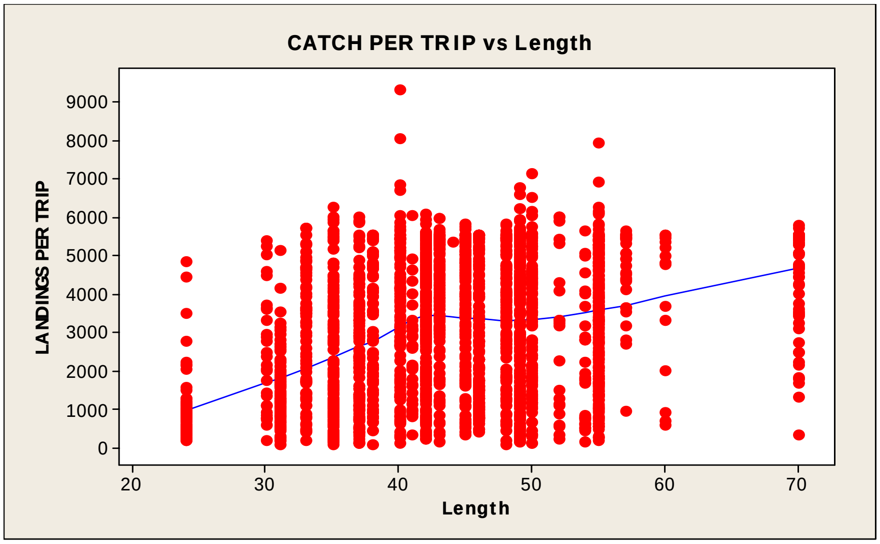


Figure 25. Scatter plot for landings per trip and vessel length.

The means for these data are plotted Figure 26. The means suggest perhaps four groupings by length: Small craft less than 32 feet, the boats from 32 feet to 41 feet, the boats 42 to 54 feet, and the largest vessels 55 feet and over.

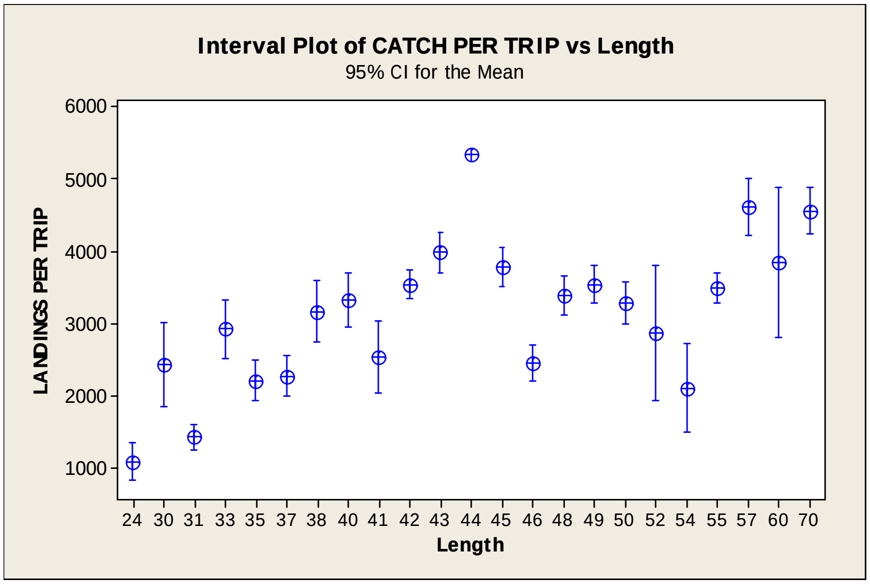


Figure 26. Mean length vs. landings per trip.

We look at these four possible Classes of Directed Shark bottom longline boats in Figure 27 on the following page. Each class consists of the data for all the vessels in the length interval.

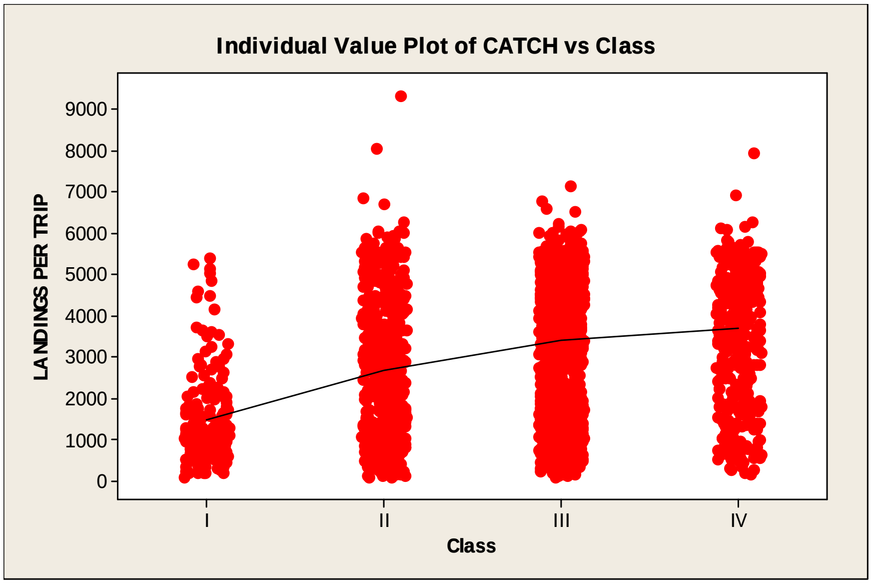


Figure 27. Scatter plot of landing per trip for vessels in four possible length classes

Each dot represents the LCS catch for one trip for each of four classes of shark boat. The line connects the means for each class. Note that some trips are in excess of the trip limit catch of 5560 total weight; one is over 9000 pounds.

Figure 28 shows four distribution plots for the Class data. None have a normal distribution. The landings for smaller vessels are skewed to lower catches per trip. The larger vessels are up against the trip limit as indicated by the spike at 5500 lb.

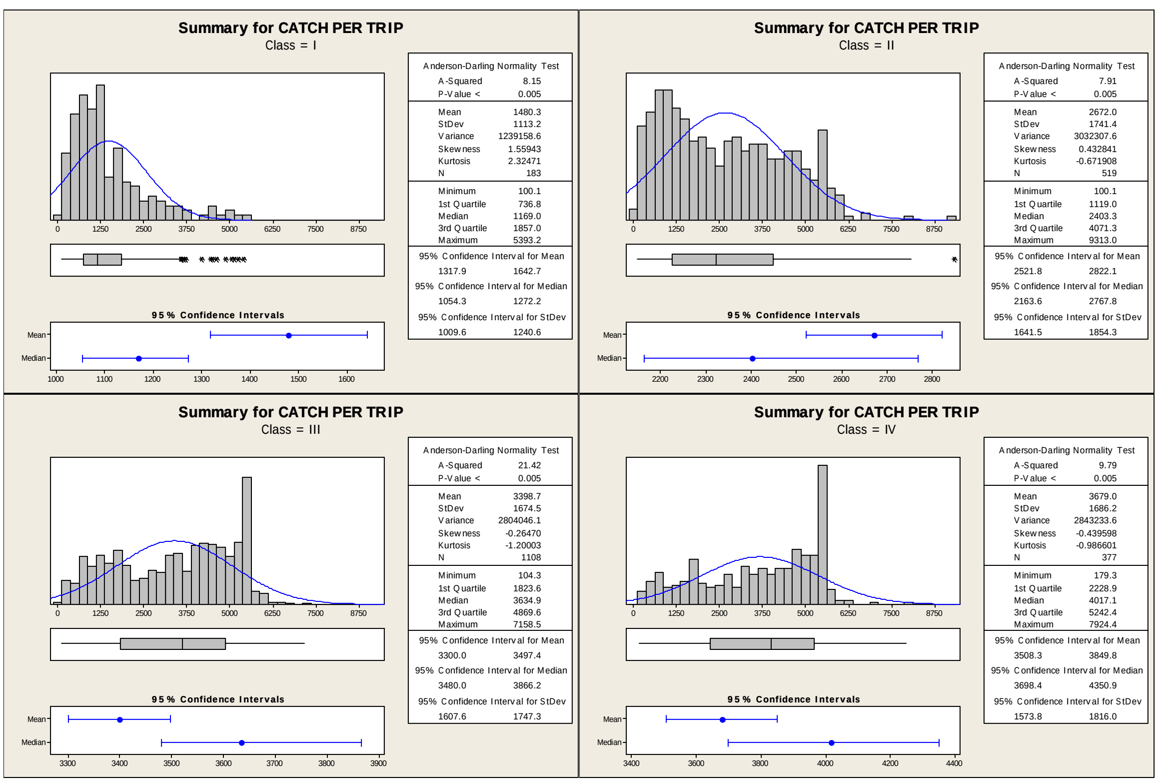


Figure 28. Distribution plots for four vessel Classes compared to a normal distribution curve.

It is less messy to look at the data in another type of plot: the boxplot (Fig. 29). The height of the boxes encompasses the two central quartiles and contains half the data points. The horizontal lines are the median of the observations. The connecting line joins the means for each Class. The whiskers extending above and below the boxes roughly indicate the expected range of the data. Outliers are denoted by an asterisk.

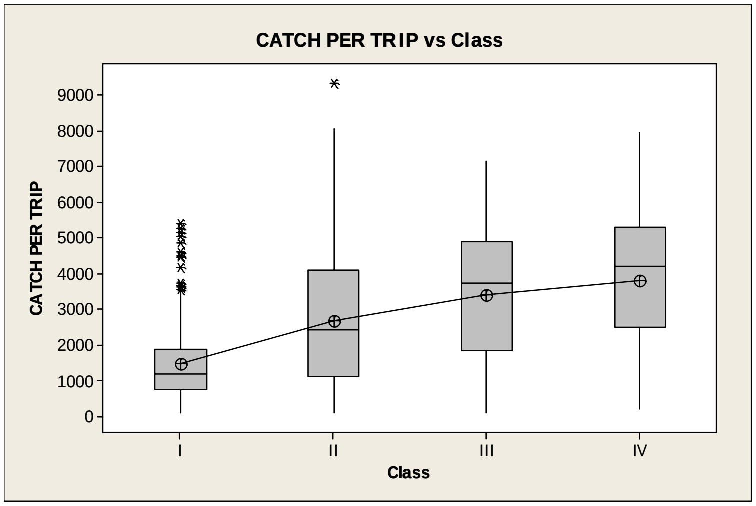


Figure 29. Box plot of landings per trip for each Class.

Why the difference among Classes? There is a considerable difference in work space, gear capacity and sea keeping between small boats and larger boats. The under 32-foot Class I is limited in carrying capacity and we doubt a 24-footer, the smallest in our sample, can pack 5000 pounds of shark on board very well. Similar limitations may affect fishing power in Class II boats. We also expect to find an increase in fishing power among larger vessels, however, the difference between Class III and Class IV is not pronounced, likely due to the 4000 lb dressed weight trip limit, which does not offer any advantage to the bigger boats aside from sea keeping, and perhaps the ability to set more gear.

To a degree, the difference among Classes is explained by the smaller boats making shorter trips (capacity limited) and setting fewer hooks. The latter, however, is complicated because the smaller boats make many more sets per trip, and may set only 25 or 50 hooks/set and make 10 or more sets per day, whereas the larger vessels typically set 200 to 800 hooks/set and may make only one set per day. Trip duration and the number of hooks are looked at in Figures 30 and 31 on the following page.

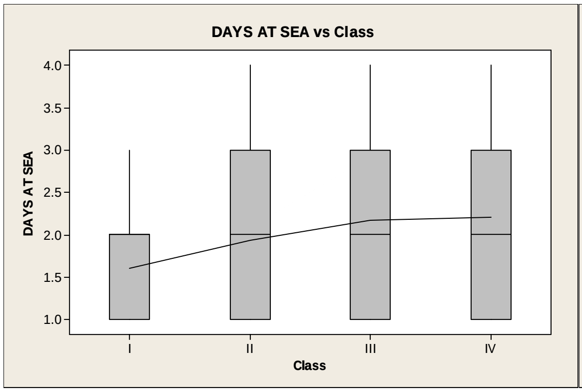


Figure 30. Days at sea

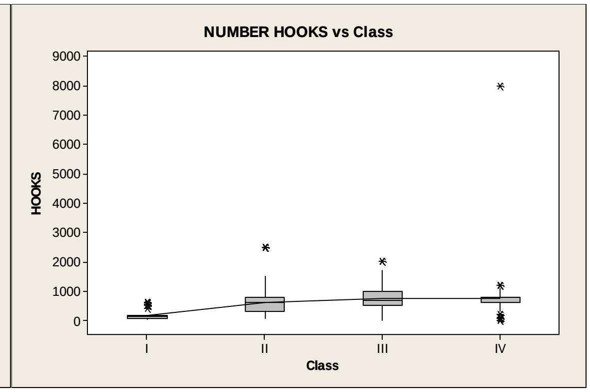


Figure 31. Hooks per set

The apparent lack of a median line for Class I in Figure 30 is because days are even integers from one to four. For this Class the median is one, which is also the bottom of the box. The squashed appearance of hooks per set in Figure 31 is caused by the outlier of 8-thousand hooks reported by the one Class IV boat. This may be a mistake in entry into the data base, but it is consistent for several sets by this boat in the data base.

So far, we have seen little to support separating Class III and Class IV vessels. None of the plots seen so far indicates much difference, and perhaps the two can be combined. Or perhaps Class I and Class II can also be combined leaving us with only two classes of vessels. This is tried in the next set of plots (Figs 32 and 33).

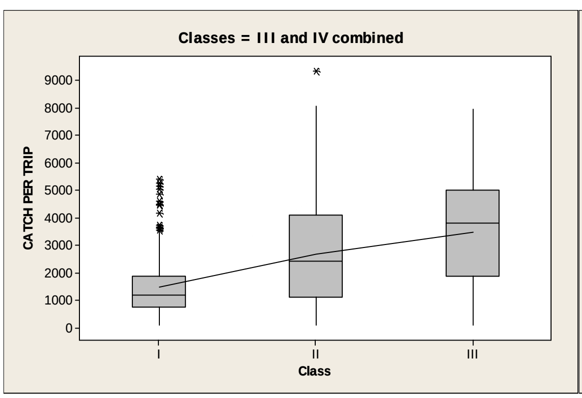


Figure 32. Classes III-IV combined

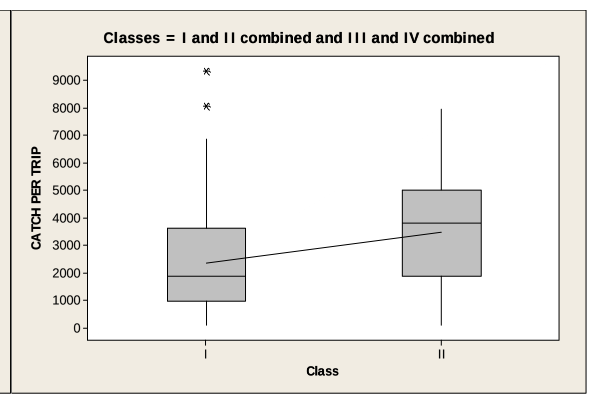


Figure 33. Classes I-II and III-IV combined

All combinations appear plausible, and we need to look at some other factors to decide which combination is most useful. One way to help decide is to model a combination of factors using GLM (General Linear Model) to see which grouping performs the best. We are trying to explain differences in landings (we equate this to catch, although this does not consider discards). There are several measures: Catch per Trip, Catch per Day Away, Catch per Set, and Catch per Hook that we can look at with the available data. Catch per Trip and Catch per Day Away are the most helpful deciding matters of fleet capacity. Catch per Set and Catch per Hook are useful in developing indexes of abundance. Unfortunately, the logbooks are incomplete in many instances, and subjective editing is necessary to develop such indexes – our data set is too short to attempt it.

The factors we think may influence catch are the Region: GOM, SA and NA, the year: 2001-2003, and the Class of vessel. Using a GLM we compare our three candidate combinations of Classes to see which best explains differences in Catch per Trip. In order, we will look at 4 Classes, 3 Classes (III and IV combined) and 2 Classes (I and II combined and III and IV combined):

Table 4. General Linear Model: CATCH PER TRIP versus Region, Year, Class

Factor	Type	Levels	Values
Region	fixed	3	GOM, NA, SA
Year	fixed	3	2001, 2002, 2003
Class	fixed	4	I, II, III, IV

Analysis of Variance for CATCH PER TRIP, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Region	2	615182949	207180715	103590358	39.68	0.000
Year	2	7906366	9637419	4818710	1.85	0.158
Class	3	446893296	446893296	148964432	57.07	0.000
Error	2077	5421784886	5421784886	2610392		
Total	2084	6491767497				

S = 1615.67   R-Sq = 16.48%   R-Sq(adj) = 16.20%

Both Region and Class have P values less than 0.01. We therefore reject the idea there are no differences among the three regions and four classes that may be affecting the catch rates. There is not a significant difference among years. R-Sq (adj) indicates that about 16-percent of the differences in Catch per Trip can be explained by the model, which is quite good for these kinds of comparisons involving fishing power of vessel classes. “S” is the pooled Standard Deviation, which is also not too bad considering the wide range of catches.

The GLM also estimates the factor means:

Table 5.Least Squares Means for CATCH PER TRIP

Region	Mean	SE Mean
GOM	3323	71.06
NA	2385	168.97
SA	2646	51.25
Year		
2001	2884	90.58
2002	2711	82.55
2003	2759	83.43
Class		
I	1618	138.69
II	2730	95.85
III	3254	63.67
IV	3536	103.93

The Standard Errors for the Means, SE Mean, a measure of uncertainty, are not bad either. The mean for the Gulf of Mexico seems quite a bit higher than the means of the other two Regions. We already know that the differences of the means for the three years are not significant. The means for the four Classes are of the main interest at this point. We use Tukey’s method[10] to test for differences:

Table 6. Tukey's HSD Test

```
Response Variable CATCH PER TRIP
All Pairwise Comparisons among Levels of Class
Class = I  subtracted from:

Class   Lower  Center  Upper  +---------+---------+---------+------
II      753.3    1112   1470            (----*----)
III    1279.6    1636   1992                   (----*----)
IV     1514.1    1918   2321                       (----*-----)
                              +---------+---------+---------+------
                              0       700      1400      2100
Class = II  subtracted from:

Class  Lower  Center   Upper  +---------+---------+---------+------
III    280.0   524.0   767.9      (--*---)
IV     498.3   805.9  1113.6         (----*---)
                              +---------+---------+---------+------
                              0       700      1400      2100
Class = III  subtracted from:

Class  Lower  Center  Upper  +---------+---------+---------+------
IV     19.21   281.9  544.7  (---*---)
                             +---------+---------+---------+------
                             0       700      1400      2100
```

If the horizontal bars do not include '0' in the interval, the difference is significant at the 5-percent level. The difference between Class III and Class IV just makes the cut. This is also shown by the adjusted P-Values below.

Class I differs significantly from the other three Classes: P-Value much greater the 0.05, the level of significance, as does Class II compared with Classes III and IV. Class III and Class IV also differ, but only at the 5-percent level.

Table 7. Tukey Simultaneous Tests

```
Response Variable CATCH PER TRIP
All Pairwise Comparisons among Levels of Class
Class = I  subtracted from:

       Difference       SE of           Adjusted
Class    of Means  Difference  T-Value   P-Value
II           1112       139.7    7.960    0.0000
III          1636       138.7   11.789    0.0000
IV           1918       157.2   12.197    0.0000

Class = II  subtracted from:

       Difference       SE of           Adjusted
Class    of Means  Difference  T-Value   P-Value
III         524.0       95.05    5.513    0.0000
IV          805.9      119.85    6.724    0.0000

Class = III  subtracted from:

       Difference       SE of           Adjusted
Class    of Means  Difference  T-Value   P-Value
IV          281.9       102.4    2.754    0.0300
```

Similar tests of Region and Year, which are not shown, indicate that Year differences are not significant, and that the Gulf of Mexico stands apart from the North and South Atlantic Regions.

Using GLM for the other two combinations of Classes give similar results in terms of Region and Year. The main observation of interest is the GLM for two Classes of vessels has an R Sq (adj) of about 13-Percent, and the GLM for the three Classes has an R Sq (adj) of a little under 16-percent, which is comparable with that of the exercise above.[11]

One last thing to look at before leaving these GLM's is the distribution of the residuals in the fit of the model (Figs 34 and 35). They are not bad, considering the departure from normality shown by the distribution of the data (Fig 26).

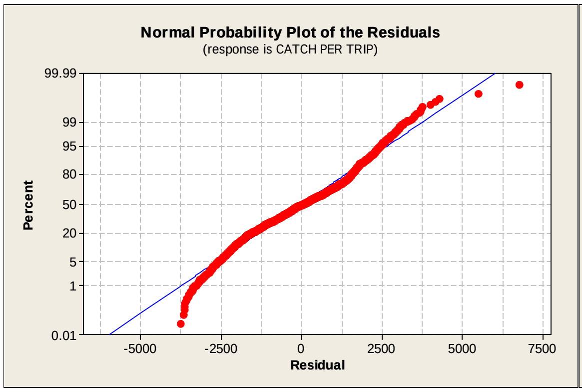


Figure 34. Probability Plot of Residuals

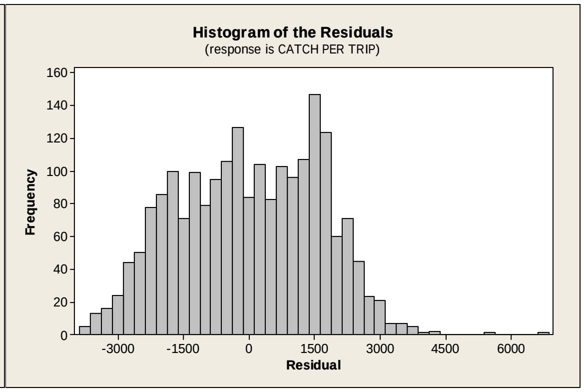


Figure 35. Histogram of Residuals

We now have estimates for Catch per Trip for our four Classes of vessels. We also noted that the GOM Region had a greater catch rate than the other two Regions. Why are there differences among Regions? We can look at the distribution of effort among Regions and see if that proves useful (Fig. 36).

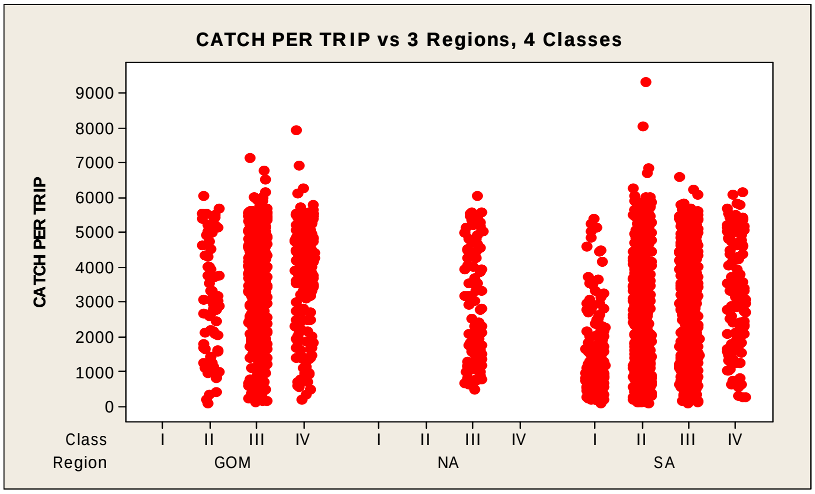
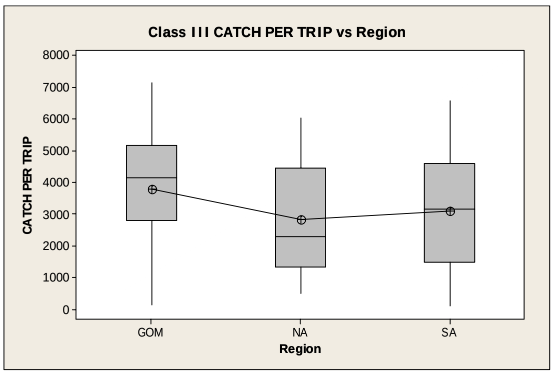


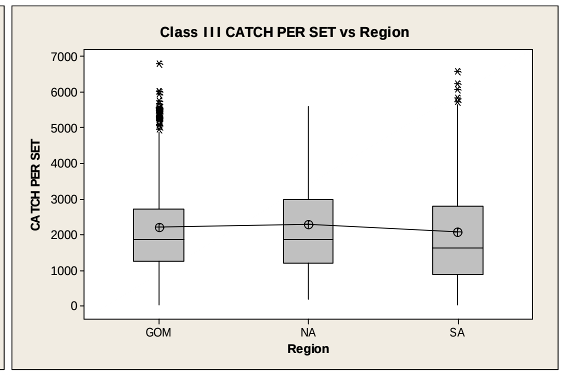
Figure 36. Catch per Trip by Region and Class

Figure 36 indicates that our sample of 47 boats contained no Class I boats that fished the Gulf of Mexico region, and no Class I, II or IV that fished the North Atlantic Region. Only Class III boats are common to all three Regions.

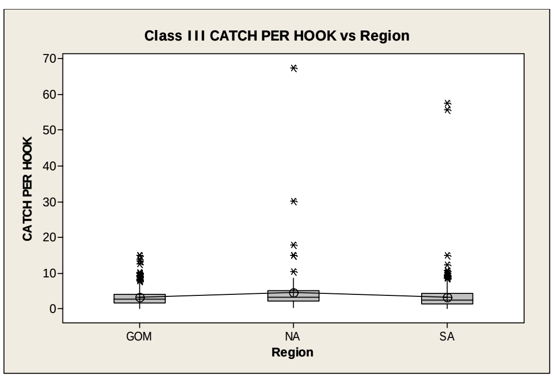
We ran the GLM again only for Class III. The results indicated that the GOM has a higher catch rate measured by Catch per Trip, but not when measured by Catch per Set or by Catch per Hook. The answer seems to be that trips in the GOM were longer on the average than in the other two Regions, the last panel of Figure 37.



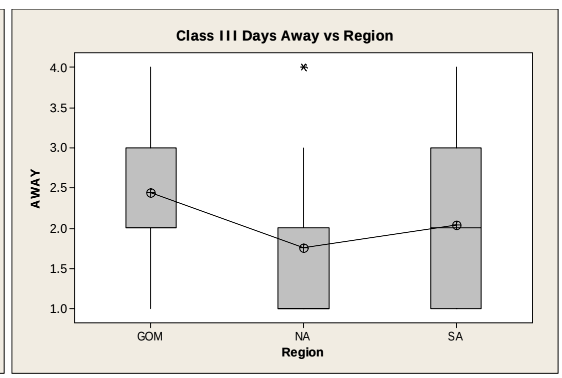
(a)



(b)



(c)



(d)

Figure 37. Performance for Class III boats as estimated by (a) Catch per trip, (b) Catch per set, (c) Catch per hook, and (d) Catch per day away for each of the three Quota Regions.

<u>Vessel Performance by Year and Region to estimate Fishing Power</u>

The 47 core vessels provided some interesting insights as to how the bottom longline fishery for Large Coastal Sharks operated during the years 2001-2003. How do the 47 compare with the larger sample of 116[12] boats that landed at least 100 pounds of LCS? The new data set picks up about 500 additional trips: 2579 vs. 2085 trips. It also includes a few Class I and Class II boats in the Gulf of Mexico and the North Atlantic Regions that were lacking in the core data set (Fig.38).

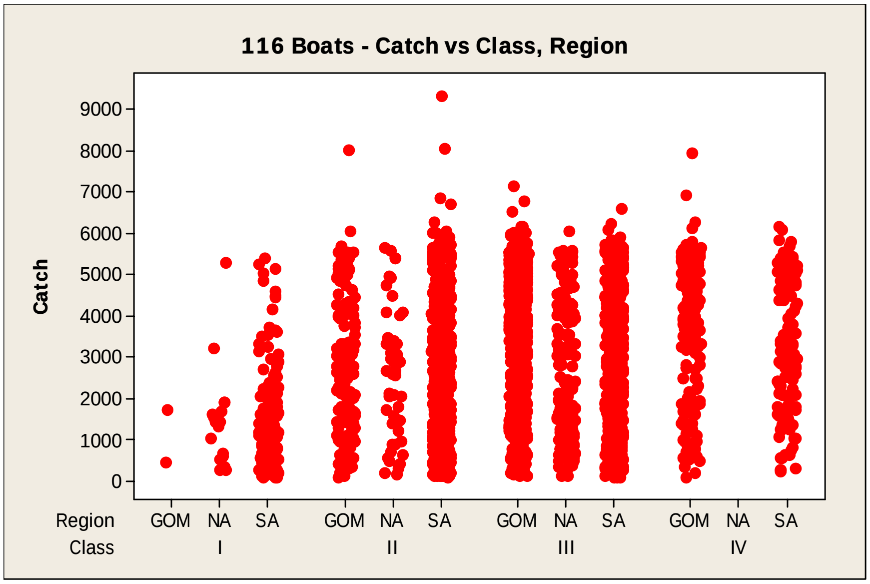


Figure 38. Scatter plot of full boat data set

Aside from the addition of Class I boats to the GOM and NA, the information is similar to the 47 boat set. Analysis indicates no appreciable effect on any of the earlier analyses or conclusions except the GLM now indicates a year effect, and the full data set has a slightly better fit to the data because we have filled in some Class I boats for the GOM and NA.

Table 8. GLM 116 Boats: Catch per Trip versus Region, Year, Class

Analysis of Variance for Catch per Trip, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P	
Region	2	795057114	274209107	137104554	51.74	0.000	
Year	2	20057561	17769350	8884675	3.35	0.035	**Significant**
Class	3	586166825	586166825	195388942	73.74	0.000	
Error	2571	6812370525	6812370525	2649697			
Total	2578	8213652024					

S = 1627.79   R-Sq = 17.06%   R-Sq(adj) = 16.83%

Table 9. GLM 47 Core Boats: CATCH PER TRIP versus Region, Year, Class

Analysis of Variance for CATCH PER TRIP, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P	
Region	2	615182949	207180715	103590358	39.68	0.000	
Year	2	7906366	9637419	4818710	1.85	0.158	**Not significant**
Class	3	446893296	446893296	148964432	57.07	0.000	
Error	2077	5421784886	5421784886	2610392			
Total	2084	6491767497					

S = 1615.67   R-Sq = 16.48%   R-Sq(adj) = 16.20%

Calculating Standardize CPUE

Class III vessels are the most numerous and about equally distributed among the three Regions. For this reason, they are selected to be the standard LCS bottom longline boat. Because the full data set picked up a few Class I and Class II boats in the Gulf of Mexico and North Atlantic Regions, and do not differ markedly from the estimates from the 47 Core Boat analysis, it seems advisable to use the full set data to standardize effort for Class III vessels. The estimates were done using GLM for Class III only and Region and Year. We found no significant differences among years when only Class III boats are used. The mean for GOM Region was significantly different from the means for the two Atlantic regions. The Region results are:

Table 10. GLM 47 Core Boats: CATCH PER TRIP versus Region, Year, Class

Region	Mean	SE Mean
GOM	3749	66.32
NA	2650	139.59
SA	2968	75.76

Because no difference was found between catch rates in the two Atlantic regions, we can use the simple average of 2800 pounds/trip for the Atlantic. The Gulf of Mexico has a different catch rate, and we will use 3750 for that Region. These two values represent catch per standard Class III LCS bottom longline trip. These are in whole weight pounds.

The management quotas for Large Coastal Shark are set using dressed weight pounds. The conversion factor NMFS is using to convert from whole to dressed weight is 0.72[13]. Multiplying whole weights by 0.72 gives dressed weight pounds per standard Class III trip of 2022 lb and 2700 lb for the Atlantic Regions and the Gulf of Mexico respectively.

The three other Classes of LCS vessels are standardized against Class III using the Class means from the full 126 vessels GLM for all four Classes, all three Regions, and all three Years (Table 11).

Table 11. Class means 126 boats

Class	Mean Catch	S.E
I	1526	115.84
II	2635	71.23
III	3156	53.42
IV	3482	94.93

Table 12. Standardization of class means to Class III

Vessel Class	Calculation	Relative Fishing Power
I	1526/3156	0.48
II	2635/3156	0.83
III	3156/3156	1.00
IV	3482/3156	1.10

Simply put, about two standard trips by a Class I vessel equal one Class III vessel trip.

VI. FINDINGS - ADJUSTING FLEET CATCHING CAPACITY

Section Summary. We look at the problem of matching fleet catching capacity to the available amount of fish.

The object is to devise a self-regulating fishery for Large Coastal Sharks that matches the available annual fishing effort to the TAC. The Directed Shark fleet achieves the TAC in the course of the year, on the average, with no early closure necessary and no quota to carry over to the next year.

The annual 2005 quota for LCS is 2,242,078 lb dressed weight. The quota is shared among six groups:

1. Incidental Commercial Catch – Coastal Fishery
2. Incidental Commercial Catch – Pelagic Longline
3. Directed Commercial Catch – Pelagic Longline
4. Directed Commercial Catch – Coastal Gillnet
5. Directed Commercial Catch – Coastal Bottom Longline
6. Directed Commercial Catch – Coastal Other Gear (handline, electric reel)

The way the quota splits among these groups according to the data is shown in Table 13.

Fishery	Permit	Species Group	Gear	2001-2003 Catch Total lb whole wt.	Percent total LCS landings
Pelagic	SKI	LCS	Pelagic and Bottom Longline	2,929	0.03
Pelagic	SKD	LCS	Longline	469,116	4.12
Coastal	SKI	LCS	All	517,209	4.54
Coastal	SKD	LCS	All	10,395,136	91.31
Coastal	SKD	LCS	Gillnet	591,061	5.19
Coastal	SKD	LCS	Other gear	547,234	4.81
Coastal	SKD	LCS	Bottom Longline	9,256,842	81.31
Total				11,384,390	

Table 13. Percent of quota taken by the six fishing elements with shark LAP's

Incidental landings by the pelagic fleet are trivial. The other groups except Coastal Bottom Longline take small percentages of the quota – about 5-percent each. However, the logbooks show that of the 73 boats holding Incidental Shark Permits that landed some Large Coastal Sharks during the three-year period 2001-2003, three boats landed 78-percent of the total (Fig. 39).

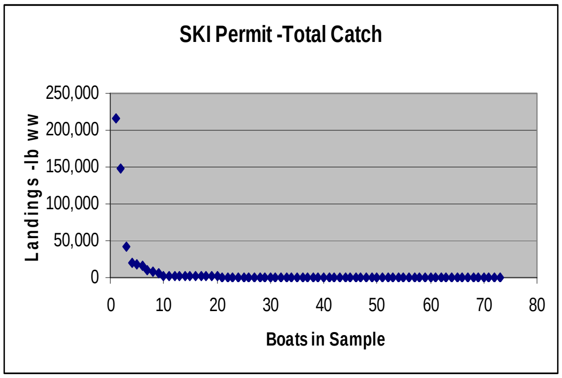


Figure 39. SKI Total Catch

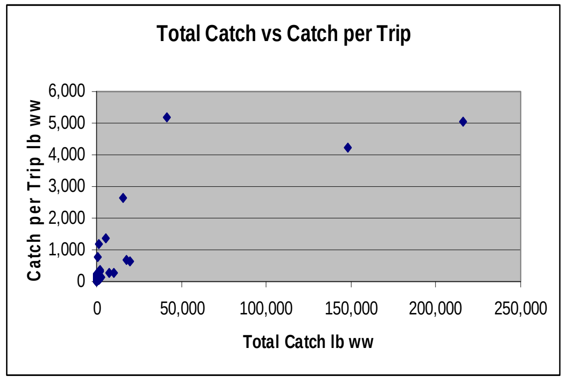


Figure 40. Total Catch vs. Catch/Trip

On a catch per trip basis, four boats reported landing more than 2000 lb per trip (Fig. 40)[14]. There is reason to believe that either the entries are in error in the Larkin File of vessels and permits, and these boats hold SKD Permits, or the captains misunderstood the regulations. In either case, we believe that for the buyout exercise, expected incidental catches should be reduced to be more in line with the regulations. Without removing the four over limit boats from the data, we calculated using the average total LCS catch for the 73 SKI boats with LCS landings, that a revised catch can be estimated at 216,891 whole weight pounds (as calculated in Table 14).

Boats	Average Sets	Average Trips	Average Away	Average Total Catch	CPT	SKI Catch
73	68.40	7.64	24.47	7,085	388.69	216,891

Table 14. Estimation of revised SKI Landings

This means that 517,209 minus 216,891, or 300,317 pounds of LCS (the final seven instead of eight for this number is due to rounding in the spreadsheet) should be subtracted from the **Coastal** SKI landings and added to the **Coastal** SKD landings. We give the revised percentages in (Table 15).

Fishery	Permit	Species Group	Gear	2001-2003 Catch Total lb Whole wt.	Percent Total LCS Landings	2001-2003 Catch Total lb Whole wt. (rev)	Percent of Total LCS Landings (rev)
Pelagic	SKI	LCS	Pelagic and Bottom Longline	2,929	0.03	2,929	0.03
Pelagic	SKD	LCS	Longline	469,116	4.12	469,116	4.12
Coastal	SKI	LCS	All	517,209	4.54	216,892	1.91
Coastal	SKD	LCS	All	10,395,136	91.31	10,695,453	93.95
Coastal	SKD	LCS	Gillnet	591,061	5.19	606,452	5.33
Coastal	SKD	LCS	Other gear	547,234	4.81	561,483	4.93
Coastal	SKD	LCS	Bottom Longline	9,256,842	81.31	9,501,030	83.46
Total				11,384,390		11,384,390	

Table15. Revised LCS Landings and Percent of Quota taken by the six fishing elements

Both the Logbook Data and the 2005 Federal Regulations suggest that the LCS annual quota will be taken in about 170 days of fishing at the current level fleet size. If the desired days needed to take the quota with the reduced fleet size after the buyout is to be 360 (we allow a few off days for vacation), the season will be extended by a factor of 2.12.

The next exercise is to estimate how much effort reduction is necessary to achieve this goal. The assumptions we make are:

1. **Regional quotas** are not in place. This simplifies the calculations in this example.

2. **All catch rates are constant at 2001-2003 levels**, that is, the relative percentages of the quota remain the same.

3. **ONLY Coastal SKD Bottom Longline** boats are reduced in number by the buyout.

4. Boats that hold Shark Permits but did not exercise them during the study period will not enter the fishery for LCS.

5. The buyout is random among the Coastal Fishery Bottom Longline boats, and all the other boats in the fishery for Large Coastal Sharks continue to fish as is their normal practice using the same gear as before the buyout.

Using these assumptions, we constructed Table 16 using the percentages from Table 15 for the 2001-2003 data set to apportion the 2005 quota among the Fishery/Permit/Gear Groups for an anticipated 170-Day Season. We extended the season to 360 days using the 2.12 multiplier for the Pelagic Fishery and Coastal SKI Fishery to get the **projected landings and percentages** for the three Groups (columns 7 and 8, rows 3-5 of Table 16).

The sum of the projected landings for these three groups for the 360-Day Season are then subtracted from the 2005 quota to give the quota remainder, 1,954,419 dressed weight pounds, to be apportioned among the Coastal SKD Permit Groups.

Next, we extended the SKD Gillnet[15] and Other Gear Groups landings under the assumption that they are not subject to buyout, and fish the 360-Day Season at the same rate as the 170-Day Season.

The extended gillnet and other gear landings are subtracted from 1,954,419 dressed weight pounds to get 1,466,798 dressed weight pounds, or about 65-percent of the quota. This is the amount of quota available to be taken by Coastal SKD Bottom Longline Gear.

Fishery	Permit	Species Group	Gear	2005 LCS Commercial Quota	170-Day Season	360-Day Season	360-Day Season
				Dressed Weight lb	Percent total	Dressed Weight lb	Percent total
Pelagic	SKI	LCS	Pelagic and Bottom Longline	577	0.03	1,223	0.05
Pelagic	SKD	LCS	Longline	92,389	4.12	195,865	8.74
Coastal	SKI	LCS	All	42,715	1.91	90,557	4.04
Coastal	SKD	LCS	All	2,106,397	93.95	1,954,419	87.17
Coastal	SKD	LCS	Gillnet	119,437	5.33	253,205	11.29
Coastal	SKD	LCS	Other Gear	110,580	4.93	234,430	10.46
Coastal	SKD	LCS	Bottom Longline	1,871,163	83.46	1,466,798	65.42
Total				2,242,078		2,242,078	

Table 16. Estimated quota shares for a 360 day season

Returning now to the fishing power calculations (Table 12 from Section IV), we calculated the relative fishing power of the four classes Coastal Bottom Longline vessels to be as shown in Table 17.

Vessel Class	Relative Fishing Power
I	0.48
II	0.83
III	1.00
IV	1.10

Table 17. Catch per Trip for each Class/Catch per Trip for Class III vessels.

The number of vessels in each Class is then multiplied by their relative fishing power to give the number of Class III equivalent vessels in the Coastal Bottom Longline Fleet (Table18).

Class	I	II	III	IV	Total
Number	11	40	64	14	129
Factor	0.48	0.83	1.00	1.10	
Class III Equivalent	5	33	64	15	118

Table 18. Number of Class III equivalent vessels in the SKD fleet.

The Bottom Longline share of the quota is 1,466,798 dressed weight pounds. The average Catch per Trip for a Class III vessel is estimated at 3156[16] whole weight pounds, or 2270 dressed weight pounds as an average over all regions and years. This can be taken to be 1,466,798/2270 = 646 Class III Trips.

The average Class III trip length is 2.2[17] days and the average days away for the 170-Day Season is 48, which becomes 102 days when raised by the factor 2.12 for the 360-Day

Season. Based on these numbers, an average Class III boat could make an estimated 46 trips for the 360-day season and land 105,000 dressed weight pounds.

The conclusion we draw from this example exercise is that a Fleet of 14 Class III equivalent boats (646 total trips/46 trips per boat) is needed to take the quota in 360 days of seasonal access. The pool of Class III boats under the assumptions for the exercise is 118; the buyout needs to remove 104 boats.

Based on a suggestion from an industry group that due to various seasonal and area closures the fishing days constituting a full annual cycle of fishing is more likely to be about 270 days,[18] we provide Table 19.

Fishery	Permit	Group	Gear	270-Day Season	Percent total
Pelagic	SKI	LCS	Pelagic and Bottom Longline	916	0.04
Pelagic	SKD	LCS	Longline	146,736	6.54
Coastal	SKI	LCS	All	67,842	3.03
Coastal	SKD	LCS	All	2,026,584	90.39
Coastal	SKD	LCS	Bottom Longline	1,661,263	74.09
Coastal	SKD	LCS	Gillnet	189,693	8.46
Coastal	SKD	LCS	Other gear	175,628	7.83
Total				2,242,078	100.00

Table 19. Estimated quota shares for a 270 day season

The Bottom Longline share of the quota is now 1,661,263 dressed weight pounds, which can be taken in 732 Class III Trips.

The Class III trip length still is 2.2 days and the average days away is 76. An average Class III boat will make an estimated 35 trips for the 270-day season and land 78,418 dressed weight pounds.

Under this example, and using the assumptions we made above in this Section, **the point estimates are that a Fleet of 21 Class III equivalent boats (732 total trips/35 trips per boat)** is needed to take the quota in 270 days of seasonal access. The pool of Class III boats under the assumptions for the exercise is 118; the buyout needs to remove 97 boats.

This exercise is useful chiefly to indicate the likely magnitude of the buyout. The 104 or 97 boats suggested above for buyout is less than half the number of SKD permits that need to be controlled if the program is to achieve its objective. Barring a revision of the TAC, there is little room within the present quota to increase the portion of the resource available to Directed Shark Boats. Even if all the other catches including incidental landings and pelagic catches were assigned to the Coastal bottom longline fishery, the numbers would support only about 28 Class III bottom longline boats.

VI. ASSESSING THE STOCKS

Section Summary. We look at how TAC was set, and speculate on the future for Atlantic coastal shark fishing.

At the beginning of this report, we point out that in the case of the Directed Shark Fishery, there exists an overall management framework, which includes a Total Allowable Catch (total allowed **commercial landings in dressed weight pounds**). We have used that TAC in the report so far. Now, what we will do now is look at the technical basis for the current TAC and discuss the prospects for a different TAC in the near future.

The TAC is based on estimates of Maximum Sustainable Yield (MSY) and Optimum Yield (OY) made subsequent to the 2002 Shark Evaluation Workshop. The OY is a political decision on what portion of MSY is allocated to the fishery. The fishery in turn has several segments: Commercial Landings, Commercial Bycatch Discard Mortality, and Recreational Catch/Landings[19]. We are interested in the TAC allocated to the commercial fishing sector.

Basic Principles

We will start with a simple discussion of MSY. This is intended as a help for readers who may not be familiar with some of the concepts. Otherwise, please skip ahead to the subsection **Assessing the stocks.** Estimation of MSY follows from Baranov's equation (Equation 2 in the beginning of this report).

Eq. 2 $$C=F\bar{B}$$

This can be modified to become,

Eq. 6 $$MSY=F_{MSY}\bar{B}_{MSY}$$

In *Eq.6*, the catch C of *Eq. 2* now represents MSY and on the right hand side of the equation F is the fishing mortality rate that yields MSY and B is the average biomass at MSY.

Simple enough stuff, but why should there be any biomass that gives a maximum sustainable yield over time? The theory for this comes out of observations that growth of many different organisms is exponential. Because microorganisms do not weigh much and reproduce very rapidly, the biomass B in weight is nearly directly proportional to the biomass N in numbers. The best agreement with theory comes from observations of microorganism such as yeasts and bacteria. These organisms reproduce by division and the growth rate over time in the population is not linear: 1, 2, 3, 4 …etc., but rather an exponential doubling[20] in each successive generation: 2, 4, 8, 16, 32,… to a vary large number in a short time. Growth continues as long as they do not run out of space or food, or encounter some other condition that slows or stops reproduction.

As long as conditions remain favorable, the food supply is replenished, the dead organisms are removed, and there is space available the population will continue to increase. But eventually one or more conditions becomes limiting; they run low on food or space and population increase becomes limited by the density of the population. The rate of increase slows until, in theory, the new cells just matches the natural deaths. At this point carrying capacity (K) is reached (Fig. 41).

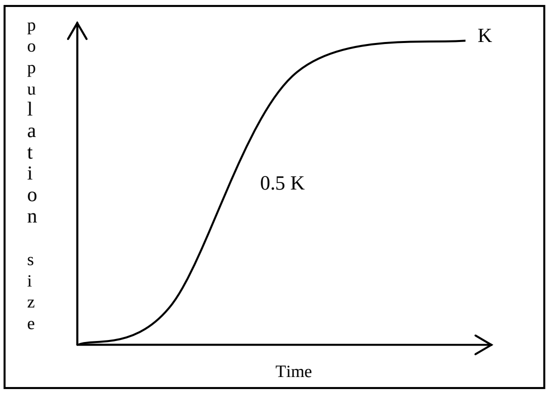


Figure 41. Schematic depiction of the growth of a hypothetical population over time to Carrying Capacity K. In this drawing the maximum rate of increase is occurring at about 0.5 K

Suppose one wishes to harvest some number of yeast cells. If one is happy with a single large batch once in while (like so-called pulse fishing)[21], the best strategy is to find a population near carrying capacity and take all, or nearly all, the cells. The problem here is that if one wants more later on, one has to give the population time to rebuild. An alternative strategy would be to take only part of the population at a rate that can be replaced with new cells in some shorter time interval, or even take some cells on a continuous basis at the rate they are being produced over and above the mortality rate. This allows continuous harvest in perpetuity unless something unforeseen happens. One can do this at any population size and find some level of harvest that will be in equilibrium with “births” and deaths. At this (theoretical) balanced level of harvest, the population neither decreases nor increases.

There will be one population size that gives the largest harvest in perpetuity, MSY. This will lie somewhere between a very low population size and the carrying capacity. Models frequently select the half-way point (0.5) K as the target for MSY (Fig. 42).

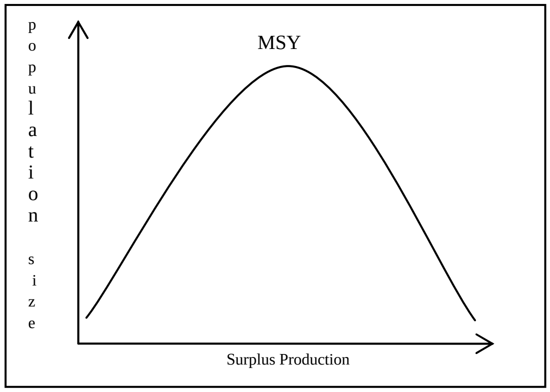


Figure 42. The amount of biomass available for harvest for different levels of a population with MSY at about 0.5 K.

To maintain the population at any given level, the number harvested must equal the number of additions or recruits to the population minus the number of deaths due to natural mortality. Below MSY, the rate of recruitment is predicted to be higher because factors like food supply and living space are more available, but the number of recruits will be lower because the population size is lower. Above MSY, the density of organisms begins to feel the adverse effects of less food and space, but since the population size is greater than at MSY and the rate of increase will slow, but there still will be some surplus for harvest until K is approached (Fig. 38). At MSY, however, the adverse factors and the favorable factors should be such that the number of recruits will exceed the number of deaths by the greatest amount.

This is the basic theory of sustained use of living resources. In practice, however, the theory has to include growth of the individuals as most resources take organism of a certain size, and time has to be allowed for each succeeding generation to reach harvestable size. Matters are further complicated by the fact that removals of organisms of harvestable size/age means that the age composition of an exploited population will change. This may have serious consequences if the TAC is based on weight and the average age and size decrease markedly under heavy exploitation. The TAC has to be adjusted lest too many small individuals are harvested to realize the same yield in weight as in earlier time was had from fewer larger individuals.

Amendment 1 and assessing the stocks

MSY theory explains how Amendment 1 can find sandbar shark to be “not overfished”- the stock level is above MSY, but “overfishing is occurring” – the rate of removals is higher than F_{msy}, which implies that the population will decline to MSY and below in time.

The assertion in Amendment 1 does not make complete sense. The 2002 Stock Assessment indicates a higher probability that the sandbar biomass[22] will be greater in 2020 than in 2000 (fig. 74 of that Assessment) than for blacktip (fig. 77 *ibid.*). This is inconsistent with overfishing occurring for sandbar and not the blacktip (Figure 43).

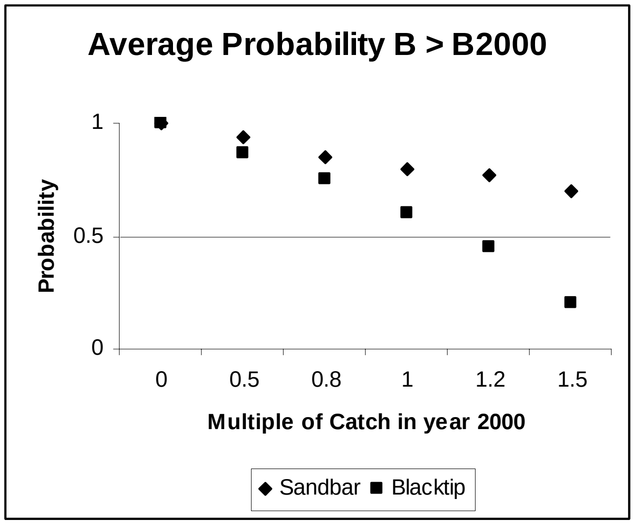


Figure 43. The probability that biomass in 2020 will be above the 2000 level for various multipliers of catch in year 2000. A multiplier of 1 means the TAC remains at the 2000 level for the entire period. (After Cortés *et al.* 2002 Stock Assessment)

What was the catch level for 2000? Table 2.2 of Amendment 1 indicates it was between 2.3- and 3- million pounds depending on whether the canvass or the Quota Monitoring System (QMS) is used. On the other hand, the 2002 assessment uses a catch in numbers shown here in Table 20. When converted to yield in weight the landings for sandbar and blacktip combined exceed the QMS estimate, and landings for the LCS Complex are around 4-million pounds.

Species	Number Landed	Average Wt.	Pounds Landed	Percent Total Pounds Landed
LCS Complex	111,200	37*	4,114,400	100
Sandbar	37,331	41.207	1,538,020	37
Blacktip	51,354	32.781	1,844,420	45
Combined SB + BT	88,685		3,382,440	82

*Note. An average weight was not in the 2002 Assessment so the average for SB and BT is used.

Table 20. Summary Table for Large Coastal Sharks – Commercial Landings for the year 2000 from 2002 Shark Assessment Tables 1, 2, 3, 10 and 12

The 2002 Assessment was an enormous undertaking. The assessment results are very variable depending on which of the five assessment models and variants are used, and it is impossible to decide which of the many results is “best”. The assessment group chose (wisely, we believe) to summarize their conclusions in very general terms and leave it up to the managers to sort them out.

Lacking any clear advice from the assessment group, NMFS chose to summarize the results in Table 3.18 in the 2005 SAFE Report (reproduced here as Table 21).

Species/ *Complex*	2001 Biomass (N_{2001})	2001 Relative Biomass (N_{2001}/N_{MSY})	Fishing Mortality Rate (F_{2001})	Maximum Fishing Mortality Threshold (F_{MSY})	Outlook
Large Coastal Complex	2,940-10,156	0.46-1.8	0.07-0.21	0.05-0.10	Overfished; Overfishing is occurring
Sandbar Sharks	1,027-4.86 E8	3.25 E4-2.22	0.0001-0.70	0.05-0.46	Not overfished:; Overfishing is occurring
Blacktip Sharks	5,587-3.16 E7	0.79-1.66	0.01-0.21	0.06-0.18	Not overfished; No overfishing occurring

Table 21. Summary Table for Large Coastal Sharks from Table 3.18 in the 2005 SAFE Report

The table is difficult to interpret in the sense that it is not clear where in the 2002 assessment the numbers occur, and how they should be interpreted. It would appear that **(N_{2001})** is the estimated biomass in numbers for the year 2001 and that these range from 2,940 to 10,156 for the LCS Complex. This seems unlikely as these in number or weight are less than the TAC and the landings used in the 2002 Assessment. The same problem exists for the two species, except that the upper ranges are more reasonable. But even disregarding the biomass numbers, one is hard pressed to see from the table why overfishing is occurring for sandbar and not for blacktip.

The issue is confused further by the sandbar outlook in the table and the statement in the Amendment about sandbar that: *"The stock assessment states that, while reductions in catch are not needed to maintain or increase biomass levels, reductions in fishing mortality may be necessary to prevent overfishing."* If reductions in catch are unnecessary, one is left wondering why F needs to be reduced? The distinction may relate to a concern that too many small sharks are being caught. But since the 2005 regulations have seasonal closers and size limits to protect pups and juveniles, a reduction in fishing mortality should result.

The lack of data available for the Assessment was and is a serious concern[23]. In order to have even rudimentary evaluation of the shark fishery, NMFS had to have a time series of data on the amount taken and the amount of fishing effort used. The 1993 Plan had available for its assessment six-years of imprecise data on combined catch and gross fishing effort. The results were of arguable precision, but it was the "best science available".[24] Unfortunately, 11 years later the amount of data available was still marginal for a reliable estimate of catches and effort. The input data do not appear to have changed much. How much improvement has occurred since 2002 will not be apparent until a new evaluation is held, and that, giving time for analysis and passage through the hearings process, means that a new TAC is several years in the future.

However, this does not mean that the current TAC cannot be revised sooner. The 2002 assessment produced different options for the TAC depending on whether or not management was done based on a single LCS complex or a simple division of the LCS complex into two categories of shark groupings. The argument put forth by NMFS in choosing the former is that the fishermen and buyers are not able at this time, and without training and certification, to differentiate between sharks that have an interdorsal ridge or not[25].

The matter may be less complicated even than choosing ridgeback and nonridgeback. The composition of landings in recent years from vessel logbooks is shown in Figure 44.

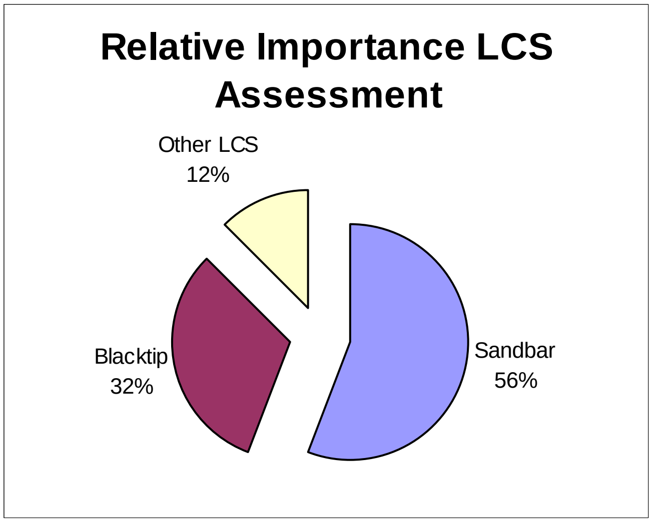


Figure 44. Percent of three species groups in landings, vessel logbook data for 2001 -2003.

This percentage composition for sandbar and blacktip in this figure are about the reverse of those in Table 20. This difference calls for an explanation. Unfortunately, we cannot give one since we lack logbook data for year 2000, and even that might not prove very helpful. However, regardless of which figures are used, there is an agreement that sandbar and blacktip landings dominate the landings with all other LCS species composing only about 20 percent of the landing. Clearly, one has to be very careful interpreting the assessment when the LCS complex assessed as a unit.

The importance of sandbar in the landings suggests that training buyers and fishermen to recognize species is not critical. A TAC set for sandbar alone might serve providing the average percent of sandbar in the landings is found to be stable over time, or a TAC set for just sandbar and blacktip in combination. Then a level of error in the identification of other species would likely have little effect on the overall assessment. Whatever the decision, the best evidence from the assessments is that the current commercial TAC could safely be around 4- to 5- million pounds.

VII. EVALUATION - CONCLUSIONS

There remains the question of the effect of the TAC on the Buyout Plan. Using the 2001-2003 Data Base, the existing Shark LAP numbers are given in Table 22:

SKI no shark landings	
Class	Total
I	34
II	48
III	54
IV	110
NA	7
Grand Total	253

SKD no shark landings		Total Latent
Class	Total	
I	7	41
II	16	64
III	17	71
IV	23	133
NA	7	14
Grand Total	70	323

SKI with landings	
Class	Total
I	24
II	28
III	25
IV	19
Grand Total	96

SKD with landings		Total Active
Class	Total	
I	21	45
II	52	80
III	72	97
IV	30	49
Grand Total	175	271

Table 22. Number and Classes for Boat Holding Shark Limited Entry Permits

These include both permits in the Coastal Fishery Log data set and the Pelagic Longline Logbook data set. These numbers are for 2003 and may have changed; permits may have lapsed or old ones reactivated in the past two years. However, they do give a good idea of the magnitude of the problem.

The numbers of boats are converted to Standard Class III Shark Boats in Table 23.

Permits	SKI Latent	SKD Latent	SKD Active
All Boats	349	70	175
(Class III)		73	158

Table 23. Number of outstanding permits (All Boats), and number of SKD permits converted to Class III equivalent permits.

The assumption is that the fishing power of every boat has the same potential based on size criterion. Since landings with an SKI permit is likely to be more or less independent of the vessel class, the number are not converted. SKD landings are related to vessel Class and are therefore converted[26].

Using these converted numbers, we have prepared a set of 12 scenarios to estimate the fleet trip capacity, that is, the expected landings of one trip if the entire fleet put to sea on the same day (Table 22). From this, a simple division gives the number of trips the fleet needs to land the TAC.

We use the current TAC and a higher TAC to see what might be expected should the TAC be increased following a new assessment. Finally, using an average turnaround time instead of trip time we estimate the length of the season for each scenario. We use a week, 7 days, rather than the shorter 3.5 days of Section V to reflect the fact that we are dealing with the whole fleet and not only SKD BLL boats.

Permit Buyout Scenarios	SKI	CPT	SKD	CPT	Fleet Trip Capacity	Trips TAC A	Trips TAC B	TT	Days TAC A	Days TAC B
A. ALL Permits	349	200	232	2270	596,440	3.8	8.4	7	26	59
B. Remove Inactive	96	200	158	2270	377,860	6.0	13.2	7	42	93
C. Convert - SKI 5/trip	419	200	158	2270	442,460	5.1	11.3	7	36	79
D. Convert - SKI median	419	10	158	2270	362,850	6.2	13.8	7	43	96
E. Status quo*	96	200	130	2270	314,300	7.2	15.9	7	50	111
F. Buyout - remove Inactive	96	200	40	2270	110,000	20.5	45.5	7	143	318
G. Buyout - convert	419	200	40	2270	174,600	12.9	28.6	7	90	200
H. Buyout - convert median	419	10	40	2270	94,990	23.7	52.6	7	166	368
I. Buyout - remove Inactive	96	200	20	2270	64,600	34.8	77.4	7	244	542
J. Buyout - convert	419	200	20	2270	129,200	17.4	38.7	7	122	271
K. Buyout - remove Inactive	96	200	40	2270	110,000	20.5	45.5	7	143	318
L. Buyout - median	96	10	40	2270	91,760	24.5	54.5	7	172	381

*Note: These are the boats with SKI landings or more than 100 lb SKD landings during the period 2001 – 2003

TAC	A - Current	B – Future
	2,250,000 lb	5,000,000 lb

Fleet trip = No. SKI*CPT+ No. SKD*CPT
Trip = TAC/Fleet Trip Capacity
Days = Trips *TT (Turnaround Time)

Table 24. Twelve Scenarios for a buyback of Shark Limited Entry Permits

The biggest obstacle to a successful buyout is the removal of latent effort. In 2003, there were 70 SKD and 253 SKI unused permits that need to be removed. That leaves 158 Class III equivalent SKD permits and 96 SKI permit that landed some shark. The scenarios that seem satisfactory in meeting the objective of achieving a stable, self-regulating shark fishery all require a reduction in active SKD permits to around 40. Allowing inactive permits to all convert to SKI do not affect the result provided the SKI landings do not change appreciably from what they are at present (average about 10 lb per trip/year/permit). However, if each SKI boat landed its allowed limit (we use 200 lb/trip), most of the inactive permits would have to be removed if the objective is to be reached. This would involve removing about 350 permits if the inactive SKD permits are included.

The more costly removal would likely involve a buyout of the "active" SKD permits. The way the landings are distributed for these permits is shown in Figure 45.

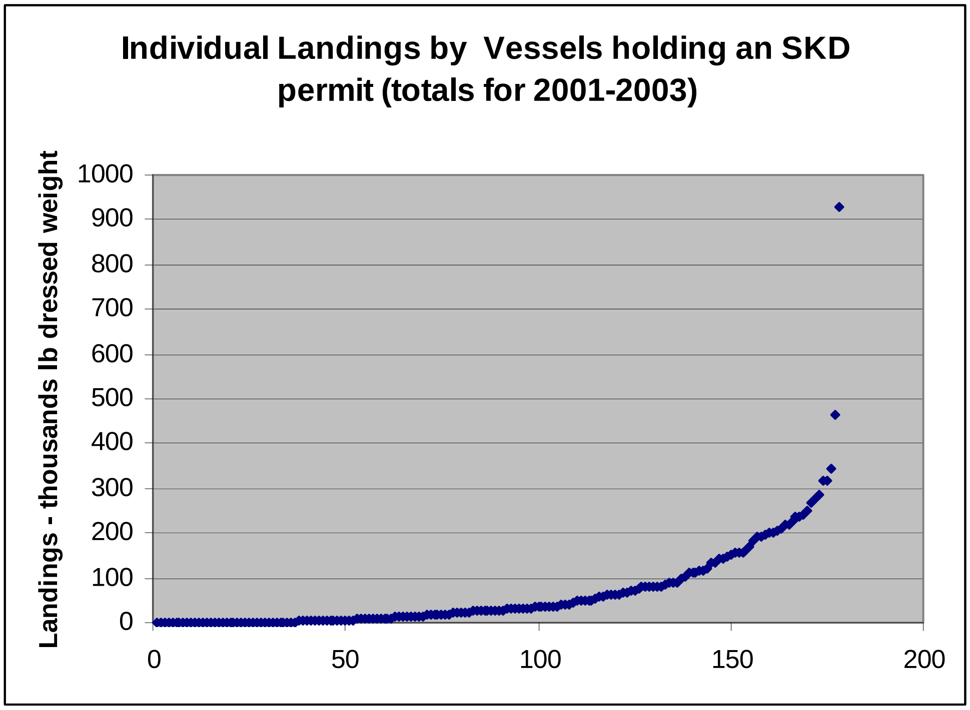


Figure 45. Distribution of total landings over a three year period LCS and SCS Combined

The figure suggests that around 100 boats will have a catch history that qualifies them for an SKD permit under most scenarios, and that this number needs to be reduced by at least half as a goal.

DISCUSSION

The “Shark Fleet” we have been working with is a small portion of the coastal fishing fleet that operates in the federal EEZ of the Atlantic, Caribbean and Gulf of Mexico. All the boats fishing in these waters share a common problem; too many units competing for a finite, and in most cases, regulated fish stocks. The problem stems from the failure to implement a scheme of LAP’s until recently, even though the need for some limits on entry into US fisheries was recognized more than 40 years ago. The shark industry has the additional problem in that its expansion was in large part the result of successful federal initiatives by NMFS and Sea Grant to develop fisheries for underutilized species. For this reason the shark fishermen, perhaps more than any other group in the coastal fleet, have a claim for assistance from NMFS in dealing with excess capacity, which arguably should have been controlled from the start.

NMFS has been working toward a solution for all the coastal fleet including shark. To date, the approach has been two pronged: set TAC’s to limit landings and freeze effort by issuing species-group specific permits to boats with an historical involvement in the various fisheries.

Setting TAC’s

Settings TAC’s has proven difficult owing to a number of factors, not the least of which is the lack of data on which to assess the stocks. There are two parts to the data problem for the shark fishery. One is the lack of data, particularly for the years prior the 1994 when little data other than total landings from dealers was available. The second is collecting and managing data since 1994. Since that time the attempts to obtain consistent information on landings has improved, and logbooks have been put in place to attempt to collect catch data. There still exist serious problems in managing the data system.

1. The logbook information is good for the pelagic fleet (PLL), but the coastal logbook data (CFL) are less informative owing to lack of daily information on location, gear, catch and effort, and information on discards. **It would be useful to modify the CFL series to make them more informative for developing catch and effort data**.

2. Both Logbook series suffer from the lack of validation both when the permits are issued and when the logbook data are submitted (See Appendix I). We found that for the vessel information submitted for the permit applications there were numerous cases where even such basic information as vessel length, horsepower and hold size were blank or some unreasonable number was entered. **Errors could be reduced if the forms were checked on entry into the data base, and some controls initiated to deny entry if required spaces are black or fall outside some reasonable range. Most any standard data base software can design forms for this purpose**.

3. We also found a number of log entries for gear, effort and catches that were likely in error. Catching and correcting these types of errors is best done by dealing directly with the fishermen at the time they return to port. This is not practical in this complex fishery given the number of landing sites and the manpower needed for dockside contact. The logbooks are, however, supposed to be compared with the delivery receipts that are also submitted to NMFS, again a labor intensive task that may not be practical to fully implement. **It is, however, worth considering a statistical spot check to assess the magnitude of the problem along with a dockside sampling program to collect species composition and size data.**

4. Dockside data collection may best be done by the states through a cooperative arrangement with NMFS that includes financial assistance. There is no substitute for personal contact to assure a both quality data and a good working relationship between the agencies and the fishermen. **There appears to be considerable room for improved cooperation between the State and the Federal Agencies. This could improve both data collection and agreeing to uniform management regulations and reporting for HMS taken in state waters.**

Freezing effort with Limited Access Permits

This is problematic in that there has been little attempt on the part of the agency to develop a long range plan to get the numbers of LAP's down to a manageable level. The strategy appears to rely on natural attrition to do the job, which will no doubt work if the LAP's are allowed to die with the boat, or the owner. However, this does not seem to be the case. Figure 46 is similar to Figure 45 (above), but includes all the units in the federally permitted coastal fishery.

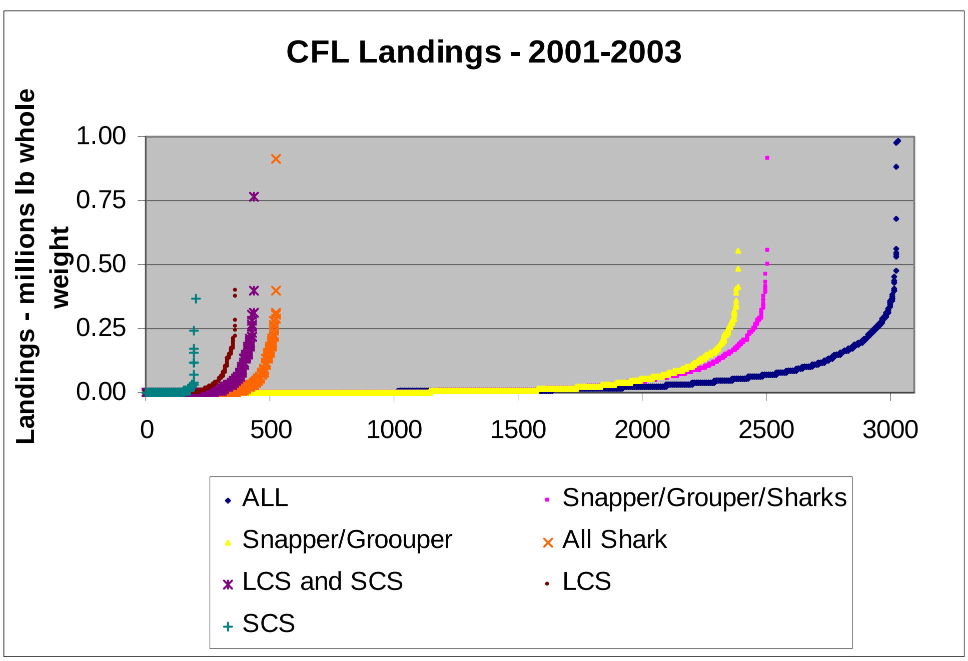


Figure 46. Individual LAP landings for some species groups.

The figure indicates that a bit more than half of the LAP's are essentially inactive in terms of fishing for federally permitted species (in the EEZ). We do not know if these vessels make a living fishing in state waters, or if they a represent part time fishermen and fishermen who are holding their LAP's on speculation waiting either for a chance to sell the permit or history, or for quotas to increase. We believe these permits are dangerous to any future sustainable fishery in the EEZ. This is because they represent a very large pool of latent effort that can easily be mobilized in the event of any increase in a TAC or any attempt to reduce the number of LAP's through a buyout.

This is a multispecies fishery with most boats holding LAP's for several species. This means that in the case of the removal of a permit, perhaps through a buyout, the boat can shift its effort to another species group, exacerbating any excess effort problem that may exist in that fishery. A similar concern applies to vessel buyouts since there is a large pool of underutilized vessels with LAP's that can be bought to replace the vessel that was sold out.

The current plan for shark involves a buyout of permits or boats with the remaining boats paying for the buyout. The feasibility of this plan remains to be established. One major obstacle will be the willingness of the remaining boats to assume the cost of the buyout. Because only a few boats would remain in the Directed Shark "fleet" the cost to them may be higher than they want to assume, and NMFS may need to take a more active part.

Regardless of the outcome for the Shark Buyout Plan, we suggest that NMFS give a high priority to developing a plan to define inactive and underutilized LAP's and to remove them from the pool.

END NOTES

[1] The use of yield in weight rather than number is necessary in many stock assessments because detailed size and age data are lacking. One consequence is that for fisheries that have been heavily fished and then managed with the objective of rebuilding the stock to some higher biomass the average size of the fish is usually smaller than the size will be once the new "equilibrium" biomass is attained. This means that fishing mortality will be higher for the yield in weight at the lower stock level, and CPUE based on catch in number will be higher than CPUE based on catch in weight. This is all taken care of in the assessment models as best it can, but it is worth remembering when planning for a fishery where controlling effort is a management strategy, and effort is calculated in catch by weight rather than numbers.

[2] The concept of MSY is theoretical. When used as a long-term goal it is sensitive to environmental factors that need to be assessed along with catches.

[3] This calculation requires an estimate of F, and the current assessment provides such a range of uncertainties for the parameter that the approach is impractical at present.

[4] If the management program aims to rebuild the stock and is working, then stock size should have a positive trend.

[5] The permits are issued on annual basis, but there may be considerable overlap with the next year.

[6] A few records do not provide vessel length data so the totals on the figures are less than total number of permits issued.

[7] We noted three errors in composition on the map: Areas 2979, 3079 and 3179 are entered properly offshore, and entered in lieu of 2981, 3081, and 3181 in the near shore sector. What is not clear is if all fishermen entered the data properly despite the errors on the map, nor is it clear what effect these errors may have on subsequent analyses. Although miss-location of catches, especially for the gillnet boats, may have occurred, these mistakes do not affect the conclusions in this report.

[8] We treat the weight as if it is whole weight, but it likely is dressed weight. For coastal sharks, unless otherwise noted, we use whole weight pounds. The CFL data base has three columns to report landings: gutted weight, whole weight and total weight. Vessels report in either one of the first two columns and all are converted to total weight, presumably by NMFS, in the third column, which are the weights we use. Gutted weight seems to be raised by a factor of 1.39 in the process to give total weight, and whole weight is considered equal to total weight. Until we provide calculations dealing with the TAC, which is set using dressed weight, we find it more convenient to use total (whole) weight.

[9] The choice of 50,000 lb is arbitrary in the sense that there is no obvious gap in the landings data to suggest this number as a break point. However, the purpose of the exercise was to establish a group that comprised boats that targeted LCS and were well distributed by length class, catches throughout the season and Region.

[10] A.J. Hayter (1984). "A proof of the conjecture that the Tukey-Kramer multiple comparisons procedure is conservative," *Annals of Statistics*, 12, 61–75.

[11] The fishing power for Class IV may be underestimated due to the 4000 lb trip limit, which may restrict their ability to fully use their size to advantage.

[12] The sample was 126 boats but ten lack length information and could not be assigned to a Class.

[13] There is some uncertainty about how appropriate the conversion rate is. Newer data suggest that we may expect some adjustment in the near future.

[14] This performance might be expected for boats holding Directed Permits, but not Incidental Permits, which limit landings to five Large Coastal Sharks per trip. Unless these fish were all very large, this is unlikely.

[15] Two thirds of LCS gillnet landings are made by two strike-net boats that use airplanes to target visible schools of chiefly blacktip shark (R. Hudson pers. comm.).

[16] Because we do not have at this time an estimate of how buyout will be apportioned among the individual Regions, we use the average for Class III boats over all Regions and all years 2001-2003.

[17] For the reason in Note 15.

[18] R. Hudson pers. comm.

[19] Canvassing the recreational sector does not generally develop data that can be used to estimate discard mortality. In fact, information on recreational catch for most states is of extremely poor quality.

[20] There is some natural mortality even in pure cell cultures; therefore, theory aside, the observed rate of increase is not exactly a doubling. Nonetheless, it is very close. The rate of increase is slower and more variable for more complex organisms that are not in a pure culture, and especially those that reproduce sexually.

[21] Pulse fishing for example was practiced by the Soviets on the Pacific sea mounts where they found virgin stock of Pacific armor head, a very slow growing species that was no economic to harvest on a sustainable basis given the cost of the operations. Whaling has also been considered in this light, although a more apt model is resource mining in that the removals were at a slower, but still unsustainable rate.

[22] A modeling difficulty specific to sandbar is the fact that for this species is there only one abundance index that goes back in time. This is the Virginia LL Series that begins in 1974 and continues, with a few gaps, to present. The series indicates a rather marked decline in apparent abundance (CPUE) prior to 1986 when the commercial fisheries started, as well as prior to 1981 when the recreational catches are supposed to have increased. The shark industry has called attention to this paradox, but the index is still given full weight and a low CV for both the sandbar and the coast LCS complex modeling. Our concern is that models generally respond well to strong signals (trends) at the beginning of the period under analysis, particularly when the CV is low.

[23] Dynamic models are quite good in describing the dynamics of single populations of simple organisms in a controlled environment. Modeling becomes much more complex applied to organism that reproduce sexually, live in an physical environment that is not constant, and share the environment with many other species of plant and animals – some serving as food and some being decidedly unfriendly. So how does one go about “managing” the take of wild, living resources? How does one specify MSY for Large Coastal Sharks?

This is where matters become difficult and complex - difficult because an evaluation requires data, complex because evaluation also means developing some sort of acceptable models to indicate a sustainable level of removals.

The biggest problem with evaluating LCS is lack of data. Following the end of WW II, many nations reopened or expanded fisheries that had been closed or reduced during the war. The different nations looked at fisheries and their management in different ways. Most managed their coastal fisheries by licensing the number of boats allowed to fish. For international waters, on the other hand, it became a free-for-all, and development in most cases was encouraged on an unrestricted basis, at least until domestic market problems caused some to license and restrict their high seas fleets. America was different in that each State managed their own waters – some better than others. The principal federal goal by the U.S.

Bureau of Commercial Fisheries was to develop fisheries, encourage expansion onto the high seas, and develop underutilized species. This continued even after BCF became part of NOAA – NMFS.

It was only after the first Magnuson Act expanded the US fishery zone offshore 200 n.m. that the NMFS became seriously interested in management, and even then, NMFS continued to encourage the development of underutilized species and expansion by U.S. vessels onto the high seas. Sharks and squid were the two big targets for development in the U.S.EEZ. For sharks, this had two unforeseen consequences. The fisheries began to expand in 1980, and expanded rapidly in the Atlantic and GOM in the late 1980's, and NMFS chose to rely on the states and port agents for landings data and the states management even though sharks were clearly an interstate problem. Data was gathered to provide annual value and landings information without much thought about management. The fisheries expanded unchecked with new units and processors encouraged to become involved without thought to economic sustainability. The consequences of poor data and overinvestment did not become obvious until 1989 and after when the Fishery Management Council asked NMFS to develop a Fishery Management Plan for US Atlantic sharks.

In 1993 the Plan was adopted and implemented resulting in a major reduction (about 50%) in allowed landings for LCS, the curtailment of finning except from sharks landed, and in 1994 a 4000 lb trip limit. Repercussions of the Plan included both a disruption of the fishery and markets including several of bankruptcies of dealer/processors and the withdrawal of large shark boats that were no longer economic with the trip limit, and the strong indication that biological and fishery data for sharks were deplorable.

[24] This is an unfortunate phrase in that it implies that any science is the "best" by definition if it is the only technical information available. Current Federal legislation leaves the decision open as to what is "best". One concern is that assessment scientists tend to accept data without questioning its logical consistency. Adding variance and using weighting factors help, but including data that is logically inconsistent is questionable. Also, models mostly ignore the fact that fish interact with their ecosystem and the environment, and neither are constant equilibrium, there exist well documented episodic and cyclic changes in the ocean climate, and these occasion regime shifts that broadly affect (K) fisheries.

[25] We find this reasoning by NMFS disingenuous based on our years of experience with fishermen and buyers who for the large part are very familiar with what they catch, land, sell or buy. One check on how big a problem mistaken identity by fishermen not knowing the species is might be made by spot checking the landings of prohibited species at dockside. The identification presumably is done at sea and any in the landings would indicate a problem in identifying species.

[26] Class conversion based on length ignores the human factor of captain and crew, and the physical capabilities of the individual vessels. The human factor no doubt is responsible for much of the variability in performance noted in Section V. The human factor is likely to be at least as important as the boat and equipment, and the two are expected to be correlated, although we have no way to test this hypothesis.

Appendix I

Data Supplied by NMFS: **Data file names and size, followed by a brief description of the content**
THE DATA FILES. The data we used was courtesy of NMFS. These data are collected as part of the Federal Shark Limited Access Permit system. The file name and size, followed by a brief description of the content are:

A. Vessels Data.

Larkinsk.xls, 107 KB
The table contains permit application data for 2003 for Coastal Fisheries Logbook (CFL) and the Pelagic Longline Logbook (PLL). Larkinsk.xls is a subset of a master file that contains data for all vessels holding Federal Limited Access Permits (LAP's). Larkinsk.xls contains data only for the 594 vessels holding LAP's for Directed Shark (SKD – 245 boats) and Incidental Shark (SKI – 349 boats). Most of these 594 boats hold one or more LAP's for other species as well. Entries in this file are by vessel registration number and list owner and operator names and addresses, ZIP Codes, home port, all LAP permits held, vessel length, engine HP, and hold capacity and additional information on gear type, etc.

B. Landings, location and effort for the coastal fishery.

cfl0l_03.dbf, 99,582 KB
File containing landings data for 2001-3 of boats holding a Federal Limited Access Permit for shark and fishing under the Coastal Fishery Logbook system. Data include trip number, departure, landing and unloading dates, days away, dealer information, species landed and their weight, area fished, gear type and size or number of hooks (bottom longline), and some indication of overall effort.

ctldatadescripton.wpd, 10 KB
File containing a description of the data elements that are in the coastal fisheries logbook data (cfl0l_03.dbf).

county.dbf, 2.7 KB
Table containing the county codes and the name and state codes used in cfl0l_03.dbf.

nmfsspec.xls, 102 KB
Table containing the common and scientific names for the species codes in cfl0l_03.dbf.

statisticalmap.pdf, 63 KB
Map of the Atlantic and Gulf of Mexico with the statistical grid identified by numeric code. These codes are entered in area fished column of cfl0l_03.dbf.

State_codes.xls, 16 KB
Table of names for the numeric state codes for cfl0l_03.dbf.

Port_codes.xls, 34 KB
Table of names for the numeric port codes for cfl0l_03.dbf.

C. Catch, discards, landings, location and effort for the pelagic fishery.

tripsumm_2001_03.xls, 1063 KB
Table of trip summary data for pelagic longline logbooks. These data include: schedule number, vessel registration number, departure date, first set date, last set date, landing date, port of departure, state code, days fished, number of crew, number of sets, port of landing, and state code. The number in the schedule number column is a unique identification number for the trip. This number is in the trip number column of the table that contains the set information (table name pll_2001_03.xls).

pll_2001_03.xls, 22,770 KB
File containing the location (latitude and longitude), catch and effort information (gear type and number of hooks, bait, etc.) for the individual longline sets for each pelagic trip. Data recorded include the schedule number, the targeting for the trip (tuna, shark, swordfish), the species and numbers of animals caught, discarded (dead and alive) and the weight of the fish kept. The number in the schedule (trip) number column links the set data to the data in the trip_summ.xls.

APPENDIX II

Data errors and omissions we found when working with the files.

We encountered a number of incomplete entries, or obviously wrong entries in the data bases. These do not present a problem in as far as they can be flagged and not used or modified in the analyses. Since our conclusions are insensitive to occasional errors in landing weights and effort, we are not very worried about the quality of the data we used. We are concerned about the possible effects of errors on assessments using these data sets, and we are concerned in general that these errors indicate a need for improvement in managing data entry in both the permit application process and in collecting Logbook data. The latter are especially important for stock assessment and suggest that it would be a wise investment to assign more effort dockside validating the logbooks when the boats are unloaded.

A) Edits we made or entries we questioned in the CFL data set.

ID 303 changed catch on trip 7/12/2001 from 54,376lb to 5437.7lb sandbar.

ID 170 not changed but flagged for trip 3/3/02 of 11,294 lb BT in one day. Since this boat holds an SKI permit, the number seems a bit unreasonable.

ID 408 and ID 561 flagged 2205 and 300 sets in 11 and 5 days; neither enter our calculations until Sections V and VI as both were >4 days away.

ID 80 and ID 112 had 81 and 31 sets in 3 days with 1000 hooks. These entries were edited out of calculations of catch per set.

Trips schedule 522748 and 49 appear to be identical, but 5 days separated in time. We used only one.

We also found about 500 entries that seemed in unreasonable in terms of catch per hook. Because we did not use catch per hook in the final analysis we kept most of these data n the set used for catch per trip. Table Appendix II-1 provides a sample of the entries with a very low number of hooks and sets, a short time away (most are inside our 4 day window) and a high catch/landings. The top two are SKI permits that either entered a number in error or caught five humungous sharks. The balance of the table indicates the type of entry of concern. We checked the ID number against other trip reports and in most cases found the same boat reported 200 or 500 hooks instead of 2 or 5.

ID	TOP	AWAY	SETS	HOOKS	COMMON	TOTLBS
170	SKI	1	10	50	SHARK,BLACKTIP	11293.8
491	SKI	5	6	800	SHARK,BLACKTIP	8326.1
392	SKD	1	1	2	SHARK,BULL	2960.7
422	SKD	2	2	5	SHARK,BLACKTIP	4231.2
366	SKD	6	3	5	SHARK,SANDBAR	4227
422	SKD	3	3	5	SHARK,BLACKTIP	4031
478	SKD	5	4	5	SHARK,SANDBAR	2636.8
487	SKD	4	4	5	SHARK,SANDBAR	2370
422	SKD	2	2	5	SHARK,HAMMERHEAD	1184.3
366	SKD	6	3	5	SHARK,HAMMERHEAD	714.5
458	SKD	1	1	7	SHARK,BLACKTIP	3405.5
68	SKD	4	6	7	SHARK,BLACKTIP	2497.8

Table Appendix II-1. Reported effort and landings that appear questionable

There remained a large number of entries of between 10 and 25 hooks/here remained a large number of entries of between 10 and 25 hooks per set that are consistent throughout. It may be that some are number between floats, or per basket if anyone uses them. But the 20 – 50 hook range seems a bit few for a bottom longline that produces near trip limits in less than four days. Assessment scientist would be well advised to look at these data to see if they make sense for their particular assessment.

B) The Larkin data base had a number of incomplete entries, some of which are summarized here.

- Length information was missing for 59 boats – 10% of total
- Horse Power 56 hp information was missing for 56 boats – 9% of total
- Hold Capacity information was missing for 185 boats – 31% o total

Some hold capacity entries were unlikely to be tons. They may have been in pounds.

ID 574 LOA 25 Hold Capacity 1000
ID 232 LOA 31 Hold Capacity 1000
ID 344 LOA 48 Hold Capacity 8000
ID 130 LOA 51 Hold Capacity 25000
None of these is a SKD bottom longline boat we used in our analysis.

ID 279 LOA 45 Hold Capacity 30000, this vessel is a shark boat and we changed the hold capacity to 30 tons, although it may be 15 tons if the entry was in pounds[1] and not a typo. Bothersome, but because we lacked over 30% of the information on capacity we later decided not to use hold capacity in the analysis, so the question of 30 vs. 15 tons is mooted.

C. Areas Fished Maps.

[1] Either is reasonable for a vessel this length depending on draft.

We noted three errors on the fishing block maps (Figs. 1 and 2): Areas 2979, 3079 and 3179 are entered properly offshore, and entered in lieu of 2981, 3081, and 3181 in the near shore sector. What is not clear is if all fishermen entered their data properly despite the errors on the map, nor is it clear what effect these errors may have on subsequent analyses. Although miss-location of catches, especially for the gillnet boats, may have occurred, these mistakes probably will not matter in using these data for assessments. This is because area fished on this fine scale is unlikely to be used; instead, only the three major-region divisions: North Atlantic, South Atlantic and Gulf of Mexico will be assessed. But in that regard, it is important to note that the division line between the North and the South Atlantic Regions cuts through the 3600 series blocks, and some decision needs to be made on how to apportion the landings between these Regions.

Appendix III

MINITAB© statistical analysis.

We have included in the appendix selected statistical analyses for standardizing the Class III shark Boat that we did not include in the report. We also have included an Excel spreadsheet containing the combined Larkin and CFL data for 116 SKD boats – 125 boats minus nine for which length data were lacking.

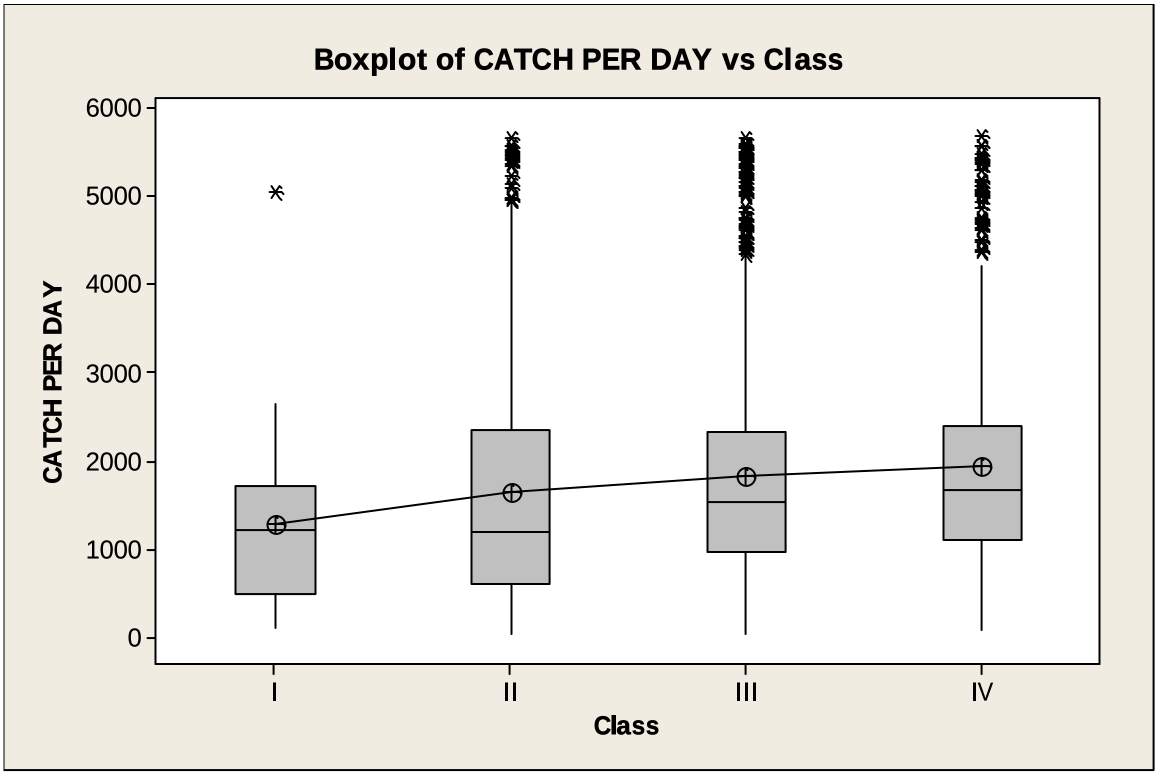
The statistical procedures (GLM and ANOVA) should be familiar to most people who look in appendices. If not, the explanations are given in Section IV of the text.

Minitab Project Report

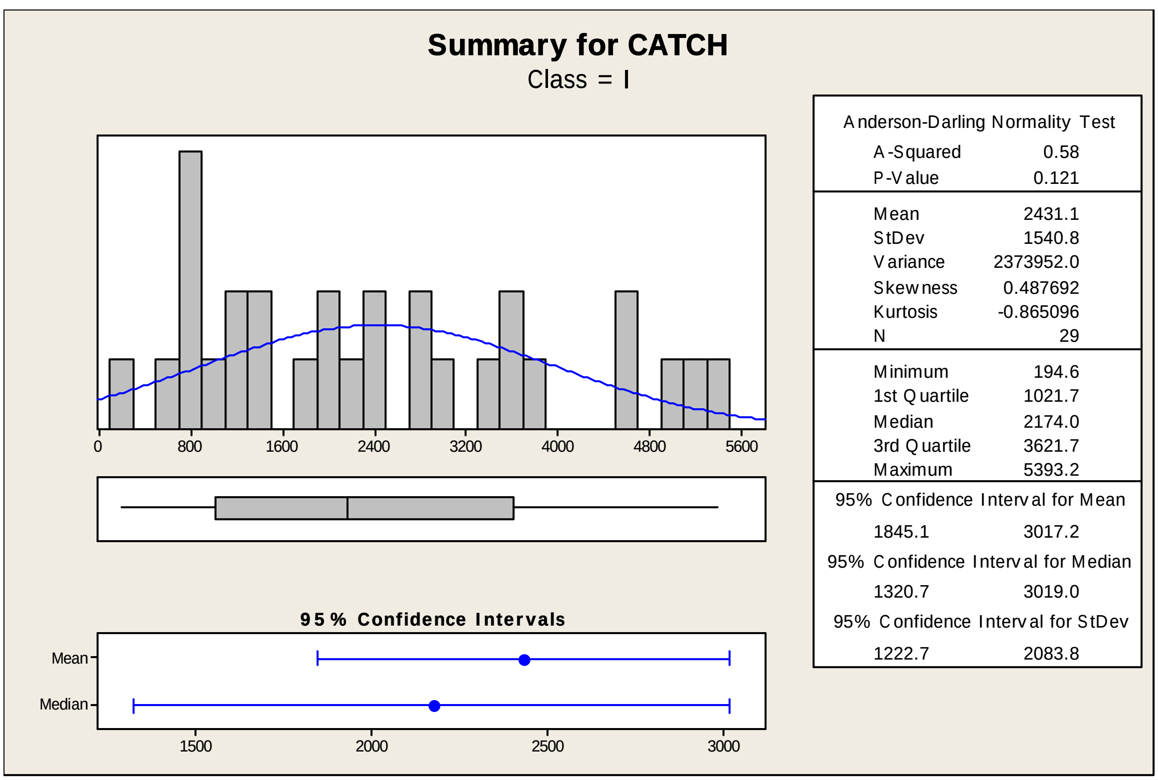
First, a quick look to see if there is evidence of a difference between the two semesters. There does not seem to be any of significance.

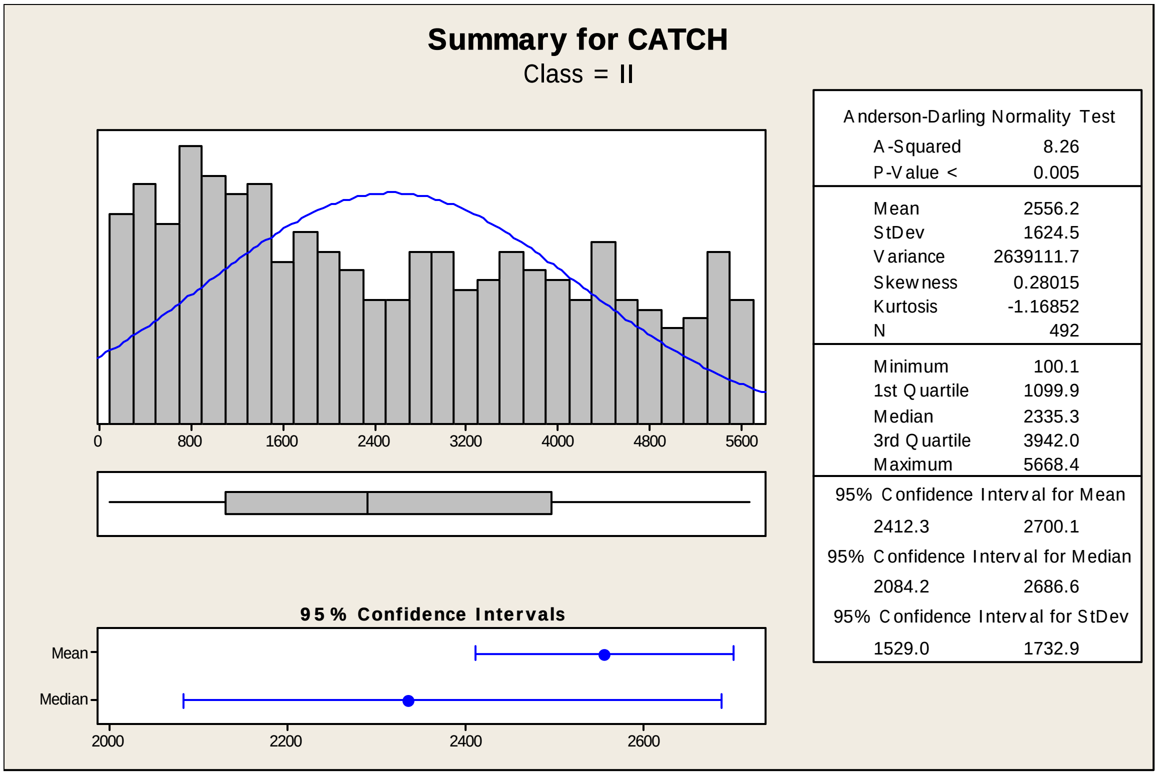
One-way ANOVA: CATCH PER SET versus Season

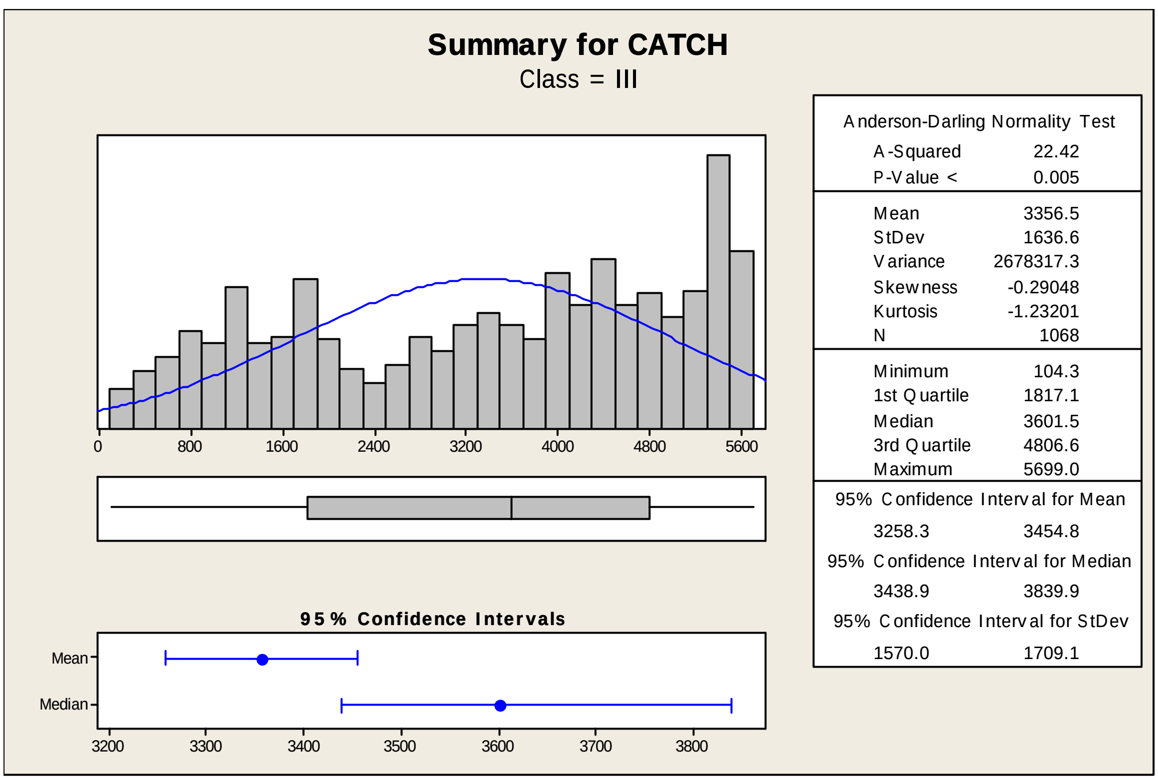
```
Source   DF          SS        MS     F      P
Season    1    11212353  11212353  4.67  0.031
Error   727  1743710222   2398501
Total   728  1754922574
S = 1549   R-Sq = 0.64%   R-Sq(adj) = 0.50%
                         Individual 95% CIs For Mean Based on
                         Pooled StDev
Level    N  Mean  StDev  ---------+---------+---------+---------+
S      205  1832   1548  (------------*-------------)
W      524  2108   1549                      (--------*-------)
                         ---------+---------+---------+---------+
                              1760      1920      2080      2240
Pooled StDev = 1549

A look at catch per day by vessel class
```



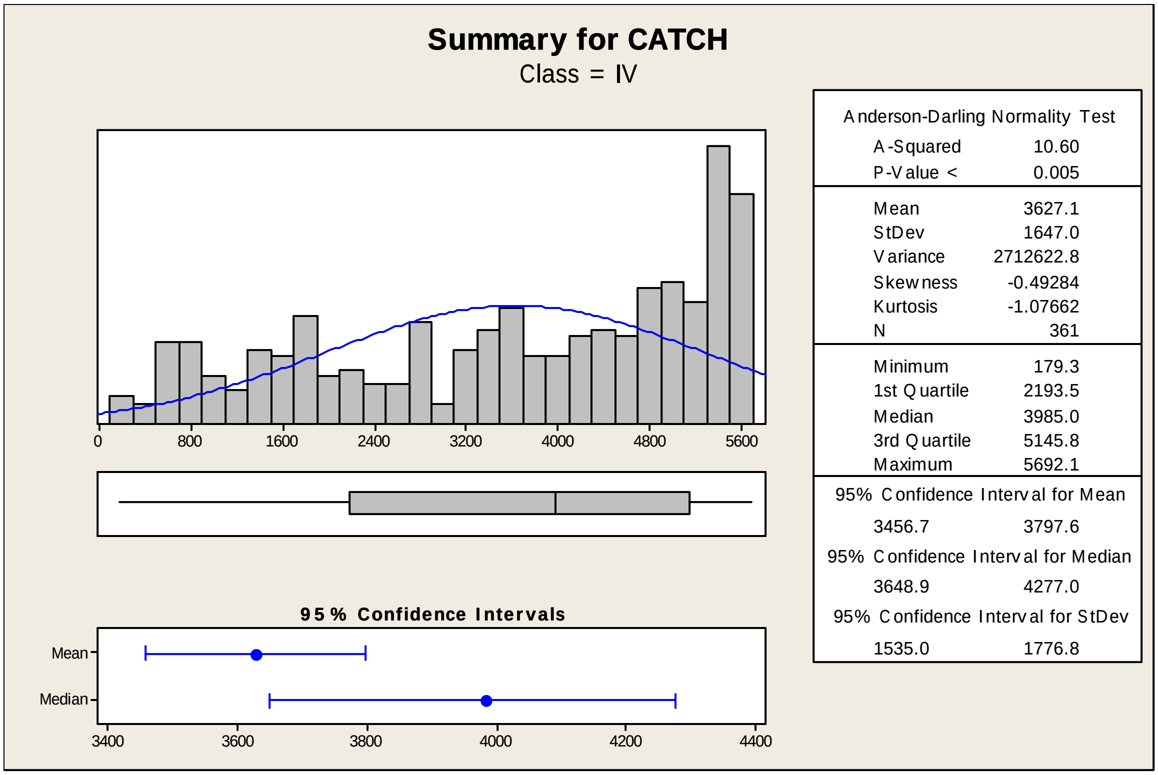
Results for: Trimmed (Catch Over 4000 lb/trip) removed 47 Boats 4 classes
Note the shift towards higher median trip landings as size class increases.





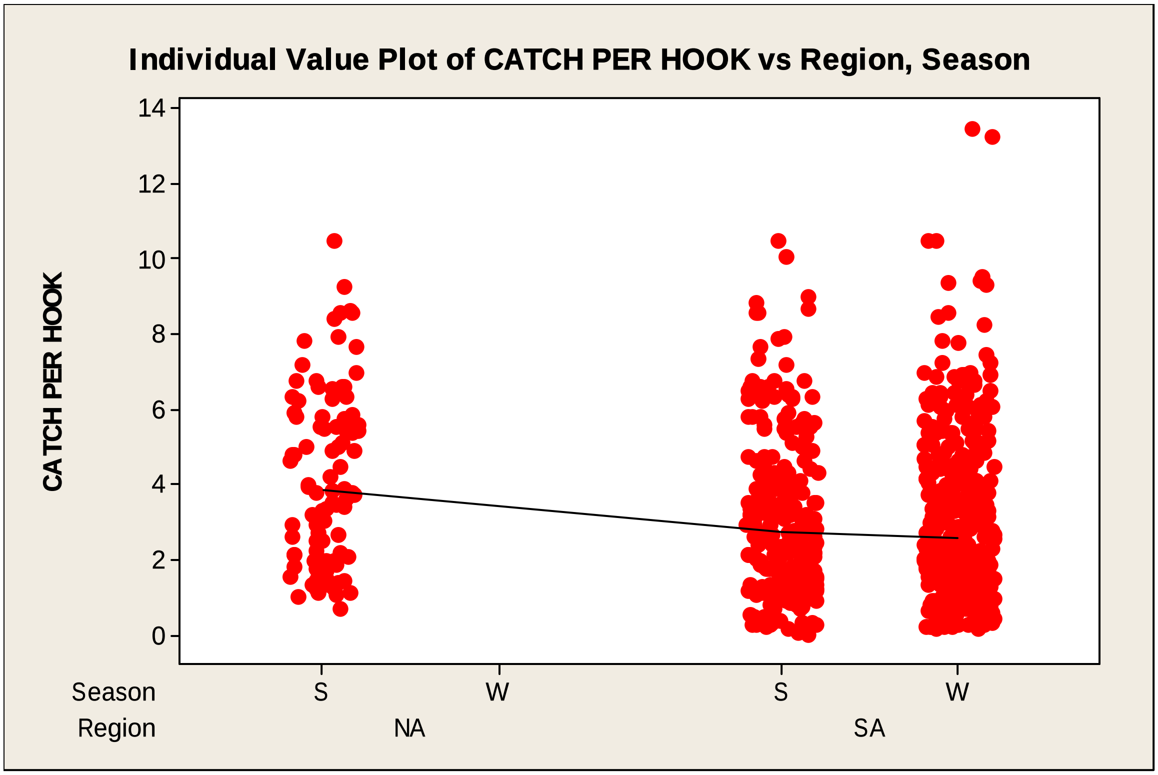


4 Summary for CATCH (Class = IV)



Individual Value Plot of CATCH PER HOOK vs Region and Season
Region (SA – south Atlantic, NA – north Atlantic),
Season (S – summer or 1st semester, W – winter or 2nd semester)
This is to see if the observer conclusion of higher hook rate in the NA in summer, proposed to be due to a northward migration of sharks as the waters warm, holds up with our data set.

Results for: N&S north area



Results and diagnostics for the GLM

General Linear Model: CATCH PER TRIP versus Region, Year, Class

```
Factor  Type   Levels  Values
Region  fixed       3  GOM, NA, SA
Year    fixed       3  2001, 2002, 2003
Class   fixed       4  I, II, III, IV


Analysis of Variance for CATCH PER TRIP, using Adjusted SS for Tests

Source    DF      Seq SS      Adj SS     Adj MS      F      P
Region     2   620078380   244479962  122239981  46.62  0.000
Year       2    10592367    11835731    5917866   2.26  0.105
Class      3   425733707   425733707  141911236  54.13  0.000
Error   2179  5712969548  5712969548    2621831
Total   2186  6769374003


S = 1619.21   R-Sq = 15.61%   R-Sq(adj) = 15.33%


Unusual Observations for CATCH PER TRIP

        CATCH
          PER
 Obs     TRIP      Fit  SE Fit  Residual  St Resid
   6   241.90  3804.76   76.50  -3562.86     -2.20 R
  16   355.80  3804.76   76.50  -3448.96     -2.13 R
```

34	593.60	3965.36	98.60	-3371.76	-2.09	R
36	647.80	3965.36	98.60	-3317.56	-2.05	R
38	504.60	3965.36	98.60	-3460.76	-2.14	R
42	563.00	3804.76	76.50	-3241.76	-2.00	R
51	422.50	3928.03	86.89	-3505.53	-2.17	R
77	590.80	3898.78	100.42	-3307.98	-2.05	R
96	486.50	3898.78	100.42	-3412.28	-2.11	R
134	243.30	3928.03	86.89	-3684.73	-2.28	R
135	243.30	3928.03	86.89	-3684.73	-2.28	R
136	433.70	3928.03	86.89	-3494.33	-2.16	R
250	549.10	3928.03	86.89	-3378.93	-2.09	R
251	665.80	3928.03	86.89	-3262.23	-2.02	R
311	361.40	3965.36	98.60	-3603.96	-2.23	R
435	148.70	3804.76	76.50	-3656.06	-2.26	R
478	7924.40	4088.63	108.83	3835.77	2.37	R
479	806.20	4088.63	108.83	-3282.43	-2.03	R
482	575.50	4088.63	108.83	-3513.13	-2.17	R
491	764.50	4088.63	108.83	-3324.13	-2.06	R
495	186.30	3738.17	83.48	-3551.87	-2.20	R
501	216.80	3898.78	100.42	-3681.98	-2.28	R
522	373.90	3804.76	76.50	-3430.86	-2.12	R
547	711.70	3965.36	98.60	-3253.66	-2.01	R
563	100.10	3417.51	116.65	-3317.41	-2.05	R
636	180.70	3804.76	76.50	-3624.06	-2.24	R
655	536.50	3804.76	76.50	-3268.26	-2.02	R
670	116.80	3804.76	76.50	-3687.96	-2.28	R
673	343.00	3804.76	76.50	-3461.76	-2.14	R
885	4865.00	1395.34	128.58	3469.66	2.15	R
930	6004.80	2499.66	86.26	3505.14	2.17	R
940	5124.90	1395.34	128.58	3729.56	2.31	R
1215	5265.30	1585.20	130.25	3680.10	2.28	R
1237	6007.60	2499.66	86.26	3507.94	2.17	R
1308	8059.20	2566.24	83.83	5492.96	3.40	R
1322	5949.30	2499.66	86.26	3449.64	2.13	R
1333	6253.60	2566.24	83.83	3687.36	2.28	R
1396	5049.90	1395.34	128.58	3654.56	2.26	R
1404	5393.20	1395.34	128.58	3997.86	2.48	R
1814	5910.30	2499.66	86.26	3410.64	2.11	R
1816	5860.20	2499.66	86.26	3360.54	2.08	R
1881	6067.40	2499.66	86.26	3567.74	2.21	R
1923	5858.90	2566.24	83.83	3292.66	2.04	R
1985	6590.00	3076.76	77.79	3513.24	2.17	R
2025	6854.10	2566.24	83.83	4287.86	2.65	R
2026	6709.50	2566.24	83.83	4143.26	2.56	R
2075	9313.00	2566.24	83.83	6746.76	4.17	R

R denotes an observation with a large standardized residual.

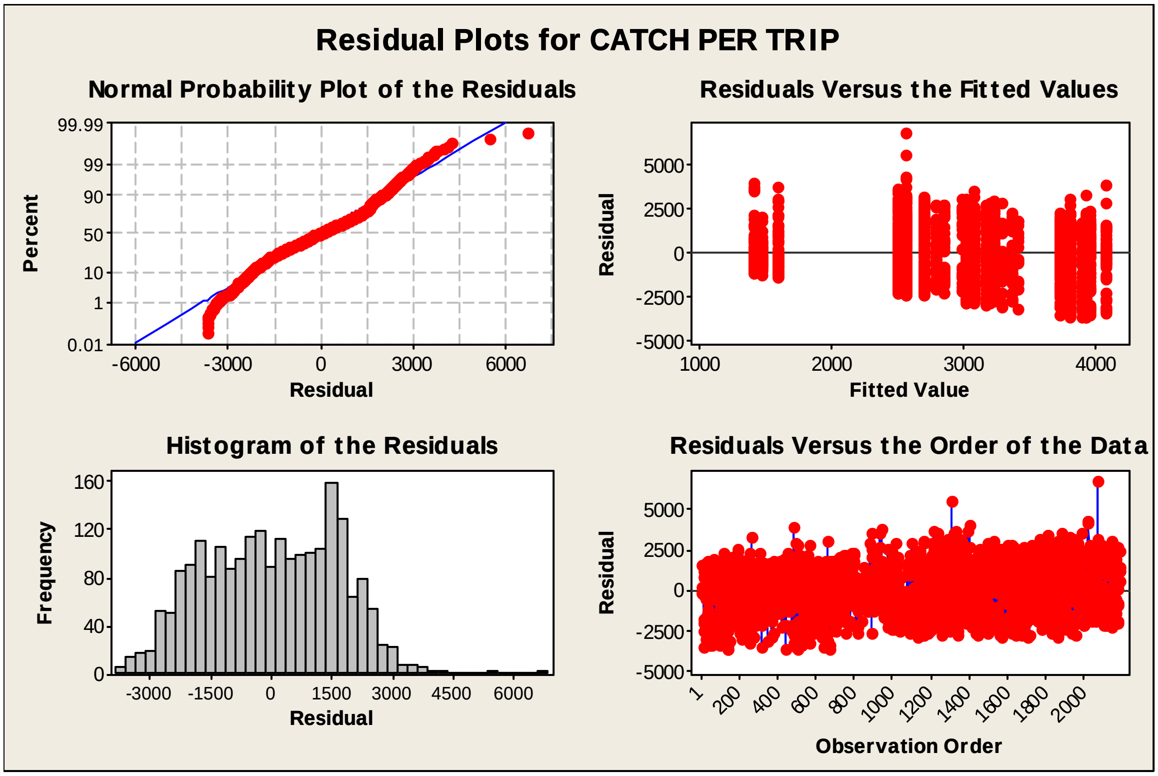
Least Squares Means for CATCH PER TRIP

Region	Mean	SE Mean
GOM	3332	70.44
NA	2384	169.24
SA	2604	49.49
Year		
2001	2878	89.93
2002	2688	82.32
2003	2755	82.28
Class		
I	1650	138.10
II	2754	95.27
III	3265	63.18

IV	3426	101.08

Residual Plots for CATCH PER TRIP

Results for: Trimmed 47 Boats 4 classes



Minitab Project Report

General Linear Model: Catch per Trip versus Region, Year, Class

Factor	Type	Levels	Values
Region	fixed	3	GOM, NA, SA
Year	fixed	3	2001, 2002, 2003
Class	fixed	4	I, II, III, IV

Analysis of Variance for Catch per Trip, using Adjusted SS for Tests

Source	DF	Seq SS	Adj SS	Adj MS	F	P
Region	2	795057114	274209107	137104554	51.74	0.000
Year	2	20057561	17769350	8884675	3.35	0.035
Class	3	586166825	586166825	195388942	73.74	0.000
Error	2571	6812370525	6812370525	2649697		
Total	2578	8213652024				

S = 1627.79   R-Sq = 17.06%   R-Sq(adj) = 16.83%

Unusual Observations for Catch per Trip

Obs	Catch per Trip	Fit	SE Fit	Residual	St Resid	
4	293.30	3570.52	75.96	-3277.22	-2.02	R
121	4865.00	1249.53	115.13	3615.47	2.23	R
129	144.60	3772.32	77.77	-3627.72	-2.23	R
178	6004.80	2358.37	77.29	3646.43	2.24	R
188	5124.90	1249.53	115.13	3875.37	2.39	R
226	241.90	3714.79	69.24	-3472.89	-2.14	R
228	1434.50	1042.29	160.05	392.21	0.24	X
229	1922.40	1042.29	160.05	880.11	0.54	X
230	1331.60	1042.29	160.05	289.31	0.18	X
231	1435.90	1042.29	160.05	393.61	0.24	X
232	340.60	1042.29	160.05	-701.69	-0.43	X
233	1915.40	1042.29	160.05	873.11	0.54	X
234	3212.30	1042.29	160.05	2170.01	1.34	X
235	287.70	1042.29	160.05	-754.59	-0.47	X
236	1618.00	1042.29	160.05	575.71	0.36	X
237	596.30	1042.29	160.05	-445.99	-0.28	X
238	1529.00	1042.29	160.05	486.71	0.30	X
239	5282.00	1186.56	166.81	4095.44	2.53	RX
240	285.00	1186.56	166.81	-901.56	-0.56	X
241	1049.50	1186.56	166.81	-137.06	-0.08	X
242	512.90	1186.56	166.81	-673.66	-0.42	X
349	355.80	3714.79	69.24	-3358.99	-2.07	R
376	685.30	1244.10	163.57	-558.80	-0.35	X
377	1705.50	1244.10	163.57	461.40	0.28	X
518	422.50	3772.32	77.77	-3349.82	-2.06	R
655	590.80	3896.40	98.42	-3305.60	-2.03	R
662	514.30	4098.21	103.42	-3583.91	-2.21	R
706	486.50	3896.40	98.42	-3409.90	-2.10	R
730	5265.30	1451.34	116.05	3813.96	2.35	R
762	6007.60	2358.37	77.29	3649.23	2.24	R
783	8025.80	3251.72	99.53	4774.08	2.94	R
828	8059.20	2502.65	75.58	5556.55	3.42	R
849	243.30	3772.32	77.77	-3529.02	-2.17	R
850	243.30	3772.32	77.77	-3529.02	-2.17	R
869	287.70	3714.79	69.24	-3427.09	-2.11	R
886	433.70	3772.32	77.77	-3338.62	-2.05	R
1018	5949.30	2358.37	77.29	3590.93	2.21	R
1057	6253.60	2502.65	75.58	3750.95	2.31	R
1073	5049.90	1249.53	115.13	3800.37	2.34	R
1075	5393.20	1249.53	115.13	4143.67	2.55	R
1086	5883.40	2560.18	81.76	3323.22	2.04	R
1264	7158.50	3772.32	77.77	3386.18	2.08	R
1351	361.40	4040.68	98.85	-3679.28	-2.26	R
1365	436.50	3714.79	69.24	-3278.29	-2.02	R
1435	5660.10	2295.40	137.13	3364.70	2.07	R
1497	148.70	3714.79	69.24	-3566.09	-2.19	R
1808	186.30	3570.52	75.96	-3384.22	-2.08	R
1816	373.90	3714.79	69.24	-3340.89	-2.05	R
1834	806.20	4098.21	103.42	-3292.01	-2.03	R
1835	764.50	4098.21	103.42	-3333.71	-2.05	R
1836	7924.40	4098.21	103.42	3826.19	2.36	R
1839	575.50	4098.21	103.42	-3522.71	-2.17	R
1881	216.80	3896.40	98.42	-3679.60	-2.26	R
1922	788.10	4040.68	98.85	-3252.58	-2.00	R
1933	711.70	4040.68	98.85	-3328.98	-2.05	R

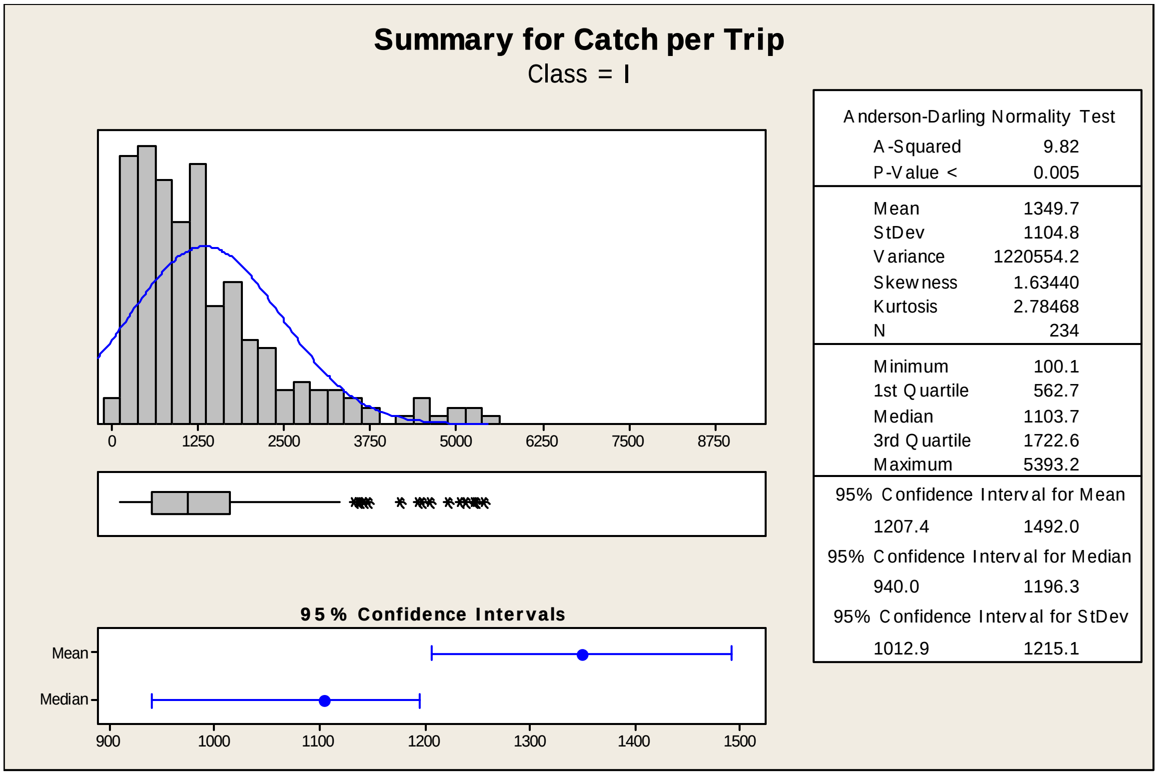
1934	104.30	3896.40	98.42	-3792.10	-2.33	R
1966	5910.30	2358.37	77.29	3551.93	2.18	R
1967	5860.20	2358.37	77.29	3501.83	2.15	R
2081	6067.40	2358.37	77.29	3709.03	2.28	R
2097	5858.90	2502.65	75.58	3356.25	2.06	R
2233	343.00	3714.79	69.24	-3371.79	-2.07	R
2309	180.70	3714.79	69.24	-3534.09	-2.17	R
2341	6590.00	3023.25	74.66	3566.75	2.19	R
2342	116.80	3714.79	69.24	-3597.99	-2.21	R
2398	6709.50	2502.65	75.58	4206.85	2.59	R
2400	6854.10	2502.65	75.58	4351.45	2.68	R
2514	9313.00	2502.65	75.58	6810.35	4.19	R

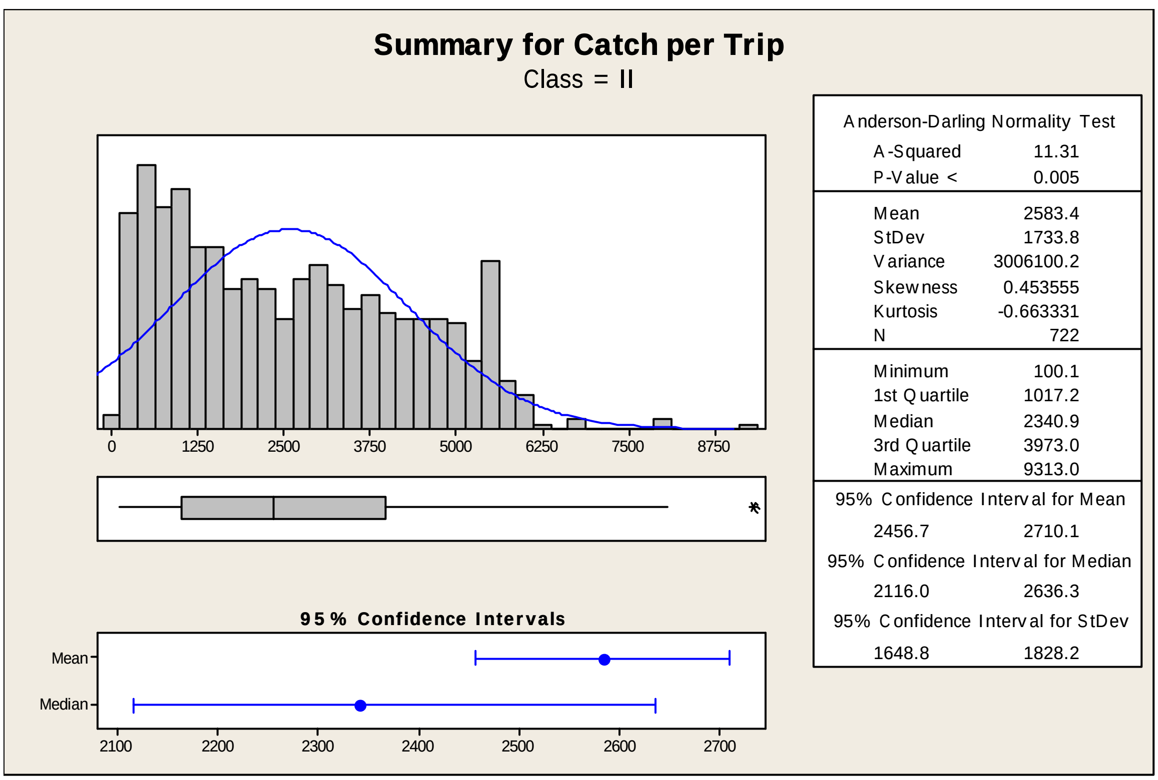
R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large influence.

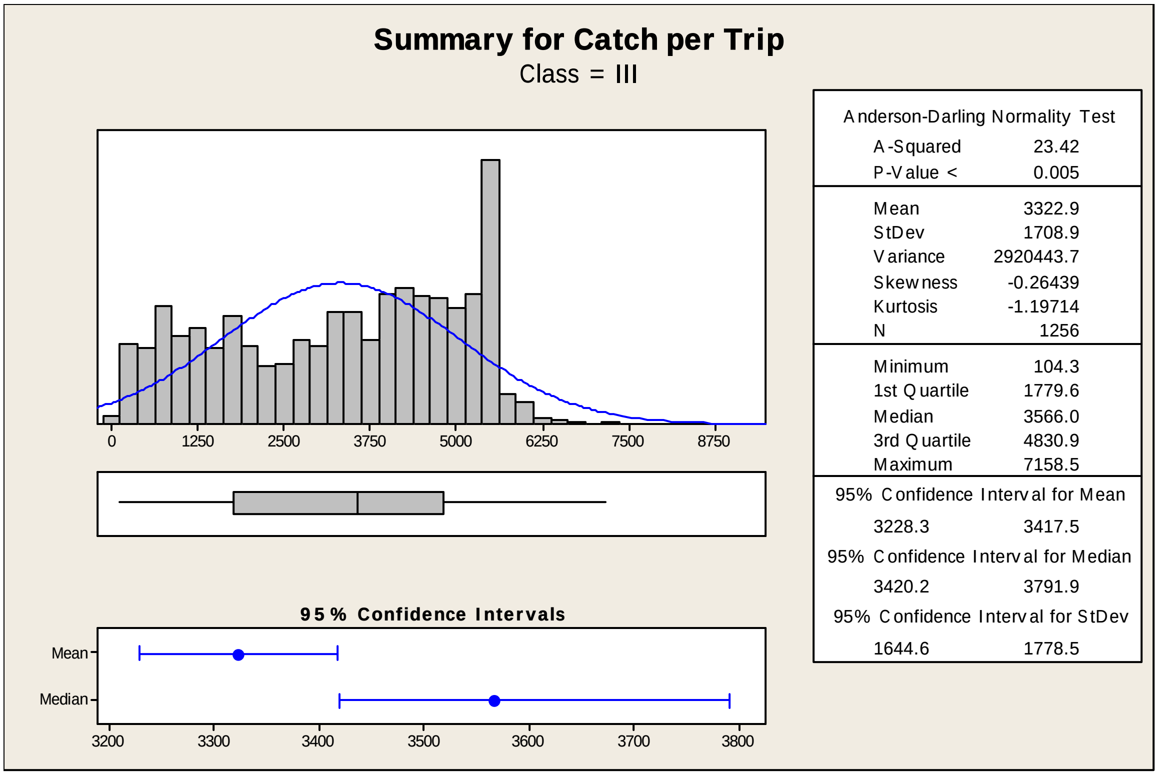
Least Squares Means for Catch per Trip

Region	Mean	SE Mean
GOM	3230	61.93
NA	2331	118.90
SA	2538	48.23
Year		
2001	2786	72.00
2002	2584	65.68
2003	2729	68.96
Class		
I	1526	115.84
II	2635	71.23
III	3156	53.42
IV	3482	94.93

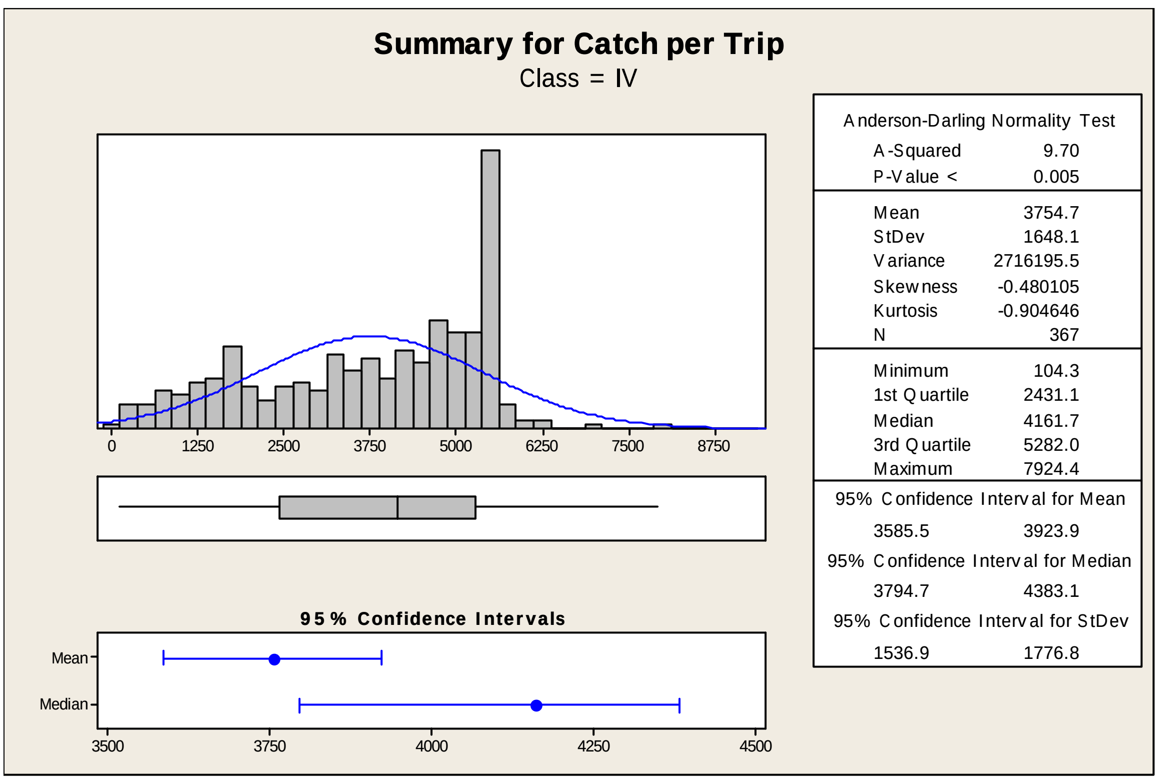
Summary Statistics for full vessel set, 11,000 lb set trimmed


Summary for Catch per Trip
Class = I
Anderson-Darling Normality Test
A-Squared 9.82
P-Value < 0.005
Mean 1349.7
StDev 1104.8
Variance 1220554.2
Skewness 1.63440
Kurtosis 2.78468
N 234
Minimum 100.1
1st Quartile 562.7
Median 1103.7
3rd Quartile 1722.6
Maximum 5393.2
95% Confidence Interval for Mean
1207.4 1492.0
95% Confidence Interval for Median
940.0 1196.3
95% Confidence Interval for StDev
1012.9 1215.1
0 1250 2500 3750 5000 6250 7500 8750
95% Confidence Intervals
Mean
Median
900 1000 1100 1200 1300 1400 1500

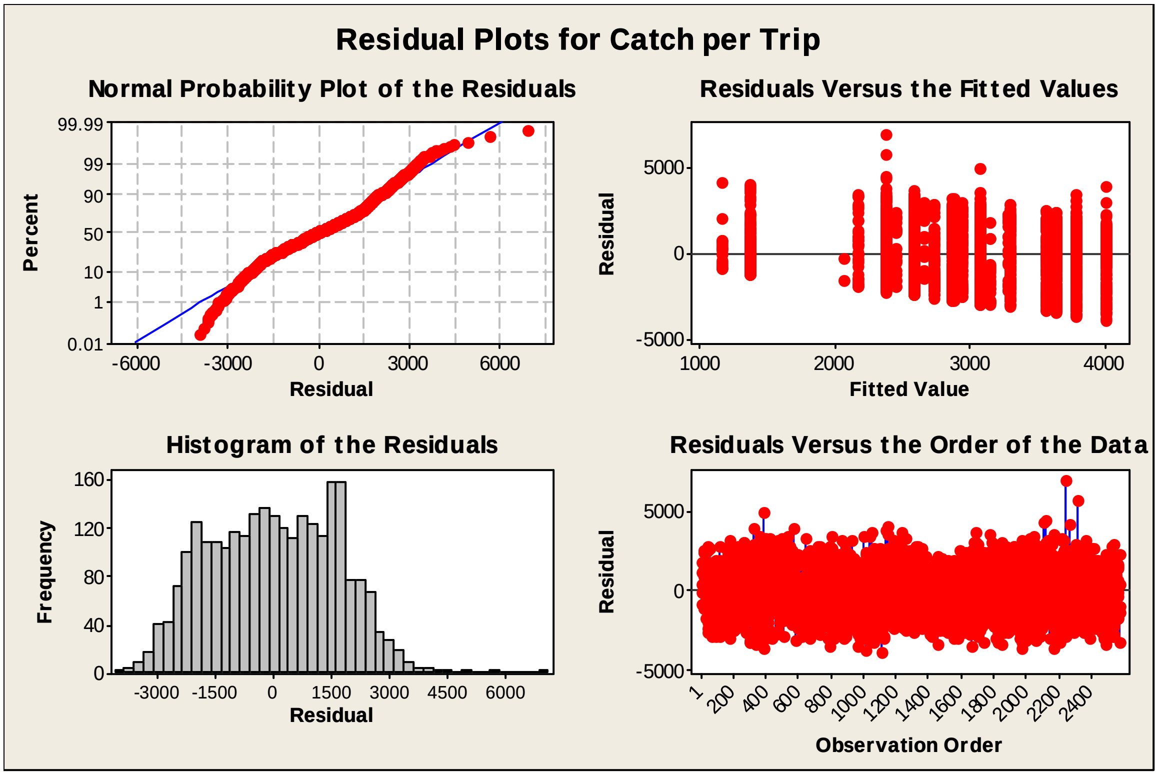

Summary for Catch per Trip
Class = II
Anderson-Darling Normality Test
A-Squared 11.31
P-Value < 0.005
Mean 2583.4
StDev 1733.8
Variance 3006100.2
Skewness 0.453555
Kurtosis -0.663331
N 722
Minimum 100.1
1st Quartile 1017.2
Median 2340.9
3rd Quartile 3973.0
Maximum 9313.0
95% Confidence Interval for Mean
2456.7 2710.1
95% Confidence Interval for Median
2116.0 2636.3
95% Confidence Interval for StDev
1648.8 1828.2
0 1250 2500 3750 5000 6250 7500 8750
95% Confidence Intervals
Mean
Median
2100 2200 2300 2400 2500 2600 2700



Summary for Catch per Trip
Class = III
Anderson-Darling Normality Test
A-Squared 23.42
P-Value < 0.005
Mean 3322.9
StDev 1708.9
Variance 2920443.7
Skewness -0.26439
Kurtosis -1.19714
N 1256
Minimum 104.3
1st Quartile 1779.6
Median 3566.0
3rd Quartile 4830.9
Maximum 7158.5
95% Confidence Interval for Mean
3228.3 3417.5
95% Confidence Interval for Median
3420.2 3791.9
95% Confidence Interval for StDev
1644.6 1778.5
0 1250 2500 3750 5000 6250 7500 8750
95% Confidence Intervals
Mean
Median
3200 3300 3400 3500 3600 3700 3800



Summary for Catch per Trip
Class = IV
Anderson-Darling Normality Test
A-Squared 9.70
P-Value < 0.005
Mean 3754.7
StDev 1648.1
Variance 2716195.5
Skewness -0.480105
Kurtosis -0.904646
N 367
Minimum 104.3
1st Quartile 2431.1
Median 4161.7
3rd Quartile 5282.0
Maximum 7924.4
95% Confidence Interval for Mean
3585.5 3923.9
95% Confidence Interval for Median
3794.7 4383.1
95% Confidence Interval for StDev
1536.9 1776.8
0 1250 2500 3750 5000 6250 7500 8750
95% Confidence Intervals
Mean
Median
3500 3750 4000 4250 4500



General Linear Model: Catch per Trip versus Region, Year, Class

```
Factor  Type   Levels  Values
Region  fixed       3  GOM, NA, SA
Year    fixed       3  2001, 2002, 2003
Class   fixed       4  I, II, III, IV


Analysis of Variance for Catch per Trip, using Adjusted SS for Tests

Source    DF      Seq SS      Adj SS     Adj MS      F      P
Region     2   795057114   281742858  140871429  53.15  0.000
Year       2   120896497    16425795    8212898   3.10  0.045
Class      3   483984334   483984334  161328111  60.87  0.000
Error   2571  6813714079  6813714079    2650219
Total   2578  8213652024


S = 1627.95   R-Sq = 17.04%   R-Sq(adj) = 16.82%


Unusual Observations for Catch per Trip

        Catch
          per
 Obs     Trip      Fit  SE Fit  Residual  St Resid
 292   243.30  3570.51   91.64  -3327.21     -2.05  R
 298   243.30  3570.51   91.64  -3327.21     -2.05  R
 319  7924.40  4003.55   89.08   3920.85      2.41  R
 338   514.30  4003.55   89.08  -3489.25     -2.15  R
 362  7158.50  3781.25   73.72   3377.25      2.08  R
 363   575.50  4003.55   89.08  -3428.05     -2.11  R
 377  8025.80  3070.71   95.23   4955.09      3.05  R
```

380	144.60	3781.25	73.72	-3636.65	-2.24	R
391	5883.40	2578.95	78.15	3304.45	2.03	R
414	685.30	1152.28	157.24	-466.98	-0.29	X
474	1705.50	1152.28	157.24	553.22	0.34	X
524	5594.80	2161.80	135.15	3433.00	2.12	R
571	5265.30	1358.69	106.83	3906.61	2.40	R
795	186.30	3781.25	73.72	-3594.95	-2.21	R
803	6004.80	2578.95	78.15	3425.85	2.11	R
960	486.50	4003.55	89.08	-3517.05	-2.16	R
1001	6007.60	2578.95	78.15	3428.65	2.11	R
1013	216.80	4003.55	89.08	-3786.75	-2.33	R
1031	5949.30	2578.95	78.15	3370.35	2.07	R
1042	708.90	4003.55	89.08	-3294.65	-2.03	R
1051	5049.90	1358.69	106.83	3691.21	2.27	R
1064	293.30	3645.62	80.18	-3352.32	-2.06	R
1110	104.30	4003.55	89.08	-3899.25	-2.40	R
1138	5124.90	1358.69	106.83	3766.21	2.32	R
1151	4865.00	1358.69	106.83	3506.31	2.16	R
1152	5393.20	1358.69	106.83	4034.51	2.48	R
1240	6067.40	2368.21	76.28	3699.19	2.27	R
1248	1434.50	1152.28	157.24	282.22	0.17	X
1251	5910.30	2578.95	78.15	3331.35	2.05	R
1260	5860.20	2578.95	78.15	3281.25	2.02	R
1307	1922.40	1152.28	157.24	770.12	0.48	X
1366	1331.60	1152.28	157.24	179.32	0.11	X
1423	1435.90	1152.28	157.24	283.62	0.18	X
1440	340.60	1152.28	157.24	-811.68	-0.50	X
1453	1915.40	1152.28	157.24	763.12	0.47	X
1458	590.80	4003.55	89.08	-3412.75	-2.10	R
1477	3212.30	1152.28	157.24	2060.02	1.27	X
1486	287.70	1152.28	157.24	-864.58	-0.53	X
1528	1618.00	1152.28	157.24	465.72	0.29	X
1536	596.30	1152.28	157.24	-555.98	-0.34	X
1557	1529.00	1152.28	157.24	376.72	0.23	X
1662	180.70	3781.25	73.72	-3600.55	-2.21	R
1696	6253.60	2578.95	78.15	3674.65	2.26	R
1738	287.70	3645.62	80.18	-3357.92	-2.07	R
1777	5858.90	2368.21	76.28	3490.69	2.15	R
1825	343.00	3645.62	80.18	-3302.62	-2.03	R
1849	373.90	3781.25	73.72	-3407.35	-2.10	R
1971	241.90	3570.51	91.64	-3328.61	-2.05	R
1976	361.40	4003.55	89.08	-3642.15	-2.24	R
2025	5651.70	2368.21	76.28	3283.49	2.02	R
2044	5749.10	2368.21	76.28	3380.89	2.08	R
2111	6709.50	2368.21	76.28	4341.29	2.67	R
2120	6854.10	2368.21	76.28	4485.89	2.76	R
2168	6590.00	3078.74	73.52	3511.26	2.16	R
2175	116.80	3781.25	73.72	-3664.45	-2.25	R
2206	436.50	3781.25	73.72	-3344.75	-2.06	R
2217	5660.10	2372.54	138.31	3287.56	2.03	R
2244	9313.00	2368.21	76.28	6944.79	4.27	R
2269	5282.00	1152.28	157.24	4129.72	2.55	RX
2306	285.00	1152.28	157.24	-867.28	-0.54	X
2319	8059.20	2368.21	76.28	5690.99	3.50	R
2360	1049.50	1152.28	157.24	-102.78	-0.06	X
2411	512.90	1152.28	157.24	-639.38	-0.39	X
2492	148.70	3645.62	80.18	-3496.92	-2.15	R
2575	711.70	4003.55	89.08	-3291.85	-2.03	R

R denotes an observation with a large standardized residual.
X denotes an observation whose X value gives it large influence.

Least Squares Means for Catch per Trip

Region	Mean	SE Mean
GOM	3253	62.93
NA	2344	120.05
SA	2550	48.94
Year		
2001	2696	76.69
2002	2831	80.07
2003	2621	74.88
Class		
I	1544	134.94
II	2629	73.85
III	3129	54.66
IV	3562	110.48

****

One-way ANOVA: Catch versus ID

To look at individual vessel performance – 116 boats taking 100 lb or more in three years

Source	DF	SS	MS	F	P
ID	115	2765912646	24051414	10.87	0.000
Error	2463	5447739378	2211831		
Total	2578	8213652024			

S = 1487   R-Sq = 33.67%   R-Sq(adj) = 30.58%

```
                         Individual 95% CIs For Mean Based on
                         Pooled StDev
Level    N  Mean  StDev  ---------+---------+---------+---------+
  1      2  5226    439                      (-----*------)
  7     30  3833   1561                      (-*-)
 25     21  2862   2050                  (--*-)
 29      2  3264    425               (------*------)
 34     15  3241   2096                   (--*-)
 36     10  2588   1367                 (--*--)
 43      1   104      *  (--------*---------)
 47     52  3439   1962                     (*-)
 48     71  1958   1446                (-*)
 53      1   247      *  (---------*---------)
 55     64  2919   1596                    (*)
 68     68  4562   1328                         (*)
 69     17  2614   1411                 (--*-)
 76     48  2733   1651                   (*-)
 80     15  3850   1871                     (--*-)
 86     14  4121   1746                      (--*-)
 95     49  2893   1579                   (-*)
 97      2   830    263       (------*------)
101      1  4829      *                 (---------*---------)
103     49  3854   1183                      (-*)
105      6  4404   1246                      (---*---)
111    128  3350   1631                     (*)
114     14  2479   1708                 (-*--)
119      6  1045    699            (--*---)
126      2   310    204     (------*------)
142     13  3105   1768                   (-*--)
144     14   782    682            (--*-)
147     17  1479   1240               (-*-)
149     11  2332   1804                (--*--)
152      5  3268   1418                  (---*---)
```

```
154     35  3376   1841                     (*-)
155     36  3838   1297                      (-*)
162     16  2059   1436               (--*-)
187     11  1558   1021             (--*--)
190     52  3890   1518                       (*)
198      1   220      *  (---------*--------)
201     31  2534   1349                  (*-)
202      1  3233      *            (---------*--------)
209     78  3173   1592                    (-*)
212      2  3776   1764                 (------*-----)
215      5  1168   1142           (---*---)
217     20  1399   1137             (--*-)
221      1   792      *    (---------*--------)
236      7  4548   1371                      (---*---)
237      3  3378   2294                 (----*-----)
264     21   372    271          (-*-)
271     20   788    623           (--*-)
279     41  4022   1319                       (*-)
280      8  1069    836           (---*--)
281      2  1093    888        (------*------)
282     15  3453   1250                    (--*-)
283     20  3803   1646                      (-*-)
288     28  3444   1752                     (*-)
291      6  1989   1951              (---*---)
293      2  5119     23                     (------*------)
296     16  3986   1109                      (-*--)
303     49  3569   1717                      (*)
314      1  5001      *                  (---------*--------)
315      4   959    923         (----*----)
316      1  4880      *                  (--------*---------)
324      8  4066   1009                     (---*--)
325     59  3624   1629                      (*)
328     25  4251   1099                       (-*-)
336      6  2202   1018              (---*---)
338     13  1659   1466              (--*-)
349     39  1498    780              (-*-)
355      8  4397   1353                      (---*--)
358     10  3143    739                  (--*---)
360     17  3675   1607                     (-*--)
366      4  3672   3125                  (----*----)
368     30  2103   1645                (-*-)
371     18  2541   2023                 (-*--)
380     17  4683   1046                        (--*-)
392     73  2826   1604                   (*-)
398     56  1085    953             (-*)
399      1  2886      *           (---------*--------)
400      1   981      *     (--------*---------)
401      1  3838      *              (---------*---------)
414      2  3973   1215                 (------*------)
420     24  4242   1261                       (-*-)
422     36  3921   1372                      (-*-)
423     59  3761   1507                      (-*)
439      1  1227      *     (---------*---------)
442     10  4057   1605                     (---*--)
444     11  3083   1362                  (--*--)
447     66  2777   1666                   (*)
458     50  4041   1515                       (*-)
460      8  2007   1844              (---*--)
478     21  2345   1500                 (-*-)
479      4   704    629        (----*----)
482     23  3217   1362                    (-*-)
487      9  2612   1772                (---*--)
488      1   905      *    (---------*---------)
```

```
490      1   193      *  (---------*--------)
497     47  2331   1649                 (-*)
503     18  3149   1542                   (-*--)
523     33  4306   1822                        (*-)
530     98  1425    872               (*)
534      7  3455   1835                   (---*--)
539     11  2717   2127                 (--*--)
541     59   938    795             (*)
542      6  4120   2027                     (---*---)
545     53  3208   1850                    (-*)
548      9  2772   1490                 (--*--)
549      2  2262    893            (------*-----)
557      8  2101   1361               (--*--)
561      1  1300      *      (--------*---------)
562     49  4165   1312                       (-*)
564     29  2431   1541                 (-*-)
567     31  4613   1102                         (*-)
568      1   145      *  (--------*---------)
580     10  2473   1536                (--*--)
586     25  2460   1747                 (-*-)
588     33  4354   1280                        (-*)
589      1  4260      *               (---------*---------)
590     55  3311   1688                     (*)
                         ---------+---------+---------+---------+
                                  0      3000      6000      9000

Pooled StDev = 1487
```

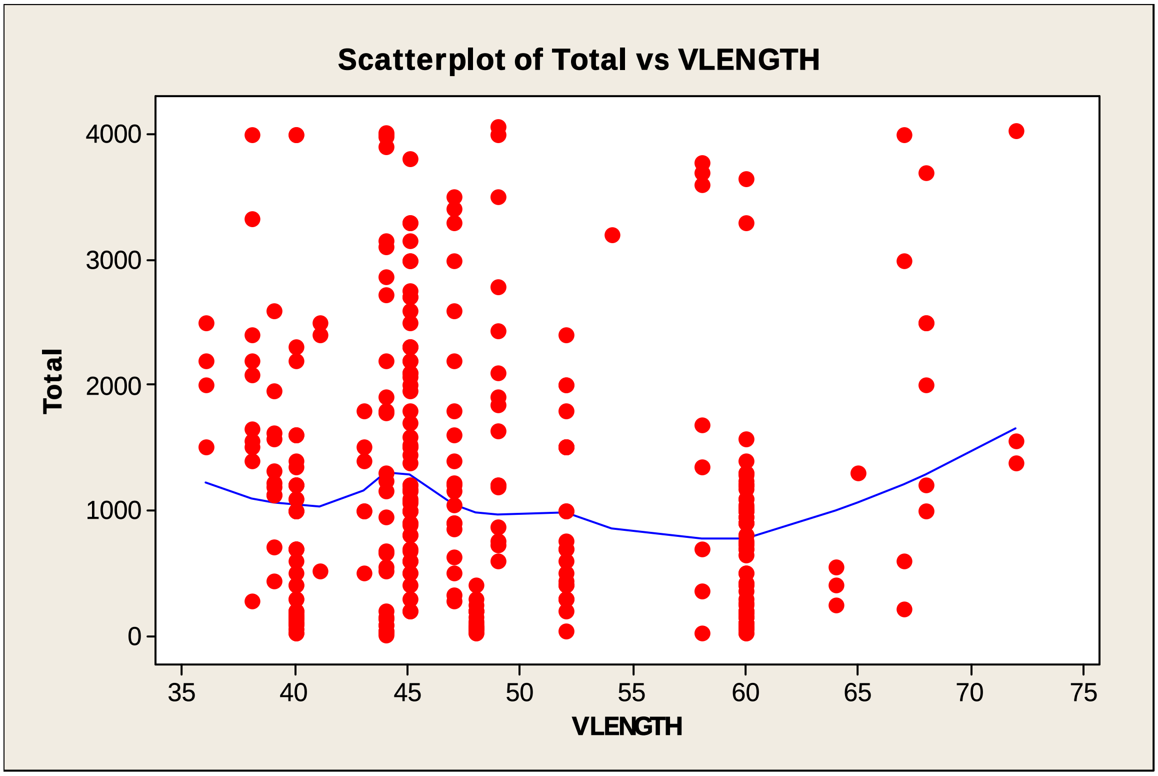
One-way ANOVA: Catch versus ID

Boats taking over 50,000 lb

```
Source    DF          SS        MS     F      P
ID        57   945885074  16594475  7.31  0.000
Error   1198  2719271738   2269843
Total   1255  3665156812

S = 1507   R-Sq = 25.81%   R-Sq(adj) = 22.28%


                        Individual 95% CIs For Mean Based on
                        Pooled StDev
Level   N  Mean  StDev  ---------+---------+---------+---------+
  1     2  5226    439                     (------*------)
  7    30  3833   1561                      (-*-)
 25    21  2862   2050                  (--*-)
 29     2  3264    425               (------*------)
 34    15  3241   2096                   (--*-)
 97     2   830    263       (------*------)
101     1  4829      *                 (---------*---------)
103    49  3854   1183                      (-*)
105     6  4404   1246                      (---*---)
149    11  2332   1804                (--*--)
152     5  3268   1418                 (----*---)
154    35  3376   1841                     (*-)
155    36  3838   1297                      (-*)
190    52  3890   1518                       (*)
217    20  1399   1137             (--*-)
237     3  3378   2294                 (----*-----)
271    20   788    623           (--*-)
279    41  4022   1319                       (*-)
282    15  3453   1250                    (--*-)
```

```
283    20  3803   1646                     (--*-)
288    28  3444   1752                     (*-)
296    16  3986   1109                      (-*--)
303    49  3569   1717                     (-*)
315     4   959    923         (----*----)
316     1  4880      *                 (---------*---------)
324     8  4066   1009                     (---*--)
325    59  3624   1629                      (*)
328    25  4251   1099                       (-*-)
349    39  1498    780              (-*-)
355     8  4397   1353                      (---*--)
360    17  3675   1607                     (-*--)
368    30  2103   1645                (-*-)
380    17  4683   1046                        (--*-)
392    73  2826   1604                   (*-)
400     1   981      *    (---------*---------)
401     1  3838      *              (---------*---------)
414     2  3973   1215                 (------*------)
420    24  4242   1261                       (-*-)
422    36  3921   1372                      (-*-)
423    59  3761   1507                      (-*)
442    10  4057   1605                     (---*--)
444    11  3083   1362                  (--*--)
447    66  2777   1666                   (*)
478    21  2345   1500                 (-*-)
479     4   704    629        (----*----)
482    23  3217   1362                    (-*-)
487     9  2612   1772                (---*--)
488     1   905      *    (---------*---------)
497    47  2331   1649                 (-*)
503    18  3149   1542                   (-*--)
523    33  4306   1822                        (*-)
539    11  2717   2127                 (--*--)
562    49  4165   1312                       (-*)
568     1   145      *  (--------*---------)
580    10  2473   1536                (--*--)
586    25  2460   1747                 (-*-)
588    33  4354   1280                        (-*)
589     1  4260      *               (---------*---------)
                        ---------+---------+---------+---------+
                                 0      3000      6000      9000

Pooled StDev = 1507
```

Pelagic Longline - non-zero catch, shark target.
Much of PLL LCS catch is from trips that are not listed as targeting shark



Non-zero sets