FORM CD-450 (REV 01/09) U. S. DEPARTMENT OF COMMERCE	☐ GRANT ☒ COOPERATIVE AGREEMENT
FINANCIAL ASSISTANCE AWARD	AWARD NUMBER **NA09NMF4540135**
RECIPIENT NAME Gulf and South Atlantic Fisheries Foundation, Inc.	
STREET ADDRESS 5401 W. Kennedy Blvd., Suite 740	FEDERAL SHARE OF COST $384,150.00
CITY, STATE, ZIP CODE Tampa FL 33609-2447	RECIPIENT SHARE OF COST $0.00
AWARD PERIOD 08/01/2009-07/31/2010	TOTAL ESTIMATED COST $384,150.00
AUTHORITY 16 U.S.C. 661; 16 U.S.C. 742(f)	
CFDA NO. AND PROJECT TITLE 11.454 Continuation of a Project to Augment the Data Collection of an Electronic Logbook System Used Within the Gulf of Mexico Shrimp Fishery	

This award offer approved by the Grants Officer constitutes an obligation of Federal funding. By accepting this award offer, the Recipient agrees to comply with the award Terms and Conditions checked below. If this was a paper issued award offer, please send two signed documents to the Grants Officer and retain one set of signed award documents for your files. If this award offer is not accepted without modification within 30 days of receipt, the Grants Officer may unilaterally withdraw this award offer and de-obligate the funds.

- ☐ Department of Commerce Financial Assistance Standard Terms and Conditions
- ☒ Government Wide Research Terms and Conditions
- ☒ Bureau Specific Administrative Standard Award Conditions
- ☒ Award Specific Special Award Conditions
- ☒ Line Item Budget
- ☒ 15 CFR Part 14, Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, Other Non-Profit, and Commercial Organizations
- ☐ 15 CFR Part 24, Uniform Administrative Requirements for Grants and Agreements to States and Local Governments
- ☐ OMB Circular A-21, Cost Principles for Educational Institutions
- ☐ OMB Circular A-87, Cost Principles for State, Local, and Indian Tribal Governments
- ☒ OMB Circular A-122, Cost Principles for Non-Profit Organizations
- ☐ 48 CFR Part 31, Contract Cost Principles and Procedures
- ☒ OMB Circular A-133, Audits of States, Local Governments, and Non-Profit Organizations
- ☒ Department of Commerce Pre-Award Notification Requirements for Grants and Cooperative Agreements REF: 73 FR 7696 (February 11, 2008).
- ☒ Other(s) 73 FR 40052 (07/11/08)

SIGNATURE OF DEPARTMENT OF COMMERCE GRANTS OFFICER	TITLE	DATE
Alan Conway	Grants Officer	06/15/2009
TYPE NAME AND SIGNATURE OF AUTHORIZED RECIPIENT OFFICIAL	TITLE	DATE
Judy Jamison		07/22/2009

COOPERATIVE RESEARCH PROJECT SUMMARY

Project Title: Continuation of a Project to Augment the Data Collection of an Electronic Logbook System Used Within the Gulf of Mexico Shrimp Fishery

Project Status/Duration: June 1, 2009 – May 31, 2010 New __X__ Cont'd _____ Project Period: 12 Months

Name, Address, and Telephone Number of Applicant:
Gulf & South Atlantic Fisheries Foundation, Inc.
Lincoln Center, Suite 740
5401 W. Kennedy Blvd.
Tampa, FL 33609-2447
(813) 286-8390

Principal Investigator(s) and Brief Statement of Qualifications:

Ms. Judy Jamison; Over 28 years administrative and grants management experience.
Dr. Michael Jepson; Over 21 years experience in social impact assessment and grants management.

Project Objectives:

(1) Complement the current ELB study with onboard observers to collect data on fishing effort, red snapper bycatch, and shrimp landings within the Gulf of Mexico; (2) Analyze all observer collected data to further ensure that ELB landings estimates are accurate and defensible; and (3) Determine the spatiotemporal abundance of juvenile red snapper, compute a total mortality (Z) estimate for shrimp-trawl red snapper bycatch, and conduct a formal cohort analysis (VPA) on all observer collected red snapper data; 4) Provide improved data collection on the extent of bycatch of small coastal sharks in the Gulf shrimp fishery.

Specific Priority(ies) in Solicitation to Which Project Responds:

1. Finfish, **a.** Characterize the total catch (from all fleets affecting the stocks), including catch composition and disposition of catch. **(2)** Investigations are needed to determine more efficient methods to record effort accurately on a real-time basis during fishing operations; **(4)** Projects are needed to utilize fully scientific observers on-board vessels as a means of collecting detailed catch, effort and disposition data.

4. Commercial Shrimp Harvest, Quantification of Effort: Research is needed to improve shrimp effort data.

Summary of Work:

The dynamics of the red snapper fishery are complex and various user groups are thought to impact the stock. As such, disagreement has existed regarding the mortality, age composition, and monthly distribution of juvenile trawl-caught red snapper. Furthermore, recent assessments of blacknose shark suggest significant mortality from bycatch in the Gulf shrimp fishery. To alleviate this confusion, the Foundation proposes the continuation of a program to augment a currently funded ELB project with fishery observers. The current program (funded through Coop. Agree. No. NA05NMF4540044) has expended its compliment of sea-days. To allow for the continued gathering of observer collected data aboard vessels that have an ELB, additional at-sea days are necessary. As before, fishery observers will be placed aboard shrimp trawl vessels that have been randomly selected and have an ELB installed. Observers will collect data on total penaeid shrimp and red snapper catch and small coastal shark (i.e., no sub-samples will be taken). Data collected during this project will be used to update the formal cohort analysis (VPA) and compute mortality estimates for all Foundation collected red snapper bycatch data (both past and present). Results will be used to validate ELB landings estimates by region (statistical zone), quantify red snapper and small coastal shark bycatch rates, and to assist fisheries managers in the assessment of the both stocks.

Project Funding:		
	Federal	$384,150
	Non-Federal	$ 0
	Total	**$384,150**

Project Title:

Continuation of a Project to Augment the Data Collection of an Electronic Logbook System Used Within the Gulf of Mexico Shrimp Fishery

Applicants Name:

Gulf & South Atlantic Fisheries Foundation, Inc.
Judy Jamison, Executive Director

Proposed Budget period:

June 1, 2009 – May 31, 2010

Introduction:

The Gulf and South Atlantic Fisheries Foundation is currently conducting research to augment the collection of data through the use of electronic logbooks with observers in the Gulf of Mexico Shrimp Fishery through Cooperative Agreement No.NA05NMF4540044 which ends in December 2008. This proposal is to continue that project which has produced important results with regard to the red snapper stock assessment (Gazey et al. {In Press} 2008). Of significance, is the estimated natural mortality of age-0 fish obtained from this research that is almost double of that used in the recent SEDAR 7. These results are awaiting peer review; nevertheless, the results underscore the need for increased data collection for red snapper and other species. This is especially true for small coastal sharks which are currently undergoing management review. Recent information suggests that blacknose shark (*Carcharhinus acronotus*) is overfished and that there is substantial bycatch in the Gulf shrimp fishery (NMFS, 2007b). Some of these figures are disputed and will be addressed by this research through the collection of information on the bycatch of small coastal sharks. Furthermore, results from a recent review of historic BRD data under MARFIN Award NA07NMF4330125 which includes data from Foundation projects should have important implications regarding BRD testing protocols. The following discussion provides a background for this research and previous efforts to collect data through the use of electronic logbooks in the Gulf shrimp fishery. The preliminary results of the Foundation research are also discussed.

Fish stocks with commercial and recreational value are typically managed via the regulation of fishing mortality to maintain a sustainable harvest (Hilborn and Walters 1992). Because the red snapper (*Lutjanus campechanus*) stock of the Gulf of Mexico is classified as overfished, the National Marine Fisheries Service (NMFS/NOAA Fisheries) has regulated the directed (commercial and recreational) red snapper fisheries to reduce mortality of large fish (size and trip limits, closed seasons, etc.). To reduce the fishing mortality of small juvenile fish, the NMFS has also regulated the shrimp trawl fishery of the Gulf of Mexico; a fishery that is thought to bottleneck adult populations. Disagreement has existed regarding the magnitude, age composition, and monthly distribution of shrimp trawl red snapper bycatch in time and space (Goodyear 1995; Schirripa and Legault 1997, 1999; Gallaway *et al.* 1998; Gallaway and Cole

1999; Ortiz *et al.* 2000). However, better and more complete observer data have provided the basis for reaching agreement (e.g., NMFS 2004).

Estimates of red snapper bycatch are directly dependent upon estimates of shrimp fishing effort. Historically, port agents have collected shrimp landings and value data from dealer records. Fishing effort data are collected by port agents through detailed interviews with fishing vessel captains and/or crew. Interview data provides resolution on shrimp fishing effort at the trip level. Due to the large number of shrimp fishing trips occurring within the Gulf of Mexico, a comprehensive survey of the shrimp fleet is not feasible and subsampling occurs. Monthly, port agents visit all shrimp dealers within their region and collect landings information for individual fishing trips. Port agents then subsample these trips by randomly selecting interviewees to obtain further information regarding effort and catch location (Nance 2004).

NMFS, historically, has not directly measured shrimp fishing effort, catch, or length-frequency data on commercial shrimp trawl red snapper bycatch. These estimates are derived through indirect approaches or modeling, thus adding to the contention of the red snapper bycatch issue. Inaccuracies in trip interviews, time fished, or reported catch data can result in skewed fishing effort calculations (Nance 2004) and biases in the assessment of the red snapper stock (NMFS 2004).

At least three possible solutions exist to resolve the current inaccuracies inherent with shrimp fishing effort data: 1) Have the fishing vessel captain maintain a tow-by-tow paper logbook; 2) Place observers on fishing vessels to maintain paper logbooks; or 3) Utilize electronic logbooks (ELB) to record the time, date, and location of fishing activities. Each of these three solutions has associated advantages and disadvantages.

Commercial fishermen are typically wary of collecting data for use by fisheries managers and are sometimes concerned that the collected data will be used against them to implement further management regulations. Asking, or mandating, fishermen to collect fishing effort data would be the most inexpensive option, but such data may be unreliable, necessitating the use of other data collection methods.

Placing observers on fishing vessels would be the optimal method to collect fishing effort data. Observers are unbiased with regard to effort data collection and can further augment the collection of data by recording the abundance and length-frequency of shrimp trawl red snapper bycatch. The overwhelming disadvantage to utilizing observers in a multi-year program, covering at least a significant portion of the shrimp fishing fleet, would be expensive (on the order of tens of millions of dollars).

The advantages of implementing an ELB system are that the device is passive, small, and it accurately and autonomously records data. Shortcomings of the ELB system include a lack of ancillary data collection and the price of the device will, most likely, be passed on to fishermen. The most appropriate and effective resolution to estimate fishing effort and bycatch would be to combine all, or part, of these solutions.

In 1998, the U.S. Congress appropriated funds to the Gulf and South Atlantic Fisheries Foundation, Inc. (Foundation) to conduct a three-year research study to enable the fishing industry to evaluate and address fishery management issues including the estimation of shrimp fishing effort and bycatch. A portion of these funds were granted to LGL Ecological Research Associates, Inc. (LGL) to allow the research and development of an electronic logbook to directly measure shrimp fishing effort thereby reducing the dependence on modeling to provide better estimates of shrimp fishing effort and red snapper bycatch. Over the course of LGL's 3 year pilot study, ELB systems were developed and placed onboard commercial shrimp fishing vessels to collect fishing effort data (see below).

To augment the data collection, both paper logbooks and observers were utilized to collect shrimp landings and red snapper bycatch data on a tow-by-tow basis. Results from this study indicated that the ELB system accurately estimated the fishing practices of a vessel on a per trip basis (see below) and that individual tows could be identified. Combining the ELB data with paper logbooks and observer collected landings data, it was demonstrated that total vessel landings (on a per trip basis) could be divided accurately on a tow-by-tow basis and allocated to specific statistical zones. Of the 135 trips where ELBs recorded effort data, port agents collected data on 62 of these trips. A comparison of the ELB and port agent data allowed for a direct comparison of fishing effort estimation methodologies (i.e. NMFS/State port agent data vs. ELB data). This analysis indicated that a directional bias exists and that port agent data overestimated effort in midshore regions (areas abundant in juvenile red snapper; between 10-30 fathoms) while underestimating effort in offshore and nearshore regions (areas where juvenile red snapper abundance is low; 30+ fathoms and 0-10 fathoms, respectively). These studies proved that an ELB system was accurate at recording shrimp-trawl fishing effort and estimating and allocating landings data (Gallaway 2001, 2003a, and 2003b).

Based upon the results derived from the above-mentioned studies and recommendations made by the SEDAR-7 Shrimp Fleet Bycatch Working Group (NMFS 2004), LGL was granted money by the NMFS to further expand the ELB program within the shrimp fishery in the Gulf of Mexico. The project, entitled "Estimation of Shrimp Fishing Effort in the Gulf of Mexico: Phase 1 and Phase 2 Implementation," was designed to capture accurate estimates of shrimp-trawl fishing effort from the construction and installation of 150 ELBs on a random and representative sample of the shrimp fishing fleet operating in the Northern Gulf of Mexico. To date, there have been approximately 450 ELBs placed aboard Gulf shrimp fishing vessels. Although the data collected during the ELB study will be invaluable to fishermen and fisheries managers in resolving effort related questions, no red snapper bycatch and shrimp landings data are collected. To continue to augment this study and make the results more robust, the Gulf & South Atlantic Fisheries Foundation, Inc. proposes to continue this program for another year. Importantly, this will increase the data available to verify models used by scientists to compute red snapper bycatch levels within the fishery.

The results of the most recent SEDAR 7 stock assessment indicate that shrimp trawl bycatch is still a source of fishing mortality for the red snapper stock within the Gulf of Mexico. Because an accurate estimate of red snapper shrimp trawl bycatch within the Gulf of Mexico is not fully known that information will be enhanced with fishery observers placed aboard vessels with ELBs.

The most recent stock assessment for small coastal sharks, SEDAR 13 suggests that blacknose shark are overfished and that overfishing is occurring, but there are some concerns about certain aspects of the assessment as evidenced by this quote: "However, because of uncertainties in indices, catches and life history parameters, the status of blacknose shark could change substantially in the next assessment in an unpredictable direction" (NMFS, 2007b: 2). One of those concerns is the extent of blacknose shark bycatch in the Gulf shrimp fishery. Including small coastal shark in the data collection protocol will enhance the assessment data regarding these species.

More specifically, this project aims to:

1) Complement the current ELB study with onboard observers to collect data on fishing effort, red snapper bycatch, and shrimp landings within the Gulf of Mexico;

2) Analyze all observer collected data to further ensure that ELB landings estimates are accurate and defensible;

3) Determine the spatiotemporal abundance of juvenile red snapper, compute a total mortality (Z) estimate for shrimp-trawl red snapper bycatch, and conduct a formal cohort analysis (VPA) on all observer collected red snapper data; and

4) Provide improved data collection on the extent of bycatch of small coastal sharks.

Materials and Methods:

ELB Description:

Hardware:

The LGL Electronic Logbook was developed to track the fishing effort of shrimp trawlers operating within the Northern Gulf of Mexico. The ELB system is currently in version 4.0 and each version has increased the systems functionality. Data formats and software have been altered to complement the ELB system and allow for all data formats to be read. A brief description of each ELB version is discussed below.

Version 1.0-1.6 – This is the original version of the LGL ELB and the only version which has been used within the Gulf of Mexico shrimp fishery. Hardware engineering was based upon the Parallax Basic Stamp II™ microprocessor, and utilized the Microchip PIC16C57 microcontroller. The Basic Stamp II is programmed in PBASIC, a language based on a subset of the BASIC computer language. This ELB version included two external EEPROM memory chips (non-volatile Microchip 24LC256) which were mounted on the same printed circuit board as the microprocessor. To receive positional data, the circuit board was connected to a Garmin Trac-Pac-35 OEM Global Positioning System unit. Versions 1.0-1.4 recorded data in a 10 byte encoded record; versions after 1.4 compressed data to 8 byte records allowing 4,096 observations to be recorded per memory chip. Increasing data compression allowed slightly more than 56

days of memory to be stored. A more complete description of the device, data collected, and results have been published in peer reviewed literature (Gallaway *et al.* 2003a and 2003b; Cole *et al.* 2002) and the reader is directed to these publications for further information.

Version 2.0 – This version modified the unit by removing the EEPROM memory chips from the main printed circuit board and replacing them with an external memory board capable of holding eight 24LC256 memory chips. This change increased the observation period from approximately 56 days to over 227 days of records; and more importantly, made the memory box serviceable by the vessel's personnel. In the event that memory was full, the vessel Captain could disconnect the full memory module and replace with new memory; thus drastically reducing the cost of unit maintenance. The most difficult and costly part of installing an ELB is intercepting the vessel in a port where the service person can access it. In theory, this version of the ELB would mean that a vessel would only need to be intercepted once (for initial installation of the unit); after which the Captain could remove and replace the memory modules as appropriate.

Version 3.0 – Version 3.0 of the ELB changed the microprocessor from the Parallax Basic Stamp II to a single board Parallax Javelin Stamp computer. This feature allowed the ELB to be programmed with a subset of Sun MicroSystem's Java programming language (a more robust programming language) and increased processing speed. As part of the programming changes, the encoded data record were reduced to 7 bytes with no loss of data precision. This change increased the observation period to an excess of 260 days. Further programming changes extended the observation period by not recording positional data if the vessel was stationary for 24 hours (e.g., tied up or at anchor). Observation periods were extended to >365 days.

Version 4.0 – This most recent version of the ELB incorporates major revisions in both hardware and software. The Parallax Javelin Stamp processor was upgraded to the Systronics JStamp and increased processing speeds and RAM availability 30 and 14 times, respectively, than that of the Javelin. This conversion only increased unit price by $10. Additionally, STMicroelectronics has released a new 512 kb EEPROM memory chip (M24512-B) compatible with the 24LC256 pin layout allowing observation periods to exceed 520 days. Although it is expected that data will be on a semiannual basis, this version would allow a vessel to be late in returning memory modules with no data being lost.

The most significant improvement in Version 4.0 is the inclusion of point-in-polygon calculation capabilities. This program, which runs at the same time as the data collection program, can warn the vessel Captain when he is approaching a designated area, and provides a different warning when he actually enters the area. This allows the unit to be preprogrammed with areas (polygons) that are to be avoided, for regulatory reasons (MPA's or closed areas) or because they contain reefs or other trawl hangs.

Software:

The original software consisted of programs written in PBASIC which were loaded into the ELB, and programs written in C++ which were used to analyze the data collected. The software

described below has since evolved along with the ELB hardware. The following descriptions for the original software are provided to show the basic functions of the ELB software.

PBASIC Programs – PBASIC programs are loaded into the microprocessor and allow it to test and reset the ELB system, collect and store data, or export previously collected data for use in other programs. Only one program can be held in the microprocessor's non-volatile memory at a time. The program in memory is run from the beginning each time the unit powers up or the reset circuit is activated. The system test program turns the GPS unit on, captures the transmitted SACII sentences, and displays them on the host PC. This program also tests the GPS for satellite coverage to ensure an accurate position. After accurate positional data is received, the system reset program is run to set a unique identifier number for the ELB system, erase previous memory locations, and set the memory index to the start.

The data collection and storage program runs continuously when in the field. In the event of a loss of power, or activiation of the reset circuit, the unit restarts the program where it last left off. The GPS unit is activated once every 10 minutes, keeping it on until it receives an accurate position fix (usually within 30 seconds). Once an accurate position is fixed, the program then turns the unit off, reformats the position and time data into an efficient 8 byte format, and writes the data to non-volatile external EEPROM memory. Upon completion of a fishing trip, the export program is loaded and executed. The program pauses for 30 seconds while the host PC activates a C++ program and uploads all data to the host PC memory.

C++ Program – ELB_Analysis, a C++ program written to run under Windows 95 and Windows 98, allows the user to select an electronic logbook data file to analyze, select the version of the program used to store the data, run the analysis and the summarization programs, and save the results. The resulting files are comma-separated ASCII files which include positional data that can be loaded directly into ArcView. The tracking file provides all positional information collected by the logbook, along with an interpretation of activity for each position. The logbook estimate file shows each ELB-detected tow including positional data and total tow time.

Activity at each position is inferred from the vessel's calculated speed which is approximated in three steps using "flat map" calculation techniques – a method that provides the required precision when working with closely located geographic points: 1) Latitude and longitude line lengths between observations are calculated in decimal degrees of longitude and latitude; 2) The line lengths are converted to kilometers using 111.18 km per degree of Latitude and 98.0052 km per degree of longitude; and, 3) The direct distance between the observation points, calculated in km using Euclidean geometry, is divided by the time between observations.

Using the calculated speed, activity is assigned in accordance with the following table:

Speed Range (Knots)	Activity Code	Activity Description
< 1.0	H	On Hook – Stopped
$\geq 1.0 < 2.0$	h	Buffer b/t Stopped & Trawling
$\geq 2.0 < 3.8$	T	Trawling
$\geq 3.8 < 5.0$	s	Buffer b/t Trawling &

		Steaming
≥ 5.0	S	Steaming

The tow summary function of the *ELB_Analysis* program estimates tows by relating the activity code associated with each location to the other activity codes from previous and following locations. Because the "H" and "h" activity codes can mask either slowing down during a trawl or turning, the program requires four "H" codes between two "T" codes to terminate a tow, while it only requires two "S" codes to terminate a tow. In either case, the time attributed to the codes that result in tow termination is not included in the total tow time.

All information collected by ELB systems are in a proprietary format that ensures the confidentiality of the data. Only LGL Ecological Research Associates, Inc. staff and the cooperating vessels will have access to the raw effort data.

Identification of Trips for ELB Datasets

Since NMFS records landings at the end of each trip, ELB vessel datasets (which can cover many trips) must be analyzed to identify the beginning and end of each separate trip. The LGL C++ program *elb-trip-calc* performs this analysis for each of the ELB datasets (one dataset is created each time a box is serviced). The program reads the location data from the first records (the location when the box is installed) and creates a rectangle 2.22 km tall by 1.97 km wide with the original location point in the center. The program then tests each record in the dataset until the vessel leaves the rectangle, at which time the program records the trip start date.

After the vessel has left the rectangle, each record is reviewed until the vessel returns to the rectangle, at which time the trip end date is recorded. This is repeated for all records in the ELB dataset.

Vessel Selection and Effort Calculation

Any permitted vessel with landings from a trimester in the previous year is used as the universe of commercial fishing vessels for sample selection. Within each time period (e.g., trimester), the landings by vessel are ordered from high to low, and this list is divided into quartiles. The ratio of summed landings for each quartile to the total landings observed for that time period constitutes the proportion of the sample to be drawn from that quartile. These selections will be made independent of the port from which the vessel operates.

The basic equation used to estimate effort in each defined time/space cell is:

$$\text{Effort} = \sum Landings_{\text{cell}} / CPUE_{\text{cell}}$$

ELB data are retrieved from each vessel and summarized by trawl tow (described in Gallaway *et al.* 2003a), and combined into a sample dataset. These data are analyzed to associate a trip completion date with each tow record. A NMFS landing data file is acquired and reduced to records that match vessel number and trip completion dates in the ELB data set. These data are also summarized into a dataset containing the vessel's trip information, along with pounds

landed. For observer collected red snapper bycatch data, effort will be calculated on a per month basis.

The spatial cells used in the analysis are created in ArcView (shapefile) and joined to the ELB starting point data to add location data to each tow record. The resulting data are then combined with the NMFS trip total landings data and each tow record is assigned landings based on the percent effort for the trip multiplied by the total landings associated with the trip (described in Gallaway *et al.* 2003a).

Current Field Program and Expected Completion:

The Foundation is currently augmenting the ongoing LGL effort program through a complementary award (Coop. Agree. No. NA05NMF4540044) which ends September 2008. A total of 17 trips with observers on board have been conducted aboard selected commercial fishing vessels originating out of ports from Texas to Florida for a total of 375 sea days. The results of this most recent research have been reported in a manuscript recently accepted for publication (Gazey et al. In Press 2008). A length-based, age-structured model was developed using length frequency data collected by observers of the Gulf of Mexico penaeid shrimp fishery from 1999 to 2006. The model results indicate that the age-0 red snapper fraction of the shrimp trawl bycatch in the first and third trimesters exceeds 90% and during the second trimester, the bycatch is more evenly split between age-0 (48%) and age-1 (52%) red snapper. The growth data suggest age-0 and age-1 fish form an opaque annulus in winter which is consistent with results found for older fish. The total mortality estimates for age-0 and age-1 red snapper were about 2.5 and 1.8, respectively. The natural mortality rate for age-0 red snapper based on this study is approximately double the value used in the last red snapper stock assessment. The evidence for the model with density dependence over the model with density independent mortality is overwhelming. Therefore, continuation of this project is essential as the continued need for data to enhance stock assessments is vital.

Observer Coverage:

Catch data will be collected by Foundation contracted observers placed onboard selected commercial shrimp fishing vessels that have an ELB installed. Observers contracted by the Foundation will have received a NMFS certificate of training prior to being deployed aboard a fishing vessel. This training will detail gear specifications, sampling protocols, data collection and documentation required by each observer and include turtle training at the NMFS Miami Lab. Training will allow for data consistency and standardization between Foundation and NMFS datasets and facilitate data analysis by interested parties (i.e., Foundation contracted Data Analyst and stock assessment scientists). Upon the successful completion of training, if necessary, vessels will be solicited to allow the placement of fishery observers to collect shrimp landings and red snapper bycatch data.

Observers will be hired/contracted by the Foundation to collect data and will record the weight (heads-on or heads-off) of all Penaeid shrimp regardless of the quantity harvested (e.g., no sub-samples will be taken). All incidentally harvested red snapper will be enumerated, weighed, and measured to produce accurate abundance and size-frequency estimates. Efforts will be taken to

sort, weigh, size, and record all red snapper from individual nets. In the event that individual net sorting becomes impractical, observers will sort, weigh, and size red snapper taken from all nets combined (i.e., catch from all fished nets will be combined and red snapper separated). All small coastal sharks will be enumerated, weighed, and measured from each net also. All turtles incidentally taken during experimental tows will be handled, measured, and flipper tagged according to established NMFS protocols.

We project 350 at-sea days are needed to adequately sample the vessels cooperating in the ELB program within the Gulf of Mexico. To the extent practicable at-sea days will be stratified by yearly trimester and proportionally allocated to each trimester based on fishing effort (e.g., more sea days will be allocated to the summer trimester due to the increased fishing activity during this time). It is at the discretion of the Foundation Regional/Field Coordinators and PIs to change the at-sea day allocation. If a redistribution of at-sea days is needed, efforts will be taken to ensure that this redistribution is performed in a scientifically rigorous manor and validated through communication with industry, NMFS, and LGL Cooperators.

Analysis of Observer Collected Red Snapper Data:

To better estimate the impact that the commercial shrimp fishing industry has on the red snapper population, a virtual population analysis (VPA; e.g., "cohort analysis") will be conducted on all observer collected red snapper bycatch data to update the cohort analysis with the most recent data. VPA's are used by fisheries managers to calculate stock size based on catches with no underlying statistical assumptions (Hilborn and Walters 1992). Once year-class stock size is known, cohort selectivity and vulnerability can be estimated.

Age-0 and age-1fish comprise the bulk (~99%) of red snapper shrimp trawl bycatch. To better define red snapper cohorts, all fish below 130 mm will be considered age-0 fish and all fish less than 300 mm that are not age-0 will be counted as age-1. Due to the continuous fishing practices (in time and space; with some time/area exceptions) of the shrimp fleet, the VPA must rely on natural mortality and population estimates for both age-0 and -1 fish. As such, mortality and population estimates derived from the most recent SEDAR-7 (Red Snapper) Assessment/Review Workshop will be utilized. This will ensure the robustness of the estimates used for, and results derived from, the analyses (i.e., all estimates will have undergone extensive peer review prior to analysis).

To compute a total mortality (Z) estimate for age-0 and -1 red snapper, catch-per-unit-effort (CPUE) data by length and month will enable the relative abundance of year classes over time to be computed. CPUE will be converted to the number of fish caught per net per 10,000 hours. Effort will be multiplied by the CPUE values to approximate bycatch by age, month, and region (e.g., statistical zone). From these data, survival can be estimated and total mortality (Z) calculated. All efforts will be made to compute a Z estimate from all Foundation datasets, both past and present.

Information Dissemination:

Cooperating fishing vessel owners will be provided with regular updates and a copy of the Foundation's analysis results and project final report. Summary reports of the project's findings will also be published as parts of the "Foundation Project Update" section of the "Gulf and South Atlantic News", the quarterly publication of the Gulf & South Atlantic Fisheries Foundation, Inc. This newsletter is distributed to over 300 organizations and individuals throughout the region. An electronic version of this newsletter (PDF) is also included in the regular updates to the Foundation's website (www.gulfsouthfoundation.org).

Copies of this project's final report will be published and distributed to various federal and state fishery agencies, university extension/Sea Grant offices, and industry associations. In addition, PDF copies of the final report will be made available for download from the Foundation's website.

Expected Results and Discussion:

The dynamics of the red snapper fishery are complex and various interest groups (recreational, head boat, charter boat, direct and indirect commercial fisheries, and the shrimp trawl fishery) are thought to impact the stock. In previous stock assessments, shrimp trawl bycatch was thought to bottleneck adult populations. Through previous efforts funded by the Foundation, shrimp trawl effort was found to be directionally biased, thus skewing shrimp trawl red snapper bycatch estimates. The continuation of the Foundation's ELB program will help to alleviate some of the confusion regarding shrimp trawl fishing effort and the F-mortality directly attributable to the shrimp trawl fishery operating in the Gulf of Mexico.

By augmenting LGL's current ELB research with onboard observers, red snapper bycatch and landings data will be collected as before. Landings data will be used to verify models used by scientists to allocate landings and effort on a trip-by-trip basis. Previous publications have shown that the ELBs can accurately predict landings on a tow-by-tow level (Gallaway *et al.* 2001). The SEDAR Shrimp Fishing Effort Working Group brought up concerns regarding these estimations. Specifically, more data were needed to validate the accuracy of the ELB landings model. If the landings model is validated and found to accurately assess shrimp landings on a tow-by-tow scale (versus the current trip-by-trip scale used by NMFS), the ELB landings information could be used by fisheries managers to accurately assign landings data to individual statistical cells.

Shrimp trawl bycatch data and the respective analyses have already illuminated the magnitude, composition, and mortality of juvenile red snapper. Results thus far indicate that age-0 red snapper are found to constitute the majority of red snapper shrimp trawl bycatch. This has important implications for the impact that the shrimp trawl fishery has on the red snapper stock which could be negligible or reduced from previous estimates. Although the dataset generated from this study cannot be considered "standalone", these data will significantly increase the current database of shrimp trawl red snapper bycatch data and constitute "the best available". These data will also be valuable to scientists assessing the impact that shrimp trawling has on the red snapper stock of the Gulf of Mexico.

Justification for Federal Support:

This project addresses a national priority regarding conservation and management of marine resources. Through National Standard 9 of the Magnuson-Stevens Conservation and Management Act (MS-FCMA) [16 U.S.C. 1826c, 1851], i.e., "*Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.*" Bycatch reduction remains a critical and high priority issue. Therefore, the impact that the shrimp fishery has on the red snapper stock serves to enhance national conservation goals set forth by the U.S. Congress. Additionally, because fisheries resources are a public commodity and various user groups (commercial fishermen, head and charter boat fishermen, recreational anglers, the commercial shrimp industry, the public-at-large, and federal and state fisheries management agencies) have a stake in the conservation of this marine resource, it is fair and reasonable to ask for Federal assistance.

Project Management:

Project Management:

Principal Investigators:

Ms. Judy Jamison, Executive Director
Dr. Michael Jepson, Program Director

Foundation Staff:

Ms. Gwen Hughes, Program Specialist
Ms. Charlotte Irsch, Grants/Contracts Specialist
Administrative Assistant

Overall project quality control and assurance will be assumed by the Gulf & South Atlantic Fisheries Foundation, Inc. through its office in Tampa, FL. Foundation personnel will each spend 20% of their time over the course of the 12 month project period in the performance of this award. This percentage is similar (if not reduced) when compared to the overhead ('indirect rate') of academic institutions. A project of this enormity is time consuming and requires the attention of each Foundation employee. Qualifications of the Principal Investigators are highlighted in the attached resumes.

The Foundation's Executive Director, Ms. Judy Jamison, has ultimate responsibility for all Foundation administrative and programmatic activities, with oversight by the Foundation's Board of Trustees. She ensures timely progress of activities to meet project objectives and confirms compliance of all activities with NOAA/NMFS.

The Foundation's Program Director, Dr. Michael Jepson, has overall responsibility for all technical aspects of Foundation projects and coordinates performance activities of all project personnel, including contractors. He confirms and evaluates the effectiveness of projects and

subcontracts and ascertains timeframe for the project. Should alterations to the described experimental design or data collection protocols be necessary, he confirms that all data are collected in a scientifically rigorous manner to ensure the usefulness of all experimentally collected data. Additionally, he coordinates all analytical efforts, prepares all progress and final reports concerning project performance, and drafts the Foundation's quarterly newsletter.

The Grant/Contracts Specialist, Ms. Charlotte Irsch, is responsible for maintaining general financial accounting of all Foundation funds including all Cooperative Agreements and contracts, as well as communicating with NOAA Grants Management personnel, and assisting fiscal auditors in their reviews. She conducts/documents internal and program (single and desk) audits, prepares backup documentation for fiscal audits, and drafts award extension requests (if applicable). Ms. Irsch provides the Executive and Program Directors with projected budgets concerning program performance and ensures that these budgets adhere to the proposed budget. Finally, she prepares the annual administrative budget, NOAA Financial Reports, and confirms compliance of all activities with NOAA/NMFS and OMB guidelines.

The Program Specialist, Ms. Gwen Hughes, is responsible for tracking programmatic activities, securing federal and state collection and experimental permits required for experimental testing, and individual scientific collection permits for contracted observers. She is also responsible for generating supporting documentation to assist in any and all programmatic audits. Ms. Hughes is responsible for the coordination of all program related meetings and auditing and paying program related invoices. She processes requests for reimbursement to conform with federal guidelines and prepares and maintains all subcontracts and amendments. Additionally, she is responsible for maintaining vessel insurance and verifies that all cooperators are maintaining worker's compensation coverage on their employees, if applicable.

The Administrative Assistant is responsible for receptionist/clerical duties, word processing, filing correspondence, dissemination of materials to industry (final reports, press releases, and newsletter). She is also responsible for creating and organizing meeting files, processing invoices and maintaining cooperative program files.

Participation by Others than Applicant:

To be successful, a project of this magnitude and importance requires the cooperation and active participation of many organizations and individuals. Most of these individuals have been associated with other similar Foundation research projects and programs since 1993. Their continued involvement will provide stability and allow for a smooth progression into this project from both a management and performance perspective.

The Foundation has chosen to sole source contract with several persons in conjunction with this project, while leaving some positions open to competition. These essential personnel are:

Mr. Gary Graham, Gulf of Mexico Regional Coordinator
(Texas A&M University Sea Grant)

Mr. Russell O'Brien, Observer/Vessel Coordinator
(Independent Contractor)

Mr. Phil Diller, Data Manager
(Independent Contractor)

LGL Ecological Research Associates, Inc.
Dr. Benny Gallaway, Data Analyst
Mr. John Cole, Data Analyst
Mr. Bill Gazey, Data Analyst

Contracted Fishery Observers (Selected from the list of individuals below)
Mr. Bob Timmeney
Mr. Konstantin Kopylov
Mr. J.L. Wiswell
Mr. Frank Helies

Through years of experience, the Foundation has found that working closely with the local Sea Grant – Marine Extension Service personnel who have years of experience with the local fishing industry, is an efficient way to achieve rapid communication and cooperation with local shrimp fishermen. As such, the Gulf of Mexico Regional Coordinator, with assistance from the Observer/Vessel Coordinator, will (1) act as liaison between the Foundation and vessel owners, relaying information about the goals of the project and securing vessel participation in the project; (2) review, with the Data Analyst and Program Director, incoming data for completeness and accuracy; and (3) monitor observer performance.

The Observer/Vessel Coordinator will assist the Foundation's Program Director and Regional Coordinator in their day-to-day activities, with all activities coordinated through continual communication with Foundation staff. The Vessel/Observer Coordinator will also recruit, train and coordinate fishery observers in the field. He will also contact and establish a good working relationship with various cooperating vessel owners and captains, and provide this information to the observers.

Only observers that have undergone rigorous NMFS certification training will be contracted by the Foundation. It is the job of the onboard observers to collect all landings and red snapper bycatch data and proof all collected data for completeness and accuracy before forwarding to the Observer/Vessel Coordinator. The Foundation has contracted observers working on related projects. Because these individuals possess the skills needed to fulfill the position and have proven themselves under field conditions, the contracted observer positions will first be offered to these individuals. If additional observers are needed to collect data, a competitive solicitation process will be conducted by the Foundation.

All data will be gathered through the cooperation and direct participation of the commercial shrimp fishing industry of the Gulf of Mexico region. Without the cooperation of industry, this project would not be possible. The use of fishing vessels as research platforms, not only reduces the costs associated with this project, but ensures that industry is aware of the research and

allows them to be involved in all steps of the scientific method. By allowing fishermen to actively participate in the collection of data, they will be more trusting of the results produced from this research and will be more willing to assist in future research.

Observer collected data for this project will be electronically entered by a Foundation contracted Data Manager and archived at both the Foundation and NMFS Galveston Laboratory. The Data Manager is responsible for checking and transferring all the collected raw data into a manageable computer database for analysis and data archive at the Foundation's office and the NMFS Galveston Laboratory. Once the data have been reviewed and entered, they will then be forwarded to the Data Analyst and Foundation Program Director.

Dr. Benny Gallaway, of LGL Ecological Research Associates, Inc., will work closely with the Foundation's Coordinators and Program Director with this project. Dr. Gallaway has traveled the region presenting the results of previously conducted effort studies to increase the awareness of the project and randomness of ELB placement. In addition, Dr. Gallaway and LGL staff/contractors (including Mr. Bill Gazey and Mr. John Cole) will be conducting all data analyses on landings and red snapper bycatch data.

Industry and NOAA Fisheries Cooperators:

Mr. John Williams, Southern Shrimp Alliance
Ms Wilma Anderson, Texas Shrimp Association

Dr. Jim Nance, NOAA Fisheries Galveston Laboratory

Direct industry participation is needed for the proposed work. Mr. John Williams, representing the Southern Shrimp Alliance and Ms. Wilma Anderson of the Texas Shrimp Association, will work with Foundation Coordinators and Dr. Gallaway to increase awareness of this project and solicit industry's support. Both Ms. Anderson and Mr. Williams have been active in the shrimp industry and related research for many years. Their contacts within the commercial fishing community will be of paramount importance.

Dr. Jim Nance has agreed to be this project's NOAA Fisheries Cooperator. Dr. Nance has worked cooperatively with the Foundation for a number of years on fishing effort related projects. He will oversee the project throughout its entirety and ensure that all data is collected in a scientifically rigorous manor. The Foundation's Program Director will have frequent contact with Dr. Nance and update him of any, and all, progress and/or problems that occur.

Monitoring of Project Performance:

Given the current controversies and conflicts among various interest groups related to the programmatic concepts outlined here, there is a possibility that one (or more) of these groups will question the validity of the Foundation's findings. For internally conducted studies, Principal Investigators (PIs) will regularly communicate with observers and Foundation Field/Regional Coordinators concerning fieldwork. PIs will also review data for completeness and accuracy, and the Foundation's Program Director will monitor data management procedures

to ensure that all data analyses meet their required statistical assumptions and fulfill the project objectives outlined within this proposal. The quality of the data collected, and the procedures used to collect those data, will be assured through the use of highly qualified and knowledgeable observers who are experienced in this line of work.

Internal and external monitors will oversee the PIs' activities and responsibilities. The Foundation's Board of Trustees, representing various commercial fishing and seafood interests throughout the southeastern United States, oversee the PIs' tasks and are kept aware of, and critically review, project reports. This program will be conducted as a Cooperative Agreement with NMFS and the timely completion of project objectives will be externally monitored by the Program Office of the NMFS Southeast Regional Office, NOAA Grants Management, and a NMFS Technical Monitor. Interim and final progress and financial reports concerning the program will be submitted to NOAA/NMFS, as required, to help the agency track the successful implementation, performance, and completion of the various tasks outlined in this proposal. During the period when analysis of the data is being conducted, the PIs and reviewers will discuss data, data analysis, and data interpretation. Only after the analysis has undergone rigorous evaluation will the final report be accepted by the Foundation and printed.

Milestone Table:

Project Activities	2009							2010							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Project Start-up Activities/Contract Negotiations	xx	xx													
Project Coordination/Monitoring	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx
Training of Observers	xx	xx													
Permit Applications & Maintenance	xx	xx													
Selection of Participating Vessels		xx	xx	xx	xx	xx	xx	xx	xx	xx	xx				
Data Collection		xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx	xx		
Statistical Analysis											xx	xx	xx		
Project Closeout & Final Report Preparation													xx	xx	xx
Final Report Submission															xx

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