PAPERWORK REDUCTION ACT
DOC/NOAA/NMFS SURVEY CLEARANCE FORM
Economic Surveys for U.S. Commercial Fisheries
OMB CONTROL NUMBER 0648-0369

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NOAA Subagency NOAA Fisheries

Title (Please be specific)

South Atlantic Commercial Shrimp Fishery Economic & Demographic Survey

Burden Hour Estimates

Number of respondents 260

Total Burden Hours 520

Hours per response 2

Cumulative Burden Hours under Program Clearance 617

Agency Contact *(person who can best answer questions about the content of the submission)*

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Certification: The collection of information requested by this submission meets the requirement of the OMB approval for OMB control number 0648-0369.

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Signature of Program Official Date

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Signature of NOAA Paperwork Clearance Officer Date

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OIRA Date

SUPPORTING STATEMENT
SOUTH ATLANTIC COMMERCIAL SHRIMP FISHERY
ECONOMIC & DEMOGRAPHICS SURVEY
OMB CONTROL NO. 0648-0369

Introduction

The following is the supporting statement for the Paperwork Reductions Act submission for the approval to collect economic and demographics data from South Atlantic commercial shrimp fishing enterprises based in North Carolina, South Carolina, Georgia, and the east coast of Florida. The proposed data gathering will be an annual and continuous data collection program.

During the first year only, for North Carolina, South Carolina, Georgia, and the east coast of Florida, this survey is requesting data for two years, 2000 and 2003. The latter year (2003) is the most recent year which we can request information, and anecdotal information suggests that 2003 was likely one of the worst years for this fishery economically, and this survey will provide the data to verify whether this was the case. Conversely, the year 2000 was one of the best years during the last decade in terms of economic performance. Production levels were high and prices maintained their levels, even with higher production. Thus, comparing data from these two years will help to determine which factors have been most influential in causing erosion in profitability. In the future, annual assessments are needed to account for such impacts, and the causes and sources of overall trends in cost and revenue data. In subsequent years, only the most recent completed year for information will be requested.

Justification

<u>Explain why you need to conduct the information collection.</u>

The collection of economic and social information from fishermen and fishing businesses affected by the management of federal commercial fisheries on the South Atlantic coast is needed to ensure that national goals, objectives, and requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MFCMA), National Environmental Policy Act (NEPA), Regulatory Flexibility Act (RFA) and Executive Order 12866 (EO 12866) are met. This information is vital in assessing the economic and social effects of fishery management decisions and regulations on individual fishing enterprises, fishing communities, and the nation as a whole.

Social and economic information on commercial fishing enterprises is vital to the Optimum Yield (OY) management of marine fishery resources as mandated under the MFCMA (16 U.S.C. 1802 M-S Act § 3). The term "Optimum" is defined under section 104-297 (28) of the Act, as: (A) will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; (B) is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factors; and (C) in the case of an over-fished fishery, provides for the rebuilding to a level consistent with producing the maximum sustainable yield in such a fishery.

The overall goal of this project is to collect up-to-date cost, revenue, and social data for this significant fishery. National Standard Guidelines for social and economic information needs are mandated in 50 CFR 600. Additionally, recent legal decisions ruled against DOC, NOAA, NMFS based on the lack of social and economic information or the inadequate analysis of existing data. Thus, it is imperative that these data be collected to accurately assess the economic and social impacts on individual shrimp fishing entities as imposed by shrimp fishery management plans and regulations. Most important, the fishing industry has been calling for the inclusion of social and economic data in the formation of fishery management plans.

It is intended that after the survey has been conducted at least once in each of the South Atlantic states, a review of the success of the survey document will be conducted, any recommended changes or modifications will be made, and the data collection effort will evolve into an on-going annual survey effort. Regular surveying is necessary to capture critical cost and revenue data that fluctuate from year to year. Fluctuations are generally due to annual fluctuations in shrimp abundance caused by environmental factors. Additionally, markets for South Atlantic shrimp are exhibiting fluctuations as farm-raised and imported shrimp (both wild caught and farm-raised) are becoming more readily available at lower prices.

This study will be conducted by contract under the auspices of the Fisheries Economics Office within the Southeast Regional Office of NOAA Fisheries.

NOAA Fisheries currently collects limited information from commercial vessels pertaining to their fishing activities, trip dates, landings, and other information through port agents and mandatory dealer reports. There are no substantial social or economic data collected in these systems other than the value of landings, which is neither consistently complete, nor detailed at the individual vessel level. The information is not comprehensive enough for full economic and social analysis.

Explain how, by whom, how frequently, and for what purpose the information will be used. If the information collected will be disseminated to the public or used to support information that will be disseminated to the public, then explain how the collection complies with all applicable Information Quality Guidelines.

Social and economic data will be collected from shrimp vessel owners who operate offshore and have primarily landed their catch in one of the four South Atlantic states: North Carolina, South Carolina, Georgia, and the east coast of Florida. This survey has already been implemented in the Gulf of Mexico and is being conducted by a NOAA Fisheries contractor using initial face-to-face interviews of vessel owners (or their designee) who are randomly chosen to participate. The Gulf survey effort is instructing how it will be implemented in the South Atlantic.

NOAA Fisheries economists and social scientists will use the information collected during this study to evaluate and modify future ongoing social and economic surveys. The analysis of the sources of variation in costs and revenue during this study will allow future social and economic surveys to be more efficient based on improved stratification and survey designs. Additionally, this first year of this program in the South Atlantic will provide an in-depth assessment of the study instrument and interview process.

These data will play an integral role in the social and economic analyses needed for determining the significance of economic impacts on small entities, as required by the Regulatory Flexibility Act and to determine how best to achieve the maximization of net benefits to society, as required by E.O. 12866. Statistical models that predict or forecast various characteristics such as fleet size, fishing activity or effort, costs versus benefits of fishing, market activity, and efficiencies of proposed fishing regulations will be just a few of the benefits and uses of these data.

Gross revenues and costs can vary within a year, and even within or across seasons/trips, as a result of changes in a number of different factors, including fishery management regulations (e.g. gear modifications, time/area closures, etc.), fluctuations in abundance (due to changes in various environmental factors), and market conditions (such as fuel or seafood prices). In recent years, there have been great changes in the shrimp fishery with respect to regulations, primary ports of operation, and gear construction, among other factors, yet the social and economic impact of these changes has not been directly assessed. As described in the introduction, during the first year only, this survey is requesting data for two years, 2000 and 2003 for North Carolina, South Carolina, Georgia, and the east coast of Florida. Additionally, anecdotal information suggests that 2003 was likely one of the worst years for this fishery economically, and this survey will provide the data to verify whether this was the case. Some of the potential causes for the downturn have been attributed to prices falling; increases in insurance premiums following September 11, 2001; and rising fuel costs. Conversely, the year 2000 was one of the best years during the last decade in terms of economic performance. Production levels were high and prices maintained their levels, even with higher production. Thus, comparing data from these two years during the first year will help to determine which factors have been most influential in causing erosion in profitability. In subsequent years, only the most recent completed year for information will be requested.

It is anticipated that the information collected by this survey will be disseminated to the public (such as through an annual economic report) or used to support publicly disseminated information. Data may be reported for various groups of fishermen (by vessel size, port, etc.), which will allow vessel owners to compare and evaluate their operations relative to others in the same group in terms of ability to generate revenues, cost efficiency, and profitability.

As will be explained in greater detail in the following paragraphs, the information gathered has utility. NOAA Fisheries will retain control over the information and safeguard it from improper access, modification, and destruction, consistent with NOAA standards for confidentiality, privacy, and electronic information. All data that are submitted are treated as confidential in accordance with NOAA Administrative Order 216-100 and the Magnuson-Stevens Act (16 U.S.C. 1881a, M-S Act § 402(b), Confidentiality of Information). This information collection is designed to yield data that meet all applicable information quality guidelines. Prior to dissemination, the information will be subjected to quality control measures and a pre-dissemination review pursuant to Section 515 of Public Law 106-554.

The following is a detailed description of justifications for the collection of these data. Section and question numbers refer to the study instrument.

Justifications for Socioeconomic Survey Questions

The Contractor will provide a copy of the survey instrument to each potential respondent in advance of the interview. This will allow respondents to compile the necessary information, thereby minimizing bias due to recall error. It is expected to also increase the efficiency of the interview process with respect to administrative time and costs.

Contact Document
A 'Contact Document' was developed to log all contact or attempts at contact by each individual involved in conducting the surveying. It identifies the person to be interviewed as the vessel owner, or his/her designee; corrects any necessary contact information in case there is a need to follow up with respondents; logs the time and date of all contact including the interview time and date; and provides space for any additional comments the vessel owner/designee may wish to share with the Contractor or NOAA Fisheries.

SECTION I. Fishing Operations and Costs
In general, this section of the survey instrument asks questions pertaining to the annual total of variable costs, fixed costs, other annual costs, capital investment in the vessel & equipment, business arrangements such as ownership and crew shares, and other production factors. Data resulting from Section I questions are generally necessary to generate cost, profit, input demand, and production functions. Such functions and the results generated from their estimation are typically used in financial analyses (used to determine a business' cost efficiency and profitability), economic impact analyses (used to determine the economic value of a particular activity to a particular locale, community, or region), bioeconomic models (used to predict how the biological and economic components of a fishery will respond to exogenous shocks, such as policy changes), cost-benefit analyses (used, in part, to determine the net economic benefits of a particular action), and behavioral models (such as those that explain or predict exit or entry decisions and decisions regarding spatial or temporal allocation of effort). These data can also be used to determine the relative efficiency of the various participating vessels in a fishery and thus whether the aggregate harvesting costs are in fact being minimized. Such models and analyses are critical to guiding fisheries management decisions whose general purpose is to maximize net national benefits and optimally distribute those benefits.

Data is being requested for both the 2000 and 2003 shrimp season. Anecdotal information suggests that the most recent year for which we can collect data, 2003, was one of the worst for this fishery due to depressed market prices for South Atlantic shrimp, the high influx of less expensive imported product, increases in insurance premiums following Sept. 11, 2001, and rising fuel costs. Conversely, the year 2000 was one of the best years during the last decade in terms of economic performance. Production levels were high and prices maintained their levels, even with higher production. Thus, comparing data from these two years will help to determine which factors have been most influential in causing erosion in profitability and will help to determine the actual impact that imported product has had on U.S. South Atlantic shrimp fishermen. In the future, annual assessments (after additional OMB approval) are needed to account for all impacts and the causes and sources of overall trends in cost and revenue data.

Part 1, Vessel information
Question 1.1 verifies who is being interviewed, the vessel name, US Coast Guard documented number, total landings, if landings are measured as "head on" or "head off," and total gross revenues for two years. This information will allow NOAA Fisheries to link this vessel information with other pertinent data, such as permit and catch information, located in other datasets. Landings and gross revenues are being requested to provide complete data at the individual vessel level. Although these data are collected by other means, it is not consistently complete or detailed at the individual vessel level.

Question 1.2 asks which port/state the vessel owner considers the base of the vessel's operations. This port may be different than the port(s) where primary landings may occur, but is likely the port where provisioning, maintenance and other cost-related activities occur.

Questions 1.3-1.5 inquire about where fishing activity occurred (in the EEZ or not), how many shrimp fishing trips and fishing days were taken inshore and offshore, and how many days at sea were related to activities other than shrimp fishing. This provides information about the average length of trip and how many days of fishing occurred during a calendar year, and will help to determine which fishermen are full time participants, which are part time, the level of dependency that each has on this fishery, and the potential impacts that regulations may have on them.

Questions 1.6-1.10 attempt to discern the amount of financial capital that has been invested in the vessel and the current value of that capital. This information can be used to estimate various rates of return on the owner's investment. The expected rate of return is a critical factor in the owner's decision to invest further in the vessel, and whether to remain in the fishing industry. Levels of net investment should be indicative of the industry's economic health (i.e. negative net investment indicates an industry in decline). Further, profitable vessels should be associated with higher levels of investment. Similarly, comparisons of the original purchase price and current market value should also be indicative of trends in the industry's health. The current market value of capital can also be considered an input in the production process.

Questions 1.11 -1.12 collect information pertaining to costs related to vessel haul-outs, hull repair and maintenance. Since vessels may not be hauled out once each year, we ask for the number of years between haul-outs (that is, to fill in "once every (blank) years").

Part 2, Major Mechanical Systems
This question will gather information on the capital investment of the engines, reduction gear, generators, compressors, and chargers used on the vessel, as well as fixed annual costs such as overhauling or replacement costs. Engine characteristics affect how fishermen can and do use their vessels and the related direct costs, such as fuel use, which affects level of production, revenues, and profitability associated with the vessel's operations. In addition, the engine make and model information will be useful in comparing fuel use, overall costs, and other engine characteristics with databases maintained by engine manufacturers.

Part 3, Trawl Gear Information
Questions 3.1 - 3.2 request information regarding the capital investment of the specific trawl gear used; types and number of nets, doors, and cables used or kept on board ready for use; replacement costs; and percent of time used; all of which will differ between individual fishermen. The detail provided in these answers is not available from alternative data sources. Gear characteristics affect how fishermen can and do use their vessels, and thus the costs, level of production, revenues, and profitability associated with the vessel's operations.

Question 3.3 specifically identifies what type of Bycatch Reduction Devices (BRDs) are in use on the vessel, how frequently, and their average costs. This information will help to assess the socioeconomic impacts of BRD regulations on individual fishing enterprises and fishing communities, and has not been gathered before.

Question 3.4 specifically identifies the type and number of Turtle Excluder Devices (TEDs) which are in use on the vessel (if multiple ones are used). By region, TED regulations specify minimum sizes and types that can be used, but not maximum sizes. Information about the types of TEDs actually in use will help to assess the socioeconomic impacts of federally-mandated TED regulations on individual fishing enterprises and fishing communities, especially in light of recent changes to the TED regulations. Not only are there direct costs associated with each type of TED, but TEDs, as with BRDs, affects the efficiency of the trawl gear in terms of its ability to catch shrimp, and thereby reduces catch per unit of effort (CPUE) and/or increases the cost per unit effort, resulting in reduced profitability. Information on the relative performance of alternative TEDs and BRDs will be useful to both managers and fishermen.

Part 4, Electronics

Questions 4.1-4.2 will gather information regarding capital investments for all on-board electronics, and replacement costs of those electronics. These questions attempt to discern the amount that has been invested in on-board electronics and expected future investments in on-board electronics. Expected future levels of investment in on-board electronics compared to the past investment in on-board should be indicative of the industry's economic health. Further, profitable vessels may be associated with higher levels of investment in on-board electronics. This is a testable hypothesis. Other research has shown that a certain level of experience or combination of experience and technology is more important than technology alone. On-board electronics affect how fishermen can and do use their vessels, and thus the costs, level of production, revenues, and profitability associated with the vessel's operations.

Part 5, Annual and Variable Costs

This subsection of the survey instrument asks questions pertaining to annual total of non-labor variable costs (fuel, oil, food), some fixed costs (e.g. insurance, costs of leases adjacent to docks), labor costs (**Questions 5.5 and 5.6**), and other costs germane to vessel's profitability (e.g. return to investment) and cash flow. These questions can be used to construct input demand function, cost functions, and production functions, all of which are needed to conduct the types of analyses mentioned previously.

Questions 5.1 - 5.4 pertain to the three types of non-labor costs (fuel, oil, and food) associated with the annual number of trips by a given vessel. They are generally related to or a function of the annual level of fishing effort. Fuel costs are a substantial variable cost for trawl fisheries. For fuel, we are also requesting information on the annual average quantity of the fuel purchased and the average price per gallon. Both fuel quantities and prices are requested since total annual costs can change due to a change in quantity purchased *or* the price per unit, and this may affect level of production. These costs may also be influenced by location, since these vessels operate out of multiple states in the South Atlantic region.

Questions 5.5 - 5.7 are meant to obtain total annual payments to the captain and crew, as well as payroll taxes for the total labor expense. This information will also be used with the information obtained through Question 7.4, which asks about the crew and captain share system. These payments basically represent the flow of annual income to the crew members and captains associated with the vessel. From the captain and crew's perspective, their share of the vessel revenues determines the incomes of their respective households. Changes in annual income received can affect the captain's and crew members' decisions to continue working in this particular fishery, and/or in fishing as a vocation. These data will allow analysts to determine how various factors, such as changes in regulations, may affect the incomes of crew.

Question 5.8 collects information on all types of insurance, related to the vessel, and health benefits. These are fixed costs, that, when incurred, are paid regardless of whether the vessel is used or not, or generates any revenue. These costs are borne entirely by the owner. The lack of hull and other related vessel insurance could be indicative of the industry's economic health. If sufficiently high, vessel owners may chose not to carry full hull or P&I insurance, and thus put their business at risk. Further, health insurance is a type of compensation, and the presence or the lack thereof is a non-economic social aspect of the human environment.

Questions 5.9 - 5.12 relate to non-labor, annual costs associated with docking or mooring arrangements, utilities while at the dock and miscellaneous hardware (e.g. cables, ropes, etc.). These costs vary across time and vessels and are typically reported on an annual basis.

Questions 5.13 - 5.15 ask for annual costs associated with repair and maintenance of the vessel, gear, and electronics, but exclude replacement costs such as for new trawl doors or nets, since these are covered in Parts 3 and 4 and are part of the capital investment. Question 5.15 asks for costs that may occur annually and is different than the costs requested in Question 1.11, which are costs that are not typically incurred every year.

Question 5.16 asks for annual depreciation charges and the type of depreciation method used. Depreciation expenses can be calculated in many ways, according to the different accounting methods. These expenses may or may not be relevant depending on the type of analysis being conducted. For example, they may be relevant in determining the net returns to a vessel, but they are not relevant in a cash-flow analysis.

Questions 5.17-5.23 ask for other costs that are basically fixed, since they do not vary according to the level of fishing activity. These costs are paid regardless of whether the vessel is used or not, or has generated revenue, and are borne entirely by the owner. If sufficiently high, fixed costs can affect the probability of entry and exit into and out of a fishery.

These questions collect information on various federal, state, and local fees (**5.17**); property tax paid related to this particular fishing vessel (**5.18**); professional service (i.e. legal, accounting, association dues; **5.19**); and vessel management fees (**5.20**), and vehicle expenses associated with the fishing operation including vehicle repairs, depreciation and fuel (**5.23**). **Questions 5.21 and 5.22** gather information about annual payments on long term, short term, and operating loans. **Question 5.21** asks for the combined principal and interest paid, rather than breaking it down. In terms of cash flow and profitability, loan payments, as a fixed cost, can be critical to annual financial performance of the vessel operation. In addition, loan interest rates can be critical component to cross-sectional financial ratio analysis (e.g. interest expense ratio) with a fishery and between fisheries.

Questions 5.24 & 5.25 asks for annual totals of variable costs associated with the cooling and/or freezing of the vessel's catch. For ice, we request information on the quantity purchased, the average price per unit, and the unit in which the input was purchased (blocks, bars or pounds). Ice quantities and prices are requested since total annual costs can be a substantial variable cost in warm-water shrimp trawler fisheries and is dependent upon the level of fishing activity. Likewise, the cost of salt and other freezing supplies for freezer-trawlers is dependent upon the level of fishing activity. Similar to fuel questions, these pieces of information can be used to construct input demand functions, cost functions, and production functions. Furthermore, the use of ice vs. freezing systems, as the predominant method for preserving a trawler's catch, may be associated with vessel size, mobility, duration of trips, and geographical range of a given vessel, each of which affects the vessel's fishing capability. Additionally, shrimp fishermen may convert storage methods between ice and freezers, which are considered more versatile. The large freezers used on shrimp vessels allow shrimp fishing at greater distances from shore, and therefore provides access to deeper-water shrimp species. In contrast, ice storage takes up less space on board, but requires vessels to stay closer to shore. As with fuel usage/capacity, these data are needed to partition the fleet for economic and management assessments of shrimp fleet harvest capacity and efficiency.

Collection of this information annually is of great benefit, since compilation of a historical database of these parameters will allow for trends to be assessed to individual vessels and the fleet (particularly the ratio of ice vs. freezer vessels) and its harvest capacity.

Questions 5.26 and 5.27. These questions capture any other costs not covered by previous questions.

Part 6, Net Revenues

Questions 6.1 and 6.2 relate to the annual net revenue (fishing related gross revenues minus fishing related costs) associated with shrimp and non-shrimp fishing activities (e.g. charter fishing, etc.) with which a given vessel may be involved. Net revenue is the income flowing to the vessel owner(s) and represents the income related to the owner's overall management (i.e. excluding his skills as a captain) of the vessel operation and related assets. Whether or not the owner's share of the net revenues is sufficient to cover costs and provide a reasonable rate of return on his capital investment and related management skills will affect his decisions to remain in the fishery, switch to another fishery, or exit from fishing altogether. The response will provide the researchers with an understanding of how fishermen estimate costs and revenues compared with how economists estimate it.

Part 7, Vessel Owner, Crew members and Crew Compensation

Question 7.1 requests information regarding the fishing business' form of legal organization and identifies whether the vessel is operated directly by the owner (owner-operator). Economic theory suggests that form of organization can impact who makes decisions within the fishing business, how those decisions are made, and what the goals or objectives of the fishing business might be. Further, form of organization can also impact how efficiently the fishing business operates and the extent to which it can access and obtain capital resources for investment purposes. Form of organization also has repercussions with respect to tax status and legal liability, which can in turn influence the fishing business' behavior.

Question 7.2 asks if the vessel owner owns other fishing vessels, and requests their identification in terms of vessel name and its U.S. Coast Guard or state documentation number. This information is necessary to determine whether a vessel or business is considered "small" by OMB for purposes of the Regulatory Flexibility Act.

Questions 7.3 and 7.4 ask for number of crew members used on an average trip and increases in the number of crew members if larger than normal catches are expected. The number of crew members directly relates to one of the vessel's most important variable costs, labor, and within season changes in crew sizes is germane to estimating vessel profitability and aggregate economic impacts associated with the early stages of season and/or area openings.

Question 7.5 – 7.9 asks for details on how payments are made to crew, whether the position is paid as a percent share or piecemeal rate (per box), and whether the crew pay part of the variable trip costs. Based on these percentages, net income can be calculated using the data from other sources (landings data) which basically represents the flow of income to the various fishermen associated with the vessel. Specifically, in **7.5** we also request information regarding fishing experience, where the crew member lives, whether the crew member is also a member of the owner's family, and what their remuneration is. The question is in the form of a table to facilitate data recording and entry. We hypothesize that the crew members' particular jobs or functions on the trip (e.g. captain, deckhand, rigger, header) and their relationships to the other crew or the owner will partially affect the size of crew and the share they receive. The presence of payment differentials may serve as an incentive for crew to invest in their own human capital. That is, a beginning header may decide to stay with a particular boat or remain in fishing in general if the opportunity for advancement and higher pay is present. Further, if the crew shares are not equal, the relative impacts of potential regulatory measures will vary across different types of crew members. Familial relationships can affect how the business operates and the degree to which people are tied to each other, the industry, and the communities in which they live. The presence of familial relationships will likely affect a fisherman's willingness to continue in the fishing business. The location where crew members live is germane to estimating and predicting regulatory impacts on fishing communities. **Question 7.6** asks for the number of years that the owner has been involved in commercial fishing because it is hypothesized that the owner's experience may be partially linked to the vessel's relative profitability. **Question 7.7** asks whether any variable costs (groceries, food and ice) are deducted before shares are allocated, and additional detail on how these costs are split between the vessel owner and crew members (as percentages). This information will be necessary to accurately calculate net income. There is no other data effort that gathers information about the income accruing to individual crew members. **Questions 7.8 and 7.9** ask whether any annual bonuses were provided. The basis of the total remuneration can affect the productivity of the crew and boat.

SECTION II: Permit Holder and Crew Member Demographics

The general purpose of this set of questions is to collect data that describes the social and economic nature of fishery participants and their communities (i.e. the human environment or social system). The data can also be used to identify the various social networks to which individual fishermen belong. This information will aid in determinations of whether and to what extent fishermen are dependent on the fisheries in which they participate and to what extent they consider fishing a way of life for them and their families. Social factor analysis can reveal differential impacts across different regions, communities, and groups of fishermen (in general, different social structures) and thereby help explain their different responses to regulatory changes. Without such information and analysis, it would be impossible to render impact determinations of potential management measures, as is generally done in Social Impact Assessments, Fishery Impact Statements, and Environmental Impact Statements and Environmental Assessments. In general, this data will assist in gauging the social costs and benefits derived from a particular fishery and management thereof, which should be included in any determination of net national benefits.

Part 8, Vessel Owner Information (only)
Questions 8.1 – 8.4 ask for basic demographic information about the vessel owner (or his/her designee) such as age, level of education, marital status, and numbers of persons in their household. Demographic characteristics of the fishery work force is one social factor category necessary to conduct a proper social impact assessment. These characteristics can be used to classify fishermen into groups who are likely to share similar associations (i.e. belong to the same network or system), behaviors, and beliefs or attitudes.

Questions 8.5-8.8 will obtain information on the cultural (race) and social structure of the vessel owner and his/her family. These questions are organized as they are currently used and developed by the Census Bureau. Social factor analysis is the analytical tool used when constructing a social impact assessment. Such analysis involves the identification and analysis of social factors (such as religion), its social-cultural and community context, and its participants. Four categories of social factors have been identified by NOAA Fisheries and various academic researchers as being critical to social factor analysis. One of these categories is the cultural issues of attitudes, beliefs, and values of fishermen. **Questions 8.5 - 8.6** asks for information about the fishermen's race and primary language of communication. **Question 8.5** identifies whether the owner is of Spanish, Hispanic, or Latino ethnicity, and provides additional information regarding the ethnic composition of the "white" race within this population. Anecdotal information suggests that people of this ethnic background play a particular and important role in this fishery, particularly in South Texas communities. **Question 8.6** asks specifically about race, as it is asked in the Census. **Question 8.7** asks which language is spoken at home. As with demographic characteristics, language may be a factor that bonds or separates various fishermen. That is, these are the initial questions that attempt to obtain information on the social structure of the fishermen, their families, and the communities to which they belong. For example, those who primarily communicate in a particular language are more likely to associate and conduct business with other fishermen who do the same. In general, fishery managers need to know how prevalent language barriers are with their constituency. Lack of communication will result in poor management, or at least perceptions of poor management. Finally, a person's religion is a general reflection of some composite set of attitudes, beliefs, and values. Religion or religious affiliations (**Question 8.8**) are clearly a potentially defining characteristic of a connected group of people, or what we call a community. A common religion, or set of values and beliefs, is one factor that "connects" people. Anecdotal information suggests that, in communities where fishermen of Vietnamese descent play an important role, their respective religion affects which people, vessels, and businesses they cooperate with and associate. Knowledge of this factor could help us determine what the bounds of a particular community are, geographically speaking, and who belongs to it. We cannot identify fishing dependent communities until we first determine which groups of people constitute a community (fishing or otherwise). Once we identify these communities, and the social systems in general within which fishermen operate, we should be able to determine how changes in fishery management will affect fishermen's lifestyles, their social and interaction patterns, their choice of where to live, and in general how they will respond. In turn, those responses will have a feedback effect on the structure of the communities and social systems to which they currently belong. These are the types of impacts we are interested in when conducting social impact assessments.

Question 8.9-8.10 are designed to determine the degree to which the vessel owner (or his/her designee) and his/her family are dependent on a particular fishery or the fishing industry in general (i.e. harvest and no-harvest sectors). Dependency is mainly gauged in terms of income dependency. **Question 8.9** identifies other occupations that the particular owner is engaged, and the time of year of that work. Not only does this identify other income sources, but from this, researchers may be able to discern if other job opportunities exist for fishermen, if particular fisheries cease to be economically sustainable for all the fishermen currently engaged in it, or if management measures lead to effort limitations. **Question 8.10** specifically asks the owner to indicate his/her household income category (categories are based on those currently used and developed by the Census Bureau). This information in conjunction with the net revenue of this vessel (**Question 6**) will enable the researcher to assess actual financial dependency on the shrimp fishery. This will allow for the distributional impacts of proposed management measures to be discerned (e.g. will a particular measure have similar or differential impacts on fishermen of different means or socioeconomic status).

Parts 10-15, Information About Crew Members (1-6)
In this last section, information will be collected on up to six (6) crew members. It is intended that this section is answered by the vessel owner, and not through an interview with the individual crew members. Due to the basic nature of the questions, many vessel owners will likely be able to answer the questions based on the existing knowledge of their crew. However, in the event that they do not, the vessel owners will be receiving a copy of the full survey document prior to the face-to-face interview, thus providing them with an opportunity to gather the information on their crew in advance.

Most of the individual questions are identical to those described in Part 8, for Vessel Owner Information (only), and have the same justification. **Question 10.1 -10.4** asks for the position of the particular crew member, in order to identify that person with their crew share and expected level of income; his/her age; marital status; and level of education.

Describe the consequences to the Federal program or policy activities if the collection is not conducted or is conducted less frequently.

Socioeconomic data has not been systematically collected by NOAA Fisheries in the past. Socioeconomic data collection efforts by individual States or Universities have been plagued by their small scope and/or their limited duration. Current economic and social data is needed for the South Atlantic shrimp fishery as a whole in order to accurately assess the positive and/or negative impacts of federal rules and regulations. Such assessments are mandated under Executive Order 12866, the Regulatory Flexibility Act, Magnuson-Stevens/Sustainable Fisheries Acts (and the National Standards attached thereto), and the Endangered Species Act, among others. Additionally, recent legal decisions against the federal government have been handed down based on the absence of social and economic data (i.e. summer flounder litigation: North Carolina Fisheries Association, et al. versus Daley - Civil Nos. 2: 97cv339; 2: 98cv606).

According to the Small Business Administration, fluctuations in short-term profitability are important in determining whether or not small businesses are forced to exit an industry. According to various lawsuits involving the shrimp industry and NMFS, industry has severely criticized the accuracy of previous social and economic analyses related to particular Council and NMFS actions. If current and accurate socioeconomic data are not available, then the social and economic assessments of management alternatives will likewise be inaccurate, thereby potentially leading the Council and NMFS to make poor management decisions. Thus, continuous data collection of cost and earnings data are needed to satisfy these various mandates and help ensure that good management decisions are made.

Describe any assurance of confidentiality provided to respondents and the basis for assurance in statute, regulation, or agency policy.

All data that are submitted are treated as confidential in accordance with NOAA Administrative Order 216-100 and the Magnuson-Stevens Act (16 U.S.C. 1881a, M-S Act § 402(b), Confidentiality of Information).

Development of a Sampling Plan for Socioeconomic Survey of Offshore Gulf Shrimp Fishermen

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1 Introduction

This report has been prepared for the Marine Resources Assessment Group, Americas (MRAG), using data on the characteristics of the offshore gulf shrimp fleet that have primary landings sites in Texas (data provided through MRAG by Mike Travis, NMFS). Data on characteristics of the fleet were compiled by merging information from the US Coast Guard on registered vessels with NFMS information from a Gulf-wide shrimp dealer reporting program. The number of vessels for which such data exist is $1,207$, and this is taken as the fixed, known size of the population of interest in this report. The data contain values for a number of physical characteristics of each vessel, such as age, length, and tonnage, and two measures of activity in 2001, total shrimp catch (Gulf only) and gross revenue.

The purpose of the survey to be conducted is to collect information on socioeconomic characteristics of the offshore fleet, with an emphasis on costs incurred and investments made at the level of individual vessels. It has been determined by NMFS that the survey will consist of about 10% of the total population, and it is strongly believed that some stratification of the population should be used to ensure coverage of various sectors that may exist in the fleet (e.g., small versus large vessels) and possibly improve efficiency (i.e., reduce variances) of the resulting estimators of population values. At this time, however, it has not been determined which, if any, characteristics of vessels for which data are available might be directly related to the response variables of interest in the survey.

This report develops a sampling and estimation strategy that may be used to provide both point and interval estimates of fleet-wide total and average values for responses of interest in the planned survey. The basic approach is that of *post-stratification*, but this is combined with a highly stratified initial sample designed to provide coverage of all sectors of the fleet relative to geographic location of primary port, size of vessel, and activity in 2001. While poststratified estimates are certainly valid in their own right, gains in efficiency may be realized if fixed stratification is employed in future years, and the design proposed here lends itself to the identification of useful strata for future use.

2 The Concept of Poststratification

Sampling plans having fixed strata for both the sample design and estimation in a survey are generally used in situations for which population units within the population may be classified into relatively homogeneous groups (i.e., strata), where homogeneous means with respect to the response of interest. If the variance in responses is smaller within strata than between strata, it is often possible to realize an increase in efficiency of a population-level estimator relative to that of a simple random sample; efficiency here refers to the mean squared error or variance of estimators, which are equal under unbiased estimation. In some situations, however, it is difficult or undesirable to designate strata at the sample design phase, even though the use of stratified estimation procedures may be appropriate. For example, strata definitions may be readily available, but obtaining a sample using some other plan, such as simple random sampling, may be less costly or more easily accomplished. A similar situation arises when a survey includes multiple responses of interest, and a single stratified sample design may not be appropriate for all of the responses. In such situations the typical statistical approach to estimation is called *poststratification.* The essence of poststratification is to classify sampled units into strata classes *after* the sample is collected, then perform estimation as if these strata had been used to design the sampling procedure in the first place. While this is certainly the concept behind poststratification, there are some differences with a fixed stratification procedure that should not be ignored.

The fundamental difference between a fixed stratification scheme and the use of poststratificaion is that, in the former, the size of samples taken from various strata are fixed prior to selection of a sample while, in the latter, the size of samples within (post) strata are random quantities. This leads to differences in the variance of estimators of population quantities under fixed stratified and poststratified estimation procedures. There are two of these differences that deserve mention here. First, the variance of poststratified estimators includes a source of variability, due to the fact that sample sizes within strata are random, that is not present in fixed stratification schemes. This source of variability is often ignored in poststratified estimation, which is then conducted *conditionally* on the realized strata sample sizes (e.g., Thompson, 1992; page 109). The second difference is more subtle and, perhaps, more important. In a fixed stratification scheme, independent estimates are available for individual strata, and these estimates may then be simply combined to population-level estimates. In poststratification, however, estimates of strata-level quantities (e.g., totals or means) are typically not independent among strata and, thus, are not easily combined to the population level. Two types of estimators are proposed in this report, one that provides unbiased estimates of poststrata totals, means, and their variances, and the other that provides more efficient estimates at the level of the entire population.

Poststratification estimators are most commonly presented in the sampling literature under the assumption that the sample (sometimes called the *parent* sample) is obtained through a simple random sampling design. This assumption is appropriate for situations in which obtaining a sample drawn from fixed strata is logistically difficult relative to obtaining a sample from a simple random sampling design. The problem considered here, however, is somewhat different in that it is not implementation of a sampling design that is problematic but, rather, the identification of appropriate strata from a number of possibilities. In addition, given the focus of the survey on the fixed and variable costs of shrimping, it is desirable to draw an initial sample that ensures reasonable coverage of the entire fleet relative to characteristics that might be connected to costs. Thus, what is recommended in this report is the use of poststratification estimators combined with a structured initial sampling design. This renders the resulting statistical estimators somewhat more complex than what is typically found in elementary sampling texts (e.g., Thompson, 1992). It is the intent of this report to give sufficient detail to allow the estimation strategy recommended to be readily understood, but (hopefully) without belaboring well-known results from elementary theory.

3 Fundamental Approach and Notation

The statistical approach adopted in this report is one in which probability is generated only through the sampling mechanism. That is, responses on observed population units are not interpreted as realizations of random variables but, rather, as fixed characteristics of those units. Thus, in the notation that follows, y_k represents a non-random characteristic of the *kth* unit of the population, the response of the *kth* unit. The population is taken to consist of a total of N units; in this report we have $N = 1,207$. Probability is applied to the chances that units of the population are included in a sample. This probability will be represented in terms of *indicator* variables,

$$I(k \in \mathcal{S}) = \begin{cases} 1 & \text{if unit } k \text{ is in sample } \mathcal{S} \\ 0 & \text{otherwise.} \end{cases}$$

Using this notation, the indicator variables $\{I(k \in \mathcal{S})$ are binary random quantities with expected value equal to the probability that the *kth* unit is selected for the sample,

$$E\{I(k \in \mathcal{S})\} = \pi_k. \tag{1}$$

In this notation, the quantities $\{\pi_k; k = 1, \ldots, N\}$ are called the *inclusion probabilities* for the population units.

Under the assumption that a sample of size n is to be drawn without replacement, so that a unit may not appear more than once in the sample, the inclusion probabilities are not independent. In particular, the probability that two particular units, k and j say, are both included in the sample is not equal to the product $\pi_k \pi_j$. For this reason we define the *second order inclusion probabilities* as,

$$E\{I(k \in \mathcal{S})\, I(j \in \mathcal{S})\} = \pi_{k,j}. \tag{2}$$

The second order inclusion probabilities will become important in determining the variances associated with possible estimators.

The sample is to be drawn from the entire population U as a stratified sample, where the strata will be defined as groups of population units that are denoted with the subscript h; $h = 1, \ldots, H$. That is, U_h will denote the *hth sampling stratum*, $U_h \equiv \{k : k \in \text{ stratum } h\}$, the set of units in the population that fall into the *hth* group, N_h will denote the number of population units in the *hth* sampling stratum, $\mathcal{S}_h$ the sample from the *hth* sampling stratum, n_h the number of units in the sample from the *hth* sampling stratum, and so forth. Thus, the summation

$$\sum_{k \in \mathcal{S}_h} y_k$$

denotes the sum of the responses y_k over the units that are selected for the sample from the *hth* sampling stratum.

For estimation under a given poststratification scheme, we will let U_g; $g = 1, \ldots, G$ denote the *analysis strata.* Subscripting for these strata will follow the same conventions as for the sample strata described immediately above. Note that both the sampling strata $\{U_h : h = 1, \ldots, H\}$ and the analysis strata $\{U_g : g = 1, \ldots, G\}$ constitute partitions of the population, but partitions that may overlap in a complex manner. For example, the $2nd$ analysis stratum may be composed of parts of the $1st$, $3rd$, and $5th$ sampling strata. This requires double subscripting of various quantities such as $U_{g,h}$ for the set of units in the gth analysis stratum that are also in the hth sampling stratum, $N_{g,h}$ for the number of such units, $\mathcal{S}_{g,h}$ for the set of sampled units in the gth analysis stratum and hth sampling stratum, $n_{g,h}$ for the number of such units, and so forth. An important mechanism that will be used repeatedly is that, for any quantity associated with population units, x_k say,

$$\sum_{k \in U_g} x_k = \sum_{h=1}^{H} \sum_{k \in U_{g,h}} x_k.$$

It is assumed that the objective is to estimate either the total or mean of a given response in the population, and these will be denoted as τ and μ, respectively. That is,

$$\begin{aligned} \tau &\equiv \sum_{k \in U} y_k, \\ \mu &\equiv \frac{1}{N} \sum_{k \in U} y_k. \end{aligned}$$

4 Drawing a Comprehensive Sample

An extensive exploratory analysis was conducted using data provided by NMFS that contained values for tonnage, length, and age of vessels registered by the US Coast Guard, total gulf shrimp pounds landed (2001) and gross revenue (2001) for these same vessels. Summary statistics, marginal histograms, and other quantities were examined for these variables. A complete presentation and discussion of this exploratory work would render this report untimely and is thus not presented here. Two figures resulting from these analyses bear presentation. Figure 1 presents a scatterplot matrix of the variables mentioned above for the entire set of $1,207$ vessels (except for plots that involve age of vessel for which there are only $1,205$ vessels represented due to missing values for age). It is evident that, aside from tonnage versus length and landed pounds versus gross revenue, relations among these variables are weak. In particular, the scatterplot of total pounds of landed shrimp versus vessel tonnage (fourth row down from the top in the first column of Figure 1) demonstrates that large size of vessel is perhaps necessary for a high level of shrimp catch, but is not sufficient for the same. The relation between total landed pounds and gross revenue (both for 2001) is particularly interesting, and a larger perspective of this relation is shown in the scatterplot of Figure 2. In Figure 2 it can be seen that, while there is a strong linear relation between these variables, which might be expected, there are also more vessels that appear to have a smaller gross revenue than the bulk of the fleet that landed a comparable number of pounds of shrimp than there are vessels that obtained a larger gross revenue than the bulk of the comparable fleet. Identification of the data points that corresponded to vessels having particular primary ports did not reveal any identifiable patterns relative to this scatterplot (i.e., all of the "low" points did not correspond to one or a few particular ports). Nevertheless, this interesting relation led to the idea that vessels might be stratified, for sampling purposes, based on whether they realized above average revenue for the total shrimp landed or below average revenue for the total shrimp landed, where average refers to the entire fleet.

Two additional factors were identified as primary candidates to define sampling strata, those being vessel tonnage and primary port. Vessels in the fleet range from 5 to 232 tons, and geographic location of primary port may reasonably be related to level of variable costs, such as the price of fuel and ice. While there is no numerical evidence that either of these factors is related to the response variables of interest in a survey of socioeconomic characteristics of the fleet, they seem to represent the most easily identifiable categories that might be claimed as "under-represented" if one was not pleased with the results of the survey to be conducted.

The recommended sampling stratification consists of 12 ports, two vessel sizes (based on tonnage), and two "economic return" categories (above and below average for the given total landings), for a total of 48 sampling strata. Vessel size was defined as "small" if tonnage was less than 100 and "large" if tonnage was greater than 100, these values based on the marginal histogram for tonnage of all vessels in the fleet. Ports 71 (Chambers County), 83 (Port Lavaca), 84 (Harris County), and 86 (Matagorda County) had all four sub-categories collapsed into one due to small numbers of vessels with these as primary ports, and port 72 (Galveston) had small and large vessels for larger than average economic return collapsed into one category for the same reason. This results in a total of 34 sampling strata, which are indexed and identified in Table 1. The division of "economic return" as + and − was based on positive and negative residuals from an ordinary least squares fit of gross revenue to total pounds of shrimp landed.

It is suggested that the sampling plan be that of a stratified random sample using proportional allocation with the 34 sampling strata identified. Since the total number of population units is $N = 1,207$, a sample of 10% of the population is $n = 121$. Allocations proportional to population size in the strata N_h yields the fixed sample sizes n_h listed in Table 1. Also given in Table 1 are the inclusion probabilities from equation (1) and the second-order inclusion probabilities from equation (2). Using simple random sampling within each of the 34 strata presented in Table 1, the inclusion probabilities are computed, for $k \in U_h$, as

$$\pi_k = \frac{(N_h - 1)!}{(n_h - 1)!\,((N_h - 1) - (n_h - 1))!} = \frac{n_h}{N_h},$$

while the second-order inclusion probabilities are computed for $k, j \in U_h;\ k \neq j$, as

$$\pi_{k,j} = \frac{(N_h - 2)!}{(n_h - 2)!\ ((N_h - 2) - (n_h - 2))!} = \frac{n_h(n_h - 1)}{N_h(N_h - 1)}.$$

Table 1. Definition of Sampling Strata

Statum id (h)	Port	Economic Return	Size	N_h	n_h	π_k	$\pi_{k,j}$
1	70	+	Small	12	1	0.0833	0.0000
2	70	+	Large	103	10	0.0971	0.0086
3	70	−	Small	77	8	0.1039	0.0096
4	70	−	Large	52	5	0.0962	0.0075
5	71	All	All	10	1	0.1000	0.0000
6	72	+	All	19	2	0.1053	0.0058
7	72	−	All	24	2	0.0833	0.0036
8	73	+	Small	8	1	0.1250	0.0000
9	73	+	Large	20	2	0.1000	0.0053
10	73	−	Small	32	3	0.0938	0.0060
11	73	−	Large	54	5	0.0926	0.0070
12	78	+	Small	24	2	0.0833	0.0036
13	78	+	Large	23	2	0.0870	0.0039
14	78	−	Small	42	4	0.0954	0.0070
15	78	−	Large	9	1	0.1111	0.0000
16	81	+	Small	25	3	0.1200	0.0100
17	81	+	Large	51	5	0.0980	0.0078
18	81	−	Small	35	4	0.1143	0.0101
19	81	−	Large	37	4	0.1081	0.0090
20	82	+	Small	29	3	0.1034	0.0074
21	82	+	Large	105	11	0.1048	0.0101
22	82	−	Small	28	3	0.1071	0.0079
23	82	−	Large	34	3	0.0882	0.0053
24	83	All	All	23	2	0.0870	0.0040
25	84	All	All	12	1	0.0833	0.0000

Table 1 (cont.)

26	85	+	Small	11	1	0.0909	0.0000
27	85	+	Large	13	1	0.0769	0.0000
28	85	−	Small	75	8	0.1067	0.0101
29	85	−	Large	38	4	0.1053	0.0085
30	86	All	All	17	2	0.1176	0.0074
31	87	+	Small	16	2	0.1250	0.0083
32	87	+	Large	69	7	0.1014	0.0090
33	87	−	Small	27	3	0.1111	0.0085
34	87	−	Large	53	5	0.0943	0.0073
TOTAL	ALL	ALL	ALL	1207	121		

To draw a stratified random sample according to the prescription of Table 1, a simple random sample of size n_h is taken from each of the 34 strata. A file giving classification of vessels into these strata is available, but is not presented here for reasons of confidentiality.

5 Estimation

Two types of estimators for totals and mean responses are presented in this section. Both depend heavily on the inclusion and second-order inclusion probabilities presented in Table 1 for the suggested sampling design of Section 4. The estimators presented in Section 5.1 are known as Horvitz-Thompson estimators. They provide unbiased estimates for any set of groups, but are difficult to combine to the population level in this situation, because estimates of the group variances are not independent under poststratification. It is recommended that these estimators be used to examine individual sectors (groups) of the fleet, those sectors corresponding to various poststrata. This should provide information about the relative homogeneity of groups that might be used as strata in the future. The estimators presented in Section 5.2 are derived from what are known as regression estimators. These estimators are not unbiased, but are generally felt to possess smaller mean squared (or total) error than the corresponding Horvitz-Thompson estimators. It is recommended that these estimators be used to examine quantities at the level of the total fleet under various poststratification schemes.

Given the definitions of π_k and $\pi_{k,j}$ in equations (1) and (2), respectively, we have that

$$\begin{aligned} var\{I(k \in \mathcal{S})\} &= \pi_k(1-\pi_k); \quad k \in U \\ cov\{I(k \in \mathcal{S}),\, I(j \in \mathcal{S})\} &= \pi_{k,j} - \pi_k\pi_j; \quad k, j \in U;\; k \neq j \end{aligned}$$

Recall in what follows that $h = 1, \ldots, H$ is used to index the sampling strata, while $g = 1, \ldots, G$ is used to index the analysis strata, or poststrata.

5.1 The Horvitz-Thompson Estimator

A well-known result from the theory of survey sampling is that, for any population (or group within a population), an unbiased estimator of the total response is the standard Horvitz-Thompson estimator,

$$\hat{\tau} = \sum_{k \in \mathcal{S}} \frac{y_k}{\pi_k}. \tag{3}$$

The proof of unbiasedness for this estimator is given here to illustrate a technique that will be used repeatedly in subsequent results. Note that, using the indicator variable notation, from Section 2, we can write (3) as

$$\hat{\tau} = \sum_{k \in U} \frac{y_k}{\pi_k} I(k \in \mathcal{S}).$$

Then,

$$\begin{aligned} E\{\hat{\tau}\} &= E\left\{\sum_{k\in U}\frac{y_k}{\pi_k}I(k\in\mathcal{S})\right\} \\ &= \sum_{k\in U}\frac{y_k}{\pi_k}E\{I(k\in\mathcal{S})\} \\ &= \sum_{k\in U}\frac{y_k}{\pi_k}\pi_k = \sum_{k\in U}y_k = \tau \end{aligned}$$

Since the above result holds for any arbitrary group of population units, we may apply the Horvitz-Thompson estimator to poststratification groups. To do this requires the recognition that not all π_k are identical for a given level of the group indicator g. That is,

$$\hat{\tau}_g = \sum_{k\in\mathcal{S}_g}\frac{y_k}{\pi_k} = \sum_{h=1}^{H}\sum_{k\in\mathcal{S}_{g,h}}\frac{y_k}{\pi_k} = \sum_{h=1}^{H}\sum_{k\in\mathcal{S}_{g,h}}\frac{y_k\,N_h}{n_h}. \tag{4}$$

That $\hat{\tau}_g$ is unbiased for τ_g follows from the fact that unbiasedness of $\hat{\tau}$ in (3) holds for any group, or may be shown directly using the same method applied to $\hat{\tau}$ above. Note that $\hat{\tau}_g$ may be written as,

$$\hat{\tau}_g = \sum_{k\in U_g}\frac{y_k}{\pi_k}I(k\in\mathcal{S}_g) = \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k\,N_h}{n_h}I(k\in\mathcal{S}_{g,h}).$$

Then,

$$\begin{aligned} E\{\hat{\tau}_g\} &= E\left\{\sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k\,N_h}{n_h}I(k\in\mathcal{S}_{g,h})\right\} \\ &= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k\,N_h}{n_h}E\{I(k\in\mathcal{S}_{g,h})\} \\ &= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k\,N_h}{n_h}\frac{n_h}{N_h} = \sum_{h=1}^{H}\sum_{k\in U_{g,h}}y_k = \tau_g. \end{aligned}$$

The variance of $\hat{\tau}_g$ in (4) is derived as,

$$
\begin{aligned}
var\{\hat{\tau}_g\} &= var\left\{\sum_{k\in U_g}\frac{y_k}{\pi_k}I(k\in\mathcal{S}_{\}})\right\} \\
&= \sum_{k\in U_g}\frac{y_k^2}{\pi_k^2}var\{I(k\in\mathcal{S}_g)\} + \sum\sum_{k,j\in U_g;k\neq j}\frac{y_k\,y_j}{\pi_k\,\pi_j}cov\{I(k\in\mathcal{S}_g),I(j\in\mathcal{S}_g)\} \\
&= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k^2}{\pi_k^2}var\{I(k\in\mathcal{S}_{g,h}) + \sum_{h=1}^{H}\sum\sum_{k,j\in U_{g,h};k\neq j}\frac{y_k\,y_j}{\pi_k\,\pi_j}cov\{I(k\in\mathcal{S}_{g,h}),I(j\in\mathcal{S}_{g,h})\},
\end{aligned}
$$

where the last line follows because any two population units k and j that are not in the same sampling stratum h have second-order inclusion probability $\pi_{k,j}=\pi_k\pi_j$, and then $cov\{I(k\in\mathcal{S})\},I(j\in\mathcal{S})\}=0$. Then,

$$
\begin{aligned}
var\{\hat{\tau}_g\} &= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k^2}{\pi_k^2}var\{I(k\in\mathcal{S}_{g,h}) + \sum_{h=1}^{H}\sum\sum_{k,j\in U_{g,h};k\neq j}\frac{y_k\,y_j}{\pi_k\,\pi_j}cov\{I(k\in\mathcal{S}_{g,h}),I(j\in\mathcal{S}_{g,h})\} \\
&= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k^2}{\pi_k^2}\pi_k(1-\pi_k) + \sum_{h=1}^{H}\sum\sum_{k,j\in U_{g,h};k\neq j}\frac{y_k\,y_j}{\pi_k\,\pi_j}(\pi_{k,j}-\pi_k\,\pi_j) \\
&= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k^2\,N_h^2}{n_h^2}\frac{n_h}{N_h}\left(1-\frac{n_h}{N_h}\right) + \sum_{h=1}^{H}\sum\sum_{k,j\in U_{g,h};k\neq j}\frac{y_k\,y_j\,N_h^2}{n_h^2}\left\{\frac{n_h(n_h-1)}{N_h(N_h-1)}-\frac{n_h^2}{N_h^2}\right\} \\
&= \sum_{h=1}^{H}\sum_{k\in U_{g,h}}\frac{y_k^2\,N_h}{n_h}\left(1-\frac{n_h}{N_h}\right) + \sum_{h=1}^{H}\sum\sum_{k,j\in U_{g,h};k\neq j}y_k\,y_j\left\{\frac{N_h(n_h-1)}{(N_h-1)n_h}-1\right\} \\
&= \sum_{h=1}^{H}\left(\frac{N_h-n_h}{n_h}\right)\sum_{k\in U_{g,h}}y_k + \sum_{h=1}^{H}\left(\frac{n_h-N_h}{n_h(N_h-1)}\right)\sum\sum_{k,j\in U_{g,h};k\neq j}y_k\,y_j. \qquad (5)
\end{aligned}
$$

An unbiased estimator of $var\{\hat{\tau}_g\}$ is obtained as,

$$
\begin{aligned}
\hat{V}\{\hat{\tau}_g\} &= \sum_{h=1}^{H}\left(\frac{N_h-n_h}{n_h}\right)\sum_{k\in S_{g,h}}\frac{y_k\,N_h}{n_h} + \sum_{h=1}^{H}\left(\frac{n_h-N_h}{n_h(N_h-1)}\right)\sum\sum_{k,j\in S_{g,h};k\neq j}\frac{y_k\,y_jN_h(N_h-1)}{n_h(n_h-1)} \\
&= \sum_{h=1}^{H}\left(\frac{(N_h-n_h)N_h}{n_h^2}\right)\sum_{k\in S_{g,h}}y_k + \sum_{h=1}^{H}\left(\frac{(n_h-N_h)N_h}{n_h^2(n_h-1)}\right)\sum\sum_{k,j\in S_{g,h};k\neq j}y_k\,y_j, \qquad (6)
\end{aligned}
$$

that is, by substituting into (5) unbiased estimators of the two quantities

$$
\sum_{k\in U_{g,h}}y_k \qquad \text{and} \qquad \sum\sum_{k,j\in U_{g,h};k\neq j}y_k\,y_j.
$$

For estimation of postrata means, we make use of the fact that $\tau_g = N_g \mu_g$. To estimate the mean response, rather than the total, for group g, divide $\hat{\tau}_g$ in equation (4) by the known group size N_g, that is, $\hat{\mu}_g = \hat{\tau}_g / N_g$. The variance and estimated variance of $\hat{\mu}_g$ are computed by dividing equations (5) and (6) by N_g^2, that is, $var\{\hat{\mu}_g\} = var\{t\hat{a}u_g\}/N_g^2$ and $\hat{V}\{\hat{\mu}_g\} = \hat{V}\{t\hat{a}u_g\}/N_g^2$.

5.2 Regression Estimator

Development of the general regression estimator under poststratification for the case in which the sample is itself selected from a stratified sampling plan is not as straightforward as the simple calculations connected with the Horvitz-Thompson estimators of Section 5.1. A complete development may be found in Sarndal, Swensson and Wretman, 1992, particularly Chapters 6 and 7. Using the same notation as in previous sections, a regression estimator of the population total may be written as,

$$\begin{aligned} \hat{\tau} &= \sum_{g=1}^{G} N_g \frac{\sum\limits_{k \in \mathcal{S}_g} y_k / \pi_k}{\sum\limits_{k \in \mathcal{S}_g} 1/\pi_k} \\ &= \sum_{g=1}^{G} N_g \frac{\sum\limits_{h=1}^{H} \sum\limits_{k \in \mathcal{S}_{g,h}} (y_k \, N_h)/n_h}{\sum\limits_{h=1}^{H} \sum\limits_{k \in \mathcal{S}_{g,h}} (n_{g,h} \, N_h)/n_h}. \end{aligned} \tag{7}$$

The variance and estimated variance for $\hat{\tau}$ from (7) is perhaps presented most easily by noting that

$$\hat{\tau} = \sum_{g=1}^{G} N_g \frac{\sum\limits_{h=1}^{H} \hat{\tau}_{g,h}}{\sum\limits_{h=1}^{H} \hat{N}_{g,h}} = \sum_{g=1}^{G} N_g \frac{\hat{\tau}_g}{\hat{N}_g}, \tag{8}$$

where,

$$\hat{\tau}_{g,h} = \sum_{k \in \mathcal{S}_{g,h}} \frac{y_k}{\pi_k} = \sum_{k \in \mathcal{S}_{g,h}} \frac{y_k N_h}{n_h},$$

and

$$\hat{N}_{g,h} = \sum_{k \in \mathcal{S}_{g,h}} \frac{1}{\pi_k} = \sum_{k \in \mathcal{S}_{g,h}} \frac{N_h}{n_h}.$$

Using this notation, a first-order Taylor's series approximation to $\hat{\tau}$, and derivation of the variances for components in this linearization (see Wolter, 1985) yields,

$var\{\hat{\tau}\} \approx$

$$\sum_{g=1}^{G} \sum_{k \in U_g} \pi_k(1-\pi_k) \frac{(y_k - \tau_g/N_g)^2}{\pi_k^2} + \sum_{g=1}^{G} \sum_{g'=1}^{G} \sum_{k \in U_g;\, j \in U_{g'};\, k \neq j} \sum (\pi_{k,j} - \pi_k \pi_j) \left(\frac{y_k - \tau_g}{\pi_k} \right) \left(\frac{y_j - \tau_{g'}}{\pi_j} \right). \quad (9)$$

This approximate variance may be estimated by substitution of the estimators $\hat{\tau}_g$ and $\hat{N}_g$ appearing in expression (8) for the corresponding quantities τ_g and N_g in (9). The expressions for $var\{\hat{\tau}\}$ and its estimated value can be further expressed in terms of N_h and n_h as has been shown previously for other estimators, but this is not shown in the current report.

6 Non-Response and Voluntary Responses

It is anticipated that both non-response and voluntary responses will occur in the planned survey of shrimp fishermen in the gulf. Suggested strategies for dealing with these potential difficulties are stated briefly here. Non-response refers to vessels selected for the sample that refuse to give information. Voluntary response refers to individuals who provide information even though their vessel was not selected for the sample.

1. Non-Response.

   Although any number of statistical approaches might be applied to missing responses, such as adjustment of estimators, hot-deck imputation, or multiple imputation, development of these approaches is beyond the scope of the current project. An alternative, which might be justified for this survey, would be to simply remove units from the population of interest if those units refuse to provide information. This might require re-computation of inclusion probabilities after it is know how many sampled vessels have refused to cooperate, but otherwise provides no additional difficulties for the methodology proposed in this report.

2. Voluntary Responses.

   Voluntary responses are easily incorporated into the estimators proposed in this report by setting inclusion probabilities equal to one. That is, for any vessel w represented by submission of an unsolicited response to the survey, $\pi_w \equiv 1$. Second-order inclusion probabilities involving vessel w are computed using independence among voluntary responses and solicited responses (i.e., sampled vessels) as $\pi_{w,j} = \pi_w \pi_j$ for any $j \neq w$. Such responses may then be directly incorporated into all of the estimators presented in previous sections.

References

Sarndal, C-E., Swensson, B. and Wretman, J. (1992), *Model Assisted Survey Sampling.* New York: Springer-Verlag.

Thompson, S.K. (1992), *Sampling.* New York: John Wiley and Sons.

Wolter, K.M. (1985), *Introduction to Variance Estimation.* New York: Springer-Verlag.

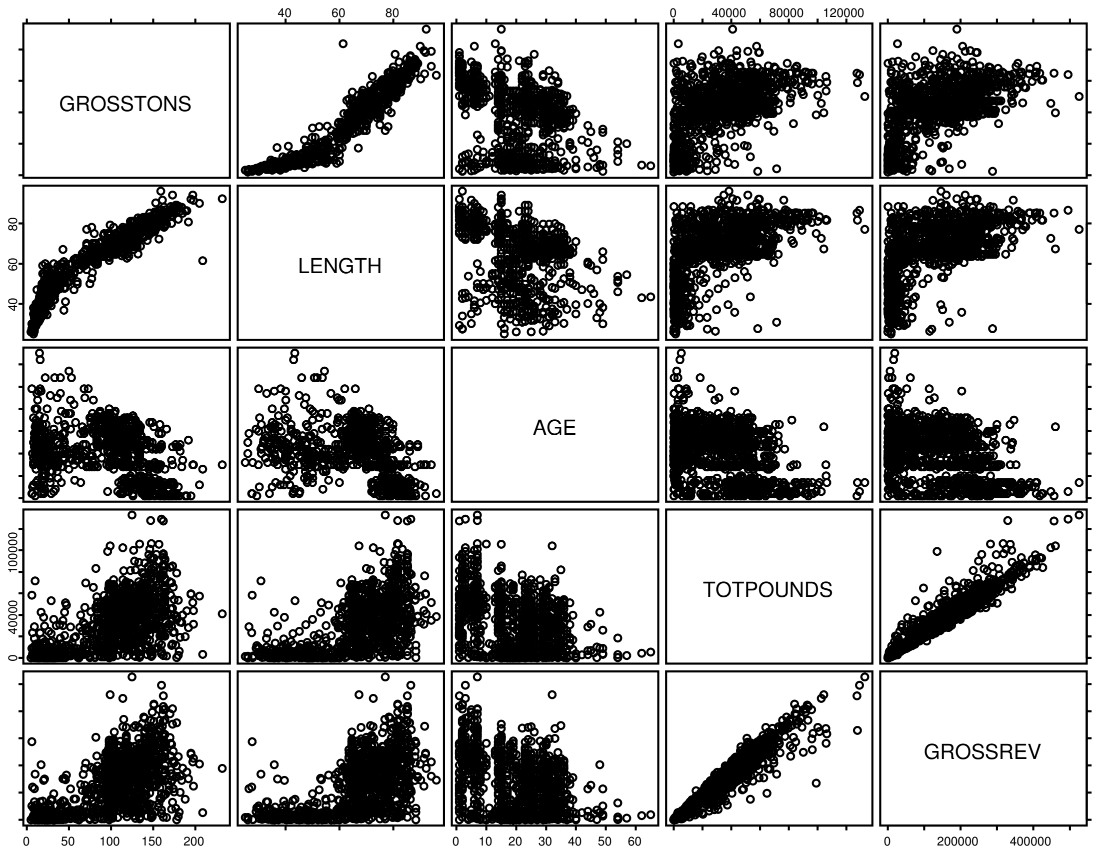

Figure 1.Scatterplot matrix of variables included in the vessel characteristics data provided by NMFS.

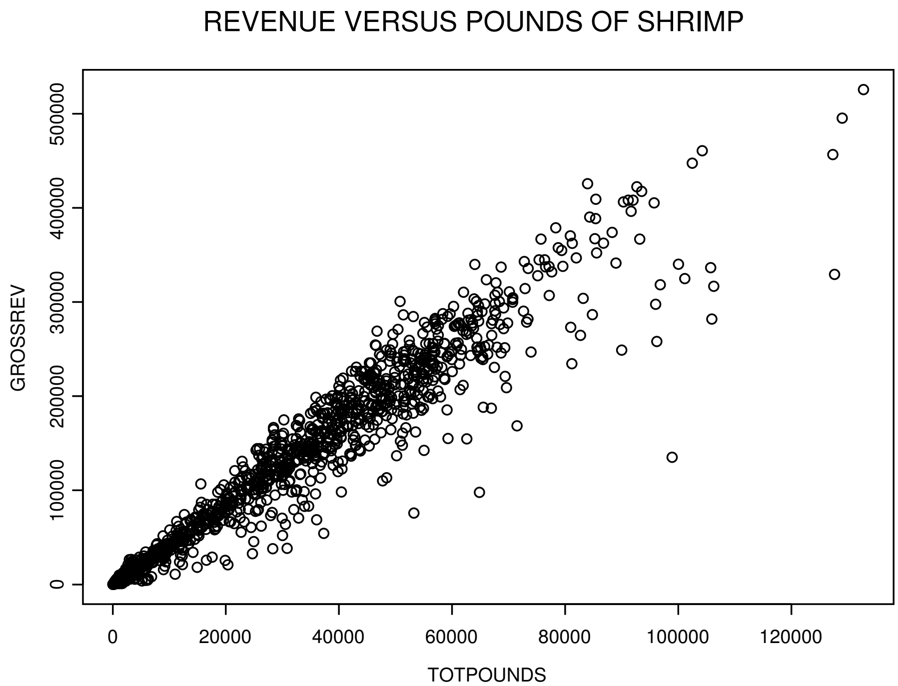

Figure 2.Scatterplot of gross revenue for vessels versus total pounds of shrimp landed. Both numbers are for 2001.

Addendum to Development of a Sampling Plan for Socioeconomic Survey of Offshore Gulf Shrimp Fishermen: Production of Random Samples and Adjustments for Nonresponse

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February 2003

1 Introduction

This report has been prepared for the Marine Resources Assessment Group, Americas (MRAG), as part of a project on the design of a survey of shrimp fishermen on the Gulf Coast. A previous report described a sampling and analysis plan for this project that relied on a highly stratified sampling design combined with the use of *post-stratification* for estimation of quantities of interest in the population. After the sample has been selected, the stratification used in its production is ignored, resulting in what can be considered simply an unequal probability sample across the population. The individual *inclusion probabilities* that result play a key role in any subsequent analyses.

Two inter-related issues, mentioned only briefly in the previous report, seem to have caused some confusion, and the purpose of this addendum is to clarify these issues. The subjects of concern may be described as *sequential versus group sample selection* and *adjustment for nonresponse*. Briefly, one recommendation given in the previous report was that, given a properly constructed sampling list, samples of any desired size could be selected and, in particular, sample size could be increased at any time, simply by selecting additional units from the list. This prescription may have been misinterpreted at some level within NMFS or OMB. In addition, it was suggested that one potential mechanism for dealing with the difficult problem of nonresponse would be to "re-define" the population of interest as excluding units who refused to respond. This was suggested as a simple and practical approach to avoid the potential deleterious effects of nonresponse bias, but would require a re-computation of inclusion probabilities for units that did respond. The approach is not entirely satisfactory because it leaves units in the population that would have refused to respond had they been chosen for the sample. In addition, it appears that NMFS is either unwilling or unable under regulations to re-define the population in this manner. Thus, some type of adjustment is necessary to account for non-response. These two issues are inter-related because the desire to increase sample size is directly related to the number of non-responses encountered in an original sample.

2 Equivalence of Sequential and Group Sampling

This section demonstrates the equivalence of group and sequential sampling methods for selecting a simple random sample of size n from a population of size N. Since the sampling plan proposed in the earlier report involves selection of a simple random sample from a number of groups or "sampling strata", this result is directly applicable to that situation.

Consider the process of selecting a simple random sample of n units from a population that contains N units. By definition, this implies that each possible sample of size n has the same probability of being selected. Denote a possible sample of size n as $S_{n,k}$. The number of such possible samples is $N!/\{(N-n)!\,n!\}$ and,

$$Pr(S_{n,k}) = \frac{(N-n)!\,n!}{N!}; \qquad k = 1, \ldots, \frac{N!}{(N-n)!\,n!}. \tag{1}$$

Another way to characterize a simple random sample is in terms of the inclusion probabilities for individual population units. Let $\{U_h : h = 1, \ldots, N\}$ denote the population units. The number of possible samples that contain unit U_h is equal to the number of samples of size $n-1$ that can be formed from the other $N-1$ population units. Then simple random sampling implies that the probability unit U_h is included in a sample of size n, S_n say, is given as the number of possible samples that contain unit U_h divided by the total number of possible samples,

$$
\begin{aligned}
Pr(U_h \in S_n) &= \frac{\left\{\frac{(N-1)!}{(N-1-(n-1))!\,(n-1)!}\right\}}{\left\{\frac{N!}{(N-n)!\,n!}\right\}} \\
&= \frac{(N-1)!\,(N-n)!\,n!}{N!\,(N-n)!\,(n-1)!} \\
&= \frac{n}{N}. \qquad (2)
\end{aligned}
$$

The probabilities in (1) and (2) are *equivalent*, that is, either characterizes a simple random sample of size n drawn from a population of size N.

Now consider the physical (or computational) process of selecting a random sample. There are several ways in which this may be accomplished. First, the units in a population are arbitrarily ordered with labels $1, \ldots, N$. How these labels are assigned is completely irrelevant so long as each unit has a distinct label. A *group* selection procedure then consists of enumeration of each of the possible samples of size n and selecting one of these samples at random. For example, if $N = 6$ and $n = 2$, the possible samples could be enumerated as,

Sample	Unit Composition	Sample	Unit Composition
1	$\{U_1, U_2\}$	9	$\{U_2, U_6\}$
2	$\{U_1, U_3\}$	10	$\{U_3, U_4\}$
3	$\{U_1, U_4\}$	11	$\{U_3, U_5\}$
4	$\{U_1, U_5\}$	12	$\{U_3, U_6\}$
5	$\{U_1, U_6\}$	13	$\{U_4, U_5\}$
6	$\{U_2, U_3\}$	14	$\{U_4, U_6\}$
7	$\{U_2, U_4\}$	15	$\{U_5, U_6\}$
8	$\{U_2, U_5\}$		

A random sample of size 2 would then be selected by choosing one integer from 1 to 15 at random, and the associated sample. By the equivalence of (1) and (2), the probability that a population unit U_h was selected for the sample would be n/N or here $2/6$. This is easily verified numerically for the present example from the number of times each unit appears in the list of 15 possible samples, which is 5; $5/15 = 2/6$.

An alternative procedure by which to select a sample is through the use of sequential sampling. To produce a sample of size n under this procedure, n steps are carried out as follows:

Step	Action
1	Select 1 unit at random from population of size N
2	Select 1 unit at random from remaining population of size $N-1$
3	Select 1 unit at random from remaining population of size $N-2$
$\vdots$	$\vdots$
n	Select 1 unit at random from remaining population of size $N-(n-1)$

Consider a particular population unit U_h. Let $E_{1,h}$ denote the event that U_h is selected for the sample in the first step of the sequential procedure. Let $E_{2,h}$ denote the event that U_h is selected in the second step of the procedure, and similarly for $E_{3,h}, \ldots, E_{n,h}$. The probability that unit U_h is selected for the sample is the probability of the union of the events $E_{1,h}$ through $E_{n,h}$. That is,

$$Pr(U_h \in S_n) = Pr\left(E_{1,h} \cup E_{2,h} \cup \ldots, \cup E_{n,h}\right).$$

Since the events $E_{1,h}, \ldots, E_{n,h}$ are mutually exclusive, the axioms of probability give that,

$$Pr(U_h \in S_n) = \sum_{i=1}^{n} Pr\left(E_{i,h}\right). \tag{3}$$

Now, $Pr(E_{1,h}) = 1/N$ and, for $i = 2, \ldots, n$,

$$Pr(E_{i,h}) = Pr\left(E_{1,h}^c \cap \ldots, \cap E_{i-1,h}^c\right) \frac{1}{N-(i-1)},$$

where $E_{j,h}^c$ denotes the complement of $E_{j,h}$, that is, the event that unit U_h is not selected at step j of the sampling procedure. Independence of the events $E_{j,h}$ implies independence of the events $E_{j,h}^c$ so that,

$$Pr(E_{i,h}) = \left\{\prod_{j<i} Pr(E_{j,h}^c)\right\} \frac{1}{N-(i-1)}. \tag{4}$$

We have that $Pr(E_{j,h}^c) = (N-j)/(N-(j-1))$, and, for $i = 2, \ldots, n$,

$$\begin{aligned} Pr(E_{i,h}) &= \left\{\prod_{j<i} \frac{N-j}{N-(j-1)}\right\} \frac{1}{N-(i-1)} \\ &= \frac{1}{N}. \end{aligned} \tag{5}$$

For example, if $i = 5$ and $5 < N$, equation (5) would give

$$\begin{aligned} Pr(E_{5,h}) &= \left\{\prod_{j<5} \frac{N-j}{N-(j-1)}\right\} \frac{1}{N-(5-1)} \\ &= \frac{N-1}{N}\,\frac{N-2}{N-1}\,\frac{N-3}{N-2}\,\frac{N-4}{N-3}\,\frac{1}{N-4} \\ &= \frac{1}{N} \end{aligned}$$

Finally, substituting $Pr(E_{1,h}) = 1/N$ and (5) into (3) gives,

$$Pr(U_h \in S_n) = \sum_{i=1}^{n} \frac{1}{N} = \frac{n}{N}, \tag{6}$$

which, by (2) is the same inclusion probability that would be obtained by the group sampling procedure. Thus, the group procedure and the sequential procedure are equivalent.

The benefits of the sequential procedure are that it is amenable to formulation of computational algorithms for random sampling and that it does not depend on a fixed sample size n being available prior to formation of the sampling list. It is, in fact, directly analogous to the physical process that one would conduct to draw n numbered balls without replacement from a box containing N such balls. What is, perhaps, less obvious is that this procedure can be used to develop a sampling list of all N units in the population. To obtain a random sample of n units one simply takes the first n units in the list. And, if it is later determined that a sample of size $n + m$ (for non-negative integer m) is desired, one merely adds the next m units from the list into the sample.

The ramification of this for the present problem is that there is no need to determine a necessary original sample size to obtain a given number of responses, under a guess that a certain percentage of the originally sampled units will respond. With a complete sampling list in hand and a desired sample size of 120, say, one would simply sample the first 120 units in the list. If only 100 of those units responded, the the next 20 units would be sampled. If only 15 of those units responded then the next 5 units would be sampled, and so forth, until a total of 120 responses were obtained. This is, of course, only a *sampling plan.* It does not solve the difficulty of how to deal with selected units that result in a nonresponse.

3 Adjustment for Nonresponse

Statistical properties of basic survey sampling estimators are typically derived under the assumption that a response is obtained from every population unit selected for a given sample. This is often not the case, and there are a variety of strategies to deal with the issue of nonresponse in sampled units. The simplest strategy is to ignore nonresponse, using the number of sampled units with response as the sample size n. For example, if a sample of size of 120 was planned, but only 118 of those units responded, one might take the selected sample size to be $n = 118$ and employ the usual formulae derived under the assumption of complete response for sampled units. Alternatively, if a sample of 120 was planned, but only 118 responses were realized, one might employ the sequential sampling plan to extend the sample until 120 responses were obtained and then use $n = 120$ in the usual estimators. Either of these strategies may very well be reasonable in cases for which the number of nonresponses is a small proportion of the sampled units. Formal definition of "reasonable" and "small" are beyond the scope of the present report, but should fall within the range of intuition for our purposes; a basic criterion would be whether estimates derived under an assumption of complete response are meaningfully different from analogous estimates that are adjusted for nonresponse; this is, of course, not known . If the level of nonresponse is more than a small proportion of the planned sample size, however, this strategy is not reliable. For example, if a sample of size 180 was drawn, from which 120 responses were realized, use of the standard estimation formulae using $n = 120$ could not be justified, and would almost certainly lead to more unreliable results than the prescription to re-define the population of interest based on response, which was made in the previous report. Thus, if NMFS is unwilling or unable to re-define the population being sampled, some type of adjustment for nonresponse is necessary.

In the present problem, little is known about either the level of nonresponse that will occur or the potential bias that nonresponse might introduce in estimates of population quantities (e.g., totals or means). There are no magic analytical procedures that can completely resolve this difficulty. To approach this problem in the current situation, it may be helpful to distinguish between what might be called *estimation bias* and *application bias*. These terms are not standard in the statistical literature, but are used here to provide a sense for the different impacts that nonresponses may have. What is called here estimation bias results from improper handling of what most statisticians call *missing completely at random* or the slightly weaker *ignorable nonresponse*. In the context of estimators proposed in the previous report, estimation bias results from the use of inaccurate inclusion probabilities in formulae for estimation and inference. That is, the probability that a given unit is sampled and provides a response to be used in estimation differs from the probability that the unit is sampled, and use of the latter in estimation may lead to inaccurate results. Such estimation bias may be adjusted for in a relatively straightforward manner.

Application bias presents a much more difficult problem. Application bias occurs if sampled units that result in a nonresponse differ in a systematic manner (with regard to the response of interest) from other units in the sample. Little can be done to alleviate the problem of application bias if nothing is known about the relation between the value of responses and the probability of response or nonresponse. Information on this relation that is useful may be either *direct* or *indirect*. Direct information is sometimes obtained through a process of *double sampling* in which additional efforts are made to obtain responses from a subset of the units that resulted in nonresponse in the original sample. This option does not appear to be feasible in the current situation. Indirect information is available if a relation can be estimated between response value and auxiliary variables. For example, if cost of refrigeration could be related to age of vessel, then it might be possible to *predict* responses for sampled nonresponding units based on vessel age. This is known as *imputation* of missing responses and there are a variety of statistical methods by which such imputation may be accomplished. No information of this type is available in the current situation, for which no responses of any kind have yet been observed, yet alone relations discovered between those responses and any other variable or variables. Thus, it is highly doubtful that formal imputation procedures hold much promise for dealing with potential application bias in the survey currently being designed. While application bias is a potentially serious problem, there is no evidence that indicates it will be present in a survey of shrimp fishermen. There is, of course, also no evidence that it will not be present. A troublesome aspect of this study is that is appears impossible to obtain direct information about possible relations (or lack thereof) between response values and probability of response. This suggests that the potential problem of application bias in survey nonresponse will be difficult to resolve based on information gathered in the present survey.

The preceding discussion implies that what is called here application bias, which results from non-random missing nonresponse, or non-ignorable nonresponse, cannot be adequately dealt with in the current survey. There appears to be no other choice than to make an assumption of missing completely at random and to take steps to adjust estimators to eliminate estimation bias. This is not terribly difficult for the estimators proposed in the previous report. Those estimators depended on the computation of inclusion probabilities for sampled units, that is, the probability that a given unit (vessel) in the population was chosen for inclusion in the sample. For example, if $\{y_i : i = 1, \ldots, N\}$ are the values of a response of interest for units in a population of size N, and if $\pi_i = Pr($ unit i is chosen for inclusion in the sample), then an estimate of the population total for the response is

$$\hat{\tau}_y = \sum_{i \in \mathcal{S}} \pi_i^{-1} y_i, \tag{7}$$

where $\mathcal{S}$ denotes a sample of size n. Equation (7) is the basic *Horvitz-Thompson* estimator of a population total, and forms the basis for many of the derived estimators proposed in the previous report. In (7) the inverse of the *inclusion probabilities* π_i are weights for estimation of the population total. One way in which this can be understood is to consider the following. If every unit in the population were observed, the actual population total could be computed using $\pi_i = 1$ for all $i = 1, \ldots, N$. If 1/2 of the units in the population were observed at random, then $\pi_i = 1/2$ for all i, and each unit in the sample would "represent" two units in the population. Similarly, if 1/10 of the population were randomly sampled, each unit included in the sample would represent 10 units in the population. Now, if a given unit is included in the sample with probability 1/20 while another unit in the sample is included with probability 1/5, then the first represents 20 units in the population, while the second represents 5 units in the population.

Under an assumption of missing at random, estimation bias can be eliminated through an adjustment of the inclusion probabilities used in estimation. That is, the weighting scheme described above is adjusted according to the probability that a sampled unit results in a usable response. For example, if a group of population units have probability of inclusion in the sample of 1/5, but the probability of a response from those sampled units is only 1/3, then the probability that one of those units contributes a usable response in estimation of the population total is 1/15. Thus, the sampled units for which responses are observed now represent 15 units in the population, rather than the original 5 units that would have resulted if all sampled units provided a response. Mathematically, this results in an adjustment of the estimator (7) to the form

$$\hat{\tau}_y = \sum_{i \in \mathcal{S}} (\pi_i \, p_i)^{-1} y_i, \tag{8}$$

where p_i represents the probability that a sampled unit results in a usable response, or the conditional probability of response given selection for the sample.

The difficulty with the estimator (8) is that the conditional probabilities of response given selection for the sample (i.e., the p_i) are not known, and are not produced through the sampling plan, as are the inclusion probabilities π_i. Thus, they must be estimated from sample data, resulting in the estimator

$$\hat{\tau}_y = \sum_{i \in \mathcal{S}} (\pi_i \, \hat{p}_i)^{-1} y_i. \tag{9}$$

The estimated response probabilities $\hat{p}_i$ in equation (9) may be taken as the proportion of sampled units that respond within a given subclass of the sample, often called *weighting classes*. For example, these values might be produced as the proportion of units within a sampling strata that provide usable responses. Or, they might be calculated as the proportion of sampled units within one of the strata in a post-stratification scheme that provide responses. Alternatively, they might be estimated based on a logistic regression of the probability of response against any number of potential auxiliary variables, possibly followed by grouping or "coarsening" of the results into classes of which all members receive equal weight. The most appropriate form of estimation for the (conditional) response probabilities cannot be selected prior to examination of data that result from the initial survey. Also, while the point estimators presented in the previous report are easily modified as illustrated above (i.e., use of $\pi_i \, \hat{p}_i$ rather than π_i alone), variance formulae are more greatly affected. This is because estimation of the p_i as $\hat{p}_i$ introduces an additional source of variability into the estimation procedure. Attempts can be made to incorporate this additional uncertainty into estimated variances through various approximations, such as the Taylor series expansions employed in the previous report. In general, adjustments such as described above are most useful in situations for which nonresponse bias is expected to constitute a larger problem than the increase in uncertainty caused by the need to estimate response probabilities.

It is worthy of repeated emphasis that the type of *weighting adjustment* described immediately above is meant to deal with potential estimation bias under an assumption of missing at random or ignorable missingness. It is not meant to deal with application bias that results from nonresponses that differ in a systematic fashion from responses. At the same time, it is superior to the naive approach of drawing a "larger than anticipated" sample, with subsequent analysis pretending that the realized sample size involved complete response (e.g., Little and Rubin, 2002).

References

Little, R.J.A. and Rubin, D.B. (2002), *Statistical Analysis with Missing Data 2nd* ed., New York: Wiley.

NORTH CAROLINA, SOUTH CAROLINA, GEORGIA, AND EAST FLORIDA COMMERCIAL SHRIMP SURVEY FOR THE 2003 SEASON

Greetings:

You have been randomly selected from over 2,200 commercial shrimp fishermen in North Carolina, South Carolina, Georgia, and east Florida to help NOAA Fisheries better understand your industry. NOAA Fisheries would like to make this study as statistically valid as possible, so it is important that you, and the others who are selected, participate.

This survey focuses on collecting financial information on shrimp fishing businesses, and social data about the people who catch shrimp in North Carolina, South Carolina, Georgia, and East Florida. Our primary goal is to gather information that will help fishery analysts assess how regulatory measures that might be proposed in the future will affect your bottom line, your family and your community. Collecting this information is needed to ensure that national goals, objectives, and requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MFCMA) and other laws are met. Responses to this survey are voluntary, but fishermen who take part in economic studies are protecting their own interests.

The survey will be conducted under a contract issued by the Fisheries Economics Office in the Southeast Regional Office of NOAA Fisheries. A summary report will be developed from this effort, but all individual vessel data is kept strictly confidential as required by Section 402(b) of MFCMA and NOAA Administrative Order 216-100, "Confidentiality of Fishery Statistics."

In developing this survey form, we have tried to ask as few questions as possible. For example, we will be relying on state and federal permit, and US Coast Guard Documentation data for information about your fishing vessel. The public reporting burden for completing this survey is estimated to average two hours.[1]

The survey will be conducted by personal interview. In the next several weeks, an interviewer or the Project Manager will contact you to schedule a time to conduct the personal interview.

We are providing this copy of the survey to you to help you understand the survey and its questions and to prepare for the interview. You may use this form as a worksheet, but it will not be collected.
The survey is divided into two main sections:

Section I asks about the gears you use in your fishing operation and the costs you incur. This information will allow economists from NOAA fisheries to estimate net revenues and crew income in the fishery under current conditions. In the past, limited information was available for these estimates, and regulations were implemented without solid estimates of how the new regulations would directly affect earnings in the fishery. We hope that by gathering this information now, we will gain a new tool to work with industry to help manage the offshore shrimp fishery in a sustainable way that also allows shrimp fishermen to continue earning a living in the Gulf of Mexico shrimp fishery.

Section II asks for information about you, your family, and your crewmembers. These questions will ask about your education level, your household income levels, other jobs you might hold, and your race. This information is necessary to understand your relative dependence on the shrimp fishery, and other opportunities for income generation you or your family members have. Demographic information is being requested so that we can document whether new or existing regulations are balanced in terms of the different groups of fishers they affect, or if they discriminate unfairly against a certain group. Studies of this type, known as

[1] Public reporting burden for this collection of information is estimated to average two hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Dr. Michael Travis, Fisheries Economics Office, Southeast Regional Office, NOAA Fisheries, 9721 Executive Center Drive N., St. Petersburg, FL 33702-2432, (727) 570-5722, email: Mike.Travis@noaa.gov.

"environmental justice" assessments, are required when any new regulation is proposed. This section will also ask information about your crewmembers—in particular about where your crewmembers live, their ages and their ethnicity. Currently very little information is collected about crewmembers. This information will help analysts gain additional understanding about how the fishery contributes to local and regional economies. We recognize that you may not have complete information about your crew, but whatever information you can provide will be very helpful.

Thank you for your cooperation with this important survey effort! If you have any questions, please contact:

Michael D. Travis, Ph.D.
Fisheries Economics Office
NOAA Fisheries
727-570-5335
Mike.Travis@noaa.gov

Note: Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

Contact Documentation

This section is to be completed by the interviewer and the person interviewed. It documents efforts to contact you or your company, and indicates who spoke with whom and when.

Interviewer: ____

This section documents efforts to contact vessel owners that have been randomly selected for this interview. Once this form is begun for a single person, please continue to use it for this individual throughout the contact and interview process. Please add any information as it becomes relevant.

1. Primary Contact Information of Selected Vessel Owner

Please complete with all known information. If additional phone or contact information becomes available, please add notes in the comment sections.

Owner ☐ Designee of Owner ☐

Vessel ID #	Vessel Name	
Last Name	First Name, Initial, Suffix	
Address	City	State, Zip code
Business Phone (area code & number)	Home Phone (area code & number)	Mobile Phone (area code & number)
Fax (area code & number)	Email Address 1	Email Address 2
Comments:		

2. Contact Log

Please complete the log when any attempt to contact the permit holder is made.

Owner ☐ Designee of Owner ☐

Interviewer	Date/Time	Method (phone #, email)	Disposition (e.g. busy signal, refused)

3. Indicate Time and Location for In-Person Interview:

Owner ☐ Designee of Owner ☐

Date/Time Scheduled: ___________________ Location: ______________________________

Final Disposition (e.g. Interview completed, respondent refused, etc.):

____

____

____

4. Additional Comments

Please add any additional comments if relevant.

Section I: Fishing Operations and Costs

This section of the survey form asks questions about the vessel, gear, costs, and crew.

1. Vessel Information

The person interviewed is the (check one):

Vessel Owner ☐ Lessee ☐ Manager ☐ Captain ☐

Other ☐ (Specify: ________________________)

1.1 In order to connect the information on this form to the correct permit and vessel information, and catch information available in other datasets, please verify that the following is correct:

The following weights of landings were measured:

			2000		**2003**	
Vessel Name	US Coast Guard or State Registration #	Heads on/ Heads off	Total landings in Shrimp Fisheries (pounds)	Total gross revenue in Shrimp Fisheries ($)	Total landings in Shrimp Fisheries (pounds)	Total gross revenue in Shrimp Fisheries ($)
		ON	lbs	$	lbs	$
		OFF				
		MIXED				

Interviewer Note: It is preferred to get data separated as heads on and heads off. ONLY fill in the "Mixed" row if the owner cannot provide separate information for each category.

1.2 Please specify the port and state from which this vessel usually was based during the **2003** season: City ________________________________, State____________

Interviewer Note: In this case, this port refers to the one that the operator considered the most likely location (in 2003 only) where the vessel is kept when it is not actively fishing. This may be different from the landings ports. It is assumed that landings ports will be reported in the landings database.

1.3 Did you shrimp in Federal waters (i.e. the EEZ[2]) of the South Atlantic?

In 2000: Yes ☐ No ☐
In 2003: Yes ☐ No ☐

[2] The Exclusive Economic Zone (EEZ) portion of the fishery is from 3 nautical miles outward off of the coasts of East Florida, Georgia, South Carolina, and North Carolina.

1.4 In 2000 and 2003, what was the number of trips and days at sea for this vessel in the offshore shrimp fishery (outside the COLREGS demarcation line[3] or beach) and the inshore shrimp fishery (inside the COLREGS line or beach)?

Year	**2000**			**2003**		
Area	Offshore	Inshore	Total	Offshore	Inshore	Total
# of Trips						
Days at Sea						

Interviewer Note: If the respondent cannot break the number of trips and/or days at sea into inshore and offshore, please request and record the total number of trips and total days at sea.

1.5 How many days at sea did this vessel operate commercially in non-shrimp fisheries during:

2000 __________ **2003 ___________**

1.6 Please specify the following information about your acquisition of this vessel.

Year Purchased	Builder/Brand	Purchase Price ($)
		$

Interviewer Note: Builder and Brand are often indicators of the quality of the vessel. A "Delta" vessel is much different than a "Marco" vessel even though the length and tons may be similar. With this information, it is also possible to correlate values to values listed in trade journals. If the owner does not know, list unknown, or if it was "homemade" list that.

1.7 Not including the purchase price of the vessel, please estimate how much you have further invested in the engines, replacement parts, gear, electronics, etc., since you obtained the vessel.
$_______________________________

Interviewer Note: Refurbishing the vessel so that it is seaworthy and fishable would be part of these expenses. Expenditures on repairs should NOT be included.

1.8 What price do you think you could have gotten for your vessel, including gear and electronics, in 2000? What if you tried to sell it today?

2000 $__________________________today: $_______________________________

Interviewer Note: This is an 'opinion' question. If the respondent says that it is not worth anything, please verify that the value entered is "0". Probe a little. You can ask "could you sell the nets, electronics, etc.?"

1.9 What is the equity (net value) in this vessel now (that is, the estimated amount you would receive above what you owe, if you were to sell it today? *(Can be a negative number)*
$___________________________________

1.10 If you had to buy a brand new vessel today, built and equipped identical to your current vessel, how much do you believe you would have to pay for it?
$___________________________________

[3] The COLREGS comes from the International Regulations for Preventing Collisions at Sea, 1972 (72 COLREGS) and demarks waters inside of the lines as Inland waters (under Inland Rules) and the waters outside the lines are COLREGS (or offshore) waters, where mariners must comply with International Navigation Rules. The line of demarcation is generally expressed in terms of latitude or longitude and appears on most navigation maps.

1.11 How often do you pull your vessel out of the water (dry dock) for hull and other major exterior maintenance?

Once every ☐ years

1.12 What is the typical cost (e.g. railway fees, etc.) for hauling your vessel out of the water, and the ensuing hull maintenance? (Please include costs for cleaning, replacing anodes, and painting and repairing the hull. Please do not include engine repair/replacement in this estimate.)
$________________________________

2. Major Mechanical Systems

Please provide information about the engines, generators, compressors and reduction gear you currently use on the vessel.

Engine Code (See below)	Make/ Model	Installed horse-power or kw	Purchase Price	Year Purchased	Hours used per day	Will your next major cost be an overhaul (O) or replacement (R)	Years until you expect to replace or overhaul	Expected cost when you next invest in this engine.
			$					$
			$					$
			$					$
			$					$
			$					$
			$					$
			$					$
			$					$

Main Engine = 4
Auxiliary Engine = 5
Generator for refrig/ processing= 994
Engine for refrig/ processing = 995
Reduction gear (clutch) = 1000
Compressor = 1001

Interviewer Notes:
(1) Interviewer Note: This covers not just main engines, but all sources of propulsion/power, such as auxiliary engines/generators and diesel engines needed to power the freezer compressors. Some fishermen may have one generator used for everything, and others may have several generators. Engines are generally measured in horsepower (hp) and generators in kilowatts (kw)
(2) Some fishermen may have an auxiliary engine they call a "petter" or "lister," or one they use just to charge batteries.
(3) If there is a separate generator used for lights (or some other purpose), but it is NOT used for refrigeration, write in "aux. generator", and we'll determine if it needs a separate code later.
(4) Engine manufacturers maintain databases that indicate expected fuel use at various horsepower ratings as well as expected overhaul costs and expected hours between overhaul.

3. Trawl Gear Information

The shaded table below lists a set of codes for gear type, net type and mesh type for typical shrimping gears used. Please use the codes in the table to complete the table in the next question.

Code	Gear Type	Code	Net Type	Code	Mesh Type
A	Otter Trawl	I	2 Seam Balloon	S	Nylon
B	Butterfly Net	J	4 Seam Balloon	T	Spectra
C	Cast Net	K	Box	U	Poly
D	Skimmer Net	L	Flat	V	Other (specify)
E	Wing Net	M	Western Jib	W	Other (specify)
F	Roller Frame	N	Add-on Bib		
G	Other (specify)	O	Built-in Bib (e.g. mongoose, cobra, etc.)		
H	Other (specify)	P	Other (specify)		
		Q	Other (specify)		
		R	Other (specify)		

3.1 Using the codes from the table above, please specify the gear owned, gear used, percent of fishing time in 2003, replacement cost, and the typical number of years that the net may be used before it needs to be replaced.

Gear Codes	Net type code	Mesh type code	Headrope length (feet)	Mesh size (inches)	Number On Board	Number Fished/ Towed	Percent of 2003 fishing time (%)	Average cost per net	Average life of net
			ft	in			%	$	
			ft	in			%	$	
			ft	in			%	$	
			ft	in			%	$	
			ft	in			%	$	
			ft	in			%	$	

Percentages should total 100%

Interviewer Note:	***Rough estimates are ok for the last three columns.***

3.2 Please indicate replacement costs and the typical number of years each may be used before it needs to be replaced.

Interviewer Note: If respondent doesn't specify cable types, enter total in Main Cable row and indicate "see Main Cable" in subsequent rows.

Doors	Number of sets on board	Replacement cost per set	Average life (in years)
Aluminum Trawl Doors		$	
Wood Trawl Doors		$	
Other Trawl Door (please specify___________)			
Trynet Doors		$	

Cable	Total length (ft)	Replacement Cost per foot	Average life (years)
Main Cable	ft	$	
Bridle Cable	ft	$	
Trynet Cable	ft	$	
Other (specify)_________________________	ft	$	
Other (specify)_________________________	ft	$	

3.3 In **2003**, what type of BRD (bycatch reduction device) did you use? Indicate the approximate percent of total fishing time by each type used.

Bycatch Reduction Device	Percent of time used	Average cost per unit
☐ Jones-Davis	%	$
☐ Fisheye	%	$
☐ Gulf Fisheye	%	$
☐ Expanded mesh	%	$
☐ Expanded funnel	%	$
☐ None	%	$
☐ Other (please specify) ________________________	%	$

Interviewer Notes:
(1) Note that BRDs were not mandatory in the EEZ off of west Florida prior to 2004. So, they may not have used BRDs on trips within that area.
(2) Interviewers should be sure that percentages add to 100%. If no BRD was used 50% of the time, then put 50% by "none" and indicate percentages by other types.

3.4 Please indicate the type of turtle excluder device (TED) you used by percent of total fishing time in 2003. If you own a particular type of TED but did not use it in 2003, please indicate 0% in time used, but complete the cost information.

☐ Single Grid Hard TEDs

Grid style[1]	grid size (width x height)	opening size	Opening direction	Accelerator Used	Flap length beyond posterior edge of grid	# on board	Cost[2] per unit	% of time used
	☐ 32"x32" minimum outside directions ☐ Other _____"x_____"	☐ 71" ☐ 44" ☐ Double-Cover ☐ Other ______"		☐ Yes ☐ No Size___			$	
	☐ 32"x32" minimum outside directions ☐ Other _____"x_____"	☐ 71" ☐ 44" ☐ Double-Cover ☐ Other ______"		☐ Yes ☐ No Size___			$	
	☐ 32"x32" minimum outside directions ☐ Other _____"x_____"	☐ 71" ☐ 44" ☐ Double-Cover ☐ Other ______"		☐ Yes ☐ No Size___			$	

Opening direction:
A = Top-opening
B = Bottom-opening

Funnel Size:
A = 44"
B = 71"

Flap length:
1= 24" maximum
2 = Less than 24" (specify)
3 = No Flap Used

☐ Parker Soft TEDs

opening type	Flap Used?	number on board	Cost[2] per unit	percent of time used
	☐ Yes ☐ No		$	
	☐ Yes ☐ No		$	

Opening type: 1 = 56" cut
2 = 96" cut

☐ Hooped Hard TEDs

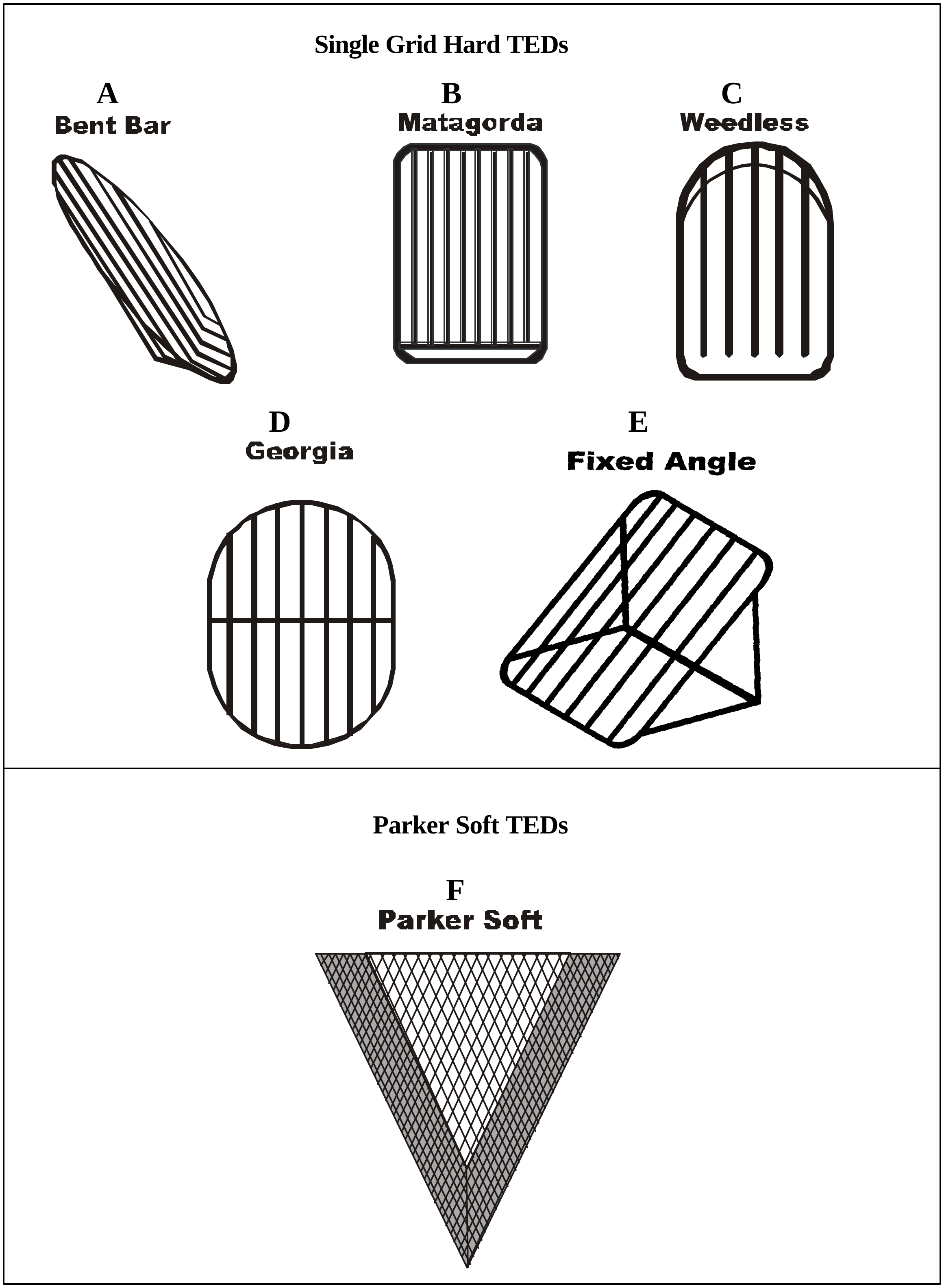
Grid style[1]	Frame size	Opening size	Opening direction	Accelerator Used	Number on board	Cost[2] per unit	percent of time used
	☐ Inshore minimum ☐ Offshore minimum ☐ Other (specify) ______	☐ 71” ☐ 44” ☐ Double-Cover ☐ Other ______”		☐ Yes ☐ No Size_____		$	
	☐ Inshore minimum ☐ Offshore minimum ☐ Other (specify) ______	☐ 71” ☐ 44” ☐ Double-Cover ☐ Other ______”		☐ Yes ☐ No Size_____		$	
	☐ Inshore minimum ☐ Offshore minimum ☐ Other (specify) ______	☐ 71” ☐ 44” ☐ Double-Cover ☐ Other ______”		☐ Yes ☐ No Size______		$	
			Opening direction: A = Top-opening B = Bottom-opening		Funnel Size: A = 44” B = 71”	Total for all TED use should equal 100%. ________	

SEE FIGURES on NEXT PAGES

Notes:
[1]See diagram
[2]Include cost of installing the TED

Interviewer Note: Remember, this asks about TEDs used in 2003, after the rules changed. In last column, be sure that percentages add to 100%.

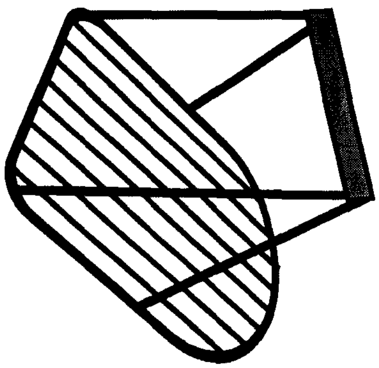
Figure 1. Common Turtle Excluder Devices



Hooped Hard TEDs

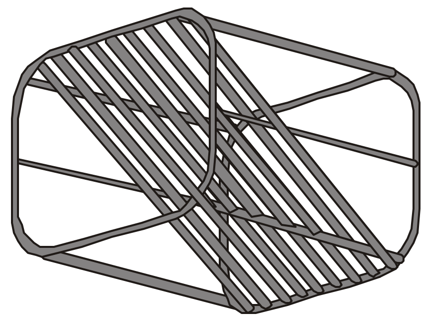
G

Coulon



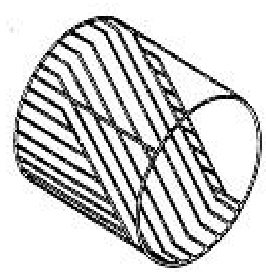
H

NMFS



I

Cameron



4. Electronics

4.1 In the list below, please check off the types of electronic equipment (either in the wheelhouse or mounted on the gear) that were on-board your vessel in 2003.

If your vessel had more than one unit of a particular type of equipment, please write in the number of units. Note that this list contains types of equipment that may not be presently used in the South Atlantic shrimp fishery, but are used in other fisheries for which this type of information is being collected.

Item	Code	Total Number of units (including backups)	Average purchase cost per unit	Average replacement cost per unit
☐ Cell phone	907		$	$
☐ VHF radio	909		$	$
☐ CB Radio	1010		$	$
☐ Single sideband radio	927		$	$
☐ Satellite phone	1011		$	$
☐ Fax	904		$	$
☐ Plotter	1012		$	$
☐ Computer (including software)	925		$	$
☐ Printer	920		$	$
☐ Hailer (Boat intercom)	1013		$	$
☐ Loran	901		$	$
☐ Vessel Tracking System	908		$	$
☐ Radar	902		$	$
☐ Global Positioning System (GPS)	906		$	$
☐ Auto Pilot	922		$	$
☐ EPIRB	1014		$	$
Echo Sounder/Depth Recorder paper ☐ video ☐ digital ☐	903		$	$
☐ Electronic Compass	916		$	$
☐ Satellite Navigation System (SatNav)	919		$	$
☐ Radio Direction Finder	928		$	$
☐ Weather Satellite Receiver	917		$	$
☐ Wind Meter	918		$	$
☐ Net Pingers	946		$	$
☐ Temperature Profiling System	926		$	$
☐ Water Temperature Sensor	939		$	$
☐ Single direction sonar	913		$	$
☐ Multiple direction sonar	914		$	$
☐ Water salinity Sensor	943		$	$
☐ Other (specify)_____________________	1015		$	$

4.2 Please estimate the total cost of electronics equipment you realistically expect to spend over the next five years.

$______________________

5. Annual and Variable Costs

Please fill out the table below indicating the annual costs to your vessel for the 2000 and 2003 season. Please include all costs including those costs shared by the crew. Do not include replacement costs. Reminder: Your individual responses will remain confidential.

Operating Costs of Vessel		**2000 Estimate**	**2003 Estimate**
5.1	Fuel (total cost including amounts paid by crewmembers)	$	$
5.1.1	How much fuel was purchased (gallons)		
5.1.2	What was the average price per gallon paid for fuel ($/gallon) ***Interviewer Note: For the above three questions, one value may be calculated. Check to be sure that it makes sense and that the respondent agrees with that value.***	$	$
5.2	Oil and lubricants	$	$
5.3	Groceries (total cost including amounts paid by crewmembers)	$	$
5.4	Total packing costs, if any (if none, enter zero)	$	$
5.5	Total payments to captain (including bonuses	$	$
5.6	Total payments to crewmembers (excluding captain, but include any bonuses)	$	$
5.7	Payroll Taxes	$	$
5.8	Insurance premiums (check appropriate boxes, and provide total cost). ☐ Hull ☐ Protection & Indemnity (P & I) Insurance ☐ Health/Medical Insurance ☐ Other Insurance: (Specify)______________________	$	$
5.9	Utilities (e.g. dock electricity)	$	$
5.10	Misc. Marine Hardware & Supplies (stay wire cable, line, etc.)	$	$
5.11	Dock or Mooring Fees	$	$
5.12	Cost of leases of property adjacent to dock (if any)	$	$
5.13	Repair & Maintenance: Electronics (Please, no replacement costs)	$	$
5.14	Repair & Maintenance: Gear (e.g. net repairs, trawl door repairs. (Please no replacement costs)	$	$
5.15	Annual repair & maintenance: Hull, Engine, Reduction gear. (e.g. filters. Please do not include costs from question 1.11 or 1.12) ***Interviewer Note: The fisherman may lump the costs of 5.13, 5.14, and 5.15 together. If this is the case, please note this in the margin or on page 2.***	$	$
5.16	Depreciation Charges . Check the depreciation method used (one box only) ☐ MACRS 1 ☐ Declining Balance 3 ☐ Straight Line 2 ☐ Sum-of-the-Year's Digits 4 ☐ Other 5 (specify ______________________________________)	$	$
5.17	Cost of State or Federal Licenses/Regulatory Fees ***Interviewer Note: Include Coast Guard inspection fees and state and federal vessel registration and licenses, export/import fees, etc. Do not include fines as these are not assumed to be repeated expenses.***	$	$
5.18	Property Tax Paid (Related to this vessel only)	$	$
5.19	Professional Fees (Surveyor, Accountant, Lawyer, Association dues, etc)	$	$
5.20	Vessel management fee, if applicable	$	$
5.21	Vessel and other long-term fishing related loans—principal and interest	$	$

Operating Costs of Vessel	**2000 Estimate**	**2003 Estimate**
Interviewer Note: An example is the loan used to purchase the vessel. In this case ask for both principal and interest payments.		
5.22 Annual Operating and other short-term fishing related loan **interest** ***Interviewer Note: An example of a short-term loan is one in which the buyer lends annual operating expenses to the Owner at the beginning of the year. In this case the interviewer should not include the principal of the loan only the interest. (Because it is a short term operating loan, the expenses it covers are included in other costs collected in this survey.***	$	$
5.23 Vehicle expenses used in fishing operations (depreciation, gas, etc.)	$	$

5.24 If you iced your shrimp what was the…
Price for ice: 2000: $________/unit 2003: $________/unit.

Choose unit: Block (B) ☐ Bar (R) ☐ Pounds (P) ☐
(Blocks and Bars are 300 pound units)

Quantity of units used in 2000:_____________
Quantity of units used in 2003:_____________

5.25 If you froze your shrimp, what was the cost for maintaining your freezing equipment (including Freon) in:

2000 $___________________ 2003 $___________________

5.26 For either ice or freezer operations, what was the cost of salt and other freezing supplies (including sodium bisulfate) in:

2000 $___________________ 2003 $___________________

5.27 Please describe any other annual expenses in **2000** not already included.
2000 expense amount $ _________

Description of expense____

____

____

5.28 Please describe any other annual expenses in **2003** not already included.
2003 expense amount $ _________

Description of expense____

____

____

6. Net Revenue

6.1 Please indicate this vessel's **NET** revenue for 2000 and 2003, excluding any crew or captain's share to you (value could be negative).

2000 $___________________ 2003 $___________________

6.2 Please indicate the net revenue from other activities for this fishing vessel in 2000 and 2003. Include other non-shrimp commercial fishing, charter fishing, and non-fishing activities, but only **NET** revenue derived using **THIS** vessel.

2000 $___________________ 2003 $___________________

Interviewer Note: The interviewer should be sure that numbers provided are net revenues NOT gross revenues. The answer for 6.1 is all inclusive (should include any revenue listed in 6.2).

7. Vessel Owner, Crewmembers and Crew Compensation

These questions are asking about your current situation, today.

7.1 Please indicate the owner's relationship to the vessel and the captain.

Owner's Relationship to **Vessel**	**Check One**
Owner owns 100% of vessel.	
Owner owns 50% or more of the vessel, but less than 100%	
Owner owns 10% or more of vessel but less than 50%	
Owner owns less than 10% of vessel	
Owner leases the vessel	
Other (specify)	

Owner's Relationship to **Captain**	**Check One**
Owner is always captain	
Owner is captain 50% or more of trips, but less than 100%.	
Owner is captain 10% or more of trips, but less than 50%.	
Owner is captain less than 10% of trips.	
Owner is never the captain or crew.	
Other (specify)	

7.2 Do you own other fishing vessels? Yes ☐ No ☐

If yes, how many vessels? ☐ (enter number)
Please identify these vessels.

Vessel name	US Coast Guard or State Registration #

7.3 Including the captain, how many crewmembers do you use on an average trip? _______

7.4 How does your crew change if you are expecting a larger than normal catch?

(fill in number): + ☐ crewmember

7.5 Do crewmembers **currently** pay shares of any variable cost items?

Yes ☐ No ☐

If yes, please complete the following table. As an example, if the boat pays 25% of the fuel and each of the five crewmembers split the remaining 75 %, then enter 25% for the boat share and 75 % for the crew share.

Please Check off which apply (v)	**Variable Cost Item**	**Total Boat share (%)**	**Total Crew Share (%)**
	Groceries	%	%
	Fuel	%	%
	Ice	%	%
	Other, (please specify)____________________	%	%
	Other, (please specify)____________________	%	%
	Other, (please specify)____________________	%	%

Interviewer Note: If an item is not shared by the crew, enter 100 under boat share and 0 under crew share.

7.6 Please describe your **current** crew including the captain.

Please specify if the share is a percent of GROSS ______ or NET ______ revenue (check only one).

Position (specify)	Years of commercial fishing experience	Typical crew share for this position—percent of gross or net revenue.	Typical piecemeal pay for this position. (specify $ per box)	City, State, & Country where crewmember lives	Is the crewmember a member of the Owner's family (Check if Yes)
			$		
			$		
			$		
			$		
			$		
			$		
			$		

Interviewer Note: Interviewer should enter either a crew share OR a piecemeal rate in each row. Please remember to check whether the owner calculates the share as a percent of GROSS or NET REVENUE (above the box). If the crew member is paid a piece-meal rate, please be sure to enter the units (i.e. 'per box').

7.7 If the vessel owner is not a member of the crew, please indicate the number of years the owner has been involved in commercial fishing. ______________

7.8 Did your crew receive some type of bonus in 2000?

Yes ☐ No ☐

If yes please indicate that total bonus amount paid for the 2000 fishing year.
$_________________________

7.9 Did your crew receive some type of bonus in 2003?

Yes ☐ No ☐

If yes please indicate that total bonus amount paid or expected to be paid for the 2003 fishing year. $___________________________

Section II. Owner or Designee and Crewmember Demographics

This section collects demographic information about the Owner or Owner's designee and crewmembers.
Reminder: Your individual responses will remain confidential.

8. Owner or Designee Information

8.1 Please indicate your age __________

8.2 Please indicate your marital status.

____Married ____Single ____Divorced ____Widowed

____Other (specify)______________________

8.3 Please indicate the number of persons in your household (do not include paid borders/renters) _______________

8.4 Please indicate the highest degree or level of school the owner has completed .

_____No schooling completed	_____High School Graduate (Diploma/GED)
_____Nursery school to 4th grade	_____Some college credit, less than 1 year
_____5th or 6th grade	_____1 or more years of college, no degree
_____7th or 8th grade	_____Associate's degree (ex: AA, AS)
_____9th grade	_____Bachelor's degree (ex: BA, AB, BS)
_____10th grade	_____Master's degree (ex: MA, MS, MEng, MEd, MSW, MBA)
_____11th grade	_____Professional degree (ex: MD, DDS, DVM, LLB, JD)
_____12th grade, No Diploma	_____Doctorate degree (ex: PhD, EdD)

8.5 Are you Spanish/Hispanic/Latino?

______Yes ______No

Interviewer Note: If the respondent indicates no, please go to the next question.

If Yes, is the Owner Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) _______________________

8.6 What is the race of the Owner: Check/specify one or more

____White
____Black, African American, or Negro
____American Indian or Alaska Native (Specify enrolled or principal tribe)____________
____Native Hawaiian
____Guamanian or Chamorro
____Samoan
____Other Pacific Islander (Specify)__________
____Asian Indian
____Chinese
____Filipino
____Japanese
____Korean
____Vietnamese
____Other Asian (Specify) _____________

8.7 Do you speak a language other than English at home?
______Yes ______No

8.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

8.8 Please indicate your religious affiliation. Indicate none if not religious. ________________

8.9 In addition to managing and/or operating this shrimp vessel, what other employment or work do you do? ________________________________

Interviewer Note: Interviewer should be certain not to include any other jobs or activities conducted on the vessel as specified in Question 6.2

8.9.1 During which months of the year do you normally do this other work?____

8.10 Please check the total income for your household.

_____Less than $10,000
_____$10,000 to $14,999
_____$15,000 to $24,999
_____$25,000 to $34,999
_____$35,000 to $49,999
_____$50,000 to $74,999
_____$75,000 to $99,999
_____$100,000 to $149,999
_____$150,000 to $199,999
_____$200,000 or more

9. Information about Crewmember Number 1

Interviewer Note: The intent here is to get as much information about CURRENT crewmembers as possible from respondent. Do not attempt to get information directly from the crewmembers. In collecting this information the Interviewer should stress that the person providing the information should do so only if they are reasonably certain about the information.

9.1 Position ______________

9.2 Please indicate the approximate age of crewmember __________

9.3 If known, please indicate marital status of crewmember.

____Married ____Single ____Divorced ____Widowed

____Other (specify)____________ ____Unknown

9.4 If known, please indicate crewmember's level of education.

_____Unknown _____Some College

_____No High School Diploma _____College Graduate

_____High School Graduate _____Graduate School

9.5 Is the crewmember Spanish/Hispanic/Latino?

______Yes ______No ______Unknown

If Yes, is the crewmember Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) _______________________

9.6 What is the race of the crewmember: Check/specify one or more

____White ____Asian Indian

____Black, African American, or Negro ____Chinese

____American Indian or Alaska Native (Specify enrolled or principal tribe)____________ ____Filipino

____Native Hawaiian ____Japanese

____Guamanian or Chamorro ____Korean

____Samoan ____Vietnamese

____Other Pacific Islander (Specify)__________ ____Other Asian (Specify) _____________

9.7 If known, does the crewmember speak a language other than English at home? ______Yes ______No ______Unknown

9.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

9.8 If known, please indicate the crewmember's religion. Indicate none if not religious, and unknown if you are not reasonably certain. ___________________

10. Information about Crewmember Number 2

10.1 Position ______________

10.2 Please indicate the approximate age of crewmember __________

10.3 If known, please indicate marital status of crewmember.

____Married ____Single ____Divorced ____Widowed

____Other (specify)____________ ____Unknown

10.4 If known, please indicate crewmember's level of education.

_____Unknown _____Some College

_____No High School Diploma _____College Graduate

_____High School Graduate _____Graduate School

10.5 Is the crewmember Spanish/Hispanic/Latino?

______Yes ______No ______Unknown

If Yes, is the crewmember Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) ______________________

10.6 What is the race of the crewmember: Check/specify one or more

____White ____Asian Indian

____Black, African American, or Negro ____Chinese

____American Indian or Alaska Native (Specify enrolled or principal tribe)____________ ____Filipino

____Native Hawaiian ____Japanese

____Guamanian or Chamorro ____Korean

____Samoan ____Vietnamese

____Other Pacific Islander (Specify)__________ ____Other Asian (Specify) _____________

10.7 If known, does the crewmember speak a language other than English at home? ______Yes ______No ______Unknown

10.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

10.8 If known, please indicate the crewmember's religion. Indicate none if not religious, and unknown if you are not reasonably certain. __________________

11. Information about Crewmember Number 3

11.1 Position ______________

11.2 Please indicate the approximate age of crewmember __________

11.3 If known, please indicate marital status of crewmember.

____Married ____Single ____Divorced ____Widowed

____Other (specify)____________ ____Unknown

11.4 If known, please indicate crewmember's level of education.

_____Unknown _____Some College

_____No High School Diploma _____College Graduate

_____High School Graduate _____Graduate School

11.5 Is the crewmember Spanish/Hispanic/Latino?

______Yes ______No ______Unknown

If Yes, is the crewmember Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) _______________________

11.6 What is the race of the crewmember: Check/specify one or more

____White ____Asian Indian

____Black, African American, or Negro ____Chinese

____American Indian or Alaska Native (Specify enrolled or principal tribe)____________ ____Filipino

____Native Hawaiian ____Japanese

____Guamanian or Chamorro ____Korean

____Samoan ____Vietnamese

____Other Pacific Islander (Specify)__________ ____Other Asian (Specify) _____________

11.7 If known, does the crewmember speak a language other than English at home? ______Yes ______No ______Unknown

11.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

11.8 If known, please indicate the crewmember's religion. Indicate none if not religious, and unknown if you are not reasonably certain. ___________________

12. Information about Crewmember Number 4

12.1 Position ______________

12.2 Please indicate the approximate age of crewmember __________

12.3 If known, please indicate marital status of crewmember.

____Married ____Single ____Divorced ____Widowed

____Other (specify)____________ ____Unknown

12.4 If known, please indicate crewmember's level of education.

_____Unknown _____Some College

_____No High School Diploma _____College Graduate

_____High School Graduate _____Graduate School

12.5 Is the crewmember Spanish/Hispanic/Latino?

______Yes ______No ______Unknown

If Yes, is the crewmember Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) ______________________

12.6 What is the race of the crewmember: Check/specify one or more

____White ____Asian Indian

____Black, African American, or Negro ____Chinese

____American Indian or Alaska Native (Specify enrolled or principal tribe)____________ ____Filipino

____Native Hawaiian ____Japanese

____Guamanian or Chamorro ____Korean

____Samoan ____Vietnamese

____Other Pacific Islander (Specify)__________ ____Other Asian (Specify) _____________

12.7 If known, does the crewmember speak a language other than English at home? ______Yes ______No ______Unknown

12.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

12.8 If known, please indicate the crewmember's religion. Indicate none if not religious, and unknown if you are not reasonably certain. ___________________

13. Information about Crewmember Number 5

13.1 Position ______________

13.2 Please indicate the approximate age of crewmember __________

13.3 If known, please indicate marital status of crewmember.

____Married ____Single ____Divorced ____Widowed

____Other (specify)____________ ____Unknown

13.4 If known, please indicate crewmember's level of education.

_____Unknown _____Some College

_____No High School Diploma _____College Graduate

_____High School Graduate _____Graduate School

13.5 Is the crewmember Spanish/Hispanic/Latino?

______Yes ______No ______Unknown

If Yes, is the crewmember Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) ______________________

13.6 What is the race of the crewmember: Check/specify one or more

____White ____Asian Indian

____Black, African American, or Negro ____Chinese

____American Indian or Alaska Native (Specify enrolled or principal tribe)____________ ____Filipino

____Native Hawaiian ____Japanese

____Guamanian or Chamorro ____Korean

____Samoan ____Vietnamese

____Other Pacific Islander (Specify)__________ ____Other Asian (Specify) _____________

13.7 If known, does the crewmember speak a language other than English at home? ______Yes ______No ______Unknown

13.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

13.8 If known, please indicate the crewmember's religion. Indicate none if not religious, and unknown if you are not reasonably certain. ___________________

14. Information about Crewmember Number 6

14.1 Position ______________

14.2 Please indicate the approximate age of crewmember __________

14.3 If known, please indicate marital status of crewmember.

____Married ____Single ____Divorced ____Widowed

____Other (specify)____________ ____Unknown

14.4 If known, please indicate crewmember's level of education.

_____Unknown _____Some College

_____No High School Diploma _____College Graduate

_____High School Graduate _____Graduate School

14.5 Is the crewmember Spanish/Hispanic/Latino?

______Yes ______No ______Unknown

If Yes, is the crewmember Mexican, Mexican Am., Chicano: _____
Or Puerto Rican: _____
Or Cuban: _____
Or Other Spanish/Hispanic/Latino (specify) _______________________

14.6 What is the race of the crewmember: Check/specify one or more

____White ____Asian Indian

____Black, African American, or Negro ____Chinese

____American Indian or Alaska Native (Specify enrolled or principal tribe)____________ ____Filipino

____Native Hawaiian ____Japanese

____Guamanian or Chamorro ____Korean

____Samoan ____Vietnamese

____Other Pacific Islander (Specify)__________ ____Other Asian (Specify) _____________

14.7 If known, does the crewmember speak a language other than English at home? ______Yes ______No ______Unknown

14.7.1 If yes, what is this language? (For example: Spanish, Vietnamese, French, Korean, Italian) ______________

14.8 If known, please indicate the crewmember's religion. Indicate none if not religious, and unknown if you are not reasonably certain. ___________________